Volume 1

Operation Manual

SONOACE R7

SAMSUNG MEDISON

WARRANTY

Samsung Medison provides the following warranty to the purchaser of this unit. This warranty is valid for a period of one year from the date of installation and covers all problems caused by faulty workmanship or faulty material. Samsung Medison will, as sole and exclusive remedy and at no charge, replace any such defective unit returned to Samsung Medison within the designated warranty period.

The warranty does not cover damages and loss caused by outside factors including, but not limited to, fire, flood, storm, tidal wave, lightning, earthquake, theft, abnormal conditions of operation, and intentional destruction of the equipment. Damage caused by equipment relocation is not covered.

The warranty is void in cases where the equipment has been damaged as a result of an accident, misuse, abuse, dropping, or when attempts to modify or alter any part or assembly of the equipment have taken place.

Parts with cosmetic defects or deterioration will not be replaced. Replacement of batteries, training materials, and supplies are not covered.

Samsung Medison will not be responsible for incidental or consequential damages of any kind arising from or connected with the use of the equipment.

Samsung Medison will not be responsible for any loss, damage, or injury resulting from a delay in services rendered under the warranty

This limited warranty is in lieu of all other warranties expressed or implied, including warranties of merchant ability or fitness for any particular use. No representative or other person is authorized to represent or assume for Samsung Medison any warranty liability beyond that set forth herein.

Defective equipment shipped from you to Samsung Medison must be packed in the replacement cartons. Shipping and insurance costs are the responsibility of the customer. To return defective material to Samsung Medison contact the Samsung Medison Customer Service Department.

Samsung Medison or a local distributor will make available, upon request, circuit diagrams, a component parts list, descriptions, calibration instructions and other information which will assist your appropriately qualified technical personnel to repair those parts of the equipment which are designed by Samsung Medison as repairable.

CAUTION: United State federal law restricts this device to sale by or on the order of physicians.

SAMSUNG MEDISON

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SONOACE R7

Diagnostic Ultrasound System

Operation Manual

Version 3.01.00
English

MI68-02773A

PROPRIETRAY INFORMATION AND SOFTWARE LICENSE

The Customer shall keep confidential all proprietary information furnished or disclosed to the Customer by Samsung Medison, unless such information has become part of the public domain through no fault of the Customer. The Customer shall not use such proprietary information, without the prior written consent of Samsung Medison, for any purpose other than the maintenance, repair or operation of the goods.

Samsung Medison's systems contain Samsung Medison's proprietary software in machine-readable form. Samsung Medison retains all its rights, title and interest in the software except that purchase of this product includes a license to use the machine-readable software contained in it. The Customer shall not copy, trace, disassemble or modify the software. Transfer of this product by the Customer shall constitute a transfer of this license that shall not be otherwise transferable. Upon cancellation or termination of this contract or return of the goods for reasons other than repair or modification, the Customer shall return to Samsung Medison all such proprietary information.

Safety Requirements

Classifications:

- Type of protection against electrical shock: Class I
- Degree of protection against electrical shock (Patient connection): Type BF or CF Applied Part
- Degree of protection against harmful ingress of water: Ordinary equipment
- Degree of safety of application in the presence of a flammable anesthetic material with air or with oxygen or nitrous oxide: Equipment not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide.
- Mode of operation: Continuous operation

Electromechanical safety standards met:

- Medical Electrical Equipment, Part 1: General Requirements for Basic Safety and Essential Performance **[IEC 60601-1:2005]**
- Medical Electrical Equipment, Part 1-2: General Requirements for Basic Safety and Essential Performance- Collateral Standard: Electromagnetic Compatibility - Requirements and Tests **[IEC 60601-1-2:2007]**
- Medical Electrical Equipment, Part 1-6: General Requirements for Basic Safety and Essential Performance - Collateral Standard: Usability **[IEC 60601-1-6:2010]**
- Medical Electrical Equipment, Part 2-37: Particular Requirements for the Basic Safety and Essential Performance of Ultrasonic Medical Diagnostic and Monitoring Equipment **[IEC 60601-2-37:2007]**
- Medical Electrical Equipment, Part 1: General Requirements for Safety **[IEC 60601-1:1988 with A1:1991 and A2:1995]**
- Medical Electrical Equipment, Part 1-1: General Requirements for Safety - Collateral Standard: safety Requirement for Medical Electrical Systems **[IEC 60601-1-1:2000]**
- Medical Electrical Equipment, Part 1-2: General Requirements for Safety - Collateral Standard: Electromagnetic Compatibility - Requirements and Test **[IEC 60601-1-2:2001, A1:2004]**
- Medical Electrical Equipment, Part 1-4: General Requirements for Safety - Collateral Standard: Programmable Electrical Medical Systems **[IEC 60601-1-4:1996, A1:1999]**

- Medical Electrical Equipment, Part 2-37: Particular Requirements for Safety - Ultrasonic Medical Diagnostic and Monitoring Equipment **[IEC 60601-2-37:2001 with A1:2004, A2:2005]**
- Medical Devices - Application of Risk Management to Medical Devices **[ISO 14971:2007]**
- Medical Electrical Equipment, Part 1: General Requirements for Safety **[UL 60601-1:2003]**
- Medical Electrical Equipment - Part 1: General Requirements for Safety **[CAN/CSA C22.2 No.601.1-M90:1990, with R2003, with R2005]**
- Biological Evaluation of Medical Devices, Part 1: Evaluation and Testing within a risk management process **[ISO 10993-1:2009]**
- Standard Means for the Reporting of the Acoustic Output of Medical Diagnostic Ultrasonic Equipment **[IEC 61157:2007]**

Declarations:

C US	This is CSA symbol for Canada and United States of America.
0123	This is manufacturer's declaration of product compliance with applicable EEC directive(s) and the European notified body.
	This is manufacturer's declaration of product compliance with applicable EEC directive(s).

Read This First

How to Use Your Manual

This manual addresses the reader who is familiar with ultrasound techniques. Only medical doctors or persons supervised by medical doctors should use this system. Sonography training and clinical procedures are not included here. This manual is not intended to be used as training material for the principles of ultrasound, anatomy, scanning techniques, or applications. You should be familiar with all of these areas before attempting to use this manual or your ultrasound system.

This manual does not include diagnosis results or opinions. Also, check the measurement reference for each application's result measurement before the final diagnosis.

It is useless to make constant or complex adjustments to the equipment controls. The system has been preset at the factory to produce an optimum image in the majority of patients. User adjustments are not usually required. If the user wishes to change image settings, the variables may be set as desired. Optimal images are obtained with little difficulty.

We are not responsible for errors that occur when the system is run on a user's PC.

Non-Samsung Medison product names may be trademarks of their respective owners.

Please keep this user guide close to the product as a reference when using the system.

For safe use of this product, you should read 'Chapter1. Safety' and 'Chapter8. Maintenance' in this manual, prior to starting to use this system.

NOTE: Some features are not available in some countries. The features with options, and specifications that this manual present can be changed without notice. Government approval is still pending in some nations.

Conventions Used in This Manual

DANGER: Describes precautions necessary to prevent user hazards of great urgency. Ignoring a DANGER warning will risk life-threatening injury.

WARNING: Used to indicate the presence of a hazard that can cause serious personal injury, or substantial property damage.

CAUTION: Indicates the presence of a hazard that can cause equipment damage.

NOTE: A piece of information useful for installing, operating and maintaining a system. Not related to any hazard.

If You Need Assistance

If you need any assistance with the equipment, like the service manual, please contact the Samsung Medison Customer Service Department or one of their worldwide customer service representatives, immediately.

Revision History

VERSION	DATE	NOTE
v3.01.00-00	2013-09-26	Initial Release
v3.01.00-01	2013-11-28	Add State of California Proposition 65 Warning (US Only)

System Upgrades and Manual Set Updates

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

Verify that Check if this version of the manual is correct for the system version. If not, please contact the Customer Service Department.

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Chapter 1 Safety

Chapter 2 Introduction

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** Reference Manual

Samsung Medison is providing an additional SONOACE R7 Reference Manual. GA tables and references for each application are included in the Reference Manual.

Chapter 1

Safety

Indication for Use

The SONOACE R7 Diagnostic Ultrasound System and transducers are intended for diagnostic ultrasound imaging and fluid analysis of the human body.

The clinical applications include: Fetal, Abdominal, Pediatric, Small Organ, Neonatal Cephalic, Adult Cephalic, Trans-rectal, Trans-vaginal, Muscular-Skeletal (Conventional, Superficial), Cardiac Adult, Cardiac Pediatric, Peripheral vessel.

Contraindications

The SONOACE R7 system is not intended for ophthalmic use or any use causing the acoustic beam to pass through the eye.

CAUTION:

- Federal law restricts this device to sale by or on the order of a physician
- The method of application or use of the device is described in the manual 'Chapter 3. Starting Diagnosis' and 'Chapter 4. Diagnosis Modes'.

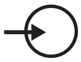
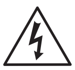
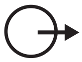
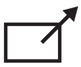
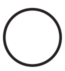
Safety Signs

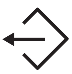
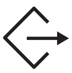
Please read this chapter before using the Samsung Medison ultrasound system. It is relevant to the ultrasound system, the probes, the recording devices, and any of the optional equipment.

SONOACE R7 is intended for use by, or by the order of, and under the supervision of, a licensed physician who is qualified for direct use of the medical device.

Safety Symbols

The International Electro Technical Commission (IEC) has established a set of symbols for medical electronic equipment, which classify a connection or warn of potential hazards. The classifications and symbols are shown below.

Symbols	Description	Symbols	Description
V~	Alternating current voltage source		Input port
	CAUTION: Risk of electric shock		Output port
	Type BF applied part (Classification based on degree of protection against electric hazard)		Print remote output
	Defibrillation-proof type CF applied part (Classification based on degree of protection against electric hazard)		Foot Switch Port
	Power on/off		ECG port
	Power on		USB port
	Power off		Network port

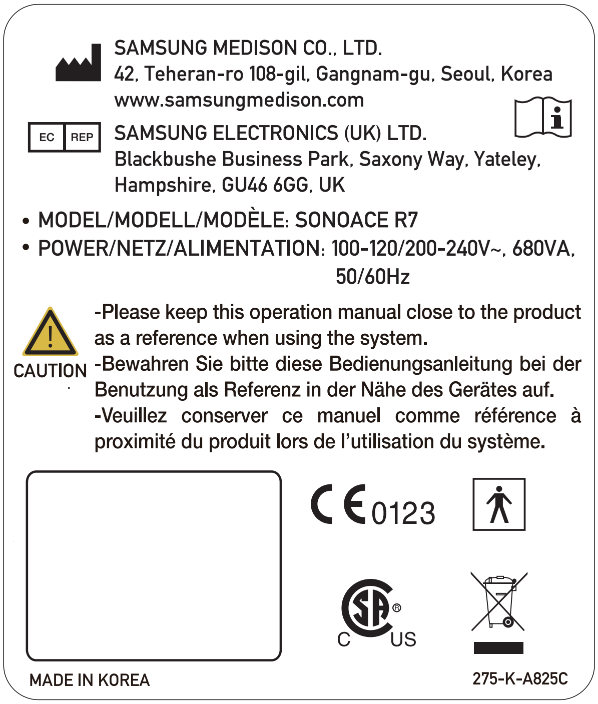
Symbols	Description	Symbols	Description
	WARNING: The accompanying information must be followed to prevent serious accidents and/or damage to property.		Microphone Port
	CAUTION: The accompanying information helps to prevent minor accidents and/or damage to property.	IPX 7	IPX 7: Protected against the effects of temporary immersion in water
	Refer to the operation manual.	IPX 1	IPX 1: Protected against vertically falling water drops
	Power ON for part of the product	IPX 8	IPX 8: Protected against the effects of continuous immersion in water
	Equipotentiality		Probe port
	Dangerous voltage (Indicates dangerous voltages over 1000V AC or 1500V DC)		CAUTION: Electrostatic sensitive devices (ESD)
	Protective earth (ground)		Do not sit on the product.
	Data output port		Do not push the product.
	Data input port		Do not lean against the product.
	Data Input/Output port		Follow the operation manual.

Symbols

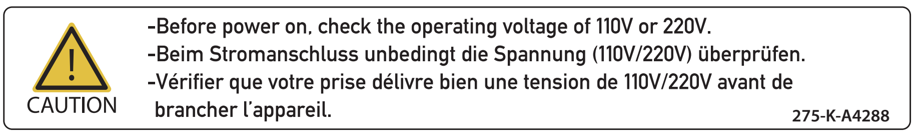
Symbols	Description	Symbols	Description
EC REP	Authorised Representative In The European Community		Manufacturer

Labels

To protect the system, you may see 'Warning' or 'Caution' marked on the surface of the product.



[Label 1. ID label]



[Label 2. Marked below OUTLET]

[Label 3. Safety note for "TIP-OVER" Precaution]

[Label 4. Prohibition of seating on Control panel]

Electrical Safety

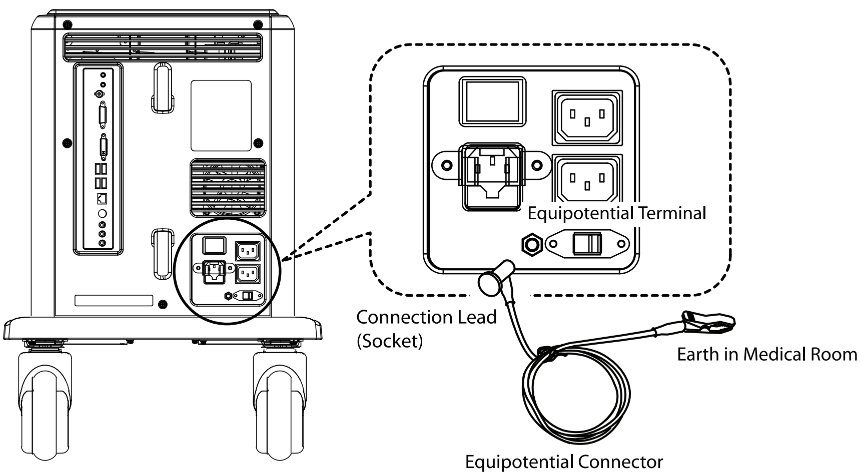
This product is categorized as a Class I device.

CAUTION:

- As for US requirement, the LEAKAGE CURRENT might be measured from a center-tapped circuit when the equipment connects in the United States to 240V supply system.
- To help assure grounding reliability, connect to a "hospital grade" or "hospital only" grounded power outlet.

Prevention of Electric Shock

In a hospital, dangerous currents are due to the potential differences between connected equipment and touchable conducting parts found in medical rooms. The solution to the problem is consistent equipotential bonding. Medical equipment is connected with connecting leads made up of angled sockets to the equipotential bonding network in medical rooms.



[Figure 1.1 Equipotential bonding]

Additional equipment connected to medical electrical equipment must comply with the respective IEC standards (e.g., IEC 60950/EN 60950 for data processing equipment, IEC 60601-1/EN 60601-1) for medical devices). Furthermore, all components of the product shall comply with the requirements for medical electrical systems IEC 60601-1-1/EN 60601-1-1. A person connecting additional equipment to signal input and output ports of medical electrical equipment must verify that the equipment complies with IEC 60601-1-1/EN 60601-1-1.

WARNING:

- Electric shock may exist result if this system, including and all of its externally mounted recording and monitoring devices, is not properly grounded.
- Do not remove the 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 Samsung Medison Customer Service Department.
- Check the face, housing, and cable before use. Do not use and disconnect the power source, if the face is cracked, chipped, or torn, the housing is damaged, or if the cable is abraded.
- Always disconnect the system from the wall outlet prior to cleaning the system.
- All patient contact devices, such as probes and ECG leads, must be removed from the patient prior to application of a high voltage defibrillation pulse.
- The use of flammable anesthetic gas or oxidizing gases (N_2O) should be avoided.
- Avoid places where the system is likely to be difficult to operate the disconnection device.
- Do not use HF surgical equipment with the system. Any malfunctions in the HF surgical equipment may result in burns to the patient.
- The System must only be connected to a supply mains with protective earth to avoid risk of electric shock.

CAUTION:

- The system has been designed for 100-120VAC and 200-240VAC; you should select the input voltage of printer and VCR. Prior to connecting a peripheral power cord, verify that the voltage indicated on the power cord matches the voltage rating of the peripheral device.
- An isolation transformer protects the system from power surges. The isolation transformer continues to operate when the system is in standby.
- Do not immerse the cable in liquids. Cables are not waterproof.
- The auxiliary socket outlets installed on this system are rated 100-120V and 200-240V with maximum total load of 150W. Use these outlets only for supplying power to equipment that is intended to be part of the ultrasound system. Do not connect additional multiple-socket outlets or extension cords to the system.
- Do not connect peripheral devices, not listed in this manual, to the auxiliary socket outlets of the system.
- Do not touch SIP/SOP and the patient simultaneously. There is a risk of electric shock from leakage current.

ECG-Related Information

WARNING:

- This device is not intended to provide a primary ECG monitoring function, and therefore does not have means of indicating an inoperative electrocardiograph.
- Do not use ECG electrodes of HF surgical equipment. Any malfunctions in the HF surgical equipment may result in burns to the patient.
- Do not use ECG electrodes during cardiac pacemaker procedures or other electrical stimulators.
- Do not use ECG leads and electrodes in an operating room.

ESD

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, creating static electricity. An ESD occurs when an individual with an electrical energy build-up comes in contact with conductive 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.

CAUTION:

- The level of electrical energy discharged from a system user or patient to an ultrasound system can be significant enough to cause damage to the system or probes.
- Always perform the pre-ESD preventive procedures before using connectors marked with the ESD warning label.
  - Apply anti-static spray on carpets or linoleum.
  - Use anti-static mats.
  - Ground the product to the patient table or bed.
- It is highly recommended that the user be given training on ESD-related warning symbols and preventive procedures.

EMI

Although this system has been manufactured in compliance with existing EMI (Electromagnetic Interference) requirements, use of this system in the presence of an electromagnetic field can cause momentary degradation of the ultrasound image.

If this occurs often, Samsung Medison suggests a review of 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 radios, TVs, or microwave transmission equipment nearby can also cause interference.

CAUTION: In cases where EMI is causing disturbances, it may be necessary to relocate this system.

EMC

The testing for EMC (Electromagnetic Compatibility) of this system has been performed according to the international standard for EMC with medical devices (IEC 60601-1-2). This IEC standard was adopted in Europe as the European norm (EN 60601-1-2).

Guidance and manufacturer's declaration - electromagnetic emission

This product is intended for use in the electromagnetic environment specified below. The customer or the user of this product should assure that it is used in such an environment.

Emission test	Compliance	ElectroMagnetic environment -guidance
RF Emission CISPR 11	Group 1	The Ultrasound System uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF Emission CISPR 11	Class B	The Ultrasound System is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies building used for domestic purpose.
Harmonic Emission IEC 61000-3-2	Class A	
Flicker Emission IEC 61000-3-3	Complies	

Approved Cables, Transducers and Accessories for EMC

Approved Cable for ElectroMagnetic Compliance

Cables connected to this product may affect its emissions; Use only the cable types and lengths listed below table.

Cable	Type	Length
VGA	Shielded	Normal
Parallel	Shielded	Normal
RS232C	Shielded	Normal
USB	Shielded	Normal
LAN (RJ45)	Twisted pair	Any
S-Video	Shielded	Normal
Foot Switch	Shielded	2.73yd
B/W Printer	Unshielded Coaxial	Normal
MIC	Unshielded	Any
Printer Remote	Unshielded	Any
Audio R.L	Shielded	Normal
VHS	Shielded	Normal
ECG AUX input	Shielded	< 3m
e-Motion Marker	Shielded	3m

Approved Transducer for ElectroMagnetic Compliance

The probe listed in 'Chapter 9. Probes' when used with this product, have been tested to comply with the group1 class B emission as required by International Standard CISPR 11.

Approved Accessories for ElectroMagnetic Compliance

Accessories used with this product may effect its emissions.

CAUTION: When connecting other customer-supplied accessories to the system, such as a remote printer or VCR, it is the user's responsibility to ensure the electromagnetic compatibility of the system. Use only CISPR 11 or CISPR 22, CLASS B compliant devices.

WARNING: The use of cables, transducers, and accessories other than those specified may result in increased emission or decreased Immunity of the Ultrasound System.

Immunity test	IEC 60601 Test level	Compliance level	ElectroMagnetic environment - guidance
Electrotatic discharge (ESD) IEC 61000-4-2	±6KV Contact ±8KV air	±6KV Contact ±8KV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst IEC 61000-4-4	±2KV for power supply lines ±1KV for input/output lines	±2KV for power supply lines ±1KV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1KV differential mode ±2KV common mode	±1KV differential mode ±2KV common mode	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	<5% U_T for 0.5cycle (>95% dip in U_T) 40% U_T for 5 cycle (60% dip in U_T) 70% U_T for 25 cycle (30% dip in U_T) <5% U_T for 5 s (<95% dip in U_T)	<5% U_T for 0.5cycle (>95% dip in U_T) 40% U_T for 5 cycle (60% dip in U_T) 70% U_T for 25 cycle (30% dip in U_T) <5% U_T for 5 s (<95% dip in U_T)	Mains power quality should be that of a typical commercial or hospital environment. If the user of this product requires continued operation during power mains interruptions, it is recommended that this product be powered from an uninterruptible power supply or a battery.
Power frequency (50/60Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
NOTE: U_T is the a.c. mains voltage prior to application of the test level.			

Immunity test	IEC 60601 Test level	Compliance level	ElectroMagnetic environment - guidance
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80MHz	0.01V	Portable and mobile RF communications equipment should be used no closer to any part of the Ultrasound System, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. **Recommended separation distance** $d = [\frac{3,5}{V_1}]\sqrt{p}$ $d = [\frac{3,5}{E_1}]\sqrt{p}$ 80MHz to 800MHz $d = [\frac{7}{E_1}]\sqrt{p}$ 800MHz to 2.5GHz
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.5GHz	3V/m	Where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recomm-ended separation distance in meters (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, [a] should be less than the compliance level in each frequency range. [b] Interference may occur in the vicinity of equipment marked with the following symbol : 

NOTE 1) At 80MHz and 800MHz, the higher frequency range applies.
NOTE 2) These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

[a] Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the Ultrasound System is used exceeds the applicable RF compliance level above, the Ultrasound System should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the Ultrasound System or using a shielded location with a higher RF shielding effectiveness and filter attenuation.
[b] Over the frequency range 150kHz to 80MHz, field strengths should be less than [V_1] V/m.

Recommended separation distances between portable and mobile RF communications equipment and the SONOACE R7

This product is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of this product can help Prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and this product as recommended below, according to the maximum output power of the communications equipment.

Rated maximum output power of transmitter [W]	**Separation distance according to frequency of transmitter [m]**		
	150kHz to 80MHz $d = [\frac{3,5}{V_1}]\sqrt{p}$	**80MHz to 800MHz** $d = [\frac{3,5}{E_1}]\sqrt{p}$	**800MHz to 2.5GHz** $d = [\frac{7}{E_1}]\sqrt{p}$
	V1=0.01Vrms	**E1=3 V/m**	**E1=3V/m**
0.01	35.00	0.11	0.23
0.1	110.68	0.36	0.73
1	350.00	1.16	2.33
10	1106.80	3.68	7.37
100	3500.00	11.66	23.33

For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where p is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.
NOTE 1) At 80MHz and 800MHz, the separation distance for the higher frequency range applies.
NOTE 2) These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

Electromagnetic environment – guidance

The Ultrasound System must be used only in a shielded location with a minimum RF shielding effectiveness and, for each cable that enters the shielded location. Field strengths outside the shielded location from fixed RF transmitters, as determined by an electromagnetic site survey, should be less than 3V/m.

It is essential that the actual shielding effectiveness and filter attenuation of the shielded location be verified to assure that they meet the minimum specification.

CAUTION: If the system is connected to other customer-supplied equipment, such as a local area network (LAN) or a remote printer, Samsung Medison cannot guarantee that the remote equipment will work correctly in the presence of electromagnetic phenomena.

Avoiding ElectroMagnetic Interference

Typical interference on Ultrasound Imaging Systems varies depending on Electromagnetic phenomena. Please refer to following table:

<table>
<tr><th>Imaging Mode</th><th>ESD[1]</th><th>RF[2]</th><th>Power Line[3]</th></tr>
<tr><td>2D or 3D</td><td rowspan="4">Change of operating mode, system settings, or system reset.
Brief flashes in the displayed or recorded image.</td><td>For sector imaging probes, white radial bands or flashes in the centerlines of the image.
For linear imaging probes, white vertical bands, sometimes more pronounced on the sides of the image.</td><td>White dots, dashes, diagonal lines, or diagonal lines near the center of the image.</td></tr>
<tr><td>M</td><td>Increase in the image background noise or white M mode lines.</td><td>White dots, dashes, diagonal lines, or increase in image background noise</td></tr>
<tr><td>Color</td><td>Color flashes, radial or vertical bands, increase in background noise, or changes in color image.</td><td>Color flashes, dots, dashes, or changes in the color noise level.</td></tr>
<tr><td>Doppler</td><td>Horizontal lines in the spectral display or tones, abnormal noise in the audio, or both.</td><td>Vertical lines in the spectral display, popping type noise in the audio, or both.</td></tr>
<tr><td colspan="4">1. ESD caused by discharging of electric charge build-up on insulated surfaces or persons.
2. RF energy from RF transmitting equipment such as portable phones, hand-held radios, wireless devices, commercial radio and TV, and so on.
3. Conducted interference on power lines or connected cables caused by other equipment, such as switching power supplies, electrical controls, and natural phenomena such as lightning.</td></tr>
</table>

A medical device can either generate or receive electromagnetic interference. The EMC standards describe tests for both emitted and received interference.

Samsung Medison Ultrasound Systems do not generate interference in excess of the referenced standards.

An Ultrasound System is designed to receive signals at radio frequency and is therefore susceptible to interference generated by RF energy sources. Examples of other sources of interference are medical devices, information technology products, and radio and television transmission towers. Due to the difficulties in finding sources of interference, refer to the following when searching for them.

- Is the interference intermittent or constant?
- Does the interference show up only with one transducers operating at the same frequency or with several transducer?
- Do two different transducers operating at the same frequency have the same problem?
- Is the interference present if the system is moved to a different location in the facility?

The answers to these questions will help determine if the problem reside with the system or the scanning environment. After you answer the question, contact your local Samsung Medison customer service department.

Mechanical Safety

Moving the Equipment

WARNING: Be extra careful when transporting it. Careless transportation of the product may result in product damage or personal injury.

- Before transporting the product, check that the brakes on the front, back wheels or wheels are unlocked. Also, make sure to retract the monitor arm completely so that it is secured in a stationary position.
- Always use the handles at the console and move the product slowly.

This product is designed to resist shocks. However, excessive shock, for example if the product falls over, may cause serious damage.

If the system operates abnormally after repositioning, please contact the Samsung Medison Customer Service Department.

The Brakes

Brakes are mounted on the front and back wheels of the console only. To lock the brakes, press the area under the locks with your foot. To unlock the brakes, press the Off area on the locks with your foot.

You can use the brakes to control the movement of the product. We recommend that you lock the brakes when using the product.

Precautions on Ramps

Always make sure that the control panel is facing the direction of movement.

WARNING: Be aware of the castors, especially when moving the system. Samsung Medison recommends that you exercise caution when moving the product up or down ramps.

When moving the product down a ramp or resting it temporarily on a ramp, the product may tilt over even with the brakes on depending on the direction of the product. Do not rest the product on ramps.

Safety Note

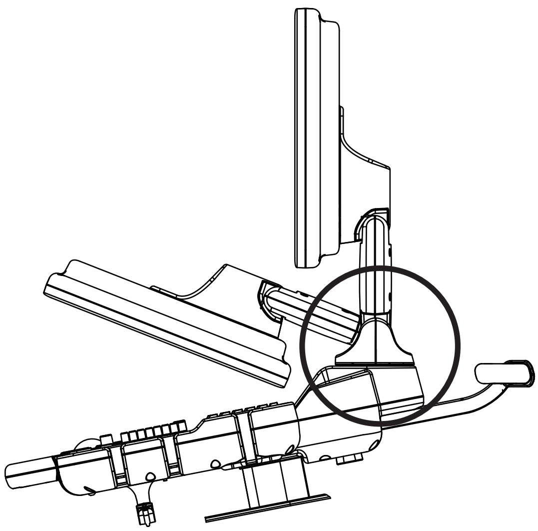
CAUTION:

- Do not press the control panel excessively.
- Never attempt to modify the product in any way.
- Check the operational safety when using the product after a prolonged break in service.
- Make sure that other objects, such as metal pieces, do not enter the system.
- Do not block the ventilation slots.
- To prevent damage to the power cord, be sure to grip the plug head – not the cord – when unplugging.
- 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.
- Repair or replacement of parts of this equipment must be performed by a qualified Samsung Medison service technician. Assuming that the equipment is maintained by a qualified service technician and meets the guideline of this provided manual, the expected service life of the equipment is approximately 7 years.

Please refer to "Chapter 8. Maintenance" for detailed information on protecting, cleaning and disinfecting the equipment.

Safety Note for Monitor

When adjusting the height or position of the monitor, be careful of the space in the middle of the monitor arm. Having your fingers or other body parts caught in it may result in injury.



[Figure 1.2 Safety note for monitor]

Biological Safety

For more safety information on probes and biopsy, please refer to Chapter 9 'Probes.'

WARNING:

- Ultrasound waves may have damaging effects on cells and, therefore, may be harmful to the patient. If there is no medical benefit, minimize the exposure time and maintain the ultrasound wave output level at low. Please refer to the ALARA principle.
- 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 the power to the system, and call your local Samsung Medison Customer Service Department.
- Do not use a system that exhibits erratic or inconsistent updating. Discontinuities in the scanning sequence are indicative of a hardware failure that should be corrected before use.
- The system limits the maximum contact temperature to 43 degree Celsius, and the ultrasonic waves output observes American FDA regulations.

ALARA Principle

Guidance 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 judgment and insight of qualified personnel. No set of rules can be formulated that would be sufficiently complete to dictate the correct response for 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 the 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, the 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 also in the applications of the technology, have resulted in the need for more and better information to guide the user. The output 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 mass, body size, location of the bone relative to the focal point, attenuation in the body, and ultrasound exposure time. Exposure time is an especially useful variable, because the user controls it. The ability to limit the index values over time support the ALARA principle.

Applying ALARA

The system-imaging mode used depends upon the information needed. 2D-mode and M-mode imaging provide anatomical information, while Doppler, Power, and Color imaging provide information about blood flow. Scanned modes, like 2D-mode, Power, or Color, disperse or scatter 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 judgment. The probe frequency, system set-up values, scanning techniques, and operator experience aid the sonographer in meeting 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 probe 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 control.

Direct Controls

Application selection and the output intensity 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 required during any exam. For example, peripheral vascular intensity levels are not recommended for fetal exams. Some systems automatically select the proper range for a particular procedure, while others require manual selection. Ultimately, the user bears the responsibility for proper clinical use. The Samsung Medison system provides both automatic and user-definable settings.

Output has direct impact on acoustic intensity. Once the application has been established, the output control can be used to increase or decrease the intensity output. The output control allows you to select intensity levels less than the defined maximum. Prudent use dictates that you select the lowest output intensity 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 probe selection.

The choice of imaging mode determines the nature of the ultrasound beam. 2D-mode is a scanning mode, Doppler is a stationary or unscanned mode. A stationary ultrasound beam concentrates energy on a single location. A moving or scanned ultrasound beam disperses the energy over a wide area and the beam is only concentrated on a given area for a fraction of the time necessary in 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 given 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 to 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 cavitations. 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.

Probe selection affects intensity indirectly. Tissue attenuation changes with frequency. The higher the probe operating frequency, the greater the attenuation of the ultrasonic energy. Higher probe operating frequencies require higher output intensity to scan at a deeper depth. To scan deeper at the same output intensity, a lower probe frequency is required. Using more gain and output beyond a point, without corresponding increases in image quality, can mean that a lower frequency probe 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 increasing output. For example; before increasing output, optimize gain to improve image quality.

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 will require a follow-up, which ultimately increases the time. Diagnostic ultrasound is an important tool in medicine, and, like any tool, should be used efficiently and effectively.

Output Display Features

The system output display comprises two basic indices: a mechanical index and a thermal index. The thermal index consists of the following indices: soft tissue (TIs), bone (TIb) and cranial bone (TIc). 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 probe application has a default selection that is appropriate for that combination. The TIb or TIs is continuously displayed over the range of 0.0 to maximum output, based on the probe 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 probe application. The default settings are invoked automatically by the ultrasound system when power is turned on, new patient data is entered into the system database, or a change in application takes place.

The decision as to which of the three thermal indices to display 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. Some factors might create artificially high or low thermal index readings e.g. presence of fluid or bone, or the flow of blood. A highly attenuating tissue path, for example, will cause the potential for local zone heating to be 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 but there is no specific MI value that means that a mechanical effect will actually occur. The MI should be used as a guide for implementing the ALARA principle.

Thermal Index (TI) Display

The TI informs the user about the potential for temperature increase occuring at the body surface, within body tissue, or at the point of focus of the ultrasound beam on bone. The TI is an estimate of the temperature increase in specific body tissues. The actual amount of any temperature rise is influenced by factors such as tissue type, vascularity, and mode of operation etc. The TI should be used as a guide for implementing the ALARA principle.

The bone thermal index (TIb) 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 (TIc) 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 TIb using the TIs/TIb selection on the Miscellaneous system setups. TIc is displayed when you select a trans-cranial application.

Mechanical and Thermal indices Display Precision and Accuracy

The Mechanical and Thermal Indices on the system are precise to 0.1 units.

The MI and TI display accuracy estimates for the system are given in the Acoustic Output Tables manual. These accuracy estimates are based on the variability range of probes and systems, inherent acoustic output modeling errors and measurement variability, as described 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 investigated 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 exposure, for the vast majority of tissue paths, is built into the measurement and calculation process. For example:

The measured water tank values are de-rated using a conservative, industry standard, attenuation coefficient of 0.3dB/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 probe 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 display values: hardware variations, algorithm accuracy estimation and measurement variability. Variability among probes and systems is a significant factor. Probe variability results from piezoelectric crystal efficiencies, process-related impedance differences, and sensitive lens focusing parameter variations. Differences in the system pulse voltage control and efficiencies are also a contributor to variability. There are inherent uncertainties in the algorithms used for estimating acoustic output values over the range of possible system operating conditions and pulse voltages. Inaccuracies in laboratory measurements are related to 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 0.3dB/cm-MHz attenuated medium are not taken into account in calculation of the accuracy estimate displayed. Neither linear propagation, nor uniform attenuation at the 0.3dB/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 particularly in water tank measurements, non-linear propagation and saturation losses occur as pulse voltages increase.

The display accuracy estimates take into account the variability ranges of probes 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. They are also independent of the effects of non-linear loss on the measured values.

Control Effects - Control 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 a MI. They change as the system responds to POWER adjustments.

In combined modes, such as simultaneous Color, 2D-mode and pulsed 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-mode Controls

2D-mode size

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

Persistence

A lower persistence will decrease the TI. Pulse voltage may be automatically increased. An increase in pulse voltage will increase MI.

Focal no.

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

Color and Power Controls

Color Sensitivity

Increasing the color sensitivity may increase the TI. More time is spent scanning for color images.

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 pulse voltage to stay below the system maximum. A decrease in pulse 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 will automatically adjust pulse voltage to stay below the system maximums. A decrease in pulse voltage will also decrease MI.

Sec Width

A narrower 2D-mode 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 as the primary 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 pulse voltage to remain below the system maximum. A decrease in pulse voltage will decrease MI.

Doppler, CW, M-mode, and Color Imaging Controls

When a new imaging mode is selected, both the TI and the MI will 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. If a mode is turned off and then reselected, the system will return to the previously selected settings.

Probe

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

Depth

A decrease in 2D-mode depth will automatically decrease the 2D-mode frame rate. This would decrease the TI. The system may also automatically choose a deeper 2D-mode 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. Samsung Medison factory defaults vary with probe, 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;

- AIUM Report, January 28, 1993, "Bioeffects and Safety of Diagnostic Ultrasound"
- Bioeffects Considerations for the Safety of Diagnostic Ultrasound, J Ultrasound Med., Sept. 1998: Vol. 7, No. 9 Supplement
- Acoustic Output Measurement Standard for Diagnostic Ultrasound Equipment. (AIUM, NEMA. 1998)
- Acoustic Output Labeling Standard for Diagnostic Ultrasound Equipment (AIUM, 1998)
- Second Edition of the AIUM Output Display Standard Brochure, Dated March 10, 1994. (A copy of this document is shipped with each system.)
- Information for Manufacturer Seeking Marketing Clearance of Diagnostic Ultrasound Systems and Transducers. FDA. September 1997. FDA.
- Standard for Real-Time Display of Thermal and Mechanical Acoustic Output Indices on Diagnostic Ultrasound Equipment. (Revision 1, AIUM, NEMA. 1998)

▶ 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, Supplement1.

Acoustic Output and Measurement

Since the first usage of diagnostic ultrasound, the possible human biological effects (bioeffects) of 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 up to date information.

The acoustic output for this system has been measured and calculated in accordance with the December 1985 "510 (K) Guide for Measuring and Reporting Acoustic Output of Diagnostic Ultrasound Medical Devices," except that the hydrophone meets the requirements of "Acoustic Output Measurement Standard for Diagnostic Ultrasound Equipment" (NEMA UD 2-1992)

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 using the following formula:

In Situ = Water $[e^{-(0,23\,alf)}]$

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 transducer/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 purpose; therefore, the *In Situ* value which is commonly reported uses the formula:

In Situ (derated) = Water [$e^{-(0,069\, lf)}$]

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

The maximum derated and the maximum water values do not always occur at the same operating condition; therefore, the reported maximum water and derated values may not be related to the *In Situ* (derated) formula. Take for example a multi-zone array transducer that has maximum water value intensities in its deepest zone: the same transducer may have its largest derated intensity in one if its shallowest focal zones.

Acoustic Output and Measurement

The terms and symbols used in the acoustic output tables are defined in the following paragraphs.

ISPTA.3 The derated spatial-peak temporal-average intensity (milliwatts per square centimeter).

ISPPA.3 The derated spatial-peak pulse-average intensity (watts per square centimeter). The value of IPA.3 at the position of global maximum MI (IPA.3@MI) may be reported instead of ISPPA.3 if the global maximum MI is reported.

MI The Mechanical Index. The value of MI at the position of ISPPA.3, (MI@ISPPA.3) may be reported instead of MI (global maximum value) if ISPPA.3 is 190W/cm2

Pr.3 The derated peak rarefactional pressure (megapascals) associated with the transmit pattern giving rise to the reported MI value.

WO The ultrasonic power (milliwatts). For the operating condition giving rise to ISPTA.3, WO is the total time-average power;. For operating conditions subject to reporting under ISPPA.3, WO is the ultrasonic power associated with the transmit pattern giving rise to the value reported under ISPPA.3

fc The center frequency (MHz). For MI and ISPPA.3, fc is the center frequency associated with the transmit pattern giving rise to the global maximum value of the respective parameter. For ISPTA.3, for combined modes involving beam types of unequal center frequency, fc is defined as the overall ranges of center frequencies of the respective transmit patterns.

