SAMSUNG

SAMSUNG MEDISON
DIAGNOSTIC ULTRASOUND SYSTEM

WS80A
Service Manual

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English

SM-WS80A-ENG-02

Safety Requirements

■ Categorization

- Type of protection against electric shocks: Class I
- Degree of protection against electric shocks (when the patient is in physical contact): Type BF or type CF applied part
- Degree of protection against the ingress of harmful liquids: General equipment
- Degree of safety of use in the presence of flammable anesthetic agent mixed with air, oxygen, or nitrous oxide: Not suitable for use near flammable anesthetic agent mixed with air, oxygen, or nitrous oxide
- Mode of operation: Continuous operation

■ Safety standards the device conforms to

- Medical electrical equipment, part 1: General requirements for basic safety and essential performance **IEC 60601-1:2005**
- Medical electrical equipment, part 1-2: General requirements for basic safety and essential performance - Collateral standard: Electromagnetic compatibility - Requirements and tests **IEC 60601-1-2:2007**
- Medical electrical equipment, part 1-6: General requirements for basic safety and essential performance - Collateral standard: Usability **IEC 60601-1-6:2010**
- Medical electrical equipment, part 2-37: Particular requirements for the basic safety and essential performance of ultrasonic medical diagnostic and monitoring equipment **IEC 60601-2-37:2007**
- Medical electrical equipment, part 1: General requirements for safety **IEC 60601-1:1988, A1:1991, A2:1995**
- Medical electrical equipment, part 1-1: General requirements for safety - Collateral standards: General requirements for medical electrical systems **IEC 60601-1-1:2000**
- Medical electrical equipment, part 1-2: General requirements for safety - Collateral standards: Electromagnetic compatibility - Requirements and tests **IEC 60601-1-2:2001, A1:2004**
- Medical electrical equipment, part 1-4: General requirements for safety - Collateral standards: Programmable electrical medical systems **IEC 60601-1-4:1996, A1:1999**

- Medical electrical equipment, part 2-37: Particular requirements for the basic safety and essential performance of ultrasonic medical diagnostic and monitoring equipment **IEC 60601-2-37:2001, A1:2004, A2:2005**
- Medical devices - Application of risk management to medical devices **ISO 14971:2007**
- Medical electrical equipment, part 1: General requirements for safety **UL 60601-1:2003**
- Medical electrical equipment - part 1: General requirements for safety **CAN/CSA C22.2 No. 601.1-M90:1990, R2003, R2005**
- Biological evaluation of medical devices – part 1: evaluation and testing **ISO 10993-1: 2009**
- Standard means for reporting the acoustic output of medical diagnostic ultrasonic equipment **IEC 61157:2007**

■ Statements

This is the CSA symbol used in Canada and the United States.

This mark certifies that the product conforms to applicable EEC standards and has been certified by the European certification agency.

This mark certifies that the product conforms to applicable EEC standards.

GMP symbol represents the good manufacturing practice and quality standards in accordance with the Korean Quality Standards.

Precautions for Use

Be sure to read this operation manual thoroughly, to familiarize yourself with the operation of the product and the relevant safety information, before attempting to use the product.

- Keep this manual near the product and refer to it when using the product.
- Please familiarize yourself with the safety precautions in 'Chapter 1. Safety' and 'Chapter 8. Maintenance' in particular.
- This operation manual does not contain clinical opinions or diagnoses. Also, please consult the reference for each study area before evaluating the measurement result of an application.
- This product is an ultrasound diagnostic system, and cannot be used with your personal computer. If you use this product in such an environment, we cannot be held responsible for any resulting problems.
- This product must be used by a person who possesses clinical pathology training and/or certification; use by unqualified persons is prohibited.
- The manufacturer is not responsible for any damage to this product caused by user carelessness and/or neglect.
- The contents of this operation manual may be changed without notice.
- Products that are not manufactured by Samsung Medison are indicated with the trademarks of their respective owners.
- The following terms are used to highlight safety precautions that the user must be aware of:

DANGER	Disregarding this instruction may result in death, serious injury, or other dangerous situations.
WARNING	Follow these instructions to prevent a serious accident or damage to property.
CAUTION	Follow these instructions to prevent a minor accident or damage to property.
NOTE	The accompanying information covers an installation, operation, or maintenance procedure that requires careful attention from the user, but has little chance of leading directly to a dangerous situation.

Revision History

The revision history of this manual is as follows.

VERSION	DATE	NOTE
V3.00.00-00	2015.10.30	Initial Release

System Upgrades and Manual Set Updates

Samsung Medison Ultrasound is committed to innovation and continued improvement. Upgrades may be announced that consist of hardware or software improvements. Updated manuals will accompany those system upgrades.
Verify that Check if this version of the manual is correct for the system version. If not, please contact the Customer Service Department.

If You Need Assistance

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

Table of Contents

Chapter 1. Introduction

Product Specifications 2

Product Configuration 5

The Monitor 7

The Control Panel 9

The Console 16

Peripheral Devices 18

Probes 21

Accessories 22

Optional Functions 23

Chapter 2. Safety

Purpose of Use 2

Safety Information 3

Safety Symbols 3

Symbols 6

LABEL 7

Electrical Safety 8

Prevention of Electric Shocks 8

ECG-related Information 10

ESD 10

EMI 11

EMC 11

Biological Safety 23

ALARA Principle 23

Environmental Protection 38

Correct Disposal of This Product(Waste Electrical & Electric Equipment) 38

Chapter 3. Installing the Product

Unpacking the Product 3

Installation Environment 4

Installing the Product 5

Power Cord Connection 6

Probe Connection 6

Connecting Peripherals 7

System Power 9

Turning the Power On 9

Shutting Down the System 10

System Settings 11

System General Setting 12

Scan Mode 17

Display 21

Annotate 26

Peripheral Device Settings 31

User Defined Keys 38

MPR Menu 40

Network 41

Options 43

DICOM Setup (optional) 45

Auto Calc 59

System Information 60

Chapter 4. Product Inspection

Inspecting Functions 2

Basic Inspections 2

Detailed Inspections 4

Chapter 5. Product Structure

Overview 3

System Block Diagram 5

Basic Structure of UGEO WS80A 7

Overview 7

Ultrasound System Part 8

PC Part 9

User Interface Part 10

AC to Power Module 10

Ultrasound System Part 11

PSA 11

Analog Control 13

Beam Former Board 15

Back End Board 19

PC Part 24

PC Module 24

Software DSC 25

Rear Board 27

Power Supply 28

User Interface Part 31

Control Panel 31

Docking CP Board 33

Touch Panel 34

Monitor 35

Chapter 6. Service Mode

System Information 2

Windows Mode 3

Admin Mode **4**

Admin Mode Functions 5

Adding and Deleting Options **11**

Adding an Option 12

Chapter 7. Troubleshooting

Power Issues **2**

Power Does Not Turn On 2

Power Does Not Turn Off 2

Power Turns Off by Itself 3

Monitor **4**

Nothing Is Displayed on the Screen 4

Screen is Discolored 4

Error Messages **5**

Error Occurs during Booting 5

Image **6**

2D Mode: There is No IMAGE ECHO or IMAGE FORMAT 6

Lines (Noise) Appear in 2D Mode Image 6

M, C, PW, CW Mode Trouble 6

Error Code **7**

Chapter 8. Disassembly and Assembly

Caution **2**

Preparation 2

Disassembling the Product **3**

Front Cover Disassembly 3

Rear Cover Disassembly 5

Control Panel Disassembly 7

Monitor Disassembly 8

Monitor Arm Disassembly 9

Assembling the Product 11

Chapter 9. Probes

Probe 2

Ultrasound Transmission Gel 15

Using Sheaths 16

Probe Safety Precautions 17

Cleaning and Disinfecting the Probe 19

Chapter 10. Maintenance

Product Maintenance 2

Cleaning and disinfecting 2

Air Filter Management 4

Accuracy Checks 5

Information Maintenance 6

Backing up User Setting 6

Backing Up Patient Information 6

Software 6

Chapter 11. Service Part List

Body Cover Parts 2

System Parts 7

Control Panel Parts 11

System Cable Parts 14

Chapter 1

Introduction

Product Specifications **2**

Product Configuration **5**

The Monitor 7
The Control Panel 9
The Console 16
Peripheral Devices 18
Probes 21
Accessories 22
Optional Functions 23

Product Specifications

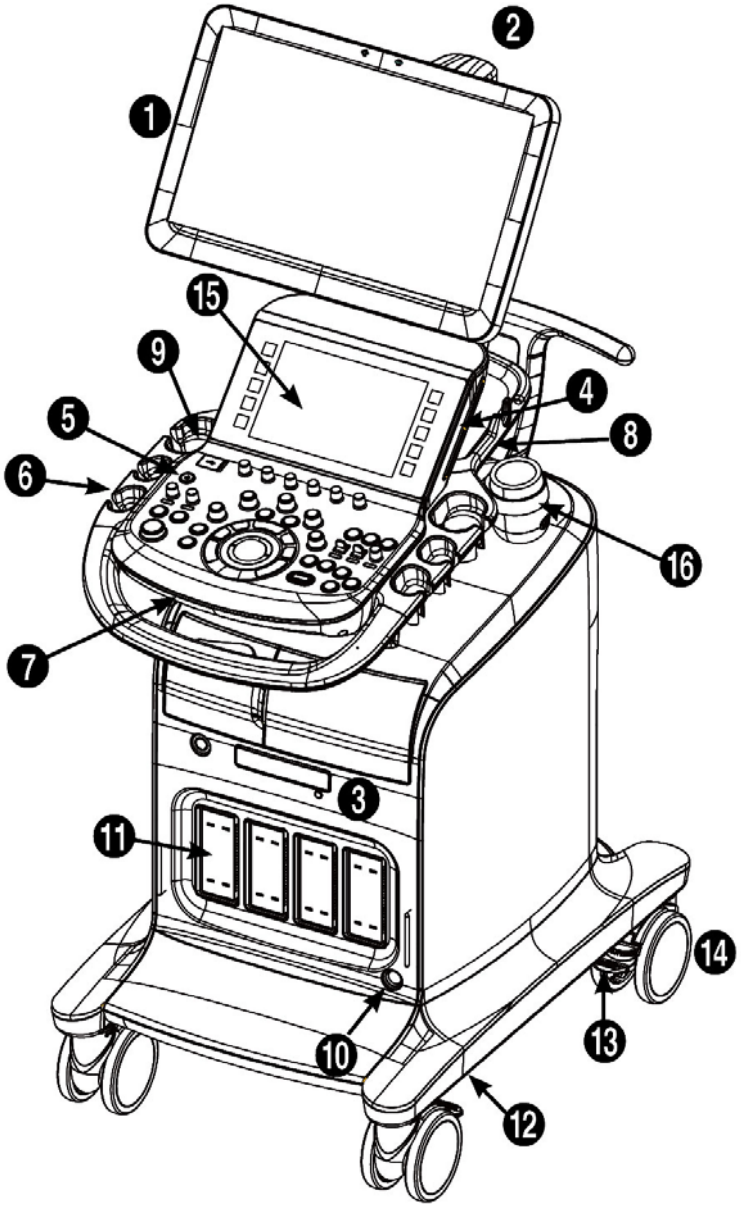
Physical Dimensions	Height: 1,430 – 1,710mm (with monitor) Width: 557mm Depth: 791 – 860mm Weight: 105.4kg (with monitor) Weight: Approx. 130kg (with Safe Working Load)
Imaging modes	2D-Mode M-Mode Color Doppler Pulsed Wave (PW) Spectral Doppler Continuous Wave (CW) Spectral Doppler Tissue Doppler Imaging (TDI) Tissue Doppler Wave (TDW) Power Doppler (PD) Directional Power Doppler (S-Flow) Color M-Mode Anatomical M mode 3D imaging Mode 4D imaging Mode ElastoScan Mode
Gray Scale	256 (8 bits)
Focusing	Transmit focusing, maximum of eight points (four points simultaneously selectable) Digital dynamic receive focusing (continuous)
Probes (Type BF / IPX7)	**Linear Array** L3-12A, L5-13, LA2-9A, LA3-16A, LA3-16AI, LA4-18B **Convex** C2-6, CA1-7A, CA2-8A, CA2-9A, CA3-10A, CF4-9, SC1-6 **Endocavity** E3-12A, EA2-11B, VR5-9 **Phased Array** PA3-8B, PE2-4, PM1-6A

	3D CV1-8A, LV3-14A, V4-8, V5-9
Probe connections	Five Active Probe Ports (include one CW probe port)
Monitor	**Main Monitor** 23 inch Full HD LCD monitor (LED backlight unit) called "LCD monitor" henceforth **Touch Screen Monitor** 10.1 inch LCD monitor (LED backlight unit) called "LCD monitor" henceforth
ECG	USB Type (Type CF)
Rear Panel **Input / Output Connections**	Audio in / out Microphone External Trigger in / out External monitor DVI-I Network USB Foot Switch
Image Storage	Maximum 12,700 frames for Cine memory Maximum 8,192 lines for LOOP memory Image filing system
Application	Obstetrics, Gynecology, Urology, Abdomen, Vascular, Small Part, MSK, Pediatric, Cardiac, TCD, Intraoperative
Electrical Parameters	100-240V~, 1100VA, 50/60Hz
Measurement Packages	OB, Gynecology, Cardiac, Vascular, Fetal Heart, Urology, Abdomen, Small Parts, MSK, TCD, Pediatric Hips * Refer the Chapter 9 for additional information
Signal processing (Pre-processing)	TGC Control (Digital / Slider) Mode-independent gain control Acoustic power control (adjustable)

	Dynamic aperture Dynamic apodization Dynamic range control (adjustable) Image view area control M-mode sweep speed control
Signal processing (Post-processing)	Frame average Edge Enhancement / Blurring Gamma-scale windowing Image orientation (left/right and up/down, rotation) White on black/black on white Zoom
Measurement	Trackball operation of multiple cursors 2D mode: Linear measurements and area measurements using elliptical approximation or trace M mode: Continuous readout of distance, time, and slope rate Doppler mode: Velocity and trace
Auxiliary	USB Video Printer USB to RS-232 Serial Cable Foot Switch(IPX8) USB Flash Memory Media USB HDD Monitor
User Interface	English, German, French, Spanish, Italian, Russian, Chinese
Pressure Limits	Operating: 700 – 1,060hPa Storage: 700 – 1,060hPa
Humidity Limits	Operating: 30 – 75% Storage & Shipping: 20 – 90%
Temperature Limits	Operating: 10 – 35^{O}C Storage & Shipping: -25 – 60^{O}C

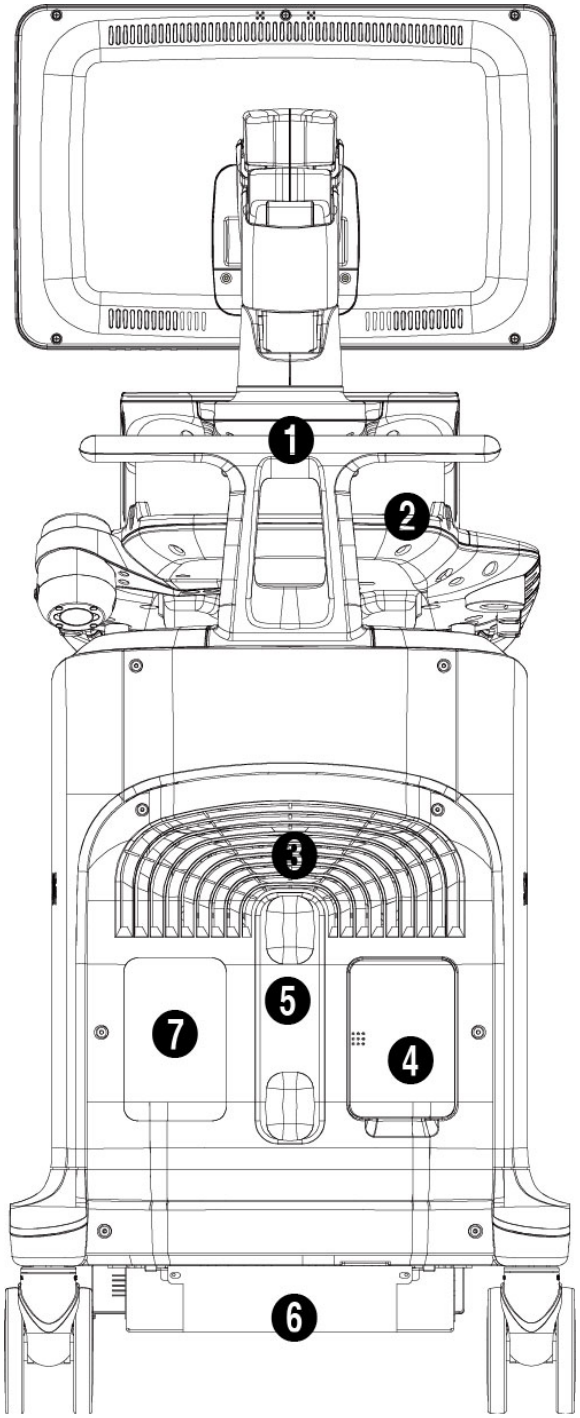
Product Configuration

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



① Monitor
② Monitor arm
③ DVD drive
④ Speaker
⑤ Control panel
⑥ Probe holder
⑦ Keyboard
⑧ Lift
⑨ USBport
⑩ CW probe port
⑪ Probe port
⑫ Air filter
⑬ Brake
⑭ Wheels
⑮ Touch panel
⑮ Gel Warmer (Option)

[Figure 1.1 Front of the product]



① Handle

② Storage compartments

③ Ventilation

④ Rear panel

⑤ Cable hook

⑥ Power terminal

⑦ ID Label

[Figure 1.2 Back of the product]

The Monitor

Ultrasound images and other information are displayed on the color LCD monitor.

Screen Layout

The screen displays ultrasound images, operation menus and a variety of other information. The main areas of the screen are ① Title Area, ② Preset Change and EZ Exam Area, ③ Image Area, ④ Thumbnail Area, ⑤ User Information Area, and ⑥ User Defined Key Area, as shown below.

[Figure 1.3 Screen Layout]

① Title Area

Displays patient name, hospital name, application, frame rate and depth, probe information, acoustic output information, and date and time.

② Preset Change and Ez Exam+ Area

Displays Preset Change. You can quickly change the preset of a probe. The Ez Exam+ menu will also appear if being used.

NOTE

You can set up the Ez Exam+ at Ez Exam+ Setup; please refer to ‘Chapter 3. Utilities’ for information on Ez Exam+ Setup.

③ Image Area

Displays ultrasound images, TGC, image information, annotation, and measurement information are also displayed.

④ Thumbnail Area

Images saved by selecting **Save** are displayed as thumbnails. If saving Single screens, up to 5 images are shown in a list; for Quad screens, up to 16 images are displayed. Clicking with the pointer will enlarge the selected thumbnail in the Image area.

⑤ User Information Area

Information that is useful to the user, such as current system status, image information, selectable items, etc., is displayed.

⑥ User Defined Key Area

Settings for User Defined Keys, including the positions of **Set** and **Exit**, are displayed. You can change the setting of each button in Setup > User Defined Key.

NOTE	For information on User Key Setup, please refer to 'Chapter 3. Utilities'.

TIP **Principles of Operation of the Diagnostic Ultrasound System**

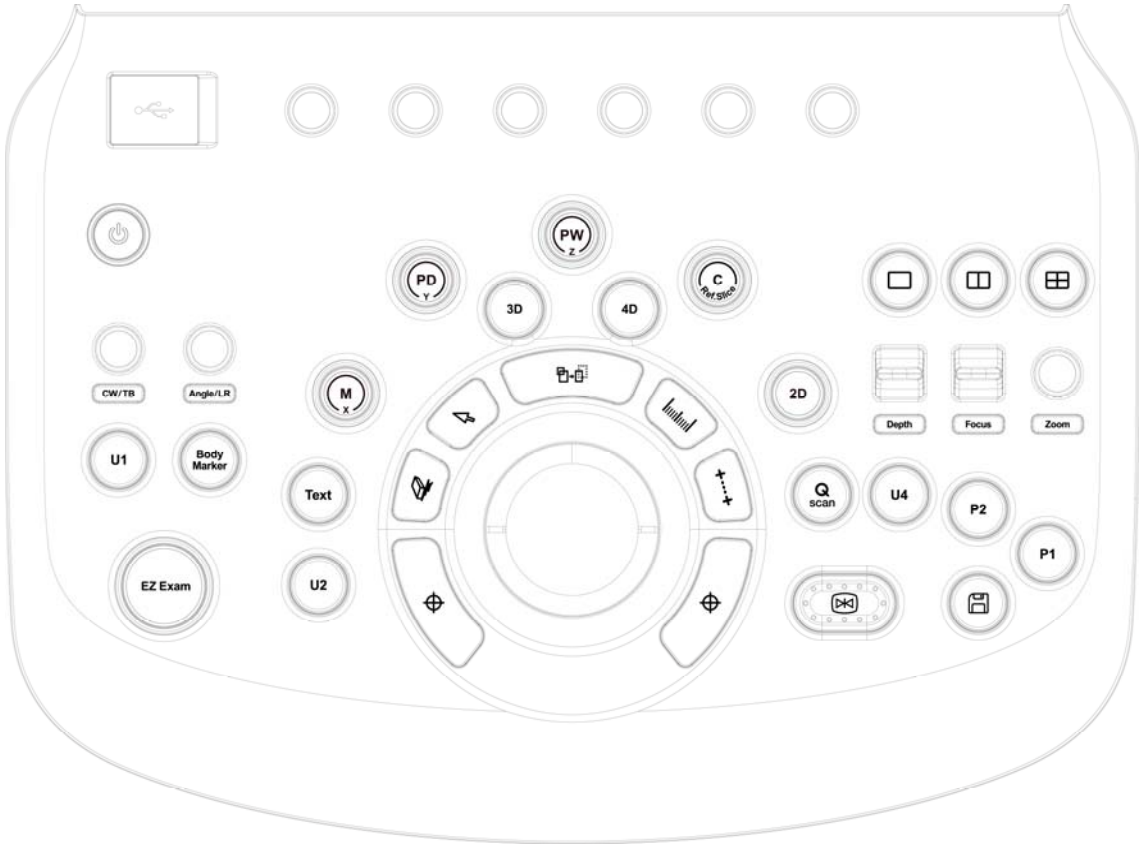
Medical ultrasound images are created when the computer's digital memory converts the high-frequency wave signals that are transmitted and received by the probe.

As ultrasound waves propagate through the human body, they generate reflected signals whenever they encounter a change in density. For example, reflected signals are generated when signals pass from fatty tissues to muscle tissues. Reflected signals return to the probe where they are converted into electronic signals. The reflected signals are amplified and processed by analog and digital circuits that have filters for various frequencies and response time options. Then they are again converted into high-frequency electronic signals, and saved as a series of digital image signals. The monitor displays the image signals stored on the storage device in real time.

The entire process of transmitting, receiving, and processing signals is controlled by the computer.

The Control Panel

The system can be controlled by using the control panel.



[Figure 1.4 Control Panel]

The control panel consists of a keyboard, soft menus, buttons, dials, dial-buttons, a slider, and a trackball.

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

Functions of the Control Panel

The followings describe each control in the control panel and show how to use them. Controls with multiple functions are described in detail in the following chapters of Chapter 3 in this manual.

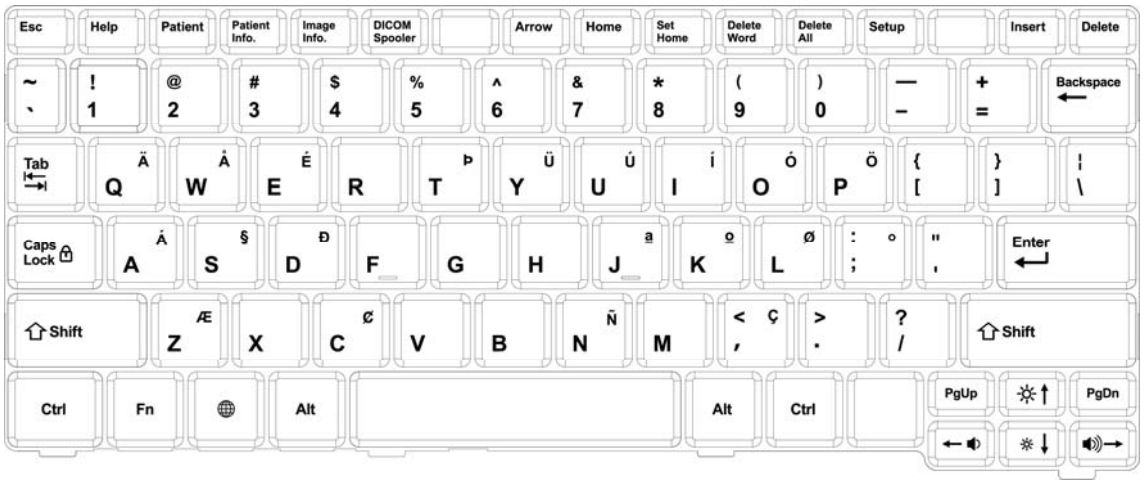
On/Off	Button	Turns the system on/off.

2D	Dial-button	Button: Starts 2D mode. Dial: Adjusts the 2D gain.
M / x	Dial-button	Button: Starts or ends M mode. Dial: Adjusts M gain. Also, turning this dial-button when in 3D View rotates the image along the x-axis.
PD / y	Dial-button	Button: Starts or ends Power Doppler mode. Dial: Adjusts the PD gain. Also, turning this dial-button, when in 3D View rotates the image along the y-axis.
PW / z	Dial-button	Button: Starts or ends PW Spectral Doppler mode. Dial: Adjusts the PW gain. Also, turning this dial-button when in 3D View rotates the image along the z-axis.
C / Ref. Slice	Dial-button	Button: Starts or ends Color Doppler mode. Dial: Adjusts the C gain. Moves the reference slice horizontally in 3D View.
3D	Button	Starts or ends 3D mode.
4D	Button	Starts or ends 4D mode.
CW / TB	Dial-button	Button: Starts or ends CW Spectral Doppler mode. Dial: Adjusts the CW gain. Adjusts top and bottom margins of ROI in 3D View-MPR. TB is an abbreviation for “Top-Bottom”.
Angle / LR	Dial-button	Button: Adjusts the angle of the sample volume in Spectral Doppler mode. It is also used to adjust the BodyMarker’s probe cursor or indicator angle. Dial: Adjusts left and right margins of ROI in 3D View-MPR. LR is an abbreviation for “Left-Right”.
Depth	Switch	Adjusts the scanning depth of the image.
Focus	Switch	Changes location and number of focus on the target location you wish to study.
Zoom	Dial-button	You can magnify an image.
Q Scan	Button	Press this button to turn the Quick Scan function on. The ‘Q Scan’ mark will appear at the top of an image.
Freeze	Button	Pauses/resumes scanning.
Save	Button	Saves an image or a report displayed on the screen to the database.

U1, 2, 4	Button	Stands for 'User Key.' This button allows users to select a function to apply to the button. The function of each button can be set in Setup > User Defined Key. The selected settings will be displayed in the User Defined Key area of the monitor.
P 1~2	Button	Stands for 'Peripheral Key.' This button allows users to select a function to apply to the button. The function of each button can be set in Setup > User Defined Key. The selected settings will be displayed in the User Defined Key area of the monitor.
BodyMarker	Button	Allows the user to enter a BodyMarker over an image.
Text	Button	Allows the user to place text on an image.
EZ Exam	Dial-button	Use the EZ Exam and Preset Change features.
	Button	In this mode, only the image is displayed on the screen.
	Button	Compares two independent images.
	Button	Compares four independent images.
 Set / Exit	Button	This button is used to assign user-defined functions. The function of each button can be set in Utility > Setup > User Defined Key. Set: Selects an item or value using the trackball or changes the function of the trackball. Exit: Exits the function currently being used and returns to the previous state.
 Pointer	Button	When this is pressed, an arrow marker appears to point to parts of the displayed image.
 Clear	Button	Deletes text, indicator, BodyMarker, and measurement result, etc. displayed on an image.
 Change	Button	This is used to change the current trackball function.
 Calculator	Button	Starts measurements by application.
 Caliper	Button	Starts to measure distance, circumference, area, and volume.
Trackball	Trackball	Moves the cursor on the screen and scrolls through Cine images.

- **Keyboard**

  The keyboard is used to type in text.



[Figure 1.5 Keyboard]

Touch Panel

These control tools are located on both sides of the touch screen. Available buttons are as follows:

[Figure 1.6 Touch Panel]

	Patient	Displays the Patient Information screen, which is used for selecting a patient ID from the list or entering new patient information.
	End Exam	Finishes the exam of the currently selected patient and resets the related data.
	Probe	Displays the Probe Selection screen to select or change the probe and application.
	Report	Displays the Report screen that shows the measurement results of the current application and other information.
	SonoView	Runs SonoView, which is the image filing program.
	U3	Stands for User Key; functions can be assigned to these buttons as desired. The function of each button can be set in Setup > User Defined Key. The settings are displayed in the User Defined Key area in the monitor.
	Utility	The Utility Menu appears on the touch screen.
	S-Flow	Initiates or terminates the S-Flow (Directional Power Doppler) Mode.
	ADVR	Initiates recording feature.
	TGC	The *TGC* screen will be displayed on the touch screen. TGC stands for Time Gain Compensation.

Touch Screen

[Figure 1.7 Touch Screen]

The touch screen is an operating tool that can be touched by the user to input data. The functions that are available in the current mode are shown in the form of buttons or a dial-button.

■ Touch screen display

① Information Area: Shows the title of the touch screen currently displayed.

② Tab Area: Shows diagnostic modes and utilities under different tabs. The touch screen can be changed by pressing one of the tabs.

③ Menu Area: The menu items that are available in the current input mode are shown in the form of buttons. The user can access the desired menu item by pressing the corresponding button. The menu currently in use is shown in blue.

④ Soft Menu Area: The soft menu items that are available in the current input mode are shown.The menus in use are shown with blue borders. Press or rotate the dial-buttons right below each menu.

⑤ Quick Preset: With predefined diagnosis mode and presets of probes frequently used by the user, this function provides quick and easy access to frequently used probe in each diagnosis mode

NOTE

For further details about setting up Quick Preset, please refer to ‘Setup > General > Quick Preset > Quick Preset Setup’ in ‘Chapter 3 Utilities’.

※Tip! When there are two Soft Menus

When there are two menus available – upper and lower, both menus can be adjusted with the corresponding dial-button. Or tap the button for the menu you want to use on the touch screen and then use the dial-button.

Adjusting the Control Panel

CAUTION	■ Do not apply excessive force to the control panel. ■ Use the handle at the back of the product when moving it.

■ **Adjust right/left**

Hold the control panel handle and move it carefully to the right or left.

■ **Adjust up/down**

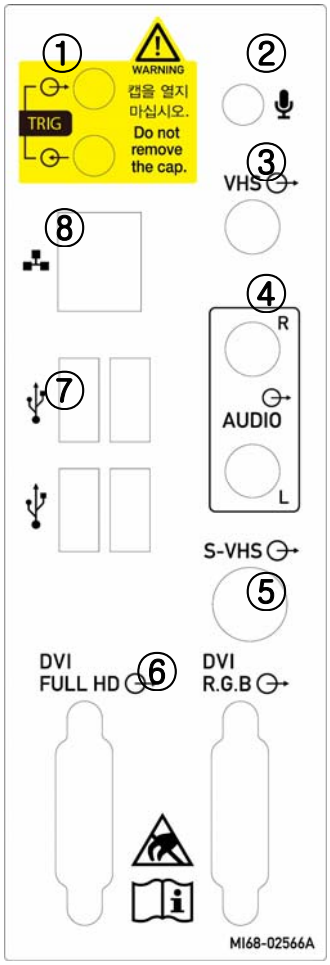
Press the lever on the control panel handle and move it carefully up or down.

The Console

The console consists of two parts – the inner and outer units. The inside of the console contains ultrasound imaging components. On the exterior of the console are various connectors, probe holders, storage compartments, handles, and wheels, etc.

Rear Panel

Various peripheral devices including monitors are connected via the rear panel at the back of the system.



[Figure 1.9 Rear panel]

① Trig port (In/Out): Not used.

② Microphone port (Input): Connect a microphone to this port.

③ VHS port (Output): Outputs composite image to the monitor.

④ Audio port (Output): Used to output audio signals.

⑤ S-VHS port (Output): Outputs S-VHS image to the monitor.

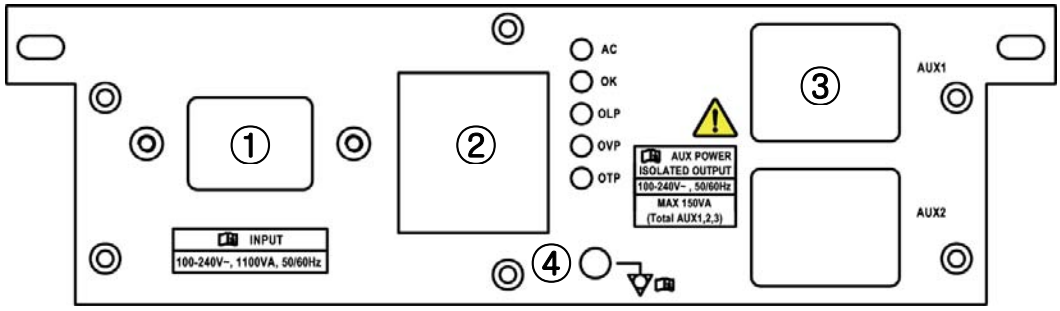
⑥ DVI port (Output): Outputs the digital signal (DVI Full HD) and analog signal (DVI R.G.B) to the monitor.

⑦ USB port: Used to connect to USB peripheral devices..

⑧ Network port: Used to connect to a network. You can transfer patient information to another server via the DICOM network.

Power Connection Part

The power connection part is located at the bottom on the rear panel.



[Figure 1.10 Power Connection Part]

① Power switch: Supplies or blocks power to the entire system.

② Power inlet: For the power cable to connect to external power

③ Power outlet: Provides power to the external peripheral devices from the internal power supply of the system.

④ Equipotential terminal: Must be connected to the equipotential bonding network in a treatment room.

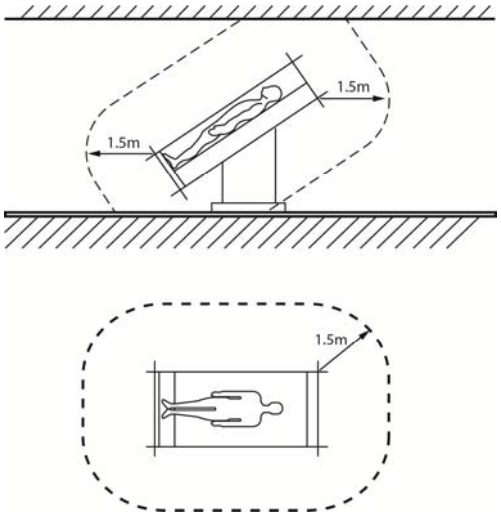
Probe Holder

Probe holders are mounted at the left and right-hand sides of the control panel.

Peripheral Devices

Peripheral devices can be connected to their corresponding ports on the left/right or rear sides of the console, as needed.

CAUTION	■ Do not install a peripheral device that is not listed in this operation manual in the patient environment. If you install an unlisted device in the patient environment, it may cause an electrical hazard ■ Do not connect additional external peripheral devices to the auxiliary socket outlet. Doing so may decrease safety level..



[Figure 1.11 Patient Environment]

NOTE	For instructions on using a specific peripheral device, refer to the device's operation manual.

Internal Peripheral Devices

These are peripheral devices mounted in the system.

- **DVD-Multi**

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

- **Hard Disc Drive**

  At least 500 GB

External Peripheral Devices

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

CAUTION	When using a peripheral device via 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 the USB devices.

NOTE	■ When removing the removable disk, use **Utility** > **Storage manager**. ■ USB ports are located both on the control panel and the rear panel of the console. We recommend that you connect USB storage devices (flash memory media, etc.) to the ports on the control panel, and other USB peripheral devices to the rear panel for convenience.

The following products are recommended:

- **USB Video Printer**
  - BW: Mitsubishi P95DE, Sony UP-D897
  - Color: Mitsubishi CP-30DW, Sony UP-D25MD
- **USB Line Printer**
  - BW: Samsung ML-2955DW
  - Color: Samsung CLP-615ND

CAUTION	■ You must install a printer and drivers that are compatible with the English version of Microsoft Windows 7™. Contact Samsung Medison's customer service department for inquiries about printer driver installation. ■ When installing a printer, make sure that the printer is the same printer selected in Microsoft Windows™ or Setup. ■ Please check the port that the printer uses before connecting. Printers should be connected to the printer port while the USB printer should be connected to the USB port.

- **USB to RS-232C Serial Cable**

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

NOTE	For more information about the Open Line Transfer, refer to `Chapter 9. Measurements and Calculations'.

- **Foot Switch**

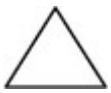
  – 3 Pedals HID Type

  To configure the foot switch function, go to Utility > Setup > Peripherals > Foot Switch. You can select one function from the following: Freeze, Update, Record, Print1, Save, Store Clip, Volume Start, PD Mode, Color Mode, M Mode, PW Mode, CW Mode, Elastoscan Mode, TDI Mode, TDW Mode, Biopsy, Save/Send, or Store Clip/Send.

WARNING	Foot Switch cannot be used in the operating room

- **Misc.**

  Flash Memory Media



NOTE

- The system cannot recognize USB 1.1 flash memory. Remove the flash memory from the console and equip again with an appropriate device.
- Regarding file formats that are not ordinarily saved: Please check first to see if it is possible to save the file format on a desktop PC before trying to save the file on flash memory.
- Do not use flash memory media which contain anti-virus programs or are defective. Otherwise, the product may fail to work properly.

NOTE	■ The system cannot recognize USB 1.1 flash memory. Remove the flash memory from the console and equip again with an appropriate device. ■ Regarding file formats that are not ordinarily saved: Please check first to see if it is possible to save the file format on a desktop PC before trying to save the file on flash memory. ■ Do not use flash memory media which contain anti-virus programs or are defective. Otherwise, the product may fail to work properly

Probes

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

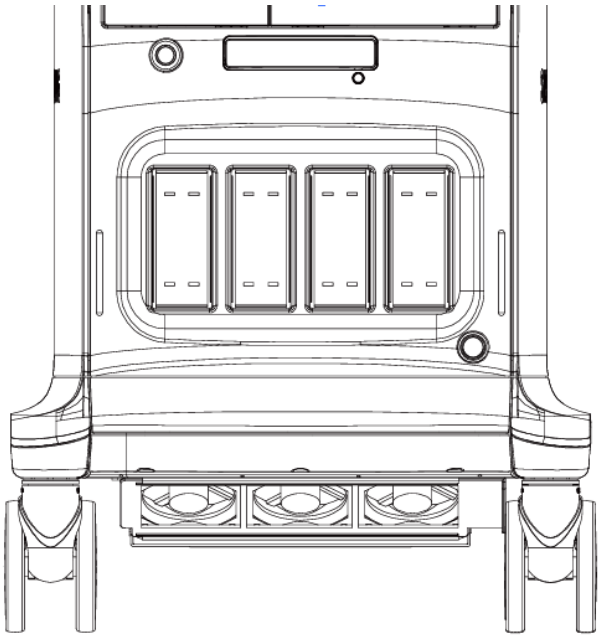
NOTE	For more information on probes, refer to ‘Chapter 5. Probes’ and the ‘Reference Manual’.

Connecting probes

To ensure the safety of the product and the probe, turn off the power before connecting the probe to, or disconnecting it from, the probe port.

1. Connect probes to the probe ports on the front panel of the system. A maximum of five probes including the CW probe can be connected at one time. The CW probe should CW only be connected to its own port.

2. To install, turn the connector turning handle clockwise.



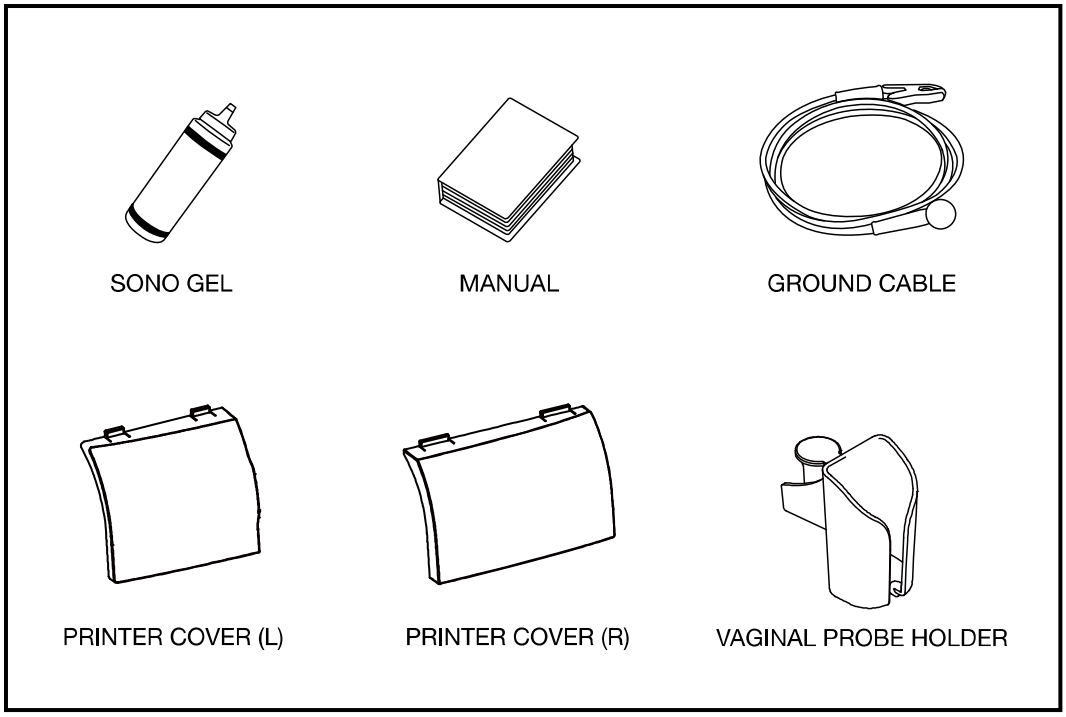
[Figure 1.11 Probe Connector]

Accessories

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

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

NOTE	Accessories can be different according to the country.



