

DC-55/DC-58
Diagnostic Ultrasound System

Operator's Manual

[Basic Volume]

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Contents of this manual are subject to change without prior notice.

All information contained in this manual is believed to be correct. Mindray shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this manual.

Mindray is responsible for the effects on safety, reliability and performance of this product, only if:

- all installation operations, expansions, changes, modifications and repairs of this product are conducted by Mindray authorized personnel;
- the electrical installation of the relevant room complies with the applicable national and local requirements; and
- the product is used in accordance with the instructions for use.



This equipment must be operated by skilled/trained clinical professionals.

Warning

It is important for the hospital or organization that employs this equipment to carry out a reasonable service/maintenance plan. Neglect of this may result in machine breakdown or personal injury.

Warranty

THIS WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

Exemptions

Mindray's obligation or liability under this warranty does not include any transportation or other charges or liability for direct, indirect or consequential damages or delay resulting from the improper use or application of the product or the use of parts or accessories not approved by Mindray or repairs by people other than Mindray authorized personnel.

This warranty shall not extend to:

- **Malfunction or damage caused by improper use or man-made failure.**
- **Malfunction or damage caused by unstable or out-of-range power input.**
- **Malfunction or damage caused by force majeure such as fire and earthquake.**
- **Malfunction or damage caused by improper operation or repair by unqualified or unauthorized service people.**
- **Malfunction of the instrument or part whose serial number is not legible enough.**
- **Others not caused by instrument or part itself.**

Customer Service Department

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Important Information

1. It is the customer's responsibility to maintain and manage the system after delivery.
2. The warranty does not cover the following items, even during the warranty period:
 - (1) Damage or loss due to misuse or abuse.
 - (2) Damage or loss caused by Acts of God such as fires, earthquakes, floods, lightning, etc.
 - (3) Damage or loss caused by failure to meet the specified conditions for this system, such as inadequate power supply, improper installation or environmental conditions.
 - (4) Damage or loss due to use of the system outside the region where the system was originally sold.
 - (5) Damage or loss involving the system purchased from a source other than Mindray or its authorized agents.
3. This system shall not be used by persons other than fully qualified and certified medical personnel.
4. DO NOT make changes or modifications to the software or hardware of this system.
5. In no event shall Mindray be liable for problems, damage, or loss caused by relocation, modification, or repair performed by personnel other than those designated by Mindray.
6. The purpose of this system is to provide physicians with data for clinical diagnosis. The physician is responsible for the results of diagnostic procedures. Mindray shall not be liable for the results of diagnostic procedures.
7. Important data must be backed up on external memory media.
8. Mindray shall not be liable for loss of data stored in the memory of this system caused by operator error or accidents.
9. This manual contains warnings regarding foreseeable potential dangers, but you shall also be continuously alert to dangers other than those indicated. Mindray shall not be liable for damage or loss resulting from negligence or ignorance of the precautions and operating instructions described in this operator's manual.
10. If a new manager takes over this system, be sure to hand over this operator's manual to the new manager.

About This Manual

This operator's manual describes the operating procedures for this diagnostic ultrasound system and the compatible probes. To ensure safe and correct operation, carefully read and understand the manual before operating the system.

Notation Conventions

In this operator's manual, the following words are used besides the safety precautions (see "Safety Precautions"). Please read this operator's manual before using the system.

NOTE: Indicates information of interest to users of this system regarding exceptional conditions or operating procedures.
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 CAUTION: The diagnostic ultrasound system is not intended for ophthalmic use. Its use in this clinical specialty is contraindicated.

Operator's Manuals

You may receive multi-language manuals on compact disc or paper. Please refer to the English manual for the latest information and registration information.

The content of the operator manual, such as screens, menus or descriptions, may be different from what you see in your system. The content varies depending on the software version, options and configuration of the system.

Hardcopy Manuals

- Operator's Manual [Basic Volume]
Describes the basic functions and operations of the system, safety precautions, exam modes, imaging modes, preset, maintenance and acoustic output, etc.
- Operator's Manual [Advanced Volume]
- Operator's Manual [Acoustic Power Data and Surface Temperature Data]
Contains data tables of acoustic output for transducers.
- Operation Note
Contains a quick guide for basic system operations.

NOTE: Manuals on CD are the manuals translated into languages other than English, according to the English manuals.

If you find that the contents of the manuals on CD are NOT consistent with the system or the English manuals, refer ONLY to the corresponding English manuals.

The accompanying manuals may vary depending on the specific system you purchased. Please refer to the packing list.

Software Interfaces in this Manual

Depending on the software version, preset settings and optional configuration, the actual interfaces may be different from those in this manual.

Conventions

In this manual, the following conventions are used to describe the buttons on the control panel, items in the menus, buttons in the dialog boxes and some basic operations:

- <Buttons>: angular brackets indicate buttons, knobs and other controls on the control panel or on the keyboard.
- [Items in menu or buttons in dialog box]: square brackets indicate items in menus, on the soft menu or buttons in dialog boxes.
- Click [Items or Buttons]: move the cursor to the item or button and press <Set> or use the soft key corresponding to the soft menu.
- [Items in menu] → [Items in submenu]: select a submenu item following the path.

Product Difference

Product Model	B-Profile	B-Histogram
DC-55	×	√
DC-58	√	√

1 Safety Precautions

1.1 Safety Classifications

- According to the type of protection against electric shock:
CLASS I EQUIPMENT
- According to the degree of protection against electric shock:
Type-BF applied part
- According to the degree of protection against harmful ingress of water:
The main unit is rated IPX0
The probes are rated IPX7
The foot switch is rated IPX8
- According to the disinfection and sterilization method(s) recommended by manufacturer:
Equipment with disinfection and sterilization method(s) recommended by manufacturer.
- According to the degree of safety of application in the presence of a FLAMMABLE ANESTHETIC MIXTURE WITH AIR or WITH OXYGEN OR NITROUS OXIDE
EQUIPMENT not suitable for use in the presence of a FLAMMABLE ANESTHETIC MIXTURE WITH AIR or WITH OXYGEN OR NITROUS OXIDE
- According to the mode of operation:
CONTINUOUS OPERATION
- Does the equipment has any defibrillation-proof applied parts:
Non-defibrillation-proof applied part
- Permanently installed equipment or non-permanently installed equipment:
Non-permanently installed equipment

1.2 Meanings of Signal Words

In this manual, the signal words  **DANGER**,  **WARNING**,  **CAUTION**, **NOTE** and **Tip** are used regarding safety and other important instructions. The signal words and their meanings are defined as follows. Please understand their meanings clearly before reading this manual.

Signal word	Meaning
 DANGER	Indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.
 WARNING	Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.
 CAUTION	Indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury.
NOTE	Indicates a potentially hazardous situation that, if not avoided, may result in property damage.
Description	Important information that helps you use the system more effectively.

1.3 Meaning of Safety Symbols

Symbol	Description
	Type-BF applied part The ultrasound probes connected to this system are type-BF applied parts. The ECG leads within this system are type-BF applied parts.
	Caution.
	General warning sign.
	Patient/user infection due to contaminated equipment. Be careful when performing cleaning, disinfection and sterilization.
	Patient injury or tissue damage from ultrasonic radiation. The ALARA principle must be practiced when operating the ultrasound system.

1.4 Safety Precautions

Please observe the following precautions to ensure patient and operator safety when using this system.

 **DANGER:** Do not operate this system and probes in an atmosphere containing flammable gases or liquids such as anesthetic gases, hydrogen and ethanol, because there is danger of explosion.

-  **WARNING:**
1. Connect the power plug of this system to wall receptacles that meet the ratings indicated on the nameplate. If adapters or multifunctional receptacles are used, it may cause the leakage current to exceed the safety requirements.
 2. Within 1.5 meters of the patient, connect peripherals to an auxiliary power outlet which is capable of isolation protection, or power peripherals by an auxiliary output cable or isolation transformer which complies with IEC 60601-1 Chapter 16 or a power input of the same safety level.
 3. **DO NOT** use different-phase power supplies to power peripherals, such as air conditioning power supply.
 4. When using peripherals which are not powered by the ultrasound system's auxiliary output, or peripherals other than those permitted by Mindray, ensure the overall leakage current of peripherals and the ultrasound system meets the requirement of the local medical device electrical regulations (e.g., the touch leakage current should be no more than 500uA as per IEC 60601-1 Chapter 16), and the responsibility is held by the user.
 5. Connect the grounding conductor before turning the system ON. Disconnect the grounding cable after turning the system OFF. Failure to do so may result in electric shock.
 6. For connecting power and grounding, follow the appropriate procedures described in this operator's manual. Failure to do so may result in the risk of electric shock. Do not connect the grounding cable to a gas pipe or water pipe. This may lead to improper grounding or a gas explosion.
 7. Before cleaning the system, disconnect the power cord from the outlet. Failure to do so may result in system failure and electric shock.
 8. This system is not waterproof. Do not use this system in any location where water leakage may occur. If any water is sprayed on or into the system, this may lead to electric shock. If water is accidentally sprayed on or into the system, contact the Mindray Customer Service Department or a sales representative.
 9. **DO NOT** use a probe that has a damaged or scratched surface, or exposed wiring of any kind. Immediately stop using the probe and contact the Mindray Customer Service Department or a sales representative. There is a risk of electric shock if using a damaged or scratched probe.

10. Do not allow the patient to come into contact with live parts of the ultrasound system or other devices, e.g., signal I/O ports. This may lead to electric shock.
11. Do not use an aftermarket probe other than those specified by Mindray. Such probes may damage the system causing a profound failure, with fire being the worst-case scenario.
12. Do not subject the probes to knocks or drops. Use of a defective probe may lead to electric shock.
13. Do not open the covers or the front panel of the system. Short circuit or electric shock may occur when the system hardware is exposed and powered on.
14. Do not use this system when any digital device, such as a high-frequency electrotome, high-frequency therapy device or defibrillator, is already applied. This would result in a risk of electric shock to the patient.
15. Only use the ECG leads provided with the physiology module. Failure to do so may result in electric shock.
16. When moving the system, hold the handle. Failure to do so may result in damage by abnormal force. Do not push the system from the left/right side. This may cause it to topple over.
17. The system's auxiliary power output is used to supply power for the recommended peripheral devices. Do not connect other devices to the outlet. The rated output power limitation may be exceeded and this may lead to failure. The maximum output power of the outlet is 240VA.
18. Additional equipment (analog or digital) connected to the ultrasound system must comply with the relevant IEC standards (e.g., IEC 60950 information technology equipment safety standard and IEC 60601-1 medical equipment standard). Furthermore, all configurations must comply with the standard IEC 60601-1. It is the responsibility of the person who connects the additional equipment to the signal input or output ports and configures a medical system to verify that the system complies with the requirements of IEC 60601-1 Chapter 16. If you have any questions regarding these requirements, consult your sales representative.
19. Prolonged and repeated use of keyboards may result in hand or arm nerve disorders for some individuals. Observe local safety or health regulations concerning the use of keyboards.
20. When using intra-cavity probes, do not activate the probe outside the patient's body.
21. DO NOT touch the Signal I/O ports if in contact with the patient. This may lead to electric shock.
22. To avoid risk of electric shock, this equipment must only be connected to a supply mains with protective earth.
23. Connecting electrical equipment to MSO effectively leads to creating an ME SYSTEM, and can result in a reduced level of safety

- 24. Use detachable power supply cord as mains power breaking device. DO NOT set equipment in place where difficult for disconnection of detachable power supply cord!**
- 25. Do not modify this equipment without authorization of the manufacturer.**
- 26. Always read and follow carefully the manufacturer instructions on the contrast agent label.**

**CAUTION:**

1. **Precautions concerning clinical examination techniques:**
This system must only be used by qualified medical professionals. This operator's manual does not describe clinical examination techniques. The clinician should select the proper examination techniques based on specialized training and clinical experience.
2. **Malfunctions due to radio waves:**
If a device emitting radio waves is used in the proximity of this system, it may interfere with operations. Do not use or take any devices transmitting RF signals (such as cellular phones, transceivers and radio-controlled products) into the room where the system is located.
If a person brings a device that generates radio waves near the system, ask him/her to immediately turn the device OFF.
3. **Precautions concerning moving the system:**
Install the system on a flat surface with the casters locked. Accidental moving may result in damage.
Do not move the system laterally. This may result in damage in case of toppling.
If on a slope, the system should be moved slowly by two people. Unexpected sliding may result in damage.
Do not sit on the system. This may result in the individual falling if the system moves.
Objects placed on the monitor may fall and result in injury to individuals.
Fasten and fully secure any peripheral devices before moving the system. Loose peripheral devices may fall and result in injury to individuals.
When moving the system on steps, ensure the system does not topple.
4. If the circuit protector is tripped, it indicates that the system or a peripheral device was improperly shut down and the system is unstable. You cannot repair the system under this circumstance and must call the Mindray Customer Service Department or a sales representative.
5. There is no risk of high-temperature burns during normal ultrasound examinations. It is possible for the surface temperature of the probe to exceed the patient's body temperature due to factors involving environmental temperature and exam type. Do not apply the probe to the same region on the patient for a prolonged period of time. Apply the probe only for the period of time required for the purpose of diagnosis.
6. Do not use the system to examine a fetus for a prolonged period of time.
7. The system and its accessories are not disinfected or sterilized prior to delivery. The operator is responsible for cleaning and disinfecting probes and sterilizing biopsy brackets according to the manuals prior to use. All items must be thoroughly processed to completely remove harmful residual chemicals, which are not only harmful to the human body, but also damage the accessory.

8. It is necessary to press <End Exam> to end the current scan that is in progress and clear the current Patient Information field. Failure to do so may result in new patient data being combined with the previous patient's data.
9. Do not connect or disconnect the system's power cord or its accessories (e.g., a printer or a recorder) without turning the system power OFF first. This may damage the system and its accessories or cause electric shock.
10. If the system is improperly powered off during operation, it may result in damage to the data on the system hard drive or system failure.
11. Do not use a USB memory device (e.g., a USB flash drive, or a removable hard disk) which contains unsafe data. This may result in system damage.
12. It is recommended to only use the video devices specified in this manual.
13. Do not use gel, disinfectant, probes, probe sheath or needle-guided brackets that are not compatible with the system.
14. The applied contrast agents should be compliant with the relevant local regulations.
15. Read the Acoustic Output Principle in the operation manual carefully before operating this system in clinical examinations.
16. The cover contains natural rubber that can cause allergic reactions in some individuals.
17. Use ultrasound gel which complies with the relevant local regulations.
18. Normal operation may be affected by an unstable mains power supply. It is recommended that the product be powered from an uninterruptible power supply.
19. DO NOT expose the system to excessive vibration through transportation. Mechanical damage may result.
20. Always keep the system dry. Avoid transporting this system quickly from a cold place to a warm place; otherwise condensation or water droplets may form allowing a short circuit and possible electric shock.

- NOTE:**
1. DO NOT use the system in the vicinity of strong electromagnetic fields (such as transformers), which may affect the performance of the system.
 2. Do not use the system in the vicinity of high-frequency radiation sources (e.g., cellular phones), which may affect the performance of the system or even lead to failure.
 3. When using or positioning the system, keep the system level to avoid instability.

4. To avoid damaging the system, do not use it in the following environments:
 - Locations exposed to direct sunlight
 - Locations subject to sudden changes in environmental temperature
 - Dusty locations
 - Locations subject to vibration
 - Locations near heat generators
 - Locations with high humidity.
5. Turn the system ON only after the power has been turned OFF for a period of time. If the system is turned ON immediately after being turned OFF, the system may not reboot properly and could malfunction.
6. Press the <Freeze> key to freeze an image or turn off the system power before connecting or disconnecting a probe. Failure to do so can lead to the system and/or probe being damaged.
7. Remove the ultrasound gel from the face of the probe when the examination is complete. Water in the gel may enter the acoustic lens and adversely affect the performance and safety of the probe.
8. You should back up the system properly to a secure external storage media, including system configuration, settings and patient data. Data stored to the system's hard drive may be lost due to system failure, improper operation or accident.
9. Do not apply external force to the control panel. This can lead to the system being damaged.
10. If the system is used in a small room, the room temperature may rise. Provide proper ventilation and free air exchange.
11. To dispose of the system or any part thereof, contact the Mindray Customer Service Department or a sales representative. Mindray is not responsible for any system content or accessories that have been discarded improperly. Mindray is not responsible for any system content or accessories that have been discarded improperly.
12. Electrical and mechanical performance may be degraded due to long usage (such as current leakage or distortion and abrasion). Image sensitivity and precision may also deteriorate. To ensure optimal system operation, it is recommended to maintain the system under a Mindray service agreement.
13. The replaceable fuse is inside the chassis. Refer replacement operations to Mindray service engineers or engineers authorized by Mindray only.
14. Do not turn OFF the system power supply during printing, file storage or invoking of other system operations. An interrupted process may not be completed, and can become lost or corrupted.
15. The iScape feature constructs a single extended image from a series of individual image frames. The quality of the final image is user-dependent and requires skill to efficiently apply the feature and technique. Exercise caution when measurements are performed from an iScape image.
16. Ensure that the current exam date and time are the same as the system date and time.
17. Use detachable cables as mains power breaking device.

Please read the following precautions carefully to ensure safety of the patient and the operator when using the probes.

-  **WARNING:**
1. **The probe is only for use with the specified ultrasound diagnostic system. See “2.5.2 Probes and Needle-guided Brackets Available” to select the proper probe.**
 2. **The ultrasonic probe must only be used by qualified professionals.**
 3. **Confirm that the transducer and probe cable appear normal before and after each examination. A defective probe may cause electric shock to the patient.**
 4. **Do not subject the probe to shock. A defective probe may cause electric shock to the patient.**
 5. **Do not disassemble the probe to avoid the possibility of electric shock.**
 6. **Never immerse the probe connector in liquids, such as water or disinfectant, as the connector is not waterproof. Immersion may cause electric shock or malfunction.**
 7. **A probe sheath must be installed over the probe before performing intra-cavity or intra-operative examinations.**

-  **CAUTION:**
1. **When using the probe, wearing sterile gloves can help to prevent infection.**
 2. **Be sure to use sterile ultrasound gel. Use ultrasound gel which complies with the relevant local regulations. and manage the ultrasound gel properly to ensure that it does not become a source of infection.**
 3. **In normal diagnostic ultrasound mode, there is no danger of a normal-temperature burn. However, keeping the probe on the same region of the patient for a prolonged period of time may cause such a burn.**
 4. **Do not use the carrying case to store the probe. If the carrying case is used for storage, it may become a source of infection.**
 5. **The ALARA principle must be practiced when operating the ultrasound system. Minimize the acoustic power without compromising the quality of images.**
 6. **The probe and the accessories supplied with it are not delivered disinfected or sterilized. Sterilization (or high-level disinfecting) is required before use.**
 7. **Disposable components should be packaged sterile and for single-use only. Do not use if the integrity of the packaging has been violated or if the expiration date has passed. Use disposable components which comply with the relevant local regulations.**
 8. **Use disinfection or sterilization solutions recommended in this operator’s manual. Mindray will not be liable for damage caused by other solutions. If you have any questions, please contact the Mindray Customer Service Department or a sales representative.**
 9. **Do not use pre-lubricated condoms as a sheath. Lubricant may not be compatible with the probe material and may result in damage.**

10. Contact with improper gel or cleaner may result in damage to the probe:

- **DO NOT** soak or saturate probes in a strong polar solution such as ethanol, chloride of lime, ammonium chloride, acetone or formaldehyde.
- **DO NOT** bring the probe into contact with solutions or ultrasound gels containing oily mediums such as mineral oil or lanoline.

NOTE: Read the following precautions to prevent probe malfunction:

- Before connecting or disconnecting the probe, freeze or turn off the diagnostic ultrasound system.
- Clean and disinfect the probe before and after each examination.
- After an examination, wipe the ultrasound gel off thoroughly. Failure to do so may result in the ultrasound gel solidifying and the image quality being degraded.

To prevent the probe from being damaged, do not use it where it will be exposed to:

- Direct sunlight or X-rays
- Sudden changes in temperature
- Dust
- Excessive vibration
- Heat generators

Repeated disinfection will eventually damage the probe. Check the probe's performance periodically.

1.5 Latex Alert

When choosing a probe sheath, it is recommended that you directly contact CIVCO for obtaining information regarding probe sheaths, pricing, samples and local distribution. For CIVCO information, please contact the following:

CIVCO Medical Instruments

Tel: 1-800-445-6741

www.civco.com



WARNING:

Allergic reactions in patients sensitive to latex (natural rubber) may range from mild skin reactions (irritation) to fatal anaphylactic shock, and may include difficulty breathing (wheezing), dizziness, shock, swelling of the face, hives, sneezing, or itching of the eyes (FDA Medical Alert on latex products, "Allergic Reactions to Latex-containing Medical Devices", issued on March 29, 1991).

1.6 Warning Labels

Warning labels are attached to this system to call your attention to potential hazards. The symbol



on warning labels indicates safety precautions.

The warning labels use the same signal words as those used in the operator's manual. Read the operator's manual carefully before using the system.

The name, design and meaning of each warning label are described as follows:

No.	Warning Labels	Meaning
1.		<p>a. Do not place the system on a sloped surface. Otherwise the system may slide, resulting in personal injury or the system malfunction. Two persons are required to move the system over a sloped surface.</p> <p>b. Do not sit on the system.</p> <p>c. DO NOT push the system. When the casters are locked.</p> <p>d. Read this information carefully before using the system.</p>
2.		Beware of excessive stress exerted to the system.
3.		Mind your hands.
4.		Please do not lift the hanger or try to push the ultrasound system by using it.

2 System Overview

2.1 Intended Use

It is intended for use in gynecology, obstetrics, abdominal, pediatric, small organ, cephalic, transcranial, musculo-skeletal, cardiac, vascular, urology, orthopedics, nerve exam.

2.2 Contraindication

The diagnostic ultrasound system is not intended for ophthalmic use.

2.3 Product and Model Code



NOTE: The functions described in the operator's manual may vary depending on the specific system purchased.

2.4 Product Specifications

2.4.1 Imaging Mode

B Mode	B
M Mode	M Anatomical M: Free Xros M, Free Xros CM
C Mode	Color Power DirPower
D Mode	PW CW
Special imaging	Smart 3D Static 3D 4D Color M iScape (panoramic imaging) TDI (Tissue Doppler imaging) Stress Echo Stress Echo Tissue Tracking QA

2.4.2 Power supply

Voltage	100-127V~ or 220-240 V~
Frequency	50/60Hz
Power consumption	630VA
Fuse	T5AH 250Vac T10AH 250Vac

2.4.3 Environmental Conditions

	Operating conditions	Storage and transportation conditions
Ambient temperature	0°C~40°C	-20°C~55°C
Relative humidity	30%~85% (no condensation)	20%~95% (no condensation)
Atmospheric pressure	700hPa~1060hPa	700hPa~1060hPa

 **WARNING:** Do not use this system in conditions other than those specified.

2.4.4 Dimensions and Weight

17 inch monitor: Dimension: 830±5mm (Length) × 510±5mm (Width) × 1145±5mm (Height)

19 inch monitor: Dimension: 830±5mm (Length) × 510±5mm (Width) × 1150±5mm (Height)Weight (including batteries) : <85KG.

2.5 System Configuration

2.5.1 Standard Configuration

- Main unit
- Built-in DVD
- Accessories
 - Control panel overlay
 - Optional disk
 - Operator's manual
 - Intra-cavity probe bracket
 - Basic accessories (holders, dust-proof cover and cables etc.)

2.5.2 Probes and Needle-guided Brackets Available

Probe model	Probe Type	Intended Use	Region Applied
3C5A	Convex	Gynecology, Obstetrics, Abdominal, Vascular	Body surface
6C2	Convex	Pediatric, Cardiac, Abdominal, Cephalic, Nerve, Vascular	Body surface
7L4A	Linear	Small organ, Vascular, Orthopedics, Musculo-skeletal, Abdominal, Pediatric	Body surface
L14-6NE	Linear	Small organ, Musculo-skeletal, Nerve, Vascular, Orthopedics, Pediatric	Body surface
V11-3	Convex	Gynecology, Obstetrics, urology	Transvaginal
V11-3B	Convex	Gynecology, Obstetrics, urology	Transvaginal
P4-2	Phased array	Cardiac, Abdominal, Pediatric, Transcranial	Body surface
P7-3	Phased array	Cardiac, Abdominal, Cephalic, Pediatric	Body surface
D7-2E	Volume	Gynecology, Obstetrics, Abdominal	Body surface
CW5s	Pencil probe	Vascular, Cardiac, Cephalic, Pediatric	Body surface
CW2s	Pencil probe	Vascular, Cardiac, Cephalic, Pediatric	Body surface
P10-4E	Phased	Abdomen, cardiac, pediatric, nerve	Body surface
DE10-3E	Convex (4D)	Gynecology, obstetrics	Transvaginal
C6-2	Convex	Gynecology, Obstetrics, Abdominal, Vascular	Body surface

Probe model	Probe Type	Intended Use	Region Applied
L9-3E	Linear	Abdomen, Pediatric, Small Parts, Musculo-skeletal, Vascular, Nerve	Body surface
7L4B	Linear	Abdomen, Pediatric, Small Parts, Musculo-skeletal, Vascular	Body surfac

Some of the probes have corresponding needle-guided brackets for biopsy. The available probes and the corresponding needle-guided brackets are listed as follows:

Probe model	Needle-guided Bracket Model	Biopsy angle/depth ($\pm 1^\circ$)	Applicable Biopsy Needle
V11-3/V11-3B	NGB-004 metal/needle un-detachable	0°	16G, 17G, 18G
	Disposable endocavity bracket TY-JD-02	/	16G, 17G, 18G
6C2	NGB-005 metal/needle un-detachable	12.7°, 24.2°	13G, 15G, 16G, 18G, 20G
3C5A	NGB-006 plastic/needle detachable metal/needle detachable	25°, 35°, 45°	Plastic: 13G, 15G, 16G, 18G, 20G Metal: 14G, 16G, 18G, 20G, 22G
7L4A/7L4B	NGB-007 plastic/needle detachable metal/needle detachable	40°, 50°, 60°	Metal: 14G, 16G, 18G, 20G, 22G Plastic: 13G, 15G, 16G, 18G, 20G
P4-2	NGB-011 metal/needle un-detachable	11°, 23°	13G, 15G, 16G, 18G, 20G
DE10-3E	NGB-021 metal/needle un-detachable	2°	16G, 17G, 18G
C6-2	NGB-022 metal/needle detachable	25°, 35°, 45°	14G, 16G, 18G, 20G, 22G
L9-3E	NGB-034 Metal-needle detachable	40°, 50°, 60°	Metal: 4G, 16G, 18G, 20G, 22G

2.5.3 Options

No.	Item	Remarks
1.	ECG module	/
2.	DC-IN cable	ECG module should be configured.
3.	Three-cable lead	ECG module should be configured.
4.	Battery	/
5.	CW module	/
6.	4D module	/
7.	Gel Warmer	/
8.	Wireless Adapter	/
9.	iScape View	/
10.	DICOM Basic (including: Verify (SCU, SCP), task management, DICOM storage, DICOM print, DICOM storage commitment, DICOM media storage (including DICOM DIR), etc.)	/
11.	DICOM WorkList	DICOM Basic should be configured.
12.	DICOM Query/Retrieve	DICOM Basic should be configured.
13.	DICOM MPPS	DICOM Basic should be configured.
14.	DICOM OB/GYN Structured Report	DICOM Basic should be configured.
15.	DICOM Cardiac Structured Report	DICOM Basic should be configured.
16.	DICOM Vascular Structured Report	DICOM Basic should be configured.
17.	DICOM Breast Structured Report	DICOM Basic should be configured.
18.	Abdominal Package	/
19.	Obstetrical Package	/
20.	Smart OB	Obstetrical Package should be configured.
21.	Gynecological Package	/
22.	Cardiac Package	/
23.	Small Parts Package	/
24.	Urological Package	/
25.	Vascular Package	/
26.	Pediatric Package	/
27.	Nerve Package	/
28.	Emergency Medicine Package	/
29.	Smart 3D	/
30.	Free Xros M (anatomical M module)	/
31.	Free Xros CM (Curved anatomical M module)	/

No.	Item	Remarks
32.	TDI (including TVI/TVM/TVD)	/
33.	TDI QA	TDI should be configured.
34.	IMT	Vascular Package should be configured.
35.	Smart Volume	4D module should be configured.
36.	iWorks	/
37.	Smart NT	Obstetrical package should be configured.
38.	Stress Echo	Cardiac package should be configured.
39.	Curved MPR (CMPR)	4D module should be configured.
40.	Slice Contrast View (SCV)	4D module should be configured.
41.	iPage	4D module should be configured.
42.	iLive	Smart 3D module or 4D module should be configured.
43.	iNeedle	/
44.	Elastography	/
45.	Tissue Tracking QA	Cardiac package should be configured.
46.	Gel	/

2.5.4 Peripherals Supported

Item	Model
Black/white digital video printer	SONY UP-D897, MITSUBISHI P95DW-N, SONY UP-D898MD, SONY UP-X898MD
Color digital video printer	SONY UP-D25MD
Graph/text printer	HP Officejet 7000 wide format
Foot switch	USB port: 971-SWNOM (2-pedal) USB port: 971-SWNOM (3-pedal)
Bar code reader	SYMBOL LS2208 (1D); SYMBOL DS6707 (2D)
MIC	SOMIC
DVR	SONY HVO 550MD

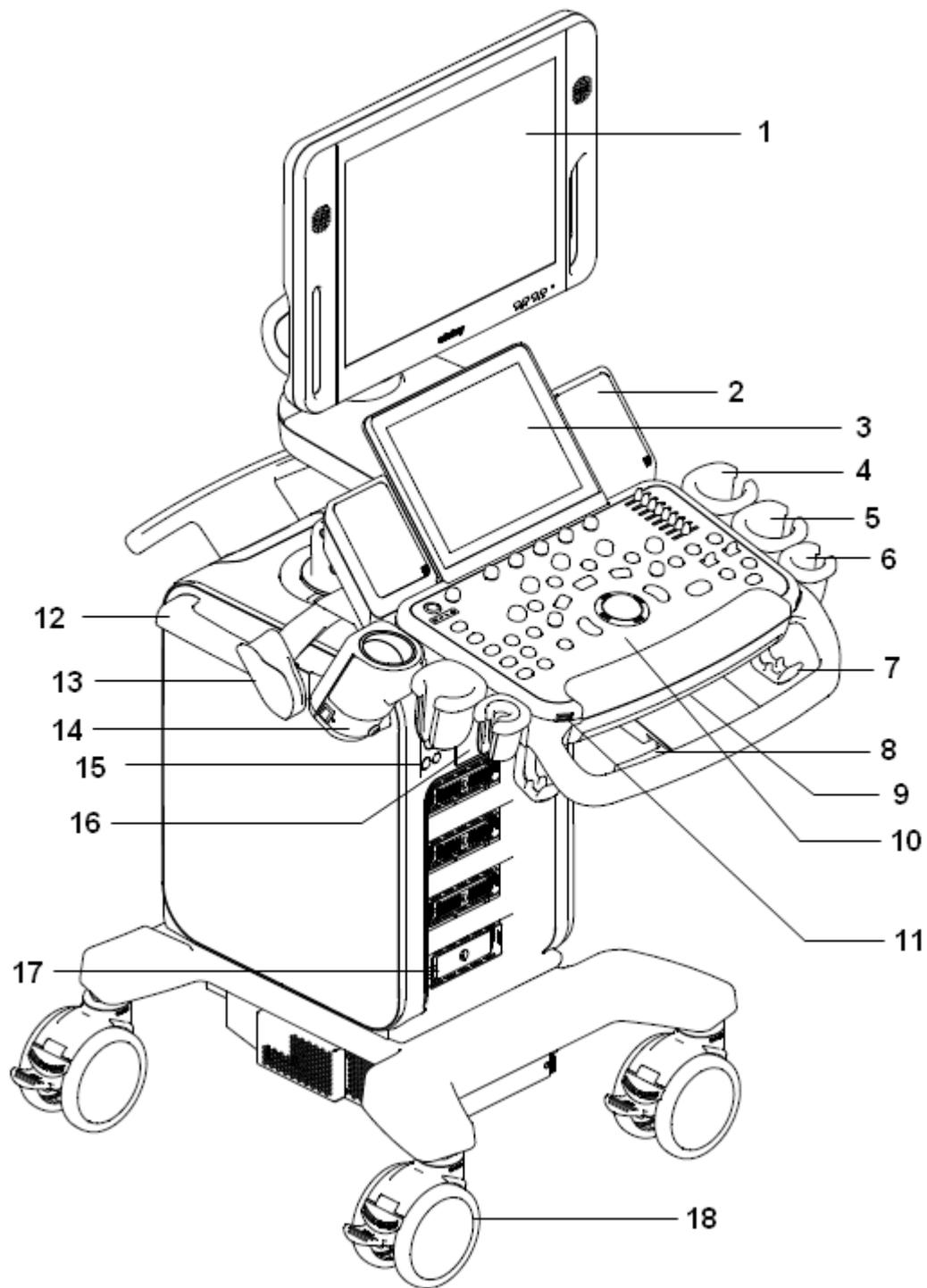
- Parts that can be used within patient environment:
 - Main unit.
 - Probes.
 - Footswitch.
 - Printers: SONY UP-D897, MITSUBISHI P95DW-N, SONY UP-D25MD, SONY UP-D898MD, SONY UP-X898MD

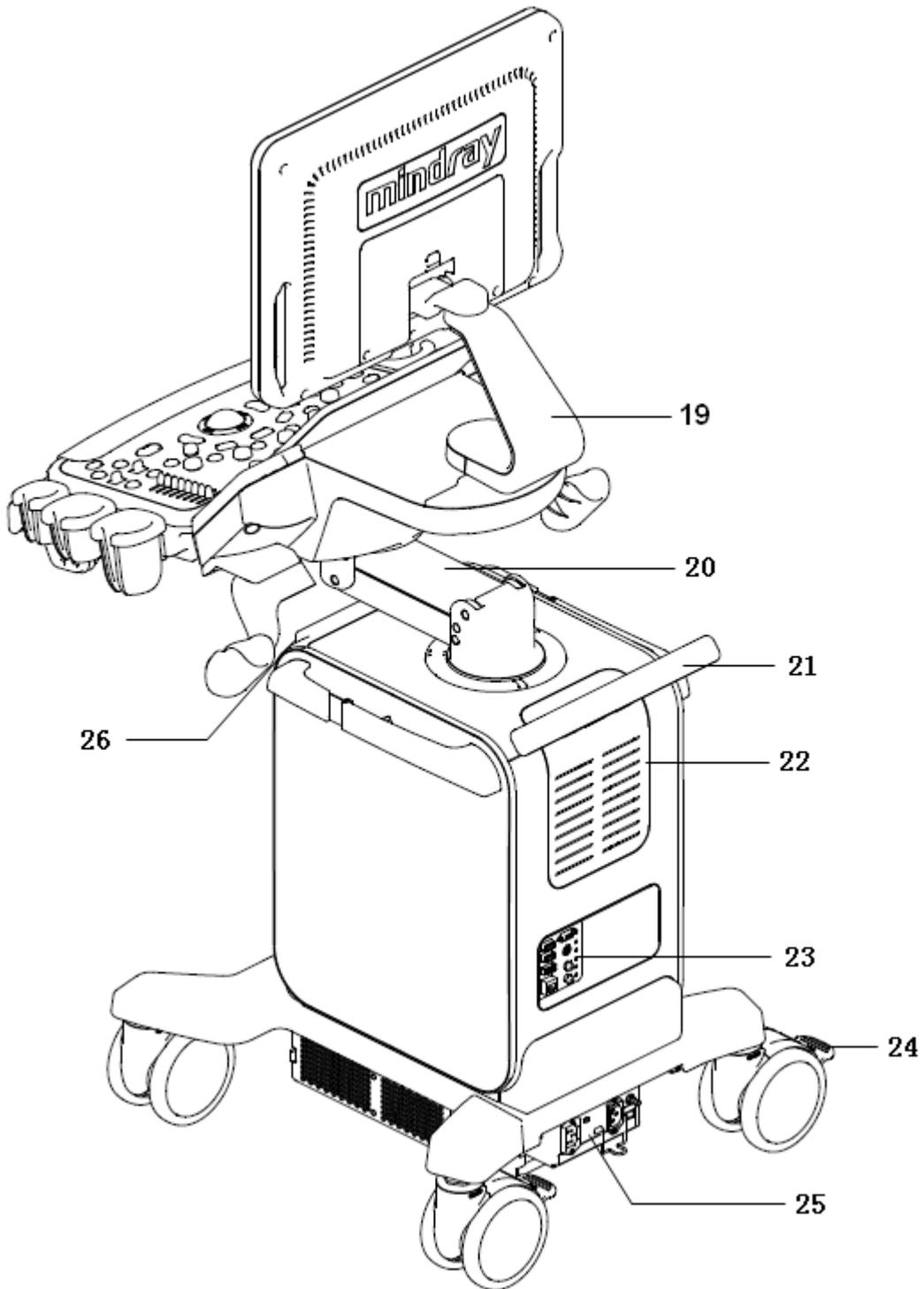


WARNING:

This system complies with IEC60601-1-2:2014, and its RF emissions meet the requirements of CISPR11 Class B. In a domestic environment, the customer or user should ensure the system is connected to Class B peripheral devices, otherwise RF interference may occur, and the customer or user must take adequate measures accordingly.

2.6 Introduction of Each Unit

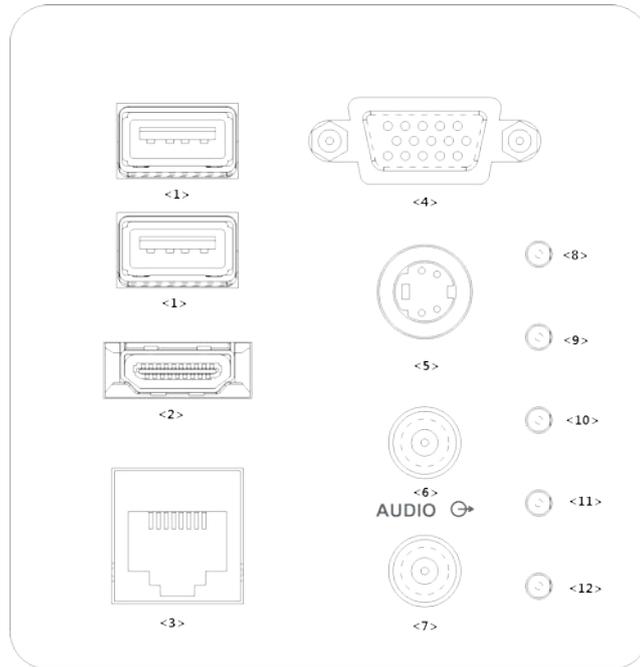




No.	Name	Function
1.	Monitor	Displays the images and parameters during scanning.
2.	Speaker	Sound output.
3.	Touch screen panel	Operator-system interface or control.
4.	Ultrasound gel holder	Used for placing the ultrasound gel.
5.	Probe holder	Used for placing the general probe (not including pencil probe or intra-cavity probe).

No.	Name	Function
6.	Pencil probe holder	Used for placing the pencil probe.
7.	Probe cable hook	Used for fixing the probe cable.
8.	Control panel adjusting lever	Used for lifting or swiveling the control panel.
9.	Keyboard	Used for typing characters or entering some functions.
10.	Main control panel	Operator-system interface or control.
11.	USB_MIC port	USB/MIC port
12.	Hanger	/
13.	Intracavitary probe holder	Used for fixing the intracavitary probe.
14.	Ultrasound gel holder/gel warmer	Used for placing the ultrasound gel or installing the gel warmer.
15.	Physio panel	Used for connecting the ECG leads and external ECG device.
16.	Compartment	Used for positioning the B/W video printer.
17.	Probe port	Sockets connecting transducers and the main unit.
18.	Caster	Used for securing or moving the system.
19.	Monitor supporting arm	Supports the monitor, for adjusting the height and position of the monitor.
20.	Control panel supporting arm	Supports the control panel, for adjusting the height of the panel.
21.	Rear handle	Used for pushing and moving the system.
22.	Cooling vent	/
23.	I/O Panel	Interface panel used for inputting and outputting signals.
24.	Caster brake	Used for locking/unlocking the caster
25.	Power supply panel	Electrical port panel.
26.	DVD-RW	DVD-RW drive.

