

HDI 4000 **Ultrasound System**

Reference Manual

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1 Read This First

1 *Read This First*

About Your System User Information

The ultrasound system user information is for the reader who is familiar with ultrasound techniques. Sonography training and clinical procedures are not included here. The user information for the ultrasound system is organized as follows:

- **Reference Manual:** Contains information about maintenance, troubleshooting, safety, scanheads, biopsy guides, peripherals, specifications, medical references, and a glossary. The glossary contains descriptions of all controls and display elements.
- **Help:** The Help is on the ultrasound system hard disk. The Help contains the instructions for use of the system. Press **?** to display the Help viewer.
- **Compact Disc:** Includes a copy of the Help and electronic copies of the *Reference Manual*, *Using Disinfectants and Gels*, *Acoustic Output Tables*, and *Medical Ultrasound Safety*.
- **Using Disinfectants and Gels:** Contains information about compatible gels and disinfectants and disinfecting Philips products.
- **Acoustic Output Tables:** Contains information about mechanical and thermal index precision and accuracy, the acoustic output default tables, and the acoustic output tables.
- **Medical Ultrasound Safety:** Contains information about bioeffects and biophysics, prudent use, and implementing ALARA (as low as reasonably achievable).
- **Operating Notes:** Contains information that clarifies certain system responses that might be misunderstood or cause user difficulty.

Conventions Used in the User Information

The user information uses the following conventions:

- All procedures are numbered. You must complete steps in the sequence they are presented to ensure a result.
- Bulleted lists indicate general information about a particular function or procedure. They do not imply a sequential procedure.
- Control names and menu items or titles are spelled as they are on the system, and they appear in bold text.
- Symbols appear as they appear on the system.

- The left side of the system is to your left as you stand in front of the system, facing the system.
- Scanheads and pencil probes both are referred to as scanheads, unless the distinction is important to the meaning of the text.

System Conventions

These conventions are used in the system:

- “Click” means to move a cursor to, or highlight, an object and press **SET**.
- The menu controls are used to adjust the system parameters listed in the menus on the left side of the screen. Those menus are related to the imaging mode or system condition. Use **MENU** and **SELECT** to change the values of the parameters or menu items.
- The trackball controls include the trackball, **SET**, **CHG.**, and **EXIT**. Those controls are used to enable display elements, move cursors, alternate control of cursor or display functions, and exit system modes or conditions.
- To enter text into a text field, use the keyboard.
- To use the scroll bar to scroll through a list, move the cursor to the scroll bar, press **SET**, and move the trackball up or down. You can also move the cursor to the arrows at either end of the scroll bar and press **SET** to move the scroll bar up or down.
- The blue menu keys appear across the bottom of the display. They assume different values based on the system mode. They provide quick access to those functions. The blue menu keys correspond to the controls labeled 1 through 6 across the top of the control panel. Press the corresponding button to initiate the blue menu key function.

System Description

The HDI 4000 Ultrasound System is a high-resolution system ([Figure 1-1](#)). You can use it for 2D, 3D, Live 3D, M-mode, Doppler, Color, and Color Power Angio (CPA) imaging. You can also perform duplex and triple-mode imaging. A range of scanheads are available: curved, phased, linear, compact linear, 3D, multiplane transesophageal, and continuous-wave Doppler. Applications for specific scanheads are listed in [Table 3-1](#).

Figure 1-1 HDI 4000 Ultrasound System



Several measurement tools are included: distance, area, and volume. In calculations, there are application-specific tools including: manual trace, limited trace, auto trace, velocity, stenosis area and diameter percentage, and vessel area and diameter. After you perform the measurements, the system makes the pertinent calculations and organizes the measurements, calculations, and patient information into a patient report.

You can store and review single images and Cine sequences. Images and Cine sequences can be stored on a compact disc (CD), magneto-optical (MO) disc, or sent over a network to a server or printer.

The control panel provides imaging controls and access to a variety of functions. A retractable keyboard allows data entry. A footswitch is also provided with the system.

Peripheral devices are available: You can connect a VCR, and black-and-white, color, and report printers to the system.

Video Monitor Controls

The video monitor has three controls on the front: **MENU**, **+** and **-** (Figure 1-2). **MENU** displays a **CONTRAST** slider; use the **+** and **-** controls to set the monitor contrast. Press the **MENU** control again to display a **BRIGHTNESS** slider; use the **+** and **-** controls to set the monitor brightness. Recommended settings are 65 for contrast and 73 for brightness. Press the **+** or **-** control to display a **DEGAUSS** display. To degauss the monitor, press the **MENU** control. To remove the **DEGAUSS** display without degaussing the video monitor, press **+** or **-**.

Figure 1-2 Video Monitor Controls



Control Module

The control module contains the imaging controls, TGC slide controls, blue menu keys, and programmable USER controls, and provides access to scanhead selection, review, calculations, setup, and annotation functions (Figure 1-3). The knobs are multipurpose controls: For example, when you press the **M** control, M-mode imaging begins; when you turn the **M** control, the 2D/M-mode gain changes; in 3D imaging, when you turn the **M** control, the magnification changes. The blue menu keys appear across the bottom of the screen. The controls related to the blue menu keys are located along the top of the control panel and assume different functions, depending on the system operating mode. Press the control corresponding to the blue menu key to perform the blue menu key function.

Figure 1-3 Control Module



Keyboard

Beneath and in front of the control panel is a retractable keyboard ([Figure 1-4](#)). Directly above the keyboard is a light. The light switch is above the keyboard to the right of the control panel.

Figure 1-4 Keyboard



Light switch

Storage Devices

An MO drive and a CD-RW disc drive are above the control panel ([Figure 1-5](#)). The system hard disk is located inside the system and can be accessed from the rear panel of the system ([Figure 1-10](#)).

Figure 1-5 Locations of the MO and CD-RW Drives



Peripherals

There is room in the peripheral bay in the front of the system for a black-and-white printer and a color printer (Figure 1-6). The VCR can be installed in the peripheral bay on the sides of the system for convenient access from either the right or left side of the system (Figure 1-9).

Figure 1-6 Peripheral Bay (Front View)



Scanhead Connections and Cable Management

Three active scanhead receptacles, a pencil-probe receptacle, and an inactive scanhead receptacle are on the front of the system (Figure 1-7). Four scanhead holders are in back of the control panel, and two cable management brackets are underneath the control panel.

Figure 1-7 Scanhead Connections



Footswitch

The footswitch receptacle is on the bottom front of the system ([Figure 1-8](#)).

Figure 1-8 Footswitch Connection



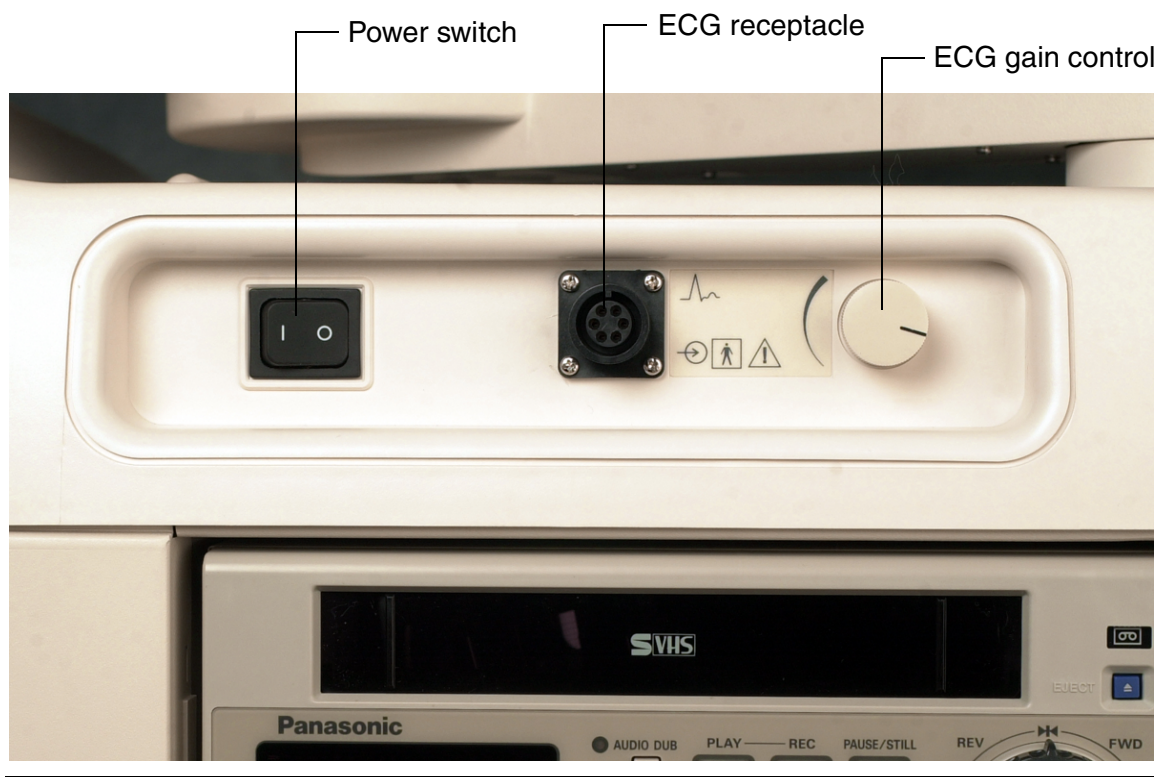
Power Switch

The power switch is on the right side of the system, above the VCR peripheral bay (Figure 1-9).

ECG

The ECG receptacle and the ECG gain control are on the right side of the system, near the power switch, above the VCR peripheral bay (Figure 1-9).

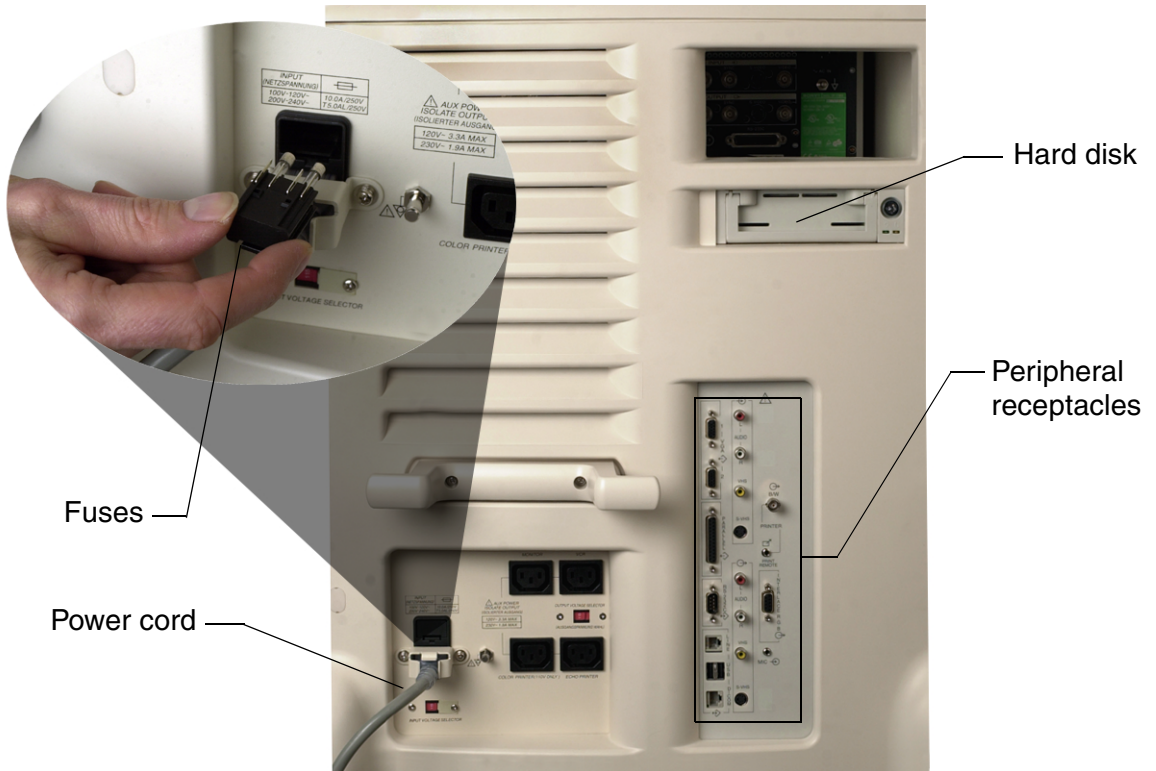
Figure 1-9 Power Switch, ECG Controls, and VCR



Rear Panel

The rear panel of the system contains the receptacles for the peripheral devices, network devices, and power cords. Also located on the rear panel is access to the hard disk and the system fuses (Figure 1-10).

Figure 1-10 Rear Panel



Wheel Locks

The front wheels can be locked ([Figure 1-11](#)).

Figure 1-11 Wheel Locks



Unlocked caster



Locked caster

System Upgrades and User Information Updates

Philips Ultrasound is committed to innovation and continued improvement. Upgrades may be announced that consist of hardware or software improvements. Updated user information will accompany those system upgrades.

Customer Comments

If you have questions about the user information, or you discover an error, please call us at (800) 433-3246; or if you are outside the USA, call our nearest office, listed later in this section. You can also send e-mail to the following address:

atl-bothell.techpubs@philips.com

Ordering Supplies and Accessories

You can order probe covers, biopsy guides, and other supplies and accessories from CIVCO Medical Instruments:

CIVCO Medical Instruments
102 First St. South
Kalona, IA 52247-9589
Telephone (800) 445-6741, Ext. 1 for Customer Service (USA)
(319) 656-4447 (International)
Fax (877) 329-2482 (USA)
(319) 656-4451 (International)
E-mail info@civcomedical.com
Internet ultrasoundsupplies.com

If You Need Assistance

Customer service representatives are available worldwide to answer questions and to provide maintenance and service.

In the United States

For assistance within the USA, contact the Philips Ultrasound corporate headquarters:

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P.O. Box 3003
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For specific questions, use the following directory:

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(800) 433-3246

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- Upgrade information
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- Delivery information
- Clinical and marketing materials

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(800) 522-7022 or (425) 487-7330

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2 Safety

2 *Safety*

Please read this information before using your ultrasound system. It applies to the ultrasound system, scanheads, recording devices, and any optional equipment.

This device is intended for use by, or by the order of, and under the supervision of a licensed physician qualified to direct the use of the device.

A **WARNING** describes precautions necessary to prevent injury or loss of life.

A **CAUTION** describes precautions necessary to protect the equipment.

Electrical Safety

This equipment has been verified by a recognized third-party testing agency as a Class I device with Type BF and Type CF isolated patient-applied parts. For maximum safety observe these warnings:

-
- WARNINGS**
- Shock hazards may exist if this system, including all externally mounted recording and monitoring devices, is not properly grounded. Protection against electrical shock is provided by grounding the chassis with a three-wire cable and plug. The system must be plugged into a grounded outlet. The grounding wire must not be removed or defeated.
 - Do not remove the protective covers on the system; hazardous voltages are present inside. Cabinet panels must be in place while the system is in use. All internal adjustments and replacements must be made by a qualified Philips Ultrasound customer service representative.
 - Do not operate this system in the presence of flammable gases or anesthetics. Explosion can result.
 - To avoid risk of electrical shock hazards, always inspect the scanhead before use: Check the face, housing, and cable before use. Do not use if the face is cracked, chipped, or torn, the housing is damaged, or the cable is abraded.
 - To avoid risk of electrical shock hazards, always disconnect the system from the wall outlet prior to cleaning the system.
 - All patient contact devices, such as scanheads, pencil probes, and ECG leads must be removed from patient contact prior to application of a high voltage defibrillation pulse.
-

- WARNINGS**
- Connection of optional devices not supplied by Philips Ultrasound could result in electrical shock. When such optional devices are connected to your ultrasound system, ensure that the total system earth leakage current does not exceed 300 μ A.
 - To avoid risk of electrical shock, do not use any scanhead that has been immersed beyond the specified cleaning or disinfection level. See *Using Disinfectants and Gels*, 4700-0249-XX.
 - To avoid risks of electrical shock and fire hazards, inspect the system power cord and plug on a regular basis. Ensure that they are not damaged in any way.

- CAUTIONS**
- Although your system has been manufactured in compliance with existing EMI/EMC requirements, use of this system in the presence of an electromagnetic field can cause momentary degradation of the ultrasound image. If this occurs often, review the environment in which the system is being used, to identify possible sources of radiated emissions. These emissions could be from other electrical devices used within the same room or an adjacent room. Communication devices such as cellular phones and pagers can cause these emissions. The existence of radio, TV, or microwave transmission equipment located nearby can cause emissions. In cases where EMI is causing disturbances, it may be necessary to relocate your system.
 - Electrostatic discharge (ESD), commonly referred to as a static shock, is a naturally occurring phenomenon. ESD is most prevalent during conditions of low humidity, which can be caused by heating or air conditioning. During low humidity conditions, electrical charges naturally build up on individuals and can create static shocks. An ESD condition occurs when an individual with an electrical energy build-up comes in contact with objects such as metal doorknobs, file cabinets, computer equipment, and even other individuals. The static shock or ESD is a discharge of the electrical energy build-up from a charged individual to a lesser or non-charged individual or object. The level of electrical energy discharged from a system user or patient to the ultrasound system can be significant enough to cause damage to the system or scanheads.
- The following precautions can help to reduce ESD: anti-static spray on carpets; anti-static spray on linoleum; anti-static mats; or a ground wire connection between the system and the patient table or bed.
-

Mechanical Safety

-
- WARNINGS**
- Be aware of the casters, especially when moving the system. The system is heavy, its weight depends upon its configuration, and it could cause injury to you or others if it rolls over feet or into shins. Exercise caution when going up or down ramps.
 - Position external hardcopy devices away from the system. Ensure that they are secure. Do not stack them on the system.

CAUTION Ensure that the cables for all patient-applied parts are secure. Use the cable management system to ensure that scanhead cables are protected from damage.

System Wheel Locks

The system has locks for the front wheels. Press down on the lock with your foot to lock and lift up to unlock. Release the locks when moving the system.

Moving the System

Only the front wheels are steerable. To maneuver the system in tight spaces, use repeated back-and-forth movements to position the system.

If the system behaves abnormally after moving contact Philips Ultrasound Customer Service immediately. The components are installed securely and can withstand considerable shock, however, excessive shock can cause a system failure.

CAUTION Ensure the keyboard is retracted before moving the system. An extended keyboard might be damaged if it hits another object.

Equipment Protection







Follow these precautions to protect your system:

CAUTIONS




- Excessive bending or twisting of cables on patient-applied parts may cause failure or intermittent operation of the system.
 - Improper cleaning or sterilization of a patient-applied part may cause permanent damage. For cleaning and disinfection instructions, see *Using Disinfectants and Gels*, 4700-0249-XX.
 - Do not submerge the cables of patient-applied parts in solution. The cables are not liquid-tight beyond the applied part/cable or cable/connector interfaces.
 - Do not use solvents such as thinner or benzine or abrasive cleaners on the system, scanheads, or any hardcopy device.
 - For optimal performance, your ultrasound system should be connected to a circuit dedicated solely for the ultrasound system.
 - All systems have 120 Vac or 230 Vac available for the installed monitor, VCR, and printers. Before connecting an OEM power cord, verify that the input and output voltage selector switch settings match and that the voltage rating of the OEM devices match the selector switch settings.
 - In general, only the area of the scanhead acoustic window is watertight. Except where specified in specific scanhead cleaning instructions, do not immerse the remainder of a scanhead in any liquid.
-


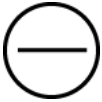

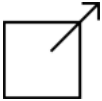
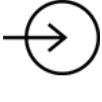

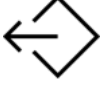
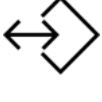
Symbols

The International Electrotechnical Commission has established a set of symbols for medical electronic equipment that classify a connection or warn of potential hazards. The classifications and symbols are shown below.



	Isolated patient connection. (Type BF)
	On the power switch, represents ON and OFF.
	This symbol identifies a safety note. Ensure you understand the function of this control before using it. Refer to the appropriate section in this manual for an explanation of the control.
	Identifies equipotential ground.
 IPX1	Indicates that this device is protected against dripping water. This degree of protection can apply to scanheads and footswitches.
 IPX7	Indicates that this device is protected against the effects of immersion. This degree of protection can apply to scanheads.

The following symbols are also used on the system:

	Connection for a pencil probe
	Connection for a scanhead
	Connection for ECG

	Connection for footswitch
	Monitor decrease control
	Monitor increase control
	Print remote output
	Input port for audio left/right, VHS/S-VHS, microphone, or DVD
	Output port for audio left/right, VHS/S-VHS, video patient monitor, black-and-white printer or interlaced RGB output port
	VGA or parallel output port
	USB/DICOM input/output port

The following symbols are used inside the system:

	Identifies high-voltage components
	Ground

Biological Safety

This section contains information about biological safety and a discussion of the prudent use of the system.

A list of precautions related to biological safety follows; observe these precautions when using the system. For more information refer to 4700-0263-XX, *Medical Ultrasound Safety* on your system user-information compact disc.

-
- WARNINGS**
- Do not use the system if an error message appears on the video display indicating that a hazardous condition exists. Note the error code, turn off power to the system, and call your customer service representative.
 - Do not use a system that exhibits erratic or inconsistent updating. Discontinuities in the scanning sequence are indicative of a hardware failure that must be corrected before use.
 - Perform ultrasound procedures prudently. Use the ALARA (as low as reasonably achievable) principle.
 - Use only acoustic standoffs that have been approved by Philips Ultrasound.
 - Verify the alignment of the biopsy guide before use. See the ["Biopsy Guides"](#) section of this manual.
 - Verify the condition of the biopsy needle before use. Do not use a bent biopsy needle.
 - Biopsy guide scanhead covers contain natural rubber latex. These covers may cause allergic reactions in some individuals. Refer to the FDA Medical Alert on Latex Products, dated March 29, 1991, in the ["Probe Covers"](#) section of this manual.
-

ALARA Education Program

The guiding principle for the use of diagnostic ultrasound is defined by the “as low as reasonably achievable” (ALARA) principle. The decision as to what is reasonable has been left to the judgement and insight of qualified personnel. No set of rules can be formulated that would be sufficiently complete to dictate the correct response to every circumstance. By keeping ultrasound exposure as low as possible, while obtaining diagnostic images, users can minimize ultrasonic bioeffects.

Since the threshold for diagnostic ultrasound bioeffects is undetermined, it is the sonographer’s responsibility to control total energy transmitted into the patient. The sonographer must reconcile exposure time with diagnostic image quality. To ensure diagnostic image quality and limit exposure time, an ultrasound system

provides controls that can be manipulated during the exam to optimize the results of the exam.

The ability of the user to abide by the ALARA principle is important. Advances in diagnostic ultrasound not only in the technology but in the applications of that technology, have resulted in the need for more and better information to guide the user. The output display indices are designed to provide that important information.

There are a number of variables which affect the way in which the output display indices can be used to implement the ALARA principle. These variables include index values, body size, location of the bone relative to the focal point, attenuation in the body, and ultrasound exposure time. Exposure time is an especially useful variable, because it is controlled by the user. The ability to limit the index values over time supports the ALARA principle.

