SONOACE R3

ENGLISH
Document No. CSD-SMESAR3
Revision 01

Safety Requirements

Classifications:

- Type of protection against electrical shock: Class I
- Degree of protection against electrical shock (Patient connection):Type BF equipment
- 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:

- IEC/EN 60601-1 Medical Electrical Equipment, Part 1General Requirements for Safety.
- IEC/EN 60601-1-1 Safety requirements for medical electrical systems.
- IEC/EN 60601-1-2 Electromagnetic compatibility -Requirements and tests.
- IEC/EN 60601-2-37 Particular requirements for the safety of ultrasonic medical diagnostic and monitoring equipment.
- IEC 61157 Declaration of acoustic output parameters.
- ISO 10993-1 Biological evaluation of medical devices.
- UL 60601-1 Medical Electrical Equipment, Part 1 General Requirements for Safety.
- CSA 22.2, 601.1 Medical Electrical Equipment, Part 1 General Requirements for Safety.

Declarations:

This is CSA symbol for Canada and United States of America

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).

This is GMP symbol for Good Manufacturing Practice of Korea quality system regulation.

READ THIS FIRST

Before asking for the product to be repaired, read this service manual thoroughly, learn how to troubleshoot, and make sure you understand the precautions fully.

The repair of the system and the replacement of parts must be carried out by an authorized dealer or the customer service department of SAMSUNG MEDISON Co., Ltd.

The company is shall not be held liable for any injury and damage caused by not following this warning.

For safe use of this product, you should read ‘Chapter 2. Safety’ in this manual, prior to starting to

useing this system.

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.

Contents

Chapter 1. General Information

Chapter 2. Safety

Contents

Chapter 3. Installing the Product

Contents

Chapter 4. Checking the Product

Contents

제5장 제품 구조

Contents

Chapter 6. Basic Maintenance

Contents

Chapter 7. Troubleshooting

Contents

Chapter 8. Disassembly and Reassembly

Contents

Chapter 9. Probe

Chapter 10. User Maintenance

Chapter 11. Service Part List

Chapter 1. General Information

1.1 Overview

Chapter 1 contains the information necessary to plan the Troubleshooting of SonoAceR3.

The SonoAceR3 is a high-resolution color ultrasound scanner with high penetration and a variety of measurement functions.

Contents

1.2 Features and Advantages of SonoAceR3

- High-end Digital Beamforming : The SonoAceR3 utilizes the newly developed Digital Beam forming technology.
- A variety of applications : The SonoAceR3 is optimized for use in a variety of ultrasound departments, cardiac, vascular, abdomen, Obsterics, Urology, Gynecology.
- Various diagnostic Modes : 2D Mode, M Mode, Color Doppler Mode, Power Doppler Mode, PW Spectral Doppler Mode, etc.
- Measurement and Report Functions : Besides the basic distance, area, circumference and volume measurement functions, the SonoAceR3 also provides application-specific measurement functions. The report function collates measurement data.
- Review of Scanned Images : The SonoAceR3 displays Cine images of 512 frames and loop images of 4096 lines.
- SonoViewTM : This is a total ultrasound image management system, which allows a user to archive, view and exchange documents.
- Digital Imaging and Communication in Medicine (DICOM) Function : This is used to archive, transmit and print DICOM images through a network.
- Peripheral/Accessory Connection : A variety of peripheral devices including VCRs and printers can be easily connected to the SonoAceR3.

1.3 Product Configuration

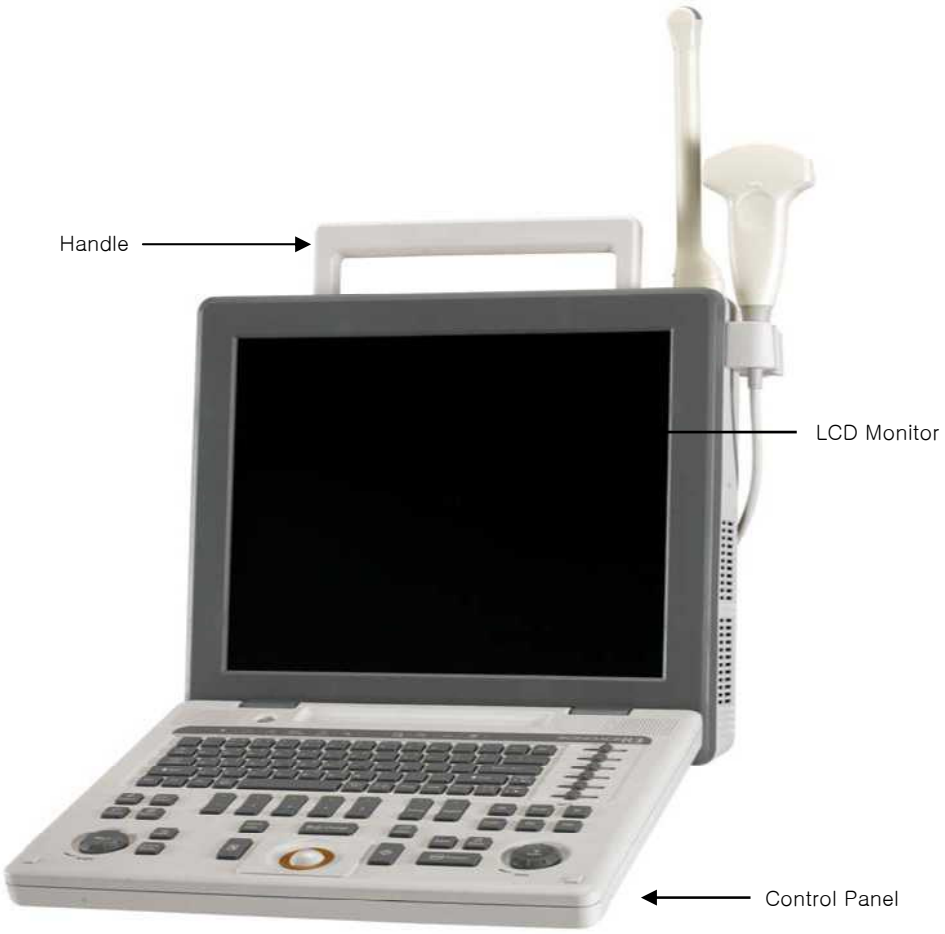
This Product consists of the monitor, the control panel, the console and, the probes and the cart(optional).

1.3.2 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.

The outside of the console consists of various connection ports and handles.



[Figure 1-1] Console of SonoAce R3

[Figure 1-2] Front and Back of SonoAce R3

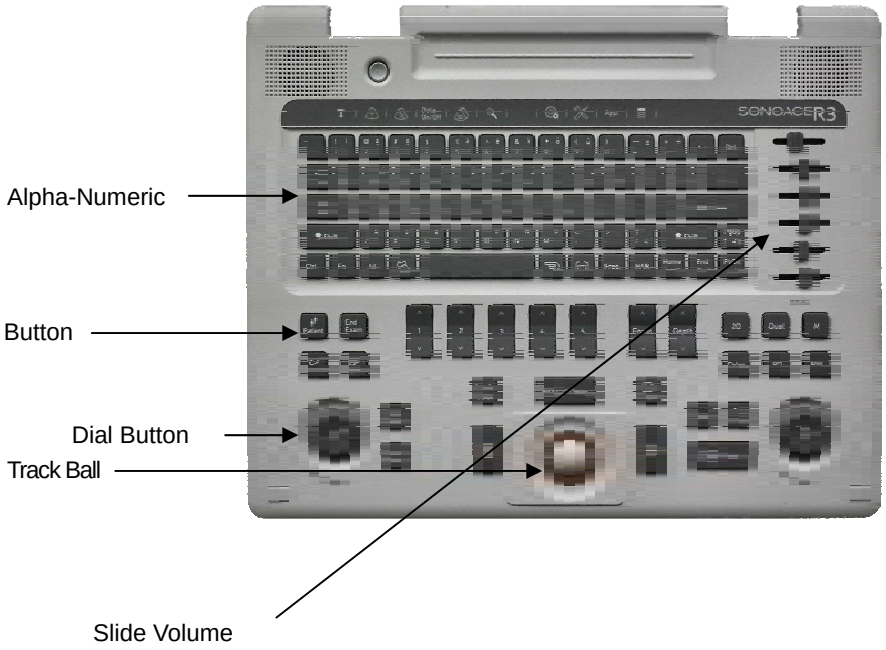
1.3.2 LCD Monitor

The monitor of this system is a color VGA monitor, which displays ultrasound images and additional information. This monitor is connected to the main body through a central pivot, allowing it to be tilted to the optimal viewing angle.

[Figure 1-3] LCD Monitor

1.3.3 Control Panel

The control panel can be used for controlling the system.



[Figure 1-4] Control Panel

1.3.4 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 'Chapter 9. Probes'.

1.3.5 SonoAceR3 Cart (Optional)

The SonoAce R3 System can be placed on a cart during use or for transport. For more information on installing and using the SonoAce R3, please refer to the installation guide that comes with it.

[Figure 1-5] SonoAce R3 Cart

1.4 Specifications

Physical Dimensions	Height: 375mm (with handle) Width: 402mm (with probe holder) Depth: 188mm(with control panel) Weight: More than 8.7kg
Imaging modes	2D real-time Dual 2D real-time 2D/M-mode Power Doppler Color Doppler for Option Pulsed-wave Doppler for Option 3D-mode (Freehand) for Option Simultaneous
Gray Scale	256 (8 bits)
Focusing	Dynamic transmit focusing, maximum of eight points (four points simultaneously selectable) Digital dynamic receive focusing (continuous)
Probes	Curved Linear Array : C2-4/20, CN2-8, CN4-9 Linear Array : L5-12/60, LN5-12/40 Endocavity Curved Linear Array : EC4-9
Probe connections	One probe connectors Two probe connectors for option
Monitor	15 inch LCD monitor
Rear Panel Input/Output Connections	USB 3ports LAN(10/100 BASE-T) DVI Output BW Printer remote control BW Output S-VHS Output Sound Output
Image Storage	Maximum 512 frames for CINE memory Maximum 4096 Lines for LOOP memory Image filing system
Application	Gynecology, Abdomen, OB, Renal, Urology, Vascular, Small Part, Fetal Heart, Breast, Musculoskeletal, Pediatric, Neonatal, Cardiac
Electrical Parameters	100-120V/200-240V, 250VA, 50/60Hz

Automatic Calculation and Quantification	Obssterics Gynecology Cardiology Fetal Echo Vascular Urology *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 HD zoom
Signal processing (Post-processing)	Frame average Gamma-scale windowing Image orientation (left/right and up/down, rotation) White on black/black on white
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	Black-and white printer Color printer VCR Monitor Foot switch
User Interface	English, German, French, Spanish, Italian, Russian, Chinese
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 ^{O}C ~ 35^{O}C Storage & Shipping: -25^{O}C ~ 60^{O}C

Chapter 2. Safety

2.1 Overview

Chapter 2 contains the information necessary to Safety

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 R3 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.

Contents

2.2 Safety – Related Information

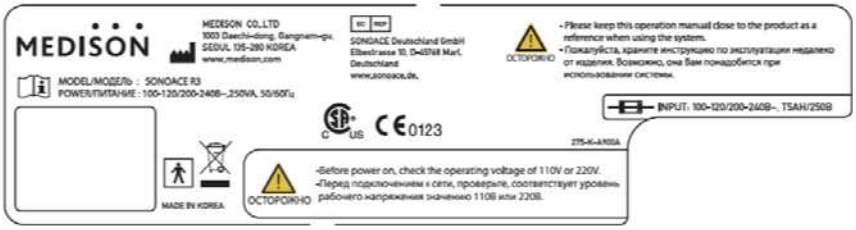
2.2.1 Safety Symbols

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

Symbols	Description
	Isolated patient connection (Type BF applied part).
	Power switch (Supplies/cuts the power for product).
	Indicates a caution for risk of electric shock.
	Indicates dangerous voltages over 1000V AC or over 1500V DC.
	Warning, Caution
	AC (alternating current) voltage source
	Print remote output
	Electrostatic discharge
	Network port
	Output port (DVI, RGB, B/W, S-VHS, SOUND)
	Protection against the effects of immersion.
	Protection against dripping water.
	Probe connector

2.2.2 LABEL

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



[Figure 2-1]Marked on the product

2.3 Electrical Safety

This equipment has been verified as a Class I device with Type BF applied parts.

2.3.1 Prevention of Electric Shock

Additional equipment connected to medical electrical equipment must comply with the respective IEC or ISO standards (e.g. IEC 60950 for data processing equipment). Furthermore all configurations shall comply with the requirements for medical electrical systems (see IEC 60601-1-1 or clause 16 of the 3 Ed. of IEC 60601-1, respectively). Anybody connecting additional equipment to medical electrical equipment configures a medical system and is therefore responsible that the system complies with the requirements for medical electrical systems.

Attention is drawn to the fact that local laws take priority over the abovementioned requirements. If in doubt, consult your local representative or the technical service department.

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, 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_20) should be avoided.

CAUTION

- The system has been designed for 100-120VAC and 200-240VAC; you should select the inputOutlet voltage of monitor, printer and VCR. Prior to connecting an OEM power cord, verify that the voltage indicated on the power cord matches the voltage rating of the OEM 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 operator does not contact the parts (SIP/SOP) and the patient simultaneously.

2.3.2 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.

[Figure 2-7] ESD symbol

2.3.3 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.

2.3.4 EMC

The testing for EMC(Electromagnetic Compatibility) of this system has been performed according to the international standard for EMC with medical devices (IEC60601-1-2). This IEC standard was adopted in Europe as the European norm (EN60601-1-2).

2.3.4.1 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 (Radiation) CISPR 11	Group 1 Class B	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. 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.
RF Emission (Radiation) CISPR 11	Group 1 Class B	
Harmonic Emission IEC 61000-3-2	Class A	
Flicker Emission IEC 61000-3-3	Complies	

2.3.4.2 Approved Cables, Transducers and Accessories for EMC

1) 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	2.5m
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

2) Approved Transducer for Electromagnetic Compliance

The probe listed in 'Chapter 8. Probes' when used with this product, have been tested to comply with the group1 class B emission as required by International Standard CISPR 11.

3) 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 inincreased emission or decreased Immunity of the Ultrasound System.

Immunity test	IEC 60601 Test level	Compliance level	Electromagnetic environment - guidance
Electrostatic 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 (>95% dip in U_T) for 0.5cycle 40% U_T (60% dip in U_T) for 5 cycle 70% U_T (30% dip in U_T) for 25 cycle <5% U_T (<95% dip in U_T) for 5 s	<5% U_T (>95% dip in U_T) for 0.5cycle 40% U_T (60% dip in U_T) for 5 cycle 70% U_T (30% dip in U_T) for 25 cycle <5% U_T (<95% dip in U_T) for 5 s	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.			
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	3 V/m	Where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and *d* is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters, as deter-mined 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.

2.3.4.3 Recommended separation distances between portable and mobile RF communications equipment and the SonoAce R3

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 $d = [\frac{7}{E_1}]\sqrt{P}$
	V_1=0.01Vrms	E_1=3 V/m	E_1=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.
NOTE2) These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

2.3.4.4 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.

2.3.4.5 Avoiding Electromagnetic Interference

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

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

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

SAMSUNG MEDISON Ultrasound System does 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 source of interference are medical device, information technology products, and radio and television transmission towers. Tracing the source of radiated interference can be a difficult task. Customers should consider the following in an attempt to locate the source:

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 transducer 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.

2.4 Mechanical Safety

2.4.1 Moving the Equipment

CAUTION

- Always turn the power off and disconnect the cables before moving the product.

NOTE

- Use the handle on the product, and move the product slowly. You can also move the product by using the SonoAce R3 Cart (Optional).

2.4.2 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.
- Incorrect cleaning or sterilization of a patient-applied part may cause permanent damage.

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

2.5 Biological Safety

Verify the alignment of the Probe before use. See the "Chapter 9. Probes" section of this manual.

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.

2.5.1 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 bio effects. Since the threshold for diagnostic ultrasound bio effects 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..

2.5.1.1 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.

2.5.1.2 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.

2.5.1.3 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.

2.5.1.4 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.

2.5.1.5 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.

2.5.1.6 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) and bone (TIb). 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.

1) Mechanical Index (MI) Display

Mechanical bio effects 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 bio effects 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 bio effects 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.

2) 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.

3) 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.

2.5.1.7 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 onscreen output values.

1) 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.

2.5.1.8 2D mode Controls

1) 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.

2) 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.

3) Persistence

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

4) 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.

5) 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.

2.5.1.9 Color and Power Controls

1) 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.

2) 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.

3) 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.

4) 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

5) 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.

2.5.1.10 M mode and Doppler Controls

1) Speed

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

2) 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.

3) 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.

2.5.1.11 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.

1) 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.

2) DEPTH

An increase 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.

3) 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.

2.5.1.12 Related Guidance Documents

For more information about ultrasonic bio effects and related topics refer to the following;

AIUM Report, January 28, 1993, “Bio effects and Safety of Diagnostic Ultrasound”

Bio effects 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.

2.5.1.13 Acoustic Output and Measurement

Since the first usage of diagnostic ultrasound, the possible human biological effects (bio effects) of ultrasound exposure have been studied by various scientific and medical institutions. In October 1987, the American Institute of Ultrasound in Medicine(AIUM)은 Bio effects Committee (Bio effects

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"Bio effects 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)

2.5.1.14 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 [$e^{-(0.23alf)}$]

where: In Situ = In Situ Intensity Value
Water = Water Value Intensity
e = 2.7183
a = Attenuation Factor

Tissue	a(dB/cm-MHz)
Brain	.53
Heart	.66
Kidney	.79
Liver	.43
Muscle	.55

l = skin line to measurement depth (cm)
f = Center frequency of the 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 [$e^{-(0.069lf)}$]

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.

2.5.1.15 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/cm_2.

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 range 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).

2.5.1.16 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 %

1) 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.

2.6 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.

Waste Electrical and Electronic Equipment

Chapter3. Installing the Product

3.1 Overview

Chapter 3 contains the information necessary to plan the installation of SonoAce R3 and install it. This chapter describes the requirements for the transportation and installation environment for the product, so that the product is installed in the best condition. Also included are product installation and set up procedures and electrical security check procedures. In addition, procedures for connecting probes and external equipment are included.

Contents

3.2 Transportation

SonoAce R3 is a sensitive piece of electronic medical equipment. Take care when moving it.

3.2.1 Precautions for Transportation

The box packaging is designed to diminish the effects of any impact to the product. However, take care not to subject the product to any external impact.

3.2.2 Temperature and Humidity

The following [Table 3-1], “Temperature and Humidity Requirements” shows the required temperature and humidity for the transportation, care and operation of the product.

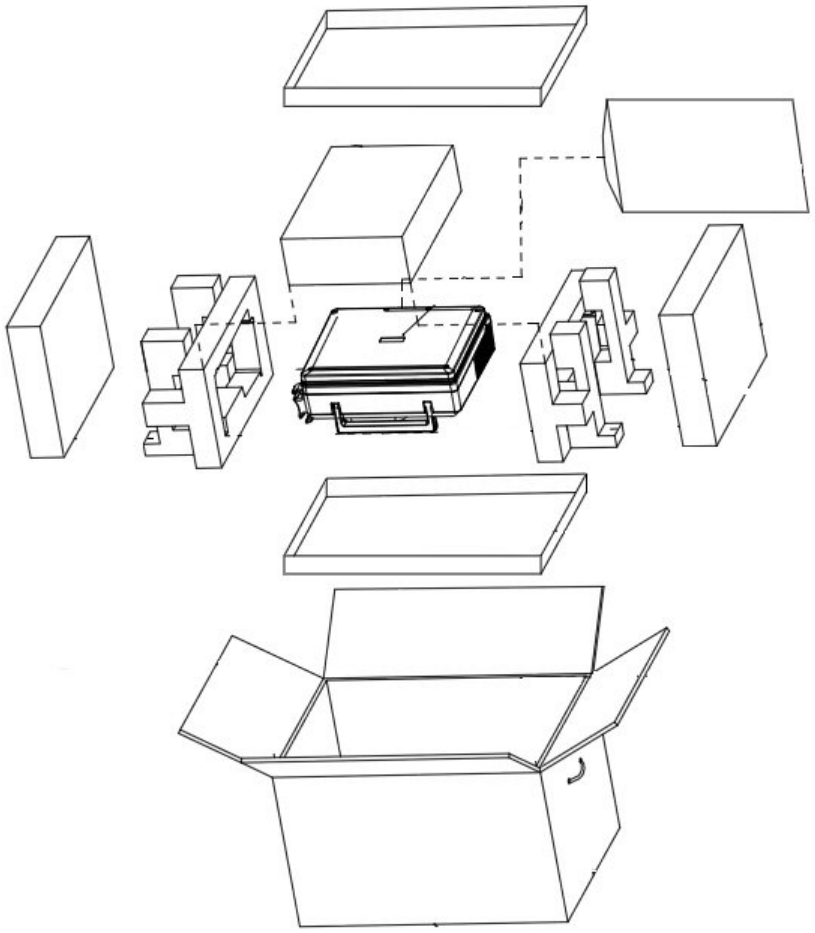
Type	Temperature [^{O}C]	Humidity [%]
Transportation	-25 ~ 60	20 ~ 90
Care	-10 ~ 50	20 ~ 90
Operation	10 ~ 35	30 ~ 75

[Table 3-1] Temperature and Humidity Requirements

3.3 Unpacking

3.3.1 Unpacking the Box

1) Remove the box strap.
2) Lift the top side of the box up and remove it.
3) Lift the box body up and remove it.
4) Remove the protective plastic packaging.
5) Take the probe and accessory boxes out and put them in a safe place.



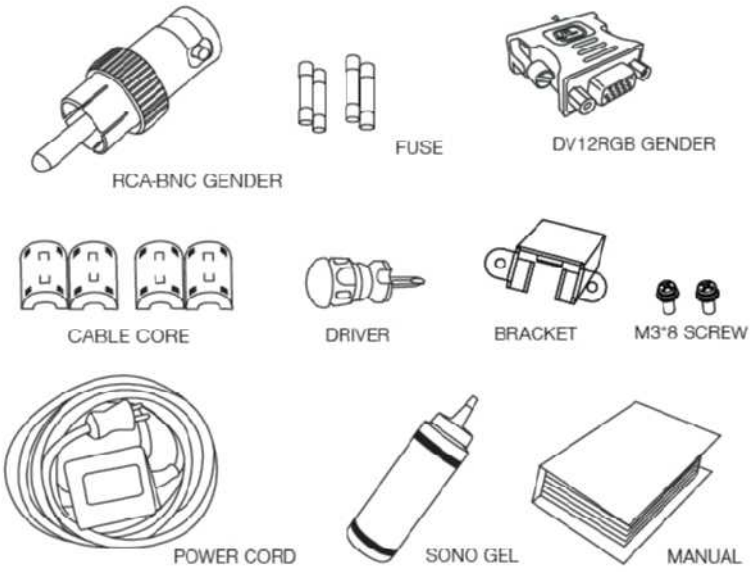
[Figure 3-1] Unpacking the Box

CAUTION

When moving the product up a steep incline or over a long distance, there is a danger of injury.

3.3.2 Checking Package Contents

Unpack the product's packaging and check the package contents.
If there are any missing parts, contact your dealer.



[Figure 3-2] Contents of SonoAce R3 Package

3.4 Precautions for Installation

3.4.1 Precautions

Please follow the precautions below.

1) Avoid installing the product where water may get into it.
2) Avoid installing the product in direct sunlight.
3) Avoid installing the product in places where there are high temperature fluctuations.
4) Temperatures of 10OC ~ 35 OC and a humidity of 30% ~ 75% are required for normal operation..
5) Avoid installing the product near a heater.
6) Avoid installing the product in a dusty location, or where there is a lack of ventilation.
7) Avoid installing the product in a location subject to vibration.
8) Avoid installing the product where there are chemicals or gas.

CAUTION

- If you use the product near a generator, X-Ray equipment, or a broadcasting transmission cable, the screen may not work normally due to interference.
- In addition, sharing the same wall outlet with other electric equipment may cause noise.

3.5 Installation Procedure

3.5.1 Installation Safety

DANGER

- If you use the product near a generator, X-Ray equipment, or a broadcasting transmission, cable, the screen may not work normally due to interference.
- In addition, sharing the same wall outlet with other electric equipment may cause noise.

CAUTION

- When moving or storing the product for a long time, you should check the temperature and humidity of the environment.
- Turn the power on after referring to the information in the following [Table 3-2] “ProductOperation Temperature”.
- Sudden temperature change causes dew and may generate problems in the product.

Temperature	-20	-15	-10	-5	0	5	10 ~ 35	45	50	55	60
Time to Wait	16	10	8	6	4	2	즉시 사용	2	4	6	10

[Table 3-2] Product Operation Temperature

3.5.2 Connecting the Power Cord

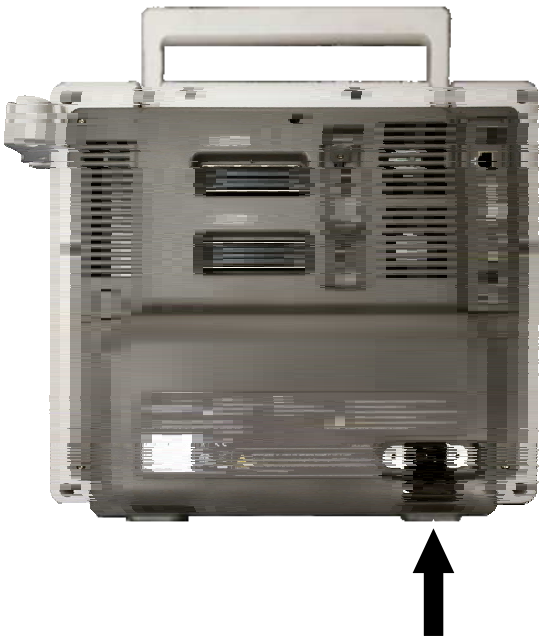
Make sure to check the output voltage of the wall outlet in the installation location.

For the stable operation of EKO7, use it within the voltage range specified in the following [Table 3-3] “Product Voltage”.

Connect the power cord to the power port on the back panel of SonoAce R3.

NOTE

The product and the power cord may be connected before shipping.



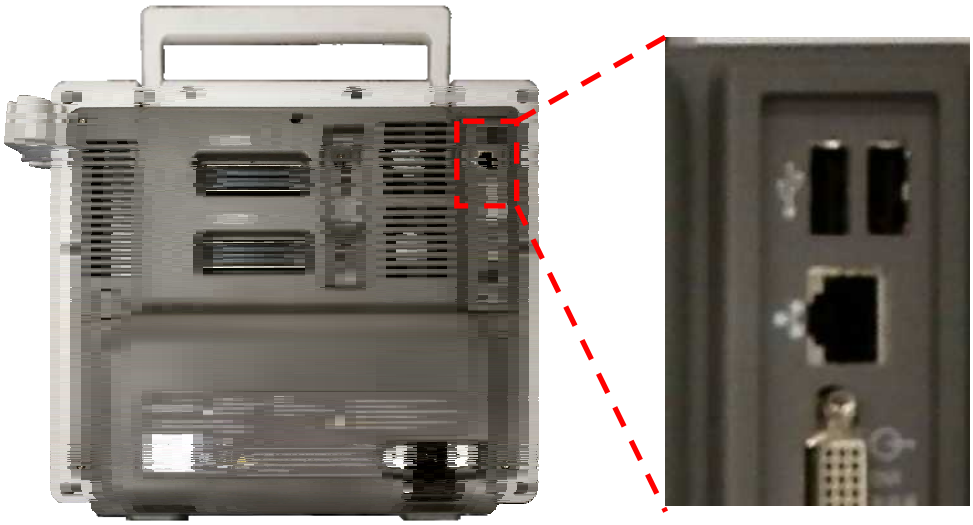
[Figure 3-3] Product Power

Voltage	Allowable Voltage Range	Current	Frequency
100-120VAC	+/- 10%	10A	50~60Hz
200-240VAC	+/- 10%	10A	50~60Hz

[Table 3-3] Product Voltage

3.5.3 Connecting the Network Cable

Connect the network cable to the LAN port on the back panel of SonoAce R3.



[Figure 3-4] Network Cable Connection

3.5.4 Connecting the Probe

SonoAce R3 provides 2 probe connections on its back panel.

Place a probe in the probe holder and connect it up.

⚠ CAUTION

Do not connect with excessive force, to prevent damage to the probe connection pin and the connector PCB.

1) Connect probe when the probe locking lever is unlocked .

2) Connect probe with the probe cable pointing downwards..

NOTE

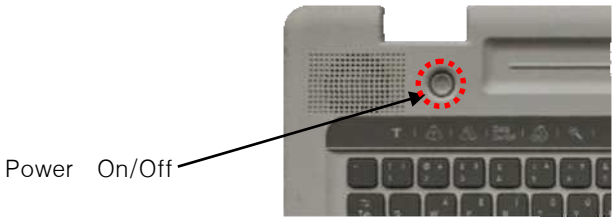
Probe of connection options, depending on the product may be a number.

⚠ CAUTION

Although you can connect a probe when the power is on, do not connect or disconnect a probe during the booting sequence of the product.

3.6 Starting the Product

1) Check again if the power capacity is compliant with EKO7 and connect the power cord to the wall outlet..
2) After checking the connection between SonoAce R3 and power cable, turn on the power switch on the control panel. [Figure 3-10]



[그림 3-5] Control Panel Power button

CAUTION

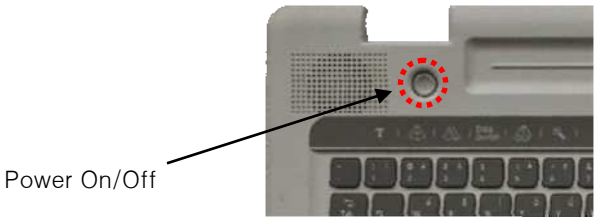
During booting the system, do not press any key of the alphanumeric keyboard. It may cause malfunction.

3) To start SonoAce R3, press the On/Off switch at the right side of the control panel (keyboard).
   ① The booting sequence is displayed on the LCD monitor. As the SonoAce R3 logo and loading bar appear.
   ② The loading bar fills with color. This represents data being copied to the Front End and Back End of system by the PC software.
   ③ When software data copying is completed, the ultrasound picture appears and the system becomes ready. The booting sequence of the product takes approximately 1 minute.

3.7 Shutting down the Product

SonoAce R3 to the end of the control panel Power On / Off button is used.

Turning the system off: Press the On/Off switch at the right side of the control panel(keyboard). Press and hold down the button for 2 seconds to turn the product On..