ZSP The axial distance at which the reported parameter is measured (centimeters).

x-6,y-6 are respectively the in-plane (azimuth) and out-of-plane (elevation) -6 dimensions in the x-y plane where ZSP is found (centimeters).

PD The pulse duration (microseconds) associated with the transmit pattern giving rise to the reported value of the respective parameter.

PRF The pulse repetition frequency (Hz) associated with the transmit pattern giving rise to the reported value of the respective parameter.

EBD The entrance beam dimensions for the azimuth and elevation planes (centimeters).

EDS The entrance dimensions of the scan for the azimuth and elevation planes (centimeters).

Acoustic Measurement Precision and Uncertainty

The Acoustic Measurement Precision and Acoustic Measurement Uncertainty are described below.

Quantity	Precision	Total Uncertainty
PII.3 (derated pulse intensity integral)	3.2 %	+21 % to - 24 %
Wo (acoustic power)	6.2 %	+/- 19 %
Pr.3 (derated rarefaction pressure)	5.4 %	+/- 15 %
Fc (center frequency)	< 1 %	+/- 4.5 %

Systematic Uncertainties.

For the pulse intensity integral, derated rarefaction pressure Pr.3, center frequency and pulse duration, the analysis includes considerations of the effects on accuracy of:

Hydrophone calibration drift or errors.

Hydrophone / Amp frequency response.

Spatial averaging.

Alignment errors.

Voltage measurement accuracy, including.

- Oscilloscope vertical accuracy.
- Oscilloscope offset accuracy.
- Oscilloscope clock accuracy.
- Oscilloscope Digitization rates.

- Noise.

The systematic uncertainties Acoustic power measurements using a Radiation Force are measured through the use of calibrated NIST acoustic power sources.

We also refer to a September 1993 analysis done by a working group of the IEC technical committee 87 and prepared by K. Beissner, as a first supplement to IEC publication 1161.

The document includes analysis and discussion of the sources of error / measurement effects due to:

- Balance system calibration.
- Absorbing (or reflecting) target suspension mechanisms.
- Linearity of the balance system.
- Extrapolation to the moment of switching the ultrasonic transducer (compensation for ringing and thermal drift).
- Target imperfections.
- Absorbing (reflecting) target geometry and finite target size.
- Target misalignment.
- Ultrasonic transducer misalignment.
- Water temperature.
- Ultrasonic attenuation and acoustic streaming.
- Coupling or shielding foil properties.
- Plane-wave assumption.
- Environmental influences.
- Excitation voltage measurement.
- Ultrasonic transducer temperature.
- Effects due to nonlinear propagation and saturation loss.

The overall findings of the analysis give a rough Acoustic Power accuracy figure of +/- 10% for the frequency range of 1 - 10 MHz.

Training

The users of this ultrasound system must familiarize themselves with the ultrasound system to optimize the performance of the device and to detect possible malfunctions. It is recommended that all users receive proper training before using the device. You can receive training on the use of the product from the Samsung Medison service department, or any of the customer support centers worldwide.

Environmental Protection

CAUTION:

- The console and peripherals could be sent back to manufacturers for recycling or proper disposal after their useful lives.
- Disposal of waste shall be disposed in accordance with national laws.
- The waste sheaths are to be disposed of safely and national regulations must be observed.

Correct Disposal of This Product (Waste Electrical & Electronic Equipment)

Applicable in countries with separate collection systems

This marking on the product, accessories or literature indicates that the product and its electronic accessories (e.g. charger, headset, USB cable) should not be disposed of with other household waste at the end of their working life. To prevent possible harm to the environment or human health from uncontrolled waste disposal, please separate these items from other types of waste and recycle them responsibly to promote the sustainable reuse of material resources.

Household users should contact either the retailer where they purchased this product, or their local government office, for details of where and how they can take these items for environmentally safe recycling.

Business users should contact their supplier and check the terms and conditions of the purchase contract. This product and its electronic accessories should not be mixed with other commercial wastes for disposal.

State of California Proposition 65 Warning (US only)

WARNING: This product contains chemicals known to the State of California to cause cancer and reproductive toxicity.

Chapter 2

Introduction

Specifications

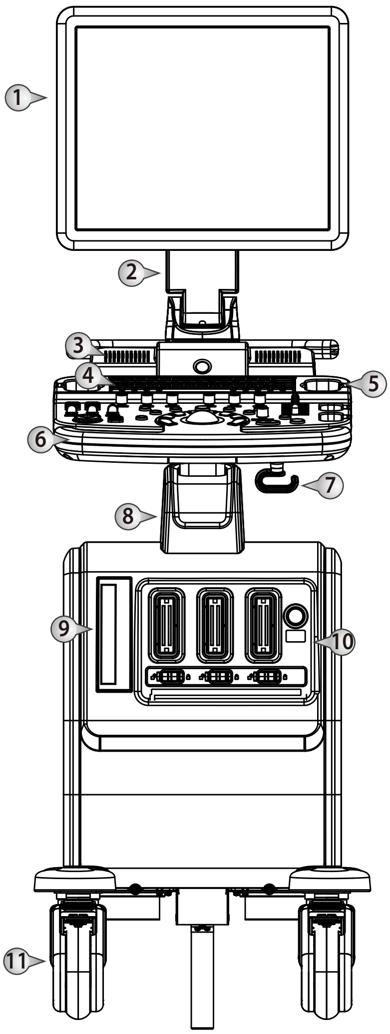
Physical Dimensions	Height: 1,380mm (with monitor) Width: 450mm Depth: 700mm Weight: more than 64kg (with monitor)
Imaging modes	2D imaging mode M imaging mode Color Doppler Imaging (CDI) mode Power Doppler Imaging (PDI) mode Directional Power Doppler Imaging (DPDI) mode Pulse Wave (PW) Spectral Doppler imaging mode Continuous Wave (CW) Spectral Doppler imaging mode Tissue Doppler Imaging (TDI) mode 3D imaging mode Dual modes Quad modes Combined modes Simultaneous mode ElastoScan mode (E Mode) Zoom
Gray Scale	256 (8 bits)
Focusing	Transmit focusing, maximum of eight points (four points simultaneously selectable) Digital dynamic receive focusing (continuous)
Probes (Type BF / IPX7)	**Mini DLP Type** **Curved Linear Array** C2-5, C2-8, C4-9, CF4-9 **Linear Array** L3-8, L5-12/50, LN5-12 **Phased Array** P2-4, PN2-4, SP3-8 **Endocavity Curved Linear Array** ER4-9, EVN4-9 **Volume Probe** 3D4-8, 3D4-9, 3DC2-6, VN4-8 **CW** CW2.0 **156 Pin Type** **Curved Linear Array** C2-5, C2-8, C4-9/10ED **Linear Array** HL5-12ED, L3-8, L5-12/50EP, LN5-12 **Phased Array** P2-4AH, P3-7AC **Endocavity Curved Linear Array** ER4-9/10ED, EV4-9/10ED **Volume Probe (260 Pin)** 3D4-8ET, 3D4-9ES, 3DC2-6

Probe connections	4 probe connectors (including one CW probe connector)
Monitor	19 inch LCD monitor (LED Backlight unit) called "LCD monitor" henceforth
ECG	Type CF
Rear Panel Input / Output Connections	VHS and SVHS VCR left and right audio B/W printer video and remote control VGA monitor Parallel port USB LAN
Image Storage	Maximum 7084 frames for Cine memory Maximum 8192 Lines for Loop memory Image filing system
Application	Obstetrics, Gynecology, Abdomen, Cardiac, Urology, Vascular, Small Parts, Musculoskeletal, TCD, Pediatric
Electrical Parameters	100-120V/200-240VAC, 680VA, 50/60Hz
Measurement Packages	Obstetrics, Gynecology, Cardiac, Carotid, Fetal Echo, UE Artery, LE Artery, UE Vein, LE Vein, Urology, Radiology, TCD, Thyroid, Breast, Testicle, Superficial, Pediatric Hips, MSK * Refer the Chapter 5 for additional information
Signal processing (Pre-processing)	TGC control Mode-independent gain control Acoustic power control (adjustable) Dynamic aperture Dynamic apodization Dynamic range control (adjustable) Image view area control M-mode sweep speed control
Signal processing (Post-processing)	Frame average Edge Enhancement / Blurring Gamma-scale windowing Image orientation (left/right and up/down, rotation) White on black/black on white Zoom
Measurement	Trackball operation of multiple cursors 2D mode: Linear measurements and area measurements using elliptical approximation or trace M mode: Continuous readout of distance, time, and slope rate Doppler mode: Velocity and trace

Auxiliary	VCR Video Page Printer Color Video Page Printer USB Video Printer USB Color Video Printer USB HDD USB Wireless LAN USB Foot Switch (IPX1) USB Flash Memory Media Monitor Microphone e-motion marker (IPX7)
User Interface	English, German, French, Spanish, Italian, Russian, Chinese, Portuguese
Pressure Limits	Operating: 700hPa to 1060hPa Storage: 700hPa to 1060hPa
Humidity Limits	Operating: 30% to 75% Storage & Shipping: 20% to 90%
Temperature Limits	Operating: 10℃ ~ 35℃ Storage & Shipping: -25℃ ~ 60℃

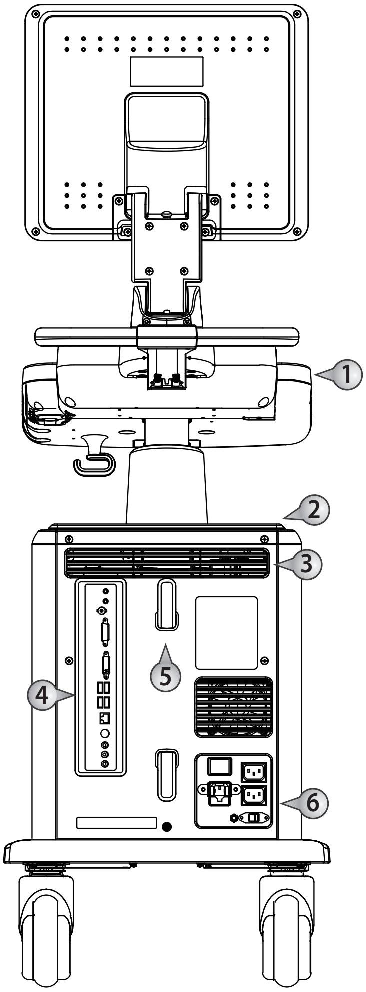
Product Configuration and Installation

This product consists of the monitor, the control panel, the console, the peripheral devices, and the probes.



[Figure 2.1 Front of the SONOACE R7]

❶ Monitor
❷ Monitor Hinge
❸ Speaker
❹ Keyboard & Control Panel
❺ Probe Holder
❻ Handle
❼ Cable Hook
❽ Lift
❾ DVD Drive
❿ Probe Port
⓫ Wheel



[Figure 2.2 Back of the SONOACE R7]

❶ Handle (Optional)
❷ Storage Space
❸ Ventilation
❹ Rear Panel
❺ Cable Hook
❻ Power Connection Part

Tips!

Principles of Operation

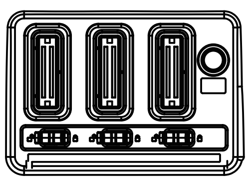
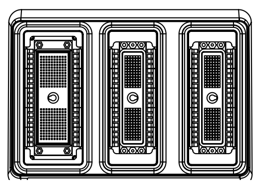
Medical ultrasound images are created by computer and digital memory from the transmission and reception of mechanical high-frequency waves applied through a probe. The mechanical ultrasound waves spread through the body, producing an echo where density changes occur. For example, in the case of tissue,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

These echo signals are highly amplified and processed by analog and digital circuits having filters with many frequency and time response options, transforming the high-frequency electrical signals into a series of digital image signals which are stored in memory. Once in memory, the image can be displayed in real-time on the image monitor. All signal transmission, reception and processing characteristics are controlled by computer.

Tips!

Type of probe port

SonoAce R7 v3.01.00 features the Mini DLP type probe port. If you have the lower version than v2.00, the probe port is 156/260 Pin type.

<Mini DLP Type PSA>	<v1.xx.xx :156 Pin Type PSA>
	 ※ 3D probes are 260 pin type.

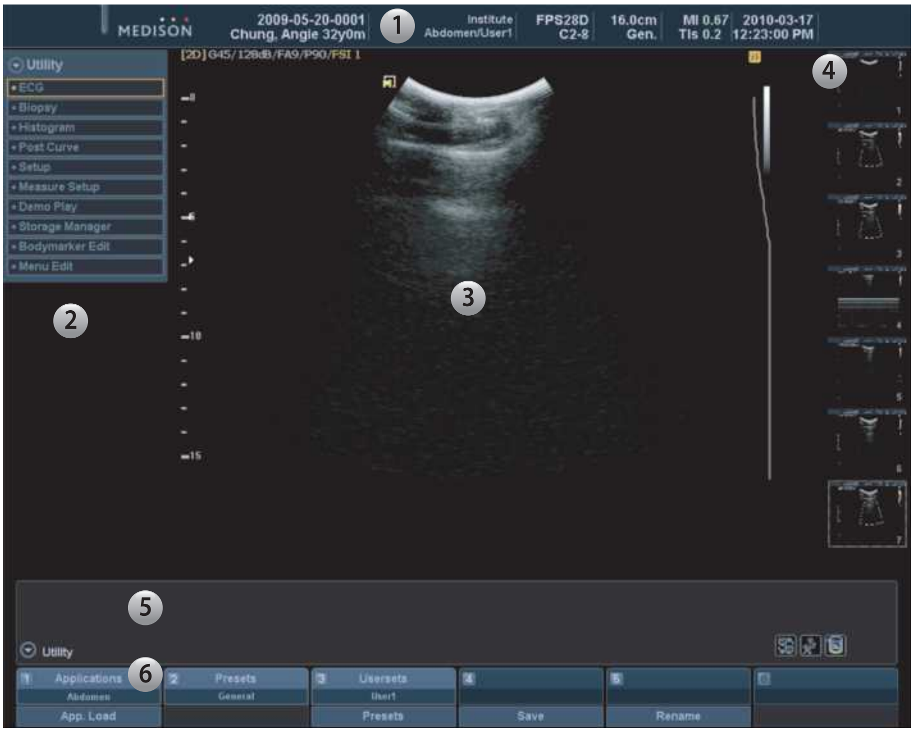
Monitor

The color LCD monitor displays ultrasound images and other information.

NOTE: The monitor of this system does not provide an OSD (On Screen Display) feature.

Monitor Display

The monitor displays ultrasound images, operation menus and a variety of other information. As shown in the figure below, the screen contains: ① Title Area, ② Menu, ③ Image Area, ④ Thumbnail Area, ⑤ User Information Area, ⑥ Soft Menu.



[Figure 2.3 Monitor Display]

Title Area

The title area displays the patient name, hospital name, application, frame rate and depth, probe information, acoustic output information, and the date and time.

■ Menu

This displays the utility menu or measurement menu.

■ Image Area

The ultrasound image, image information, annotation, and measurement are displayed in the image area.

■ Thumbnails Area

When clicking on the **Save** button, the saved images are displayed. If you place the pointer on an image and click, the image is magnified. Up to 7 images are displayed.

■ User Information Area

User information area provides a variety of information necessary for system use e.g. current system status, image information, available items, BodyMarkers, and so on.

Tips!

Displaying the current status of the system

 : Shows the status of LAN connection.

 : Shows whether a removable disk is connected to the system. Double-click the icon to display the **Storage Manager** window.

 : Shows the total disk space and available disk space for the system.

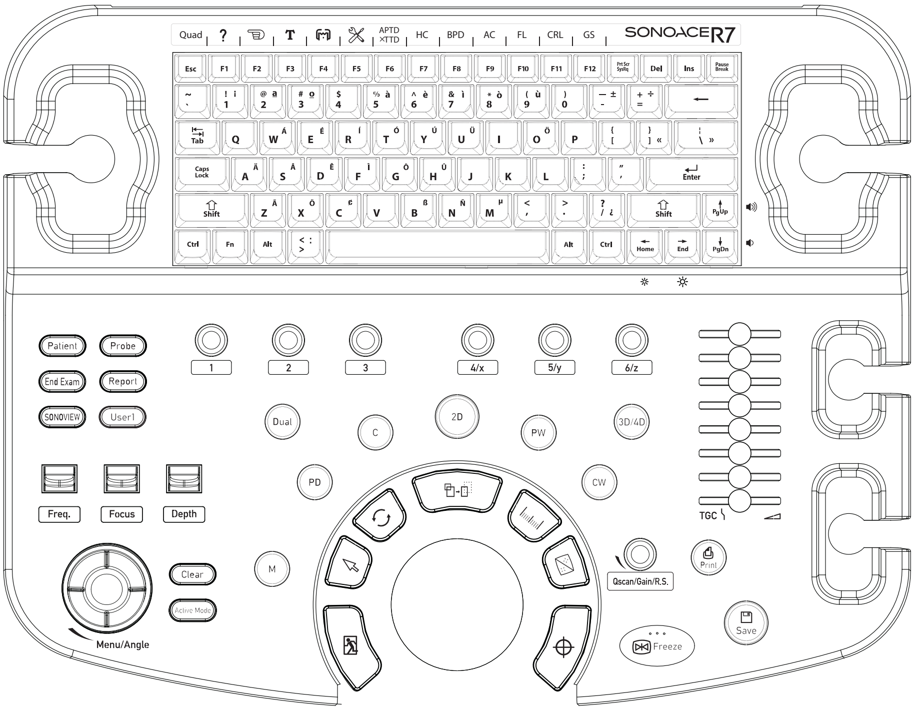
 : Shows Caps Lock 'On' When user press the **Caps Lock** on the alphanumeric keyboard. Under the 'Caps Lock On' status, user can input text as large character.

■ Soft Menu

Different items are displayed in the menu, depending on the current status of the system. To set or change the items in the Soft Menu, use the dial-button for the corresponding number on the control panel.

Control Panel

The system can be controlled with the control panel.



[Figure 2.4 Control Panel]

The control panel consists of a keyboard, buttons, dial-buttons, a switch, a slide, and a Trackball.

The dial-button can be used both as a dial and a button.

Control Panel Map

The following are descriptions and instructions for the controls on the control panel. For more information on the buttons with multiple functions, see Chapter 3 and later of this manual.

On/Off	Button	Turns the system on/off.
Patient	Button	Displays the Patient Information screen, which allows you to select a patient ID or enter information on a new patient.

Probe	Button	Displays the Probe Selection screen to select or change probes and applications.
End Exam	Button	Finishes the current patient's exam and resets the related data.
Report	Button	Displays the Report screen to show the measurement results of the corresponding application.
User 1	Button	Performs preset functions. See Chapter 7 'Setting Peripheral Devices' in 'Utilities' for more detailed information.
SonoView	Button	Runs SonoView, which is the image filing program.
Freq.	Switch	Changes the frequency of the probe.
Focus	Switch	Moves focus onto the area for observation.
Depth	Switch	Adjusts the scanning depth of the image.
Dual	Button	Used for Dual mode.
M	Button	Press this dial-button to start/stop M mode.
PD	Button	Press this dial-button to start/stop Power Doppler mode.
C	Button	Press this dial-button to start/stop Color Doppler mode.
2D	Button	Press this dial-button to start 2D mode.
PW	Button	Press this dial-button to start/stop PW Spectral Doppler mode.
CW	Button	Press this dial-button to start/stop CW Spectral Doppler mode. This can only be used for the Phased Array probe.
Q Scan / Gain / R.S	Dial-button	▶ Q Scan: When pressing this dial-button, the Quick Scan function turns on. The Q Scan indication displays at the top of an image. This can be used in specific applications with specific probes. ▶ Gain: Rotate this dial-button to adjust the gain. ▶ R.S: In 3D View mode, you can move the reference slice parallel by rotating this dial-button. R.S stands for Reference Slice.
3D / 4D	Button	Starts/Finishes 3D/4D mode.
Freeze	Button	Pauses/Resumes scanning.
Print	Button	Prints the image on the screen using the printer connected to the system.

Save	Button	Saves the images or reports on the screen in the database.
Menu / Angle	Dial-button	▶ Menu: Press this dial-button to change a page on the Soft Menu. Select an item when the measurement menu or utility menu is displayed. ▶ Angle: Adjust the angle by rotating this dial-button. In Spectral Doppler mode, the angle of a sample volume is adjusted by 1°. In 2D mode, if the **sector width** is not 100%, the image can be shifted horizontally. In BodyMarker mode and Indicator mode, the angle of the probe cursor and the indicator can be adjusted.
Clear	Button	Deletes the text, indicator, BodyMarker, and measurement result, etc. displayed on an image.
Active Mode	Button	Changes the Soft Menu. Every time you press this button, the Soft Menu changes to the Soft Menus for the other modes that are used in the current Active mode.
Set	Button	Selects an item or value using the trackball.
Exit	Button	Exits the currently used function and returns to the previous function.
Caliper	Button	Starts to measure distance, circumference, area, and volume.
Calculator	Button	Starts measurements by application.
Change	Button	Changes the function of the trackball to other functions. For example, this button resets the location of the dot which was last placed during the measurement.
Update	Button	Changes the image to panning status. In PW or CW Spectral Doppler mode, if this button is pressed, the mode changes to D only mode.
Pointer	Button	Displays an arrow-shaped pointer on the screen.
Trackball	Trackball	Moves the cursor on the screen and scrolls through Cine images.
TGC	Slide	Adjusts the TGC values for each depth using 8 slides. TGC stands for Time Gain Compensation.

CAUTION: If the gain values of neighboring TGC slides are adjusted with a large difference, bands may occur on the image.

Soft Menu

Soft Menu 1 ~ 6	Dial-button	Performs the functions of the corresponding number on the Soft Menu. Different items are displayed in the menu, depending on the current status of the system. Adjust the items by pressing or rotating the dial-button.

Tips!

How to use the Soft Menu Dial-Buttons

The Soft Menu is divided into top and bottom rows. Depending on the situation, you can use two functions with one **Soft Menu** button.

- ▶ Soft Menu Top (❶): Turn the Soft Menu dial-button to select or adjust a function.
- ▶ Soft Menu Bottom (❷): Press the Soft Menu dial-button to select or adjust a function.

[Figure 2.5 Soft Menu]

Tips!

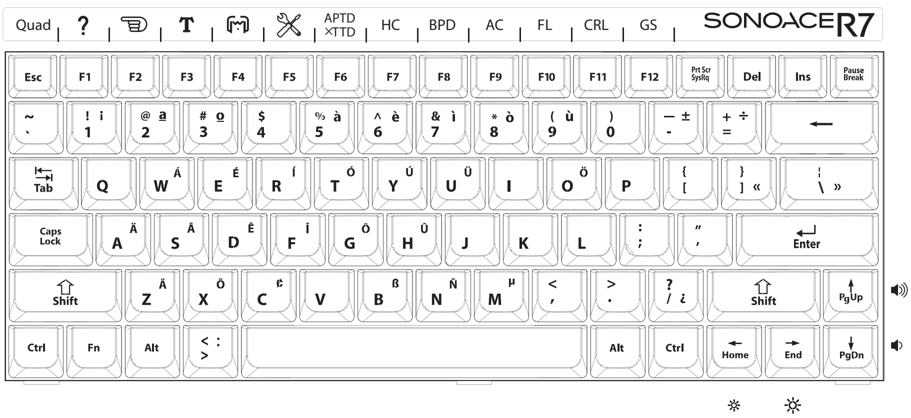
Soft Menu Dial-buttons [4] to [6]

In 3D View mode, the Soft Menu dial-buttons **[4]** to **[6]** have the following functions:

- ▶ Soft Menu Dial-button **[4]**: Rotates the image to the X axis.
- ▶ Soft Menu Dial-button **[5]**: Rotates the image to the Y axis.
- ▶ Soft Menu Dial-button **[6]**: Rotates the image to the Z axis.

Keyboard

The keyboard allows you to enter text and execute a variety of functions quickly using the function keys.



[Figure 2.6 keyboard]

Esc	Quad	Starts Quad mode.
F1	? Help	Displays the Help Manual on the screen.
F2	Indicator	Starts Indicator mode.
F3	T Text	Starts Text mode. But, if you select the checkbox: Utility > Setup > Utility > Text Setup > Quick Text, you can enter text immediately without pressing this key.
F4	BodyMarker	Starts BodyMarker mode.
F5	Utility	Displays the Utility menu on the screen.
F6	APTD X TTD	Starts APTD X TTD measurement
F7	HC	Starts HC measurement
F8	BPD	Starts BPD measurement.
F9	AC	Starts AC measurement.
F10	FL	Starts FL measurement.
F11	CRL	Starts CRL measurement.
F12	GS	Starts GS measurement.
Space Bar		Every time you press the Space bar, the information on the screen disappears in this sequence, Image Information → Gray Scale Bar / Color Bar → TGC. After all the information has disappeared, if you press the Space bar, all the information returns to the screen.
☼←, ☼→		Allows you to adjust the monitor brightness.
🔊↑, 🔉↓		Allows you to adjust volume in Spectral Doppler Mode.

Adjusting Control Panel

Carefully move the control panel up and down while pressing the lever on the control panel handle.

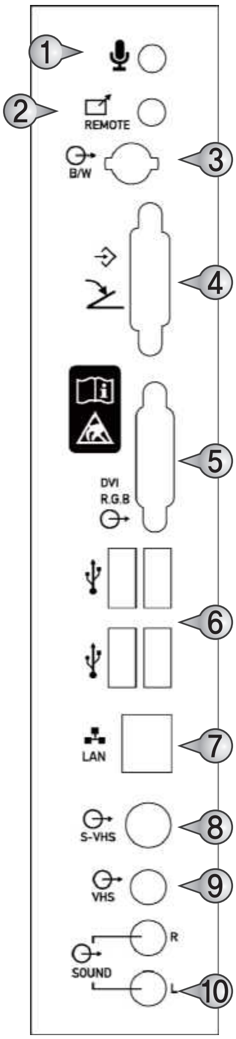
CAUTION: Do not apply excessive force to the control panel.

Console

The console consists of two parts – the inner unit and the outer unit. The interior of the console mainly contains devices that produce ultrasound images. On the exterior of the console are various connectors, probe holders, storage compartments, handles, wheels, etc.

Rear Panel

A monitor and other peripheral devices like printer, VCR, etc. are connected via the rear panel at the back of the system.

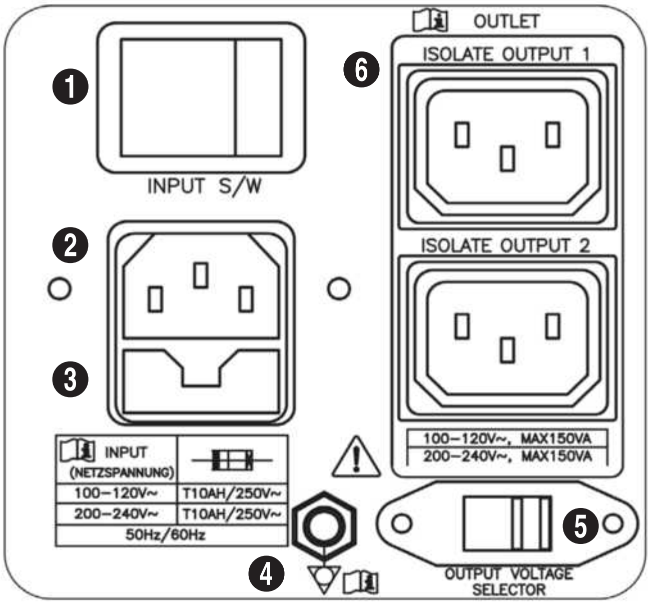


[Figure 2.7 Rear Panel]

❶ MIC Port (Input): Connects the mic.
❷ Remote Print Port (Output): Prints out remotely by connecting the Echo printer.
❸ B/W Printer Port (Output): Connects the Echo printer.
❹ Parallel Port (Output): Connects the printer and foot switch.
❺ DVI Port (Output): Outputs digital signals on the monitor.
❻ USB Port: Connects USB peripheral devices.
❼ Network Port: Connects to network. Patient information can be transferred to other servers through the DICOM network.
❽ S-VHS Port (Output): Connects S-VHS VCR.
❾ VHS Port (Output): Connects VHS VCR.
❿ Audio Port (Output): Used for outputting audio signals.

Power Connection Part

The power connection part is located at the back of the system body.



[Figure 2.8 Power Connection Part]

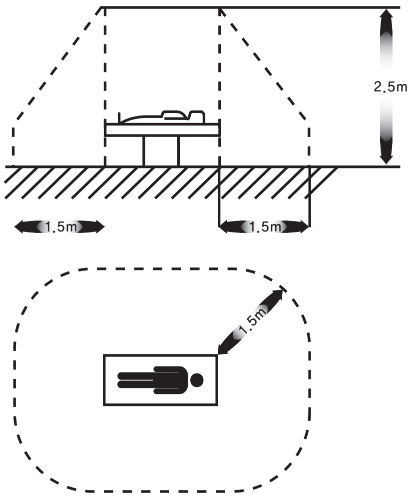
Item	Descriptions
❶	Power Switch: Supplies or cuts power to the entire system.
❷	Power Inlet: Connects the power cable to an external power source.
❸	Fuse Holder: Holds the inlet fuse
❹	Equipotential Terminal: This should be connected to the equipotential connection part in the exam room.
❺	Output rating change switch: Selects the output power.
❻	Auxiliary socket outlet: Supplies an external peripheral device with power from the product's internal power supply.

Probe Holder

A probe holder is mounted at the left and right side of the control panel.

Peripheral Devices

CAUTION: Do not place peripheral devices, not listed in this manual, inside the patient environment. If you place them in the patient environment, it may cause electrical hazard.



[Figure 2.9 Patient Environment]

NOTE: Refer to the operation manual of peripheral device about its operating.

Internal Peripheral Devices

These are peripheral devices mounted in the system.

DVD-Multi

DVD+R, DVD+R DL, DVD+RW, DVD-R, DVD-R DL, DVD-RW, DVD -RAM, DVD-ROM, CD-ROM, CD-R, CD-RW

Hard Disc Drive

Min. 200Gbyte-SATA

External Peripheral Devices

These are peripheral devices that can be connected for use when needed and are connected via the USB port located at the rear panel.

CAUTION:

- When using a peripheral device from a USB port, always turn the power off before connecting/disconnecting the device. Connection/discon-nection of USB devices during power-on may lead to malfunction of the system and USB devices.
- Do not connect additional external peripheral devices to the auxiliary socket outlet. Doing so may decrease safety level.

NOTE:

- When remove the removable disk, use **Utility** > **Storage manager**.
- USB ports are located both on the front panel and the rear panel of the console.
  Connect a USB storage device (Flash memory media, etc) to the port on the front panel. Connect other USB peripheral devices to the port on the rear panel for your convenience.

The following products are recommended:

Video Cassette Recorder (VCR)

Panasonic MD835, SONY DVO-1000MD, JVC BD-X201

Video Page printer

- Color : Mitsubishi CP910U, Mitsubishi CP910E, SONY UP-20
- Black and White : Mitsubish P93W, SONY UP-897MD

USB Video Printer

- Color : Mitsubish 30DW, SONY UP-D23MD, SONY UP-D25MD
- Black and White : Mitsubishi P93DW, Mitsubishi P95D, SONY UP-D897

CAUTION:

- You must install a Microsoft Windows XP™ or above (English) compatible printer and driver. Contact Samsung Medison Customer Service Center for inquiries about printer driver installation.
- When connecting the printer, ensure that the printer is configured under Microsoft Windows™ or system setup and has been chosen as the default printer.
- Please check the port used in printer before connecting. Printers should be connected to the Printer port while the USB printer connected to the USB port.

USB to RS-232C Serial Cable

USB to Serial (RS-232C) Converter with FTDI Chipset (FTDI FT232BM Compatible)

NOTE: For more information about the Open Line Transfer, refer to `Chapter 5. Measurements and Calculations'.

USB Foot Switch

Set the function of the foot switch in **Utility** > **Setup** > **Peripherals** > **Foot Switch**; Freeze, Update, Record, Print, Store, or Volume Start.

WARNING: Foot Switch cannot be used in the operating room.

Others

Flash Memory media

NOTE:

- If you use the USB 1.1 flash memory, the system cannot recognize it. In the case of this, delete the flash memory from the console and quip again.
- Regarding file formats that are not ordinarily saved: Please check first to see if it is possible to save the file format on a desktop PC before trying to save the file on a Flash Memory.

Probe

Probes are devices that generate ultrasound waves and process reflected wave data for the purpose of image formation.

NOTE: For more information, refer to `Chapter9 Probes'.

Be sure to connect or disconnect probes when the power is off to ensure the safety of the system and the probes.

1. Push the probe's lockdown switch to the left and disconnect the probe.
2. Connect the probe to the probe port.
3. Push the probe's lockdown switch to the right to lock it in place.

Tips!

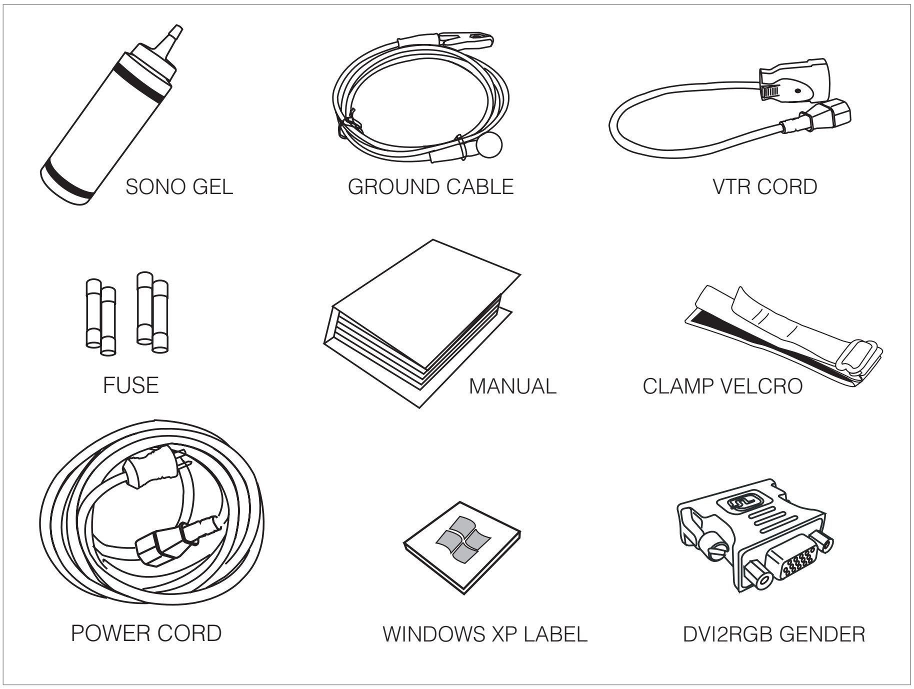
How to connect 156 Pin Type probe (include 3D probes)

1. Equip probes to the probe connectors on the front panel of the system. A maximum of three probes can be connected at one time.
2. Turn the connector-locking handle clockwise.

Accessories

An accessory box containing the items below is supplied with the product.

CAUTION: Main cord set, separately certified according to the relevant standards, is to be used when supplied to EU and USA/CAN.



[Figure 2.10 Accessories]

NOTE: Accessories can be different according to the country.

Optional Functions

This product has the following optional functions:

- 4D
- 3D XI
- Cardiac Measurement
- Spatial Compound
- ElastoScan
- Stressecho
- Strain
- DICOM
- Auto IMT
- Auto IMT+
- CW Function
- DynamicMR/DynamicMR+
- Panoramic
- e-Motion Marker

For further information about optional functions, please refer to the relevant chapters in this manual.

Chapter 3

Starting Diagnosis

Power Supply

Boot the system for use.

CAUTION: Make sure to connect the probe and peripheral devices that will be used before powering on the system. If you attempt to connect them during system use, it may lead to patient injury or fatal damage to the console.

Powering On

Press the **On**/**Off** button when the power is off. Booting begins, and the product logo appears on the screen. When booting is completed, the 2D mode screen appears in End Exam status.

CAUTION: Before starting the diagnosis, you must register the patient information.

NOTE:

- The product should be turned on about 10 seconds after the power switch at the back of the product is turned on.
- During system booting, do not press any key on the keyboard. It may cause product malfunction.
- If you turn on the power after turning it off forcibly, the system may turn on and off momentarily. This is one of the characteristics of the Intel® PC main board, not a system error.

Powering Off

Press the **On**/**Off** button while using the system.

CAUTION: If you hold down the **On**/**Off** button for five seconds or longer, the product power is turned off forcibly. This may cause hard disk damage.

NOTE: To ensure that the product is safely cut off from electrical power, always set the power switch at the rear of the product to the Off position when the product is not in use.

Probes & Applications

Before scanning, select a probe and an application.

CAUTION: Please refer to "Chapter 9. Probes" for more information about the probes supported by this system.

Press the **Probe** button on the control panel and then the *Probe Selection* screen will appear. In this window, you can select or change probes and applications and edit probe presets.

[Figure 3.1 Probe Selection]

Probe Selection and Application

1. Select a probe and an application on the screen by using the Trackball and the **Set** button.
2. Press the Soft Menu dial-button **[5]** OK to make a selection. Press the Soft Menu dial-button **[6]** Cancel to cancel a selection.

Tips!

Selecting a probe with a Soft Menu button

Press a **Soft Menu** button for the probe that you want.

Changing Application

1. After checking the currently selected probe, select an application using the Trackball and **Set** button.
2. Press the Soft Menu dial-button **[5]** OK on the screen. Press the Soft Menu dial-button **[6]** Cancel to cancel a selection.

Editing Probe Preset Values

The probe settings are preset with optimal values for each application. However, if needed, you can change the preset values as follows:

1. After checking the currently selected probe and application, change the probe settings using the Trackball and **Set** button under Preset.

   ▶ A Userset such as User1 can be selected for each setting. Usersets are available under Preset.

Tips!

User Preset

If user presets are specified, the specified name will appear in the title area.

For example, if the Cardiac application along with the preset User1 is selected, 'Cardiac/User1' will be displayed in the title area.

2. Press the Soft Menu dial-button **[5]** OK on the screen. Press the Soft Menu dial-button **[6]** Cancel to cancel a selection.

Tips!

Changing probe settings with a Soft Menu button

Press the **Utility** button on the control panel. The current probe settings are shown in the Soft Menu **[2]** and **[3]**. Rotate the Soft Menu dial-button **[2]** and **[3]** to select desired settings. Press the Soft Menu dial-button **[3]** to apply the selected settings to the system.

NOTE: To change the value for presets, press **Utility**. Please refer to 'Chapter 7. Utility' for details.

Patient Information

Press the **Patient** button on the control panel and the *Patient Information* screen will appear on the screen.

In this screen, you can enter, search, or change patient information. Patient information includes basic information such as the patient ID, name, DOB, and gender, together with additional information for applications.

NOTE: The ID and name fields are required.