Applying ALARA

The system imaging mode used depends upon the information needed. 2D and M-Mode imaging provide anatomical information, while Doppler, Color Power Angio (CPA), and Color imaging provide information about blood flow. A scanned mode, like 2D, CPA, or Color, disperses or scatters the ultrasonic energy over an area, while an unscanned mode, like M-Mode or Doppler, concentrates ultrasonic energy. Understanding the nature of the imaging mode being used allows the sonographer to apply the ALARA principle with informed judgement. Additionally, the scanhead frequency, system setup values, scanning techniques, and operator experience allow the sonographer to meet the definition of the ALARA principle.

The decision as to the amount of acoustic output is, in the final analysis, up to the system operator. This decision must be based on the following factors: type of patient, type of exam, patient history, ease or difficulty of obtaining diagnostically useful information, and the potential localized heating of the patient due to scanhead surface temperatures. Prudent use of the system occurs when patient exposure is limited to the lowest index reading for the shortest amount of time necessary to achieve acceptable diagnostic results.

Although a high index reading does not mean that a bioeffect is actually occurring, a high index reading should be taken seriously. Every effort should be made to reduce the possible effects of a high index reading. Limiting exposure time is an effective way to accomplish this goal.

There are several system controls that the operator can use to adjust the image quality and limit the acoustic intensity. These controls are related to the techniques that an operator might use to implement ALARA. These controls can be divided into three categories: direct, indirect, and receiver controls.

Direct Controls

Application selection and the **POWER** control directly affect acoustic intensity. There are different ranges of allowable intensity or output based on your selection. Selecting the correct range of acoustic intensity for the application is one of the first things that occurs in any exam. For example, peripheral vascular intensity levels are not recommended for fetal exams. Some systems automatically select the proper range for a particular application, while others require manual selection. Ultimately, the user has the responsibility for proper clinical use. The your ultrasound system provides both automatic or default and manual or user-selectable settings.

POWER has direct impact on acoustic intensity. Once the application has been established, the **POWER** control can be used to increase or decrease the intensity output. The **POWER** control allows you to select intensity levels less than the established maximum. Prudent use dictates that you select the lowest output intensity that is consistent with good image quality.

Indirect Controls

The indirect controls are those that have an indirect effect on acoustic intensity. These controls affect imaging mode, pulse repetition frequency, focus depth, pulse length, and scanhead selection.

The choice of imaging mode determines the nature of the ultrasound beam. 2D is a scanning mode, Doppler is a stationary or unscanned mode. A stationary ultrasound beam concentrates energy in a single location. A moving or scanned ultrasound beam disperses the energy over an area and the beam is concentrated on the same area for a fraction of the time as that of an unscanned mode.

Pulse repetition frequency or rate refers to the number of ultrasound bursts of energy over a specific period of time. The higher the pulse repetition frequency, the more pulses of energy in a period of time. Several controls affect pulse repetition frequency: focal depth, display depth, sample volume depth, color sensitivity, number of focal zones, and sector width controls.

Focus of the ultrasound beam affects the image resolution. To maintain or increase resolution at a different focus requires a variation in output over the focal zone. This variation of output is a function of system optimization. Different exams require different focal depths. Setting the focus at the proper depth improves the resolution of the structure of interest.

Pulse length is the time during which the ultrasonic burst is turned on. The longer the pulse, the greater the time-average intensity value. The greater the time-average intensity, the greater the likelihood of temperature increase and cavitation.

Pulse length or burst length or pulse duration is the output pulse duration in pulsed Doppler. Increasing the Doppler sample volume increases the pulse length.

Scanhead selection indirectly affects intensity. Tissue attenuation changes with frequency. The higher the scanhead operating frequency, the greater the attenuation of the ultrasonic energy. A higher scanhead operating frequency requires more output intensity to scan at a deeper depth. To scan deeper at the same output intensity, a lower scanhead frequency is required. Using more gain and output beyond a point, without corresponding increases in image quality, can mean that a lower frequency scanhead is needed.

Receiver Controls

Receiver controls are used by the operator to improve image quality. These controls have no effect on output. Receiver controls only affect how the ultrasound echo is received. These controls include gain, TGC, dynamic range, and image processing. The important thing to remember, relative to output, is that receiver controls should be optimized before output is increased. For example: before increasing output, optimize gain to improve image quality.

An Example of Applying ALARA

An ultrasound scan of a patient's liver begins with selecting the appropriate scanhead frequency. After selecting the scanhead and the application, which are based on patient anatomy, adjustments to output power should be made to ensure that the lowest possible setting is used to acquire an image. After the image is acquired, adjusting the focus of the scanhead, and then increasing the receiver gain to produce a uniform representation of the tissue follows. If an adequate image can be obtained with the increase in gain, then a decrease in output should be made. Only after making these adjustments should you increase output to the next level.

Having acquired the 2D display of the liver, Color can be used to localize blood flow. As with the 2D image display, gain and image processing controls must be optimized before increasing output.

Having localized the blood flow, use the Doppler controls to position the sample volume over the vessel. Before increasing output, adjust velocity range or scale and Doppler gain to obtain an optimal Doppler trace. Only if maximum Doppler gain does not create an acceptable image do you increase output.

In summary: select the correct scanhead frequency and application for the job; start with a low output level; optimize the image using focus, receiver gain, and other imaging controls; if the image is not diagnostically useful at this point, then increase output.

Additional Considerations

Ensure that scanning time is kept to a minimum, and ensure that only medically required scanning is performed. Never compromise quality by rushing through an exam. A poor exam may require a follow-up, which ultimately increases exposure time. Diagnostic ultrasound is an important tool in medicine, and, like any tool, it should be used efficiently and effectively.

Output Display

The system output display comprises two basic indices: a mechanical index and a thermal index. The thermal index further consists of the following indices: soft tissue (TI_s), cranial (TI_c), and bone (TI_b). One of these three thermal indices will be displayed at all times. Which one depends upon the system preset or user choice, depending upon the application at hand.

The mechanical index is continuously displayed over the range of 0.0 to 1.9, in increments of 0.1.

The thermal index consists of the three indices, and only one of these is displayed at any one time. Each scanhead application has a default selection that is appropriate for that combination. The TI_b or TI_s is continuously displayed over the range of 0.0 to maximum output, based on the scanhead and application, in increments of 0.1.

The application-specific nature of the default setting is also an important factor of index behavior. A default setting is a system control state which is preset by the manufacturer or the operator. The system has default index settings for the scanhead application. The default settings are invoked automatically by the ultrasound system when power is turned on, new patient data is entered into the system data base, or a change in application takes place. [Figure 2-1](#) illustrates the implementation of the output display.

Figure 2-1 On-Screen TI and MI

The decision to display one or the other of the three thermal indices should be based on the following criteria:

- Appropriate index for the application: TIs is used for imaging soft tissue; and TIb for a focus at or near bone.
- Mitigating factors that might create artificially high or low thermal index readings: location of fluid or bone, or blood flow. For example, is there a highly attenuating tissue path so that the actual potential for local zone heating is less than the thermal index displays.
- Scanned modes versus unscanned modes of operation affect the thermal index. For scanned modes, heating tends to be near the surface; for unscanned modes, the potential for heating tends to be deeper in the focal zone.
- Always limit ultrasound exposure time. Do not rush the exam. Ensure that the indices are kept to a minimum and that exposure time is limited without compromising diagnostic sensitivity.

Mechanical Index (MI) Display

Mechanical bioeffects are threshold phenomena that occur when a certain level of output is exceeded. The threshold level varies, however, with the type of tissue. The potential for mechanical bioeffects varies with peak pressure and ultrasound frequency. The MI accounts for these two factors. The higher the MI value, the greater the likelihood of mechanical bioeffects occurring. There is no specific MI value that means that a mechanical effect is actually occurring. The MI should be used as a guide for implementing the ALARA principle.

Thermal Index (TI) Displays

The TI informs the user about the conditions that exist that might lead to an increase in temperature at the surface of the body, within the body tissue, or at the point of focus of the ultrasound beam on bone. That is, the TI informs the user of the potential for temperature rise in body tissue. It is an estimate of temperature increase in body tissue with specific properties. The actual amount of any temperature rise is influenced by factors such as tissue type, vascularity, mode of operation and others. The TI should be used as a guide for implementing the ALARA principle.

The bone thermal index (Tlb) informs the user about potential heating at or near the focus after the ultrasound beam has passed through soft tissue or fluid, for example, at or near second or third trimester fetal bone.

The cranial bone thermal index (Tlc) informs the user about the potential heating of bone at or near the surface, for example, cranial bone.

The soft tissue thermal index (TIs) informs the user about the potential for heating within soft homogeneous tissue.

You can select either TIs or Tlb using the TIs/Tlb selection on the **General** system setups. Tlc is displayed when you select a transcranial application.

Mechanical and Thermal Indices Display Precision and Accuracy

The MI and TI precision is 0.1 unit on the system.

The MI and TI display accuracy estimates for the system are given in *Acoustic Output Tables*, 4706-0037-XX, on the system user-information compact disc. These accuracy estimates are based on the variability range of scanheads and systems, inherent acoustic output modeling errors and measurement variability, as discussed below.

The displayed values should be interpreted as relative information to help the system operator achieve the ALARA principle through prudent use of the system. The values should not be interpreted as actual physical values in interrogated tissue or organs. The initial data that is used to support the output display is derived from laboratory measurements based on the AIUM measurement standard. The measurements are then put into algorithms for calculating the displayed output values.

Many of the assumptions used in the process of measurement and calculation are conservative in nature. Over-estimation of actual in situ intensity exposure, for the vast majority of tissue paths, is built into the measurement and calculation process. For example:

- The measured water tank values are derated using a conservative, industry standard, attenuation coefficient of 0.3 dB/cm-MHz.
- Conservative values for tissue characteristics were selected for use in the TI models. Conservative values for tissue or bone absorption rates, blood perfusion rates, blood heat capacity, and tissue thermal conductivity were selected.
- Steady State temperature rise is assumed in the industry standard TI models, and the assumption is made that the ultrasound scanhead is held steady in one position long enough for steady state to be reached.

A number of factors are considered when estimating the accuracy of the displayed values: hardware variations, estimation algorithm accuracy, and measurement variability. Variability among scanheads and systems is a significant factor. Scanhead variability results from piezoelectric crystal efficiencies, process-related impedance differences, and sensitive lens focusing parameter variations. Differences in system pulser voltage control and efficiencies is also a contributor to variability. There are inherent uncertainties in the algorithms used to estimate acoustic output values over the range of possible system operating conditions and pulser voltages. Inaccuracies in laboratory measurements are related to, among others, differences in hydrophone calibration and performance, positioning, alignment, and digitization tolerances, and variability among test operators.

The conservative assumptions of the output estimation algorithms of linear propagation, at all depths, through a 0.3 dB/cm-MHz attenuative medium is not considered in the accuracy estimate for the display. Neither linear propagation, nor uniform attenuation at the 0.3 dB/cm-MHz rate, occur in water tank measurements or in most tissue paths in the body. In the body, different tissues and organs have dissimilar attenuation characteristics. In water, there is almost no attenuation. In the body, and in particular, in water tank measurements, non-linear propagation and saturation losses occur as pulser voltages increase.

Therefore, the display accuracy estimates are based on the variability range of scanheads and systems, inherent acoustic output modeling errors, and measurement variability. Display accuracy estimates are not based on errors in, or caused by measuring according to, the AIUM measurement standards, or the effects of non-linear loss on the measured values.

Control Effects

Controls Affecting the Indices

As various system controls are adjusted, the TI and MI values may change. This will be most apparent as the **POWER** control is adjusted; however, other system controls will affect the on-screen output values.

POWER

POWER controls the system acoustic output. Two real-time output values are on the screen: a TI and MI. They change as the system responds to **POWER** adjustments.

In combined modes, such as simultaneous Color, 2D and pulsed-wave Doppler, the individual modes each add to the total TI. One mode will be the dominant contributor to this total. The displayed MI will be from the mode with the largest peak pressure.

2D Controls

Sector Width

Narrowing the sector angle may increase frame rate. This action will increase the TI. Pulser voltage may be automatically adjusted down with software controls to keep the TI below the system maximums. A decrease in pulser voltage will decrease MI.

Zoom

Increasing the zoom magnification may increase frame rate. This action will increase the TI. The number of focal zones may also increase automatically to improve resolution. This action may change MI since the peak intensity can occur at a different depth.

Number of Focal Zones

More focal zones may change both the TI and MI by changing frame rate or focal depth automatically. Lower frame rates decrease the TI. MI displayed will correspond to the zone with the largest peak intensity.

Focus

Changing the focal depth will change MI. Generally, higher MI values will occur when the focal depth is near the natural focus of the scanhead.

Color and Power Controls

Sensitivity

Increasing the color sensitivity may increase the TI. More time is spent scanning the color image. Color pulses are the dominant pulse type in this mode.

Color Sector Width

Narrower color sector width will increase color frame rate and the TI will increase. The system may automatically decrease pulser voltage to stay below the system maximum. A decrease in pulser voltage will decrease the MI. If pulsed Doppler is also enabled then pulsed Doppler will remain the dominant mode and the TI change will be small.

Color Sector Depth

Deeper color sector depth may automatically decrease color frame rate or select a new color focal zone or color pulse length. The TI will change due to the combination of these effects. Generally, the TI will decrease with increased color sector depth. MI will correspond to the peak intensity of the dominant pulse type which is a color pulse. However, if pulsed Doppler is also enabled then pulsed Doppler will remain the dominant mode and the TI change will be small.

Scale

Using the **SCALE** control to increase the color velocity range may increase the TI. The system may automatically adjust pulser voltage to stay below the system maximums. A decrease in pulser voltage will also decrease MI.

Sector Width

A narrower 2D sector width in Color imaging will increase color frame rate. The TI will increase. MI will not change. If pulsed Doppler is also enabled, then pulsed Doppler will remain the dominant mode and the TI change will be small.

M-Mode and Doppler Controls

Speed

M-mode and Doppler sweep speed adjustments will not affect the MI. When M-mode sweep speed changes, TI changes.

Simultaneous and Update Methods

Use of combination modes affects both the TI and MI through the combination of pulse types. During simultaneous mode, the TI is additive. During auto-update and duplex, the TI will display the dominant pulse type. The displayed MI will be from the mode with the largest peak pressure.

Sample Volume Depth

When Doppler sample volume depth is increased the Doppler PRF may automatically decrease. A decrease in PRF will decrease the TI. The system may also automatically decrease the pulser voltage to remain below the system maximum. A decrease in pulser voltage will decrease MI.

Other

2D, C, M, CPA, PW, and CW

When a new imaging mode is selected (except 3D imaging, which is based on images in system memory), both the TI and MI may change to default settings. Each mode has a corresponding pulse repetition frequency and maximum intensity point. In combined or simultaneous modes, the TI is the sum of the contribution from the modes enabled and MI is the MI for the focal zone and mode with the largest derated intensity. The system will return to the previously selected state if a mode is turned off and then reselected.

Scanhead

Each scanhead type has unique specifications for contact area, beam shape, and center frequency. Defaults are initialized when you select a scanhead. Factory defaults vary with scanhead, application, and selected mode. Defaults have been chosen below the FDA limits for intended use.

Depth

An increase in 2D depth will automatically decrease the 2D frame rate. This would decrease the TI. The system may also automatically choose a deeper 2D focal depth. A change of focal depth may change the MI. The MI displayed is that of the zone with the largest peak intensity.

Application

Acoustic output defaults are set when you select an application. Factory defaults vary with scanhead, application, and mode. Defaults have been chosen below the FDA limits for intended use.

Related Guidance Documents

For more information about ultrasonic bioeffects and related topics refer to the following:

1. AIUM Report, January 28, 1993, "Bioeffects and Safety of Diagnostic Ultrasound"
2. Bioeffects Considerations for the Safety of Diagnostic Ultrasound, *J Ultrasound Med.*, Sept. 1988: Vol. 7, No. 9 Supplement

3. Acoustic Output Measurement Standard for Diagnostic Ultrasound Equipment. (AIUM, NEMA. 1998)
4. Acoustic Output Labeling Standard for Diagnostic Ultrasound Equipment (AIUM, 1998)
5. Second Edition of the AIUM Output Display Standard Brochure, Dated March 10, 1994. (A copy of this document is shipped with each system.)
6. Information for Manufacturers Seeking Marketing Clearance of Diagnostic Ultrasound Systems and Transducers. FDA. September 1997. FDA.
7. Standard for Real-Time Display of Thermal and Mechanical Acoustic Output Indices on Diagnostic Ultrasound Equipment. (Revision 1, AIUM, NEMA. 1998)
8. WFUMB. Symposium on Safety of Ultrasound in Medicine: Conclusions and Recommendations on Thermal and Non-Thermal Mechanisms for Biological Effects of Ultrasound, *Ultrasound in Medicine and Biology*, 1998: Vol. 24, Supplement 1.

Acoustic Output and Measurement

Since the initial use of diagnostic ultrasound, the possible human biological effects (bioeffects) from ultrasound exposure have been studied by various scientific and medical institutions. In October 1987, the American Institute of Ultrasound in Medicine (AIUM) ratified a report prepared by its Bioeffects Committee (Bioeffects Considerations for the Safety of Diagnostic Ultrasound, *J Ultrasound Med.*, Sept. 1988: Vol. 7, No. 9 Supplement), sometimes referred to as the Stowe Report, which reviewed available data on possible effects of ultrasound exposure. Another report "Bioeffects and Safety of Diagnostic Ultrasound," dated January 28, 1993, provides more current information.

The acoustic output for this system has been measured and calculated in accordance with the "Acoustic Output Measurement Standard for Diagnostic Ultrasound Equipment" (AIUM, NEMA 1998), the "Standard for Real-Time Display of Thermal and Mechanical Acoustic Output Indices on Diagnostic Ultrasound Equipment" (Revision 1, AIUM, NEMA 1998), and the September, 1997 FDA document "Information for Manufacturers Seeking Marketing Clearance of Diagnostic Ultrasound Systems and Transducers."

In Situ, Derated, and Water Value Intensities

All intensity parameters are measured in water. Since water does not absorb acoustic energy, these water measurements represent a worst case value. Biological tissue does absorb acoustic energy. The true value of the intensity at any point

depends on the amount and type of tissue and the frequency of the ultrasound that passes through the tissue. The intensity value in the tissue, *In Situ*, has been estimated by using the following formula:

$$In\ Situ = Water [e^{-0.23alf}]$$

where: *In Situ* = *In Situ* Intensity Value

Water = Water Value Intensity

e = 2.7183

a = Attenuation Factor

Tissue = a(dB/cm-MHz)

Brain = .53

Heart = .66

Kidney = .79

Liver = .43

Muscle = .55

l = Skin line to measurement depth (cm)

f = Center frequency of the scanhead/system/mode combination (MHz)

Since the ultrasonic path during an examination is likely to pass through varying lengths and types of tissue, it is difficult to estimate the true *In Situ* intensity. An attenuation factor of 0.3 is used for general reporting purposes; therefore, the *In Situ* value which is commonly reported uses the formula:

$$In\ Situ\ derated = Water [e^{-0.069lf}]$$

Since this value is not the true *In Situ* intensity, the term “derated” is used.

Mathematical derating of water based measurements using the 0.3 dB/cm-MHz coefficient, may yield lower acoustic exposure values than would be measured in a homogenous 0.3 dB/cm-MHz tissue. This is true because non-linearly propagating acoustic energy waveforms experience more distortion, saturation, and absorption in water than in tissue, where attenuation present all along the tissue path will dampen the buildup of non-linear effects.

The maximum derated and the maximum water values do not always occur at the same operating conditions; therefore, the reported maximum water and derated values may not be related by the *In Situ* (derated) formula. For example: a multi-zone array scanhead that has maximum water value intensities in its deepest zone also has the smallest derating factor in that zone. The same scanhead may have its largest derated intensity in one of its shallowest focal zones.

Conclusions Regarding Tissue Models and Equipment Survey

Tissue models are necessary to estimate attenuation and acoustic exposure levels *In Situ* from measurements of acoustic output made in water. Presently, available models may be limited in their accuracy because of varying tissue paths during diagnostic ultrasound exposures and uncertainties in acoustical properties of soft tissues. No single tissue model is adequate for predicting exposures in all situations from measurements made in water, and continued improvement and verification of these models is necessary for making exposure assessments for specific applications.

A homogeneous tissue model with an attenuation coefficient of 0.3 dB/cm-MHz throughout the beam path is commonly used when estimating exposure levels. The model is conservative in that it overestimates the *In Situ* acoustic exposure when the path between the scanhead and the site of interest is composed entirely of soft tissue, because the attenuation coefficient of soft tissue is generally higher than 0.3 dB/cm-MHz. When the path contains significant amounts of fluid, as in many first and second-trimester pregnancies scanned transabdominally, this model may underestimate the *In Situ* acoustical exposure. The amount of underestimation depends on each specific situation.

Fixed-path tissue models, in which soft tissue thickness is held constant, sometimes are used to estimate *In Situ* acoustical exposures when the beam path is longer than 3 cm and consists largely of fluid. When this model is used to estimate maximum exposure to the fetus during transabdominal scans, a value of 1 dB/MHz may be used during all trimesters.

The maximum acoustic output levels of diagnostic ultrasound devices extend over a broad range of values:

- A survey of 1990-equipment models yielded mechanical index (MI) values between 0.1 and 1 at their highest output settings. Maximum MI values of approximately 2 are known to occur for currently available equipment. Maximum MI values are similar for real-time 2D, M-mode, pulsed Doppler, and Color flow imaging.
- Computed estimates of upper limits to temperature elevations during transabdominal scans were obtained in a survey of 1988 and 1990 pulsed Doppler equipment. The vast majority of models yielded upper limits less than 1 degree C and 4 degrees C for exposures of first-trimester fetal tissue and second-trimester fetal bone, respectively. The largest values obtained were approximately 1.5 degrees C for first-trimester fetal tissue and 7 degrees C for second-trimester fetal bone. Estimated maximum temperature elevations given here are for a “fixed-path” tissue model and are for devices having I_{SPTA}

values greater than 500 mW/cm². The temperature elevations for fetal bone and tissue were computed based on calculation procedures given in Sections 4.3.2.1-4.3.2.6 in *Bioeffects and Safety of Diagnostic Ultrasound* (AIUM, 1993).

Acoustic Output Tables

Acoustic output tables are in *Acoustic Output Tables*, 4706-0037-XX, on your system user-information compact disc.

Acoustic Measurement Precision and Uncertainty

All table entries have been obtained at the same operating conditions that give rise to the maximum index value in the first column of the tables. Measurement precision and uncertainty for power, pressure, intensity, and center frequency are shown in [Table 2-1](#) and [Table 2-2](#).