[그림 3-6] Power Switch

CAUTION

- Switching off the cut-off switch : You can cut off the power by switching off the cut-off switch after turning the system off.
- Cut the power off in the event of storing the product for a long period of time, or when repairing the product.

3.8 Connecting the Peripherals

SonoAce R3 provides various connectors so that various external devices can be connected. Peripherals can include a mono printer, color printer, line printer, USB storage device, and VCR. These are peripheral devices that can be connected for use when needed and are connected via the USB port located at the rear panel.

NOTE

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

CAUTION

When using a peripheral device from a USB port, always turn the power off before connecting/disconnecting the device. Connection / disconnection of USB devices during power-on may lead to malfunction of the system and USB devices.

NOTE

- When remove the removable disk, use Utility > Storage manager.
- We recommend that you connect USB storage devices (MO drive, flash memory media,etc.) to the ports on the front panel and other USB peripheral devices to the rear panel for added convenience..

3.8.1 External Peripherals

3.8.1.1 Video Page Printer

Color : SONY UP-20, SONY UP-21MD

Black and White : SONY UP-897MD, MITSUBISHI P-91, MITSUBISHI P-93W

3.8.1.2 USB Video Printer

Color : SONY UP-D23MD

Black and Whiite : SONY UP-D897

3.8.1.3 InkJet Printer

HP DeskJet 5650, HP DeskJet 5940, HP DeskJet 6540, HP DeskJet 6970, HP DeskJet 6980

3.8.1.4 LaserJet Printer

HP LaserJet 1320, HP LaserJet 2420, HP LaserJet P2015, HP Color LaserJet 3600, HP OfficeJet J5780, HP OfficeJetPro K550

3.8.1.5 USB MO Disk Drive

Fujitsu DynaMO1300U2B

3.8.2.6 Flash Memory media

Imation iFLASH USB2.0 1GB, Imation USB Swing Blue 1G

3.8.2.7 CD-RW

MyBox(External USB Case)+ LG CDRW 52x, LiteON LTR-52327SX CD-RW

LiteON CD-RW/DVD-ROM(SOHC-5232KX), LiteON CD-RW(SOHR-5239SX)

CAUTION

- You must install Linux or above (English) compatible printer and driver Contact SAMSUNG MEDISON customer service Team for inquiries about printer driver installation.
- When connecting the printer, ensure that the printer is configured under Linux 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.

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 possibleto save the file format on a desktop PC before trying to save the file on a Flash Memory.

3.9 System Settings

This mode is used for system settings. It does not affect image output. The setup may be modified depending on specific needs or preferences.

1. Press the “8” key, Setup, on the keyboard
2. The Setup screen will appear. Select a tab that has items to specify.
3. Specify settings for each item.
4. The setting is completed when you press the “8”key.

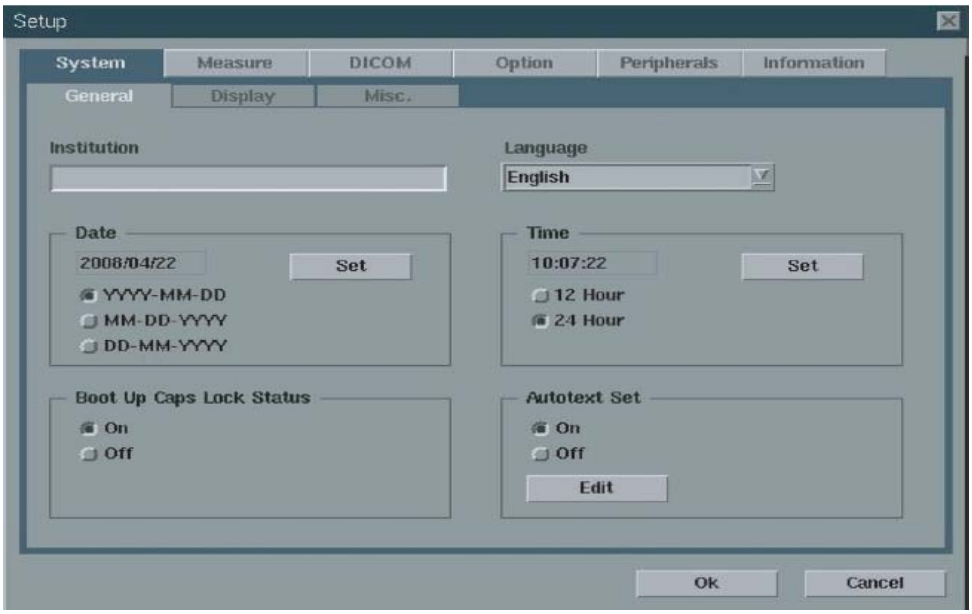
※ Tips! –Selecting a tab

-You can select a tab in either of two ways as desired.

- Use the Trackball and the Set button to select a tab.

3.9.1 General System Setup

Select the General tab in the Setting screen. You can specify general settings such as title settings



[Figure 3-7] Setup-General

3.9.1.1 Institution

Enter the name of the hospital / institution

3.9.1.2 Language

This sets the language to be used. English, Deutsch, Français, Italiano, Español, Russian, and Simplified Chinese are available. To display the screen in the selected language, reboot the system after completing setup.

The input setup of key button is automatically updated..

NOTE

You cannot input following characters; # [" ; : ? | ₩

3.9.1.3 Date

The current date is displayed. To change the date, press.

3.9.1.4 Time

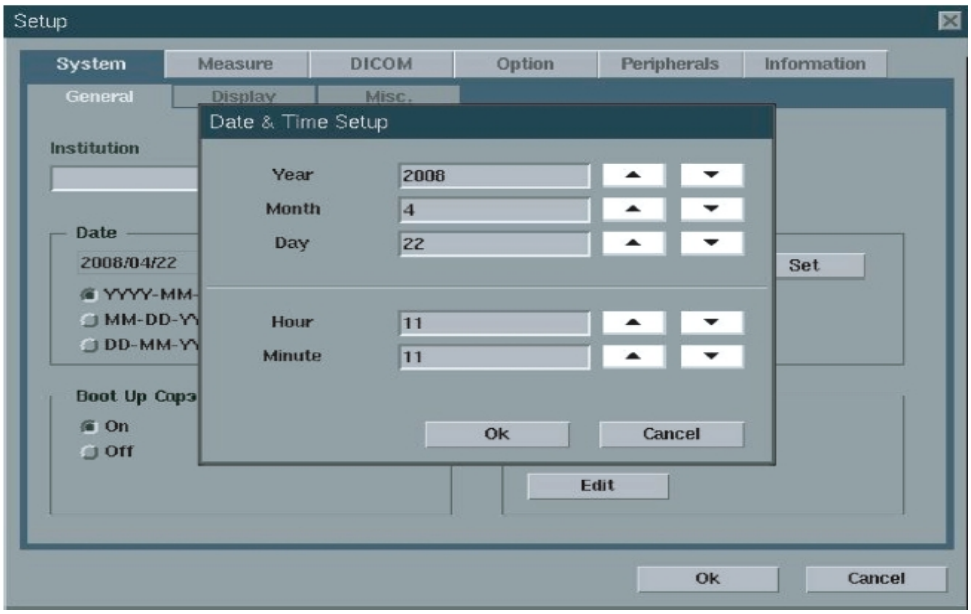
The current time is displayed.

NOTE

- You cannot change the date and time when a patient ID is registered. To change the date and time, you should finish the current diagnosis by pressing End Exam on the control panel.
- You can select the year from 2006 to 2027.

※Tip! How to set the date and time

1. Press [Set] in the Date (or Time) button.
2. Set the date and time by using the Trackball and the Set button on the control panel.
3. If it is properly set, press Apply to apply changes. Press OK to close the Date & Time window. To cancel, press Cancel or the Exit button on the control panel.



[Figure 3-8] Date & Time

3.9.1.5 Boot Up Caps Lock Status

This menu sets the initial status of Caps Lock after system boot-up. Its default value is 'Off'. This Caps Lock enables capital letter entry without the need to press the Shift key.

3.9.1.6 Autotext Set

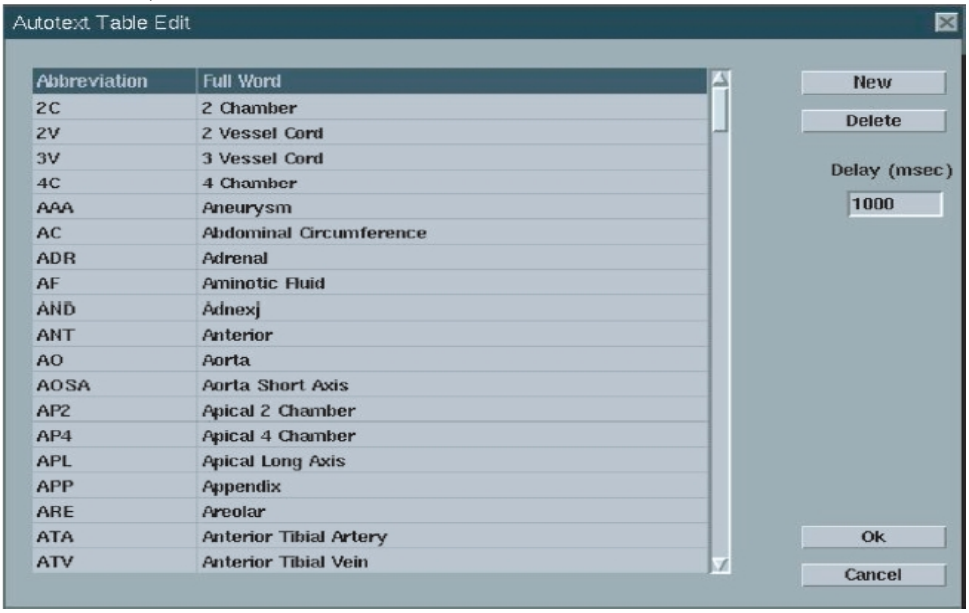
Select Autotext Set to use the Autotext text function. Its default value is 'Off'.

Using the Autotext text function allows fast and easy input of text statements. For example, to enter the text 'Tumor', you only need to enter 'Tu' and the system will search the word from the abbreviation list and automatically enter the word 'Tumor'.

※Tip! Autotext Set Edit

Click Edit on the screen. The Autotext Table Edit Table window will be appeared. To add a new abbreviation, click New, and to completely delete an existing abbreviation, click the entry to be deleted and then click Delete.

'Delay(msec)' sets seconds to input the full word after enter the abbreviation. The unit value is msec, and 1000msec is 1second.



[Figure 3-9] Autotext Set Edit

3.9.2 Display Setup

To set the information about images and related data, select the Display tab in the System menu.

3.9.2.1 Auto Freeze

After the preset time span (Minute) of inactivity, the scan mode is automatically frozen

3.9.2.2 Post Map

This sets the display of the Post Map in the Feedback section at the bottom of the screen.

3.9.2.3 TGC Line

This sets whether or not the TGC line is displayed. If 'Off' is selected, the TGC Line is not shown. If 'Off after 3 seconds' is selected, the TGC value appears when a TGC value is adjusted, but disappears after 3 seconds. If 'On' is selected, the TGC Line is always shown.

3.9.2.4 TI (Thermal Index) Display

The system sets TI values automatically. However, this menu allows the user to choose manually from one of the three TI parameters as desired: Default, TIs or TIb

3.9.2.5 HPRF

Enable or disable High Pulse Repetition Frequency (HPRF) supported in the PW Spectral Doppler mode. If it is set to 'On,' HPRF is supported by default

3.9.2.6 Bodymarker After Freeze

Determine whether the system will automatically switch to the Body Marker mode when the Freeze button is pressed. If it is set to 'On,' a Body Marker appears when the Freeze button is pressed during scanning. If it is set to 'Off,' a Body Marker appear only when BodyMarker is pressed during scanning

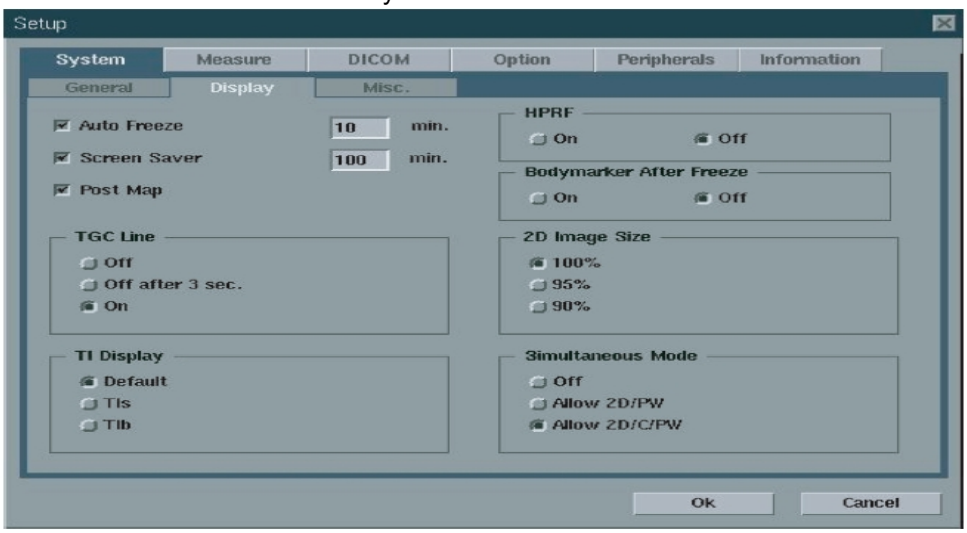
3.9.2.7 2D Image Size

The Image size can be set to 100%, 95% or 90%.

3.9.2.8 Simultaneous Mode

This menu determines whether or not simultaneous mode is enabled in PW Spectral Doppler Mode.

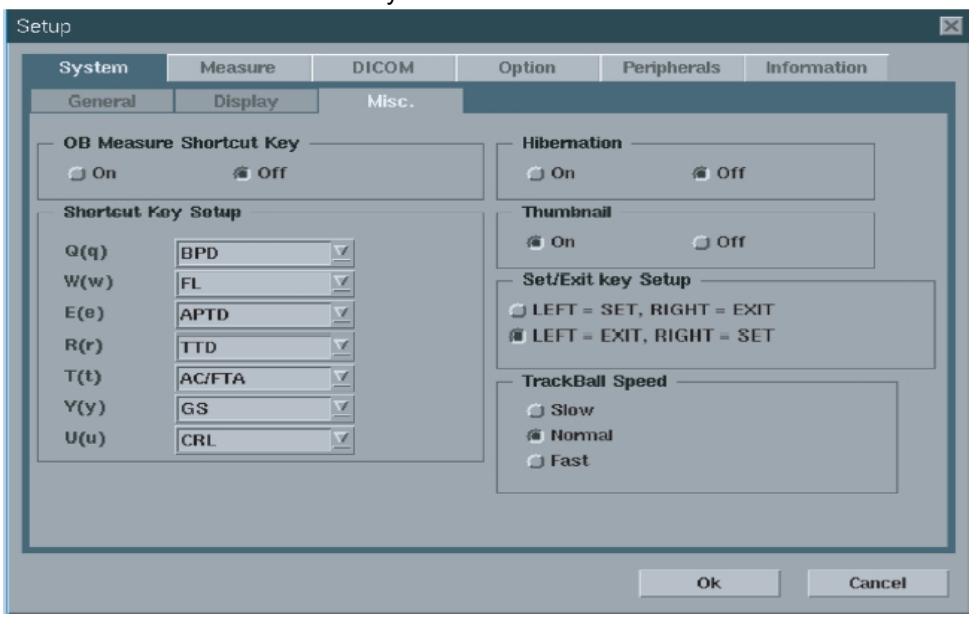
- 'Off': Select this if you do not wish use simultaneous mode.
- 'Allow 2D / PW: Select this if you wish to use simultaneous mode in 2D / PW mode.
- 'Allow 2D / C / PW: Select this if you wish to use simultaneous mode in 2D / C / PW mode.



[Figure 3-10] System-Display

3.9.3 Misc

Select the Misc. tab in the System menu.



[Figure 3-11] Misc.

3.9.3.1 OB Measure Shortcut Key

Assign commonly used obstetrics measurement items to number keys in the alphanumeric keyboard. You can use this feature to start a desired obstetrics measurement instantly while scanning.

3.9.3.2 Shortcut Key Setup

Metrics in the obstetrics of the numeric keyboard set. BPD, FL, APTD, TTD, AC / FTA, GS, CRL can choose.

3.9.3.3 Hibernation

To booting speed up, set this item as ‘On’.

NOTE

The system turns off with normal shutdown after 30th booting with ‘Hibernation On’. However the system will start with ‘Hibernation On’ on the next booting.

3.9.3.4 Thumbnail

To use thumbnail list, set this item as ‘On’. Thumbnails of saved images are showed up on the right side of the screen.

3.9.3.5 Set/Exit Key Setup

Set the position of the Set and Exit buttons.

3.9.3.3 TrackBall Speed

Set the trackball speed during scan mode to Slow, Normal or Fast

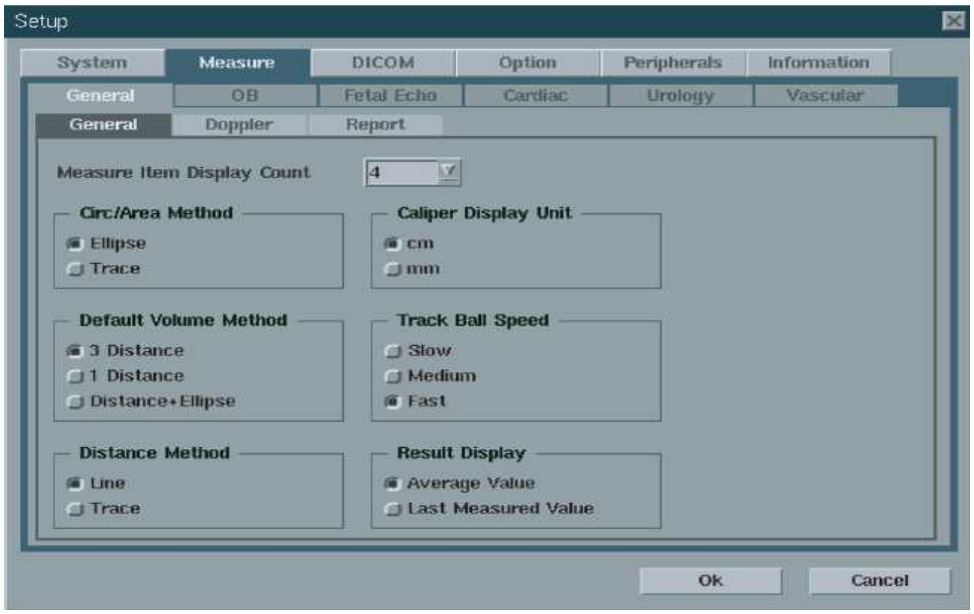
3.10 Setting Measurements

Select Measure in the Setup menu to set up measurement functions.

1. Press the Setup key on the keyboard. Setup screen is appeared.
2. Select Measure in the Setup menu.
3. Set the specific system values according to each item on the screen.
4. Click Ok to finish the setup. To close the screen, click Cancel or X.

3.10.1 General

Select the General tab in the Measure menu to set general measurement settings.



[Figure 3-12] Measure-General

3.10.1.1 Measure Item Display Count

Select the number of measurement items to be between 1 and 3. If you select 'Hide', measurement items are not displayed.

3.10.1.2 Circ/Area Method

Select either the 'Ellipse' or 'Trace' caliper to be the default tool for measurement.

3.10.1.3 Default Volume Method

Select either the '3 Distance', '1 Distance' or 'Distance + Ellipse' items to be used as the default tool in volume measurement.

3.10.1.4 Distance method

Set either 'Line' or 'Trace' as the distance measurement method.

3.10.1.5 Caliper Display Unit

Set either ‘cm’ (centimeter) or ‘mm’ (millimeter) as the caliper display unit.

3.10.1.6 Track Ball Speed

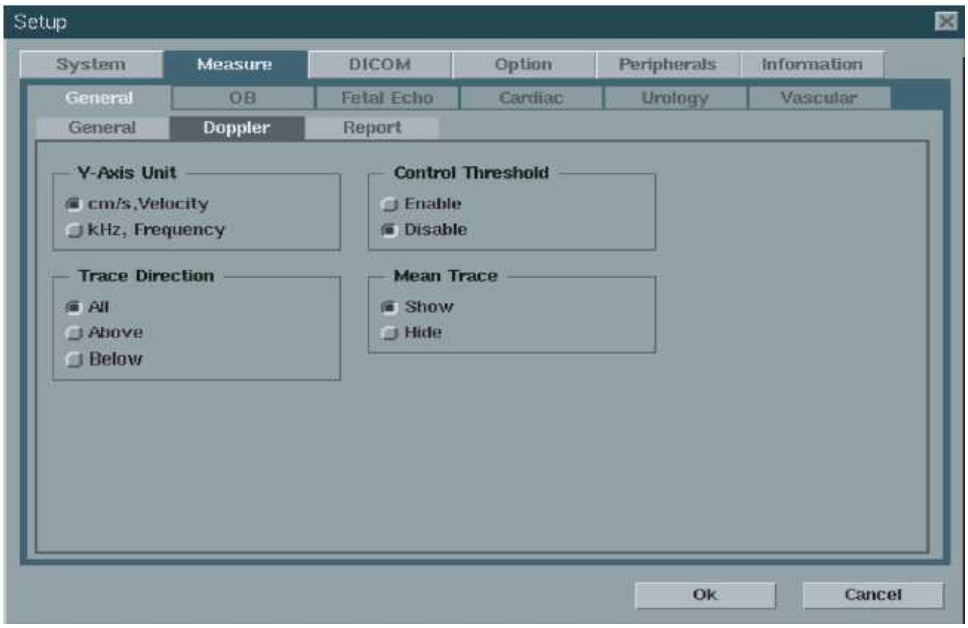
Set the trackball speed to either ‘Fast’, ‘Medium’ or ‘Slow’

3.10.1.7 Result Display

Set the output format of measurement results in the report. When ‘Average Value’ is selected, the report shows the average value of the last three measurement results. When ‘Last Measured Value’ is selected, the last measurement value is shown

3.10.2 Doppler

Select the Doppler tab in the General tab.



[Figure 3-13] Measure-Doppler

3.10.2.1 Y-Axis Unit

This sets the vertical (Y) axis unit in Spectral Doppler Mode.

3.10.2.2 Trace Direction

When Auto Trace and Limited Trace functions are used in Spectral Doppler Mode, this sets the range of the measurement values

3.10.2.3 Control Thershold

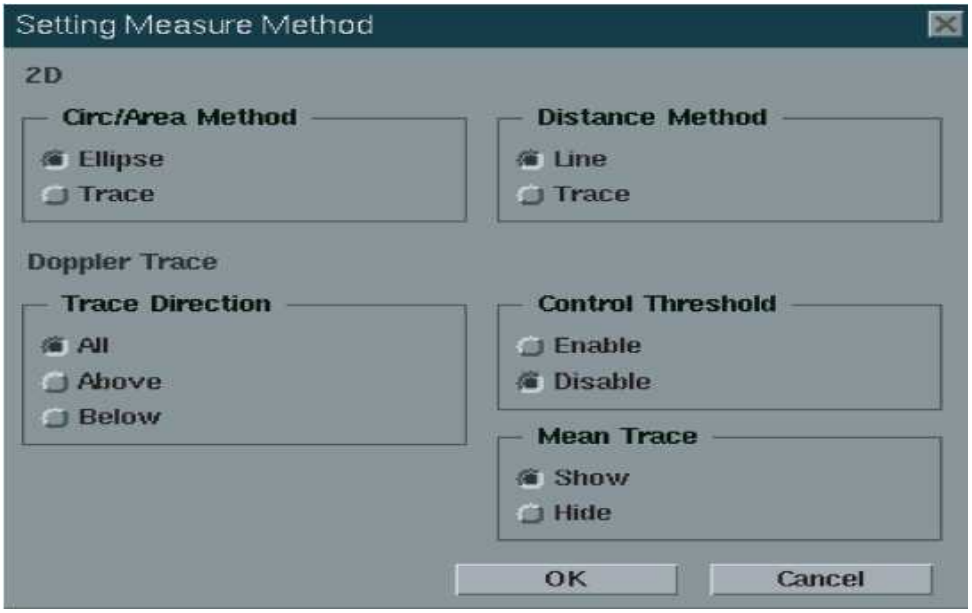
The trace threshold can be adjusted by rotating the Menu dial-button when tracing is not finished after Auto trace / Limited trace.

3.10.2.4 Mean Trace

This menu specifies the use of Mean Trace Line on the screen for Auto trace / Limited trace.

※Tip! How to change Doppler setting during measurement

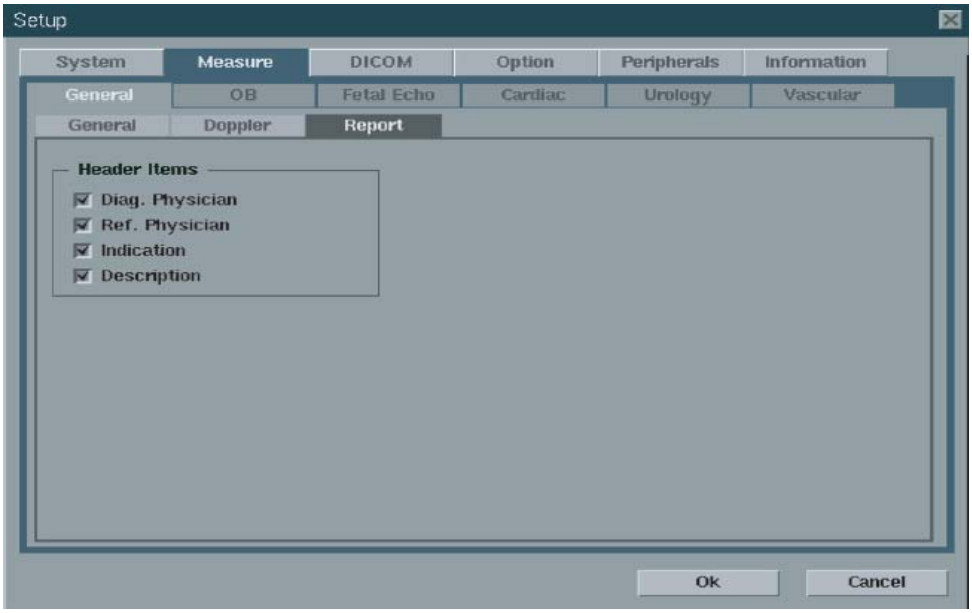
Press the space bar after pressing the Calc button to bring up the Setting Measure Method window shown below.



[Figure 3-14] Setting Measure Method

3.10.3 Report

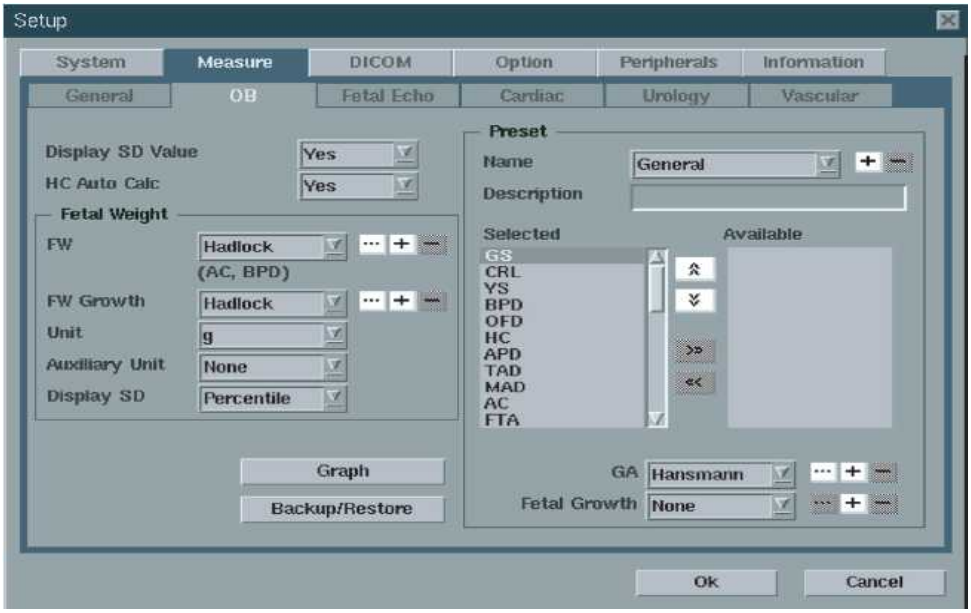
Select the Report tab in the General tab. Select items to mark the header on the report. The header will be shown only the item has its data.



[Figure 3-15] Measure-Report

3.10.4 OB

Select the OB tab in the Measure menu.



[Figure 3-15] Measure-OB

3.10.4.1 Display SD Value

This menu sets whether SD (Standard Deviation) is displayed or not. If ‘Yes’ is selected, the SD value is shown on the screen and on the report. If ‘No’ is selected, it is not shown and its range value appears on the report.

3.10.4.2 HC Auto Calc

Set whether to automatically calculate the HC. 'Yes' if you were selected to measure its own or as a result of OFD and BPD to calculate the value of HC appears on the screen. 'No' if the OFD and BPD were selected to measure the value of HC can not appear on the screen.

3.10.4.3 Fetal Weight

This menu is used to set the measurement items used for fetal examination. In the fetal weight and fetal weight growth fields, more measurement items can be added.

▶ Unit : This sets the unit of fetal weight measurement. You can choose from grams [g], ounces [oz], and pounds [lb].

▶ Auxiliary Unit : This sets the auxiliary unit of fetal weight measurement. Unit sets the available auxiliary unit. For instance, set the unit as Gram [g], available units are None, oz, lb, or lb+oz. If you select lb+oz as an auxiliary unit, the value will be shown like as xx lb yy oz.

▶ Display SD: This menu sets the SD information shown in the result display section: No, SD or Percentile. Both SD and Percentile appear in the report.

3.10.4.4 Preset

Measurement items used during exams are set. Set a specific preset in the Name field

User Preset

If the [+]beside the Name field is selected, a user can set a new preset.

Enter a title in the Preset Name field and an explanation in the Description field. Press Ok.

[Figure 3-16] New Preset

After a new preset is made, register items in the right-hand list to use in obstetrics measurement. When [<<] is clicked, the items in the right list are moved to the left list to be used with the user preset. To delete the items from the left list, select them and click [>>].

To delete a user preset, select it and click [-]. Because `General and Fetal Biometry' are system presets, cannot be deleted..

Table and Equation

The measurement items used in the Preset menu are GA and Fetal Growth. The measurement values of GA and Fetal Growth are shown in table or equation form.