Entering Basic Patient Data

You can enter or change basic patient data at the top of the *Patient Information* screen.

Use the Trackball and the **Set** button to select the desired field. Or, use the **Menu** dial-button to move between fields.

ID

Enter a patient ID.

- To enter it manually, enter an ID in the ID field.
- To enter it automatically, select **Auto ID Creation** and press **New**. The icon is changed to .
- If you enter an ID that exists already, the icon next to the ID field is changed to .

Name

Enter patient's full name.

- Last Name: Enter the patient's last name.
- First Name: Enter the patient's first name.
- Middle Name: Enter the patient's middle name.
- The name that you have entered will appear in the title area and reports.

Birth

Enter the patient's birth date in the specified format.

Age

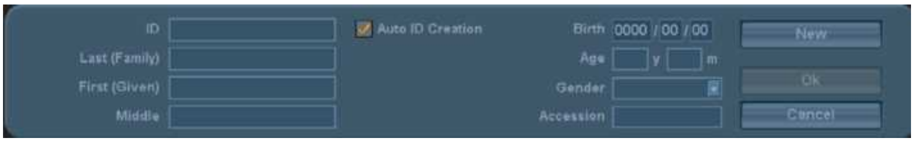
Enter the patient's age in "yy-mm" format. When a birth date is specified in the **Birth** field, this information is automatically calculated and displayed.

Gender

Select the patient's gender.

Accession

When viewing the worklist for a patient via the DICOM server, this information is automatically filled.



[Figure 3.2 The Patient Information]

Patient Information for Application

In Study Information, enter additional patient information or change the existing patient information required for a diagnosis.

1. In *the Patient Information* screen, press the **Study Information** tab.
2. In **Category**, select an application.
3. Enter additional information required for a diagnosis.

Pressing **Clear Measure** deletes all existing measurements entered.

General

In **Category**, select **General**. Enter additional information. The items in **General** are also included in the *patient information* screen for other applications.

Height

Enter the patient's height in Inches (in) or Centimetres (cm). Press the unit button to change the unit. When the unit is changed, the entered number is automatically recalculated and displayed in the changed unit.

Weight

Enter the patient's weight in Ounces (oz), Pounds (lb) or Kilograms (Kg). Press the unit to change it.

BSA (Body Surface Area)

When height and weight are entered, BSA (Body Surface Area) is automatically calculated and displayed.

HR (Heart Rate)

Enter a heart rate.

Diag. Physician (Diagnostic Physician)

Enter the name of the physician who diagnosed the patient. When there is more than one physician available, you can use the combo button to make a selection.

Ref. Physician (Ref. Physician)

Enter the name of the physician. When there is more than one physician available, you can use the combo button to make a selection.

Sonographer

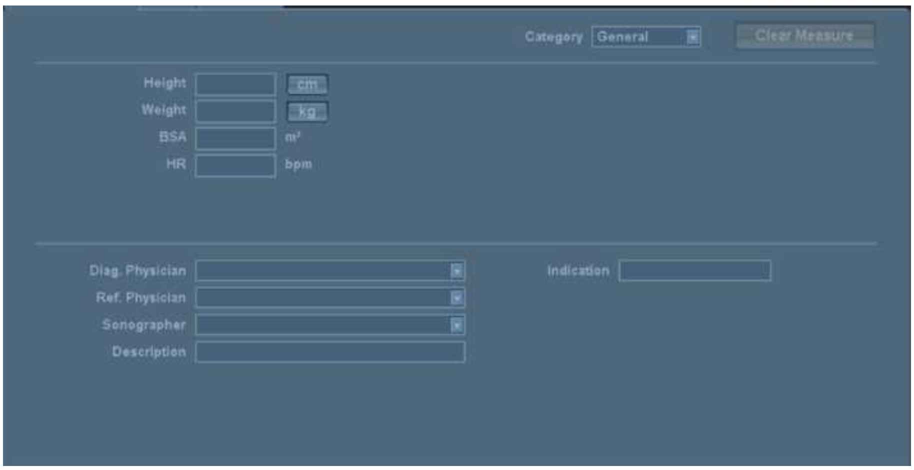
Enter the name of the sonographer who scanned the patient. When there is more than one sonographer available, you can use the combo button to make a selection.

Description

Enter a description of the diagnosis. If a description is entered, it can be searched for and viewed under **Description** in **SonoView**.

Indication

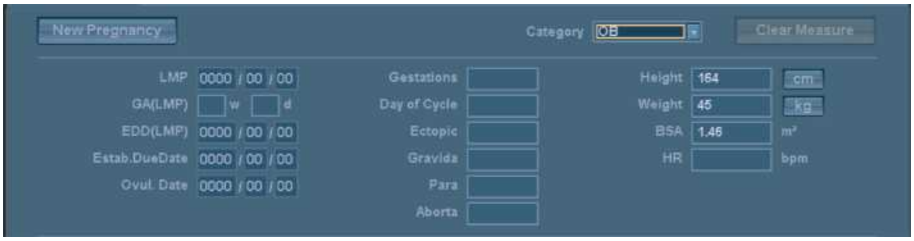
Enter a brief description of the symptom or disease.



[Figure 3.3 Study Information - General]

OB

In **Category**, select **OB**. Enter additional information for OB.



[Figure 3.4 Study Information - OB]

LMP (Last Menstrual Period)

Enter the last menstrual period for a patient. You can enter it manually in the specified format, or have it automatically calculated and displayed with the GA entered.

GA (LMP)

It indicates the gestational age of a patient. You can enter it manually in the specified format, or have it automatically calculated and displayed with the LMP entered.

EDD (LMP)

With the LMP or GA entered, EDD (Expected Date of Delivery) is calculated and displayed.

Tips!

Calculating EDD (LMP)

EDD can be calculated by entering LMP or GA.

▶ When LMP is entered: GA and EDD are automatically calculated and displayed on the screen.

▶ When GA is entered: LMP and EDD are automatically calculated and displayed on the screen.

Estab. Due Date

Enter EDD in the specified format.

Ovul. Date

Enter an ovulation date in the specified format. LMP, GA, and EDD will be automatically calculated and displayed.

> **Tips!**
>
> **Calculating LMP and EDD (LMP) with Ovul. Date**
>
> The following formulae are used:
>
> ▶ LMP = Ovul. Date - 14
>
> ▶ EDD = (280 -14) + Ovul. Date

Gestations

Enter the number of fetuses, up to maximum of 4.

Day of Cycle

Enter a menstrual period in number of days (dd).

Ectopic

Enter the number of ectopic pregnancies

Gravida

Enter the number of pregnancies.

Para

Enter the number of deliveries.

Aborta

Enter the number of miscarriages.

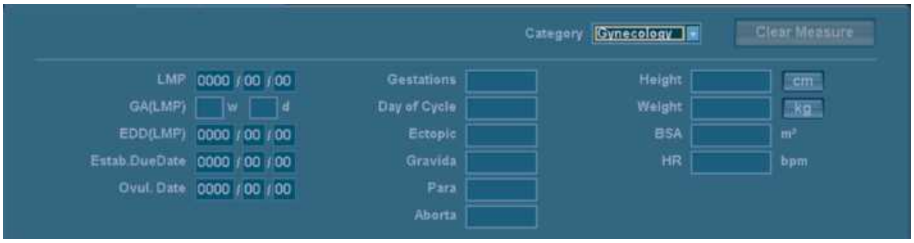
New Pregnancy

Delete previous OB data for this patient.

Gynecology

In **Category**, select **Gynecology**. Enter additional information for Gyn. This is the same information as for OB.

NOTE: In the GYN information input screen, even if the Ovul. Date is entered, LMP and EDD will not be calculated automatically.



[Figure 3.5 Study Information - Gynecology]

Cardiac

In **Category**, select **Cardiac**. Enter additional information for Cardiac.

[Figure 3.6 Study Information - Cardiac]

RAP (Right Atrium Pressure)

Enter blood pressure.

BP (Body Pressure)

Enter maximum/minimum blood pressures.

Urology

In **Category**, select **Urology**. Enter additional information for Urology.

PSA (Prostate Specific Antigen)

Enter the PSA value.

[Figure 3.7 Study Information - Urology]

Finding Patient Information

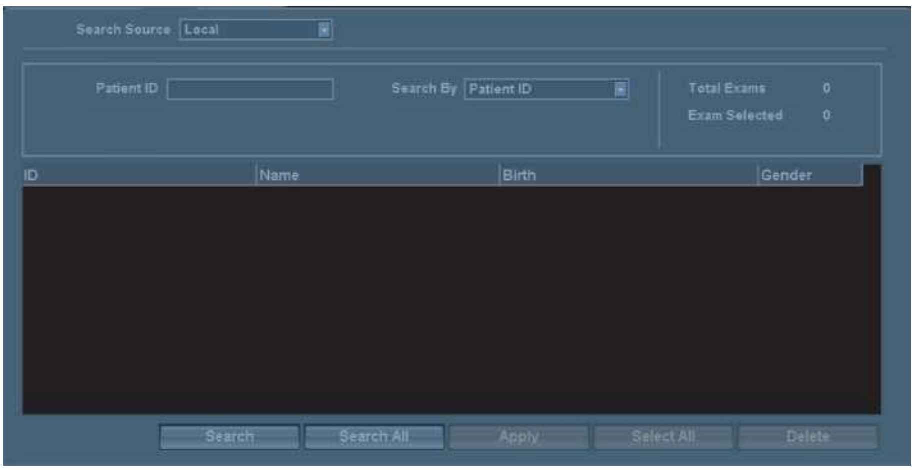
In the *Patient Information* screen, select the **Search** tab.

Local Search

Search through the information stored in the system.

1. In **Search Source**, select **Local**.
2. In **Search By**, select a search condition.
   - ▶ Select **Patient ID** to search by ID, or select a patient's name under **Patient Name** to search by name.
3. In the Search window, enter an ID or name and press **Search**. The list of patients who meet the conditions will appear. Pressing **Search All** will show a list of all the patients stored in the system.
   - ▶ In the list, press ID or Name to sort the information alphabetically or numerically by the selected item.
4. Select the desired patient and press **Apply**. The information on the selected patient will be applied to the system.

Press **Select All** to select all the patients in the list. Press **Delete** to delete the ID and other information for the selected patient.



[Figure 3.8 Search - Local]

WARNING: If a patient ID is deleted, all related data and images stored in SonoView are erased.

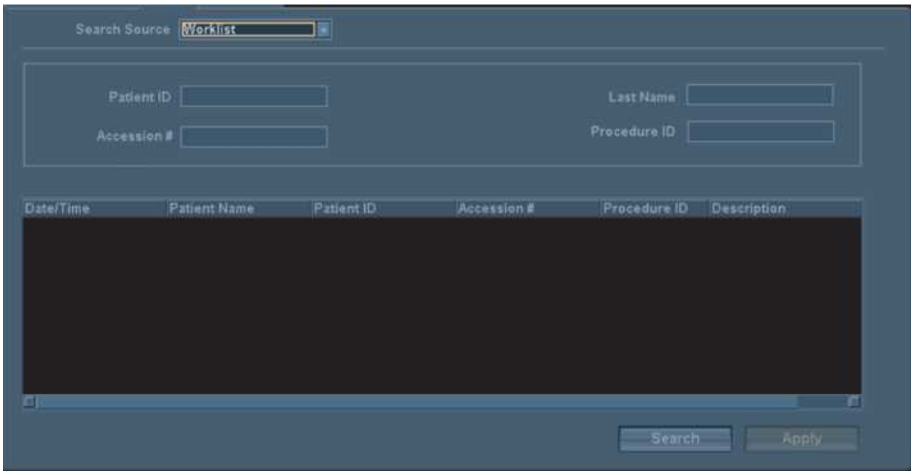
Worklist Search

Perform a search by connecting to the DICOM Modality Worklist server in the hospital network.

1. In **Search Source**, select **Worklist**.
2. Enter more than one item from among Patient ID, Last Name, Accession # or Procedure ID, and then press **Search**. The list of patients who meet the condition will appear.

   ▶ In the list, press Date/Time or Patient Name to sort the information alphabetically or numerically by the selected item.

3. Select the desired patient and press **Apply**. The information on the selected patient will be applied to the system.



[Figure 3.9 Search - Worklist]

NOTE: The worklist server is configured under the **DICOM** tab on the *Setup* screen. Please refer to "DICOM Setting" in 'Chapter 7. Utility'.

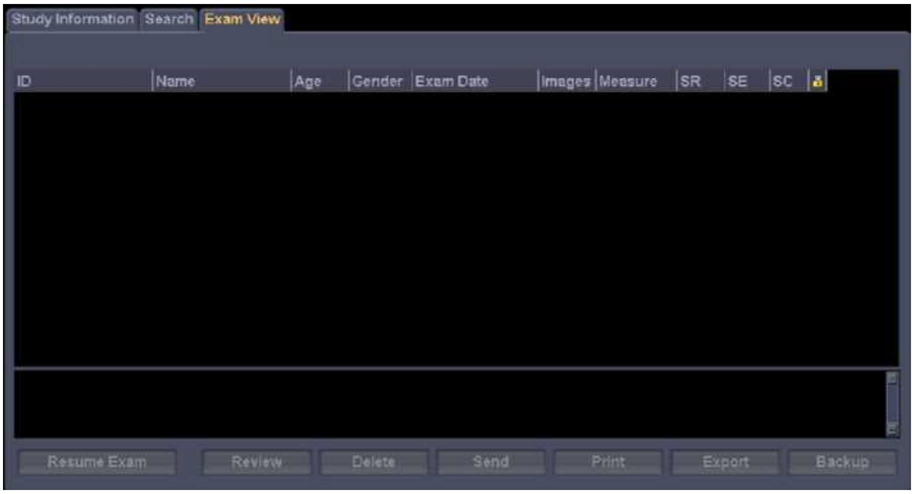
Managing Patient Exams

In the *Patient Information* screen, select the **Exam View** tab. The list of exams for the patient ID applied in the previous search will appear.

NOTE: The exam list appears only when a patient searches is completed and the related patient information is applied to the system.

In addition to the patient ID, Age and Gender, information such as the Exam Date, the number of images stored (Images), the measurement status (Measure), the report creation status (Structured Report, SR), the exam transfer status (Storage Commit, SC) and the lock status are displayed. You can press ID or Name to sort the information alphabetically or numerically by the selected item.

To select more than one exam, press the **Set** button while holding down the **Ctrl** button on the keyboard.



[Figure 3.10 Exam View]

Executing Exam

Use the Trackball and the **Set** button to select an exam, and then press **Review Exam** or **Continue Exam** on the screen. For an exam currently being executed, the button is displayed as **Current Exam** and disabled.

NOTE: If the selected exam has been executed in the past 24 hours, the button in the lower left corner is displayed as **Continue Exam**. If the exam was executed earlier than this, the button is displayed as **Review Exam**.

Continue Exam

In addition to using the **Resume Exam** function, you can update the current scan with the exam executed previously.

The selected exam appears on the screen and scanning is available. The initial execution date for the corresponding exam (Exam Resumed) is displayed in the feedback area.

Double-clicking a stored image in the thumbnail area in the right side of the screen retrieves the image and displays the stored image information. In the retrieved exam screen, you can perform measurements or enter text, BodyMarkers or indicators.

Review Exam

The selected exam appears on the screen. Double-clicking a stored image in the thumbnail area in the right side of the screen retrieves the image and displays the initial execution date for the corresponding exam (Exam Reviewed) and the stored image information. In the retrieved exam screen, you can perform measurements or enter text, BodyMarkers or indicators.

Viewing Exam

Select an exam by using the Trackball and the **Set** button, and press **Review** on the screen. Switch to the *SonoView* screen.

NOTE: For information on using SonoView, please refer to "Chapter 6. Image Management."

Deleting Exam

Select an exam by using the Trackball and the **Set** button, and press **Delete** on the screen. All images for the exam will be deleted. However, an exam in progress or a locked exam cannot be deleted.

NOTE: Once deleted, exams cannot be restored.

Sending Exams via DICOM

You can send the selected exams via the DICOM network.

NOTE: Before using this feature, make sure that DICOM is properly configured. For information on configuring DICOM, please refer to the "DICOM Setting" section in 'Chapter 7. Utility'.

1. Select an exam(s) and then press **Send** on the screen. The DICOM Storage window will appear.

   ▶ To check the connection between the server and DICOM before sending, press **Test**.

[Figure 3.11 DICOM Storage]

2. Select an image or report to send. You can select images under Storage Image, and reports under Storage SR.

3. Pressing **Transfer** starts a transfer and displays the transfer progress (%). To cancel the transfer, press **Close**.

Printing Exams via DICOM

You can print the selected exams via the DICOM network. You cannot print exams if DICOM has not been properly configured.

1. Select an exam(s) and then press **Print** on the screen. The DICOM Printer window will appear.

   ▶ To check the connection between the server and DICOM before sending, press **Test**.

2. Select an Exam(s) to print.
3. Pressing **Print** starts printing and displays the transfer progress (%). To cancel printing, press **Close**.

[Figure 3.12 DICOM Printer]

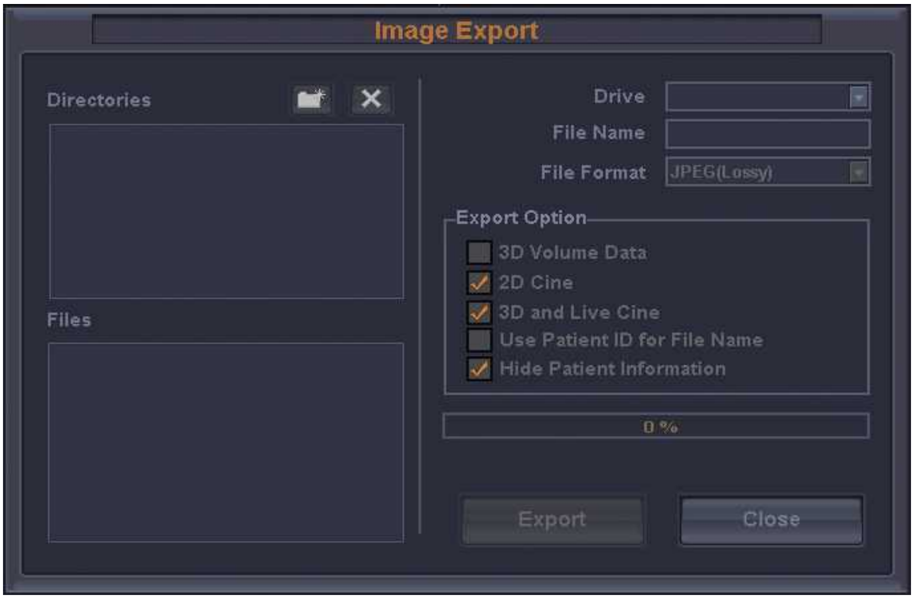
Exporting Exam

You can save the selected exams in an external storage device.

1. Select exam(s) and then press **Export** on the screen. The *Image Export* window will be displayed.
2. Under **Drive**, select a media where the selected exams will be saved. You can select CD-ROM or Flash Memory.
3. Under **File Name**, specify the file name. The same file name is assigned to all images associated with an exam. When there is more than one image, a serial number is automatically appended to the end of the file name.
4. Under **File Format**, specify a file format in which files will be saved. You can select BMP, JPEG, TIFF or DICOM.
5. Under **Export Option**, select a file option(s). You can select more than one option.

- 3D Volume Data: Export the 3D volume data along with an image.
- 2D Cine: Convert the stored Cine image to an. AVI file before exporting.
- 3D and Live Cine: Convert the 3D Cine and Live Cine images to an .AVI file before exporting.
- Use Patient ID for File Name: Use patient ID for file name automatically.
- Hide Patient Information: Export an image without a patient ID and name.

6. Under **Directories**, select a location where the selected exams will be saved. To create a new directory, press and specify a directory name. To delete a directory, press . Under **Files**, files saved in the storage device are displayed.
7. Press **Export** to start saving. To cancel saving, press **Close**.

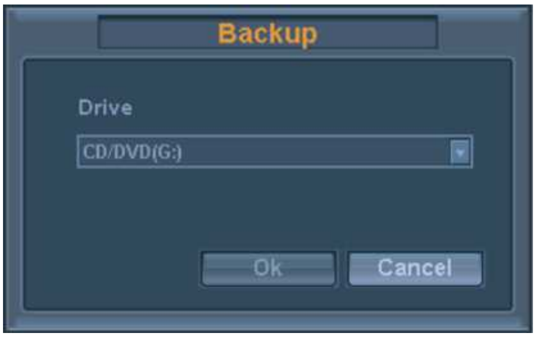


[Figure 3.13 Image Export]

Backing up Exam

You can back up the selected exams in an external storage device.

1. Connect a storage media for backup. CD-ROM or Flash Memory can be used.
2. Select an exam(s) and then press **Backup** on the screen.
3. A confirmation window will appear asking whether to continue the backup. Press **Yes** to continue. Press **No** to cancel.
4. The Select Drive window will appear. Under **Drive**, select the media where the selected exams will be saved.
5. Press **OK** to start the backup. Press **Cancel** to cancel.



[Figure 3.14 Exam Backup]

Changing Measurements

In the *Patient Information* screen, press the **Measure Data** tab. Under the **Measure Data** tab, you can enter obstetrics measurements for a patient or check the existing measurements. Press the button, and the Insert screen will appear.

NOTE:
- ▶ This option is available for obstetrics only and enabled only when a patient ID is selected.
- ▶ If OB data has been changed under **New Pregnancy** at **Patient Information** > **Study Information** > **OB**, enter LMP before measurement data can be changed.

The Insert Screen

You can enter the existing obstetrics measurements.

Exam. Date

Enter the measurement date.

NOTE: If OB data has been changed under **New Pregnancy**, only dates between the new LMP and yesterday can be entered.

Fetus

If the fetus is a twin, identify each fetus. Up to 4 fetuses (A, B, C, D) can be specified.

Exam No.

Up to 8 exam numbers can be entered for each date. An exam number appears next to the **Fetus** field.

New Data

Cancel all measurement data entered for other exams and enter new measurement data.

Clear

Cancel entering the measurement data.

■ Insert

Complete entering the measurement data.

■ Page Browse

Use the **>>** or **<<** button.

■ View

Switch to the *View* screen.

[Figure 3.15 Measure Data - Insert]

The View Screen

You can view the measurements entered or save them in an Excel file. The * symbol next to Exam Date indicates that the data is the current measurement data.

■ Package

Select a measurement package to display on the screen. Enter the measurement date.

■ Refresh

Update the measurement data. New measurements, or the measurements entered, are added.

Save

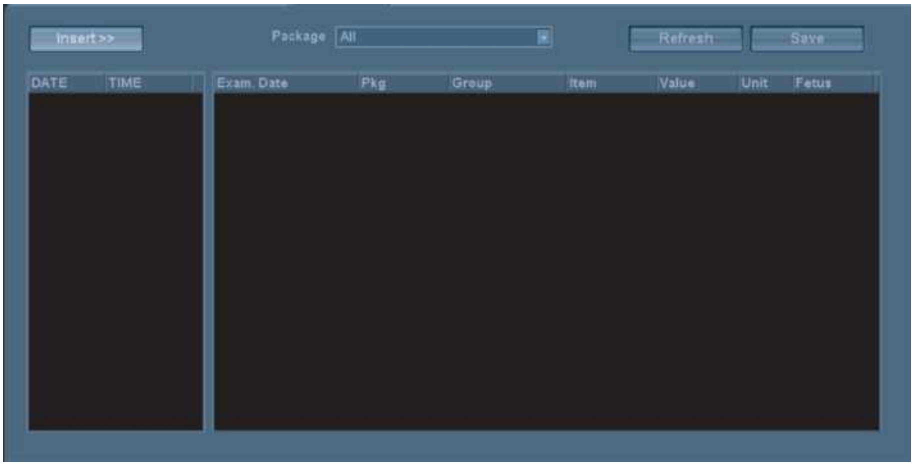
The *Save To Excel* window appears, allowing you to save information on the screen in an Excel file. By default, the Excel file name is set to the measurement ID.

After specifying the target path and file name, press **Save** to save the information. To cancel saving, press **Close**.

NOTE: Checking the HTML checkbox saves information in an HTML file instead of an Excel file.

Insert

Switch to the Insert screen.



[Figure 3.16 Measure Data - View]

Chapter 4

Diagnosis Modes

Chapter 4

Information

Diagnosis Mode Type

This product supports a variety of diagnosis modes including Basic Mode, Combined Mode, Multi-Image Mode, and 3D Mode.

- Basic Mode: Consists of different modes, each of which has a specific usage and function. By default, 2D Mode is applied together with other mode.
- Combined Mode: For an image, two or three Basic Modes are applied at the same time. By default, 2D Mode is applied together with other mode. An image is viewed in a single screen.
- Multi-Image Mode: The screen is divided into two (dual) or four (quad) sub screens, each of which is used to view an image. Since each sub screen can display a different image, it can be a very useful feature, allowing multilateral views of an organ.
- 3D / 4D Mode: 3D images can be obtained. Consist of Freehand 3D, Static 3D Mode and 4D Modes.

The types of diagnosis mode that are available with the product are shown below:

Mode	Type
Basic Mode	2D Mode Color Doppler Mode Power Doppler Mode M Mode PW Spectral Doppler Mode CW Spectral Doppler Mode TDI Mode TDW Mode ElastoScan Mode (E Mode)
Combined Mode	2D/C/PW Mode 2D/PD/PW Mode 2D/C/CW Mode 2D/PD/CW Mode 2D/C/M Mode 2D/C Live Mode
Multi-Image Mode	Dual Mode Quad Mode
3D / 4D Mode	Freehand 3D Mode Static 3D Mode 4D Mode

NOTE: The functionalities for each mode may be restricted by the selected probe.

Basic Use

The items that can be used commonly in each diagnosis mode are shown below:

Using Control Panel

The items that can be used in each diagnosis mode are provided as menu items. You can change the image format or optimize an image to facilitate your diagnosis.

Q Scan / Gain / R.S

- Q Scan: Press the dial-button to turn the Quick Scan function on. The Q Scan indication is displayed at the top of an image. In 2D Mode, the brightness and shading are optimized by automatically adjusting the gain and TGC.

NOTE: The Quick Scan function can be used in specific diagnoses with specific probes.

- Gain: Rotate the dial-button to adjust the gain. The **Gain** buttons differ depending on the diagnosis mode and the dial-button is usually used for selecting diagnosis modes.

  Also use the dial-button to adjust the brightness of the image. Rotating the dial-button clockwise increases the gain.

- R.S: In 3D View mode, you can move the reference slice parallel by rotating the dial-button. R.S stands for Reference Slice.

TGC (Time Gain Compensation)

Use the TGC slide on the control panel.

In general, ultrasound penetration gets weaker with depth. TGC can be used to compensate for this effect.

The product provides eight TGC slides for varying depths, allowing you to adjust Gain by area. Among the eight slides, the top slide represents the shallowest area, while the lower slides represent the deeper ones.

Move the slide to the right (+) to increase Gain, brightening the image.

Frequency

Use the **Freq.** switch-button on the control panel.

Use the switch-button to adjust the frequency of the currently used probe. Select from Res, Pen and Gen.

- Res (Resolution): High frequency
- Gen (General): General frequency
- Pen (Penetration): Low frequency

The selected frequency is displayed in the title area, allowing you to determine the state of the current frequency easily.

Focus

Use the **Focus** switch-button on the control panel.

Use the switch-button to adjust the location of the focus. When the top of this button is pressed, the location of the focus becomes shallow.

Depth

Use the **Depth** switch-button on the control panel.

Use the switch-button to adjust the scanning depth of an image. When the upper end of the button is pressed, the scanning depth of the image becomes shallow. When the lower end of the button is pressed, the scanning depth of the image becomes deep.

The range of adjustment differs depending on the probe type you use.

Using Soft Menu

The items that are commonly used in each diagnosis mode during scanning are provided as Soft Menu items. You can use the Soft Menu dial-button corresponding to a specific menu item on the control panel. If you rotate the dial-button, the setting for the selected item changes.

If the Soft Menu is more than a page long, press the **Menu** dial-button on the control panel to change pages.

Basic Mode

2D Mode

This basic mode, also referred to as B Mode (Brightness mode), provides scan planes of organs. This is used to display two-dimensional anatomy images in the direction of scanning in real time.

[Figure 4.1 2D Mode]

Entering 2D Mode

NOTE: Because 2D Mode is applied by default for all diagnosis modes, it cannot be terminated.

Press the **2D** button on the control panel.

If you press the **2D** button in other diagnosis modes, it will switch to the basic 2D Mode.

2D Mode Soft Menu

The items that are commonly used in 2D Mode during scanning are provided as Soft Menu items. You can use the Soft Menu dial-button corresponding to a specific menu item on the control panel. If you rotate the dial-button, the setting for the selected item changes.

Dynamic Range / Harmonic

Use the Soft Menu dial-button **[1]**.

▶ Dynamic Range

The contrast of an image is adjusted by adjusting the ratio of the minimum and maximum values of the input signals. Select a value between 50 and 200 by rotating the Soft Menu dial-button **[1]**. The larger the ratio, the smoother the image gets.

▶ Harmonic

When pressing the Soft Menu dial-button **[1]**, the HAR indication appears on the image information. The OHI (Optimal Harmonic Imaging) function, which allows you to optimize images by using high frequencies, is provided.

NOTE: The Harmonic function can be used with specific probes.

Reject Level / 2D/C Live

Use Soft Menu dial-button **[2]**.

▶ Reject Level

Noise or echo is removed to make the image clearer. Select a value between 1 and 32 by rotating the Soft Menu dial-button **[2]**.

▶ 2D/C Live

Press the **Soft Menu** dial-button **[2]**. You can observe a scanned area in 2D and Color Doppler images simultaneously in real time.

FSI / M Line

Use the Soft Menu dial-button **[3]**.

▶ FSI

Select a value between 1 and 3 by rotating the Soft Menu dial-button **[3]**. FSI stands for Full Spectrum Imaging. An image can be combined with the data obtained in 2D Mode using frequencies with various characteristics. Therefore the resolution is improved in a shallow area for observation and the penetration is improved in a deep area for observation.

▶ M Line

An M line is displayed on an image. Press the Soft Menu dial-button **[3]** to turn it on or off. The M line indicates where the observing image is located in the 2D image when M Mode or PW Mode is used with 2D mode.

Read Zoom / Write Zoom

Use the Soft Menu dial-button **[4]**.

You can magnify an image. The zoom function is categorized as Read Zoom and Write Zoom according to magnification methods.

▶ Read Zoom: Magnifies the images stored on the hard disk drive.

1. Rotate the dial-button to the left or right.
2. Adjust the location of the Zoom box using the Trackball. The location of the Zoom box on the image can be found through the Zoom Navigation box on the top left side of the screen.
3. Observe the magnified image. Rotate the dial-button clockwise to magnify the image.

▶ Write Zoom: Magnifies and scans an image in real time.

1. Press the dail-button to select Write Zoom box.
2. The image is magnified and scanned. Use the **Change** button to adjust the location and size of the Zoom box. Every time the **Change** button is clicked, the current status of the Zoom box is displayed on the bottom left of the screen.
   - PreZoom position: The location of the Zoom box can be changed. Move the Zoom box using the Trackball.
   - PreZoom size: The size of the Zoom box can be changed. Use the Trackball to adjust the size of the Zoom box.

If you change the depth of the image when using the Write Zoom function, the Zoom mode ends automatically.

Spatial Compound (Optional) & Trapezoidal

Use the Soft Menu dial-button **[5]**.

▶ Spatial Compound: Rotate the dial-button to select from Off, Low, Middle or High.

> **NOTE:** This item appears in the Soft Menu only when a Linear Probe is used.

▶ Trapezoidal: Press the dial-button to turn it on or off.

In general, the rectangular frame provided by a Linear Probe is changed to a trapezoidal shape. This allows a wider view of an image.

The Trapezoid function may not be available for certain depths. In addition, the Write Zoom function cannot be accessed with the **Zoom** button when the Trapezoidal function is in use. (However, Read Zoom can be used.)

> **NOTE:** The Trapezoidal item appears in the menu only when a Linear Probe is used.

SRF

Press the Soft Menu dial-button **[6]** to turn it on or off.

▶ SRF Index: SRF stands for Speckle Reduction Filter. The image is optimized by minimizing the noise and automatically adjusting the brightness of the boundaries. Select a value between 0 and 3 by rotating the dial-button.

Chroma

Press the Soft Menu dial-button **[1]** to turn it on or off.

▶ Chroma Map: Changes the color of an image. Select Type 1 to Type 9 or User 1 to User 3 by rotating the dial-button.

> **NOTE:** The user type setting can be changed in **Utility** > **Post Curve** > **2D Post** > **Edit**.
> See 'Post Curve' in 'Chapter 7 Utility'. for detailed information.

Gray Map / L/R Flip

▶ Gray Map

Changes a 2D Post Curve. Select from Type 1 to Type 9 or User 1 to User 2 by rotating the Soft Menu dial-button **[2]**.

▶ L/R Flip

When the Soft Menu dial-button **[2]** is pressed, the left and right sides of an image are flipped. The M indication at the top of the image indicates the direction of the current image.

Focus / U/D Flip

▶ Focus

Use the Soft Menu dial-button **[3]** to set the number of focusing points to between 1 and 4.

▶ U/D Flip

Press the Soft Menu dial-button **[3]**. Whenever the dial-button is pressed, an image is flipped upside down.

Sector Width

Change the sector width. Select a value of between 40 to 100 % by rotating the Soft Menu dial-button **[4]**. When the width is increased, the frame rate is reduced.

NOTE: If the application is set as Fetal Heart, you can select up to 20%.

Frame Avg

When images are updated, the previous and current images are averaged. Select a value between 0 and 15 by rotating the Soft Menu dial-button **[5]**. If you scan the same area repeatedly, speckles may appear on the updated image. This item is used to minimize this phenomenon.

Power

Adjusts the intensity of the ultrasound output. Select a value between 10 and 100 by rotating the Soft Menu dial-button **[6]**.

2D Image Size

Press **2D Image Size** in the menu.

You can adjust the overall size of a 2D image. Select a value between 80~100(%).

NOTE: You can set this function in **Utility** > **Menu Edit**. For details on Menu Edit, please refer to 'Chapter 7. Utility'.

Edge Enhance

Press **Edge Enhance** in the menu.

This function allows you to view more accurate images of organ or tissue boundaries. Use the **Menu** dial-button to select a value between -3 – 3. A higher value provides more accurate images of boundaries.

NOTE: You can set this function in **Utility** > **Menu Edit**. For details on Menu Edit, please refer to 'Chapter 7. Utility'.

Pulse Inversion

Press the dial-button to turn it on or off. If it is turned on, pulses are inverted for a clear view of images.

NOTE:

- Pulse Inversion is available with specific probes only.
- You can set this function in **Utility** > **Menu Edit**. For details on Menu Edit, please refer to 'Chapter 7. Utility'.

Tissue

Press **Tissue** in the menu.

Optimize an image by using an appropriate ultrasound speed for the characteristics of the object (tissue) to view. Use the **Menu** dial-button to select from Solid, Normal, Adipose or Cystic.

NOTE: You can set this function in **Utility** > **Menu Edit**. For details on Menu Edit, please refer to 'Chapter 7. Utility'.

Frame Rate

Press **Frame Rate** in the menu.

The frame rate is the number of images generated per second. Use the **Menu** dial-button to select from Fast, Normal or Slow.

It is recommended to set a high frame rate for objects that are highly active or fast-moving.

NOTE: You can set this function in **Utility** > **Menu Edit**. For details on Menu Edit, please refer to 'Chapter 7. Utility'.

DynamicMR (Optional)

Press **DynamicMR** in the menu. You can obtain a clearer image by eliminating noise and enhancing boundaries. Five pre-configured indices are provided.

If it is turned on, the DMR Index appears in the menu. Use the **Menu** dial-button to set the index between 1~3. DynamicMR+ is available with OB, Gynecology, Urology only and set the index between 1~5.

NOTE:

- Connect a dongle to the console before using DynamicMR. (Dongles can be purchased separately from the product.)
- For information on installing a dongle, please refer to the DynamicMR User Manual.
- You can set this function in **Utility** > **Menu Edit**. For details on Menu Edit, please refer to 'Chapter 7. Utility'.

Panoramic

NOTE:
- Panoramic is an optional feature of this product.
- The Panoramic function is only available in 2D mode with Linear and Convex probes.

Panoramic Imaging is the function that acquires images over a wider range by using continuous ultrasonographic images. Up to 500 frames can be used.

Acquiring a Pasnoramic Image

1. Press **Panoramic**. The monitor will switch to the *Panoramic Ready* screen.
2. Press the **Start/Stop** button. Acquisition of the Panoramic image will begin.
3. To finish acquiring the Panoramic image, press the **Start/Stop** button. The monitor will switch to the *Panoramic Review* screen.

Tips!

Cautions for Acquiring a Panoramic Image
- When scanning a curved surface, ensure that the scan surface and the contact surface of the probe are always at right angles.
- Moving in the opposite direction while acquiring an image erases the previously saved frames and saves new frames.
- The image quality may deteriorate if the contact surface of the probe loses contact with the scan surface.
- If the scan speed is fast or the angle of the contact surface of the probe changes, artifacts may occur.

Reviewing a Panoramic Image

NOTE:
- You can take measurements by using the **Ruler** button.
- **L/R Flip**, **U/D Flip**, and **Magnifying** are available only when the **Layout** is set to Full Screen.

- L/R Flip: Flip the panoramic image horizontally.
- U/D Flip: Flip the panoramic image vertically.
- Ruler: Press this button to turn this function on/off. When turned on, a ruler will be displayed in the Panoramic image.

- Cine Save: Save Cine images.
- Layout: Specify how the panoramic image will be displayed on the screen.
  - Full Screen: Display the panoramic image in full screen mode.
  - Left/Right: Display the 2D and panoramic images at the left and right of the screen, respectively.
  - Top/Down: Display the 2D and panoramic images at the top and bottom of the screen, respectively.
- Rotation: Rotate the panoramic image.
- Magnifying: Magnify the panoramic image.
- Return: Return to the *Panoramic Ready* screen.
- Exit: Exit Panoramic Imaging.

NOTE: For more information on other items, refer to the '2D Mode' section.

M Mode

The M Mode is used to specify an observation area in a 2D image with the M Line, and display changes over time.

This mode is appropriate for the observation of organs with a lot of movement such as cardiac valves. The 2D Mode image is also shown, allowing the marking and adjustment of an observation area within the entire image.

[Figure 4.2 M Mode]

Entering & Exiting M Mode

Press the **M** button on the control panel. Press the M button again. M Mode will be terminated and the mode switched to 2D.

M Mode Screen

M Line

Use the Trackball on the control panel to move to the right or left. The M Line indicates the relative position of the M Mode image in the 2D image. Therefore, you can move the M Line to change the observation area.

M Mode Soft Menu

Speed

Rotate the dial-button to adjust the progression speed of M images. Available options are 60Hz, 120Hz, 180Hz, 240Hz, 300Hz and 360Hz.

Negative

Reverses the color of an M image. Press the Soft Menu dial-button **[6]** to turn it on or off.