[Figure 1.12 Accessories]

Optional Functions

This product has the following S/W optional functions

- 4D
- 3D XI
- CW Function
- Cardiac Measurement
- DICOM
- XI STIC
- Elastoscan
- Panoramic
- 3DMXI
- HDVI
- ADVR
- E-Thyroid
- Realistic Vue
- AutoIMT+
- E-Breast
- 2D NT
- 5D LB
- 5D NT
- Mobile Export
- 5D Heart
- 5D Follicle
- 5D CNS
- Elite
- MPI
- Software Trial
- DICOM Q/R
- S-Detect
- 5D Limb
- Crystal Vue
- 5D Heart Color
- 5D CNS+

For further information about the options listed above, please refer to the relevant chapters in the operation manual.

NOTE

- Elite is a package for WS80A v3.00 and does not refer to any particular function.
- Software Trial does not refer to any particular function.

Chapter 2

Safety

Purpose of Use **2**

Safety Information **3**

Safety Symbols 3
Symbols 6
Labels 7

Electrical Safety **8**

Prevention of Electric Shock 8
ECG-related Information 10
ESD 10
EMI 11
EMC 11

Mechanical Safety **19**

Moving the Equipment 19
To Use the Product Safely 20

Biological Safety **23**

ALARA Principle 23

Environmental Protection **38**

Correct Disposal of This Product (Waste Electrical & Electronic Equipment) 38

Purpose of Use

The WS80A Diagnostic Ultrasound System and transducers are intended for diagnostic ultrasound imaging and fluid analysis of the human body.

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

NOTE	For detailed information on applications and presets, please refer to 'Chapter 2. Introduction' and 'Chapter 5. Probes' in this operation manual.

Contraindications

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

CAUTION	■ Federal law restricts this device to sale by or on the order of a physician. ■ For information on the use or clinical application of this product, please refer to 'Chapter 6. Starting Diagnosis' and 'Chapter 7. Diagnosis Mode' in this operation manual.

Safety Information

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.

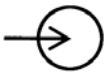
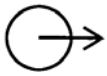
This system is intended for use by, or by the order of, and under the supervision of, a licensed physician who is qualified for direct use of the medical device.

Safety Symbols

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

Symbols	Description
	WARNING: The accompanying information must be followed to prevent serious accidents and/or damage to property.
	CAUTION: The accompanying information helps to prevent minor accidents and/or damage to property.
	Refer to the operation manual.
	Follow the operation manual.
	CAUTION: Risk of electric shock
	Type BF applied part (Classification based on degree of protection against electric hazard)

Symbols	Description
	Defibrillation-proof type CF applied part (Classification based on degree of protection against electric hazard)
	Power on/off
	Power on
	Power off
	Power ON for part of the product
	Power Off for part of the product
	Alternating current voltage source
	Direct current voltage source
	Dangerous voltage (Indicates dangerous voltages over 1000V AC or 1500V DC)
	Protective earth (ground)
	Equipotentiality

Symbols	Description
	Data output port
	Data input port
	Data Input/Output port
	Input port
	Output port
	Print remote output
	Foot Switch Port
	ECG port
	USB port
	Network port
	Microphone Port
	Probe port
IPX 1	IPX 1: Protected against vertically falling water drops

Symbols	Description
IPX 7	IPX 7: Protected against the effects of temporary immersion in water
IPX 8	IPX 8: Protected against the effects of continuous immersion in water
	CAUTION: Electrostatic sensitive devices (ESD)
	Do not sit on the product.
	Do not push the product.
	Do not lean against the product.
	Be mindful of the space. Do not place a finger, and or any part of your body in the space.

Symbols

Symbols	Description
	Authorised Representative In The European Community
	Manufacturer

Labels

Phrases containing the words ‘warning’ and/or ‘caution’ are displayed on the product's surface in order to protect it.

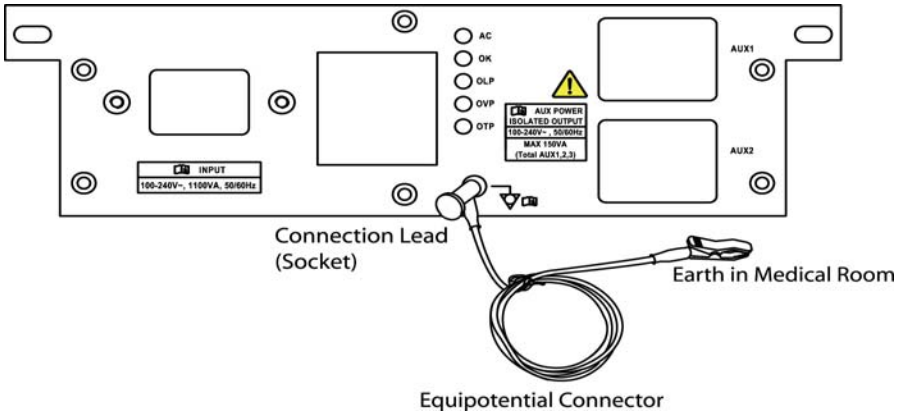
Electrical Safety

This equipment is categorized as a Class I device with Type BF or Type CF (ECG) applied parts.

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

Prevention of Electric Shock

In a hospital environment, hazardous current can form due to potential differences between exposed conductive parts and connected devices. The solution to the problem is consistent equipotential bonding. Medical equipment is connected with connecting leads made up of sockets which are angled to the equipotential bonding network in medical rooms.



[Figure 1.1 Equipotential Bonding]

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

WARNING

- Electric shock may result if this system, including all of its externally mounted recording and monitoring devices, is not properly grounded.
- Never remove the cover from the product. Hazardously high voltage flows through the product. All internal adjustments and replacements must be made by a qualified Samsung Medison Customer Service Department.
- Always check the product's casing, cables, cords, and plugs for damage before using the product. Disconnect and do not use the power source if the face is cracked, chipped, torn, the housing is damaged, or if the cable is abraded.
- Always disconnect the system from the wall outlet prior to cleaning it.
- All patient contact devices, such as probes and ECG leads, must be removed from the patient prior to the application of a high voltage defibrillation pulse.
- The use of flammable anesthetic gas or oxidizing gases (N_2O) should be avoided. Doing so may cause an explosion.
- Avoid placing the system where it is likely to be difficult to operate, or disconnect.
- Do not use HF surgical equipment with the system. Any malfunctions in the HF surgical equipment may result in burns to the patient.
- The System must only be connected to a supply mains with protective earth to avoid risk of electric shock.

CAUTION

- The system has been designed for 100-240VAC; you should select the input voltage of any connected printer and VCR. Prior to connecting a peripheral power cord, verify that the voltage indicated on the power cord matches the voltage rating of the peripheral device.
- An isolation transformer protects the system from power surges. This continues to operate when the system is on standby.
- Do not immerse the cable in liquids. Cables are not waterproof.
- Make sure that the inside of the system is not exposed to or flooded with liquids. In such cases, fire, electric shock, injury, or damage to the product may occur.
- The auxiliary socket outlets installed on this system are rated 100-240VAC, with a maximum total load of 150VA. Only use these outlets for supplying power to equipment that is intended to be part of the ultrasound system. Do not connect additional multiple-socket outlets or extension cords to the system.
- Do not connect any peripheral devices not listed in this manual to the auxiliary socket outlets of the system.
- Do not touch SIP/SOP and the patient simultaneously. There is a risk of electric shock from current leakage.

ECG-related Information

WARNING	■ This device is not intended to provide a primary ECG monitoring function, and therefore does not have means of indicating an inoperative electrocardiograph. ■ Do not use ECG electrodes with HF surgical equipment. HF surgical equipment may be damaged, which may result in fire. ■ Do not use ECG electrodes during cardiac pacemaker procedures or any procedures that involve other types of electrical stimulators. ■ Do not use ECG leads and electrodes in an operating room.

ESD

Electrostatic discharge (ESD), commonly referred to as a static shock, is a naturally occurring phenomenon. ESD is most prevalent during conditions of low humidity, which can be caused by heating or air conditioning. The static shock, or ESD, is a discharge of the electrical energy build-up from a charged individual to a lesser or uncharged individual or object. An ESD occurs when an individual with an electrical energy build-up comes in to contact with conductive objects such as metal doorknobs, file cabinets, computer equipment, and even other individuals.

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 to carpets or linoleum. - Use anti-static mats. - Ground the product to the patient's table or bed. ■ It is highly recommended that the user be given training on ESD-related warning symbols and preventive procedures.

EMI

This product complies with EMI (Electromagnetic Interference) standards. However, using the system inside an electromagnetic field can lower the quality of ultrasound images and even damage the product.

If this occurs often, Samsung Medison suggests a review of the environment in which the system is being used, to identify possible sources of radiated emissions. These emissions could be from other electrical devices used within the same room or an adjacent room. Communication devices, such as cellular phones and pagers, can cause these emissions. The existence of radios, TVs, or microwave transmission equipment nearby can also cause interference.

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

EMC

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

Guidance and Manufacturer's Declaration - Electromagnetic Emissions

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 Status	Electromagnetic Environment - Guideline
RF Emission CISPR 11	Group 1	The Ultrasound System uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF Emission CISPR 11	Class A	The Ultrasound System is suitable for use in all establishments other than domestic, and may be used in domestic

Harmonic Emission IEC 61000-3-2	Class A	establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes, provided the following warning is heeded: Warning: This system is intended for use by healthcare professionals only. This system may cause radio interference or may disrupt the operation of nearby equipment. It may be necessary to take mitigation measures, such as re-orienting or relocating the Ultrasound System or shielding the location.
Flicker Emission IEC 61000-3-3	Complies	

Approved Cables, Probes and Accessories for EMC

■ Cables

Cables connected to this product may affect its emissions.

Refer to the table below for recommended cable types and lengths:

Cable	Type	Length
VGA	Shielded	Normal
RS232C	Shielded	Normal
USB	Shielded	Normal
LAN(RJ45)	Twisted pair	Any
S-Video	Shielded	Normal
Foot Switch	Shielded	2.99m
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
Parallel	Shielded	Normal

■ Probes

The image probe used with this product may affect its emission. The probe listed in ‘Chapter 5. Probes’ when used with this product, have been tested to comply with the group1 Class A emission as required by International Standard CISPR 11.

■ **Peripherals**

Peripherals used with this product may affect its emissions.

CAUTION	When connecting other customer-supplied accessories to the system, it is the user's responsibility to ensure the electromagnetic compatibility of the system.

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

Immunity Test	IEC 60601 Test Level	Standard Level	Electromagnetic Environment - Guideline
Electrostatic Discharge (ESD) IEC 61000-4-2	±6KV contact ±8KV wait	±6KV contact ±8KV wait	Wooden, concrete, or porcelain tiles must be used for floor materials. If the floor materials are synthetic materials, the relative humidity level must be maintained at least 30% at all times.
Electronic fast excess/burst IEC 61000-4-4	±2KV (for lines of power supply device) ±1KV (for lines of input/output)	±2KV (for lines of power supply device) ±1KV (for lines of input/output)	The quality of main power must be same as the power quality used in common commercial or medical environment.
Surge IEC 61000-4-5	±1KV differential mode ±2KV common mode	±1KV differential mode ±2KV common mode	The quality of main power must be same as the power quality used in common commercial or medical environment.
Voltage drop, short blackout, and voltage fluctuation in power supply device IEC 61000-4-11	in 0.5 cycle <5%U_T (>95% drop, unit: U_T) in 5 cycles, 40%U_T (60% drop, unit: U_T) in 25 cycles, 70%U_T (30% drop, unit: U_T) for 5 seconds <5%U_T (<95% drop, unit: U_T)	in 0.5 cycle <5%U_T (>95% drop, unit: U_T) in 5 cycles, 40%U_T (60% drop, unit: U_T) in 25 cycles, 70%U_T (30% drop, unit: U_T) for 5 seconds <5%U_T (<95% drop, unit: U_T)	The quality of main power must be same as the power quality used in common commercial or medical environment. If uninterrupted operation is required when there is a malfunction to the main power, it is recommended that you use the uninterruptible power supply or the battery to supply the power.
Commercial frequency (50/60Hz) magnetic field IEC 61000-4-8	3A/m	3A/m	The magnetic field of power frequency must be same as the magnetic field used in common commercial or medical environment.
Note : U_T is the main voltage (AC) prior to the application of the test level.			

Immunity Test	IEC 60601 Test Level	Standard Level	Electromagnetic Environment - Guideline
RF Conduction IEC 61000-4-6	3Vrms 150kHz ~ 80MHz	3V	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. This is calculated using the equation applicable to the frequency of the transmitter. Recommended separation distance $d = 1.2\sqrt{p}$ $d = 1.2\sqrt{p}$ 80MHz to 800MHz $d = 2.3\sqrt{p}$ 800MHz to 2.5GHz
RF discharge IEC 61000-4-3	3V/m 80MHz ~ 2.5GHz	3V/m	Where P is the transmitter's maximum output power rating in watts (W) according to the transmitter's manufacturer, and d is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, a should be less than the compliance level in each frequency range. [b] Interference may occur in the vicinity of equipment marked with the following symbol: 

NOTE 1) At 80MHz and 800MHz, the higher frequency range applies.

NOTE 2) These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

[a] Field strengths from fixed transmitters, such as base stations for radio, (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcasts and TV broadcasts cannot be predicted 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 reorienting 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 3V/m.

Recommended distance between wireless communication device and this product

This product is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The user 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 $d = 1.2\sqrt{p}$	**80MHz to 800MHz** $d = 1.2\sqrt{p}$	**800MHz to 2.5GHz** $d = 2.3\sqrt{p}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23

For the maximum power rated output of transmitters not on the above list, the recommended separation distance, *d*(m), can be calculated by using the equation applicable to the transmitter's frequency. *p* is the maximum power rated output (in Watts) of the transmitter.

Note 1) At 80MHz and 800MHz, a separation distance for a higher frequency range applies.
Note 2) This guideline may not be applicable to every situation. The electromagnetic wave can be absorbed or reflected by structures, objects, or humans.

Electromagnetic environment – guidance

It is recommended to use ultrasound systems in shielded locations offering RF shielding effectiveness, with shielded cables. Field strengths outside the location shielded from fixed RF transmitters, as determined by an electromagnetic site survey, should be less than 3V/m.

It is essential to verify that the actual shielding effectiveness and filter attenuation of the shielded location meet the minimum specifications.

CAUTION	If the system is connected to 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 emission phenomena.

Avoiding Electromagnetic Interference

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

Imaging mode	ESD[1]	RF[2]	Power Line[3]
2D	When changing the operation mode or system configuration, or reconfiguring the system, a short blinking appears on the image of the screen or on the recorded image.	For sector image probes, a white radial band or blinking appears on the center line of the image. For linear imaging probes, a white radial band appears or sometimes the image edge will appear brighter.	White dot, line table, or diagonal line is displayed or a diagonal line is displayed near the image center.
M		Background noise for the image gets louder or a white M mode line is displayed.	White dot, line table, or diagonal line is displayed or background noise for the image gets louder.
Color		The color blinks, radial/vertical band appears, background noise gets louder, or color image changes.	The color blinks, dot or line table appears, or color noise level changes.

Doppler (Doppler)		A horizontal line is displayed on the spectrum display or tone, abnormal noise is created, or both occur together.	A vertical line is displayed on the spectrum display or a bursting noise is created, or both occur together.
1. ESD which occurs when charges accumulated on an insulated floor or human is discharged. 2. RF energy created from the RF transmission devices such as mobile phone, portable radio, wireless device, commercial radio and TV. 3. Malfunction which occurs due to switch of power supply to power cable or connected cable, electronic control, or natural phenomenon 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's ultrasound systems do not generate electromagnetic interference in excess of the referenced standards.

An Ultrasound System is designed to receive signals at radio frequency and is therefore susceptible to interference generated by RF energy sources. Examples of other sources of interference are medical devices, information technology products, and radio and television transmission towers. Tracing the source of radiated interference can be a difficult task. Users 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 probe operating at the same frequency or with several probes?
- Do two different probes 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 to determine if the problem resides with the system or the scanning environment. After you answer the questions, contact your local Samsung Medison customer service department.

Mechanical Safety

Moving the Equipment

WARNING	The product weighs more than 100 kg; be careful when you move it. Careless transporting may cause injury to the user or may damage the product.

- Make sure that the brakes on wheels have been unlocked before you move it. Also, make sure to retract the monitor arm completely so that it is secured in a stationary position.
- Always use the handles at the back of the console and move the product slowly.

This product is designed to be resistant to physical shocks. However, subjecting the product to excessive shocks, such as dropping it, may seriously damage the product.

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

Foot Lock

You can use the brakes to control the movement of the product. The brakes are mounted on each wheel of the main body with interlinked on/off buttons. This is how you engage or release the brakes:

- Engaged: To engage the brakes, press the On button with your foot. The Off button will rise.
- Released: To release the brakes, press the Off button with your foot. The On button will rise.

We recommend that you lock the brakes when using the product.

Cautions on an inclined surface

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

WARNING	Pay attention to the movement of wheels when transporting the product. Practice is recommended before transporting the product on an inclined surface.

Leaving the CART unattended on an inclined surface may cause the CART to topple, even if you engage the foot lock. Avoid an inclined surface to station the product.

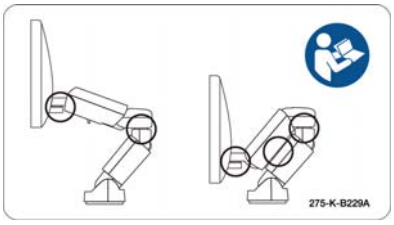
To Use the Product Safely

CAUTION	■ Do not press the control panel excessively. ■ Never attempt to modify the product in any way. ■ Read the instructions on safe operation of the product if using the product after a prolonged period of non-use. ■ Make sure that other objects, such as metal pieces, do not enter the system. ■ Do not block the ventilation slots. ■ To prevent damage to the power cord, be sure to grip the plug head – not the cord – when unplugging. ■ Excessive bending or twisting of cables on patient-applied parts may cause failure or intermittent operation of the system. ■ Improper cleaning or sterilization of a patient-applied part may cause permanent damage. ■ Assuming that the product is used in accordance with the guidelines contained in this manual and maintained by qualified service personnel, the expected lifespan of the product is approximately 7 years.

Please refer to 'Chapter 10. Maintenance' for detailed information on protecting, cleaning and disinfecting the equipment.

Precautions for Using Monitor

When adjusting the height or position of the monitor, be careful not to leave your fingers or hand in area between the monitor arms - they may get trapped and hurt.

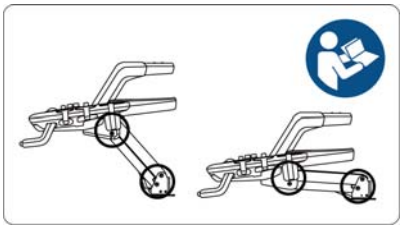


[Figure 2.2 Safety note for monitor]

Caution for Using Control Panel

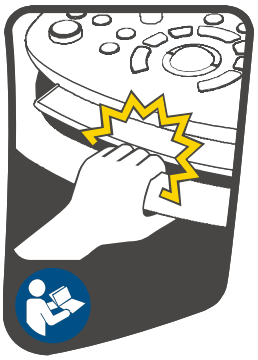
CAUTION	■ Do not push the control panel with excessive force or lean on it. ■ Do not sit on the control panel or exert excessive force on it.

When adjusting the height or position of the control panel, be careful not to leave your fingers or hand in area between the control panel and the lift - they may get trapped and hurt.



[Figure 2.3 Cautions on Using Control Panel]

When using the handle of the control panel, be careful of the space between the handle and the keyboard. The keyboard may come out to collide with the hand.



[Figure 2.4 Cautions on Using Handle]

Biological Safety

For safety information on the probe and biopsy, refer to 'Chapter 5. Probes'.

WARNING	■ Ultrasound waves may have damaging effects on cells, and therefore may be harmful to the patient. If there is no medical benefit, minimize the exposure time and maintain a low ultrasound wave output level. Please refer to the ALARA principle. ■ Do not use the product if an error message or a warning message about a dangerous situation is displayed on the screen. Write down the message displayed on the screen, turn the power off, and contact the service department of Samsung Medison. ■ Do not use a system that exhibits erratic or inconsistent behavior. Discontinuities in the scanning sequence are an indication of a hardware failure that must be repaired before use. ■ The system limits the maximum contact temperature to 43℃, and the ultrasonic waves output observes American FDA regulations.

ALARA Principle

Performing diagnoses using an ultrasound device is defined by the “As Low As Reasonably Achievable” (ALARA) principle. The decision as to what is reasonable has been considered and defined by many people. However, no set of rules can be formulated that would be sufficiently complete to dictate the correct response for every circumstance. By keeping ultrasound exposure as low as possible, while obtaining diagnostic images, users can minimize ultrasonic bioeffects.

Since the threshold for diagnostic ultrasound bioeffects is undetermined, it is the sonographer’s responsibility to control the total energy transmitted into the patient. The sonographer must reconcile exposure time with diagnostic image quality. To ensure diagnostic image quality and limit exposure time, the ultrasound system provides controls that can be manipulated during the exam to optimize the results of the exam.

The user's knowledge of, and the ability to abide by, the ALARA principle is very 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. This important information is based on a variety of ultrasound output data, and plays an important

role in putting the ALARA principle into effect.

Numerous variables affect the output data that forms the basis of the provided information. These variables include mass, body size, location of the bone relative to the focal point, attenuation in the body, and ultrasound exposure time. Among these, exposure time is the variable that one must pay the most attention to. For, unlike other variables, exposure time is entirely controlled by the operator of the ultrasound system.

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 unscanned modes like M-mode or Doppler concentrate 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 necessarily mean that a bioeffect is occurring, it should still be taken seriously. Every effort should be made to reduce the possible effects of a high index reading. Limiting exposure time is an effective way to accomplish this goal.

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

Direct Controls

Application selection and the 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 priorities 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. Samsung Medison's systems provide both automatic and user-definable settings.

Output has a 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 lower than the defined maximum. Prudent use ensures good image quality while employing the lowest output intensity.

Indirect Controls

The indirect controls are those that have an indirect effect on the acoustic intensity. These controls affect the 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 scanned 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.

The 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.

The focus of the ultrasound beam affects the image resolution. Maintaining or increasing the resolution at a different focal zone involves the adjustment of numerous outputs from the focal zone. This output adjustment is one of the system’s optimization features. 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 cavitation. Pulse length, burst length, and pulse duration refer to the output pulse duration in pulsed Doppler mode. In addition, 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 greater output intensity to scan at a deeper depth. To scan deeper at the same output intensity, a lower probe frequency is required. Using more gain and output beyond a point, without corresponding increases in image quality, can mean that a lower frequency probe is needed.

- **Receiver Controls**

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

Additional Considerations

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

Output Display Features

The system output display comprises two basic indices: a mechanical index and a thermal index. The thermal index consists of the following indices: soft tissue (TIs), bone (TIb) and cranial bone (TIc). One of these three thermal indices will be displayed at all times. One of the indices will be displayed according to the application currently in use, depending on the system settings or user choice.

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 all the time. Each probe application has an appropriate default selection for the 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. The default setting is the 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 applied automatically by the ultrasound system when the power is turned on, new patient data is entered into the system database, or a change of application takes place. The decision as to which of the three thermal indices is displayed is 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 a bone. Elements such as fluid, bone, and blood flow may act as artifacts that increase or decrease the TI. A highly attenuating tissue path, for example, may cause the potential for local zone heating to be lower than the thermal index displays.

In comparison with the probe mode, unscanned modes of operation also affects the thermal index. For scanned modes, heating tends to be near the surface; for unscanned modes, the potential for heating tends to be deeper in the focal zone.

Always limit ultrasound exposure time. Do not rush the exam. Ensure that the indices are kept to a minimum, and that exposure time is limited without compromising diagnostic sensitivity.

- **Mechanical Index (MI) Display**

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

- **Thermal Index (TI) Display**

  The TI informs the user of the potential for temperature increase occurring 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. The TI should be used only 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, such as the skeletal structure of a 2-3 month old fetus. The cranial bone thermal index (TIc) informs the user about the potential heating of bone at or near the surface, for example, the cranial bone. The soft tissue thermal index (TIs) informs the user about the potential for heating within soft homogeneous tissue. TIc is displayed when you select a transcranial application.

You can select the TI to display at Setup > Imaging > Display.

- **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 section of this operation manual. These accuracy estimates are based on the variability ranges of probes and systems, inherent acoustic output modeling errors, and the 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 of 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 to calculate 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 is built into the measurement and calculation process for the vast majority of tissue paths. For example, the acoustic output values measured underwater 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 a steady state to be reached.

A number of factors are considered when estimating the accuracy of display values; hardware variations, algorithm accuracy estimation, measurement variability, and variability among probes and systems are significant factors. Probe deviation results from piezoelectric crystal efficiencies, process-related impedance differences, and sensitive lens focusing parameter variations. Differences in the system pulse voltage control and efficiencies also contribute to variability. There are inherent uncertainties in the algorithms used to estimate 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 the calculation of the accuracy estimate displayed. Neither linear propagation nor uniform attenuation at the 0.3dB/cm-MHz rate occurs in underwater 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 underwater 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 measured according to AIUM measurement standards but not based on errors caused during the measurement. They are also independent of the effects of non-linear loss on the measured values.

Control Effect- Controls Affecting the Indices

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

- **Power**

  The power controls the system's acoustic output. Two real-time output values are on the screen: a TI and an 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. Each mode is a vital contributor to this total; the displayed MI will be from the mode with the largest peak pressure.

2D Mode Controls

- **2D Mode Size**

  Narrowing the sector angle may increase the frame rate. This will increase the TI. The pulse voltage may be automatically adjusted down by the software controls to keep the TI below the system maximum. A decrease in pulse voltage will decrease MI.

- **Zoom**

  Magnifying the image increases frame rate. This will also increase the TI. The number of focal zones may automatically increase to enhance the resolution. In such circumstances, the maximum intensity may occur at a different depth, which may change the MI.

- **Persistence**

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

- **Focal no.**

  Increasing the number of focal zones may change both the TI and MI by changing the

frame rate or focal depth automatically. Lower frame rates decrease the TI. The MI displayed will correspond to the focal zone with the largest peak intensity.

- **Focus**

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

Color and Power Controls

- **Color Sensitivity**

  Increasing the color sensitivity increases the TI and the time spent to scan color images. Color pulses are the dominant pulse type in this mode.

- **Color Sector Width**

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

- **Color Sector Depth**

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

- **Scale**

  Using the scale control to increase the color velocity range may increase the TI. The system will automatically adjust the pulse voltage to stay below the system maximum. A decrease in pulse voltage will also decrease the MI.

- **Sec Width**

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

M Mode and Doppler Controls

- **Speed**

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

- **Simultaneous and Update Methods**

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

- **Sample Volume Depth**

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

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

When a new imaging mode is selected, both the TI and the MI will revert to their 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 the MI is the value for the focal zone of the mode with the largest de-rated intensity. If a mode is turned off and then reselected, the system will return to the previously selected settings.

- **Probes**

  Each probe model available has unique specifications for the contact area, beam shape, and center frequency. Settings are reset when you select a probe. Samsung Medison's

factory defaults vary with probe, application and mode. Defaults that are below the FDA limits have been chosen for intended use.

- **Depth**

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

- **Application**

  Acoustic output defaults are set when you select an application. Samsung Medison's factory defaults vary with probe, application, and mode. Defaults that are below the FDA limits have been chosen for intended use.

Related Guidance Documents

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

- AIUM Report, January 28, 1993, “Bioeffects and Safety of Diagnostic Ultrasound”
- Bioeffects Considerations for the Safety of Diagnostic Ultrasound, *J Ultrasound Med*., Sept. 1998: Vol. 7, No. 9 Supplement
- Acoustic Output Measurement Standard for Diagnostic Ultrasound Equipment. (AIUM, NEMA. 1998)
- Acoustic Output Labeling Standard for Diagnostic Ultrasound Equipment (AIUM, 1998)
- Second Edition of the AIUM Output Display Standard Brochure, Dated March 10, 1994. (A copy of this document is shipped with each system.)
- Information for Manufacturer Seeking Marketing Clearance of Diagnostic Ultrasound Systems and Transducers. FDA. September 1997. FDA.
- Standard for Real-Time Display of Thermal and Mechanical Acoustic Output Indices on Diagnostic Ultrasound Equipment. (Revision 1, AIUM, NEMA. 1998)
- WFUMB. Symposium on Safety of Ultrasound in Medicine: Conclusions and Recommendations on Thermal and Non-Thermal Mechanisms for Biological Effects of Ultrasound, *Ultrasound in Medicine and Biology*, 1998: Vol. 24, Supplement1.

Acoustic Output and Measurement

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

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

In Situ, De-rated, and Water Value Intensities

All intensity parameters are measured in water. Since water does not absorb acoustic energy, these water measurements represent the largest possible value. Biological tissue absorbs 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. A de-rating factor of 0.3 is used for general reporting purposes; therefore, the *In Situ* value which is commonly reported uses the formula:

In Situ (*derated*) = Water $e^{-(0.069lf)}$

Since this value is not the true *in situ* intensity, the term “de-rated” is used.

The maximum de-rated and maximum water values do not always occur under the same operating conditions. Therefore, the reported maximum water and de-rated values may not be related to the *In Situ* (de-rated) formula. For example, a multi-zone array transducer has the greatest water value intensities in its deepest zone. The same transducer may have its largest de-rated intensity in one of its shallowest focal zones.

Acoustic Output and Measurement

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

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

ISPPA.3 The **derated spartial-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.

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

WO **Ultrasonic power**(milliwatts). For operating conditions 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 **Center frequency** (MHz). For MI and ISPPA.3, Fc is the **Center frequency** associated with the transmit pattern giving rise to the global maximum value of the respective parameter. For ISPTA.3, for combined modes involving beam types of unequal **Center frequency**, Fc is defined as the overall ranges of center frequencies of the respective transmit patterns.

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

x-6,y-6 These 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** (centimeters) for the azimuth and elevation planes.

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

Acoustic Measurement Precision and Uncertainty

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

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

- **Systematic Uncertainties.**

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

Hydrophone calibration drift or errors.

Hydrophone / Amp frequency response.

Spatial averaging.

Alignment errors.

Voltage measurement accuracy, including.

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

The acoustic power is measured using a Radiation Force for systematic uncertainties through

the use of calibrated NIST acoustic power sources.

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

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

Balance system calibration.

Absorbing (or reflecting) target suspension mechanisms.

Linearity of the balance system.

Extrapolation to the moment of switching the ultrasonic transducer (compensation for ringing and thermal drift).

Target imperfections.

Absorbing (reflecting) target geometry and finite target size.

Target misalignment.

Ultrasonic transducer misalignment.

Water temperature.

Ultrasonic attenuation and acoustic streaming.

Coupling or shielding foil properties.

Plane-wave assumption.

Environmental influences.

Excitation voltage measurement.

Ultrasonic transducer temperature.

Effects due to nonlinear propagation and saturation loss.

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

Training

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

Environmental Protection

CAUTION	■ To dispose of the system or accessories that have come to the end of their lifespan, contact the vendor or follow appropriate disposal procedures. ■ You are responsible for complying with the relevant regulations for waste disposal. ■ The lithium ion battery used in the product must be replaced by aSamsung Medison service engineer or an authorized dealer.

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

Applicable in countries with separate collection systems

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

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

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

For information on Samsung's environmental commitments and product specific regulatory obligations e.g. REACH visit:
Samsung.com/uk/aboutsamsung/samsungelectronics/corporatecitizenship/data_corner.html

State of California Proposition 65 Warning (US only)

WARNING

This product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

Chapter 3

Installing the Product

Unpacking the Product 3

Installation Environment 4

Installing the Product 5

Power Cord Connection 6

Probe Connection 6

Connecting Peripherals 7

System Power 9

Turning the Power On 9

Shutting Down the System 10

System Settings 11

System General Setting 12

Scan Mode 17

Display 21

Annotate 26

Peripheral Device Settings 31

User Defined Keys 38

MPR Menu 40

Network 41

Options 43

DICOM Setup (optional) 45

Auto Calc 59

System Information 60

Transporting

This product is a finely tuned piece of medical electronic equipment; careful attention is required when transporting it.

Precautions when transporting the product

The package box is designed to protect the product from physical impacts. Nevertheless, exercise caution to protect the product from external knocks.

Humidity and Temperature

"[Table 3-1. The Product's Humidity and Temperature Tolerance]" shown below illustrates the temperature and humidity ranges for transporting, storing, and operating the product.

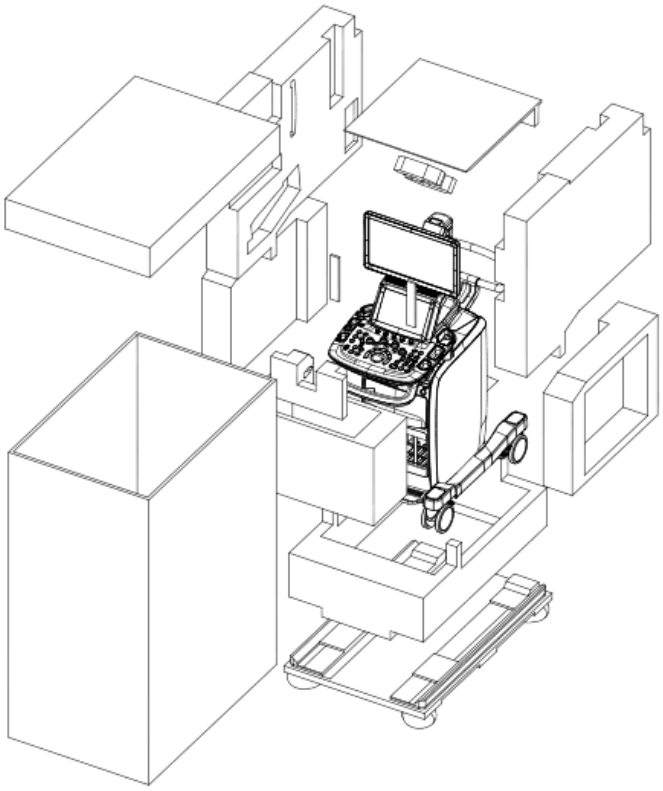
Category	Temperature **OC**	Humidity **%**
Transporting	-25 ~ 60	20 ~ 90
Storage	-10 ~ 50	20 ~ 90
Operating	10 ~ 35	30 ~ 75

[Table 3-1. The Product’s Humidity and Temperature Tolerance]

Unpacking the Product

Dismantling the Product Box

1. Open the box.
2. Remove the protection cover.
3. Take out the probe box and accessory box and store them in a safe place.
4. Unlock the brakes on wheels.
5. Grab the rear handle on the product and move it to a place to install.



[Figure 3.1 Dismantling the Product Box]

Accessory

This product includes a box containing various accessories. If the accessory box is not appropriate for your purchase, contact the vendor from which you made the purchase.

Installation Environment

Caution

When installing the product, please pay attention to the following information. For more information on using and setting up the WS80A, refer to the accompanying manual.

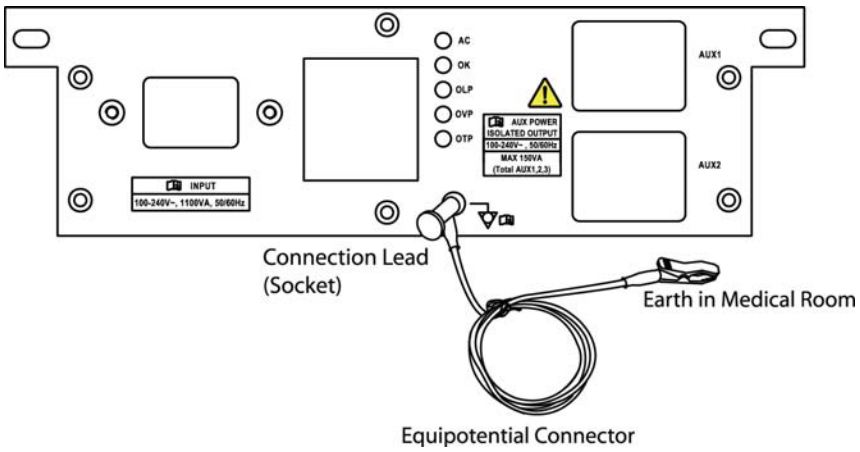
CAUTION	If the product is used near a generator, an X-ray system, or a broadcasting cable, noise may cause the screen to display images incorrectly. Sharing the power source with another electric appliance may also cause noise.

- Optimal conditions for the system are a temperature of 10-35 and a humidity of 30-75%.
- Avoid excess humidity.
- Avoid direct sunlight.
- Avoid excessive fluctuations in temperature.
- Optimal conditions for the system are a temperature of 10-35°and a humidity of 30-75%.
- Avoid installing the product near a heating appliance.
- Avoid dusty and/or poorly ventilated locations.
- Avoid locations that are subject to vibration.
- Avoid a location where chemical substances or harmful gases are present.

Installing the Product

Installation Safety

In a hospital environment, dangerous electrical current may occur as a result of the potential difference between a contactable conductive part and connected equipment in treatment rooms. The solution to the problem is consistent equipotential bonding. Equipotential terminals on medical equipment should be connected to the equipotential bonding network in medical rooms as shown in the picture.



[Figure 3.3 Equipotential bonding]

CAUTION	■ If the product needs to be transported or stored for an extended duration, the temperature and humidity of the environment must be checked. ■ A sudden change in temperature may cause condensation and lead to product failure.

Refer to "[Table 3-2. Operational Temperature of Product]" before turning the product on.

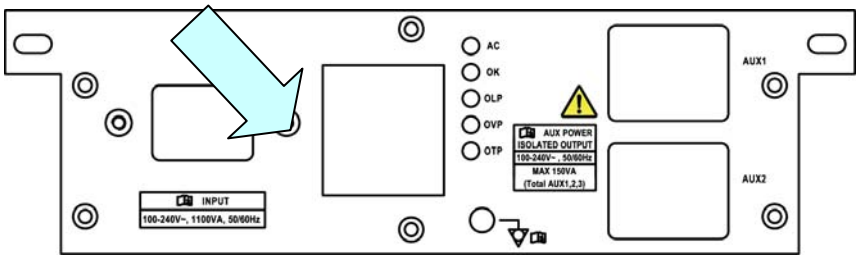
Temperature	-20	-15	-10	-5	0	5	10 ~ 35	45	50	55	60
Waiting time	16	10	8	6	4	2	Use immediately	2	4	6	10

[Table 3-2. Operational Temperature of Product]

Power Cord Connection

Prior to connecting a power cord, verify that the voltage indicated on the power cord matches th e voltage rating of the place to install.

NOTE	The product may ship with the power cable connected to the console.



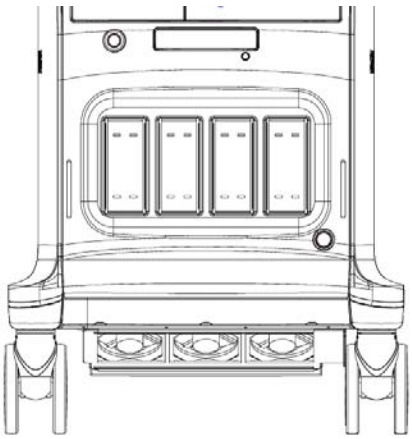
[Figure 3.4 Power Connection Part]

Probe Connection

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

1. Connect probes to the probe connectors on the front panel of the system. Up to four (five including CW) probes may be connected. However, the CW probe should only be connected to its own connector.

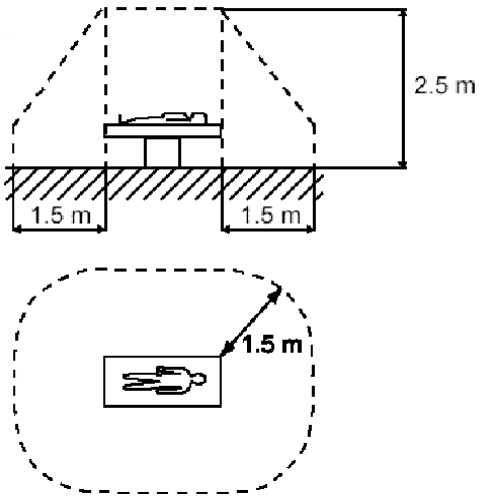
2. To install, turn the connector turning handle clockwise.



[Figure 3.5 Connecting the Probe]

Connecting Peripherals

CAUTION	Do not install a peripheral device not listed in this operation manual in the patient environment. Installation of such a device may cause an electrical hazard**.**



[Figure 3.5 Patient Environment]

NOTE	For more information on the recommended peripheral devices, refer to "Chapter 1. Introduction".

Internal Peripheral Devices

These are peripheral devices mounted in the system.

- **DVD-Multi**
- **Hard Disc Drive**

External Peripheral Devices

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

CAUTION	■ When installing or uninstalling a peripheral device that uses a USB port on the console, be sure to turn the console's power off. If the power is not turned off completely, the system or the USB peripheral device may fail to work correctly. ■ Do not connect additional external peripheral devices to the auxiliary socket outlet. Doing so may decrease safety level.

NOTE	■ When remove the removable disk, use Utility > Storage manager. ■ If you are using USB 1.1 flash memory, the system may fail to recognize the device. In such circumstances, remove the flash memory from the console and then reconnect it.

- **USB Video Printer**
- **USB Line Printer**
- **USB to RS-232C Serial Cable**
- **Foot Switch**
- **Other Flash Memory Media**

System Power

Boot up the system for use.

CAUTION	Before turning the power on, connect the probes and peripheral devices you want to use. Connecting them while you are using the product may injure the patient or severely damage the product.

Turning the Power On

While the power is turned off, press the **On/Off** button. Booting will start, and the product logo will be displayed on the screen. When booting is complete, a 2D mode screen will be displayed in End Exam state.

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

NOTE	■ If the power switch near the power connection port on the rear panel of the product has been switched off, wait for 10 seconds before turning on the product. ■ While the system is booting, do not press buttons on the keyboard, and make sure that there are no objects sitting on the keyboard buttons; otherwise the system may not work correctly. ■ If you forcefully turn off the power and then turn on the product again, the system may momentarily turn on and then turn off again. This is a characteristic of the Intel® PC main board contained in the product, and not a system error.