When is clicked, the contents of the GA or Fetal Growth's table and equation contents are shown. When is clicked, a user can set a specific value, and when is clicked, the table and equation set by the user are erased. However, the default values provided by the system are not erased.

For more information about each table and equation, refer to the Reference Manual

3.10.4.5 Graph

The user can select graphs to mark on the OB report or print. Press Graph button and select items. After selecting / deselecting a specific item, click Close.

MCA / UA Graph

MCA / UA is associated with four different graphs (MCA PI, MCA RI, UA PI, UA RI) to be included in the OB Report Graph whether to select it.

HC / AC Graph

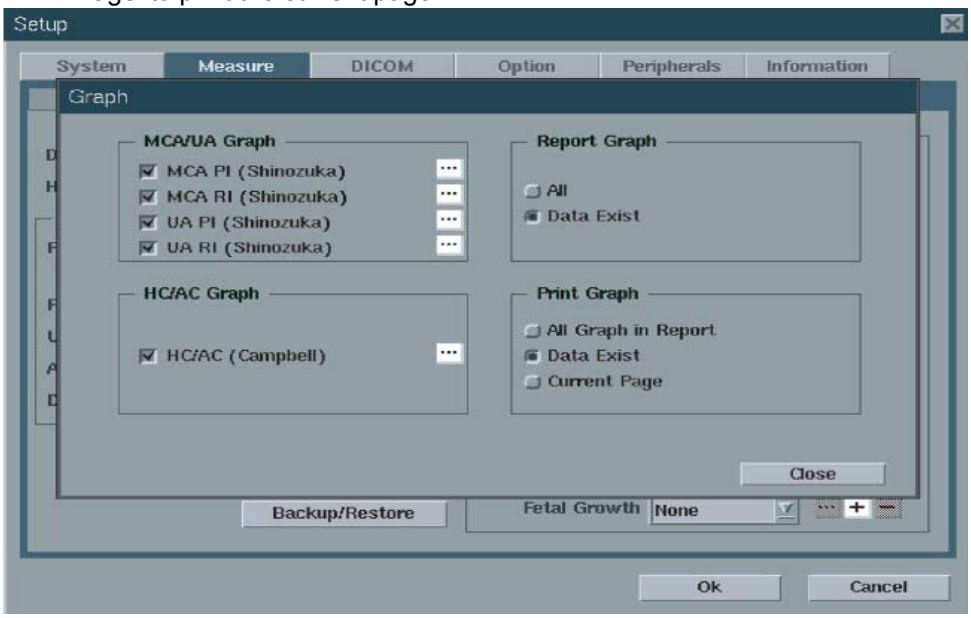
Ratio of HC and AC are displayed in the graph.

Report Graph

Select the reports to display graphs. 'All' is selected, all graphs are displayed, 'Data Exist', select a graph that displays the data.

Print Graph

Select to print the graph. 'All Graph in Report' indicated in the report to print all the graphs and the 'Data Exist' If you choose to print the data in the graph. 'Current Page' to print the current page



[Figure 3-17] Graph

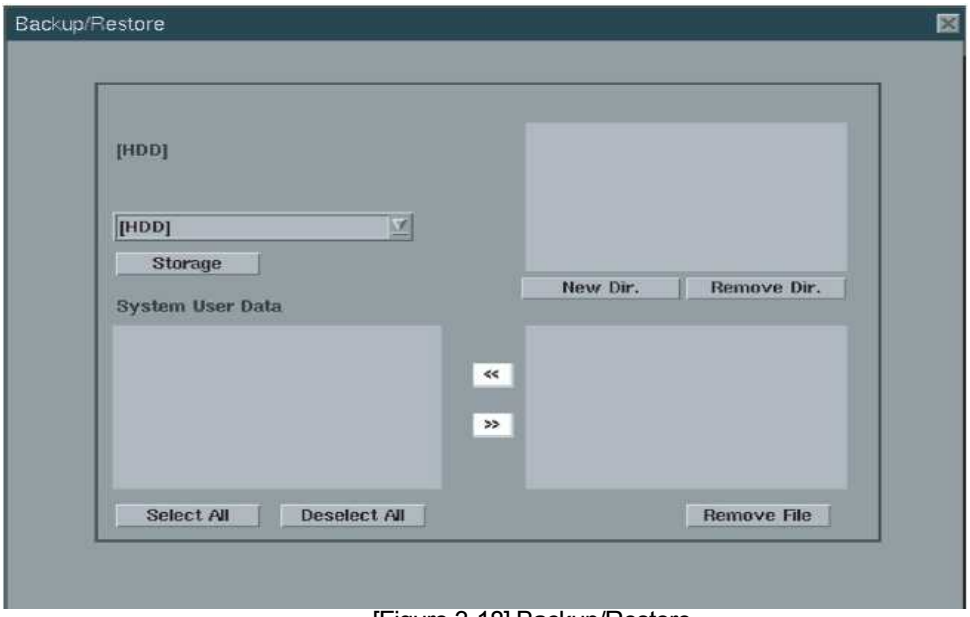
3.10.4.6 Backup / Restore

Backup

If you want to back up a n ew user preset to Mo Media, Flash Memory or a HDD, press Backup/Restore on the screen. When the setting window is displayed, select the disk and directory. Directories can be created or deleted using the New Dir. or Remove Dir. Take care when deleting directories or files. Once a file or directory is erased, it cannot be restored. During user-preset backup, all user reference tables / equations are backed up. Separate tables/equations backup is therefore not necessary.

Restore

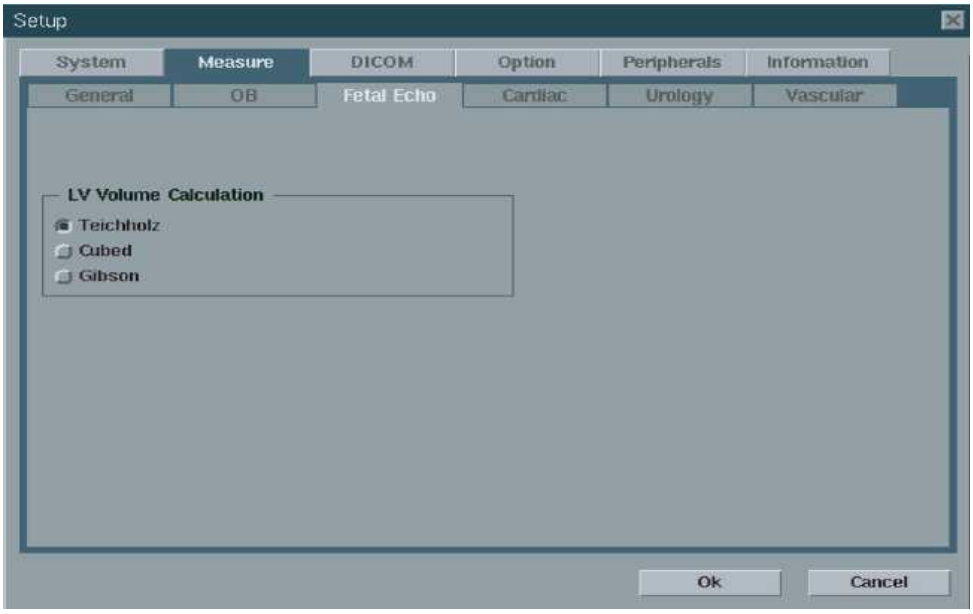
To bring up the backed up user preset, click Backup/Restore. When the Backup / Restore screen appears, select the disk and directory which the user preset is to be restored to.



[Figure 3-18] Backup/Restore

3.10.5 Fetal Echo

Select the Fetal Echo tab in the Measure menu.



[Figure 3-19] Measure-Fetal Echo

During obstetric measurement, Fetal volume can be measured in M Mode. The calculation method is set in the 'LV Volume Calculation'. The options are the same as those in the cardiac package (Teichholz, Cubed, or Gibson).

3.10.6 Cardiac

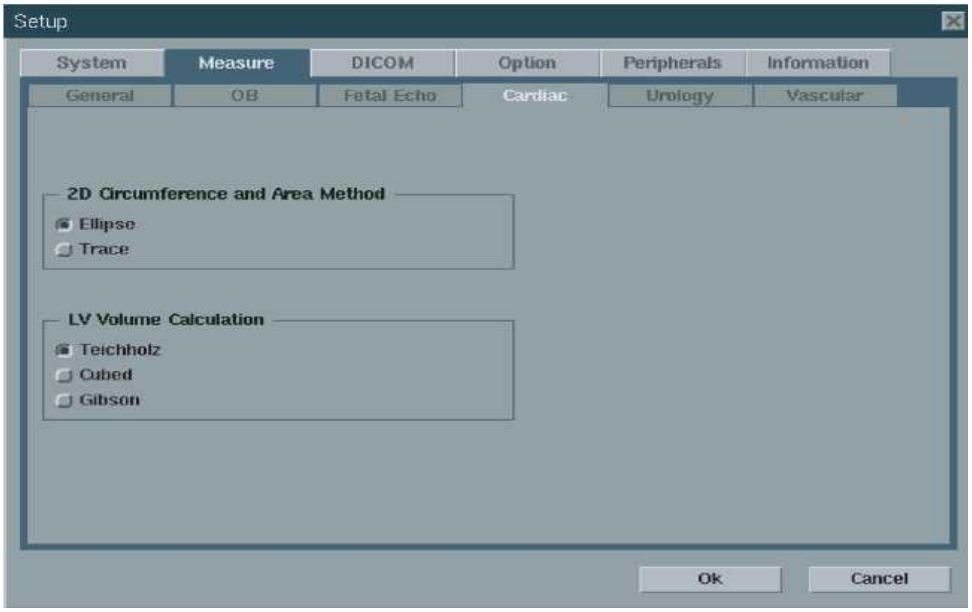
Select the Cardiac tab in the Measure menu.

3.10.6.1 2D Circumference and Area Method

Select either the 'Ellipse' or 'Trace' caliper to be the default tool for area measurement.

3.10.6.2 LV Volume Calculation

The LV Volume Calculation method is set with this menu.



[Figure 3-20] Measure-Cardiac

3.10.7 Urology

Select the Urology tab in the Measure menu.

3.10.7.1 Volume Method

▶3 Distance : The volume value is calculated using three diameters in the longitudinal and transverse planes. (4 / 3 x 3.14 x A x B x C / 8)

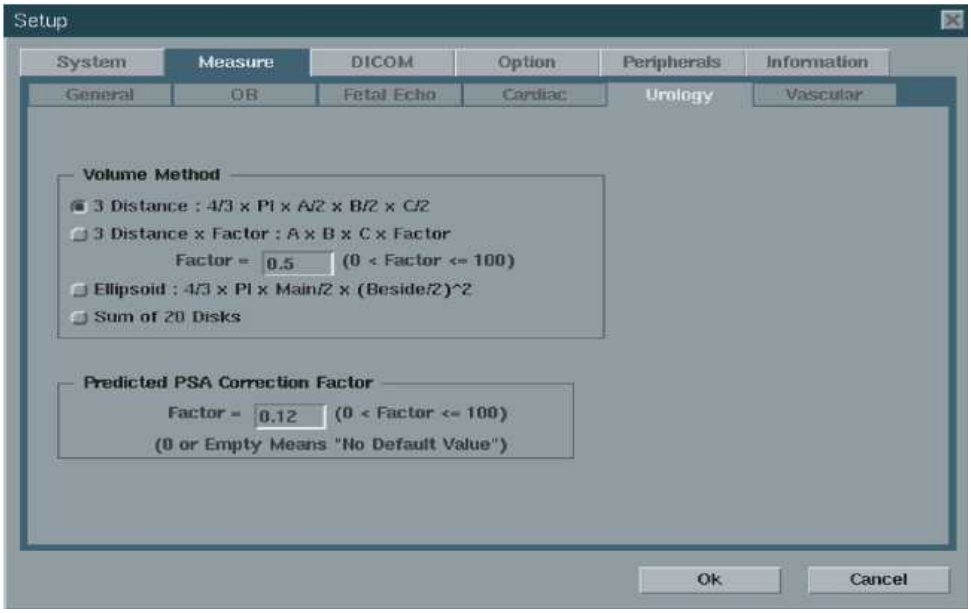
▶3 Distance x Factor: The volume value is calculated using three diameters from the longitudinal plane and transversal plane and a factor (F) value entered by a user. (A x B x C x F)

▶Ellipsoid: The volume value is calculated using the lengths of the Main axis and the beside axis. (4 / 3 x 3.14 x Main / 2 x (Beside / 2)Λ2)

▶Sum of 20 Disks: The volume value is calculated by summing the areas in the 20-parallel planes. (d / 20 x (A1 + A2 + ... A20), d : the sum of distances between disks)

3.10.7.2 Predicted PSA Correction Factor

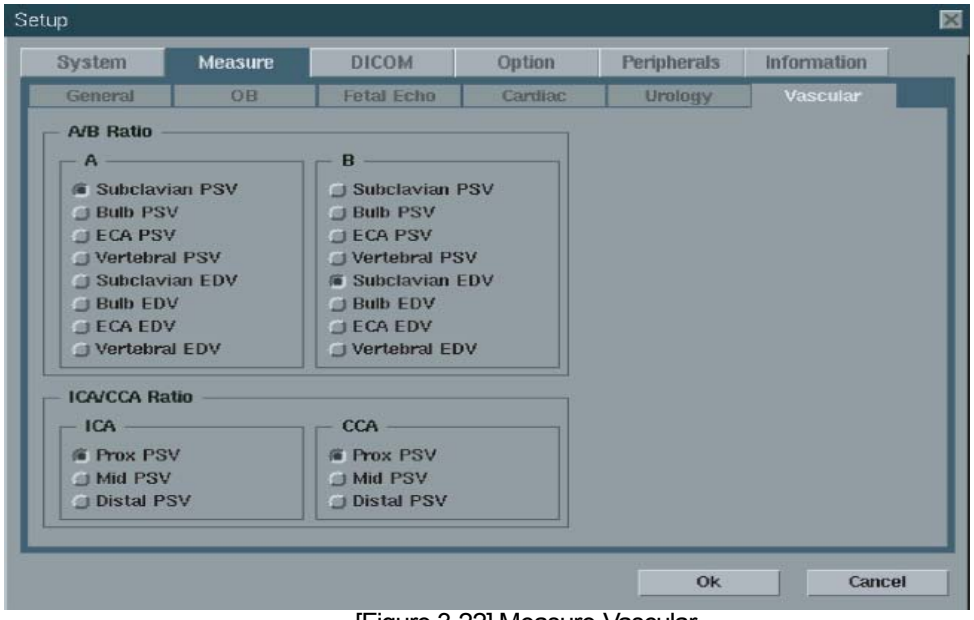
The Predicted PSA Correction Factor can be changed. The default value is 0.12.



[Figure 3-21] Measure-Urology

3.10.8 Vascular

Select the Vascular tab in the Measure menu. You can set the peak velocity used in the calculation of the ‘A/B Ratio’ and ‘ICA/CCA Ratio’.



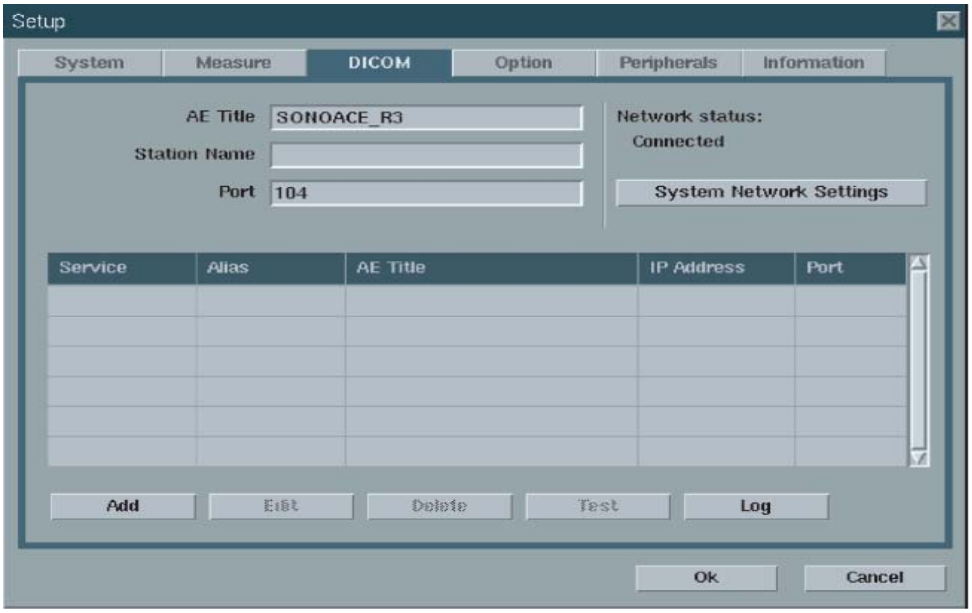
[Figure 3-22] Measure-Vascular

3.11 Setting DDICOM (Optional)

Select the DICOM tab in the Setup menu. This function is used to set up the DICOM server and other DICOM-related functions.

NOTE

For more information, refer to the user manual of the corresponding server and the DICOM Conformance Statement.



[Figure 3-23] DICOM

3.11.1 Setting DICOM Information

Enter the DICOM information for the product in use. For automatic DICOM transmission, select 'Acquisition in Progress' after completing the fields. For automatic print out, select 'Print After Each image'.

3.11.1.1 AE Title

Enter the DICOM Application Entity title of the ultrasound system. This title uses to distinguish the ultrasound system in the network. (Ex. US1, US2)

3.11.1.2 Station Name

Enter a name to differentiate pieces of ultrasound system. (Ex. SonoAce1, SonoAce2)

3.11.1.3 Port No.

Enter the Port Number of the server being used.

3.11.1.4 Network Status

Display the current status of the network.

3.11.2 Network Setup

To set the network like IP address, press System Network Settings. To set the IP value automatically, press 'Using Dynamic IP Configuration'. If you enter the wrong IP address, the network will not run. To finish the network setup, click Apply. To cancel setup, click Close.

3.11.3 Adding or Changing the DICOM Server

Click Add to enter the information related to the DICOM Server.

Store Server Information

Select STORE under Services. Configure the Image Storage Service using DICOM.

3.11.3.1 Service

Select the kind of server to use. The supported DICOM servers are Store, Print, and Worklist.

3.11.3.2 Alias

Enter the name of the server being used.

3.11.3.3 Transfer Mode

Select any one of the three image transfer methods.

▶Batch: send all images when you click the End Exam.

▶Send As You Go: send the image whenever you press the Save button.

▶Manual: send the image manually only in the SonoView.

3.11.3.4 Connect Timeout

Set how many seconds the system will wait until get response.

3.11.3.5 IP Address

Enter the IP address of the server being used.

3.11.3.6 Port

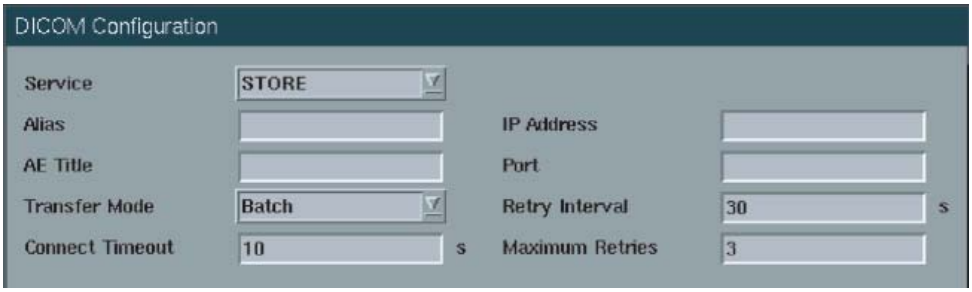
Enter the Port Number of the server being used.

3.11.3.7 Retry Interval

Set how many seconds the system will wait if the transmission fails.

3.11.3.8 Maximum Retries

Set how many times the system will retry.



[Figure 3-24] DICOM Configuration- Store

Print Server Information

Select PRINT under Services. Configure the Print Service using DICOM.

NOTE

You can configure a printer connected to the DICOM network only.

Depending on the printer, some of the following functions may not be available. Before configuring a printer service, please refer to the user manual for the printer or the DICOM Conformance Statement.

3.11.3.9 Color

Specify whether to use colors. Select Grayscale or RGB.

3.11.3.10Format

Specify the paper layout. Select from 1 x 1, 1 x 2, 2 x 2, 2 x 3, 3 x 3, 3 x 4, 3 x 5, 4 x 4, 4 x 5 and 4 x 6..

3.11.3.11Orientation

Specify the paper orientation. Select Landscape or Portrait.

3.11.3.12Magnification

When resizing an image to print, specify the interpolation. Select from Replicate, Bilinear, Cubic and None.

3.11.3.13Border Density

Specify the border density of an image to print. Select Black or White.

3.11.3.14Empty Density

Specify the background color of an image to print. Select Black or White

3.11.3.15Min Density

Specify the minimum brightness of an image to print. If this option is not specified, the default value is applied.

3.11.3.16Max Density

Specify the maximum brightness of an image to print. If this option is not specified, the default value is applied.

3.11.3.17Medium Type

Specify the paper type. Select from Paper, Clear Film, and Blue Film.

3.11.3.18Film Size

Specify the paper size. Select from 8inch x 10 inch, 10 inch x 12 inch, 10 inch x 14 inch, 11inch x 14 inch, 14 inch x 14 inch, 14 inch x 17 inch, 24cm x 24cm, 24cm x 30cm, and A4

3.11.3.19Destination

Specify the paper pathway. Select Magazine or Processor.

3.11.3.20Priority

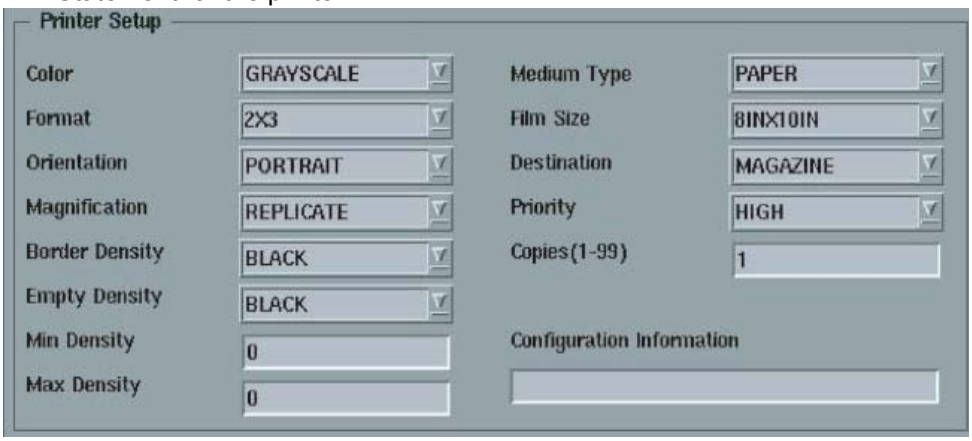
Specify a priority for the print command. Select from High, Med and Low.

3.11.3.21Copies

Enter the number of copies between 1 and 99.

3.11.3.22Configuration Info

Specify the unique value for a printer. Please refer to the DICOM Conformance Statement for the printer.



[Figure 3-25] DICOM Configuration- Print

Worklist Server Settings

Select WORKLIST under Services. Configure the Modality Worklist Service using DICOM.

3.11.3.23Open MWL on Patient key

Sets the screen that appears when pressing the Patient button on the control panel. If this function is selected, pressing the Patient button opens the Modality Worklist window. If not selected, pressing the Patient button opens the Patient Information screen.

3.11.3.24Update Method

Sets the method for updating Worklist.

▶Only on user Request: Update only when asked by the user.

※Tip! WorkList Tips.

To update a worklist, in the Search tab on *the Patient Information* screen, select Worklist for Search Source and press Search.

▶On Startup and Every: Worklist is updated at the system boot-up and then updated continually at a set interval. Note that Worklist is not updated while the Modality Worklist window is open.

3.11.3.25Scheduled Station AE Title

Sets the range of AE Title to fetch from the hospital's Worklist server.

▶All: Obtains the list of patients saved under all AE Titles within the server.

▶This System: Obtains the list of patients for the AE Titles set under the DICOM tab.

▶Another: Obtains the list of patients for the AE Title directly entered by the user.

NOTE

This function is available only if when the Worklist server is configured.

3.11.3.26Start Date

Set the range of dates to search.

▶Today: Obtains the list of patients for the current date.

▶Prior_days, Next_days: Obtains the list of patients for dates between n days prior to the current date and n days after the current date.

▶Period

From Date: Enter a date and the system obtains the list of patients starting from the date entered up until the current date.

To Date: Enter a date and the system obtains the list of patients starting from the current date up until the date entered.

From Date To Date: Enter two separate dates and the system obtains the list of patients between the two dates entered..

3.11.4 Editing the DICOM Server Information

Click Edit in the setting DICOM window to edit the server information already entered.

3.11.5 Deleting DICOM Server

Click Delete in the setting DICOM window to erase the current server information.

3.11.6 Testing DICOM Server

Select a service and click Test on the screen. The connection with the selected service is tested and the results are shown under the Ping and Verify items. If the result is Normal, it indicates that the connection is normal.

3.11.7 DICOM Log

Click Log in the setting DICOM window, and the screen will be changed. Set or copy the current DICOM log file.

DICOM log file is the history of all DICOM services performed so far on the product. Click Close to finish the DICOM log.

3.11.7.1 Log Settings

Set the DICOM Log..

▶Delete archived log file after: set the number of days to wait before deleting the archived history. After that period, the log file will be deleted. However there is only one log file, it will not be deleted.

▶Log File Maximum Size: set the maximum size of each history file archived. Set the unit as Kbytes

3.11.7.2 Explanation

View the log setting.

3.11.7.3 DICOM Log

View, copy, or delete the DICOM log files.

▶View Selected File: Select the log file from ‘Select log files to copy’ and click View selected file.

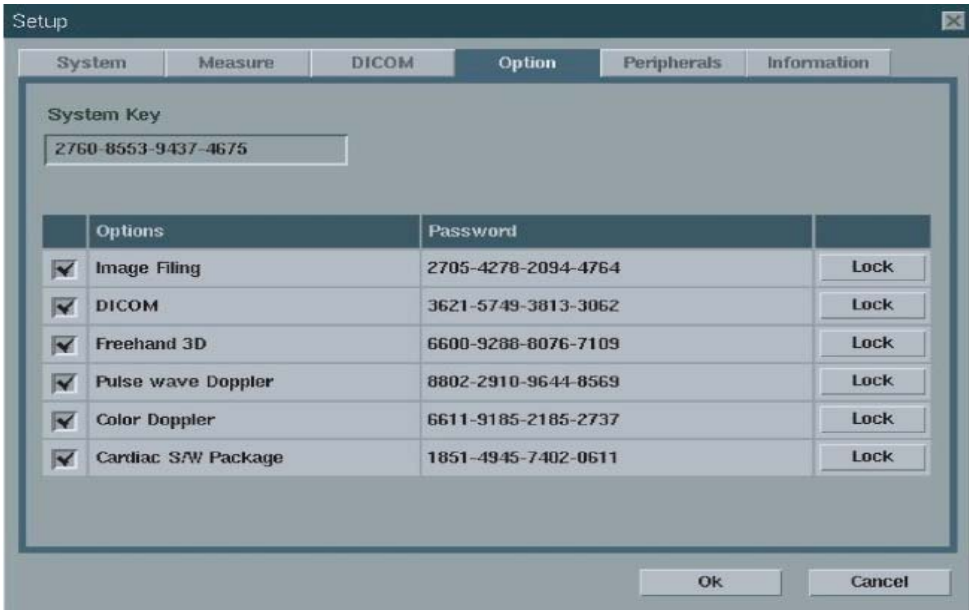
▶Copy Selected Files:

1. Select the log files and set the storage file format on the ‘Copy to’.
2. Set the ‘Delete files after copy’ whether to delete the log files saved in the hard disk of the system.
3. Click Copy selected files.

▶Delete Selected Files: Select the log file and click Delete Selected Files.

3.12 Setting Option

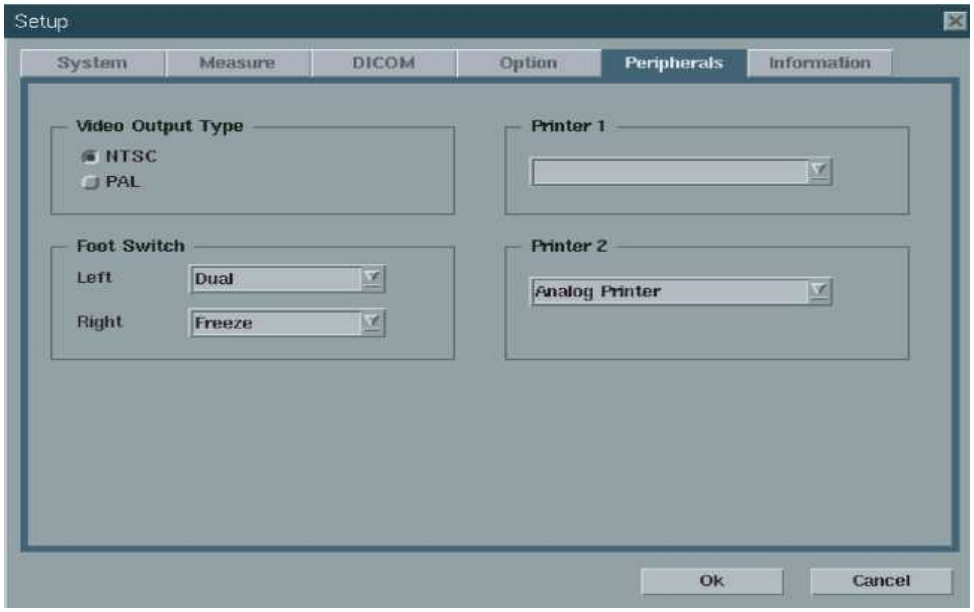
The S/W serial No information of the system is shown in this window. You can select / cancel S/W options. A user cannot modify options. Click Option tab in the Setup menu. If the password you enter is not correct, the options are not activated. If the password is not correct, click Cancel..



[Figure 3-25] Setup-Option

3.13 Setting Peripheral Devices

The following describes how to set up the video output type, video input type, printer, foot switch and network. Select the Peripherals tab in the Setup menu.



[Figure 3-26] Setup-Peripherals

3.13.1 Video Out Type

Set the video output type as NTSC or PAL.

3.13.2 Foot Switch

Assign functions to the left and right pedals of the foot switch. Four options are available: Dual, Store, Freeze and Update.

3.13.3 Printer 1

Select a printer to use. After connecting a USB printer to the USB port of the system, select the printer type on the screen and click Ok. The printer can then be used immediately.