Table 2-1 Acoustic Measurement Precision

Note *Per Section 6.4 of the Output Display Standard, measurement precision on the following quantities is determined by making repeated measurements and stating the standard deviation as a percentage.*

Quantity	Precision (Percentage Standard Deviation)
Pr is the un-derated and Pr.3 is the derated peak rarefactional pressure measured in MegaPascals.	Pr: 2.2% Pr.3: 5.4%
Wo is the ultrasonic power in milliWatts.	6.2%
f _c is the center frequency in MHz (NEMA UD-2 definition).	<1%
PII is the un-derated and PII.3 is the derated spatial-peak pulse intensity integral in Joules/cm ² .	PII: 3.2% PII.3: 3.2%

Table 2-2 Acoustic Measurement Uncertainty

Quantity	Measurement Uncertainty (percentage, 95% confidence value)
Pr is the un-derated and Pr.3 is the derated peak rarefactional pressure measured in MegaPascals.	Pr: $\pm 13\%$ Pr.3 $\pm 15\%$
Wo is the ultrasonic power in milliWatts.	$\pm 19\%$
f_c is the center frequency in MHz (NEMA UD-2 definition).	$\pm 4.5\%$
PII is the un-derated and PII.3 is the derated spatial-peak pulse intensity integral in Joules/cm ² .	PII: $+18\%$ to -23% PII.3: $+19\%$ to -24%

3 Scanheads

3 *Scanheads*

The scanhead that you select is the most important factor in image quality. Optimal imaging cannot be attained without the correct scanhead. The system is optimized for use based on your scanhead selection.

The system limits patient contact temperature to 41 degrees Celsius, and acoustic output values to their respective U.S. Food and Drug Administration limits. A power-protection fuse circuit protects against over-current conditions. If the power monitor protection circuit senses an over-current condition, then the drive current to the scanhead is shut off immediately, preventing overheating of the scanhead surface and limiting acoustic output. Validation of the power protection fuse circuit is performed under normal system operation.

Scanhead Selection

Pressing **SCANHEAD** displays the **Scanhead Selection** display. From this display, you select a scanhead, an application, and a setting. After you select those, the system runs through a set routine: It calibrates the scanhead; enables the scanhead for operation; and updates system status to reflect scanhead type and the application you selected.

Applications

The applications for each scanhead for the system are shown in [Table 3-1](#).

Table 3-1 Scanhead Applications

Scanhead	Applications
C5-2	Abdomen, Fetal Heart, General, Gynecology, OB, Renal
C7-4	Abdomen, Fetal Heart, General, Gynecology, OB, Renal
C8-4v	General, Gynecology, OB
C8-5	General, Neonatal Head, Pediatric Abdomen, Venous
C9-5 ICT	General, Gynecology, OB, Prostate
CL15-7	General, Intraoperative, Musculoskeletal, Small Parts, Venous
D2 CW	Cardiology
D5 CW	Cardiology, Venous
L7-4	Carotid, General, Musculoskeletal, Small Parts, Venous
L12-5 38 mm	Breast, General, Musculoskeletal, Pediatric, Small Parts, Venous
L12-5 50 mm	Breast, General, Musculoskeletal, Pediatric, Small Parts, Venous
MPT7-4	Cardiology Transesophageal
P4-2	Abdomen, Cardiology, General, Transcranial Doppler
P5-3	Abdomen, Cardiology, General
P7-4	General, Neonatal Head, Pediatric Cardiology
3D5-3	Abdomen, General, Gynecology, OB
3D7-4	Abdomen, General, Gynecology, OB
3D8-5v	General, Gynecology, OB

Scanhead Maintenance

Scanheads require proper care, cleaning, and handling. Reasonable care includes inspection, cleaning, and disinfection or sterilization, as necessary.

Inspect the scanhead cable, case, and lens before each use. Check for cracks or other damage that jeopardizes the integrity of the scanhead. Report any damage to your Philips Ultrasound customer service representative, and discontinue use of the scanhead.

CAUTION

Some ultrasound coupling gels, precleaning, disinfecting, and sterilizing solutions can damage a scanhead. Before using a gel or solution on a scanhead, refer to *Using Disinfectants and Gels*, 4700-0249-XX.

Acoustic Artifacts

The scanhead adds its own signature to the echo information in the form of beam width effects, axial resolution limitations, and frequency characteristics. The control choices made by the sonographer that affect amplification, signal processing, and echo signal display can lead to significant differences in the displayed appearance of echo data. Following is a brief discussion of acoustic artifacts. An understanding of the physical basis for the production of signals displayed on ultrasound images is helpful in minimizing artifacts on images and interpreting the results of studies.

An artifact is an echo displayed in a different position than its corresponding reflector in the body. Artifacts can also be caused by intervening tissue properties. Artifacts can originate from external noise, reverberations, multi-path reflections, or misadjusted equipment. They can also come from the ultrasonic beam geometry and unusual changes in beam intensity. Artifacts and their manifestations are listed below, and following are some definitions of various artifacts.

- Added objects displayed as speckle, section thickness, reverberation, mirror image, comet tail, or ring down.
- Missing objects due to poor resolution.
- Incorrect object brightness due to shadowing or enhancement.
- Incorrect object location due to refraction, multi-path reflections, side lobes, grating lobes, speed error, or range ambiguity.
- Incorrect object size due to poor resolution, refraction, or speed error.
- Incorrect object shape due to poor resolution, refraction, or speed error.

Comet tail is a form of reverberation artifact produced when two or more strong reflectors are close together and have a high propagation speed. In this case, sound does not travel directly to a reflector and back to the transducer; and a strong linear echo appears at the reflector and extends deeper than the reflector.

Enhancement is an increased relative amplitude of echoes caused by an intervening structure of low attenuation.

Focal enhancement, also known as focal banding, is the increased intensity in the focal region that appears as a brightening of the echoes on the display.

Mirror imaging artifact is most commonly seen around the diaphragm; this artifact results from sound reflecting off another reflector and back.

Multi-path positioning and refraction artifacts describe the situation in which the paths to and from a reflector are different. The longer the sound takes traveling to or from a reflector, the greater the axial error in reflector positioning (increased range). Refraction and multi-path positioning errors are normally relatively small and contribute to general degradation of the image rather than to gross errors in object location.

A propagation speed error occurs when the assumed value for propagation speed by the ultrasound system is incorrect. If the actual speed is greater than that assumed, the calculated distance to a reflector is too small, and the reflector will be displayed too far from the transducer. Speed error can cause a structure to be displayed with incorrect size and shape.

In ultrasound imaging, it is assumed that for each pulse produced, all reflections are received before the next pulse is sent out. If this is not the case, range ambiguity can result. The ultrasound system calculates the distance to a reflector from the echo arrival time assuming that all echoes were generated by the last emitted pulse. The maximum depth to be imaged unambiguously by the system determines its maximum pulse repetition frequency.

Reverberation is the continuing reception of a particular signal because of reverberation rather than reflection from a particular acoustic interface. This phenomenon is analogous to the effect created by mirrors positioned on opposite walls when an object, a head for instance, is placed between the mirrors. The image of the head is reflected back and forth infinitely between the two mirrors, creating the optical illusion of multiple heads. Reverberations are easily identifiable, because they are equally spaced on the display screen.

A condition of acoustic saturation occurs when received signals reach a system's high-amplitude limit. At that point the system becomes unable to distinguish or

display signal intensities. At the point of saturation, increased input will not increase output.

Scattering is the diffuse, low-amplitude sound waves that occur when acoustic energy reflects off tissue interfaces smaller than a wavelength. In diagnostic ultrasound, Doppler signals come primarily from acoustic energy back-scattered from red blood cells.

Shadowing is the reduction in echo amplitude from reflectors that lie behind a strongly reflecting or attenuating structure. This phenomenon occurs when scanning a lesion or structure with an attenuation rate higher than that of the surrounding tissue. The lesion causes a decrease in beam intensity, which results in decreased echo signals from the structures beyond the lesion. Consequently, a dark cloud behind the lesion image forms on the screen. This cloud, or shadow, is useful as a diagnostic clue.

Side lobes (from single-element transducers) and grating lobes (from array scan-heads) cause objects that are not directly in front of the transducer to be displayed incorrectly in lateral position.

Speckle appears as tissue texture close to the transducer but does not correspond to scatterers in tissue. It is produced by ultrasound wave interference and results in general image degradation.

Speed of sound artifacts occur if the sound propagation path to a reflector is partially through bone, and the speed of sound is greater than in the average soft tissue. Echo position registration artifacts will be produced. Reflectors appear closer to the transducer than their actual distance because of this greater speed of sound, resulting in a shorter echo transit time than for paths not containing bone.

When the detected Doppler frequency exceeds the Nyquist limit, aliasing occurs. It is characterized on the spectral display by the Doppler peaks going off the display, top or bottom, and then continuing on the other side of the baseline. On the Color display an immediate change in color from one Nyquist limit to the other is seen.

Mirroring is the appearance of artifacts on a spectral display when there is improper separation of forward and reverse signal processing channels. Consequently, strong signals from one channel mirror into the other.

Spectral broadening is a display phenomenon that occurs when the number of energy-bearing Fourier frequency components increases at any given point in time. As a consequence, the spectral display is broadened. Spectral broadening can indicate the disturbed flow caused by a lesion, and therefore it is important

diagnostically. However, broadening can also result from interaction between flow and sample volume size, in which case it is an artifact.

4 Transesophageal Scanheads

4 *Transesophageal Scanheads*

This section covers transesophageal scanheads and is arranged as follows:

- Description
- Operating Instructions
- Maintenance

Description

The MPT7-4 Multiplane Transesophageal Scanhead is a multi-element ultrasound scanhead mounted on a gastroscopic articulating device. The transducer elements are electronically time- and phase-coordinated to generate a steered and focused ultrasound beam, which produces a high-resolution real-time image. The scanhead is capable of imaging in multiple scan planes.

The MPT7-4 allows a circular continuum of tomographic images within a 185-degree arc without moving the scanhead. Using the MPT7-4, one can acquire intermediate, transitional, and off-axis images between the primary planes. Although additional tomographic information is obtained by the MPT7-4 compared to a bi-plane scanhead, the primary advantage of the MPT7-4 is the ability to obtain an uninterrupted series of adjacent images simply by rotation of the transducer array.

The MPT7-4 has a transducer array that rotates along an axis perpendicular to the axis of the scanhead shaft. At 0-degree orientation, the acquired tomographic plane is equivalent to the transverse plane, and at approximately 90-degree orientation, sagittal plane images can be obtained with the transducer array about 30 cm from the patient's teeth. The transducer array can be rotated up to 180 degrees, which provides a mirror image of the 0-degree orientation. Multiple tomographic image planes are continuously selected by rotating the transducer array without significant manipulation of the MPT7-4.

The MPT7-4 is used for transesophageal 2D and M-mode imaging, pulsed-wave and continuous-wave Doppler, Color flow, and Color Power Angio (CPA) imaging.

MPT7-4 scanhead applications include monitoring of cardiac ventricular function of patients during long non-cardiac surgery; pre- and post-operative evaluation of cardiac valvular surgery; and general diagnostic and outpatient imaging of difficult-to-image patients.

Scanhead Characteristics

Refer to [Table 4-1](#) for MPT7-4 scanhead characteristics

The MPT7-4 maximum acoustic power and intensity values are listed in the *Acoustic Output Tables*, 4706-0037-XX, on the system user-information compact disc.

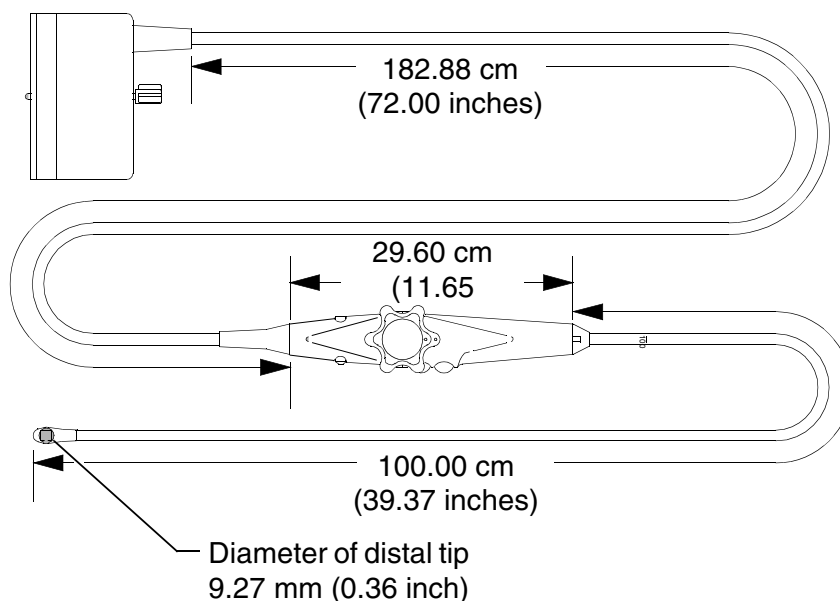
Table 4-1 MPT7-4 Scanhead Characteristics

Frequency (MHz)	Acoustic Aperture (mm)	Transmit Focal Range (cm)	Elements
5.4–6.3	10.0 x 8	0.8–11.0	64

Physical Dimensions

Refer to [Figure 4-1](#).

Figure 4-1 MPT7-4 Features and Control Locations



Transesophageal Scanhead Icon

When the MPT7-4 is selected, an icon is displayed to the left of the image. The icon represents the current scan plane position relative to the scanhead tip (Figure 4-2). It also displays the offset of the scan plane, in degrees, and the patient applied part temperature (PAPT), in degrees Celsius (Figure 4-2).

Figure 4-2 Transesophageal Scanhead Icon



Articulating Device Characteristics

The gastroscopic articulating device is controlled by two articulation knobs on the handle of the scanhead (Figure 4-3). You can move the gastroscope through articulating ranges of 60 degrees to the left through 60 degrees to the right and 60 degrees posteriorly through 120 degrees anteriorly. A brake on the MPT7-4 allows you to lock the articulation position (Figure 4-4). When the brake is on, a lock icon appears above the scanhead icon.

The two articulation knobs are arranged one on the other. The smaller knob controls the left/right articulation and the larger one controls the anterior/posterior articulation. The rotation of the two knobs is directly related to the articulation of the scanhead tip. A one-degree change in the knob corresponds to a one-degree change in the scanhead tip in the selected direction ([Figure 4-5](#)).

WARNING Do not manipulate the MPT7-4 scanhead while inserted in a “locked” (“click-stop”) position. While it is physically possible to do so, it is difficult for the operator to gauge the amount of pressure applied to internal surfaces, and a hazard to the patient exists.

Figure 4-3 MPT7-4 Features and Control Locations

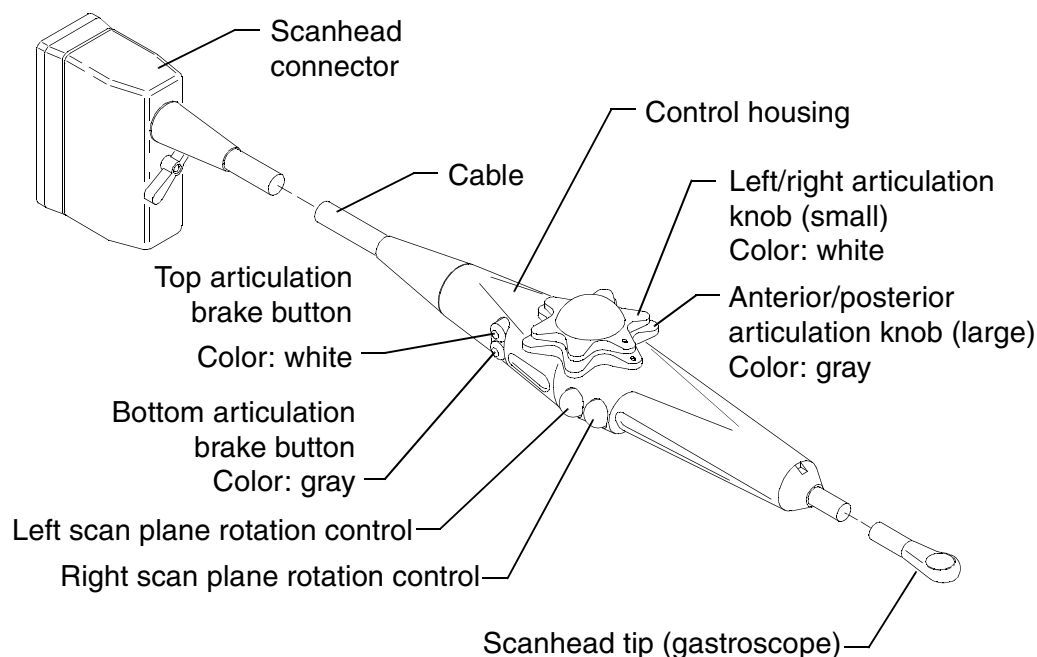


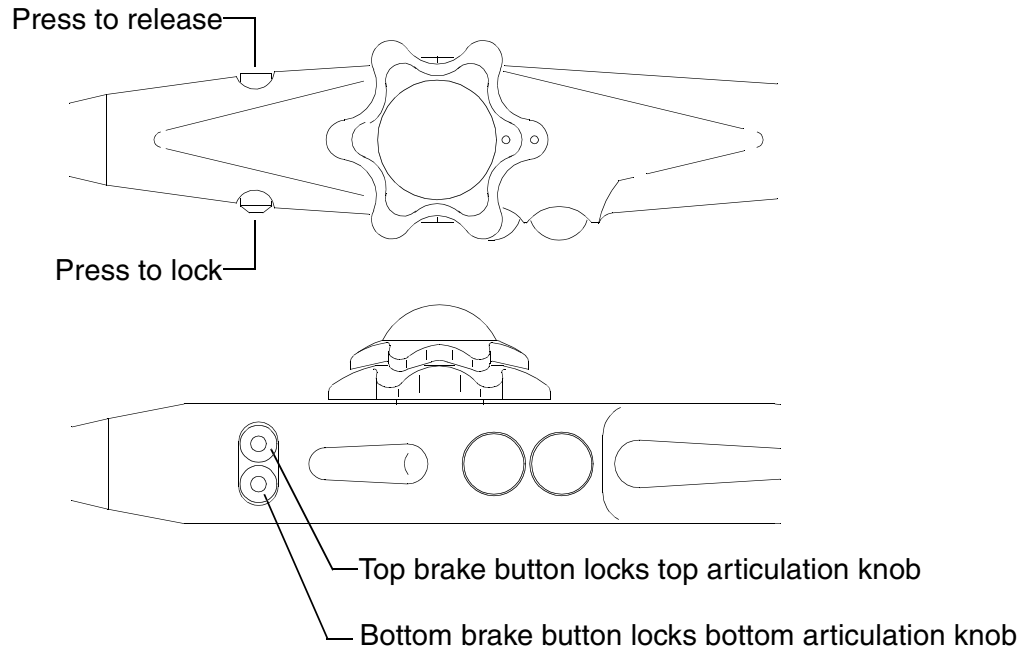
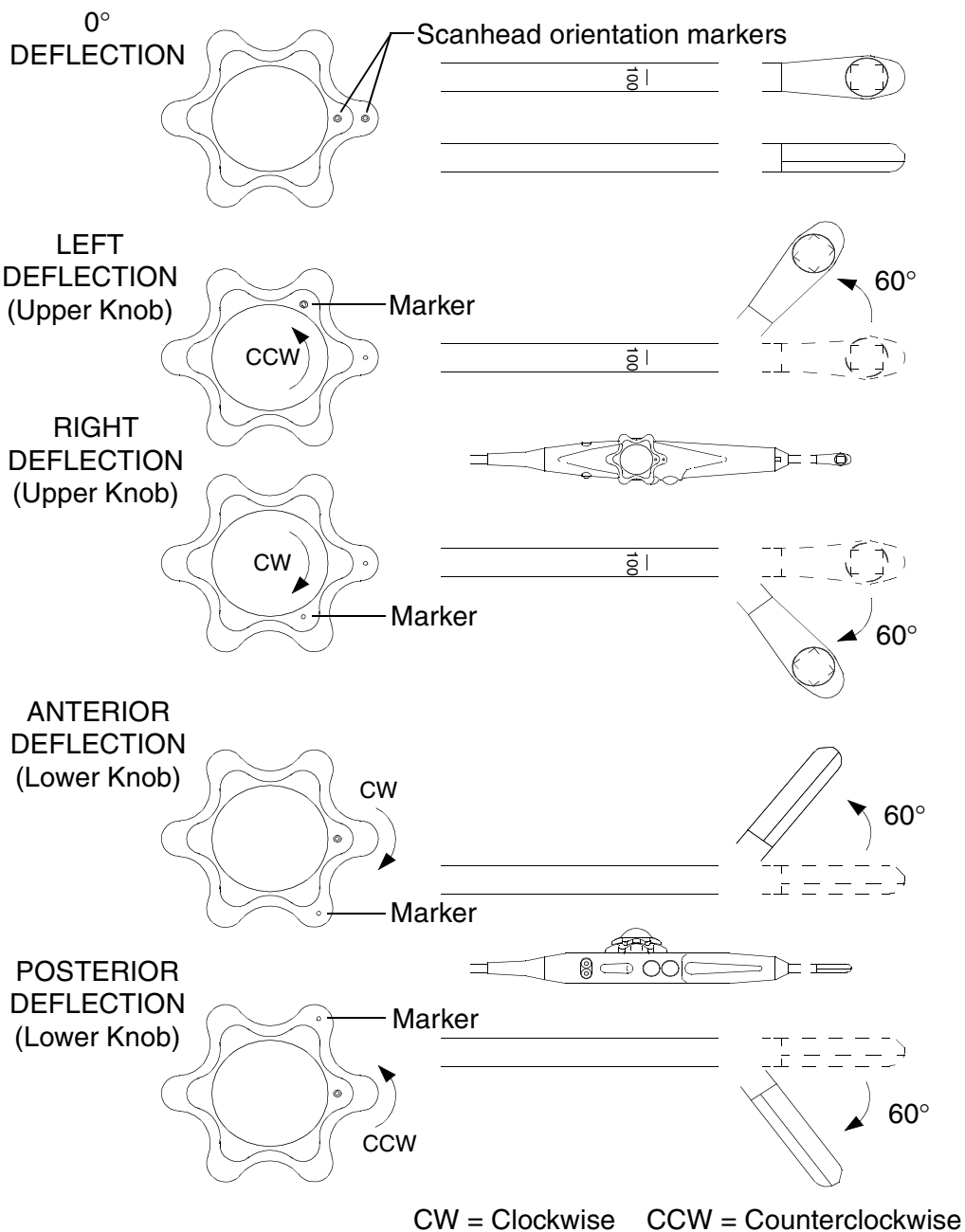
Figure 4-4 Scan Plane Position Brake

Figure 4-5 Articulating Device Deflection

Scan Plane Orientation

The scan plane orientation of the MPT7-4 is shown in [Figure 4-6](#).

When you select the MPT7-4 scanhead, the scan plane orientation is set to -5 degrees during initialization. Fully depressing the left and right scan plane rotation controls at the same time will also reset the scan plane orientation to the -5 degrees position.