2.7 I/O Panel

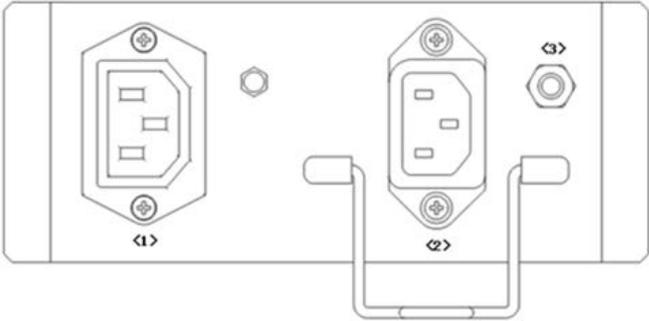


No.	Symbol	Function
<1>		USB ports.
<2>	HDMI	High definition multimedia interface.
<3>		Network port.
<4>	VGA	VGA signal output.
<5>	S-Video	Used for separate video output.
<6>		Audio signal output port, left channel.
<7>		Audio signal output port, right channel.
<8>	/	12V power indicator
<9>	/	5V power indicator
<10>	/	3.3V power indicator
<11>	/	PC_LVDS indicator
<12>	/	PHV protection indicator

NOTE:

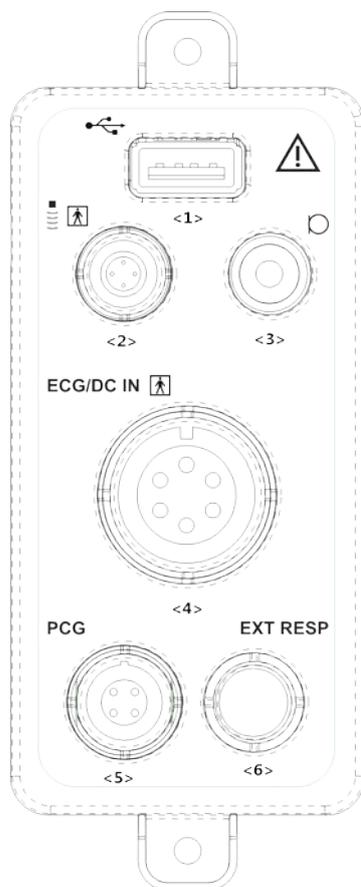
1. The S-VIDEO port performs better with analog video printing.
2. When connecting an external video device (HDMI/VGA), make sure the display resolution setting is 1280x1024, otherwise the image quality may be degraded.

2.8 Power Supply Panel



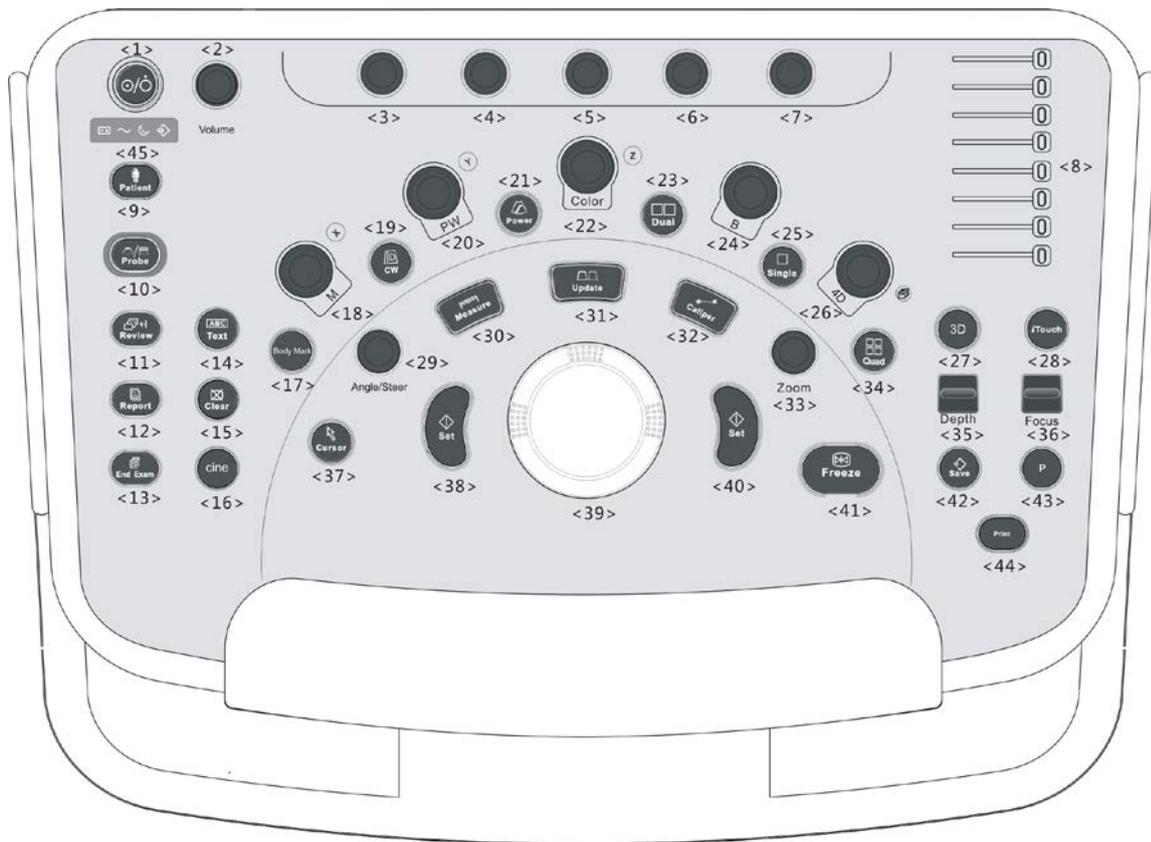
No.	Name	Function
<1>	Power outlet	Supplies power to optional peripheral devices.
<2>	Power inlet	AC power inlet.
<3>	Equipotential terminal ↓ ▽	Used for equipotential bonding which balances the protective earth potentials between the system and other electrical equipment.

2.9 Physio Panel



No.	Name	Function
<1>	USB port	Connects USB device.
<2>	Pencil probe port	Used for connecting a pencil probe.
<3>	MIC port	Used for connecting a microphone.
<4>	ECG lead signal input port/external ECG signal input port	Connects to ECG leads to directly obtain the patient's ECG signals. Connects the signal output port of an external ECG monitoring device.
<5>	PCG signal input port	Reserved.
<6>	Reserved port	Reserved.

2.10 Control Panel



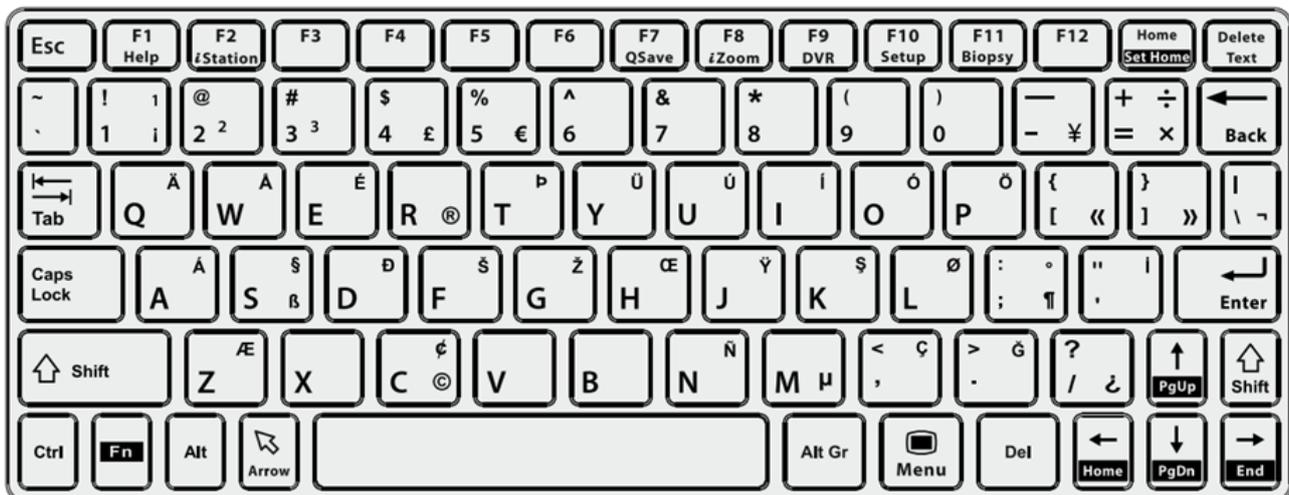
No.	English Name	Description
<1>	/	Power button Press the button to turn on the system, the system enters the work status and the indicator becomes green.
<2>	Volume	Adjust the volume.
<3>	/	Adjust the corresponding functions on the touch screen.
<4>	/	
<5>	/	
<6>	/	
<7>	/	
<8>	TGC	Slide to adjust the depth gain.
<9>	Patient	Enter/exit Patient Info screen.
<10>	Probe	Switch probe and exam mode.
<11>	Review	Review the stored images.
<12>	Report	Open/close the exam report.
<13>	End Exam	End the current exam.
<14>	Text	Enter/exit the textual comment status.
<15>	Clear	Clear the comments or measurement caliper.

No.	English Name	Description
<16>	Cine	Press to enter the Cine Review status from non-cine status when there is a multi-frame cine file playing.
<17>	Body Mark	Enter/exit Body Mark.
<18>	M	Press to enter M mode, and rotate to adjust M mode gain. While in 3D/4D mode, rotate the knob to make the 3D image to rotate around X-axis.
<19>	CW	Enter CW mode.
<20>	PW	Press to enter PW mode, and rotate to adjust PW or CW gain. While in 3D/4D mode, rotate the knob to make the 3D image rotate around Y-axis.
<21>	Power	Enter Power mode.
<22>	Color	Press to enter Color mode, and rotate to adjust Color or Power gain. While in 3D/4D mode, rotate the knob to make the 3D image rotate around Z-axis.
<23>	Dual	Enter Dual mode in Non-Dual mode. Switch between the two display windows in the Dual mode.
<24>	B	Press to enter B mode, and rotate to adjust B mode gain.
<25>	Single	Enter single window in multiple window mode.
<26>	4D	Press to enter 4D function and rotate to make the 3D image rotate.
<27>	3D	Enter the 3D imaging function: Smart 3D or Static 3D.
<28>	iTouch	Optimize the image.
<29>	Angle/Steer	Adjust the angle. Adjust the steering of the probe.
<30>	Measure	Enter/exit the application measurement mode.
<31>	Update	Switching key: Press to change the currently active window. Start/stop image acquisition in iScape or 3D/4D mode.
<32>	Caliper	Enter/exit the general measurement mode.
<33>	Zoom	Rotate to enter the pan-zoom mode, and press to enter the spot-zoom mode.
<34>	Quad	Enter Quad mode in Non-Quad mode. Switch between the four display windows in the Quad mode.
<35>	Depth	Adjust the depth in real-time imaging.
<36>	Focus	Change the focus position.
<37>	Cursor	Show/hide the cursor.
<38>	Set	Confirm an operation. The function is same with the left-button of the mouse.
<39>	/	Move the trackball to change the cursor position.
<40>	Set	Confirm an operation. The function is same with the left-button of the mouse.

No.	English Name	Description
<41>	Freeze	Freeze/defreeze the image.
<42>	Save	Save the image; user-defined key.
<43>	P	User-defined keys, functions of which can be defined in preset.
<44>	Print	Print: user-defined key.
<45>		Battery status indicator. <ul style="list-style-type: none"> Charging status: It illuminates in green when batteries are charged fully. Discharging status: It illuminates in green color when the power of the batteries is more than 20%; It illuminates in orange color for low battery power.
		AC indicator The indicator is on at AC supply.
		Standby indicator. Standby: blinking in orange.
		Hard disk status indicator. The indicator blinks in green when hard disk is running.

NOTE: “/” means the key are undefined or have no silk print. For the undefined keys, you can customize them.

Keyboard



Common functional keys

No.	Key	Function
1.	Enter	Confirm the entered data, or move the cursor to the top of the next row of the text or input field.
2.	Esc	Cancel the operation or exit.
3.	Tab	Jump to the next operable item.

No.	Key	Function
4.	Back space	Insert a space.
5.	Caps Lock	Switch between upper/lowercase.
6.	Home	Activate the Home function: return to start position of the comment.
7.	Delete Text	Delete all comments on the screen.
8.	Direction-control keys	Move the cursor one letter each time, or, select the surrounding objects in the selectable area.
9.	Del	Delete the character after the cursor
10.	Back Space	Delete the character before the cursor

■ Functions of the F1 to F12 keys

No.	Key	Function
1	F1 Help	Open or close the accompanying help documents.
2	F2 iStation	Enter or exit the Patient Info system.
3	F3~F6	User-defined keys, the functions of which can be preset.
4	F7 QSave	Save the current image parameters quickly.
5	F8 iZoom	Enter/exit full-screen zoom status.
6	F9 DVR	Reserved, enter/exit DVR mode.
7	F10 Setup	Enter/exit Setup.
8	F11 Biopsy	Display/hide the guide line.
9	F12	User-defined keys, the functions of which can be preset.

■ Functions of key combinations

The system supports multi-language input using key combinations. Key combinations include [Shift], [Alt Gr], [Ctrl], [Fn] and some alphabet keys. For details about switching the system to multi-language, see "12.1.1 Region" for details.

- <Shift> key
 <Shift> + key: enter the top left letter on the key.
 For the alphabet keys (<A>~<Z>), press <Shift> + key to enter the current letter in a different case.
- [Alt Gr] key
 Combined with other letter keys, [Alt Gr] can be used for entering other languages.
 Press [Alt Gr] and a letter key simultaneously. The letter in the top-right corner of the key is entered.
- [Ctrl] key combined keys
 On the iStation or Review screen, use <Ctrl> and <Set> to select more than one patient or more than one image.

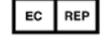
- [Fn] key

For these combination keys, press <Fn> + key to use the functions indicated with a frame on the key.

No.	Fn+	Name	Function
1.	→	End	Move the cursor to the end of the row, or the rightmost side of an editable unit.
2.	←	Home	Home
3.	↑	Pg Up	Turn pages upward.
4.	↓	Pg Dw	Turn pages downward.
5.	Home	Set Home	Activate the Set Home function: set the start point of a comment.

2.11 Symbols

This system uses the symbols listed in the following table. Their meanings are explained as follows:

Symbol	Description
	Type-BF applied part
	Caution !
	AC (Alternating current)
	Functional grounding
	Equipotentiality
	Power button
	Foot switch
	Transducer sockets
	Pencil probe port
	Network port
	USB port
VGA 	Used for VGA output.
S-VIDEO 	Reserved, used for separate video output
AUDIO 	Used for stereo audio output.
HDMI	High definition multimedia interface.
	Microphone input jack
	When the lever located at the bottom of the monitor supporting arm points to  , you can move the monitor to the right and left.
	When the lever located at the bottom of the monitor supporting arm points to  , the supporting arm is fixed in the middle position.
	Product serial number
	Manufacture date
	Non-ionizing radiation, RF emitting devices included in the device and system.
	Authorized representative in the European Community

Symbol	Description
	<p>This product is provided with a CE marking in accordance with the regulations stated in Council Directive 93/42/EEC concerning Medical Devices. The number adjacent to the CE marking (0123) is the number of the EU-notified body certified for meeting the requirements of the Directive.</p> <p>The radio device used in this product complies with the essential requirements and other relevant provisions of Directive 1999/5/EC (Radio Equipment and Telecommunications Terminal Equipment Directive). The product is in compliance with ETSI EN 300 328 and ETSI EN 301 489.</p> <p>NOTE: The product complies with the Council Directive 2011/65/EU.</p>

3 System Preparation



WARNING:

1. Do not connect the system's three-wire cable with a two-wire plug without protective grounding. This may lead to electric shock.
2. Connect the power plug of this system to wall receptacles that meet the ratings indicated on the nameplate. If adapters or multifunctional receptacles are used, it may cause the leakage current to exceed the safety requirements.
3. Within 1.5 meters of the patient, connect peripherals to an auxiliary power outlet which is capable of isolation protection, or power peripherals by an auxiliary output cable or isolation transformer which complies with IEC 60601-1 Chapter 16 or a power input of the same safety level.
4. **DO NOT** use different-phase power supplies to power peripherals.
5. When using peripherals which are not powered by the ultrasound system's auxiliary output, or peripherals other than those permitted by Mindray, ensure the overall leakage current of peripherals and the ultrasound system meets the requirement of the local medical device electrical regulations (e.g., the enclosure leakage current should be no more than 500uA as per IEC 60601-1 Chapter 16), and the responsibility is held by the user.

3.1 Move/Position the System

Read and understand the safety precautions before positioning the system to ensure the safety of both the operator and the devices.

1. Switch off the power, and pull out the plug.
2. Disconnect all cables from off-board peripheral devices (printer, recorder, etc.).
3. Release the four casters and hold the handle to move the system.
4. When moving the system to a desired location, lock the four casters.



CAUTION:

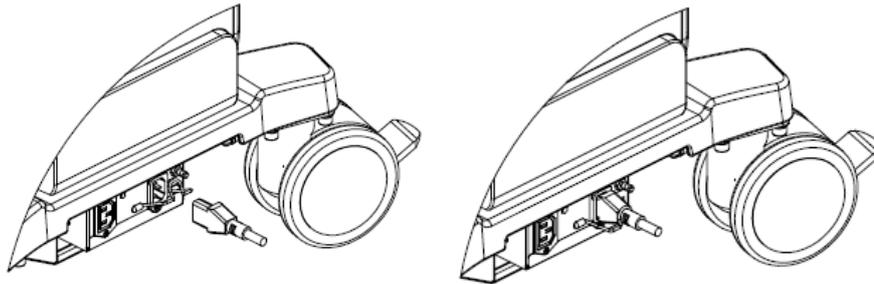
1. Maintain a generous, free air flowing space around the back and both sides of the system. Not doing so may result in failure due to the increased rise in the system's operating temperature.
2. Pay extra attention when moving the system on a sloping surface. Do not move it on a surface with a slope of more than 10° to avoid the system toppling.

3.2 Connecting the Power Cord & Protective Grounding

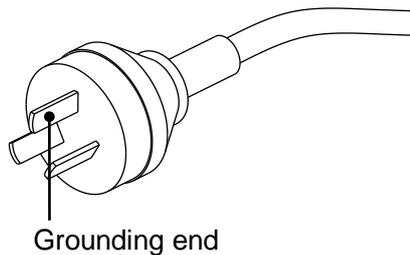
3.2.1 Connecting Power

■ The connection method is described as follows:

1. Push the retaining clamp upward, and insert the power plug into the receptacle, as shown in the figure below.



2. Pull the retaining clamp downward to lock the power cord, as shown in the figure above.
3. Plug the power plug at the other end into an appropriate outlet. The grounding terminal should be connected with a power grounding cable to ensure that protective grounding works normally.



NOTE: Be sure to allow sufficient slack in the cable so that the plug will not be pulled out of the receptacle if the system is moved slightly. If the plug is pulled out accidentally, data may be lost.

3.2.2 Equipotential terminal

The symbol  represents the equipotential terminal that is used for balancing the protective earth potentials between the system and other electrical equipment.

WARNING:

1. **Be sure to connect the equipotential wire before inserting the power plug into the receptacle. Be sure to remove the power plug from the receptacle before disconnecting the equipotential wire. Failure to do so may result in electric shock.**
2. **When you connect another device to this system, you should use the equipotential wire to connect each of equipotential terminals. Failure to do so may result in electric shock.**
3. **Connect the earth cable before turning the system ON. Disconnect the earth cable after turning the system OFF. Failure to do so may result in electric shock.**
4. **DO NOT connect this system to outlets with the same fuses that control the current to devices such as life-support systems. If this system malfunctions and generates overcurrent, or when there is an instantaneous current at power ON, fuses of the building's supply circuit may be tripped.**

3.2.3 Power the System ON

 **CAUTION:** To ensure safe and effective system operation, you must perform daily maintenance and checks. If the system begins to function improperly, immediately stop scanning. If the system continues to function improperly, fully shut down the system and contact the Mindray Customer Service Department or a sales representative. If you use the system in a persistent improperly functioning state, you may harm the patient or damage the equipment.

■ Check before Powering ON

Check before the system is powered on:

No.	Check Item
1	The temperature, relative humidity and atmospheric pressure meet the requirements of the operating conditions. See “2.4.3 Environmental Conditions” for details.
2	There is no condensation.
3	There is no distortion, damage or dirt on the system and peripheral devices. If any dirt is found, cleaning shall be performed as illustrated in section “17 System Maintenance.”
4	There are no loose screws on the monitor or control panel.
5	There is no cable damage (e.g., power cord). Maintain secure connections to the system at all times.
6	The probes and probe cables are free from damage or stains. See chapter “13 Probes and Biopsy” for details of probe cleaning and disinfection.
7	No miscellaneous odds and ends are attached or affixed to the control panel.
8	Ensure that all connections are free from damage and remain clear of foreign object blockages. There are no obstacles around the system and its air vent.
9	Probe cleaning and disinfection.
10	The entire scanning environment and field must be clean.
11	The locking mechanism of the casters works normally.

Before turning the system on, check if the system is plugged in. Press the power button (to the left of the control panel) to power the system on.

- Check the system after it is powered on
Check after the system is powered on:

No.	Check Item
1	There are no unusual sounds or smells indicating possible overheating.
2	There are no persistently displayed system error messages.
3	There is no evident excessive noise, or discontinuous, absent or black items in the B mode image.
4	Check whether there is abnormal heat on the surface of the probe during an ultrasound procedure. If you use a probe which is giving off excessive heat, it may burn the patient.
5	The control panel keys and knobs are fully functional.
6	The touch screen and the main monitor screens display normally depending on the system modes and image status.
7	The exam date and time are the same as the system date and time, and are displayed correctly.

 **WARNING:** If you use a probe giving off excessive heat, it may burn the patient. If you find anything not functioning properly, this may indicate that the system is defective. In this case, shut down the system immediately and contact Mindray Customer Service Department or sales representative.

3.2.4 Power the System OFF

You must follow the correct procedures to power the system off. Also, after you upgrade the software or when the system is down, you need to power off and restart it.

- To power the system off normally
Press the power button on left of the control panel to see the option:
 - Shut down: to power the system off normally.
 - Standby: to enter standby status.
 - Cancel: to cancel the operation.
- To shut down the system directly if it cannot be done normally:
Unplug the power cord directly.

NOTE:

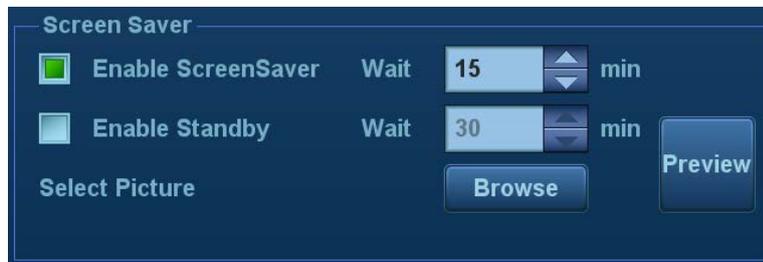
1. DO NOT rush direct shutdown of the system. It may damage the data.
2. After the system is upgraded, use “Shut Down” to power the system off to make the upgraded data effective.

3.2.5 Standby

When the battery is charged to full capacity, the system's standby time is no less than 24 hours.

- To enter standby:

Open [Setup] → [System] → "General" to set the time for screensaver and standby. If the system is not carrying out an operation, the screensaver appears after the screensaver delay period. If there is still no operation, the system enters standby after the standby delay period.



Press the power button and select "Standby", the system enters standby mode.

- To exit standby:

Press the power button.

- Under the standby status:

Press the power button to exit standby status and then power off the system.

NOTE: If the system will not be used for a long period of time, you should disconnect the power adapter, disconnect the mains power, and turn off the power to all peripherals connected to the system.

3.3 Monitor Adjustment

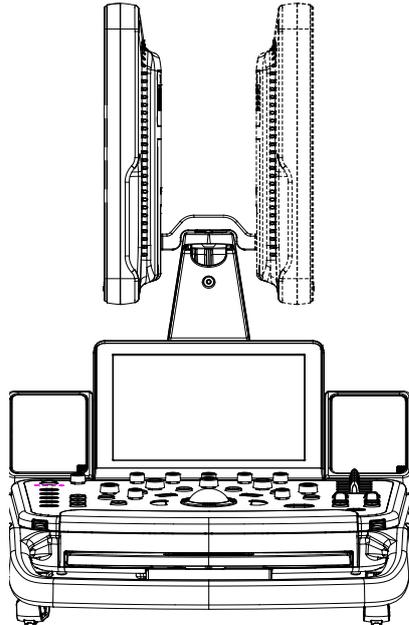
3.3.1 Monitor Position Adjustment

Gently hold the bottom edge of the monitor when adjusting its position.

- Rotate the monitor

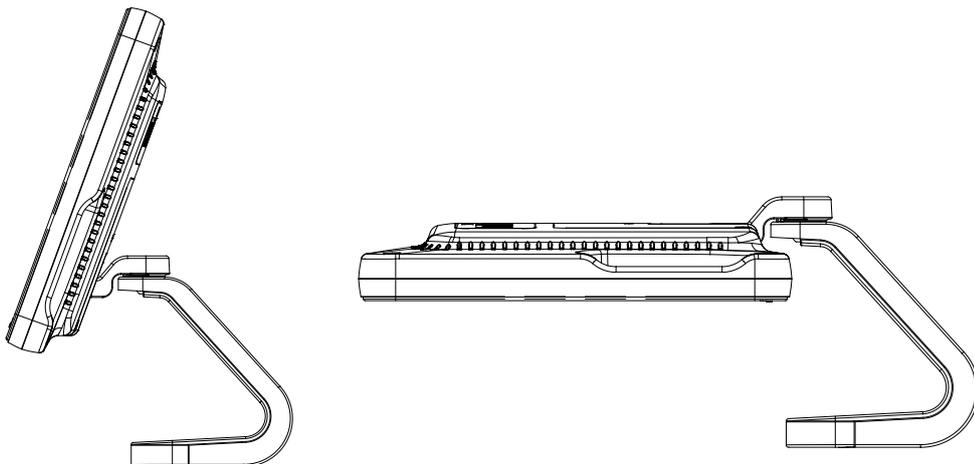
- Monitor rotation

The monitor can be rotated $\pm 90^\circ$.



- Tilt the monitor

When positioned vertically, the monitor can be tilted 20° backward and can be tilted forward to a horizontal position. When transporting or moving the system, keep the monitor in the horizontal position, as shown below:



3.3.2 Monitor Brightness/Contrast Adjustment

Monitoring the brightness and contrast adjustment is one of the most important factors for proper image qualities. If set incorrectly, the gain, TGC, dynamic range or even acoustic output have to be changed more often than necessary to compensate.

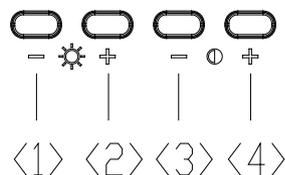
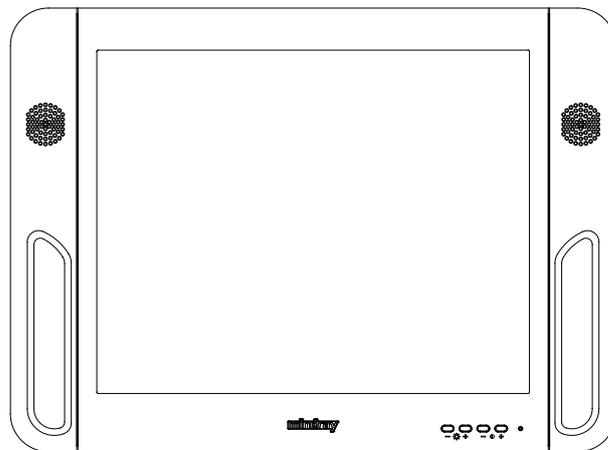
The adjusting buttons are shown as follows:

- Brightness adjustment:

<1>, <2> refer to the brightness control keys with a sun marked at the top. Key <1>, marked with a “-” on the top, can be used to decrease the brightness, while key <2>, marked with a “+” on the top, can be used to increase the brightness.

- Contrast adjustment:

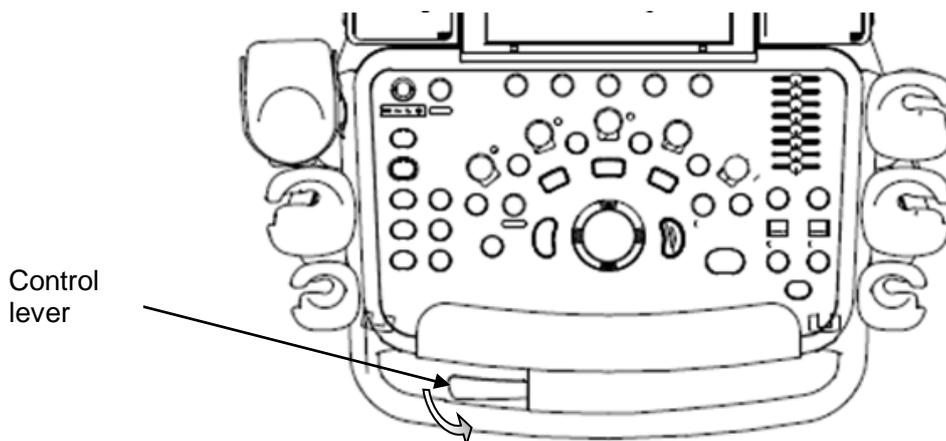
<3>, <4> refer to the contrast control keys with a moon marked at the top. Key <3>, marked with a “-” on the top, can be used to decrease the contrast, while key <4>, marked with a “+” on the top, can be used to increase the contrast.



NOTE: On the monitor, the brightness adjustment comes before contrast. After readjusting the monitor's contrast and brightness, adjust all preset and peripheral settings.

3.4 Control Panel Position Adjustment

Press the control lever downwards for about 30° to rotate the control panel $\pm 90^\circ$. Press the lever downwards for about 60° to move the control panel upwards or downwards.



3.5 Connecting a Probe

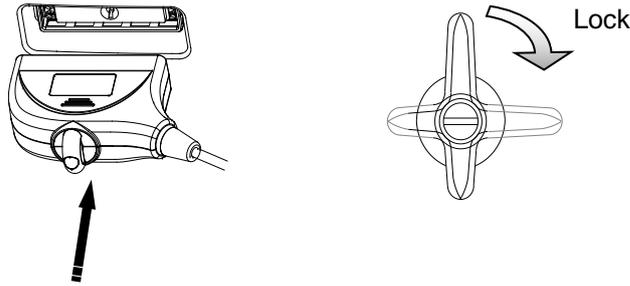
- CAUTION:**
1. Press <Freeze> to freeze an image or turn off the system power before connecting or disconnecting a probe. Failure to do so may result in system or probe failure.
 2. When connecting or disconnecting a probe, place it in the proper position to prevent the probe from falling off or becoming damaged.
 3. Hang the probe cable on the hanger located under the control panel to avoid excessive bending and damage.
 4. Only use probes provided by Mindray. Aftermarket probes may result in damage or cause a fire.

NOTE: If a probe port is not used for a long period of time, use the dustproof cover to protect the probe port from dust. Failure to do so may result in bad contact.

3.5.1 Connecting a Probe

WARNING: The probes, cables and connectors should be in proper operating order and free from surface defects, cracks and peeling. Otherwise, this may lead to electrical shock.

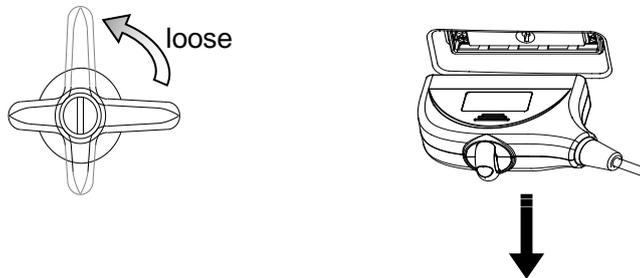
1. Keep the cable end of the transducer to the right side of the system, insert the connector into the system port, then press in fully. (Shown in the left figure)
2. Turn the lock handle 90° clockwise to lock it securely. (Shown in the right figure)
3. Position the probe properly to avoid it being treaded on or becoming wrapped around other devices. DO NOT allow the probe head to hang free.



NOTE: Before inserting the connector into the probe port, inspect the connector pin. If the pin is bent, do not use the probe until it has been inspected/repaired/replaced.

3.5.2 Disconnecting a probe

1. Turn the locking lever 90° counterclockwise to the vertical position. (Shown in the left figure)
2. Pull the transducer connector straight out vertically (shown in the figure below).



3.6 Connecting Peripheral Devices

3.6.1 Connecting USB Devices

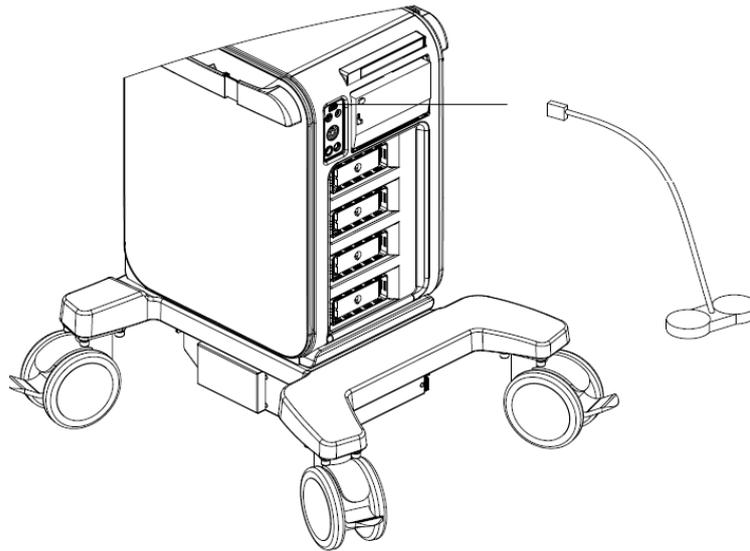
WARNING: DO NOT directly remove a USB memory device, as the USB device and/or the system may become damaged.

- When connecting a USB memory device to the ultrasound system via a USB port, a sound is heard if it is connected successfully and the symbol  appears in the bottom-right corner of the screen.
- To remove the USB device: click  to open the [Remove USB Device] screen. Select the device to be removed and click [OK]. A sound is heard when removing the USB memory device.

3.6.2 Connecting a Foot Switch

The system supports USB port-type foot switches.

- Connection
Directly insert the USB port of the foot switch into the system's applicable USB port.



- **Function setting**

The function of the foot switch can be preset. For details, see “12.1.6 Key Configuration.”

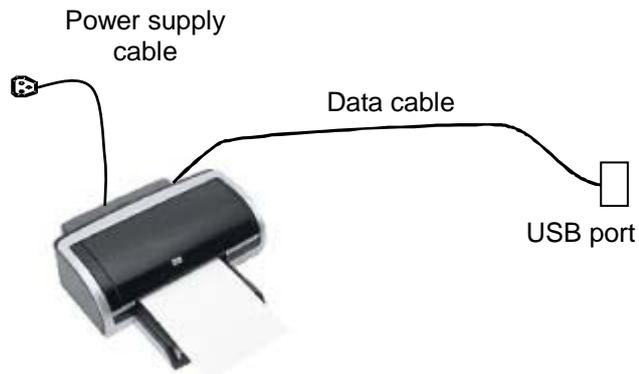
3.7 Installing a Printer

3.7.1 Installing a Graph/Text Printer

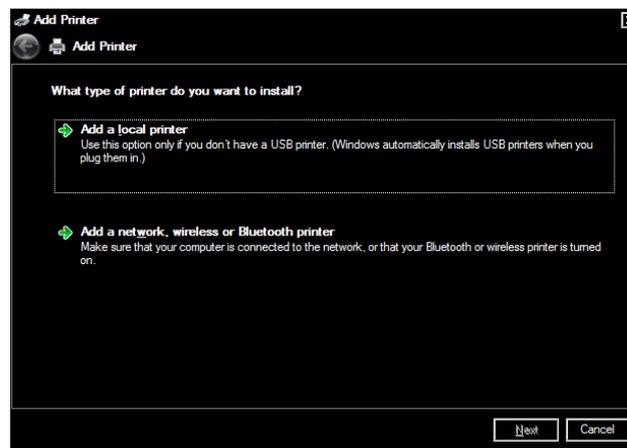
- Connecting a local printer

Note: Printers listed in “2.5.4 Peripherals Supported” Chapter have drivers installed already.

As shown in the figure below, a graph / text printer has a power cord and data cable. The power cord shall be directly plugged into a well-grounded outlet.

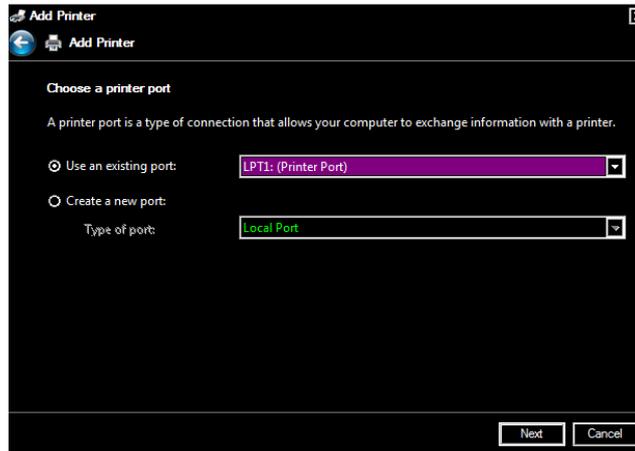


1. Connect the data cable to the USB port on the ultrasound system.
2. Power the system and the printer on.
3. Put the installation optical disk of the printer driver into the DVD R/W drive.
4. Install the printer driver: Select [Setup]→[Print]→[Add Printer].



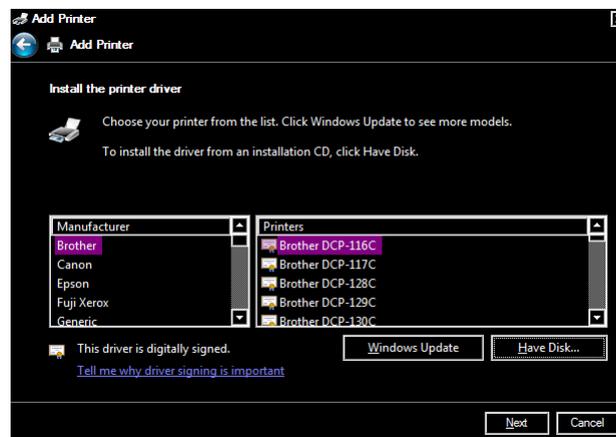
Note: all the operations are finished with right <Set> key.

5. Select [Add a local printer] and click [Next] to enter the screen used for browsing driver.



Note: see the printer's operation manual to select the port, or try to use the default port of the system.

6. Click [Have Disk...] to find the driver path (the installation type should be WIN7 64), and then click [Next] to install the driver.



7. Complete the operation according to the tips on the screen. Click [Finish] to end the installation.

■ Add network printer

1. As the system is connected into a LAN, open [Setup]-> [Print] screen.
2. Click [Add Printer], select [Add a network, wireless or Bluetooth printer].
3. The system starts to search all available printers within the network. Select the target printer and click [Next], the system tries to connect to this printer.
4. When the connection is successful, the system prompts the dialogue box, click [Next] according to the screen tips and then click [Finish].The printer is installed successfully.