The USB printer can only be used to print out Report and SonoView screens.

- ▶ HP Color LaserJet 3600 ▶ HP DeskJet 6540 ▶ HP DeskJet 5650
- ▶ HP DeskJet 5940 ▶ HP DeskJet 6940 ▶ HP OfficeJet J5780
- ▶ HP LaserJet 1320 ▶ HP LaserJet 6980 ▶ HP OfficeJet ProK550
- ▶ HP LaserJet2420 ▶ HP LaserJetP2015

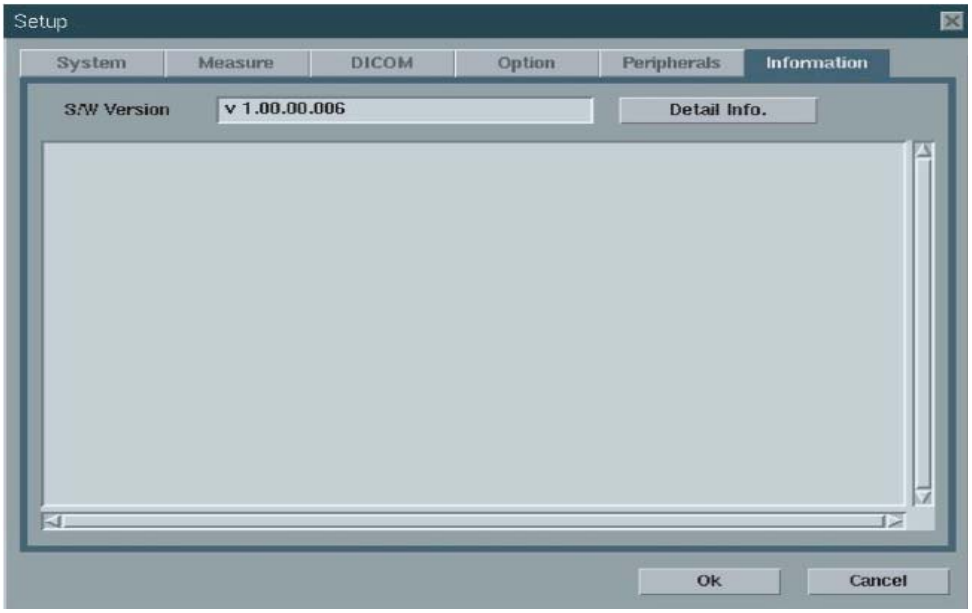
3.13.4 Printer 2

Select a printer to use when you press the Print button. Following printers are available;.

- ▶ Analog Printer ▶ Sony UP-D897 ▶ Sony UP-D23MD

3.14 Information

The information menu displays information about the system S/W version. Select the Information tab in the Setup menu. Press the Detail Info. to view more detailed information.



[Figure 3-27] Setup-Information

* The S/W version of your system may be different from that in the figure above.

Chapter 4. Checking the Product

4.1 Overview

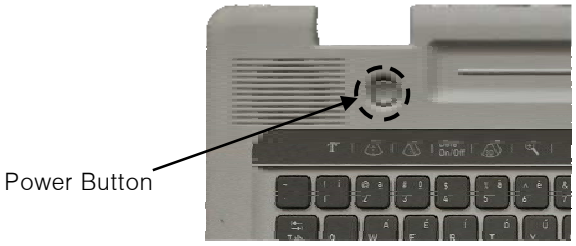
Chapter 4 describes how to check SonoAce R3 and how to check if its major functions and the power supply are working properly.

Contents

4.2 Starting the Product

1) Check again if the power capacity is compliant with SonoAce R3 and connect the power cord to the wall outlet.

2) Check if the SonoAce R3 power cord is properly connected and switch on the power button for the control panel. [Figure 4-1]



[Figure 4-1] Power Button

CAUTION

- During booting the system, do not press any key of the alphanumeric keyboard It may cause malfunction.
- Off again after a power button for about 5 seconds to boot time interval is required.

The booting sequence is displayed on the LCD monitor. The SonoAce R3 logo and loading bar appear..

4.3 Monitor

The monitor of this system is a color VGA monitor, which displays ultrasound images and additional information. This monitor is connected to the main body through a central pivot, allowing it to be tilted to the optimal viewing angle.

4.3.1 Monitor Display

The monitor displays ultrasound images, operation menus and a variety of other information. The screen is divided into six sections: ①Title, ②Menu, ③Image, ④Thumbnail, ⑤User Information, and ⑥ Softmenu sections

[Figure 4-2] Monitor Display

①Title Area

This section displays the Logo, Patient Name, Hospital Name, Application, Frame Rate & Depth, Probe Information, Acoustic Output Information and Date & Time.

②Menu Area

The menu is divided into 3 kinds : Image adjustment menu, Measurement menu and Utility menu. Use Menu dial-button to select an item from the menu

③Image Area

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

④Thumbnail Area

Saved images, by pressing the Save button on the control panel, are displayed in the thumbnails area. Thumbnails are showed when you check ‘on’ in Setup > System > Misc. This area shows up to four images.

⑤User Information Area

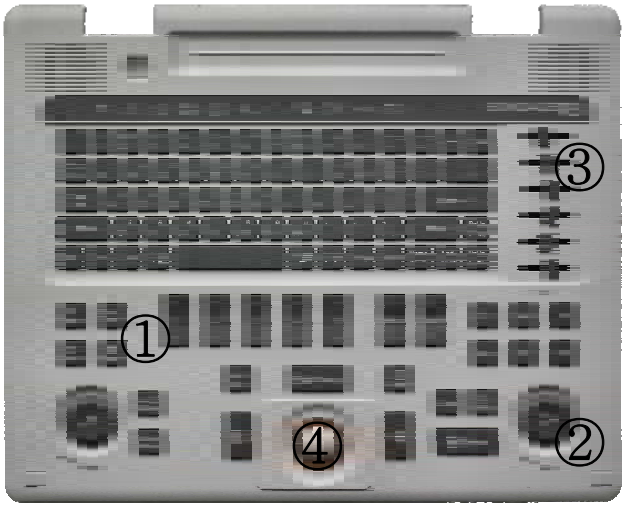
A variety of information necessary for system use e.g. current system status and Body Markers.

⑥Softmenu

Available menu items may vary depending on the current system state. To set or change a Soft Menu item, use the corresponding dial-button on the control panel.

4.4 Control panel

The control panel can be used for controlling the system.



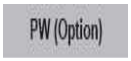
① Button
② Dial-Button
③ Slide
④ Track Ball

[Figure 4-3] Control Pane

4.4.1 Detail Control Panel

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	On/Off	Turns the system on/off.
Patient	Patient	Displays the Patient Information screen for patient selection and information entry.
End Exam	End Exam	Finishes the exam of the currently selected patient and resets the related data.

	Sonoview	Runs SONOVIEW TM which is the image filing program.
	Report	Displays the Report screen that shows the measurement results of the current application and other information.
	2D/ Single	[Allows you to select the 2D or Single function - 2D: Use this button to enable 2D Mode. Pressing this button in 2D mode does not disable the mode. Pressing it in Combined Mode switches to 2D Mode. - Single: In Dual Mode, press this button to switch to 2D Mode.
	M Mode	Use this button to enable/disable M Mode.
	C Mode	Use this button to enable/disable Color Doppler Mode.
	PD Mode	Use this button to enable/disable Power Doppler Mode
	D Mode	Use this button to enable/disable PW Spectral Doppler Mode.
	Dual Mode	Use this button to enable Dual Mode.
	Focus	Use this switch to adjust the focus position. The focus position changes on the ruler as you adjust its position
	Depth	Use this switch to adjust the scanning depth for the selected image. The depth information changes in the Title area as you adjust the depth.
	Calc	Starts measurements by application. The measurement menu is displayed on the left side of the screen.
	Caliper	Starts to measure distance, circumference, area, and volume. The current measurement item is displayed on the left side of the screen.
	Trackball	Use the trackball to move the cursor on the screen. It can also be used to search through Cine or Loop images when Freeze is enabled.
	Change	Use this button to change the function of the trackball.
	Set	Use this option to select an item or value. In Spectral Doppler Mode and 3Dmode, it is also used as update function.

	Exit	Exits the currently used function and returns to the previous staus.
	Menu/ Angle	Carries out the Menu or Angle function. Menu: Press dial button to activate the available menu item of current scan mode. Angle: Rotate the dial-button to adjust the angle. Adjust the angle of sample volume in PW Spectral Doppler Mode. It is also used to adjust the Indicator angle or the Probe angle of Body Marker.
	Clear	Deletes text, Indicator, body marker, and measurement result, etc. displayed on an image
	Active Mode	Changes the menu or soft menu on the screen.
	Save	Use this button to save the selected image or report in a database
	Print	Use this button to print the image on the screen via a printer.
	Freeze	Use this button to freeze the image that is being scanned. Press it again to return to scan mode.
	Q Scan/ Gain	Carries out the Q Scan or Gain function. - Q Scan: Press this dial-button to enable Quick Scan. If Quick Scan is enabled, ‘Q’ mark is shown in the right hand side of the screen. - Gain: Rotate this dial-button to adjust Gain in each mode.
	TGC	Adjusts TGC values for each depth using 6 slides. TGC stands for Time Gain Control.

CAUTION

Too large a difference in the gain value settings of adjacent TGC slides may lead to the generation of stripes in an image.

4.4.2 Soft menu(1~5)

Use the Soft Menu that appears on the screen. Available menu items may vary depending on the current system state.

[Figure 4-4] Soft menu button

4.4.3 Keyboards

This product comes with an alphanumeric keyboard, which can be used to enter text and run a variety of functions by using function keys

[Figure 4-5] Keyboards

T Text	Text	This is used to start Text mode.
M Cursor	M Cursor	This is used to display M line or hide.
Biopsy	Biopsy	This is used to start the biopsy.
Data on / off	Data on/off	This button is used to display information of image on the upper right side of screen or hide.

	3D	This is used to start or finish the 3D Mode.
	Zoom	This is used to start or finish the Zoom Mode. The Zoom Navigation Box is displayed on the user information area.
	Setup	This button is used to appear the Setup screen for setting system parameters.
	Utility	This button is used to appear the utility menu.
	Application	This is used to appear Application screen to select/change probes and applications.
	Probe	This is used to change another probe. This button is available when you use the two probe connector (optional).
	Storage Manager	This button is used to appear the Storage Manager window.
	Indicator	This is used to start or finish the indicator Mode.
	Body Marker	This is used to start or finish the Body Marker Mode.
	Frequency	Press the button to change frequency for the probe. Select Res, Pen or Gen. The selected frequency will be displayed in the title area.
	Harmonic Imaging	This is used to turn Harmonic Imaging on. Press this button again to turn the mode off. This button is only activated with the specific probe.
	Brightness	Allows you to adjust the monitor brightness.
	Sound	Allows you to adjust volume in Spectral Doppler Mode.

CAUTION

If you set the language in Russian, you cannot use function keys under Caps Lock is on.

4.5 Checking the Performance

4.5.1 Basic Check

1) Monitor

   Check the screen color, focus, dots, residual image, spot, blurring, etc..

   Check the screen status when a shock is applied to the monitor and check the signal when you shake the cable.

2) Control Panel and LED Status

   Press on control panel key and check if the corresponding character is displayed on the screen.

   Check if the Key board LED is turned on.

3) Body Mark Key

   Check if the Body Mark [Body Mark Key] is properly displayed and if the key works properly.

4) Indicator Key

   Check if the trackball works properly by moving it up, down, left and right.

5) Clear Key

   Check if TEXT and measurement data is erased properly when this key is pressed.

6) Zoom Operation Examination

   Check that the Zoom works properly.

7) Sonoview Examination

   Save an IMAGE and CINE INAGE in each mode.

   Check if the images are properly saved.

   Check if Backup & Restore works properly.

8) Measure

   Check if DISTANCE, CALIPER and CALC works properly.

9) Patient

   Enter information in PATIENT and check if the entered contents appear in the report or SonoView.

10) End Exam

    Measure for a New Patient and check if the measured data is cleared when End Exam is selected.

11) Probe Key

    Check if it works properly when the probe is changed.

4.5.1 Detail Check

1) B Mode

① Check if there is any missing line in an image by doing a Knife Test.

② Check if the image is displayed properly through Phantom.

③ Check if Freeze Cine (Broken Image, Auto run, Auto run Speed and Track ball Cine) and its related functions work properly.

④ Check if there is an image brightness change when the Gain is adjusted.

⑤ Check if there is an image brightness change when the TGC Gain is adjusted.

⑥ Check if the image is flipped horizontally or vertically and left or right when the Left/Right Flip, Up/Down Direction and Rotation keys are pressed.

⑦ Check if the image select menus (EE, DR, View Area, Tissue, Frame Rate) work properly.

⑧ Check if the frequency (Phantom, Res, Pen, Gen) is normal.

⑨ Check if the image changes according to Depth change.

⑩ Check if the image changes according to Depth change when the focus is changed.

⑪ Check if the image compensation modes (FSI, Harmonic, DMR, SRF, Quick Scan, Spatial Compound Imaging) work properly.

2) Dual Mode

① Check if the image is displayed properly through Phantom.

② Check if the image is flipped horizontally or vertically and left or right when the Left/Right Flip, Up/Down Direction and Rotation keys are pressed.

③ Check if the image select menus (EE, DR, View Area, Tissue, Frame Rate, Sane angle, Power) work properly.

④ Check if the frequency (Phantom, Res, Pen, Gen) is normal.

⑤ Check if the image changes according to Depth change.

⑥ Check if the image changes according to Depth change when the focus is changed.

⑦ Check if the left or right image Cine (number of pages, Auto run, Auto run Speed and Track ball Cine) and its related functions work properly.

3) M Mode

① Check if the image is displayed properly through Phantom.

② Check if theinformation on M Line is displayed in the Image area.

③ Check if there is an image brightness change when the GAIN is adjusted..

④ Check if image select menus (EE, DR, View Area, Tissue, Frame Rate, Sane angle, Power) work properly.

⑤ Check if image changes according to Depth change.

⑥ Check if the image changes according to Depth change when the focus is changed

⑦ Check if the speed change and information is correct according to the SPEED conversion step.

⑧ Check if an image is reversed when Negative operates.

⑨ Check if the Top Down Format and Side by Sede Format Image are correct when Loop Format is selected.

⑩ Check if the Freeze Cine (Broken Image, Auto run, Auto run Speed and Track ball Cine) and its related functions work properly.

.

4) C Mode & PD Mode

① Check if the image is displayed properly through Phantom.

② Check if the image select menus (Balance, Sensitivity, Color Mode, Display) work properly.

③ Check if the image changes according to Depth change.

④ Check if Freeze Cine (Broken Image, Auto run, Auto run Speed and Track ball Cine) and its related functions work properly.

⑤ Check if there is image brightness change when the Color Gain is adjusted.

⑥ Check if an image is broken or if there is noise (B or C Mode Noise) When ROI Box is moved.

⑦ Adjust the Scale up and down and check if the frequency is converted and blood flow speed range is controlled. (Check with directly scan)

⑧ Operate the filter and check if small signals are removed by step.

⑨ Check if the Color Bar is reserved when the Invert key is pressed.

⑩ Move the Baseline up and down and check if the blood flow range moves to + or - part.

5) D Mode

① Check if the image is displayed properly through Phantom.

② Check if the Doppler PRF value changes as the Simultaneous is turned on or off.

③ Check if the Doppler spectrum works properly.

④ Change the Scale and check the speed range change.

⑤ Move the Baseline up and down and check if the blood flow range moves to + or – part.

⑥ Operate the filter and check if small signals in the spectrum are removed.

⑦ Operate the Invert and check if the Doppler waveform is reversed.

⑧ Operate the Angle.

⑨ Move the SV or Size and check if it works properly.

⑩ Change the Spectrum Type and check if the spectrum video changes.

⑪ Check if Sound Volume works properly.

⑫ Check if the line when appears when Auto Calc runs is continuous and if the subsequent calculations are automatically done correctly.

⑬ Check if the Top Down Format and Side by Side Format Image are correct when LOOP FORMAT is selected.

⑭ Check if the CINE/LOOP (Broken Image, Auto run, Auto run Speed and Track ball Cine) and its related functions work properly.

Chapter 5. Product Structure

5.1 Overview

Chapter 5 describes the internal structure and operation mechanism of SonoAce R3.

This chapter must be read for the product maintenance and upgrade.

SonoAce R3 is high technology ultrasound system.

It not only adopted 15 inch LCD monitor and provides high resolution ultrasound Image, but also provides the premium grade system functions. To improve the processing speed, SAMSUNG MEDISON Co., Ltd. developed new interface to connect a latest PC and the ultrasound system with its proprietary technology. The enhancement of processor speed makes the system operations faster and reduces diagnosis time.

SonoAce R3 can use up to 96 Element probes and adopted Digital Beamforming of TX 32 Channels. Ultrasound image is displayed on the LCD through the Front End Part and Back End Part (including PC Part).

The resolution of the LCD monitor is 1024 X 768 pixels and various image formats are provided. The wide view angle of the LCD panel provides convenient work environment for diagnosis.

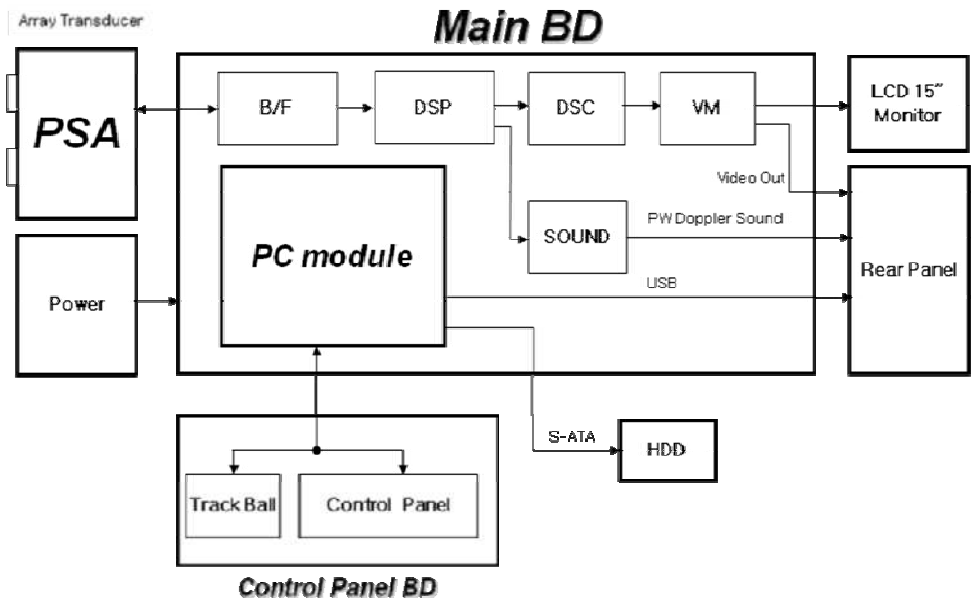
The USB port are placed on the front panel of the system for easier image backup and software service. Since this system supports various external storage devices such as USB MO, USB Flash Memory and external-type USB HDD, upgrade becomes more easier.

SonoAce R3 consists of the following major components.

- Ultrasound System Part : PSA, Main Board, Rear Board, PC Module
- Monitor Part
- Control Panel Part : Control Panel Board, Track Ball,
- Power Part

Contents

5.2 System Block Diagram



[Figure 5-1] System Block Diagram

5.3 Basic Structure of SonoAce R3

5.3.1 Overview

SonoAce R3 consists of Ultrasound System Part, PC Part, User Interface Part and Power Part. However, it consists of Front End Part, Back End Part, User Interface Part, and Power Part from the electronical view point.

The following is the description of electronical structure of SonoAce R3.

Front End Part refers to PSA (Probe Select Assembly), and BF (Beamformer) Part of the Ultrasound System Part. The Front End Part delivers High Voltage Pulser to the probe so that ultrasound is generated, amplifies the returned echo signal and processes Digital Beamforming. The RF signal generated here is delivered to the Back End Part.

Back End Part refers to the BE(Back End) Board and PC of the Ultrasound System Part. The RF signal generated in the FE(Front End) Board is processed to diagnosis image such as BW, Color Doppler, PW Doppler, and Power Doppler and displayed on the monitor so that users can see it.

User Interface Part refers to the LCD monitor and control panel.

5.3.2 Ultrasound System Part

It recognizes probes and delivers system and application information depending on the user environment to each board. Based on the information, TX Focusing and RX Focusing are done. When high-voltage Pulser is delivered to probe along through the TX Focusing, ultrasound is generated and the echo signal returned from human body is amplified by the amplifier circuit and then is processed by Digital Beamforming. The RF signal generated here is delivered to the PC Part to process it to provide diagnosis image such as BW, Color Doppler, PW Doppler, and Power Doppler and display it on the monitor.

5.3.3 User Interface Part

User Interface Part enables users to view ultrasound image on the LCD monitor and control SonoAce R3 through the control panel

The image output from the Back End Board is transferred to the LCD monitor and external device. Image output interface includes VHS, S-VHS, Composite, and DVI In addition, the control panel enables users to easily operate the system through various interfaces.

5.3.4 AC to DC Power Module

It converts 110/230V AC voltage from external into DC voltage and supplies power to the Ultrasound System Part and It provides power cut-off switch and fuse to prevent problem due to over-voltage.

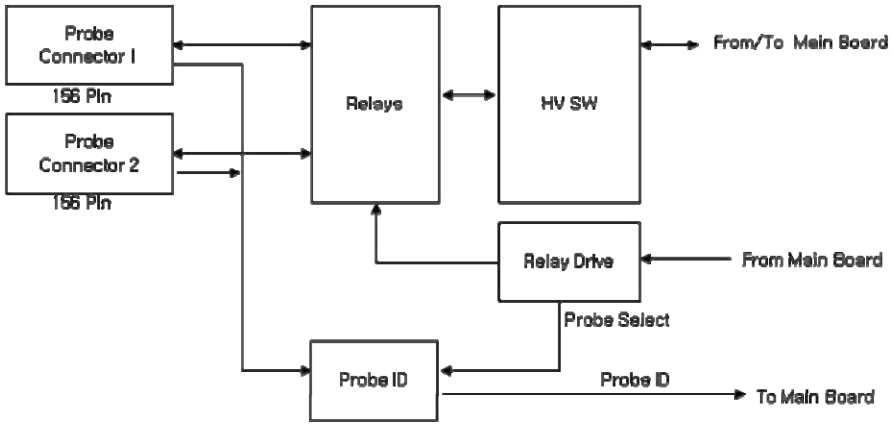
5.4 PSA (2 Port Option)

5.4.1 Major Function

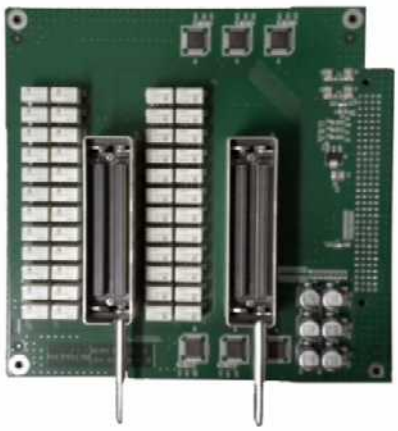
PSA (Probe Select Assembly) connects the system and probe.

It has 2 260-Pin Array Probe Connector and. The pins of Probe Connector are defined for Probe ID and HV-MUX control functions and consist of Relay circuit to select one of 2 Array Probes. In addition, High Voltage Switching is applied so that the BF (Beamformer Board)'s 32 Channel Signal and Probe's 96 Element are switched.

5.4.2 Block Diagram



[Figure 5-2] PSA Diagram



[Figure 5-3] PSA

5.4.3 Specification

- 32 Channel BF Board Support
- 260 Pin Array Probe Connector 2ea(Option)
- High Voltage Switching (32 Channel : 80 Element)
- Probe Switching
- Probe ID Reader

5.4.4 Operation Mechanism

5.4.4.1 High Voltage Switching Process

SonoAce R3 supports 32 Channels and 192 Elements Probes.

Since the BF(Beamformer part)'s Pulser and Receiver circuit consists of 32 Channels only, additional Element Selection is necessary. Element Selection uses High Voltage Switches and switches based on the Control Signal output from the DSP FPGA Control Signal is connected through the Mother Board Connector.

High Voltage Switch consists of the Shift Register and High Voltage FET.

5.4.4.2 Probe Switching

It consists of circuit to select one of 2 probes. It can select a probe selected by the user by using Latched type relay. It drives the Relay with the Probe Select signal transmitted from the DSP FPGA. The Probe Select signal is connected through Mother Board Connector.

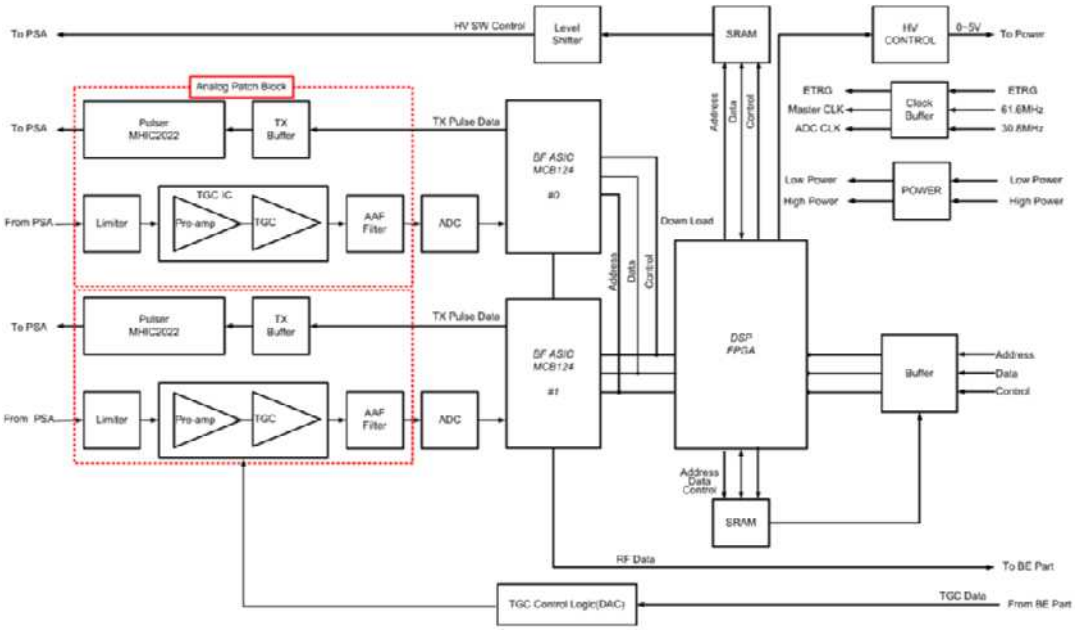
5.5 Beamformer Board

5.5.1 Major Function

Beamformer Part (hereafter, BF Part) delivers High Voltage Pulser to a probe, generates ultrasound, amplifies the returned echo signal and does Digital Beamforming.

Active aperture is in charge of 32 Channel and supports up to 96 Element Probe. It consists of TX Pulser circuit, Receiving circuit and Beamformer ASIC(MCB124) to construct the Active aperture 32 Channels and does the Dynamic Apodization, Multi Beam Receiving, and TGC functions to enhance ultrasound image.

5.5.2 Block Diagram



[Figure 5-4] Beamformer Board Diagram

[Figure 5-5] Main Board

5.5.3 Specification

- TX Pulser
- Limiter
- TGC amp
- AD converter
- BF ASIC 2ea (MCB124)
- RX Dynamic Aperture Function
- RX Apodization Function
- Board Version Reader
- BFIC Operation Control Support
- PSA Probe Selecting Function
- Synthetic Aperture Support
- Trapezoidal Imaging Support
- Multi-Line Receiving Support
- TX Focal Point Support

5.5.4 Operation Mechanism

5.5.4.1 TX Pulser

The Exciting pulse data provided by BF ASIC(MCB124) is applied to TX Pulser via TX Pulse Buffer. TX Pulser(MHIC2022) generates Bipolar Pulser using the Exciting pulse data and the High Voltage. Bipolar Pulser is sent to the Probe element by using the PSA (Probe Select Assembly) to generate ultrasound.

Since Active aperture 132 Channels provide up to 96 Elements, additional Element Selection is necessary. For this purpose, High Voltage Switch is used. High Voltage Switch is constructed in PSA (Probe Select Assembly).

5.5.4.2 Receive Channel

Receive Channel amplifies echo that is penetrated through the medium of human body and the reflected, and does the role of Analog Digital Converter so that Beamforming can be conducted. It consists of Limiter and Pre-Amp, TGC-Amp, Low-Pass Filter and A/D Converter.

1) Limiter

It removes unnecessary signal from the Echo returned through the PSA (Probe Select Assembly)'s High Voltage Switch. Up to 180 Vpp Tx Pulses and a few mV Echo signals are mixed. Since actually necessary RX data is the echo signal of a few mV, Tx Pulse should be removed before the signal to the Pre-Amp. Limiter removes signal of higher than approximately 0.6V and transfers the echo signal to the Pre-Amp.

2) Pre-Amp

Pre-Amp amplifies echo signal of a few mV that is not processed.

3) TGC-Amp

Each TGC(Time Gain Compensation) Amp consists of 4 channels. Since the echo signal that is penetrated and reflected by medium diminishes as it traverses, it compensates the attenuation of the signal.

4) Low Pass Filter(Anti-aliasing)

Low-Pass Filter filters noise in Stop Band that is out of ultrasound band. In addition, it does the role of Anti-aliasing Filter that minimizes the Aliasing Effect that may appear in a high frequency probe such as 7.5MHz probe. The Aliasing of high frequency probe occurs due to the limitation of the Sampling Clock in the BF ASIC.

5) A/D Converter

It converts the digital signal to be used in the Digital Beamforming into analog.

5.5.4.3 Digital Beamforming

The ultrasound generated by a probe takes channel mode that uses a number of elements for TX Focusing. The ultrasound generated by channel is penetrated through medium and reflected as echo signal. However, since echo signals do not return to Probe Element simultaneously, but they return with delay variation. Therefore, a countermeasure against the delays is necessary for RX Focusing and it is very important to construct ultrasound image.

Digital Beamforming samples the echo signal returned to Probe Element and save the sampled data into the memory. The data saved in the memory when the sampling is complete means that time compensation is complete. The time compensation is done by the Sampling Clock itself. RX Focusing becomes complete, just by reading the data saved in memory and adding the data. Since this method requires different Sampling Clock for each element, VSCG(Variable Sampling Clock Generator) is necessary. VSCG(Variable Sampling Clock Generator) uses 61.6Mhz that is the same as A/D Sampling Clock and generates data necessary for BF ASIC(MCB024A).