Figure 4-6 Scan Plane Orientation

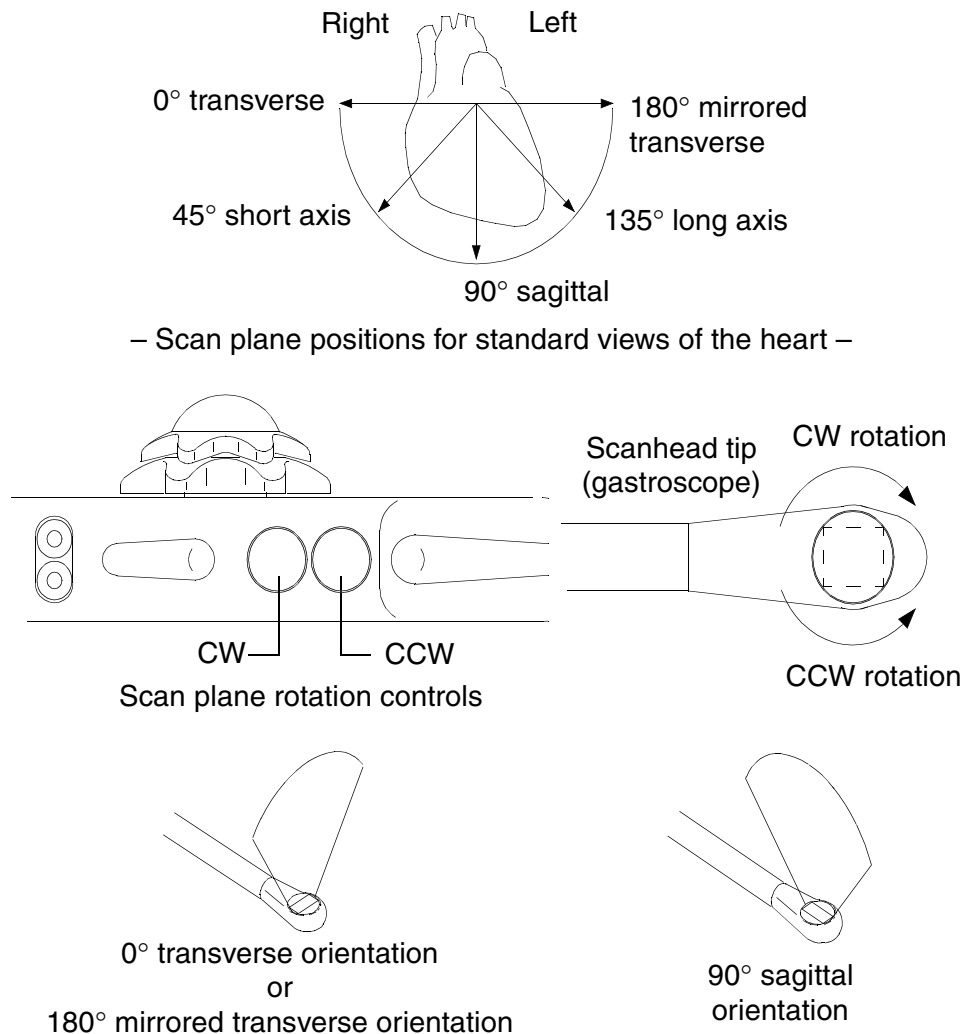
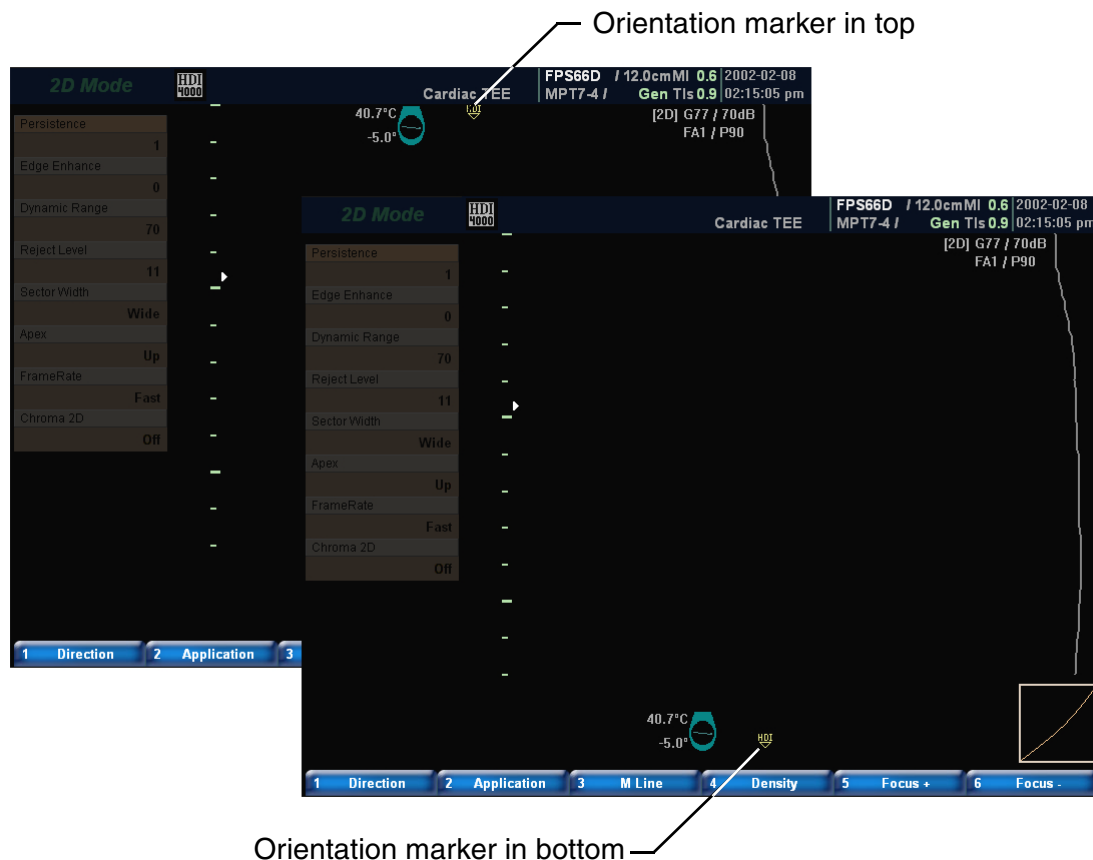


Image Orientation

Image presentation is defined by the location of the orientation marker. Top (normal) and bottom image presentations are shown in [Figure 4-7](#).

Figure 4-7 Top/Bottom Image Presentation



Thermal Monitor

As a safety precaution, a thermal sensor is mounted on the MPT7-4 scanhead tip adjacent to the transducer array. This sensor is part of the ultrasound system's thermal monitoring system, which provides continual thermal monitoring at the scanhead tip while the MPT7-4 is selected. The temperature, measured in degrees Celsius, is displayed as part of the scanhead icon.

When the patient applied part temperature (PAPT) is greater than or equal to 44 degrees Celsius, the following warning is displayed:

Approaching thermal limit.

If this message appears, then reduce output power, lower PRF, or change imaging parameters to reduce scanhead tip heating. The temperature will be updated as it changes.

The system will assume a circuit failure at PAPT that is greater than or equal to 45 degrees Celsius. This situation will result in an electronic disconnect of the MPT7-4 and the display of the following messages:

Critical scanhead temperature.

Please reselect the scanhead.

Selecting OK will display the **Scanhead Select** display. You can reselect the MPT7-4 from this display.

If you wish to resume scanning, use a lower power setting. If the scanhead does not enable within two minutes, or becomes disabled again, discontinue use and call an Philips Ultrasound representative.

Due to limited clinical experience with febrile subjects, clinical utility of the thermal monitor shutdown threshold under these conditions has not been established. A patient with a fever may cause the system to disable the transducer. If this occurs, attempt scanning at a lower power setting or change modes.

Operating Instructions

Inspection

Before using the scanhead, examine it for damage to the scanhead tip, casing, cable, and connector.

WARNING

Do not use the scanhead if there are any signs of damage to the cable, connectors, casing, scanhead tip, or any other part. Notify your local Philips Ultrasound representative in the event of observed or suspected damage.

Scanning the Patient

- WARNINGS**
- The MPT7-4 is to be used only by a skilled, trained physician. Before scanning, the physician should be thoroughly familiar with the articulating device (scan plane orientation, range of deflection, and position indicators).
 - Prior to each exam, examine the scanhead for damage.
 - Do not manipulate the MPT7-4 scanhead while inserted in a “locked” position (refer to ["Articulating Device Characteristics"](#) on [page 59](#)). While it is physically possible to do so, it is difficult for the operator to gauge the amount of pressure applied to internal surfaces, and a hazard to the patient exists.
 - If you encounter resistance while manipulating the scanhead in the esophagus or stomach, stop the procedure immediately.
 - Follow approved medical practices when anesthetizing and positioning the patient, inserting the scanhead into the esophagus and locating anatomic structures. Ensure the patient’s airway remains open at all times.

CAUTION *Do not* use the MPT7-4 without a bite guard. The MPT7-4 can be damaged if a bite guard is not used. Mechanical damage can be very costly to repair and is not covered by the warranty. Bite guards are available from CIVCO Medical Instruments (see ["Ordering Supplies and Accessories"](#) on [page 17](#)).

➤ **To scan the patient with the MPT7-4**

1. Insert the bite guard into the patient’s mouth.
2. Introduce the gastroscope with the array lens surface of the scanhead facing toward the patient’s tongue. As the scanhead enters the esophagus, a 60-degree bend in the tip of the gastroscope using the articulation knobs may aid insertion; straighten the tip once the esophagus is entered.
3. Most images are acquired from points between 25 and 45 centimeters of depth, measured from the patient’s incisor teeth. Markings on the gastroscope from 20 cm to 100 cm (every 10 cm measured from the scanhead tip) are provided for reference.
4. The scanhead orientation in the esophagus may be adjusted by turning the handle about the scanhead longitudinal axis; the transducer array may be deflected laterally (right/left) and anteriorly/posteriorly by rotating the adjustment knobs.

Maintenance and Storage

CAUTION Before cleaning the scanhead or using any disinfectant, refer to *Using Disinfectants and Gels*, 4700-0249-XX, for information on cleaning and compatibility of scanhead and disinfectant.

Before you store or transport the MPT7-4, ensure that you install the tip guard over the tip of the MPT7-4. The tip guard is a cylindrical foam protector that fits over the distal tip of a transesophageal scanhead to protect the transducer from damage. Tip guards are available from CIVCO Medical Instruments (see "[Ordering Supplies and Accessories](#)" on [page 17](#)).

WARNING To protect against disease transmission, do not reuse a tip guard. Once you remove the tip guard, dispose of it. Install a new tip guard before storing or transporting the MPT7-4.

5 Probe Covers

5 *Probe Covers*

Overview

Probe covers are recommended for clinical applications of an invasive nature, including intraoperative, transrectal, intravaginal, transesophageal, and biopsy procedures. Philips Ultrasound recommends the use of qualified covers. See CIVCO Medical Instruments Supplies and Accessories in ["Read This First"](#) to order qualified covers.

-
- WARNINGS**
- Some probe covers contain natural rubber latex and talc, which can cause allergic reactions in some individuals. Refer to the FDA Medical Alert, March 29, 1991, reprinted here.
 - In neurosurgical applications, sterilized scanheads should be used with sterile gel and a sterile pyrogen-free probe cover.
 - If the sterile probe cover becomes compromised during an intraoperative application involving a patient with Creutzfeldt-Jakob disease, the probe cannot be sterilized with any sterilization method.
-

FDA Medical Alert, March 29, 1991, Allergic Reactions to Latex-Containing Medical Devices

Because of reports of severe allergic reactions to medical devices containing latex (natural rubber), the FDA is advising health care professionals to identify their latex sensitive patients and be prepared to treat allergic reactions promptly. Patient reactions to latex have ranged from contact urticaria to systemic anaphylaxis. Latex is a component of many medical devices, including surgical and examination gloves, catheters, intubation tubes, anesthesia masks, and dental dams.

Reports to the FDA of allergic reactions to latex-containing medical devices have increased lately. One brand of latex cuffed enema tips was recently recalled after several patients died as a result of anaphylactoid reactions during barium enema procedures. More reports of latex sensitivity have also been found in the medical literature. Repeated exposure to latex both in medical devices and in other consumer products may be part of the reason that the prevalence of latex sensitivity appears to be increasing. For example, it has been reported that 6% to 7% of surgical personnel and 18% to 40% of spina bifida patients are latex sensitive.

Proteins in the latex itself appear to be the primary source of the allergic reactions. Although it is not now known how much protein is likely to cause severe reactions,

the FDA is working with manufacturers of latex-containing medical devices to make protein levels in their products as low as possible.

FDA's recommendations to health professionals in regard to this problem are as follows:

- When taking general histories of patients, include questions about latex sensitivity. For surgical and radiology patients, spina bifida patients and health care workers, this recommendation is especially important. Questions about itching, rash or wheezing after wearing latex gloves or inflating a toy balloon may be useful. Patients with positive histories should have their charts flagged.
- If latex sensitivity is suspected, consider using devices made with alternative materials, such as plastic. For example, a health professional could wear a non-latex glove over the latex glove if the patient is sensitive. If both the health professional and the patient are sensitive, a latex middle glove could be used. (Latex gloves labeled "Hypoallergenic" may not always prevent adverse reactions.)
- Whenever latex-containing medical devices are used, especially when the latex comes in contact with mucous membranes, be alert to the possibility of an allergic reaction.
- If an allergic reaction does occur and latex is suspected, advise the patient of a possible latex sensitivity and consider an immunologic evaluation.
- Advise the patient to tell health professionals and emergency personnel about any known latex sensitivity before undergoing medical procedures. Consider advising patients with severe latex sensitivity to wear a medical identification bracelet.

The FDA is asking health professionals to report incidents of adverse reactions to latex or other materials used in medical devices. (See the October 1990 FDA Drug Bulletin.) To report an incident, call the FDA Problem Reporting Program, operated through the U.S. Pharmacopoeia toll-free number: 800-638-6725. (In Maryland, call collect 301-881-0256.)

For a single copy of a reference list on latex sensitivity, write to: LATEX, FDA, HFZ-220, Rockville, MD 20857.

WARNINGS

- Probe covers are disposable and must not be reused.
 - If an installed probe cover is cut or contaminated prior to use, the probe should be cleaned and disinfected, and a new sterile cover installed.
-

Installing the Probe Cover

A cover is recommended for some ultrasound procedures, including intracavity, surgical, and biopsy procedures. The basic installation is described in the following procedure.

► **To install the cover**

1. Wearing sterile gloves and without unrolling the cover, remove the cover from its package.
2. Refer to the figure of the type of cover you are using, and fill the cover with sterile acoustic coupling gel as shown in the appropriate figure ([Figure 5-1](#) or [Figure 5-2](#)).
3. Insert the tip of the scanhead into the center of the rolled cover, and then unroll or pull the cover to completely cover the scanhead, and if appropriate, the scanhead cable.

WARNING Maintain the sterility of the cover.

Figure 5-1 Applying Gel to a Cover: Example 1

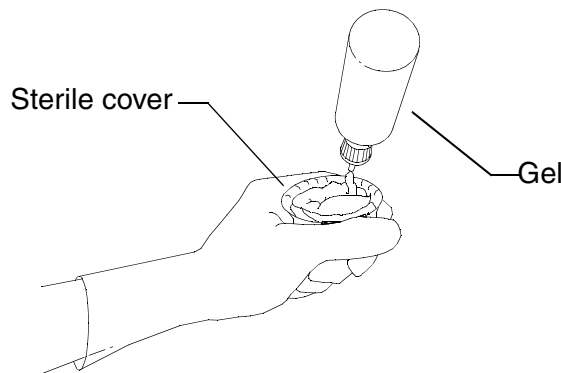
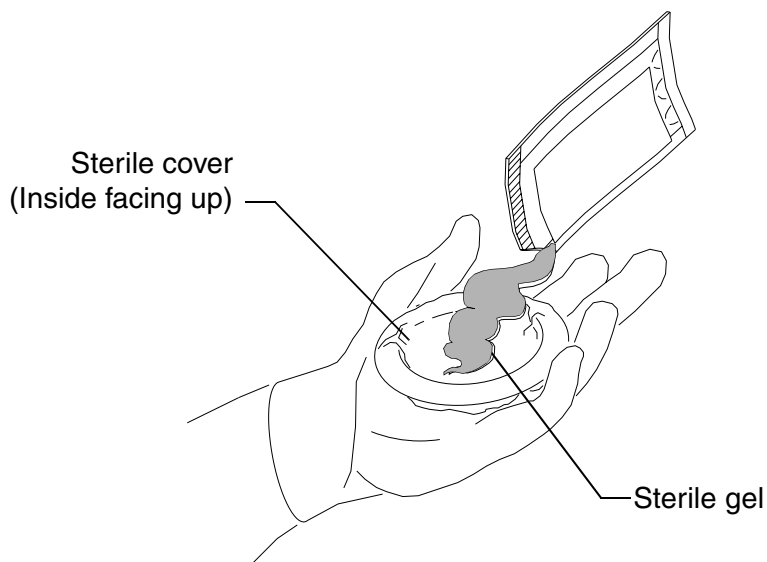


Figure 5-2 Applying Gel to a Cover: Example 2

4. Pull the tip of the sterile cover snugly over the scanhead, ensuring there are no air bubbles in the acoustic gel on the face of the array.
5. Secure the cover to the scanhead, and if appropriate, the scanhead cable. A securing O-ring is not required if a biopsy guide is installed over the cover on the scanhead.

CAUTION

The tape strips are very strong. To remove them, carefully cut the tape with blunt-end scissors. Do not use scalpels or other sharp instruments that will damage the cable or scanhead.

6. After the exam, dispose of the cover.

6 Biopsy Guides

6 *Biopsy Guides*

Biopsy guides are used to assist in the guidance of a biopsy tool. The system generates a guideline that represents the anticipated path of the biopsy tool. The echoes of the anatomical target and the tool are displayed on the video display and assist in guiding the biopsy tool to the target.

Starter kits, which include the biopsy guide or biopsy guide bracket and procedure kits, are available from CIVCO Medical Instruments; see ["Ordering Supplies and Accessories"](#) on [page 17](#).

Attaching and Removing a Biopsy Guide

Detailed information about attachment and removal of biopsy guides is shipped with the biopsy starter kits, guides, and brackets.

-
- WARNINGS**
- Inspect all components. Ensure that the biopsy guide you are using is the correct one for the scanhead, the system, and system software. Your Philips Ultrasound customer service representative can verify this information for you.
 - Alignment verification must be performed at the selected depth for the intended procedure, prior to a biopsy procedure. See ["Verifying the Biopsy Guide Alignment"](#) on [page 79](#).
 - Use only Philips-approved biopsy guides, brackets, supplies, components, and accessories. Other brands may not properly fit Philips Ultrasound scanheads. Improper installation may result in patient discomfort.
 - Some biopsy guides must be installed over a sterile scanhead cover. See the ["Probe Covers"](#) section of this manual.
 - Biopsy guides must be sterilized after each use. Refer to *Using Disinfectants and Gels*, 4700-0249-XX.
 - Most scanheads can only be disinfected; they cannot be sterilized. Only the probecover provides the sterile barrier.
-

Using the Biopsy Guideline Display

WARNING Do not attempt to use the biopsy guide until you have read the instructions for selecting the display, installing the sterile probe cover, and verifying alignment of the biopsy guide.

The system generates a biopsy guideline through the displayed real-time ultrasound image to indicate the anticipated path of the needle. You can use this guideline to ensure that the needle or instrument is following the correct path.

When the biopsy display is active, a biopsy guideline is displayed on the left side of the screen during normal image presentation and on the right side when the image presentation is reversed. Image presentation is defined by the location of the orientation marker.

When depth is changed, the biopsy display is redrawn to reflect the new relationships at the new depth setting.

► **To show or hide the biopsy guideline**

1. Press the **UTILITY** control. The **Utility** menu appears.
2. Turn the **MENU** control to highlight **Biopsy**.
3. Press **SELECT** to display the **Biopsy** menu.
4. Turn the **MENU** control to highlight **Biopsy**.
5. Press **SELECT** to turn the biopsy guideline on or off ([Figure 6-1](#)).

Figure 6-1 Biopsy Guideline



Verifying the Biopsy Guide Alignment

Perform the alignment verification before the biopsy procedure. The alignment verifies the system, scanhead, and biopsy guide relationships.

- WARNINGS**
- Alignment verification is necessary prior to performing procedures with the biopsy guide.
 - Do not use the biopsy guide if the needle is not following the intended path.
 - The needle used for this alignment verification must not be used for the actual procedure. Always use a new, sterile needle for each biopsy procedure.
 - To assist in an accurate projection of the needle, use a straight, new needle for each alignment procedure.

Do not use the biopsy guide, if the needle is not following its indicated path. Contact a Philips Ultrasound customer service representative.

The following items are needed for the alignment verification:

- Scanhead
 - Biopsy guide or bracket (The bracket is not disposable. The type of bracket you use depends upon the scanhead you are using. For the correct bracket, contact CIVCO Medical Instruments; see ["Ordering Supplies and Accessories"](#) on [page 17](#).)
 - Needle guide (Contact CIVCO for the needle guide that fits your biopsy guide bracket).
 - Sterile procedure kit (disposable)
 - New, straight, biopsy needle
 - Beaker of water (or water bath)
- **To verify alignment of the biopsy guide for the C5-2, C7-4, C8-5, L7-4, L12-5 38 mm, L 12-5 50 mm, P4-2, P5-3, P7-4, 3D5-3, and the 3D7-4 scanheads**
1. Attach the biopsy guide.
 2. Set the system depth for the procedure to be performed.
 3. Display the biopsy guideline as described in ["To show or hide the biopsy guideline"](#).
 4. Immerse the scanhead no more than 6 mm (0.25 in) into the water bath.
 5. Insert a straight, new needle into the biopsy guide.
 6. Move the needle down into the water bath until its ultrasound image is visible on the video display.

WARNING If the needle enters from the unexpected side of the display, verify that the biopsy guide is correctly mounted on the scanhead and that the orientation of the scanhead is correct. If the needle is still not following the expected path along the guideline, *do not use* the biopsy guide. Contact your Philips Ultrasound customer service representative.

7. Verify that the needle, as seen on the video display, falls along the guideline along the entire depth of the guideline display. The biopsy guideline is only intended to provide an indication of the expected path of the needle. Actual position must be verified by identifying the echoes from the needle.

► **To verify alignment of the biopsy guide for the C9-5 ICT, C8-4v, and the 3D8-5v scanheads**

1. Attach the biopsy guide. A second probe cover is unnecessary for the alignment verification.
2. Set the system depth to maximum.
3. Display the biopsy guideline as described in ["To show or hide the biopsy guideline"](#).
4. Immerse the scanhead no more than 6 mm (0.25 in) into the water bath.
5. Insert a straight, new needle into the biopsy guide.
6. Move the needle down into the water bath until its ultrasound image is visible on the video display.

WARNING

If the needle enters from the unexpected side of the display, verify that the biopsy guide is correctly mounted on the scanhead and that the orientation of the scanhead is correct. If the needle is still not following the expected path along the guideline, *do not use* the biopsy guide. Contact your Philips Ultrasound customer service representative.

7. Verify the needle, as seen on the display, falls along the guideline along the entire depth of the guideline display. The biopsy guideline is only intended to provide an indication of the expected path of the needle. Actual position must be verified by identifying the echoes from the needle.