Tips: the system has combined many types/brands of printer drivers, if targeted printer drive is not included in the system, you may need to install the driver for the network printer. Please use the optical disk or USB disk with the driver to install according to the system prompts.

NOTE: When you install the printer's driver, you must specify the specific path for installation. A vague path may result in longer searching times.

The network printer functions depending on the configured network environment in the hospital, please consult the network configuration manager in case of failure.

■ Print

Both report and image can be printed on a graph / text printer.

To set the default report printer and its attribute:

In "[Setup]→[Print]" screen, select the "Report Print" column in the service list. You can select printer from the driver list next to "Printer" in the lower screen and set the items in the "Property" box. Click [Save] after you have finished setting.

Please refer to the accompanying manuals of the printers for more details.

3.7.2 Installing a Video Printer

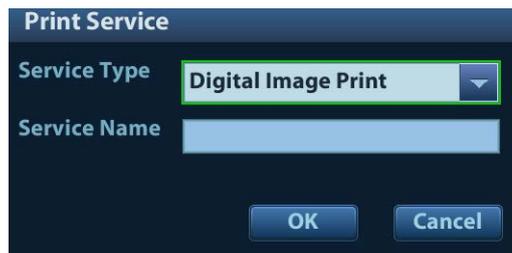
The system support video printers, consist of the B/W digital printers and color digital printers.

■ Local printer installation

1. Position the printer in the proper place.
2. Plug the printer power cord into an appropriate outlet.
3. Use a USB cable to connect between the system's USB port and the printer's USB port.
4. Load a paper roll, and turn on the system and printer.

See section "3.7.1 Installing a Graph/Text Printer" for the driver installation procedure (printer drivers listed in chapter "2.5.4 Peripherals Supported" are installed already).

5. Add a print service:
 - (1) Open the "[Setup] → [Print]" screen.
 - (2) Click [Add Service] to enter the page.



- (3) Select the service type and enter the service name manually.
- (4) Click [OK] to return to the page.
- (5) Select the target printer from the drop-down list in the "Property" box and set other printing properties.
- (6) Click [Save] to complete.

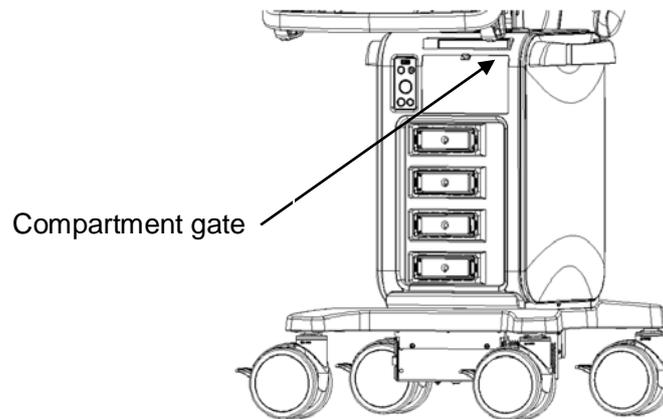
3.7.3 Installing a Wireless Printer

The system supports wireless graph/text printer for report printing.

1. Plug the printer power cord into an appropriate outlet.
2. Power the system and the printer on.
3. Make sure the ultrasound machine and the printer are connected to the same LAN, and turn the printer's W-LAN function on.
4. Add a wireless adapter, following the steps described in "Add network printer." See chapter "3.7.1 Installing a Graph/Text Printer" for details.
5. Open the [Setup] → [Print] page, select "Report Print" from the printer list, select the printer to be the wireless printer, and set properties.
6. Click [Save] to exit the preset and make the settings effective.

3.7.4 Position the Printer

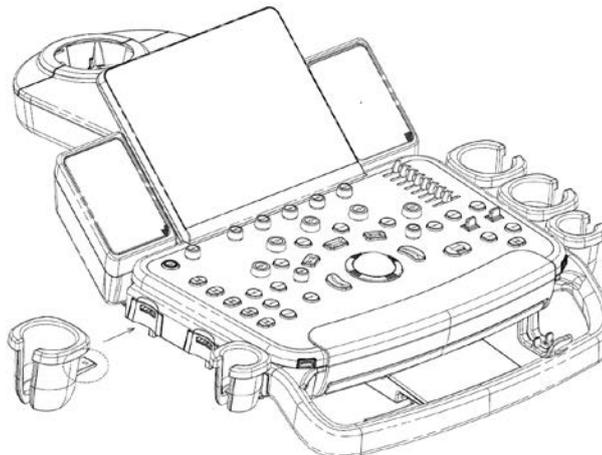
As shown in the following figure, you can open the video printer compartment gate and then place the black/white digital video printer in the video printer compartment.



3.7.5 Installing/ uninstalling Probe/Gel Holder

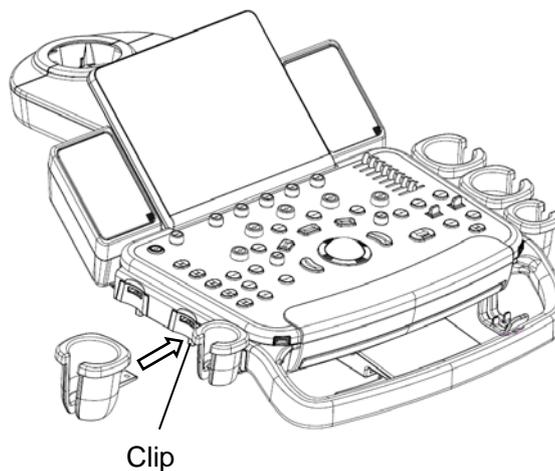
■ Installing

As shown in the figure below, align the buckle of the holder to the slot at the side of the control panel and then insert the buckle into the slot until the buckle clicks and locks.



■ Uninstalling

Press the clip in the direction of the arrow to get out the holder.



3.8 Basic Screen & Operation

3.8.1 Screen Display

The screen displays ultrasound images, parameters, menus and measurement results windows.

The following diagram maps out the different areas, such as patient information, image parameter & menu, image area, thumbnail of images saved, help information, soft menu, system status icon, etc.

Logo	Hospital Name			Patient Name	Age /DOB	Probe Model	Probe parameter
	Date	Time	Operator	ID	Gender /GA	Exam mode	HR
Menu	Image Area					Grays cale/ Color Bar	Image parameter area
	ECG						User-defined key hint area
	Cine Review						
Help Information							User-defined key hint area
Thumbnail area							
Soft menu parameter window						System Icon	

■ Patient/Exam information

The Information area consists of the hospital name, patient name, the exam mode, the probe model, the exam time, operator, patient ID, DOB, GA or age etc. To preset which kind of patient information is displayed, enter the path: [Setup]→[System]→[General]. For more details, please refer to “12.1.2 General” chapter.

- Hospital name
Display the hospital name. Hospital name can be set via "[Setup] → [System] → [Region]".
- Patient Information
Displays patient name, ID, gender, GA and age(DOB) etc. Enter the patient information through the "Patient Info" screen. Or, import the saved patient data from DICOM/HL7 Worklist server. See “4.1 Patient Information” chapter for details.

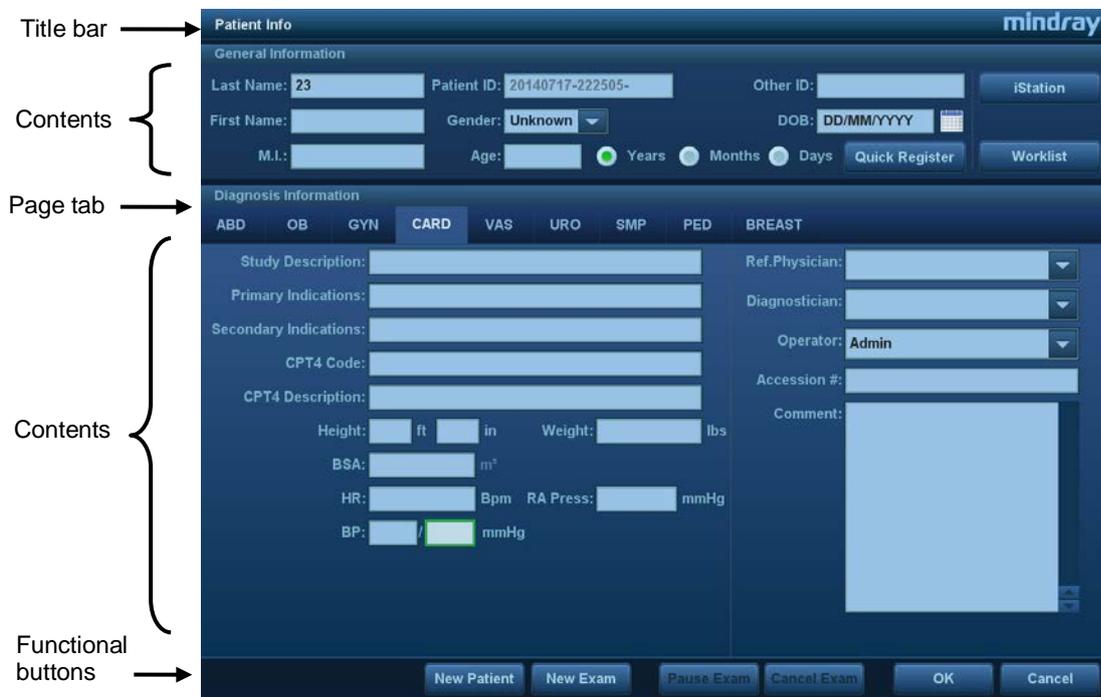
- Exam Mode
Displays the currently used exam type, e.g. Abdomen.
 - Probe Model
Display the currently-used probe model, or the default model.
 - Probe parameter area
Displays the acoustic power. Including the acoustic power, MI (Mechanical Index) and TI (Thermal Index). For how to set, see “MI/TI Display.”
 - Exam time
Displays the exam time, including date and time. Exam time can be set via “[Setup]→[Region]”. Exam time will be frozen with the frozen image.
 - Operator
Displays the operator’s name on the screen. This information is entered through the “Patient Info” screen.
- Menu area
Includes the image menu, measurement menu, comment menu, body mark menu, and so on.
 - Image area
The image area displays the ultrasound images, ECG waveforms, probe mark (or activating window mark “M”), coordinate axis (including depth, time, velocity/frequency) and focal position (located on the depth axis in the form of ). Annotations, body marks, measurement calipers, color bar/grayscale bar are also displayed here.
 - Parameter area
Displays the image parameters for the active window. If there are more than one imaging modes, the parameters are displayed by each mode.
 - Clip board/Thumbnails
Displays the thumbnail images stored under the current patient.
 - ECG icon and ECG curve
 - ECG icon
Displays the ECG icon, which consists of a heart icon and heart rate, e.g., 
 - ECG curve
ECG Display

Tip: The amplitude and position of ECG waveform can be changed.
 - Help information area
The help information area displays various help information items or the progress bar in the current status.
Tip: In terms of help information, “TB” refers to “Trackball”.
 - Thumbnail
Displays the thumbnail images stored under the current patient.
 - Grayscale/color bar
Displays the grayscale/color bar corresponding to the current mode.
 - Soft Menu area
The monitor's soft menu area displays the items that simultaneously appear at the bottom of the touch screen.

- System status icon
This area displays the relevant system icons, such as USB memory device, printer, network, Chinese/English entry, and current system time, etc.
- User-defined key function display region
This area displays the function defined for those user-defined keys. For details about user-defined key, see “12.1.6 Key Configuration”.
- Other Operations
The positions of areas illustrated here are not fixed. They can be moved within a certain area on the monitor using the trackball.
 - Results window
 - Comments area
 - Body marks area

3.8.2 Basic Operations of the Dialog Box

A dialog box screen consists of a title, page tabs, contents and buttons, as shown in the figure below:



Composition	Description
Title Bar	The title bar is used to give a description of the content and function of the screen.
Page Tab	For some screens, the contents are distributed across several pages. Use the <Set> key to open/close the available pages.
Contents	<ul style="list-style-type: none"> ■ Radio box: click to select the item. ■ Check box: click to check or uncheck the item. ■ Entry box: enter characters manually using the keyboard. ■ Drop-down list box: click ▼ to show the list and select an item.
Functional buttons	When a screen's operation is complete, click the [OK] or [Cancel] button to save or cancel the operation, and close the screen.

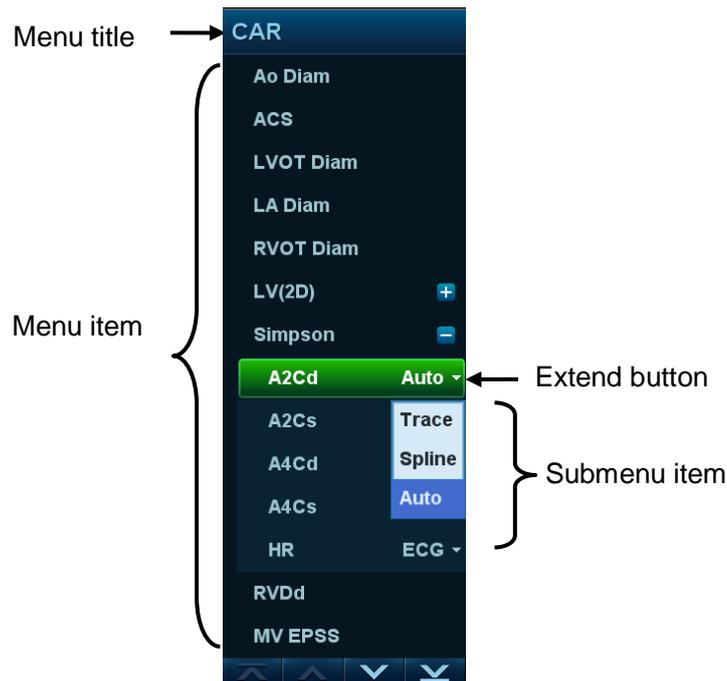
■ To reposition a dialog box which is not a full-screen dialogue box:

1. Roll the trackball to move the cursor over the title bar of the dialog box. The cursor becomes a . Press the <Set> key.
2. Roll the trackball and position the rectangular graphic in the new desired location.
3. Release the <Set> key, and the dialog box is moved to the desired position.

3.8.3 Menu Operation

Use the trackball to use the menu.

Menus of different modes display in real time in the top-left corner of the screen.



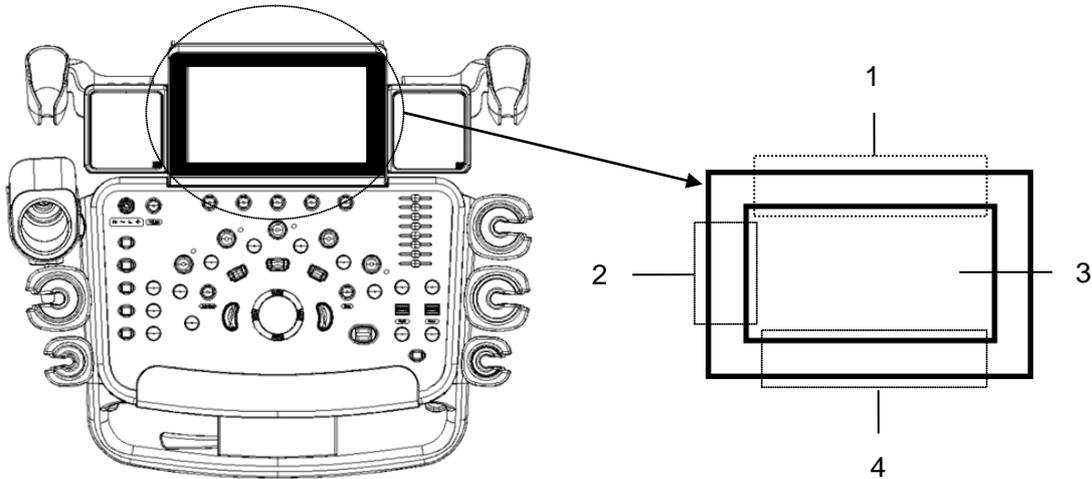
For details of measurement menu operations, see the [Advanced Volume].

■ Operate the menu using the trackball and left/right <Set> key.

1. Press <Cursor> to show the cursor.
2. Roll the trackball to position the cursor on the item to be adjusted.
 - For a commanding item or command optional item: press <Set> to activate the item.
 - For a parameter item or ON/OFF item: press <Set> to activate the item (the item turns green when active), then press <Set> to switch between the available values.
 - For a parameter optional item: press <Set> to extend the available parameters and position the cursor on the list. Roll the trackball to position the cursor on the item to be adjusted, then press <Set> to set the value.

3.8.4 Touch Screen Operation

■ Mapping mode

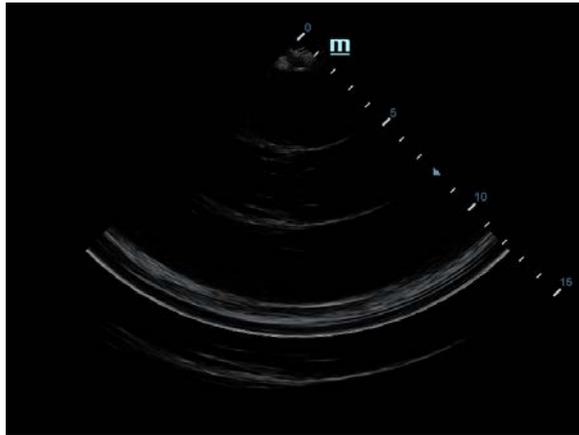


Operating region	Operations
1	Swipe from this area to bottom to enter the mapping mode.
2	Under mapping mode, swipe from this area to right to display the mapping menu.
3	Under mapping mode, this area displays mapping menu, soft menu and tool bar, where you can adjust image parameters, perform measurement, image sending and review. See “5.1.2 Image Adjustment” for details. Under mapping/non-mapping mode, you can do fast operation using two-finger gesture according to the gesture hints  on the bottom-right of the screen.
4	Under mapping mode, swipe from this area to the top to exit mapping mode.

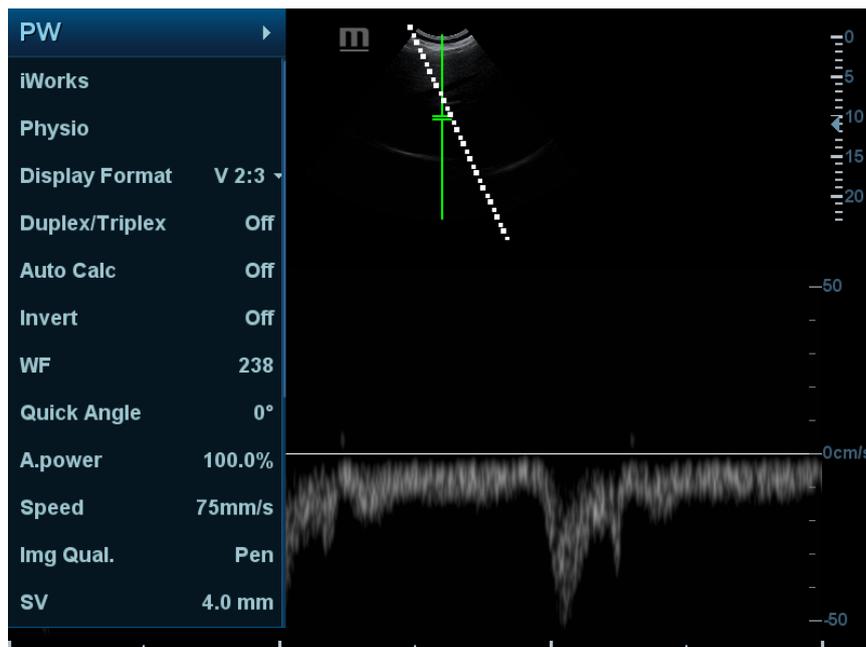
● Enter mapping mode

Swipe the touch screen from top (region 1) to bottom to enter the mapping mode. The system maps the image of the monitor onto the touch screen. See the figure below.

Tips: if a dialogue box is displayed on the screen, mapping mode is not available.



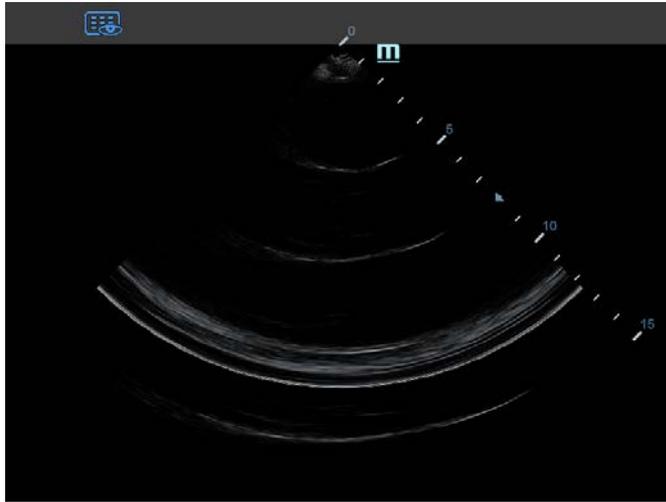
- **Menu Operations**
 Swipe the touch screen from left (region 2) to right to show the mapping menu. See the figure below.
 For detailed operations, see Chapter “5.1.2 Image Adjustment”.
 Touch or flip the menu to the left/right to adjust the image parameters; touch the measurement menu to select measurement tools and start measurement.
 Click any blank area on the touch screen to hide the mapping menu.



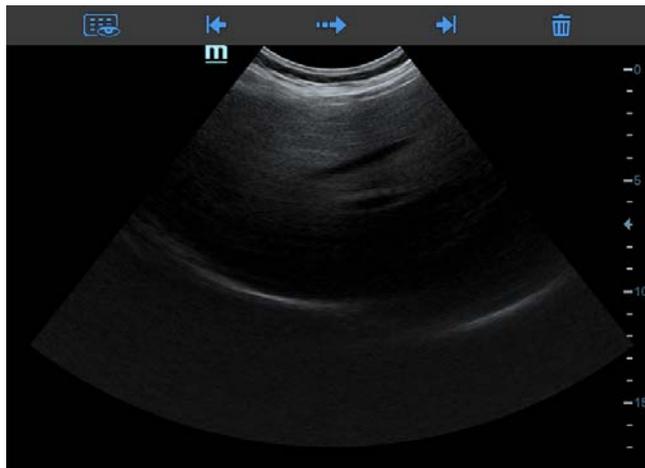
- See “5.1.2 Image Adjustment” for menu operation.
- **Soft Menu Operations**
 Under mapping mode, rotate the knobs beneath the touch screen to show the soft menu. Rotate the knob to complete the adjustment.
 - **Two-finger gesture**
 For details about two-finger gesture function setting, see “12.1.6 Key Configuration” chapter.
 Swipe the touch screen (region 3) with two fingers by the hint in user-defined key function display region on the bottom-right of the screen. (See “3.8.1 Screen Display” chapter for details)

➤ Operations on Tool Bar

- Under mapping mode, touch the real-time image on the touch screen (region 3), a toolbar will display on the top of the touch screen, touch  to enter review status.



- Under mapping mode, open the saved image on the main screen, and touch the saved image on the touch screen (region 3), a toolbar will display on the top of the touch screen, you can perform review, send to, delete operations.



Icon	Description
	Enter review status, see “10.2.10.1 Review an Image” for details.
	View last image.
	Send image file, see “10.2.12 Sending Image Files” for details.
	View next image.
	Delete the current image.

- Exit mapping mode
Swipe the touch screen from bottom to top to exit the mapping mode.

- Non-mapping mode of touch screen

The layout of the touch screen varies with the applications or modes. Swipe the touch screen to go to another interface. Learn the interface display and operations by referring to related chapters.

3.8.5 Soft Keyboard

Under report, setup, comment adding and iStation screen, the soft keyboard icon  is displayed on the touch screen. Touch the icon to enter the soft keyboard typing screen.

Or, under patient info screen, you can see the soft keyboard typing screen on the touch screen directly.



4 Exam Preparation

A patient exam can be started as per the following situations:

- New patient information: to start a new patient exam, patient information must first be entered.
- New exam: to start a new exam for patient who is already registered, the recorded information can be obtained through either iStation or Worklist.
- Activate exam: to select an exam that has been completed within 24 hours, continue the exam with imported patient information and exam data.
- Continue an exam: to select an exam that has been paused within 24 hours, continue the exam with imported patient information and exam data.

General procedure for an exam:

Enter the patient information → select an exam mode and probe → Choose an imaging mode → Start the exam.

- The system supports image scanning and measurement without patient information.

4.1 Patient Information

To start a new patient exam, it is best to enter detailed patient information. The system will set up a unique information database for each patient based on the patient information entered, so that the information of one patient will not be confused with that of another patient.



CAUTION:

Before examining a new patient, press the <End Exam> key to end the exam of the previous patient. Update the patient ID and information to avoid mixing data between patients.

- To enter the Patient Info screen
Press <Patient>.
- To exit the Patient Info screen
 - Click [OK] on the Patient Info screen, press <Patient> on the control panel.
 - Click [Cancel] on the Patient Info screen and touch [Cancel] on the touch screen. Or press <Esc> on the control panel to exit the screen without saving any of the entered patient data.
 - Press or <Freeze> to return to the current exam mode and save the entered information.
- Click [Quick Register] on the screen to quickly save the patient information and return to the main screen.

4.1.1 New Patient Information

The Patient Info screen is shown as follows:

Place the cursor over the desired box. The field box is highlighted and a flashing cursor appears. Information can be entered or selected from the options.

You can also change the cursor's position using <Tab>, <Enter> or the up/down controls. Information includes:

1. General information

- Patient ID

The Patient ID is generated automatically by the system after starting a new patient, and can be modified manually. “\”, “*” or “?” is not permitted.

The ID can also be obtained using the bar code reader.

- Name

Enter the patient's name using the keyboard.

- Gender

Select Male, Female or Unknown for patient gender from the drop-down list.

- DOB (date of birth):

You can either enter the patient's date of birth manually,



Or click to select the date, and click [OK] to finish.

- Age

- Auto-generated age: once the DOB is obtained, the system displays an auto-generated age in the field box. The unit can be “Years”, “Months” or “Days.” If the age is less than one year, the system will automatically calculate the age in months or days.

- You can also enter the age manually.

NOTE: When you enter dates manually, enter them in same the format as that of the system.

2. Exam Type

■ Exam application type

You can select from: ABD (Abdomen), OB (Obstetrics), GYN (Gynecology), CARD (Cardiac), VAS (Vascular), URO (Urology), SMP (Small Part), PED (Pediatrics) and BREAST (Breast).

Select the exam type tab to enter exam-specific information.

■ General information:

Study description:	To enter a description for each exam.
Primary indications:	To enter the primary indications (reason for performing the exam.)
Secondary indications:	To enter the secondary indications.
CPT4 code:	To enter the CPT4 code.
CPT4 description:	To enter the CPT4 description.
Remarks:	Exam-specific explanation or remarks.

■ Exam-specific information:

Exam Type	Information	Description
ABD (Abdomen)	Height	/
	Weight	/
	BSA (body surface area)	After the height and weight are entered, the system will automatically calculate the BSA based on the formula which is set via "[Setup] → [System] → [General]."
OB (Obstetrics)	Calculation index	<p>Calculate the gestation age (GA) and estimated delivery date (EDD) based on the last menstrual period (LMP), date of conception (DOC), in vitro fertilization (IVF), basic body temperature (BBT) and previous exam date (PRV). Select LMP, DOC, IVF, PRV, BBT, or EDD from the drop-down list, or calculate the GA and LMP according to the EDD and entered date.</p> <ul style="list-style-type: none"> ● LMP: after you enter the LMP, the system will calculate the GA and EDD. ● DOC: after you enter the DOC, the system will calculate the GA and EDD. ● IVF: after you enter IVF, the system will calculate the GA and EDD. ● PRV: enter the date and GA of the last exam, the system will calculate a new GA and EDD. ● BBT: enter the BBT, the system will calculate the GA and EDD. ● EDD: after you enter the EDD, the system will calculate and display the GA and LMP.
	Gravida	Times of pregnancy.
	Ectopic	Times of abnormal pregnancy, e.g., extrauterine pregnancy
	Gestations	Number of embryos (1, 2, 3, 4)
	Para	Times of delivery.
	Aborta	Times of abortion.
GYN (Gynecology)	LMP	Last menstrual period.
	Gravida	Times of pregnancy.

Exam Type	Information	Description
	Para	Times of delivery.
	Ectopic	Times of abnormal pregnancy, e.g., extrauterine pregnancy.
	Aborta	Times of abortion.
CARD (Cardiology)	Height	/
	Weight	/
	BSA (body surface area)	After the height and weight are entered, the system will automatically calculate the BSA based on the formula which is set via "[Setup] → [System] → [General]."
	BP	Blood pressure.
	HR	/
	RA Press.	Right Atrium Pressure.
VAS (Vascular)	Height	/
	Weight	/
	BP(L) (blood pressure)	Input left blood pressure.
	BP(R) (blood pressure)	Input right blood pressure.
URO (Urology)	Serum PSA	/
	PPSA coefficient:	/
SMP (Small Parts)	None	/
PED (Pediatrics)	None	/
Breast	Height	/
	Weight	/

3. Operating Information

Accession #: refers to the exam number used in DICOM.

Diagnostician: person responsible for the exam.

Operator: person responsible for image collection and scanning.

Ref. Physician: person who requires the operator to carry out the ultrasound.

Tip: If the name has been entered before, it is memorized by the system and can be selected from the drop-down list.

4. Functional keys

- [Pause Exam]: pauses the current exam due to particular circumstances or system power off.
- [Cancel Exam]: cancels the current exam.

NOTE: A canceled exam cannot be restored.

- [New Patient]: clears the current patient information in the patient information screen so new patient information can be entered.

- [New Exam]: clears the current exam information so a new exam can be created for the current patient.
- [OK]: saves the patient data entered and exits the screen.
- [Cancel]: cancels the patient data entered and exits the screen.

4.1.2 Retrieve Patient Information

4.1.2.1 iStation

The patient data can be obtained in iStation from the system hardware or USB memory device. You can enter search conditions for the patient.

- To enter the iStation screen (the screen is shown below):
 - Press <iStation> on the keyboard, or
 - Click [iStation] in the Patient Info screen, or
 - Click [iStation] in the Review screen.

The screenshot shows the iStation software interface. The main window displays a table of patient exam records. The table has the following columns: ID, Name, Exam Type, Exam Date/Time, and Image. The data is as follows:

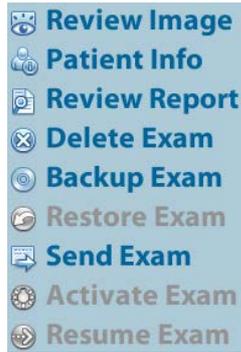
ID	Name	Exam Type	Exam Date/Time	Image
20140717-222505-	23	CARD	17/07/2014 22:25:10	1
20140715-215718-		CARD	15/07/2014 21:57:18	1
20140708-010537-		SMP	08/07/2014 01:05:37	1
20140626-034516-	DFA	OB	26/06/2014 04:12:09	6
20140626-034516-	DFA	CARD	26/06/2014 03:45:16	0
20140626-032159-		OB	26/06/2014 03:21:59	3
20140620-032412-	ABD	CARD	20/06/2014 03:24:29	0
20140618-010706-	16XX	ABD	18/06/2014 01:09:57	2
20140611-011205-	1112	OB	11/06/2014 01:12:12	3
20140609-215820-	1234	OB	09/06/2014 21:58:28	0
20140609-214646-		CARD	09/06/2014 21:46:46	3
20140609-204032-	1231	ABD	09/06/2014 20:40:40	3
20140609-090517-		SMP	09/06/2014 09:05:17	1
20140609-053532-		CARD	09/06/2014 05:35:32	0
20140606-093218-		CARD	06/06/2014 09:32:18	0
20140606-042133-	211	CARD	06/06/2014 04:21:33	0

On the right side of the interface, there is a search panel with the following elements:

- Keyword: [Text input field]
- Item: [Name] (dropdown menu)
- Data Source: [HD(D:)] (dropdown menu)
- Find in results
- Buttons: Activate Exam, New Exam, Delete, Send Exam, Select All Exams, Query/Retrieve, Compare, Exit

- Select the data source

Select the data source from the “Data Source” drop-down list.
- Enter the search condition:
 - Item: including Name, ID, DOB and Exam Date. Then enter a keyword in accordance with the Item selected.
 - Select “Find in results.” The system will search on the keyword in the existing searched results.
- Select the desired patient information in the list, and the system brings up the following menu:



Button	Function	Description
	Review an Image	Click to enter the review screen.
	Patient Information	Click to enter the patient info screen.
	Review Report	Click to enter diagnostic report screen.
	Delete Exam	Click to delete the selected record.
	Backup Exam	Click to back up the selected patient record to supported media.
	Restore Exam	Click to import the patient data from an external media.
	Send Exams	Click to send the selected patient data to an external device, MedTouch/MedSight devices, DICOM storage server or printer.
	Activate Exams	Click to continue an exam that has been completed within 24 hours.
	Resume Exams	Click to continue an exam that has been paused within 24 hours.

Other buttons:

- [New Exam]: click to enter the Patient Info screen. The corresponding patient information is also imported to the new exam simultaneously. After editing the patient information in the Patient Info screen, select [OK] to start a new exam.
- [Select All Exams]: click to select all records.
- [Exit]: click to exit iStation.

4.1.2.2 Worklist

Worklist is an option. To use Worklist function, you have to configure DICOM Basic and DICOM Worklist options.

When the DICOM basic package is configured and the Worklist server has been set, click [Worklist] in the Patient Info screen to query or import the patient data. (For details about the Worklist server setting, see the DICOM chapter.)

Worklist can retrieve patient data of two kinds of protocols: DICOM and HL7.

Basic operation:

- (1) Press the <Patient> key to open the Patient Info screen.
- (2) Click [Worklist] to enter the Worklist page.

Patient ID	Patient Name	Accession #	Exam Description	Exam Date	Gender	DOB
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- (3) Select the data source: select the server type (DICOM or HL7), choose a Worklist server in the "Worklist Server" drop-down list, and all the patient exam records are listed.
- (4) Enter the search condition:
 - Set query criteria from Patient ID, Patient Name, Accession #, Search Key, Scheduled Station AE Title, Worklist Server or Exam Date.
 - Or select the keyword type, enter the keywords, then click [Query] to search.
 - To reset the criteria, click the [Clear] button.
 - After finishing the first query, you can perform the second query based on the previous results. The scheduled patients in the list will update in real time.
- (5) Select the desired patient record in the displayed patient list:
 - a) Select the desired patient and click [Start Exam]. The patient information is imported into the system and then an exam is started.
 - b) Click [Transfer] and the patient information is imported into the [Patient Info] screen. After editing the patient information in the Patient Info screen, select [OK] to start a new exam.
- (6) Click [Exit] to exit the Worklist.

4.2 Select Exam Mode and Probe

CAUTION: If the exam mode is changed during a measurement, all measurement calipers on the image will be cleared. The general measurement data will be lost, but application measurement data will be stored in the reports.

■ Selecting exam mode

1. Connect suitable probes to the system and press <Probe> on the control panel. The touch screen displays the following dialog box:



2. Touch the screen to select the probe type and exam mode. The system exits the dialog box and enters the selected exam mode and probe.

Click [Exit] or press <Probe> again to cancel the selection and exit the screen.

4.2.1 Dual-probe Switch

A user-defined key for dual-probe switch can be defined in preset, by which you can fast switch the probe under B/ Color/ Power mode.

This function applies only to probes with the same exam modes.

1. Scan to obtain the image by current probe.
2. Press the user-defined key. The available probes appear on the screen.
3. Choose the probes to be compared. The system enters dual-probe mode. The image from previous probe is frozen.
4. Scan and obtain the required image from the current probe.
5. Press the user-defined key to switch the images of two probes.

The path for setting the keys: <F10 Setup>→[System]→[Key Settings].

1. Select the key to be defined from [Key] tab on the left side. Or, select a key from [Footswitch] tab.
2. Select [Image Mode]→[Dual-Probe].
3. Click [OK] to confirm the setting or exit. The setting comes into effect then.

4.3 Select the Imaging Mode

For detailed operations in each imaging mode, see chapter “5 Image Optimization”.

4.4 Activate & Continue an Exam

4.4.1 Activate an Exam

On the iStation screen, select an exam record which was completed within 24 hours and click [Activate Exam] from the menu which appears. Or click [Active Exam] on the iStation or Review screen to activate the exam.

Tip:

- The system can automatically load the patient information and exam data to continue the exam.
- If you want to continue an exam with data in an external memory database, first allow the system to load the patient data to the system's patient database.
- For an activated exam, you can modify the patient ID if this patient has only one exam recorded in the system.

4.4.2 Continue an Exam

On the iStation screen, select an exam record which was paused within 24 hours, and click [Resume Exam] from the menu which appears to continue the exam.

If you want to select patient data in an external memory database, first allow the system to load the patient data to the system's patient database.

For an activated exam, you can modify the patient ID if this patient has only one exam recorded in the system.

4.5 Pause & End an Exam

4.5.1 Pause an Exam

- Sometimes it is necessary to stop an uncompleted exam due to particular circumstances. When the exam is paused, the system can begin other exams.

1. Press <Patient> to enter the Patient Info screen.
2. Click [Pause Exam].

- If the system is powered off during scanning, the exam status turns to "paused" after the system restarts.

When an exam is paused, the system will:

1. Save the exam-related images, reports and measurement data, and modify the status as "Paused."
2. Save the exam information, including imaging mode, exam mode, image parameters, operation mode, and so on.

4.5.2 End an Exam

Before examining a new patient, press <End Exam> to end the exam of the previous patient. Update the patient ID and information to avoid mixing data between patients.

To end an exam, do one of the following:

- Press <End Exam> on the control panel.
- Click [New Patient] on the Patient Info screen to end the last patient exam.
- Click [New Exam] on the Patient Info screen (or iStation or Review screen) to end the last exam.

5 Image Optimization

⚠ WARNING: The images displayed in this system are for reference only. Mindray is not responsible for the correctness of diagnostic results.

In Dual-B imaging mode, the measurement results of the merged image may be inaccurate. Therefore, the results are provided for reference only, not for confirming diagnoses.

5.1 Imaging Mode

5.1.1 Switching Between Imaging Modes

Switch between imaging modes according to the actual situation. See “2.10 Control Panel” for details.

5.1.2 Image Adjustment

- Adjust using the image menu:
For details about menu adjustment, see chapter “3.8.3 Menu Operation.”
- Adjust using the touch screen (non-mapping mode)



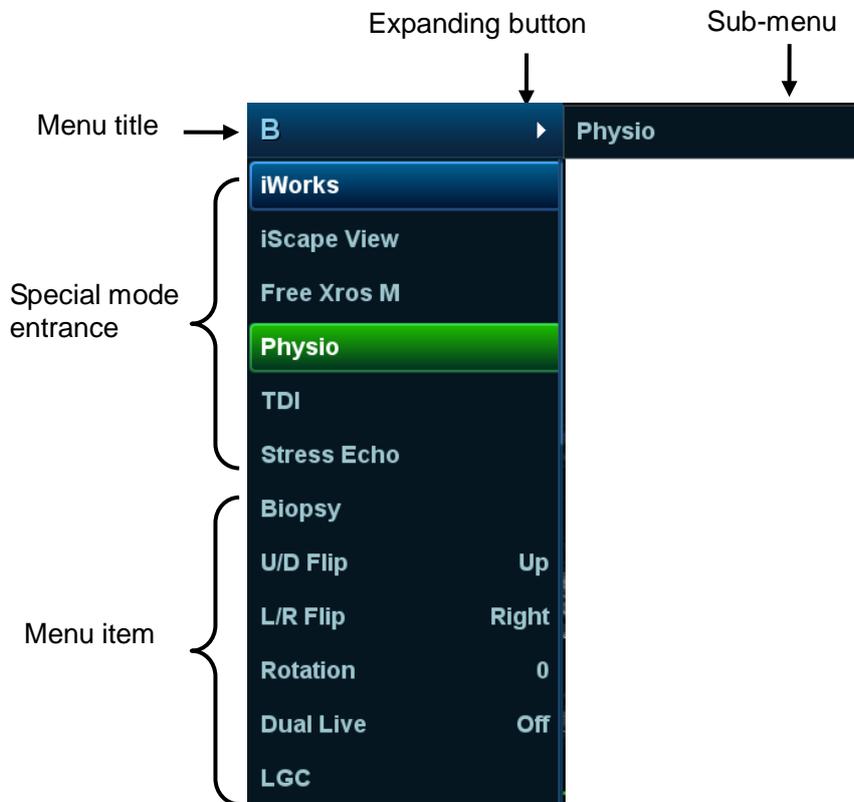
1. Mode display area (or main functional tabs): displays the current modes. Touch the tab to enter the mode.
2. Other application mode access: displays the available related application modes. Touch to enter the modes.