5.6 Back End Part

5.6.1 Major Function

Back End Board (hereafter, BE Part) consists of DSP(Digital Signal Processing) Part, VM Part, and Analog Sound Part.

The DSP Part receives RF data and CW I/Q Data from the FE Board, processes the data and outputs the data as image data such as BW Image, PW Doppler, Color Doppler, and Power Doppler

The DSC Part receives doppler data and BW data(2D and M), which are saved in the DSC Part. the data is then scan converted and send the Video Manager at appropriate Vsync and H sync.

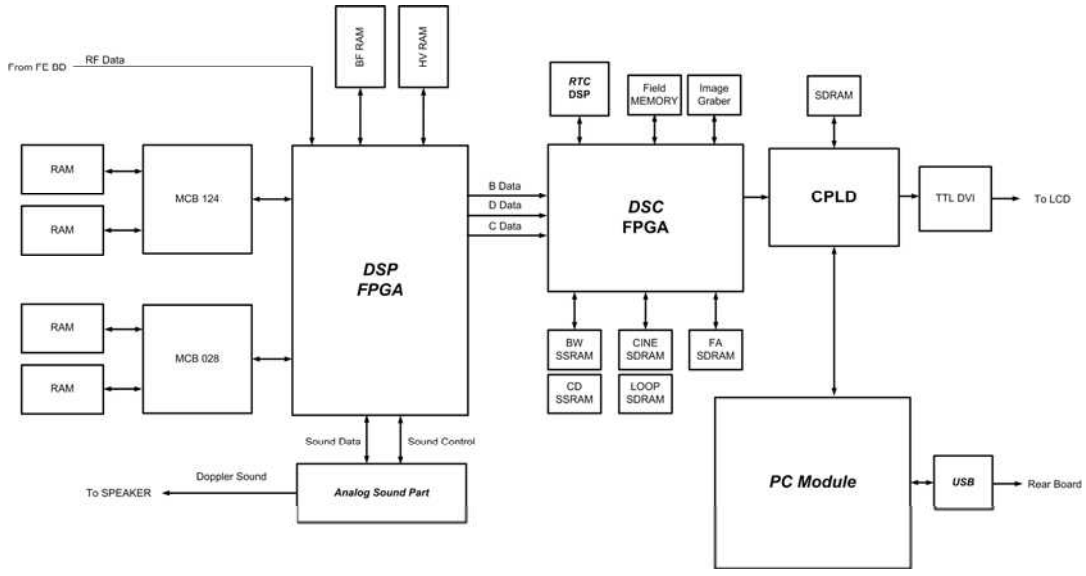
The Video Manger displays the VGA 1024 X 768 image on the monitor screen. An area of 640 X 440 only is allocated for displaying ultrasound images

Analog Sound Part processes the Doppler Sound Data from the DSP Part, with the Digital Analog Converter, amplifies the signal and sends it to the speaker.

In order to operate the PC Module, an industrial PC is usually incorporated into the system. Operating system in use Linux, which supports a wide array of peripherals.

BE Part consists of ASIC(MBC028) FPGA 2ea, CPLD. and Analog sound Part.

5.6.2 Block Diagram



[Figure 5-6] Back End Board Block Diagram

5.6.3 Specification

5.6.3.1 DSP Part

- BW mode (B-Mode) Image Data Processing
- Motion mode (M-mode) Image Data Processing
- Color Flow Mapping mode (CFM-mode) Image Data Processing
- Directional Power Doppler Image Data Processing
- Pulsed wave (PW) spectral Doppler Image Data Processing
- Synthetic aperture Processing
- Tissue Doppler Imaging Processing
- Multibeam processing Processing
- Tissue Harmonic Imaging Processing
- Speckle Reduction filter(SRF) Processing
- Extreme High Dynamic Range (18dB)
- Full Spectrum Imaging (FSI) Processing
- High Pulse Repetition Frequency (HPRF) Processing

5.6.3.2 DSC Part

- Frame Average Support
- Real Time Controller (RTC) Support
- ECG Interface
- Digital Scan Converter
- Cine for 512 frame
- Loop Review for 4096 lines
- Zoom
- Edge Enhancement
- Freehand 3D
- Quick Scan

5.6.3.3 VM Part

- Image Sync Generation
- BW, Loop Dual Display Windows Generation
- Image Header Mapping (BW, M, Doppler, Color)
- ECG Image Mapping
- Image Grabber Memory (Gray Bar, B Dual, B/Loop, Sonoview data)
- Field Memory (Video Frame Memory)
- DVI(VGA) Out
- Interlace VGA Out
- Interlace CV Out

5.6.3.4 PC Module

- Model : SOM-4455 (Advantech)
- CPU : Embeded AMD Geode LX800-500 Mhz

5.6.4 DSP Part Operation Mechanism

5.7.4.1 BW Mode and M Mode Image Data Processing

RF data generated in the BF Board in Input to the FPGA.

The input RF data in converted into RF data, which can be processed by the FPGA, and Input to the ASIC (MCB028A).

The ASIC (MCB028A) generate BW mode image data (hereafter, BW Data) and send the data to the DSP FPGA.

ASIC(MCB028) not only generate BW data but also do the functions of FSI(Full Spectrum Image), Spatial Compound Imaging (SCI), Trapezoidal Imaging, and Synthetic Aperture.

Especially, BW data is generated using the received RF data and through the DTGC(Digital Time Gain Compensation), Decimation, Quadrature mixer, Envelope detection, Log compression and various filters.

The BW data generated by ASIC(MCB028A) as described above are input to the DSP FPGA again. The data are processed by FSI(Full Spectrum Image) and Lateral filter, which is used to remove Multibeam artifact, and sent to the DSC Part.

For your reference, BW data can also be used as Motion Mode Image Data.

5.7.4.2 Doppler Image Data Processing

The RF data generated in the BF Board is input to the FPGA.

The input RF data is converted into RF data that can be processed by the FPGA and input to the ASIC (MCB028A).

ASIC (MCB028A) receives RF data and does the DTGC (Digital Time Gain Compensation), Decimation, and Quadrature mixer processing for the RF data . The RF data becomes I/Q data (In-phase & Quadrature Data). I/Q data are input to the DSP FPGA again.

I/Q data are processed by the FPGA and Doppler DSP and become Doppler Data and are sent to the DSC Part. Detailed descriptions are given below.

The DSP FPGA that received the I/Q Data, sends the data to the Doppler DSP via filtering.

I/Q Data passes through the Clutter Filter. After that, the Doppler Sound is generated through the Hilbert transform that separates sound directions. The data are input to the DSP FPGA again and is sent to the Analog Sound Part of the DSC Part.

In addition, I/Q Data are sent to the FFT (Fast Fourier Transform) circuit to generate the Doppler Spectrum, after passing through the Clutter Filter. By extracting the basic Doppler components of Power, Velocity, and Variance components, the Doppler Data are generated. The data are input to the DSP FPGA again and is sent to the DSC Part

5.7.4.3 Color Image Data Processing

The RF data generated in the BF Board is input to the FPGA.

The input RF data is converted into RF data that can be processed by the FPGA and input to the ASIC (MCB028A).

ASIC (MCB028A) receives RF data and does the DTGC (Digital Time Gain Compensation), Decimation, and Quadrature mixer processing for the RF data . The RF data becomes I/Q data (In-phase & Quadrature Data). I/Q data are input to the DSP FPGA again.

I/Q data are processed by the FPGA and Doppler DSP and become Doppler Data and are sent to the DSC Part. Detailed descriptions are given below.

The DSP FPGA receives the I/Q Data, sends the data to the ASIC (MCB028A) to extract color components. However, since the color component include Wall (blood vessel wall) Noise, the data are sent to the DSP FPGA again and passes through the Rejection, Smooth Filter, and Post Filter.

Color Data are completed in the process and sent to the DSC Part

5.6.5 Analog Sound Part Operation Mechanism

Processes the Doppler Sound and outputs to the speaker.

Doppler Sound is generated in the Doppler Part and is sent to the Analog Sound Part.

Doppler Sound passes through Audio Digital Analog Converter because the speaker requires analog signal.

5.6.6 DSC Part Operation Mechanism

The DSC Part is an image filter circuit that improves image quality. It consists of the screen conversion part which writes the received scan line data reads the monitor by the H-sync cycle, frame memory part, and zoom and freehand 3D path parts.

The DSC Part sums data from 2D mode and spectral Doppler mode produced by different paths together as one set of common data.

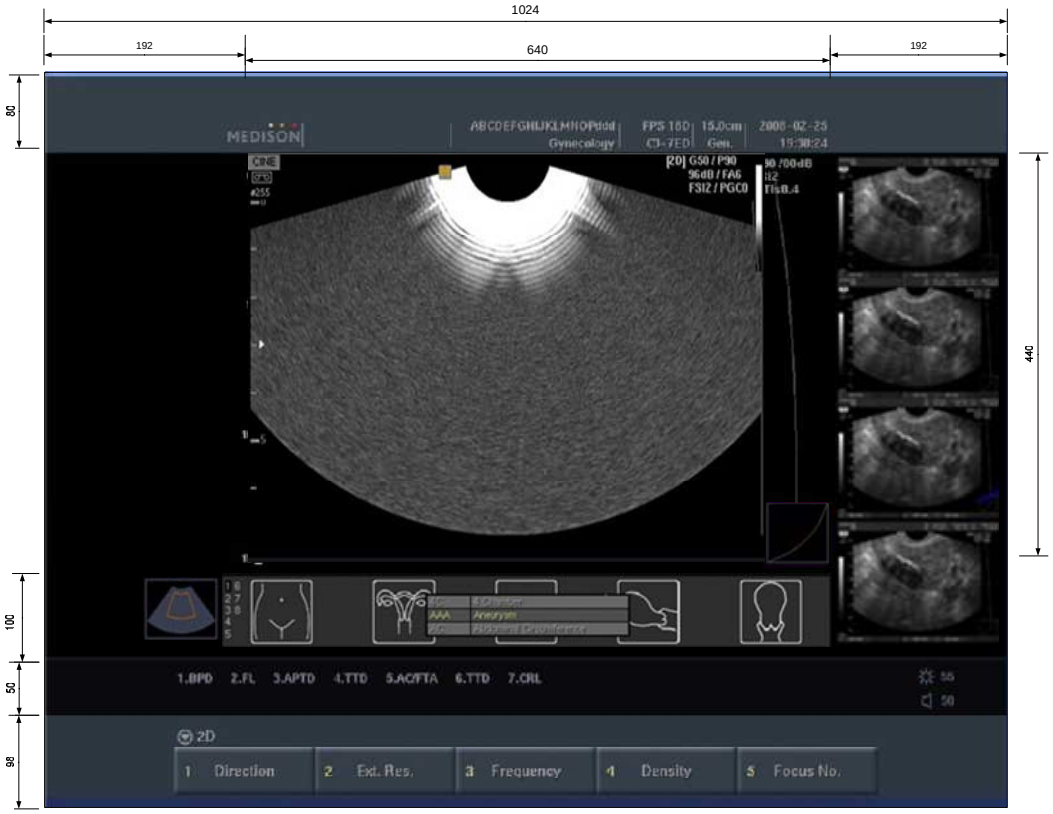
If facilitates various functions such as Digital Scan Conversion and Frame Average, 3D(DMA), Cine, RTC, Read Zoom, and Edge Enhance along with Memory.DMA (Direct Memory Access) consists of FA(Frame Average), DMA and ECG In/Out Part.

Since DMA processes data using the DMA path with the PC Module, it plays key role to improve the product performance.

RTC(Real Time Controller) generates base signal necessary for entire system operation in real-time and controls the system operations. It generates and controls the PRF (Pulse Repeat Frequency), OF(One Frame), RP(Rate Pulse), Line Type, and Scan Line signals necessary.

5.6.7 VM Part Operation Mechanism

The Video Manger Part converts the image data received from the DSC Part into Video image for displaying on the monitor and key it in with PC's VGA data. The keyed data id turmed into interlace and non-interlace signals for displaying the final output through a VGA monitor, interlace monitor, echo printer, etc.



[Figure 5-7] Display

- LCD Resolution: 1024 x 768
- Area 1 : Left Menu Area
- Area 2 : Image Area and VCR output area. (Size: 640 x 440)
- Area 3 : Thumbnail Area.
- Area 4 : User Info Area.1
- Area 5 : User Info Area. 2
- Area 6 : Soft Menu and Information Tab Area.

5.6.8 PC Module Operation Mechanism

5.6.8.1 PCI/Local Bus Interface

PCI/Local Bus Interface connects to the PCI bus of the CPU, converting it into a Local Bus so that various devices in the Local bus can be allocated in absolute address ranges fir their direct use.

5.6.8.2 Peripheral Port Interface

- CPU : Embedded AMD Geode LX800-500MHz
- Main Memory : 512MB DDR SDRAM
- Operating System : Linux Kernel 2.6.17.14
- Compiler : g++ v3.2.2
- USB 2.0

5.7 Rear Board

5.7.1 Major Function

Does the Input/Output function with external devices.

[Figure 5-8] Rear Board

5.7.2 Specification

- DVI Port (with VGA)
- USB Ports (2ea)
- LAN Port
- S-VHS Output (NTSC or PAL)
- VHS Output (NTSC or PAL)
- Sound out
- BW Echo Printer Remote Output

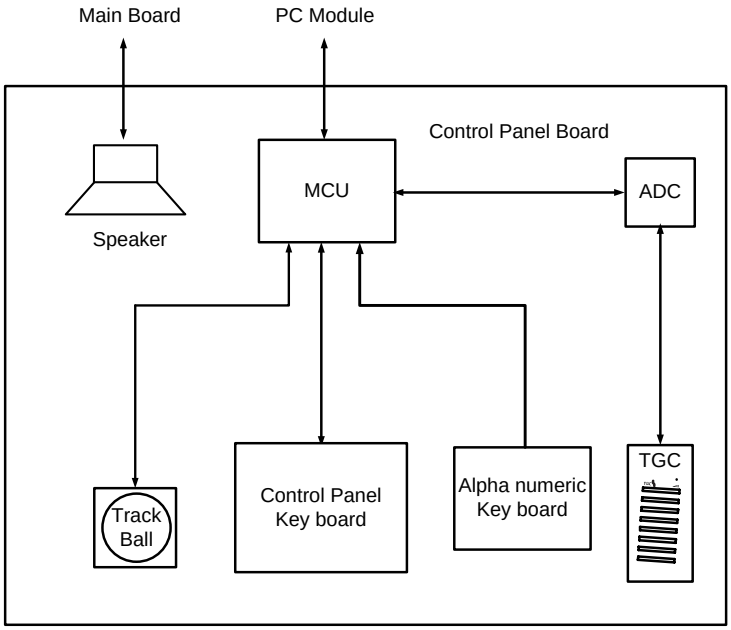
5.8 Control Panel

5.8.1 Major function

It plays the role of the interface between the user and the system.

Key Matrix Board, Alphanumeric Keyboard, and Track Ball do the role of User Interface.

5.8.2 Block Diagram



[Figure 5-9] Control Panel Block Diagram

5.8.3 Specification

- Alpha Numeric Board
- Track Ball
- Control Panel Key Matrix Board
- TGC Control
- Power Control Support
- Printer Remote Support

5.9 Power Supply

5.9.1 Input Voltage

SonoAce R3 is designed so that it operates when the input voltage is either 100V ~ 240V.

Standard Voltage	Input Frequency	Inrush Current
100 ~ 240 V	47 ~ 63 Hz	1.63 ~ 0.7A

[Table 5-1] Input Vlotage

5.9.1 Output Voltage

Output Name	Output Voltage	Minimum Current
P2.5V	+2.3Vdo	6.0A
P3.5V	+3.5Vdo	7.5A
P5V	+5Vdo	5.0A
P12V	+12Vdo	4.0A
N12V	-12Vdo	0.5A
PTHV	0 ~ +80Vdo	80mA
NTHV	0 ~ -80Vdo	80mA
PSHV	+97Vdo	10mA
NSHV	-97Vdo	10mA

[Table 5-2] Output Vlotage

5.9.3 Protection Power

5.9.3.1 Over Output Current Protection (OLP: Over Current Protection)

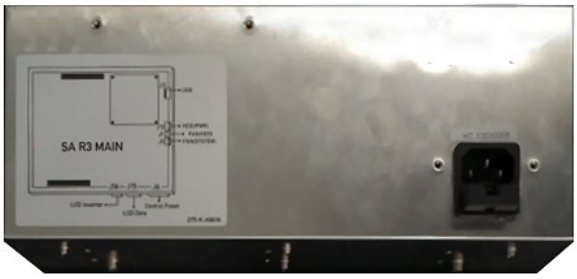
If current flows in the Over-Current Range exceeding the standard input and max output current, the OLP is activated and all powers of Power supply are cut off.

5.9.3.1 Over Output Voltage Protection (OVP : Over Voltage Protection)

If current flows in the Over-Voltage Range exceeding the standard input and max output voltage, the protection circuit is activated and all powers of Power supply are cut off.

5.9.3.1 Over Temperature Protection (OTP)

If the temperature of the DDM Case is equal to or higher than 80℃, all powers of Power supply are cut off.



[Figure 5-10] Power Supply

Chapter 6. Basic Maintenance

6.1 Overview

Chapter 6 describes basic EKO7maintenance procedures.

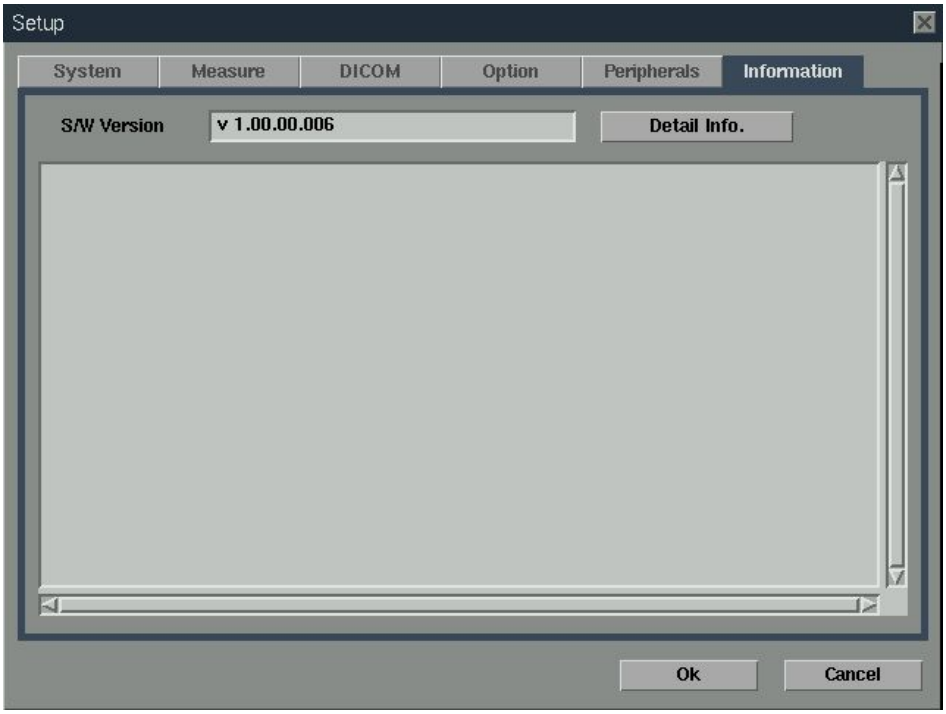
How to upgrade and how to use Admin Mode (Service Mode) are described.

Contents

6.2 System Information

To view system information, select the [Information] tab in the Setting screen.

The software version of the system will be displayed. Press [Detail] to view the detailed version information of the product.



[Figure 6-1] Setup-Information

NOTE

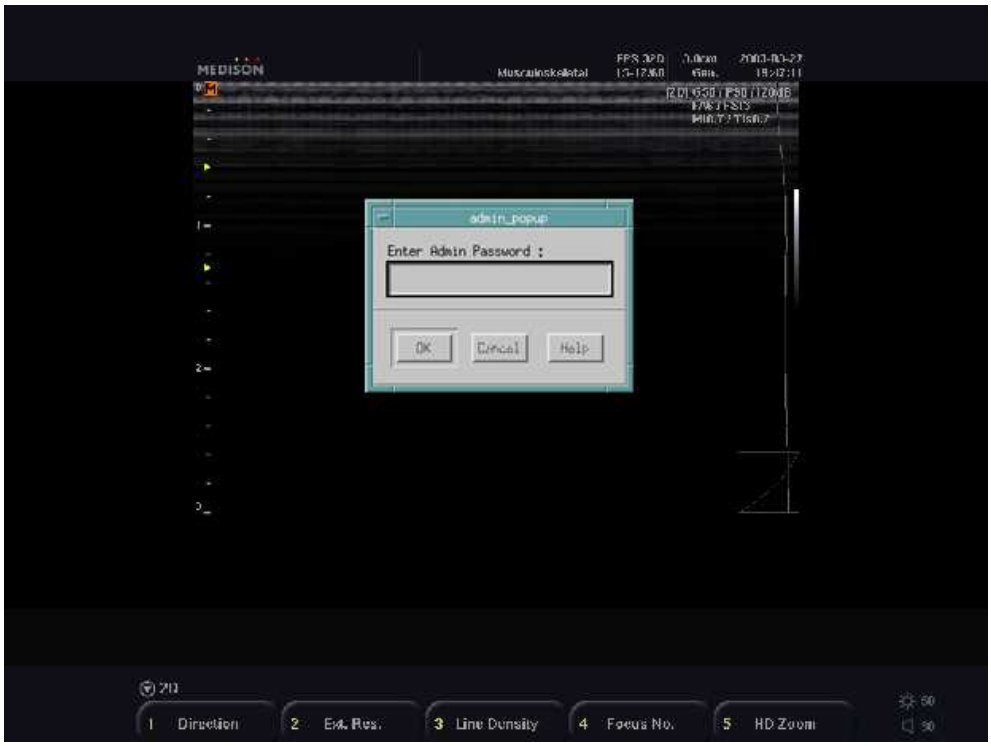
The software version number in the above figure may differ from the actual software version of the system

6.3 Admin Mode

Admin Mode is also called Service Mode. Admin Mode functions are described below. Admin Mode is necessary for critical settings and to add or delete options.

6.3.1 Entering Admin Mode

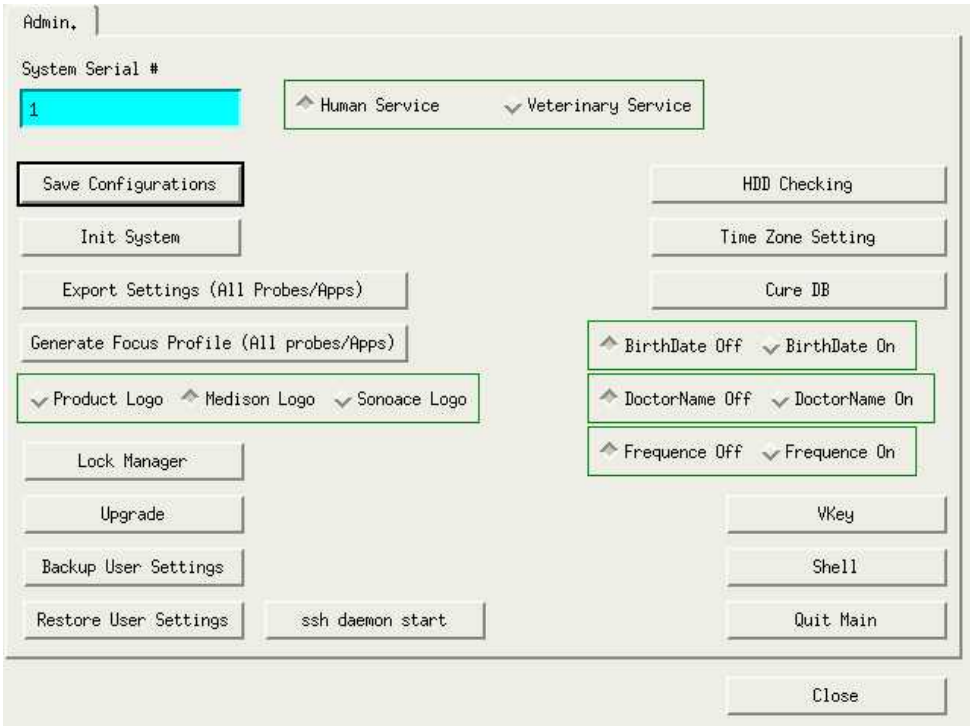
1) You have to enter a password with a combination from the alphanumeric keyboard in order to enter Admin Mode.
2) In Live mode, enter the admin password "[***] + [***] + [***] + [***]" and the admin mode popup will appear as shown below. You must keep the "[***]key" held down until the complete admin password is entered.
3) Enter the password "*********" in the admin mode popup to enter admin mode.



[Figure 6-2] Admin popup

6.3.2 Admin Mode Functions

This section describes admin mode.



[Figure 6-3] Admin Mode

6.3.2.1 System Serial#

Enter the System Serial No. in system serial #.

6.3.2.2 Save Configurations

Saves all settings in the system.

6.3.2.3 Init System

Initializes the system back to the factory default settings.

6.3.2.4 Export Settings (All Probes/Apps)

R&D only.

6.3.2.5 Logo

Supported logo is Product Logo, SAMSUNG MEDISON Logo and SONOACE Logo

6.3.2.6 Lock Manager

R&D only.

6.3.2.7 Upgrade

Referring to “6.4.1 Soft ware Upgrade”.

6.3.2.8 Backup User Settings

Referring to “6.5.1 Backup user Setting”.

6.3.2.9 Restore User Settings

Referring to “6.5.2 Restore User Setting”.

6.3.2.10 Ssh daemon start

R&D only.

6.3.2.11 Human Service & Veterinary Service

Select the setting for human and veterinary.

6.3.2.12 HDD Checking (needs rebooting)

Checks the hard disk for any problems.

6.3.2.13 Time Zone Setting

Setup can determine the correct time zone.

6.3.2.14 Cure DB

R&D only.

6.3.2.15 Vkey

Referring to “6.7 Control Panel Test”.

6.3.2.16 Shell

R&D only.

6.4 Upgrade

You can upgrade the software and hardware of SONOACE X6.

Upgrade includes the addition and improvement of functions and improves system performance.

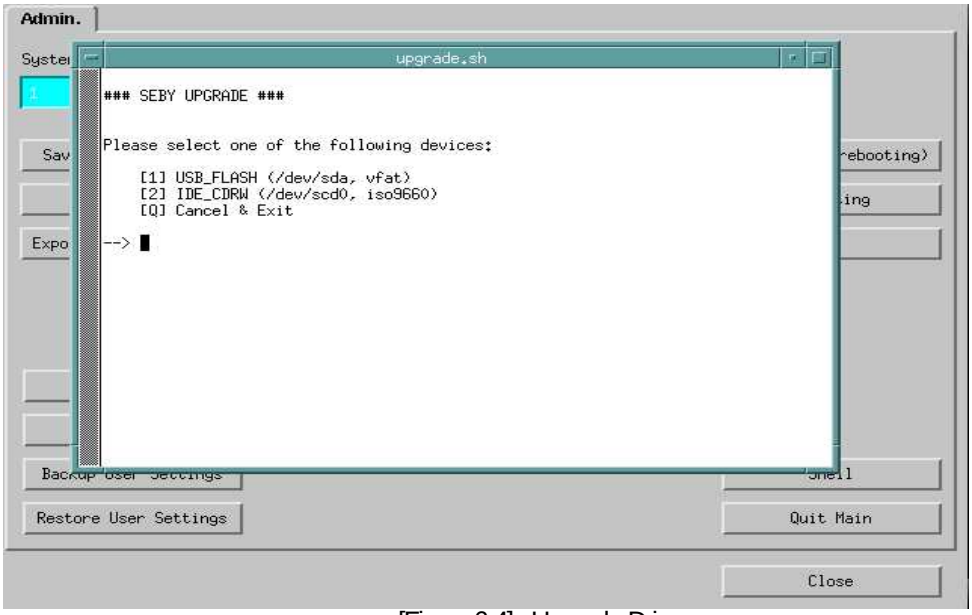
NOTE

- The installed software should be compatible with the hardware. If the installed software and hardware are not compatible, a problem may occur in functions or operations.
- A compatibility table is additionally provided by the customer service department of SAMSUNG MEDISON Co., Ltd.

6.4.1 Software Upgrade

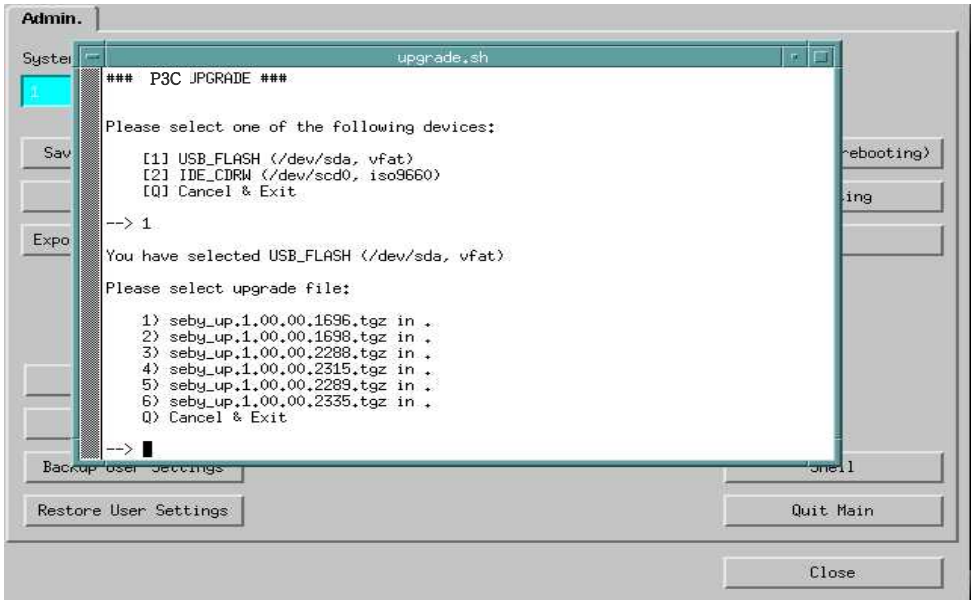
Follow these instructions to software upgrade the system.