Biopsy Procedure

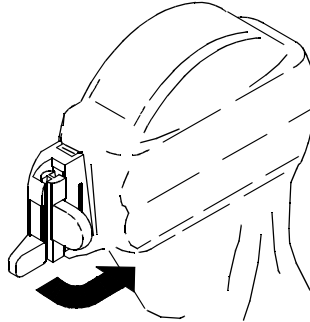
- WARNINGS**
- Alignment verification should be performed at the selected depth prior to the biopsy procedure to ensure that the biopsy guide and the needle have been installed properly.
 - Use a straight, new needle for each procedure.
 - The biopsy guideline is intended only to provide an indication of the expected path of the needle. Actual position must be verified by identifying the echoes from the needle.
 - If the needle is not following the expected path, discontinue the procedure and contact your Philips Ultrasound customer service representative.
 - Thin needles can bend when entering tissue. Actual position must be verified by identifying the echoes from the needle.
 - Reverberation or other tissue artifacts may produce false needle images, which can cause confusion in locating the actual needle image. Ensure the needle path is along the guideline, and that you are not using a false needle image to locate the needle.
 - Philips Ultrasound does not recommend anatomical survey of the prostate with the biopsy guide attached.
-

➤ **To perform a biopsy procedure**

1. Install the scanhead cover and the biopsy guide.
2. Set the system controls for the biopsy procedure.
3. Orient the scanhead to match image presentation. Use the 2D scan plane orientation marker.
4. If necessary, apply sterile acoustic coupling gel to the patient.
5. Begin scanning the patient. Position the scanhead so that the puncture target is intersected by the guideline displayed on the screen.
6. Insert the needle into the needle guide groove closest to the scanhead.
7. Perform the puncture by sliding the needle through the groove in the guide until the needle, as shown on the display, intercepts the target.
8. If you are using a biopsy guide bracket and procedure kit, you can remove the scanhead from the patient while the needle is still inserted in the patient: Separate the needle from the biopsy guide by pulling the tab up so that the pin snaps out of the needle guide ([Figure 6-2](#)).

9. Remove the biopsy guide after use, as described in the instructions included with the biopsy guide or bracket.

Figure 6-2 Releasing the Needle



Turn to unlock

Biopsy Guide Maintenance

WARNING The procedure kit components are disposable and must not be reused.

CAUTION Before cleaning, disinfecting, or sterilizing the biopsy guide or the transition wedge, refer to *Using Disinfectants and Gels*, 4700-0249-XX.

7 Peripherals

7 *Peripherals*

Printing

You can print using an internal device or an external device. The device can be a color printer, black-and-white printer, or a report printer. The system interface for printing is consistent across the range of compatible devices. For internal devices, the primary system print controls are located on the system control panel. The different print devices and their controls are all covered in the device manufacturer's operating instructions, which are included with each device shipped by Philips Ultrasound.

WARNING All OEM devices, when external to the system, must be connected to a grounded outlet. Do not defeat the ground.

CAUTION Do not operate a device if condensation is present inside the device. Before operating the device, replace a damp paper roll. The paper roll can be used after all traces of condensation are gone.

Adjusting Print Quality

Examine the print for print quality. If print quality is unacceptable, refer to the manufacturer's instructions for printer control adjustments that affect print quality.

- Notes**
- *Do not touch prints with wet hands, or the prints may fade.*
 - *Store prints in a low-humidity location away from direct sunlight to avoid discoloration or deterioration of the image.*
 - *When print paper absorbs volatile organic solvents such as alcohol, ether, and ketone, the image will discolor or fade. Cellophane tapes and soft vinyl chlorides also may cause discoloration or fading. Also, avoid contact with wet diazo copies, as the image may fade away.*
 - *Dirt or dust on the paper can result in poor-quality prints. Advance or feed the paper until clean paper is visible.*
 - *Paper loading instructions and diagrams are sometimes located inside the device door.*
 - *If the paper is stuck or jammed, refer to the information in the manufacturer's instructions on correcting paper jams.*

Image Printers

Black-and-White Printer

The black-and-white printer is used to print black-and-white screen images. You can use the **PRINT** control to print with either the black-and-white printer or the color printer, depending upon which one is connected to the remote print input on the rear panel of the system. In the following procedures, we assume the black-and-white printer is connected to the remote print input.

► **To print with the black-and-white printer**

1. Acquire the desired image.
2. Press the printer **PRINT** control, or press the system **PRINT** control.

Color Printer

The color printer is used to print color images. After capturing the color image you can use the color printer remote control to print the color images. You can use the **PRINT** control to print with the color printer if you connect it to the remote print input on the rear panel of the system.

► **To print with the color printer**

1. Acquire the desired image.
2. Press the printer **CAPTURE** control.
3. Press the printer **PRINT** control. (You can use the system **PRINT** control to print with either the black-and-white printer or the color printer, depending upon which one is connected to the remote print input on the rear panel of the system.)

Report Printer

You can use a compatible report printer to print reports or text. A report printer is much more cost-effective than an image printer, especially when printing text.

► **To use the report printer**

1. Select the desired report page.
2. Click **Print**.

Recording

For recording the High Definition video images generated by the system, a state-of-the-art recording device, specially developed and manufactured for the system, is provided. The S-VHS VCR is recommended for recording and playback of ultrasound images. A copy of the manufacturer's operating instructions for your VCR

has been included with the VCR. Please read the manufacturer's operating instructions before connecting, operating, or adjusting the VCR. The VCR accommodates different sizes of videocassette tapes with different recording and playback times. Use only the cassette tapes compatible with the VCR.

VCR playback with an external VCR (one connected to the rear of the system) is controlled with the VCR controls.

The VCR has a video indexing system; refer to the VCR operating instructions for information on this topic or any related VCR topic.

CAUTIONS

- Do not insert a videotape before the system has completed the initialization and warm-up phase.
 - Periodically clean the external surfaces of a device with a soft cloth. Stubborn stains may be removed with a cloth lightly dampened with a mild detergent solution.
-

VCR Record

➤ To use the VCR to record

1. Ensure the patient data is accurate.
2. Press **RECORD** on the system control panel.

VCR Playback

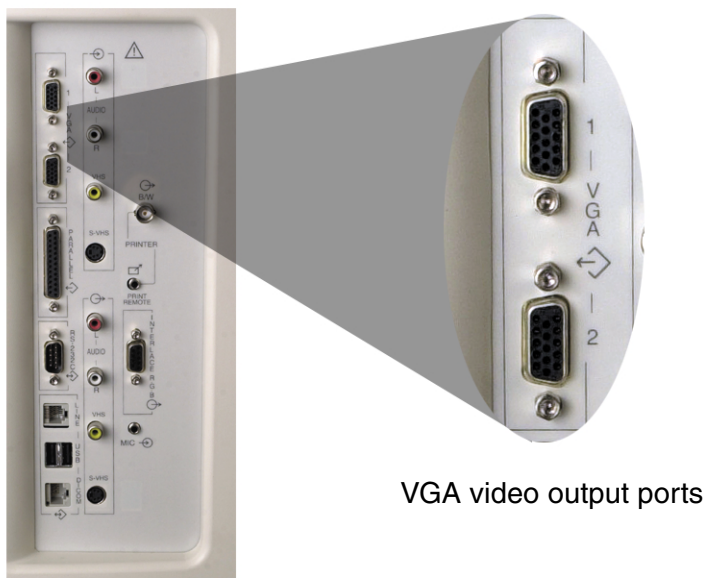
➤ To view VCR playback on the system monitor

1. Press **UTILITY** to display the **Utility** menu.
2. Select **VCR**.
3. Press any of the following blue menu keys to perform the necessary functions:
 - **Play** to play back the video at normal speed
 - **Stop** to stop the playback
 - **REW** to rewind the video tape
 - **FF** to advance the video tape
 - **Counter** to display the VCR counter dialog
 - **Search** to enter search mode

External Color Monitor

You can connect a compatible external color monitor to a **VGA** video output port on the rear panel of the ultrasound system ([Figure 7-1](#)). You can also connect external monitors to the **S-VHS**, **INTERLACE RGB**, and **PATIENT MONITOR** video output ports. **VGA** will provide the best quality image. The power cord for the external monitor plugs directly into the wall socket.

Figure 7-1 Connecting an External Color Monitor



VGA video output ports

8 Maintenance

8 *Maintenance*

Maintenance should be performed as needed. Contact your Philips Ultrasound customer service representative for more information.

Ultrasound System

WARNING Always turn off the system, and then disconnect the system from the wall outlet before performing maintenance or cleaning.

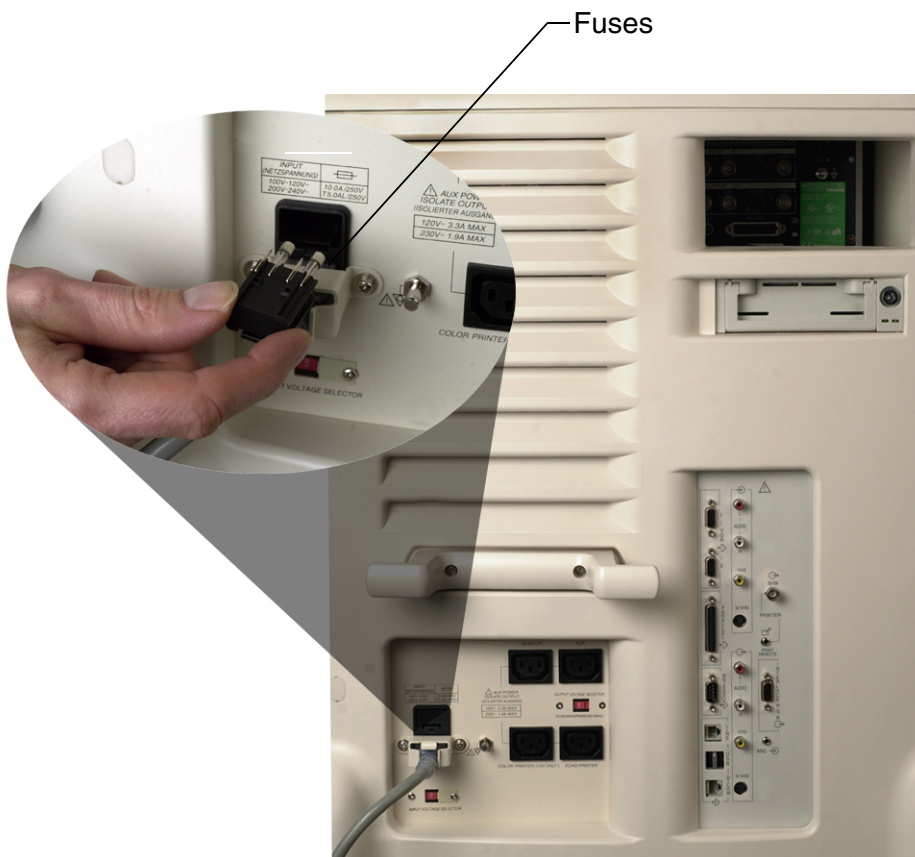
CAUTION Do not use strong solvents such as thinner or benzine, or abrasive cleansers, because these will damage the cabinet.

Circuit Protection

All systems have two primary fuses for protection.

➤ **To exchange the fuses**

1. Turn off the system.
2. Unplug the system from the wall socket.
3. On the bottom back of the system, remove the fuse holder with a common screwdriver ([Figure 8-1](#)).
4. Check the fuses. Replace the fuses, if necessary.

Figure 8-1 Fuse Replacement

Cleaning

Periodically, clean all exterior surfaces of the system using a soft cloth moistened with a mild detergent solution. For chemically compatible cleaning solutions, see *Using Disinfectants and Gels*, 4700-0249-XX, on your system user-information compact disc.

When cleaning the system keyboard and monitor, take care not to get any solution inside the housings. Also take care not to scratch the face of the monitor while cleaning it.

Scanheads

For all information regarding scanhead cleaning and disinfection and the use of acoustic coupling gels, refer to *Using Disinfectants and Gels*, 4700-0249-XX, on your system user-information compact disc.

Printers

WARNING Before performing any maintenance on a device, always disconnect it from the source of power by either of the following: Disconnect the system from the wall outlet, if the device is internal to the system; or disconnect the device from the wall outlet, if it is external to the system.

CAUTION Do not scratch the roller or allow dirt and dust to contact the roller of a printer.

Care of the Printer Cabinet

CAUTIONS

- Do not use strong solvents such as thinner or benzine, or abrasive cleaners, because these will damage a device cabinet.
- Periodically clean the external surfaces of a device with a soft cloth. Stubborn stains may be removed with a cloth lightly dampened with a mild detergent solution.

9 Troubleshooting

9 Troubleshooting

If you encounter difficulty in the operation of the system, use the information in this section to help correct the problem. If the problem is not covered here, contact your Philips Ultrasound customer service representative.

Troubleshooting Table

The troubleshooting table contains a list of symptoms and the actions to take to correct the problems ([Table 9-1](#)).

Table 9-1 Troubleshooting

Symptom	Corrective Action
The system does not power up. The monitor indicator light is off.	1. Verify the power connections. 2. Check the fuses.
The monitor indicator light is on, but there is no image.	1. After power up, the system takes about 20 seconds to initialize. During this time the monitor is blank. 2. After 20 seconds, adjust the monitor brightness and contrast controls. 3. Check the monitor cables and connections.
No audio from the system speakers.	Use the VOLUME control to ensure the speakers are not muted.

Error Messages

The system also displays error messages in response to operating or error conditions detected by the system. The error messages must be noted and reported to your Philips Ultrasound customer service representative. Do not use the system if an error message is displayed.

10 Specifications

10 Specifications

Physical Dimensions

- Width: 64.77 cm (25.5 in)
- Height: 148.5 cm (58.5 in)
- Depth: 109.0 cm (42.9 in)
- Weight: approximately 101 kg (222.7 lb)

Gray Shades

256 (8 bits)

Channels

512 digital channels

CPU

Pentium 3

Monitor

15-inch monitor with individual brightness and contrast controls, on a tilt/swivel mount, with 128 hues of color available

Input Signals

- Video: composite video, S-VHS
- Three scanhead receptacles
- Pencil probe receptacle

Output Signals

Composite video output to VCR, external monitor, report printer

Maximum Measurable Doppler Velocities

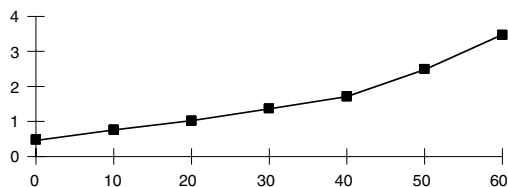
The accuracy with which maximum measurable Doppler velocity (MMV) can be measured is related to the accuracy of the parameters shown in [Table 10-1](#). The maximum measurable Doppler velocities using a 0° Doppler angle with an accuracy of $\pm 1\%$ are shown in [Table 10-2](#) and [Table 10-3](#). If angle correction is used, the MMV will increase. For example, with an angle correction of 60°, the MMV will be twice that listed in [Table 10-2](#). See [Figure 10-1](#) for the variation of accuracy with Doppler angle.

Table 10-1 Doppler Accuracy

Parameter	Systematic Error	Notes
Doppler frequency	$\pm 0.4 \%$	As a function of maximum frequency
Doppler angle	$\pm 1^\circ$	See Figure 10-1
Velocity	$\pm 0.4 \%$	As a function of maximum velocity at 0° Doppler angle
Time	± 2.5 ms	Slow scroll rate
	± 5 ms	Medium scroll rate
	± 10 ms	Fast scroll rate

Figure 10-1 Accuracy Variation with Doppler Angle

% Accuracy variation



Doppler angle (degrees)

Table 10-2 Maximum Measurable Doppler Velocities: Pulsed Wave

Scanhead	Doppler Frequency (MHz)	MMV (m/sec)
C5-2	2.6	6.9
C7-4	3.6	4.9
C8-4v	5.1	3.5
C8-5	5.1	3.5
C9-5 ICT	5.1	3.5
CL15-7	6.2	2.9

Table 10-2 Maximum Measurable Doppler Velocities: Pulsed Wave (Continued)

Scanhead	Doppler Frequency (MHz)	MMV (m/sec)
L7-4	4.7	4.3
L12-5 38 mm	5.6	2.2
L12-5 50 mm	5.6	2.2
P4-2	2.0	8.6
P5-3	2.8	6.3
P7-4	3.8	4.6
MPT7-4	3.6	4.9
3D5-3	2.6	6.9
3D7-4	2.8	6.3
3D8-5v	5.1	3.4

Table 10-3 Maximum Measurable Doppler Velocities: Continuous Wave

Scanhead	Doppler Frequency (MHz)	MMV (m/sec)
MPT7-4	3.6	9.1
P4-2	2.0	15.6
P5-3	2.8	11.8
P7-4	3.8	9.1
D2 CW	3.1	17.2
D5 CW	3.1	7.0

Peripherals

- Black-and-white printer
- Color printer
- Super VHS VCR
- Report printer

Modality Interface

DICOM standard

Electrical Parameters

- 120 V, 60 Hz
- 220-240 V, 50/60 Hz

Languages

- English
- French
- German
- Italian
- Spanish

Pressure Limits

- Operating: 700 hPa to 1,060 hPa
- Storage: 500 hPa to 1,060 hPa

Humidity Limits

- Operating: 30% to 75%
- Storage: 10% to 95%

Temperature Limits

- Operating: 10°C to 40°C (50°F to 104°F)
- Storage: -10°C to 60°C (14°F to 140°F)

Safety Requirements

- Classification:
 - Class I equipment with Type BF and CF applied parts
 - Ordinary Equipment
 - Non-AP/APG
- Electromechanical safety standards met:
 - CSA C22.2 No. 601.1, Canadian Standards Association, Medical Electrical Equipment
 - EN 60601-1, Second Edition, including Amendments 1 and 2, European Norm, Medical Electrical Equipment

- EN 60601-1-2, First Edition, European Norm, Collateral Standard, Electro-magnetic Compatibility
- IEC 1157:1992, International Electrotechnical Commission, Requirements for the declaration of the acoustic output of medical diagnostic ultrasonic equipment
- UL 2601-1, Underwriters Laboratories, Medical Electrical Equipment
- Agency approvals:
 - Canadian Standards Association (CSA)
 - ISO 9001 Quality Assurance Standard
 - CE marked to the European Community Medical Device Directive 93/42/EEC as a Class IIa device

Philips Ultrasound reserves the right to change specifications contained herein or discontinue manufacture at any time without prior notice. Current specifications are supplied with each system purchased or are available from your Philips Ultrasound representative.

11 References

11 References

Cardiology

Table 11-1, Table 11-2, and Table 11-3 contain the cardiology calculations for the 2D, M-mode, and Doppler protocols. The reference numbers in these tables refer to Table 11-4, which lists the references for the calculations.

Table 11-1 2D Cardiology Protocols

Cardiology Protocol	Calculation	Reference Number (Table 11-4)
Simpson	A4C Diastole/A4C Systole	4
	A2C Diastole/A2C Systole	4
	Bi. Dias Vol./Bi. Sys Vol.	4
	Stroke Volume	3
	Stroke Volume Index	3
	Cardiac Output	3
	Cardiac Index	3
	Ejec Frac	3
Vol A/L	LV Vol. Diastole/LV Vol. Systole	4
	Stroke Volume	3
	Stroke Volume Index	3
	Cardiac Output	3
	Cardiac Index	3
	Ejec Frac	3

Table 11-1 2D Cardiology Protocols (Continued)

Cardiology Protocol	Calculation	Reference Number (Table 11-4)
2D Measure	IVSd/IVSs	2
	LVDd/LVDs	3
	LVPWd/LVPWs	2
	LV Vol. d/LV Vol. s	9, 10, 11
	Stroke Volume	3
	Stroke Volume Index	3
	Cardiac Output	3
	Cardiac Index	3
	Ejec Frac	3
	LV Mass	6, 7, 8
LV Mass	All calculations	4

Table 11-2 M-Mode Cardiology Protocols

Cardiology Protocol	Calculation	Reference Number (Table 11-4)
Left Ventricle	LV Vol. d/LV Vol. s	9,10,11
	Stroke Volume	3
	Cardiac Output	3
	Ejec Frac	3
	Frac Short	3
	LV Mass	6, 7, 8
	LV Mass Index	3
Ao/LA	Ao Cusp Sep	1
	Ao Root Dia	1
Mitral Valve	All calculations	1

Table 11-3 Doppler Cardiology Protocols

Cardiology Protocol	Calculation	Reference Number (Table 11-4)
Mitral Valve Inflow	All calculations	3
Mitral Valve Regurgitation	All calculations	3,5
LVOT Doppler	All calculations	3
Aortic Valve Systolic Flow	All calculations	3,12
Aortic Valve Regurgitation	All calculations	3,5
Tricuspid Valve Inflow	All calculations	3
Tricuspid Valve Regurgitation	All calculations	3,5
Pulmonary Valve Inflow	All calculations	3
Pulmonary Valve Regurgitation	All calculations	3,5
Pulmonic Veins	All calculations	3
Qpulm:Qsys	All calculations	3

Table 11-4 References for Cardiology Calculations

Number	Reference
1	Feigenbaum, H. <i>Echocardiography, Fifth Edition</i> . Lea & Febiger, Philadelphia, 1994.
2	Laurenceau, J. L., Malergue, M.C. <i>The Essentials of Echocardiography</i> . Le Hague: Martinus Nijhoff, 1981.
3	Oh, J.K., Seward, J.B., Tajik, A.J. <i>The Echo Manual</i> . Boston: Little, Brown and Company, 1994.

Table 11-4 References for Cardiology Calculations (Continued)

Number	Reference
4	Schiller, N.B., Shah, P.M., Crawford, M., et. al. "Recommendations for Quantitation of the Left Ventricle by Two-Dimensional Echocardiography." <i>Journal of American Society of Echocardiography</i> . September-October 1989, 2:362.
5	Schmailzl, K.J.G., Ormerod, O. <i>Ultrasound in Cardiology</i> . Blackwell Science, Cambridge, 1994.
6	Byrd, B.F., et. al. "Left ventricular mass and volume/mass ratio determined by two-dimensional echocardiography in normal adults." <i>Journal of American College of Cardiology</i> . 6, 1021, 1985.
7	Devereux, R.B., et al. "Echocardiographic Assessment of Left Ventricular Hypertrophy: Comparison to Necropsy Findings." <i>American Journal of Cardiology</i> , 1986, Vol. 57, p. 450-458.
8	Sahn, D., DeMaria, A., Kisslo, J., Weyman, A. The Committee on M-mode Standardization of American Society of Echocardiography, "Recommendations Regarding Quantitation in M-Mode Echocardiography: Results of a Survey of Echocardiographic Measurements." <i>Circulation</i> , 1978, Vol. 58, No. 6, p. 1072-1083.
9	Teichholz, L.E., Kreulen, T., Herman, M.V., et. al. "Problems in echocardiographic volume determinations: echocardiographic-angiographic correlations in the presence or absence of asynergy." <i>American Journal of Cardiology</i> , 1976, 37:7.
10	Pombo, J.F., et.al. "Left Ventricular Volumes and Ejection Fraction by Echocardiography." <i>Circulation</i> , Vol. XLIII, 482, April, 1971.
11	Harry, Mark, J. <i>Basic Echocardiography</i> . Iowa Heart Center. January, 1997.
12	Otto, C.M., Pearlman, A.S., et. al. "Simplification of the Doppler Continuity Equation for Calculating Stenotic Aortic Valve Area." <i>Journal of American Society of Echocardiography</i> , 1:155-157, 1988.