3. Parameter adjusting area: displays the parameters in the current imaging mode or function.
 - Parameter magnitude setting: touch ◀ or ▶ to increase/decrease the value.
 - ON/OFF setting: some of the parameters can only be set to ON or OFF. ON activates the function, and when the function is activated the key is highlighted in green.
 - Page selection: if there is more than 1 page for the current mode, touch  to turn the pages.
 - Functional item: touch to go to the corresponding function.
4. Knob-adjusting area: displays the knob-controlled parameters.

There are five knobs at the bottom of the touch screen. Their functions vary depending on the current menu. Press or rotate the knobs to adjust the corresponding parameters.

■ Adjust using the touch screen (mapping mode)

1. Enter the mapping mode to see the following mapping menu. See “3.8.4 Touch Screen Operation” for details.



2. Touch the item on the touch screen to operate:
 - a) Menu title: displays current imaging mode. Touch the expanding button to show all available imaging modes under the current status, Touch to enter the modes.
 - b) Current available special mode entrance: displays the available imaging modes related, touch to enter the modes. For example: iWorks, Physio.
 - c) Parameter adjusting area: displays the parameters in the current imaging mode or function.
 - Value adjustment: touch the parameter to adjust the value. To increase the value by flipping from left to right and decrease the value by flipping from right to left.

- ON/OFF setting: some of the parameters only can be set at ON or OFF, ON is to activate the function, and when the function is activated, the menu item is highlighted in green.
 - Functional item: touch to go to the corresponding function.
 - Scroll bar item: when a scroll bar displays on the right of the menu, touch the item and swipe it up or down to show all menu items.
- Control Panel
Adjust using the trackball, control panel key, deflector rod, knob or slider.

5.1.3 Quickly Saving Image Settings

Press <F7> or user-defined key for QSave to access the image data saving dialog box.



- Save the image parameter adjustment:
Click [Save] to save the current image values for the current exam mode of the particular probe.
- Create new exam data (using the current image parameter settings):
Enter the name in the box after “Save As” to assign a name for a user-defined exam mode, and click [Create] to save the current image parameters, measurements, comments and body mark settings to the exam mode.
- Restore the factory settings:
The settings of the current exam mode and the probe can be restored to factory data by clicking [Restore].
- Check image parameter level and other settings:
 - Click [Image Params] to check levels of different image parameters. Click [Save Image Parameter] to save the current image values for the current exam mode of the particular probe.
 - Select “Advanced” tab to set TIC/TIB/TIS parameter.
 - Select “Advanced” and set “Sampling Line Displaying” to “On”, then PW/M/TVM mode can be entered by pressing the imaging mode key only one time.

This function is not available under dual-probe frozen mode.

5.2 B Mode Image Optimization

B mode is the basic imaging mode that displays real-time images of anatomical tissues and organs.

5.2.1 Basic Procedures for B Mode Imaging

1. Enter the patient information. Select an appropriate probe and exam mode.
 2. Press on the control panel to enter B mode.
 3. Adjust the parameters to optimize the image.
 4. Perform other operations (e.g., measurement and calculation) if necessary.
- Press on the control panel to return to B mode at any time.

5.2.2 B Mode Parameters

In B mode scanning, the image parameter area in the top-right corner of the screen displays the real-time parameter values as follows:

Parameter	F	D	G	FR	DR	iClear	iBeam	iTouch	Zoom	Echo Boost
Meaning	Frequency	Depth	Gain	Frame Rate	Dynamic Range	Display when the function is turned on.				

5.2.3 B Mode Image Optimization

Image Quality

Description To switch between the fundamental frequency and harmonic frequency, and select the corresponding frequency type. The real-time frequency value is displayed in the image parameter area in the top-right corner of the screen, and if harmonic frequency is used “F H” is displayed as the harmonic frequency value.

Rotate the knob under [Image Quality] on the touch screen to select the different fundamental/harmonic frequency values.

Press the knob to switch between fundamental frequency and harmonic frequency.

The adjusting range of the fundamental frequency values can be divided into 3 levels: penetration preferred (HPen), general mode (HGen), resolution preferred (HRes).

The adjusting range of harmonic frequency values can be divided into 3 levels: penetration preferred (Pen), general mode (Gen), and resolution preferred (Res).

Impacts The system provides an imaging mode using harmonics of echoes to optimize the image. Harmonic imaging enhances near-field resolution and reduces low-frequency and large amplitude noise, so as to improve small parts imaging.

Select the frequency according to the detection depth and current tissue features.

Gain

Description To adjust the gain of the whole receiving information in B mode. The real-time gain value is displayed in the image parameter area in the top-right corner of the screen.

Operations Rotate the knob clockwise to increase the gain, and counter-clockwise to decrease it.

The adjusting range is 0-100 in increments of 1.

Effects Increasing the gain will brighten the image and you will see more received signals. However, noise may also be increased.

Depth

Description This function is used to adjust the sampling depth, the real-time value of which is displayed in the image parameter area in the top-right corner of the screen.

Operations Use the <Depth> deflector rod in the bottom-right part of the control panel to adjust the depth.

The adjustable depth values vary depending on the probe types.

Effects Increase the depth to see tissue in deeper locations, or decrease the depth to see tissue in shallower locations.

TGC

Description	<p>The system compensates the signals from deeper tissue by segments to optimize the image.</p> <p>There are 8-segment TGC sliders on the control panel corresponding to the areas of the image.</p>
Operations	<p>To increase the gain compensation in an area of interest, move the TGC slider to the right.</p> <p>To decrease the gain compensation in the corresponding area of interest, move the TGC slider to the left.</p> <p>About 1.5 seconds after the adjustment is complete, the TGC curve disappears.</p>
Effects	<p>Adjust the signal gain for a particular image area to achieve a balanced image.</p>

Acoustic Power

Description	<p>Refers to the power of ultrasonic waves transmitted by the probe, the real-time value of which is displayed in the upper part of the screen.</p>
Operations	<p>Adjust the acoustic power through the [A.Power] item on the touch screen . The adjusting range is 3.2-100%.</p>
Effects	<p>Generally, increasing the acoustic power will increase the brightness and contrast of the image and the force of penetration.</p>
Impacts	<p>You should perform exams according to actual situations and follow the ALARA Principle.</p>

Focus

Description	<p>Refers to adjusting the focus of the ultrasonic beams, using the “◀” symbols which are displayed to the right of the image.</p>
Operations	<p>Adjust the focus number using the [Focus Number] item on the touch screen or by the mapping-menu on the touch screen.</p> <p>Use the <Focus> deflector rod in the bottom-right part of the control panel to adjust the focus position.</p> <p>In B mode, the available focus number can be switched between 1-4.</p>
Effects	<p>The area that is focused will be of a higher contrast and resolution.</p>
Impacts	<p>The greater the number of focal zones, the slower the frame rate.</p>

Imaging Adjustment

Description	More information can be obtained without moving the probe or changing the sampling position.
FOV (Field of View)	<ol style="list-style-type: none">1. To change the scan range, touch [FOV] on the touch screen to enter the FOV range and FOV position adjustment status.2. Press <Set> to switch between FOV range and FOV position.3. Rotate the trackball to adjust the FOV position or the FOV range. <p>When the scan range is adjusted to its widest, the FOV position cannot be changed.</p> <p>Or you can adjust the focus by the mapping-menu on the touch screen.</p> <p>You can get a much larger field of view when selecting a larger FOV.</p> <p>The frame rate decreases when using a larger FOV.</p>
B Steer	Use the <Angle/Steer> deflector rod on the control panel to adjust the steer angle.
ExFOV (Extended FOV)	<p>Touch [ExFOV] or the mapping-menu item on the touch screen to turn the function on/off.</p> <p>For linear probes, the ExFOV function displays as trapezoid imaging.</p> <p>For convex probes, the ExFOV function displays as extending the scanning angle.</p>
Impacts	<p>The FOV position/range is available only for convex and phase probes.</p> <p>The ExFOV function is available only for linear and convex probes.</p> <p>The B Steer function is available only for linear probes.</p>

Line Density

Description	The function determines the quality and information of the image.
Operations	<p>Adjust the line density using the [Line Density] item or the mapping-menu item on the touch screen.</p> <p>There are four levels of line density available: UH, M, H, L.</p>
Effects	The higher the line density, the higher the resolution.
Impacts	The higher the line density, the lower the frame rate.

Dynamic Range

Description	This function is used to adjust the B image resolution to compress or expand the gray display range. The real-time value displays in the image parameter area in the top-right corner of the screen.
Operations	<p>Adjust the dynamic range through the [Dyn Ra.] item or mapping-menu on the touch screen.</p> <p>Rotate the knob clockwise to increase the value. Rotate the knob counterclockwise to decrease the value.</p> <p>The adjusting range is 30-180dB, in increments of 5dB.</p>
Impacts	The more the dynamic range, the more specific the information and the lower the contrast with more noise.

iClear

- Description** The function is used to enhance the image profile so as to distinguish the image boundary for optimization.
- Operations** Adjust using the [iClear] item or mapping-menu on the touch screen.
The system provides 7 levels of iClear adjustment: off represents no iClear effect, and the bigger the value the stronger the effect.
- Impacts** It may cause increased noise.

Persistence

- Description** This function is used to superimpose and average adjacent B images, so as to optimize the image and remove noise.
- Operations** Rotate the knob under the [Persistence] item or the mapping-menu item on the touch screen to adjust the value.
The system provides 7 levels of frame average adjustment: the bigger the value the stronger the effect.
- Effects** Persistence can remove image noise to make details clearer.
- Impacts** Increasing Persistence may lead to missing signals.

Rotation/Invert (U/D Flip and L/R Flip)

- Description** The function provides better observation for image display.
- Rotation** Rotate the image using the [Rotation] item or the mapping-menu item on the touch screen.
Images can be rotated by 0°, 90°, 180° and 270°.
When the image is rotated by 90° or 270°, the depth scale is displayed in the top part of the screen.
- Invert (U/D Flip and L/R Flip)** To invert the image horizontally or vertically.
Touch [U/D Flip] or [L/R Flip] on the touch screen or the mapping-menu to invert the image
- Effects** You can identify the image orientation using the “M” mark on the screen. By default, the M mark is located in the top-left corner of the imaging area.

iBeam (Spatial Compound Imaging)

- Description** This function is used to superimpose and average images of different steer angles to achieve image optimization.
- Operations** Adjust using the [iBeam] item or the mapping-menu item on the touch screen.
The system provides difefnt levels of iBeam adjustment in single B mode. Off represents no iBeam.
- Effects** Images can be optimized with less spot noise and higher resolution, so that more details for the structure are revealed.
- Impacts** iBeam is valid for linear and convex probes, and it is not available when the ExFOV function is turned on.

Image Merge

Description In the Dual-split mode, when the images of the two windows have the same probe type, depth, invert status, rotation status and magnification factor, the system will merge the two images so as to extend the field of vision.

Operations Turn the function on or off using the [Auto Merge] item or the mapping-menu item on the touch screen.

Impacts The function is valid only for linear probes.

Gray Map

Description This function applies the gray correction to obtain optimum images.

Operations Select from among the maps by rotating the knob under the [Gray Map] item or the mapping-menu item on the touch screen. The system provides 10 different gray effect maps.

Tint Map

Description This function provides an imaging process based on color difference rather than gray distinction.

Operations Rotate the knob under the [Tint Map] item or the mapping-menu item on the touch screen to select the map. The system provides 8 different color effect maps.

TSI (Tissue Specific Imaging)

Description The TSI function is used to optimize the image by selecting acoustic speed according to tissue characteristics.

Operations Select from among the TSI modes using the [TSI] item or the mapping-menu item on the touch screen.

The system provides four ways of optimizing for specific tissues: general, muscle, fluid and fat.

iTouch (Auto Image Optimization)

Description To optimize image parameters as per the current tissue characteristics for a better image effect.

Operations Press <iTouch> on the control panel to turn the function on.

The iTouch symbol will be displayed in the image parameter area in the top-right corner of the screen once <iTouch> is pressed.

Select different levels of iTouch effect using [iTouch] on the touch screen or the mapping-menu.

Long press the <iTouch> key to exit the function.

H Scale

Description Display or hide the width scale (horizontal scale).

The scale of the horizontal scale is the same as that of the vertical scale (depth). They change together in zoom mode, or when the number of the image window changes. When the image is turned up/down, the H Scale will also be inverted.

Operations Touch [H Scale] or the mapping-menu item on the touch screen to display or hide the scale.

Dual Live

Description Display different image effects of one probe for better observation.

Operation Touch [Dual Live] item or the mapping-menu item on the touch screen to turn the function on/off. Dual-split windows of the images are displayed on the main screen. Two pages of adjustable parameters are displayed in the touch screen. Shared parameters and left window parameters are displayed in the B(L) page, while right window parameters are displayed in the B(R) page. In the image parameter area in the top-right corner of the main screen, parameters of both windows are displayed.

Impacts Image magnification is available in dual live mode.

LGC

Description Adjust the gain of scan lines to increase the image lateral resolution.

Operation Touch [LGC] or the mapping-menu item on the touch screen to access the adjusting dialog box.

The 8 rods displayed on the touch screen indicate the corresponding image areas on the main screen.

Touch the  to adjust the gain, move downwards to decrease the gain, or move upwards to increase the gain.

The system also provides several preset parameters for imaging.

Echo Boost

Description This function can improve contrast and decrease noise, so that a much clearer boundary can be seen.

Operation Touch [Echo Boost] on the touch screen or the mapping-menu item to turn the function on (when the function is turned on, the [Echo Boost] button is highlighted in green and the system indicates "Echo Boost" in the image parameter area).

Impacts This function is only available using the phased probe in cardiac exam mode

5.3 M Mode Image Optimization

5.3.1 Basic Procedures for M Mode Imaging

1. Select a high-quality image during B mode scanning, and adjust to position the area of interest in the center of the B mode image.
2. Press <M> on the control panel, and roll the trackball to adjust the sampling line.
3. Press <M> on the control panel again or <Update> to enter M mode. You can then observe the tissue motion along with the anatomical images of B mode. During the scanning process, you can also adjust the sampling line accordingly when necessary.
4. Adjust the image parameters to obtain optimized images.
5. Perform other operations (e.g., measurement and calculation) if necessary.

If “Sampling Line Displaying” is selected, then the screen will display the sampling line all the time and pressing <M> one will lead to entering M mode directly. See “5.1.3 Quickly Saving Image Settings” chapter for details.

5.3.2 M Mode Image Parameters

- In M mode scanning, the image parameter area in the top-right corner of the screen displays the real-time parameter values as follows:

Parameter	F	D	G	V	DR
Meaning	Frequency	Depth	M Gain	M Speed	M Dynamic Range

- During M mode imaging, menus for B mode and M mode are displayed on the touch screen at the same time. You can switch between the 2 modes by clicking the mode tabs.
- During M mode scanning, the frequency, depth, focus position and acoustic power of the probe are synchronous with that of B mode.
- Adjustment of the depth, focus position or TGC to the B mode image will lead to synchronous changes in the M mode image.

5.3.3 M Mode Image Optimization

Gain

- Description** To adjust the gain of M mode image. The real-time gain value is displayed in the image parameter area in the top-right corner of the screen.
- Operations** Rotate the <M> knob clockwise to increase the gain, and counter-clockwise to decrease it.
The adjusting range is 0-100 in increments of 1.
- Effects** Increasing the gain will brighten the image and you will see more received signals. However, noise may also be increased.

Display Format

- Description** To set the display format of M mode images and B mode images.
- Operations** Touch the different display format ratio buttons on the touch screen to adjust.
There are 5 formats available for image display: H2:3, V2:3, V3:2, V3:1, Full.
- Effects** Select different format types according to the actual situation and obtain a desired analysis through comparison.

Speed

- Description** This function is used to set the scanning speed of M mode imaging, and the real-time speed value is displayed in the image parameter area in the top-right corner of the screen.
- Operations** Rotate the knob under the [Speed] item or the mapping-menu item on the touch screen to adjust.
There are 6 levels of scan speed available: the smaller the value the faster the speed.
- Effects** Changing speed makes it easier to identify disorders in cardiac cycles.

Tint Map

- Description** This function provides an imaging process based on color difference rather than gray distinction.
- Operations** Rotate the knob under the [Tint Map] item or the mapping-menu item on the touch screen to select the map. The system provides 8 different color effect maps.
Press the knob under the [Tint Map] item on the touch screen to turn the function on/off.

Gray Map

- Description** This function applies the gray correction to obtain optimum images.
- Operations** To select from among the maps, turn the knob under [Gray Map] item or the mapping-menu item on the touch screen. The system provides 10 different gray effect maps.

Edge Enhance

- Description** This function is used to enhance the image profile so as to distinguish the image boundary for optimization.
- Operations** Adjust using the [Edge Enhance] item or the mapping-menu item on the touch screen.
There are 3 levels of edge enhance adjustment available: the bigger the value the stronger the effect.
- Impacts** Larger edge enhance may lead to increased noise.

Dynamic Range

- Description** This function is used to adjust the M image resolution to compress or expand the gray display range.
The real-time dynamic range value is displayed in the image parameter area in the top-right corner of the screen.
- Operations** Rotate the knob under the [Dyn Ra.] item or the mapping-menu item on the touch screen.
The adjusting range is 30-180dB, in increments of 5dB.
- Effects** The more the dynamic range, the more specified the information.

M Soften

- Description** This feature is used to process the scan lines of M images to reject noise, making image details clearer.
- Operations** Adjust using the [M Soften] item or the mapping-menu item on the touch screen.
The system provides 4 levels of M Soften adjustment: the bigger the value the stronger the effect.

5.4 Color Mode Image Optimization

The Color mode is used to detect color flow information, and the color is designed to judge the direction and speed of blood flow.

Generally, the color above the color bar indicates the flow towards the probe, while the color below the color bar indicates the flow away from the probe. The brighter the color, the faster the flow speed, while the darker the color, the slower the flow speed.

5.4.1 Basic Procedures for Color Mode Imaging

1. Select a high-quality image during B mode scanning, and adjust to position the area of interest in the center of the B mode image.
2. Press <Color> to enter B + Color mode. Roll the trackball to change the position and size of the Region of Interest (ROI) and press the <Set> key to set.
3. Adjust the image parameters during scanning to obtain optimized images.
4. Perform other operations (e.g., measurement and calculation) if necessary.

5.4.2 Color Mode Image Parameters

- In Color mode scanning, the image parameter area in the top-right corner of the screen displays the real-time parameter values as follows:

Parameter	F	G	PRF	WF
Meaning	Frequency	Color Gain	Pulse Repetition Frequency (PRF)	Color Wall Filter

- During Color mode imaging, the image optimizing menus for B mode and Color mode are displayed on the touch screen at the same time. You can switch between the 2 modes by clicking the mode tabs.
- In Color mode, the acoustic power is synchronous with that of B mode. Adjustment of the depth to the B mode image will lead to corresponding changes in Color mode image.

5.4.3 Color Mode Image Optimization

Color Gain

Description Refers to the overall sensitivity to flow signals. This function is used to adjust the gain in Color mode. The real-time gain value is displayed in the image parameter area in the top-right corner of the screen.

Operations Rotate the <Color> knob clockwise to increase the gain, and counter-clockwise to decrease it.
The adjusting range is 0-100 in increments of 2.

Effects Increasing the gain will increase the flow signal presented and noise. The signals may be missing when the gain is adjusted too low.

ROI Adjustment

- Description** This function adjusts the width and position of the ROI in Color mode.
- Operations** When the ROI box is a dotted line, roll the trackball to change the size.
When the ROI box is a solid line, roll the trackball to change the position.
Press <Set> to switch between the solid line and the dotted line.
- Impacts** The larger the ROI box, the lower the frame rate, and the lower the resolution and color sensitivity.

Image Quality

- Description** Refers to the operating frequency of the probe in Color mode, the real-time value of which is displayed in the image parameter area in the top-right corner of the screen.
- Operations** Rotate the knob under [Image Quality] on the touch screen or the mapping-menu item to select the different frequency values.
The adjusting range of frequency values can be divided into 3 levels: penetration preferred (Pen), general mode (Gen), and resolution preferred (Res).
Frequency values vary according to probe types. Select the frequency according to the needs of the detection depth and the current tissue characteristics.

B/C Align

- Description** To set and restrict the maximum width of the B mode image to that of the Color ROI.
- Operations** Turn the function on or off using the [B/C Align] item or the mapping-menu item on the touch screen.
- Impacts** The frame rate increases when the function is turned on.

Dual Live

- Description** This function is used to display the B image and Color image synchronously.
- Operations** Turn the function on or off using the [Dual Live] item or the mapping-menu item on the touch screen.
When the function is turned on, the window will automatically switch to dual windows (one for the B image, and the other for the Color image).

Steer

- Description** The feature is used to adjust the ROI of the color flow of different angles with immobility of the linear probe.
- Operations** Adjust using the <Angle/Steer> deflector rod on the control panel.
- Effects** This function is used to adjust the scan angle of linear probes, so as to change the angle between the transmitting beam and flow direction.
- Impacts** Steer is only valid for linear probes.

Line Density

- Description** Line density determines the quality and information of the image.
- Operations** Adjust using the [Line Density] item or the mapping-menu item on the touch screen.
4 levels of line density are provided: H, L, UH, M.
- Effects** The higher the line density, the higher the resolution.
- Impacts** The higher the line density, the lower the frame rate.

Packet Size

- Description** This function is an indication of the ability to detect flow, which is used to adjust the accuracy of color flow.
- Operations** Rotate the knob under the [Packet Size] item or the mapping-menu item on the touch screen to adjust the value.
There are 3 levels of packet size available: 0 represents no packet size control and the bigger the value the higher the sensitivity.
- Effects** The higher the packet size, the more sensitive the indication for low-velocity flow.
- Impacts** Adjusting the packet size may lead to the frame rate changing.

Flow State

- Description** This function is used for fast image optimization.
- Operations** Adjust using the [Flow State] item or the mapping-menu item on the touch screen.
3 levels are provided: L, M, H.

Persistence

- Description** This function adjusts the temporal smoothing in Color mode to optimize the image.
- Operations** Adjust through the [Persistence] item or the mapping-menu item on the touch screen.
The system provides 6 levels of persistence adjustment: 0 represents no persistence, and the bigger the value the stronger the effect.

Smooth

- Description** This feature is used to reject noise and smooth the image.
- Operations** Adjust using the [Smooth] item or the mapping-menu item on the touch screen.
The system provides 6 levels of smooth function: the bigger the value the stronger the effect.

Scale

Description This function is used to adjust the speed range of the color flow, which is adjusted using the PRF in the system. The real-time PRF value is displayed in the image parameter area in the top-right corner of the screen.

Operations Adjust through the [Scale] item or the mapping-menu item on the touch screen. The adjusting range varies according to the frequency, probe and depth. Adjust according to the actual situation.

Effects Provides a much clearer color flow image.
Use a low PRF to observe low-velocity flows, and a high PRF to observe high-velocity flows.

Impacts Aliasing may occur if a low-velocity scale is used and high velocities are encountered.
Low velocities may not be identified when a high-velocity scale is used.

Baseline

Description Refers to the area where the velocity is zero in the scale. Adjust according to the actual situation so as to get an optimum flow display.

Operations Adjust through the [Baseline] item or the mapping-menu item on the touch screen. A positive value means increase the signals above the baseline, and a negative value means increase the signals below the baseline.

Invert

Description To set the display mode of the color flow. The color scale will be inverted when the function is turned on.

Operations Turn the function on or off using the [Invert] item or the mapping-menu item on the touch screen.
Select "Auto Invert" in "[Setup] (F10) → [System] → [Image]", so the color bar can automatically invert when the color flow is steered to a certain angle to accommodate the operator's desire to distinguish the flow direction.
Auto invert function is available only for linear probes.

Color Map

Description This function is a combination of several image parameters, which indicates the display effect of the color image.

Operations Rotate the knob under the [Color Map] item or the mapping-menu item on the touch screen to select from among the maps.
The system provides 21 different maps for selection. The V group provides 11 ordinary maps and the VV group provides 10 2D maps.

WF (Wall Filter)

- Description** It filters out low-velocity signals to provide effective information, and this function is used to adjust the filtered frequency. The real-time value is displayed in the image parameter area in the top-right corner of the screen.
- Operations** Select using the [WF] item or the mapping-menu item on the touch screen.
There are 8 levels of wall filter function available. Select the value according to the actual situation.
- Impacts** Flow signals may be missing.

Smart Track

- Description** To optimize image parameters as per the current tissue characteristics for a better image effect. The angle and the position of the ROI are adjusted after the function is enabled. The area is tracked without being affected by the dynamic moves.
- Operation** Tap [Smart Track] on the touch screen under Color/Power mode. The vessels lay in the middle of the ROI.
Enable the function under B+Color/Power+PW mode. The PW sampling line, SV size and SV position are adjusted automatically.
- Impacts** The probe L14-6NE for Upper Ext Artery, Upper Ext Vein, Lower Ext Artery, Lower Ext Vein, carotid, EM Vascular exam supports the smart track.

Priority

- Description** This function is used to set the levels of the flow display and to display the grayscale signal or color signal.
- Operations** Rotate the knob under the [Priority] item or the mapping-menu item on the touch screen to select the value.
The adjusting range of the priority is 0-100% in increments of 1%.
The higher the value, color signals are first to be displayed. The lower the value, grayscale signals are first to be displayed.

Velocity tag

- Description** This function is used to mark the specified velocity range in the flow to check the flow function or specific flow velocity value.
- Operation**
1. Touch [Velocity Tag] or the mapping-menu item on the touch screen to enter the velocity marking status. A green mark appears on the color bar.
 2. Roll the trackball upwards and downwards to select the marking velocity.
 3. Press <Set> to enter the tag range selection status, and roll the trackball upwards and downwards to select the range.
- Press <Set> to switch between marking position and marking range.

ITouch (Auto Image Optimization)

Description To optimize image parameters as per the current tissue characteristics for a better image effect.

Operations Press <iTouch> on the control panel to turn the function on.

HR Flow (High Resolution Flow)

Description This function enhances the micro vessel imaging effect, and can be used to analyze the tissue blood supply condition.

Operations Touch [HR Flow] or the mapping-menu item on the touch screen to turn on HR Flow status (the [HR Flow] button is highlighted in green when the status is turned on.)

The parameters in HR Flow mode are independent from those in Color mode.

5.5 Power Mode Image Optimization

Power mode provides a non-directional display of the blood flow in terms of intensity as opposed to flow velocity.

DirPower (Directional Power mode) provides additional information of the flow direction toward or away from the probe.

5.5.1 Basic Procedures for Power Mode Imaging

1. Select a high-quality image during B mode or B + Color scanning, and adjust to position the area of interest in the center of the image.
2. Press <Power> to enter B + Power mode. Roll the trackball to change the position of the Region of Interest (ROI) and press the <Set> key to set. Roll the trackball to change the size and position of the ROI.
3. Adjust the image parameters during B + Power mode scanning to obtain optimized images.
4. Perform other operations (e.g., measurement and calculation) if necessary.

5.5.2 Power Mode Image Parameters

- In Power mode scanning, the image parameter area in the top-right corner of the screen displays the real-time parameter values as follows:

Parameter	F	G	PRF	WF
Meaning	Frequency	Power Gain	Pulse Repetition Frequency (PRF)	Power Wall Filter

- During Power mode imaging, the image optimizing menus for B mode and Power mode are displayed on the touch screen at the same time. You can switch between the 2 modes by clicking the mode tabs.
- In Power mode, the acoustic power is synchronous with that of B mode. Adjustment of the depth to the B mode image will lead to corresponding changes in Power mode image.

Parameters consistent with those in Color mode and B mode are not to be introduced. See the relevant Color mode and B mode sections, while special items of the Power mode are introduced in the following.

5.5.3 Power Mode Image Optimization

Power Gain

- Description** Refers to the overall sensitivity to flow signals. This function is used to adjust the gain in Power mode.
The real-time gain value is displayed in the image parameter area in the top-right corner of the screen.
- Operations** Rotate the <Color> knob clockwise to increase the gain, and counter-clockwise to decrease it.
The adjusting range is 0-100 in increments of 2.
- Effects** Increasing the gain will increase the flow signal presented and noise. The signals may be missing when the gain is adjusted too low.

Color Map

- Description** This feature indicates the display effect of the Power image.
The maps in the Power mode image are grouped into two categories: Power maps and Directional Power maps.
- Operations** To select from among the maps, turn the knob under [Color Map] on the touch screen or adjust through the mapping-menu item.
There are 8 kinds of maps provided: P0-3 belong to Power mode maps, while Dp0-3 belong to Directional Power mode maps.
The Power maps provide information about blood flow, which are highly sensitive to the low-velocity flows.
The Directional Power maps provide information about flow direction.

Dynamic Range

- Description** This function adjusts the transformation of echo intensity into color signal.
- Operations** Adjust through the [Dyn Ra.] item or the mapping-menu item on the touch screen to adjust the dynamic range.
The adjusting range is 10-70dB in increments of 5dB.
- Effects** Increasing the dynamic range leads to higher sensitivity to low-power signals, thus enhancing the range of signals to display.

5.6 PW/CW Doppler Mode

PW (Pulsed Wave Doppler) mode or CW (Continuous Wave Doppler) mode is used to provide blood flow velocity and direction utilizing a real-time spectrum display. The horizontal axis represents time, while the vertical axis represents Doppler frequency shift.

PW mode provides a function for examining flow at one specific site for its velocity, direction and features. CW mode proves to be much more sensitive to high-velocity flow display. Thus, a combination of both modes will contribute to a much more accurate analysis.

CW imaging is an option.

Adjustment items, such as SV, Steer, Duplex, Triplex, iTouch and HPRF, are not available in CW mode.

5.6.1 Basic Procedures for PW/CW Mode Exam

1. Select a high-quality image during B mode or B + Color (Power) mode scanning, and adjust to position the area of interest in the center of the image.
2. Press <PW>/<CW> to adjust the sampling line,
 - The sampling status will be displayed in the image parameter area in the top-right corner of the screen as follows:

PW F2.3 /G50 PRF4.8k /WF341 SVD75.5 /SV4.0 Angle 0°	CW F2.0 /G56 PRF16.7k /WF1183 SVD97.8 Angle 0°
PW Sampling Line Adjustment	SV
	Angle
	SVD
CW Sampling Line Adjustment	Angle
	CW Focus Depth

3. Set the position of the sample line by moving the trackball left and right. Set the SVD by moving the trackball up and down. Adjust the angle and SV size according to the actual situation.
4. Press <PW>/<CW> or <Update> again to enter PW/CW mode and perform the examination. You can also adjust the SV size, angle and depth in real-time scanning.
5. Adjust the image parameters during PW/CW mode scanning to obtain optimized images.
6. Perform other operations (e.g., measurement and calculation) if necessary.

If “sampling line displaying” is selected, then the screen will display the sampling line all the time and pressing <M> one will lead to entering M mode directly. For details, see “5.1.3 Quickly Saving Image Settings” chapter.

5.6.2 PW/CW Mode Image Parameters

In PW/CW mode scanning, the image parameter area in the top-right corner of the screen displays the real-time parameter values as follows:

PW	Parameter	F	G	PRF	WF	SVD	SV	Angle
	Meaning	Frequency	Gain	PRF	Wall Filter	SV Position	SV Size	Angle
CW	Parameter	F	G	PRF	WF	SVD		Angle
	Meaning	Frequency	Gain	PRF	Wall Filter	SV Position		Angle

- During PW/CW mode imaging, the image optimizing menus for B mode and PW/CW mode are displayed on the touch screen at the same time. If Color mode (Power mode) is also working, menus for certain modes will be displayed on the touch screen synchronously, and you can switch between them by clicking the mode tabs.
- When you adjust the depth of the B mode image, related changes will occur in the PW/CW mode image as well.
- Most of the parameters are the same for the PW mode and CW modes, so parameters of both are combined together to be introduced here.

Only phased probes support CW mode.

5.6.3 PW/CW Mode Image Optimization

Gain

- Description** This function is intended to adjust the gain of the spectrum map. The real-time gain value is displayed in the image parameter area in the top-right corner of the screen.
- Operations** Rotate the [PW] knob clockwise to increase the gain, and counter-clockwise to decrease it.
The adjusting range is 0-100 in increments of 2.
- Effects** Increasing the gain will brighten the image and you will see more received signals. However, noise may also be increased.

SV

- Description** To adjust the SV position and size of sampling in PW mode, the real-time value of SV and SVD are displayed in the image parameter area in the top-right corner of the screen.
- SV size** Rotate the knob under [SV] or the mapping-menu item on the touch screen to adjust the SV size.
Value: 0.5-20 mm.
- SVD** Roll the trackball to select the SV depth.
- Effects** The smaller the SV size, the more accurate the result. More details are obtained when selecting a large SV size.

CW Focus Position

- Description** To adjust the CW mode SVD. The real-time focus position value is displayed in the image parameter area in the top-right corner of the screen.
- Operation** Roll the trackball to select the focus depth.

Image Quality

- Description** Refers to the operating frequency of the probe in PW mode, the real-time value of which is displayed in the image parameter area in the top-left corner of the screen.
- Operation** Rotate the knob under [Image Quality] item or the mapping-menu item on the touch screen to select the different frequency values.
The adjusting range of frequency values can be divided into 3 levels: penetration preferred (Pen), general mode (Gen), and resolution preferred (Res).
Select the frequency according to the detection depth and current tissue features.
- Effects** The higher the frequency, the better the resolution and sensitivity, and the worse the force of penetration.

Scale

Description	<p>This function is used to adjust the speed range of the flow, which is adjusted using the PRF in the system.</p> <p>The real-time PRF value is displayed in the image parameter area in the top-right corner of the screen.</p>
Operations	<p>Rotate the knob under the [Scale] item on the touch screen or through the mapping-menu item .</p>
Effects	<p>Provides a much clearer color flow image.</p> <p>Use a low PRF to observe low-velocity flows, and a high PRF to observe high-velocity flows.</p>
Impacts	<p>Aliasing may occur if a low-velocity scale is used and high velocities are encountered.</p> <p>Low velocities may not be identified when a high-velocity scale is used.</p>

iTouch

Description	<p>To optimize image parameters as per the current tissue characteristics for a better image effect.</p>
Operations	<p>Press <iTouch> on the control panel to turn the function on.</p>

Auto-Calculation

Description	<p>This function is used to trace the spectrum and calculate the PW/CW mode image parameters. The results are displayed in the results window.</p> <ol style="list-style-type: none">1. Touch [Auto Calc] on the touch screen or the mapping-menu to turn the auto calculation function on or off.2. After the auto calculation function is turned on, touch "Auto Calculation" tab.
Auto Calculation Parameter	<p>Select parameters in the dialog box prompted by touching [Auto Calc. Param.] on the Auto Calculation page.</p>
Auto Calculation Cycle	<p>To set the heart cycle number for auto-calculation.</p> <p>Touch [Auto Calc Cycle] on the touch screen to select the cycle number, the adjusting range is 1-5.</p>
Trace Area	<p>To set the trace area of the Doppler wave in the spectrum map, applicable for auto calculation, V Max and V Mean display.</p> <p>To change the trace area, adjust through [Trace Area] item or the mapping-menu item on the touch screen.</p> <p>The available selections of trace area are: Above, Below, All.</p>
Trace Smooth	<p>To set the smooth level when tracing.</p> <p>To change the trace area, adjust through [Trace Smooth] item or the mapping-menu item on the touch screen.</p> <p>There are 4 levels of smooth effect provided, the bigger the value, the higher the smooth processing.</p>
Trace	<p>This function is used to set the sensitivity of tracing in the spectrum.</p>

Sensitivity To change the trace area, adjust through [Trace Sensitivity] item or the mapping-menu item on the touch screen.

There are 5 levels of sensitivity adjustment, the bigger the value the higher the sensitivity.

Operations In real-time scanning, the results displayed are derived from the calculation of the latest cardiac cycle.

In the freeze and cine status, the results displayed are calculated from the current selected area.

Invert

Description This function is used to set how the spectrum is displayed.

Operations Turn the function on or off using the [Invert] item or the mapping-menu item on the touch screen.

Select "Auto Invert" in the "[Setup] (F10) → [System] → [Image]", so the spectrum can automatically invert when the color flow is steered to a certain angle to accommodate the operator's desire to distinguish the flow direction.

Speed

Description This function is used to set the scanning speed of PW mode imaging.

Operations Rotate the knob under the [Speed] item or the mapping-menu item on the touch screen.

There are 6 levels of scan speed available: the smaller the value the faster the speed.

Effects Changing the speed makes it easier to identify the cardiac cycles and to detect more details.

T/F Res.

Description This function is used to create a balance between time resolution and spatial resolution.

Operations Adjust using the [T/F Res.] item or the mapping-menu item on the touch screen. There are 4 levels of T/F Res. values available.

Wall Filter

Description It filters out low-velocity signals to provide effective information, and this function is used to adjust the filtered frequency. The real-time value is displayed in the image parameter area in the top-right corner of the screen.

Operations Select using the [WF] item or the mapping-menu item on the touch screen. 7 levels of wall filter function are provided.

Impacts Signals of low-velocity flow may be missing.

Tint Map

- Description** This function provides an imaging process based on color difference rather than gray distinction.
- Operations** Adjust through the [Tint Map] item or the mapping-menu item on the touch screen to select the map. There are 8 color effect maps available.

Gray Map

- Description** This function applies the gray correction to obtain optimum images.
- Operations** To select from among the maps, turn the knob under [Gray Map] on the touch screen. There are 10 gray effect maps available.

Display Format

- Description** To set the display format of PW mode images with B mode images.
- Operations** Touch the different display format ratio buttons on the touch screen to adjust. There are 5 formats for displaying the images: H2:3, V2:3, V3:2, V3:1, Full.

Duplex/Triplex

- Description** This function is used to set whether a B image (B + Color image) and PW image are displayed synchronously.
- Operations** Touch [Duplex]/[Triplex] on the touch screen or on the mapping-menu to turn the synchronization on or off.

HPRF

- Description** HPRF mode is used when detected velocities exceed the processing capabilities of the currently selected PW Doppler scale, or when the selected anatomical site is too deep for the selected PW Doppler scale.
- Operations** Turn the function on or off using the [HPRF] item or the mapping-menu item on the touch screen.
- Effects** HPRF enhances the range for detecting high-velocity flow.

Baseline

- Description** Refers to the area where the velocity is zero in the spectrum.
- Operations** Rotate the knob under [Baseline] or use the mapping-menu to adjust.
- Effects** Changes the flow-velocity range to optimize the image.

Angle

Description This function is used to adjust the angle between Doppler vector and flow to make the velocity more accurate.

The real-time adjusting angle value is displayed on the right part of the spectrum map.

Operations Rotate the <Angle/Steer> knob on the control panel to adjust it.
The adjustable angle range is -89~89°, in increments of 1°.

Quick Angle

Description To adjust the angle faster, in increments of 60°. The real-time value is displayed on the right part of the spectrum map.

Operations Adjust using the [Quick Angle] item or the mapping-menu item on the touch screen.

There are 3 angles for quick adjustment: -60°, 0° and 60°.

Dynamic Range

Description The dynamic range conveys the information which is being transformed from echo intensity to grayscale.