1) Prepare a software file provided by the customer service department of SAMSUNG MEDISON.
2) Turn on SonoAce R3.
3) When system booting is complete, enter admin mode referring to "6.3.1 Entering Admin Mode".
4) Insert a CD/DVD into the CD/DVD-ROM drive or inert a Fresh Memory or MO into the USB port.
5) Press the upgrade button in the Admin mode.
6) Select the drive in the upgrade popup. [Figure 6-4]



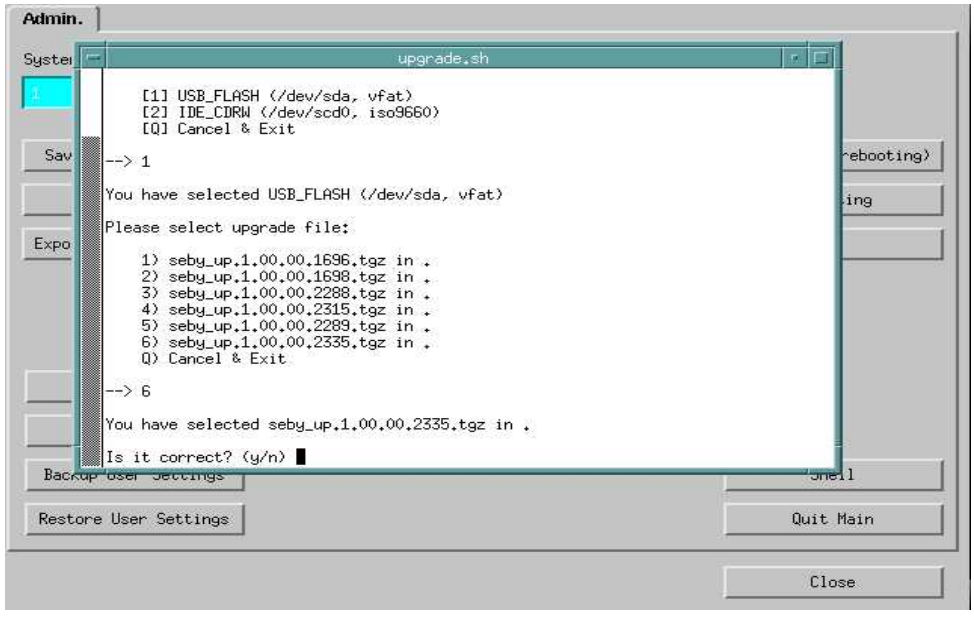
[Figure 6-4] Upgrade-Drive

7) Select the upgrade version. [Figure 6-5]



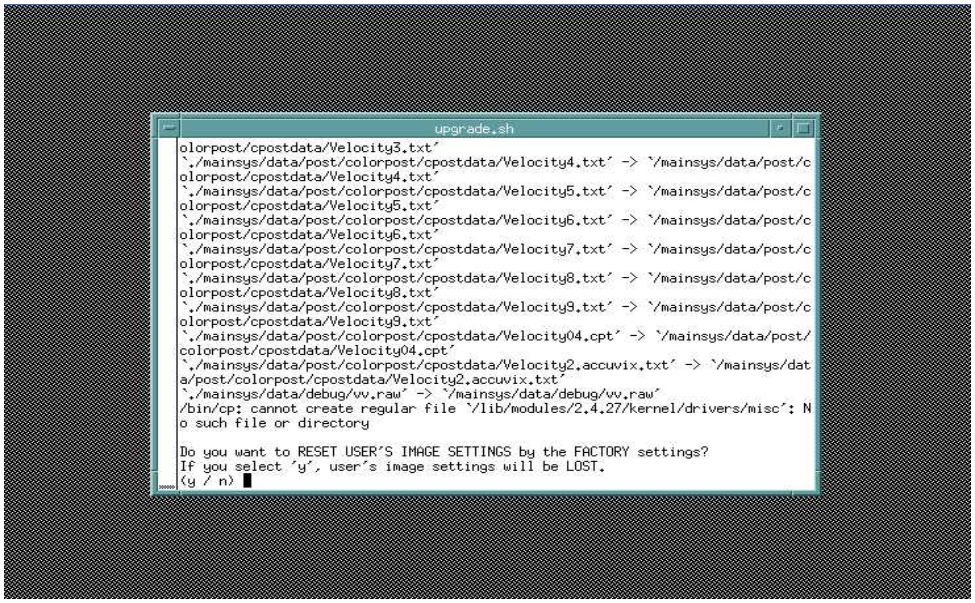
[Figure 6-5] Upgrade-Select Upgrade

8) Select "y" for the correct file.



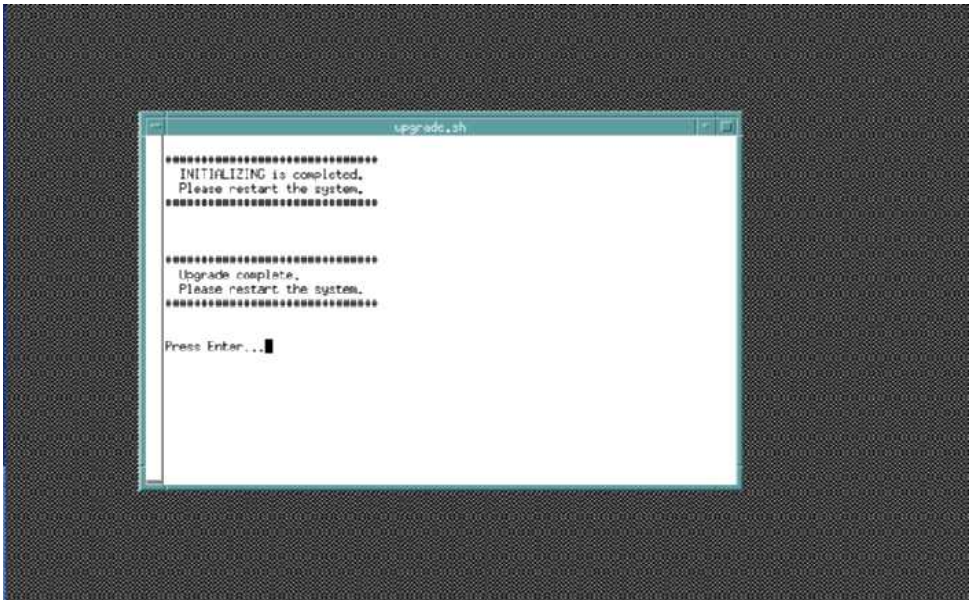
[Figure 6-6] Upgrade-connect Upgrade

9) When upgrade is complete, the system will ask whether you would like to upgrade the image user settings with factory settings. [Figure 6-7]



[Figure 6-7] Upgrade-Factory Setting

10) When the software upgrade is complete, restart SonoAce R3. [Figure 6-8]



[Figure 6-8] Upgrade-Rebooting

11) Check if the software version in the start screen is changed to the new version.

6.4.2 Hardware Upgrade

This means the replacement or addition of hardware.

NOTE

For information on hardware upgrade, refer to the “Chapter 8 Disassembly and Reassembly” of the Service Manual.

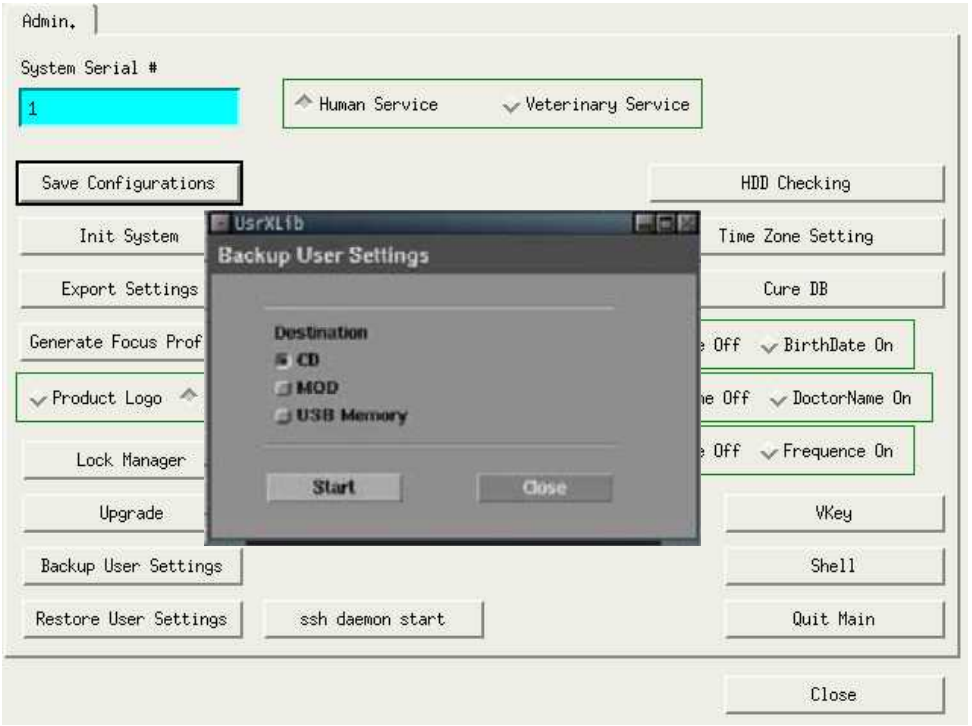
6.5 Backup & Restore

Follow the instruction to backup and restore user setting values.

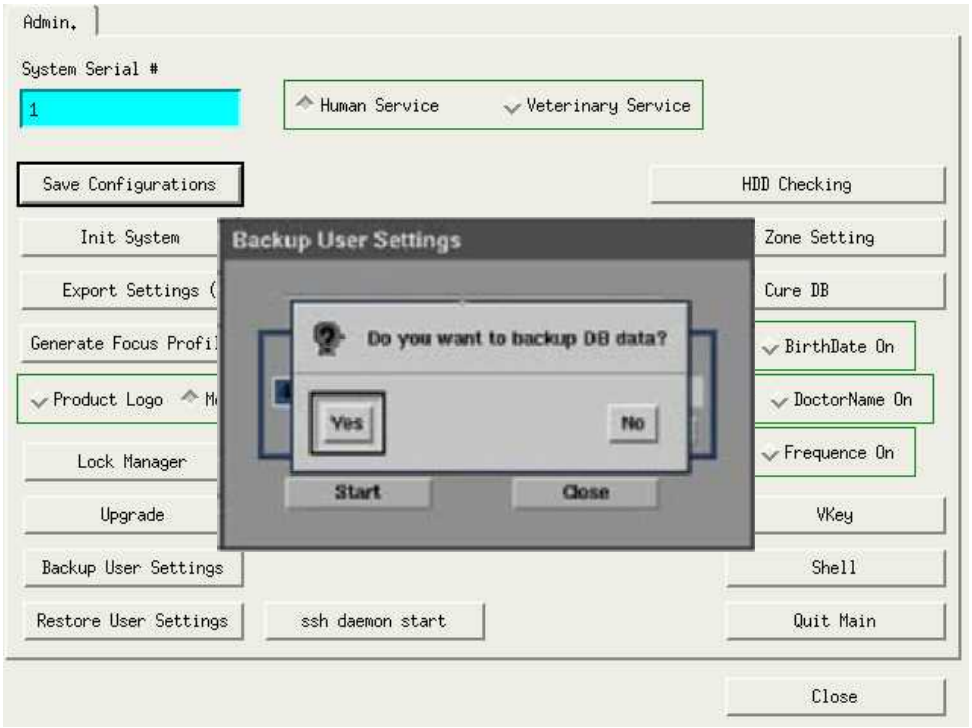
6.5.1 Backup User Setting

Using this function, you can backup your user settings onto external media. This function is available only in the Admin Mode.

1) Turn on SonoAce R3.
2) When system booting is complete, enter admin mode referring to “6.3.1 Entering Admin Mode”.
3) Insert a CD/DVD into the CD/DVD-ROM drive or a Fresh Memory or MO into the USB port.
4) Press the Backup User Settings button in the Admin mode.
5) Select the drive in the Backup User Settings pop-up and press the start button..
6) The system asks about Backup DB data. Press “yes” or “no”.



[Figure 6-9] User Setting-Backup1



[Figure 6-10] User Setting-Backup2

7) Backup again message

① CD/DVD Destination

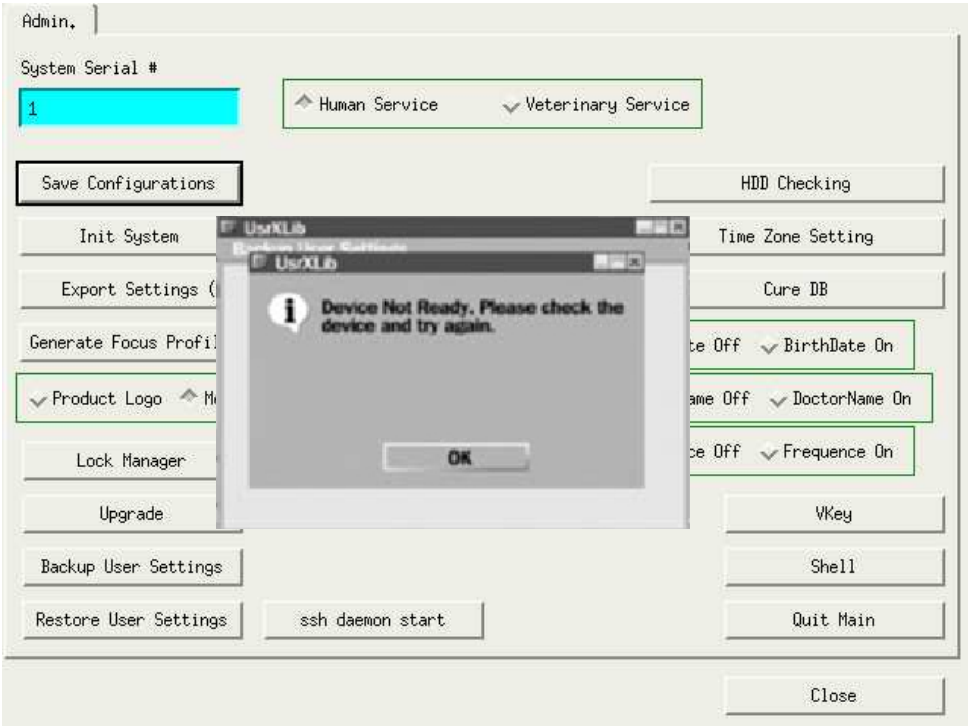
The CD media check progress bar will appear, Checking the media. When bar reaches 100%, the PC Write Progress bar will appear and the system will start writing to the CD. When the bar reaches 100%, the CD Writing Complete windows and the OK button will appear. Press the OK button to close the windows.

② MO or USB Memory Destination

The Progress bar will appear and the system will start writing to the MO/USB memory, When the bar progress 100%, the OK button will appear, Press the OK button to close in window.

③ Message appears when medium does not exist

The following message will appear if the medium is not ready.

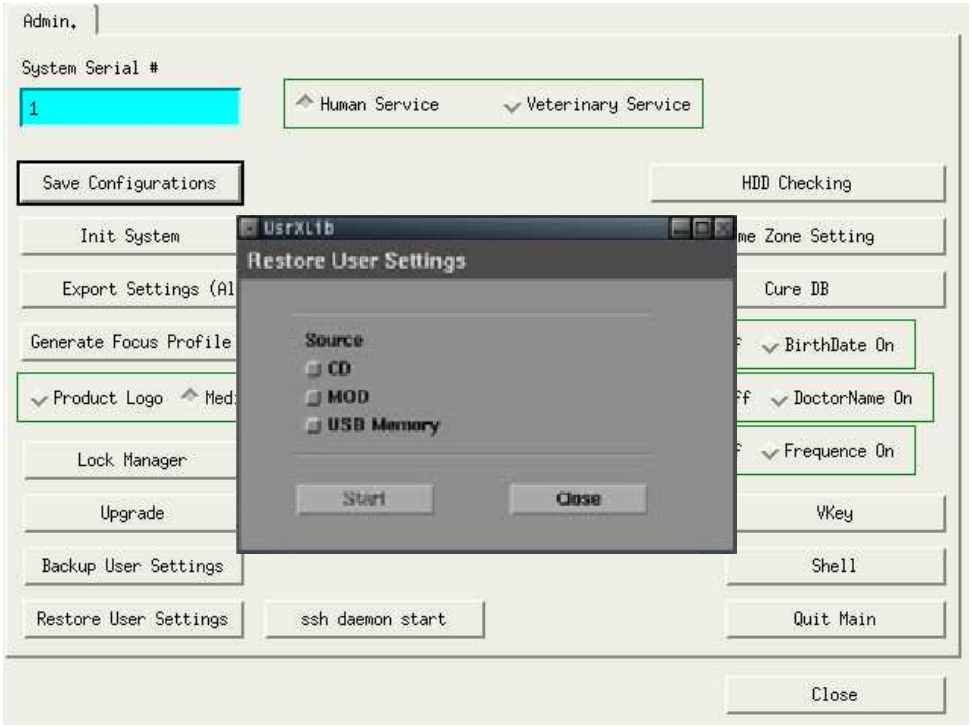


[Figure 6-11] Backup-again message

6.5.2 Restore User Setting

Using this function, you can restore your user settings onto external media. This function is available only in the Admin Mode.

1) Turn on SonoAce R3.
2) When system booting is complete, enter admin mode referring to “6.3.1 Entering Admin Mode”.
3) Insert a CD/DVD into the CD/DVD-ROM drive or a Fresh Memory or MO into the USB port.
4) Press the Restore User Settings button in the Admin mode. [Figure 6-12]
5) Select the drive in the Restore User Settings pop-up and press the start button.
6) The Progress bar will appear and the system will start decompressing restore data into the temp directory.
7) When the bar progress is100%, Press the close button to close window.



[Figure 6-12] User Setting-Restore

6.6 Adding and Deleting Options

This section describes how to add and delete options from SonoAce R3.

Adding and Deleting Options consist of Unlock / Lock types. Unlock means a state in which an option is available, while Lock means a state in which an option is unavailable.

Options are classified into software and hardware type. You can view the contents of an option in the Setup Mode.

6.6.1 Option Types

SonoAce R3 options become available by entering an Option Password or installing hardware.

For option types and registration methods, refer to the following table.

Option	Registration Method (Unlock)
Image Filing	Entering Option Password
DICOM	Entering Option Password
Freehand 3D	Entering Option Password
Pulse wave Doppler	Entering Option Password
Color Doppler	Entering Option Password
Cardiac S/W Package	Entering Option Password

[Table 6-1] Option Types

6.6.2 Registering Options

6.6.2.1 Entering Option Password

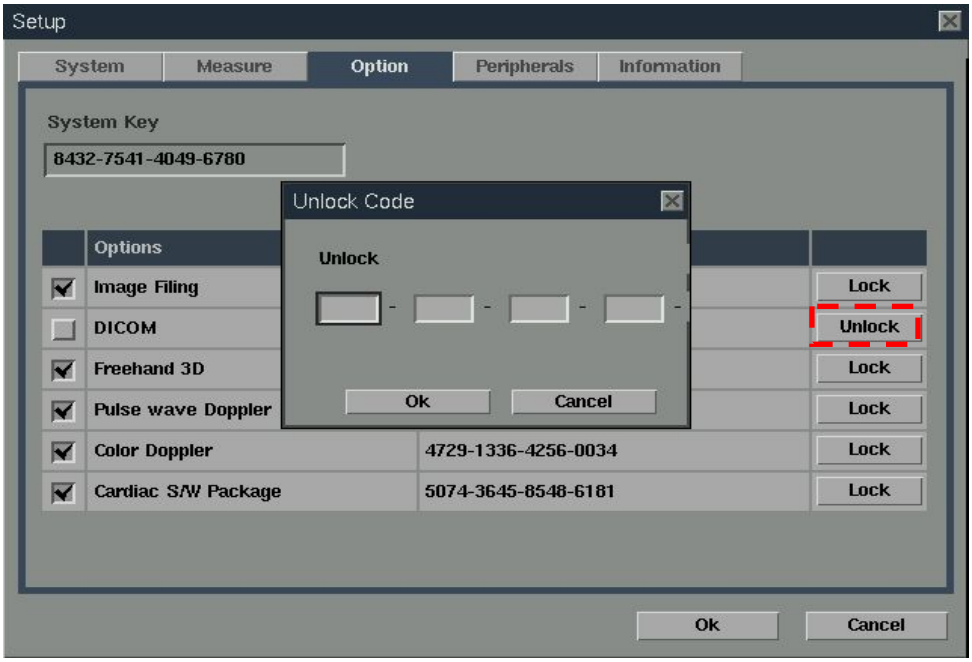
Procedures to register (Unlock) an option by entering a password will be described below.

1) Select the Option tab in setup mode.
2) Select an option to be added and enter the password.
3) If the entered password is correct, press the [OK] button and restart the system.

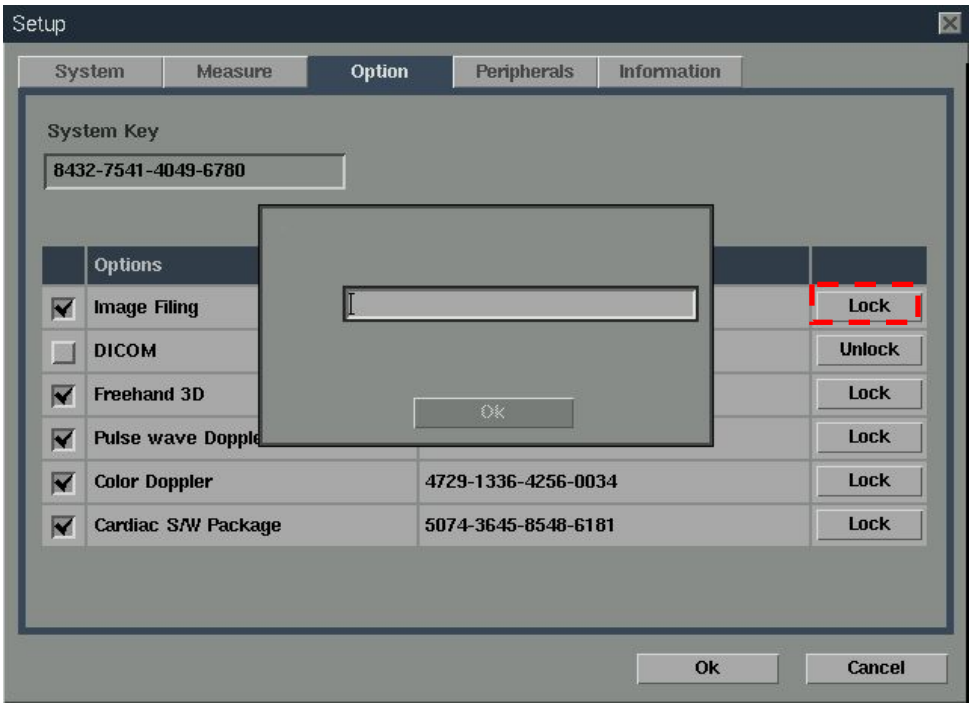
6.6.2.2 Deleting Options

Procedures to delete options are described below.

1) Select the Option tab in setup mode.
2) Select an option to be deleted, and enter the password.
3) If you have deleted a password, click the [OK] button and then restart the system.



[Figure 6-13] Registering Options



[Figure 6-14] Deleting Options

6.7 Control Panel Test

This section describes how to test control panel from SonoAce R3.

1) Turn on SonoAce R3.
2) When system booting is complete, enter admin mode referring to "6.3.1 Entering Admin Mode".
3) Select the Vkey button in Admin mode.
4) Start the Control panel Test in the Vkey pop.
5) When test is complete, Press the exit button to close in window.

Chapter 7. Troubleshooting

7.1 Overview

Chapter 7 describes basic troubleshooting procedures.

NOTE

Procedures for troubleshooting expected problems are described. Unexpected situations may occur.

Procedures for troubleshooting normal problems are described.

Contents

7.2 Power

7.2.1 Power Failure

This may occur if the power cord is not properly connected or the Power Supply is not working.

1) Check if the power cord is properly connected and if the cut-off switch of the ADM is turned on.
2) Check the fuse status.
3) Connect another device to the wall outlet and check if it works.
   If the device works, there is a Power Supply problem.
   If the device does not work, the problem is down to the wall outlet.
4) Check if the system fan works.
   If the fan works, the problem is not a power supply problem.
   If the fan does not work, a PC Power problem is likely.

7.2.2 Power cannot be turned off

A software error or PC Motherboard or Main Board problem is likely.

1) The power is automatically turned off when the Power Switch is pressed for more than 3 seconds. If software such as printer software is running or an operating system error occurs, the power is not turned off.
2) If you cannot turn the power off after completing the procedures in 1), a PC Motherboard or Main Board problem is likely.

7.2.3 Power is automatically turned off

Power cord, PC Mother Board, Main Board trouble is expected.

1) Check if the power cord is properly connected.
2) Check the fuse status.
3) Connect another device to the wall outlet and check if it works.
   If the device works, it is due to Power Supply problem.
   If the device does not work, it is due to wall outlet problem.
4) If the power is automatically turned off after completing the procedures of “1), 2), and 3)”, PC Mother Board, Main Board trouble is expected.

7.3 Monitor

7.3.1 Blank Screen

LCD Data Cable or PC Part trouble is expected.

1) Try to print to check the product status.
   If printing is normal, monitor or PC Part trouble is expected.
2) Check the cable is properly connected with the monitor.
3) If no problem has been found in the above “1) and 2)”, monitor and PC Part trouble is expected.

7.3.2 Screen Color is Abnormal

Data Cable of the monitor or PC Part is improperly connected or monitor or PC Part trouble is expected.

1) Check the monitor connection cable status.
2) If no problem has been found in the above “1)”, monitor and PC Part trouble is expected..

7.4 Error Messages

7.4.1 System hangs after an error during booting

Temporary software error or product trouble is expected.

1) Turn the power off by force and then turn it on again after 1 to 2 minutes.
2) If the symptom continues after completing “1)”, check when the error message appears
   If the error message appears while SonoAce R3 logo appears, system software or ultrasound system part trouble is expected.

7.4.2 System works even if an error occurred

Temporary software error or product trouble is expected.

1) Turn the power off by force and then turn it on again after 1 to 2 minutes.
2) If the symptom continues after completing “1)”, check when the error message appears
   If the error message appears while SonoAce R3 logo appears, system software or ultrasound system part trouble is expected.

7.5 Image

7.5.1 No BW Mode Image Echo & No BW Mode Image Format

Probe and the system connection, Main Board or Power trouble is expected.

1) Check the connection between the probe and the system.
2) Check if probe oscillation sound is heard.
   If oscillation sound is heard, the problem may be DDM trouble.
4) If no problem has been found in the above “1), 2) BF Board trouble is expected

7.5.2 Noise Like Rain over the BW Mode Image (Noise)

Power noise or BF Board trouble is expected.

1) Check if the system shares the wall outlet with another device.
   If the system shares the wall outlet with a device that uses electric motor or consumes high power, noise may be generated.
2) If the symptom continues when you connect the system to the wall outlet of another room, the problem is power noise.
3) If no problem has been found in the above “1) and 2)”, Main Board trouble is expected.

7.5.3 PW & Color Doppler Mode Trouble

Main Board trouble is expected.

Chapter 8. Disassembly and Reassembly

8.1 Overview

Chapter 8 describes how to disassemble SonoAce R3.

Refer to this chapter when you upgrade or repair the hardware.

⚠ WARNING

- The system contains dangerous high voltage. Never disassemble the system. There is a risk of electric shock and injury.
- The repair of the system and the replacement of parts must be carried out by an authorized engineer or the customer service department of SAMSUNG MEDISON Co., Ltd.
- The company is not responsible for any injury and damage caused by not following this warning.
- When working with the system on, do not wear a static electricity protective wristband There is a risk of electric shock and injury.

NOTE

- When disassembling or reassembling the system, wear static electricity protective gloves and a wristband.
- These will prevent any accidents due to carelessness, and damage to the system due to static electricity.

[Figure 8-1] Static Electricity Protective Gloves and Wristband

Contents

8.2 Disassembly and Reassembly of the Body Cover

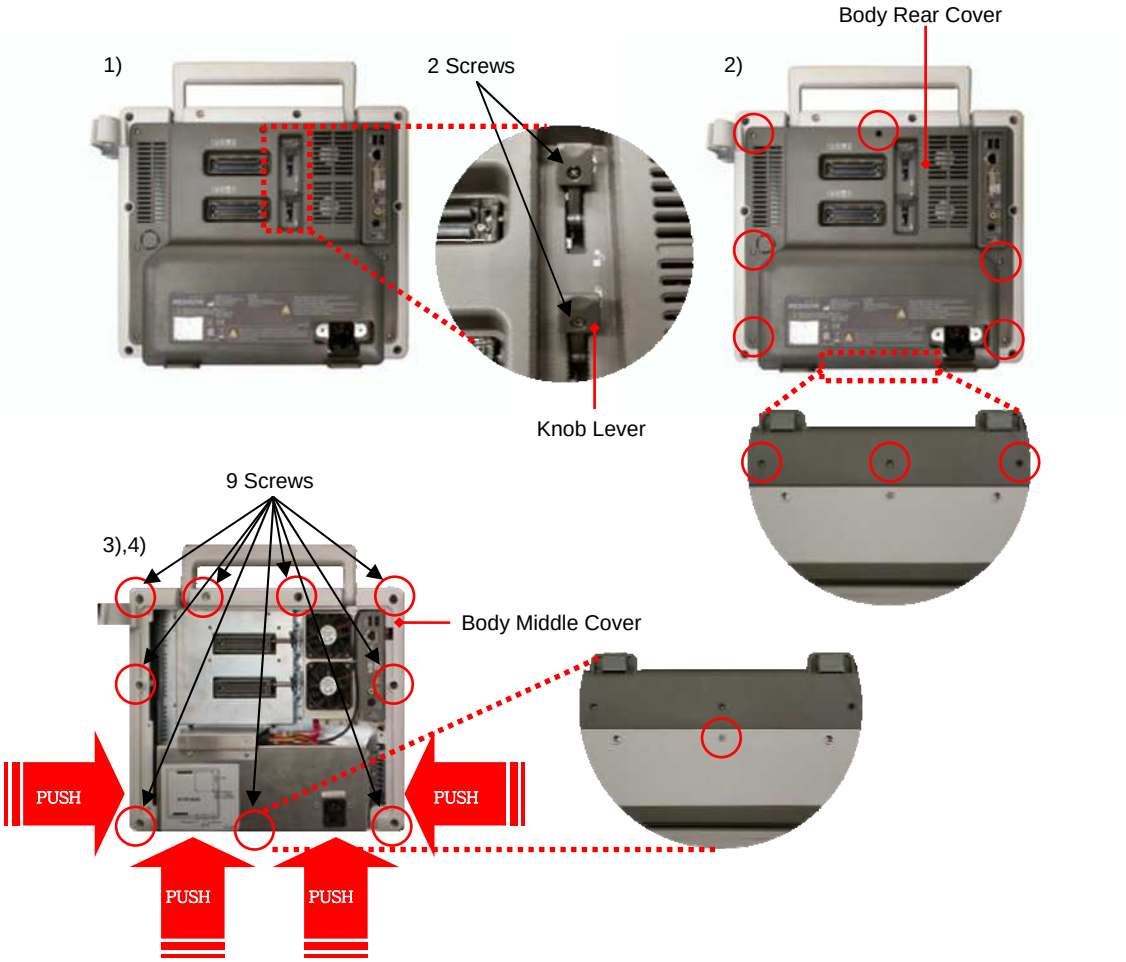
8.2.1 Preparations

1) Prepare a (+) screwdriver and static electricity protective gloves.
2) Shut down the system referring to “3.7 System Shutdown (Power Shut Down)”.