General

Goldberg, B.B., Kurtz, A.B. *Atlas of Ultrasound Measurements*. Year Book Medical Publishers, 1990.

Body Surface Area (BSA) in Square Meters

Grossman, W. "Blood Flow Measurement: Hemodynamic Principles." *Cardiac Catheterization and Angiography*, 1980, p. 90.

Gynecology

Beyer, W.H. *Standard Mathematical Tables, 28th Edition*. CRC Press, Boca Raton, Florida, 1987, page 131.

Hip Angle

Goldberg, B.B., Kurtz, A.B. *Atlas of Ultrasound Measurements*. Year Book Medical Publishers, 1990, p. 20-30.

Obstetrics

Amniotic Fluid Index (AFI)

Jeng, C.J., et.al., "Amniotic Fluid Index Measurement with the Four Quadrant Technique During Pregnancy." *The Journal of Reproductive Medicine*, 35: 7, 674-677, July 1990.

Biophysical Profile

Manning, Frank A., Platt, L., Sipos, L. "Antepartum Fetal Evaluation: Development Of A Fetal Biophysical Profile." *American Journal Obstetrical Gynecology*, Volume 136 No. 6, March 15, 1980, p. 787-795.

Gestational Age (G.A.)

Abdominal Circumference (AC)

Campbell, Professor Campbell's Group at Harris Birthright Centre, King's College Hospital.

Hadlock, F., Deter, R.L., Harrist, R.B., Park, S.K. "Estimating Fetal Age: Computer-Assisted Analysis of Multiple Fetal Growth Parameters." *Radiology*, 1984, 152: 497-501. (Biometric Age and Growth Equations)

Hansmann, Hackeloer, Staudach, Wittman. *Ultrasound Diagnosis in Obstetrics and Gynecology*. Springer-Verlag, New York, 1986, p.431.

Merz, E., Goldhofer, W., Timor-Tritsch, E. *Ultrasound in Gynecology and Obstetrics*. Textbook and Atlas, 308-338, Georg Thieme Verlag, 1991.

Tokyo. *Japan Journal of Medical Ultrasonics*, Vol. 23, No. 12, 1996.

Antero-Posterior Diameter (APD)

Hansmann, M., Hackeloer, Staudach, Wittman. *Ultrasound Diagnosis in Obstetrics and Gynecology*. Springer-Verlag, New York, 1986, p. 431. (or Ultraschallbiometrie im II. und III. Trimester der Schwangerschaft. *Gynäkologe* 9:133, 1976, p. 138.)

Antero-Posterior Thorax Diameter (APTD)

Hansmann, M., Hackeloer, Staudach, Wittman. *Ultrasound Diagnosis in Obstetrics and Gynecology*. Springer-Verlag, New York, 1986. (or Ultraschallbiometrie im II. und III. Trimester der Schwangerschaft. *Gynäkologe* 9:133, 1976, p. 138.)

Biparietal Diameter (BPD)

Campbell, Professor Campbell's Group at Harris Birthright Centre, King's College Hospital.

Chitty, L.S., Altman, D.G. "New Charts for Ultrasound Dating of Pregnancy." *Ultrasound in Obstetrics and Gynecology*. Vol. 10: 174-191, 1997. (Out-In and Out-Out)

Hadlock, F., Deter, R.L., Harrist, R.B., Park, S.K. "Estimating Fetal Age: Computer-Assisted Analysis of Multiple Fetal Growth Parameters." *Radiology*, 1984, 152: 497-501. (Biometric Age and Growth Equations).

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Tokyo. *Japan Journal of Medical Ultrasonics*, Vol. 23, No. 12, 1996.

Cerebellum (CEREB)

Chitty, L.S., Altman, D.G., et.al. "Charts of Fetal Size: 2 Head Measurements." *British Journal of Obstetrics and Gynecology*. Vol. 101, 35-43, 1994. (Measured and Derived)

Hill, Lyndon, M., et. al. "The Transverse Cerebellar Diameter in Estimating Gestational Age in the Large for Gestational Age Fetus." *Obstetrics and Gynecology*, Vol. 75, No. 6, 981-985, June 1990.

Clavicle Length (CLAV)

Yarkoni, S., et. al. "Clavicular Measurement: A New Biometric Parameter for Fetal Evaluation." *Journal of Ultrasound in Medicine*, 4:467-470, September, 1985.

Crown-Rump Length (CRL)

Hadlock, F., Shah, Y.P., Kanon, D.J., Math, B., Lindsey, J.V. "Fetal Crown-Rump Length: Re-Evaluation of Relation to Menstrual Age (5-18 weeks) with High-Resolution Real-Time Ultrasound." *Radiology*, 182: 501-505, 1992.

Hansmann, Hackeloer, Staudach, Wittman. *Ultrasound Diagnosis in Obstetrics and Gynecology*. Springer-Verlag, New York, 1986, p.439, Table 3.

Nelson, L. "Comparison of Methods for Determining Crown-Rump Measurement by Real-Time Ultrasound." *Journal of Clinical Ultrasound*, 9: 67-70, February, 1981.

Robinson, H.P., Fleming, J.E.E. *British Journal of Obstetrics and Gynecology*, 82: 702-710, September 1975.

Tokyo, Japan Journal of Medical Ultrasonics, Vol. 23, No. 12, 1996.

Femur Length (FL)

Campbell, Professor Campbell's Group at Harris Birthright Centre, King's College Hospital.

Chitty, L.S., Altman, D.G. "New Charts for Ultrasound Dating of Pregnancy." *Ultrasound in Obstetrics and Gynecology*. Vol. 10: 174-191, 1997.

Hadlock, F., Deter, R.L., Harrist, R.B., Park, S.K. "Estimating Fetal Age: Computer-Assisted Analysis of Multiple Fetal Growth Parameters." *Radiology*, 1984, 152: 497-501. (Biometric Age and Growth Equations)

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Hohler, C. W., Quetel, T. A. "Fetal Femur Length: Equations for Computer Calculation of Gestational Age from Ultrasound Measurements." *American Journal of Obstetrics and Gynecology*, Vol. 143, No. 4: 479-481, June 15, 1982.

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Gestational Sac (GS)

Hansmann, Hackeloer, Staudach, Wittman. *Ultrasound Diagnosis in Obstetrics and Gynecology*. Springer-Verlag, New York, 1986, p. 431.

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Head Circumference (HC)

Campbell, Professor Campbell's Group at Harris Birthright Centre, King's College Hospital.

Chitty, L.S., Altman, D.G., et.al. "Charts of Fetal Size: 2 Head Measurements." *British Journal of Obstetrics and Gynecology*. Vol. 101, 35-43, 1994. (Measured and Derived)

Hadlock, F., Deter, R.L., Harrist, R.B., Park, S.K. "Estimating Fetal Age: Computer-Assisted Analysis of Multiple Fetal Growth Parameters." *Radiology*, 1984, 152: 497-501. (Biometric Age and Growth Equations)

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Humerus Length (HUM)

Hansmann, Hackeloer, Staudach, Wittman. *Ultrasound Diagnosis in Obstetrics and Gynecology*. Springer-Verlag, New York, p.431, 1986.

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Occipito-Frontal Diameter (OFD)

Hansmann, Hackeloer, Staudach, Wittman. *Ultrasound Diagnosis in Obstetrics and Gynecology*. Springer-Verlag, New York, p.431, 1986.

Outer Ocular Distance (OOD)

Jeanty, P., et. al. "The Binocular Distance: A New Way to Estimate Fetal Age." *Journal of Ultrasound in Medicine*, 3:241-243. June 1984.

Tibia Length (TL)

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Transverse Abdominal Diameter (TAD)

Hansmann, Hackeloer, Staudach, Wittman. *Ultrasound Diagnosis in Obstetrics and Gynecology*. Springer-Verlag, New York, p.431, 1986.

Transverse Thorax Diameter (TTD)

Hansmann, Hackeloer, Staudach, Wittman. " *Ultrasound Diagnosis in Obstetrics and Gynecology*. Springer-Verlag, New York, p.431, 1986

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Jeanty, P., Rodesch, F., Delbeke, D., Dumont, J. "Estimation of Gestational Age from Measurements of Fetal Long Bones." *Journal of Ultrasound in Medicine* 3:75-79, February, 1984.

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Campbell, S., Chitty, L.S. "Charts of Fetal Size: Abdominal Measurements." *British Journal of Obstetrics and Gynecology*.

Chitty, L.S., Altman, D.G., et. al. Chart of Fetal Size: 2 Head Measurement. *British Journal of Obstetrics and Gynecology*. Vol. 101, 125-131, 1994. (Measured and Derived.)

Hadlock, F., Deter, R.L., Harrist, R.B., Park, S.K. "Estimating Fetal Age: Computer-Assisted Analysis of Multiple Fetal Growth Parameters." *Radiology*, 1984, 152: 497-501. (Biometric Age and Growth Equations).

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Biparietal Diameter (BPD)

Chitty, L.S., Altman, D.G., et. al. Chart of Fetal Size: 2 Head Measurement. *British Journal of Obstetrics and Gynecology*. Vol. 101, 35-43, 1994. (Out-In and Out-Out)

Hadlock, F., Deter, R.L., Harrist, R.B., Park, S.K. "Estimating Fetal Age: Computer-Assisted Analysis of Multiple Fetal Growth Parameters." *Radiology*, 1984, 152: 497-501. (Biometric Age and Growth Equations).

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Cerebellum (CER)

Goldstein. "Cerebellar Measurements with Ultrasonography in the Evaluation of Fetal Growth and Development." *American Journal of Obstetrics and Gynecology*. 156: 1065-1069, 1987.

Clavicle Length (CLAV)

Yarkoni, S., et. al. "Clavicular Measurement: A New Biometric Parameter for Fetal Evaluation." *Journal of Ultrasound in Medicine*, 4:467-470, September, 1985.

Femur Length (FL)

Campbell, S. Chitty, I., Chart of Fetal Size: 4. Femur Length. *British Journal of Obstetrics and Gynecology*. Vol. 101, 132-135, Table 1.

Chitty, L.S., Altman, D.G., et. al. Chart of Fetal Size: 4. Femur Length. *British Journal of Obstetrics and Gynecology*. Vol. 101, 132-135, 1994.

Hadlock, F., Deter, R.L., Harrist, R.B., Park, S.K. "Estimating Fetal Age: Computer-Assisted Analysis of Multiple Fetal Growth Parameters." *Radiology*, 1984, 152: 497-501. (Biometric Age and Growth Equations).

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Fetal Trunk Area (FTA)

Osaka University (from Nakai), Medison, Japan, January 15, 2001.

Head Circumference (HC)

Chitty, L.S., Altman, D.G., et. al. Chart of Fetal Size: 2 Head Measurement. *British Journal of Obstetrics and Gynecology*. Vol. 101, 35-43, 1994. (Measured and Derived).

Hadlock, F., Deter, R.L., Harrist, R.B., Park, S.K. "Estimating Fetal Age: Computer-Assisted Analysis of Multiple Fetal Growth Parameters." *Radiology*, 1984, 152: 497-501. (Biometric Age and Growth Equations).

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Humerus Length (HUM)

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Hansmann, Hackeloer, Staudach, Wittman. *Ultrasound Diagnosis in Obstetrics and Gynecology*. Springer-Verlag, New York, 1986.

Merz, E. "Fetal Biometry." *Radiology*, 1083: 147:602.

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Hansmann, Hackeloer, Staudach, Wittman. *Ultrasound Diagnosis in Obstetrics and Gynecology*. Springer-Verlag, New York, 1986, p.182.

Jeanty, P., Romero, R. "Obstetrical Ultrasound." New York, McGraw-Hill, 1983, p. 192.

Merz, E., Grupner, A., Kern, F. "Mathematical Modeling of Fetal Limb Growth." *Journal of Clinical Ultrasound*, 17:179-185, March/April, 1989.

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Estimated Fetal Weight (EFW)**Abdominal Circumference (AC)**

Campbell, S., Wilkin, D. "Ultrasonic Measurement of Fetal Abdomen Circumference in the Estimation of Fetal Weight." *British Journal of Obstetrics and Gynecology*, Vol. 82, , 9: 689-697, September 1975.

Abdominal Circumference, Biparietal Diameter (AC, BPD)

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Merz, E., Goldhofer, W., Timor-Tritsch, E. *Ultrasound in Gynecology and Obstetrics*. Textbook and Atlas, Georg Thieme Verlag, 308-338, 1991.

Shepard, M., Richards, V., Berkowitz, R., Warsof, S., Hobbins, J. "An Evaluation of Two Equations for Predicting Fetal Weight by Ultrasound." *American Journal of Obstetrics and Gynecology*, Vol. 142, No. 1:47-54, January 1, 1982.

Abdominal Circumference, Femur Length (AC, FL) Hadlock1

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Abdominal Circumference, Biparietal Diameter, Femur Length (AC, BPD, FL) Hadlock2

Hadlock, F., Harrist, R.B., Sharman, R.S., Deter R.L., Park, S.K. "Estimation of Fetal Weight with the use of Head, Body, and Femur Measurements-A Prospective Study." *American Journal of Obstetrics and Gynecology*, Vol. 151, No. 3: 333-337, February 1, 1985.

Abdominal Circumference, Femur Length, Head Circumference (AC, FL, HC) Hadlock3

Hadlock, F., Harrist, R.B., Sharman, R.S., Deter R.L., Park, S.K. "Estimation of Fetal Weight with the use of Head, Body, and Femur Measurements-A Prospective Study." *American Journal of Obstetrics and Gynecology*, Vol. 151, No. 3: 333-337, February 1, 1985.

Abdominal Circumference, Biparietal Diameter, Femur Length, Head Circumference (AC, BPD, FL, HC) Hadlock4

Hadlock, F., Harrist, R.B., Sharman, R.S., Deter R.L., Park, S.K. "Estimation of Fetal Weight with the use of Head, Body, and Femur Measurements-A Prospective Study." *American Journal of Obstetrics and Gynecology*, Vol. 151, No. 3: 333-337, February 1, 1985.

Antero-Posterior Thorax Diameter, Biparietal Diameter, Transverse Thorax Diameter (APTD, BPD, TTD)

Tokyo1

Antero-Posterior Thorax Diameter, Biparietal Diameter, Femur Length, Transverse Thorax Diameter (APTD, BPD, FL, TTD)

Tokyo2

Biparietal Diameter, Femur Length, Fetal Trunk Area (BPD, FL, FTA)

Osaka

Biparietal Diameter, Transverse Thorax Diameter (BPD, TTD)

Hansmann, Hackeloer, Staudach, Wittman. *Ultrasound Diagnosis in Obstetrics and Gynecology*. Springer-Verlag, New York, 1986, p. 154.

Estimated Fetal Weight Growth

Hadlock, F., Harrist, R.B., Martinez-Poyer, J. "In-utero Analysis of Fetal Growth: A Sonographic Weight Standard." *Radiology*. 1991, 181: 129-133.

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Fetal Ratios

Cephalic Index (CI) (BPD/OFD)

Hadlock, F., Deter, R., Carpenter, R., Park, D. "Estimating Fetal Age: Effect of Head Shape on BPD." *American Journal of Radiology*, 137: 63-85, July 1981.

FL/AC

Hadlock, F., Deter, R., Harrist, R., Roecker, E., Park, P.A. "Date-Independent Predictor of Intrauterine Growth Retardation: Femur Length/Abdominal Circumference Ratio." *American Journal of Radiology*, 141: 979-984.

FL/BPD

Hohler, C.W., Quetel, T.A. "Comparison of Ultrasound Femur Length and Biparietal Diameter in Late Pregnancy." *American Journal of Obstetrics and Gynecology*, Vol. 141, No. 7:759-762, December 1, 1981.

HC/AC

Campbell, S. "Ultrasound Measurement of the Fetal Head to Abdomen Circumference Ratio in the Assessment of Growth Retardation." *British Journal of Obstetrics and Gynecology*, Vol. 84, 165-174, March 1977.

Vascular

Jacob, N. M. et. al. "Duplex Carotid Sonography: Criteria for Stenosis, Accuracy, and Pitfalls." *Radiology*, 154: 385-391, 1985.

12 Glossary

12 Glossary

For definitions of ultrasound terms not covered here, refer to the American Institute of Ultrasound in Medicine, *recommended ultrasound terminology*, Second Edition, 1997.

Terms

?

A control used to display the Help.

+

A control used to adjust the video monitor contrast and brightness.

-

A control used to adjust the video monitor contrast and brightness.

%Stenosis

Percent Stenosis. An area or distance measurement used to calculate the percent of stenosis in a vessel.

1 Distance

In the **Measure** setups, a default volume method that uses one distance measurement to estimate the volume of an object.

3 Distances

In the **Measure** setups, a default volume method that uses three distance measurements to estimate the volume of an object.

2D

(1) Two-dimensional. Pressing this control starts 2D imaging and displays the **2D Mode** menu. Turning this control adjusts 2D gain. (2) In 3D imaging, used to display a full-size multiplanar 2D image.

2D Chroma

A **Utility 2D Post** menu item used to turn on or off a 2D Chroma map.

2D Circumference and Area Method

A **Measure** and **Cardiac** setup used to select ellipse or trace setting as the default area method.

2D Image Size

In the **General** setups, a **Display** setting used to select the size of the 2D image: 100 percent, 95 percent, and 90 percent.

2D Maps

A **Utility 2D Post** menu item used to select, view, and create 2D maps.

2D Mode Depth

A **Utility VCR** menu item used to calibrate the system for the measurement of 2D VCR-playback images.

2D Post

A **Utility BW Postmap** menu item used to display another menu from which you can select a 2D map, edit a 2D map, select a Chroma map, and edit a Chroma color.

3D

(1) Three-dimensional. A control that starts 3D imaging and displays the **3D** menu. The menu lists system parameters related to 3D imaging. (2) A category of setups for 3D imaging. (3) In 3D imaging, used to display a full-size 3D volume image. (4) A blue menu key used to select 3D imaging.

3D Orientation



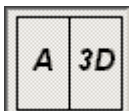
In Live 3D imaging, used to change the orientation of the 3D volume image in increments of 90 degrees.

3D Orientation (Transparent Volume)



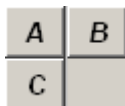
An icon used to display a transparent 3D volume image, which includes a 2D plane corresponding to the selected multiplanar 2D image. The transparent volume is useful in helping understand the orientation of the multiplanar 2D images relative to the 3D volume image.

A3D



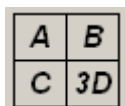
In Live 3D imaging, allows you to live scan while displaying the 2D multiplanar reference image and the 3D volume image.

ABC



In 3D imaging, used to select a multiplanar 2D image.

ABC3D



In 3D imaging, used to display the ABC multiplanar 2D images and the 3D volume image without the ROI.

ABORTA

Abortion. In the study information, on the **Patient Information** display, a number can be entered in this field for the number of abortions or miscarriages a woman has experienced.

Above

In **Measure** setups, a **Doppler Trace Mode** setting used to include only the displayed Doppler data above the baseline in calculations.

Accession Number

A 16-character number that may be assigned to each patient file for information management purposes.

Acquisition in Progress

A classification for a DICOM-compatible network server that stores image data. A setting on the **DICOM Configuration** dialog box.

Additional Doppler Result

In the **General** setups, a **Display** setting used to show or hide the display of Doppler results.

AE title

Application entity title. A DICOM standard name assignment given to a DICOM device. The ultrasound system and all devices configured for DICOM operations have AE titles, and they are used in DICOM setups. Additional information about AE titles can be found in the DICOM conformance statements for the various entities.

Alias

A **DICOM Device** setting, a data-entry field into which you enter an alias for the device you are configuring for DICOM operation with the ultrasound system. An alias is an arbitrary name you assign to the device being configured.

All

In **Measure** setups, a **Doppler Trace Mode** setting used to include all of the displayed Doppler data in calculations.

All Points

A calculations protocol that provides a programmed sequence of measurement points that comprise the individual measurements within the protocol.

ANGLE

Turn this to control correct the angle between the beam axis and the direction of blood flow. Press this control to select a Doppler correction angle of 0, 60, or -60 degrees.

Apex

A **2D Mode** menu item that changes image orientation, top to bottom.

Application

(1) A menu on the **Scanhead Select** display from which you select an application for the selected scanhead. (2) A **Utility** menu from which you select an application. (3) A blue menu key that displays the **Application** menu.

archive device

A destination to which patient exam data is sent. Examples of archive devices are the hard disk, a network server, and a phase disk.

AREA

A control used to start an area measurement. Area and circumference are calculated and displayed for this measurement.

Area + Distance

In the **Measure** setups, a default volume method that uses a distance measurement and an area measurement to estimate the volume of an object.

Auto Freeze

In the **General** setups, a **Display** setting used to automatically cause the system to enter freeze after a 10-minute hiatus in control activity.

Auto ID Creation

On the **Patient Information** display, a checkbox used to automatically create an ID for the current patient.

Autorun

A blue menu key used to play the Cine sequence, which automatically plays to the end and repeats until you press the blue menu key again.

Auto Th. Low

A Live 3D setup used to enable or disable the automatic assignment of a low threshold value to the 3D image.

Average

In the **Measure** setups, a **Result Display** setting used to display the average of up to three measurements as the default result display in the patient report.

Backspace

A key used to move the data-entry cursor back a space.

BASELINE

A control that shifts the zero baseline in Doppler and Color imaging.

Below

In **Measure** setups, **Doppler Trace Mode** setting used to include only the displayed Doppler data below the baseline in calculations.

Bias

In 3D imaging, a slider used to adjust the gamma curve for the ABC multiplanar 2D images and the 3D volume image.

Bilinear

A **DICOM Device** setting for printer magnification.

Biopsy

A **Utility** menu used to turn on or off the biopsy guideline.

biopsy guideline

A guideline through the ultrasound image indicating the anticipated path of the biopsy needle.

blue menu keys

Across the bottom of the screen there are six blue menu keys that correspond to the six controls across the top of the control panel. You press the controls on the control panel to activate the function designated on the blue menu key on the screen.

BODY MARK

A control used to display the **Utility Group** menu and the currently selected group of body marks.

BodyMark Edit

A **Utility** menu from which you can select, save, add, delete, and edit body marks.

Border Density

A **DICOM Device** setup used to set border density to white or black.

BRIGHTNESS

A slider, displayed when you press the monitor MENU control, that adjusts the light output of the display.

BSA

Body surface area. In the study information, on the **Patient Information** display, a text field in which the BSA appears. The BSA is calculated from the height and weight values that you enter into the study info.

BW/Post

A **Utility** menu item used to display the **BW Postmap** menu.

BW Postmap

A **Utility** menu used to display the post menus, from which you can select a map, Chroma map, and edit your own maps.

CALC.

A control that displays a menu of protocols or measurements associated with a the current system application.

Calibration

A calibration is performed before the system measures stored or frozen images. The **Utility VCR** menu allows you to perform calibration.