Operations Adjust using the [Dyn. Ra.] item or the mapping-menu item on the touch screen.
The adjusting range is 24-72dB.

Effects The more the dynamic range, the more specific the information and the lower the contrast with more noise.

Audio

Description This function is used to adjust the output audio in the spectrum map.

Operations Rotate the <Volume> knob on the left of the touch panel to adjust the volume.
Press the <Volume> knob to open or shut down the volume.
The adjusting range of the audio is 0-100%.

Effects Utilizing the output audio helps to identify the feature and the status of flow.

PW Steer

Description This function is used to adjust the angles for the sampling line.

Operations Press the <Angle/Steer> knob on the control panel to switch to "Steer adjustment".
Rotate the knob to adjust.

Effects This feature is used to steer the direction of the beam so as to change the angle between the beam and flow direction with immobility of the linear probe.

The values of steer angles vary according to the probe.

Impacts The PW Steer function is available only for linear probes.

5.7 Color M Mode

Color M mode provides information about color flow or tissue on the M mode images to indicate the cardiac motion state. It is highly sensitive to the flow or tissue movement.

The Color M mode includes Color Flow M mode and Color Tissue M mode.

CM mode is not available for linear probes.

5.7.1 Enter Color M Mode

- Color Flow M Mode
 - In B + M mode, press <Color> on the control panel to enter the sampling line adjustment status, and press <M> again.
 - In B + Color, B + Color + PW or B + Color + CW mode, press <M> twice on the control panel.
- Color Tissue M Mode (TVM)
 - In B + TVI/TVD, or B + TVI + TVD mode, press <M> twice on the control panel.
 - In Color Flow M mode, press user-defined key for TDI on the control panel (Assign a key as user-defined TDI: the setting path is "[Setup]→ [System] →[Key Config]", see "12.1.6 Key Configuration" chapter for details) or touch [TDI] on the touch screen to enter the sampling line adjustment status, and press <M> again.

5.7.2 Exit Color M Mode

- Press <Color> or <M> on the control panel to exit Color M mode.
- Or, press on the control panel to return to B mode.

5.7.3 Color M Mode Image Parameters

- In Color Flow M mode, the parameters that can be adjusted are the same as those in B, M and Color modes. See the relevant B, Color and M mode sections for details.
- In Color Tissue M mode, the parameters that can be adjusted are the same as those in B, M and TVI modes. See the relevant B, M and TVI mode sections for details.
- In Color M mode scanning, the image parameter area in the top-right corner of the screen displays the real-time parameter values.
- ROI Adjustment

The ROI determines the size and position of the color flow or color tissue displayed in the Color M mode image.

 - Set the position of the sampling line by moving the trackball left and right, and set the ROI position by moving the trackball up and down.
 - Set the ROI size by moving the trackball.
 - Press <Set> to switch the cursor status between ROI position adjustment and ROI size adjustment.
- Press <Update> on the control panel to switch between the real-time mode and freeze mode.

5.8 Anatomical M Mode



CAUTION:

Anatomical M Mode and Color Anatomical M mode images are provided for reference only, not for confirming diagnoses. Compare the image with those of other machines, or make diagnoses using non-ultrasound methods.

For an image in the traditional M mode, the M-mark line goes along the beams transmitted from the probe. Thus it is difficult to obtain a good plane for difficult-to-image patients who cannot be moved easily. However, in the Anatomical M mode, you can manipulate the M-mark line and move it to any position at desired angles. The system supports anatomical M scanning (including Free Xros M mode and Free Xros CM mode) in 2D imaging modes (B, Color, Power and TVI mode).

■ Shortcut key setting

You can preset a user-defined key for entering Free Xros M mode: [Setup] (F10) → [System] → [Key Config.]. See “12.1.6 Key Configuration” for details.

Free Xros M imaging and Free Xros CM imaging are options.

5.8.1 Free Xros M Imaging (Anatomical M-Mode)

5.8.1.1 Basic Procedures for Free Xros M Imaging

1. In real-time 2D mode or M mode, adjust the probe and image to obtain the desired plane. Or select the desired 2D cine files.
 2. Click [Free Xros M] on the touch screen of the B mode tab to enter Free Xros M mode, or press the user-defined key.
 3. Adjust the M-mark (single or multiple) line to obtain optimized images and necessary information.
- In Dual-split or Quad-split mode, it is the currently activated window that enters the Free Xros M mode.

Free Xros M imaging is supported on frozen B images, B+M images and B+Power/Color/TVI images.

5.8.1.2 Free Xros M Image Parameters

- During Free Xros M mode imaging, the image optimizing menus for B mode and Free Xros M mode are displayed on the touch screen at the same time. You can switch between the 2 modes by clicking the mode tabs.
- Parameters consistent with those in M mode are not to be introduced. See the relevant M mode section, while Free Xros M mode special items will be introduced in the following.

Display/Hide the M-mark Line

Description	There are 3 M-mark lines available, each with "A", "B" or "C" at the one end as identification and an arrow at the other end to mark the direction.
M-mark Line Selection	Perform the selection using the [Show A], [Show B] or [Show C] item on the touch screen or the mapping-menu, and the corresponding image will be displayed on the screen once the related item is selected.
Display current	Touch [Display Cur.] or [Display All] on the touch screen or the mapping-menu to select whether to display the image of the current M-mark line or all.
Impacts	When there is only one M-mark line on the screen, it cannot be hidden.

Switching between the M-mark Lines

Description	To switch between the M-mark lines in Free Xros M mode.
Operations	Press <Set> to switch between the M-mark lines and press <Cursor> to show the cursor. The activated M-mark line will be green and the inactivated one will be white.

Adjusting the M-mark Line

Description	To adjust the position and angle of the M-mark line.
Operations	<ul style="list-style-type: none">● Position Adjustment When the M-mark line is activated, move the trackball left and right to adjust the position. The direction is recognized by the arrow at the end of the line.● Angle Adjustment When the M-mark line is activated, move the trackball to adjust the fulcrum of the line, and adjust using the [Angle/Steer] deflector rod on the control panel. The adjusting angle range is 0-360°, in increments of 1°.

5.8.1.3 Exit Free Xros M

In Free Xros M mode, touch [Free Xros M] or press B or the user-defined Free Xros M key to exit Free Xros M mode.

5.8.2 Free Xros CM (Curved Anatomical M-Mode)



CAUTION:

Free Xros CM images are provided for reference only, not for confirming diagnoses. Compare the image with those of other machines, or make diagnoses using non-ultrasound methods.

In Free Xros CM mode, the distance/time curve is generated from the sample line manually depicted anywhere on the image. Free Xros CM mode can be entered using TVI and TEI modes. Only the phased probe supports Free Xros CM.

5.8.2.1 Basic Procedures for Free Xros CM

1. In 2D real-time imaging mode, adjust the probe and image to get the desired image, then fix the probe.
2. Press [TDI] user-defined key to enter TDI imaging and acquire the necessary images.
3. Press the user-defined key for Free Xros CM or touch [Free Xros CM] on the touch screen to enter Free Xros CM mode.
4. Roll the trackball to define the start point of the sample line on the 2D image.
The cursor displays as ■, and can only be moved within the 2D image.
5. Press <Set> to fix the start point. The digital number “1” is marked beside the point.
6. Define the next point using the trackball and <Set> key (touch [Undo] to cancel the current point and activate the preview point). The system updates the time-motion curve in real time. The sample line is displayed in green, and each point is marked with a number in sequence.
7. Repeat Step 6 to finish the sample line.
8. Double-click the <Set> key to end editing. The sample line is displayed in white.
9. Adjust the image parameters to optimize the image, obtain the relevant tissue image for data analysis, then save the image if necessary.
10. Press the user-defined key again or to exit Free Xros CM mode.

Sample Line Modification

1. To enter curve (sample line) modification status:
For a completed sample line, set [Edit] to “On” and the sample line is editable.
2. Anchor the cursor to a certain point, press the <Set> key to activate the point, then roll the trackball to drag the point for a desired sample line.
3. Double-click the <Set> key to end editing. The sample line is displayed in white.

Delete a Sample Line

touch [Delete] to delete the selected line. You can re-create a new sample line.

Tip:

The free Xros M mode and Free Xros CM mode parameters are independent of each other, but their functions are the same. Free Xros CM parameters are not to be introduced. See the relevant M mode and Free Xros M mode sections.

5.9 TDI

TDI mode is intended to provide information about low-velocity and high-amplitude tissue motion, specifically for cardiac movement.

4 types of TDI mode are available:

- Tissue Velocity Imaging (TVI): this imaging mode is used to detect tissue movement with direction and speed information. In general, the warm color indicates movement toward the probe, while the cool color indicates movement away from the probe.
- Tissue Energy Imaging (TEI): this imaging mode reflects the status of cardiac movement by displaying the intensity of tissue. The brighter the color the less the intensity.
- Tissue Velocity Doppler Imaging (TVD): this imaging mode provides quantifiable direction and velocity information about the tissue.
- Tissue Velocity M Imaging (TVM): this function assists in observing the cardiac motion through a direct angle. TVM mode is also called Color Tissue M mode which has been introduced in the Color M mode chapter. See “5.7 Color M Mode” for details.

TDI imaging and TDI QA are options.

Only the phased probe in cardiac exam mode supports the TDI function.

5.9.1 Basic Procedures for TDI Imaging

- Press user-defined key for TDI on the control panel in real-time scanning to enter the modes (Assign a key as user-defined TDI: the setting path is "[Setup]→ [System] →[Key Config]", see "12.1.6 Key Configuration" chapter for details), or touch [TDI] on the touch screen directly:
 - In B or B+Color mode: to enter TVI Mode, TVI mode parameters will be displayed on the touch screen.
 - In Power mode: to enter TEI Mode, TEI mode parameters will be displayed on the touch screen.
 - In PW mode: after pressing the [TDI] user-defined key, press <PW> or <Update> to enter TVD Mode, TVD mode parameters will be displayed on the touch screen.
 - In M mode: after pressing the [TDI] user-defined key, press <M> or <Update> to enter TVM Mode, TVM mode parameters will be displayed on the touch screen.
- Switching between the TDI sub-modes
In TDI mode, press <Color>, <Power>, <M> or <PW> to switch between the modes.
- Exit TDI
 - Press [TDI] user-defined key to exit TDI mode and enter general imaging modes.
 - Or, press on the control panel to return to B mode.

5.9.2 TDI Image Parameters

- In TDI mode scanning, the image parameter area in the top-right corner of the screen displays the real-time parameter values as follows:

- TVI/TEI

Parameter	F	G	PRF	WF
Meaning	Frequency	Gain	PRF	Wall Filter

- TVD

Parameter	F	G	PRF	WF	SVD	SV	Angle
Meaning	Frequency	Gain	PRF	Wall Filter	SV Position	SV Size	Angle value

5.9.3 TDI Image Optimization

In each TDI mode, the parameters that can be adjusted are similar to those in the color flow modes (Color, PW, and Power). See the relevant sections for details. The following introduces the specific items in TDI mode.

Tissue State

Description This function is used for fast image optimization.

Operations Adjust using the [Tissue State] item or mapping-menu item on the touch screen. 3 levels are provided: L, M, H.

5.9.4 TDI Quantitative Analysis (QA)

 CAUTION:	TDI Quantitative Analysis results are provided for reference only, not for confirming diagnoses. Compare the results with those of other machines, or make diagnoses using non-ultrasound methods.
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TDI QA is applied for TVI original data analysis, for evaluating the velocity change of the same cardiac muscle with cardiac cycles.

The system provides 3 kinds of curves for quantitative analysis:

- Speed – Time curve;
- Strain – Time curve;
- Strain Rate – Time curve.

Strain:	Deformation and displacement of the tissue within the specified time.
Strain rate:	Speed of the deformation, as myocardial variability will result in velocity gradient. Strain rate is commonly used to evaluate how fast the tissue is deforming.

TDI QA Workflow:

1. Perform image scanning on cardiac muscle, freeze the image and select a range of images for analysis, or select a desired cine loop from the stored images.
Tip:
 - Images from the current scan session (already in freeze mode) or from a saved image loop can be used for TDI QA.
 - TDI QA is only available if the user has selected an image loop. If the user has selected a saved still image (just one frame), the TDI QA function is not available.
2. Touch [TDI QA] on the TVI touch screen page to activate the TDI QA function, or press the user-defined key for TDI QA directly.
3. Mark out the part of interest.
4. Select the quantitative analysis curve: touch [Speed] / [Strain Rate] / [Strain] to select.
5. Save the curved image, export the data and perform parameter analysis.
6. Touch [Exit] to exit the TDI QA function.

5.9.4.1 TDI QA Screen Description



TDI QA Screen (using the Speed – Time curve as an example)

1 - TVI Cineloop window

Sample area: indicates the sampling position of the analysis curve. The sample area is color-coded, 8 (maximum) sample areas can be indicated.

2 - B Cineloop window

Tip:

- The images in the TVI cineloop window and B cineloop window are the frozen image of the same moment. Roll the trackball to review the images in the two cineloop windows.
- Sample areas are linked in the TVI cineloop window and B cineloop window.

3 - Displays the analysis curve

- The Y-axis represents the speed (unit: cm/s). [In the Strain Rate – Time curve, the Y-axis represents the strain (%). In the Strain – Time curve, the Y-axis represents the strain rate (1/s).]
- The X-axis represents the time (unit: s).
- Frame marker: a white line perpendicular to the X-axis which can be moved horizontally left to right (and right to left) by rolling the trackball.
- Click the checkbox beside the ROI to set whether to hide or display the QA curve.
- You can get the current X/Y-axis value by moving the cursor onto one point on the curve. If you press <Set> now, the frame marker will move to that spot.

4 - Displays the ECG trace (no ECG trace displayed here).

5.9.4.2 Basic TDI QA Procedures

Setting the ROI

This function is used for setting the TDI QA target.

Up to eight ROIs can be saved on the reference image, with the corresponding eight traces plotted simultaneously on the graph. Each ROI display has a different color, and its corresponding trace data is plotted with the same color.

There are two different methods for determining the shapes of the sample area: Standard ROI and Freehand ROI.

ROI types:

- Standard ROI: if selected, the ROI is drawn automatically with its shape determined by "Standard Height/Width/Angle".
- Ellipse ROI: if selected, the ROI is drawn by the trackball.

■ Standard ROI

1. Touch [Standard ROI] on the touch screen.
2. Browse the image to a desired frame.
3. When the trackball positions the cursor over the reference image(s), an elliptical ROI is automatically generated and displays on the reference image(s).
4. When scanning with an elliptical ROI, press <Set> to fix the ROI position and freeze its corresponding trace on the plot.

The average intensity value inside the ellipse is calculated for every image in the image analysis range and plotted in the image display area.

The last generated or selected ellipse is considered to be the active ROI, and its trace plot automatically updates as the user repositions it on the reference image.

A new active ROI is generated whose position is manipulated by the trackball and whose analysis curve traces will be plotted as before, while the previous ROI and trace remain fixed at the points they were saved at.

Press <Clear> to delete last ROI.

■ Ellipse ROI

1. Touch [Ellipse ROI] on the touch screen. When the cursor appears in the image review area (TVI image review window or 2D image review window), it displays as a color-coded ellipse.
2. Browse the image to a desired frame.
3. Use the trackball to position the caliper on the reference image at the start point. Press <Set> to fix the start point.
4. Trace the outline of the desired ROI by moving the cursor with the trackball.
5. Press the <Set> key, and roll the trackball to create the ROI. When a suitable ROI has been drawn, confirm the ROI by double-clicking the <Set> key. Press the <Clear> key to cancel the drawing.

■ **Delete an ROI**

Press the <Clear> key to clear the last ROI. Touch [Delete All] on the touch screen to clear all ROIs.

The corresponding traces for the deleted ROIs are erased from the plot.

Press <Clear> to delete the last added ellipse ROI.

■ **Standard Height/Standard Width/Standard Angle**

Use the touch screen selections [Std. Height], [Std. Width], [Std. Angle] to adjust the height, width and tilt angle of the standard ROI for the current or following ROIs.

■ **Strain Distance**

Sampling distance for calculating deformation. Use the knob under [Strain Dist.] on the touch screen to select the corresponding value for the Strain – Time curve or Strain Rate – Time curve.

ROI tracking

Touch [ROI Tracking] to be On to start tracking.

This function provides a motion-compensated ROI as precise time-intensity information can be acquired using active tracking.

Tip:

- Elliptical ROIs can be positioned in any way that keeps their center within the image boundaries. If part of the ROI is outside the image boundary, only data from within the image boundary is used for calculating the mean intensity value.
- When the user repositions an ROI, the old trace data is erased from the plot and the trace data for the new position re-plotted.

X Scale

Rotate the knob under [X Scale] on the touch screen to choose a different value. The X scale display will be changed. This function can be used to track detailed tissue information.

Smooth

Use this function to smooth the curve. The system provides 7 levels of smooth effect.

Export/Save Trace Data

1. Click [Export] on the touch screen.
2. Select the drive and enter the file name in the displayed window.

Select [OK] to save the data and return to the QA Analysis screen.

- All displayed ROI traces are saved in the exported file.
- The parameters are included in the trace file if the user has fixed a ROI.
- After exporting, a .BMP format image is displayed in the thumbnail area in the lower part of the screen.
- Only data from the user-selected image range is included in the exported trace file.

5.10 3D/4D

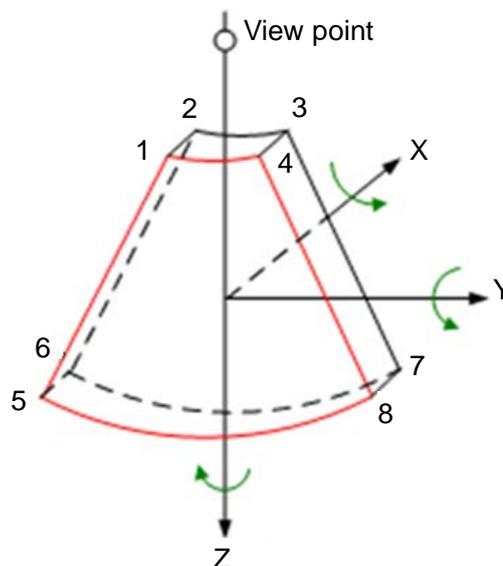
NOTE: 3D/4D imaging is largely environment-dependent, so the images obtained are provided for reference only, not for confirming diagnoses.

5.10.1 Overview

Ultrasound data based on three-dimensional imaging methods can be used to image any structure where a view cannot be achieved with the standard 2D-mode and to improve the understanding of complex structures.

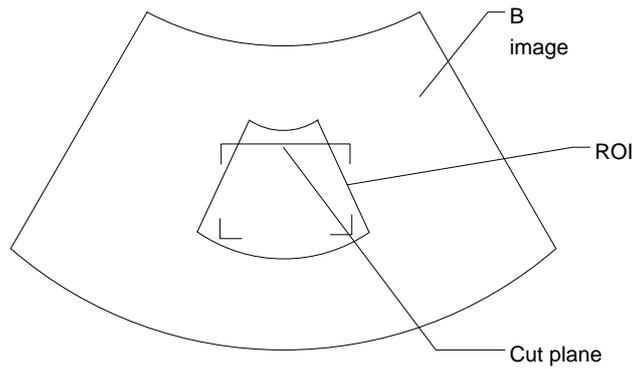
■ Terms

- 3D image Volume Rendering (VR): the image displayed to represent the volume data.
- 4D: continuous-sweep volume acquisition.
- View point: a position for viewing volume data/3D image.
- MultiPlaner Rendering (MPR): the three sectional planes of the volume acquisition. As shown in the figure below, the XY-paralleled plane is the C-section, the XZ-paralleled plane is the B-section, and the YZ-paralleled plane is the A-section. The probe is moved along the X-axis.
- ROI (Region of Interest): a volume box used to determine the height and width of scanning volume.
- VOI (Volume of Interest): a volume box used to display the 3D image (VR) by adjusting the region of interest in MPR.



■ ROI and VOI

After the system enters 3D/4D imaging, a B image with ROI displays on the screen. A line (shown in the following figure) shows that the upper edge position of the VOI is inside the ROI.



- ROI size and position
Roll the trackball to change the ROI size and position. Press the <Set> key to toggle between setting the size (dotted line) and position (solid line).
- Curved VOI adjustment
Roll the trackball to change the curved VOI position. Press the <Set> key to switch between the changing ROI and curved VOI states.

This function changes the curved shape of the nearest VOI section and facilitates observation of the volume data of interest.

When a triangle of control point is displayed on the curved VOI, it can be adjusted both in acquisition preparation status, and in the A, B and C sections of review/4D imaging status.

The orientation and shape (line or dot) of curved VOI vary depending on the view direction:

View	Curved VOI
U/D	At the upper part of curved VOI
D/U	At the lower part of curved VOI
L/R	At the left part of curved VOI
R/L	At the right part of curved VOI
F/B	Displays as a dot
B/F	Displays as a dot

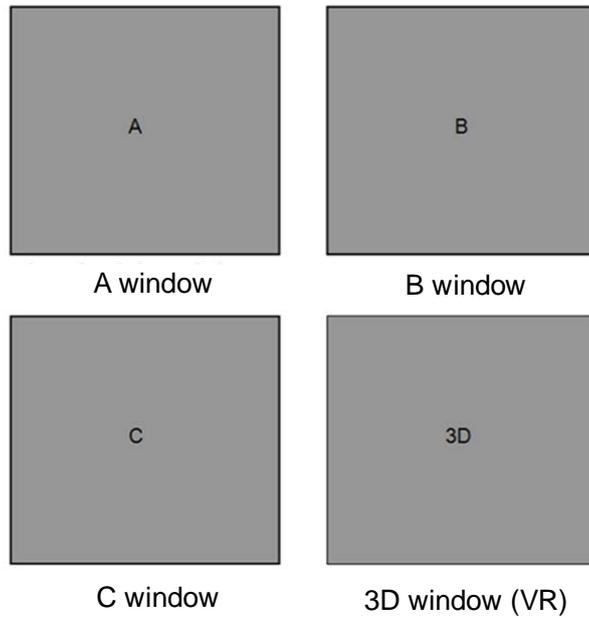
■ About the probes

A 2D imaging probe can be applied for Smart 3D imaging. However, to realize Static 3D imaging, 4D imaging, STIC, iPage, SCV, CMPR, Color 3D or Niche, a volume probe should be selected.

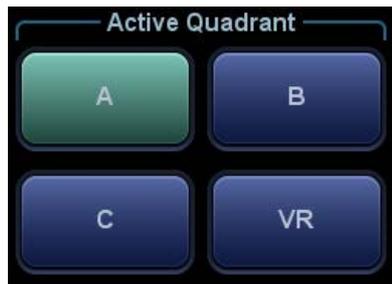
■ MPR

The principle of 3D imaging is to render a 3D image from multiple 2D image information. The following describes the spatial relationship of 3 MPRs (A, B and C) and the 3D image (VR).

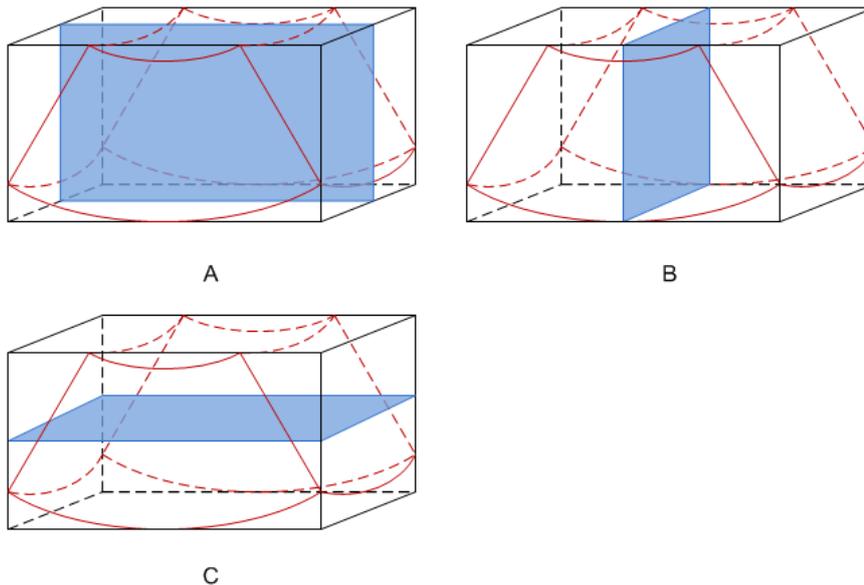
In the quad display format view, the screen displays 3 MPRs (A, B and C) and the 3D image.



- On the touch screen, the current window's icon is highlighted, as shown below. Window A is the currently activated window.



A, B and C sectional images correspond to the following sections of the 3D image.



- Section A: corresponds to the 2D image in B mode. Section A is the sagittal section in fetal face-up posture, as shown in Figure A above.
- Section B: is the horizontal section in fetal face-up posture, as shown in Figure B above.
- Section C: is the coronal section in fetal face-up posture, as shown in Figure C above.

Tip: the upper part of the 3D image in the 3D window corresponds to the orientation mark on the probe. If the fetal posture is head down (toward the mother's feet), and the orientation mark is toward the mother's head, then the fetus posture is head down in the 3D image. The 3D image can be rotated by touching [180°] on the touch screen to show the fetus head-up.



CAUTION: Ultrasound images are provided for reference only, not for confirming diagnoses. Use caution to avoid misdiagnosis.

■ Free View (Free View Imaging)

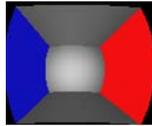
With this function, the probe scanning direction can be controlled just by changing the probe scanning angle. The image of interest can be easily found without any actual probe position and direction change. This not only reduces the operations, but most importantly, it decreases patient discomfort resulting from moving the probe.

When the intra-cavity 4D probe (DE10-3E) is activated, the parameter [Free View] can be adjusted on the B image touch screen for adjusting the probe angle.

Range: -45° ~ $+45^{\circ}$, in increments of 5° .

■ Wire cage

When viewing a 3D/4D image on the display monitor, it is sometimes difficult to recognize the orientation. To help, the system displays a three-dimensional drawing to illustrate the orientation. The blue plane shows the image acquisition where started, while the red plane shows the image acquisition where ended. A yellow plane in the wire cage shows the position of the MPR. See the image below:



Wire Cage

5.10.2 Note Before Use

5.10.2.1 3D/4D Image Quality Conditions

NOTE: In accordance with the ALARA (As Low As Reasonably Achievable) principle, try to shorten the sweeping time after a good 3D image is obtained.

The quality of images rendered in 3D/4D mode is closely related to the fetal condition, angle of a B tangent plane and scanning technique (only for Smart 3D). The following description uses fetal face imaging as an example. Imaging of other parts is the same.

■ Fetal Condition

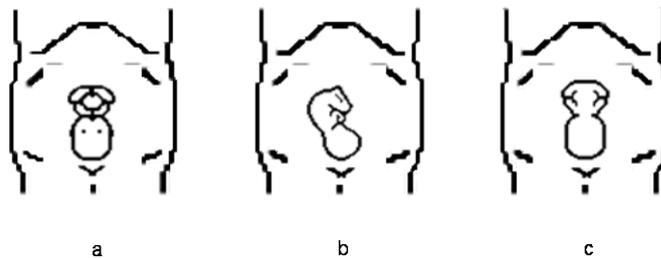
(1) Gestational age

Fetuses of 24~30 weeks old are the most suitable for 3D imaging.

(2) Fetal body posture

Recommended: cephalic face up (Figure a) or face to the side (Figure b);

NOT recommended: cephalic face down (Figure c).



(3) Amniotic fluid (AF) isolation

The desired region is adequately isolated by amniotic fluid.

The region to be imaged is not obscured by limbs or umbilical cord.

(4) The fetus keeps still. If there is fetal movement, it is necessary to rescan.

■ Angle of a B tangent plane

The optimum tangent plane to the fetal face 3D/4D imaging is the sagittal section of the face. To ensure high image quality, scan the maximum face area and maintain edge continuity.

■ Image quality in B mode (2D image quality)

Before entering 3D/4D capture, optimize the B mode image to ensure:

- High contrast between the desired region and the surrounding AF.
- Clear boundary of the desired region.
- Low noise of the AF area.

■ Scanning technique (only for Smart 3D)

- Stability: the body, arm and wrist must move smoothly, otherwise the restructured 3D image distorts.
- Slowness: move or rotate the probe slowly.
- Evenness: move or rotate the probe at a steady speed or rate.

NOTE:

1. A region with a qualified image in B mode may not be optimal for 3D/4D imaging. E.g., adequate AF isolation for one MPR does not mean the whole desired region is isolated by AF.
2. Practice is needed for a high success rate of qualified 3D/4D imaging.
3. Even with good fetal condition, acquiring a suitable 3D/4D image may require more than one scanning.

5.10.3 Static 3D

Static 3D provides single frame image acquisition of 3D images. During scanning, the probe performs the scanning automatically.

Only probe D7-2E and DE10-3E supports Static 3D imaging.

5.10.3.1 Basic Procedures for Static 3D Imaging

To perform Static 3D imaging:

1. Select the appropriate probe and exam mode. Make sure there is sufficient gel on the probe for scanning.
2. Obtain a 2D image.

Make sure there is:

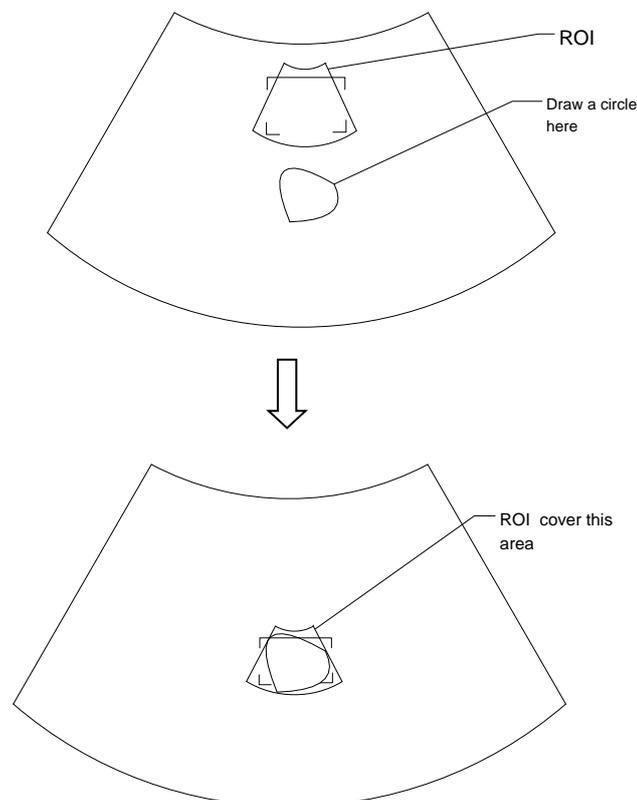
- High contrast between the desired region and the surrounding AF (amniotic fluid).
- Clear boundary of the desired region.
- Low noise of the AF area.

3. Press  to enter Static 3D acquisition preparation mode, and define the ROI as well as the curved VOI.

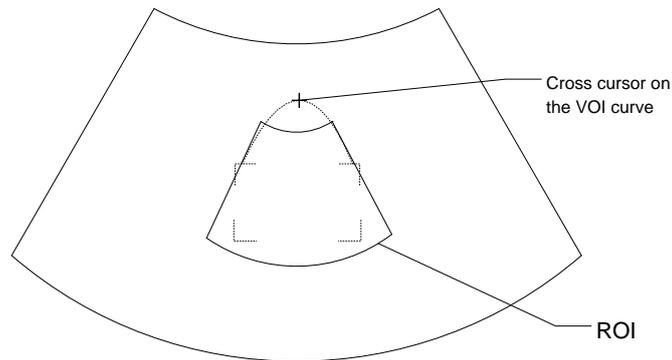
To adjust the ROI:

- Under acquisition preparation status: roll the trackball to change the ROI size, ROI position and curved VOI, press the <Set> key to toggle between setting the ROI size, ROI position and curved VOI.
- Enter touch screen mapping mode, see “3.8.4 Touch Screen Operation” for details.

Draw a circle around the interested region, then the system will position the ROI to cover the region. You can adjust ROI size and position if necessary.



Touch the cross cursor on the VOI curve and move the cursor with finger to adjust VOI curve.



For setting the ROI, be sure to:

- Set the ROI on the 2D image with the largest section area of the fetal face.
- Set the ROI a little larger than the fetal head.

NOTE: When defining an ROI, try to eliminate useless data so as to reduce the volume data and shorten the time for image storing, processing and rendering.

4. Select a render mode on the touch screen and set parameters such as [Angle] and [Image Quality] on the touch screen accordingly.
5. Press <Update> on the control panel to start the 3D image acquisition.

The system enters 3D image viewing status when the acquisition is completed.

In image viewing status, you can perform VOI setting, image editing and other operations. For details, see "5.10.3.3 Static 3D Image Viewing."

6. Exit Static 3D.

Press or  to enter B mode.

5.10.3.2 Static 3D Acquisition Preparation

Description of parameters:

Type	Parameter	Description
Parameter adjusting	Angle	Function: to set the range for imaging. Range: 10-80°.
	Quality	Function: to adjust the image quality by changing the line density. Image quality can affect the imaging speed: the better the image quality, the longer the time. Range: Low2, Low1, Mid, High1, High2
Render Mode	Surface	Function: set Surface as the 3D image rendering mode. This is useful for surface imaging, such as fetus face, hand or foot. Tip: you may have to adjust the threshold to obtain a clear body boundary.
	Max.	Function: set Max. as the 3D image rendering mode. Displays the maximum echo intensity in the observation direction. This is useful for viewing bony structures.
	Min.	Function: set Min. as the 3D image rendering mode. Displays the minimum echo intensity in the observation direction. This is useful for viewing vessels and hollow structures.
	X-ray	Function: set X-ray as the 3D image rendering mode. Displays the average value of all gray values in the ROI. X Ray: used for imaging tissues with different internal structures or tissues with tumors.

5.10.3.3 Static 3D Image Viewing

Enter/Exit Image Viewing

- To enter image viewing:
The system enters image viewing when image acquisition is complete.
- Exit
To return to 3D/4D image acquisition preparation status, press <Update> or <Freeze>.

Activate MPR

Touch [A], [B], [C] or [VR] to activate MPR or 3D image (VR).

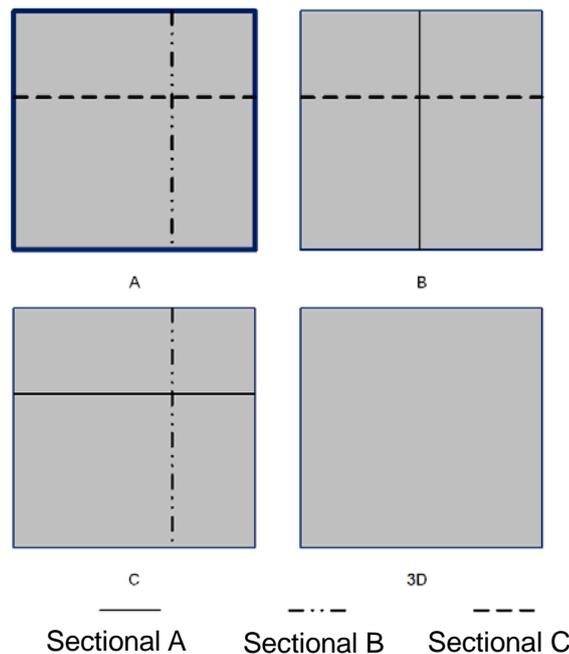


MPR Viewing

In the actual display, different colors for the window box and the section line are used to identify the MPR A, B and C.

- Window A is blue, and the lines (representing MPR A) displayed in the other two windows are also blue.
- Window B is yellow, and the lines (representing MPR B) displayed in the other two windows are also yellow.
- Window C is orange, and the lines (representing MPR C) displayed in the other two windows are also orange.

The positions of the other two MPRs are indicated in the selected plane. You can roll the trackball to change the position.



MPR Only



Touch  on the touch screen to display MPR only. The adjustable image parameters are changed to MPR parameters automatically.

Only A, B and C MPR are displayed, and VR is not displayed.

The MPR Only function is available in image acquisition status.

Asymmetric

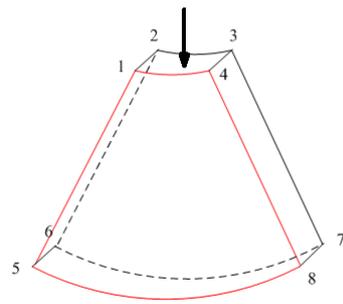


Touch  on the touch screen to display MPR along with VR. A larger VR image along with 3 small MPR images will be displayed.

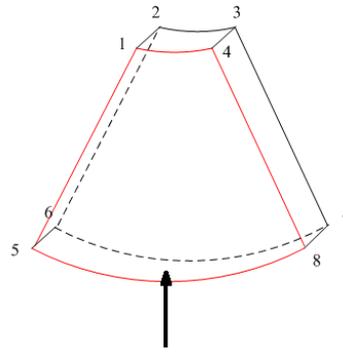
View Direction

The Region of Interest (ROI), also referred to as the Render Box in rendering, contains the section of the volume you want to render. Therefore, objects that are not inside the box are not included in the render process and are cut out (this is important in surface mode to allow a free line of sight). This may or may not be the entire VOI.

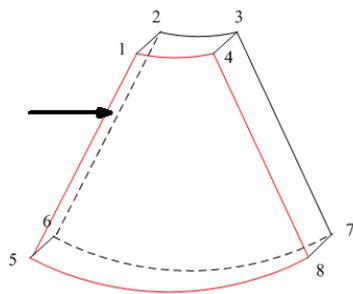
You can adjust the view direction of the ROI.



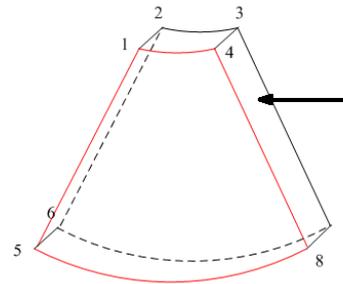
a



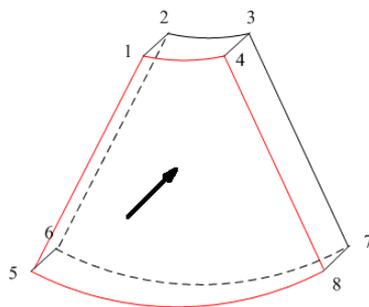
b



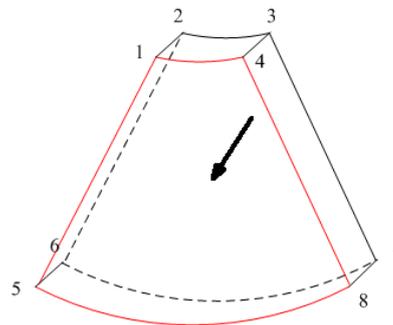
c



d



e



f

View Direction

a. Up/Down	b. Down/Up
c. Left/Right	d. Right/Left
e. Front/Back	f. Back/Front

Touch [Up/Down], [Left/Right] or [Front/Back] on the second page of the touch screen to select the direction of the above Figure a, c and e.

Touch [Flip] on the touch screen to view in the opposite direction to the current direction, as shown in Figures b, d and e.

Adjust VOI

■ VOI On

The VR image displays VOI information.

1. In image viewing status, touch [VOI] to turn it to "On."
2. Select the desired window by touching [A], [B] or [C] or [VR].

- Roll the trackball to adjust the VOI position, size and curved VOI, and press <Set> to switch between the adjusting status. Or rotate the <4D> knob on the control panel to adjust the relative position of MPRs so as to slice through the VR.

■ VOI Off

The VR image displays ROI information.

Touch [VOI] to turn it to “Off.” The ROI image is displayed on the screen. Roll the trackball to observe the MPR.

■ Accept VOI

- This function is usually used for MPR observation and to determine the relative position of the MPR to the VR.
- Touch [Accept VOI] on the touch screen.
- Select the desired MPR by touching [A], [B] or [C] or [VR].
- Roll the trackball to view the current active MPR. The other two MPRs change correspondingly. Or rotate the <4D> knob to adjust the relative position of MPRs so as to slice through the VR.