8.2.2 Body Rear & Middle Cover

1) Remove the 2 screws from the Probe Knob Lever using the (+)screwdriver.
2) Remove the 9 screws from the Body Rear Cover using the (+)screwdriver.
3) Remove the 9 screws from the Body Middle Cover using the (+)screwdriver.
4) Press the direction of the arrow of Body Middle Cover to disassemble it

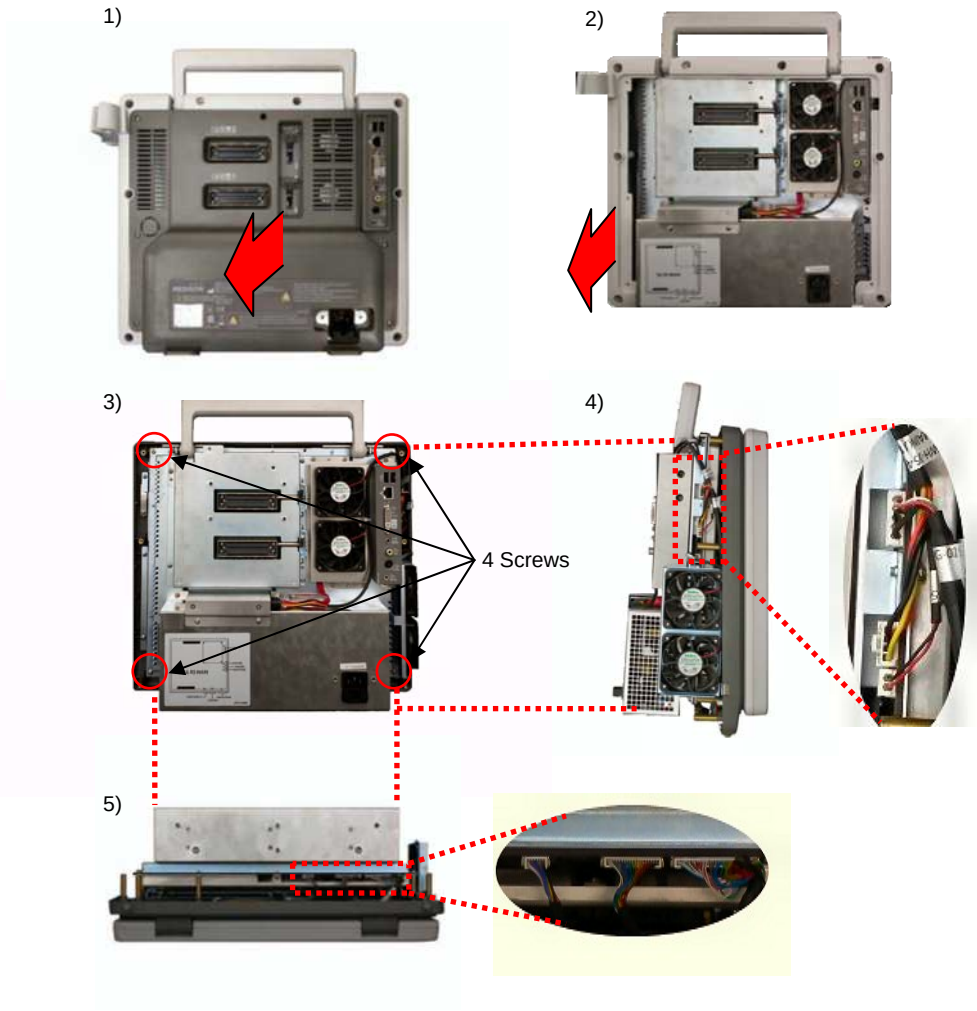
.



[Figure 8-2] Body Front Cover

8.2.3 Disassembly of the Main Part and LCD/Control Panel

1) Disassemble the Body Rear Cover referring to “8.2.2 Body Rear&Middle Cover”.
2) Disassemble the Body Middle Cover referring to “8.2.2 Body Rear&Middle Cover”.
3) Remove the 4 screws from the LCD using the (+)screwdriver.
4) Disassemble 3 cables which are connected to Beside of System.
5) Disassemble 3 cables which are connected to Bottom of System.



[Figure 8-3] Main Part and LCD / Control Panel

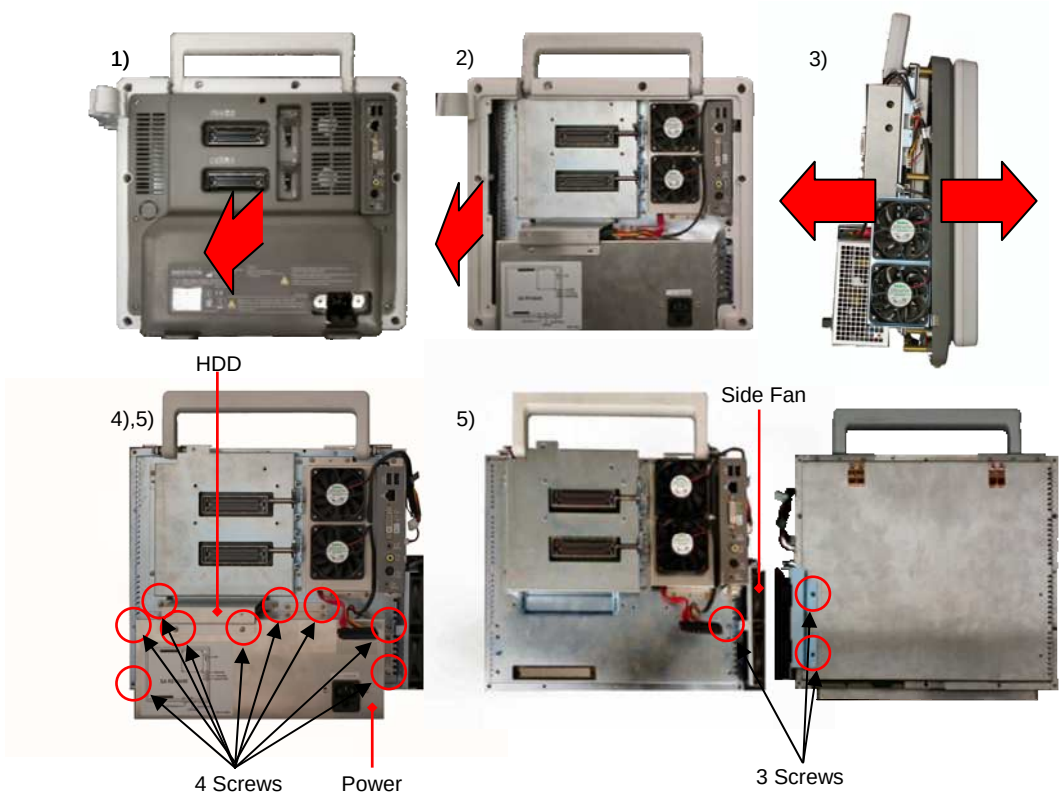
8.3 Disassembly and Reassembly of the Main System Part

8.3.1 Preparations

1) Prepare a (+) screwdriver and static electricity protective gloves.
2) Shut down the system referring to “3.7 System Shutdown (Power Shut Down)”.

8.3.2 Power & HDD & Side Fan

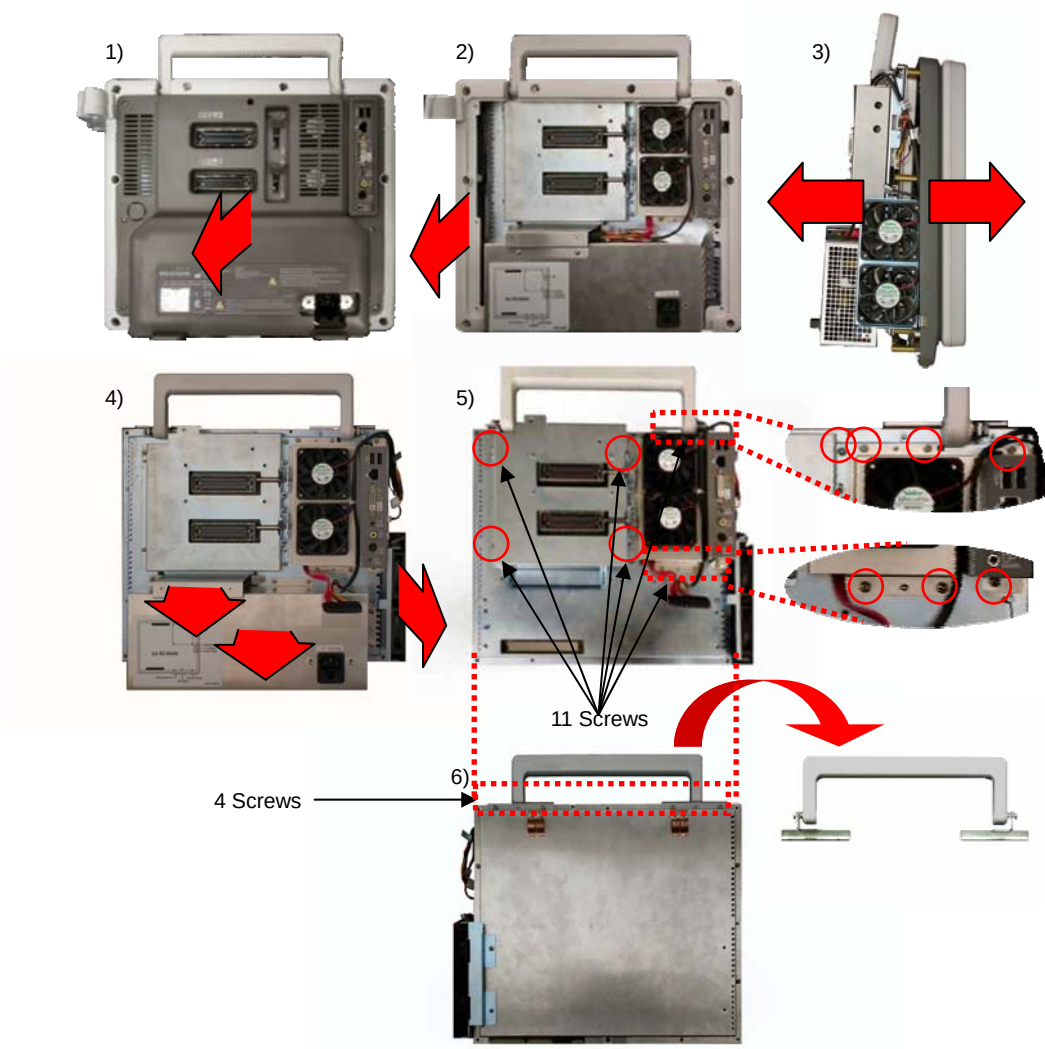
1) Disassemble the Body Rear Cover referring to “8.2.2 Body Rear&Middle Cover”.
2) Disassemble the Body Middle Cover referring to “8.2.2 Body Rear&Middle Cover”.
3) Disassemble the Main Part and LCD/Control Panel referring to ”8.2.3 Main Part and LCD/Control Panel”.
4) Remove the 10 screws from the HDD/Powr using the (+) screwdriver.
5) Remove the 6 screws from the Power using the (+) screwdriver.
6) Remove the 3 screws from the Front/Back of Side Fan using the (+) screwdriver.



[Figure 8-4] Power & HDD & Side Fan

8.3.3 PSA & Rear & Rear Fan & Handle

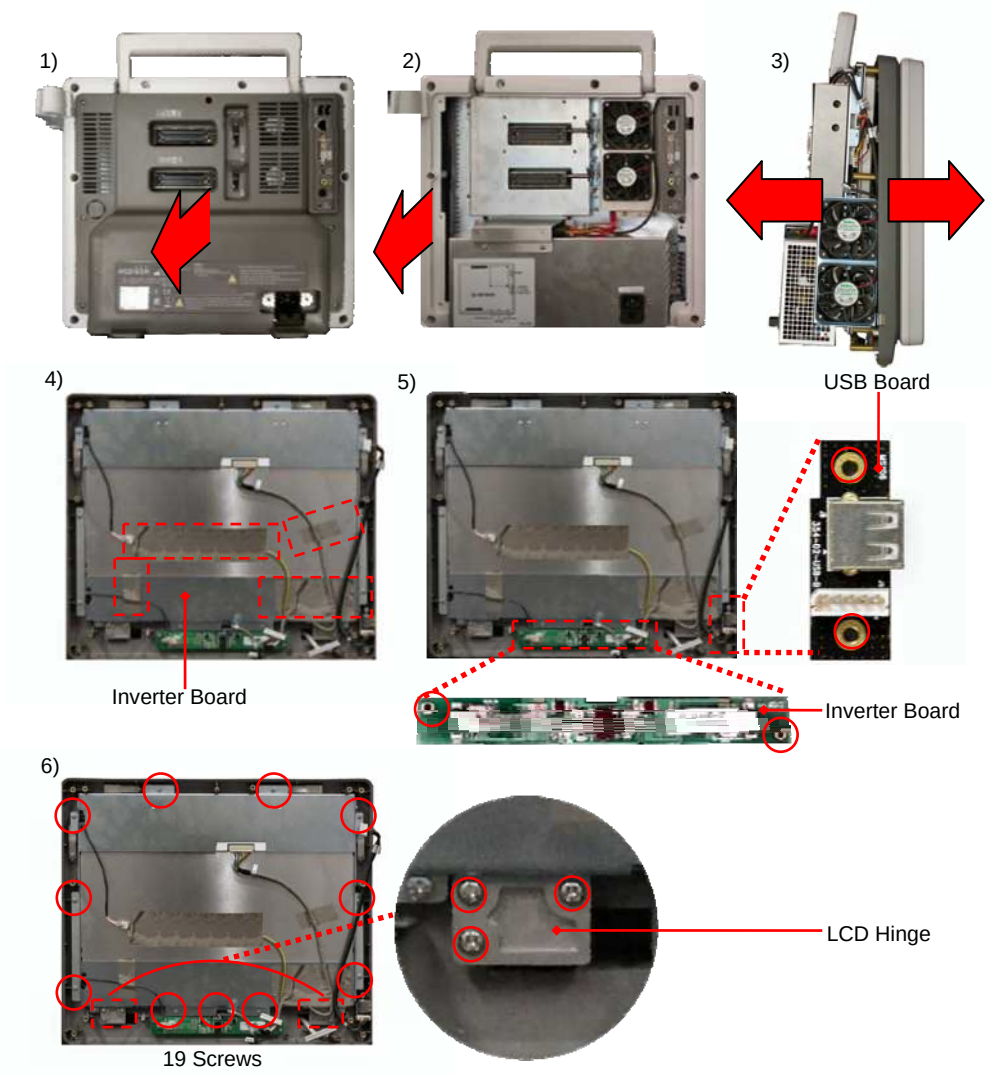
1) Disassemble the Body Rear Cover referring to “8.2.2 Body Rear&Middle Cover”.
2) Disassemble the Body Middle Cover referring to “8.2.2 Body Rear&Middle Cover”.
3) Disassemble the Main Part and LCD/Control Panel referring to ”8.2.3 Main Part and LCD/Control Panel”.
4) Disassemble the Power & HDD & Side Fan referring to ”8.3.2 Power & HDD & Side Fan”.
5) Remove the 11 screws from the PSA & Rear & Rear Fan using the (+)screwdriver.
6) Remove the 4 screws from the Main Board using the (+) screwdriver.



[Figure 8-5] PSA & Rear & Rear FAN & Handle

8.3.4 LCD & Inverter & USB Board

1) Disassemble the Body Rear Cover referring to “8.2.2 Body Rear&Middle Cover”.
2) Disassemble the Body Middle Cover referring to “8.2.2 Body Rear&Middle Cover”.
3) Disassemble the Main Part and LCD/Control Panel referring to ”8.2.3 Main Part and LCD/Control Panel”.
4) Gasket LCD is attached to the back of the Cable is connected to the wash to remove all.
5) Remove the 2 screws from the Inverter & USB Board using the (+) screwdriver.
6) Remove the 19 screws from the LCD Panel & Hinge using the (+) screwdriver.



[Figure 8-6] LCD & Inverter & USB Board

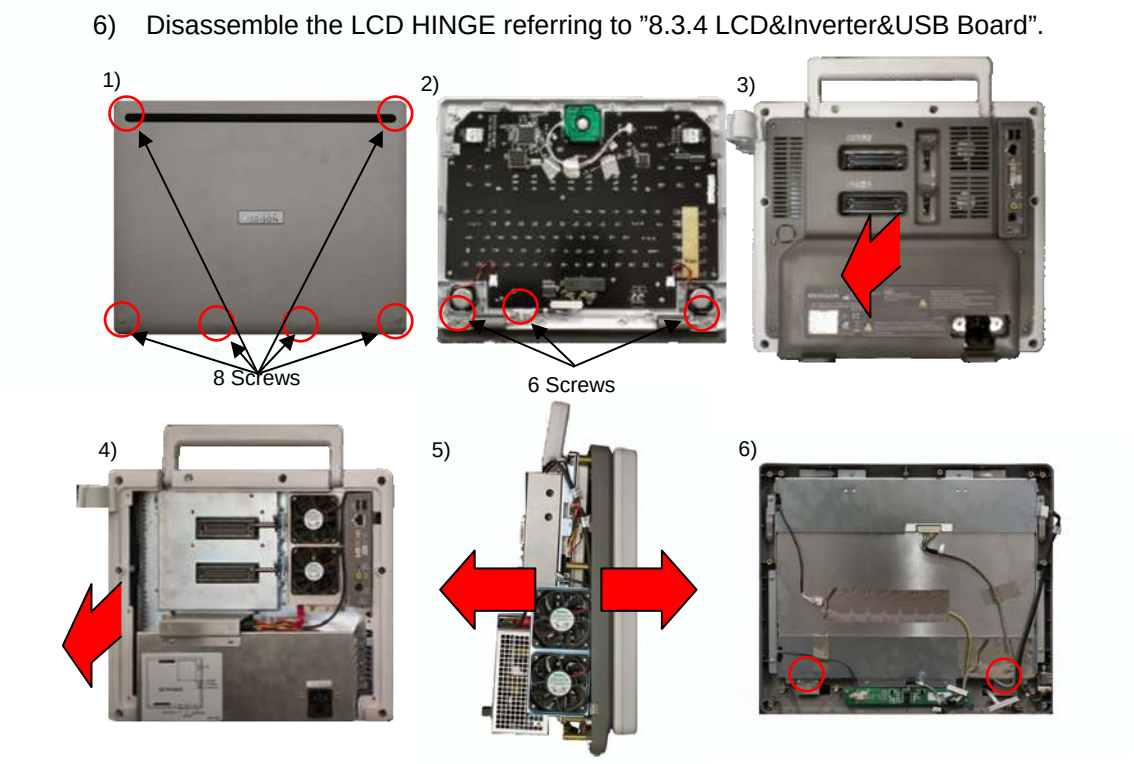
8.4 Disassembly and Reassembly of the Control Panel

8.4.1 Preparations

1) Prepare a (+) screwdriver and static electricity protective gloves.
2) Shut down the system referring to “3.7 System Shutdown (Power Shut Down)”.

8.4.2 Disassembly Control Panel and LCD

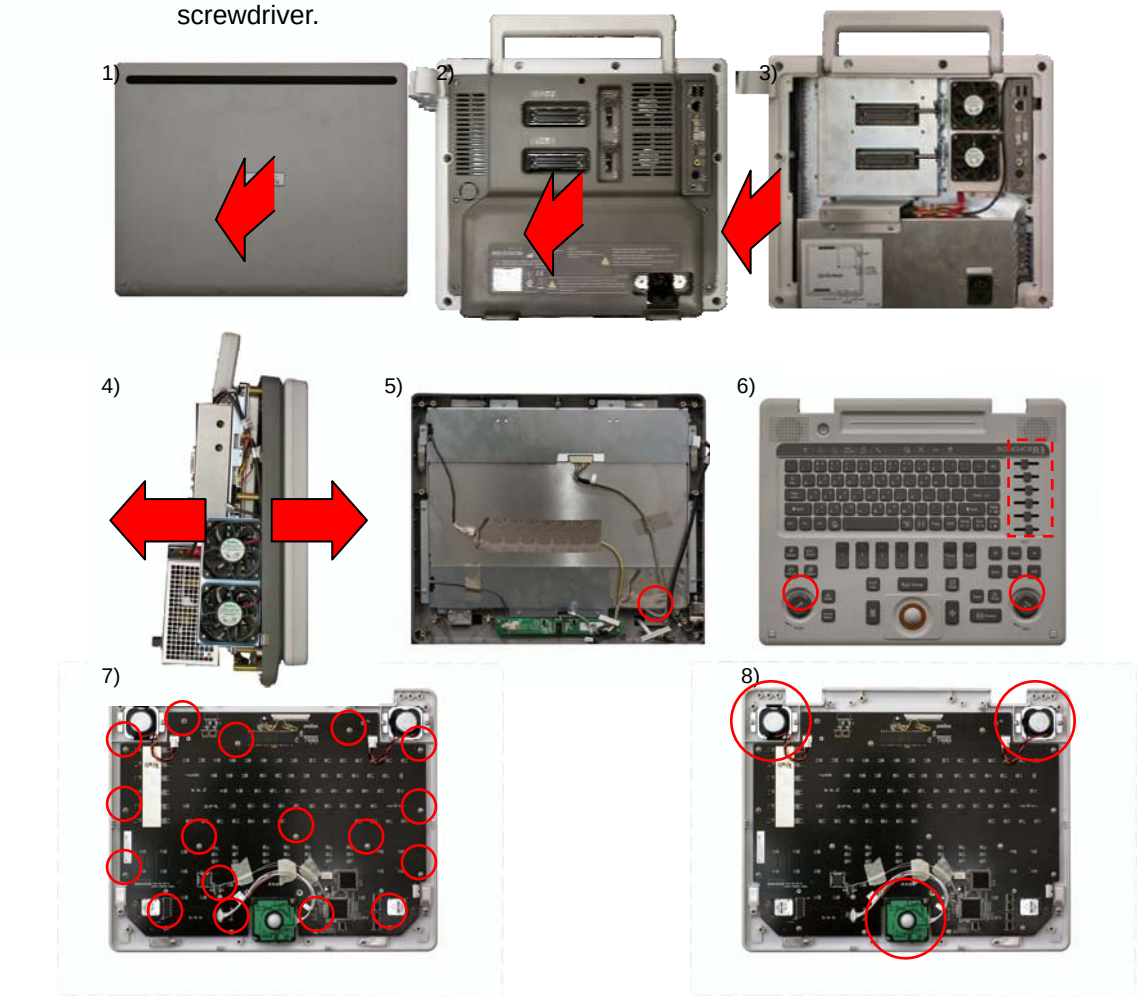
1) Remove Rubber of CP Front Cover and then unscrew 8 screws by using (+) Screwdriver.
2) Remove the 6 screws from the LCD HINGE using the (+)screwdriver and disconnect any cables connected to control panel.
3) Disassemble the Body Rear Cover referring to “8.2.2 Body Rear&Middle Cover”.
4) Disassemble the Body Middle Cover referring to “8.2.2 Body Rear&Middle Cover”.
5) Disassemble the Main Part and LCD/Control Panel referring to ”8.2.3 Main Part and LCD/Control Panel”.
6) Disassemble the LCD HINGE referring to ”8.3.4 LCD&Inverter&USB Board”.



[Figure 8-7] Control Panel and LCD

8.4.3 Control Panel

1) Disassemble CP Front Cover and LCD Hinge step by step. Please refer to the Disassemble of Control Panel and LCD.
2) Disassemble the Body Rear Cover referring to “8.2.2 Body Rear&Middle Cover”.
3) Disassemble the Body Middle Cover referring to “8.2.2 Body Rear&Middle Cover”.
4) Disassemble the Main Part and LCD/Control Panel referring to ”8.2.3 Main Part and LCD/Control Panel”.
5) Disassemble the LCD Panel Hinge referring to ”8.3.4 LCD&Inverter&USB Board”.
6) Disassemble the MENU & Q SCAN & TGC Knob of Control Panel.
7) Remove the 17 screws from the Control Panel using the (+) screwdriver.
8) Remove the 6 screws from the Speaker and Track Ball using the (+) screwdriver.



[Figure 8-8] Control Panel

Chapter 9. Probe

9.1 Overview

The probe is a device that sends and receives ultrasound for acquiring image data. It is also called a Transducer or Scanhead.

The system limits patient contact temperature to 43℃degrees Celsius, and acoustic output values to their respective U.S. FDA limits. A power protection fuse circuit protects against over-current conditions. If the power monitor protection circuit senses an overcurrent condition, then the drive current to the probe is shut off immediately, preventing overheating of the probe surfaces and limiting acoustic output. Validation of the power protection fuse circuit is performed under normal system operation. For invasive probes, additional protections are designed to keep patient contact surface temperature under 43℃ degrees Celsius in the event of a single fault failure.

Contents

9.2 Probe List

The ultrasound image scanner uses probes to obtain graphic data of the human body and then displays it on the screen. Always use application-specific probes in order to obtain the best quality images. It is also important to configure the probe with the best settings for the particular organ being scanned

9.2.1 Probe Application and Preset

Probes, applications and settings available for this product are as follows.

Probe	Application
C2-4/20	Abdomen, Cardiac
CN4-9	Neonatal, Pediatric, Vascular
CN2-8	Abdomen, OB, Gynecology, Renal, Fetal Heart
LN5-12/40	MSK, Small Parts, Vascular
L5-12/60	Abdomen, Cardiac, Pediatric Cardiology, TCD
LV5-12/60	OB, MSK
LV2-5/180	MSK
EC4-9	OB, Gynecology, Urology

NOTE

- Besides, user can have or select own preset between User 1- 5.
- Refer to ‘Chapter 3. Starting Diagnosis’ for how to set probe and its preset.

9.3 Thermal Index (TI Table) Tables

TI(TI;Thermal Index) values displayed on the screen title bar can change depending on probes and applications. EKO7 decides automatically which TI value will be displayed out of TIs(TI;Thermal Index System), TIb(TI;Thermal Index Bone), and TIc(TI;Thermal Index Cranium). The TI values are as follows.

Probe	Application												
	Obstetrics	Gynecology	Abdomen	Fetal Heart	Cardiac	Breast	Vascular	Urology	Renal	Small Parts	Neonatal	Pediatric	Musculoskeletal
C2-4/20			TIs		TIs								
CN4-9							TIs				TIc	TIs	
CN2-8	TIb	TIs	TIs	TIb									
LN5-12/40						TIs	TIs			TIs			TIs
L5-12/60						TIs	TIs			TIs			TIs
LV5-12/60	TIb												TIs
LV2-5/180													TIs
EC4-9	TIb	TIs						TIs					

9.4 Ultrasound Transmission Gel

Using an inappropriate ultrasound gel may damage the probe. For proper transmission of the acoustic beam, only use ultrasound transmission gel only approved by SAMSUNG MEDISON.

WARNING

- Do not use mineral oil, iol-based solutions, or other non-approved material as they may cause damage to the probe.
- Do not use gels that contain any of the following agents:
  - Acetone
  - Methanol
  - Denatured Ethyl Alcohol
  - Mineral Oil
  - Iodine
  - Lanolin
  - Any lotions or gels containing perfume

9.5 Probe Precautions

The probe can easily be damaged by improper use or by contacting certain chemical substances. Always follow the instructions in the user manual to inspect the probe cable, case and lens before and after each use.

Check for cracks, broken parts, leaks and sharp edges. If there is any damage, immediately stop using the probe and contact the SAMSUNG MEDISON Customer Support Department. Using damaged probes may result in electric shocks and other hazards to the patients and/or users

CAUTION

- Do not apply mechanical shock to the probe.
- Do not place the probe cable on the floor where the cable can be run over by equipment wheels, etc. Do not apply excessive force to bend or pull the cable.
- Do not immerse the probe into any inappropriate substances such as alcohol, bleach, ammonium chloride and hydrogen peroxide.
- Do not expose the probe to temperatures of 50°C or higher.

9.5.1 Use and Infection Control of the Probe

The ultrasonographic image scanner uses ultrasound, and it makes direct contact with the patient when in use. Depending on the types of examinations, such contact can be made to a wide variety of locations including the ordinary skin or the location of blood transfusion during a surgery.

The most effective method to prevent infection among patients is to use each probe only once. However, probes may need to be reused, as they are complex in design and expensive. Consequently, protective devices such as sheaths must be used, and the safety instructions must be followed carefully in order to minimize the risk of infection among patients.

WARNING

No neurosurgical treatments or examinations should be carried out on a patient with Creutzfeldt-Jakob disease (critical brain disease caused by virus). If the probe has been used on such a patient, it cannot be sterilized by any method whatsoever.

CAUTION

Sufficient washing and disinfecting must be carried out for preventing infection.

This is the responsibility of the user who manages and maintains the disinfection procedures for the equipment. Always use legally approved detergents and sheaths.

9.5.2 Electric Shocks

The probe uses electrical energy. If it touches conductive materials, there are risks of electric shocks to the patient or the user.

WARNING

- Regularly receive short-circuit examination from the SAMSUNG MEDISON Service Department.
- Do not immerse the probe into liquid.
- Do not drop the probe or apply mechanical shocks.
- Inspect the housing, stran relief, lens and seal for damage, and check for any functional problem before and after each use.
- Do not apply excessive force to twist, pull or bend the probe cable. It may result in a short circuit.
- The power protection fuse protects the probe and the product from excess current. If the power monitoring protection circuit detects excess current, it immediately shuts off the current to the probe in order to prevent the probe surface from overheating and to restrict the ultrasound power output.
- The temperature of the product for making contact with patients is limited under 43°C. The ultrasound power output (AP&I) is in compliance with US FDA standards.

9.6 Cleaning and Disinfecting the Probe

Using an inappropriate detergent or disinfectant may damage the probe.

WARNING

Always use protective eyewear and gloves when cleaning and disinfecting.