Shutting Down the System

Press the **On/Off** button while using the system to initiate shutdown.

CAUTION	■ Pressing the **On/Off** button for longer than five seconds will immediately turn the power off and may damage the hard disk; do not turn off the power by using this method unless absolutely necessary. ■ To ensure that the product is safely cut off from electrical power, set the power switch at the rear of the product to Off position after using the product.

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.

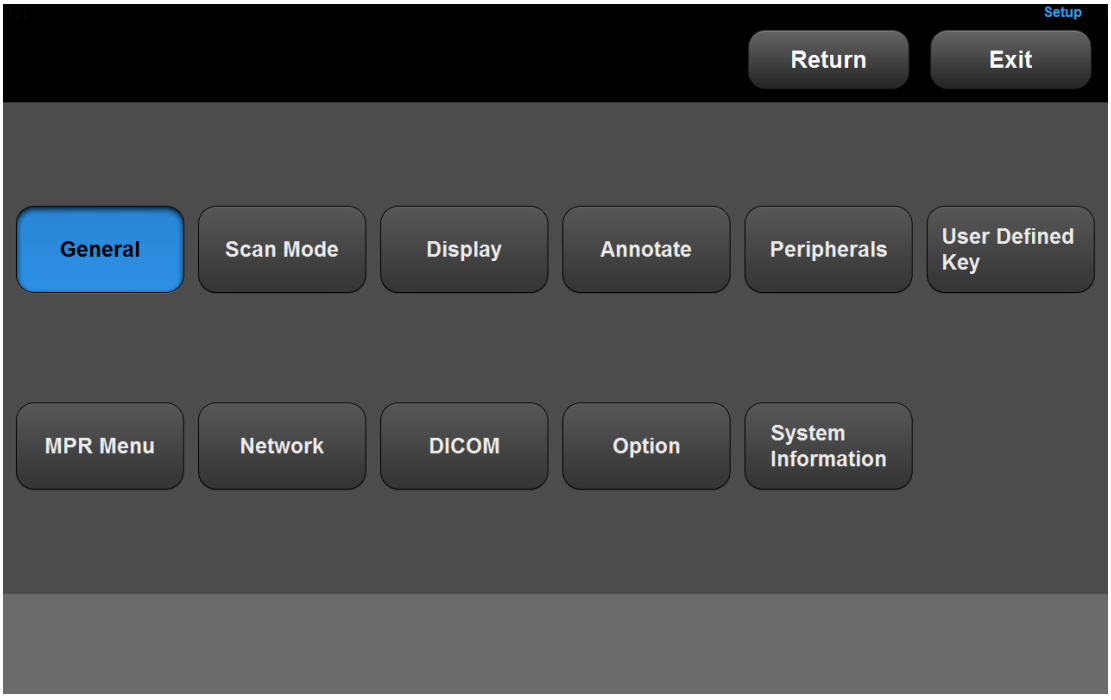
1. Press the **Setup** button on the touch panel, or tap **Utility** > **Setup** button on the touch screen.
2. The *Settings* screen will appear. Select a tab that has items to specify.

TIP **Selecting a tab**

You can select a desired tab in either one of two ways. Select the method that suits you.

- Use the trackball and the **Set** button to select a tab.
- Tap a corresponding button on the touch screen.

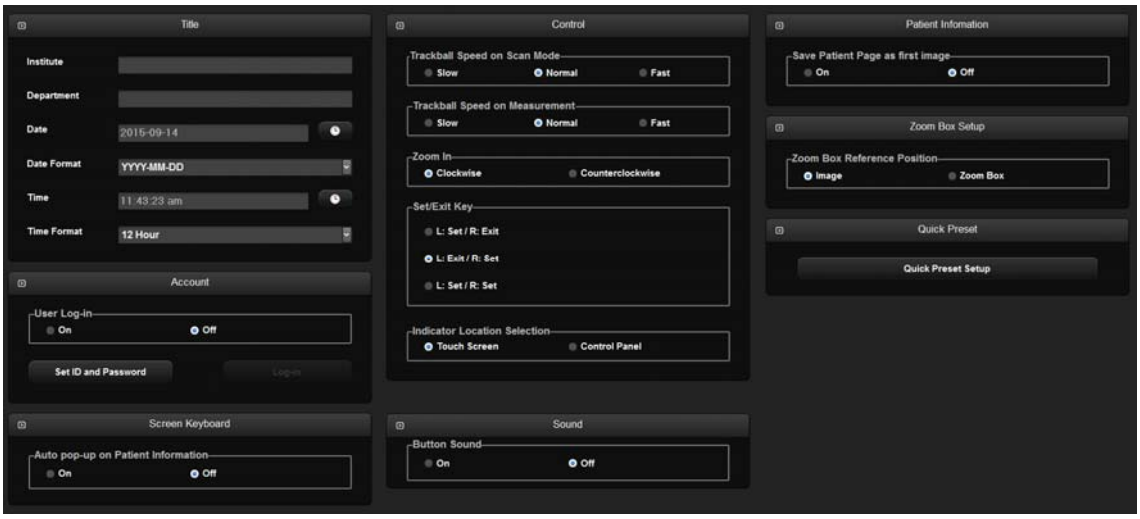
3. Specify settings for each item.
4. Save the settings and exit. Either click the **Close** button on the monitor screen, tap the **Exit** button on the touch screen, or press the **Exit** button on the control panel to switch to Scan mode.
5. Tap **Return** on the touch screen to go back to the Utility menu.



[Figure 3.6 Setup - Touch Screen

System General Setting

On *Setup* screen, touch the **General** tab. Or tap **General** on the touch screen. You can specify general settings such as title settings.



[Figure 3.7 Setup - General]

Title

You can specify the information that is displayed in the title area on the screen.

- **Institution**

  Enter the name of the hospital/institution where the product is installed.

NOTE	You cannot input the following characters: #, [, ", :, ?, |, \, "

- **Department**

  Enter details about the medical institution or the organization. This information is used to identify information transferred via DICOM.

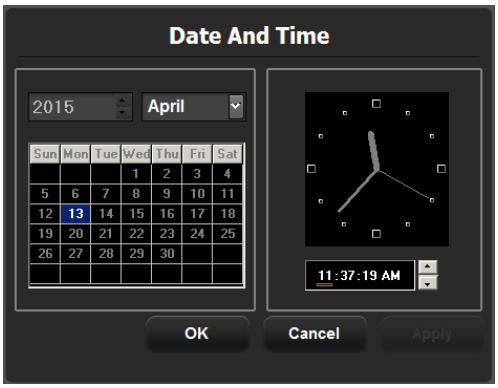
- **Date**

  Today's date is displayed. To change the date, tap  .

NOTE	■ You cannot change the date and time when a patient ID has been registered. To change the date and time, you should finish the current examination by pressing the **End Exam** button on the control panel. ■ You can select a year from 2006 to 2027.

※Tip! How to set the date and time

1. Click  next to the Date (or Time) field.
2. Set the date and time by using the trackball and the **Set** button on the control panel.
3. When the date and time have been properly set, click **Apply** to apply changes. Click **OK** to close the Date and Time window. Click **Cancel** or the **Exit** button on the control panel to cancel.



[Figure 3.8 Date & Time]

■ **Date Format**

Select the date display format. Press the combo button to select the preferred display format. The date display format you select will also apply to various entry fields in *Patient Information*.

■ **Time**

The current time is displayed.

■ **Time Format**

Select the time display format. Press the combo button to select the preferred display format (12 Hour or 24 Hour).

Account

Register a user ID and password.

- **User Log-in**

  Set the user account (log-in) function. If the user log-in is set to on, it can be used for the following areas:

  – Screen Saver

  – Accessing SonoView/Patient

  – *Search* window for patient

- **Set ID and Password**

  This is the exclusive administrator function for approval and management of accounts. *Account List* window will be enabled.

  – Add: Fill out the User ID, Password, and Name fields. Then click the **Add** button to create a new ID.

  – Modify: Save the changes.

  – Delete: Delete the selected ID.

  – Close: Close the settings.

- **Log-in**

  You can set the User Account ID after logging in to the Admin account. Please contact a service engineer for more information on the Admin account.

NOTE

- The Admin account cannot be deleted.
- Once the user account function is activated, you cannot load other exams without logging in.
- The password must be 6 to 15 characters and composed of at least three of the following:
  - English alphabet upper case
  - English alphabet lower case
  - Numbers
  - Special characters

Screen Keyboard

- **Auto Pop-up on Patient Information**

  Set this to On or Off by using the trackball. If it is set to on, the on-screen keyboard appears automatically when entering patient information.

Control

- **Trackball Speed on Scan Mode**

  Specify the trackball speed as Slow, Normal, or Fast.

- **Trackball Speed on Measurement**

  Specify the trackball speed as Slow, Normal, or Fast. Slower speeds allow more precise measurements.

- **Zoom In**

  Selects the direction in which to rotate **Zoom** dial to zoom in on an image.

  - Clockwise: Rotating the dial-button clockwise zooms in on an image.
  - Counterclockwise: Rotating the dial-button counter-clockwise zooms in on an image.

- **Set/Exit Key**

  Set the functions of the buttons to the left and right of the trackball on the control panel.

  - L: Set/R: Exit: The left button is set to **Set** and the right button is set to **Exit**.
  - L: Exit/R: Set: The left button is set to **Exit** and the right button is set to **Set**.
  - L: Set/R: Set: Both the left and the right buttons are assigned the **Set** function. When this button is selected, a warning message appears, stating that Exit function needs to be established.

- **Indicator Location Selection**

  You can set the position to use the Indicator. Select touch screen or control panel.

Sound

Generate a buzzer sound when a button or dial-button is used.

- **Button Sound**

  Set this to On or Off using the trackball. When this is set to on, the buzzer sounds each time a button or dial-button is used.

Patient Information

- **Save Patient Page as First Images**

  Set this to On or Off by using the trackball. If it is On, the *Patient Information Entry* screen will be saved when creating an ID.

Zoom Box Setup

- **Zoom Box Reference Position**

  Select the position of the Zoom Box Reference. You may select either Image or Zoom Box.

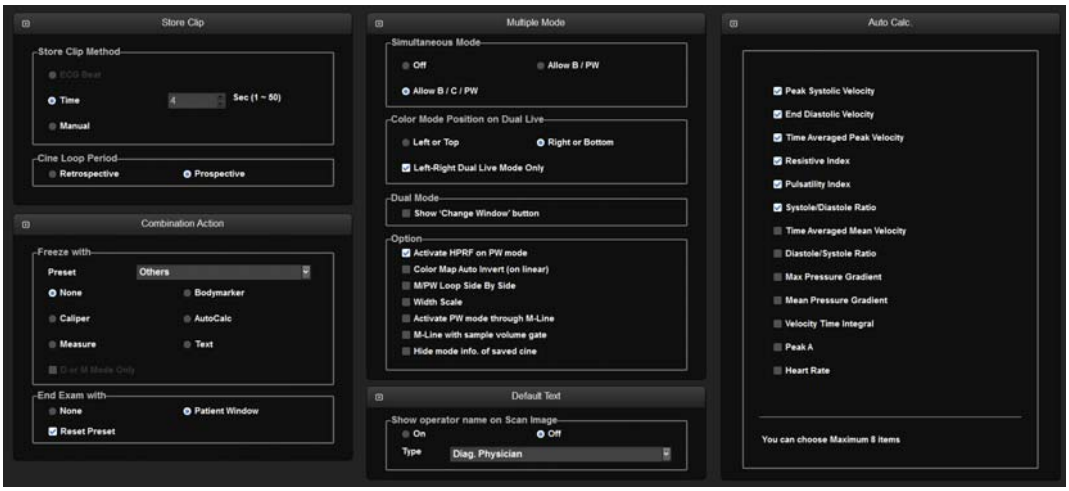
Quick Preset

- **Quick Preset Setup**

  Press the button to display *Quick Preset Setup* screen. After selecting the Probe, Application, and Preset connected to the port, press the **+** button to add them to Quick Preset. Up to 4 sets can be saved. The Probe, Application, and Preset saved will be shown on the touch screen in the diagnosis mode.

Scan Mode

Select the **Scan Mode** tab on the *Setup* screen. Or tap **Scan Mode** on the touch screen.



[Figure 3.9 Setup – Scan Mode]

Store Clip

- **Store Clip Method**

  Specify the method and range in which an image is acquired and saved.

  You can select ECG Beat, Time or Manual. Note that ECG Beat can be selected only when ECG is on.

  – ECG Beat: Specify the heart beat as 1-8 beats.

  – Time: Specify it as 1-50 seconds.

  – Manual: Pressing the button on the control panel that has been designated as **Store Clip** automatically starts saving the images; pressing the same button again stops saving.

- **Cine Loop Period**

  – Retrospective: When the **Store Clip** button is pressed during scanning, the previous images are saved.

  – Prospective: When the **Store Clip** button is pressed during scanning, the subsequent images are saved.

NOTE

To configure the **Store Clip** button, go to Utility > Setup > User Defined Key > User Key Setup.

Combination Action

- **Freeze with**

  Select a function to automatically execute when the **Freeze** button on the control panel is pressed. It can be set up for each preset using the combo button. Available options are BodyMarker, Caliper, AutoCalc, Measure, Text, and None.

  – D or M Modes Only: When 'Freeze with' is set to Measure, Measure Freeze Action will function only in Doppler and M Modes.

- **End Exam with**

  – None: Tapping the **End Exam** button on the touch screen exits Exam Mode and switches the screen to the *B Mode Scan* screen.

  – Patient Window: Tapping the **End Exam** button on the touch screen switches the screen to the *Patient Information* screen.

  – Reset Preset: The established preset has been initialized.

Multiple Mode

- **Simultaneous Mode**

  You can decide whether to enable Simultaneous Mode in Spectral Doppler Mode, using the following three options:

  – Off: Select this if you do not wish to use Simultaneous Mode.

  – Allow B/PW: Select this if you do not wish to use Simultaneous Mode in 2D/C/PW Modes, but do wish to use it in 2D/PW Mode.

  – Allow B/C/PW: Select this if you wish to use Simultaneous Mode for both 2D/PW Mode and for 2D/C/PW Modes.

- **Color Mode Position on Dual Live**

  Select the position of the Color Doppler Mode in Dual Live Mode.

  – Left or Top: Color Doppler Mode is located in the left or upper part of the screen.

- Right or Bottom: Color Doppler Mode is located in the right or lower part of the screen.
- Left-Right Dual Live Mode Only: The **Top-Bottom Dual** button disappears when you check this checkbox.

■ **Dual Mode**

Show ‘Change Window’ button: Select whether to activate the *Change* window in Dual Mode.

■ **Option**

You can specify more than one item. Select an item with the trackball or the **Set** button to check or uncheck an item.

- Active HPRF on PW mode: Select whether to activate HPRF (High Pulse Repetition Frequency), which is supported in PW Spectral Doppler Mode. Check the checkbox to use the HPRF function.
- Color Map Auto Invert (on linear): Check this checkbox to automatically highlight the Color Map. This is only applied when you change Steer in 2D/C/D Mode, C Mode, or DPDI Mode in PD Mode.
- M/PW Loop Side By Side: Add Loop Side By Side display in M Mode or Power Spectral Doppler Mode.
- Width Scale: Automatically fit the image size to the screen size, when the depth of a 2D image is adjusted. This function can be used only with a Linear Probe.
- Active PW mode through M-Line: In 2D Mode, pressing the **Set** button when **M Line** is “On” will take you directly to PW Mode.
- M-Line with sample volume gate: When **M Line** is in use, a sample volume Gate is shown together with the M Line.
- Hide mode info.of saved cine: Hide mode info of the saved cine and increase the image size.

Default Text

■ **Show Operator Name on Scan Image**

Type: Select Diag. Physician, Ref. Physician, or Sonographer. Turn this option Off to hide it from the screen.

Auto Calc.

Auto Calc. is a Spectral Doppler Mode feature that automatically performs specific

calculations based on measured values.

NOTE

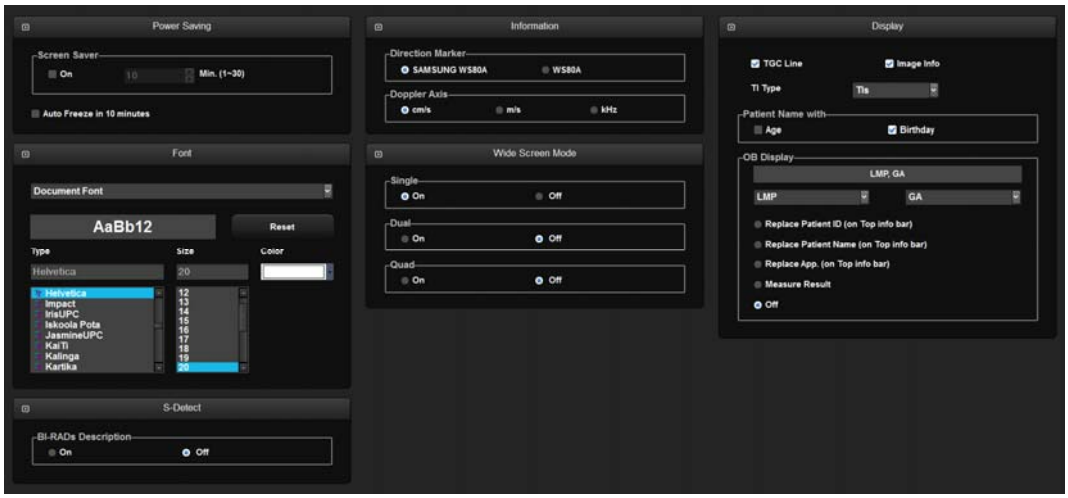
The specified items will appear on the screen only when the **Auto Calc.** button on the touch screen is tapped in Spectral Doppler Mode.

Enable or disable the following items for automatic calculation by checking their checkbox. You can select up to eight values.

When the Peak Systolic Velocity and End Diastolic Velocity values are 0, not all results for the items will be displayed on the screen. In addition, the result value for Time Averaged Mean Velocity is displayed only when Mean Trace is ‘On’.

Display

Select the **Display** tab in the *Setup* screen. Or tap **Display** on the touch screen. Specify display-related options.



[Figure 3.10 Setup – Display]

Power Saving

- **Screen Saver**

  Select whether or not to display the screen saver. When this is On, you can set the screensaver to be activated in 1 to 30 minutes.

- **Auto Freeze in 10 Minutes**

  Scan mode will freeze automatically if the product is not used for 10 minutes.

TIP The Scan Mode is frozen automatically, regardless of Auto Freeze setting, when the product is not used for 1 hour.

NOTE

In 3D mode, Auto Freeze is activated when the product is not used for 20 minutes.

Font

Specify the target for which you want to set the font. Choose from Document Font and Measure Result Font. The selected font can be previewed.

- **Reset**

  This sets the system's default fonts. The default settings are as follows:

	Document Font	Measure Result Font
Font Name	Helvetica	Verdana
Font Size	20	11
Font Color	White	Yellow

- **Type**

  Select the font type to use.

- **Size**

  Select the font size to use.

- **Color**

  Select the font color to use.

NOTE

Certain fonts may not appear correctly on the screen.

S-Detect

- **S-Detect: BI-RADs Description**

  Show or hide the on-screen call text based on the BI-RADs score in S-Detect. Turn this option off to hide the call text from the screen.

Information

- **Direction Marker**

  Set the Direction Marker. Select between SAMSUNG WS80A or WS80A.

- **Doppler Axis**

  Select the units of measurement for the axis scale in Spectral Doppler Mode.

  - cm/s: Specify the Doppler axis scale unit as cm/s.
  - m/s: Specify the Doppler axis scale unit as m/s.
  - kHz: Specify the Doppler axis scale unit as kHz.

Wide Screen Mode

The Wide Screen mode can be turned On or Off by using the trackball in Single, Dual, or Quad mode. Turn this option off to set the screen to 4:3 ratio.

Display

- **TGC Line**

  This sets whether to display the TGC line. When TGC Line is Off, the TGC line appears when you set the TGC line, and then disappears after three seconds.

- **Image Info**

  This sets whether to display image information. When the image information interferes with an image and is turned off, it will not be displayed.

- **TI Type**

  Specify the TI to display on the screen as TIs (Soft tissue Thermal Index), TIb (Bone Thermal Index), or TIc (Cranial bone Thermal Index).

- **Patient Name with**

  - Age: Select whether to display the name and age under the patient ID.
  - Birthday: Select whether to display the name and date of birth underneath the patient ID.

‘Age’ and ‘Birthday’ cannot be used simultaneously.

NOTE

- **OB Display**

  Specify how the LMP, GA and EDD entered in the *Patient Information* screen will be displayed on the monitor screen. Select two from LMP, GA, and EDD.

  – Replace Patient ID (on Top info bar): Replace the ID in the title area.

  – Replace Patient Name (on Top info bar): Replace the patient name in the title area.

  – Replace App. (on Top info bar): Replace the application in the title area.

  – Measure Result: Display the measurement result along with the selected LMP, GA or EDD.

  – Off: None of the options are displayed on the screen.

Patient Name Formatting

This function is to display patient names in Asian languages, such as Korean, Chinese, and Japanese.

This setting is initialized when you click **Reset**.

This button only appears on the screen in a product that supports Asian patient names.

NOTE

- **Name Formatting**

  Set the order in which patient names are displayed.

  – Default **“Last, First Middle”**: Names are displayed in the order of last name, first name and middle name (E.g. Smith, Robert L).

  – Custom: For Item, specify the order of the last name, first name and middle name. For “Separator”, specify a symbol, such as a comma, colon or a space, to separate each name.

- **Representation Priority**

  Patient Information

  Specify how patient names are displayed. Select the precedence of Roman, Ideographic and Phonetic letters.

Annotate

Select the **Annotate** tab on the *Setup* screen. Or tap **Annotate** on the touch screen. You can configure settings related to image display.

[Figure 3.11 Setup – Annotate]

Screen Keyboard

Screen Keyboard

You can directly enter patient information by using the on-screen keyboard on the *Patient Information* screen. Setting the screen keyboard to On enables screen keyboard support.

NOTE	When you enter a birth date or age, the numerical on-screen keyboard is activated.

BodyMarker

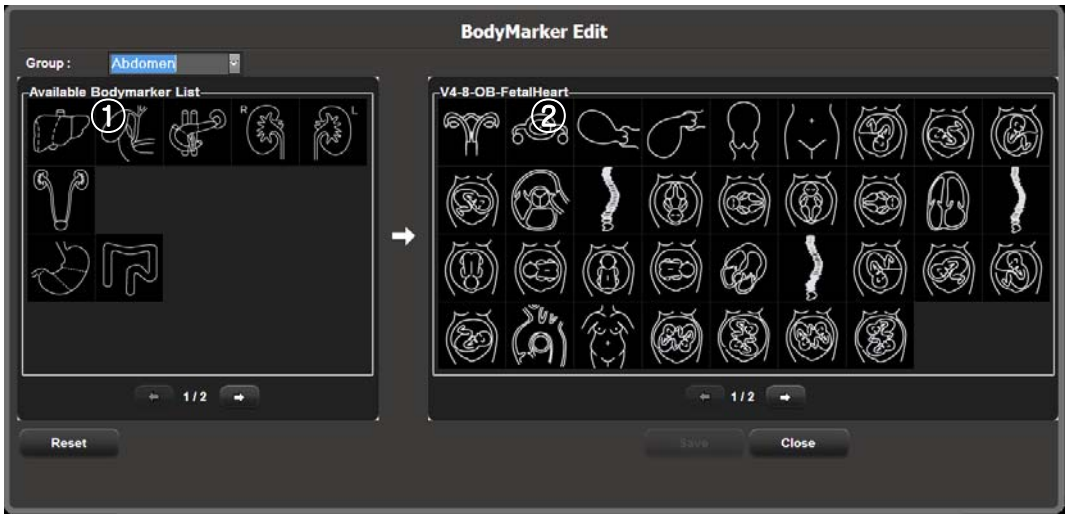
Size

Set the BodyMarker size (Small, Medium, or Large).

Option

- BodyMarker Auto Active: Set whether to activate BodyMarker Mode automatically when changing an active image region.

■ **BodyMarker Edit**



[Figure 3.12 BodyMarker Edit]

① BodyMarker list: The list varies depending on the group selected from Group. Current page/Total pages is displayed below the list. If the total pages are two or more, you can move to other pages by using [⇨] or [⇦].

② BodyMarker list of probes or presets currently being used. Current page/Total pages is displayed below the list. If the total pages are two or more, you can move to other pages by using [⇨] or [⇦].

NOTE	You can add or save between 1 and 100 BodyMarkers in each list.

- Adding a BodyMarker

  Select and double-click a BodyMarker in the list on the left (①). The selected BodyMarker is added to the list on the right (②). The right list cannot have duplicated BodyMarkers. If this occurs, a warning message will pop-up.

- Removing a BodyMarker

  Select and double-click a BodyMarker in the list (②) on the right.

- Saving and Canceling the BodyMarker list

  Click **Save** to save the list. Click **Close** to cancel.

- Resetting the BodyMarker list

Click **Reset**. The BodyMarker list is reset to the system defaults.

Text Setup

Select whether to use Quick Text, Auto Text Erase, Boot up Caps Lock on, Auto Text, Edit Text, Auto Text Edit, or Clear Annotation.

- **Quick Text**

  If the checkbox is selected, the Quick Text function is enabled. Quick Text switches the system to the Text Input Mode as soon as a character key is pressed on the Alphanumeric Keyboard.

NOTE	■ The Quick Text checkbox is checked by system default. ■ You can enter text even if you do not select Quick Text. In this case, you need to tap **Annotation** on the touch screen to switch to text mode.

- **Auto Text Erase**

  If this checkbox is checked, all of the text that has been entered is deleted at once when you return to scan mode by pressing the **Freeze** button.

- **Boot up Caps Lock on**

  If this checkbox is checked, Boot up Caps Lock On is turned on. This means that when text is entered, it is entered in capital letters.

- **Autotext**

  If an abbreviation is entered, the system retrieves and enters a full word automatically. When this option is selected, you can enter text more easily and quickly. For example, if you input “AC”, the system will search for the full word and display it on the screen as “Abdominal Circumference”.

  To enable Autotext, check the **Autotext** checkbox by using the trackball. Otherwise, uncheck the checkbox.

  If this option is selected, an abbreviation list appears on the screen when text is entered.

[Figure 3.13 Abbreviation list]

A list of abbreviations for this function is stored on the system. You can add a new abbreviation or edit the existing abbreviations as desired.

TIP **Editing the Abbreviation List**

To enable the abbreviation list stored in the system, click the **Autotext Edit** button. The system will switch to the *Auto Text Edit* screen.

To save the changes and finish editing, click the **Close** button.

- Modify Word

  1. Use the trackball and the **Set** button to select a word to modify from the list. An abbreviation for the selected word and its full version are displayed under Abbreviation and Full Word at the bottom of the screen.
  2. Modify words in the Abbreviation and Full Word fields. The abbreviation list is updated in real time.

- Add Word

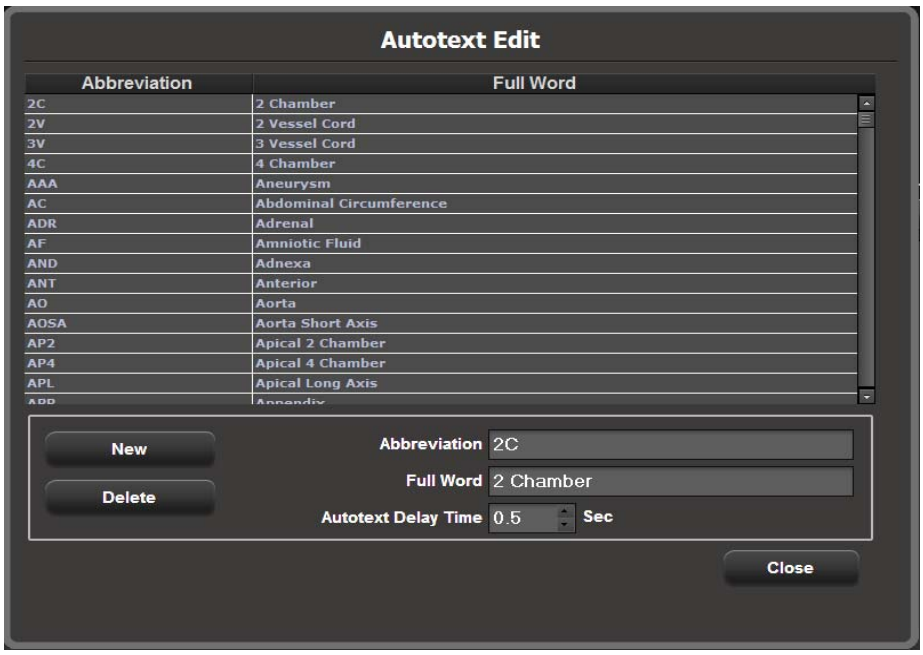
  1. Click the **New** button.
  2. Enter words to add in the Abbreviation and Full Word fields at the bottom of the screen. The entered words are added to the abbreviation list.

- Delete Word

  1. Use the trackball and the **Set** button to select a word to delete from the list. An abbreviation for the selected word and its full version are displayed under Abbreviation and Full Word at the bottom of the screen.
  2. Click the **Delete** button. The following warning message will appear:
  3. To delete the selected word, click **OK**. The selected word will be deleted from the abbreviation list. Click **Cancel** to cancel.

- Specify Word Input Delays

  Specify the time taken by the system to automatically convert an abbreviation into a full word and display it on the screen. In the Auto Text Delay Time field at the bottom of the screen, enter the input delay time as a value from 0.1 - 5 seconds.



[Figure 3.14 Autotext Edit]

Text library (Touch Screen)

Edit the whole text page shown on the touch screen. Select the application and preset to be modified by using the combo button.

- **Word List**

  Select and edit the text you wish to modify, and then save it by tapping the **Save** button. Up to four different preset text entries can be added for one text button.

Duplicate letters and certain special characters cannot be entered.

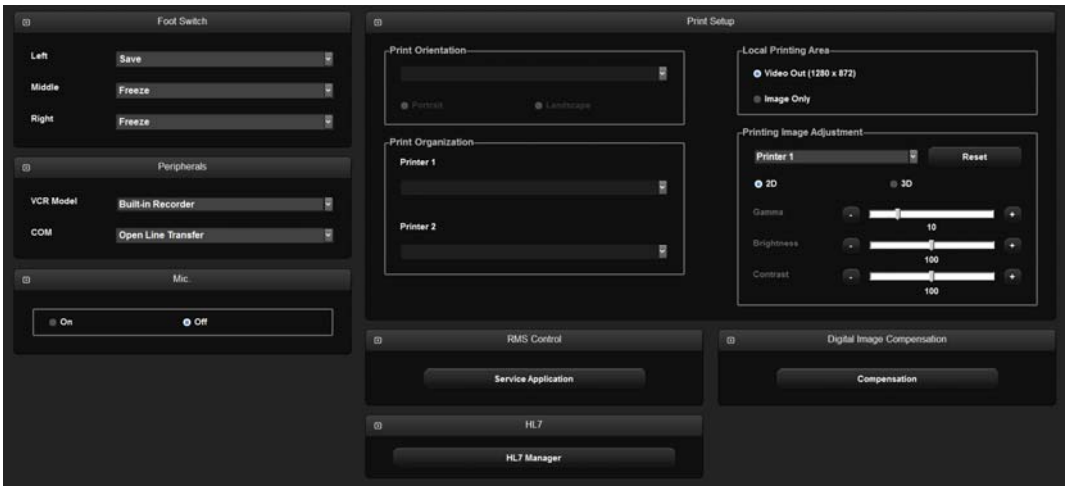
NOTE

- **Export/Import**

  Share the text saved on the system with another system, or import a text entry from another system.

Peripheral Device Settings

Select the **Peripherals** tab on the *Setup* screen. Or tap **Peripherals** on the touch screen. You can configure keys, buttons, and the peripheral devices connected to the product.



[Figure 3.15 Setup - Peripherals]

Foot Switch

Set the functions of the left, middle, and right pedals of the foot switch. The functions that can be set are shown below. Freeze, Update, Record, Printer 1, Save, Store Clip, Volume Start, PD Mode, Color Mode, M Mode, PW Mode, CW Mode, Elastoscan Mode, TDI Mode, TDW Mode, Biopsy, Save/Send, Store Clip/Send.

Peripherals

- **VCR Model**

  Set as Built-in Recorder. The user cannot change this setting.

- **COM**

  Configure a device to connect to a serial port. Choose between Open Line Transfer and Reserved. If you select Reserved, the COM port will not be used.

  Select Open Line Transfer, connect the device, and reboot the system.

Mic.

Set this to On or Off by using the trackball. The default setting for microphone is Off.

Print Setup

■ Printer Orientation

This option is available only for an Echo printer that uses roll paper.

NOTE

Set the type and page orientation of the Echo printer.

- Printer Settings: Select the printer to use by using the combo button.
- Portrait: When printed, the long side of the page is vertical.
- Landscape: When printed, the long side of the page is horizontal.

■ Printer Organization

Used to assign printers to the control panel's **Printer 1** and **Printer 2** buttons.

RMS Control

RMS is the abbreviation for Remote Maintenance Service. When an error occurs in the product, this function supports trouble shooting through remote device control.

■ Service Application

When you press this button, the *Service Application* screen.

The *Service Application* screen consists of VPN, and Service tabs.

TIP **Using RMS**

You will not be able to use RMS if you do not agree with the following items displayed on the Service tab.

Equipment status is inspected by remote access. The results are used for customer service and product failure prevention.

Product screen will be shared as service is conducted via remote access.

Information related to patients will not be transmitted externally or to Samsung Medison.

HL7

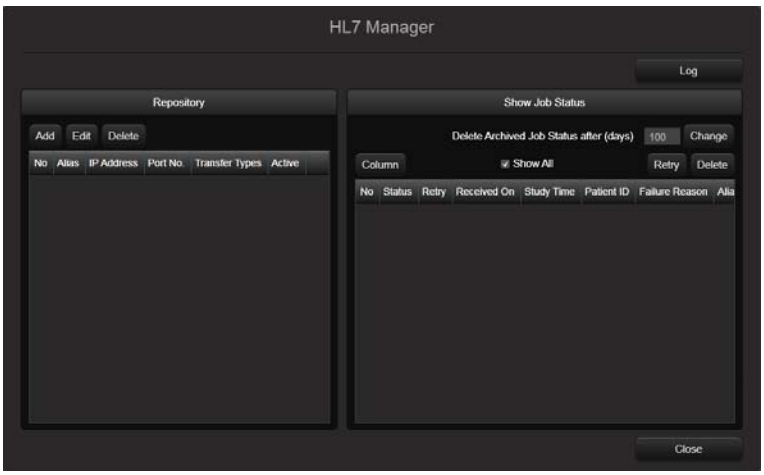
HL7 (Health Level 7) is a set of standards for transfer of information between health information systems that is accredited by the American National Standards Institute (ANSI); it is the most widely used set of standards for health information not only in the United States but across the world.

■ **HL7 Manager**

Press the button to open the *HL7 Manager* window. Configure settings for transferring the report information created by this system to the HL7 server (repository).

TIP HL7 Manager

To configure the HL7 server, use Repository. For data transfer and management, use Show Job Status and **Log**.

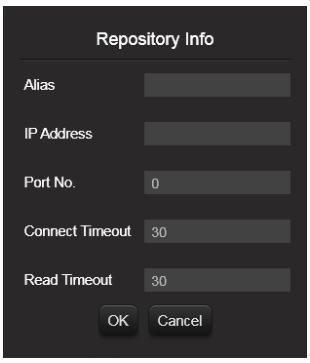


[Figure 3.16 HL7 Manager]

■ Repository

① Shows the information about the repository server that is being used by the system. To activate or deactivate the use of the server, use the **Active** checkbox.

- Add: Add a server. The *Repository Info* window will open. For the information to enter in IP Address and Port No., ask the network administrator of the institution this product is installed at.



[Figure 3.17 Repository Info]

- Alias: Enter the name of the server.
- IP Address: Enter the IP address of the server.
- Port No.: Enter the port number of the server.
- Connect Timeout: Enter the TCP/IP connection timeout (in seconds) for transferring data.
- Read Timeout: Enter the TCP/IP connection timeout (in seconds) for receiving server response.

- Edit: Edit the information for the selected server.
- Delete: Delete the selected server.

■ Show Job Status

② Review and manage the status of data transfer (jobs). Only jobs that are being transferred or have failed to transfer are displayed. To show all jobs, including the ones that have been successfully transferred, use the **Show All** checkbox.

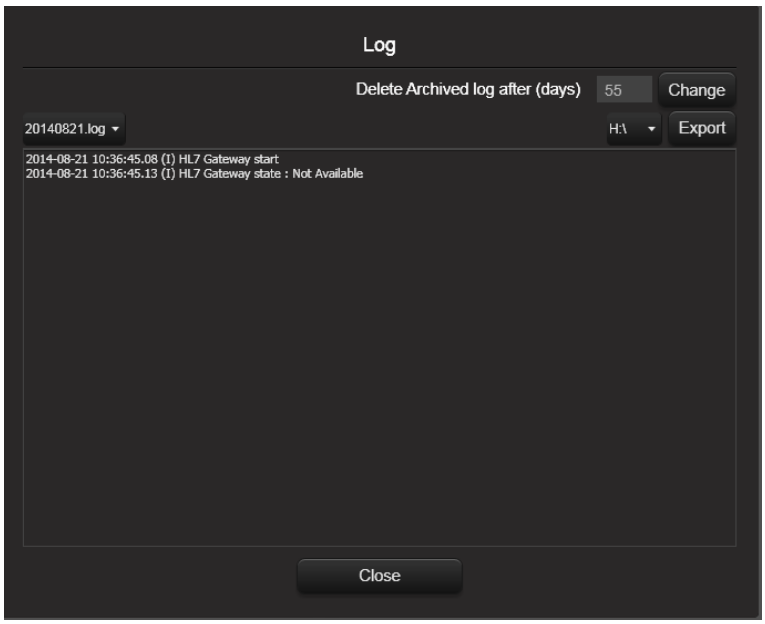
- Delete Archived Job Status after (days): Enter the retention period for jobs. Press **Change** to set the number of days you entered as the retention period.
- Column: Select the job information to display on the screen.
  - No: Message Control ID
  - Status: Transfer status
  - Retry: Number of transfer attempts
  - Received On: Transfer start time

  - Study Instance UID: ID for identifying the study (Unified Identifier)
  - Study Time: Study start time for this product
  - Patient ID: Patient ID
  - Patient Name: Patient name
  - Failure Reason: Reason for transfer failure
  - Alias: Server name
  - IP Address: Server IP
  - Port No.: Server port No.
  - Transfer Types: Type of transfer
  - Error Message: Reason for failure that was sent by the server
- Retry: Transfer the selected job again. Note that only jobs that have failed to transfer can be re-transferred.
- Delete: Delete the selected job. Note that jobs that are currently being transferred cannot be deleted.

■ Log

③ Manage all HL7-related logs on this product. You may use the combo box to view logs by date.

- Delete Archived log Status after (days): Enter the retention period for log file. Press **Change** to set the number of days you entered as the retention period.
- Export: Use the combo box to select the media to save the log file to. Press **Export** to save the log file.



[Figure 3.18 Log]

- **Local Printing Area**

  Set the area that will be printed.

  – Video Out (1280 x 872): Print part of the monitor screen (1280 x 872), containing the image area.

  – Image Only: Print only the image area.

- **Printing Image Adjustment**

  Adjust the print quality of images. Select the image type and adjust Gamma, Brightness, and Contrast.

NOTE

This is only supported by some digital printers.

Digital Image Compensation

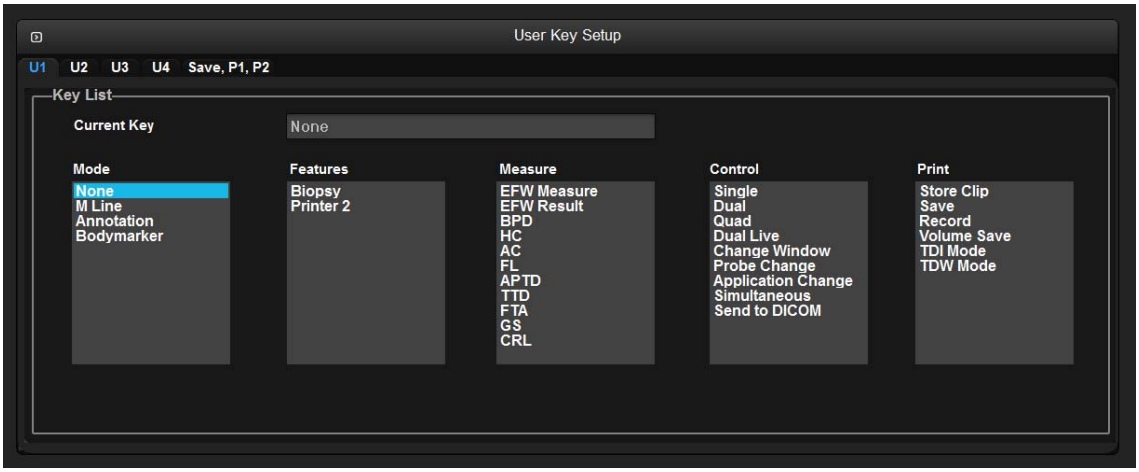
Used to set the Post Curve of the image to use the DICOM service. Press the button to display the *Compensation* window. Adjust Gamma, Brightness, and Contrast by using the slider for each option. If **Default** is clicked, the system's default settings will be restored.

TIP **Compensation**

Adjusting the post curve settings for images allows other monitors to display them as closely as possible to the original images, which is convenient in diagnosis.

User Defined Keys

Select the **User Defined Key** tab on the *Setup* screen. Or tap **User Defined Key** on the touch screen. You can configure keys or buttons connected to the product.



[Figure 3.19 Setup – User Defined key]

User Key Setup

Assign functions to the **U1**, **U2**, **U3**, and **U4** buttons on the control panel or touch panel. The functions you can assign are as follows:

■ Key List

– Current key : Displays the current settings of the User Key button.