In Accept VOI status, when the VR is active or the MPR which is perpendicular to the view direction is active, the center point of the VR displays. Adjust the position using the trackball.

Image Rendering Parameters

In image viewing status, render the image by adjusting the relevant parameters.

Render setting parameters description:



Touch   on the touch screen to select VR or MPR parameter adjustments.

- When [VR] is highlighted in green, parameter adjustment is performed on the VR image.
- When [MPR] is highlighted in green, parameter adjustment is performed on the MPR.

Adjustable parameters are as follows:

Parameter	Description
Threshold	<p>Function: to set the threshold for VR rendering. The VR is rendered using the signal between the high and low thresholds.</p> <p>When signals are received, from small to large, they are divided into different levels assigned within the range of 0-100%. The threshold is a selected range where the system filters out signals below it and above it to render the VR image.</p> <p>The lower threshold can eliminate lower range noises and echo, which contributes to a clearer and smoother image.</p> <p>Range: 0%-100%.</p> <p>Available in Surface render mode only.</p>
Opacity	<p>Function: to set the transparency value for VR rendering.</p> <p>Range: 0%-100%.</p> <p>The lower the number, the more transparent the grayscale information.</p>
Smooth	<p>Function: to set the smoothness of VR.</p> <p>Selection: 0-20. 0 refers to no smooth effect, 0-20 represent 21 effects in incremental order.</p> <p>Tip: Insufficient smoothness can result in a fuzzy image, while too much smoothness will lead to image distortion.</p>

Parameter	Description
Brightness	Function: to set the brightness of VR. Range: 0%-100%. 0% represents the minimum brightness, while 100% represents the maximum.
Contrast	Function: to set the contrast of VR. Range: 0%-100%.
Tint	Switch tint map on/off. Selection: Off, 1-8.
VR Orientation	To quickly rotate the VR. Selection: 0°, 90°, 180°, 270°.
iClear	Enhances the B mode image profile for better boundary details. Range: Off, 1-7.

■ Reset Curve

Parameter	Description
Reset Ori.	To reset the volume rotation, shifting and zooming to its original status.
Reset Curve	To reset the curve to its original status.
Reset All	To reset the volume to its original orientation and original parameters.

■ Render Mode

Parameter	Description
Gray/Inversion	Surface Function: set Surface as the VR rendering mode. This is useful for surface imaging, such as fetus face, hand or foot. Tip: you may have to adjust the threshold to obtain a clear body boundary.
	Max. Function: set Max. as the VR rendering mode. Displays the maximum echo intensity in the observation direction. This is useful for viewing bony structures.
	Min. Function: set Min. as the VR rendering mode. Displays the minimum echo intensity in the observation direction. This is useful for viewing vessels and hollow structures.
	X-ray Function: set X-ray as the VR rendering mode. Displays the average value of all gray values in the ROI. X Ray: used for imaging tissues with different internal structures or tissues with tumors.
The above four rendering methods can be applied to both gray and inversion modes. Where inversion means to invert the grayscale of the image, so as to enhance observation for low-echo regions, applicable for vessels, cysts, etc. When the function is turned on, the rendering mode parameters change to the corresponding inverse parameters.	

Rotate an Image

The system supports the following rotation modes:

- Axial rotation
- Auto rotation

■ Axial rotation

Axial rotation rotates the currently activated image around the X-, Y- or Z-axis.

- Procedures
 - a) Select the current image.
 - b) Rotate the corresponding knobs to make the image rotate:
 - To rotate along the X-axis: rotate the <M> button on the control panel clockwise and the image rotates right along the X-axis. Rotate the button counter-clockwise and the image rotates to the left.
 - To rotate along the Y-axis: rotate the <PW> button on the control panel clockwise and the image rotates right along the Y-axis. Rotate the button counter-clockwise and the image rotates to the left.
 - To rotate along the Z-axis: rotate the <Color> button on the control panel clockwise and the image rotates right along the Z-axis. Rotate the button counter-clockwise and the image rotates to the left.
- Or, enter the touch screen mapping mode and hide the tool bar. Rotate the image by touching the image window and move slowly.
 - To rotate along the X-axis: swipe from top to bottom and the image rotates right along the X-axis. Swipe from bottom to top and the image rotates to the left.
 - To rotate along the Y-axis: swipe from left to right and the image rotates right along the Y-axis. Swipe right to left and the image rotates to the left.

■ Auto rotation

- (1) In 3D viewing mode, touch the [Auto Rot.] tab on the touch screen. The system enters the auto rotation preparation state.
- (2) Touch [Left/Right] or [Up/Down] to set the auto rotation direction.
- (3) Set the Start position and End position:

Start position: roll the trackball to view at a certain position. Press the trackball "Set Start" function key according to the trackball hint area.

End position: roll the trackball to view at a certain position. Press the trackball "Set End" function key according to the trackball hint area.
- (4) Set the rotation mode: touch  for single direction rotation, and touch  for bidirectional rotation.
- (5) Touch [Speed] to set the rotation speed.
- (6) Touch  to activate rotation.
- (7) Touch [Step] to set the rotate step.

NOTE: You can view the back of the VR by rotating it 180°. The back view image may not be as vivid as the front. (Here we call the initial view of the VR the "front"). It is recommended to re-capture rather than rotate the VR if a certain desired region is obscured in the VR.

Image Zooming

To adjust the zoom factor of VR. The sectional images will be zoomed in/out accordingly.

■ Operation

Set the VR window as the current window.

- Rotate the <Zoom> knob to increase or decrease the magnification factor.
- Under touch screen mapping mode, zoom the image by pinching the two fingers on the touch screen.

Sync

This function switches the view direction perpendicular to the current active plane, so as to get a better view of VR.

In the following image, the current active plane is MPR A. After performing Sync on Figure A, you can see the same fetal face profile in VR.



Figure A

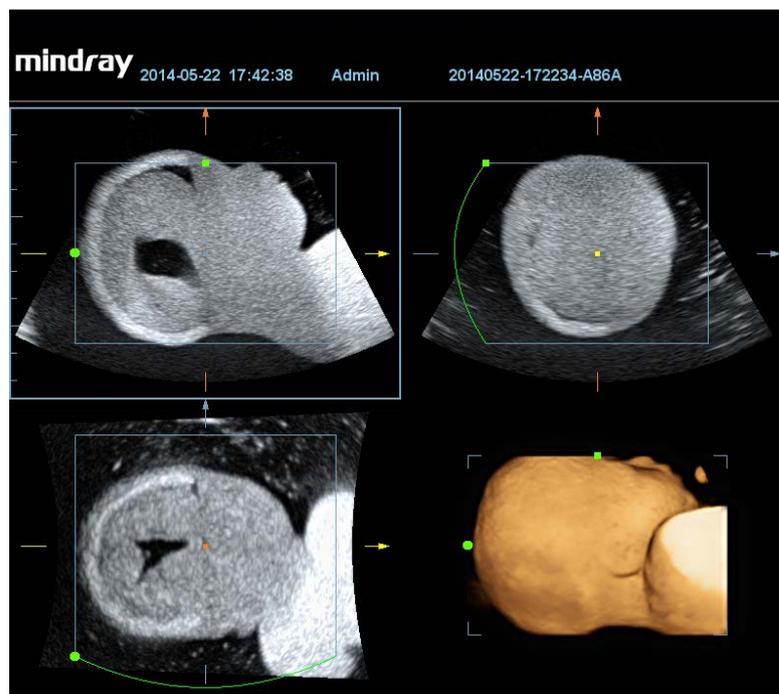


Figure B

Comments and Body Marks

- **Function:**
Add comments and body marks to the MPR and VR.
- **Operation:**
The operation is the same as adding comments and body marks in B image mode.

Image Editing

- **Function**
Image editing is a more elaborate function than VOI adjusting for optimizing the 3D image by clipping (removing) the obscured part of the region of interest.
Tip:
 - In image editing status, no image parameters can be changed. A cutting cursor is displayed  or an eraser cursor , and the system enters "Accept VOI" status.
 - The editing function is available only on VR.
- **Procedures**
 1. Enter image editing status by touching the [Edit] tab.
 2. Select an edit/erase tool:
 - **Polygon**
 - a) Press <Set> to position the start point, roll the trackball to set a region, and press <Set> to trace the region.
 - b) When the start point and end point coincide, the region is selected, or press <Set> twice to finish tracing.
 - c) Move the cursor to the region you want to cut and press <Set> again to cut.
 - **Contour**
 - a) Press <Set> to position the start point, and roll the trackball to trace the region.
 - b) When the start point and end point coincide, the region is selected, or press <Set> twice to finish tracing.
 - c) Move the cursor to the region you want to cut and press <Set> again to cut.
 - **Rectangle**
 - a) Press <Set> to fix the rectangle's position, roll the trackball to change the size, and press <Set> again to finish drawing the rectangle
 - b) Move the cursor to the region you want to cut and press <Set> again to cut.
 - **Line**
 - a) Press <Set> to position the start point and the system will display a reference line. Roll the trackball to set the line orientation and press <Set> to start drawing. Press <Set> when ends are required. Press <Set> twice to finish drawing.
 - b) Move the cursor to the region you want to cut and press <Set> again to cut.
 - **Soft/ hard eraser**
Press <Set> to position the start point and roll the trackball to select the region. Press <Set> when ends are required. You can repeat the step to erase all parts blocking the interesting region.
 - rotate the knob under [Eraser Size] to adjust eraser diameter.
 - To undo the last cutting, touch [Undo] on the touch screen.
 - To undo all cuttings, touch [Undo All].

The image cutting parameters are described as follows:

Type	Parameters	Description
Edit Type	Contour	Allows you to trace the portion of the image you want to cut.
	Rect.	Displays a box which can be used to define the portion of the image you want to cut.
	Soft eraser	Applies to softer or smoother boundary within a small range of the image.
	Hard eraser	Applies to a distinct boundary of within a wider range of the image.
	Polygon	Allows you to trace a polygon on the image you want to cut.
	Line	Use a multi-point line to trace the boundary quickly.
	Eraser size	As the eraser erases the image by means of sphere, you can adjust the size so as to adjust the erased area and depth. The eraser sphere center has a more distinct effect of clearing compared to other parts.
Edit Depth	Depth	Reserved.
Other Operations	Undo	To undo the last cut only.
	Undo All	To undo all cuts since you entered image edit mode.

■ Section image (MPR) measurement.

2D related measurements can be performed on MPR. For details, see [Advanced Volume].

Measurement is not available in acquisition preparation status.

5.10.3.4 Image Saving and Reviewing in Static 3D

■ Image saving

- In 3D viewing mode, press the single image Save key (Save Image to hard drive) to save the current image to the patient information management system in the set format and image size.
- Save clip: in 3D viewing mode, press the user-defined Save key (Save Clip (Retrospective) to hard drive) to save a CIN-format clip to the hard drive.

■ Image review

Open an image file to enter the image review mode. In this mode, you can perform the same operations as in VR viewing mode.

5.10.4 4D

4D provides continuous, high-volume acquisition of 3D images. During scanning, the probe performs the scanning automatically.

4D image acquisition operations are similar to those of Static 3D. The only difference is that in static 3D mode, only a single frame 3D image is captured, while in 4D mode, continuous, high-volume acquisition of 3D images is provided.

4D imaging is an option.

Only probe D7-2E and DE10-3E supports 4D imaging.

5.10.4.1 Basic Procedures for 4D Imaging

1. Select the appropriate 4D-compatible probe and exam mode. Make sure there is sufficient gel on the probe for scanning.
2. Obtain a 2D image as described in the Static 3D imaging procedure.



3. Press  to enter 4D imaging preparation status. Define the ROI as well as the curved VOI. For details, see “5.10.3.1 Basic Procedures for Static 3D Imaging.”
4. Select a render mode, and set parameters.
5. Press <Update> on the control panel to enter the 4D image real-time display status.
6. Press <Freeze> on the control panel to freeze the image. Perform image cutting, rotation, annotation and image saving if necessary. For detailed operations, see “5.10.3.3 Static 3D Image Viewing.”
7. Exit 4D.

Press <Update> to return to 4D image acquisition preparation,



or, press or the  key to enter B mode.

5.10.4.2 4D Acquisition Preparation

The parameters are the same as those for Static 3D. For details, see “5.10.3.2 Static 3D Acquisition Preparation.”

5.10.4.3 4D Real-time Display

In 4D real-time display status, operations are similar to those in Static 3D. For details, see the corresponding section in Static 3D.

4D Real-time Editing

You can remove unnecessary information from the VR in real-time scanning by using a line tool.

1. In 4D real-time imaging, touch [Edit] on the touch screen to enter the status.
2. Select the starting point in the VR and press <Set>.
3. Rotate the trackball to adjust the orientation, and press <Set> again to define the cutting boundary.
4. Move the cursor to the region you want to remove and press <Set> to remove it.

Touch [Undo] or [Undo All] to restore the operations.

5.10.4.4 4D Image Saving

- In 3D viewing mode, press the single image Save key (Save Image to hard drive) to save the current image to the patient information management system in the set format and image size.
- Save clip: in 3D viewing mode, press the user-defined Save key (Save Clip (Retrospective) to hard drive) to save a CIN-format clip to the hard drive.

Tip: After freezing a 4D image, press <Cine> to switch between cine auto-play mode and manual mode.

5.10.4.5 3D/4D Fast Switching

In 4D real-time imaging mode, press  to quickly switch to VR viewing status, where you can obtain the same image of a better quality.

In 3D imaging viewing mode, press  to quickly switch to 4D image real-time imaging status, where you can obtain the same image in dynamic mode.

5.10.5 Smart 3D

The operator manually moves the probe to change its position/angle when performing the scan. After scanning, the system carries out image rendering automatically, then displays a frame of the 3D image.

Smart 3D is an option.

5.10.5.1 Basic Procedures for Smart 3D Imaging

NOTE: In Smart 3D image scanning, if the probe orientation mark is oriented to the operator's finger, perform the scan from right to left in linear scan, or rotate the probe from left to right in rocked scanning. Otherwise, the VR direction will be wrong.

To perform Smart 3D imaging:

1. Select the appropriate probe (non-4D probe) and exam mode. Make sure there is sufficient gel on the probe for scanning.
2. Obtain a 2D image. Optimize the image as described in the Static imaging procedure.
3. Press  to enter the Smart 3D imaging preparation status, and define the ROI as well as the curved VOI.
4. Select a render mode.
5. Select an acquisition method, and set the corresponding parameters on the touch screen.
Rocked mode: set [Angle] parameter.
Linear mode: set [Distance] parameter.
6. Press <Update> on the control panel to start the 3D image acquisition.
The system enters the 3D image viewing status when the acquisition is complete. Or, end the acquisition by pressing <Freeze> or <Update> on the control panel.
In image viewing status, operations such as VOI setting and image editing can be performed. For details, see "5.10.3.3 Static 3D Image Viewing."
7. Exit Smart 3D.

Press <Update> or <Freeze> to return to Smart 3D image acquisition preparation. Or, press

 or  to enter B mode.

5.10.5.2 Smart 3D Acquisition Preparation

In Smart 3D mode, you need to set the scan method in addition to the other items in Static 3D mode. The other parameters are the same as those for Static 3D. For details, see “5.10.3.2 Static 3D Acquisition Preparation.”

■ Method

Capture images using Linear scan or Rocked scan.

● Linear scanning

Move the probe across the surface. See the following figure.



● Rocked scanning

Rotate the probe once from the left to the right side (or from the right to the left) to include the entire desired region. See the figure.

■ Description of parameters:

Parameter	Description
Method	<p>Function: select the image acquisition method. Selection: Rocked, Linear.</p> <p>Linear mode: during the sweep, the probe must be kept parallel. The scanning speed should be constant.</p> <p>Rocked mode: in this mode, the probe must be moved to a position where you can clearly see a middle cut of the object you want to scan and render. Tilt the probe to about 30 degrees until the object you want to scan disappears. Start the acquisition and tilt the probe over a distance of around 60 degrees until the object disappears again. During the sweep, the probe may not be moved parallel, just tilted.</p> <p>Tip: the speed is related to scanning distance or angle.</p>
Distance	<p>Function: to set the distance the probe covered from one end to the other end during a linear sweep. Range: 10-200 mm, in increments of 10 mm.</p>
Angle	<p>Function: to set the angle the probe covered during a fan sweep. Range: 10-80°, in increments of 2°.</p>

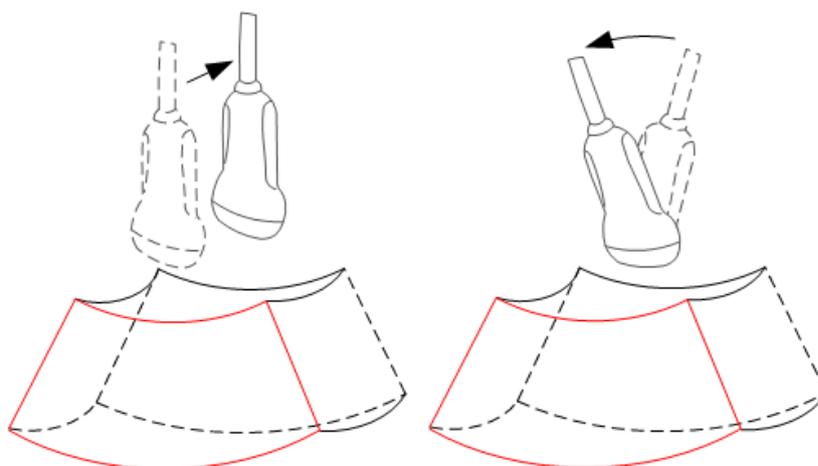
5.10.5.3 Smart 3D Image Viewing

In VR viewing, the system supports the following functions:

- Render setting.
 - B-mode parameter adjustment.
 - Setting the display format.
 - Viewing MPR.
 - Image zooming.
 - Rotation.
 - Image editing.
 - VR parameter adjustment.
- Scanning plane and probe movement

Move the probe across the body surface.

The arrow in the figure below indicates the movement of the probe (you can move the probe in the opposite direction to the arrow.).



5.10.5.4 Image Saving and Reviewing in Smart 3D

- Image saving
- In 3D viewing mode, press the single image Save key (Save Image to hard drive) to save the current image to the patient information management system in the set format and image size.
 - Save clip: in 3D viewing mode, press the user-defined Save key (Save Clip (Retrospective) to hard drive) to save a CIN-format clip to the hard drive.
- Image review
- Open an image file to enter the image review mode. In this mode, you can perform the same operations as in VR viewing mode.

5.10.5.5 Color Smart 3D

The system also supports the color Smart 3D flow image function.

5.10.6 iPage (Multi-Slice Imaging)

iPage is a new “Visualization” mode for displaying sectional images. The data is presented as slices through the data set, which are parallel to each other.

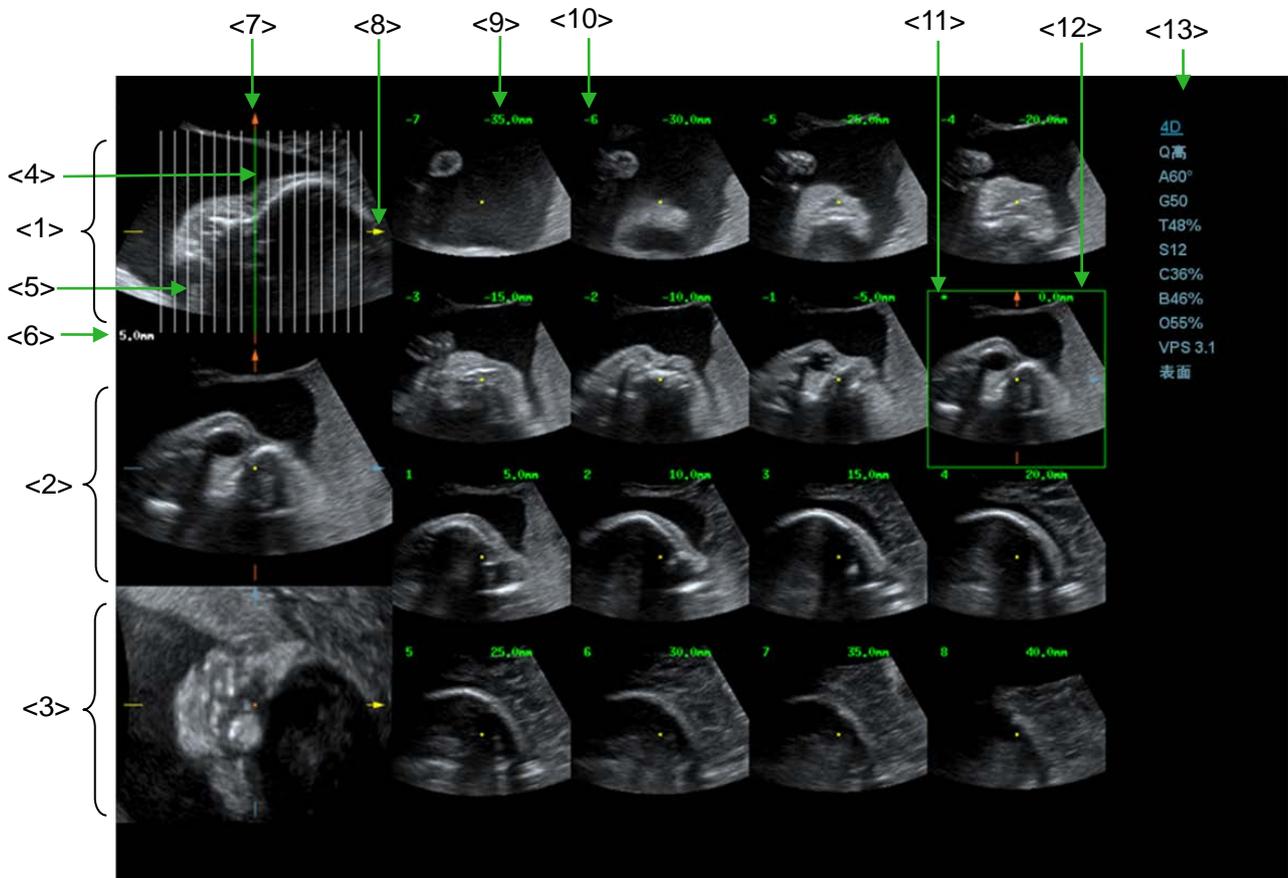
iPage is an option and is not available for Smart 3D images.

Only probes D7-2E and DE10-3E support the iPage function.

5.10.6.1 Basic Procedures for iPage

1. Acquire 3D/4D data.
 - Single-frame VR:
 - STIC/4D mode: freeze the system, then roll the trackball to select the image.
 - Static 3D: an image frame is acquired automatically after the acquisition is completed.
 - Multi-frame 3D images: acquire multiple 3D images in 4D imaging mode.
2. Perform operations such as rotation and VOI adjusting to the image to find the region of interest.
3. Touch the [iPage] tab on the touch screen to enter iPage mode.
4. Check the A/B/C sectional planes and select the reference image.
5. Confirm whether the slices displayed are the target planes. If not, re-select the reference image again.
6. Observe the interested structure through multiple slices.
 - Select the proper image layout and space according to the size of the target structure.
 - To view the details or a tiny part of the region of interest, use image zooming.
7. Rotate the 3D image to observe the slices of other orientations. Repeat step 6 if necessary.
 - If the target orientation and region cannot be observed even after image rotation and shifting, touch [Reset Ori.] to reset the 3D image.
8. Perform operations such as commenting on the region of interest.
9. Save the image as required.

5.10.6.2 iPage Basic Functions and Operations



<1>	A plane (the current reference image)	<2>	B plane	<3>	C plane
<4>	Central slice line (current active slice)	<5>	Slice line	<6>	Space between two slice lines
<7>	Y-axis	<8>	X-axis	<9>	Slice position (to the central slice)
<10>	Slice order number	<11>	Central slice mark	<12>	Active slice is highlighted in green
<13>	Image parameter				

■ Layout

The system supports several types of display layout: 2*2, 3*3, 4*4 and 5*5. Touch the corresponding icon on the touch screen to select, and the selection [Slice Number] changes accordingly.

■ Reference image

Touch [A], [B] or [C] to select the reference image.

■ Slice and slice line

- Central slice: the central plane which corresponds to the central slice line is the central slice, marked with a green "*" in the top-left corner of the image.
- Touch  to position the slice lines vertically, and touch  to position the slice lines horizontally.
- Active slice: the central plane which corresponds to the green slice line is the active slice, marked with a green box. The default active slice is the central slice.
- Slice order number: indicates the order of the slices. The position of the central slice is "0", the slices before the central slice are marked with negative integral numbers, and the slices after the central slice are marked with positive integral numbers.
- Slice position (to the central slice): displayed in the top-left corner of each image, indicating the position of each image (such as -6 mm, -3 mm, 3 mm, 6 mm).
- Coordinate axis: indicated on the three A, B, C reference images. Correspond to the central slice line, and will move accordingly with the central slice line.

■ Slice shifting

Roll the trackball to shift the crossing point of the central axis up/down and left/right. The slice lines will shift accordingly with the crossing point.

Rotate the knob under [Range Pos.] on the touch screen to fine-tune slice lines horizontally.

■ Slice position

Rotate the knob under [Slice position] to move the active slice line (green) either forward or backward within the range. The corresponding slice will be highlighted in green.

■ Spacing

The value is displayed on the top-right side of the slice. Unit: mm. Adjust it using the touch screen selection [Spacing].

■ Slice numbers

Change slice numbers as necessary using the knob under [Slice Numbers] on the touch screen.

■ Image rotation

Rotate <M>, <PW> and <Color> to perform axial rotation or rotate the <4D> knob to adjust the nearest VOI section (cut plane) position.

For details, see the descriptions in Static 3D.

- **Image zooming**
Same as Static 3D image zooming.
- **Hide/show reference image**
The system displays 3 standard sectional images (A plane, B plane, C plane) on the left side indicating the position of the slice lines. Touch  to hide the 3 reference images, then slices are displayed on the whole image area.
- **Quick switch to single display**
Select a particular slice, double-click <Set> to see the slice in full screen, then double-click <Set> again to return to the original display format.
- **Reset Ori.**
Touch [Reset Ori.] to reset the orientation and zoom status of the image.
- **Comments & Body Marks**
The operations are the same as those in the other modes.
- **Measurement**
Measurement can be done on any slice when it is in the single format display.

5.10.7 iLive

iLive brings you a better imaging experience by adding a light rendering effect to the traditional method. It supports the global lighting mode as well as the partial scattering mode, allowing human tissue texture to be revealed more clearly.

iLive is an option, and is available under Smart 3D, Static 3D and 4D modes. To use the iLive function, you must configure the Smart 3D module or the 4D module.

■ To Activate iLive

1. Enter 3D/4D image viewing status, or double-click the saved 3D/4D cine file in the iStation or Review screen.
2. Touch [iLive] on the second page of the touch screen to turn the function on, and adjust the parameters.

■ Imaging using iLive

1. Select the imaging mode:

- Use the 2D ordinary probe and press  to enter Smart 3D.

- Or, use D7-2E and DE10-3E probes and press  or  to enter 4D mode or Static 3D mode.

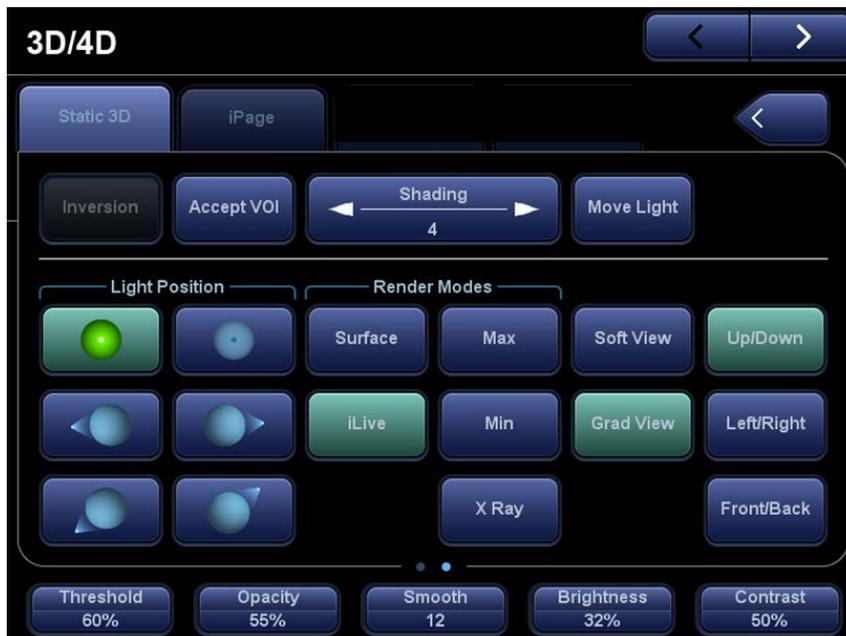
2. Select the render mode to be iLive by touching the touch screen, and set the related parameters (quality and angle, etc.).
3. Press <Update> to begin acquisition.
4. The system finishes acquisition and enters the image viewing screen.

In image review status, you can perform operations such as VOI setting, image editing, comment adding, body mark adding, etc. For details, see “5.10.3.3 Static 3D Image Viewing.”

5. Or press or  /  to exit the mode.

5.10.7.1 Operation Controls

Adjustable parameters for iLive are on the second page of the touch screen.



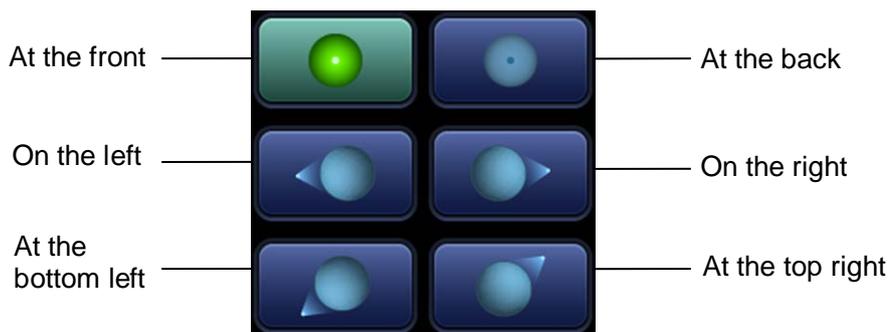
■ Shading

Adjusts the effect of shadowing and scattering. When the selected level is 0, the rendered image will be bright and sharp, and the shadow border will be clear while the area of the shadow will be relatively small. As the level increases, the rendered image will become warmer but the details remain the same. Also, the shadow border will be smoother while the shadow area will be large

■ Light source adjustment

This function adjusts the position of the light source toward the VR image.

- Select the direction by touching the buttons under the “Light Position” box.



- You can also make fine adjustments by touching [Move Light] and rolling the trackball to adjust.

■ Soft View

Using this function, an even smoother rendered surface can be observed. This function smooths volumes with a larger kernel while the 3D/4D imaging [Smooth] parameter changes the mix ratio between the unsmoothed data and the smoothed data. Using Soft View, some trivial noise structures will be suppressed and the surface will become smoother. However, Soft View may also suppress the details of volumetric surfaces.

- Grad View

After this function is activated, VR details will be revealed and enhanced.

Other operation controls and adjusting methods are similar to those in 3D/4D mode.

Other Operations

iLive does not support Inversion mode.

- Zoom

Same as in 3D/4D mode.

- Rotation

Roll the trackball to view sectional images as necessary. Rotate <M>, <PW>, <Color> to perform axial rotation or rotate the <4D> knob to adjust the nearest VOI section (cut plane) position.

- Comments and Body Marks

Same as in other modes.

5.11 iScape View (Real-time Panoramic Imaging)

The iScape panoramic imaging feature extends your field of view by piecing together multiple B images into a single, extended B image. Use this feature, for example, to view a complete hand or thyroid.

When scanning, move the probe linearly and acquire a series of B images. The system pieces these images together into a single, extended B image in real time. The system also supports out-and-back image piecing.

After obtaining the extended image, you can rotate it, move it linearly, magnify it, add comments or body marks, or perform measurements on the extended image.

The system provides a color iScape function, so you can get more information from extended images.

iScape imaging is an option.

 CAUTION:	<ol style="list-style-type: none">1. iScape panoramic imaging constructs an extended image from individual image frames. The quality of the resulting image is user-dependent and requires operator skill and additional practice to become fully proficient. Therefore, the measurement results can be inaccurate. Exercise caution when you perform measurements in iScape mode. A smooth and even speed will help produce optimal image results.2. Color iScape images are provided for reference only, not for confirming diagnoses.
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Tip:

- iScape is an optional module, the function is available only if the module has been installed on the ultrasound system.
- Displaying the biopsy guideline is not allowed in iScape mode.

5.11.1 Basic Procedures for iScape Imaging

To perform iScape imaging:

1. Connect an appropriate iScape-compatible probe. Make sure there is enough coupling gel along the scan path.
2. Set the user-defined key for iScape via the path: [Setup] → [System] → [Key Config]. Press the user-defined key for iScape on the control panel to enter iScape (to acquire color iScape

images, enter iScape mode from B+Power mode), or touch [iScape View] on the touch screen directly:

3. Optimize the B mode (Power mode) image:

In the acquisition preparation status, touch the [B] ([Power]) page tab to select B mode (color) image optimization. Perform measurement or add comments/body marks to the image if necessary. Tip: in iScape mode, [FOV] is limited to "W."

4. Image acquisition:

Click the [iScape] page tab to enter the iScape acquisition preparation status. Click [Start Capture] or press <Update> on the control panel to begin the acquisition. For details, see "5.11.2 Image Acquisition."

The system enters image viewing status when the acquisition is completed. You can perform operations such as parameter adjusting. For details, see "5.11.3 iScape Viewing."

5. Exit iScape:

- Press <Freeze> or <Update>, or touch [Recapture] on the touch screen to enter image acquisition status.
- Press the button to return to B mode.

5.11.2 Image Acquisition

To create an iScape image, start with an optimized 2D (color) image. The 2D image serves as the mid-line for the resulting iScape image.

1. Press the <Update> key or touch [Start Capture] on the touch screen to start the iScape image capture.
2. Scan slowly to obtain a single extended field of view image. You can also erase and retrace if the image is not satisfactory.
3. End image capture:

To end the image capture:

- Click [Stop Capture] on the touch screen, or,
- Press the <Update> key, or,
- Wait until the acquisition completes automatically.

After the acquisition is completed, the panoramic image will be displayed and the system enters iScape viewing mode.

Tip:

- During image acquisition, none of the parameters are adjustable, and functions such as measurement, comments and body marks are not available.
- ROI: a green box on the image indicating the boundary between the merged images and the unfinished images.
- Tip on the probe speed: During image slicing, the system gives feedback on the probe's moving speed in the form of colors and words. The meanings are as follows:

Status	ROI Color	Tip
Speed too low	Blue	Moving speed of the probe is too low.
Appropriate	Green	None.
Speed too high	Red	Moving speed of the probe is too high.

Guidance and precautions for even movement:

- Make sure there is enough coupling gel along the scan path.
- Always move the probe slowly and steadily.
- Continuous contact is required throughout the length of the extended image. Do not lift the probe from the skin's surface.

- Always keep the probe perpendicular to the skin's surface. Do not rock, rotate or tilt the probe during the scan.
- The system accommodates a reasonable range of motion velocity. Do not make abrupt changes in motion speed.
- Deeper scans generally require reduced acquisition speed.

5.11.3 iScape Viewing

After completing image acquisition, the system performs image splicing and then enters the iScape viewing mode.

In iScape viewing mode, you can perform the following functions:

- Setting image parameters. For details, see “5.11.3.1 Adjusting Image Parameters.”
- Image zooming. For details, see “5.11.3.2 Image Zooming.”
- Image rotation. For details, see “5.11.3.3 Rotating the Image.”
- Measurement, comments and body marks. For details, see “5.11.3.4 Measurement, Comments and Body Marks.”

5.11.3.1 Adjusting Image Parameters

In image viewing mode, you can adjust the following parameters:

- Image size
 - Touch [Actual Size] to display the image in its actual size.
 - Touch [Fit Size] to display the image in a size that fits the current window. This is the system's default format.
- Tint map
 - Press the knob under [Tint Map] to activate the function, then change the effect by rotating the knob.
- Ruler
 - Touch [Ruler] on the touch screen to hide or show the ruler around the image.
- Color Display (in Power iScape)
 - Touch [Color Disp.] on the touch screen to display or hide the color image.
- Color Map (in Power iScape)
 - Rotate the knob under [Color Map] on the touch screen to select the map, as in Power mode.

5.11.3.2 Image Zooming

Rotate the <Zoom> button to zoom in/out on the panoramic image.

- Rotate the button clockwise to zoom in on the image.
- Rotate the button counter-clockwise to zoom out on the image.
- Roll the trackball to change the position of the magnified image.
- Press the <Zoom> key again to exit zoom mode.
- When the image displayed is bigger than the image area, the thumbnail is automatically displayed.

5.11.3.3 Rotating the Image

For the convenience of image viewing, you can rotate the image by rotating the knob under [Rotation] on the touch screen in increments of 5° .

5.11.3.4 Measurement, Comments and Body Marks

In iScape image viewing status, you can perform measurement, comments and body marks. The operations are the same as in B mode.

NOTE:

1. The measurement accuracy for spliced images may be degraded - exercise caution when measurements are performed on an iScape image.
2. If there is a trace during the retracing, do not perform measurement across the trace.

5.11.3.5 Evaluate Image Quality

Many variables may affect the overall image quality. It is important to evaluate the image content and quality before an image is used for diagnosis or measurements.

NOTE: iScape panoramic imaging is intended for use by well-trained ultrasound operators or physicians. The operator must recognize image items that will produce a sub-optimal or unreliable image.

The following items may produce a sub-optimal image. If the image quality does not meet the following criteria, you must delete the image and repeat image acquisition.

- The image must be continuous (no part of an image moves suddenly or disappears.)
- No shadow or absent signal along the scan plane.
- Clear profile of anatomy through the entire scan plane without distortion.
- Skin line is continuous.
- The images are captured from the same plane.
- There are no large black areas in the image.

5.11.4 Cine Review

Click [Review Cine] on the touch screen in panoramic image viewing status to enter cine reviewing mode. In cine reviewing mode, a green frame marker indicates the sequence of the currently reviewed images in the panoramic image on the left-hand side of screen.

In cine review status:

- Roll the trackball to review the captured images frame by frame.
- Click [Auto Play] to start or end auto play.
- In auto play mode, touch [Auto Play] on the touch screen, or press/rotate the corresponding knob to change the play speed. When the speed is off, the system exits auto play mode.
- Review to a certain image. Press the knob under [Set Begin] to set the start point. Review to another image. Press the knob under [Set End] to set the end point. In auto play mode, the review region is confined to the set start point and end point.
- Click [Return] on the touch screen to exit cine review mode. The panoramic image displays.
- In cine review mode, press <Freeze> on the control panel to return to the acquisition preparation status.

5.12 Stress Echo

Stress Echo is an option.

The following probes under certain exam modes support stress echo function:

- Cardiac exam modes: P4-2/P7-3



CAUTION:

Stress echo data are provided for reference only, not for confirming diagnoses.

5.12.1 Overview

The Stress Echo feature allows you to capture and review cardiac loops for multiple-phase (multiple-stage) Stress Echo protocols.

Stress Echo data consists of Stress Echo loops, wall motion scores, and all other information pertaining to the Stress Echo portion of a patient examination.

A loop is a clip that displays the motion of an entire heart cycle, or from the beginning systole to the end systole, as indicated by the R-wave of the ECG trace and determined by the QT – Time Table.

The loops in a given protocol are acquired by stages (phases), according to stage configuration (continuous (prospective) or retrospective (non-continuous)).