Capture

A **Utility Color Post** menu item and menu used to turn color capture on or off and to set the number of frames include in the capture. Color capture is used in both Color and CPA imaging, during real-time, to calculate the highest mean velocity per pixel from a series of color frames and display a composite image that is the sum of the highest mean velocities.

Cardiac Setup

A category of **Measure** setups, including the 2D circumference and area method and M-mode volume calculation method.

CAUTION

Information in the manual that describes precautions necessary to protect the equipment.

cavitation

A mechanical bioeffect that refers to the reaction to ultrasound energy of bubbles or pockets of gas or vapor in tissue or fluid.

CHG.

A control used to change the trackball function and alternate cursor control.

Chroma

(1) A **2D/M Mode** and **PW/CW** menu item that turns the Chroma map on or off. (2) A **Utility M Post** and **PW/CW Post** menu item used to turn on and off the Chroma map. (3) In 3D, an image setting used to assign Chroma maps to the ABC multiplanar 2D images and the 3D volume image.

Cine

A process for digitally acquiring and reviewing a series of sequential images.

Cine/Loop

A blue menu key used to alternate trackball control between 2D and scrolling Cine review.

Cine Edit

A blue menu key that begins an edit of the Cine sequence. You can select the first frame and last frame of the Cine sequence, and then save the edited Cine sequence, using the blue menu keys displayed when you select **Cine Edit**.

Cine Save

A blue menu key used to save a Cine sequence for review.

CLEAR

A control used to clear text annotation from the display.

COLOR

(1) Press this control to start Color imaging. Turn this control to change Color gain. (2) On the **Utility** menu, a menu item used to set the color of a 2D Chroma map.

Color

(1) A **DICOM Device** setup used to set the printer type to grayscale or color. (2) A **Utility** menu item used to edit the color of the Chroma maps.

Color Capture

Color capture is used in both Color and CPA imaging, during real-time, to calculate the highest mean velocity per pixel from a series of color frames and display a composite image that is the sum of the highest mean velocities.

Color Mode

(1) A **Color** menu item used to select velocity, power, or variance Color display modes. (2) 3D display and setup used to set the thresholds and mix of the 3D image.

Color Post

A **Utility** menu item used to display the **Color Post** menu.

Color Postmap

A **Utility** menu used to display the post menus, from which you can select a Color map.

Color Priority

A **Color** and **CPA** menu item that selects the balance between Color and 2D or black-and-white.

Color Tag

A **Utility Color Post** menu item and a menu used to turn a color tag on or off, set the position of the color tag, and set the color width of the color tag. Color tags are used in Color imaging to identify velocities of interest in the Color image.

Color Tag Position

A **Utility Color Tag** menu item used to set the position of the color tag.

Color Tag Width

A **Utility Color Tag** menu item used to set the width of the color tag.

COM1

In **Peripherals** setups, a setup used to configure the serial port for a Panasonic MD830 VCR or Open Line Transfer to a report printer, or to indicate that the serial port is not used.

Compare

In Review, a view mode that allows you to select images and display them in the layout positions you determine.

Compression

A **3D** setup used to select a lossy or lossless compression algorithm or no algorithm for the 3D image.

Configuration Information

A **DICOM Device** setup, a text-entry field used to enter text describing your configuration information for DICOM printing.

control panel

The primary user interface module that includes the imaging controls, blue menu keys, keyboard, light, and trackball.

Convert

A **3D** menu control item that starts the 3D rendering process.

Copies

A **DICOM Device** setup used to set the number of copies that will be printed for each DICOM print operation.

CPA

Press this control to turn on CPA imaging and display the **CPA** menu. Turn this control to adjust CPA gain.

CPA Post

(1) A **Utility** menu item used to display the **CPA Post** menu. (2) A **Utility** menu used to select a CPA map.

Cubed

An **M Mode Volume Calculation** setting used as the default method to calculate left ventricular volume.

Cubic

A **DICOM Device** printer setting for magnification.

Current Exam

In Review, a selection used to display the images saved for the current exam.

current patient

The patient name displayed on the **Patient Information** display. When you enter the patient name, patient ID, or both, a patient file is opened.

cursor

Any one of several user-controlled graphic objects used to pinpoint the location of an object on the screen.

curved array

A scanhead with parallel elements in a curved layout.

Custom Field 1

In the study information, on the **Patient Information** display, a text field into which you can enter information.

CW

Press this control to turn on continuous-wave (CW) Doppler imaging and display the **PW/CW** menu. Turn this control to adjust CW Doppler gain.

D-line

The D-line is the 2D column on which the sample volume is located and from which the Doppler display is derived. Also called the M-line.

D Mode Vel/Freq

A **Utility VCR** menu item used to calibrate the system for the measurement of Doppler VCR-playback images. Velocity or frequency must be specified to ensure that the correct scale is used for the calibration.

Date

In the **General** setups, a text-entry field used to set the system date and date format.

Date Format

In the **General** setups, a **Date** setting used to select the date format from three options.

Day of Cycles

In the study information, on the **Patient Information** display, a number can be entered for this value.

Default

A setting on the **Scanhead Select** display. When a default setting is selected, the system operating parameters assume their power-up values.

Default Volume Method

A **Measure** setup used to select a volume method that uses three distance measurements, one distance measurement, or one area and one distance measurement.

Defined

In 3D Cine, used to create your own 3D Cine sequence.

Demo Images

A **Utility** menu item used to create a repository for demonstration images.

Density

A blue menu key used to select line density settings for the 2D image. Increasing line density decreases frame rate.

DEPTH

A control used to select the 2D imaging depth.

Description

In the study information, on the **Patient Information** display, a text-field into which you can enter some pertinent descriptive information for the current patient.

Destination

A **DICOM Device** setup used to select either magazine or processor for the DICOM printer.

Device Type

A **Misc.** setup used to select a modem or serial port for remote service.

Diag. Physician

Diagnosing Physician. In the study information, on the **Patient Information** display, the name of this physician can be entered in this text field.

dialog box

A system display element that requires your interaction or response.

DICOM

Digital Imaging and Communication in Medicine. A standard for network communication.

DICOM setups

A category of system setups covering connectivity to Modality Worklist servers, network servers, and network printers.

Direction

A blue menu key used to select the scanning direction, left to right or right to left. The orientation marker changes to indicate the direction.

Display

- (1) A **Color** and **CPA** menu item that selects the display of color, black-and-white, or both.
(2) In **General** setups, a group of setups used to set several imaging display parameters.

DISPLAY CHANGE

A footswitch used to toggle image activity between left and right sides of the display.

Display Format

An **M** and **PW/CW** menu item that selects the size of the scrolling display format.

Display Mode

- (1) A **Color** menu item that selects a velocity, variance, or power display mode. (2) A 3D setup used to select the 3D display options.

DIST.

A control used to start a distance measurement.

Doppler Mode Y-Axis Unit

A **Measure** setup used to select velocity or frequency units for the vertical axis of the PW Doppler display.

Doppler Trace Mode

A **Measure** setup used to select the area from which Doppler calculations will be derived: above the baseline, below the baseline, or all of the displayed Doppler data.

Dotted Line

In the **General** setups, a **Display** setting used to show or hide the dotted line connecting measurement points.

Drive

In Review, a drop-down list used to select the exam list from the hard disk, the CD-ROM, or the MO disk.

DUAL

A control used to display the dual image format.

dual 2D image

Two 2D images displayed at the same time. May be used to compare two images or to line up two different parts of one structure to see more of the structure. (Also applies to Color and CPA images.)

Dynamic Range (dB)

A **2D/M Mode** and **PW/CW** menu item used to select the system dynamic range. Dynamic range of signal amplitudes extending from the largest unsaturated signal to the smallest signal just discernible above system noise. On the display, dynamic range is expressed in decibels (dB). Low dynamic range implies high contrast images, while high dynamic range implies the full use of the gray scale.

E-Mail

In the study information, on the **Patient Information** display, a text field into which you enter an e-mail address. (Not available.)

ECG

Electrocardiogram. (1) A record of the electrical activity of the heart. (2) A **Utility** menu used to turn on the electrocardiograph, select the size, position, and triggers.

ECG trigger

Electrocardiogram (ECG) trigger. Allows you to set one or two points relative to the R-wave of the ECG in which some event takes place.

EDD

Established Due Date. The established due date is a user-entered date. If the LMP is entered into the the study information before the established due date is entered, the established due date is calculated from the LMP. If the established due date is entered before LMP is entered, LMP is calculated from the established due date, and this denoted in the patient report.

Edge Enhance

A **2D Mode** menu item used to enhances edges and border areas, giving better object perspective to the image.

Edit

A **Utility** post menu item used to create a graymap and a Chroma map.

Editor

In **Obstetrics** setups, the names associated with specific measurement types, equations, and tables. Also referred to as “investigator.”

Ellipse

A **2D Circumference and Area Method** setting used to set the default area measurement method.

Empty Density

A **DICOM Device** setup used to set the density of empty cells to black or white.

End

In 3D Cine, used to select the last 3D volume image in your 3D Cine sequence.

END EXAM

A control used to end an exam. This control must be used to save trending data to the hard drive.

Erase CD-RW



In Review, this icon displays the **Erase CD/RW** dialog box, from which you can erase all data from the CD-RW disc.

Exam

In Review, a view mode that displays the images in the selected layout in the order in which they were acquired.

Exam List

Selecting **Open in Review** displays the **Exam List**, from which you can select a drive, a patient, search for an exam, and perform various functions in Review.

Exam Navigator

In Review, a listing of patient exams from which you can select an exam by clicking on the exam date for the desired patient.

Exam Type

On the **Modality Worklist** display, a field in the worklist used to identify the type of exam scheduled for the patient.

EXIT

A control used to end functions and exit displays.

Exp. Ovul.

Expected Ovulation. In the study information, on the **Patient Information** display, this date can be entered.

Export Images



In Review, this icon starts the process of exporting images for viewing on personal computer.

external monitor

A monitor that connects to the rear of the system for simultaneous viewing of the image display.

Fetal Biometry

In **Obstetrics** setups, a system OB preset used to calculate ultrasound and average ultrasound age or estimated fetal weight from fetal measurements.

Film Size

A **DICOM Device** setup used to set the film size for a DICOM print.

FILTER

A control used to select a high-pass filter that removes high-amplitude, low-frequency signal content from the Doppler, CPA, and Color echo.

First Frame

A blue menu key used to select the first frame in the Cine sequence.

focal length

The length over which the beam width is less than or equal to twice the beam width at the focal point.

focal point

The point where the focal plane and the beam axis intersect.

FOCAL POS.

A control used to set focal depth.

focal zones

That portion of a focused ultrasound beam extending axially on either side of the focal point in which the amplitude of an echo from a standard echo source is not reduced more than 6 dB. The focal zone is the region of optimal resolution. It is possible to have multiple focal zones in a single image by using more than one transmit/receive cycle per column, with each one having its own focal zone.

Focus +, -

Blue menu keys used to select the number of focal zones.

footswitch

The footswitch is a dual footswitch consisting of a right and left footswitch. It is connected to the front of the system. The right and the left footswitches can be set up in **Peripherals** setups for the following functions: freeze, update, record, print, store, 3D, and ECG trigger.

Format

A **DICOM Device** setup used to set the number and arrangement of images on the film. Examples are 1x1 and 2x2.

Format MO Disk



In Review, this icon displays the **MO Disk Formatter** dialog box, from which you can format the MO disk.

Frame

A **Utility Capture** menu item used to set the number of frames used in the Color Capture.

FrameRate (FPS)

A **2D Mode** menu item used to set the number of acquisition image updates per second. On the display frame rate is expressed in frames per second (FPS).

FREEZE

A control used to stop or start image acquisition.

GA

Gestational Age. A date in the study information, on the **Patient Information** display, calculated from LMP.

gain

The total system gain is the ratio of the output signal amplitude to the input signal amplitude. On the system display, gain is expressed as a number from G0 to G100, in increments of 1, for each active imaging mode.

Gamma

- (1) An imaging mode menu item used to adjust the gray levels displayed on the screen.
- (2) In 3D imaging, an image setting used to adjust the bias and position of the grayscale curve applied to the ABC multiplanar 2D images and the 3D volume image.

General

- (1) A category of setups including the institution, date, time, display setups, thermal index display selection, 2D image size, and access to measurement setups.
- (2) A category of OB setups including presets, pregnancy weeks, and fetal weight units.
- (3) A blue menu

key that displays the general **Measure** setups. (4) In **Obstetrics** setups, a system OB preset. The **General** preset includes more measurement types than the **Fetal Biometry** preset.

Gibson

An **M Mode Volume Calculation** setting used as the default method to calculate left ventricular volume.

GRAVIDA

In the study information, on the **Patient Information** display, the number of pregnancies a woman has had can be entered in this field.

Gray Maps

A video depiction of the gray scale that is displayed on the system monitor.

Gray Mode

A 3D setup used to set the low threshold (**Th. Low**), high threshold (**Th. High**), and mix between **Mode 1** and **Mode 2**.

gray scale

The scale used to assign shades of gray to different signal amplitudes. The brightness of the dot representing a particular signal is proportional to the signal amplitude. The gray scale varies from black to white through a specified range of gray shades.

hard disk

An electronic storage device installed in the ultrasound system used to store ultrasound images. Capacity depends upon the size of the hard disk and the type of images stored on the hard disk. Color images require more memory than black-and-white images.

Height

In the study information, on the **Patient Information** display, a text field into which you enter the current patient's height. This value and the value you enter for the patient's weight are used to calculate BSA.

Help Language

In **Misc.** setups, a drop-down menu used to select the language for the help system.

hertz (Hz)

A unit of frequency equal to one cycle per second.

High Q

A blue menu key that initiates the automatic calculation and display of specific values associated with the Doppler waveform.

Histogram

(1) A **Utility** menu used to create a histogram. (2) A graphic representation of a frequency distribution in which the widths of contiguous vertical bars are proportional to the class widths of the variable, and the heights of the bars are proportional to the class frequencies.

HR

Heart rate. In the study information, on the **Patient Information** display, a text field into which you enter the current patient's heart rate.

ID

A system control that displays the **Patient Information** display, into which you enter patient data.

image

An ultrasound display or a report screen.

Image Compression

A 3D and Live 3D setup that lets you select the compression technique applied to stored 3D images.

Image Info

In the **General** setups, a **Display** setting used to show or hide the image information.

Image Layouts

In Review, a dialog box that appears when you select **Layout**, and from which you select or create the Review image layout.

Image Print

A DICOM setup that allows you to set the number of prints for the selected DICOM printer.

image printer

A printer used to print ultrasound images.

Image Setting

In 3D imaging, a display used to adjust the gamma curves and select a Chroma map for the multiplanar 2D images and the 3D volume image.

INDIC.

A control used to display one or several arrows for indicating objects on the display.

Indication

In the study information, on the **Patient Information** display, a text field into which you enter any pertinent indications for the current patient exam.

Information

A category of setups including system version information with details listed, a **Diagnostics** selection, and a **Remote Service** selection.

INIT

In 3D imaging, a selection used to reset the display to the original image, previous to any image manipulation.

Input Unit

In **Obstetrics** setups, the unit information for the input units for the selected measurement.

Institution

In **General** setups, a data-entry field used to enter the name of the hospital, clinic, or other appropriate entity.

intensity

A measure of the amount of acoustic energy flowing through a unit area that is perpendicular to the direction of the energy flow. Expressed as power per unit area in units of Watts/cm². Intensity can be averaged over space, over time, or expressed as peak values over space or time.

intracavity transducer (ICT)

A scanhead which is inserted into the rectum or vagina for imaging in those areas. Typically used to study the prostate or ovaries.

INVERT

A control used to invert the Doppler data relative to the baseline.

IP Address

Internet Protocol. On the **DICOM Device Setup** screen, a text field into which you enter the IP address for the device you are configuring for DICOM operation with the ultrasound system.

Language

A **Misc.** setup used to select the language that appears on the display.

Last

In the **Measure** setups, a **Result Display** setting used to display the last measurement as the default result display in the patient report.

Last Frame

A blue menu key used to select the last frame in a Cine sequence.

Layouts

In Review, a selection used to display the **Image Layouts** dialog box, from which you select or create the Review image layout.

line density

Line density refers to the number of lines of ultrasound data that make up the image.

linear array

Scanhead in which a large number of long, narrow elements are placed side by side. A subset of the elements is used to produce each column of data. This subset, called the aperture, is shifted across the scanhead to produce an array of parallel columns which form a rectangular image on the display.

Live 2D/3D

In 3D imaging, used to select the live multiplanar 2D image or the 3D volume image. (2) A blue menu key used to select Live 3D imaging.

Live 3D

A category of setups for Live 3D imaging.

Live CINE

In 3D imaging, displays the **Live 3D Cine** display, allowing Cine review of up to 64 collected volumes.

Live Mode

In Review, click on this selection to return to live or real-time imaging mode.

LMP

Last Menstrual Period. A date entered into the study information, on the **Patient Information** display, used to calculate gestational age (GA).

LOOP

In 3D imaging, sets 3D Cine to play the Cine sequence repeatedly from the beginning to the end.

L/R

A control that inverts the horizontal orientation of the 2D image.

M

Press this control to start M-mode acquisition and display the **2D/M Mode** menu. Turn this control to adjust the 2D/M-mode gain.

M Line

A blue menu key used to display the M-line or D-line. The M-line is the 2D column from which the M-mode display is derived.

M Maps

A **Utility M Post** menu item used to select, view, and create M Maps.

M-mode

The “M” stands for motion. The motion occurs over time, which is represented by a scrolling M-mode display.

M Mode Depth

A **Utility VCR** menu item used to calibrate the system for the measurement of M-mode VCR-playback images.

M Mode Time

A **Utility VCR** menu item used to calibrate the system for the measurement of M-mode VCR-playback images.

M Mode Volume Calculation

A Cardiac setup used to select the equation for calculating left ventricular volume from an M-mode display. Teichholz, Cubed, and Gibson are available.

M Post

A **Utility BW Postmap** menu item used to display another menu from which you can select an M map, edit an M map, select a Chroma map, and edit a Chroma color.

MAG

A control used to adjust the magnification factor of the 3D image.

Magazine

A **DICOM Device** setting for the **Destination** setup. It describes a film that is taken to a developer for processing.

Magicut

In 3D imaging, displays an image cropping and trimming tool set for editing the 3D volume image.

Magnification

(1) In 3D imaging and setups, a slider used to change the size of the the 3D image from 0.25 to 4.0 times normal. (2) A **DICOM Device** setup used to set the film printer magnification to **Replicate**, **Bilinear**, **Cubic**, or no magnification.

Magnify



In Review, this icon allows you to magnify an area of interest.

Main Menu

In 3D imaging, use to return to 3D View.

maps

Maps are used to encode ultrasound information for video display based on the system mode. There are several different types of maps: M maps, Chroma maps, CPA maps, 2D maps, and Color maps.

Map 1-8

On the **Utility Color** and **CPA Post** menus, the map selections for Color and CPA imaging.

Max. Density

A **DICOM Device** setup used to set the maximum optical density of the film for a DICOM print.

Measure

In 3D imaging, used to display the 3D measurement tools.

Measure Setup

A category of setups comprising general, OB, and cardiac setups.

Medium Type

A **DICOM Device** setup used to set the film type to paper, clear, or blue film for a DICOM print.

MENU

(1) Turn the system **MENU** control to highlight a menu item, press **SELECT** to select the menu item, and then turn the **MENU** control to set the value of the menu item. (2) Press the video monitor MENU control to adjust the brightness and contrast.

Menu Setting

A **Utility Miscellaneous** menu used to change the “sleep” setting of the menus. For example, selecting a **Sleep After** setting of one minute will result in the menu staying highlighted for one minute.

Min. Density

A **DICOM Device** setup used to set the minimum optical density of the film for a DICOM print.

Misc.

(1) Miscellaneous setups. A category of setups comprising system language, text setup, test pattern, remote services, and help language selection. (2) In **Obstetrics** setups, a category of setups, including user table backup and restore. Restoring Obstetrics user table data requires a system reboot.

Miscellaneous

A **Utility** menu from which you can create histograms and user presets, change menu settings, and store demonstration images.

Mix

A 3D imaging and setup slider used to adjust the mix of **Mode 1** and **Mode 2** rendering effects in the 3D volume image.

Modality Worklist

A classification for a DICOM-compatible network server that stores patient data.

Mode 1 and 2

In 3D imaging, categories of rendering effects that can be applied to the 3D volume image.

Modem

In **Misc.** setups, a device type setting.

Modem Port

In **Misc.** setups, a drop-down menu used to configure the modem port for a compatible baud rate.

Network Config.

In DICOM setups, a selection used to display an authorization dialog box for access to system network configuration. See your customer service representative for information.

New Cine

In Live 3D imaging, used to create a new Cine sequence.

Niche



In 3D imaging, used to display a tool that you use to visualize the changes in orientation and positions in the multiplanar 2D images relative to the 3D volume image.

Note

Information in the manual that provides additional system knowledge.

NTSC

(1) National Television Standards Committee. Standard video signal for all broadcast TV in the North America. (2) In **Peripherals** setups, a VCR type setting.

Obstetrics setups

A category of setups comprising the range of measurement types, a list of investigators, fetal tables, and a **Pregnancy Weeks** setting.

Open

In Review, a selection used to open the exam list.

Open Line Transfer

A serial port COM1 setting used to set up the serial port for a report printer.

Option

A category of setups that displays the software serial number and a list of installed options with relevant passwords for the options. Also included is an ECG installation setup.

Orientation

(1) In Live 3D imaging, used to select 0-, 90-, 180-, or 270-degree orientation for the live 3D image. (2) A **DICOM Device** setup used to set the film orientation to portrait or landscape.

Output Unit

In **Obstetrics** setups, the unit information for the output units for the selected measurement.

PAL

(1) Phase Alternating Line. European video standard. (2) In **Peripherals** setups, a VCR type setting.

Panasonic MD830

A serial port COM1 setting used to setup the serial port for a VCR.

PARA

In the study information, on the **Patient Information** display, a number can be entered in this text field to identify the times a woman has produced a viable infant (weighing 500 grams or more, or of over 20 weeks gestation), regardless of whether the infant is alive at birth. Multiple births are considered to be single parous experience.

patient data

Includes images, graphics, and other information associated with a specific patient from an ultrasound or other type of medical exam.

patient file

A file created when you enter patient data.

Performed Procedure Step

A classification for a DICOM-compatible network server that tracks the transmission of image data.

Peripheral setups

A category of setups including settings for the VCR, serial port, footswitch, and Windows printer.

Persistence (FA)

A menu item on the **2D/M**, **Color**, and **CPA** menus. On the display, the persistence setting is expressed as a frame-averaging (FA) setting for the active imaging mode.

phased array

A scanhead type with an array of transducer elements that are electronically time-phase coordinated to generate a focused and steerable wavefront.

PIH

Pulse Inversion Harmonics. A control used to start Pulse Inversion Harmonic imaging.

Pombo

An **M Mode Volume Calculation** setting used as the default method to calculate left ventricular volume.

Port

A **DICOM** setup used to enter the port number for the ultrasound system. The port number is normally 104 for ultrasound operations.