Mode	None, M Line, Annotation, BodyMarker
Features	Biopsy, Printer2
Measure	EFW Measure, EFW Result, BPD, HC, AC, FL, APTD, TTD, FTA, GS, CRL
Control	Single, Dual, Quad, Dual Live, Change Window, Probe Change, Application Change, Simultaneous, Send to DICOM, Exit (only **U2** can be set)
Print	Store Clip, Save, Record, Volume Save, TDI Mode, TDW Mode

Select the functions to assign to the Peripheral Keys (**P1** and **P2** buttons) or **Save** button on the control panel. The functions you can assign are as follows:

■ **Key List**

Setting List	Save, Cine, Print1, Print2, Rec, Send

NOTE

Up to three functions may be assigned to the **P1** and **P2** buttons.

MPR Menu

In the *Setup* screen, select the **MPR Menu** tab. Or tap **MPR Menu** on the touch screen. Assign or modify the menu on the MPR touch screen.

MPR Menu Setting

MPR Menu List displays items that can be assigned to menu of the MPR touch screen. Select a menu to be modified and change the order using the arrow on the monitor screen. Order No. of **MPR Menu List** is the number assigned on the **MPR Touch Screen**.

Press the **Save** button to store the modified MPR touch screen setting. Tapping **Default Reset** on the screen restores the default settings.

[Figure 3.20 Setup – MPR Menu]

Network

Select the **Network** tab on the *Setup* screen. Or tap **Network** on the touch screen. You can set E-mail, Network Status, etc.

[Figure 3.21 Setup - Network]

LAN

- **Network Configuration**

  The *System Network* window will open to allow you to configure the IP.

Wireless

- **WLAN**

  Use a USB adapter to connect the system to a wireless network.

NOTE

The *Wireless Network Settings* window is enabled only when the system is connected to a wireless USB adapter.

- SSID: Displays the name of the connected wireless network. SSID stands for Service Set IDentifier.
- Authentication: Displays the authentication method for the wireless network.
- Encryption: Displays the data encryption method for communicating with the wireless network.
- Password: Enter the password for the network.

TIP **Connecting to a Wireless Network**

1. Use the trackball and the **Set** button to press the **Scan** button.
2. Select a wireless network to connect to.
3. Tap the **Connect** button to connect the system to the wireless network.
4. Tap the **Disconnect** button to disconnect the system from the wireless network.
5. Press the **Close** button to complete the setup.

E-Mail

You can specify a server through which you will send and receive e-mails.

- **Mail (SMTP) Server**

  Specify the e-mail server.

- **Port No.**

  Enter a port number.

- **ID**

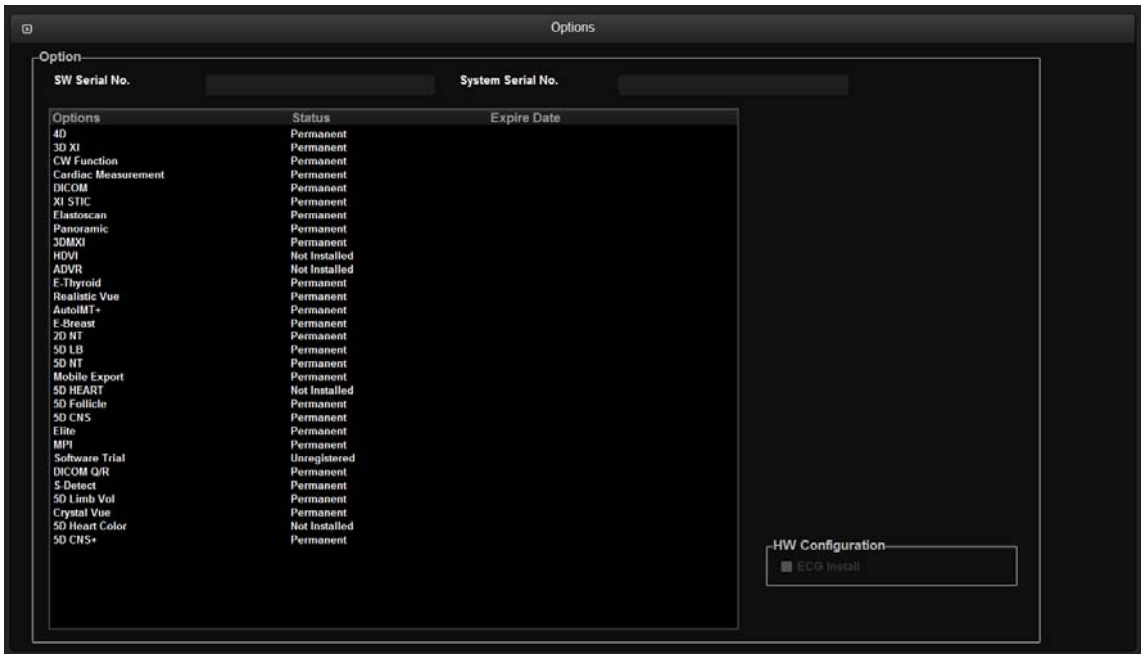
  Enter an ID for the e-mail server.

- **Password**

  Enter a password for the e-mail server.

Options

On the *Setup* screen, select the **Option** tab. Or tap **Option** on the touch screen. Enables or disables optional software or hardware.



[Figure 3.22 Setup - Option]

* Actual options may vary.

Options

The list of optional software will appear.

NOTE	To purchase optional software, please contact the software's distributor.

■ **Option**

This shows the types of optional software that can be installed on the product.

■ **Status**

Shows the current status of optional software.

- Lock_Not Installed: Hardware is not connected.
- Lock_Unregistered: The software license has not been registered yet.

- Lock _Installed: Hardware is installed but cannot be used yet.
- Unlock_Permanent: The hardware or software can be used for an unlimited period.
- Unlock_Restricted: The hardware or software can be used only for a certain period of time.
- Lock_Expired: Use of the software is restricted and it cannot be used because a specified period of use has expired.

■ HW Configuration

The list of optional hardware will appear. Currently, only ECG is supported.

Select a hardware item to use by using the checkbox. Reboot the system to complete the settings.

TIP **Software Trial**

The following options will be disabled automatically when this option is disabled.
You can only disable this option to be used only for a certain period of time.

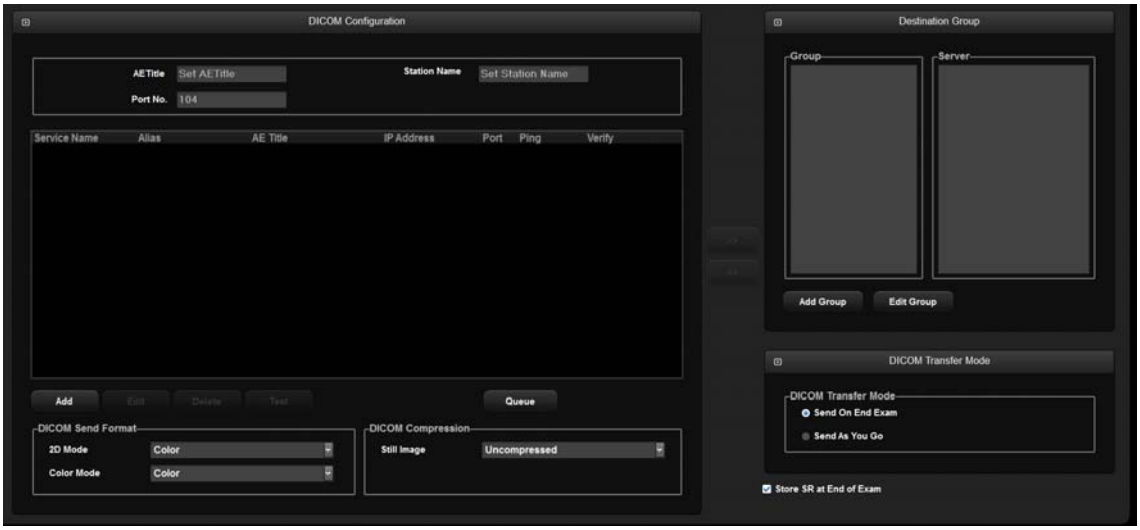
- 4D
- 3D XI
- XI STIC
- Elastoscan
- Panoramic
- 3DMXI
- Realistic Vue
- AutoIMT+
- 2D NT
- 5D LB
- 5D NT
- 5D Follicle
- 5D CNS+
- MPI
- Mobile Export

DICOM Setup (optional)

Select the **DICOM** tab on the *Setup* screen. Or tap **DICOM** on the touch screen. Used to configure DICOM (Digital Imaging and Communication in Medicine) operation and DICOM server.

NOTE

- You cannot change DICOM settings when a patient ID is registered. To change the DICOM settings, you should finish the current diagnosis by tapping the **End Exam** button on the touch screen.
- For more information, please refer to the server's user manual, or the DICOM Conformance Statement.



[Figure 3.23 Setup - DICOM]

DICOM Configuration

Information about the DICOM server used by the system is displayed.
You can change the information, or add or delete a server. The server information is used to identify the DICOM for the system within a network. It is also used to transfer data to other DICOM servers.

NOTE	For the 'IP Address', 'AE Title', and 'Port No' settings, contact your organization's network administrator.

AE Title

Enter a name for the DICOM AE(Application Entity). This is used to identify devices that use DICOM on the network.

■ **Station Name**

Enter a name for the system. Along with 'AE Title', this is used to identify the system in the DICOM network.

■ **Port No.**

Enter the port number for the server being used.

DICOM Send Format

Specify the storage format for the 2D or Color Mode images for which the DICOM services will be used. Select either Color or Gray using the Combo button. If you select Gray, images are saved in grayscale format.

NOTE	DICOM Send Format settings begin to apply when an image is saved. For example, if it is set to Gray, saving an image will save it in grayscale format.

DICOM Compression

Select whether to compress the still images for the DICOM service. Select Uncompressed or JPEG Baseline using the Combo button. When you select Uncompressed, the images are saved without compression.

NOTE	DICOM Compression settings are applied when an image is saved. For example, if it is set to JPEG Baseline, saving the image will compress it.

Destination Group

Use Send to DICOM function to set the destination group for sending images when the User Defined Key (User Key or Peripheral Key) is pressed. The intended destination group will be displayed under DICOM Destination in the *Patient Information* screen. Once the destination group is set and the user defined key is pressed, the image is sent to the destination group designated as DICOM Destination on the *Patient Information* screen. Press **Add Group** or **Edit Group** to bring up *DICOM Group* window.

- Add: Add a Destination Group.
- Edit: Edit a Destination Group.
- Delete: Delete a Destination Group added by a user.
- Press **OK** to finish. Tap **Cancel** to cancel.

DICOM Transfer Mode

Select a transfer method:

- **DICOM Transfer Mode**
  - Send On End Exam: Send all saved images when you press the **End Exam** button.
  - Send As You Go: Send an image whenever you press the **Save** button to save it.

Store SR at End of Exam

Select whether to store SR at the end of the exam. When you select this checkbox, SR is automatically stored at the end of the exam. Otherwise, it is not stored.

Adding DICOM Services

Click **Add** on the screen. A screen is displayed where you can enter a DICOM service to add. After adding a service, click **Save** to save the information. Click **Cancel** to cancel.

- **Services**

  Select the type of service to use via DICOM. The supported DICOM servers are Storage, Print, Worklist, PPS, SC, and Storage SR.

- **Alias**

  Enter the name of the DICOM server.

- **AE Title**

  Enter the AE Title for the DICOM server. Please contact your organization's network administrator to find out the correct value.

- **Transfer Mode**

  Select a transfer method:

  - Batch: Send all saved images when you press the End Exam button.
  - Send As You Go: Send an image whenever you press the **Save** button to save it.
  - Manual: Send an image selected from the Exam List or in SonoView.

- **Connect Timeout**

  The connection will time out if there is no response within the configured time period. Specify this time period in seconds.

■ **IP Address**

Enter the IP Address for the server being used. Please contact your organization's network administrator to find out the correct value.

■ **Port No.**

Enter the Port Number for the server being used. Please contact your organization's network administrator to find out the correct value.

■ **Retry Interval**

Specify how many seconds the system will wait before it retries a failed transmission. Specify this time period in seconds.

■ **Maximum Retries**

Specify how many times a failed transmission will be retried.

Storage Server Information

Select STORAGE under **Services**. Configure the Image Storage Service using DICOM.

■ **Storage Options**

- Send Cine Loops: Select this checkbox to transfer Cine Loops.
- Include Pixel Spacing: In addition to the area information used in ultrasonography, the area information used in CT or radiography is also included. Measurements can be taken from a PACS system that does not support ultrasonic area information.

NOTE	However, only 2D and 2D Color Mode images are supported. In Dual and Quad Mode, the depths of the included images must be identical.

- Include 3D Volume: Select whether to send 3D volume data together with the 3D images.

NOTE	Select this only when you use a storage service which supports the 3D volume data of Samsung Medison Co., Ltd.

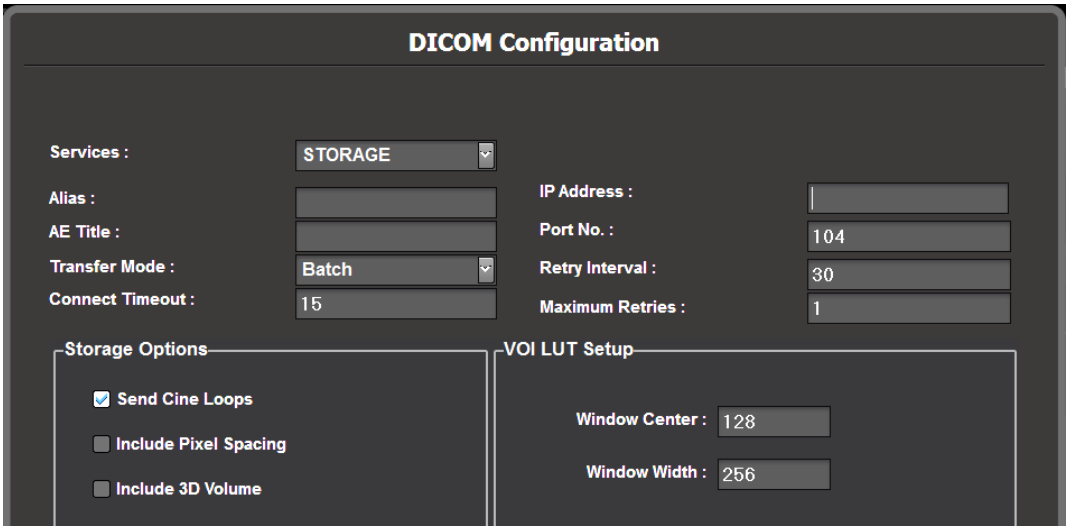
■ **VOI LUT Setup**

Configure VOI LUT (Value Of Interest, Look Up Table). Adjust the brightness and contrast of a DICOM image when saving it. The saved images can be viewed with any PACS device that has DICOM-standard VOI LUT implemented.

- Window Center: Enter a value for the DICOM Tag (0028, 1050) setting. The set value indicates the brightness of the image displayed by the storage service. The image will

get darker if the value is set to 128 or higher. Note that this function can be used only when it is supported by the storage service.

- Window Width: Enter a value for the DICOM Tag (0028, 1051) setting. The set value indicates the contrast of the image displayed by the storage service. The contrast will get lower if the value is set to 256 or higher. Note that this function can be used only when it is supported by the storage service.



[Figure 3.24 DICOM Configuration - Storage]

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 the printer service, refer to the printer's user manual or its DICOM Conformance Statement.

■ **Color**

Select whether to use color for printing. You may select Grayscale or Color.

■ **Format**

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.

■ **Orientation**

Select the orientation of the paper. You may select either Landscape or Portrait.

- **Magnification**

  Select the interpolation method to use when resizing the image to print. You may select Replicate, Bilinear, Cubic, or None.

- **Border Density**

  Select the border color of the printed image. You may select Black or White.

- **Empty Density**

  Select the background color of the printed area. You may select Black or White.

- **Min Density**

  Specify the minimum density of the image to print. If you do not select a density, the default density of the printer will be used.

- **Max Density**

  Specify the maximum density of the image to print. If you do not select a density, the default density of the printer will be used.

- **Medium Type**

  Select the type of printing paper. Select from Paper, Clear Film, Blue Film, Mammo Clear Film, or Mammo Blue Film.

- **Film Size**

  Select the paper size. Select from 8inch x 10 inch, 5 inch x 11 inch, 10 inch x 12 inch, 10 inch x 14 inch, 11 inch x 14 inch, 11 inch x 17 inch, 14 inch x 14 inch, 14 inch x 17 inch, 24cm x 24cm, 24cm x 30cm, A4, and A3.

- **Destination**

  Select the output port for the printed paper. You may select Magazine or Processor.

- **Smoothing Type**

  Used only if 'Magnification' is set to 'CUBIC'; enter the value listed in the DICOM Conformance Statement of the printer.

- **Priority**

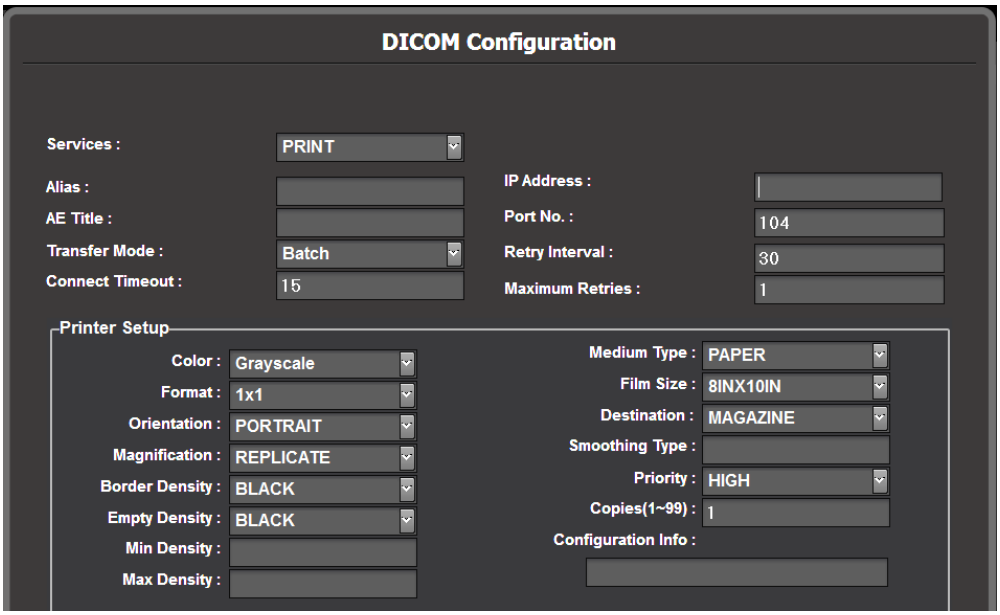
  Select the priority to assign to the printing task. You may select High, Med, or Low.

- **Copies**

  Enter the number of copies to print, using a value between 1 and 99.

■ **Configuration Info**

Set up the configuration parameters for the printer; refer to the DICOM Conformance Statement of the printer.



[Figure 3.25 DICOM Configuration - Print]

Worklist Server Information

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

■ **Show Worklist first when the patient screen opens**

When you check this checkbox, the Worklist window appears when you press the control panel's **Patient** button. Otherwise, the Study Information window appears.

■ **Update Method**

Specify the update method for Worklist.

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

> ※ **Tip!**To update a worklist, set Search Source to **Worklist** in the **Search** tab on the *Patient Information* screen, and then click **Search**.

- On Startup and Every: Update automatically at a specified interval after the system boots and the Worklist is updated.

■ **Scheduled Station AE Title**

Specify the range of AE Titles to retrieve from the Worklist server in a hospital.

- Any: Retrieve the patient list stored in all AE Titles in the server.
- This System: Retrieve the patient list in the AE Title specified under the DICOM tab.
- Another: Retrieve the patient list stored in the AE Title specified by the user.

NOTE	This option is available only when the Worklist server is enabled.

- **Start Date**

  Specify the range of dates to search.

  - Today: Retrieve the patient list for the current date.
  - Range: Retrieve the patient list for ‘n’ days before and ‘n’ days after the current date.
  - Past Week: Retrieve the patient list for 7 days before the current date.
  - Past Month: Retrieve the patient list for a month before the current date.
  - Custom Date: Specify a certain date and retrieve the patient list for that date.

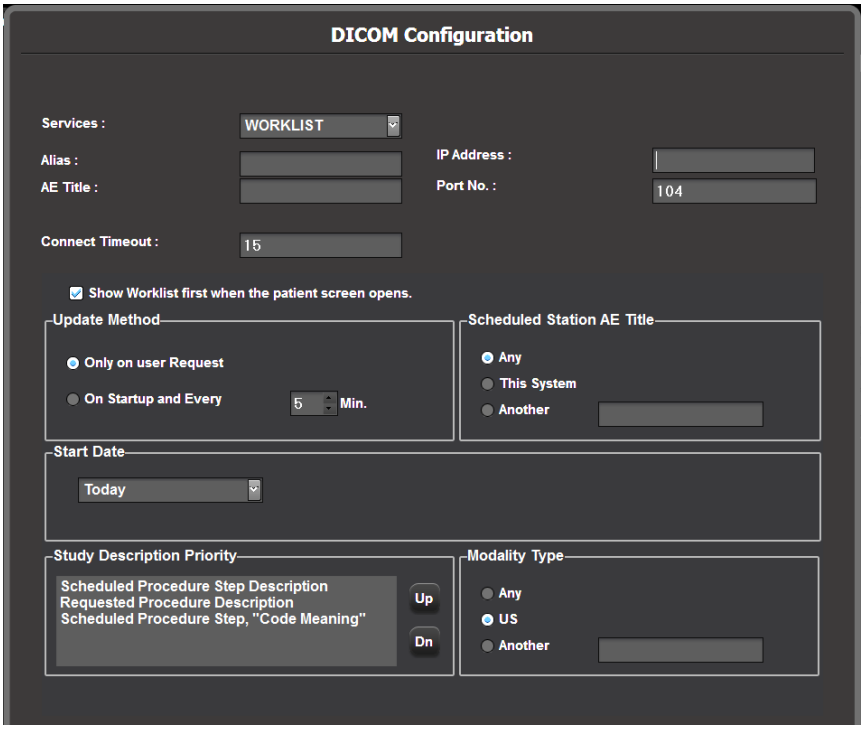
- **Study Description Priority**

  Specify the sorting order for when an exam is retrieved from the worklist server under Patient Information > Patient > Description. The list is sorted in order of high to low priority. Select an item that you wish to rearrange, and change its position by using the **Up** and **Dn** buttons.

- **Modality Type**

  These options are used to specify the modality of exams retrieved from the worklist server.

  - Any: Retrieves all registered worklist exams, regardless of their modality.
  - US: Retrieves ultrasound exams only.
  - Another: Allows the user to specify the modality and retrieve matching exams only. Leaving it blank means “Any”.

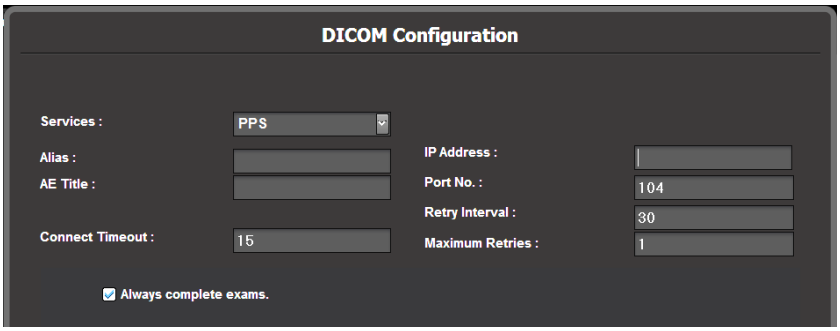


[Figure 3.26 DICOM Configuration - Worklist]

PPS Server Information

Select PPS (Performed Procedure Step) under **Services**. Configure the Modality Performed Procedure Step Service using DICOM.

The configuration options are the same as those for the storage server.



[Figure 3.27 DICOM Configuration - PPS]

- **Always complete exams**

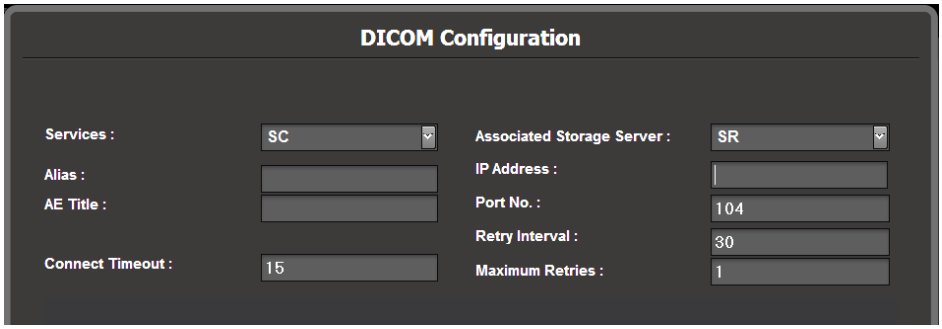
  When you check this checkbox, exams are always reported in complete condition. If you click the **Cancel** button without checking this checkbox, the cancel message is sent to the RIS server.

SC Server Information

Select SC (Storage Commitment) under **Services**. Configure the Storage Commitment Service using DICOM. The Storage Commitment Service is used after a diagnosis is finished and all saved images and reports are sent.

■ **Associated Storage Server**

Select an Image Storage server to connect to.

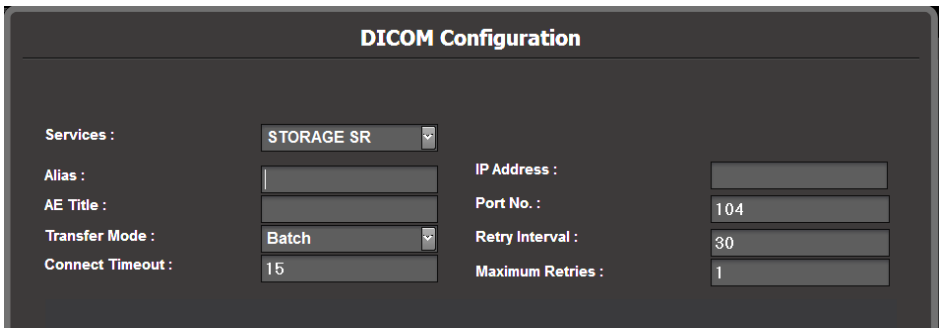


[Figure 3.18 DICOM Configuration - SC]

Storage SR Server Information

Select Storage SR (Storage Structured Report) under **Services**. Configure the Report Storage Service using DICOM.

The configuration options are the same as those for the storage server.



[Figure 3.29 DICOM Configuration – Storage SR]

Editing DICOM Information

Select a service and click **Edit** on the screen. The information on the selected service will appear.

After changing the information, click **Save** to save the changes. To cancel, press **Cancel**.

Deleting a DICOM Service

Select a service and click **Delete** on the screen.

Testing a DICOM Server

Select a service on the screen, and press **Test**. The result of the test will be displayed in the Ping and Verify fields. If the result shows as Normal, the connection is normal.

Managing DICOM

Click **Queue** on the screen to switch to the DICOM Job Status screen. You can review the current job status using Job ID, Patient ID, etc.

The following describes the elements of the *DICOM Job Status* screen.

[Figure 3.30 DICOM Job Status]

- Job ID: Displays the job ID.
- Patient ID: Displays the patient ID.

- Alias: Displays the alias set in the *DICOM Configuration* screen.
- Type: Displays the job type. The available job types are Storage, Print, Storage SR, MPPS Start, MPPS End, and Storage CMT.
- Instances: Displays the number of instances. What this denotes differs depending on the job type. For Storage and Print, it means the number of images. For Storage SR, it means the amount of measurement data. For MPPS Start, it is always displayed as 0.
- Data/Time: Displays the date and time when the job was created.
- Status: Displays the current status of the job.

Status	Description
Fail	The job failed.
Transfer	The job is in progress.
Imperfect	Job suspended while being processed. The status will be switched to the Ready state immediately.
Wait	The job is waiting for execution.
Wait Resp	The job is waiting for a response.
Hold	The job is being held. This occurs when the job has failed, but the maximum retry count has not yet been reached.
Ready	The job is waiting for execution. There is no connection to the network.
Not Ready	The Ready state is not complete. This occurs when MPPS (Modality Performed Procedure Step) End occurs before MPPS Start is completed or the case that a Storage or Print batch job is not completed.

■ **Network Status**

The network connection status is displayed. When connected, ‘Connected’ is displayed. When disconnected, ‘Disconnected’ is displayed.

■ **Number of Jobs**

Displays the number of jobs listed in the *DICOM Job Status* screen.

- **Log**

  Displays the *DICOM Log* window.

- **Retry**

  Performs the selected job again. Retries the selected job; this button is enabled only when the status of the selected job is either Fail or Wait Resp.

- **Retry All**

  Retries all jobs for which the status is Fail.

- **Delete**

  Deletes the selected job. This button is enabled only when the status of the selected job is Fail, Imperfect, Wait Resp, or Not Ready.

- **Clear**

  Deletes all jobs.

DICOM Log

Click **Log** on the DICOM Job Status window to display the DICOM Log window. This is used to manage the history of all DICOM services performed on this product.

- **Log Settings**

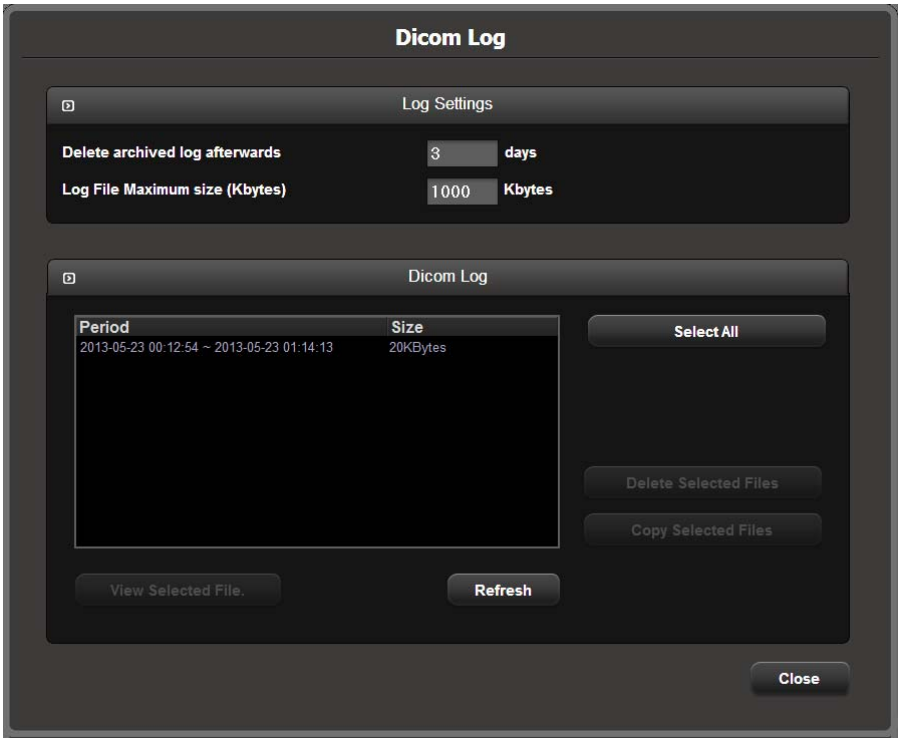
  Specify how log files will be managed.

  - Delete Archived Log Afterwards: Specify how long a log file will be archived. Enter a number of days. If the specified time has elapsed after the log file was created, the file is deleted from the system.
  - Log File Maximum Size: Specify the maximum size of a log file that can be archived. Enter a number of kilobytes. A log file that is larger than the specified size is not archived on the system and is deleted immediately.

- **DICOM Log**

  Displays a list of log files with their information.

  - Select All: Selects all log files.
  - Delete Selected Files: Deletes the selected log files.
  - Copy Selected Files: Copies the selected log file to external storage media.
  - View Selected File: Displays the details of the selected log file on the screen.
  - Refresh: Updates the information of a log file.

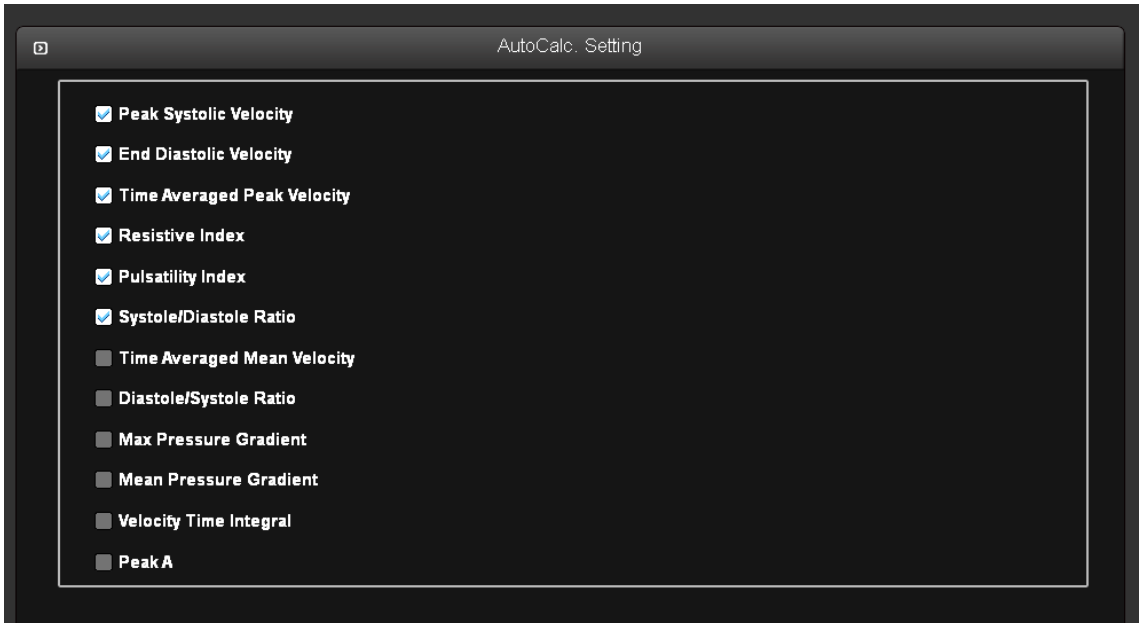


[Figure 3.31 DICOM Log]

Auto Calc

Select the **Auto Calc** tab on the *Setup* screen. Or tap **Auto Calc** on the touch screen. The Auto Calc function calculates specified measurement items automatically with measurement data and is supported in Spectral Doppler Mode.

NOTE	The specified items will appear on the screen only when the **Auto Calc** button on the touch screen is tapped in Spectral Doppler Mode.



[Figure 3.32 Setup - Auto Calc]

Auto Calc Setting

Add and remove automatic calculations by using the check boxes. You can select up to six values.

When the Peak Systolic Velocity and End Diastolic Velocity values are 0, not all the results are displayed on the screen. In addition, the result value for Time Averaged Mean Velocity is displayed only when Mean Trace is turned on.

System Information

On the *Setup* screen, select the **System Information** tab. Or tap **System Information** on the touch screen. Displays the software version of the product.

Press **Detail** to view detailed version information about the product.

[Figure 3.33 Setup - Information]

* The actual system version may differ from the software version shown in the above image.

Chapter 4

Product Inspection

Inspecting Functions 2

Basic Inspections 2

Detailed Inspections 4

Inspecting Functions

After installation, inspect the device and use the major functions to verify that the product works properly.

Basic Inspections

Monitor

Check the screen for color, focus, dots, afterimage, stain, and blurriness.
Check the screen while impacting the monitor, and check the signal while shaking the cable to the left and right.

Control Panel and LED Status

Press any keys on the control panel and see if text appears or breaks.
Verify that the Keyboard LEDs turn on.

BodyMarker Key

Check if BodyMarker image appears correctly, and whether selection works properly.

Indicator Key

Check that the trackball works properly by rolling it up, down, left, and right.

Clear Key

Check that all text and measurements are cleared properly.

Check Zoom Functionality

Check the zoom function for proper action and ensure that there are no errors.

Check SonoView

Save images and Cine images in each mode.
Check for errors in saving the images.
Check whether Backup & Restore function properly.

Measure

Check the operation of Distance, Caliper, Calc, etc.

Patient

Enter information in Patient, and check that the same Patient information is displayed in the Report, SonoView, etc.

End Exam

Make an arbitrary measurement in New Patient, and see whether the measurement is erased when you press End Exam.

Probe Key

Perform a Probe Change, and check that it functions correctly.

Detailed Inspections

2D Mode

① Perform a Knife Test to check that a part of image is not displayed.

② Perform a Phantom to check for errors in image.

③ Check the Freeze Cine actions (broken image, Auto Run, Auto Run Speed, Trackball Cine).

④ Check for changes in the image brightness when you adjust the Gain.

⑤ Check that the TGC Gain operates correctly by adjusting it and checking for changes in the image brightness in accordance with depth.

⑥ Perform Left/Right Flip, Up/Down Direction, and Rotation to check whether the image changes its orientation correctly.

⑦ Check whether the Select Image menus (EE, DR, View Area, Tissue, Frame Rate) work properly.

⑧ Check for errors in frequency (Phantom, Res, Pen, Gen).

⑨ Check for changes in the image in accordance with changes in depth.

⑩ Check for changes in the image by depth when you change the focus.

⑪ Check whether or not the Image Compensation Mode works.

Dual Mode

① Perform a Phantom to check for errors in image.

② Perform Left/Right Flip, Up/Down Direction, and Rotation to check whether the image changes its orientation correctly.

③ Check the proper operation of Select Image menus (EE, DR, View Area, Tissue, Frame Rate, Power).

④ Check for errors in frequency (Phantom, res, pen, gen).

⑤ Check for changes in the image in accordance with changes in depth.

⑥ Check for changes in the image by depth when you change the focus.

⑦ Check for errors in operations related to left and right image Cine (number of pages, Cine progression order, broken image, Auto Run, Auto Run Speed, Track Ball Cine).

M Mode

① Perform a Phantom to check for errors in image.

② Check whether the M-Line's information is displayed in the Image area.

③ Check for changes in the image brightness when you adjust the Gain.

④ Perform Left/Right Flip, Up/Down Direction, and Rotation to check whether the image changes its orientation correctly.

⑤ Check that the Select Image menus (EE, DR, View Area, Tissue, Frame Rate, Sane angle, Power) operate correctly.

⑥ Check for changes in the image in accordance with changes in depth.

⑦ Check for changes in the image by depth when you change the focus.

⑧ Check for changes in speed when you change Speed gradually, and for errors in the information.

⑨ Check whether the image becomes inverted when Negative is performed.

⑩ Check for errors in Top Down Format and Side by Side Format images when Loop Format is selected.

⑪ Check for changes in the Format B-Mode and M Line area sizes.

⑫ Check the Freeze Cine actions (broken image, Auto Run, Auto Run Speed, Trackball Cine).

Color Doppler/Power Doppler Mode

① Perform a Phantom to check for errors in image.

② Check the operations related to the Select Image menus (Balance, Sensitivity, Color Mode, Display, CFR).

③ Check for changes in the image in accordance with changes in depth.

④ Check the Freeze Cine actions (broken image, Auto Run, Auto Run Speed, Trackball Cine).

⑤ Check for changes in the image brightness when you adjust Color Gain.

⑥ Check for noises and breaks in the image (B or C Mode Noise) when you move the ROI Box.

⑦ Check for noises and breaks in the image (B or C Mode Noise) when you resize the ROI Box.

⑧ Adjust the Scale up and down to check whether or not the frequency changes and speed range of blood flow is adjusted. (Check by actually performing a scan)

⑨ Operate Filter to check whether small signals are removed by stage.

⑩ Check whether or not the Color Bar is inverted when you operate the Invert key.

⑪ Move the Baseline up and down to check whether the speed range of blood flow moves to "+" or "-" position.

PW Spectral Doppler Mode

① Perform a Phantom to check for errors in image.

② Check whether Doppler's PRF value changes when you set Simultaneous to on/off.

③ Check for errors in the Doppler spectrum.

④ Change the Scale to check the change in velocity range.

⑤ Move the Baseline up and down to check whether the spectrum range moves to "+" or "-" position.

⑥ Check whether changing Filter removes low signals from the Spectrum.

⑦ Check whether the Doppler wave form is inverted when you operate Invert.

⑧ Perform Angle action.

⑨ Change the position and size of SV, and check for errors.

⑩ Check whether Spectrum's image changes when you change Spectrum's Type.

⑪ Check for errors in Sound Volume.

⑫ Perform Auto Calc, and check whether the line is displayed without breaks; check whether the calculated results are automatically carried out.

⑬ Check for errors in Top Down Format and Side by Side Format images when Loop Format is selected.

⑭ Check the Cine/Loop (broken image, Auto run, Auto run speed, Trackball Cine) operations.

3D / 4D Mode

① Check whether loading is performed correctly when you proceed with Free Hand 3D SCAN and when you skip to Freeze; check for broken images and noise while you are proceeding.

② Check whether loading is performed correctly when you proceed with Static 3D Scan, and check for broken images and noise while you are proceeding.
Check the probe for noise, and check whether the probe's motor works normally.

③ Check whether loading is performed correctly when you proceed with Live 3D Scan, and check for broken images and noise while you are proceeding.

Check the probe for noise, and check whether the probe's motor works normally.

④ Check for errors in ROI 3D, ABC 3D, and Full images.

⑤ Check whether the 3D image changes to the selected angle.

⑥ Check whether the 3D image's contrast changes to the selected value.

⑦ Check for errors in the image when you change the size of the image.

⑧ Check the Display Format Image (ACB, Volume CT Image).

⑨ Select Step Angle, Rotation Angle, and Rot. Axis and then proceed with Cine; check whether Cine Loading works according to the specified setting, and check for breaks and errors in the image.

Chapter 5

Product Structure

Overview **3**

System Block Diagram **5**

Basic Structure of WS80A **7**

Overview 7

Ultrasound System Part 8

PC Part 9

User Interface Part 10

AC to Power Module 10

Ultrasound System Part **11**

PSA 11

Analog Control 13

Beam Former Board 15

Back End Board 22

PC Part **28**

PC Module 28

Software DSC 29

Rear Board 31

Power Supply 32

User Interface Part **35**

Control Panel 35

Docking CP Board 37

Touch Panel 38

Monitor..... 39

Overview

WS80A is an ultrasound diagnostic imaging system utilizing software DSC.