Display Format

Select the M image and 2D image layout. Press the control panel dial-button **Menu/Angle** to select a layout; rotate the Soft Menu dial-button **[4]** to select Side By Side, 4:6, 5:5, or 6:4.

- Side By Side: Places a 2D image on the left and an M image on the right side of the screen.

FreeAngle M

You can use the FreeAngle M function to freely define the M line and study the image. Use the Trackball and the pointer on the control panel to define the length, position, and angle of the M line.

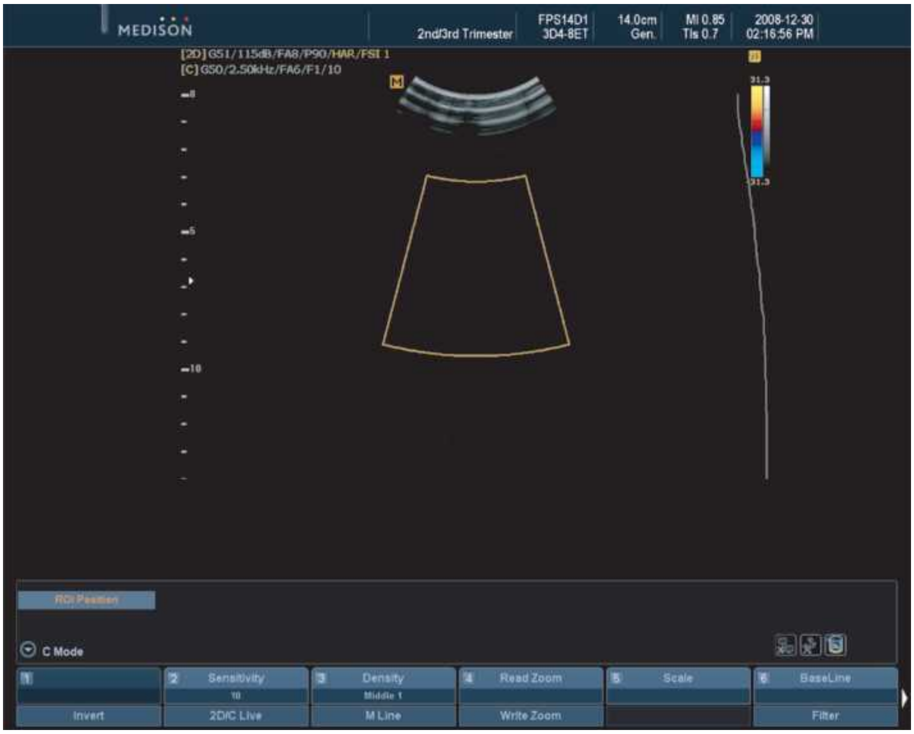
NOTE:

- Use the Menu Edit to add this function to the Soft Menu.
- The FreeAngle M function appears in the Soft Menu only when a phased array probe is used.

Color Doppler Mode

This mode displays the colored blood flow pattern of the ROI (Region of Interest) within the 2D image.

It is appropriate for examining the presence of the blood flow, its average speed and direction. The 2D Mode image is also shown allowing the marking and adjustment of the ROI within the entire image.



[Figure 4.3 Color Doppler Mode]

Entering & Exiting C Mode

Press the **C** button on the control panel. Press the **C** button again. C Mode will be terminated and the mode switched to 2D.

C Mode Screen

ROI Box

ROI stands for Region of Interest. The ROI Box outlines the area of the 2D image where color (blood flow) information is displayed in Color Doppler Mode.

Use the **Change** button to move and resize the ROI box. Each time you press the **Change** button, the current state of the ROI box is displayed in the lower left of the screen.

- ROI Position: You can move the ROI box. Use the Trackball to move the ROI box.
- ROI Size: You can resize the ROI box. Use the **Change** button to resize the ROI box.

C Mode Soft Menu

Steer / Invert

Use the Soft Menu dial-button **[1]**.

- Steer: Rotate the dial-button to adjust the angle of the ultrasound beam. This can minimize loss of color information based on the angle of the ultrasound beam. Select ROI from Left, None or Right.

NOTE: The Steer function appears in the Flexible Soft menu only when a Linear Probe is used.

- Invert: Press the dial-button to invert the color bar. Inverting the color bar also inverts the colors displayed on the image.

Sensitivity

Use the Soft Menu dial-button **[2]** to select a value between 8 and 31. Increasing **Sensitivity** enhances the sensitivity of a color image, but reduces the frame rate.

Density

Selects the density of a scan line. Select Low, Middle1, Middle2 or High using the Soft Menu dial-button **[3]**.

If you select High, the number of scan lines are increased and the resolution of an image improves. The Frame Rate however reduces.

Scale (PRF)

Use the Soft Menu dial-button **[5]**. Rotating the Scale dial clockwise makes the PRF (Pulse Repetition Frequency) increase so that the speed range of the blood flow is widened, and vice versa.

Baseline / Filter

▶ Baseline

If you rotate the Soft Menu dial-button **[6]** clockwise, the baseline rises.

In Color Doppler Mode, the color bar indicates the direction and speed of blood flow. Relative to the baseline in the centre, the red color indicates the direction and speed of the blood flow towards a probe. By contrast, the blue color indicates the direction and speed of the blood flow away from a probe.

▶ Filter

The filter is an electrical filter used to eliminate low-frequency Doppler signals caused by the motion of vessel walls. Adjust the Cutoff Frequency to remove the Doppler signals for which the frequencies are lower than the Cutoff Frequency from the screen.

Select a value between F 0 and F 3 by pressing the Soft Menu dial-button **[6]**. The value will be displayed on the monitor.

Color Map

Sets the Post Curve of an image. Select a type between 1 and 14 by rotating Soft Menu dial-button **[1]**.

Balance

Adjust the range of color image display by comparing the Gray Level of the 2D image with the Doppler signal values of the color image. As the Balance value increases, the color image appears, even in regions with a high Gray Level in 2D image (bright regions), expanding the range of the color image.

Use the Soft Menu dial-button **[2]** to choose a Balance value between 1~16.

Color Format

Sets C Mode to use. Select Color + B/W, B/W Only or Color Only by rotating the Soft Menu dial-button **[3]**.

Color Mode

Sets the color display. Select Velocity or Vel + Var by rotating the Soft Menu dial-button **[4]**. If Velocity or Vel+ Var is selected, a numeral representing the number of a color scale is indicated above and below the color bar.

Power Doppler Mode

This mode displays the color intensity of blood flow within the ROI in the 2D image.

It is appropriate for examining the presence and amount of blood flow. The 2D Mode image is also shown, allowing the marking and adjustment of the ROI within the entire image.

[Figure 4.4 Power Doppler Mode]

Entering & Exiting PD Mode

Press the **PD** button on the control panel. Press the button again. PD Mode will be terminated and the mode switched to 2D.

PD Mode Screen

Color Bar

In Power Doppler Mode, the colour bar varies depending on the screen display for Power Doppler Mode that is selected in the PD Mode menu.

- PD Mode: The color bar indicates the presence of blood flow and its amount. The top of the colour bar is the brightest section, where the amount of blood flow is at its highest.
- DPDI Mode: The color bar indicates the direction and intensity of blood flow. With the baseline in the centre, the red colour represents the direction and intensity of blood flow moving toward the probe, and the blue colour represents the direction and intensity of blood flow away from the probe.

ROI Box

The ROI (Region of Interest) outlines the area of the 2D image where color (blood flow) information is displayed in Power Doppler Mode.

PD Mode Soft Menu

PD Mode

Rotate the Soft Menu dial-button **[4]** to select between PD Mode and DPDI Mode.

- PD Mode: Shows only the intensity of the blood flow.
- DPDI Mode: Directional Power Doppler Imaging (DPDI) shows the intensity and direction of blood flow.

NOTE: Use of the menu and Soft Menu items is the same as in Color Doppler Mode.

PW Spectral Doppler Mode

PW stands for Pulse Wave. PW Spectral Doppler Mode gives information on the speed of blood flow at a specific site in the form of a spectral trace and audio signal. Distance (depth) information can also be obtained by transmitting pulses over time frames.

This mode is useful for measuring low-speed blood flow such as in the abdomen and peripheral vessels. The 2D Mode image is also shown, allowing the marking and adjustment of an observation area within the entire image.

[Figure 4.5 PW Spectral Doppler Mode]

Entering & Exiting PW Spectral Doppler Mode

Press the **PW** dial-button on the control panel. Press it again to return to 2D Mode.

Click the **Update** button to obtain a Spectral Doppler image.

PW Spectral Doppler Mode Screen

Sample Volume

When Sample Volume is on the blood flow of the 2D image, it represents Doppler Spectrum. The size and depth of Sample volume is displayed in **[mm]** units. Its position is moved with the Trackball and displayed in the xx.xx@yy.yy mm format. The format means that a Sample Volume of 'xx.xx' mm size is located at a depth of 'yy.yy' mm.

For example, 2.00@16.70 mm means that a Sample Volume of 2.00mm size is located at a depth of 16.07mm.

Moving Sample Volume

Use the Trackball on the control panel.

Resizing Sample Volume

Adjust the Sample Volume size by pressing the **Change** button and using the Trackball on the control panel. Press the **Change** button again to return to the Sample Volume Position Control screen. The icon showing the two Trackball functions (SV Position/SV Size) is shown for a second and then disappears.

Adjusting the angle of Sample Volume

Use the **Menu** dial-button on the control panel. If you rotate the dial-button clockwise, the angle increases from between –70 ~ +70.

HPRF (High PRF) Function

This function measures blood flow for which the speed exceeds the specified limit at a specified depth. It expands the scale into double the size of the original scale. This function is available only in PW Spectral Doppler Mode (D Only).

Activating HPRF

To activate HPRF, increase the Scale values at the required depth. A The Phantom Gate will appear on the D Line at a position higher than the sample volume. Once HPRF starts, PRF does not increase even if you increase the scale value.

Finishing HPRF

While HPRF is in use, decrease the scale value by one step to finish HPRF. The maximum PRF values in PW Spectral Doppler Mode are shown.

▶ **Moving Sample Volume**

To move the Sample Volume position in the D Only state, the system calculates PRF values and the Phantom Gate position, and updates them on the PW Spectral Doppler image. HPRF is terminated when HPRF cannot be activated.

When Sample Volume is moved in the 2D Only state, the PRF values don't change.

NOTE: HPRF is not activated in Simultaneous Mode. It is also not activated if [PRF*2] exceeds 23KHz.

CAUTION:

▶ The Phantom Gate position can be located outside the 2D image area in Zoom Mode.

▶ Make sure that sample volume and Phantom Gate are not placed together in the measuring area. If more than two Sample Volumes are located in the vessels, all Doppler components will appear in the spectrum, causing noise.

PW Spectral Doppler Mode Soft Menu

SV Size / Angle

▶ **SV Size**

Set the size of the Sample Volume. Select a size between 0.5 and 15 by rotating the Soft Menu dial-button **[2]**.

▶ **Angle**

If you press the Soft Menu dial-button **[2]**, the angle changes – 60, 0 or 60 degrees. The speed can be measured accurately by adjusting the angle of the Sample Volume.

Auto Calc

Press the Soft Menu dial-button **[3]** to turn it on or off.

If it is turned on, Doppler Trace is performed and the resulting values are displayed. When it is on, the **Mean Trace** button is activated. The displayed values are as below. For information on setting display values, please refer to "Chapter 7. Utility."

- Peak Systolic Velocity (PSV)
- End Diastolic Velocity (EDV)
- Time Averaged Peak Velocity (TAP)
- Resistive Index (RI)
- Pulsatility Index (PI)
- Systole / Diastole Ratio (S/D)
- Time Averaged Mean Velocity (TAM)
- Diastole / Systole Ratio (D/S)
- Max Pressure Gradient (PGmax)
- Mean Pressure Gradient (PGmean)
- Velocity Time Integral (VTI)
- PeakA

CAUTION: The measurements done by Auto Trace under Measure and Real Time Automatic Doppler Trace (Automatic Calculator) may be different from each other. This is because the algorithms for these two methods are different. It is recommended to use Auto Trace under Measure for more accurate measurement.

Tips!

Things to Consider for Real Time Automatic Doppler Trace

1. Aliasing occurs because PRF is too low in comparison to the image speed, or the spectrum is clustered around the baseline because PRF is too high.
2. Peak is indistinctive or intermittent such as in Spectral waveforms for veins.
3. Meaningful spectrum distinction becomes difficult because Doppler Gain is set too high or too low.
4. An index is displayed during the transition time after Sample Volume is moved with the **Trackball**.
5. The major spectral signals are cut off because Doppler Wall Filter is set too high.
6. Peak Trace is interrupted due to abnormal Doppler noise or artifact, and the heart rate is above approximately 140 bpm.

The trace and/or results of Real Time Automatic Doppler Trace may not be accurate in the above situations. Furthermore, during auto calculation, results will not be displayed if the Freeze function is run against inaccurate values.

AutoCalc Direction

Use the Soft Menu dial-button **[3]**. You can select the part of spectrum to use AutoCalc from Up, Down, or All.

Simultaneous

Each time you press the Soft Menu dial-button **[4]**, the Simultaneous function turns on and off.

NOTE: It appears in the PW menu only when "**Utility** > **Setup** > **General** > **Simultaneous Mode**" is set to Allow.

If the Simultaneous function is enabled, you can view the 2D image and Spectral Doppler image simultaneously in real time. If it is disabled, you can view only one of the two images.

The Simultaneous function decreases Doppler PRF, thus decreasing the measurable speed range.

Mean Trace

NOTE: When **AutoCalc** is on, Mean Trace is displayed in the Soft Menu.

Displays a mean value by performing Doppler Trace. Press the Soft Menu dial-button **[5]** to turn it on or off.

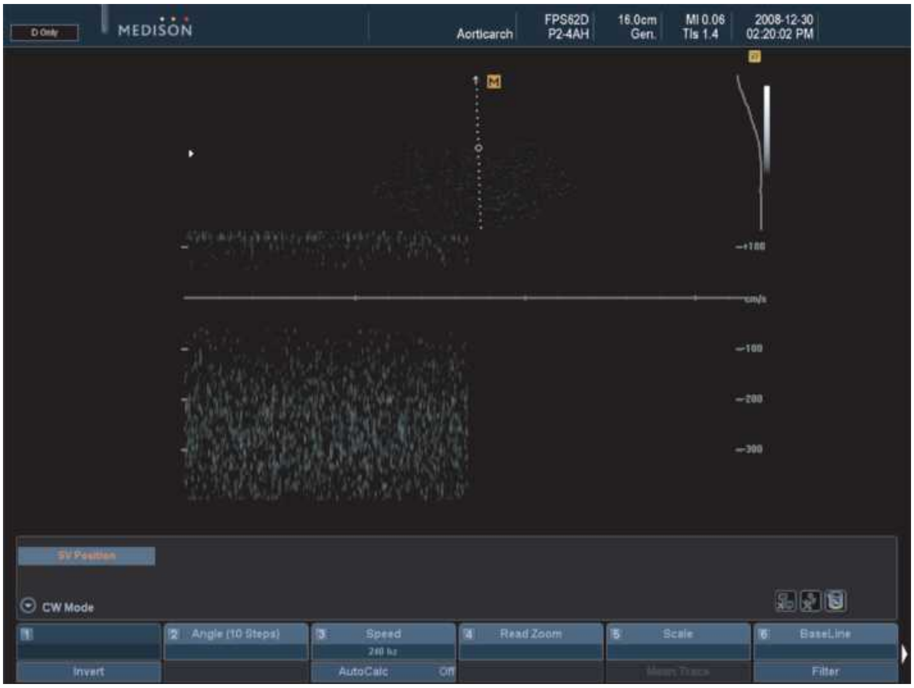
Baseline

Use the Soft Menu dial-button **[6]**. Adjust the X-axis of a Doppler image by rotating the dial-button.

NOTE: For information on the menu and other items in the Soft Menu, please refer to '2D Mode' and 'Color Doppler Mode.'.

CW Spectral Doppler Mode

CW stands for Continuous Wave. PW Spectral Doppler Mode gives information on the speed/direction of blood flow at a specific site in the form of a spectral trace and audio signal. Unlike PW Spectral Doppler Mode, it does not provide Sample Volume.



[Figure 4.6 CW Spectral Doppler Mode]

Steered CW Spectral Doppler Mode

This mode is available with a Phase Array Probe only.

The 2D Mode image is also shown, allowing the marking and adjustment of an observation area within the entire image.

Entering & Exiting CW Spectral Doppler Mode

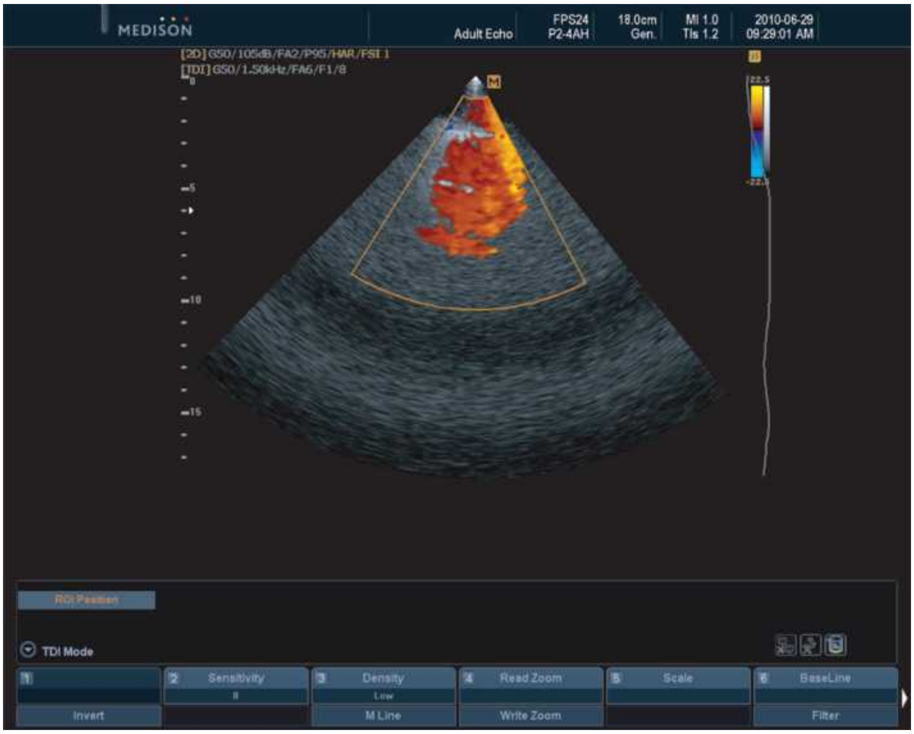
Press the **CW** button on the control panel. Press it again to return to 2D Mode.

NOTE: The information on menu and Soft Menu items for PW Spectral Doppler Mode also applies to this mode.

TDI Mode

NOTE: This function appears in the Soft Menu only when a Phased Array Probe is used for cardiac application.

TDI stands for Tissue Doppler Imaging. It represents movements of tissues such as a heart.



[Figure 4.7 Tissue Dopple Imaging Mode]

Entering TDI Mode

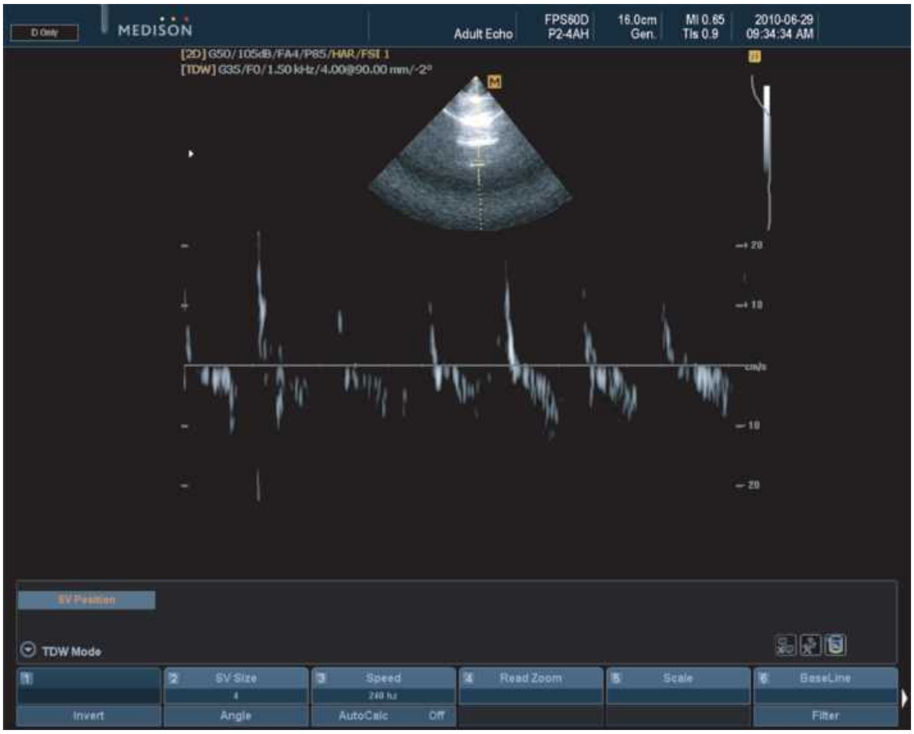
Press the Soft Menu dial-button **[6]** in Color Doppler Mode.

NOTE: For information on other items, please refer to 'Color Doppler Mode'.

TDW Mode

NOTE: TDW is available only when the cardiac application with a Phased Array probe is selected.

TDW stands for Tissue Doppler Wave. It represents movements of tissues such as a heart.



[Figure 4.8 TDW Mode]

Entering TDW Mode

Press the Soft Menu dial-button **[6]** in Color Doppler Mode or PW Spectral Doppler Mode.

NOTE: For information on other items, please refer to 'PW Spectral Doppler Mode.

ElastoScan Mode

The elasticity of ROI in a 2D image is shown in color. The 2D Mode image is also shown, so that you can mark and adjust the position of the ROI within the scanned image.

NOTE:

- ElastoScan Mode is an option for this product.
- The probes, applications, and presets that support ElastoScan are as follows: LN5-12 (Small parts – Breast), L5-12/50 (Small parts – Breast), EVN4-9 (Gynecology-Uterus, Urology-Prostate), ER4-9 (Gynecology-Uterus, Urology-Prostate)

Tips!

ElastoScan

This process converts the elastic modulus (ultrasound image data) of a target object, obtained from continuous ultrasound images, into an elastogram. A lesion's location can be estimated by using the differences in elastic modulus obtained from elastograms. The function of elastography is to determine the difference in hardness or stiffness between healthy organs and lesions. Palpation has been used to measure stiffness, but this method is only useful at depths close to the surface of tissue. ElastoScan allows the user to identify the existence of solid masses in tissue, and converts the hardness data into an image by sonically enhancing the palpation.

Elastography shows the spatial distribution of tissue elasticity properties in a region of interest by estimating the strain before and after tissue distortion caused by external or internal forces. Quantitative elastography is not provided.

E Entering and Exiting E Mode

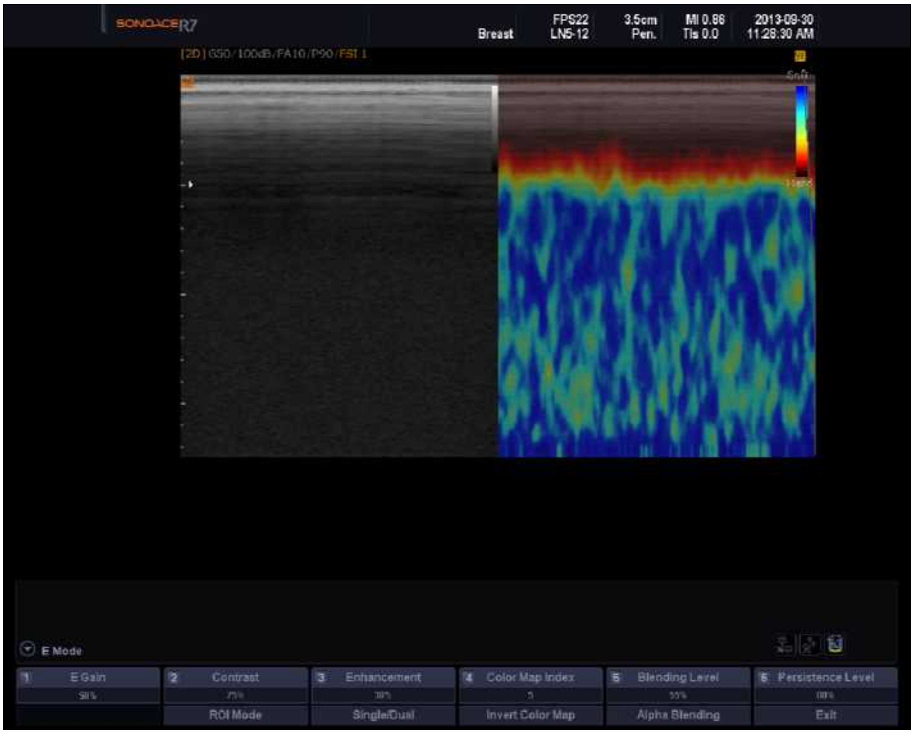
In 2D mode, press **ElastoScan** in the menu.

E Mode Screen

E Dual Mode

In this mode, the elastogram and the 2D image are displayed together on the screen. Press **Single/Dual** to select either Single or Dual mode.

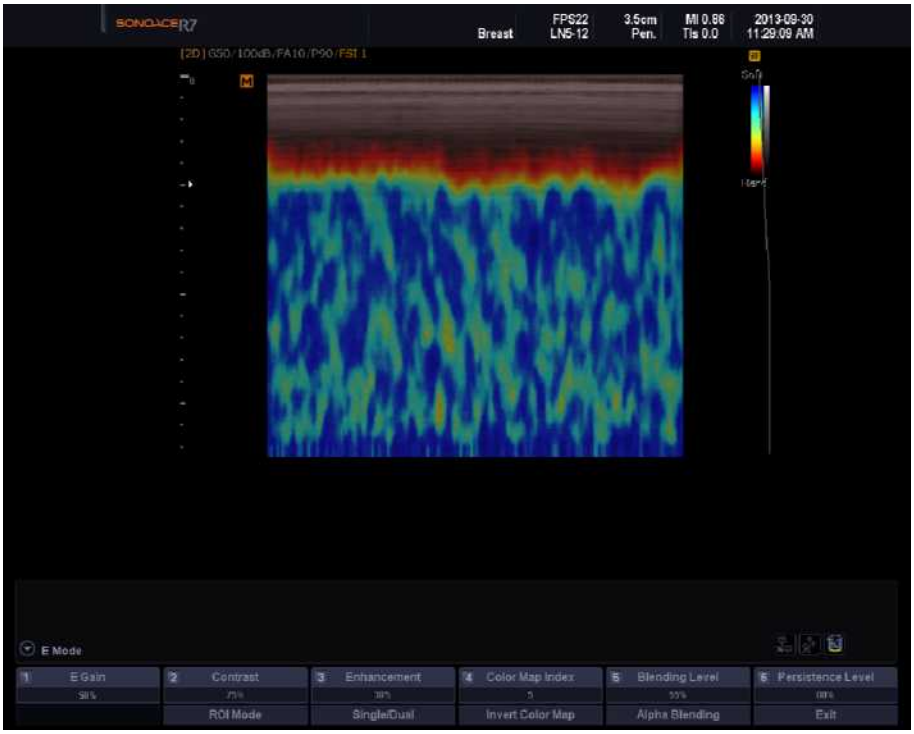
To facilitate comparative observation, the 2D image is shown on the left and an E image is shown on the right.



[Figure 4.9 E Dual Mode]

■ E Single Mode

In this mode, the E image is displayed alone on the screen. Press **Single/Dual** to select either Single or Dual mode.



[Figure 4.10 E Single Mode]

ROI Mode

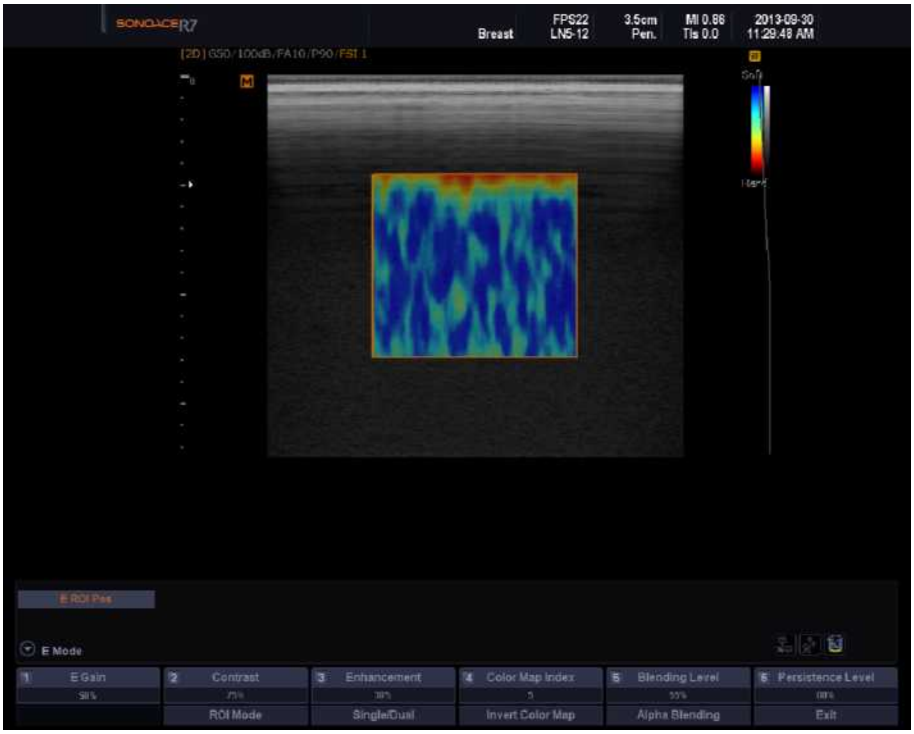
ROI stands for Region of Interest. In E Mode, the ROI Box represents the area where elasticity information is shown. Press **ROI Mode** to enter or exit ROI Mode.

You can adjust the position and size of the ROI box by using the **Change** button on the control panel. Each time the **Change** button is pressed, the current status of the ROI Box is shown in the bottom left corner of the screen.

– E ROI Pos.: In this state, the position of the ROI Box can be changed. Use the trackball to reposition the ROI Box.

– E ROI Size: In this state, the size of the ROI Box can be changed. Use the trackball to resize the ROI Box, and press the **Change** button to apply the new size.

NOTE: ROI Mode is available in E Single Mode as well as in E Dual Mode.



[Figure 4.11 ROI Mode]

Performing a Scan

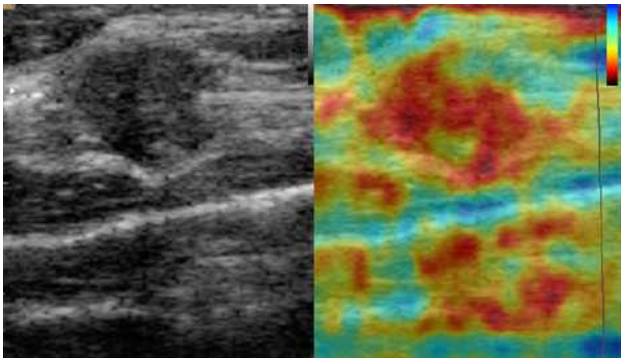
When using E mode, place a probe onto the surface of the area you wish to observe and apply periodic compression to it. The compression should be adjusted so that the strain stays within 3 - 5 %.

Breast

A breast is a complex organ that consists of latecomer, laticifer, glandular mammaria, fatty tissues, fibrous tissues and chest muscles. Moving a probe along vertically causes unintended movements of the tissues. To observe a lesion in ElastoScanMode (E Mode), it is recommended that you minimize lateral or other directional movements, including vertical movement of tissues along the axis.

The following are the images of a breast tumor scanned in 2D mode and E mode.

a: b:



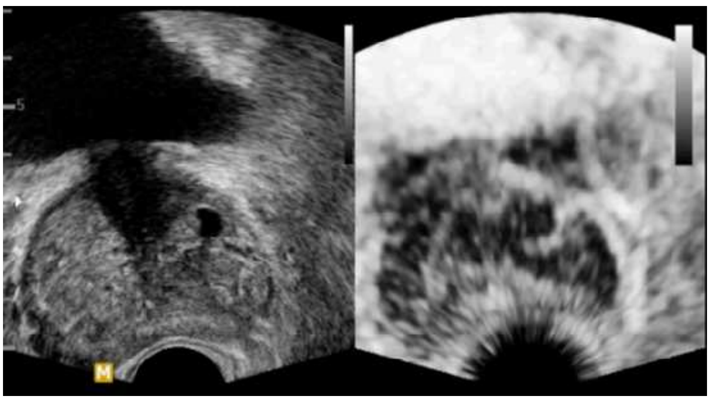
[Figure 4.12 Image of a Breast Tumor (a: 2D Mode, b: E Mode)]

Prostate

The prostate consists of tissues that are simpler than those of a breast, and there are relatively fewer unintended movements.

The following are the images of a prostate tumor scanned in 2D mode and E mode .

a: b:



[Figure 4.13 Image of a Prostate Tumor (a: 2D Mode, b: E Mode)]

Screen Layout

Color Bar

In E Mode, the color bar indicates the stiffness of the tissue. Regardless of the color, the lower section of the bar indicates that the target area is stiffer than the surrounding tissues, and the upper section indicates that the target area is less stiff than the surrounding tissues.

E Mode Menu

Invert Color Map

Inverts the color bar. Inverting the color bar also inverts the color displayed on the image.

Alpha Blending

Press **Alpha Blending** to turn this function On or Off. Alpha Blending blends 2D and E images so that they appear to overlap with each other. Use **Blending Level** to adjust the blending ratio.

E Gain

Adjust the brightness of E image between 1 – 100%.

Contrast

Select the contrast for an E image between 1 – 100%.

Enhancement

Adjusts the enhancement of the image. Use the Soft Menu dial-button to select a value between 0 and 100%. A higher value provides more clearly defined boundaries, at the expense of increased noise.

Color Map Index

Select the color of the elastogram. Use the Soft Menu dial-button to select from types 1 to 5. If you change the Color Map, the color bar will also change accordingly.

Blending Level

Select the ratio of Alpha Blending. You can adjust the level in 1% increments between 0 and 100% by using the Soft Menu dial-button. Setting the value to 0% shows an E image only and setting it to 100% shows a 2D image only.

Persistence Level

Specify the speed of change between frames. You can adjust the level in 1% increments between 0 and 100% by using the Soft Menu dial-button. Selecting a lower value increases the rate of frame change.

NOTE:

- The Following are not available or have limited functionality in E mode;
  - Unavailable functions: Scan Area, ECG
  - Only one Focus option is available.
  - Biopsy can only be turned On or Off.
  - Only distance, circumference, area, volume, and other measurements that can be taken in 2D mode are supported.

Cine/Measurement

- Elastograms processed with ElastoScan are saved in the Cine Memory; 728 images from Freeze are stored.
- After performing a scan, press the **Freeze** button to enter Freeze mode. In Cine mode, you can use the trackball and menu buttons to review the elastogram.
- 2D-image measuring tools that are relevant to elastogram, including Line, Line Trace, Hip joint, Ellipse, and Trace, Vol., are provided.

Cine Edit

Define the area in the Cine Memory which you can explore and save.

Cine Review

Explore the area you have defined with Cine Edit.

Cine Save

You can save the elastogram.

Combined Mode

In Combined Mode, three different modes are combined including the default 2D Mode. Note that, in 2D/C Live Mode, only two modes are combined: 2D and Color Doppler Modes.

2D/C/PW Mode

Color Doppler Mode and PW Spectral Doppler Mode are displayed simultaneously.

In Color Doppler Mode, press the **PW** button on the control panel. Or, in PW Spectral Doppler Mode, press the **C** button on the control panel.

2D/PD/PW Mode

Power Doppler Mode and PW Spectral Doppler Mode are displayed simultaneously.

In Power Doppler Mode, press the **PW** button on the control panel. Or, in PW Spectral Doppler Mode, press the **PD** button on the control panel.

2D/C/CW Mode

Color Doppler Mode and **CW** Spectral Doppler Mode are displayed simultaneously. This mode is available only with certain probes.

In Color Doppler Mode, press the **CW** button on the control panel. Or, in CW Spectral Doppler Mode, press the **C** button on the control panel.

2D/PD/CW Mode

Power Doppler Mode and CW Spectral Doppler Mode are displayed simultaneously. This mode is available only with certain probes.

In Power Doppler Mode, press the **CW** button on the control panel. Or, in CW Spectral Doppler Mode, press the **PD** button on the control panel.

2D/C/M Mode

Color Doppler Mode and M Mode are displayed simultaneously.

In Color Doppler Mode, press the **M** dial-button on the control panel. Or, in M Mode, press the **C** dial-button on the control panel. (This button is enabled for specific diagnostic applications with specific probes only.)

2D/C Live Mode

2D Mode and Color Doppler Mode are displayed simultaneously. In 2D Mode, press the **Soft Menu** dial-button **[2]** 2D/C Live.

Changing Combined Mode Format

Changing the active image mode

Press the Update button on the control panel. The current active image mode - 'D Only' or '2D Only' - is displayed above the menu on the screen.

In Combined Mode, more than two image modes are used at the same time. The image mode currently in use is called 'Active Image Mode.' For example, if Sample Volume is moved with the Trackball in 2D/C/PW Mode, PW Spectral Doppler Mode becomes the current active image mode.

Because the menu and button options vary depending on the active image mode, use the **Update** button change the active image mode.

Note that the active image mode cannot be changed with the **Update** button when the Freeze function is in effect.

Changing menu

Press the **Active Mode** button on the control panel.

You can change the menu and Soft Menu items without changing the active image mode. Buttons for the active image mode appear on the control panel.

For example, if the Soft Menu for 2D Mode is displayed on the screen in 2D/C/PW Mode, press the **Active Mode** button to switch to the Soft Menu for Color Doppler Mode.

NOTE: For information on optimizing an image in Combined Mode, please refer to "Basic Mode."

Multi-Image Mode

The product supports Dual Mode and Quad Mode.