9.6.1 Information of Detergent, Disinfectant and Ultrasound Gel

Use an appropriate one with following tables. The information is also listed on the SAMSUNG MEDISON web site. (http://www.SAMSUNG MEDISON.com).

Names	Disinfectants															
	T-Spray II	T-Spray	Sani-Cloth HB	Sani-Cloth Active	Setptiwipes	Clieanisept Wipes	Ster-Bac Blu	Trasneptic Spray	Incidin Foam	Super Sani-Cloth	Sani-Cloth Germicidal	Asepti-Wipes	Asepti-Wipes II	CaviWipes	MetriWipes	Cidex 2%
Type	S	S	W	W	W	W	L	S	S	W	W	W	W	W	W	L
Active Ingredient	Quaternary Ammonium (N-Alkyl)							IPA								NA
C2-4/20																
CN4-9		●														●
CN2-8		●	●													●
LN5-12/40		●	●													●
L5-12/60		●	●													
LV5-12/60		●	●													●
LV2-5/180		●	●													●
EC4-9		●	●													●

Names	Disinfectants															
	Cidex OPA [2,3]	Cidex Plus [2]	Metricide [2]	Omnicide (28)	Omnicide 14NS	Omnicide - FG2	Nuclean	Wavicide-01 [3]	Sekusept Extra	Salvanios pH 7	Salvanios pH10	Steranios 2%	Surfaces Hautes	Sekusept Plus	Milton	Bleach 5.25%
Type	L	L	L	L	L	L	L	L	L	L	L	L	S	L	L	L
Active Ingredient	Glutaraldehyde													Nonionic surfactant		Sodium Hypochlorite
C2-4/20		●						●								●
CN4-9	●	●				●	●	●							●	
CN2-8	●	●				●	●	●							●	
LN5-12/40	●	●						●							●	
L5-12/60	●	●				●	●								●	
LV5-12/60	●	●				●	●	●							●	
LV2-5/180	●	●				●	●	●							●	
EC4-9	●	●				●	●	●							●	

Names	Disinfectants								Cleaner					
	Virkon	Sporox	Sporox II	Gigasept	Gigasept AF [3]	Gigasept FF	Hibitane	PeraSave	Enzol	Alkazyme	Cidezyme	Klenzyme	Isopropyl alcohol(70%)	Isopropyl alcohol(80%)
Type	L	L	L	L	L	L	L	P			L	L	L	L
Active Ingredient	NA	Hydrogen Peroxide		Succindialdehyde, formaldehyde		Bersteinsaure	Chlorhexidine gluconate solution	Peracetic Acid	Dodecylphenolethoxylate, Sodium Xylene Sulfonate	NA	Proteolytic Enzymes		Alcohol	
C2-4/20			●											
CN4-9											●	●	●	
CN2-8											●	●	●	
LN5-12/40											●	●	●	
L5-12/60											●		●	
LV5-12/60		●										●	●	
LV2-5/180		●									●	●		
EC4-9											●	●	●	

Names	Cleaner								Gel		
	Ethanol 75%	Metrizyme	KcKesson	Natural Image	Aquasonics 100 [3]	GE Ultrasound Contact Gel	Clear Image	Kendall	Scan	Wavelength	Sonogel
Type	L	L	L	G	G	G	G	G	G	G	G
Active Ingredient	Alcohol	Propylene Glycol	PCMX (Chloroxylenol)	Ammonium Chlorides	NA						
C2-4/20	●				●						
CN4-9		●	●		●						
CN2-8		●	●		●						
LN5-12/40		●	●		●						
L5-12/60		●	●		●						
LV5-12/60		●	●		●						
LV2-5/180			●		●						
EC4-9		●	●		●						

※ Symbols

(1)	Compatible but no EPA Registration
(2)	FDA 510(k) qualified
(3)	Has CE mark
(4)	Discontinued
(5)	Under Development
S	Spray
W	Wipe
L	Liquid
P	Powder
G	Gel
x	Not compatible(DO NOT USE)
●	Compatible
★	Staining may occur on housing parts; however, the acoustic performance and image quality are not affected.
■	Must not be used longer than 5 minutes.
◐	Must not be used longer than 10 minutes.
▲	Must not be used longer than 15 minutes.
◆	Must not be used longer than 20 minutes.
◇	Must not be used longer than 25 minutes.
◎	Must not be used longer than 30 minutes.
▣	Must not be used longer than 50minutes.
Blank	Untested (DO NOT USE)

Following is information about manufacturer (or Distributor) of Detergent, Disinfectant, and Ultrasound Gel

Product	Manufacturer or Distributor	Telephone number
Aquasonics	Parker Co.	+1-800-631-8888(USA)
Cidex	CIVCO Co.	+1-800-445-6741(USA) +1-319-656-4447(Worldwide)
Enzol	CIVCO Co.	+1-800-445-6741(USA) +1-319-656-4447(Worldwide)
GIgasept AF	S&M(Schulke&mayr) Co.	+44-114-254-3500(UK)
Gigasept FF	S&M(Schulke&mayr) Co.	+44-114-254-3500(UK)
Isoproppyl alcohol (70%)	Local drugstore	None
Klenzyme	Steris Co.	+1-800-548-4873(USA)
Metricide	CIVCO Co.	+1-800-445-6741(USA) +1-319-656-4447(Worldwide)
Metrizyme	Metrex Research Corp.	+1-800-841-1428(USA)
Milton	Product & Gamble Australia Pty. Ltd.	+61-1800-028-280(Australia)
Nuclean	Nation Diagonostics Co.	+1-800-526-3867(USA) +44(0)-148-264-6020(UK)
Omnicide	Cottrell Ltd.	+1-800-THE-EDGE(USA)
Sani-cloth	PDI Nice/Pak Products Co.	+1-914-365-1602(USA)
Sekusept Extra	Henkel Hygiene GmbH.	+49-0211-797-0(Germany)
Sporox II	Sultan Chemist Inc.	+1-800-637-8582(USA)
T-Spray	CIVCO Co.	+1-800-445-6741(USA) +1-319-656-4447(Worldwide)
Virkon	Antec International LTD.	+1-403-286-1771(USA)
Wavicide	Wave Energy System Inc.	+1-800-252-1125(USA)

9.6.2 Cleaning

Cleaning is an important procedure that is carried out before disinfecting the probe. The probe must be cleaned after each use

CAUTION

- Do not use a surgical brush when cleaning probes. The use of even soft brushes can damage the probe.
- During cleaning and disinfection, keep the parts of the probe that must remain dry higher than the other parts during wetting until all parts are dry. This will help prevent liquid from entering non-lipuid-tight areas of the probe.

1) Disconnect the probe from the system.
2) Remove any biopsy adapters or biopsy needle guides. (Biopsy adapters are reusable and can be disinfected).

3) Discard sheaths. (Sheaths are single-use items).
4) Use a soft cloth lightly dampened with mild soap or compatible cleaning solution to remove any particulate matter and body fluid that remain on the probe or cable.
5) To remove remaining particulates, rinse with water up to the immersion point.
6) wipe with a dry cloth.
7) If necessary, wipe first with a water-dampened clothe to remove soap residue.

9.6.3 Disinfection

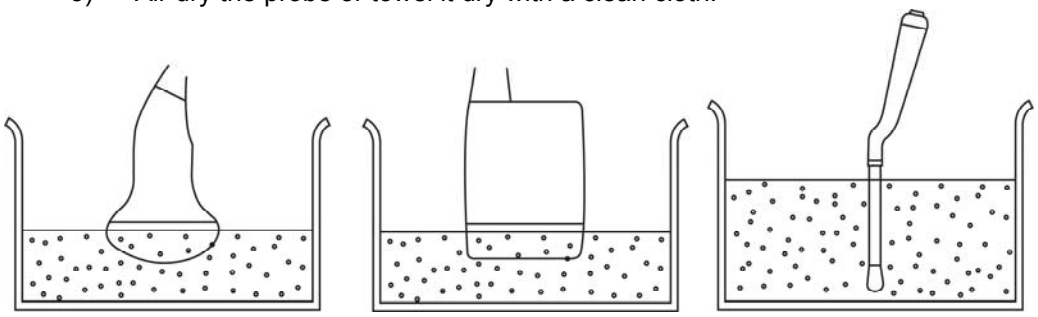
WARNING

- If a pre-mixed solution is used, be sure to observe the solution expiration date.
- The type of tissue it will contact during use dictates the level of disinfection required for a device. Ensure that the solution strength and duration of contact are appropriate for disinfection.

CAUTION

- Using a non-recommended disinfectant or not following the recommended disinfection method can damage and or discolor the probe and will void the probe warranty.
- Do not immerse probes for longer than one hour, unless they are sterilizable.
- Only sterilize probes using liquid solutions. Avoid using autoclave, gas (EtO) or other non-SAMSUNG MEDISON-approved methods.

1) Follow the instructions on the disinfectant label for storage, use and disposition of the disinfectant.
2) Mix the disinfectant compatible with your probe according to lavel instructions for solution strength.
3) Immerse the instructions on the disinfectant, rinse the probe after the immersion process is complete.
4) Using the instructions on the disinfectant, rinse the probe after the immersion process is complete.
5) Air dry the probe or towel it dry with a clean cloth.



[Figure 9-1] Disinfection

Chapter 10. User Maintenance

10.1 Overview

Chapter 10 describes how to extend the life of SonoAce R3. It includes are how to maintain the product and how to backup information. Make sure to read this chapter for proper maintenance of the product.

Contents

10.2 System Maintenance

10.2.1 Installation Requirements

When installing:.

1) Avoid humidity.
2) Avoid direct sunlight.
3) Avoid places with extreme temperature variations.
4) Optimal conditions for the system are temperatures of 10℃ ~ 35℃ and humidity of 30% ~ 75%.
5) Avoid heat sources.
6) Avoid dusty and unventilated areas.
7) Avoid places where the system is likely to be exposed to vibration or impacts.
8) Avoid place wher the system is likely to be exposed to chemical substances or gases

⚠ CAUTION

Placing the system near generators, X-Ray machines, or broadcast cables may result in screen noise and abnormal visual images. Using the power source with other electric devices may also induce noise.

10.2.2 Cleaning and disinfections

Using inappropriate detergent or disinfectant may damage the product. Please read the following carefully..

⚠ WARNING

- Turn off the system and disconnect the system power cord from the wall outlet. Otherwise, it may result in electric shock or fire.
- Always use protective eyewear and gloves when cleaning and disinfecting the equipment.

10.2.2.1 Cleaning

1) Console : Use a soft cloth lightly dampened in a mild soap or detergent solution to clean exterior surfaces on the system.
2) Cleaning Monitor : Wipe the LCD surface with a soft dry cloth. When the LCD panel has dirt on it, wipe it 2 – 3 times or more in one direction system.

CAUTION

Do not use a spray directly on the product exterior. It may cause cracks in the appliance, or the color to deteriorate.

Do not use chemical substances such as wax, benzene, alcohol, thinner, mosquito repellant, deodorant, lubricant or detergent.

NOTE

For information on cleaning and disinfection of the probe & biopsy kit, please refer to Chapter 8 “Probes.” In User Manual

10.2.2.2 Disinfections

CAUTION

Use only recommended disinfectants on system surfaces.

A disinfectant qualified by the FDA 510(k) process is recommended. The following disinfectants are recommended because of both their biological effectiveness (as qualified through the FDA 510(k) process) and their chemical compatibility with SAMSUNG MEDISON ultrasound products.

Solutions	Country	Type	Active ingredient	FDA 510(k)
Cidex	USA	Liquid	Gluteraldehyde	K934434
Cidex Plus	USA	Liquid	Gluteraldehyde	K923744

[Table 10-1] Solutions

1) Turn off the system and disconnect the system power cord from the wall outlet.
2) Mix the disinfection solution compatible with your system according to label instructions for solution strength.
3) Wipe the system surfaces with the disinfectant solution, following the disinfectant label instruction for wipe durations, solution strength and disinfectant contact duration.
4) Air dry or towel dry with a sterile cloth according to the instructions on the disinfectant label.

10.2.3 Fuse Replacement

The power protection fuse protects the product from excess current. If the power monitoring protection circuit detects excess current, it shuts off the current to the equipment in order to prevent overheating and to restrict the ultrasound power output. If the fuse blows, replace it as shown below.

⚠ DANGER

To avoid risk of electric shock, always disconnect the plug from the system prior to fuse replacement.

[Figure 10-2] Fuse Replacement

1) Turn off the system and disconnect the system power cord from the wall oulet.
2) Press the fuse holder in the direction of the arrow and pull it out.
3) Remove the old fuse and replace it with a new one.
4) After installing the new fuse, connect the plug to the system.

Input Ratings	Fuse Ratings	Maker	Order No.
100-120VAC	10AH/250V	Orisel	55T210000
200-240VAC	10A/H250V	Orisel	55T210000

[Table 10-2] Fuse Information

10.2.4 Accuracy Check

The product's maintenance status may affect the measurements obtained using the product. The product should be maintained in an optimal state to ensure reliable measurements.

To ensure optimal operation of the product, perform an accuracy check every year. The equations and table related to measurement accuracy are included in Chapter 5 "Measurements" in User manual

NOTE

Allow the wet filter to dry thoroughly before installing. The wet filter can cause the malfunction.

10.3 Administration of Information

CAUTION

You may lose information files on user settings or patients, because of shock on the product or internal error. Thus, back-up on a regular basis.

10.3.1 User Setting Back-up

Always keep a separatebackup copy of theall information related to the user settings in case of data loss. Clients cannot back-up the user settings of the product. Please contact the SAMSUNG MEDISON Service Department to attain support for back-up.

However, clients may back up the user setting on GA Table used in obstetrics diagnosis. For further information please refer to ‘Chapter 3. Settings of User Manual’.

10.3.2 Patient Information Back-up

The SonoView program can be used for backing up patients’ basic information and scanned images. The user can choose to save the data by himself/herself, and the data is also saved in the system by default. If the system needs to be reinstalled due to product failure, etc., the SAMSUNG MEDISON customer support staff will restore the patients’ basic information and scanned images that are saved in the system. For more information on this, see ‘Chapter 6 Image Management of User Manual.

10.3.3 Software

The product software may be updated to enhance performance. The user cannot make any changes to the software by himself/herself.. Please contact the SAMSUNG MEDISON customer service for help in software changes.

CAUTION

Minor software updates may be carried out without the prior notice from the manufacturer.

Should errors occur in the operating system and should you desire to upgrade the operating system, please follow the instructions of the operating system manufacturer.

Chapter 11. Service Part List

11.1 Overview

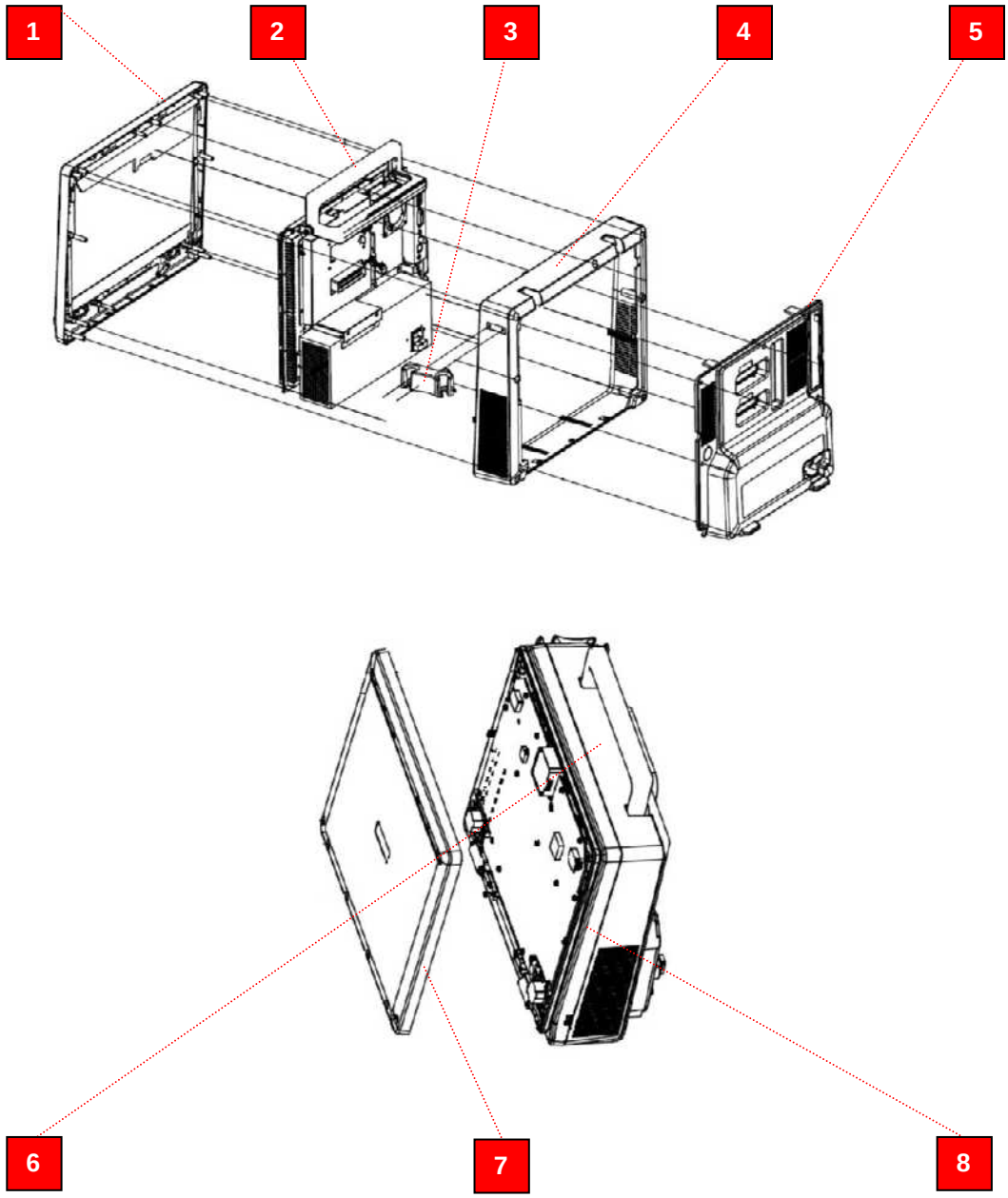
This chapter 11 contains information on the SonoAce R3 Service Part. Please refer to the SonoAce R3 Part Catalogue to Check the replacement parts and their software versions for each system configuration.

For installing and verifying system parts, please refer to figures and part table in this chapter. Part numbers are indicated in the corresponding table. Prior to ordering parts, please verify whether the existing parts can be replaced according to the current service policy

Contents

[Figure 11-1] SonoAce R3 Views

11.2 Body Cover

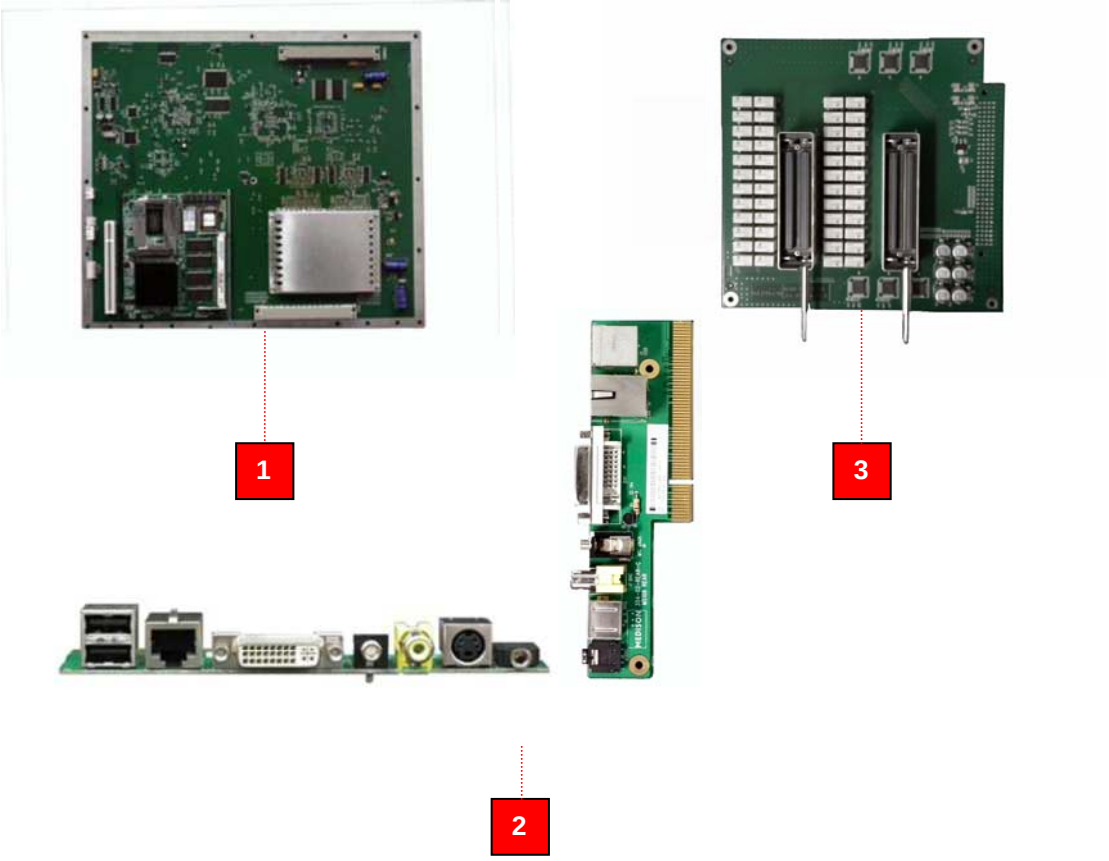


[Figure 11-2] Body Cover

	PART NAME	PART NUMBER	DESCRIPTION
1	BODY FRONT AY CASE	A213-106A	BODY FRONT AY CASE R3
2	HANDLE AY	A252-019A	HANDLE AY R3
3	PROBE AY CASE	A213-112A	PROBE AY CASE R3
4	BODY MIDDLE AY CASE	A213-107A	BODY MIDDLE AY CASE R3
5	BODY REAR AY CASE	A213-108A	BODY REAR AY CASE R3
6	BODY AY CASE	A213-098A	BODY AY CASE R3
7	CONTROL PANEL AY CASE	A213-099A	CONTROL PANEL AY CASE R3
8	B AY CASE	A213-115A	B AY CASE R3

[Table 11-1] SonoAce R3 Cover

11.3 Ultrasound System Part



[Figure 11-3] Ultrasound System Part

No	PART NAME	PART NUMBER	DESCRIPTION
1	MAIN BOARD	BD-354-MAIN	MAIN BOARD R3
2	REAR BOARD	BD-354-REAR	REAR BOARD R3
3	PSA BOARD	BD-354-PSA	PSA BOARD R3

[Table 11-2] Ultrasound System Part

11.4 LCD Part

[Figure 11-4] LCD Part

No	PART NAME	PART NUMBER	DESCRIPTION
1	LCD MNT M150XN07	MNT-LCD/M150XN07	LCD MNT M150XN07 U5
2	LCD MNT INVERTER KT-2150MD	BD-354-INVERTER	LCD MNT INVERTER KT-2150MD R3
3	FRONT CASE	213-M-15A	FRONT CASE R3
4	USB BOARD	BD-354-USB	USB BOARD R3

[Table 11-3] LCD Part

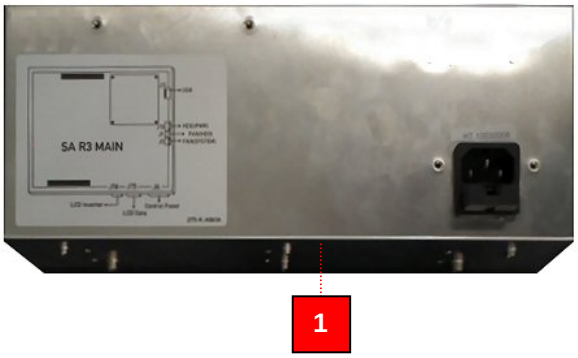
11.5 PC Part

[Figure 11-5] PC Part

No	PART NAME	PART NUMBER	DESCRIPTION
1	SEAGATE 160G HDD	HDD-160G-ST9160314AS	SEAGATE 160G HDD
2	BRACKET HDD	253-P-636A	BRACKET HDD R3

[Table 11-4] PC Part

11.6 Power Part

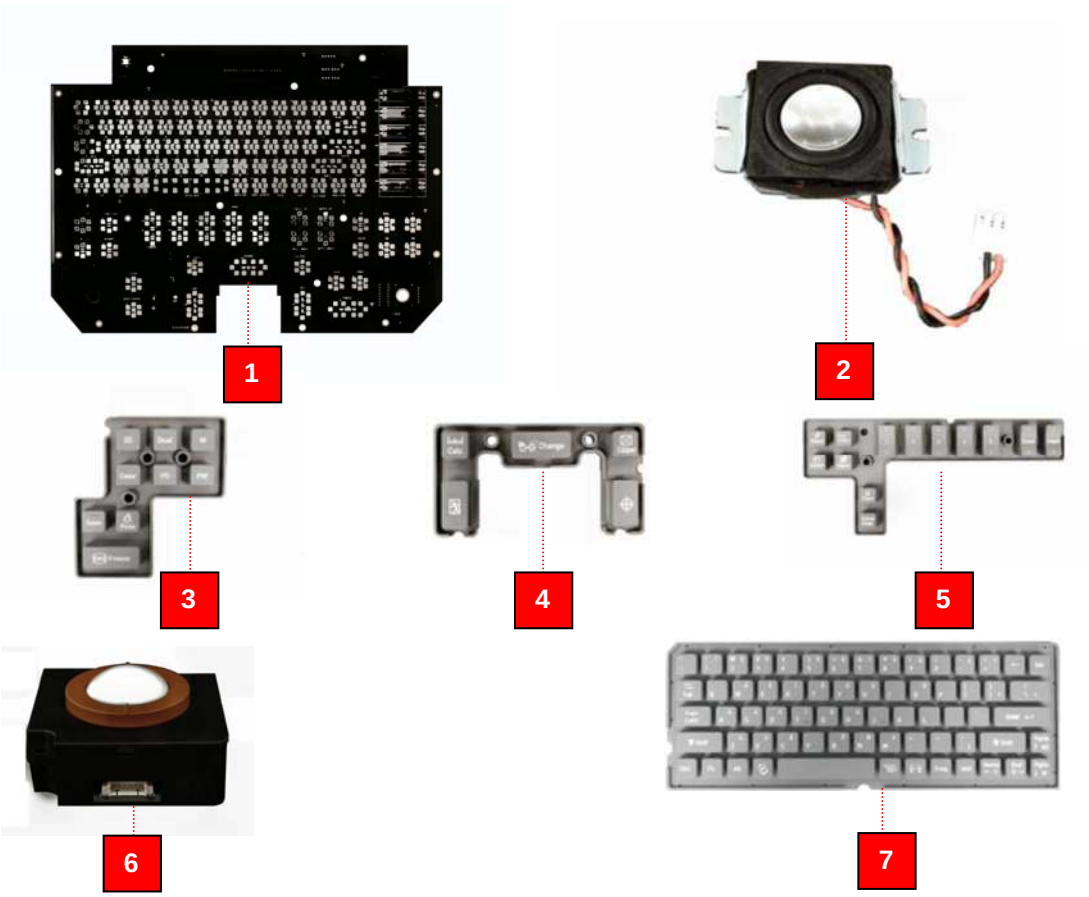


[Figure 11-6] Power Part

No	PART NAME	PART NUMBER	DESCRIPTION
1	POWER ASSY	AY-354-POWER	POWER ASSY R3

[Table 11-5] Power Part

11.7 User Interface Part



[Figure 11-7] User Interface Part

No	PART NAME	PART NUMBER	DESCRIPTION
1	CONTROLPANEL BOARD	BD-354-CP	CONTROLPANEL BOARD R3
2	CASE SPEAKER ASSY	A213-116A	CASE SPEAKER ASSY R3
3	KEY LEFT	261-R-005A	KEY LEFT R3
4	KEY MIDDLE	261-R-004A	KEY MIDDLE R3
5	KEY RIGHT	261-R-006A	KEY RIGHT R3
6	ORACOM T/B UNIT 1INCH	AY-TB254A	ORACOM T/B UNIT 1INCH R3
7	KEY ALPHA NUMERIC	261-R-003A	KEY ALPHANUMERIC R3

[Table 11-6] User Interface Part

11.8 ETC Part

[Figure 11-8] ETC Part

No	PART NAME	PART NUMBER	DESCRIPTION
1	BRACKET REAR FAN AY	A235-119A	BRACKET REAR FAN AY R3
2	BRACKET SIDE FAN AY	A235-120A	BRACKET SIDE FAN AY R3
3	KNOB ENCODER QSCAN	267-M-104A	KNOB ENCODER QSCAN R3
4	KONB ENCODER MENU	267-M-103A	KNOB ENCODER MENU R3
5	CUSHION POWER BUTTON	313-Z-106A	CUSHION POWER BUTTON R3
6	KNOB TGC	267-M-102A	KNOB TGC R3
7	HANDLE AY	A252-019A	HANDLE AY R3

[Table 11-7] ETC Part

11.9 Options

No	PART NAME	PART NUMBER	DESCRIPTION
1	Image filing-SONOVIEW	OPT-354-SONOVIEW	SAR3 SONOVIEW Option
2	Pulse wave Doppler	OPT-354-PW	SAR3 PW Doppler Option
3	DICOM	OPT-354-DICOM	SAR3 DICOM Option
4	Color Doppler	OPT-354-COLOR	SAR3 COLOR Doppler Option
5	Freehand 3D	OPT-354-FREEHAND/3D	SAR3 FREEHAND 3D Option
6	Cardiac S/W Package	OPT-354-CARDIAC	SAR3 CARDIAC MEAS Option

[Table 11-8] Options

11.10 Probes

No	PART NAME	PART NUMBER	PICTURE
1	Convex Probe	PB-TZCN2-8	
2	Convex Probe	PB-TZCN4-9	
3	Convex Probe	PB-TZC2-4/20	
4	Vaginal Probe	PB-TZEC4-9	
5	Linear Probe	PB-TZLN5-12/40	
6	Linear Probe	PB-TZL5-12/60	
7	Linear Probe	PB-TZLV5-12/60	
8	Linear Probe	PB-TZLV2-5/180	

[Table 11-9] Probes

SONOACE R3

Publisher SAMSUNGMEDISON Co., Ltd
Address SAMSUNGMEDISON Bldg., 1003, Deachi-dong, Gangnam-gu,
Seoul 135-280 Korea
Homepage http://www.samsungmedison.com