It features a 23-inch LCD monitor, provides high-resolution ultrasound images, and includes premium-grade features. Samsung Medison's new proprietary technology is incorporated into the latest spec PC and ultrasound system interface to enhance processing speed. Enhanced processor speed results in faster processing speed of the product, which in turn reduces exam time.

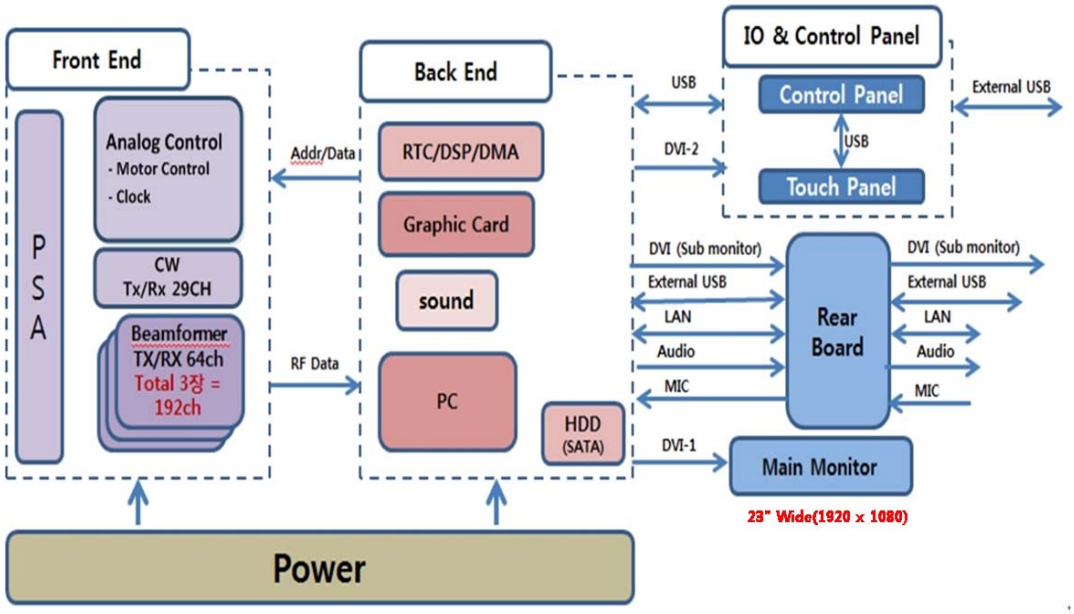
The major specifications are as follows:

Monitor	23" Full-HD Wide LED Backlight (1920*1080, Mitsubishi Panel)
PC	Com-Express PC (Industrial)_SamSung
CPU	INTEL CORE i7-3635QM
Memory	DDR3 SDRAM 8GB
OS	Windows 7 Embedded Standard
HDD	SSD 512G (Booting Time 59sec)
VGA	General VGA Card(Nvidia GTX650)
Chanel	TX 192 CH
Probe port	4 Probe Port (without CW Port, OB&GYN exclusive equipment)
BFIC	MCB124
MID Processor	MCB028
DSC	S/W DSC
3D Driver	AC B/D

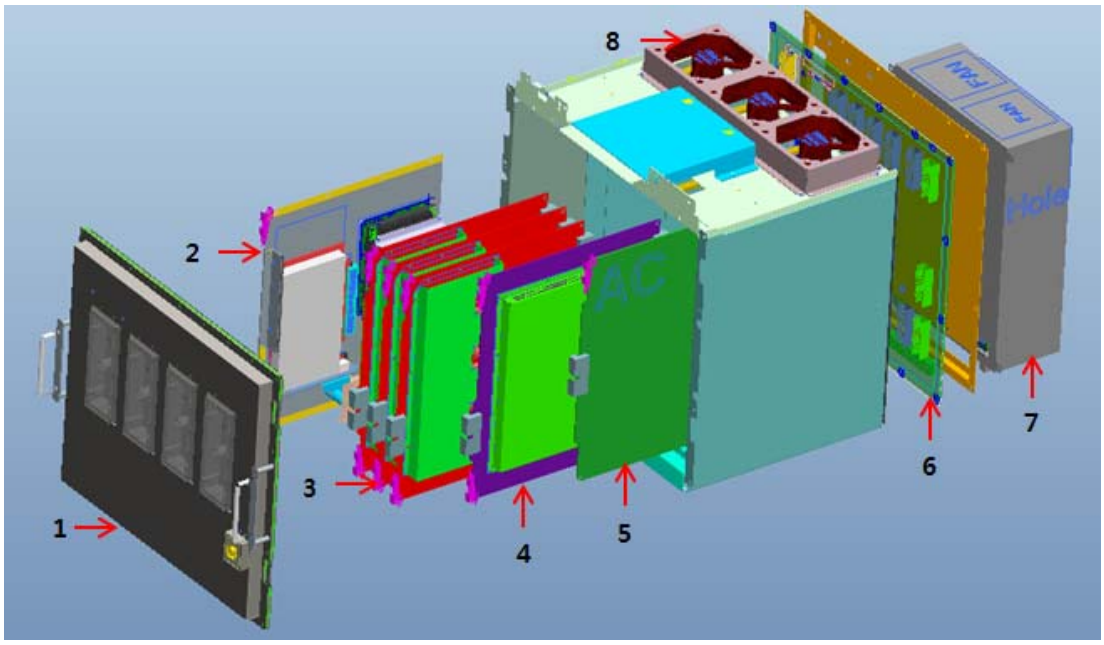
The major structure of WS80A includes the following:

Ultrasound System Part	• BF(Beamformer Board) 3ea 192ch • PSA(Probe Select Assembly) 4 Ports • BE(Back End Board) • AC (Analog Control Board) • USB ECG Module • USB Foot Switch • Gel Warmer • Easy Install System FAN
User Interface Part	• 23” Wide LED Monitor • 10.1” Touch LED Backlight LCD • Key Matrix Board • Alpha Numeric Key Board • 1.2” Track Ball • SW ECG • Easy Touch on the side of the touch
PC Part	• PC Module: COM Express I, CPU: Intel Core i7-3635QM(2.4G, 6M) • RAM : DDR3 SDRAM 8GB(4GB*2) • HDD: SSD 512G • VGA: GF 650GT
Power Module	• DDM • ACM

System Block Diagram



[Figure 5.1 System Block Diagram]



[Figure 5.2 System RACK Design]

No	Name
1	PSA
2	BE (Back End Board) + PC included
3	BF (Beamformer Board) : 3EA, 192ch
4	CW (Continuous Wave Board)
5	AC (Analog Control Board)
6	BP
7	DDM
8	FAN

Basic Structure of WS80A

Overview

WS80A consists of the Ultrasound System Part and the User Interface Part. However, when considered as an electronic structure, it consists of a Front End Part, a Back End Part, a User Interface Part, and a Power Part. A description of WS80A as an electronic structure is as follows.

Front End Part refers to the PSA (Probe Select Assembly) and the BF (Beamformer). The main functions of the Front End Part are to deliver High Voltage Pulser to the probe, thereby generating ultrasonic waves, and to amplify the returning echo signal to process Digital Beamforming. The RF signal generated here is sent to the Back End Part.

Back End Part refers to the BE (Back End) of the Ultrasound System Part as well as the PC Module.

It generates various diagnostic images such as BW, Color Doppler, PW Doppler, Power Doppler, etc. from the RF signal generated by the BF (Beamformer), and displays the images on the monitor so that the user can view them. In addition, it incorporates new technologies such as SCI and SDMR to facilitate a wide variety of diagnostic exams.

User Interface Part means the LCD monitor and control panel (including touch panel).

The Power Part can be divided as AC-DC Power Module and DC-DC Power Module; AC-DC Power Module converts the AC voltage to the DC voltage to supply power to DC-DC Power Module and supply power to PC Power of PC Part. DC-DC Power Module supplies the voltage to the boards of the Ultrasound System Part and PC Power supplies the voltage of PC Part.

Ultrasound System Part

Its major function is to process the ultrasound data prior to the Scan Converter. Also, it performs some functions of Front End Part and Back End Part. This detects probes and sends system information and application information in accordance with user environment to each Board. It performs TX Focusing and RX Focusing based on such information. When high voltage Pulser is sent to the probe according to TX Focusing, ultrasonic waves are generated; echo signals returning from the body go through an amplification circuit to undergo Digital Beamforming processing. The RF signal obtained here goes through various filtering and processing to generate image signals such as BW, Color Doppler, PW Doppler, CW Doppler, Power Doppler, etc., which are sent to the PC Module to be implemented on the monitor.

The DC to DC Power Module supplies power to the Ultrasound System Part.

The Ultrasound System Part consists of the following:

- PSA(Probe Select Assembly) Board
- AC(Analog Control)
- BF(Beamformer) Board
- BE(Back End Board)
- DDM (DC to DC Power Module)
- CW (Continuous Wave Board): currently not supported

PC Part

It consists of the Scan Converter and image output circuits for displaying the ultrasound information generated by the Ultrasound System Part on the monitor. It also performs control panel and interface functions.

The ultrasound image information from the Ultrasound System Part is connected to PC Part at PCIF with DMA method, and the ultrasound image is displayed through the software DSC and VGA.

Previous type of the ultrasound image scanner uses the Hardware DSC method, but WS80A uses the Software DSC and the ultrasound images are displayed on a LCD monitor.

PC Power Supply uses Micro ATX as standard, and it supplies power to PC Part.

The PC Part consists of the following:

- PCIE(Peripheral Component Interconnect Express)
- DVI(Digital Video Interface)
- VGA(Video Graphics Array)
- PC Mother Board
- Rear Panel
- PC Power Supply

User Interface Part

This part allows the user to view ultrasound images on the LCD monitor to make a diagnosis, and to control WS80A by using the control panel and touch panel.

The images from PC Part are transmitted to the LCD monitor and external devices. The output images are VHS, S-VHS, Composite, DVI, etc. and the input images available are VHS and S-VHS. Also, the control panel is made to provide various interfaces for user convenience.

The User Interface Part consists of the following:

- LCD Monitor(LCD Inverter Board, LCD Control Volume)
- AD Board
- Control Panel Board
- Touch Panel
- Track Ball
- Alpha-Numeric Key Board

AC to Power Module

It converts external 110/230V AC voltage to the DC voltage to supply power to DDM (DC to DC Power Module) of Ultrasound System Part, and it also supplies stabilized AC voltage to PC Power Supply of PC Part. Power circuit breaker prevents any possible troubles due to overcurrent.

Ultrasound System Part

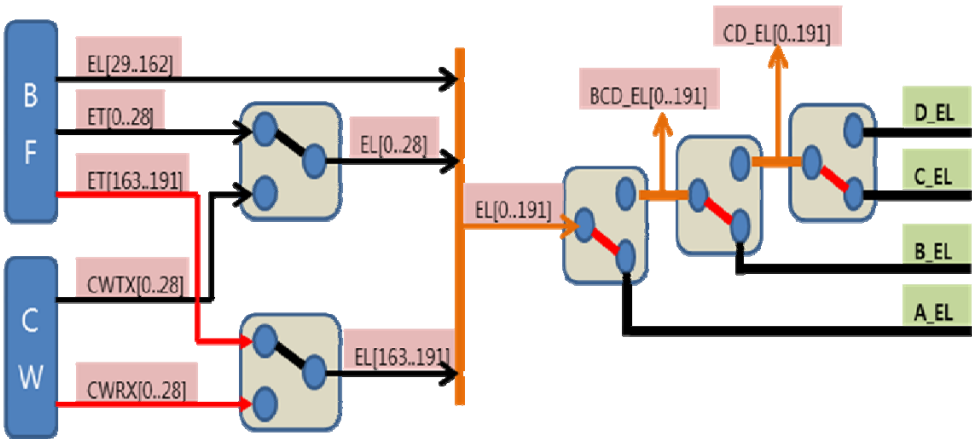
PSA

Main Functions

PSA serves as an interface for the System and the Probe.

Probe Connector has 4 of 408-pin Connectors and 1 of LEMO Connector and has the CW selection relay to support CW.

Also, it has 3D Probe Drive Path, Probe Insert Path, Port Select Path, CW Path, etc. and it has the Relay circuit to select one probe out of 4 probes.



[Figure 5.3 PSA Block Diagram]

Specification

- Local Power distribution
- LV/HV Power Switching
- 4 Probe Port Support
- Probe Check
- 3D probe path

Operational Principles

■ High Voltage Switching Process

WS80A supports 128 Channels and uses up to 192 Element Probes. A separate element selection is required because Pulser and Receiver circuit of BF (Beamformer Board) have only 128 channels. Element Selection uses 24 of High Voltage Switches and switching is carried with the control signals transmitted from the Control Logic (CPLD) of BF (Beamformer Board). The Control Signal is connected through Mother Board Connector.

The inner structure of the High Voltage Switch consists of Shift Register and High Voltage FET.

■ High Voltage Switching Process

It consists of a circuit to select one probe out of 4 probes. It can use the relay of the latched type to select a probe chosen by user.

The relay is operated by the probe select signal transmitted from the control logic (CPLD) of CW (Continuous Wave Board). Probe Select signal is connected through the Mother Board Connector.

■ CW Probe Switching

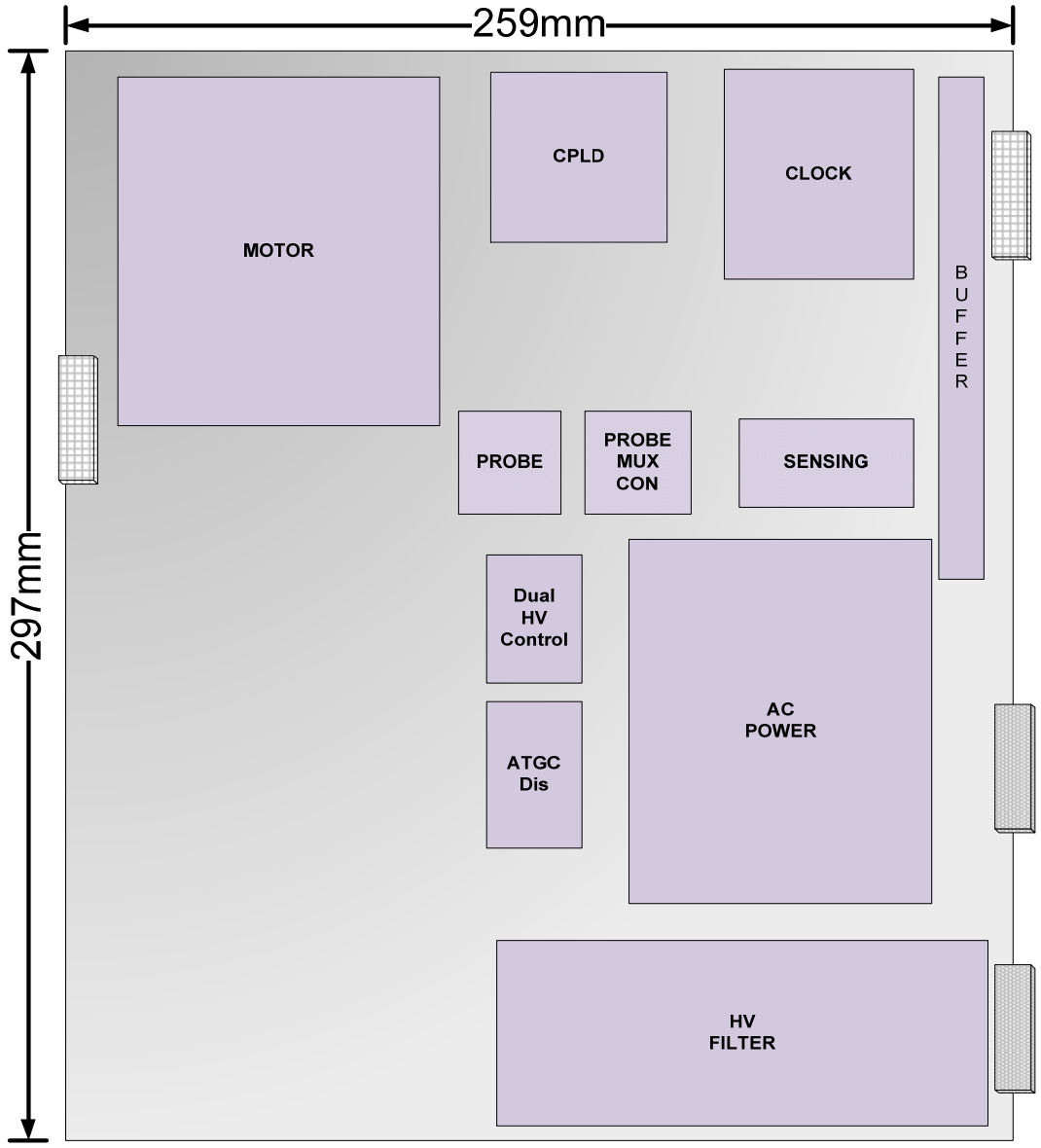
Steered CW Switching: Steered CW has, separate from the Beam former Board, Tx 29CH and Rx 29CH and, by using Not latch Relay, it converts the signal line from Phased Array Probe to the CW Board at Steered CW Mode. Because it has 29CH, there are 15 AGN20012 for CW Tx and there are 15 AGN20012 for CW Rx.

Static CW Switching:Static CW, separate from the Beam Former Board, has Tx 1CH and Rx 1CH. At Stactic CW Mode, the signal lines from Pencil Probe are connected directly to the CW Board without Relay.

Analog Control

Main Functions

It checks the versions of 3D probe drive, Clock Generation, Probe Control, HV Switch Control, and BackPlane.



[Figure 5.4 AC Board Layout]

- The main function of the **Analog Control**board is to control the motor of 3D Probe, to supply clocks to the entire system and to monitor the status of power.
- **Motor Part**controls the stepping motor inside the 3D Probe.
- **HV Filter** is a high voltage filter used in BF.
- **Clock Part**generates system Clock 61.6Mhz used in BF and BE.
- **Pulser Sensing Part**monitors the status of High Voltage and current used in the BF board.
- **ATGC Part**supports analog time gain control curve used in BF.
- **AC Power**generates power for the AC & PSA board.
- **Probe Part** checks Probe port selection,
- Probe ID read, and Probe Insert of the PSA board at all times.

Specification

- 3D Probe Motor Driver
- System Clock Drive
- Pulser Voltage Sensing
- HV Mux Sensing
- ATGC
- AC Power
- Probe Check (ID/Insert/Port)

Operational Principles

3D Probe works as the Stepping Motor operates to run 3D Mode. Motor Board controls its feed back with the SIN and COS wave which have a phase of 90^{o}. In this case, 3D Probe gives a Null Position signalto the Motor Board and the Motor Board sends the One Frame signal, a standard signal to acquire 3D Image, to the BE Board.

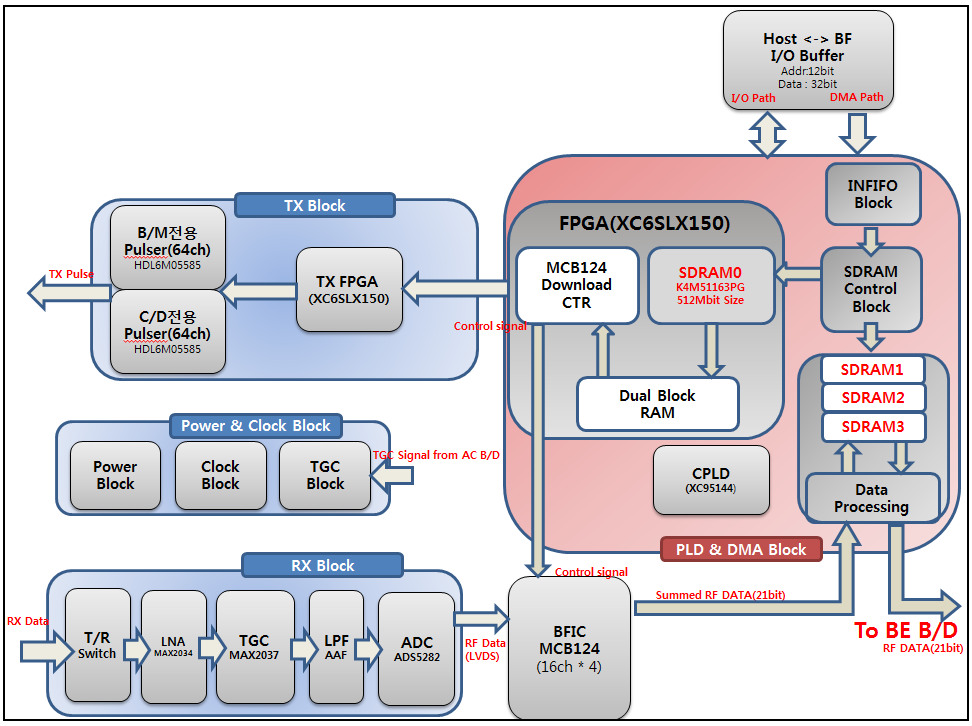
It monitors the voltage of HV Power in the BF Board and sends it to PC.

It provides the ATGC Curve to the BF Board.

Beam Former Board

Main Functions

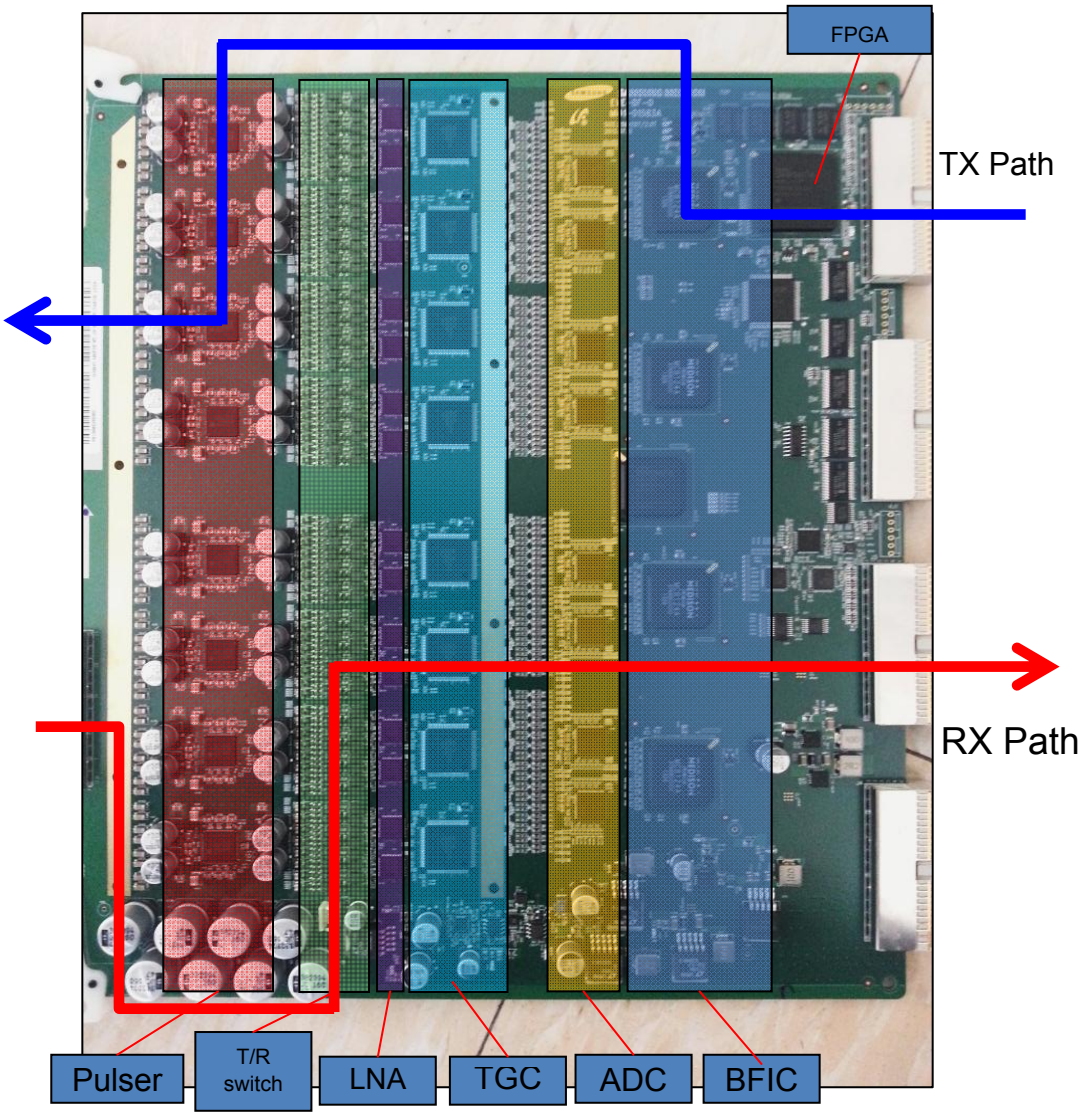
Beamformer board is located between PSA and Back-end and it sends a ultrasound signal focused on a specific position of the body and amplifies the received signal to convert it to a Digital signal. Then it beamforms the signal and relays the Focused data to Back-end for Mid-processing. BF Board consists of Pulser, TR Switch, LNA, TGC, ADC, and BFIC.



[Figure 5.5 Front End Block Diagram]

- Pulser: consists of 192 channels and it can run 192 element Probes.
- TR Switch: deletes the HV element from Probe to prevent it from flowing to LNA.
- LNA: amplifies the received ultrasound signal and TGC Amp compensates the attenuation due to Depth to send the signal to ADC.
- ADC: converts the amplified Echo signal to digital data.
- BFIC: Rx focuses the RX echo signals of 128 CH and sends them to BE Part.
- TX FPGA: The generated exciting pulse signal is entered into Pulser, converted to high-

pressured bipolar pulse and sent to Probe.



[Figure 5.6 Signal Path]

Specification

- TX Pulser 16 (HDL6M05585, 4CH)
- T/R switch 64CH
- Pre amp 32 (MAX2034, 4CH)
- TGC amp 8 (MAX2037, 8CH)

- AD converter 8 (ADS5282, 8CH)
- BF ASIC 4 (MCB124,16CH)
- RX Dynamic Aperture
- RX Apodization
- BFIC controlling
- Synthetic Aperture
- Trapezoidal imaging
- Multi-line receiving
- TX Focal point

Operational Principles

■ TX Pulser

Exciting pulse data provided by the BF ASIC (MCB124) go through the TX Pulse Buffer and are provided to the TX Pulser (MAX4811). The TX Pulser uses the high voltage provided by the DC-DC Module and exciting pulse data to generate Bipolar Pulser. Bipolar Pulser uses PSA (Probe Select Assembly) to send to the Probe Element, thereby generating ultrasonic waves.

■ Receive Channel

The Receive Channel serves the function of an Analog Digital Converter, which enables Beamforming by amplifying the echo propagated through, and reflected from, the media of human body.

It consists of a Limiter, a Pre-Amp, a TGC-Amp, a Low-Pass Filter, and an A/D Converter.

1) Limiter

This removes unnecessary signals from the echo signals returned through the PSA (Probe Select Assembly)'s High Voltage Switch. Tx Pulse up to 180 Vpp and echo signals of a few mV are mixed together, but since the RX data actually needed are echo signals of extremely small magnitude in mV range, the Tx Pulse must be eliminated before they

are sent to the Pre-Amp. The Limiter removes signal over approximately 0.6V before sending the echo signal to the Pre-Amp.

2) Pre-Amp

The Pre-Amp amplifies the unprocessed small-magnitude echo signal in mV range.

3) TGC-Amp

The TGC (Time Gain Compensation) Amp consists of 4 channels per one unit.

It compensates for the time or distance-dependent reduction characteristics of echo signals that have been propagated through, or reflected from, media

4) Anti-aliasing Filter (Low Pass Filter)

The Low-Pass Filter filters the noise out of Stop Band, which is not the band of ultrasound signals. It also serves as an anti-aliasing filter, minimizing the aliasing phenomena that may occur with high frequency probes such as the 7.5MHz probe. Aliasing phenomena of high-frequency probes are caused by the restriction of the sampling clock in BF ASIC.

5) A/D Converter

This converts an analog signal into a digital signal to be used for Digital Beamforming.

■ Digital Beam forming

Ultrasonic waves generated by a probe use a Channel method that utilizes multiple Elements to perform TX Focusing. Ultrasonic waves generated from each channel are reflected by media and return as reflected echo signals. However, the echoes do not return to the Probe Element simultaneously; they return to each Element at different times, which necessitates a way to compensate for this time difference. It is required to perform RX Focusing; it is also very important for generating ultrasound images.

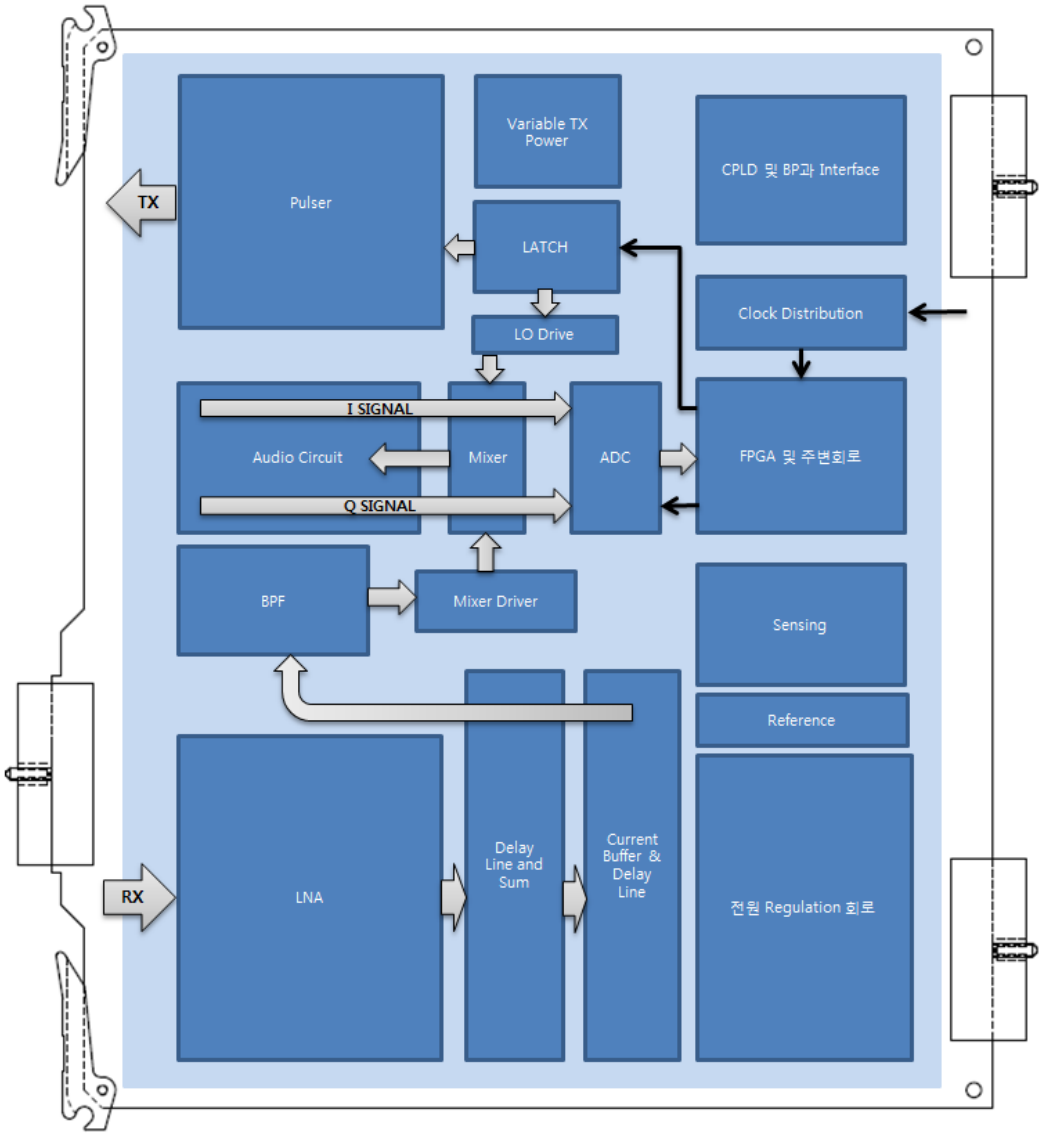
Digital Beamforming takes the echo signals entering the Probe Element and samples the data at the junction of the time axis and the curve, which is then stored in the memory. When sampling is complete, the data accumulated in the memory have been time-compensated when they were stored; time compensation is performed by the Sampling Clock itself. RX Focusing is completed by simply reading the data stored in the memory and adding them. Since this method requires different Sampling Clocks for each Element,

the VSCG (Variable Sampling Clock Generator) is necessary. The VSCG (Variable Sampling Clock Generator) uses 61.6Mhz, which is same as the A/D Sampling Clock; necessary data is generated within BF ASIC (MCB124A).

CW Board

주요기능

CW Board 에서는 System 동작을 위한 기본적 기능과 실질적인 Continuous Wave Doppler 기능을 제공합니다.



[그림 5.7 AC Board Layout]

- CW Board 는 PSA Board 와의 연결을 통하여 CW Tx 신호의 출력과 CW Rx 신호의 입력을 수행하고 PSA Board 로 필요한 전원을 전달합니다.
- CW Board 는 Back Plane Board 와의 연결을 통하여 CW I/Q 신호를 전달하고, Master Clock 의 입력 및 PSA 로부터 받은 정보를 전달합니다.
- Pulser: 29 채널로 구성되어 있으며 29 element Probe 를 동작시킬 수 있습니다.
- LNA: 수신된 초음파 신호를 증폭합니다.
- ADC: 증폭된 신호를 디지털 Data 로 변환합니다.
- FPGA 와 Clock Part 는 시스템에 사용되는 61.6MHz Clock 을 생성합니다.
- Sensing Part 는 CW 보드에 사용되는 Voltage 와 current 의 이상유무를 모니터링 합니다

Specification

- Input noise: 3nV/SqRtHz
- Input Signal Level: ~250mVpp
- 사용 가능 주파수: 1.5~6MHz
- Input impedance: 1Kohm
- Gain: 60dB
- PRF: ~ 43KHz
- Number of Channel: TX/RX 각 29channel
- Transmit Delay Tab: 32.5MHz
- Receive Delay Tab: Min. 30ns, Max.100ns
- Power Noise: 100nV/SqRtHz 이하

동작원리

■ TX Pulser

FPGA에서 제공되는 Pulse data는 Latch를 지난 다음 Tx Pulse(Max4811)로 전달되고, PSA(Probe Select Assembly)를 이용하여 Probe Element로 전송되어 초음파를 발생시키게 됩니다.

■ Receive Channel

Receive Channel은 인체의 매질에서 전파되고 반사되어 온 Echo를 증폭하여 Delay & Focusing 하는 부분과 Analog Digital Conversion 하는 기능을 수행합니다.

1) LNA: 수신된 신호를 증폭하는 역할을 합니다.
2) Delay & Focusing: 29채널 Rx 입력신호를 하나의 신호로 집속하는 역할을 합니다.
3) Mixer: Doppler 신호를 검출하기 위하여 송신 주파수 와 같은 신호를 RF신호와 Mixing합니다.
4) I/Q Signal: 혈류의 방향 정보를 얻기 위해서 기준신호와 90° 위상이 다른 신호를 입력합니다.
5) Audio Circuit: Mixer 후 신호에 대하여 높은 주파수 성분을 제거하여 도플러 편이 주파수 신호를 얻습니다.
6) ADC: 디지털 신호를 아날로그 신호로 변환하는 역할을 합니다.

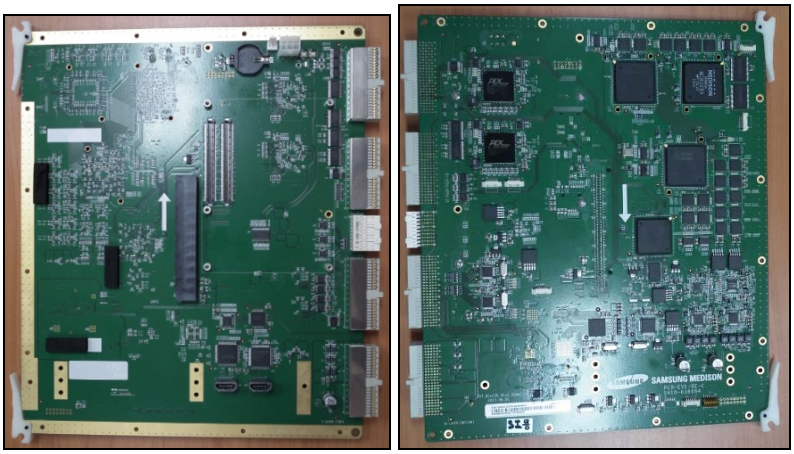
Back End Board

Main Functions

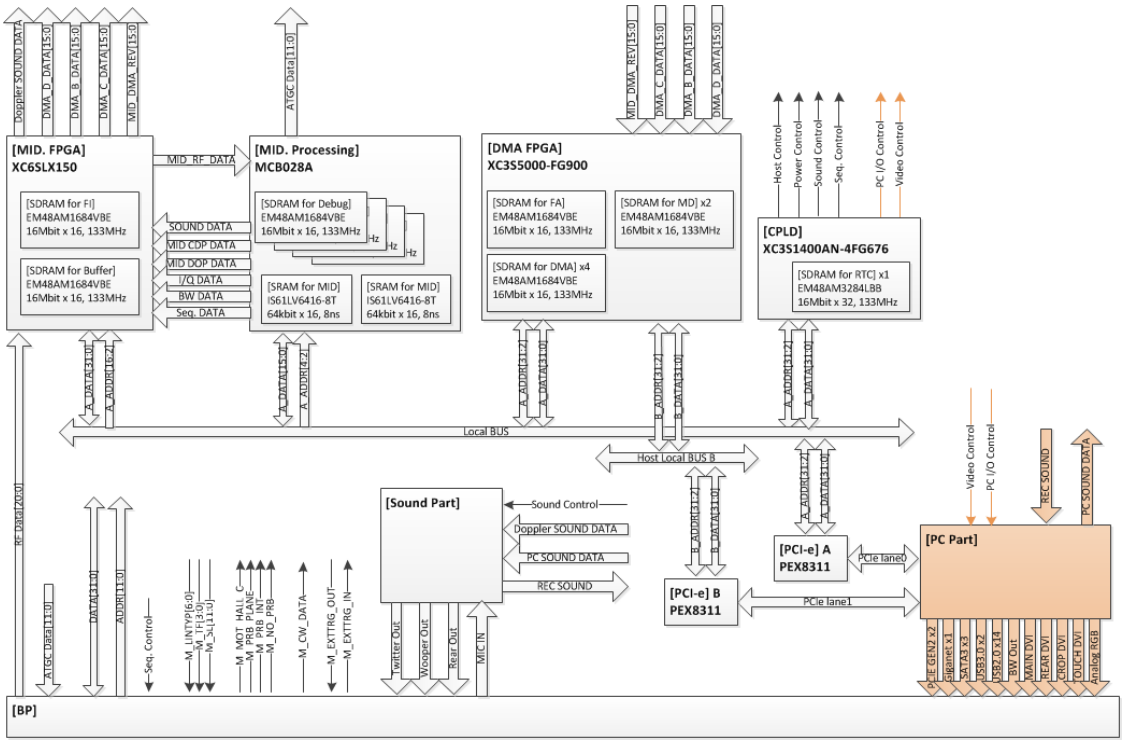
Back End Board (hereinafter BE Board) can be divided into DSP (Digital Signal Processing) Part, DMA & RTC Part, and, Analog Sound Part.

DSP Part receives input of RF Data and CW I/Q Data from BF Board and CW Board and processes it into Image data such as BW Image, PW Doppler, CW Doppler, Color Doppler, or Power Doppler. These Image Data goes through the process of Frame Average in DMA & RTC Part of the BE Board and, through PCI BUS, they are relayed to PC Part for the Software DSC process. Analog Sound Part processes the Doppler Sound Data from DSP Part with the Digital Analog Converter to amplify and send it to the Speaker.

BE Board consists of ASIC (MCB028A), FPGA, Analog Sound part and more.



[Figure 5.8 Back End Board]



[Figure 5.9 Back End Board Block Diagram]

Specification

- Focused RF Data Interface
- RTC(Real Time Controller)

- PCI-express Interface
- BW Data Processing
- Spectral Doppler Data Processing
- Color Doppler Data Processing
- Motion Data Processing
- Digital Signal Processing (Pre Processing, Post Processing)

- Direct Memory Access
- Sound Control(Doppler, PC Wave) - 4CH Sound System(2CH Twitter, 2CH Woofer)

Operational Principles of DSP Part

■ Image Data Processing in BW Mode and M Mode

RF Data generated by the BF Board is entered as FPGA Input.

The entered RF Data is converted into computable RF Data at FPGA Input, and then entered as the input for ASIC (MCB028A).

ASIC(MCB028A) generates BW mode Image Data (hereinafter, BW Data) and sends it to FPGA.

ASIC(MCB028A) creates BW Data and processes FSI (Full Spectrum Image), Spatial Compound Imaging (SCI), Trapezoidal imaging, Synthetic aperture, and more.

To generate BW Data, it receives RF Data input and go through the process of DTGC (Digital Time Gain Compensation), Decimation, Quadrature mixer, Envelope detection, Log compression and several filtering.

The BW Date created from ASIC (MCB028A) is entered into FPGA again. It goes through FSI (Full Spectrum Image) and Lateral filter to remove Multibeam artifact and the final BW Date is sent to FPGA.

Note that the BW Data can be used as Motion mode Image Data.

■ Doppler Image Data Processing

RF Data generated by the BF Board is entered as FPGA Input.

The entered RF Data is converted into computable RF Data at the FPGA, and then entered as the input for ASIC (MCB028A).

ASIC (MCB028A) receives RF Data input and processes through DTGC (Digital Time Gain Compensation), Decimation, Quadrature Mixer, etc. to create I/Q data (In-phase & Quadrature Data). I/Q Data is entered into FPGA again.

I/Q Data is processed at FPGA to generate Doppler Data and it is sent to DMA & RTC Part. Detailed descriptions are as follows.