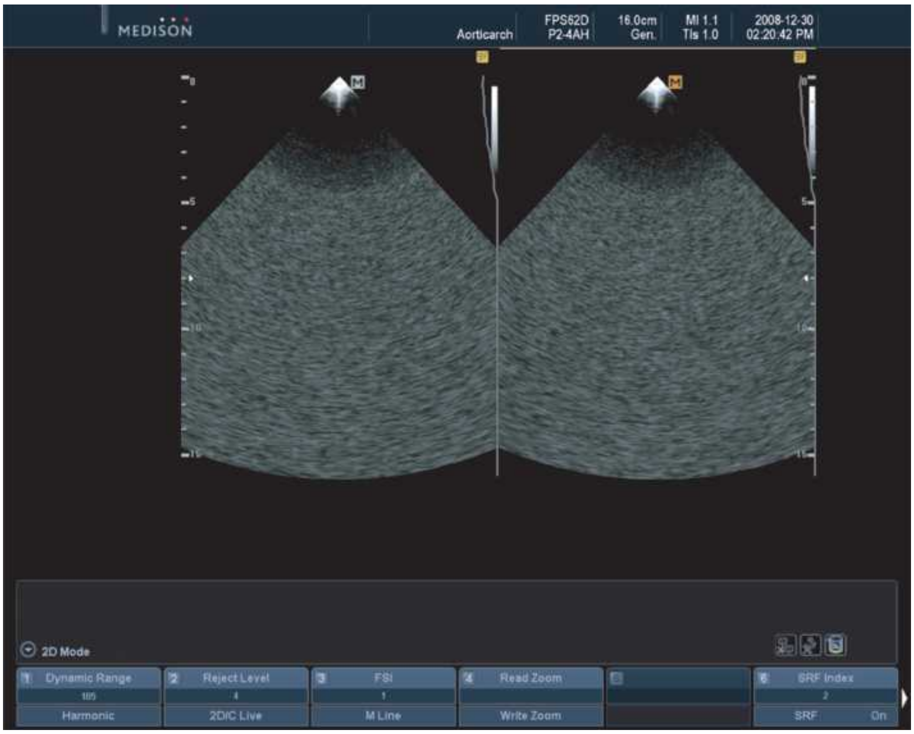
In Multi-Image Mode, an image can be displayed in different combined modes. Button operations in an active area are the same as in Combined Mode.

Dual Mode

Press the **Dual** button on the control panel.

You can compare two different images at the same time. Each time you press the **Dual** button, one of the two images is selected. The current active image mode is displayed as a yellow line at the top. Button and menu items for the current image mode are displayed.

Press the **2D** button on the control panel to exit Dual Mode.



[Figure 4.14 Dual mode]

Quad Mode

Press the **ESC** key button on the keyboards.

You can compare four different images at the same time. Each time you press the **ESC** key, one of the four images is selected. The current active image mode is displayed as a yellow line at the top. The button controls and menus of the active image mode are used.

To exit from Quad Mode, press the **2D** button.

[Figure 4.15 Quad mode]

3D/4D Mode

An observation area is displayed in a 3D image. SONOACE R7 provides 3D and 4D Modes.

3D/4D Mode

3D Mode

In this mode, 3D or standard probes are used to obtain 3D images.

NOTE: Standard probes may not be used in 4D Modes and their use may be limited in 2D and 3D Modes.

Depending on the probe used and how images are obtained, 3D Mode can be divided into the following:

2D/3D

In this mode, 3D or standard probes are used to obtain 3D images.

Tips!

In Static 3D Mode, a 3D probe is used. In Freehand 3D Mode, a standard probe is used.

4D Mode

In this mode, a 3D probe is used to obtain 3D images in real time. It is also called Live 3D Mode.

Entering & Exiting 3D/4D Mode

Press the **3D/4D** button on the control panel. Press it again to exit 3D/4D Mode and return to 2D Mode.

3D/4D Mode Screen

ROI Box

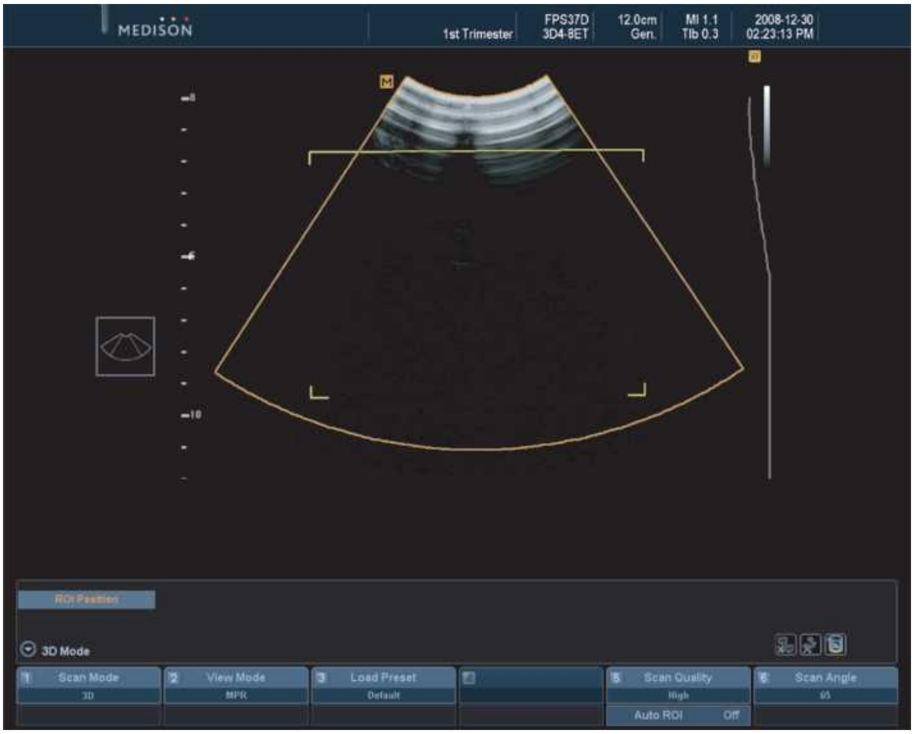
In 3D/4D Mode, the ROI box is also called the Volume Box, which indicates an area in a 2D image to be converted into a 3D/4D image.

The location and size of the ROI box can be adjusted with the **Change** button on the control panel. Each time the **Change** button is pressed, the state of the ROI box is shown in the lower left corner of the screen as below:

- ROI Position: The ROI Box can be relocated. Use the Trackball to move the ROI box to another location.
- ROI Size: The ROI Box can be resized. Use the Trackball to change the size of the ROI box, and then press the **Change** button to set the new size.

3D StandBy Mode

In this mode, various parameters can be set before 3D or 4D images are obtained.



[Figure 4.16 3D StandBy Mode]

3D StandBy Mode Soft Menu

NOTE: In Freehand 3D Mode, where only standard probes are allowed, **Soft Menus [1]**, **[2]** and **[3]** are available.

Scan Mode

Use the Soft Menu dial-button **[1]**. Rotate the dial-button to select the desired 3D Mode between 3D and 4D.

When a standard probe is used, 3D is displayed, and this may not be changed.

View Mode

Use the Soft Menu dial-button **[2]**. Rotate the dial-button to select the desired View Mode from MPR, MSV and Oblique View.

- MPR (Multi Planar Rendering): A standard 3D mode. Once 3D images are obtained, the 3D View screen appears.
- MSV (Multi Slice View): A type of 3D XI. Once 3D images are obtained, the 3D XI screen appears.
- Oblique View: A type of 3D XI. Once 3D images are obtained, the Oblique View screen of 3D XI appears.

When a standard probe is used, MPR is displayed, and this may not be changed.

NOTE: For more information on MSV and Oblique View, please refer to '3D XI.'

Load Preset

Use the Soft Menu dial-button **[3]**. Rotate the dial-button to select the desired preset.

When a standard probe is used, available options are Default or User1 - User5.

NOTE: You can select Default, Surface, Skeleton or User3~User5 for OB application.

Scan Quality / Auto ROI

- Scan Quality

  Use the Soft Menu dial-button **[5]**. Rotate the dial-button to select the scan speed from Low, Middle, High, Extreme.

  - Extreme: The image quality is excellent. Use this option to observe detailed images.
  - High: The image quality is lower than Extreme but the speed is faster than Extreme.
  - Middle: The image quality is lower than High but the speed is faster than High.
  - Low: The image quality is low but the 3D image speed (or rendering speed) is fast.

- Auto ROI

NOTE: This option appears only when the application for a 3D probe is set to OB.

Select Auto ROI in the menu. Press the button to turn it on or off. If it is turned on, the Volume Box is automatically placed over an area that will be converted to a 3D image.

When Auto ROI is used, the following should be considered:

– Images can be obtained over the fetal body only.

– The resulting 3D image is affected by the brightness or contrast of a 2D image.

– Once Auto ROI is turned on, the location or size of the Volume Box cannot be changed.

Scan Angle

Use the Soft Menu dial-button **[6]**. Rotate the dial-button to adjust the scan angle. The desired scan angle varies depending on the probe used.

Acquiring 3D Images

1. Select the desired 3D Mode in the Soft Menu **[1]**.
2. Specify the location and size of the ROI box as desired.
3. Use the **Menu** button and the Soft Menu dial-buttons **[2]** - **[6]** to set various parameters.
4. Once done, press the Freeze or Set button. The system will start acquiring 3D images.
5. Once 3D images are acquired, the **3D View** or **3D XI** screen appears.

   ▶ In the Soft Menu **[2]**, if **MPR** is selected, 3D View is enabled, and if **MSV** or **Oblique View** is selected, 3D XI is enabled. Depending on the mode selected, 3D View or 3D XI is displayed in the upper left corner of the screen.

   ▶ If a 3D image is acquired with its left and right sides flipped, it appears in 3D View or 3D XI with its sides flipped.

6. After optimizing the acquired 3D images, proceed with diagnosis

Tips!

How to Improve 3D Image Quality

- Consider the direction, division and size of the viewpoint, as well as the visibility of an object.
- Before acquiring 3D images, adjust the contrast in 2D Mode.
- If the ROI box is bigger, it takes more time to acquire 3D images. Therefore, set the ROI box to an appropriate size.
- To see the 3D scan of a fetus in a frontal view, position the fetal head in the direction of "Direction Mark", putting it in the coronal plane. Then scan the fetus from back to abdomen.
- The 3D image of the fetal face can be more easily found in the coronal plane than in the sagital plane.
- In case echo is not generated (ex. amniotic fluid), to determine surface contour, the surfaces of objects should be insulated with hypo-echoic textures.
- To obtain a high quality 3D surface, adjust Low-Threshold. As a general rule, do not adjust High-Threshold; set it to the maximum value of 255.

3D View-MPR

This screen appears after 3D images are acquired when View Mode is set to **MPR** in 3D StandBy Mode. **3D View** is displayed in the upper left corner of the screen.

After optimizing the acquired 3D images, proceed with diagnosis and measurement.

NOTE: When 3D images are acquired with a standard probe, 3D View is automatically enabled.

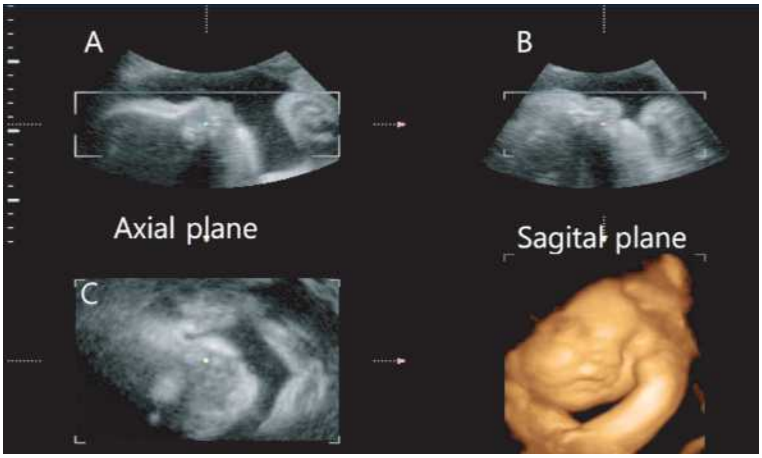
[Figure 4.17 3D View - MPR]

3D View Screen

Screen Layout

The main 3D View screen consists of Axial Section, Sagital Section and Coronal Section surface images — which are volume data cut by anatomical locations — and 3D images.

For the purpose of convenience, Axial Section is displayed as "A plane," Sagital Section as "B plane," and Coronal Section as "C plane."



Trackball Mode

The current Trackball mode is displayed in the user information area. You can choose Trackball mode from Cursor, Move and ROI. To change the Trackball mode, press the **Change** button on the control panel. Each time the button is pressed, the Trackball mode is toggled.

- Cursor: The Trackball can be used to position the cursor. Use the Trackball and **Set** button to select the icon menu on the screen. Press the **Pointer** button on the control panel to switch to the cursor mode.
- Move: The Trackball can be used to move 3D images. The acquired 3D image is moved around according to the movement of the Trackball.
- ROI: The Trackball can be used to resize the ROI box. The size of the ROI box over a 3D image is changed according to the Trackball movement. The ROI mode is available only when Basic in the icon menu is set to ROI.

Moving Images

Place the Trackball pointer over an image to move, and then move it while pressing the **Set** button. Alternatively, use the Trackball to move an image when Trackball mode is set to Move.

- **Set** Button: An image can be rotated around the center.
- **Exit** Button: An image can be moved up/down/left/right.

■ Resizing ROI

When the Trackball mode is set to ROI, move the Trackball to resize the ROI box. When the Trackball mode is set to Cursor, place the cursor over the ROI box and then use the Trackball and **Set** button to resize it.

■ Rotating Images by X-axis

Use the Soft Menu dial-buttons **[4/X]** on the control panel. Alternatively, when the Trackball mode is set to Cursor, place the cursor on the A Plane image and then move the Trackball while pressing the **Set** button.

■ Rotating Images by Y-axis

Use the Soft Menu dial-buttons **[5/Y]** on the control panel. Alternatively, when the Trackball mode is set to Cursor, place the cursor on the B Plane image and then move the Trackball while pressing the **Set** button.

■ Rotating Images by Z-axis

Use the Soft Menu dial-buttons **[6/Z]** on the control panel. Alternatively, when the Trackball mode is set to Cursor, place the cursor on the C Plane image and then move the Trackball while pressing the **Set** button.

■ Showing/Hiding Menu

Press the **Menu** dial-button to show the menu on the screen. Press the **Exit** button to hide the menu.

■ Moving Menu Tabs

Use the Trackball and the **Set** button to move a tab in the menu. The Active mode can also be used.

■ Selecting Items

Press the **Menu** dial-button.

■ Returning to Upper Menu

Press the **Exit** button.

Entering Text and Indicator

Entering Text

Press the **[F3]** button on the alphanumeric keyboard.

Entering Indicator

Press the **[F2]** button on the alphanumeric keyboard.

Saving and Printing

Saving Images

Press the **Save** button on the control panel. The *3D Data Save* window will appear.

Select **Image** under Save Type and then press the **Save** button to save images

[Figure 4.18 3D Data Save]

Saving Images with Volume Data

Press the **Save** button on the control panel and then the *3D Data Save* window will appear.

Select **Volume** under **Select Item** and then press the **Save** button again to save images along with volume data. If volume data contains Cine images, they are also saved together.

NOTE: If volume data contains both 4D and 3D Cine images, choose one or other under **Select Item** and save it.

▶ If images are saved with volume data, they can be converted to 3D rendering images with SonoView.

Printing Image

Press the **Print** button on the control panel.

MPR Mode Menu

Display

Select **Display** in the menu to specify the desired display format.

2D

Axial, Sagital or Coronal plane images and Orientation Help (OH) are displayed on the screen. OH shows the relative position of the selected plane in reference to volume data.

Tips!

How to Improve 3D Image Quality

Since diagnosis is performed with multi-planar images only in 2D Mode, **Soft Menu Full** can be used for more detailed observation.

2D / 3D

Axial, Sagital or Coronal plane images and 3D images are displayed on the screen.

Volume CT

Axial, Sagital or Coronal plane images and the actual combination of them are displayed on the screen. The boundary of each plane is shown in a different color.

ROI 3D

Axial, Sagital or Coronal plane images and 3D images are displayed on the screen. The ROI Box can be changed for better observation.

■ **Fixed 3D**

Axial, Sagital or Coronal plane images and the 3D image that is set within the ROI box in ROI 3D Mode are displayed on the screen. The ROI Box does not appear.

Ref. Image

Use the **Menu** dial-button to select a reference image from A, B and C. Depending on the reference image selected, the direction of the arrow changes.

3D Orientation

Select 0, 90, 180 or 270 degrees using the **Menu** dial-button. The coordinate system rotates to the Z-axis in the 3D Reference Coordinate System.

VCE

Press the **Menu** dial-button to turn it on or off. If it is on, the contrast ratio of a 3D image is enhanced. VCE stands for Volume Contrast Enhancement.

NOTE:

- Select VCE in the Quick menu in **MPR** Mode.
- VCR is available only in the **2D/3D**, **ROI 3D** and **Fixed 3D** modes.

Auto Contour

Press the **Menu** dial-button to turn it on or off.

This function automatically locates the fetal face area in a fetus image scanned for Sagital. If it is turned on, a contour line appears and a 3D image is contoured in the ROI box on A Plane.

NOTE: This function is only available in ROI 3D Mode where **Render Direction** under **Render Setup** is **C+**.

3D Cine

Use the **Menu** dial-button to select **3D Cine** in the **3D View** menu. Then 3D Cine Mode will be enabled.

§ 3D Cine Define

Specify settings required for Cine execution.

■ Rotation Angle

Use the Soft Menu dial-button **[1]** to set all of the rotation angles for an image. Valid values are 30, 45, 60, 90, 180 and 360˚.

■ Step Angle

Use the Soft Menu dial-button **[2]** to set the rotation angle by step for an image. Valid values are 1, 3, 5 and 15˚.

Tips!

The Difference between Rotation Angle and Step Angle

A Cine image rotates to the angle set in **Rotation Angle** in increments as set in **Step Angle**. For example, if Rotation Angle is set to 360˚ and Step Angle is set to 15°, 3D Cine rotates to 360° using 15˚ steps.

■ Rotate Axis

Use the Soft Menu dial-button **[3]** to set the rotation direction to X or Y.

■ Start Angle

Use the Soft Menu dial-button **[4]** to set the start point of a Cine image. Valid values are -180 to -1. If Start Angle is set, Rotation Angle is disabled.

■ End Angle

Use the Soft Menu dial-button **[5]** to set the end point of a Cine image. Valid values are 1 - 180. If End Angle is set, Rotation Angle is disabled.

■ Mix

Use the Soft Menu dial-button **[6]** to set the rendering mix. Valid values are 0 - 100.

■ Calculate

Press the Soft Menu dial-button **[6]**. Start configuring a Cine image with the specified settings.

■ 3D Cine

Specify settings required for Cine execution.

Play Mode

Use the Soft Menu dial-button **[1]** to select how 3D Cine is played.

- Loop: Continues to play 3D Cine in one direction repeatedly.
- Yoyo: Plays 3D Cine in one direction until the end is reached and then continues to play it in the reverse direction.

Speed (%)

Use the Soft Menu dial-button **[2]** to set the playback speed of a Cine image. Valid options are 25, 50,100, 200, 300 and 400%.

Cine Frame

Use the Soft Menu dial-button **[3]** to select and observe a specific Cine image. Cine Frame is displayed in the menu only when the Cine playback is stopped. The number of the frame for the current image, out of all the frames, is indicated in the menu.

Mix

Use the Soft Menu dial-button **[4]** to set the rendering mix. Valid values are 0 - 100.

Cine Playback / Pause

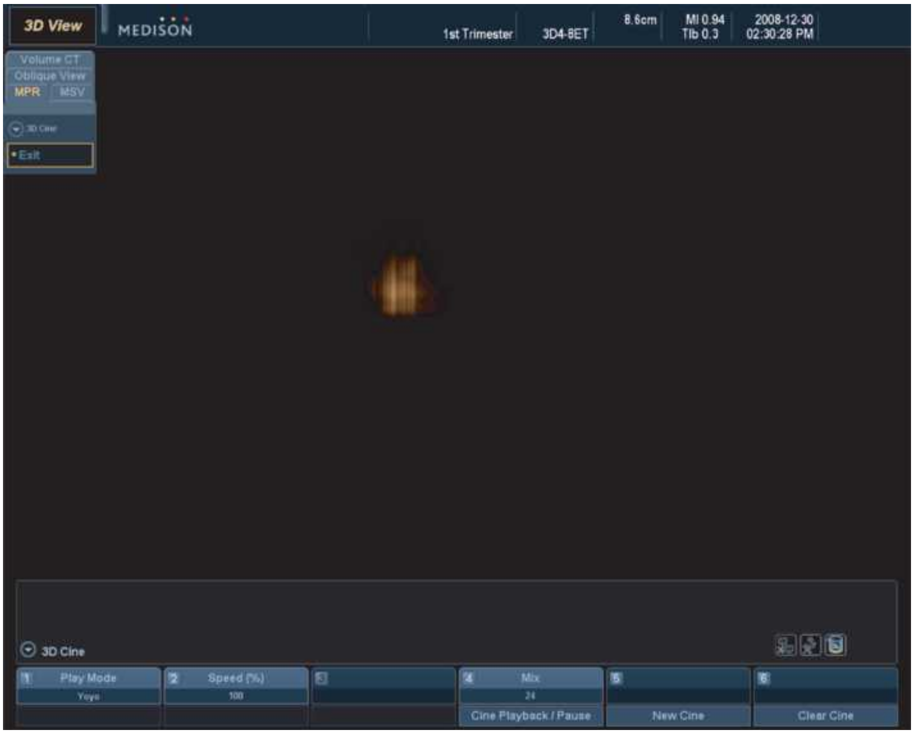
Press the Soft Menu dial-button **[4]** to pause or play.

New Cine

Use the Soft Menu dial-button **[5]** to enable New Cine Mode. Return to the *3D Cine Define* screen.

Clear Cine

Use the Soft Menu dial-button **[6]** to delete the current Cine image. Return to the *3D Cine Define* screen.



[Figure 4.19 3D Cine]

4D Cine

Use the **Menu** dial-button to select **4D Cine** in the **3D View** menu. Then 4D Cine Mode will be enabled.

[Figure 4.20 4D Cine]

NOTE: 4D Cine can also be enabled by pressing the **Freeze** button in 4D Mode.

After specifying the playback mode and Cine type, press the **Play** button to start playing a Cine image.

■ Cine Type

In the menu on the screen, use the **Menu** dial-button to select Cine type.

- ▶ Image: The standard Cine playback mode. [Start Angle], [End Angle], [Speed(%)], [Image Position] appear in the Soft Menu.
- ▶ Volume: While a Cine image is being played, the *MPR* screen appears on the screen. The display format can be changed to optimize Cine image playback. **Vol. Indexs** appears in the Soft Menu.

Play Mode

Use the Soft Menu dial-button **[1]** to select the playback mode of a Cine image.

- Loop: Continues to play a Cine image in one direction repeatedly.
- Yoyo: Plays a Cine image in one direction until the end is reached and then continues to play it in the reverse direction.

Cine Type

Use the Soft Menu dial-button **[2]** to select a Cine type.

Start Angle

Use the Soft Menu dial-button **[3]** to set the start point of a Cine image. This option appears only when Cine Type is Image.

End Angle

Use the Soft Menu dial-button **[4]** to set the end point of a Cine image. This option appears only when Cine Type is Image.

Speed (%)

Use the Soft Menu dial-button **[5]** to set the playback speed of a Cine image. Valid values are 25 - 400%. This option appears only when Cine Type is Image.

Image Position

Use the Soft Menu dial-button **[6]** to select a Cine image that will be shown on the current screen. This option appears only when Cine Type is Image.

Vol. Index

Use the Soft Menu dial-button **[6]** to select volume data that will be shown on the current screen. This option appears only when Cine Type is Volume.

Preset

Use the **Menu** dial-button to select. Set or rename a preset as desired.

■ Preset

Select a preset between Default or User1 and User 5. If you click Default, it is set to the default value of the system.

■ Load Preset

Loads the selected preset onto the system.

■ Save Preset

Saves the changes of the preset.

■ Rename

Changes the name of a User Preset in a Name pop-up window.

Render Setup

Use the **Menu** dial-button to select **Render Setup**.

§ Gray Render Mode

This mode shows volume data acquired by the gray method as a 3D rendering image.

■ Render Mode 1

Sets Render Mode 1.

- ▶ Surface: Represents a 3D image in the Ray-casting method where the surface of an image is expressed with curves.
- ▶ Smooth: Provides a 3D image that is smoother than **Surface**.
- ▶ Max: Represents a 3D image in maximum intensity. This option can be useful for observation of bone structure.
- ▶ Min: Represents a 3D image in minimum intensity. This option can be useful for observation of vessels or cavities in the human body.
- ▶ X-Ray: Represents a 3D image in average intensity. An image is shown like an X-ray image.

■ Render Mode 2

Sets Render Mode 2. It can be set in the same way as for Render Mode 1.

■ TH. High

Sets the minimum range of a threshold. Select between 0 and 255.

MagiCut

Use the **Menu** dial-button to select **MagiCut** in the 3D View menu. MagiCut can be used to eliminate parts in a 3D image that are irrelevant for diagnosis.

NOTE: This function is not available in 4D Mode.

[Figure 4.21 MagiCut]

■ CutMode

Use the **Menu** dial-button to set Cut Mode.

- ▶ Inside Contour: Cuts the inside of the selected area.
- ▶ Outside Contour: Cuts the outside of the selected area.
- ▶ Inside Box: Cuts the inside of the box.
- ▶ Outside Box: Cuts the outside of the box.
- ▶ Small Eraser: Cuts with a small eraser.
- ▶ Big Eraser: Cuts with a big eraser.

■ Depth

Use the **Menu** dial-button to set Cut Depth.

- ▶ Full: Cuts the entire area.
- ▶ Defined: Cuts the defined area. Define an area to cut as below:

1. Use the Trackball and the **Set** button to define an area to cut.
2. Use the **Menu** dial-button to set the cutting depth. Valid values are 1 - 100.
   - Use the **Undo** function or **Undo All** function to restore the image and to cut the same area.
   - **Undo**: Cancels cutting the selected area.
   - **Redo**: Redoes the cancelled area.
   - **Undo** All: Cancels all cutting operations.
3. Press the Soft Menu dial-button **[6]** Apply to complete the setting.

Palette

Use the **Menu** dial-button to select **Palette** in the **3D View** menu. Then set the colors for 2D and 3D images.

■ 2D Palette

Use the Soft Menu dial-button **[1]** to set the color of a 2D image. Valid options are Palettes 0 - 9.

■ 3D Palette

Use the Soft Menu dial-button **[2]** to set the color of a 3D image. Valid options are Palettes 0 - 9.

MPR Mode Soft Menu

Mix

Use the Soft Menu dial-button **[1]** to set the rendering mix between 0 and 100.

NOTE: This option is available in 2D/3D, ROI 3D and Fixed 3D only.

Init

Press the Soft Menu dial-button **[1]**. The initial 3D image and settings will be restored.

Th.Low

Use the Soft Menu dial-button **[2]** to set the value between 0 and 254.

Tips!

Threshold

A threshold is used to eliminate unnecessary data from an image. If it is increased, more cyst components are shown. If it is decreased, more bone components are shown.

NOTE: This option is available in **2D/3D**, **ROI 3D** and **Fixed 3D** only.

Full

Press the Soft Menu dial-button **[2]**. A 3D image will be displayed in the full screen mode. Press the button again to return to the previous screen.

Transparency

Use the Soft Menu dial-button **[3]** to set the transparency to between 20 and 250 for a 3D image.

The lowest value of 20 is the most transparent level, and the highest value of 250 is a completely opaque level.

NOTE: This option is available in **2D/3D**, **ROI 3D** and **Fixed 3D** only.

U/D Flip

Press the Soft Menu dial-button **[3]**. An image is flipped upside down.

Rotate X / Y / Z

Rotates a 3D image in the selected axis direction. Use the Soft Menu dial-buttons **[4]**, **[5]** or **[6]** to rotate the image to the X, Y or Z axis, respectively.

Next Page

Press the Soft Menu dial-button **[6]** to move to the next page.

Select

Use the Soft Menu dial-button **[1]** to select a Post Curve to change the settings for.

NOTE: This option is available in **2D/3D**, **ROI 3D** and **Fixed 3D** only.

Position

Use the Soft Menu button **[2]** to change the location of a Post Curve that is selected under **Select**. Valid values are 0 – 100.

Bias

Use the Soft Menu button **[3]** to change the bias of a Post Curve that is selected under **Select**. Valid values are -100 to 100.

Zoom

Use the Soft Menu dial-button **[4]** to adjust a value between 25 and 400.

Prev Page

Press the Soft Menu dial-button **[6]** to move to the previous page.

3D XI Mode (Optional)

If View Mode is set to **MSV** or **Oblique View** in 3D StandBy Mode, this screen appears when a 3D image is acquired. 3D XI is displayed in the upper left corner of the screen.

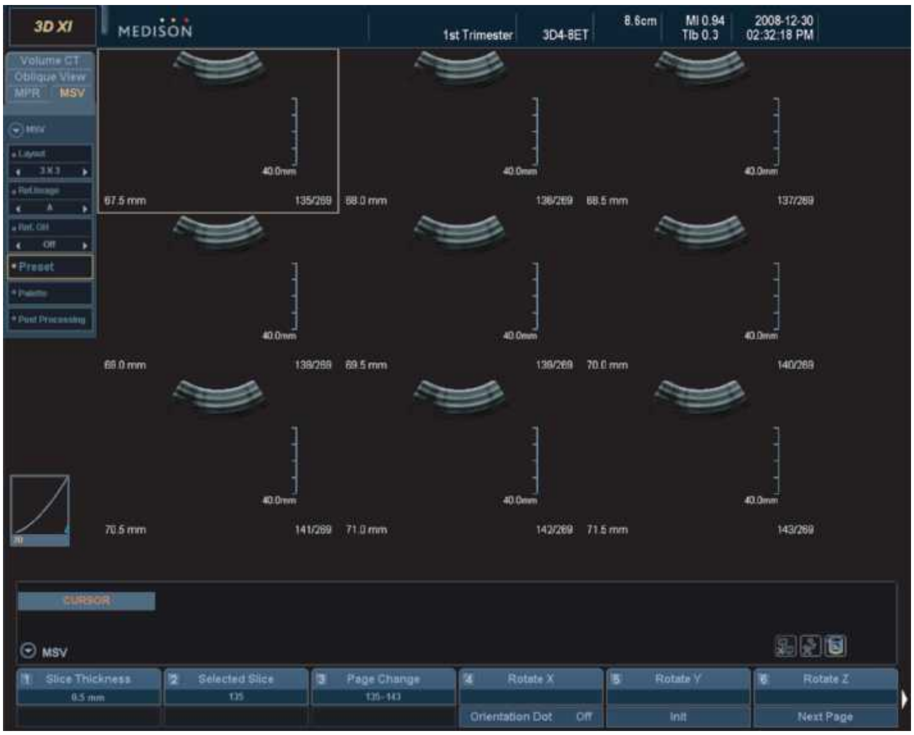
3D XI Mode also appears if **MSV**, **Oblique View** or **Volume CT** is selected in the 3D View screen. 3D XI is displayed in the upper left corner of the screen.

In 3D XI Mode, the plane of an image is divided into several sections and displayed to enhance the effectiveness of diagnosis. It has three sub-modes as below.

NOTE: 3D XI is available only when a 3D probe is used.

MSV Mode

Press the **MSV** tab in the menu. MSV stands for Multi-Slice View, which allows you to divide an image into several slices for better observation.



[Figure 4.22 Multi-Slice View]

NOTE: This mode provides a number of functions including **Calculator**, **Caliper**, **Text** and **Indicator**.

MSV Mode Menu

Layout

Set the screen layout by selecting one out of the **1x1**, **2x1**, **3x2**, **3x3**, **4x3** and **6x4** buttons on the screen.

Tips!

- If 1×1 is selected, one image can be viewed at a time. - If 6×4 is selected, 24 slice images can be viewed at a time.
- Each time a new layout is selected, the currently selected image moves to the first position on the screen.

Ref. Image

Choose a plane in which to view multi-slice images by selecting from A, B and C planes.

Ref. OH

Select a plane to be used as Reference OH.

- If Ref. OH is **3D**: Indicates the location of the selected slice in relation to volume data.
- If Ref. OH is **A**, **B** or **C**: Indicates the location of the selected slice.

Preset

Sets a preset or renames.

- Preset: Use the dial-button to select **Default** or **User1** ~ **User5**. If you select **Default**, it is set to the default value of the system.
- Rename: Renames a preset. If you press the dial-button, a *Name* window will appear.
- Save Preset: Press the dial-button to save changes of a preset.
- Load Preset: Press the dial-button to load the selected preset onto the system.

■ Palette

Set the color of a 2D image. The Soft Menu changes.

▶ 2D Palette: Use the dial-button to set the color to between 0 and 9 for a 2D image.

Post Processing

Use the Menu dial-button to select **Post Processing** in the **3D XI** menu. The **Post Processing** menu will appear.

Post Processing performs post processing for a multi-slice image.

■ Invert

Press the **Menu** dial-button to turn it on or off. If it is turned on, the brightness of multi-slice images is inverted.

■ Auto Contrast

Press the **Menu** dial-button to turn it on or off. If it is turned on, the brightness of multi-slice images is automatically adjusted.

■ Thres.

Press the **Menu** dial-button to turn it on or off.

This function moderates excessive brightness in an image. If it is turned on, **Th. Low** and **Th. High** appear in the Soft Menu.

▶ Th. Low: Use the Soft Menu dial-button **[3]**.

▶ Th. High: Use the Soft Menu dial-button **[4]**.

■ Sharp

Press the **Menu** dial-button to turn it on or off.

This function allows you to adjust the boundary of Multi-Slice images. If it is turned on, **Sharp** appears in the Soft Menu.

▶ Sharp: Use the Soft Menu dial-button **[5]** to set the value between 100 and 400. If it is set to a higher value, the boundary becomes clearer.

■ XI MR

Press the **Menu** dial-button to turn it on or off. XI MR is used to improve the image quality by stressing the contrast and edges of images. When it is turned on, it only affects the index image in a yellow frame.

■ Gradient Mask

Rotate the **Menu** dial-button to select **Top**, **Bottom**, **Left** or **Right**. Gradient Mask adjusts the brightness of a certain area in a multi-slice image. An area corresponding to the selected button gets brighter.

NOTE: For information on **Preset** and **Palette**, please refer to '3D View-MPR Mode.'

MSV Mode Soft Menu

■ Slice Thickness

Use the Soft Menu dial-button **[1]** to select a multi-slice cutting space between 0.5, 1.0, 2.0, 3.0, 4.0 and 5.0 mm.

NOTE: Slice Thickness represents a slice space in the volume data, and thus it does not represent the actual anatomical location.

■ Selected Slice

Use the Soft Menu dial-button **[2]** to select a slice line. The selected line can be viewed in a 2D reference image. The volume slice image for the selected slice line is indicated with an orange color band.

■ Page Change

Use the Soft Menu dial-button **[3]** to change page. This option is used when there is more than one page due to multiple indices.

■ Orientation Dot

Press the Soft Menu dial-button **[4]** to turn it on or off. If it is on, a dot is indicated in the center of the image.

Init

Press the Soft Menu dial-button **[5]** to return to the initial screen in MSV Mode.

Ruler

Press the Soft Menu dial-button **[1]** to set the location of the ruler. You can select None, Right, Left, Top, Bottom or All.

Bias

Use the **Soft Menu** dial-button **[3]** to adjust the bias of a Post Curve. Valid values are -100 to 100.

Position

Use the Soft Menu dial-button **[2]** to adjust the location of a Post Curve. Valid values are 0 to 100.

Zoom

Use the Soft Menu dial-button **[4]** to adjust a value between 25 and 400.

L/R Flip

Use the Soft Menu dial-button **[4]**. When the button is pressed, the left and right sides of an image are flipped.

U/D Flip

Use the Soft Menu dial-button **[5]**. When the button is pressed, an image is flipped upside down.

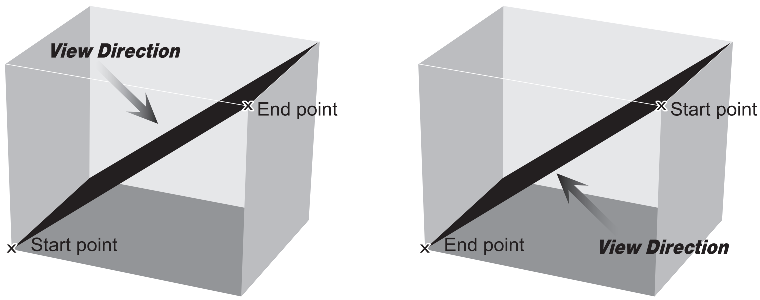
Oblique View

Press the **Oblique View** tab in the menu. Perpendicular plane images can be viewed by applying a line or contour on Coronal, Sagital and Axial images.

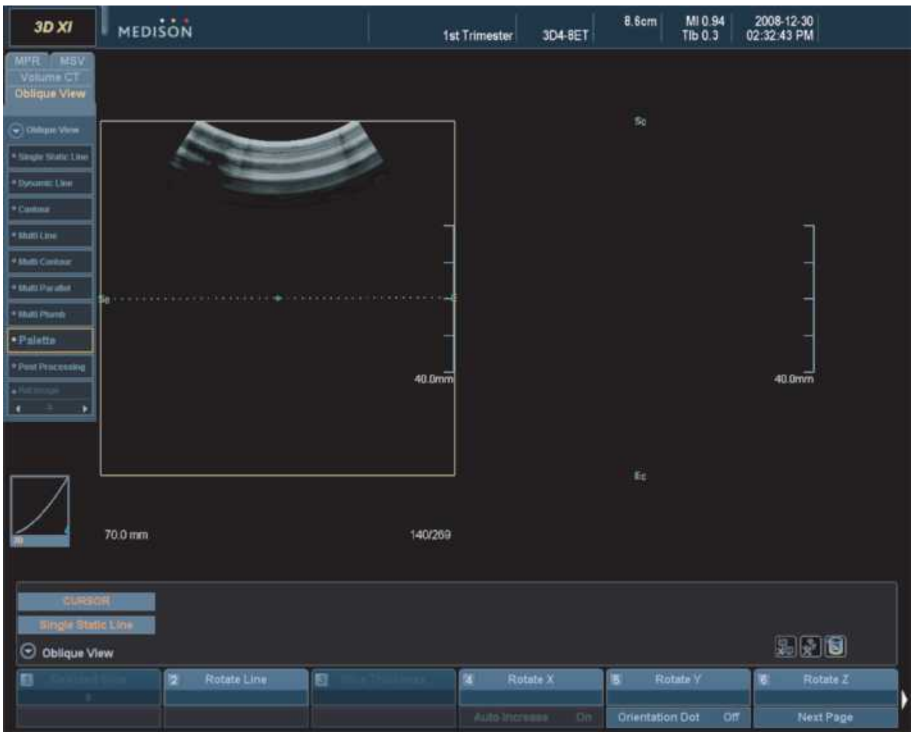
Tips!

The View Direction of Perpendicular Plane Image

The direction of view is perpendicular to a cross-sectional plane in volume data. Please refer to the following illustration:



NOTE: While measurement functions such as **Calculator** and **Caliper** are not available, **Text** and **Indicator** functions are available.



[Figure 4.23 Oblique View]

Oblique View Mode Menu

Single Static Line

This allows you to view a plane that is perpendicular to the default line in an image. Use the Soft Menu dial-button **[2]** Rotation Line dial-button on the control panel to rotate the default line.

Dynamic Line

This allows you to draw a straight line and view a plane that is perpendicular to the line.