- Loops in non-continuous stages are limited to a specified loop-per-view maximum (such as four). View labels can only be selected in the configured order. Acquisition is retrospective - when you press the <Save> key on the control panel, the system saves the previously acquired images.
- Loops in continuous stages are limited by time rather than a maximum number of loops - the system stops acquisition after two minutes. Acquisition is prospective - when you select the stage label and then press the <Save> key on the control panel, the system starts saving newly acquired images. In some protocols, the system will jump to Select Mode after retrospective saving.

When images are saved, the system places a green checkmark to the right of the view or continuous stage and then shifts the red mark to the next view or next stage.

5.12.2 Stress Echo Acquisition Procedure

To acquire Stress Echo loops, you must enable the ECG function.

1. Use the proper probe and cardiac-related exam mode, press the user-defined key for Stress Echo (Set the user-defined key for Stress Echo via the path: [Setup] → [System] → [Key Config].) or touch [Stress Echo] on the touch screen on the top left of the screen to enter stress echo imaging.
2. The system displays the “Select Protocol” window with the protocol selections. Select the desired protocol and then click [OK].

The system displays the real-time imaging screen.

If the Stress Echo manual ROI option is selected in the Maintenance dialog box ([Setup]->[Stress Echo]->[Maintenance]), the system also displays a region of interest (ROI). If Acquire Mode is set as Full-screen in Maintenance, then no ROI box is displayed. For details, see “5.12.5 Maintenance and Protocol.”



3. According to the help information in the bottom of the screen, if an ROI is displayed, adjust the ROI size and position. Press <Update> key on the control panel to confirm the ROI.
 Tip: When you confirm the ROI size by pressing <Update>, you cannot adjust the ROI size during acquisition. You can only adjust the ROI position using the trackball.
4. Press the <Save> key on the control panel to start acquisition.
 The system displays the Protocol window on the left of the screen, listing the phases for the selected protocol along with the first phase views (phases are stages). The system selects the first view for acquisition by default, indicating the selected view by placing a red mark to the right of the view name.
5. Proceed through each view in each stage according to the following instructions:
 - Non-continuous stages:
 - To save acquired images for the selected view, press the <Save> key on the control panel. The system goes to the next view for acquisition by default, saved views are marked with a green “√.”
 - Rotate the knob under [Stages XXX] or [Views XXX] to select the stage and view for image acquisition (or reacquisition). Press the <Save> key to start acquisition.
 Tip: Views can be re-acquired until you click [End Acquisition].
 - If the protocol contains continuous stages (for alternative workflows), then proceed through each continuous stage according to the following instructions:
 - To begin saving acquired images for the selected stage, press the <Save> key on the control panel.
 The system displays a percentage marker below the selected stage indicating the progress of the continuous capture.
 - To stop saving acquired images for the selected stage, rotate the knob under [Pause] on the touch screen or press <Freeze> directly. The percentage stops increasing.
 - Select [Continue] or press the <Freeze> key again to continue.
 - To end the current acquisition, press <Save> on the control panel.
 - To select another continuous stage, rotate the knob under [Stage XXX] on the touch screen.
 - Suspending is not allowed under continuous exam.

When acquisition is complete for each stage, the system advances to the next stage. If the stage is non-continuous, the system displays the stage views. When image acquisition is completed for all views and continuous stages, the system switch to Select Mode.

6. To start or restart the timer, click [Stage Timer]/[Exam Timer] on the soft menu to turn it on.

The Stage time is displayed to the right side of each stage in the protocol list, while the Exam time is displayed in the left side of the screen.

Each saved image will be marked with two times T1 and T2. T1 refers to the total time of the whole acquisition, while T2 indicates the time the acquisition lasted for a certain stage.

7. To review loops before ending acquisition, select [Review/WMS] on the menu. You can redisplay the real-time imaging screen to continue acquisition by selecting [Acquire].
8. To end the acquisition and review the acquired images, click [End Acquisition].

NOTE: When the acquisition is ended, no stress echo image acquisition can be performed for the same exam.

5.12.3 Selecting Preferred Stress Echo Loops (Select Mode)

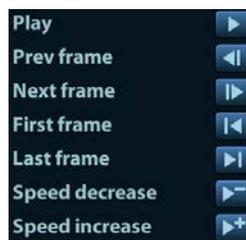
The selected clips are used for analysis in the review mode and wall motion scoring mode. Select Mode is used to select the best loops of the examination.

When the acquisition is ended, select mode is enabled automatically.

In Select Mode, you can select the representative loop (“preferred” loop) for each view.

To select “preferred” loops:

1. Use the <Update> key according to tips in the trackball hint area or select [Select] on the menu to enter the Select Mode, or the system enters the Select Mode directly after the acquisition is finished.
2. Select the loop. Use the buttons displayed during Select Mode to designate another loop or another view for display.
 - Use [Stage: XX] or [View: XX] on the soft menu to select the target stage/view.
 - Single-click a clip to select the clip for current stage/view and zoom in the clip to the full-screen.
 - Double-click a clip. The clip will be magnified.
 - Touch , ,  or  on the touch screen to display another loop in the current view.
 - Click buttons on the left side of the screen to view the cine files by frame.



3. Select the stage and view to display all loops for the view and then continue designating the “preferred” loop for each displayed view until all views are completed.

Description of select mode controls:

The screenshot shows the Mindray ultrasound interface with the following control panels:

- Mode:** Stress Echo, Acquire, Select, Review/WMS.
- Cine controls:** Play, Prev frame, Next frame, First frame, Last frame.
- Other controls:** Speed decrease, Speed Increase, Text, Apply Edit All, Clip Length, Delete Unselected.
- Soft menu:** Stages, Peak, Views, PLAX.
- Phase/view selection:** Stage (Rest, Peak, Im Peak, Post), View ((0) PLAX, (0) PSAX, (0) A4C, (0) A2C).

Touch screen controls:

Selection	Description
Stages: XX	Rotate the corresponding knob under the button to select a stage.
Views: XX	Rotate the corresponding knob under the button to select a view.
Acquire/ Select/ Review/WMS	To switch the mode status.
1. Clip /2. Clip /3. Clip /4. Clip	For selecting views in the selected stage.
Next	Next four Clips.
Previous	Previous four Clips.
First	Go to "first" Clips.
Last	Go to "last" Clips.
Play	Click to play/stop cine play.
Prev frame	See previous frame of the cine file.
Next frame	See next frame of the cine file.
First frame	See first frame of the cine file.
Last frame	See last frame of the cine file.

Selection	Description
	Decreases or increases playback speed.
Text "On"/"Off"	Function that turns the screen graphic text "On" or "Off." The function is the same as the Labels on/off icon at the top of the screen. Information includes: name of level, name of view, heart rate, time stamp acquisition, timers, frame slider, loop ID, clip control. For the cine without distributed view, the name of level and name of view are displayed in "--".
Apply edit all	Clip edit applied to all clips taken.
Clip Length	Specify the clip segments: systole, diastole, full cycle or user-defined.
Bookmark	For continuous acquisition, when the bookmark is set to "On", only the selected loops for the current view can be displayed.
Delete Unselected	Delete clips that are not selected. If selected, the system will delete all clips that are not selected after the exam is ended.
Suspend exam	Pauses the stress echo exam but does not end the stress echo exam. When a stress echo exam is suspended, the user can perform image acquisition of all other imaging modes, or perform operations such as measurement.
End SE exam	End the stress echo exam.

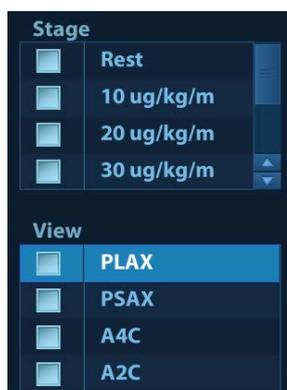
5.12.4 Review/WMS Mode

Review/WMS mode is used by cardiologists to evaluate clips for cardiac wall motion abnormalities. Different views from different stages are selected for comparison across a wide variety of combinations. The most common workflow is to compare "same views" but at "different stages" of the exam (e.g., PSLA view, Rest stage compared to PSLA view, Post-exercise stage).

5.12.4.1 Enter review mode

Select [Review/WMS] on the menu on the left side of the screen.

1. Select [Shuffle Mode] on the touch screen.
2. Select the label of the phase or view (for example, Rest or Long Axis) on the right part of the screen.



The system displays all loops that represent the selected phase or view.

- To display phases for the selected view(s)
1. To include a phase or view for display, select the leftmost, gray box to the left of each required phase and/or view.

The system inserts a checkmark into each selected gray box.

- To exclude a phase or view from display, select the blue box to the left of each required phase and/or view.

The system inserts a red X into each selected box, like .

- Select [Display Selected] on the touch screen.

The system displays the selected phases for each selected view side by side.

- To display all views for a specific phase:

Select the phase label (for example, Rest).

- To display all phases for a specific view:

Select the view label (for example, PLAX).

The system displays all phases for the selected view.

- To display a loop in full-screen format:

- Double-click the loop to display in full-screen format.
- Double-click the loop again to display the loop in its initial size, select the loop again.

Description of review/WMS mode keys (keys with the same function as in select mode are not described below):

Key	Description
Shuffle	<p>Perform side-by-side comparison of the same views at different stages (PLAX, PSAX, A4C, A2C at "Rest" compared to PLAX, PSAX, A4C, A2C "Post-Exercise"). Clips are synchronized.</p> <p>Selection: On, Off</p> <p>Under [Shuffle Mode] "Off" status, when you select one stage, all view loops are displayed on the screen; when you select one view, all loops of the same view in different stages will be displayed on the screen.</p> <p>Set [Shuffle Mode] to "Off", the system will select loops of first two views of the first two stages to display automatically. If you choose [Shuffle Forward], then loops of the next two views of the first stages will be displayed. If you click [Shuffle Back], loops of the first two views in the 3rd and 4th stage will be displayed.</p> <p>In the meantime, if you choose one stage, loops of all views under this stage will be displayed on the screen (4 at most), and choosing one view will lead to loops of this view in different stages be displayed (4 at most).</p>
Display Selected	Displays loops of all the stages and views selected.

5.12.4.2 Wall Motion Scoring

The WMS-Report lists user-assigned wall motion scores and associated data.

The Wall Motion Score (WMS) measurement is an application prepared for assisting in stress echo semi-quantitative evaluations of abnormalities with left ventricular wall motion or changes in wall thickness. The left ventricle is divided into segments for scoring to evaluate the degree of abnormality from the sum of the scores in each segment using the motion of the walls of the entire left ventricle.

You can assign wall motion scores to specific portions within each view (representative loop). You can also assign a normal wall motion score (WMS) to the currently selected view or to all displayed views.

Two methods of chamber segment division, ASE 16 and ASE 17, are supported. In addition, each segment has 3 kinds of scoring method: 4, 5 and 7 points. Select through the [Scoring] control on the touch screen.

To assign a wall motion score (WMS):

1. Select a colored number in the bottom-right area of the screen.
The meanings and colors used in segments are listed in the table below.

Score	Meaning	Color
1	Normal	Green
2	Hypokinesia	Yellow
2.5	Severe Hypokinesia	Khaki
3	Akinesia	Blue
4	Dyskinesia	Red
5	Aneurysm	Purple

2. Roll the trackball to select the value and then click the target segments, then the segment is assigned with a value.
3. Repeat step 2 to perform value assign for all segments.
 - To assign a normal wall motion score (WMS) to all currently displayed loops:
Select [Set All Normal] on the touch screen.
 - To assign a normal wall motion score (WMS) to the currently selected loop:
Select [Set Current Normal] on the touch screen.

5.12.5 Maintenance and Protocol

5.12.5.1 Maintenance

Select "<F10 Setup>->[Stress Echo]->[Maintenance]" to enter the screen.



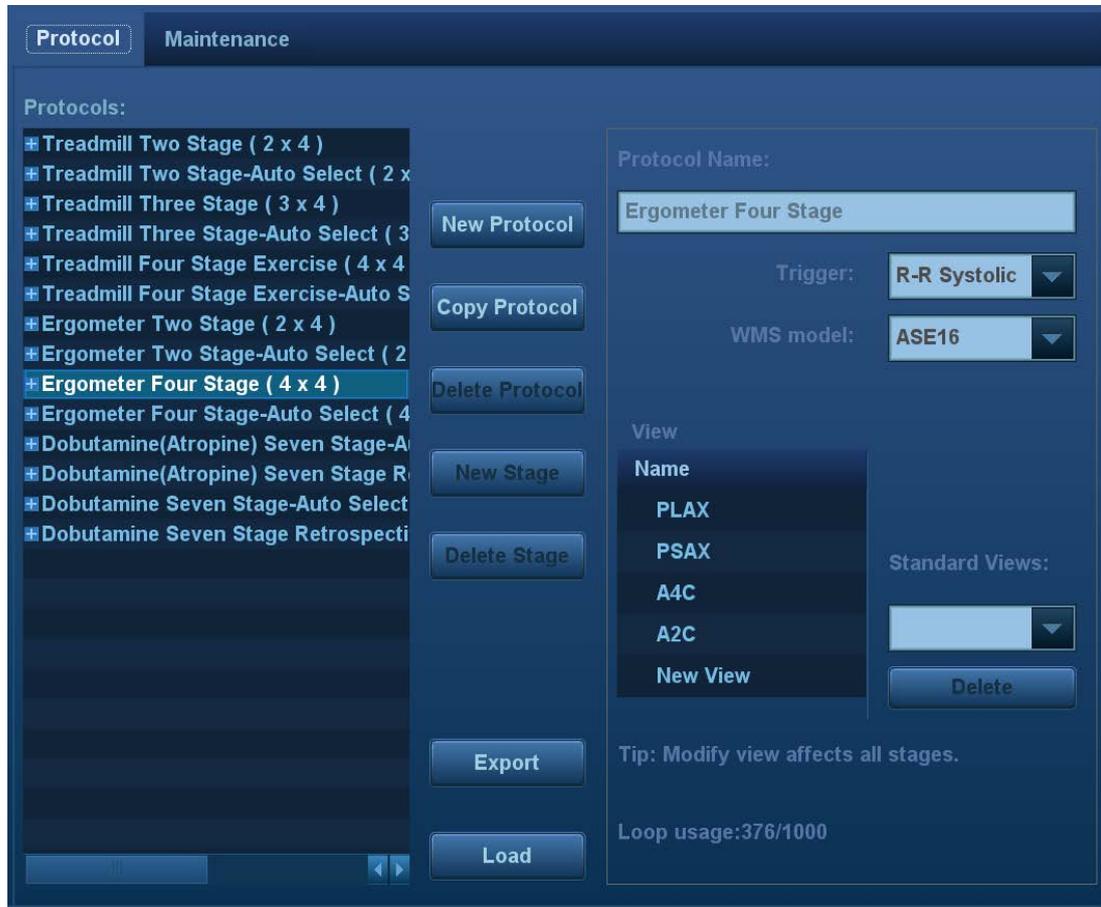
Item	Function Description
Acquire mode	Set the type of ROI: manual ROI or full-screen.
Overlay	Select the items to be labeled on each loop.
WMS score type	Set the chamber segment division method.
QT-Time table	To customize the length of systolic duration acquired for a specific heart rate. If "Trigger" is selected as "R-R Systolic" in Protocol Editor, it will store the clip duration. You can add and remove entries in this table. You can also load the factory defaults.
Heart rate	Enter the heart rate.
Syst. duration	Enter the systolic duration.
Load factory	To reset the QT time table.

QT-Time Table Operation:

- To add an entry:
Enter a heart rate and the referring systolic duration and then click [Update].
- To delete an entry:
Select the required heart rate and systolic duration pair from the QT – Time Table and then click [Delete].

5.12.5.2 Protocol Edit

You can create, edit and delete Stress Echo protocols using the Protocol Editor dialog box. Access the Protocol Editor dialog box by clicking [Protocol] in [Setup]->[Stress Echo]->[Protocol], or clicking [Edit] on the Select Protocol screen as shown in the figure below:



Item	Function Description
Protocol name	Enter the protocol name.
Trigger	Set the trigger type.
WMS model	Set the chamber segment division method.
Loop usage	Displays the acquired loop number as well as the total usable loop number.
View	Set the views for each stage.
Standard view	Set the standard view.
Load	Import a protocol.
Export	Export a protocol.
New protocol	Create a new protocol.
Copy protocol	Create a new protocol with an existing one.
Load	Load an existing protocol.
Save	Save the changes to the protocol.
Delete protocol	Delete the protocol.

Item	Function Description
New stage	Create a stage for the current protocol.
Quit	Remove the Protocol Editor dialog box.

Creating a Stress Echo Protocol

To create a stress echo protocol:

1. Click the [New Protocol] button to the right of the Protocol Editor dialog box.
2. Enter the protocol name in the Protocol Name box at the top.
3. For each view (all views display for each phase):
 - (a) Select "New View" in the View list.
 - (b) Select a standard view from the Standard View list. Or you can customize the view name.
4. For each phase in the protocol:
 - (a) Select "new" in the Stage list.
 - (b) Enter a phase name.
 - (c) Select "Auto Select", the system jumps to Select Mode after retrospective acquisition.
 - (d) Select the required option from the Clip Capture drop-down list.
 - (e) Select the number of loops to acquire (per view in the selected phase) in the Loops list (for non-continuous stages).
 - (f) Select the type: exercise or drug.
5. Click [Save] to save changes and quit.

Editing or Deleting a Stress Echo Protocol

- To delete a protocol:

Select the protocol or one of its component phases or views and then click [Delete].

- To Edit a Stress Echo Protocol:

1. Click an available protocol on the Select Protocol screen.
2. Click [Edit] to enter the Protocol Editor screen.
3. Edit the protocol as described in the create protocol.

5.12.6 Saving Stress Echo Data

Stress Echo data consists of Stress Echo loops, wall motion scores, and all other information pertaining to the Stress Echo portion of a patient examination.

When the exam is ended, the system will save all images within the exam.

5.12.7 Exiting the Stress Echo Feature

To exit the Stress Echo feature:

Press the <End Exam> key on the control panel or click [End SE exam] on the screen.

5.12.8 Measurement and Report

Suspend the stress echo exam by selecting [Suspend Exam] on the soft menu. Press the measurement related keys or buttons to enter cardiology measurement. For details, see the [Advanced Volume].

Reports contain the entered indication, if any, and also any entered comments that are specific to the report. You can include or exclude data from specific phase(s). You can preview and print the report for the currently selected mode. You can also enable colored report printing in Maintenance.

■ Entering Indications or Comments for the Reports

You can enter an indication for display in Stress Echo reports.

To enter an indication:

1. Press <Report> on the control panel to open the report.
2. Use the keyboard to enter text in the Indication dialog box and then click [OK].

5.13 Elastography

⚠ CAUTION: Elastography images are provided for reference only, not for confirming diagnoses.

Elastography imaging is an option.

Only probe L14-6NE in thyroid, breast exam mode, and probe 7L4A in thyroid, breast and nerve exam modes support the Elastography function.

5.13.1 Basic Procedure for Elastography

1. Perform a B scan to locate the region.
2. Set the user-defined key for Elastography via the path: [Setup] → [System] → [Key Config]. Press the user-defined key for Elastography on the control panel to enter the mode. Adjust the ROI according to the actual situation.
3. Select the probe according to the experience and actual situation.
4. Adjust the image parameters to obtain the optimized image and necessary information.
5. Adjust the ROI on the frozen image if necessary.
6. Save the image or review the image if necessary.
7. Perform measurement or add comments/body marks to the image if necessary.
8. Estimate the hardness of lesions according to the results.
9. Press to return to B mode.

5.13.2 Enter/Exit

■ Enter

Press the user-defined Elasto key on the control panel to enter the mode.

After entering the mode, the system displays two windows in real-time on the screen. The left one is the 2D image, and the right one is the Elasto image.

■ Exit

Press or the user-defined Elasto key on the control panel to exit and enter the mode.

5.13.3 Pressure Hint Curve

The screen displays the pressure curve in real time:



The X-axis represents time and the Y-axis represents pressure.

ROI Adjustment

Description To adjust the width and position of the ROI in Elasto imaging.

Operation When the ROI box is solid line, roll the trackball to change its position.
When the ROI box is a dotted line, roll the trackball to change the size.
Press <Set> to switch between the solid line and the dotted line status.

Smooth

Description To adjust the smooth feature of the Elasto image.

Operation To adjust the image smoothness. Adjust using the [Smooth] item or the mapping-menu item on the touch screen.

The system provides 5 levels of smooth function: the bigger the value the stronger the effect.

Opacity

Description To adjust the opacity feature of the Elasto image.

Operation Rotate the knob under the [Opacity] item or adjust through the mapping-menu item on the touch screen.

The system provides 5 levels of opacity function: the bigger the value the stronger the effect.

Invert

Description To invert the E color bar and therefore invert the colors of benign and malignant tissue.

Operation Touch [Invert] or the mapping-menu item on the touch screen.

Single E

Description To switch between the B+E dual window and the single E window.
E represents the Elastography image.

Operation Touch [Single E] or the mapping-menu item on the touch screen. When the button is highlighted in green, the screen displays the single window E image.

Map

Description To select different maps for observation.

Operation Rotate the knob under the [Map] item on the touch screen or adjust through the mapping-menu item to select the map.

The system provides 6 maps, including 1 grayscale map and 5 color maps.

Tip: In Elasto imaging mode, image magnification is not available.

5.13.4 Mass Measurement

Press <Measure> to enter measurement status.

You can measure shell thick, strain ratio, strain-hist, etc.

For details, see [Advanced Volume].

5.13.5 Cine Review

Press <Freeze> or open a elastography imaging cine file to enter cine review status.

5.14 Tissue Tracking Quantitative Analysis (QA)

Apart from the TDI imaging function, the system also provides a tissue tracking QA function for myocardial movement evaluation.

Using the tissue tracking QA function, the ultrasound system will scan each pixel position by frame within the cardiac cycle, then use the region matching method and auto-correlation searching method to trace each spot and calculate the movement, so as to determine myocardial motion in a more quantitative way.

 **CAUTION:** Tissue Tracking Quantitative Analysis images are provided for reference only, not for confirming diagnoses.

Tissue tracking feature is an option.

The Tissue Tracking QA function can only be used with the phased array probes in cardiac (adult cardiac, cardiac-difficult (car-penetration), pediatric cardiac, neonatal cardiac) of the system with ECG function.

5.14.1 Basic Procedures for Tissue Tracking QA

1. Select a saved B mode cardiac cine file (a cin. format file which contains more than 1 cardiac cycle (with 2 R waves) and ECG signal).
2. Touch [TT QA] on the touch screen to activate the function:
 - a) You can determine the image of interest by previewing the image
 - b) To find the image of interest, roll the trackball or rotate the knob under [Cycle] on the touch screen to select.

Select the corresponding section name on the touch screen and press <Cursor> to show the cursor. Use the cursor to set the reference point (for details, see chapter "5.14.4 Myocardial Boundary Tracing"):

- Long axis section: use the "3-point" method or "Manual" method to set
 - Short axis section: enter multiple points (at least 6 points) using the cursor manually to set.
3. After reference points are set, the system will display the boundary of the endocardium and epicardium. Adjust the thickness if necessary.

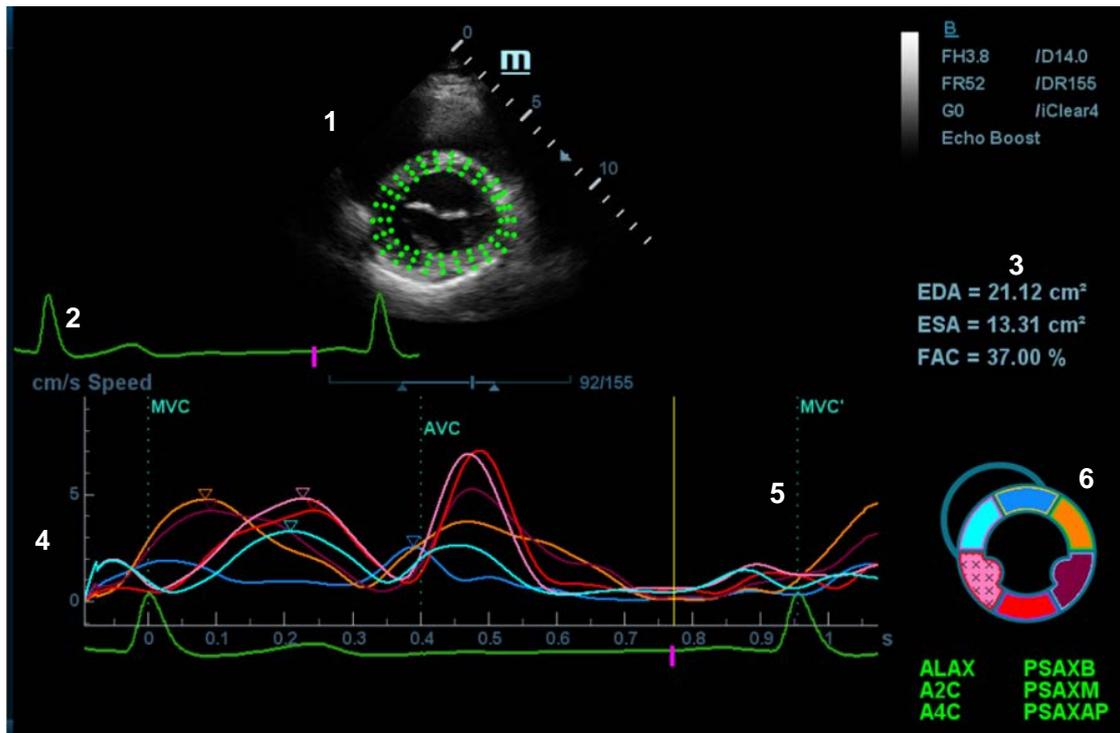
If the traced result is poor, touch [Reload] on the touch screen to re-trace the reference points, or make fine adjustments to the points using the cursor.

If the cycles are not adequate to provide the information, switch to another cycle to trace.

4. Touch [Start Tracking] on the touch screen to start the tracking function. Adjust the parameters if necessary.

Touch [Edit] on the touch screen to display the free cursor. Roll the trackball and press <Set> to re-select the trace reference points. Move the cursor to the exact boundary position and press <Set> again to set the right place.
5. Touch [Accept & Compute] on the touch screen to calculate and display the curve. Adjust the parameters if necessary.
6. Touch  on the touch screen to turn to the other page. Touch [Bull's Eye] to see the result.
7. Touch [Data Export] on the touch screen to export analyzed data.
8. Touch [Exit] on the touch screen.

5.14.2 Tissue Tracking QA Screen Description



1 - Displays the image used to generate the trace curve

2 - Displays the ECG trace

3 - Displays the measurement and calculation results:

EDV:	maximum value of the end diastolic volume during the trace.
EDA:	maximum value of the end diastolic area (Left Ventricular) during the trace.
ESV:	maximum value of the end systolic volume (Left Ventricular) during the trace.
ESA:	maximum value of the end systolic area (Left Ventricular) during the trace.
FAC:	Fractional Area Change = $(EDA - ESA)/EDA$. This parameter is available in the short axis section.
EF:	Ejection fraction. This parameter is available in the long axis section.
HR:	Heart rate.

The system also displays the TPSD value on the Bull's Eye graph:

Time to Peak Standard Deviation (TPSD):

$$TPSD = \sqrt{\frac{\sum_{i=1}^N (TP_i - \overline{TP})^2}{N}}$$

Where the standardized value of time to peak data: $\{TP_i | i \in [1, N]\}$. (N is the number of time to peak data) Average standardized value of time to peak data: \overline{TP}

4 - Display curve: Velocity/Displacement/Strain/Strain Rate. Each curve on the image is matched with a certain segment in the cardiac segmentation model (6), identified by different colors.

Velocity curve	The X-axis represents time (s); The Y-axis represents velocity (cm/s).
Displacement curve	The X-axis represents time (s); The Y-axis represents displacement (mm).
Strain curve	The X-axis represents time (s); The Y-axis represents deformation of the tissue (%).
Strain-rate curve	The X-axis represents time (s); The Y-axis represents strain by time (s ⁻¹).

5 - Displays the corresponding time of AVO (aortic valve open)/AVC (aortic valve close)/MVO (mitral valve open)/MVC (mitral valve close).

6 - Displays the cardiac segmentation model. Each segment name is illustrated beneath the model.

- In the figure,  marks the peak position of the curve.
- Click on a segment in the cardiac segmentation model. The segment turns gray and its corresponding curve no longer displays.
- You can get the current X/Y-axis value by moving the cursor onto one point on the curve. If you press <Set> now, the frame marker will move to that spot.
- If the segment is filled with "XXX", it means that this segment is not well tracked.

5.14.3 Select Image and Cardiac Cycle

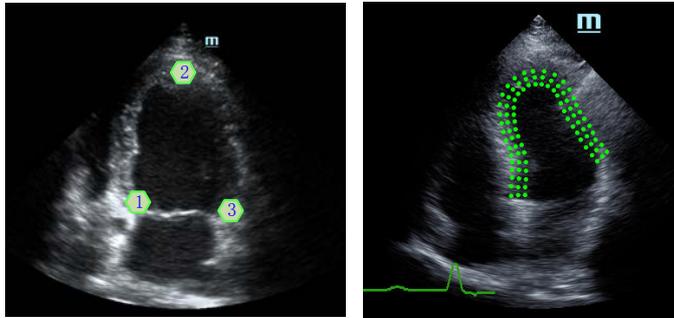
You can select images with a better image quality to get a better analysis result.

- Switch cine files
 1. Press <Review> on the control panel to enter review status
 2. Double-click the target file
 3. The system closes the currently displayed file and switches to the newly selected file.
- Switch cardiac cycles within the cine file
 1. After a cine file with more than one cycle is opened, the system displays a thumbnail of each cardiac cycle on the thumbnail area.
 2. Press <Cursor> to acquire the cursor. Roll the trackball to position the cursor over the desired image.
 3. Double-click the file, the system will switch to the selected cycle.
Or rotate the knob under the [Cycle] item on the touch screen to select directly.

5.14.4 Myocardial Boundary Tracing

- The system provides two kinds of tracing methods for two kinds of sections:
 - Long axis section (A4C, A2C, ALAX): the 3-point method and manual tracing method are both available.
 - 3-point method

As shown in the following figure, after pressing <Set> to place 3 points clockwise on the image, the system generates the trace automatically.



- Manual trace method

Press <Set> and roll the trackball along the boundary to add the trace points gradually. After the trace is finished, press <Set> twice to finish tracing.

At least 6 points should be determined by you before the system generates an automatic trace.

- Short axis section (PSAX B, PSAX M, PSAX AP): only manual tracing is available.

■ Retracing

If the current trace is not satisfactory, touch [Reload] on the touch screen to clear the trace and start another tracing.

During the trace, press <Clear> to clear already-traced items.

■ Make fine adjustments to the trace

You can make fine adjustments to the trace:

1. In tracing curve adjusting status, the cursor becomes .
2. Move the cursor to the editable point (inner dotted line of the curve) and press <Set>.
3. Roll the trackball to drag the curve to the desired position. Press <Set> again to set the point in the new position.
4. Repeat steps 2-3 to complete all points that need adjustment.

In tracking status, touch [Edit] on the touch screen to enter the status.

5.14.5 Tissue Tracking Operations

Switch the operation controls

- [Start Tracking]: touch to start tracking.
- [Accept & Compute]: touch to start calculation and display the curve.
- [Exit]: touch to exit tissue tracking.
- [Parameter]: rotate to select the curve type.
- [Bull's Eye]: touch to turn on/off bull's eye and the peak data table.

View Selection

Before tracing, touch the corresponding button to select the view.

- [A4C]: apical four-chamber view.
- [A2C]: apical two-chamber view.
- [ALAX]: apical long axis view.
- [PSAX B]: short axis base view.
- [PSAX M]: short axis mid view.
- [PSAX AP]: short axis apex view.

Parameter Adjustment

- [Thickness]: adjusts the tracing thickness, i.e., the distance between the endocardium wall and the tracking points on the epicardium.
- [Tracking Points]: adjusts the number of points within the segment.
- [Cycle]: rotates clockwise to select the next cycle, and vice versa.
- [Smooth]: adjusts the smooth effect of the curve.
- [Display Effect]: turns on/off the arrow vector graphical display of the myocardial movement.

Image display

According to the status of the current section, touch the appropriate button on the touch screen to check the corresponding time.

- [AVO]: displays the aortic valve open time.
- [AVC]: displays the aortic valve close time.
- [MVO]: displays the mitral valve open time.
- [MVC]: displays the mitral valve close time.

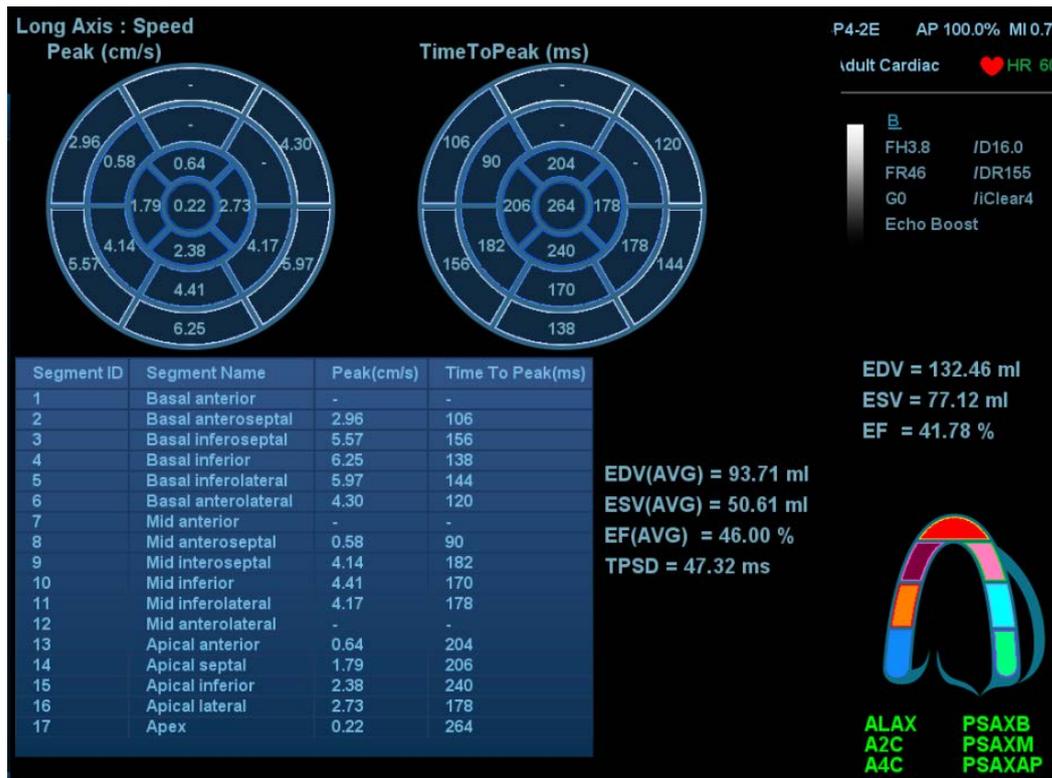
5.14.6 Bull's Eye

After tracking, the system displays a Bull's Eye graph for judging the reverse movement or scope of myocardium.

1. Touch [Bull's Eye] on the touch screen to turn the function on:

You can acquire:

- Time to peak value and peak value of the 17 segments;
 - Display measurement result EDV/ESV/EF/TPSD.
2. Rotate the knob under [Parameter] on the touch screen to see a bull's eye graph for different parameters.



"-" will display in the table to indicate those segments that are not well tracked.

5.14.7 Measurement/Comment

In tissue tracking QA mode, only the Time measurement is available. For details, see the Operator's Manual [Advanced Volume].

Comments and Body Mark operations are the same as in other modes.

5.14.8 Data Export

The system provides a data exporting function, so that you can export calculation results for analysis (for instance, SPSS analysis).

Touch [Data Export] on the touch screen to export analyzed data for each segment in .csv format.

6 Display & Cine Review

6.1 Splitting Display

The system supports dual-split and quad-split display format. However, only one window is active.

- Dual-split: press the  key on the control panel to enter dual-split mode.

Under Dual-split mode, press <Freeze> to freeze the image and then use  to switch between the two images.

Press on the control panel to exit.

Modes support dual-split display: B mode, Color mode, Power mode, PW mode, CW mode, M mode and Color M mode.

- Quad-split: press the  key on the control panel to enter the quad-split mode.

Under Quad-split mode, press <Freeze> to freeze the image and then use  to switch between the four images.

Press on the control panel to exit.

Modes support quad-split display: B mode, Color mode and Power mode.

For the detailed display format, see the imaging mode chapters.

6.2 Image Magnification

NOTE: Zooming an image changes the frame rate which tends to change the thermal indices. The position of the focal zones may also change, which may cause the peak intensity to occur at a different location in the acoustic field. As a result, the MI may change.

6.2.1 Spot zoom

To use the function, use the  knob on the control panel.

1. Press <Zoom> to enter the sample volume definition status.
2. Roll the trackball to change the box size and position. Press <Set> to toggle between setting the size and position, or rotate the <Zoom> knob to adjust the size. After the sample volume is set, press the <Zoom> key again to enter spot zoom status.
3. Rotate the <Zoom> knob or to change the magnification factor. Or enter the touch screen mapping mode, and zoom the image by pinching two fingers on the touch screen. The image magnification factor value will display in real time in the image parameter area. For example, **Z1.3** indicates that the magnification factor is 1.3.
4. Press <Zoom> again to exit spot zoom.

Tip:

- Spot zoom can only be achieved on real-time images.
- The size and position of the sample volume box change along with the scanning depth and area.

6.2.2 Pan zoom



To use the function, use the **Zoom** knob on the control panel.

1. Rotate the <Zoom> knob to directly enter the pan zoom status. Or enter the touch screen mapping mode, and zoom the image by pinching the two fingers on the touch screen. Image-in-image is displayed.
2. Magnification factor adjustment: rotate the [Zoom] knob or pinch two fingers under mapping mode to change the magnification factor. The image magnification factor value will display in real time in the image parameter area. For example, **Z1.3** indicates that the magnification factor is 1.3.
3. Shifting the image: roll the trackball or touch and translate the image.
4. Press <Zoom> to exit pan zoom.

6.2.3 iZoom (Full Screen View)

Function: to magnify the image in full screen.

Procedures:



1. Press **F8 iZoom** on the control panel to zoom in on the image. The zoom area includes the image area, parameter area, image banner, thumbnail area and so on.
2. Press the key again to zoom in on the image area only.
3. Press the key again to exit iZoom.

6.3 Freeze/Unfreeze the Image.

Press the <Freeze> key on the control panel to freeze a scanning image. In freeze mode, the probe stops transmitting acoustic power, and all images and parameters are frozen.

Tip: After freezing an image, the system may enter cine review, measure, comment adding or body mark mode, depending on what has been preset. (Setting path: [Setup] → [System] → [Image] → "Freeze Config.")

Press <Freeze> in freeze mode to unfreeze the image, and the system continues image scanning.

6.3.1 Imaging Mode Switching When Frozen

Imaging mode switching in freeze mode follows these principles:

- In splitting display B mode, press <Dual>/<Quad> to switch between the windows. Press <Single> to exit splitting display mode and enter the image of the currently activated window in full screen.
- In freeze mode, the system supports imaging mode switching between the sub-modes (only for the activated window). For example, if the frozen image is in B+C+PW mode, the system supports imaging mode switching between B+C+PW, B+C, B+PW and B by pressing <Color> or <PW>.
- The imaging mode and parameters of an unfrozen image are the same as those before freezing. The display format is the same as that before being unfrozen.

6.3.2 Imaging Display Format Switching When Frozen

Image display format switching in freeze mode follows these principles:

- 2D+PW (press <Freeze> in 2D+PW imaging mode)

If the imaging mode before freezing is 2D (frozen) + PW (real time) or 2D (real time) + PW (frozen), then in freeze mode, you can switch between 2D (frozen) + PW (activated) or 2D (activated) + PW (frozen) by pressing the <Update> key on the control panel.