FPGA which received I/Q Data filters the data and filters CW I/Q Data from CW Board in the same way to send the final Doppler Data to PC Part. PW and CW cannot be processed simultaneously, therefore all operations are controlled by the internal control process.

I/Q Data go through a Clutter Filter and are sent to a FFT (Fast Fourier Transform) circuit for generating Doppler Spectrum, which isolates the basic elements of Doppler, i.e. power, velocity, and variance, to generate Doppler Data. Then it is entered into DSP FPGA again and sent to the DMA & RTC Part of BE Board.

Filtered I/Q Data from FPGA go through the Clutter filtering to remove the Wall Noise from Doppler DSP and is processed with Hilbert transform. The direction of sound is removed to generate Doppler Sound.

■ Color Image Data Processing

RF Data generated by the BF Board is entered as FPGA Input.

The entered RF Data is converted into computable RF Data at the ASIC (MCB028A), and then entered as the input for ASIC (MCB028A).

ASIC (MCB028A) receives RF Data input and processes through DTGC (Digital Time Gain Compensation), Decimation, Quadrature Mixer, etc. to create I/Q data (In-phase & Quadrature Data). I/Q Data is entered into FPGA again.

I/Q Data is processed at ASIC (MCB028A) to generate Color Data and it is sent to PC Part. Detailed descriptions are as follows.

FPGA which received I/Q Data sends it to ASIC (MCB028A) to detect the Color component. However, the Color component contains the Wall Noise and it go through the process of Rejection, Smooth Filter, Post filter, etc. after sent to FPGA. In this process, the Color Data is created and relayed to DMA & RTC Part of BE Board.

Operational Principles of Analog Sound Part

The Analog Sound Part processes Doppler Sound and sends it to the speaker.

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

Doppler Sound goes through the Audio Digital Analog Converter process because the Speaker receives the Analog wave and it requires conversion. Noise is removed and Doppler Sound is amplified and sent to the Speaker.

Operational principle of DMA & RTC Part (including FPGA function)

■ DMA Part

DMA (Direct Memory Access) consists of FA (Frame Average), DMA and ECG In/Out Part.

FA (Frame Average) processes BW, Doppler, and Color Data with the average value of Scan line data in the current Frame and previous Frame. And DMA temporarily saves frame-averaged BW, Doppler, and Color Data and sends the required data to the PC Part through PCI BUS. Also, it saves ECG Data and sends it in the same way.

Since DMA uses the PC Part and the DMA Path for processing, it plays a very important role in enhancing the performance of the product.

■ RTC Part

RTC (Real Time Controller) creates the standard signal for the entire system operations

in real time to control the system operations. It creates and controls signals for PRF (Pulse Repeat Frequency), OF (One Frame), RP (Rate Pulse), Linotype, Scan Line, etc. in DSP Part of the BF Board and BE Board. Also, it controls the internal flow of data at DMA FPGA.

PC Part

PC Module

Main Functions

It implements the existing Hardware DSC Board and Video Manager Board in PC Part. PC Module implements DSC Part in the Software Program and thus its performance is very important.

COM Express Type II PC Module applies.

Specification

- PC : Com-Express PC (Samsung Embeded PC)
- CPU : Intel Core i7-3635QM
- RAM : DDR3 8GB Memory
- SDD : SATA SSD 512GB
- OS : WES(Windows Embedded Standard) 7
- VGA : General VGA Card(Nvidia GTX650)
- Monitor : 23” Full-HD(1924 ㅧ1080) LED Display
- DVD

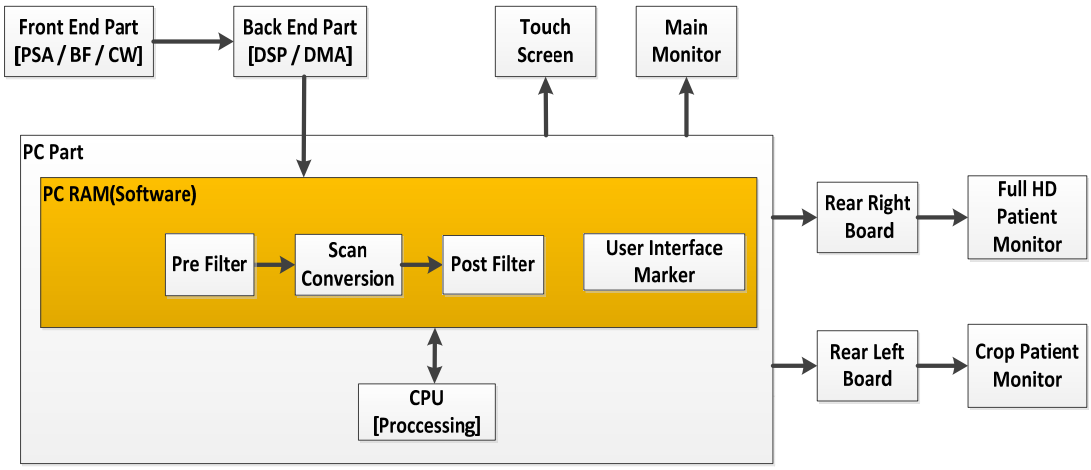
[Figure 5.10 PC Module]

Software DSC

Main Functions

It processes Hardware DSC with the Software DSC created with the Software Program.

Image signals generated by the BE Board are copied directly to PC Memory by using DMA, where they are processed by Software DSC and the programs needed for ultrasound images, to be implemented as images on the monitor through VGA card and DVI board.



[Figure 5.11 Software DSC Block Diagram]

Specification

- Cine for 5,140 frame
- Loop Review for 8,192 lines
- Zoom
- Edge Enhancement
- Multi-Slice View
- Dynamic MR (Optional)
- Quick Scan
- Real-Time Auto Calculation time Doppler Auto Trace
- Free Angle M-Mode
- Post measurement
- Post image optimizing process Arbitrary M mode
- Help function

Operational Principles

The image data generated from DMA Part of BE Board is copied directly to PC Memory by DMA method through cables connected to Mother Board and PCI Board.

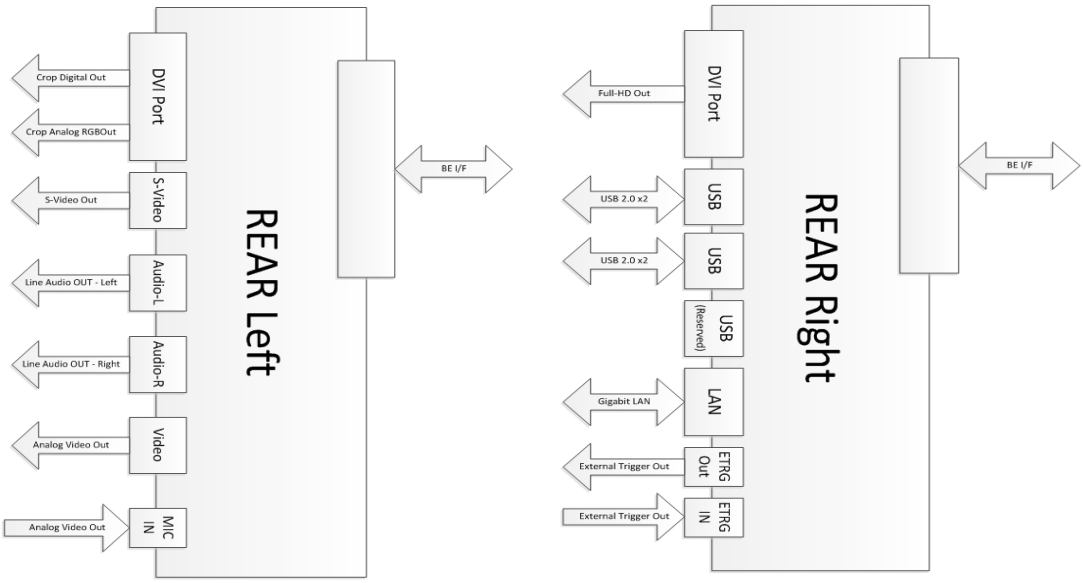
They are stored into Cine Memory through UCAgency Buffer, in which they are processed with Software DSC and Image Save.

Software DSC processes all functions that can be handled by Hardware DSC with Program; Filter and Rendering handle DSC, and sends data to VGA Card.

Rear Board

Main Functions

It serves as In/Out Interface to external devices.



[Figure 5.12 Rear Board Block Diagram]

Specification

- Rear Left
  - DVI Patient Monitor Port(Image Only)
  - BW Video Out
  - Audio Line Out
  - S-Video Out
  - Mic In
- Rear Right
  - DVI Patient Monitor Port(Full-HD)
  - Ext. Trigger In / Out
  - LAN Port
  - USB Port x4(A30 6Port)0

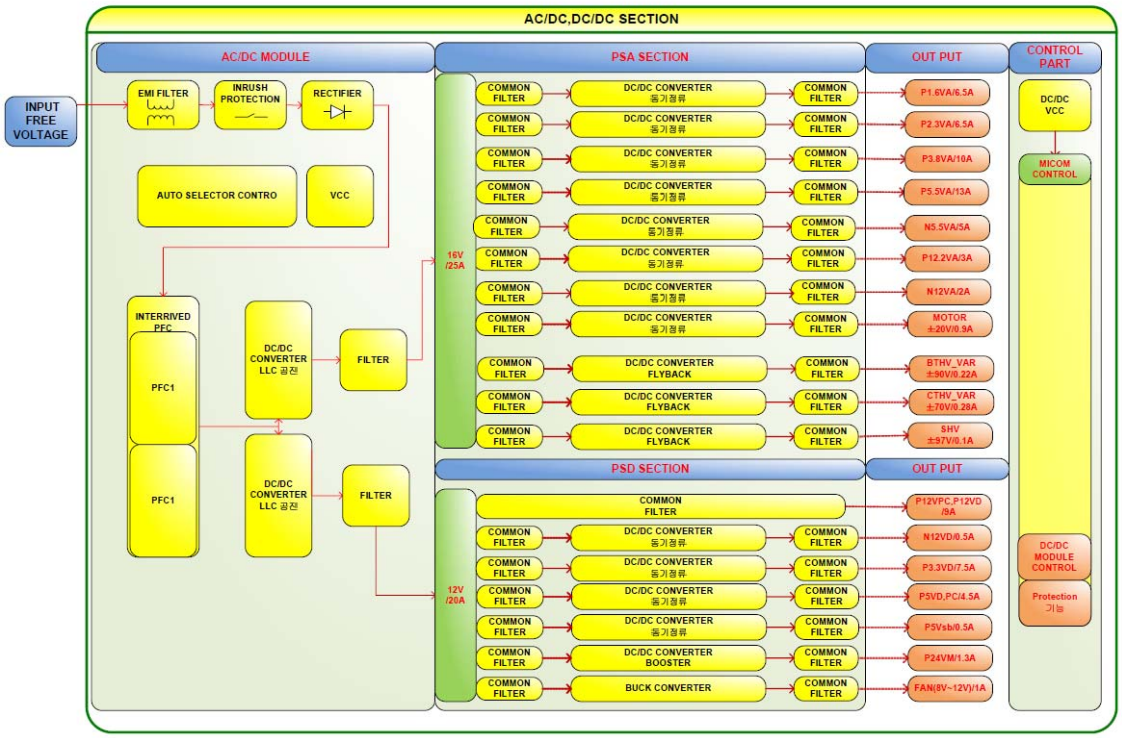
Power Supply

Main Functions

WS80A is designed to have an input voltage of 90V~ 264V. It does not require any adjustment of voltage before use.

INPUT Voltage Selector is used to set the voltage and power for the product and OUTPUT Voltage Selector is used to set the power directly provided for the external devices.

AC voltage and DC voltage are generated; AC voltage is for external devices and PC Power Supply, and DC voltage is to supply power for Ultrasound System Part.



[Figure 5.13 Power supply Block Diagram]

■ **AC to DC Power Module**

[Figure 5.14 AC-DC Power Module]

■ **DC to DC Power Module**

[Figure 5.15 DC-DC Power Module]

PC Power Supply

It receives AC 220V from ADM and uses it as internal power for PC Part. Also, it uses the voltage as power for LCD Monitor and DVD RW Drive through the external connector of PC Part.

Power Control

The operation flow of Power when the power is on/off is described.

When the Power On Switch in the Control Panel is on, the power for PC part is supplied and the Power On Signal from the PCI Board is relayed to trigger the Ultrasound power.

Vice versa, when the Power Off Switch in the Control Panel is pressed, the power for PC part is no longer supplied and the Power Off Signal from the PCI Board is relayed to turn off the Ultrasound power.

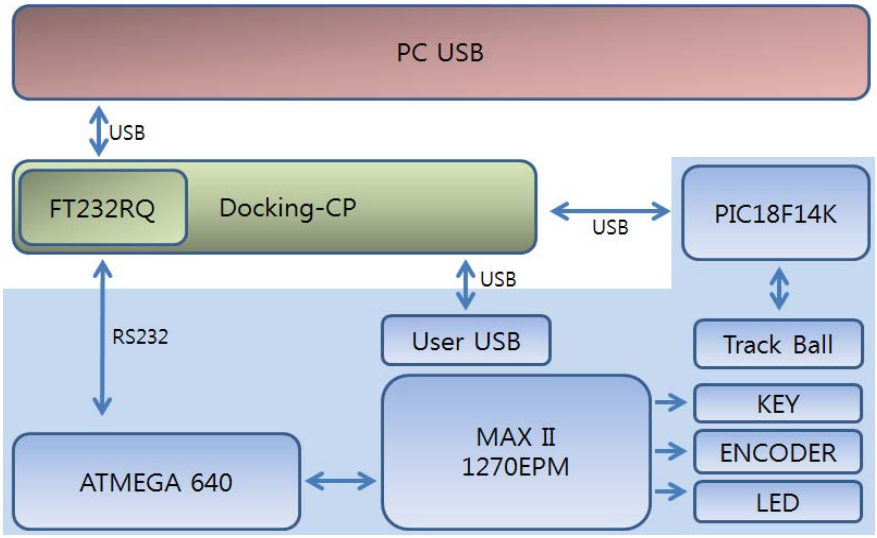
User Interface Part

Control Panel

Main Functions

The Control Panel serves as the interface between the user and the system.

Key Matrix Board, Touch Panel, Alpha-Numeric Keyboard, and Track Ball serve as User Interface.



[Figure 5.16 Control Panel Block Diagram]

Specification

- **Docking Part** - Supplies power and sends signals to CP Board (USB, reset, RS232).
- **Input part** - Consists of Switch, Encoder, and Trackball.
- **Control part**

  1). ATMEGA640 (8bit Microcontroller)

  Processes input Data and relays it to Docking B/D.

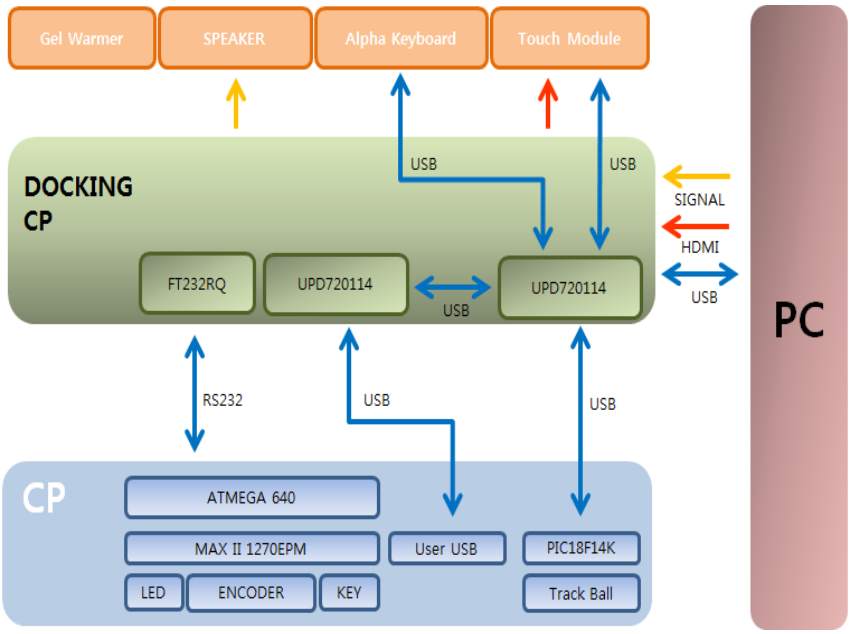
  2). MAX II EPM1270 (Altera CPLD)

- Touch Panel Backlight on/off Control
- LED outputs / Knob control
- Alpha Key, Trackball power on/off control

3). PIC18F14K50 (USB Mouse Controller)

- Track ball interface

Docking CP Board



[Figure 5.17 Docking-CP Block Diagram]

Specification

- **UPD720114 USB HUB(2ea)** - HUB2 (port1), touch Key (port2), alpha key (port3), trackball (port4) connection
- **Power part(PVX006A)** - 12V input 5V output
- **I/O part** - Uses HDMI, Data, and USB Connector FT232 Chip to send the CP control signal to PC.
- **Hub part** - Uses UPD720114 Chip (HUB) to connect each module to PC.

Touch Panel

Main Functions

10.1 Inch Samsung panel applies.

Specification

Item	SPECIFICATION	UNIT
Display Size	10.1 Inch Samsung Display	mm
Display colors	16.2M	colors
Number of pixel	1280 x 800(16:9)	pixel
Pixel arrangements	RGB vertical stripe	
Pixel pitch	0.1695(H) x 0.1695 (V) (TYP.)	Mm
Display Mode	Normally Black	
Surface treatment	Hardness 3H	

Monitor

Main Functions

23 Inch LG Panel applies.

Specification

Item	SPECIFICATION	UNIT
Display area	23” SAMSUNG Display	Inch
Number of Pixels	1920 x 1080 RGB vertical stripe arrangement	Pixels
Pixel Pitch	0.2652 (H) × 0.2652 (W)	mm
Electrical Interface	LCD Panel Input: Display Port (LVDS 2CH) Monitor Input: HDMI	
Display colors	16,777,216 (Hi-FRC)	
Viewing angle	89°/89°/89°/89° (CR≥10)	
Display mode	Normally Black	

Chapter 6

Service Mode

System Information **2**

Windows Mode **3**

Admin Mode **4**

Admin Mode Functions 5

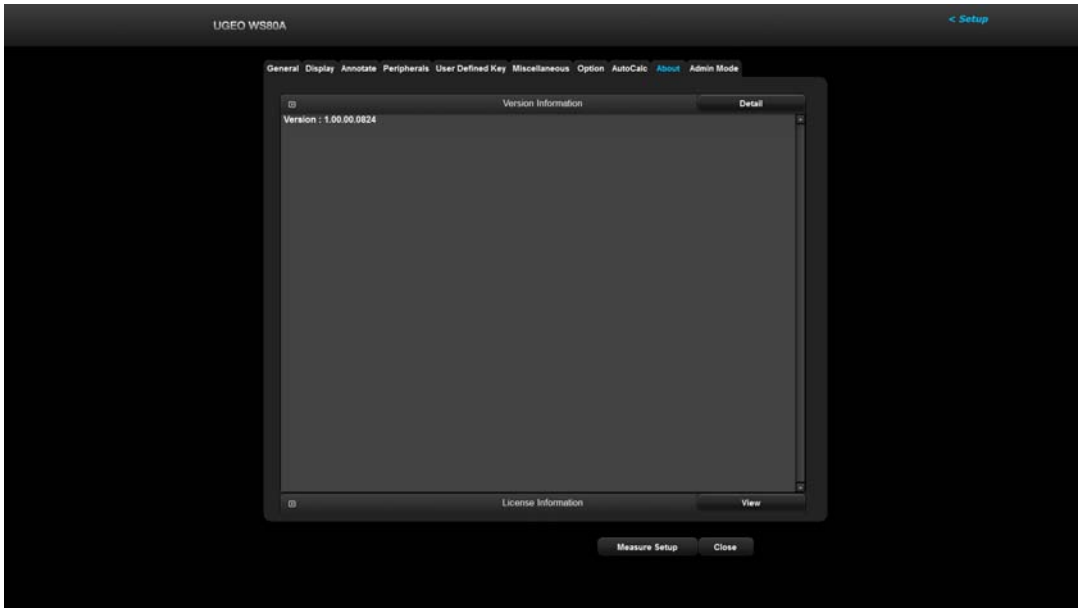
Adding and Deleting Options **11**

Adding an Option 12

System Information

On *Setup* screen, select **About** tab. Or tap **About** on the touch screen. The S/W version inform ation of the product will be displayed.

Click **Detail** to view more detailed information on the product version.



[Figure 6.1 Setup – Information]

* The actual system version may differ from the software version shown in the above image.

Windows Mode

This is to enter the Windows mode from the ultrasound system and update of software version is required.

Entering the Mode

1. On the keyboard, press ******* + ******* + ******* simultaneously.
2. When Windows Password window opens, enter "**********"을 and then press Enter.
3. When you press Shift + Ctrl + Esc, "Windows Task Manager" will open.

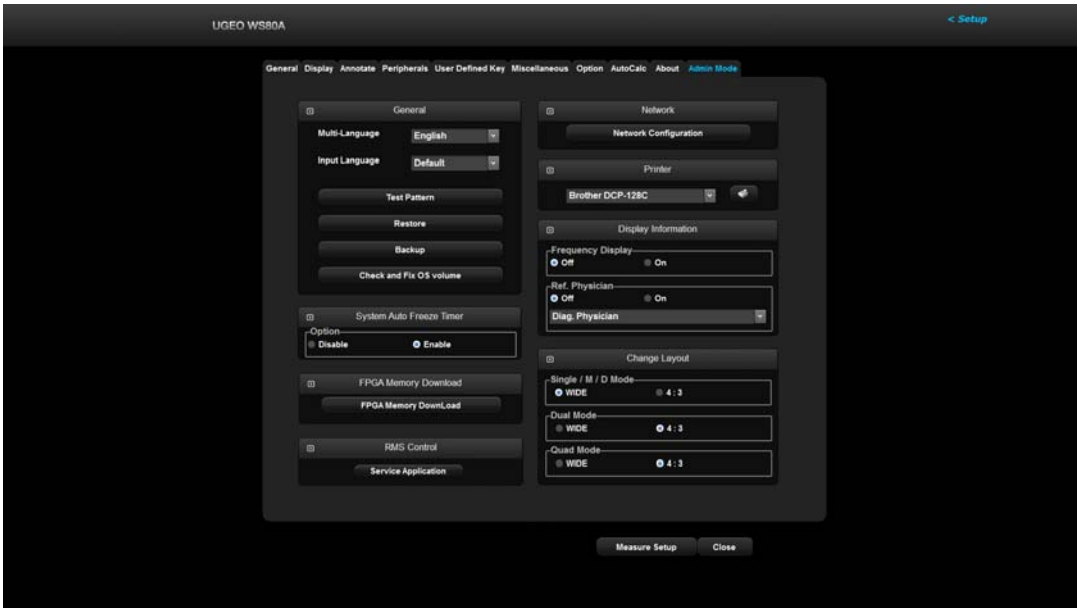
Admin Mode

Admin mode, also called Service mode, provides various functions, which are explained here.

These functions are needed for configuring important settings and adding or removing options.

Entering the Mode

1. On the keyboard, press ***.
2. Enter "**********" and then press Enter.
3. If the password is correct, the 'Admin Mode' tab will be created in Setup mode.
4. Select 'Admin Mode' to enter Admin mode.



[Figure 6.2 Admin Mode]

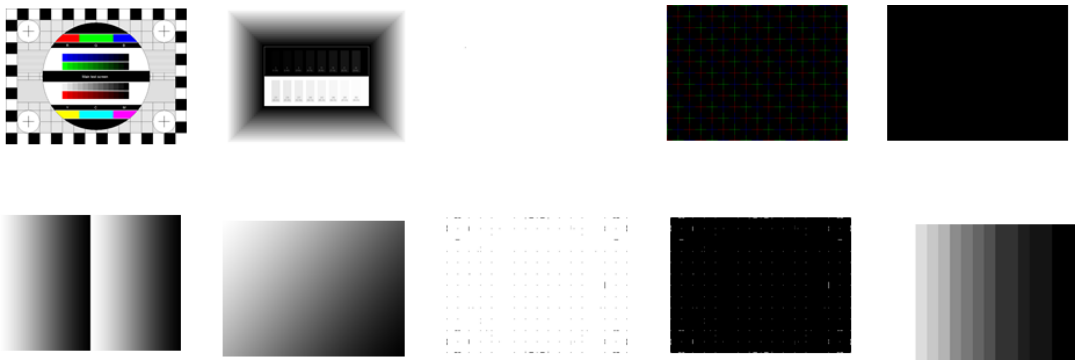
Admin Mode Functions

Language

Select the language you want the system to use. You can select by using the filter; select one of the following seven languages: English, German, French, Spanish, Italian, Russian, or Chinese.

Test Pattern

You can test the properties of the monitor. Select **Test Pattern**, and press the **Set** button on the keyboard to cycle through three different test patterns to test the monitor, as shown below in [Figure 6-3].

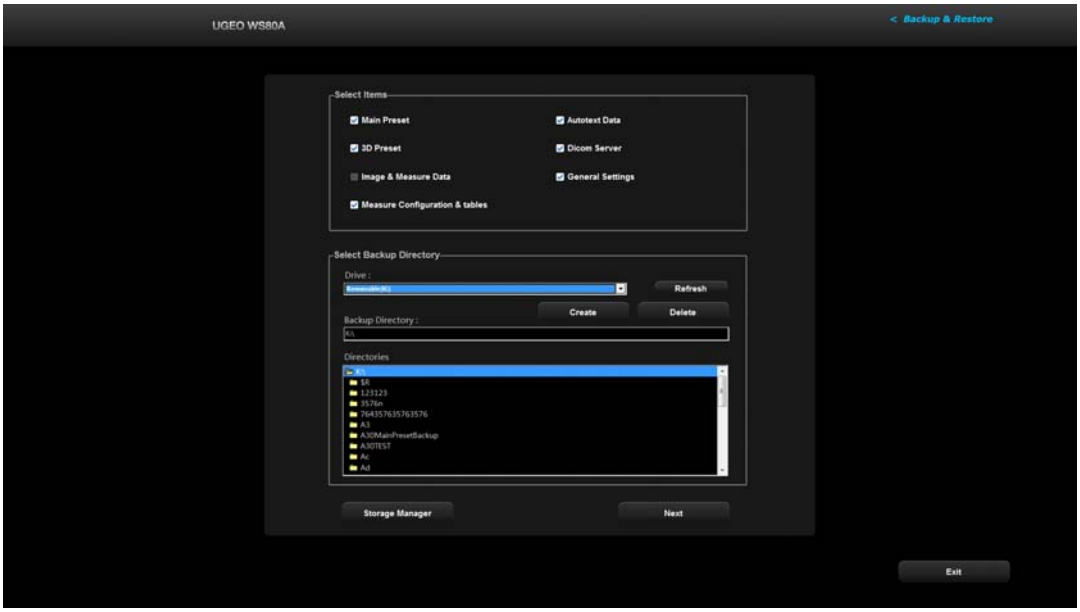


[Figure 6.3 Test Pattern]

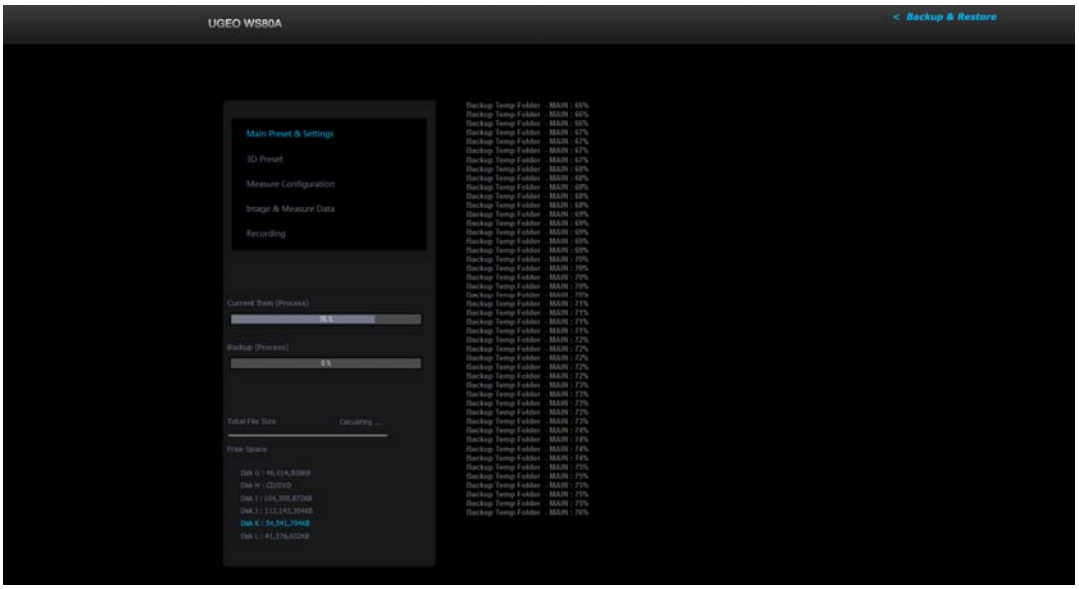
Backup

This function backs up the user settings to external media, and can only be performed in Admin mode.

1. When you press **Backup**, the ultrasound program will close, and the Backup function will be initiated. Select **OK** when you are asked whether you want to exit the ultrasound program before starting Backup.
2. In **Backup** screen, you can select user setting items and backup media.
3. Press **Next** to perform the Backup function.
4. The system will reboot when the backup is complete.



[Figure 6.4 Backup]

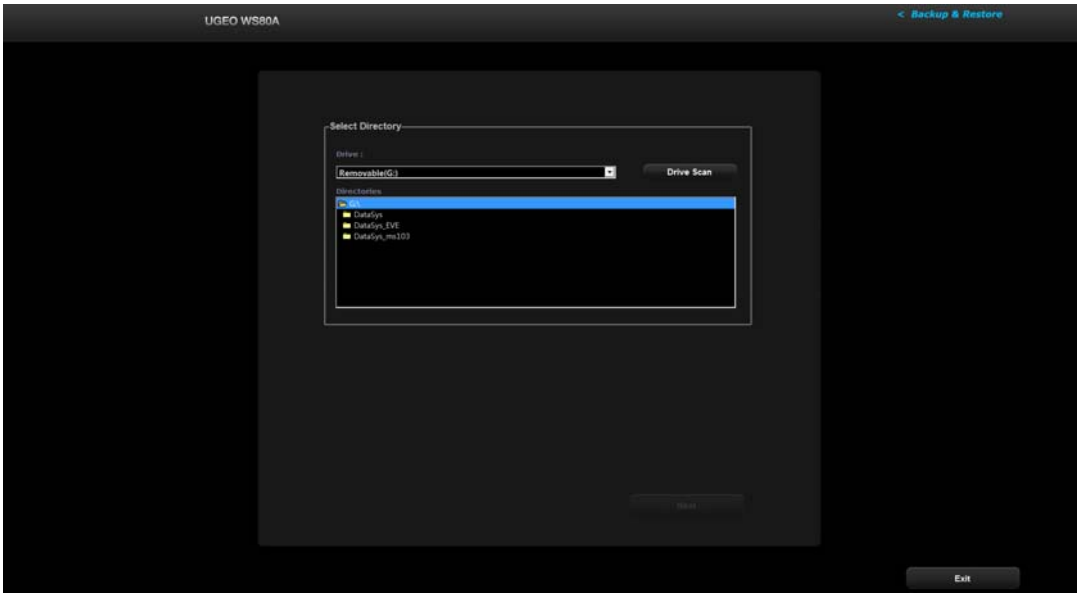


[Figure 6.5 Performing Backup]

Restore

This function restores the product with backed-up user settings, and can only be performed in Admin mode.

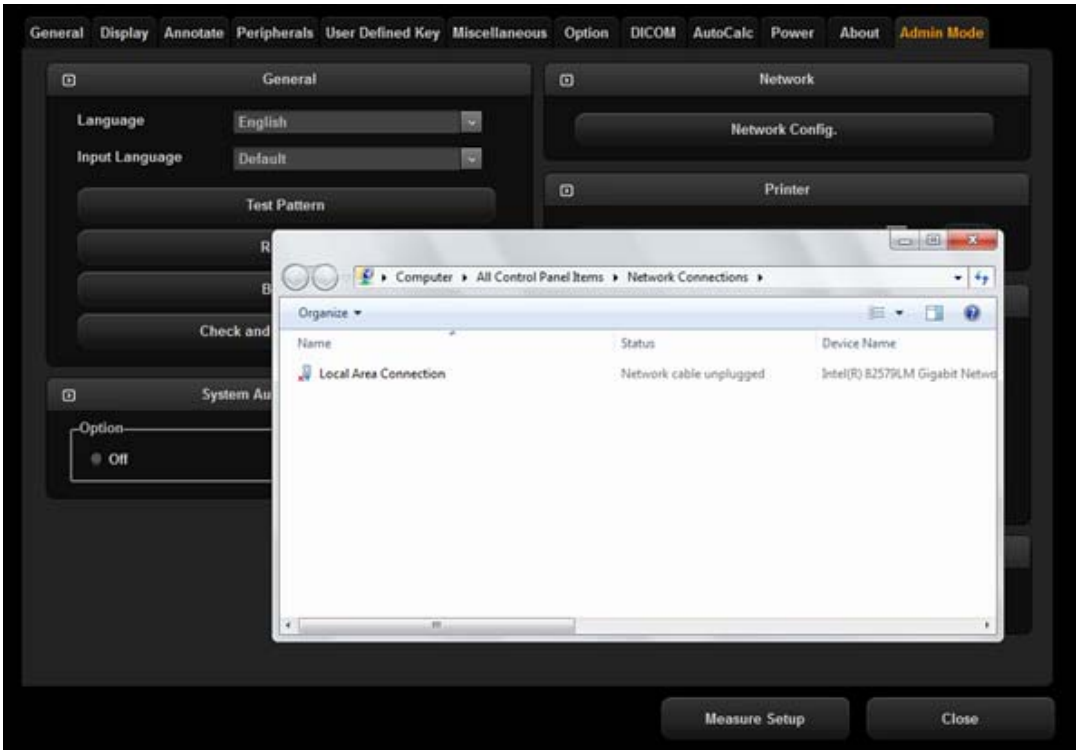
1. When you press **Restore**, the ultrasound program will close, and the Restore function will be initiated. Select **OK** when you are asked whether you want to exit the ultrasound program before starting Restore.
2. In the **Restore** screen, you can select user setting items and backup media.
3. Press **Next** to perform the Restore function.
4. The system will reboot when the restoration is complete.



[Figure 6.6 Restore]

Network Configuration

Selecting this option will take you to the Network Configuration screen of Windows. You can configure networks such as DICOM.



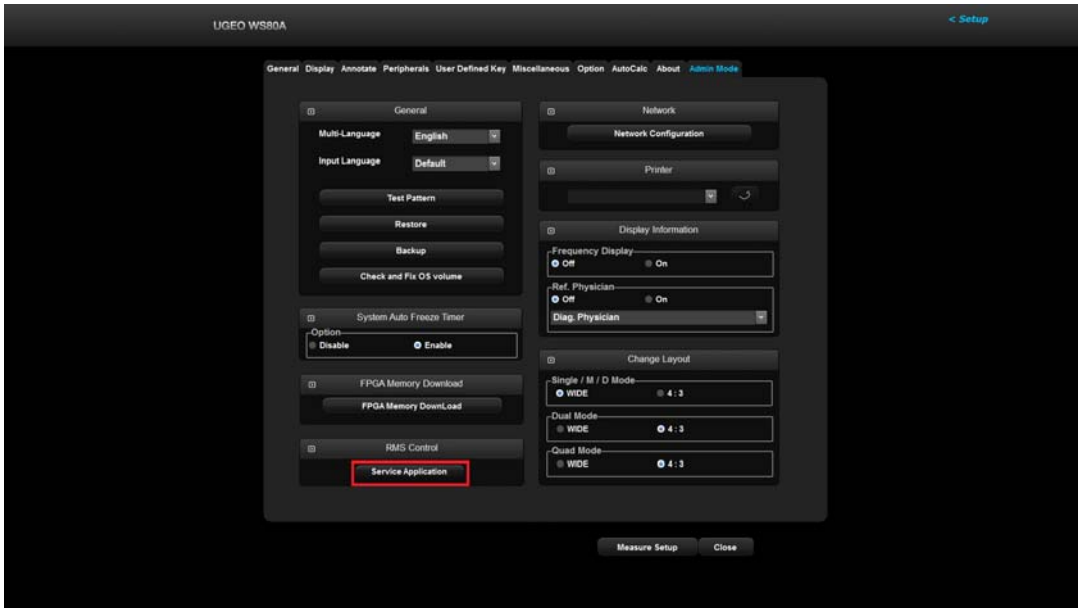
[Figure 6.7 Network Configuration]

Printer

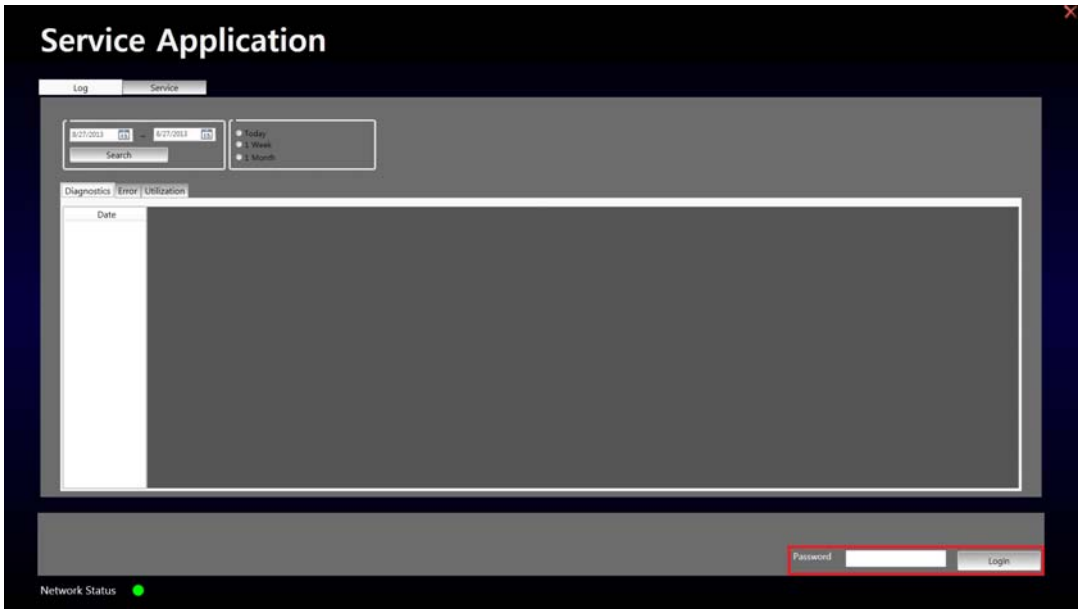
You can configure the Printing Preferences for the printer. After connecting the Samsung CLP-615NDK printer, and when the name of the printer is changed to Samsung CLP-615NDK Copy 1, you can use Printing Preferences settings to change the Paper settings for 615NDK from Letter to A4.

RMS Log Export

Supports the export function for the RMS logs. Press the Service Application button from the Admin mode to enter the Service Application mode.

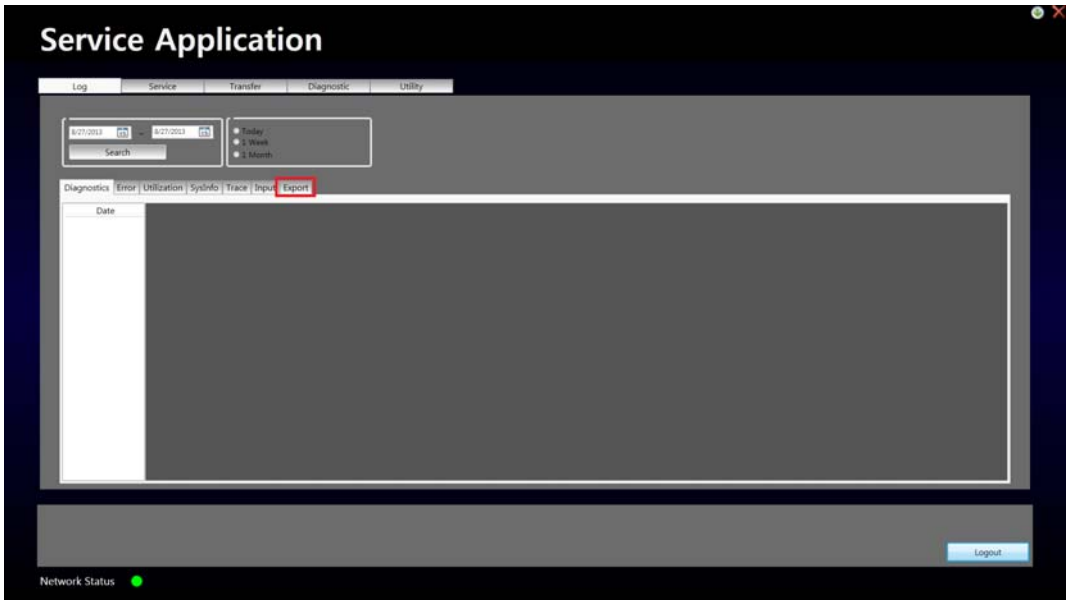


[Figure 6.8 Service Application]



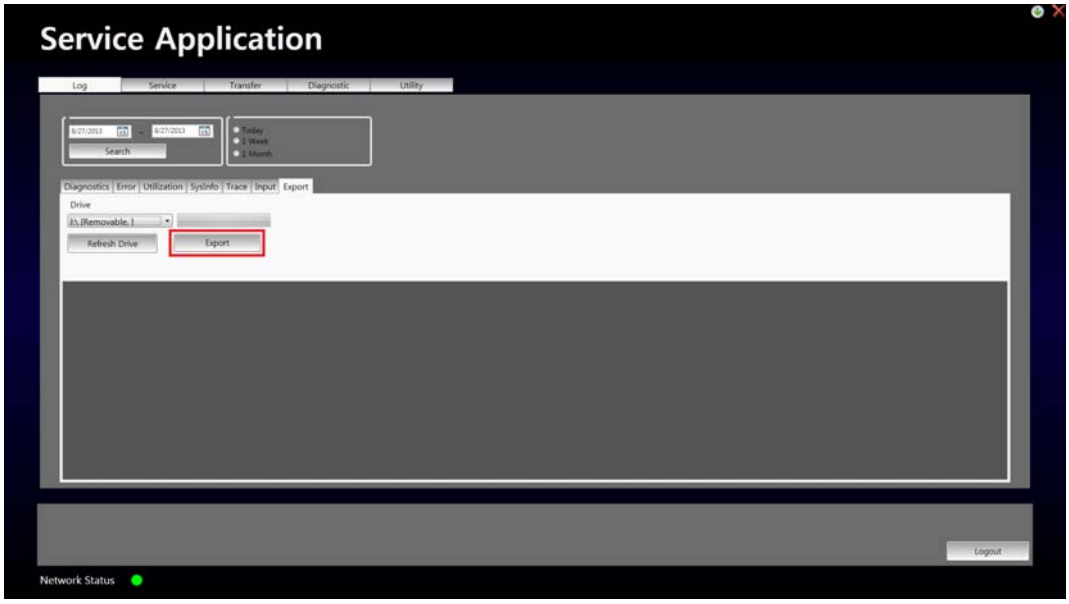
[Figure 6.9 Service Application]

After entering the page, enter the password, “****”, to log in and the following tab will be added. Select this tab to move to the Export tab.