- Use the Trackball and the **Set** button to draw a straight line. For the line drawn, the start point is marked with S and the end point is marked with E.
- Use the **Change** button on the control panel to move the line. Use the Trackball to place the line at the desired location and then press the **Set** button to set the new location.
- Use the Angle dial-button on the control panel or the Soft Menu dial-button **[2]** Rotation Line to change the angle of the line.

Contour

This allows you to contour a straight line or curve and view a plane that is perpendicular to it. The contouring, moving and modifying of a line are the same as in **Dynamic Line**.

Multi-Line

This allows you to draw a straight line and view a plane that is perpendicular to the line. The drawing, moving and modifying of a line are the same as in **Dynamic Line**.

NOTE: With **Multi-Line** and **Multi-Contour**, more than one line can be drawn only when **Auto Increase** is turned on.

Multi Contour

This allows you to contour a straight line or curve and view a plane that is perpendicular to it. The contouring, moving and modifying of a line are the same as in **Dynamic Line**.

Multi Parallel

If you draw a straight line, four lines parallel to it are applied to a reference image to display an oblique image.

▶ After pressing **Multi-Parallel**, use the Trackball and the **Set** button to draw a reference line. Parallel lines are then automatically drawn.

▶ Use the Soft Menu dial-button **[3]** Slice Thickness to adjust the spaces between parallel lines.

■ Multi Plumb

If you draw a straight line, four lines perpendicular to it are applied to a reference image to display an oblique image.

▶ After pressing **Multi-Plumb**, use the Trackball and the **Set** button to draw a reference line. Perpendicular lines are then automatically drawn.

▶ Use the Soft Menu dial-button **[3]** Slice Thickness to adjust the spaces between perpendicular lines.

NOTE:

▶ For information on **Orientation Dot**, please refer to 'MSV Mode.'

▶ For information on **Preset** and **Palette**, please refer to '3D View-MPR Mode.'

Oblique View Mode Soft Menu

■ Rotate Line

Use the Soft Menu dial-button **[2]** to adjust the location of a line. This option is not available when **Contour** or **Multi-Contour** is selected in the Oblique View Mode menu.

■ Rotate X / Y / Z

Rotates a 3D image in the selected axis direction. Use the Soft Menu dial-buttons **[4]**, **[5]** or **6** to rotate the image to the X, Y or Z axis, respectively.

■ Orientation Dot

Press the Soft Menu dial-button **[5]** to turn it on or off. If it is on, a dot is indicated in the center of the image.

■ Next Page

Press the Soft Menu dial-button **[6]** to move to the next page.

■ Position

Use the Soft Menu dial-button **[2]** to adjust the location of a Post Curve. Valid values are 0 – 100.

■ Bias

Use the Soft Menu dial-button **[3]** to adjust the bias of a Post Curve. Valid values are -100 to 100.

■ Prev Page

Press the Soft Menu dial-button **[6]** to move to the previous page.

Volume CT Mode

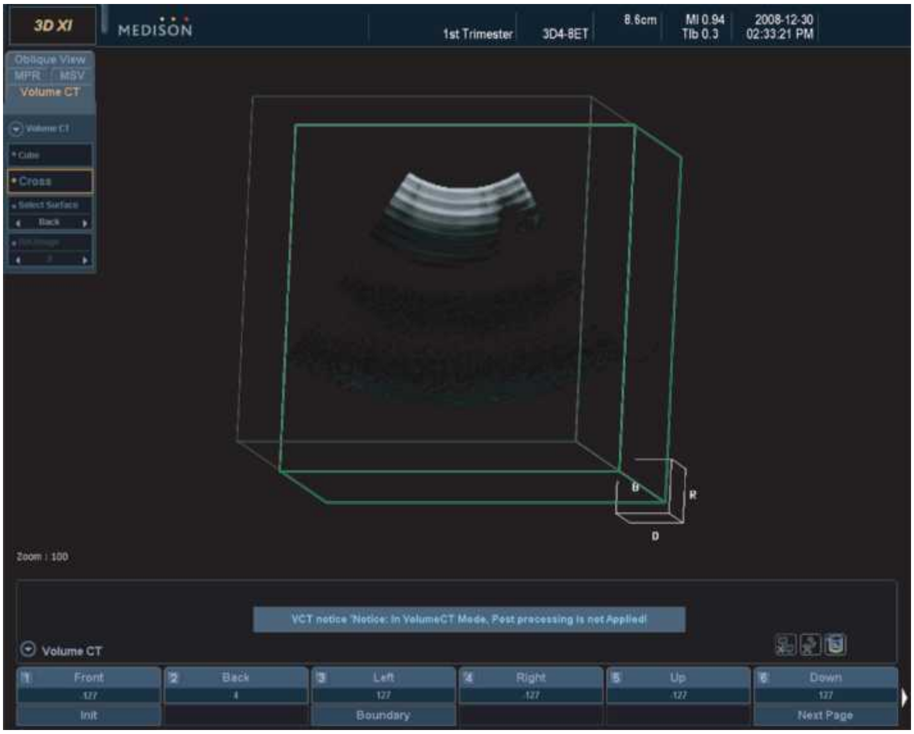
Press the **Volume CT** tab in the menu. In this mode, an image is divided into Axial, Sagital and Coronal images, which are then recombined in 3D for display. This mode provides information on surface images.

Volume CT Mode has two sub-modes: Cube Volume CT and Cross Volume CT.

NOTE: While measurement functions such as **Calculator** and **Caliper** are not available, **Text** and **Indicator** functions are available.

§ Cube Volume CT

Press the **Cube** in the Volume CT menu. This mode provides information on neighboring external surface images in a cube.



[Figure 4.24 Cube VolumeCT]

■ Select Surface

Use the **Menu** dial-button to select a reference surface to view. Available options are Front, Back, Left, Right, Up and Down. The selected surface appears in frontal view. The orientation of the current cube is shown in the lower right corner of the screen.

Use the Soft Menu dial-buttons **[1]~[6]** to change the location of the selected reference surface.

■ Init

Press the Soft Menu dial-button **[1]** to return to the initial screen in Volume CT Mode.

■ Boundary

Press the Soft Menu dial-button **[3]** to turn it on or off. This option allows you to show or hide additional boundary lines in Cube Volume CT. Additional boundary lines indicate the external area of the entire volume.

■ Zoom

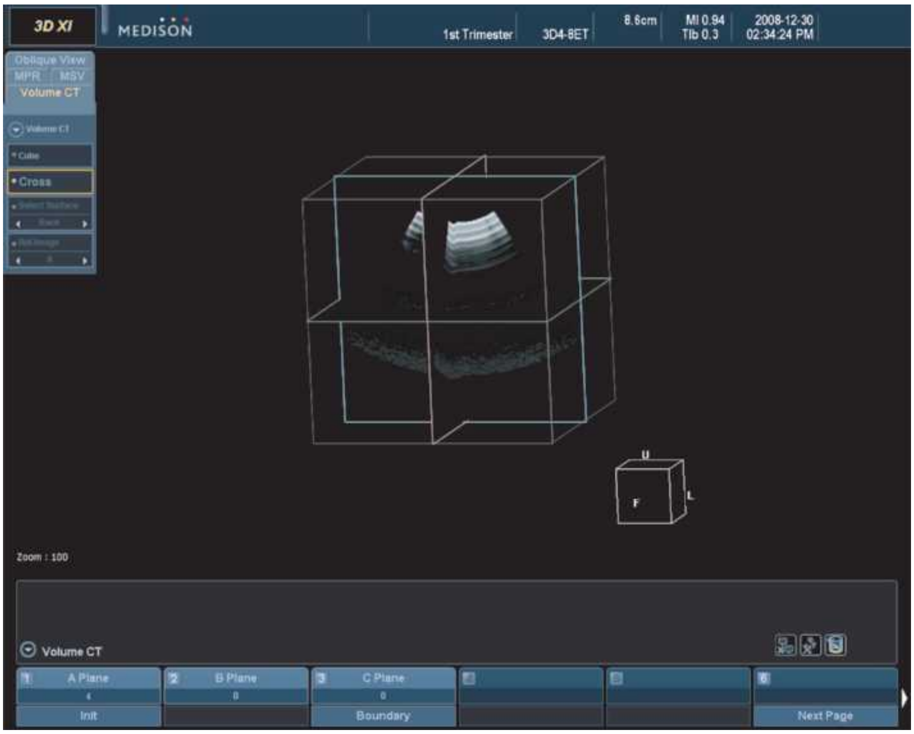
Use the Soft Menu dial-button **[1]** on the control panel to zoom an image by 25 – 400 times.

■ Rotation

Use the 4/X, 5/Y and 6/Z dial-button on the control panel to rotate a Cube Volume CT image by the X-, Y- or Z-axis.

§ Cross Volume CT

Press the **Cross** in the Volume CT menu. This mode provides information on images within the planes intersecting each other.



[Figure 4.25 Cross Volume CT]

■ A Plane

Use the Soft Menu dial-button **[1]** to set the location of the Front Surface from between -127 and 127. It will be displayed in blue frames on the screen.

■ B Plane

Use the Soft Menu dial-button **[2]** to set the location of the Upper Surface from between -127 and 127. It will be displayed in red frames on the screen.

■ C Plane

Use the Soft Menu dial-button **[3]** to set the location of the Left Surface from between -127 and 127. It will be displayed in frames on the screen.

NOTE: Other usages are the same as for Cube Volume CT.

Chapter 5

Measurements and Calculations

Chapter 5

Measurement Accuracy

Measurement values can vary, depending on the nature of the ultrasound, the body's response to ultrasound, the measurement tools, algorithms, product settings, probe type and user operation.

Before using this product, make sure to read and understand the following information regarding the causes of measurement errors, and measurement optimization.

Causes of Measurement Errors

Image Resolution

The resolution of ultrasound images may be limited by the available space.

- Errors due to a signal range may be minimized by adjusting focus settings. Optimizing focus settings increases the resolution of the measurement area.
- In general, lateral resolution is lower than axial resolution. Therefore, measurements should be performed along the axis of the ultrasound beam to obtain accurate values.
- Gain has a direct impact on resolution. Gain can be adjusted by using the **Gain** button for each mode.
- In general, increasing the frequency of ultrasound enhances resolution.

Pixel Size

- An ultrasound images in the product consist of pixels.
- Since a single pixel represents the basic unit of an image, a measurement error may result in the displacement of approximately ±1 pixel when compared to the original image size.
- However, this error becomes significant only when a narrow area in an image is measured.

Ultrasound Velocity

- The velocity of ultrasound used during measurement is usually 1,540 m/s on average.
- The velocity of ultrasound may vary depending on the cell type.
- The possible range of error is between approximately 2-5% depending on the structure of cells (about 2% for typical cells and about 5% for fatty cells).

Doppler Signal Adjustment

- During velocity measurement, an error may occur depending on the cosine angle between the blood flow and the ultrasound beam.
- For Doppler velocity measurements, the most accurate results can be ensured when the ultrasound beam is aligned in parallel with the blood flow.
- If that is not possible, the angle between them should be adjusted by using the **Angle** option.

Aliasing

- PW Spectral Doppler Mode uses a signal sampling technique to calculate the frequency (or velocity) spectrum.
- Adjust the baseline or the velocity scale to minimize aliasing. A lower frequency probe can also be used to reduce aliasing.
- Aliasing is dramatically reduced in CW Spectral Doppler Mode.

Calculation Equation

- Some of the calculation equations used for clinical purposes originate from hypotheses and approximation.
- All calculation equations are based on medical reports and articles.

Human Error

- Human error may occur due to inappropriate use or lack of experience.
- This can be minimized through compliance with and thorough understanding of the manuals.

Optimization of Measurement Accuracy

2D Mode

- Resolution is in proportion to the frequency of the probe.
- Penetration is in inverse proportion to the frequency of the probe.
- The highest resolution can be obtained at the focus of the probe where the ultrasound beam is narrowest.
- The most accurate measurements can be obtained at the focus depth. The accuracy decreases as the distance from the focus increases, widening the beam width.
- Using the zoom function or minimizing the depth display makes distance or area measurements more accurate.

M Mode

- The accuracy of time measurements can be increased when the speed and the display format are set to high values.
- The accuracy of distance measurements can be increased when the display format is set to higher values.

Doppler Mode

- It is recommended to use lower frequency ultrasound for measurement of faster blood flows.
- The size of the sample volume is limited by the axial direction of the ultrasound.
- Using lower frequency ultrasound increases penetration.
- The accuracy of time measurements can be increased when the speed is increased.
- The accuracy of velocity measurements can be increased when the vertical scale is set to smaller values.
- It is most important to use an optimal Doppler angle to enhance the accuracy of velocity measurements.

Color/Power Doppler Mode

- A protocol is not specified for images in Color Doppler Mode or Power Doppler Mode. Therefore, the same limitations imposed when measurements are taken in B/W images apply to the accuracy of the measurements taken in these modes.
- It is not recommended to use images in Color/Power Doppler Mode for measurement of accurate blood flow velocity.
- The amount of blood flow is calculated based on the average velocity rather than the peak velocity.
- In all applications, the amount of blood flow is measured in PW/CW Spectral Doppler Mode.

Cursor Position

- All measurements are affected by input data.
- To ensure accurate positioning of the cursor:
- Adjust the images on the screen so that they are displayed at maximum granularity.
- Use the front edge or boundary point of a probe to make the start and end points of a measurement object more distinct.
- Make sure that the probe direction is always aligned during measurement.

Measurement Accuracy Table

The following tables show the accuracy of the measurements available using the product. Ensure that the results of measurement accuracy checks are kept within the ranges specified in the table. Except for certain applications or probes, the following accuracy ranges should be maintained for measurement of a straight distance.

NOTE: To ensure accurate measurements, an accuracy check should be performed at least once per year. If the measurement accuracy falls outside the ranges specified in the following table, contact Samsung Medison Customer Service.

2D Mode

Measurements	System Tolerance (Whichever is greater)	Test Methodology	Accuracy [1] Based on	Range [2]
Axial Distance	< +/- 4% or 1mm	Phantom	Acquisition	Full Screen
Lateral Distance	< +/- 4% or 2mm	Phantom	Acquisition	Full Screen

(1) The accuracy of the measurements differs from the table above, depending on the user's skills.

(2) The distance is indicated as 'cm' up to two decimal points.

M Mode

Measurements	System Tolerance (whichever is greater)	Test Methodology	Accuracy [1] Based on	Range [2]
Depth	<+/- 5% or 3 mm	Phantom	Phantom	1 - 25 cm
Time	< +/- 5%.	Signal generator	Phantom	.01 - 11.3 sec

(1) The accuracy of the measurements differs from the table above, depending on the user's skills.

(2) The distance is indicated as 'cm' up to two decimal points. The speed is indicated as 'cm/s' up to two decimal points.

PW/CW Spectral Doppler Mode

Doppler Measurement	System Tolerance (whichever is greater)	Methodology	Range [2]
Velocity	< ± 15%	Phantom	PW:0.1cm/s - 8.8 m/s CW:.1cm/s - 19.3 m/s
Time:	< +/- 5%.	Signal generator	.01 - 11.3 sec

(1) The accuracy of the measurements differs from the table above, depending on the user's skills.

(2) The distance is indicated as 'cm' up to two decimal points. The speed is indicated as 'cm/s' up to two decimal points.

Basic Measurements

Press the **Caliper** button on the control panel.

NOTE: Take basic measurements of distance and area regardless of the application. For information on measurements for each application, please refer to "Measurements by Application" in this chapter.

The available measurement methods vary depending on the current diagnosis mode. Please refer to the following table:

Measurement	Diagnosis Mode	Measurement Method
Distance Measurement	2D, M, D	Distance Line Trace Angle %StD
	M	M Distance
	D	D Velocity D A/B D Trace D time
Circumference and Area Measurement	2D, M, D	Ellipse Trace %StA
Volume Measurement	2D, M, D	3 Distance 1 Distance Distance + Ellipse Ellipse MOD

[Table 5.1 Basic Measurements by Diagnosis Mode]

Basic Measurement Operations

The following is the information on common button operations for basic measurements:

Select/Change Measurement Method

Use the Soft Menu dial-button on the control panel. The Soft Menu items displayed vary depending on the diagnosis mode. The selected measurement method is displayed in the user information area.

Set Display Location of Measurement Results

Use the Soft Menu dial-button **[4]** Result Action.

- **Move**: Change the display location of measurement results. Use the Trackball to change the location and then press the **Set** button.
- **Reset**: Press the Soft Menu dial-button to initialize the display location of measurement results.

NOTE: When measurement results are displayed in more than one screen because there are too many of them, use **Move** to find the desired measurement results.

Cancel Measurement Results

Press the Soft Menu dial-button **[5]** Undo to cancel the current measurement and take it again.

NOTE: Among volume measurement items, only **3 Distance** and **Distance+Ellipse** can be undone.

Delete Measurement Result

Press the **Clear** button on the control panel.

Print Measurement Result

Press the **Print** button on the control panel.

Finish Basic Measurements

Press the **Exit** button on the control panel.

NOTE: To change various settings such as measurement units, press **[F5]** Utility and select **Measure Setup** > **General**. For more information, please refer to "Chapter 7. Utility."

Distance Measurement

Distance

This is a basic measurement that is available in all diagnosis modes. You can specify two points in a 2D image and measure the straight distance between them.

1. Select **Distance** in the Soft Menu **[1]**. Distance will appear in the user information area.
2. Use the Trackball and the **Set** button on the control panel to specify both end points of the measurement area.
   ▶ Use the Trackball to place the cursor at the desired position and press the **Set** button.

Tips!

Repositioning Point

Pressing the **Change** button before pressing the **Set** button to complete positioning resets the position of a point just set.

3. Specify both end points and then the distance between them will be measured.
4. Once measurement is done, the result is displayed on the screen.

Line Trace

It is a basic measurement that is available in all diagnosis modes. You can specify a point in a 2D image and trace a curve from that point to measure the distance between them.

1. Select **Line Trace** in the Soft Menu **[1]**. Line Trace will appear in the user information area.
2. Use the Trackball and the **Set** button on the control panel to specify the start point of the measurement area.
   ▶ Use the Trackball to place the cursor at the desired position and press the **Set** button.
3. Use the Trackball to draw the desired curve and then press the **Set** button to set the end point.

Tips!

Editing Curve

Before pressing the **Set** button to specify the end point, you can rotate the Soft Menu dial-button **[5]** Delete to delete a part of the curve being traced.

4. Specify both end points and then the length of the curve will be automatically measured.

Angle

A basic measurement that is available in all diagnosis modes. Specify two straight lines in a 2D image and measure the angle between them.

1. Select **Angle** in the Soft Menu **[1]**. Angle will appear in the user information area.
2. Draw two straight lines. For information on drawing a straight line, please refer to 'Distance.'
3. The angle between two lines will be calculated and displayed on the screen.

   ▶ When two angles are calculated, the smaller angle is displayed.

%StD

StD stands for Stenosis Distance, which is a basic measurement available in all diagnosis modes. In a 2D image, the diameter of a vessel is measured and the stenosis ratio calculated.

1. Select **%StD** in the Soft Menu **[1]**. %StD will appear in the user information area.
2. Measure the total diameter of a vessel using the Distance measurement method.
3. When a new cursor appears, measure the inner wall diameter of the vessel under stenosis.
4. Calculate %StD with the following equation:

   ▶ **%StD = (Outer Distance – Inner Distance) / Outer Distance × 100**

M Distance

This is a basic measurement that is available in M Mode only. You can specify two points in an M image and measure the distance, elapsed time and velocity between them.

1. Select **M Distance** in the Soft Menu **[1]**. M Distance will appear in the user information area.
2. Specify two points and then measure the shortest distance between them. The way that it is measured is the same as in 'Distance.'
3. Once measurement is done, the result is displayed on the screen.

D Velocity

This is a basic measurement that is available in Spectral Doppler Mode only. You can specify two points in a Spectral Doppler image and measure the distance between them, and the velocity at each point to calculate the velocity change, time change and acceleration.

NOTE: In a Spectral Doppler image, the X- and Y-axes represent time and velocity, respectively.

1. Select D Velocity in the Soft Menu **[1]**. D Velocity will appear in the user information area.
2. Specify two points and then measure the shortest distance between them. The way that it is measured is the same as in 'Distance.'
3. Once measurement is done, the result is displayed on the screen.

- V1 : Velocity at Point 1
- V2 : Velocity at Point 2
- PGmax : Max Pressure Gradient
- V2-V1 : Change in Velocity
- Time : Change in Time
- Acc : Acceleration
- RI : Resistivity Index
- S/D : Systolic to Diastolic Ratio

The equations used for D Velocity measurement are as follows:

- $RI = \frac{V_1 - V_2}{V_1}$
- $dV = V_2 - V_1$
- $Acceleration = \frac{(V_2 - V_1)}{(T_2 - T_1)} = \frac{dV}{dT}$

NOTE: If Application is set to Cardiac at **Utility** > **Measure Setup** > **General** > **Caliper**, the results including Vmax, PGmax, V2-V1, Time, and Acc will be shown on the screen.

D A/B

This is a basic measurement that is available in Spectral Doppler Mode only. You can specify two points in a Spectral Doppler image and measure the velocity at each point to calculate the ratio of the velocity between them.

1. Select **D A/B** in the Soft Menu **[1]**. D A/B will appear in the user information area.
2. Specify two points for which to measure velocity.
   - ▶ Use the Trackball to place the cursor at the desired position and press the **Set** button.
3. Once measurement is done, the result is displayed on the screen.
   - ▶ V1 : Velocity at Point 1
   - ▶ V2 : Velocity at Point 2
   - ▶ PGmax : Max Pressure Gradient
   - ▶ V1/V2 : The Ratio of Velocity

NOTE: If Application is set to Cardiac at **Utility** > **Measure Setup** > **General** > **Caliper**, the results including Vmax, PGmax, V2-V1 will be shown on the screen.

D Trace

This is a basic measurement that is available in Spectral Doppler Mode only. You can specify a point in a Spectral Doppler image and trace a curve from that point to calculate the velocity, integral value and average velocity of blood flow.

1. Select the Soft Menu dial-button **[1]** D Trace. "D Trace" is displayed in the user information area.
2. Trace a curve. The method for measuring a curve is the same as in "2D Line Trace."
3. When the measurement is finished, its result is shown on the screen.
   - ▶ PSV: Peak Systolic Velocity
   - ▶ EDV: End Diastolic Velocity
   - ▶ PI: Pulsatility Index
   - ▶ RI: Resistivity Index
   - ▶ S/D: Ratio of PSV to EDV
   - ▶ Vmax: Max Velocity
   - ▶ Vmean: Mean Velocity
   - ▶ PGmax: Max Pressure Gradient
   - ▶ PGmean: Mean Pressure Gradient
   - ▶ VTI: Velocity Time Integral
   - ▶ PHT: Pressure Half Time
   - ▶ Acc: Acceleration
   - ▶ AccT: Acceleration Time
   - ▶ Dec: Deceleration
   - ▶ DecT: Deceleration Time

The equations used for D Trace measurement are as follows:

▶ $$V\ mean = \frac{VTI}{Duration\ of\ \ flow}$$

▶ $$RI = \frac{PSV - EDV}{PSV}$$

▶ $$PI = \frac{PSV - EDV}{Vmean}$$

▶ $$S / D = \frac{PSV}{EDV}$$

NOTE: If Application is set to Cardiac at **Utility** > **Measure Setup** > **General** > **Caliper**, the results including Vmax, PGmax, PGmean, VTI, PHT, Acc, AccT, Dec and DecT will be shown on the screen.

Circumference and Area Measurement

Ellipse

This is a basic measurement that is available in all diagnosis modes. You can measure the circumference and area of a circular (elliptical) object in a 2D image.

1. Select the Soft Menu **[2]** Ellipse. "Ellipse" is displayed in the user information area.
2. Use the Trackball and the **Set** button on the control panel to specify the diameter (axis) of the measurement area.
   - ▶ Place the cursor at a desired position with the Trackball, and press the **Set** button.

Tips!

Repositioning Point

Pressing the **Change** button before pressing the **Set** button to complete positioning resets the position of a point just set.

3. Specify the size of the circle (ellipse).
   - ▶ Adjust the size using the Trackball, and press the **Set** button.
4. When the measurement is finished, its result is shown on the screen.

The equations used for ellipse measurement are as follows:

$$Circ = 2\pi \cdot \sqrt{\frac{1}{2} \cdot \left\{ \left(\frac{A}{2}\right)^2 + \left(\frac{B}{2}\right)^2 \right\}}$$, (A: Long axis, B: Short axis)

Area = $\pi \times a \times b$, (a, b: Axis)

Trace

This is a basic measurement that is available in all diagnosis modes. You can measure the circumference and area of an irregular object in a 2D image.

1. Select the Soft Menu **[2]** Trace. "Trace" is displayed in the user information area.
2. Use the Trackball and the **Set** button on the control panel to specify the start point for tracing over the contour of the measurement area.

   ▶ Place the cursor at a desired position with the Trackball, and press the **Set** button.

3. Trace the curve so that the measurement cursor returns to the start point, and then press the **Set** button.

> **NOTE:** Trace lines must be closed. If you press the **Set** button before tracing is complete, tracing may be done over a straight line between the current point and the start point, resulting in a significant error.

4. When the measurement is finished, its result is shown on the screen.

The equations used for Trace measurement are as follows:

$$Circ = sum \sqrt{\{X(n) - X(n-1)\}^2 + \{Y(n) - Y(n-1)\}^2}\ ,\ \text{(N = 1,2… last point)}$$

$$Area = sum \left[\sqrt{X(n-1) \times Y(n) - X(n) \times Y(n-1)}\right]\ ,\ \text{(N = 1,2… last point)}$$

%StA

StA stands for Stenosis Area, which is a basic measurement available in all diagnosis modes. In a 2D image, the area of a vessel is measured and the stenosis ratio (%) calculated.

1. Select **%StA** in the Soft Menu **[2]**. %StA will appear in the user information area.
2. Measure the area of the vessel outer wall using the Area measurement method.
3. When a new cursor appears, measure the inner wall area of the vessel under stenosis.
4. Calculate %StA with the following equation:

   %StA = (Outer Area – Inner Area) / Outer Area × 100

Volume Measurement

NOTE: Since Dual Mode simultaneously displays two images on the screen, you don't have to return to the diagnosis mode to measure volume in Dual Mode.

3 Distance

This is a basic measurement that is available in all diagnosis modes. You can measure the volume of an object in a 2D image by using 3 straight lines.

1. Select the Soft Menu **[3]** 3 Distance. "3 Distance" is displayed in the user information area.
2. Specify two points and measure the straight distance between them. The method for measuring a line is the same as in "Distance."
3. Measure the length of the remaining two straight lines as in the above. Measure other two distance using the same method with 2.
4. When the measurement is finished, its result is shown on the screen. The volume of the object along with the length of each straight line are calculated.

The equations used for 3 Distance measurement are as follows:

$$Vol = \frac{4}{3}\pi \cdot \frac{D_1}{2} \cdot \frac{D_2}{2} \cdot \frac{D_3}{2}$$, (D: distance)

1 Distance

This is a basic measurement that is available in all diagnosis modes. You can measure the volume of an object in a 2D image by using only one straight line.

1. Select the Soft Menu **[3]** 1 Distance. "1 Distance" is displayed in the user information area.
2. Specify two points and measure the straight distance between them. The method for measuring a line is the same as in "Distance."
3. When the measurement is finished, its result is shown on the screen. The volume of the object along with the length of the straight line are calculated.

The equations used for 1 Distance measurement are as follows:

$$Vol = \frac{4}{3}\pi \cdot \left(\frac{D}{2}\right)^3$$, (D: distance)

Distance + Ellipse

This is a basic measurement that is available in all diagnosis modes. You can measure the volume of an object in a 2D image by using one straight line and one circle (ellipse).

1. Select the Soft Menu **[3]** Distance + Ellipse. "Distance + Ellipse" is displayed in the user information area.
2. Specify two points and measure the straight distance between them. The method for measuring a line is the same as in "Distance."
3. Specify the size of the circle (ellipse). The method for measuring a circle (ellipse) is the same as in "Ellipse."
4. When the measurement is finished, its result is shown on the screen.
   - ▶ D: The length of a straight line
   - ▶ Long: The length of the long axis in an ellipse
   - ▶ Short: The length of the short axis in an ellipse
   - ▶ Area: The area of a circle
   - ▶ Vol.: Volume

The equations used for Distance + Ellipse measurement are as follows:

$$Vol = \frac{\pi}{6} \times a \times b \times d$$, (a : Short axis, b : Long axis , d : Distance)

Ellipse

A basic measurement that is available in all diagnosis modes. In a 2D image, the volume of a conical object is measured using an ellipse.

1. Select **Ellipse** in the Soft Menu **[3]**. Ellipse will appear in the user information area.
2. Set the size of the ellipse. The way it is measured is the same as in 'Ellipse.'
3. Once measurement is done, the result is displayed on the screen.

The following equation is used for 'Ellipse' measurement:

$$Vol. = \frac{4}{3}\pi \cdot \frac{Long}{2} \cdot \frac{Short}{2} \cdot \frac{Short}{2}$$

MOD

A basic measurement that is available in all diagnosis modes. In a 2D image, the area of an irregular object and the length of its long axis are obtained to calculate its volume. MOD is an abbreviation for 'Method of Disk.'

1. Select **MOD** in the Soft Menu **[3]**. MOD will appear in the user information area.
2. Draw a contour to measure. The way it is measured is the same as in 'Trace.'
3. Measure the length of the long axis. The way it is measured is the same as in 'Distance.'
4. Once measurement is done, the result is displayed on the screen.

Calculations by Application

Press the **Calc** button on the control panel.

Things to note

Before Taking Measurements

Register Patient

Make sure t hat the currently registered patient information is correct. If the patient is not registered, press the **Patient** button on the control panel.

Check Probe, Application & Preset

- Check the probe name and application that are displayed in the title bar. Press the **Probe** button on the control panel to use another probe or application.
- Check the preset settings in the *Probe Selection* screen.

Measurement Operations

The following gives information on the common button operations for measurements:

Change/Select Application

Use the **Calculator** button on the control panel. Each time the **Calculator** button is pressed, the application toggles in the order determined under Measure Setup. The order in which applications appear can be specified at **Utility** > **Measure Setup** > **General** > **Packages**.

Select Measurement Item

After moving the cursor by using the Trackball or the **Menu** dial-button on the control panel, press the **Set** button or the **Menu** dial-button.

Change Measurement Method

Press the **Change** button on the control panel. If the current measurement item can be measured in more than one way, the measurement method is changed. The current measurement method is displayed in the user information area. Once measurement is started, it cannot be changed.

Measurement Result Display Settings

Use the Soft Menu dial-button on the control panel to set the location and to adjust the font size.

Delete Measurement Result

Press the **Clear** button on the control panel.

> **NOTE:** The measurement results are deleted from the screen but still shown on the report for the corresponding application.

Print Measurement Result

Press the **Print** button on the control panel.

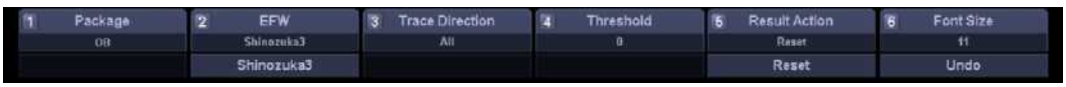
Exit Measurement

Press the **Exit** button on the control panel.

End Diagnosis

Press the **End Exam** button on the control panel. The diagnosis for the current patient ends and all measurement results are saved.

Measurement



[Figure 5.1 The Soft Menu for Measurement Results Display]

Package

Rotate the **Soft Menu dial-button [1]** to set the package.

HR Cycle

Enabled when a heart rate is measured in M/D Mode. Rotate the **Soft Menu dial-button [4]** to set the Heart Rate Cycle and select a value between 1 and 20.

EFW

Enabled when obstetrics measurement menu is taken. you may use the dial-button **[2]** to change the EFW Reference.

Trace Direction

Enabled after Auto or Limited Trace is performed in Spectral Doppler Mode. Rotate the Soft Menu dial-button **[3]** and select a direction to trace from **Up**, **Down** and **All**.

- **Up**: Traces only the positive part on the Doppler spectrum.
- **Down**: Traces only the negative part on the Doppler spectrum.
- **All**: Traces the whole Doppler spectrum.

Threshold

Rotate the Soft Menu dial-button **[4]** to set the threshold. Enabled after Auto or Limited Trace is performed in Spectral Doppler Mode. Adjusting the threshold value helps the contouring of a Doppler spectrum.

Result Action

Rotate the Soft Menu dial-button **[5]** to set the position for the measurement results.

- **Move**: Change the position where the measurement results are displayed. After changing the position, press the **Set** button.

> **NOTE:** When there are too many measurement data and they cannot all be displayed on the screen at one time, the **Move** button can be used to navigate through the measurement data.

- **Reset**: Press the Soft Menu dial-button to initialise the position where the measurement results are displayed.

Delete

Enabled when a trace is measured. Rotate the Soft Menu dial-button **[3]** to delete the part of the curve which is being traced.

Font Size

Use the Soft Menu dial-button **[6]** to set the font size for the measurement results between 10 and 30.

Undo

Press the Soft Menu dial-button **[6]** to cancel the last measurement.

Common Measurement Methods

This section provides information on the common measurement methods used for applications.

Measurements in Spectral Doppler Mode

In general, if you trace a Doppler spectrum, you can obtain results for various measurement items automatically. There are 3 ways to trace a Doppler spectrum.

SONOACE R7 also allows you to select a specific item under the Measurement menu and take measurements individually without tracing a Doppler spectrum.

Auto Trace

A spectrum is traced automatically. It is enabled in the Measurement menu in Spectral Doppler Mode.

1. Press Auto Trace in the Measurement menu.
2. The system traces a spectrum automatically.
3. When Trace is complete, the measurement results are displayed on the screen.

Tips!

Things to consider for Doppler Spectrum Auto Trace

The state of a Doppler spectrum may affect measurement results. Please see the following:

▶ **Causes for Trace Failure**

- If Gain is changed for a Doppler image in the Freeze state, Contour Trace and Peak Trace will not work.
- If there is little or no noise in an image without a spectrum, Contour Trace will not work.
- If there is severe noise in an image, Contour Trace will not work.
- If the Clutter filter is set too high, Auto Trace or Limited Trace may not work.

▶ **Causes for Inaccurate Peak Trace**

- If PRF (Pulse Repetition Frequency) is lower than the velocity of the observation area, aliasing may occur. If the original signals are separated from aliasing, Trace can be done but the peak measurement may not be accurate.
- If the peak of a spectral waveform is not clear or occurs intermittently, Trace can be done but the peak measurement may not be accurate.
- If the Doppler Gain is set to high or low, it becomes difficult to distinguish spectrums. This may result in measurement error(s).
- If the Wall Filter is set too high, only part of the spectrum is displayed. In this case, Trace can be done but Peak measurement may not be accurate.
- If abnormal noise or artifact occurs, Trace can be done but Peak measurement may not be accurate.

▶ **Misc.**

Limited Trace is supported only for two-peak spectrums such as Mitral Valve Inflow and Tricuspid Valve Inflow in the cardiology application.

■ Limited Trace

If you specify a measurement range, a spectrum is traced automatically. It is enabled in the menu in Spectral Doppler Mode.

1. Press **Limited Trace** in the Measurement menu. A bar appears allowing you to specify a measurement area.
2. Specify the measurement range.
   ▶ Place the bar at a desired position with the Trackball, and press the **Set** button.
3. The system traces spectrums within the specified range automatically.
4. When Trace is complete, the measurement results are displayed on the screen.

■ Manual Trace

A spectrum is traced manually. It is enabled in the menu in Spectral Doppler Mode.

1. Press **Manual Trace** in the Measurement menu. A measurement cursor appears over a spectrum.
2. Trace the spectrum. The measuring method is the same as in "D Trace."
3. When Trace is complete, the measurement results are displayed on the screen.

■ Itemized Measurement

In the Measurement menu, select an individual item and take a measurement.

1. Press the **Calculator** button on the control panel after obtaining a desired image.
2. Select a desired item in the Measurement menu. The "+" cursor appears over a spectral waveform.
3. Position the "+" cursor and press the **Set** button.
4. The measurement results for the selected item are displayed on the screen.

Measurement items for Doppler Spectrum are as follows:

Item	Type	Unit	Equation
PSV (Peak Systolic Velocity)	Velocity	cm/s or m/s	
EDV (End Diastolic Velocity)	Velocity	cm/s or m/s	
TAMV (Time Average Mean Velocity)	Velocity	cm/s or m/s	
TAPV (Time Average Peak Velocity)	Velocity	cm/s or m/s	
PGmean (Mean Pressure Gradient)	Calculation	mmHg	
PGmax (Max Pressure Gradient)	Calculation	mmHg	4 × PSV 2
S/D (Ratio of PSV to EDV)	Calculation	Ratio	(PSV / EDV)
D/S (Ratio of EDV to PSV)	Calculation	Ratio	EDV /PSV
RI (Resistivity Index)	Calculation	Ratio	(PSV – EDV) / PSV
PI (Pulsatility Index)	Calculation	Ratio	(PSV – EDV) / Vmean

Tips!

Taking measurements via Auto Calc

You can use Auto Calc to take measurements on predetermined item(s).

Items measured are as follows. For information on setting measurement item(s), please refer to "Auto Calc" in "Chapter 7. Utility.'

- Peak Systolic Velocity (PSV)
- End Diastolic Velocity (EDV)
- Time Averaged Peak Velocity (TAPV)
- Resistive Index (RI)
- Pulsatility Index (PI)
- Systole / Diastole Ratio (S/D)
- Time Averaged Mean Velocity (TAMV)
- Diastole / Systole Ratio (D/S)
- Max Pressure Gradient (PGmax)
- Mean Pressure Gradient (PGmean)
- Velocity Time Integral (VTI)
- PeakA

Volume Flow Measurement

Select **Volume Flow** in the Measurement menu.

Volume Flow allows you to measure and calculate an area or distance. For information on distance or area measurements, please refer to "Basic Measurements." The TAMV (Time Avg. Mean Velocity) value is automatically measured.

Vesl. Area (Vessel Area)

Measure the area of a blood vessel and calculate TAMV and Volume Flow.

$$VolumeFlow(A) = Area \times TAMV \times 60$$

Vesl. Dist. (Vessel Distance)

Measure the width of a blood vessel and calculate TAMV and Volume Flow.

$$VolumeFlow(D) = \frac{\pi \times d^2}{4} \times TAMV \times 60$$

Stenosis Measurement

You can measure the stenosis of each blood vessel system by measuring and calculating an area or distance.

% StA

Measure the area of the inner and outer walls of a blood vessel. StA stands for Stenosis Area.

1. Select the **%StA** menu and the first cursor will appear in 2D Mode.
2. Measure the area of the vessel's outer wall using the Circ/Area measurement method.
3. When the second cursor appears, measure the area of the vessel's inner wall under stenosis.
   %Stenosis Area. = (Outer Area – Inner Area) / Outer Area × 100

% StD

Measure the diameter of a blood vessel. StD stands for Stenosis Distance.