Pos. Horizontal & Vertical

In 3D imaging, sliders used to select a multiplanar 2D image, using a cutting line horizontally and vertically across the selected image.

Position (ECG)

A **Utility ECG** menu item used to establish the location of the ECG trace on the display.

Post Map

In the **General** setups, a **Display** setting used to show or hide the name of the current post map on the display.

POWER

A control used to adjust acoustic output.

Pregnancy Weeks

An **Obstetrics** setup used to set the pregnancy duration by weeks.

PRESET

A **Utility** menu item used to access a menu from which you create user presets.

Preset

(1) A **Utility** menu used to create user presets and restore them as needed. (2) In 3D setups, a drop-down menu that can be used to create and select a user preset for the 3D image. There are three user presets available. (3) In Obstetrics setups, a display used to create user-defined OB tables and equations.

Preset Name Edit

In 3D setups, used to create the 3D View settings for **User 1-3** presets.

Prev. Cine

In 3D imaging, used to display the previous 3D Cine sequence.

PRINT

A control used to print an image.

Print After Each Image

A classification for a DICOM-compatible network printer. A setting on the **DICOM Configuration** dialog box.

Print Images



In Review, this icon displays a **Print Layouts** dialog box, from which you select the layout, range, orientation, format, number of copies, and **Ink Save Mode**. The **OK** selection displays the **Print** dialog box, from which you print the selected images.

Printer Setup

In **DICOM Device Setup**, a category of setups used to configure the DICOM printer for operation.

Priority

(1) A **CPA** menu item used to set the write priority threshold for the CPA display. Priority is the threshold value at which the 2D grayscale echo information is considered strong enough to indicate a solid structure such as a heart wall, rather than blood flow, even though that structure may be moving. (2) A **DICOM Device** setup used to set high, medium, or low print priority.

Procedure ID

On the **Modality Worklist** display, a text-entry field used for search criteria.

Processor

A **DICOM Device** setting for the **Destination** setup. It describes a film cassette with a built-in developer.

Protocol

A series of parameters and their calculations associated with a specific application or clinical option.

pulse repetition frequency (PRF)

The number of ultrasound pulses per second, measured in hertz.

PW/CW Maps

A **Utility PW/CW Post** menu item used to select, view, and create PW/CW Maps.

PW/CW Post

A **Utility BW Postmap** menu item used to display another menu from which you can select a PW/CW map, edit an PW/CW map, select a Chroma map, and edit a Chroma color.

PW/CW Time

A **Utility VCR** menu item used to calibrate the system for the measurement of PW or CW Doppler VCR-playback images.

PWD

Pulsed-wave Doppler. Press this control to start pulsed-wave Doppler imaging. Turn this control to adjust Doppler gain.

PWD Mode Velocity

A **Utility VCR** menu item used to calibrate the system for the measurement of Doppler VCR-playback images.

Queue

In **DICOM** setups, a selection used to display a list of DICOM transfers with status for each one.

Range Type

In **Obstetrics** setups, a setting for the table type for the selected editor's table data. The deviation for the calculation can be based on a range determined by the editor of the table.

RECORD

A control used to start a VCR recording of the image display. Pressing it a second time, during recording, pauses the recording.

RECT. L

Turn this control to view the 3D reference slices. Press this control to display the selected reference images full-screen size.

Ref. Physician

Referring physician. In the study information, on the **Patient Information** display, a text field into which the referring physician's name can be entered.

Ref. Slice

In 3D imaging, a slider used to scroll through the selected A, B, or C multiplanar 2D image.

Reject Level

A selection on the **2D** menu that displays different image depths.

Remote Service

Misc. setups used to select a device type and to configure that device.

Rendering Mode

In 3D imaging, a display used to select the rendering effects for the 3D volume image.

Replicate

A **DICOM Device** setting for printer magnification.

Report



In Review, this icon displays a report containing patient information for the currently selected review image.

report printer

Optional device connected to the ultrasound system to print analysis reports or graphs onto paper.

Result Display

A **Measure** setup used to select a result display that is the average of results or the last result obtained.

Retry Count

A **DICOM** setup used to set the number of times the ultrasound system will attempt to perform a print or store operation to the network devices for which it is configured.

Retry Interval

A **DICOM** setup used to set the interval in minutes between each retry event, which is set using the **Retry Count** setup.

REVIEW

A control used to display the **Review** display, from which you can view the current exam images, open the exam list, select a view mode, select a layout, print images, magnify images, export images, display a report, add voice or text annotation, manipulate 3D data sets, perform selective send or print DICOM operations, and change review settings.

ROI 3D



In 3D imaging, displays the ROI lines on the multiplanar 2D images, with which you can set the ROI and establish the amount of each region that will contribute to the 3D volume image.

ROI Size

In **3D** setups, a slider used to set the size of the region of interest of the 3D image.

ROI View Direction

A **3D** setup used to change the X, Y, and Z orientation of the 3D image.

ROI XYZ

In 3D imaging, sliders used to adjust the size of the 3D volume image by changing the dimensions of the A, B, or C multiplanar 2D images.

Rot Angle

In 3D Cine, used to select the angle through which the 3D volume rotates in the Cine sequence. The Cine steps through this rotation based on your step selection on this display.

Rot Direction

In 3D imaging, used to select the direction through which the 3D volume image rotates in the Cine sequence.

Rotation B, O

In **3D** setups, two sliders used to set the angular rotation along one of two planes (B and O) of the 3D image.

sample volume

The listening region or the volume of blood being sampled by a beam of ultrasound during pulsed Doppler. Sample volume size is defined by the length of the pulse and the width of the ultrasound beam.

SCALE

A control used to select the range of the velocity or frequency display by varying the pulse repetition frequency of the Doppler, Color, or CPA signal.

Scan Angle

A **3D** menu item used to select the angle through which the scanhead will sweep.

SCANHEAD

A system control used to select a scanhead, application, and setting. The **scanhead 1, 2, 3, and 4** blue menu keys are also used to select the scanhead connected to the corresponding scanhead port.s

scanhead select

A display used to select the scanhead, application, and setting.

Scan Time

A **3D** menu item used to select the time it takes for the scanhead to sweep through the scan angle.

Scroll Format

An **2D/M Mode** and **CW/PW** menu item used to select a **Top/Bottom** or **Side by Side** scrolling format.

SD Type

Standard Deviation. In **Obstetrics** setups, a setting for the table type for the selected editor's table data. The range of deviation for the calculation is based on a standard deviation.

SDev Unit

In **Obstetrics** setups, the unit information for the standard deviation units for the selected measurement.

Search Criteria

On the **Modality Worklist** display, text-entry fields used to search for an exam. The patient name and ID, accession number, procedure ID, and date are search criteria.

Search Results

On the **Patient Information** display, the search results include the ID, name, and birth-date of the patients matching the search criteria entered on the **Modality Worklist** display.

Sector Width

A **2D/Mode** menu item used to change the 2D sector width.

SELECT

A control used with the **MENU** control to select settings for menu items.

Selective Print



In Review, this icon prints the currently selected review image to a configured DICOM printer. It also displays a **DICOM Print** dialog box appears, which can be used to add, modify, delete, test, send, or cancel the DICOM print operation.

Selective Send



In Review, this icon sends the currently selected review image to configured DICOM storage device. It also displays a **DICOM Storage** dialog box, which can be used to add, modify, delete, test, send, or cancel the DICOM store operation.

Send Email



In Review, this icon displays the **Send Email** dialog box, which enables you send images attached to an e-mail message. (Not available.)

Sensitivity

A **Color** and **CPA** menu item that selects the number of pulses used to generate a line of the Color Velocity or Variance display.

SET

A control used to set a cursor position or select an item on the screen or in some dialog boxes.

Setting

The name of the setups display.

Settings



In Review, this icon displays the **Setting** dialog box, which allows you to set up network, text annotation, CD recorder, and miscellaneous functions.

SETUP

A control that displays the system setups: **General**, **Peripherals**, **Option**, **Information**, **Misc.**, **3D**, **Live 3D**, **DICOM**, and **Measurement**.

Serial Baud Rate

In **Misc.** setups, a drop-down menu used to configure the serial port for a compatible baud rate.

Serial Port

(1) In **Peripherals** setups, the COM1 serial port can be set to **Panasonic MD 830**, **Open Line Transfer**, or **Not Used**. (2) In **Misc.** setups, the device type can be set to **Modem** or **SerialPort**.

Service

A **DICOM Device** setup text field into which you enter the service type of the device you are configuring for DICOM use with the ultrasound system. A drop-down menu provides three options: **Worklist**, **Storing**, and **Printing**.

Service Object Pair (SOP) Class

A communication context for the DICOM standard.

Setting

A **Scanhead Select** menu used to select either a default setting or one of five user settings for a specific application for the selected scanhead.

Show In Days

In **Obstetrics** setups, a setting used to display the table data in days. When this setting is unselected, the table data appears in weeks and days.

Side by Side

A scroll format setting.

Simultaneous

A blue menu key used to start or stop simultaneous image acquisition.

Size (ECG)

A **Utility ECG** menu item used to select a large, normal, or small ECG display.

Sleep After

A **Utility Miscellaneous** menu item used to set the period of time before the menus darken.

slide controls

Controls used to adjust time gain compensation.

slider

An on-screen control in 3D imaging that adjusts settings.

Sonographer

In the study information, on the **Patient Information** display, a text field into which the sonographer's name can be entered.

Speed

In 3D imaging, used to set the speed of the 3D Cine sequence.

Start/Pause

In 3D imaging, used to start or pause the 3D Cine sequence.

Station Name

A DICOM setup used to enter the station name for the ultrasound system. The station name is an arbitrary name given to the ultrasound system for internal departmental identification purposes.

STEER

A control used to select among five steering angles for linear array Doppler, Color, and CPA imaging.

Step

In 3D imaging, used to select the rate in degrees through which the 3D volume rotates.

Stop

In 3D imaging, used to stop the live 3D imaging and display the **CINE** display.

Storage Commitment

A classification for a DICOM-compatible network server that ensures image data is received at the designated destination.

STORE

A control used to store data to the patient file for review.

Study Info

A selection on the **Patient Information** display that displays the study information. The study information includes the following fields: **LMP, GA, EDD, GRAVIDA, PARA, ABORTA, Exp. Ovul, Day of Cycles, Diag. Physician, Ref. Physician, Sonographer, Description, Gestation, Height, Weight, BSA, HR, Indication, Custom Field1**, and **E-Mail**.

S-VHS

In **Peripherals** setups, a VCR source setting.

SV Size +, SV Size -

Blue menu keys that allow you to increase or decrease the sample volume size.

SWEEP

A control used to adjust the sweep speed of the scrolling display.

Sync Angle

A **3D** menu item used to synchronize the scan angle. If you notice sector shift in the image, you can adjust the center or zero offset of the scan angle using sync angle.

Table Type

In **Obstetrics** setups, the settings **Range Type**, **SD Type**, or **Value Only** are the settings available for the table type. The table type setting describes the type of variation used for the fetal calculation.

Tables

A tab in **Obstetrics** setups used to select, view, and create gestational age (G.A.), fetal growth, or fetal weight tables.

Teichholz

An **M Mode Volume Calculation** setting used as the default method to calculate left ventricular volume.

Test Pattern

A **Misc.** setup used to start or stop the display of a test pattern on the video display.

TEXT

A control used to activate a text cursor and enable the blue menu keys for text entry. You can position the text cursor with the trackball. You can enter text with the keyboard or use the blue menu keys to select terms for display.

Text Annotation



In Review, this icon starts text annotation for the currently selected review image.

Text Setup

A **Misc.** setup used to determine where on the display the text cursor initially appears.

TGC Line

In the **General** setups, a **Display** setting used to show or hide the TGC display.

TGC slide controls

Controls used to adjust the time gain compensation.

TH. Low

A **3D** setup used to set the low threshold in the grayscale parts of the 3D image.

TH. High

A **3D** setup used to set the high threshold in the grayscale parts of the 3D image

Thermal Index (TI)

A displayed index that provides information about the conditions that exist that might lead to an increase in temperature at the surface of the body, within the body tissue, or at the point of focus of the ultrasound beam on bone.

THI

Tissue Harmonic Imaging. A control used to start THI. THI is the reception and processing of harmonic frequencies generated by tissue.

Threshold

3D display and setup slider used to adjust the low and high thresholds to improve the border recognition of surface structures, while eliminating superfluous echoes above or below the threshold settings.

Threshold Low/High

In **3D** imaging, a slider used to select the low and high thresholds at which echoes are rejected.

TI Display

In the **General** setups, a **Display** setting used to select the thermal index in the output display: Thermal Index for bone (Tlb), Thermal Index for cranial bone (Tlc), or Thermal Index for soft tissue (TIs).

Time

In the **General** setups, field used to set the system time.

Time Format

In the **General** setups, a **Time** setting used to select the 12-hour or 24-hour time format.

time gain compensation (TGC)

A process of changing signal amplification to compensate for ultrasound beam attenuation, transducer focusing, and pulse frequency. The purpose of TGC is to permit display of images of equal echogenicity (echo generating capability) to appear with equal brightness regardless of depth. Echoes from greater depths require more gain than echoes from shallower depths.

Top/Bottom

A scroll format setting.

Trace Direction

A **PW/CW** menu item enabled during High Q automatic Doppler measurement. It allows you to select the range of Doppler information that will be included in the automatic calculation: above the baseline (up), below the baseline (down), or both.

trackball

A control used to move objects on a display.

transesophageal scanhead

Scanhead in which the transducer is located at the end of a long flexible gastroscope, which is inserted through the patient's mouth to image from within the esophagus.

Trapezoid

A **2D Mode** menu item used to enable trapezoidal imaging with specific linear array scanheads. Changing system depth changes the image shape. Trapezoidal imaging increases the field of view at shallower depths while imaging in 2D mode.

Trigger (ECG)

A **Utility ECG** menu item used to select the number of ECG triggers along the ECG trace.

Trigger Time (ECG)

A **Utility ECG** menu item used to select the time interval between triggers.

TSI OPT.

Tissue Specific Imaging Optimization. A control used to optimize the image for body habitus.

Type 1-5

On the **Utility Post** menus, the map selections for the imaging modes.

UPDATE

A control used to activate ECG triggering, select between dual image Cine update, switch between duplex and simultaneous image update, and switch between 2D and scrolling image update in duplex.

USER 1, 2, 3, 4, 5

(1) **User 1** through **4** are controls used to store a series of key presses and menu selections into memory. These actions are saved and can be replayed by pressing the corresponding **User** control. (2) **User 1** through **5** are settings on the **Scanhead Select** display. (3) **User 1** and **2** are available for the creation of user maps for 2D, M-mode, and PW and CW Doppler. (4) In 3D imaging, **User 1**, **2**, and **3** are available for preset assignment, and they determine the initial settings for 3D View. **User 1**, **2**, and **3** are selected using the blue menu keys.

UserKey

A **Utility Miscellaneous** menu item used to display the **User Key Setup** display, from which you record a control sequence.

User Table Backup and Restore

In Obstetrics setups, a **Misc.** setup, used to backup OB user-defined tables and equations to removable media, and to restore OB user-defined tables and equations to the system hard disk.

UTILITY

A control used to display the **Utility** menu, from which you can select and display the following menus: **Application**, **VCR**, **ECG**, **Biopsy**, **B/W Post**, **Color Post**, **PRESET**, **Miscellaneous**, and **SONOATLAS**.

Value Only

In **Obstetrics** setups, a setting for the table type for the selected editor's table data. The deviation for the calculation can be based on a value determined by the editor of the table.

VCR

A **Utility** menu from which you calibrate the system for VCR playback. Calibration is necessary before VCR-playback images can be measured. The VCR blue menu keys are also displayed.

VCR counter

In the **General** setups, a **Display** setting used to show or hide the VCR counter on the display. The VCR counter will appear during recording regardless of this setting.

VCR Source

In the **Peripherals** setups, a VCR setting used to select the source of the video recording, VHS or S-VHS.

VCR Type

In the **Peripherals** setups, a VCR setting used to select a NTSC or PAL video type.

VHS

In the **Peripherals** setups, a VCR source setting.

View

A **3D** menu item that displays the 3D image.

View Mode

In Review, a selection used to select Compare or Exam mode for viewing the images in the selected exam.

Vocal

In 3D imaging, Virtual Organ Computer-Aided Analysis (VOCAL), assists in defining, analyzing, and modeling anatomical structures.

Voice Annotation



In Review, this icon enables voice annotation of a subsequently selected image.

VOLUME

A control used to adjust system audio volume.

Volume Selection

In 3D imaging, a slider used to set the starting and ending 3D volume image in the 3D Cine sequence.

WARNING

Information that describes precautions necessary to protect you and the patient.

Weight

In the study information, on the **Patient Information** display, a text field into which you enter the current patient's weight. This value and the value you enter for the patient's height are used to calculate BSA.

Windows Printer

In **Peripherals** setups, drop-down menu used to select the type of Windows printer connected to the system printer port.

Worklist

On the **Patient Information** display, a selection used to display the **Modality Worklist** display, from which you can search for a patient or select a scheduled exam.

Worklist Server

On the **Modality Worklist** display, a drop-down menu from which you select a worklist.

Write Priority

A **Color** menu item used to set the write priority threshold for the Color display. Priority is the threshold value at which the 2D grayscale echo information is considered strong enough to indicate a solid structure such as a heart wall, rather than blood flow, even though that structure may be moving.

X

A control used to display X-planes in a 3D image.

Y

A control used to display Y-planes in a 3D image.

YOYO

In 3D imaging, sets 3D Cine to play the Cine sequence from the beginning to the end, and then from the end to the beginning.

Z

A control used to display Z-planes in a 3D image.

ZOOM

A control used to zoom the image, after which you can use the trackball to pan areas of the image in real-time or freeze.

Acronyms and Abbreviations

%St

percent stenosis

2D

two dimensional

3D

three dimensional

A

area, velocity in atrial systole

A2C

apical two chamber

A4C

apical four chamber

AC

abdominal circumference

Acc

acceleration

AD

abdominal diameter

AE

application entity

AFI

Amniotic Fluid Index

AIUM

American Institute of Ultrasound in Medicine

Ao

aorta

AoV

aortic valve

AP&I

acoustic power and intensity

APD

antero-posterior diameter

APTD

antero-posterior trunk diameter

AV

aortic valve

Av, Avg.

average

AVA

aortic valve area

Bio

biophysical

BPD

biparietal diameter

BPM

beats per minute

BSA

body surface area

C, c

color, circumference, curved

CALC.

calculations

CCA

common carotid artery

CEREB

cerebellum

CHG.

change

CI

Cephalic Index, Cardiac Index

Cist

cisterna

Clav

clavicle

Clr

clear

cm

centimeters

CO

cardiac output

CPA

Color Power Angio imaging

CPU

central processing unit

CRL

crown rump length

CW

continuous wave

D, d

day, density, diameter, diastole, diastolic, distance, Doppler

dB

decibel

Dec

deceleration

Del

Delete

Dia

diastole, diastolic, diameter

Diag

diagnosing

Dias

diastole, diastolic

DICOM

Digital Imaging and Communications in Medicine

Dist

distance

Dopp

Doppler

DR

dynamic range

Dur

duration

E

velocity in ventricular systole

ECA

external carotid artery

ECG

electrocardiogram

EDD

established due date

EDV

end diastolic velocity, end diastolic volume

EE

edge enhancement

EF

ejection fraction

EFW

estimated fetal weight

Ejec Frac

ejection fraction

Endo

endocardium

Epi

epicardium

EPSS

E point septal separation

ERO

effective regurgitant orifice

Esc

Escape

ESV

end systolic volume

ET

ejection time

Ex

excursion

Exp. Ovul.

Expected Ovulation

F

female, fetal

FA

frame averaging (persistence)

FDA

Food and Drug Administration

FF

Fast Forward

Fib

fibula

FL

femur length

Fmean

mean frequency

Fpeak

peak frequency

FPS

frames per second

Frac Short

fractional shortening

Freq.

frequency

FTA

fetal trunk area

F.W.

fetal weight

G

gain, pressure gradient

GA

gestational age

Gmean

mean pressure gradient

Gpeak

peak pressure gradient

GS

gestational sac

HC

head circumference

HDI

High Definition Imaging

HR

heart rate

HUM

humerus

Hz

hertz

ICA

internal carotid artery

ICT

intracavity transducer

ID

identification

INDIC.

Indicator

IOD

inner ocular distance

IP

Internet Protocol

IVRT

isovolumic relaxation time

IVS

interventricular septum

IVT

intravaginal transducer

kHz

kilohertz

L

length, left, linear

LA

left atrium, left arm

Lat

lateral

LL

left leg

LMP

last menstrual period

L/R

Left/Right

Lt.

left

LV

left ventricle, lateral ventricle

LVD

left ventricle dimension

LVOT

left ventricular outflow tract

LVPW

left ventricular posterior wall

M

motion, mega-, male

MA

menstrual age

Magn.

Magnification

Max

maximum

MCA

middle cerebral artery

MHz

megahertz

MI

Mechanical Index

Mid

middle

Min

minimum

Misc.

Miscellaneous

MO

magneto-optical

MP

middle phalanx

MPT

multiplane transesophageal

MV

mitral valve

MVA

mitral valve area

N

name

No.

number

NTSC

National Television Standards Committee

OB

obstetrics

OEM

original equipment manufacturer

OFD

occipital-frontal diameter

OOD

outer ocular distance

Opt.

Optimize

P, p

pressure, power, phased

PAL

Phased Alternating Line

PD

pulse duration

Per

persistence

PET

pre-ejection time

PHT

pressure half-time

PI

Pulsatility Index

PIH

Pulse Inversion Harmonic imaging

PISA

proximal isovelocity surface area

Plac. Loc.

placental location

PRF

pulse repetition frequency

PSV

peak systolic velocity

PTI

pressure time integral

PV

pulmonary valve

PWD

pulsed-wave Doppler

Q

quadrant, quantification

RA

right arm

Rad

radius

REC, Rec

Record

REF, Ref

referring, reference

Regurg

regurgitation

REW, Rew

Rewind

RGB

red, green, blue

RI

Resistive Index

RL

right leg

ROI

region of interest

ROT, Rot

Rotation

Rt.

right

S, s

systole, systolic

S/D

systole/diasole

SD

standard deviation

Sep

separation

Short

shortening

sl

slope

SOP

service object pair

St

stenosis

SV

stroke volume

S/W

software

Sys

systole, systolic

T, t

time

TAD

transverse abdominal diameter

TCD

transcranial Doppler

TEE

transesophageal echocardiographic

TGC

time gain compensation

Th.

Threshold

THI

Tissue Harmonic Imaging

TI

Thermal Index

TIB, Tib

Thermal Index, Bone

TIC, Tlc

Thermal Index, Cranial

TIS, TIs

Thermal Index, Soft Tissue

TTD

transverse trunk diameter

TV

tricuspid valve

TVA

tricuspid valve area

TVI

time velocity integral

Umb.

umbilical

UIF

user interface

V, v

velocity, vaginal

VCR

videocassette recorder

Vel.

velocity

Vent

ventricle

VF

volume flow

Vm

mean velocity

VOL, Vol.

volume

W

weeks

Y

year

YS

yolk sac

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