[Figure 6.10 Service Application-Export]

Select a USB drive to save the Export result and select the Export button to export the RMS log.



[Figure 6.11 Service Application-Export]

Adding and Deleting Options

Options are added and deleted by using the Unlock/Lock method; Unlock means that an option can be used, while Lock means that the option cannot be used.

Options

This shows the types of optional software that can be installed on the product. Optional software for WS80A includes the following:

4D	Auto IMT
3D XI	Elastoscan
Volume NT	Panoramic
Cardiac Measurement	HDVI
CW Function	XI STIC
DICOM	ADVR
Spatial Compound	

Status

Status: Shows the current status of optional software.

Lock_Not Installed: Hardware is not connected.

Lock_Unregistered: The software license has not been registered yet.

Lock_Installed: Hardware is installed but cannot be used yet.

Unlock_Permanent: The hardware or software can be used for an unlimited period.

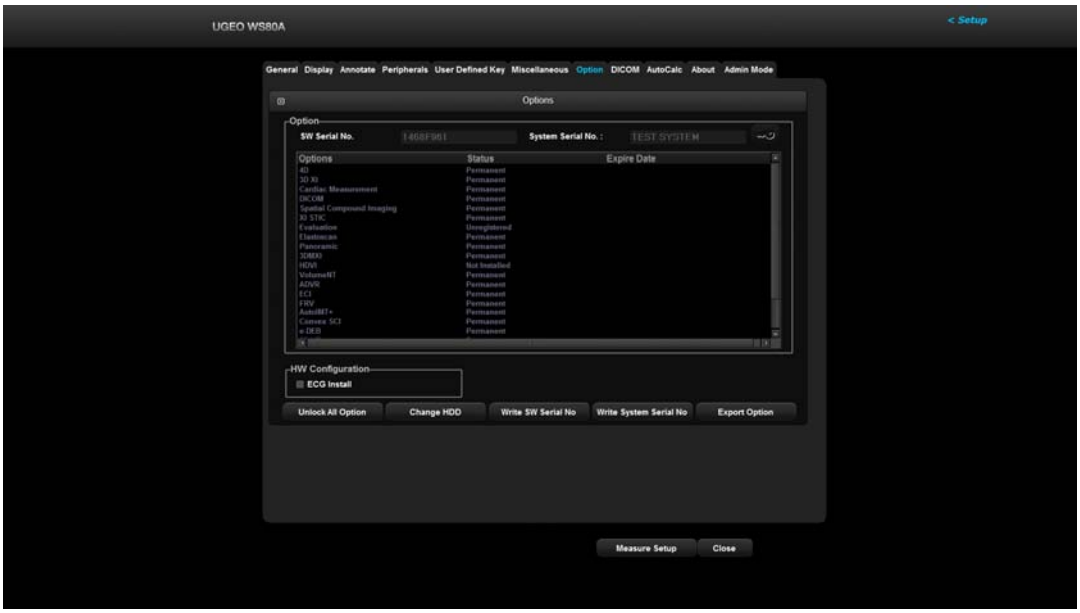
UnlLock_Restricted: The hardware or software can be used only for a certain period of time.

Adding an Option

Entering Option Password

The method of entering a password to add an option (Unlocking) is described.

1. Switch to Admin Mode. Please refer to ‘Entering Admin Mode’.
2. A key-shaped button will be enabled at the upper right corner of the Option tab. You can only enter the option password if this button is enabled.
3. Select the option that you want to add, and press the key-shaped button to enter the password.
4. If the password is correct, press **OK** button and reboot the system.



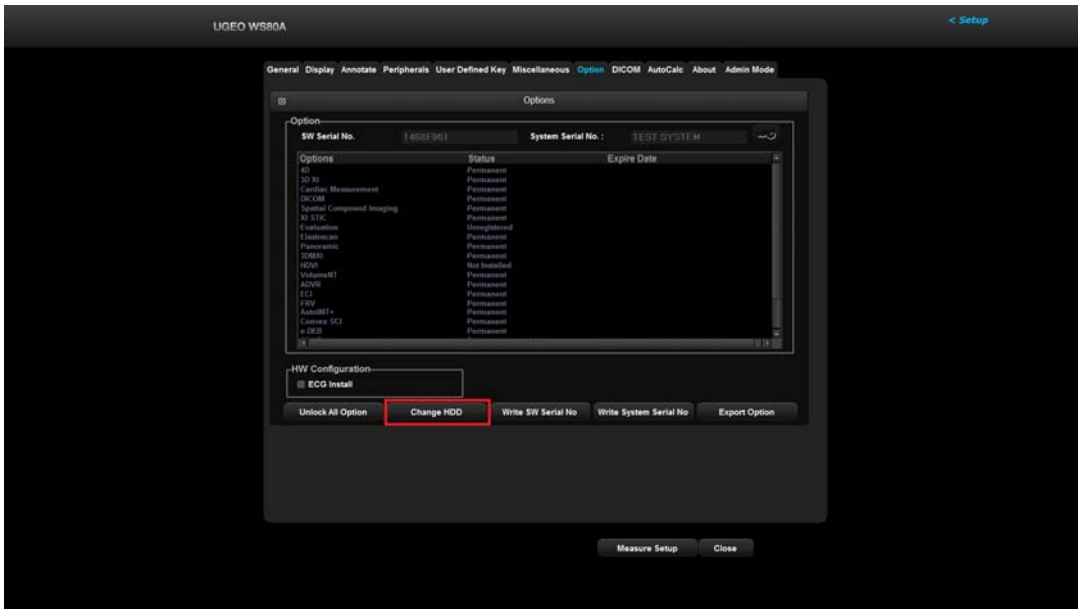
[Figure 6.12 Options]

Adding Option Password after Replacing HDD

WS80A is designed to preserve the option password even if the HDD fails and is replaced. The method of entering the option password (Unlocking) after replacing the HDD is described.

1. Switch to Admin Mode. Please refer to ‘Entering Admin Mode’.
2. A **Change HDD** button will be created in the middle of the Option tab.
3. When you press the **Change HDD** button, the option password for the product will be entered (Unlocked).
4. Check if the option is unlocked and reboot the system.

5. Select the option that you want to add, and press the key-shaped button to enter the password.
6. If the password is correct, press **OK** button and reboot the system.



[Figure 6.13 Change HDD]

Chapter 7

Troubleshooting

Power Issues 2

Power Does Not Turn On 2

Power Does Not Turn Off 2

Power Turns Off by Itself 3

Monitor 4

Nothing Is Displayed on the Screen 4

Screen is Discolored 4

Error Messages 5

Error Occurs during Booting 5

Image 6

2D Mode: There is No IMAGE ECHO or IMAGE FORMAT 6

Lines (Noise) Appear in 2D Mode Image 6

M, C, PW, CW Mode Trouble 6

Error Code 7

Power Issues

Power Does Not Turn On

The power cord may be unplugged or power supply may be broken.

1. Make sure the power cord is properly plugged and power switch is on.
2. Connect a different appliance to the power outlet to see whether it works.
   - If the appliance works, the power supply has failed.
   - If the appliance doesn't work, the power outlet has failed.
3. Check whether the system's fan works.
   - If the fan works, the problem is likely to be caused by some reason other than the Power Supply.
   - If the fan does not work, it is likely that the PC Power has failed.
4. Check the output voltage of ADM.
5. Check the PC Power and DDM.

Power Does Not Turn Off

A software error may have occurred, or the PC Motherboard and/or Main Board may have failed.

1. Press and hold the Power Switch for at least 3 seconds, and the power will turn off automatically.

   However, the power will not turn off if hardware such as the printer hasn't stopped working yet, or if an OS error has occurred.
2. If the method in "1" fails to turn off the power, it is likely that the PC board and/or BE board have failed.

Power Turns Off by Itself

The power cord, PC Motherboard, and/or Main Board may have failed.

1. Make sure the power cord is properly plugged and power switch is on.
2. Connect a different appliance to the power outlet to see whether it works.
   - If the appliance works, the power supply has failed.
   - If the appliance doesn't work, the power outlet has failed.
3. If the problem is not solved by the methods in '1' and '2', it is likely that the PC Motherboard, PCI Board, DVI Board, and/or LCD IF Board have failed.

Monitor

Nothing Is Displayed on the Screen

The DVI Cable, VGA Cable, the monitor, or the PC part may have failed.

1. Check the status of the product with the printer output.
2. Check the status of the monitor connection cable.
3. If the methods in ‘1’ and ‘2’ fail to solve the problem, it is likely that the monitor and/or the PC Part have failed.

   Check the DVI board and VGA card of the computer.

Screen is Discolored

The DVI Cable, the monitor, or the PC Part may have failed.

1. Check the status of the monitor connection cable.
2. If the method in '1'fails to solve the problem, it is likely that the monitor and/or PC part have failed.

   Check the DVI board and VGA card of the computer.

Error Messages

Error Occurs during Booting

A temporary error in the software or a temporary failure of the product may have occurred.

1. Force the power to turn off, and turn the power back on in 1~2 minutes.
2. If the method in “1” does not solve the problem, identify when the error message is shown.

   If the error occurs while WINDOWS is initiating, it is likely that the OS and/or PC part have failed.

   If the error occurs after the logo is displayed, it is likely that the System Software or Ultrasound System part has failed.

Image

2D Mode: There is No IMAGE ECHO or IMAGE FORMAT

Contact between the probe and the product may be poor, or the Main Board or DDM may have failed.

1. Check whether the contact between the probe and the system is poor.
2. Check the probe for vibrating sound. If you can hear the sound, it is likely that DDM has failed.
3. If the methods in "1" and "2" fail to solve the problem, it is likely that the Main Board has failed.

Lines (Noise) Appear in 2D Mode Image

Power noise and/or Main Board failure may have occurred.

1. Check whether the product is sharing its power outlet with another appliance.

   Sharing a power outlet with a motor or other appliance that consumes large amount of power may cause noise.
2. Check whether the symptom persists when you plug the system into an outlet in a different room.

   If the noise occurs, it is caused by power noise.
3. If the methods in "1" and "2" fail to solve the problem, it is likely that the Main Board has failed.

M, C, PW, CW Mode Trouble

It is likely that Main Board has failed.

Error Code

Error code	Location of failure	Estimated failure
0	FILE and OTHERS	FILE_NOT_FOUND
1	FILE and OTHERS	DEMO_PERIOD_EXPIRED_ERROR
2	FILE and OTHERS	CRC32DLL_LOAD_FAIL
10	PC Module, MAIN Board	C_INTERFACE_OPENDMA_FAIL_IN_HWINIT
15	MAIN Board(BE & OS)	PC_INTERFACE_INIT_INTERRUPT_FAIL
21	MAIN Board(AC part)	NO_MOTOR_CONTROL_FOUND
22	MAIN Board(AC part)	MOTOR_NULL_POSITION_LOST
23	MAIN Board(AC part)	MOTOR_CONTROL_SEQUENCE_BROKEN
24	MAIN Board(AC part)	GAIAMOT_DLL_LOAD_ERROR
25	MAIN Board(AC part)	GAIAMOT_DLL_OLD_LOAD_ERROR
40	BF Board	FPGA_DOWNLOAD_ERROR_BF
163	MAIN Board(AC part)	BF_DMA_WRITE_CHECKSUM_ERROR
100	MAIN Board(BE part)	FPGA_DOWNLOAD_ERROR_BE
101	MAIN Board(CW part)	FPGA_DOWNLOAD_ERROR_DMA
102	MAIN Board(BE part)	FPGA_DOWNLOAD_ERROR_DMA
114	MAIN Board(BE part)	RTC_STOP_ERROR
162	DDM, BF Board	HV_HIGH

[Table 7.1] Error Code Table

Chapter 8

Disassembly and Assembly

Caution 2

Preparation 2

Disassembling the Product 3

Front Cover Disassembly 3

Rear Cover Disassembly 5

Control Panel Disassembly 7

Monitor Disassembly 8

Monitor Arm Disassembly 9

Assembling the Product 11

Caution

This chapter describes the assembly/disassembly process of WS80A. Refer to this chapter for upgrade or repair of the hardware.

WARNING	■ Samsung Medison Global Technology Support Group or its authorized engineers are allowed to repair or replace the parts of the products. ■ The interior of this product contains dangerous high-voltage electricity. Do not disassemble the product; there is a risk of electrocution. ■ Do not wear an antistatic wrist strap while you are working when the product is powered on; you may sustain an electrical injury.

Preparation

You will need the following items: A crosshead (+) screwdriver, antistatic gloves, and an antistatic wrist strap.

Turn off the power of the product, and disconnect the battery

NOTE	Wear antistatic gloves and a wrist strap when you are disassembling or assembling the product. They help prevent accidents that could injure the engineer, and product failure caused by static electricity.

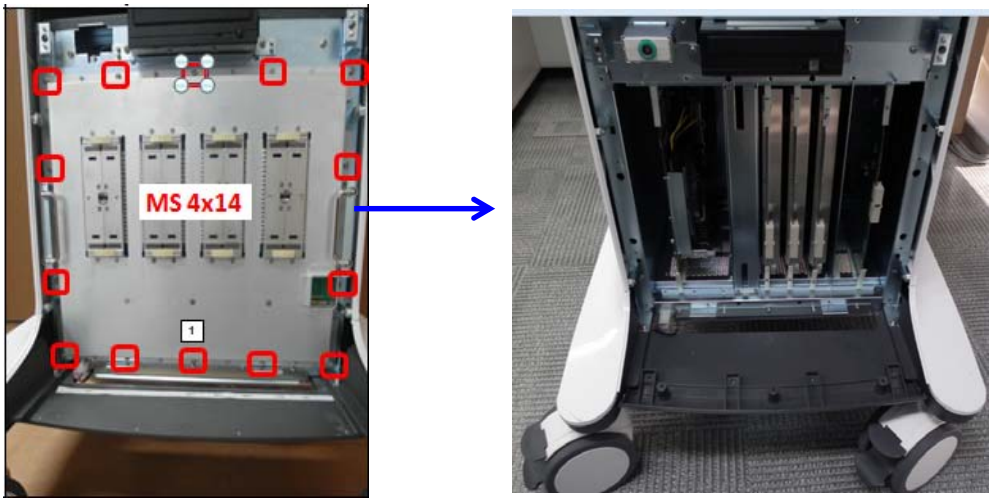
[Figure 8.1] Antistatic Gloves and Wrist Strap

Disassembling the Product

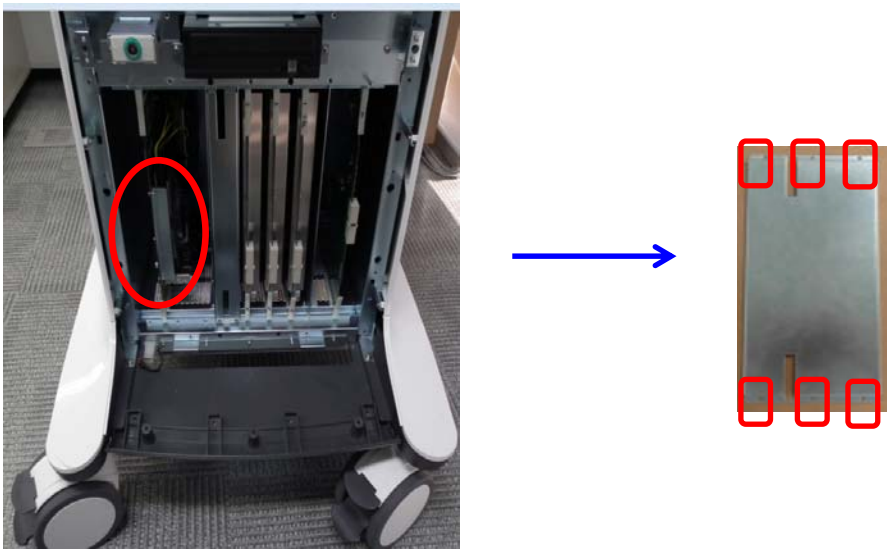
Front Cover Disassembly

1. Remove 3 screws and pull the front cover to the front to detach.

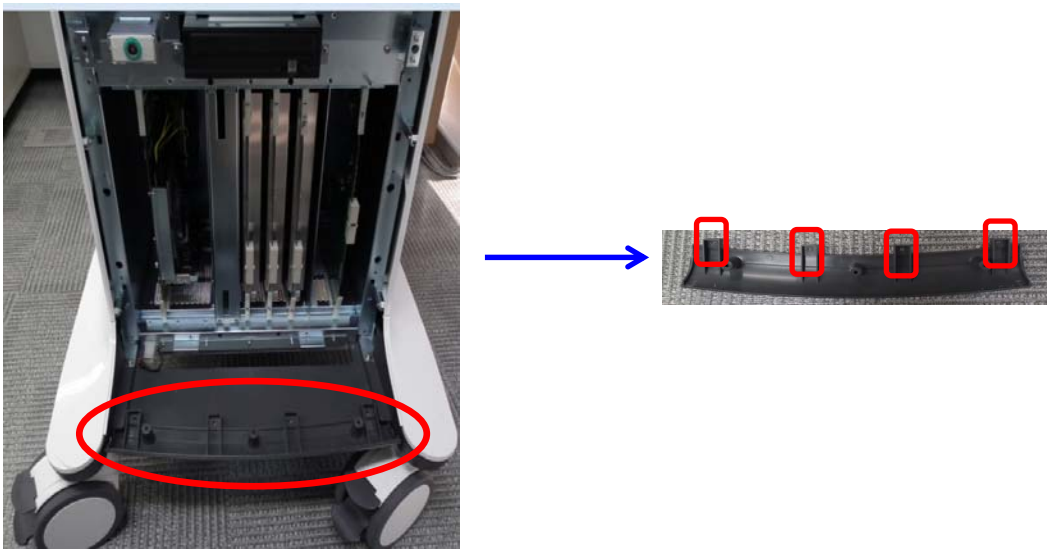
2. Remove 14 screws and detach PSA.



3. Remove 6 screws and detach the cover.



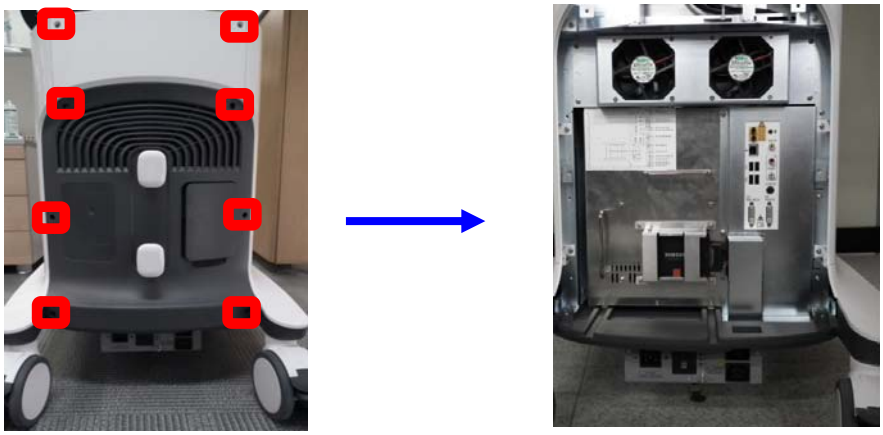
4. Remove 4 screws and detach the cover.



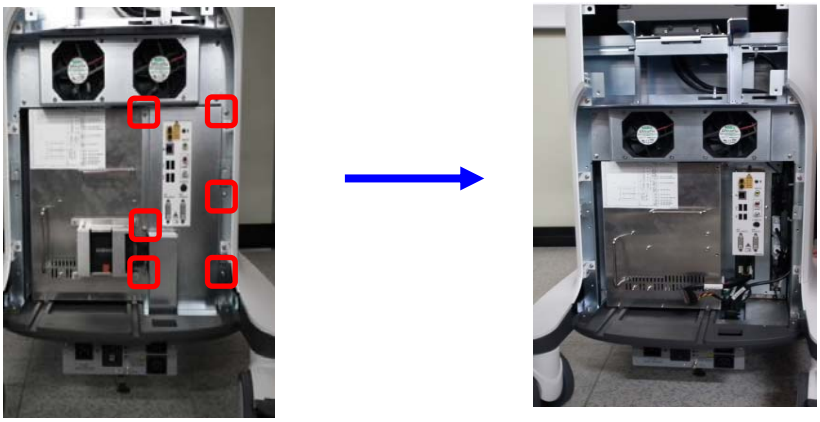
5. Remove 5 screws and 1 connector and detach the fan.

Rear Cover Disassembly

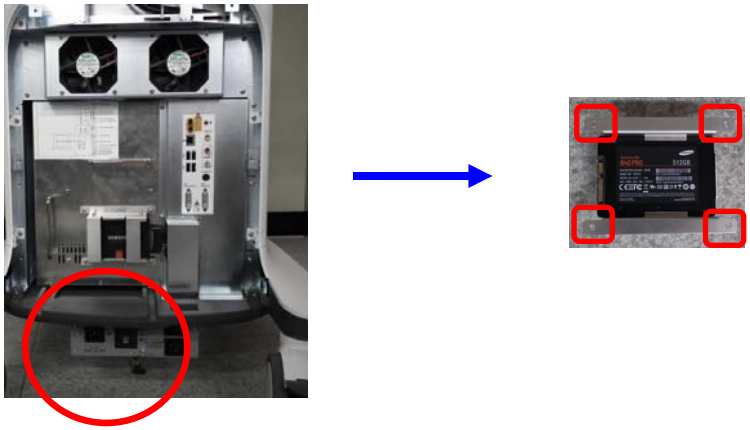
1. Remove 8 screws and detach the rear cover.



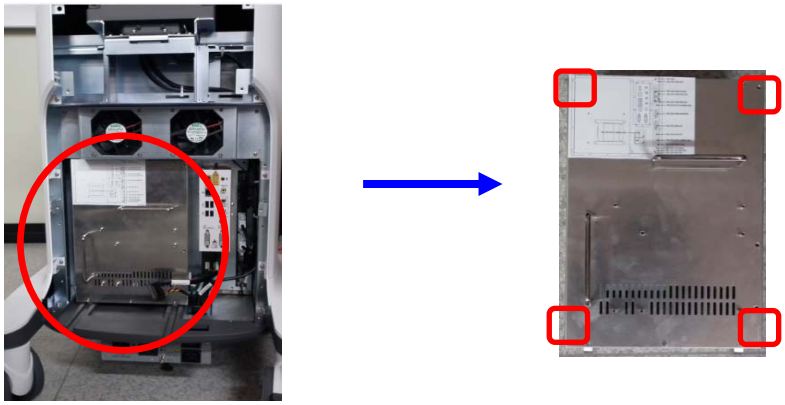
2. Remove 6 screws and detach the shield cover.



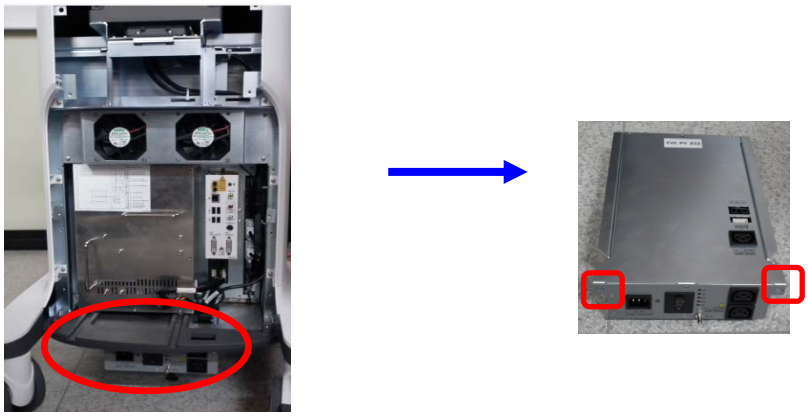
3. Remove 4 screws and detach SSD.



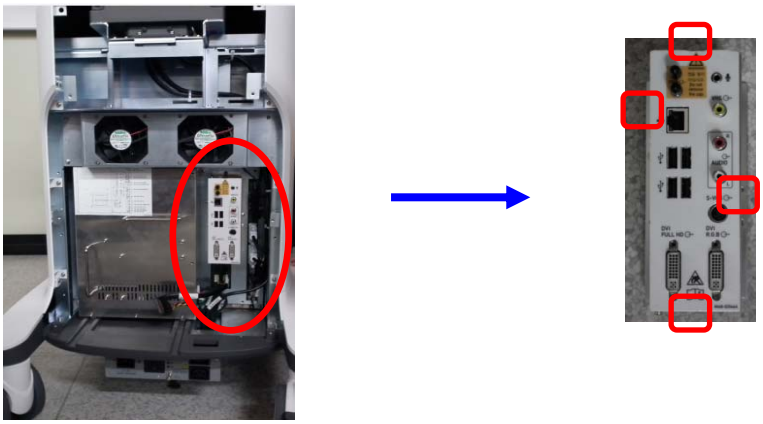
4. Remove 4 screws and detach DDM.



5. Remove 4 screws and detach ADM.

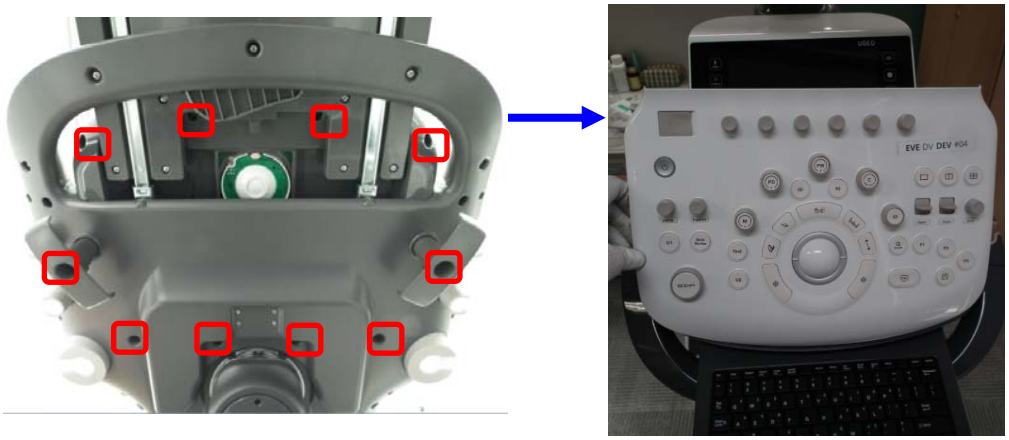


6. Remove 4 screws and detach the rear.

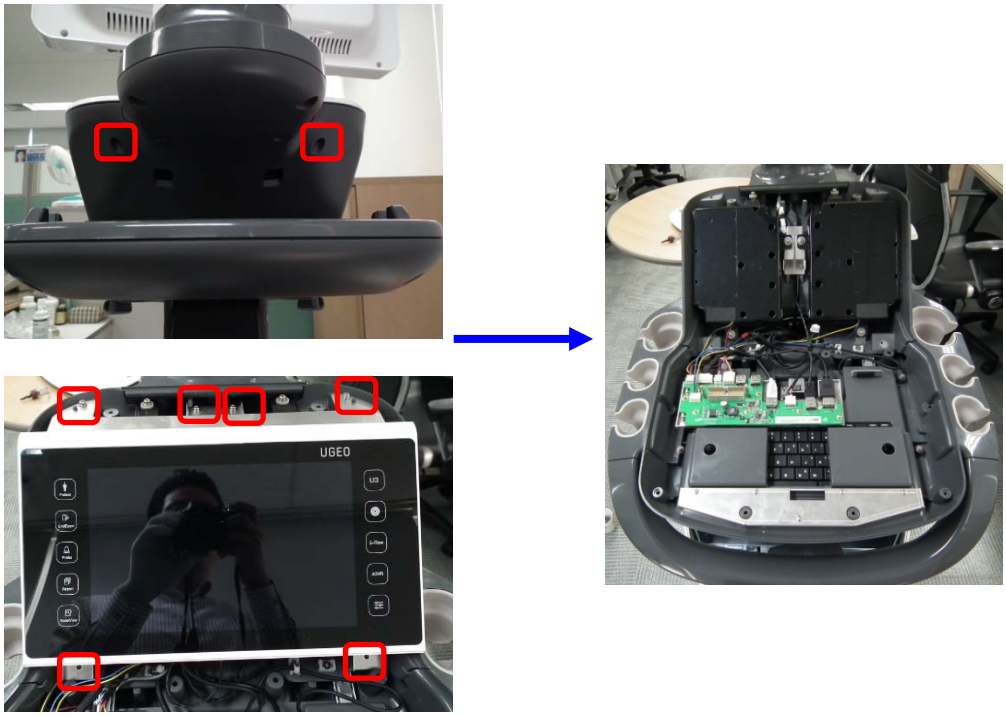


Control Panel Disassembly

1. Remove 10 screws on the floor of the control panel and lift the CP module to detach.

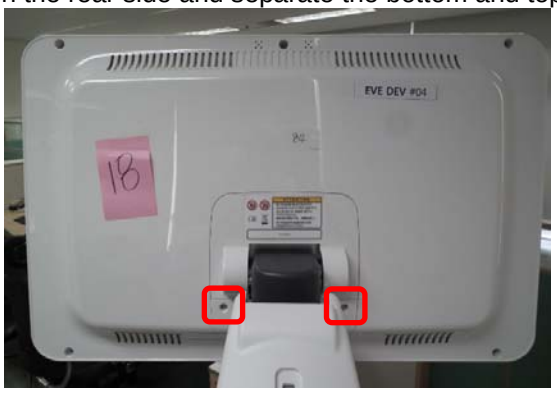


2. Remove 8 screws and detach the touch panel.

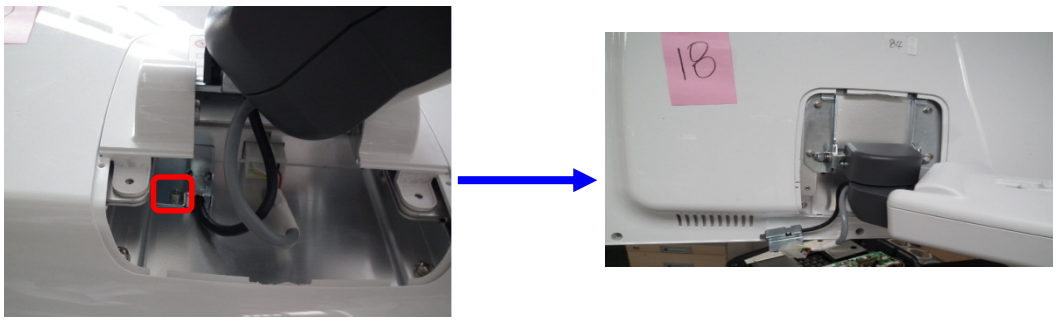


Monitor Disassembly

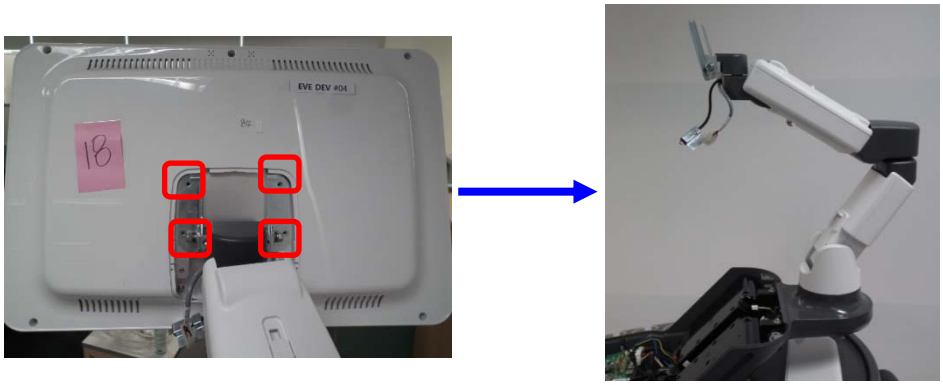
1. Remove 2 screws on the rear side and separate the bottom and top cover.



2. Remove 8 screws and detach the touch panel.



3. Remove 4 screws and detach the monitor module.

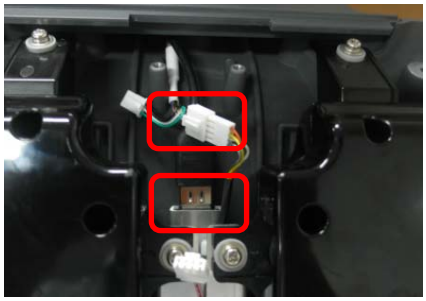


Monitor Arm Disassembly

1. Pull the right cap to the right to detach (6 hooks, not screw.)

2. Remove 2 screws and detach the left cap.

3. Separate 2 connectors.



3. Remove 4 screws which fix the arm and detach the arm.





Assembling the Product

To assemble the product, follow the disassembly procedure described in this chapter in reverse order.

Chapter 9

Probe

Probe 2

Ultrasound Transmission Gel 15

Using Sheaths..... 16

Probe Precautions 17

Cleaning and Disinfecting the Probe 19

Probe

A probe is a device that sends and receives ultrasound for acquiring image data. It is also called a Transducer or a Scanhead.
The system limits patient contact temperature to 43 degrees Celsius, and acoustic output values to their respective FDA limits. A power protection fuse circuit protects against overcurrent conditions. If the power-monitoring protection circuit senses an overcurrent condition, the drive current to the probe is shut off immediately, preventing overheating of the probe surfaces and limiting acoustic output.

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.

■ Probe Application and Preset

Probes, applications and presets available for this product are as follows:

Probe	Application	Preset
L3-12A	Small Parts	Bowel, Breast, Breast1, Testicle, Thyroid
	Vascular	Arterial, Carotid, Venous
	MSK	Shoulder/Knee, Hand/Foot, Elbow/Wrist, Penetration, Pediatric Hip
	Abdomen	General, Superficial, Pediatric ABD
	OB	1st Trimester
L5-13	Small Parts	Bowel, Breast, Testicle, Thyroid
	Vascular	Arterial, Carotid, Venous
	MSK	Shoulder/Knee, Hand/Foot, Elbow/Wrist
LA2-9A	Small Parts	Bowel, Breast, Testicle, Thyroid
	Vascular	Arterial, Carotid, Venous
	Abdomen	General
	MSK	General
LA3-16A	Small Parts	Bowel, Breast, Testicle, Thyroid
	Vascular	Arterial, Carotid, Venous
	MSK	Shoulder/Knee, Hand/Foot, Elbow/Wrist, Penetration

Probe	Application	Preset
LA3-16AI	MSK	General, Superficial
	Intraoperative	General
LA4-18B	Small Parts	Breast, Testicle, Thyroid
	Vascular	Superficial, Carotid
	MSK	General, Superficial
C2-6	Abdomen	Aorta, General, Renal
	OB	1st Trimester, 2nd Trimester, 3rd Trimester, Fetal Heart, NT, Fetal Heart_Pen
	Gynecology	General, Adnexa
CA1-7A	Abdomen	Aorta, General, General1, Pediatric ABD, Penetration, Renal, Urology
	OB	1st Trimester, 2nd Trimester, 3rd Trimester, Fetal Heart, NT
	Gynecology	General, Adnexa
	MSK	General, Spine
CA2-8A	Abdomen	Aorta, General, Renal
	OB	1st Trimester, 2nd Trimester, 3rd Trimester, Fetal Heart, NT
	Gynecology	General, Adnexa
CA2-9A	Abdomen	Aorta, General, Renal
	OB	1st Trimester, 2nd Trimester, 3rd Trimester, Fetal Heart, NT
	Gynecology	General, Adnexa
CA3-10A	Abdomen	Bowel, General, Renal
	OB	1st Trimester, 2nd Trimester, NT
	Gynecology	Uterus, Adnexa
	Pediatric	Pediatric ABD, Pediatric Hip
	Vascular	Arterial, Venous
CF4-9	Pediatric	Abdomen, Neohead
	Vascular	Arterial, Carotid, Venous
SC1-6	Abdomen	Aorta, General, Renal, Penetration
	OB	1st Trimester, 2nd Trimester, 3rd Trimester, Fetal Heart, NT
	Gynecology	General, Adnexa
E3-12A	OB	1st Trimester
	Gynecology	General, Adnexa
	Urology	Prostate
EA2-11B	OB	1st Trimester
	Gynecology	General, Adnexa

Probe	Application	Preset
	Urology	Prostate
VR5-9	OB	1st Trimester
	Gynecology	General, Adnexa
	Urology	Prostate
PA3-8B	Abdomen	Aorta, General, Renal
	Cardiac	Aortic Arch, Adult Echo, Ped Echo
	Pediatric	Abdomen, NeoHead
PE2-4	Abdomen	Aorta, General, Renal
	Cardiac	Aortic Arch, Adult Echo, Adult Echo1, Adult Echo2, Ped Echo
	TCD	General
PM1-6A	Abdomen	Aorta, General, Renal
	Cardiac	Aortic Arch, Adult Echo, Ped Echo
	TCD	General
CV1-8A	Abdomen	Aorta, General, Renal
	OB	1st Trimester, 2nd Trimester, 3rd Trimester, Fetal Heart, NT, Fetal Heart_Pen
	Gynecology	General, Adnexa
LV3-14A	Small Parts	Breast, Testicle, Thyroid
	Vascular	Arterial, Carotid, Venous
	MSK	Shoulder/Knee, Hand/Foot, Elbow/Wrist
V4-8	Abdomen	Aorta, General, Renal
	OB	1st Trimester, 2nd Trimester, 3rd Trimester, Fetal Heart, NT
	Gynecology	General, Adnexa
V5-9	OB	1st Trimester
	Gynecology	General, Adnexa
	Urology	Prostate

NOTE

- Other than the system-optimized presets, users may configure the usersets to meet the needs.
- For more information on selecting and configuring a probe, please refer to 'Chapter 3. Starting Diagnosis' in the operation manual.