1. Select the **%StD** menu and the first cursor will appear in 2D Mode.
2. Measure the total diameter of a blood vessel using the Distance measurement method.
3. When the second cursor appears, measure the diameter of the vessel's inner wall under stenosis.
   %Stenosis Dist. = (Outer Distance – Inner Distance) / Outer Distance × 100

Heart Rate Measurement

HR (Heart Rate)

You can calculate heart rates for a certain period of time.

1. Select **HR** in the Measurement menu. A bar appears allowing you to specify a measurement area.
2. Specify the measurement range.
   - ▶ Place the bar at a desired position with the Trackball, and press the **Set** button.
3. The system measures the heart rate within the specified range automatically. The measurement results are displayed on the screen.

OB Calculation

Before Taking OB Measurements

OB Basic Information

Enter the information required for OB diagnosis in the *Patient Information* window. The basic OB information includes LMP (Last Menstrual Period) and Gestations.

Once LMP is entered, EDD (Estimated Delivery Date) and GA (Gestational Age) are calculated automatically. LMP is required for the calculation of values such as EDD and SD in obstetrics measurement.

▶ EDD(LMP) = LMP + 280 days

▶ GA(LMP) = Current System Date - LMP

Regardless of LMP, enter the EDD with a physician's opinion into Estab. Due Date. If LMP is not available, when Estab. Due Date is modified, LMP is automatically calculated and the "C" mark is displayed next to the LMP information.

A maximum of four fetuses can be entered in the **Gestations** menu. The default value is '1'. In the case of twins, enter '2'.

For further information about patient information menus and how to input patient information, refer to "Entering Patient Data" in "Chapter 7. Utility.

OB Measurement Menu Settings

Set up the GA Equation, GA Table and OB measurement menus that are used in obstetrics measurements. The user can manually write, back up or restore GA Tables. For more information on the GA Equation and Table, refer to the Reference Manual.

Refer to the "Setting Measurements" section in "Chapter 7. Utility" for additional information.

NOTE:

▶ It will be convenient to set the function of the **User Key 1** buttons on the control panel to the two obstetrics measurement items you want to use. Set their functions in **Utility** > **Setup** > **Peripherals** > **User Key Setup**.

▶ For twins, distinguish fetuses by specifying them as Fetus A and Fetus B in the Measurement menu. Press the **Change** button on the control panel to change a fetus to measure.

Measurement Menu

When the measurements for the selected items are complete, the measurements and gestational age are displayed on the screen. The measurement method for each item is the same as for basic measurement.

Measured items are automatically recorded in a report.

[Figure 5.2 OB Measurement Menu]

Measurement Menu	Items	Mode	Methods	Unit
Fetal Biometry	GS	All	Distance	cm, mm
	MSD	All	Automatic calculation	cm, mm
	D1	All	Distance	cm, mm
	D2	All	Distance	cm, mm
	D3	All	Distance	cm, mm
	CRL	All	Distance	cm, mm
	YS	All	Distance	cm, mm

Measurement Menu	Items	Mode	Methods	Unit
Fetal Biometry	BPD, HC	All	Distance	cm, mm
	BPD	All	Distance	cm, mm
	OFD	All	Distance	cm, mm
	HC	All	Circumference or automatic calculation	cm, mm
	APD	All	Distance	cm, mm
	TAD	All	Distance	cm, mm
	AC	All	Circumference or automatic calculation	cm, mm
	FTA	All	Area or automatic calculation	cm^2, mm^2
	FL	All	Distance	cm, mm
	SL	All	Distance	cm, mm
	APTD, TTD	All	Distance	cm, mm
	APTD	All	Distance	cm, mm
	TTD	All	Distance	cm, mm
	ThC	All	Circumference or automatic calculation	cm, mm
Fetal Long Bones	HUM	All	Distance	cm, mm
	ULNA	All	Distance	cm, mm
	TIB	All	Distance	cm, mm
	RAD	All	Distance	cm, mm
	FIB	All	Distance	cm, mm
	CLAV	All	Distance	cm, mm
	Vertebral	All	Distance	cm, mm

Measurement Menu	Items	Mode	Methods	Unit
Fetal Cranium	CEREB	All	Distance	cm, mm
	CM	All	Distance	cm, mm
	NF	All	Distance	cm, mm
	NT	All	Distance	cm, mm
	OOD	All	Distance	cm, mm
	IOD	All	Distance	cm, mm
	NB	All	Distance	cm, mm
	Rt.Va	All	Distance	cm, mm
	Lt.Va	All	Distance	cm, mm
	Rt.Vp	All	Distance	cm, mm
	Lt.Vp	All	Distance	cm, mm
	Rt.Hem	All	Distance	cm, mm
	Lt.Hem	All	Distance	cm, mm
Fetal Others	Foot	All	Distance	cm, mm
	Ear	All	Distance	cm, mm
	MP	All	Distance	cm, mm
	Lt/Rt. Renal L	All	Distance	cm, mm
	Lt/Rt.Renal AP	All	Distance	cm, mm
	Pelvis	All	Distance	cm, mm
AFI	All	All	Distance	cm, mm
	Q1	All	Distance	cm, mm
	Q2	All	Distance	cm, mm
	Q3	All	Distance	cm, mm
	Q4	All	Distance	cm, mm
	MVP	All	Circumference	cm, mm
Cervix	Cervix Length	All	Distance	cm, mm

Measurement Menu	Items	Mode	Methods	Unit
CTAR	All (D)	All	Calculated after distance measurement	%
	ThD ap	All	Distance	cm, mm
	ThD trans	All	Distance	cm, mm
	HrtD ap	All	Distance	cm, mm
	HrtD trans	All	Distance	cm, mm
	All (A)	All	Calculated after area measurement	%
	ThA	All	Area	cm^2, mm^2
	HrtA	All	Area	cm^2, mm^2
PLI	All	PW	Calculated after velocity measurement	
	Sys Flow	PW	Velocity	cm/s, m/s
	A. Rev Flow	PW	Velocity	cm/s, m/s
	Dias Flow	PW	Velocity	cm/s, m/s
Umbillical A	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm

Measurement Menu	Items	Mode	Methods	Unit
Mid Cereb A	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
Rt. / Lt. Uterine Artery	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm

Measurement Menu	Items	Mode	Methods	Unit
Placenta A	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum Trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
Rt. / Lt. Fetal Carotids	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum Trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm

Measurement Menu	Items	Mode	Methods	Unit
Fetal Aorta	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum Trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
Ductus Venosus	Duct V All	PW	Velocity	cm/s, m/s
	Duct V S Vmax	PW	Velocity	cm/s, m/s
	Duct V D Vmax	PW	Velocity	cm/s, m/s
	Duct V A Vmax	PW	Velocity	cm/s, m/s
	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum Trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm

Measurement Menu	Items	Mode	Methods	Unit
Renal Artery	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum Trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after Distance measurement	%
Volume Flow	Volume Flow(Auto)	PW	Automatic calculation	ml/m
	Volume Flow(D)	PW	Automatic calculation	ml/m
	TAMV(M)	PW	Doppler spectrum Trace	cm/s or m/s
	TAMV	PW	Doppler spectrum trace	cm/s or m/s
	Vesl. Dist.	All	Distance	cm, mm
	Vesl. Area.	All	Area	cm^2, mm^2
Fetal HR	Fetal HR	PW	Heart Rate	bpm
Rt. / Lt. Ovary	All	All	Calculated after Distance measurement	ml
	Length	All	Distance	cm, mm
	Height	All	Distance	cm, mm
	Width	All	Distance	cm, mm

Measurement Menu	Items	Mode	Methods	Unit
Rt. / Lt. Ovarian A	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum Trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	Vesl. Dist.	All	Distance	cm, mm
	Vesl. Area.	All	Area	cm^2, mm^2
Fetal HR	Fetal HR	PW	Heart Rate	bpm

NOTE:
- PLI, Renal Artery, and Fetal HR can only be measured in Doppler Mode.
- For information on basic measurements, please refer to "Basic Measurements" in this chapter.
- For references on measurement items, please refer to "Reference Manual – Part 1."

Automatic Calculation

Some items in the measurement menu are automatically calculated based on measurements of other items.

HC

This is automatically calculated using the following formula, provided there are measured BPD and OFD values.

$$HC = \pi \times \sqrt{(BPD^2 + OFD^2)/2}$$

Exception: when you use Merz reference, $HC = 2.325 * \sqrt{BPD^2 + OFD^2}$

AC

This is automatically calculated using the following formula, provided there are measured APD and TAD values.

$$AC = \pi \times \sqrt{(APD^2 + TAD^2)/2}$$

Exception: when you use Merz reference, $AC = \pi \times (APD + TAD)/2$

FTA

This is automatically calculated using the following formula, provided there are measured APD and TAD values.

$$FTA = \pi \times (APD \times TAD) / 4$$

ThC

This is automatically calculated using the following formula, provided there are measured APTD and TTD values.

$$ThC = \pi \times \sqrt{(APTD^2 + TTD^2) \div 2}$$

AFI (Amniotic Fluid Index)

Measure the amniotic fluid index. Measurements are performed by dividing the pregnant woman's abdomen into four parts. The distance between the fetus and the farthest point of each area is measured. To obtain a specific image from each quadrant plane, press the **Freeze** button to go to the diagnosis mode. After obtaining the image, press the **Freeze** button again to return to the measurement mode.

Calculating Fetal Weight (EFW)

When measurements for the following items are complete, the system uses the results to calculate the estimated fetal weight automatically. For an equation for calculating fetal weight, please refer to "Estimated Fetal Weight Formula" in the Reference Manual Part 1.

- BPD and AC
- BPD, FL and FTA
- BPD, APTD, TTD and FL
- BPD, APTD, TTD and SL
- BPD and TTD
- AC and FL
- BPD, AC and FL
- HC, AC and FL
- BPD,HC, AC and FL
- AC

NOTE: For reference, the Osaka University /Tokyo University methods are mainly used in Asia, the Merz method in Europe, and the Shepard/ Hadlock methods on the American continent.

Continuous Measurement / Review for EFW Calculation

You can measure OB item(s) continuously for EFW calculation.

Tips!

Before Measurement

1. Check whether the User key has been set to measure the EFW consecutively. To measure the EFW consecutively using the User key, set it in **Utility** > **Setup** > **Peripherals** > **User Key**.
2. When the Confirm Current EFW Reference is not selected or when you want to change it, select or change it in **Utility** > **Measure Setup** > **OB** > **Tables** > **Fetal weight** > **EFW Equation**.

NOTE: This function is not available in 3D Mode.

How to measure

1. Press the **User Key1** on the control panel. OB menu and measure items are displayed on the screen.
2. Measure the items for EFW calculation using trackball and the **Set** button.
3. Press the **Freeze** button to finish the first measurement.
4. Press the **Freeze** button to measure the next items.
5. When you finish the measurement for all items, the result will be displayed on the monitor.

See following table;

Reference	Measure Item (by Order)
Campbell	AC
Hadlock	BPD→AC
Hadlock1	AC→FL
Hadlock2	BPD→AC→FL
Hadlock3	AC→FL→HC
Hadlock4	BPD, HC→AC→FL
Hansmann	BPD→TTD
Merz	BPD→AC
Osaka	BPD→FTA→FL

Reference	Measure Item (by Order)
Shepard	BPD→AC
Shinozuka1	BPD→AC→FL
Shinozuka2	BPD→APTD, TTD→SL
Shinozuka3	BPD→APTD, TTD→FL
Ferrero	AC→FL
Higginbottom	AC
Thurnau	BPD→AC
Warsof	BPD→AC
Weiner1	HC→AC
Weiner2	AC→FL→HC
Woo	BPD→AC→FL

■ Review the Result of EFW Calculation

▶ Press the **User Key1** on the control panel. Measured items and its results are displayed on the screen.

▶ To remove the results, press the **Clear** button on the control panel.

Gynecology Calculation

Before Taking GYN Measurements

Enter the information required for GYN diagnosis in the *Patient Information* screen. Basic Information for gynecology includes Gravida, Para, Aborta, Ovul Date, Day of Cycle and Ectopic.

Measurement Menu

The measurement method for each item is the same as for basic measurement. Measured items are automatically recorded in a report.

[Figure 5.3 GYN Measurement Menu]

Measurement Menu	Item	Mode	Method	Unit
Uterus	Uterus All	All	Calculated after distance measurement	ml
	Uterus L	All	Distance	cm, mm
	Uterus H	All	Distance	cm, mm
	Uterus W	All	Distance	cm, mm
	Endo. Thick	All	Distance	cm, mm
	Cervix All	All	Volume	ml
	Cervix L	All	Distance	cm, mm
	Cervix H	All	Distance	cm, mm
	Cervix W	All	Distance	cm, mm
Rt. / Lt. Cyst	All	All	Calculated after distance measurement	ml
	Length	All	Distance	cm, mm
	Height	All	Distance	cm, mm
	Width	All	Distance	cm, mm
Rt. / Lt. Ovary	All	All	Calculated after distance measurement	ml
	Length	All	Distance	cm, mm
	Height	All	Distance	cm, mm
	Width	All	Distance	cm, mm
Rt. / Lt. Follicles	1 ~ 12	All	Volume calculated after distance measurement	cm, mm and ml

Measurement Menu	Item	Mode	Method	Unit
Mass 1~3	All	All	Calculated after distance measurement	ml
	Length	All	Distance	cm, mm
	Height	All	Distance	cm, mm
	Width	All	Distance	cm, mm
	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
Rt. / Lt. Ovarian A	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. Uterine A	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
Pericystic	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
Endometrial	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Endo. Polyp	All	All	Calculated after distance measurement	ml
	Length	All	Distance	cm, mm
	Height	All	Distance	cm, mm
	Width	All	Distance	cm, mm
	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	Vesl. Area	All	Area	$cm^{2,}$ mm^2
	Vesl. Dist	All	Distance	cm, mm
Rt. / Lt. Ovarian Mass	Vol.	All	Calculated after distance measurement	ml
	Length	All	Distance	cm, mm
	Height	All	Distance	cm, mm
	Width	All	Distance	cm, mm
	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	Vesl. Area	All	Area	$cm^{2,}$ mm^2
	Vesl. Dist	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Uterine Tumor 1~3	All	All	Calculated after distance measurement	ml
	Length	All	Distance	cm, mm
	Height	All	Distance	cm, mm
	Width	All	Distance	cm, mm
	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	Vesl. Area	All	Area	$cm^{2,}$ mm^2
	Vesl. Dist	All	Distance	cm, mm
Cervical Tumor	All	All	Calculated after distance measurement	ml
	Length	All	Distance	cm, mm
	Height	All	Distance	cm, mm
	Width	All	Distance	cm, mm
	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	Vesl. Area	All	Area	$cm^{2,}$ mm^2
	Vesl. Dist	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Ectopic	All	All	Calculated after distance measurement	ml
	Length	All	Distance	cm, mm
	Height	All	Distance	cm, mm
	Width	All	Distance	cm, mm
	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
	Fetal HR	PW	Heart Rate	bpm

Most of the gynecology measurements are distance measurements and volume measurements based on the distance measurement results. If multiple images, such as long axis images and transverse axis images are needed, press the **Freeze** button to switch to Scan Mode and obtain images from another perspective.

NOTE:

- For information on basic measurement methods, see 'Basic Measurements' and 'Common Measurement Methods'.
- For references on measurement items, see the Reference Manual – Part 2.

Cardiac Calculation

NOTE: Cardiac measurement is an optional item.

Before Taking Cardiac Measurements

Cardiology Basic Information

Enter the patient information required for cardiology diagnosis in the *Patient Information* window. The basic information for cardiology includes Height, Weight, HR (Heart Rate), RAP (Right Arterial Pressure) and BP (Blood Pressure). When the patient's height and weight are entered, BSA (Body Surface Area) is automatically calculated and displayed.

For more information about patient information menus and how to enter information, please refer to "Entering Patient Data" in "Chapter 7. Utility."

Cardiac Measurement Menu Settings

Set the related menus for convenient measurement. You can specify how an area and volume can be calculated. Please refer to the "Setting Measurements" section in "Chapter 7. Utility" for more information on measurement menus and settings.

Measurement Menu

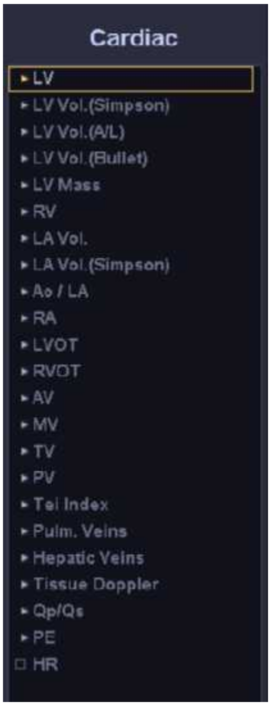
The measurement method for each item is the same as for basic measurement. Measured items are automatically recorded in a report.

Dist20

Traces the cardiac circumference and then draw the cardiac axis. The system automatically draws 20 straight lines perpendicular to the axis and calculates its volume.

NOTE:

- For information on basic measurement methods, see 'Basic Measurements' and 'Common Measurement Methods'.
- For references on measurement items, see the Reference Manual – Part 2.



[Figure 5.4 Cardiac Measurement Menu]

Measurement Menu	Item	Mode	Method	Unit
LV	LVd	All	Continuous measurement	
	IVSd	All	Distance	cm, mm
	LVIDd	All	Distance	cm, mm
	LVPWd	All	Distance	cm, mm
	LVs	All	Continuous measurement	
	IVSs	All	Distance	cm, mm
	LVIDs	All	Distance	cm, mm
	LVPWs	All	Distance	cm, mm
	RVAWs	All	Distance	cm, mm
	RVAWd	All	Distance	cm, mm
	RVIDs	All	Distance	cm, mm
	RVIDd	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
LV(M)	LV	M	Continuous measurement	
	IVSd	M	Distance	cm, mm
	LVIDd	M	Distance	cm, mm
	LVPWd	M	Distance	cm, mm
	IVSs	M	Distance	cm, mm
	LVIDs	M	Distance	cm, mm
	LVPWs	M	Distance	cm, mm
	RVAWd	M	Distance	cm, mm
	RVIDd	M	Distance	cm, mm
	RVAWs	M	Distance	cm, mm
	RVIDs	M	Distance	cm, mm
LV Vol. (Simpson)	A2C Vol.d	All	Dist20	ml
	A2C Vol.s	All	Dist20	ml
	A4C Vol.d	All	Dist20	ml
	A4C Vol.s	All	Dist20	ml
LV Vol. (A/L)	Vol. d	All	Volume	ml
	Vol. s	All	Volume	ml
LV Vol. (Bullet)	LVAd sax	All	Area	cm^2, mm^2
	LVAs sax	All	Area	cm^2, mm^2
	LVLd apical	All	Distance	cm, mm
	LVLs apical	All	Distance	cm, mm
LV Mass	All	All	Calculated after area measurement	g
	LVAd sax epi	All	Area	cm^2, mm^2
	LVAd sax endo	All	Area	cm^2, mm^2
	LVLd apical	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
RV	RVAWd	All	Distance	cm, mm
	RVIDd	All	Distance	cm, mm
	RVAd	All	Area	cm^2, mm^2
	RVAWs	All	Distance	cm, mm
	RVIDs	All	Distance	cm, mm
	RVAs	All	Area	cm^2, mm^2
	RV Major	All	Distance	cm, mm
	RV Minor	All	Distance	cm, mm
	LPA Diam	All	Distance	cm, mm
	MPA Diam	All	Distance	cm, mm
	RPA Diam	All	Distance	cm, mm
RV (M)	RVAWd	M	Distance	cm, mm
	RVIDd	M	Distance	cm, mm
	RVAWs	M	Distance	cm, mm
	RVIDs	M	Distance	cm, mm
	RVPEP	M	Time	ms
	RVET	M	Time	ms
LA Vol.	All	All	Calculated after distance measurement	ml
	LA Major	All	Distance	cm, mm
	LA Minor	All	Distance	cm, mm
	LA Diam	All	Distance	cm, mm
LA Vol. (Simpson)	LA EDV A2C	All	Dist 20	ml
	LA ESV A2C	All	Dist 20	ml
	LA EDV A4C	All	Dist 20	ml
	LA ESV A4C	All	Dist 20	ml

Measurement Menu	Item	Mode	Method	Unit
Ao / LA	All	All	Continuous measurement	
	Ao Root	All	Distance	cm, mm
	LA Diam	All	Distance	cm, mm
	LVOT Diam	All	Distance	cm, mm
	Ao Arch	All	Distance	cm, mm
	Asc Ao	All	Distance	cm, mm
	Desc Ao	All	Distance	cm, mm
	Ao Isth Diam	All	Distance	cm, mm
	Ao ST Junct Diam	All	Distance	cm, mm
	Ao Sinus Diam	All	Distance	cm, mm
Ao / LA (M)	All	M	Continuous measurement	
	Ao Root	M	Distance	cm, mm
	AV Cusp Sep	M	Distance	cm, mm
	LA Diam	M	Distance	cm, mm
	LVPEP	M	Time	ms
	LVET	M	Time	ms
RA	RA Major	All	Distance	cm, mm
	RA Minor	All	Distance	cm, mm
	RAAd	All	Area	cm^2, mm^2
	RAAs	All	Area	cm^2, mm^2
	RAEDV	All	Dist20	Ml
	RAESV	All	Dist20	Ml
	IVC Diam Exp.	All	Distance	cm, mm
	IVC Diam Ins.	All	Distance	cm, mm
	SVC Diam Exp.	All	Distance	cm, mm
	SVC Diam Ins.	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
LVOT	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
LVOT	Manual Trace	PW	Doppler spectrum trace	
	LVOT Diam	All	Distance	cm, mm
	LVOT Vmax	PW	Velocity	cm/s, m/s
	LVOT VTI	PW	Distance	cm, mm
	LVOT AccT	PW	Time	ms
	LVOT ET	PW	Time	ms
RVOT	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	RVOT Diam	All	Distance	cm, mm
	RVOT Vmax	PW	Velocity	cm/s, m/s
	RVOT VTI	PW	Distance	cm, mm
	RVOT ET	PW	Time	ms
AV	AV Auto Trace	PW	Doppler spectrum trace	
	AV Limited Trace	PW	Doppler spectrum trace	
	AV Manual Trace	PW	Doppler spectrum trace	
	AV Cusp	All	Distance	cm, mm
	AV Diam	All	Distance	cm, mm
	AVA Planimetry	All	Area	cm^2, mm^2
	AV Vmax	PW	Velocity	cm/s, m/s
	AV PHT	PW	Time	ms
	AV VTI	PW	Distance	cm, mm
	AV AccT	PW	Time	ms
	AV DecT	PW	Time	ms

Measurement Menu	Item	Mode	Method	Unit
AV	AV ET	PW	Time	ms
	R-R Interval	M, PW	Heart Rate	Bpm
	AR Auto Trace	PW	Doppler spectrum trace	
	AR Limited Trace	PW	Doppler spectrum trace	
	AR Manual Trace	PW	Doppler spectrum trace	
	AR VC Diam	All	Distance	cm, mm
	AR Vmax	PW	Velocity	cm/s, m/s
	AR ed Vmax	PW	Velocity	cm/s, m/s
	AR PHT	PW	Time	ms
	AR VTI	PW	Distance	cm, mm
	AR AccT	PW	Time	ms
	AR DecT	PW	Time	ms
	AR PISA Rad	C	PISA-Radius	cm, mm
	AR Alias Vel.	C	Velocity	cm/s, m/s
	AR IVRT	PW	Time	ms
	AR IVCT	PW	Time	ms
	AVO	C,PW	Time	ms
	AVC	C,PW	Time	ms
MV (M)	All Points	M	Continuous measurement	
	D-E	M	Distance	cm, mm
	E-F Slope	M	Velocity	cm/s, m/s
	A-C Interval	M	Time	ms
	EPSS	M	Distance	cm, mm
	Propagation Vel.	M	Velocity	cm/s, m/s

Measurement Menu	Item	Mode	Method	Unit
MV	MV Ann Diam	All	Distance	cm, mm
	MV Diam 1	All	Distance	cm, mm
	MV Diam 2	All	Distance	cm, mm
	MVA Planimetry	All	Area	cm^2, mm^2
	MV Limited Trace	PW	Doppler spectrum trace	
	MV Manual Trace	PW	Doppler spectrum trace	
	E-DT-A	PW	Time-Velocity-Time	ms and m/s
	MV Peak E	PW	Velocity	cm/s, m/s
	MV Peak A	PW	Velocity	cm/s, m/s
	MV Vmax	PW	Velocity	cm/s, m/s
	MV PHT	PW	Time	ms
	MV VTI	PW	Distance	cm, mm
	MV AccT	PW	Time	ms
	MV DecT	PW	Time	ms
	MV A Dur.	PW	Time	ms
	MV ET	PW	Time	ms
	MV IVRT	PW	Time	ms
	MV IVCT	PW	Time	ms
	R-R Interval	M, PW	Heart Rate	bpm
	MR VC Diam	All	Distance	cm, mm
	MR Auto Trace	PW	Doppler spectrum trace	
	MR Limited Trace	PW	Doppler spectrum trace	
	MR Manual Trace	PW	Doppler spectrum trace	
	MR Vmax	PW	Velocity	cm/s, m/s
	MR VTI	PW	Distance	cm, mm
	MR dp / dt	PW	Calculated after time measurement	mmHg/s

Measurement Menu	Item	Mode	Method	Unit
MV	MR PISA-Rad.	C	Distance	cm, mm
	MR Alias Vel.	C	Velocity	m/s
TV	TV Limited Trace	PW	Doppler spectrum trace	
	TV Manual Trace	PW	Doppler spectrum trace	
	TV Ann Diam	All	Distance	cm, mm
	TV Diam 1	All	Distance	cm, mm
	TV Diam 2	All	Distance	cm, mm
	TVA Planimetry	All	Area	cm^2, mm^2
	TV Vmax	PW	Velocity	cm/s, m/s
	TV Peak E	PW	Velocity	cm/s, m/s
	TV Peak A	PW	Velocity	cm/s, m/s
	TV PHT	PW	Time	ms
	TV VTI	PW	Distance	cm, mm
	TV AccT	PW	Time	ms
	TV DecT	PW	Time	ms
	TV A Dur.	PW	Time	ms
	Q to TV Open	PW	Time	ms
	R-R Interval	M, PW	Heart Rate	bpm
	TR Auto Trace	PW	Doppler spectrum trace	
	TR Limited Trace	PW	Doppler spectrum trace	
	TR Manual Trace	PW	Doppler spectrum trace	
	TR VC Diam	All	Distance	cm, mm
	TR Vmax	PW	Velocity	cm/s, m/s
	TR VTI	PW	Distance	cm, mm
	TR dp / dt	PW	Calculated after time measurement	mmHg/s
	TR PISA-Rad.	C	PISA-Radius	cm, mm
	TR Alias Vel.	C	Velocity	cm/s, m/s

Measurement Menu	Item	Mode	Method	Unit
PV	PV Auto Trace	PW	Doppler spectrum trace	
	PV Limited Trace	PW	Doppler spectrum trace	
	PV Manual Trace	PW	Doppler spectrum trace	
	PV Ann Diam	All	Distance	cm, mm
	PVA Planimetry	All	Area	cm^2, mm^2
	PV Vmax	PW	Velocity	cm/s, m/s
	PV PHT	PW	Time	ms
	PV AccT	PW	Time	ms
	PV DecT	PW	Time	ms
	PV ET	PW	Time	ms
	R-R Interval	M, PW	Heart Rate	Bpm
	Q to PV Close	PW	Time	ms
	PR Auto Trace	PW	Doppler spectrum trace	
	PR Limited Trace	PW	Doppler spectrum trace	
	PR Manual Trace	PW	Doppler spectrum trace	
	PR VC Diam	All	Distance	cm, mm
	PR Vmax	PW	Velocity	cm/s, m/s
	MPA Vmax	PW	Velocity	cm/s, m/s
	PR PHT	PW	Time	ms
	PR AccT	PW	Time	ms
	PR DecT	PW	Time	ms
Tei Index	All		Calculated after continuous measurement	
	MV TST	PW	Time	ms
	MV ET	PW	Time	ms
	MV IVCT	PW	Time	ms
	MV IVRT	PW	Time	ms

Measurement Menu	Item	Mode	Method	Unit
Pulm. Veins	All	PW	Continuous measurement	
	Sys Vel.	PW	Velocity	cm/s, m/s
	Dias Vel.	PW	Velocity	cm/s, m/s
	A. Rev Vel.	PW	Velocity	cm/s, m/s
	A. Rev Dur.	PW	Time	ms
Hepatic Veins	All	PW	Continuous measurement	
	Sys Vel.	PW	Velocity	cm/s, m/s
	Dias Vel.	PW	Velocity	cm/s, m/s
	A. Rev Vel.	PW	Velocity	cm/s, m/s
	A. Rev Dur.	PW	Time	ms
Tissue Doppler	All	PW	Continuous measurement	
	Peak E’	PW	Velocity	cm/s, m/s
	Peak A’	PW	Velocity	cm/s, m/s
	Peak S’	PW	Velocity	cm/s, m/s
	AccT	PW	Time	ms
	DecT	PW	Time	ms
Qp: Qs	LVOT Diam	All	Distance	cm, mm
	Sys.HR	PW	Heart Rate	bpm
	Sys.VTI	PW	Distance	cm, mm
	RVOT Diam	All	Distance	cm, mm
	Pulm. HR	PW	Heart Rate	bpm
	Pulm. VTI	PW	Distance	cm, mm
PE	PEd	All	Distance	cm, mm
	PEs	All	Distance	cm, mm
HR	HR	M, PW	Heart Rate	bpm

NOTE:

- In Dual 2D Mode, two images can be viewed simultaneously.
- For **RVAWd**, **RVIDd**, **RVAWs**, and **RVIDs**, see the **LV** measurement method.
- **MPA Diam**, **RPA Diam**, and **LPA Diam** are measured under Aortic Valve Level in Parasternal Short Axis.
- C Mode is mainly used for measuring reverse cardiac blood flow.
- As **PISA-Radius** or **PISA-Alias Vel.** measurements require Velocity values, you have to select color display for Velocity or Vel + Var in C Mode. For more information, see the 'Color Doppler Mode' section in "Chapter 4. Diagnosis Mode".

Carotid Calculation

Before Taking Carotid Measurements

Set the related menus for convenient measurement. You can also specify how an area and volume are calculated. Please refer to the “Setting Measurements” section in "Chapter 7. Utility” for more information on the measurement menus and settings.

Measurement Menu

[Figure 5.5 Carotid Measurement Menu]

The measurement method for each item is the same as for basic measurement. Measured items are automatically recorded in a report.

NOTE:

- For information on basic measurements, please refer to “Basic Measurements” in this chapter.
- For references on measurement items, please refer to “Reference Manual – Part 2.”

Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. Subclavian A	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
Rt. / Lt. Prox CCA	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
	IMT	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. Mid CCA	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
	IMT	All	Distance	cm, mm
Rt. / Lt. Distal CCA	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
	IMT	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. Bulb	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
	IMT	All	Distance	cm, mm
Rt. / Lt. Prox ICA	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
	IMT	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. Mid ICA	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
	IMT	All	Distance	cm, mm
Rt. / Lt. Distal ICA	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
	IMT	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. ECA	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
	IMT	All	Distance	cm, mm
Rt. / Lt. Vetebral A	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
General	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
Volume Flow	Volume Flow(Auto)	PW	Automatic calculation	ml/m
	Volume Flow(D)	PW	Automatic calculation	ml/m
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	TAMV	PW	Doppler spectrum trace	cm/s or m/s
	Vesl. Dist.	All	Distance	cm, mm
	Vesl. Area.	All	Area	cm^2, mm^2
HR	HR	PW	Heart Rate	bpm

Auto IMT (Optional)

This function allows you to take IMT measurement easily and quickly.

NOTE: Auto IMT is available only under the following conditions:
- Probe: Linear Probe
- Application: Vascular
- Diagnosis Mode: 2D, C or PD Mode

Auto IMT Screen

Risk Color Bar

It is shown in colors based on the IMT thickness. If the thickness is <= 0.5 mm, the entire bar is shown in green. If the thickness is >= 1.1 mm, the entire bar is shown in red. For a thickness between these values, it is shown in the corresponding color.

Rular and Range Bar

Use the Trackball and **Set** button to specify the location and range at which IMT will be measured.

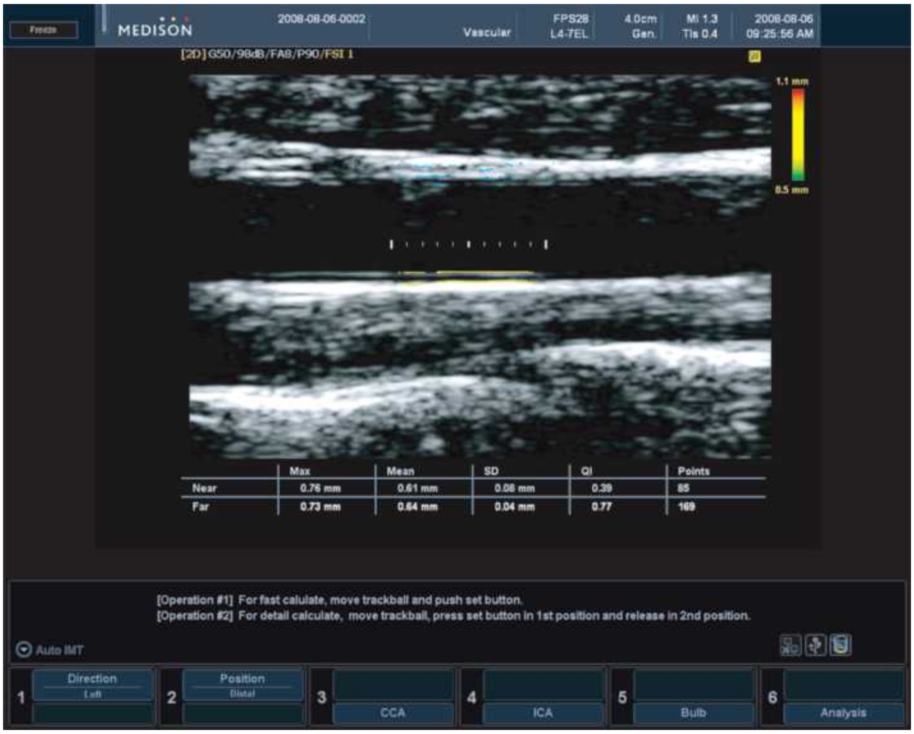
- Rular: The grid unit is 10 mm. This option is used when a vessel is lying laterally. At the measurement location, press the **Set** button to take IMT measurement at 10 mm interval.
- Range Bar: This option is used when a vessel is not lying laterally, or the length of a specific segment is measured. Press and hold the **Set** button at the start point, and then drag the Trackball to specify the end point.

Intima and Adventitia Pair

- Between the Near and Far zones, the one with the higher QI is automatically selected as a measurement value and it is represented by the color of the Risk Color Bar.
- A pair with lower QI is represented in dark sky blue.
- Press Change to move the Near and Far zones that are automatically selected with QI. The measurement value and color presentation are also changed. However, if QI is 0, it will not be changed.

Measure Result Table

- Max: The maximum thickness of the Intima/Adventitia pair.
- Mean: The average thickness of the Intima/Adventitia pair.
- SD : Standard Deviation
- QI: The distance ratio of the measured point in a distance for Quality Index measurement.
- Points: The total number of the measured Intima/Adventitia pairs.



[Figure 5.6 Auto IMT]

Auto IMT Measurement

1. After checking the probe, application and preset, start carotid measurement.

2. If the desired images are obtained, press **Freeze**. Use the Trackball to select an image for IMT measurement.

3. Press the Soft Menu dial-button **[1]** Auto IMT. The *Auto IMT* screen will appear.

   ▶ If scanning is performed when the center of the vessel is aligned with the center of the image area, IMT measurement starts automatically.

4. Use the Trackball and the Set button to set a location for IMT measurement.

> Tips!
>
> **Operation #1, #2**
>
> If Operation #1, #2 in the user information area is followed, IMT measurement can be taken more easily.

   ▶ Select a point between Near and Far.

   ▶ If the vessel image quality is poor, select an area that is close to the Intima to be measured.

   ▶ If a detailed area has to be selected, use Range Bar.

   ▶ Press Space Bar in the keyboard to turn on/off the Intima and Adventitia Marker.

5. Once the measurement location is set, measurement values are listed in a table.

Auto IMT Measurements Analysis

1. Press the Soft Menu dial-button **[6]** Analysis. The Analysis screen will appear.

2. Use the Trackball and the **Set** button to select the desired analysis from **Framingham**, **Risk Factor**, **Normal IMT** and **User Graph**.

   ▶ Bars corresponding to the measurement results will be shown on each graph. However, bars are not shown when the measurement results are smaller than the Framingham Risk Factor.

> Tips!
>
> **User Graph**
>
> **User Graph** can be used to customize a graph for better analysis of measurement results.

3. Press the Soft Menu dial-button **[6]** Analysis again to complete analysis.

The following materials were referred to when analyzing the measurements of Auto IMT.

■ **Framingham**

Correlation between the Framingham Risk Score and Intima Media Thickness: the Paroi Arterielle et Risque Cardio-vasculair (PARC) Study.

Pierre-Jean Touboul, EricVicaut, Julien Labreuche, Jean-Pierre Belliard, Serge Cohen, Serge Kownator, Jean-Jacques Portal, Isabelle Pithois-Merli, Pierre Amarenco. On behalf of PARC Study participating physicians.

■ **Risk Factor**

Mannheim Carotid Intima-Media Thickness Consensus (2004~2006)

P.-J. Touboul, M.G. Hennerici, S.Meairs, H.Adams, P.Amarenco, N.Borstein, L.Csiba, M.Desvarieux, S.Ebrahim, M.Fatar, R.Hermandez Hernandez, M.Jaff, S.Kownator, P.Prati, T.Rundek, M.Sitzer, U.Schiminke, J.-C. Tardif, A.Taylor, E.Vicaut, K.S.Woo, F.Zannad, M.Zureik

■ **Normal IMT**

Simon A, Gariepy J, Chironi G, Megnien JL, Levenson J: Intima-media thickness: a new tool for diagnosis and treatment of cardiovascular risk. Journal of Hypertension 20:159-169, 2002

Saving Auto IMT Measurement Values

1. Use the **Soft Menu** dial-button **[1]** Direction to select the direction of the measurement area.
2. Use the **Soft Menu** dial-button **[2]** Position to select the location of the measurement area.
3. Use one of the Soft Menu dial-buttons **3** CCA, **[4]** ICA, and **5** Bulb to select the appropriate name for the study area. Press the button to save the measurement and exit Auto IMT measurement mode. The saved content will be displayed on the left side of the screen.

Annotation

Displays information for the current measurement item on the screen.

1. Press the Annotation button at the bottom left corner of the image.
2. Select the information for the measured area, and press the **OK** button to record the position of the measured area at the location of the Annotation button. Press the **Cancel** button to cancel.
   - ▶ Direction (Left/Right): Shows the direction of the measured area.
   - ▶ Position #1(Distal/Mid/Proximal): Shows the position of the measured area.
   - ▶ Position #2(CCA/ICA/Bulb): Shows the name of the measured area.