■ Function List

The functions available in this product for various probes and applications are as follows:

Probe	Application	Harmonic	S-Harmonic	Multi Vision	Clear Vision	Q Scan	ECG	Elasto Scan	Biopsy
L3-12A	Small Parts	O	O	O	O	O	O	O (Only Breast, Breast1, Thyroid)	O
	Vascular	O	O	O	O	O	O	X	O
	MSK	O	X	O	O	O	O	X	O
	Abdomen	O	O	O	O	O	O	X	O
	OB	O	X	O	O	O	X	X	O
L5-13	Small Parts	O	X	O	O	O	O	O (Only Breast, Thyroid)	O
	Vascular	O	X	O	O	O	O	X	O
	MSK	O	X	O	O	O	O	X	O
LA2-9A	Small Parts	O	O	O	O	O	O	X	O
	Vascular	O	O	O	O	O	O	X	O
	Abdomen	O	O	O	O	O	O	X	O
	MSK	O	O	O	O	O	O	X	O
LA3-16A	Small Parts	O	X	O	O	O	O	O (Only Breast, Thyroid)	O
	Vascular	O	X	O	O	O	O	X	O
	MSK	O	X	O	O	O	O	X	O
LA3-16AI	MSK	O	X	O	O	O	O	X	X
	Intraoperative	O	X	O	O	O	O	X	X
LA4-18B	Small Parts	O	O	O	O	O	O	X	O
	Vascular	O	O	O	O	O	O	X	O
	MSK	O	O	O	O	O	O	X	O
C2-6	Abdomen	O	O	X	O	O	X	X	O
	OB	O	O	O	O	O	X	X	O
	Gynecology	O	O	X	O	O	X	X	O
CA1-	Abdomen	O	O	O	O	O	X	X	O

Probe	Application	Harmonic	S-Harmonic	Multi Vision	Clear Vision	Q Scan	ECG	Elasto Scan	Biopsy
7A	OB	O	O	O	O	O	X	X	O
	Gynecology	O	O	O (Except Adnexa)	O	O	X	X	O
	MSK	O	O	O	O	O	X	X	O
CA2-8A	Abdomen	O	O	O (Only General)	O	O	X	X	O
	OB	O	O	O	O	O	X	X	O
	Gynecology	O	O	X	O	O	X	X	O
CA2-9A	Abdomen	O	O	O	O	O	X	X	O
	OB	O	O	O	O	O	X	X	O
	Gynecology	O	O	O	O	O	X	X	O
CA3-10A	Abdomen	O	O	O	O	O	X	X	O
	OB	O	O	O	O	O	X	X	O
	Gynecology	O	O	O	O	O	X	X	O
	Pediatric	O	O	O	O	O	X	X	O
	Vascular	O	O	O	O	O	X	X	O
CF4-9	Pediatric	X	X	X	O	O	X	X	X
	Vascular	X	X	X	O	O	X	X	X
SC1-6	Abdomen	O	O	O	O	O	X	X	O
	OB	O	O	O	O	O	X	X	O
	Gynecology	O	O	X	O	O	X	X	O
E3-12A	OB	O	X	O	O	O	X	X	X
	Gynecology	O	X	O	O	O	X	O	X
	Urology	O	X	O	O	O	X	O	X
EA2-11B	OB	O	X	O	O	O	X	X	O
	Gynecology	O	X	O	O	O	X	O	O
	Urology	O	X	O	O	O	X	O	O
VR5-9	OB	O	X	O	O	O	X	X	O
	Gynecology	O	X	O	O	O	X	O	O
	Urology	O	X	O	O	O	X	O	O
PA3-8B	Abdomen	O	O	X	O	O	X	X	X
	Cardiac	O	O	X	O	O	O	X	X
	Pediatric	O	O	X	O	O	X	X	X
PE2-4	Abdomen	O	O	X	O	O	X	X	X

Probe	Application	Harmonic	S-Harmonic	Multi Vision	Clear Vision	Q Scan	ECG	Elasto Scan	Biopsy
	Cardiac	O	O	X	O	O	O	X	X
	TCD	O	O	X	O	O	X	X	X
PM1-6A	Abdomen	O	O	X	O	O	X	X	X
	Cardiac	O	O	X	O	O	O	X	X
	TCD	O	O	X	O	O	X	X	X
CV1-8A	Abdomen	O	O	X	O	O	X	X	O
	OB	O	O	O	O	O	X	X	O
	Gynecology	O	O	X	O	O	X	X	O
LV3-14A	Small Parts	O	X	O	O	O	X	X	O
	Vascular	O	X	O	O	O	X	X	O
	MSK	O	X	O	O	O	X	X	O
V4-8	Abdomen	O	O	X	O	O	X	X	O
	OB	O	O	O	O	O	X	X	O
	Gynecology	O	O	X	O	O	X	X	O
V5-9	OB	O	X	O	O	O	X	X	O
	Gynecology	O	X	O	O	O	X	X	O
	Urology	O	X	O	O	O	X	X	O

NOTE

The significance of each symbol is as follows:

- Har: Harmonic imaging
- PI: Pulse Inversion
- Q Scan: Quick Scan
- ECG: Electro Cardio Graph Imaging
- CM: Color M
- TDI: Tissue Doppler
- PD: Power Doppler
- TDW: Tissue Doppler Wave
- CW: Continuous Wave

Probe	Application	CM	TDI	PD	S-Flow	TDW	CW
L3-12A	Small Parts	X	X	O	O	X	X
	Vascular	X	X	O	O	X	X
	MSK	X	X	O	O	X	X
	OB	X	X	O	O	X	X
L5-13	Small Parts	X	X	O	O	X	X
	Vascular	X	X	O	O	X	X
	MSK	X	X	O	O	X	X
LA2-9A	Small Parts	X	X	O	O	X	X
	Vascular	X	X	O	O	X	X
	Abdomen	X	X	O	O	X	X
	MSK	X	X	O	O	X	X
LA3-16A	Small Parts	X	X	O	O	X	X
	Vascular	X	X	O	O	X	X
	MSK	X	X	O	O	X	X
LA3-16AI	MSK	X	X	O	O	X	X
	Intraoperative	X	X	O	O	X	X
LA4-18B	Small Parts	X	X	O	O	X	X
	Vascular	X	X	O	O	X	X
	MSK	X	X	O	O	X	X
C2-6	Abdomen	X	X	O	O	X	X
	OB	O (Only Fetal Heart)	X	O (Except Fetal Heart)	O	X	X
	Gynecology	X	X	O	O	X	X
CA1-7A	Abdomen	X	X	O	O	X	X
	OB	O (Only Fetal Heart)	X	O (Except Fetal Heart)	O	X	X
	Gynecology	X	X	O	O	X	X
CA2-8A	Abdomen	O	X	O	O	X	X
	OB	O (Only Fetal Heart)	X	O (Except Fetal Heart)	O	X	X
	Gynecology	O	X	O	O	X	X
CA2-9A	Abdomen	X	X	O	O	X	X
	OB	O (Only Fetal Heart)	X	O	O	X	X

Probe	Application	CM	TDI	PD	S-Flow	TDW	CW
	Gynecology	X	X	O	O	X	X
CA3-10A	Abdomen	X	X	O	O	X	X
	OB	X	X	O	O	X	X
	Gynecology	X	X	O	O	X	X
	Pediatric	X	X	O	O	X	X
	Vascular	X	X	O	O	X	X
CF4-9	Pediatric	X	X	O	O	X	X
	Vascular	X	X	O	O	X	X
SC1-6	Abdomen	X	X	O	O	X	X
	OB	O (Only Fetal Heart)	X	O (Except Fetal Heart)	O	X	X
	Gynecology	X	X	O	O	X	X
E3-12A	OB	X	X	O	O	X	X
	Gynecology	X	X	O	O	X	X
	Urology	X	X	O	O	X	X
EA2-11B	OB	X	X	O	O	X	X
	Gynecology	X	X	O	O	X	X
	Urology	X	X	O	O	X	X
VR5-9	OB	X	X	O	O	X	X
	Gynecology	X	X	O	O	X	X
	Urology	X	X	O	O	X	X
PA3-8B	Abdomen	X	X	O	O	X	O
	Cardiac	O	O	X	X	O	O
	Pediatric	X	X	O	O	X	O
PE2-4	Abdomen	X	X	O	O	X	O
	Cardiac	O	O	X	X	O	O
	TCD	X	X	O	O	X	O
PM1-6A	Abdomen	X	X	O	O	X	O
	Cardiac	O	O	X	X	O	O
	TCD	X	X	O	O	X	O
CV1-8A	Abdomen	X	X	O	O	X	X
	OB	O (Only Fetal Heart)	X	O (Except Fetal Heart)	O	X	X
	Gynecology	X	X	O	O	X	X

Probe	Application	CM	TDI	PD	S-Flow	TDW	CW
LV3-14A	Small Parts	X	X	O	O	X	X
	Vascular	X	X	O	O	X	X
	MSK	X	X	O	O	X	X
V4-8	Abdomen	X	X	O	O	X	X
	OB	O (Only Fetal Heart)	X	O (Except Fetal Heart)	O	X	X
	Gynecology	X	X	O	O	X	X
V5-9	OB	X	X	O	O	X	X
	Gynecology	X	X	O	O	X	X
	Urology	X	X	O	O	X	X

NOTE

The symbols used in the table have the following meanings:

- S-Har: S-Harmonic Imaging
- Q Scan: Quick Scan
- ECG: Electro Cardio Graph Imaging
- CM: Color M
- TDI: Tissue Doppler
- PD: Power Doppler
- TDW: Tissue Doppler Wave
- CW: Continuous Wave

Thermal Index (TI Table)

The Thermal Index (TI) is displayed in the Title area of the screen, and represents the probability of temperature rise in a particular area of the body. Depending on body parts, thermal indices are categorized as soft tissue thermal index (TIs), bone thermal index (TIb), and cranial bone thermal index (TIc). This product automatically displays an appropriate thermal index for the current probe and application. Refer to the following table:

Probe	Application	Preset	Thermal Index
L3-12A	Small Parts	Bowel, Breast, Breast1, Testicle, Thyroid	TIs
	Vascular	Arterial, Carotid, Venous	TIs
	MSK	Shoulder/Knee, Hand/Foot, Elbow/Wrist, Penetration, Pediatric Hip	TIs
	Abdomen	General, Superficial, Pediatric ABD	TIs
	OB	1st Trimester	TIs
L5-13	Small Parts	Bowel, Breast, Testicle, Thyroid	TIs
	Vascular	Arterial, Carotid, Venous	TIs
	MSK	Shoulder/Knee, Hand/Foot, Elbow/Wrist	TIs
LA2-9A	Small Parts	Bowel, Breast, Testicle, Thyroid	TIs
	Vascular	Arterial, Carotid, Venous	TIs
	Abdomen	General	TIs
	MSK	General	TIs
LA3-16A	Small Parts	Bowel, Breast, Testicle, Thyroid	TIs
	Vascular	Arterial, Carotid, Venous	TIs
	MSK	Shoulder/Knee, Hand/Foot, Elbow/Wrist, Penetration	TIs
LA3-16AI	MSK	General, Superficial	TIs
	Intraoperative	General	TIs
LA4-18B	Small Parts	Breast, Testicle, Thyroid	TIs
	Vascular	Superficial, Carotid	TIs
	MSK	General, Superficial	TIs

Probe	Application	Preset	Thermal Index
C2-6	Abdomen	Aorta, General, Renal	TIs
	OB	1st Trimester	TIs
		2nd Trimester, 3rd Trimester, Fetal Heart, NT, Fetal Heart_Pen	TIb
	Gynecology	General, Adnexa	TIs
CA1-7A	Abdomen	Aorta, General, General1, Pediatric ABD, Penetration, Renal, Urology	TIs
	OB	1st Trimester	TIs
		2nd Trimester, 3rd Trimester, Fetal Heart, NT	TIb
	Gynecology	General, Adnexa	TIs
	MSK	General, Spine	TIs
CA2-8A	Abdomen	Aorta, General, Renal	TIs
	OB	1st Trimester	TIs
		2nd Trimester, 3rd Trimester, Fetal Heart, NT	TIb
	Gynecology	General, Adnexa	TIs
CA2-9A	Abdomen	Aorta, General, Renal	TIs
	OB	1st Trimester	TIs
		2nd Trimester, 3rd Trimester, Fetal Heart, NT	TIb
	Gynecology	General, Adnexa	TIs
CA3-10A	Abdomen	Bowel, General, Renal	TIs
	OB	1st Trimester	TIs
		2nd Trimester, NT	TIb
	Gynecology	Uterus, Adnexa	TIs
	Pediatric	Pediatric ABD, Pediatric Hip	TIs
	Vascular	Arterial, Venous	TIs
CF4-9	Pediatric	Abdomen	TIs

Probe	Application	Preset	Thermal Index
		Neohead	TIc
	Vascular	Arterial, Carotid, Venous	TIs
SC1-6	Abdomen	Aorta, General, Renal, Penetration	TIs
	OB	1st Trimester	TIs
		2nd Trimester, 3rd Trimester, Fetal Heart, NT	TIb
	Gynecology	General, Adnexa	TIs
E3-12A	OB	1st Trimester	TIs
	Gynecology	General, Adnexa	TIs
	Urology	Prostate	TIs
EA2-11B	OB	1st Trimester	TIs
	Gynecology	General, Adnexa	TIs
	Urology	Prostate	TIs
VR5-9	OB	1st Trimester	TIs
	Gynecology	General, Adnexa	TIs
	Urology	Prostate	TIs
PA3-8B	Abdomen	Aorta, General, Renal	TIs
	Cardiac	Aortic Arch, Adult Echo, Ped Echo	TIs
	Pediatric	Abdomen	TIs
		NeoHead	TIc
PE2-4	Abdomen	Aorta, General, Renal	TIs
	Cardiac	Aortic Arch, Adult Echo, Adult Echo1, Adult Echo2, Ped Echo	TIs
	TCD	General	TIs
PM1-6A	Abdomen	Aorta, General, Renal	TIs
	Cardiac	Aortic Arch, Adult Echo, Ped Echo	TIs
	TCD	General	TIs

Probe	Application	Preset	Thermal Index
CV1-8A	Abdomen	Aorta, General, Renal	TIs
	OB	1st Trimester	TIs
		2nd Trimester, 3rd Trimester, Fetal Heart, NT, Fetal Heart_Pen	TIb
	Gynecology	General, Adnexa	TIs
LV3-14A	Small Parts	Breast, Testicle, Thyroid	TIs
	Vascular	Arterial, Carotid, Venous	TIs
	MSK	Shoulder/Knee, Hand/Foot, Elbow/Wrist	TIs
V4-8	Abdomen	Aorta, General, Renal	TIs
	OB	1st Trimester	TIs
		2nd Trimester, 3rd Trimester, Fetal Heart, NT	TIb
	Gynecology	General, Adnexa	TIs
V5-9	OB	1st Trimester	TIs
	Gynecology	General, Adnexa	TIs
	Urology	Prostate	TIs

NOTE

- The default thermal index may vary by preset.
- You may change the thermal index at Setup > Display > Option > TI Display.

Ultrasound Transmission Gel

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

WARNING	■ The use of inappropriate ultrasound gels could result in damages in the probe. Using damaged probe could cause injuries such as electric shock in users or patients. ■ Do not use ultrasound gels or contact media that contain the following contents. – Oils such as mineral oil, cooking oil, gasoline, solvents, rust inhibitors, lanolin, paraffin-based grease, ester and excessive silicon-based release agent. – Alcohols such as acetone, methanol, plasticizer (dioctylphtalate) or denatured alcohols. – Glacial acetic acid and iodine. – All types of lotions or gels that contain aromatic substances.

Gel Warmer (Optional)

Gel Warmer maintains the warmth of the gel used for ultrasound diagnosis. It takes 5 minutes to heat the ultrasound gel.

WARNING	■ Always turn the Gel Warmer off when it is not in use. ■ Do not put your hands inside the Gel Warmer, as it may burn your skin.

CAUTION	■ Do not use the Gel Warmer for purposes other than to control the temperature of ultrasound gel. ■ Do not place the probe or any other equipment inside the Gel Warmer. ■ Do not touch the power terminal of the Gel warmer while diagnosing the patient. There is a risk of electric shock from leakage current. ■ Do not apply excessive force to the Gel Warmer, or you may damage its support parts.

Using Sheaths

Sheaths are recommended for clinical applications of invasive nature, including intraoperative, transrectal, transvaginal, and biopsy procedures, during which the sheath prevents material from the human body from contaminating the probe.

Samsung Medison does not supply sheaths, so appropriate sheaths should be purchased independently.

WARNING	■ Always keep sheaths in a sterile state. ■ Sheaths are disposable. Do not reuse them. ■ If sheaths are torn or soiled after use, clean and disinfect the probe. ■ In neurosurgical applications, a disinfected probe must be used with sterile gel and a sterile pyrogen-free sheath. ■ If the sterile sheath becomes compromised during neurosurgical applications involving a patient with Creutzfeldt-Jakob disease, the probe cannot be successfully sterilized by any disinfection method. ■ Some sheaths contain natural rubber latex and talc, which may cause allergic reactions in some individuals. Please refer to the FDA Medical Alert released on March 29, 1991.

Installing the Sheath

1. Put on sterile gloves. Unpack the sheath and fill it with acoustic coupling gel.
2. Insert the probe into the sheath and pull the latex tip to cover the probe completely. If possible, cover the probe cable as well.
3. Ensure that there are no air bubbles within the ultrasound gel. If necessary, secure the sheath to the probe and the probe cable.
4. Dispose of the sheath after use.

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Probe Precautions

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.

The probe can be easily damaged by improper use or by coming into contact with certain chemical substances. Always follow the instructions in the operation manual to inspect the probe cable, case, and lens before and after each use.
Check the probe for cracks, broken parts, leaks and sharp edges. If there is any damage, stop using the probe immediately and contact the Samsung Medison customer service department. Using damaged probes may result in electric shocks and other hazards to the patients and/or users.

Use and Infection Control of the Probe

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 in order to prevent infection. This is the responsibility of the user who manages and maintains the disinfection procedures for the equipment. Always use legally approved detergents.

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 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, the safety instructions must be followed carefully in order to minimize the risk of infection among patients.

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

- Have the system regularly inspected by Samsung Medison technicians for electric leaks.
- Do not immerse the probe into liquid.
- Do not drop the probe or apply mechanical shocks.
- Inspect the housing, strain 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.
- 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.

Cleaning and Disinfecting the Probe

WARNING	■ Always use protective eyewear and gloves when cleaning and disinfecting probes. ■ Inspect the housing, strain relief, lens and seal for damage, and check for any functional problem after cleaning and disinfecting the probe.

Using an inappropriate cleaning or sterilizing agent may damage the probe.

NOTE	Only use the disinfect and disinfectants approved by the country's government in Canada

Information of Detergent, Disinfectant, and Ultrasound Gel

An appropriate detergent, disinfectant or ultrasound gel should be selected based on the following tables. All probes have been tested in accordance with IPX 7 Criteria.

Names	Disinfectants															
	Tristel Duo	Tristel Sporicidal Wipe	T-Spray II	T-Spray	Sani-Cloth HB	Sani-Cloth Plus	Sani-Cloth Active	Sani-Cloth AF Germicidal	Sani-Cloth AF3 Germicidal	Sani-Cloth Bleach Germicidal	Septiwipes	Cleanisept Wipes	Ster-Bac Blu	Transeptic Spray	Incidin Foam	Super Sani Cloth	Sani-Cloth Germicidal
Type	S	W	S	S	W	W	W	W	W	W	W	W	L	S	S	W	W
Active Ingredient	Quaternary Ammonium (N-Alkyl)													IPA			
L3-12A	●	●	●		●												

Names	Disinfectants																
	Tristel Duo	Tristel Sporicidal Wipe	T-Spray II	T-Spray	Sani-Cloth HB	Sani-Cloth Plus	Sani-Cloth Active	Sani-Cloth AF Germicidal	Sani-Cloth AF3 Germicidal	Sani-Cloth Bleach Germicidal	Septiwipes	Cleanisept Wipes	Ster-Bac Blu	Transeptic Spray	Incidin Foam	Super Sani Cloth	Sani-Cloth Germicidal
Type	S	W	S	S	W	W	W	W	W	W	W	W	L	S	S	W	W
Active Ingredient	Quaternary Ammonium (N-Alkyl)													IPA			
L5-13	●	●		●													
LA2-9A			●	●	●												
LA3-16A	●	●	●		●												
LA3-16AI				●	●												
LA4-18B																	
C2-6	●	●	●	●	●												
CA1-7A	●	●	●		●												
CA2-8A	●	●	●		●												
CF4-9			◆	◆	◎												
SC1-6				●													
E3-12A				●													
EA2-11B			◆	◆	◎												
VR5-9			◆	◆	◎												
PA3-8B	●	●	●	●	●	●		●	●	●							

Names	Disinfectants																
	Tristel Duo	**Tristel Sporicidal Wipe**	**T-Spray II**	**T-Spray**	**Sani-Cloth HB**	**Sani-Cloth Plus**	**Sani-Cloth Active**	**Sani-Cloth AF Germicidal**	**Sani-Cloth AF3 Germicidal**	**Sani-Cloth Bleach Germicidal**	**Septiwipes**	**Cleanisept Wipes**	**Ster-Bac Blu**	**Transeptic Spray**	**Incidin Foam**	**Super Sani Cloth**	**Sani-Cloth Germicidal**
Type	**S**	**W**	**S**	**S**	**W**	**W**	**W**	**W**	**W**	**W**	**W**	**W**	**L**	**S**	**S**	**W**	**W**
Active Ingredient	**Quaternary Ammonium (N-Alkyl)**													**IPA**			
PE2-4	●	●	●	●	●	●		●	●	●							
PM1-6A				●													
V4-8	●	●	◆	◆	◎			●	●	●	▲	▲	▣				
V5-9	●	●	◆	◆	◎		▲	●	●	●	▲	▲	▣	▲	■		▲
CV1-8A			●		●												
LV3-14A	●	●	◆	◆	◎		▲	●	●	●	▲	▲	▣				

Names	Disinfectants															
	Asepti-Wipes	Asepti-Wipes II	CaviWipes[7]	MetriWipes	Cidex	Cidex OPA[2, 3, 6, 7]	Cidex 2%	Cidex Plus[2, 7]	Metricide[2, 7]	Metricide 14	Metricide 28	Metricide 30	Metricide OPA Plus	Omnicide (28)	Omnicide 14NS	Omnicide - FG2
Type	W	W	W	W	L	L	L	L	L	L	Soak	Soak	Soak	L	L	L
Active Ingredient	IPA				Ortho-phthalaldehyde	Glutaraldehyde										
L3-12A						●	●	●			●	●				●
L5-13												●				
LA2-9A													●			
LA3-16A						●	●	●			●	●	●			●
LA3-16AI						●	●	●			●	●				●
LA4-18B						●	●									
C2-6						★		●	●				●	●		
CA1-7A						●	●	●			●	●	●			●
CA2-8A						●	●	●			●	●	●			X
CF4-9													●			
SC1-6																
E3-12A																
EA2-11B																
VR5-9													●			
PA3-8B						●	●	●	●		●	●	●	●	●	

Names	Disinfectants															
	Asepti-Wipes	**Asepti-Wipes II**	**CaviWipes[7)]**	**MetriWipes**	**Cidex**	**Cidex OPA[2, 3, 6, 7)]**	**Cidex 2%**	**Cidex Plus[2, 7)]**	**Metricide[2, 7)]**	**Metricide 14**	**Metricide 28**	**Metricide 30**	**Metricide OPA Plus**	**Omnicide (28)**	**Omnicide 14NS**	**Omnicide - FG2**
Type	**W**	**W**	**W**	**W**	**L**	**L**	**L**	**L**	**L**	**L**	**Soak**	**Soak**	**Soak**	**L**	**L**	**L**
Active Ingredient	**IPA**				**Ortho-phthalaldehyde**	**Glutaraldehyde**										
PE2-4						●	●	●	●		●	●	●	●	●	
PM1-6A																
V4-8						▲	▣		▣		●	●	●			
V5-9	▲			▲		▲	▣	◇	▣		●	●	●			
CV1-8A						●	●	●			●	●	●			●
LV3-14A						▲	▣		▣		●	●	●			

Names	Disinfectants														
	Nuclean	**Wavicide-01** [3]	**Sekusept Extra**	**Salvanios pH 7**	**Salvanios pH 10**	**Steranios 2%**	**Surfaces Hautes**	**Sekusept Plus**	**Milton**	**Bleach 5.25%**	**Virkon**	**Sporox**	**Sporox II**	**Gigasept**	**Gigasept AF** [3]
Type	**L**	**L**	**L**	**L**	**L**	**L**	**S**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
Active Ingredient	**Glutaraldehyde**							**Nonionic surfactant**	**Sodium Hypochlorite**		**NA**	**Hydrogen Peroxide**		**Succindialdehyde, formaldehyde**	
L3-12A	●	●							●			X			
L5-13															
LA2-9A		●													●
LA3-16A	●								●			X			
LA3-16AI	X	X							●				●		
LA4-18B					●	●									
C2-6		●	●						★		X		X		X
CA1-7A	●								●			●			
CA2-8A	●								●			●			
CF4-9		▣													◎
SC1-6									●				●		
E3-12A									●		●		●		
EA2-11B		▣													◎
VR5-9		▣													◎
PA3-8B		●			●	●			●						
PE2-4		●			●	●			●						

Names	Disinfectants														
	Nuclean	Wavicide-01 [3]	Sekusept Extra	Salvanios pH 7	Salvanios pH 10	Steranios 2%	Surfaces Hautes	Sekusept Plus	Milton	Bleach 5.25%	Virkon	Sporox	Sporox II	Gigasept	Gigasept AF [3]
Type	L	L	L	L	L	L	S	L	L	L	L	L	L	L	L
Active Ingredient	Glutaraldehyde							Nonionic surfactant	Sodium Hypochlorite		NA	Hydrogen Peroxide		Succindialdehyde, formaldehyde	
PM1-6A															
V4-8		▣													
V5-9		▣						◎						◎	◎
CV1-8A	●	●							●			●			
LV3-14A		▣												◎	

Names	Disinfectants			Cleaner							
	Gigasept FF	Hibitane	PeraSafe	Anioxyde 1000	Enzol	Alkazyme	Cidezyme	Klenzyme	Isopropyl alcohol (70%)	Isopropyl alcohol (80%)	Ethanol 75%
Type	L	L	P	Soak			L	L	L	L	L
Active Ingredient	Bersteinsaure	Chlorhexidine gluconate solution	Peracetic Acid	NA							
L3-12A							●	●	●		
L5-13											
LA2-9A	●	●	●								
LA3-16A							●	●	●		
LA3-16AI							●	●	●		
LA4-18B						●	●	●			
C2-6	★				●			●	X		
CA1-7A				●			●	●	●		
CA2-8A				●			●	●	●		
CF4-9	◎	◎	▲								
SC1-6									●		
E3-12A											
EA2-11B	◎	◎	▲				●				
VR5-9	◎	◎	▲								
PA3-8B					●			●	●		
PE2-4						●			●	●	

Names	Disinfectants			Cleaner							
	Gigasept FF	Hibitane	PeraSafe	Anioxyde 1000	Enzol	Alkazyme	Cidezyme	Klenzyme	Isopropyl alcohol (70%)	Isopropyl alcohol (80%)	Ethanol 75%
Type	L	L	P	Soak			L	L	L	L	L
Active Ingredient	Bersteinsaure	Chlorhexidine gluconate solution	Peracetic Acid	NA							
PM1-6A									●		
V4-8	◎		▲								
V5-9	◎		▲					◐			
CV1-8A							●	●	●		
LV3-14A	◎		▲								

Names	Cleaner		Gel								Trophon
	Metrizyme	McKesson	NaturalImage	Aquasonics100[3)]	GEUltrasound ContactGel	ClearImage	Kendall	SCAN	Wavelength	Sonogel	
Type	L	L	G	G	G	G	G	G	G	G	
ActiveIngredient	PeraceticAcid		Ammonium Chlorides		NA						
L3-12A	●	●		●							●
L5-13				●							●
LA2-9A				●				●		●	●
LA3-16A	●	●		●							●
LA3-16AI	●	●		●							●
LA4-18B											
C2-6	●			●							
CA1-7A	●	●		●							●
CA2-8A	●	●		●							●
CF4-9				●				●		●	●
SC1-6	●			●				●			
E3-12A				●							●
EA2-11B				●				●		●	
VR5-9				●				●		●	●
PA3-8B	●			●							●
PE2-4	●			●							●

Names	Cleaner		Gel								Trophon
	Metrizyme	McKesson	NaturalImage	Aquasonics100[3)]	GEUltrasound ContactGel	ClearImage	Kendall	SCAN	Wavelength	Sonogel	
Type	L	L	G	G	G	G	G	G	G	G	
ActiveIngredient	PeraceticAcid		Ammonium Chlorides		NA						
PM1-6A	●			●				●			●
V4-8				●	●				●		●
V5-9				●	●				●		●
CV1-8A	●	●		●							●
LV3-14A				●	●				●		●

※ Symbols

The significance of each symbol is as follows:

(1)	Compatible but no EPA Registration
(2)	FDA 510(k) qualified
(3)	Has CE mark
(4)	Discontinued
(5)	Under Development
(6)	ANVISA Registered
(7)	Health Canada Approved; CaviWipes (DIN: 2242209), Cidex OPA (DIN: 2239732), Cidex Plus (DIN: 2158396), Metricide(DIN: 1963996)
S	Spray
W	Wipe
L	Liquid
P	Powder
G	Gel
Soak	Soak
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)

The following is information about the manufacturers (or Distributors) of detergents, disinfectants, and ultrasound gels.

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)
Isopropyl 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	Procter & Gamble Australia Pty. Ltd.	+61-1800-028-280(Australia)
Nuclean	National Diagnostics Co.	+1-800-526-3867(USA) +44(0)-148-264-6020(UK)
Omnicide	Cottrell Ltd.	+1-800-843-3343(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)

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 to clean probes. Even the use of 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.

1. Disconnect the probe from the system.
2. Remove any biopsy adapters or needle guides. (Adapter may be reused after disinfection.)
3. Remove the sheath. (Sheaths are disposable.)
4. Use a soft cloth, lightly dampened with mild soap or compatible cleaning solution, to remove any particulate matter and bodily fluids that remain on the probe or cable.
5. To remove remaining contaminants, rinse with water up to the immersion point.
6. Wipe with a dry cloth.
7. If necessary, wipe first with a water-dampened cloth to remove soap residue, and wipe with a dry cloth again.

Disinfecting

Disinfect the probe using a disinfectant solution recommended by Samsung Medison to reduce pathogens to the level of 10^{-6}.

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 probe. 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 use liquid solutions to sterilize probes. Do not sterilize the probe using autoclave or EtO gas.

1. Please refer to the user instructions of the disinfectant for details of proper storage, use, and disposal of the disinfectant.
2. Mix the disinfectant compatible with your probe according to label instructions for solution strength.
3. Immerse the probe into the disinfectant as shown in the illustration below.
4. Using the instructions on the disinfectant, rinse the probe after the immersion process is complete.
5. Allow the probe to air dry or wipe it with a dry cloth.

[Figure 9.1 Disinfecting a Probe]

Chapter 10

Maintenance

Product Maintenance 2

Cleaning and disinfecting 2

Air Filter Management 4

Accuracy Checks 5

Information Maintenance 6

Backing up User Setting 6

Backing Up Patient Information 6

Software 6

Product Maintenance

Cleaning and disinfecting

Using an inappropriate cleaning or sterilizing agent may damage the product. Take the following information into account.

WARNING	■ Turn off and unplug the product before cleaning or sterilizing the product to prevent electric shock or fire. ■ Always use protective eyewear and gloves when cleaning and disinfecting the product.

Cleaning

CAUTION	■ Do not use a spray directly on the product exterior. It may cause cracks in the product or cause the color to deteriorate. ■ Do not use chemical substances such as wax, benzene, alcohol, paint thinner, insecticide, aerosol deodorant, lubricant, or detergent.

■ **Console**

Wipe the exterior of the product with a soft cloth, dampened with mild soap or detergent.

■ **Cleaning the Monitor**

Wipe the surface of the LCD with a soft, dry cloth. If the LCD panel has been contaminated, gently wipe 2–3 times or more in the same direction to remove the contaminant.

■ **Trackball**

CAUTION	During cleaning of the trackball, make sure that any liquid or other substance do not enter the product.

1. Turn the rim of the trackball in the control panel counterclockwise to separate.
2. Wipe the trackball with a soft cloth and assemble it in reverse order of the disassembly.

[Figure 10.1 Disassembling trackball]

NOTE	Refer to ‘Chapter 9. Probe' for cleaning and disinfecting of probe.

Disinfecting

CAUTION	When disinfecting the product's exterior, be sure to use disinfectants recommended by Samsung Medison.

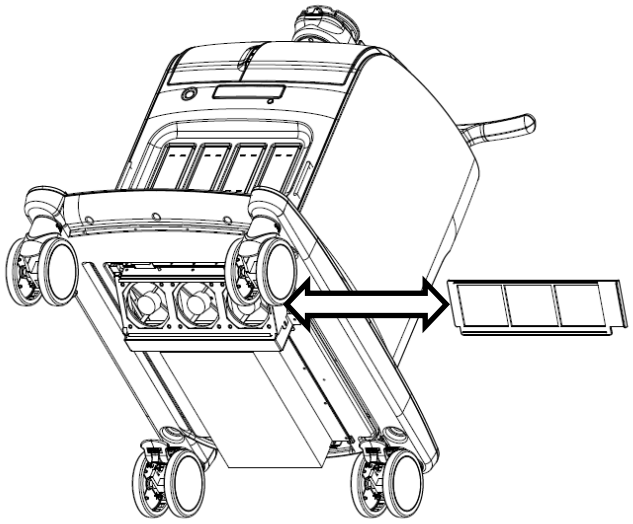
When disinfecting the product, disinfectants certified through the FDA 510(k) process are recommended. For more information, please refer to the section on cleansing agents, disinfectants, and ultrasound gels in ‘Chapter 5. Probes’ in the operation manual.

1. Turn off the system and disconnect the power cord from the wall outlet.
2. Mix the disinfectant solution that is compatible with your system to the solution strength specified on the instruction label.
3. Wipe the system surfaces with the disinfectant solution according to the instructions given in disinfectant's user manual.
4. Either air-dry at an indoor location or wipe with a dry cloth, as instructed in the manual for the disinfectant.

Air Filter Management

The air filters minimize the intake of dust. Clean the air filter to ensure that a clogged filter does not cause the system to overheat and reduce the noise and the system performance.
It is recommended that the air filters be cleaned once every three months.

CAUTION	Be sure to lock the brakes on the front wheels before cleaning the air filters to avoid injury by any unexpected movement of the product.



[Figure 10.2 Disassembling air filter]

1. Pull out the filter under the front of the console and take it away from the product.
2. Shake the filter to remove the dust and wash it in a mild, soapy solution.
3. Afterwards, dry the filter with a cloth, then air dry it in the shade.
4. Slide the filter back into the product.

NOTE	Allow the wet filter to dry thoroughly before reinstalling it. A wet filter can cause the system to malfunction.

Accuracy Checks

NOTE	The user must ensure that safety inspections are performed every 2 years according to the requirements of safety standard EN 60601-1. Only trained persons are allowed to perform these safety inspections.

Measurements obtained with this product are influenced by the maintenance status of the product. To obtain reliable measurements, the product must be maintained in optimal condition.

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 8. Measurements and Calculations’ in the operation manual.

Information Maintenance

CAUTION	Back up the data on the system on a regular basis, since an external shock or an internal error may result in data loss.

Backing up User Setting

Always keep a backup copy of all information related to the user settings in case of data loss. Users should not attempt to back up the user settings of the product on their own; they must contact the Samsung Medison Global Tech Support Group, so that its representative may perform the backup procedure for them. Note that the User Settings for GA Table used for obstetrical measurements may be backed up by the user. For more information, please refer to 'Obstetrics' in 'Chapter 3. Utilities' in the operation manual.

Backing Up Patient Information

You can back up patients' basic information and scanned images. You can save the backup manually; backups can only be saved externally, either to CD or DVD. It is recommended that you back up patients' basic information and scanned images regularly. For more information, please refer to 'Chapter 6. Starting Diagnosis'.

Software

The software may be updated in order to improve its functionalities. You may not update the software yourself; a member of the Samsung Medison customer support department will assist you in updating the software.

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

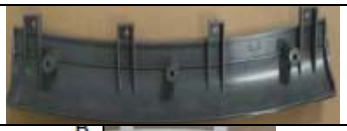
If errors occur in the operating system (Windows), or you desire to upgrade the operating system, please follow the instructions of the operating system manufacturer.

Chapter 11

Service parts list

Body Cover Parts **2**
System Parts **7**
Control Panel Parts **11**
System Cable Parts **14**

Body Cover Parts

Part Code	Part Name	Part Image
MI61-01021A	BRACKET	
MI63-01989A	COVER-ARM BASE LOWER R	
MI63-01990A	COVER-ARM BASE LOWER L	
MI63-02005A	COVER CASE-BODY FRONT FAN FILTER	
MI63-02013A	COVER-CP MAIN TOUCH TOP	
MI63-02020A	COVER-CP HANDLE REAR TOP	
MI63-02025A	COVER-BODY BOTTOM	
MI63-02037A	COVER-REAR TOP LED	
MI63-02038A	COVER-REAR BTM LED	
MI68-01976A	LABEL CAUTION	

Part Code	Part Name	Part Image
MI68-01978A	LABEL CAUTION	
MI68-02567A	LABEL-ID	
MI68-02710A	LABEL CAUTION-HANDLE	
MI63-02021A	COVER-CP MAIN TOP	
MI63-02082A	COVER-CP CAP CW_TB	
MI63-02095A	COVER-CP CAP ANGLE_LR	
MI63-02096A	COVER-CP CAP DEPTH	
MI63-02097A	COVER-CP CAP FOCUS	
MI63-02098A	COVER-CP CAP ZOOM	
MI67-01090A	RUBBER-CP USB COVER	
MI67-01100A	RUBBER-CP POWER BUTTON	
MI67-01101A	RUBBER-CP BUTTON	

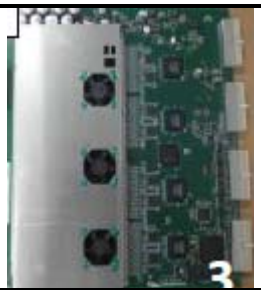
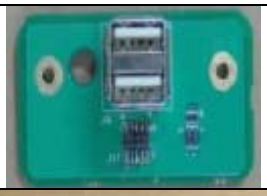
Part Code	Part Name	Part Image
MI68-02566A	LABEL-I/O PORT	
MI96-01313A	ASSY FAN-RACK	
MI97-02656A	ASSY COVER-SIDE R	
MI97-02695A	ASSY COVER-TOP SIDE R	
MI97-02657A	ASSY COVER-SIDE L	
MI97-02696A	ASSY COVER-TOP SIDE L	
MI97-02659A	ASSY COVER-FRONT	

Part Code	Part Name	Part Image
MI97-02697A	ASSY COVER-FRONT BOTTOM	
MI63-02027A	COVER-BODY FRONT BOTTOM	
MI97-02660A	ASSY COVER-REAR	
MI63-02032A	COVER-BODY REAR TOP	
MI63-02034A	COVER-BODY REAR DOOR	
MI97-02698A	ASSY COVER-REAR BOTTOM	
MI63-02033A	COVER-BODY REAR	
MI97-02709A	ASSY COVER-HANGER	
MI61-03228A	HANGER-BODY TOP	
MI61-03229A	HANGER-BODY BOTTOM	
MI68-02095A	LABEL-CP DO NOT SIT	
MI97-02671A	ASSY CASE-CP MAIN BOTTOM 2	
MI61-03105A	BASE-CP TOUCH	
MI97-02642A	ASSY BRACKET-GEL WARMER	
MI61-03107A	BASE-BODY HANDLE	
MI61-03268A	BRACKET-WIRE HOLDER	
MI63-02019A	COVER-CP HANDLE LEVER	
MI63-02022A	COVER-CP HANDLE TOP	
MI97-02004A	ASSY CASTER	

Part Code	Part Name	Part Image
MI63-01687B	COVER-FRONT JOINT LIFT	
MI63-01688B	COVER-UPPER LINK	
MI63-01689A	COVER	
MI63-01689B	COVER-BOTTOM LINK	
MI97-02658A	ASSY COVER-BODY TOP	
MI97-02699A	ASSY COVER-PRINT L	
MI97-02700A	ASSY COVER-PRINT R	

System Parts

Part Code	Part Name	Part Image
MI39-01378A	HARNESS UNIT	
MI92-01919A	ASSY BOARD	
MI92-01920A	ASSY BOARD	
MI92-01923A	ASSY BOARD	
MI82-02253A	A/S ASSY-BOARD	
5902-005111	CARD VGA	
MI82-02254A	A/S ASSY-PC MODULE	
MI59-01112A	BOARD-I7-3XM77	

Part Code	Part Name	Part Image
MI92-02107A	ASSY BOARD	
3001-002741	SPEAKER	
MI61-01706A	MAGNET	
MI61-01766A	RAIL	
MI92-02140A	ASSY BOARD	
5903-004793	SSD	
MI92-01925A	ASSY BOARD	
MI92-01926A	ASSY BOARD	

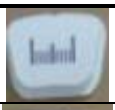
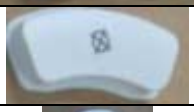
Part Code	Part Name	Part Image
MI61-03308A	MAGNET-CATCH	
MI92-01987A	ASSY BOARD	
MI92-01928A	ASSY BOARD	
5903-004300	CD-ROM	
6623-000061	LATCH	
MI61-03214A	SUPPORT-LATCH	
MI59-01064A	MODULE	
MI96-01297A	ASSY MONITOR	

Part Code	Part Name	Part Image
MI96-01299A	ASSY TRANS	
MI96-01300A	ASSY DDM	
MI96-01306A	ASSY TOUCH PANEL-EXP	
MI96-01314A	ASSY FAN-FRONT	
MI97-02100B	ASSY LIFT-EVE	
MI61-02089A	SPRING ETC	
MI97-01995A	ASSY HINGE	
5902-004233	CARD VGA	

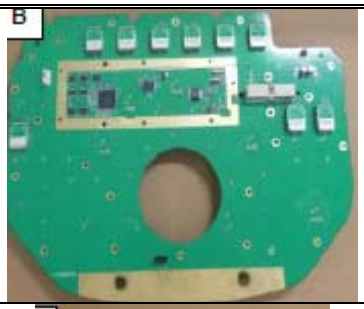
Control Panel Parts

Part Code	Part Name	Part Image
MI95-01306A	ASSY ALPHA KEYBOARD-EXP	
MI59-01111A	TRACK BALL	
MI64-01911A	KNOB-ENCORDER	
MI64-01912A	KNOB-ENCORDER EZ EXAM	
MI64-01915A	BUTTON-CAP KEY U1	
MI64-01916A	BUTTON-CAP KEY CLEAR	
MI64-01917A	BUTTON-CAP KEY CHANGE	
MI64-01918A	BUTTON-FREEZE	
MI64-01919A	BUTTON-ENCORDER EZ EXAM	
MI64-01920A	BUTTON-ENCORDER M	

Part Code	Part Name	Part Image
MI64-01921A	BUTTON-CAP KEY U2	
MI64-01922A	BUTTON-CAP KEY BODY MARKER	
MI64-01923A	BUTTON-CAP KEY TEXT	
MI64-01924A	BUTTON-CAP KEY 3D	
MI64-01925A	BUTTON-CAP KEY 4D	
MI64-01926A	BUTTON-CAP KEY Q SCAN	
MI64-01927A	BUTTON-CAP KEY P1	
MI64-01928A	BUTTON-CAP KEY P2	
MI64-01929A	BUTTON-CAP KEY U4	
MI64-01930A	BUTTON-CAP KEY SAVE	
MI64-01931A	BUTTON-CAP KEY SINGLE	
MI64-01932A	BUTTON-CAP KEY DUAL	
MI64-01933A	BUTTON-CAP KEY QUAD	
MI64-01934A	BUTTON-CAP KEY POINTER	

Part Code	Part Name	Part Image
MI64-01935A	BUTTON-CAP KEY CALC	
MI64-01936A	BUTTON-CAP KEY CALIPER	
MI64-01937A	BUTTON-CAP KEY SET L	
MI64-01938A	BUTTON-CAP KEY SET R	
MI64-01939A	BUTTON-ENCORDER PD	
MI64-01940A	BUTTON-ENCORDER PW	
MI64-01941A	BUTTON-ENCORDER COLOR	
MI64-01942A	BUTTON-ENCORDER 2D	
MI95-01304A	ASSY CAP KEY-POWER	
MI95-01310A	ASSY CAP KEY-TOGGLE	
MI64-01913A	BUTTON-TOGGLE LOWER	
MI95-01311A	ASSY CAP KEY-KNOB	
MI95-01312A	ASSY CONTROL PANEL-PROBE HOLDER R	
MI95-01313A	ASSY CONTROL PANEL-PROBE HOLDER L	

System Cable Parts

Part Code	Part Name	Part Image
MI92-01924A	ASSY BOARD	
MI97-02507A	ASSY ARM	
MI61-02434A	HOLDER-WIRE	