Auto IMT+

This system supports optional Auto IMT+. Auto IMT+ uses a more powerful engine than Auto IMT to provide more accurate measurements.

NOTE:

- ▶ If both Auto IMT and Auto IMT+ options are installed, using this function will perform Auto IMT+; If you disable the Auto IMT+ option, the function will automatically switch to Auto IMT.
- ▶ The button for using this function, as well as the on-screen description, will read 'Auto IMT', regardless of whether Auto IMT or Auto IMT+ is being used.

Urology Calculation

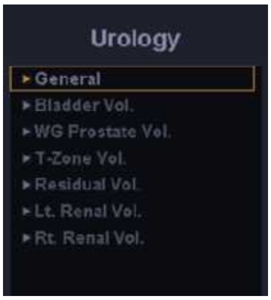
Before Taking Urology Measurements

Set the related menus for convenient measurement.

You can select the volume method for measurement. There are four types of volume method. The factor value can be set manually for the formulae that need it.

For more information on the measurement menus and settings, please refer to “Setting Measurements” in "Chapter 7. Utility.”

Measurement Menu



[Figure 5.7 Urology Measurement Menu]

The measurement method for each item is the same as for basic measurement. Measured items are automatically recorded in a report.

NOTE:

- The measurement methods of each menu vary with the Volume Method set at **Utility** > **Measure Setup** > **Urology**.
- For information on basic measurement methods, see ‘Basic Measurements’ and ‘Common Measurement Methods’.
- For references on measurement items, see the Reference Manual – Part 2.

3Distance

Calculate a volume by measuring three distances.

Measurement Menu	Item	Mode	Method	Unit
General	Auto Trace	PW	Doppler spectrum trace	cm, mm
	Limited Trace	PW	Doppler spectrum trace	cm, mm
	Manual Trace	PW	Doppler spectrum trace	cm, mm
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl.Area	All	Area	cm2, mm2
	Vesl.Dist.	All	Distance	cm, mm
Bladder Vol.	All	All	Calculated after distance measurement	ml
	Length	All	Distance	cm, mm
	Height	All	Distance	cm, mm
	Width	All	Distance	cm, mm
WG Prostate Vol.	All	All	Calculated after distance measurement	ml
	Length	All	Distance	cm, mm
	Height	All	Distance	cm, mm
	Width	All	Distance	cm, mm
T-Zone Vol.	All	All	Calculated after distance measurement	ml
	Length	All	Distance	cm, mm
	Height	All	Distance	cm, mm
	Width	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Residual Vol.	Pre All	All	Calculated after distance measurement	ml
	Pre L	All	Distance	cm, mm
	Pre H	All	Distance	cm, mm
	Pre W	All	Distance	cm, mm
	Post All	All	Calculated after distance measurement	ml
	Post L	All	Distance	cm, mm
	Post H	All	Distance	cm, mm
	Post W	All	Distance	cm, mm
Rt. / Lt. Renal Vol.	All	All	Calculated after distance measurement	ml
	Length	All	Distance	cm, mm
	Height	All	Distance	cm, mm
	Width	All	Distance	cm, mm
	Pelvis	All	Distance	cm, mm

Transitional Zone Prostate Volume, Bladder Volume, Left Renal Volume, Right Renal Volume are the same measurements as for Prostate Volume.

3 Distance * Factor

The same as for "3 Distance."

Ellipsoid

Calculate a volume by using the Main Diameter and Beside Diameter values.

Measurement Menu	Item	Mode	Method	Unit
Bladder Vol.	Vol.	All	Calculated after distance measurement	ml
	Main Dia.	All	Distance	cm, mm
	Beside Dia.	All	Distance	cm, mm
WG Prostate Vol.	Vol.	All	Calculated after distance measurement	ml
	Main Dia.	All	Distance	cm, mm
	Beside Dia.	All	Distance	cm, mm
T-Zone Vol.	Vol.	All	Calculated after distance measurement	ml
	Main Dia.	All	Distance	cm, mm
	Beside Dia.	All	Distance	cm, mm
Residual Vol.	Pre All	All	Calculated after distance measurement	ml
	Pre Main Dia.	All	Distance	cm, mm
	Pre Beside Dia.	All	Distance	cm, mm
Residual Vol.	Post All	All	Calculated after distance measurement	ml
	Post Main Dia.	All	Distance	cm, mm
Residual Vol.	Post Beside Dia.	All	Distance	cm, mm
Rt. / Lt. Renal Vol.	All	All	Calculated after distance measurement	ml
	Main Dia.	All	Distance	cm, mm
	Beside Dia.	All	Distance	cm, mm
	Renal Pelvis	All	Distance	cm, mm

Sum of 20 Disks

After measuring the circumference of a prostate, use the Trackball and the **Set** button to calculate the volume by measuring the axis of the prostate.

Measurement Menu	Item	Mode	Method	Unit
Bladder Vol.	Vol.	All	Dist20	ml
WG Prostate Vol.	Vol.	All	Dist20	ml
T-Zone Vol.	Vol.	All	Dist20	ml
Residual Vol.	Pre Vol.	All	Dist20	ml
	Post Vol.	All	Dist20	ml
Rt. / Lt. Renal Vol.	Vol.	All	Dist20	ml
	Renal Pelvis	All	Distance	cm, mm

Fetal Echo Calculation

Before Taking Fetal Echo Measurements

Set the related menus for convenient measurement. You can also specify how volume can be calculated.

Please refer to the “Setting Measurements” section in "Chapter 7. Utility” for more information on the measurement menus and settings.

Measurement Menu

The measurement method for each item is the same as for basic measurement. In addition, measurement items are similar to those for cardiac calculation.

Measured items are automatically recorded in a report.

[Figure 5.8 Fetal Echo Measurement Menu]

NOTE:

- For information on basic measurement methods, see ‘Basic Measurements’ and ‘Common Measurement Methods’.
- For references on measurement items, see the Reference Manual – Part 2.

Measurement Menu	Item	Mode	Method	Unit
LV Vol. (Simpson)	A2C Vol.d	All	Dist20	ml
	A2C Vol.s	All	Dist20	ml
	A4C Vol.d	All	Dist20	ml
	A4C Vol.s	All	Dist20	ml
2D Echo	Asc Ao	All	Distance	cm, mm
	MPA Diam	All	Distance	cm, mm
	Duct Art	All	Distance	cm, mm
	LA Diam	All	Distance	cm, mm
	RA Diam	All	Distance	cm, mm
	RV Diam	All	Distance	cm, mm
	IVS	All	Distance	cm, mm
	LVIDd	All	Distance	cm, mm
	LVIDs	All	Distance	cm, mm
	LVPW	All	Distance	cm, mm
	HrtC	All	Circumference	cm, mm
	ThC	All	Circumference	cm, mm
CTAR	All (D)	All	Calculated after distance measurement	%
	ThD ap	All	Distance	cm, mm
	ThD trans	All	Distance	cm, mm
	HrtD ap	All	Distance	cm, mm
	HrtD trans	All	Distance	cm, mm
	All (A)	All	Calculated after area measurement	%
	ThA	All	Area	cm^2, mm^2
	HrtA	All	Area	cm^2, mm^2

Measurement Menu	Item	Mode	Method	Unit
Fetal M-mode	All	M	Continuous measurement	cm, mm
	IVSd	M	Distance	cm, mm
	LVIDd	M	Distance	cm, mm
	LVPWd	M	Distance	cm, mm
	IVSs	M	Distance	cm, mm
	LVIDs	M	Distance	cm, mm
	LVPWs	M	Distance	cm, mm
	RVDd	M	Distance	cm, mm
MPA	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
Duct Artriosus	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
IVC	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s

Measurement Menu	Item	Mode	Method	Unit
Duct Venosus	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
Asc Aorta	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
Dsc Aorta	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
MV Inflow	Peak E	PW	Velocity	cm/s, m/s
	Peak A	PW	Velocity	cm/s, m/s
MV Regurg	Vel.	PW	Velocity	cm/s, m/s
TV Inflow	Peak E	PW	Velocity	cm/s, m/s
	Peak A	PW	Velocity	cm/s, m/s
TV Regurg	Vel.	PW	Velocity	cm/s, m/s
PLI	All	PW	Calculated after velocity measurement	
	Sys Flow	PW	Velocity	cm/s, m/s
PLI	Dias Flow	PW	Velocity	cm/s, m/s
	A. Rev Flow	PW	Velocity	cm/s, m/s

Measurement Menu	Item	Mode	Method	Unit
Tei Index	All	PW	Calculated after continuous measurement	
	TST	PW	Time	ms
	ET	PW	Time	ms
Fetal HR	Fetal Heart Rate	M, PW	Heart Rate	bpm

CTAR (Cardio-Thorax Area Ratio)

This measurement is for comparing the sizes of the fetus' chest and heart. The comparison is made by obtaining the ThD ap, ThD trans, HrtD ap, and HrtD trans values.

$$CTAR = \frac{\text{HrtD ap} \times \text{HrtD trans}}{\text{ThD ap} \times \text{ThD trans}} \times 100$$

LE Artery Calculation

Measurement Menu

[Figure 5.9 LE Artery Measurement Menu]

The measurement method for each item is the same as for basic measurement. Measured items are automatically recorded in a report.

NOTE:

- It is convenient to calculate each measurement value on the Spectral Doppler image
- For information on basic measurement methods, see 'Basic Measurements' and 'Common Measurement Methods'.
- For references on measurement items, see the Reference Manual – Part 2.

Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. CIA	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
Rt. / Lt. IIA	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. EIA	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
Rt. / Lt. CFA	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. SFA	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
Rt. / Lt. DFA	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. Pop A	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
Rt. / Lt. ATA	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. PTA	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
Rt. / Lt. Peroneal A	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. DPA	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
Rt. / Lt. MPA	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. LPA	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
Rt. / Lt. Metatarsal A	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. Digital A	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm2, mm2
	Vesl. Dist	All	Distance	cm, mm
General	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Volume Flow	Volume Flow(Auto)	PW	Automatic calculation	ml/m
	Volume Flow(D)	PW	Automatic calculation	ml/m
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	TAMV	PW	Doppler spectrum trace	cm/s or m/s
	Vesl. Dist.	All	Distance	cm, mm
	Vesl. Area.	All	Area	cm^2, mm^2
HR	HR	M, PW	Heart Rate	bpm

UE Artery Calculation

Measurement Menu

[Figure 5.10 UE Artery Measurement Menu]

The measurement method for each item is the same as for basic measurement. Measured items are automatically recorded in a report.

NOTE:

- It is convenient to calculate each measurement value on the Spectral Doppler image.
- For information on basic measurement methods, see 'Basic Measurements' and 'Common Measurement Methods'.
- For references on measurement items, see the Reference Manual – Part 2.

Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. Subclabian A	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
Rt. / Lt. Axillary A	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. Brachial A	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
Rt. / Lt. Radial A	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. Ulnar A	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
Rt. / Lt. SPA	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
General	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
Volume Flow	Volume Flow(Auto)	PW	Automatic calculation	ml/m
	Volume Flow(D)	PW	Automatic calculation	ml/m
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	TAMV	PW	Doppler spectrum trace	cm/s or m/s
	Vesl. Dist.	All	Distance	cm, mm
	Vesl. Area.	All	Area	cm^2, mm^2
HR	HR	M, PW	Heart Rate	bpm

LE Vein Calculation

Measurement Menu

The measurement method for each item is the same as for basic measurement. Measured items are automatically recorded in a report.

NOTE:

- It is convenient to calculate each measurement value on the Spectral Doppler image.
- For information on basic measurement methods, see 'Basic Measurements' and 'Common Measurement Methods'.
- For references on measurement items, see the Reference Manual – Part 2.

[Figure 5.11 LE Vein Measurement Menu]

Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. FV	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	Vmax	PW	Velocity	cm/s, m/s
	Dur T	PW	Time	ms
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist.	All	Distance	cm, mm
Rt. / Lt. GSV	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	Vmax	PW	Velocity	cm/s, m/s
	Dur T	PW	Time	ms
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist.	All	Distance	cm, mm
Rt. / Lt. POP V	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	Vmax	PW	Velocity	cm/s, m/s
	Dur T	PW	Time	ms
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist.	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. SSV	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	Vmax	PW	Velocity	cm/s, m/s
	Dur T	PW	Time	ms
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist.	All	Distance	cm, mm
Rt. / Lt. MPV	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	Vmax	PW	Velocity	cm/s, m/s
	Dur T	PW	Time	ms
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist.	All	Distance	cm, mm
Rt. / Lt. LPV	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	Vmax	PW	Velocity	cm/s, m/s
	Dur T	PW	Time	ms
	Vesl. Area	All	Area	cm2, mm2
	Vesl. Dist.	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. Metatarsal V	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	Vmax	PW	Velocity	cm/s, m/s
	Dur T	PW	Time	ms
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist.	All	Distance	cm, mm
Rt. / Lt. Digital V	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	Vmax	PW	Velocity	cm/s, m/s
	Dur T	PW	Time	ms
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist.	All	Distance	cm, mm
General	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	Vmax	PW	Velocity	cm/s, m/s
	Dur T	PW	Time	ms
	Vesl. Dist.	All	Distance	cm, mm

UE Vein Calculation

Measurement Menu

The measurement method for each item is the same as for basic measurement. Measured items are automatically recorded in a report.

[Figure 5.12 UE Vein Measurement Menu]

NOTE:

- It is convenient to calculate each measurement value on the Spectral Doppler image.
- For information on basic measurement methods, see 'Basic Measurements' and 'Common Measurement Methods'.
- For references on measurement items, see the Reference Manual – Part 2.

Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. Internal Jugular	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	Vmax	PW	Velocity	cm/s, m/s
	Dur T	PW	Time	ms
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
Rt. / Lt. Innominate V	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	Vmax	PW	Velocity	cm/s, m/s
	Dur T	PW	Time	ms
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist.	All	Distance	cm, mm
Rt. / Lt. Subclavian V	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	Vmax	PW	Velocity	cm/s, m/s
	Dur T	PW	Time	ms
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. Axillary V	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	Vmax	PW	Velocity	cm/s, m/s
	Dur T	PW	Time	ms
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist.	All	Distance	cm, mm
Rt. / Lt. Brachial V	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	Vmax	PW	Velocity	cm/s, m/s
	Dur T	PW	Time	ms
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist.	All	Distance	cm, mm
Rt. / Lt. Cephalic V	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	Vmax	PW	Velocity	cm/s, m/s
	Dur T	PW	Time	ms
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist.	All	Distance	cm, mm

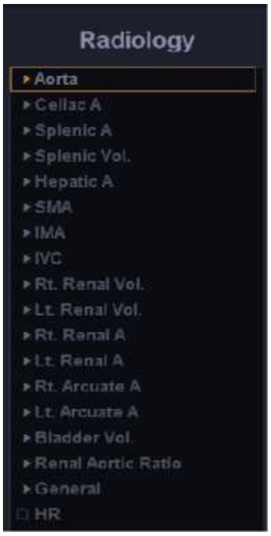
Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. Basilic V	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	Vmax	PW	Velocity	cm/s, m/s
	Dur T	PW	Time	ms
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist.	All	Distance	cm, mm
Rt. / Lt. Radial V	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	Vmax	PW	Velocity	cm/s, m/s
	Dur T	PW	Time	ms
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist.	All	Distance	cm, mm
Rt. / Lt. Ulnar V	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	Vmax	PW	Velocity	cm/s, m/s
	Dur T	PW	Time	ms
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
General	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	Vmax	PW	Velocity	cm/s, m/s
	Dur T	PW	Time	ms
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm

Radiology Calculation

Measurement Menu

The measurement method for each item is the same as for basic measurement. Measured items are automatically recorded in a report.



[Figure 5.13 Radiology Measurement Menu]

NOTE:

- It is convenient to calculate each measurement value on the Spectral Doppler image.
- For information on basic measurement methods, see 'Basic Measurements' and 'Common Measurement Methods'.

Measurement Menu	Item	Mode	Method	Unit
Aorta	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
Celiac A	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Splenic A	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
Splenic Vol.	All	All	Calculated after distance measurement	ml
	Length	All	Distance	cm, mm
	Height	All	Distance	cm, mm
	Width	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Hepatic A	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
SMA	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
IMA	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
IVC	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. Renal Vol.	All	All	Calculated after distance measurement	ml
	Length	All	Distance	cm, mm
	Height	All	Distance	cm, mm
	Width	All	Distance	cm, mm
Rt. / Lt. Renal A	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm

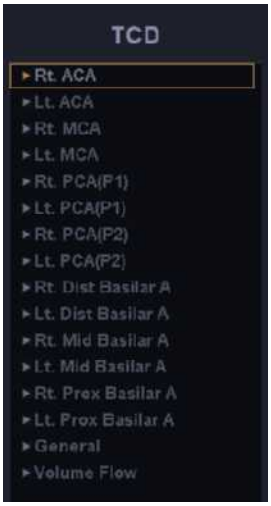
Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. Arcuate A	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
Bladder Vol.	All	All	Calculated after distance measurement	ml
	Length	All	Distance	cm, mm
	Height	All	Distance	cm, mm
	Width	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
General	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
HR	Fetal Heart Rate	M, PW	Heart Rate	bpm
Renal Aortic Ratio	Renal A. PSV	PW	Velocity measurement	cm/s, m/s
	Aorta PSV	PW	Velocity measurement	cm/s, m/s

TCD Calculation

Measurement Menu

The measurement method for each item is the same as for basic measurement. Measured items are automatically recorded in a report.



[Figure 5.14 TCD Measurement Menu]

NOTE:

- It is convenient to calculate each measurement value on the Spectral Doppler image.
- For information on basic measurement methods, see 'Basic Measurements' and 'Common Measurement Methods'.

Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. ACA	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
Rt. / Lt. MCA	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. PCA(P1)	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
Rt. / Lt. PCA(P2)	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. Distal Basilar A	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
Rt. / Lt. Mid Basilar A	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm

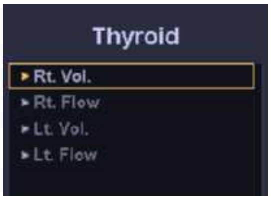
Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. Prox Basilar A	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
General	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Volume Flow	Volume Flow(Auto)	PW	Automatic calculation	ml/m
	Volume Flow(D)	PW	Automatic calculation	ml/m
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	TAMV	PW	Doppler spectrum trace	cm/s or m/s
	Vesl. Dist.	All	Distance	cm, mm
	Vesl. Area.	All	Area	cm^2, mm^2

Thyroid Calculation

Measurement Menu

The measurement method for each item is the same as for basic measurement. Measured items are automatically recorded in a report.



[Figure 5.15 Thyroid Measurement Menu]

NOTE:

- It is convenient to calculate each measurement value on the Spectral Doppler image.
- For information on basic measurement methods, see 'Basic Measurements' and 'Common Measurement Methods'.

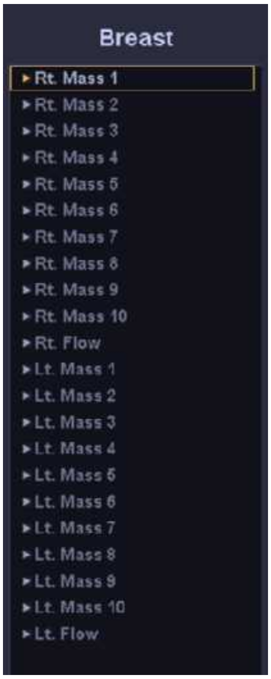
Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. Vol.	All	All	Calculated after distance measurement	ml
	Length	All	Distance	cm, mm
	Height	All	Distance	cm, mm
	Width	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. Flow	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
	Vel A	PW	Velocity	cm/s, m/s
	Vel B	PW	Velocity	cm/s, m/s

Breast Calculation

Measurement Menu

The measurement method for each item is the same as for basic measurement. Measured items are automatically recorded in a report.



[Figure 5.16 Breast Measurement Menu]

NOTE: For information on basic measurement methods, see 'Basic Measurements' and 'Common Measurement Methods'.

Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. Mass 1-10	All	All	Calculated after distance measurement	ml
	Length	All	Distance	cm, mm
	Depth	All	Distance	cm, mm
	Width	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. Flow	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
	Vel A	PW	Velocity	cm/s, m/s
	Vel B	PW	Velocity	cm/s, m/s

Testicle Calculation

Measurement Menu

The measurement method for each item is the same as for basic measurement. Measured items are automatically recorded in a report.

[Figure 5.17 Testicle Measurement Menu]

NOTE:

- It is convenient to calculate each measurement value on the Spectral Doppler image.
- For information on basic measurement methods, see 'Basic Measurements' and 'Common Measurement Methods'.

Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. Vol.	Vol.	All	Calculated after distance measurement	ml
	Length	All	Distance	cm, mm
	Depth	All	Distance	cm, mm
	Width	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Rt. / Lt. Flow	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after Area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
	Vel A	PW	Velocity	cm/s, m/s
	Vel B	PW	Velocity	cm/s, m/s

Superficial Calculation

Measurement Menu

The measurement method for each item is the same as for basic measurement. Measured items are automatically recorded in a report.

[Figure 5.18 Superficial Measurement Menu]

NOTE:

- It is convenient to calculate each measurement value on the Spectral Doppler image.
- For information on basic measurement methods, see 'Basic Measurements' and 'Common Measurement Methods'.

Measurement Menu	Item	Mode	Method	Unit
Vol.	Vol.	All	Calculated after distance measurement	ml
	Length	All	Distance	cm, mm
	Depth	All	Distance	cm, mm
	Width	All	Distance	cm, mm

Measurement Menu	Item	Mode	Method	Unit
Flow	Auto Trace	PW	Doppler spectrum trace	
	Limited Trace	PW	Doppler spectrum trace	
	Manual Trace	PW	Doppler spectrum trace	
	TAMV(M)	PW	Doppler spectrum trace	cm/s or m/s
	PSV	PW	Velocity	cm/s, m/s
	EDV	PW	Velocity	cm/s, m/s
	%StA	All	Calculated after area measurement	%
	%StD	All	Calculated after distance measurement	%
	Vesl. Area	All	Area	cm^2, mm^2
	Vesl. Dist	All	Distance	cm, mm
	Vel A	PW	Velocity	cm/s, m/s
	Vel B	PW	Velocity	cm/s, m/s

Pediatric Hips Calculation

Measurement Menu

Measured items are automatically recorded in a report.

[Figure 5.19 Pediatric Hips Measurement Menu]

Measurement Menu	Item	Method	Unit
Hip Angle	Type	Three Distance Measurement	°

Measurement Method

1. Use the Trackball and the **Set** button on the control panel to specify the first straight line.
   ▶ Place the cursor at a desired position with the Trackball, and press the **Set** button.

Tips!

Repositioning Point

Pressing the **Change** button before pressing the **Set** button to complete positioning resets the position of a point just set.

2. Repeat the above process to specify two other straight lines.
3. The angle between them will be calculated automatically.
   ▶ α: The angle between the first and second straight lines.
   ▶ β: The angle between the first and third straight lines.
4. When the measurement is finished, its result is shown on the screen.

Please refer to the table below for Hip Joint Type information:

Type	α	β
1a	60 ≤ α < 90	0 < β < 55
1b	60 ≤ α < 90	55 ≤ β < 90
2a/b	50 ≤ α < 60	0 < β < 90
2c	43 ≤ α < 50	77 ≤ β < 90
d	43 ≤ α < 50	0 < β < 77
3/4	0 ≤ α < 43	

[Table 5.2 Hip Joint Type Table]

Musculoskeletal Calculation

Measurement Menu

The measurement method for each item is the same as for basic measurement. Measured items are automatically recorded in a report.

[Figure 5.20 MSK Measurement Menu]

Measurement Menu	Item	Method	Unit
Rt. / Lt. Shoulder	1~10	Distance Measurement	cm, mm
Rt. / Lt. Wrist	1~10	Distance Measurement	cm, mm
Rt. / Lt. Knee	1~10	Distance Measurement	cm, mm
Rt. / Lt. Ankle	1~10	Distance Measurement	cm, mm

Report

Measurement results are arranged by application and displayed on the screen in the form of a report.

[Figure 5.21 The Report Screen - Example]

Viewing Report

Press the **Report** button on the control panel. The system switches to the *Ultrasound Report* screen.

When measurement results cannot be displayed in a screen, they can be moved into the upper and lower portions of the screen in three ways as below:

- Use the scroll bar on the right side of the screen.
- Rotate the **Menu** dial-button on the control panel.
- The measurement menus saved in the current application report are displayed in the left side of the screen. Select a menu to review from them.

To view a report for another application, press **Next App**. on the screen. Each time **Next App**. is pressed, reports for other applications are shown.

NOTE: Reports for applications in which no measurements have been made will not be shown.

Video Out

Press **Video Out** on the **Ultrasound Report** screen. Choose whether to fit the size of the Report screen to 1024 x 768.

Editing Report

Press **Edit** on the *Ultrasound Report* screen to switch to a screen where the report can be edited. You can edit measurement results or change the way that measurements are displayed.

Press **OK** on the screen or the **Exit** button on the control panel to save the changes and close the edit screen. Press **Cancel** to close the edit screen without saving the changes.

[Figure 5.22 Editing Report]

Modify Measurements

Use the Trackball, the **Set** button and the alphanumeric keyboard on the control panel to modify measurements. The values are displayed in grey, indicating that they are modified.

Measurement Display Method

The product allows you to measure one measurement item several times. However, only the first three measurement results are saved in a report.

When taking the same item more than once, measurements can be displayed in four ways as below: On the edit report screen, you can specify or change the measurement display method.

Avg.

Obtain the average of measurements and display it on the screen.

Last

Display the last measurements on the screen.

Max

Display the largest value of the measurements on the screen.

Min

Display the smallest value of the measurements on the screen.

Fetal Description

Move the trackball to select **Description** at the bottom left corner of the screen. This item only becomes active when OB measurement is available. You may select Normal, Abnormal, Not seen, or Seen. If you select one of the group selection items in the combo box, it will be applied to all items.

Adding Comment

Press **Comment** on the *Ultrasound Report* screen to switch to a screen where text can be entered. You can enter a comment or opinion. You can also modify existing comments. You can enter comments without acquiring a measurement.

Press **OK** on the screen or the **Exit** button on the control panel to save the changes and close the edit screen. Press **Cancel** to close the edit screen without saving the changes.

■ Comment Editor

Use this function to save comments you use frequently, so that you can automatically paste the comments later. Enter your comment and press **Apply** to apply the comment immediately. Pressing **Save** will save up to 10 comments.

[Figure 5.23 Comment]

Printing Report

Press **Print** in the report screen. If there is no connection with a printer, this button will not be displayed.

NOTE: You can change the settings for printing measurement reports in **Utility** > **Setup** > **Peripherals** > **Print Setup** > **Measure Report Print**. For more information, refer to "Peripherals Setup" in "Chapter 7. Utility".

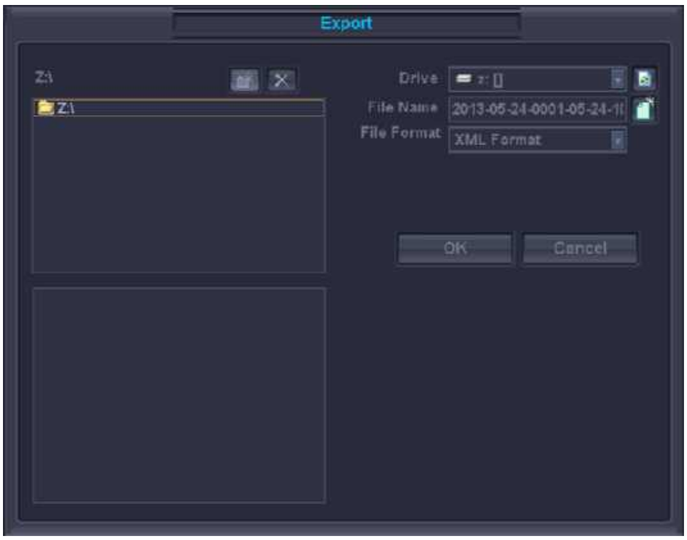
Saving Report

Press **Export** on the report screen. You can save reports into a file.

NOTE: If **Utility** > **Measure Setup** > **General** > **Data Transfer** > **Save to File** > **Write to file** is checked, this button will be displayed.

When the *Write to file* window opens, specify the directory, drive, filename and file type. When using an external storage media, make sure to connect to or disconnect from the storage media by using **Storage Manager**.

Press **OK** to save the report. Press **Cancel** to cancel.



[Figure 5.24 Saving Report]

Transferring Report

Press **Transfer** on the report screen. Transfer the report data using an RS232C cable. A button is created when a measurement is completed.

To use this button,

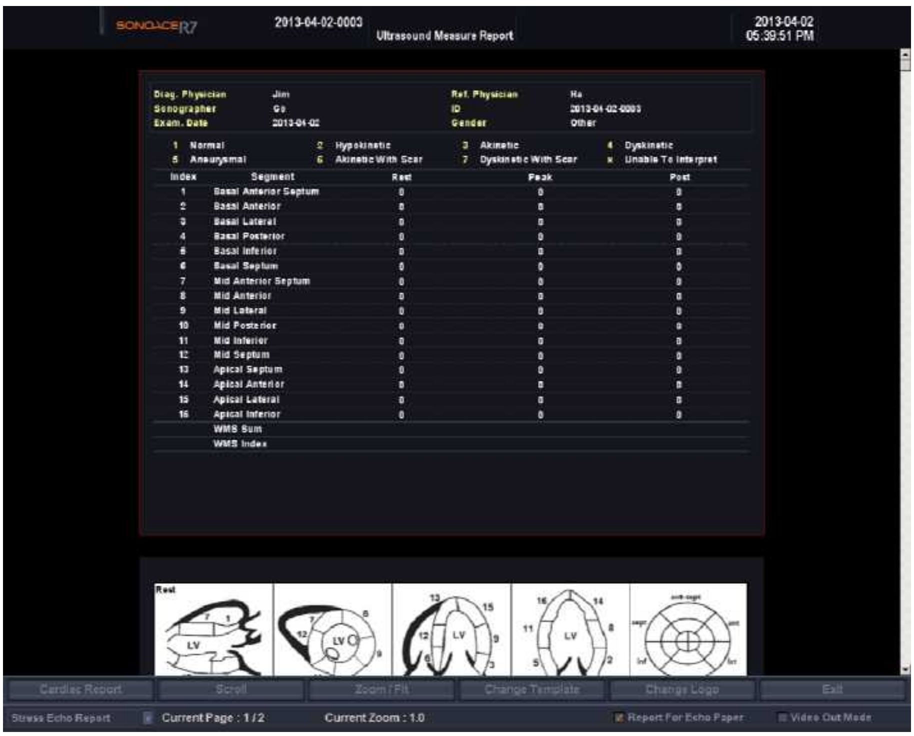
1. Connect the RS232C cable with the console.
2. Set **Utility** > **Setup** > **Peripherals** > **COM** as 'Open Line Transfer'.

Stress Echo Report

Pressing the **Report** button on the control panel while measuring the Stress Echo opens the Stress Echo Report.

NOTE:

- The Stress Echo Report cannot be edited.
- Otherwise, it may be used in the same way as general reports.
- For information on the Stress Echo, please refer to 'Chapter 7. Utility'.



[Figure 5.25 Stress Echo Report]

Graph Function

On the *Ultrasound Report* screen, pressing **Graph** switches to the graph screen, where you can review graphs and history.

NOTE: The graph function is available with OB reports only.

NOTE: If you select 'Graph' for the function of User Key, Graph screen will be displayed when you press the User Key button. Set the function for User Key at **Utility** > **Setup** > **Utility** > **User Key Setup** > **User Key**> **User Key1**.

Press **Report** on the screen to return to the report screen.

Graph

The list of measured items appears in the left side of the screen. If you select an item, a graph for the selected item will appear on the screen.

[Figure 5.26 Graph]

NOTE:

- To display a graph, the LMP or Estab. Due Date should be saved under Patient Information, and the GA table and Fetal Growth table should be enabled.
- A graph is created based on the patient ID, LMP and measurement date.

Select Graph

Use the Trackball and the **Set** button to select an item from the list.

Display Graph

If the **2 x 2** checkbox is checked, 4 graphs will be displayed in a screen.

Specify a desired graph by checking the checkbox for a measurement item.

Percentile Criteria

Select from LMP, EstabDD and Avg.US GA.

- GA by LMP: GA is calculated based on the maternal LMP.
- Estab. Due Date: GA is calculated based on the Estab. Due Date that is entered in the Patient Information.
- Average US GA: GA is calculated using the average value of several ultrasound measurements.
- GA View: If the checkbox is checked, the current GA instead of the current date is shown under History.

Patient

- Patient Information: View patient information.
- Fetus Information: View fetus information.
- Comment: Enter a comment or opinion. Modify existing comments.

Measure

View measurement data.

Trend

Select a graph you want, or select all.

■ History

The current and past measurements for a fetus are displayed in a concise format.

■ Print Checked Graph

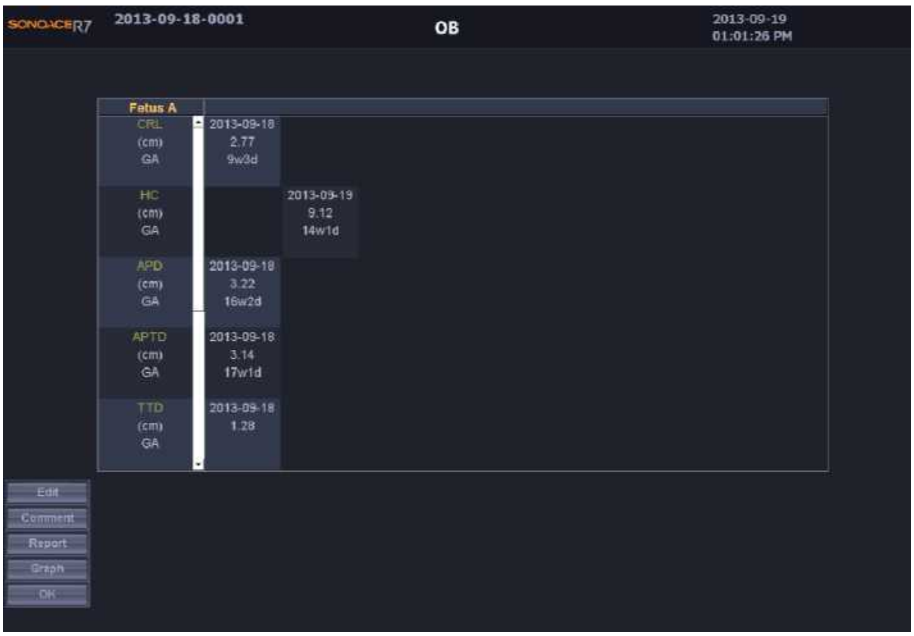
Set the graph layout when you wish to print the reports.

NOTE: Only the graphs selected from the list will be printed.

- ▶ Print Current Graph: Only the currently selected graph is printed.
- ▶ Print Checked Graph (1 x 1): The selected graph is printed in a 1 x 1 format.
- ▶ Print Checked Graph (3 x 2): The selected graph is printed in a 3 x 2 format.
- ▶ Print Screenshot: Capture the screen to print the graph.

History

Press **History** in the left menu on the graph screen. The current and past measurements for a fetus are displayed in a tabular format. You can change the percentile criteria as desired.



[Figure 5.27 History]

Tips!

Standard Deviation & Percentile

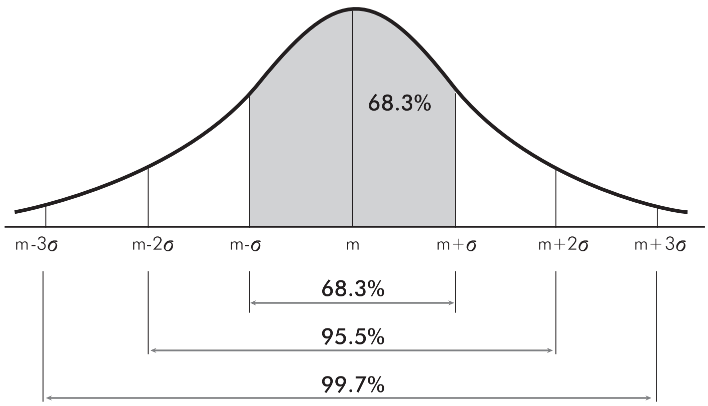
Among OB information, the Growth Table and the typical fetal distribution for the same number of weeks are used to determine the following information:

- The normal distribution curve.
- The measurements for an actual fetus or a position in EFW distribution.
- Whether a distribution point is within the normal range.

The reference number of weeks for the Growth Table can be set to LMP, Estab. DD or Average US GA under **[Pctl.Criteria]**. The typical setting is LMP.

When LMP is not known or uncertain, or when the difference between LMP and Average US GA is substantial, care must be taken, as selecting different **[Pctl.Criteria]** can result in a significant difference.

The distribution of the number of weeks in the Growth Table for the selected reference is a normal distribution that is laterally symmetrical around 50% (the average), and it shows the distance from the average as a deviation. The deviation can be represented by Standard Deviation (SD) or Percentile.



[Figure 5.28 The distribution of the Growth Table for the selected number of weeks (m: Average, σ: Standard Deviation)]

When represented by SD, a point near the average indicates a value closer to ±0 SD and a point away from the average indicates a value closer to the maximum or minimum value. The greater part of the range falls within ±3 SD, and ±1 SD represents 68.3% of the entire range. Thus it can be seen that most fetal measurements are tightly clustered around the average value.

The Percentile represents a point in distribution from between 0 and 100 inclusive. Therefore, the average point is represented as 50 Percentile.

As shown in the figure, the average point corresponds to 0 SD (that is, 50 Percentile). If a point is in the range between -1 SD and +1 SD, it falls within 68.3% of the entire range. This means that the point falls within the range between 16 and 84.

Further, if a point is in the range between -2 SD and +2 SD, it falls within 95.5% of the entire range. Thus, the point falls in the range between 3 and 97.

Tips!

SD and Percentile are interchangeable. Percentile can be used when a fetal measurement ranking is desired, and SD can be used when the distance between actual fetal measurements and the average measurement is sought.

While the range of Growth Table references that are primarily used with OB measurement data varies depending on the user, the typical range accepted by most users is as below:

1) When references are created based on SD:

▶ 2.0 SD - +2.0 SD (when converted to Percentile: 2.28 Percentile - 97.72 Percentile)

▶ 1.5 SD - +1.5 SD (when converted to Percentile: 6.68 Percentile - 93.32 Percentile)

▶ 1.0 SD - +1.0 SD (when converted to Percentile: 15.87 Percentile - 84.13 Percentile)

2) When references are created based on Percentile:

▶ 2.5 Percentile - 97.5 Percentile (when converted to SD: -1.96 SD - 1.96 SD)

▶ 5.0 Percentile - 95.0 Percentile (when converted to SD: -1.645 SD - 1.645 SD)

▶ 10.0 Percentile - 90.0 Percentile (when converted to SD: -1.288 SD - 1.288 SD)

Closing Report

Press **Exit** on the *Ultrasound Report* screen or the **Exit** or **Report** button on the control panel. The system will return to the previous diagnosis mode screen.