- Dual/quad splitting display mode (press the <Freeze> key in dual/quad splitting display mode)
 - When entering freeze mode, the default activated window is the real-time window before freezing. Other image windows display the corresponding cine memories. If a certain cine memory is empty, then no image is displayed.
 - Press <Dual>/<Quad> to switch between dual-splitting and quad-splitting modes.
 - Press <Single> on the control panel to enter the single display format, which displays the currently activated window. In single display format, press <Dual>/<Quad> to return to splitting display mode.
 - Unfrozen: in splitting display status, when you unfreeze the image you can only unfreeze the image in the activated window, other images remain frozen. In single-window display status, the system displays the single image after being unfrozen.

6.4 Cine Review

After pressing the <Freeze> key, the system allows you to review and edit the images prior to the image being frozen. This function is called cine review. The magnified images can also be reviewed after the <Freeze> key is pressed, and the operating method is the same. You can perform zoom, measurements, add comments and body marks on the images being reviewed.

The system supports manual review as well as automatic review. The default setup is Manual Cine, but you can switch between Auto Cine and Manual Cine.

In addition, the system supports the images reviewed along with physiological waveforms, if the detection of physiological waveforms is performed.



CAUTION:

Cine Review images can be inadvertently combined in-between separate patient scans. The Cine Review memory must be cleared at the end of the current patient exam and before starting the next new patient exam by pressing the <End Exam> key on the control panel.

Cine files stored in the system's hard drive shall contain patient information, to avoid the selection of an incorrect image file and potential misdiagnosis.

6.4.1 Entering/Exiting Cine Review

- To enter Cine Review:

- Enter "[Setup] → [System] → [Image] → "Freeze Config." to set "Status after Freeze" to "Cine." The system enters manual cine review status once <Freeze> is pressed to freeze the image.
- Open cine files in thumbnail, iStation or Review, the system enters automatic cine review status.
- Under touch screen mapping mode, touch  /  or swipe the screen leftwards/rightwards to review the cine file.

- To exit Cine Review:

Press <Freeze> or and the system will return to image scanning and exit cine review.

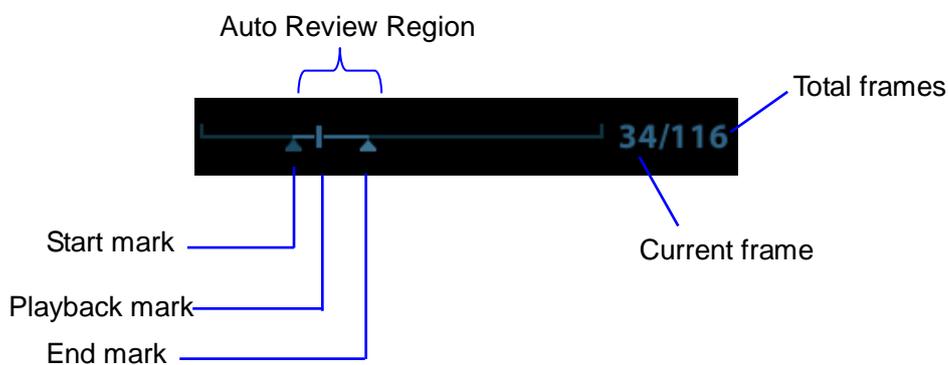
6.4.2 Cine Review in 2D Mode (B/B+Color/B+Power/B+TVI/B+TEI)

■ Manual Cine Review:

After entering cine review in 2D mode, roll the trackball to review the cine images on the screen one by one. Or under touch screen mapping mode, touch the touch screen and swipe left and right to review the images.

If you roll the trackball to the left or swipe leftwards (under mapping mode), the review sequence is reversed to the image-storing sequence, and the images are displayed in descending order. If you roll the trackball to the right or swipe rightwards, the review sequence is the same as the image-storing sequence, and the images are displayed in ascending order. When you review images to the first or last frame, rolling the trackball further will display the last or first frame.

The cine progress bar at the bottom of the screen (as shown in the figure below):



■ Auto Review

● Reviewing all

- In manual cine review status, press the knob under [Auto Play] (not selecting "Stop") on the touch screen to activate auto cine review.
- Reviewing speed: in auto cine review status, press the knob under [Auto Play] on the touch screen to adjust the review speed or use the mapping menu. When the speed is changed to 0, the system exits auto cine review.
- In auto play status, set [Auto Play] to "Stop" or roll the trackball to exit auto play.

● Setting the Auto Review Region

You can set a segment of cine loop which can be reviewed automatically. After the auto review region is set, the auto cine review can only be performed within this region; but the manual cine review can be performed beyond this region. When the cine file is saved, only the images within this region are saved.

- Set the start frame: rotate the knob under [Start Frame] in the touch screen to manually review the images for the frame you want to set as the start point; or manually review the cine file by trackball and touch [Set Begin] on the touch screen to set current frame to be the start point.
- Set the end frame: rotate the knob under [End Frame] in the touch screen to manually review the images for the frame you want to set as the end point; or manually review the cine file by trackball and touch [Set End] on the touch screen to set current frame to be end.
- Press the knob under [Auto Play] on the touch screen or use the mapping menu. The system plays the auto review region automatically.
- Rotate the knob under [Auto Play] to increase/decrease the auto play speed or use the mapping menu.

- e) In auto cine review, pressing the knob under [Auto Play] on the touch screen or rolling the trackball will stop the auto cine review and enter the manual cine review.
- f) Click [Jump to First]/[Jump to Last] to review the first or last image.

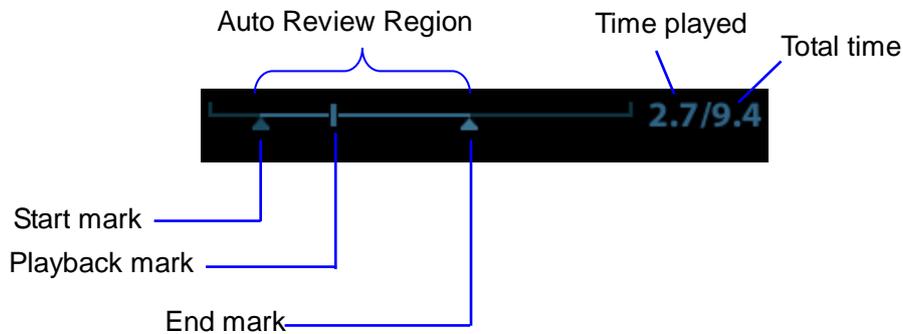
Tip: you can perform cine review on each image window in the dual/quad splitting mode, and set the auto review region for each window.

6.4.3 Cine Review in M/PW/CW/TVD Mode

Enter cine review in M/PW/CW/TVD mode and roll the trackball. The cine images are displayed on the screen one by one.

Roll the trackball to the left. Or under touch screen mapping mode, swipe the touch screen leftwards. The review progress slider moves to the left, the images move to the right and the earlier stored images are displayed. Or, roll the trackball to the right (swipe rightwards). The review progress slider moves to the right, the images move to the left and the recently stored images are displayed. When you review images to the first or last frame, rolling the trackball further will display the last or first frame.

The cine progress bar at the bottom of the screen (as shown in the figure below):



Cine review operations are the same as those in 2D mode.

Tips: when replaying the spectrum cine files, the audio is synchronous with image file when the auto play speed is set 1.

6.4.4 Linked Cine Review

Linked cine review reviews images captured at the same moment.

- Dual live mode (B/Color/Power/TVI/TEI)
- B+M
- B/B Dual liveDuplex mode (B+PW/CW/TVD)
- Triplex mode, TVM or CM mode

Frame synchronization mark



Playback progress bar

The frame mark on the time mark of the M/PW image indicates the corresponding 2D image. In statuses other than dual live status, you can only review images in the currently active window.

6.5 Image Compare

6.5.1 Image Compare under Review Mode

You can perform image compare through the path:

- Thumbnail area in the main screen;
- iStation screen (press <iStation> to enter);
- Review screen (press <Review> to enter).

1. In the above condition, press <Cursor> to show the cursor and click the target image file.
2. 3 buttons will appear to the right of the image, click  to select the image for comparison marked by .

If the wrong image has been chosen, click  to cancel the selection of this image.

Tip: for B/B+COLOR/B+TVI/B+POWER/B+TEI mode image, you can select at most 4 images; for PW/M/CW/TVD/Elasto single mode image, you can select at most 2 images.

3. Repeat the above steps to add other image files for comparison.
4. Click [Image Compare] (click  in thumbnail status) to enter image compare mode.
5. Review images from different image windows. Press the <Dual> or <Quad> key to switch the active image window.

The window with the highlighted "M" mark is the currently activated window.

6. Save the image if necessary.
7. Click [Return] on the screen or press <Freeze> to exit image compare.

Image compare of different exams for the same patient:

- a) Select different exams in the iStation screen, then select [Review Image] in the menu which appears to enter the Review screen.
- b) In the Review screen, click [Exam History] to select the exam. Click to select the image to be compared in different exams, and click [Compare].

You can select if cine files are synchronously replayed by the soft menu control: select [PlayMode: XX] to [SyncPlay] to play all files synchronously or [ASyncPlay] to play asynchronously.

6.5.2 Frame Compare

1. Freeze the image in B/C mode. Touch [Frame Compare] on the touch screen to enter frame compare mode.
2. Review the images of different image windows (cine replaying cannot be performed for single-frame image files). Press the <Update> or <Dual> key to switch the active image window.
3. Save the image if necessary.
Measurements and adding comments and body marks are allowed.
4. Touch [Frame Compare] again to return to image frozen status. Press <Freeze> to enter real-time imaging.

Tip: Cine compare can only be performed on single-format 2D images.

6.6 Cine Saving

■ Live capture

Live capture refers to saving the images or cines in image scanning status. After storing them, the system continues with image scanning.

Live capture can be divided into two types: retrospective and prospective.

- Retrospective saving saves specified images which were captured before the current moment. Images stored in the cine memory are saved to the system's hard drive.
- Prospective saving saves specified images which are captured later than the current moment. Images are saved to both the cine memory and the system's hard drive.

The live capture time can be set.

- In imaging mode, press the user-defined key for “Save Cine (Prospective)/(Retrospective)” on the control panel.

Tip:

- Press the save key again or <Freeze> to stop saving.
- When saving is complete, a thumbnail displays in the Thumbnail area.

■ Frozen image storage

In frozen mode, press the user-defined key for “Save Cine (Prospective)/(Retrospective)” on the control panel.

After the cine is successfully saved, a thumbnail is displayed on the screen.

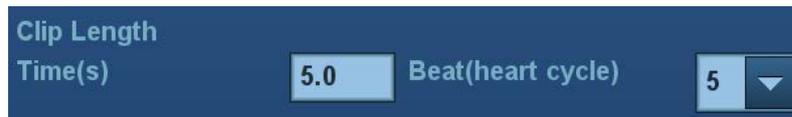
The live capture time can be set.

6.7 Preset

6.7.1 Setting Cine Length

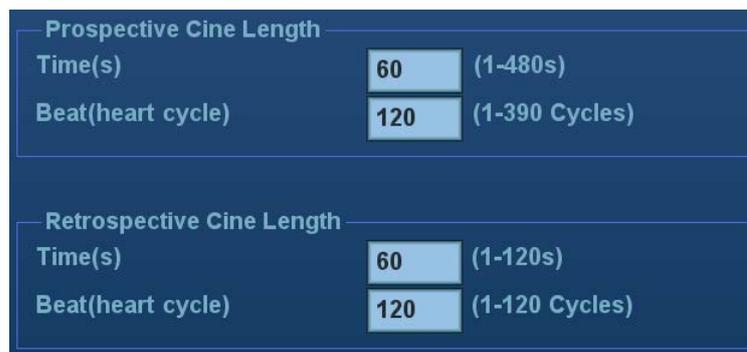
Open [Setup] → [System] → “General” to perform the following settings:

■ Non-live storage



■ Live capture

- Type: Retrospective, Prospective.
- Cine length:



Tip: If the value is out of range, the system can change it to the nearest effective value.

7 Physiological Signal

A physiological input panel is available for this system. The physiological module consists of two channels: ECG and DC IN. DC IN is capable of handling external ECG signals from other ECG signal devices.

The scanned image displayed is synchronized with the ECG traces. So ECG signals can be used as a time reference in an ultrasound exam (mainly in cardiology exams).

The ECG function is an option.

<p>⚠ WARNING: DO NOT use the physiological traces for diagnosis and monitoring.</p> <p>To avoid electric shock, the following checks must be performed prior to an operation:</p> <p>The ECG electrode cable must not be cracked, frayed or show any signs of damage or strain.</p> <p>The ECG electrode cable must be correctly connected.</p> <p>You must use the ECG leads provided with the physiological module. Failure to do so may result in electric shock.</p> <p>The ECG electrode cable must be connected to the system first. Only after the cable is connected to the system can the patient be connected to the ECG electrodes. Failure to follow these instructions can subject the patient to electric shock.</p> <p>DO NOT place the ECG electrodes directly in contact with the patient's heart. This can stop the patient's heartbeat.</p> <p>DO NOT apply the ECG electrodes if the voltage exceeds 15 volts. This could result in an electric shock.</p> <p>Before using the high-frequency electric surgical unit, high-frequency therapeutic equipment or defibrillator, be sure to remove the ECG electrode from the patient in order to prevent electric shock.</p> <p>Conductive parts of electrodes and associated connectors for ECG must not come into contact with other conductive parts including earth/grounding.</p> <p>Frequent trampling on or squeezing of the cables may result in cable failure or fracture.</p> <p>If an abnormality is detected in physio trace, check that the ECG leads are properly connected to the system.</p>
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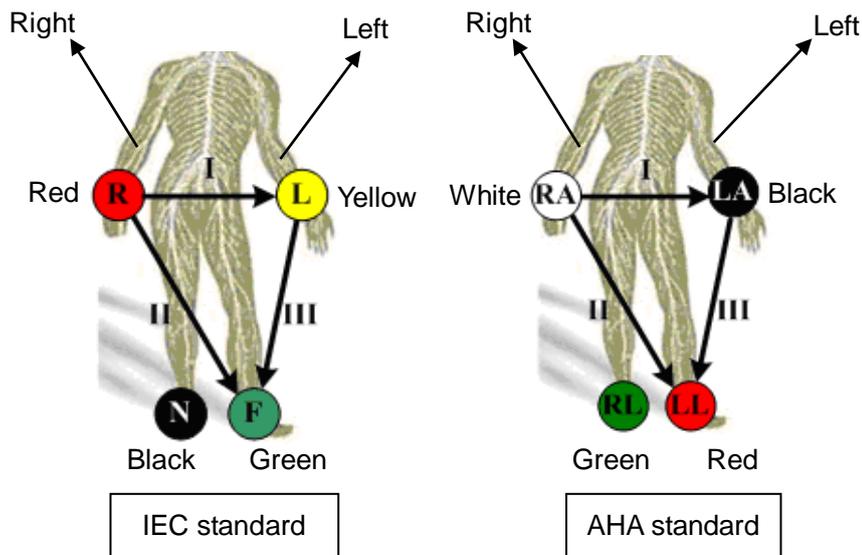
7.1 ECG

7.1.1 ECG Operation Basic Procedures

1. Connect the device.

- Turn off the system power supply, and connect the ECG cable to the ECG port on the physio panel of the machine.
- Turn on the system power supply.

Place the ECG electrodes on the patient's body (as shown in the following figures).



2. Touch [Physio] on the touch screen to enter physio operation status.
3. Switch the imaging modes and display formats. Adjust the parameters to obtain an optimized image.
4. Parameter adjustment:
 - On ECG touch screen page, touch [ECG] to be On (highlighted in green).
 - Adjust the [Speed], [ECG Gain], [Position] and [Invert].
5. Trigger:
 - Select the trigger mode, or switch on [Real & Trig], set the trigger time.
6. Freeze the image(s) and review the image(s).
7. Touch [Physio] to exit ECG mode, and remove the ECG electrodes from the patient.
If an external ECG is used as input for the ECG signal, touch [ECG source] to be "External".

7.1.2 ECG Triggering

7.1.2.1 Overview

ECG triggering means that image scanning is activated at some time points of ECG signals, thus obtaining B images at these time points. In most cases, the triggered images are 2D-mode images.

For single/dual trigger, when ECG triggering occurs, a mark appears on the ECG waveform, indicating the time points when the B images are captured (corresponding to the delay time from R curve started).

Tips:

- The trigger mark is displayed in both freeze mode and live mode.
- The marks in Dual trigger are different in color.
- Trigger function is unavailable if the ECG trace is disappeared. Only the live 2D image can be triggered.
- No delay time or time interval shall less than the time required to scan a single image.
- If the delay time is longer than a heart cycle, then the heart cycle between the delay time is omitted, that is to say no trigger is occurred when R waveform is detected in the duration.

7.1.2.2 Triggering Mode

There are three triggering modes available: Single, Dual and Timer.

- Single Trigger: when an R waveform is detected, the image will be triggered after delay time T1. The value of T1 can be changed in triggering status.
- Dual Trigger: when an R waveform is detected, the image will be triggered respectively after delay time T1 and T2. The value of T1 and T2 can be changed in triggering status.
- Timer Trigger: an image will be triggered after a certain interval. The time interval can be changed in triggering status.

The image trigger operation is described as follows (Take single trigger as an example):

1. Select exam mode.
2. Touch [Trig Mode] on the touch screen to enable the trigger.
3. Select [Single].
4. Set the delay time on the soft menu according to actual situation.

7.1.2.3 Real & Trigger

Click [Real & Trigger] on the soft menu to enable or disable the real trigger function.

After the [Real & Trigger] is turned on, two images are displayed respectively in two windows, one is triggered by ECG, and the other is non-triggered real time image.

7.2 Parameter Description

The physio parameters are described as follows:

Parameter	Description
ECG Source	Select ECG source.
Gain	Function: to set the amplitude of the trace. Method: click [Gain] on the soft menu, or press/rotate the corresponding knob. Each adjustment takes you to the next setting. Value: 0-30, in increments of 1.
Position	Function: to set the vertical position of the traces on the image display. Method: select [Position] on the touch screen. Each adjustment cycles you to the next setting. Value: 0%-100%, in increments of 5%.
Speed	Function: change the speed of the physio trace. Value: 20-145mm/s.
T1	Function: to set the delay time T1 in Single trigger or Dual trigger.
T2	Function: to set the delay time T2. Method: select a proper value in the drop-down list.
Interval	Function: to set the time interval for Timer. Method: select a proper value.
Invert	To invert the display.

8 Measurement

You can perform measurements on zoomed images, cine reviewing images, real-time images or frozen images. For measurement details, see the [Advanced Volume].

 **WARNING:** Be sure to measure areas of interest from the most optimal image plane to avoid misdiagnosis arising from inaccurate measurement values.

To obtain accurate Doppler flow measurement values, make sure the transmitting beam is not perpendicular to the flow as this may lead to false readings and potential misdiagnosis.

 **CAUTION:** If an image is unfrozen or the mode is changed during a measurement, the calipers and measurement data will be cleared from the screen. Measurement data will be stored in the report.

If the system is turned off or <End Exam> is pressed during a measurement, unsaved data will be lost.

In dual-B imaging mode, the measurement results of the merged image can be inaccurate. Therefore, the results are provided for reference only, not for confirming diagnoses.

You can create user-defined measurement tools using the UltraAssist tool and then import them into the ultrasound system to carry out specific measurements.

For details about this feature, see the UltraAssist manual.

8.1 Basic Operations

■ To enter/exit measurement

To enter: press <Caliper> on the control panel to enter general measurement. Press the <Measure> key to enter application measurement.

To exit: press the <Caliper> key or the <Measure> key again.

■ Measurement results and help information

The system displays and updates measurement results in the results window.

The help information concerning measurement and calculation is displayed in the Help Information area at the bottom of the screen.

8.2 General Measurements

8.2.1 2D General Measurements

2D general measurements are general measurements on images in B, Color, Power or iScan imaging modes. The measurements listed below can be performed:

Measurement Tools	Function
Distance	Measures the distance between two points of interest.
Depth	Measures the distance between the probe surface and the probing point along the ultrasound beam.
Angle	Measures the angle between two intersecting planes.
Area	Measures the area and perimeter of a closed region.
Volume	Measures the volume of a target.
Double Dist.	Measures the length of two line segments which are perpendicular to each other.
Parallel	Measures the distances between each pair of parallel lines in a sequence.
Trace Length	Measures the length of a curve.
Distance Ratio	Measures the lengths of any two lines and calculates the ratio.
Area Ratio	Measures the areas of any two regions and calculates the ratio.
B histogram	Measures the grayscale distribution of ultrasonic echo signals in a closed region.
B profile	Measures the grayscale distribution of ultrasonic echo signals across a line.
Color Velocity	Measures the color flow-velocity (only in Color mode).
Volume Flow	Measures the blood flow through a vascular cross section per unit time.

8.2.2 M General Measurements

M general measurements are general measurements on M-mode, CM-mode and AM-mode images. The measurements listed below can be performed:

Measurement Tools	Function
Distance	Measures the vertical distance between two points.
Time	Measures the time interval between any two points.
Slope	Measures the distance and time between two points and calculates the slope.
HR	Measures the time of n ($n \leq 8$) cardiac cycles and calculates the heart rate in M mode images.
Velocity	Calculates the average velocity by measuring the distance and time between two points.

8.2.3 Doppler General Measurements

Doppler general measurements are general measurements on PW/CW-mode images. The measurements listed below can be performed:

Measurement Tools	Function
Time	Measures the time interval between any two points.
HR	N intervals ($n \leq 8$) are measured to calculate a PW mode derived HR value in Beats Per Minute (BPM).
Velocity	On Doppler mode images, velocity and PG (pressure gradient) of a point on the Doppler spectrum waveform are measured.
Acceleration	The velocity and time interval between two points are measured to calculate the speed difference and acceleration.
D Trace	On PW mode images, one or several Doppler waveforms are traced to obtain the speed and PG, etc.
PS/ED	Velocity and PG between two peaks on the Doppler spectrum are measured to calculate the RI (resistance index) and PS/ED (peak systolic/end diastolic).
Volume Flow	Measures the blood flow through a vascular cross section per unit time.
Ratio (Vel.)	Measures the D velocity and calculates the ratio value for blood analysis.
Ratio (VTI)	Measures the VTI values from the spectrum and then calculates the ratio value.

8.3 Application Measurements

- Abdomen measurements - used for measuring abdominal organs (liver, gall bladder, pancreas and kidney, etc.) and large abdominal vessels.
- OB measurements - used for measuring fetal growth indices (including EFW) as well as GA and EDD calculations. The fetus can be evaluated through growth graph analysis and the fetal biophysical profile.
- Cardiac measurements - used for left ventricle function measurements and measuring main artery and vein parameters, etc.
- Gynecology measurements - used for the uterus, ovary and follicles, etc.
- Small Part measurements - used for small parts such as the thyroid.
- Urology measurements - used for the prostate, seminal vesicle, renal, adrenal, micturated and testicular volume.
- Pediatrics measurements - used for hip joint measurement.
- Vascular measurements - used for carotid, cerebral, upper and lower extremities vessels, etc.
- EM measurements - used for EM-related full functional measurements.

8.4 Measurement Accuracy

Table 1 2D Image Measurements

Parameter	Range	Error
Distance	Full Screen	Within $\pm 3\%$
Area (ellipse, circle)	Full Screen	Within $\pm 7\%$
Trace Area	Full Screen	Within $\pm 7\%$
Circ	Full Screen	Within $\pm 10\%$
Angle	Full Screen	Within $\pm 3\%$
Volume	Full Screen	Within $\pm 10\%$

Table 2 Basic Time Motion Measurements

Parameter	Range	Error
Distance	Full Screen	Within $\pm 3\%$
Time	Timeline Display	Within $\pm 2\%$
Heart Rate	Timeline Display	Within $\pm 4\%$
Velocity (PW mode)	10-200cm/s (for 3C5A/6C2/7L4A/7L4B/L14-6NE/V11-3/V11-3B/D7-2E/C6-2/L9-3E/P7-3) 10-300cm/s (for P4-2)	When angle $\leq 60^\circ$, $\leq 5\%$
Velocity (CW mode)	10-200cm/s (for 3C5A/6C2/7L4A/7L4B/L14-6NE/V11-3/V11-3B/D7-2E/C6-2/L9-3E/P7-3) 10-300cm/s (for P4-2)	When angle $\leq 60^\circ$, $\leq 5\%$. (not including pencil probe)

Table 3 iScape measurements

Parameter	Range	Error
Distance	Full Screen	Within $\pm 5\%$ (for 3C5A/7L4A/7L4B/L14-6NE/V11-3/V11-3B/P4-2/P7-3/D7-2E/C6-2/L9-3E)
		Within $\pm 10\%$ (for 6C2)

Table 4 3D/4D image measurements

Parameter	Range	Error
Distance	Section A/B/C	Single window display: Within $\pm 5\%$ (not including Smart 3D mode)
Area (ellipse, circle)	Section A/B/C	Single window display: Within $\pm 7\%$ (not including Smart 3D mode)

Parameter	Range	Error
Trace Area	Section A/B/C	Single window display: Within $\pm 7\%$ (not including Smart 3D mode)
Circ	Section A/B/C	Single window display: Within $\pm 10\%$ (not including Smart 3D mode)
Angle	Section A/B/C	Single window display: Within $\pm 5\%$ (not including Smart 3D mode)
Volume	Section A/B/C	Within $\pm 20\%$ (not including Smart 3D mode)

NOTE: Within the selected field range, measurement accuracy is ensured within the range mentioned above. The accuracy specifications are performed in the worst conditions, or based on real system tests, regardless of acoustic speed error.

9 Comments and Body Marks

9.1 Comments

Comments can be added to an ultrasound image to bring attention, notate or communicate information observed during the examination. You can add comments to: zoomed images, cine review images, real-time images, frozen images. You can type comments as characters, insert pre-defined comments from the comments library or insert arrow markers.

 **WARNING:** Ensure that the entered comments are correct. Incorrect comments may lead to misdiagnosis!

9.1.1 Comments Basic Procedures

To enter a comment:

1. Enter comment status:

- Press , or,
- Press any alphanumeric key or the space bar to enter comment status, or,

- Press  to enter arrow-adding status.

2. Position the cursor over the desired location for the comment,

3. Add a new comment to the image in accordance with the actual situation. You can modify, move or delete a completed comment.

4. To exit comment status:

- In comment status, press , or
- In arrow-adding status, press , or,
- Press <ESC> or other operating mode keys to exit.

9.1.2 Touch Screen Display in Comments

The system can be configured with comment text libraries including Abdomen, Cardiology, GYN (Gynecology), OB (Obstetrics), Urology, SMP (Small Part), Vascular, PED (Pediatric), Nerve Blocks and emergency medicine. In comments status, you can enter the comment text using the screen menu or touch screen.

- To set the comment home location.
Roll the trackball to move the cursor to the desired comment location and touch [Set Home] on the touch screen.
- Return the cursor to the set home location.
Press <Home> on the control panel or touch [Home] on the touch screen to return the cursor to the set home location.
- Grab/Del.
Rotate the knob under the [Grab/Del.] button on the touch screen to select the entered comment items. Press the knob to delete the selected item.
- Navigate through the comment libraries
To select the comment library, rotate/press the knob under the [Library] button on the touch screen.
- Add/modify comment positions
Touch [RT/LT], [Sag/XS] or [Prox/Mid/Distal] to directly mark the position. Move the cursor onto the comment item to be modified, touch [RT/LT], [Sag/XS] or [Prox/Mid/Distal] to change the already-added comment position.
- Change Font Size/Arrow Size
To change the font size of comment text, rotate the knob under the [Font Size] button on the touch screen to select from Small, Medium and Large.
To change the arrow size, rotate the knob under the [Arrow Size] button on the touch screen to select from Small, Medium and Large.
- Comment display/hide
Touch [Hide]/[Display] on the touch screen to display or hide the comments.
- Page-turning
If there is more than one page of comment text for the current exam mode, you can navigate to other pages by swiping the touch screen leftwards/rightwards.
- User-defined comments
You can customize comments if necessary, including adding/deleting comments and adjusting the comment display on the touch screen menu.
- Trace
Touch [Trace] on the touch screen to enter trace commenting status.
 - Tracing by trackball
Move the trackball to the desired starting point and press <Set>.
Roll the trackball to trace the curve: roll the trackball to the right to draw the curve and to the left to cancel the curve.
Press <Set> to confirm the end; or the trace curve will close automatically if the cursor is near the starting point.
 - Trace on touch screen
Touch the touch screen to set the starting point and trace the curve, touch the touch screen again to set the end.

9.1.3 Adding Comments

■ Typing comment characters

1. To set the comment location:

Roll the trackball or press the direction keys on the keyboard to move the cursor to the desired comment location.

2. To type alphanumeric characters:

You can enter characters using the keyboard.

- Type alphanumeric characters using the qwerty or soft keyboard (characters are uppercase by default).
 - In edit status (the characters are green in color), press <Enter> to move the cursor to the new line. The cursor is aligned with the first line.
3. In edit status, press <Set> or <Enter> on the control panel to confirm the added character. The color of the added character turns to yellow.

■ Adding a Comment Text

1. In comment status, select the comment to be added.

You can add comment texts using the following methods:

- Roll the trackball to move the cursor over the desired comment text on the screen menu and press <Set>. The system adds the selected comment text to the screen. Move the trackball to confirm.
 - Touch the desired comment text on the touch screen. The system adds the selected comment text to the screen where the cursor is positioned. Edit the comment directly and roll the trackball to confirm.
2. Exit comment edit status

In comment edit status, press the <Set> or <Enter> key, or roll the trackball to confirm the added comment text and exit the edit status. The comment changes to yellow.

■ Adding an arrow

You can add an arrow to a location you want to highlight.

To add an arrow:

- (1) Press the <Arrow> key and an arrow will appear in the default position.
- (2) Adjust the shape and position of the arrow:
 - To position the arrow on the area of interest: roll the trackball to the desired position.
 - To change the orientation of the arrow: rotate the <Angle> knob to change the arrow's orientation (in increments of 15°).
 - Adjust the arrow size: rotate the knob under the [Arrow Size] button on the touch screen to change the size.
- (3) Press <Set> or <Enter> to anchor the arrow's position. The arrow turns yellow. Repeat the above steps to add more arrows.
- (4) Press <Arrow> on the control panel to exit arrow comment status.

■ Tracing

- (1) In comment status, touch [Trace] on the touch screen to activate the trace function. The current image is also displayed on the touch screen.
- (2) Control Panel operation:
 - a) Roll the trackball to the desired position and press <Set> to confirm the start point.
 - b) Roll the trackball to move the cursor along the edge of the desired region and trace the outline of the region.
 - Rotate the <Angle> knob counter-clockwise to cancel 1 pixel of trace.
 - Rotate the <Angle> knob clockwise to restore 1 pixel of trace.
 - Short press <Clear> to clear last trace. Long press <Clear> to delete all tracing.
 - c) Press <Set> to finish tracing.

Touch screen operation:

- a) Trace around the ROI by touching the touch screen image with your finger.
- b) Remove your finger to finish tracing.
 - [Clear]: touch to delete traces in reverse order one by one.
 - [Clear All]: touch to delete all traces.
- c) Click [Exit] to exit tracing.

9.1.4 Moving Comments

1. Select the comment to be moved.
2. Roll the trackball to move the comment to a new position.
3. Press the <Set> key to anchor the comment in the new position.

9.1.5 Modifying (Editing) Comments

■ Modifying (Editing) characters

1. In comment status, move the cursor over the comments to be modified.
 - Press the alphabetic keys to enter the character at the cursor position.
 - Or, double press <Set> to enter comment editing status and use the direction keys to move the cursor to the desired location to insert/delete characters. Either type characters by pressing the corresponding keys or select the new comment text from the menu.
2. Press <Del.> to delete the comment character or text on the right side of the cursor. Press <Backspace> to delete the comment character or text on the left side of the cursor.
3. Roll the trackball or press <Set> to confirm the modification and exit the edit status. The comment turns to yellow.

If there are already comments on the screen, press the space bar to enter editing status.

■ Modifying (Editing) Arrows

1. Move the cursor over the arrow that needs to be modified. After the cursor turns to , press the <Set> key. The current arrow turns green, and there is a green frame around the arrow indicating that the arrow can be edited. Move the cursor to change the arrow's position.
2. Rotate the <Angle> knob to modify the arrow's direction.
3. Press the <Set> or <Enter> key to complete the operation.

9.1.6 Deleting Comments

■ Deleting Comment Characters, Texts or Arrows

1. Move the cursor to the comment to be deleted.
2. Press the <Set> key to select the comment.
3. Press the <Backspace>, <Del.> or <Clear> key to delete the comment.

■ Deleting a recently-added character, text or arrow

After adding several comments and the cursor is in “|” or “↔” status, press <Clear> to delete recently-added or recently-edited comments.

■ Delete All Comments

Long press <Clear> to delete all the comments.

NOTE: When no object is selected, long pressing the <Clear> key will clear all comments and all measurement calipers.

After powering off, the system will clear all comments on the image.

9.1.7 Comment Setting

See “12.4 Comment Preset” for comment preset.

■ Comment Setting

Enter the “[Setup] → [System] → [Application]” screen to perform the following setting:

- You can preset whether to clear the comments when unfreezing the image or changing the probe/exam.
- Set whether body marks are erased when the image is unfrozen.
- Set whether voice comments are enabled.

9.2 Body Mark

NOTE: After powering off, the system will clear all comments on the image.

The Body Mark (Pictogram) feature is used to indicate the patient's position during the exam as well as the transducer position and orientation.

The system supports body marks for Abdomen, Cardiology, GYN, OB, Urology, Small Part and Vascular applications. In addition, the system supports to import user-defined body marks.

9.2.1 Touch Screen Display in Body Mark

The body mark touch screen displays the settings for the current mode:

■ Library

Rotate the knob under the [Library] button on the touch screen or press the knob to switch to the body mark library. Corresponding body marks are shown on the left.

■ Page-turning

If there is more than one page of body marks, rotate the knob under [Page] to turn the pages.

■ User-defined body mark

Touch [Custom] to enter the dialog. You can import body mark graphs here.

You can import a user-defined body mark in BMP/PNG format of 120*120 (unit: pixel) in size.

■ Save Probe

If the probe mark direction and position is determined for the current body mark being added, touch [Save Probe] to save the current probe mark direction and position for the body mark.

9.2.2 Adding Body Marks

1. Enter Body Mark status. Use the knob under [Library] to select the body mark category.
2. Adding Body Marks:
 - Adding body marks using the trackball and <Set> key.
Move the cursor over the desired body mark to highlight your choice. Press <Set> to add the body mark.
 - Adding body marks using the touch screen.
Touch the desired body mark on the touch screen directly.
3. To adjust the probe position and orientation marker:
 - Roll the trackball to position the probe marker.
 - Rotate the <Angle/Steer> knob to adjust the orientation.
 - Touch [Save Probe] to save the current probe mark direction and position for the body mark.
4. Press <Set> to confirm the position and orientation of the probe marker and exit body mark mode.

9.2.3 Moving Body Marks

You can move the body mark graphics to any desired position within the image area.

1. Press <Cursor> and roll the trackball to move the cursor over the body mark. The cursor then changes to , indicating you can move the pictogram to a new position.
2. Press the <Set> key to select the body mark.
3. Roll the trackball to move the Body Mark graphic to the desired position.
4. Press <Set> to anchor and confirm the graphic's new position.

NOTE: In Dual B Mode, a body mark cannot be moved between the separate image windows.

9.2.4 Deleting Body Marks

1. Use the trackball to position the cursor over the body mark graphic and press <Set> to select.
2. Press <Clear> to delete the selected body mark.

NOTE: If no object is selected, long pressing the [Clear] key will clear all comments, body marks and general measurements from the screen.

9.2.5 Body Mark Setting

Returning to the preset or changing the exam/patient/mode/probe will clear the body marks.

10 Patient Data Management

An exam record consists of all the information and data for one exam.

An exam record consists of the following information:

- Patient basic information and exam data
- Image files
- Report

<p>NOTE:</p> <ol style="list-style-type: none">1. DO NOT use the internal hard drive for long-term image storage. Daily backup is recommended. External storage media is recommended for archiving images.2. The system's patient database space is limited. Back up or clear patient data regularly.3. Mindray is not responsible for lost data if you DO NOT follow the recommended backup procedures.

10.1 Patient Information Management

10.1.1 Enter Patient Information

General patient information and exam information are entered using the Patient Info screen. For details, see “4.1 Patient Information.”

10.2 Image File Management

You can store image files either in the patient database in the system, or to external memory devices. For a saved image, you can perform operations such as reviewing, analyzing and demonstrating images (iVision).

10.2.1 Memory Media

The system supports memory media including:

- System hard disk
- USB memory devices: USB flash drive, removable USB hard disk
- DVD+R, DVD+RW, DVD-R, DVD-RW, CD-RW, CD-R

10.2.2 Image File Formats

The system supports two types of image file formats: system-relevant and PC-compatible.

■ System-relevant formats:

- Single-frame image file (FRM)
Refers to single-frame static image files which cannot be compressed. You can add measurements and comments on this type of file.
- Cine file (CIN)
System-defined multi-frame file format. You can perform manual or auto cine review, and perform measurements or add comments for the reviewed images. After you open a stored CIN file, the system automatically enters cine review status.

The system can save FRM files as BMP, JPG, TIFF, PNG or DCM files, or save CIN files as AVI or DCM files by Send To function in iStation screen. For details, please refer to “10.2.12 Sending Image Files” chapter.

- PC-compatible formats:
 - Screen file (BMP)
Single-frame file format, used to save the current screen, non-compressed format.
 - JPG: single frame export format.
 - TIFF: single frame export format.
 - Multi-medium file (AVI)
Multi-frame export format.
 - DICOM file (DCM)
DICOM standard file format, single-frame or multi-frame format, used to record patient information and images, you can only open DCM files to view rather than to edit.

10.2.3 Image Storage Preset

- Set image size

You can set the image size via “[Setup] → [System] → [General]”:



- Set cine saving length (clip length)

For details, see “6.7 Preset.”

- Set send/print image after ending the exam

Open “[Setup] → [System] → General]”, check “Sending/printing after Ending Exam” in the Patient Management area. Then every time you press <End Exam>, the system will send images of the exam to the connected default DICOM server.

10.2.4 Quickly Saving Images to the System

- To save a single-frame image to the system quickly:

- Operating procedure:
 - a) Set the user-defined key via the path: [Setup] → [System] → [Key Config]. Select a key in the Key Function field on the left side, and select “Save Image” in the Output page of the Function field on the right side.
 - b) Press the user-defined key to save the image.
- Format:
 - a) On the image screen, the image is saved with the default filename in the default file directory in FRM format.
 - b) When a dialog box is displayed on the current screen, interface for the current dialogue box is saved in BMP format.

Single-frame image is saved to the system by default name. The image thumbnail will appear in the thumbnail area on the right side of the screen. When you move the cursor over the thumbnail, its filename and suffix will be displayed.

- To save a cinelooop image to the system quickly:

1. Set the user-defined key via the path: [Setup] → [System] → [Key Config]. Select a key in the Key Function field on the left side, and select “Save Clip (Retrospective)” or “Save Clip (Prospective)” in the Output page of the Function field on the right side.
2. Press the user-defined key to save the cine file in the default file directory in CIN format.

The image thumbnail will appear in the thumbnail area on the bottom of the screen. When you move the cursor over the thumbnail, its filename and suffix will be displayed.

You can set the clip saving length in the path: [Setup] → [System] → [General].

10.2.5 Quickly Saving Full Screen Images to the System

■ Operating procedure:

1. Set the user-defined key via the path: [Setup] → [System] → [Key Config]. Select a key in the Key Function field on the left side, and select "Save Screen" in the Output page of the Function field on the right side.
2. Press the user-defined key to save the image in BMP format.

The image thumbnail will appear in the thumbnail area on the bottom side of the screen. When you move the cursor over the thumbnail, its filename and suffix will be displayed.

10.2.6 Quickly Saving Images to USB Flash Drive

Use the user-defined key to quickly save the single-frame to USB flash drive.

The image file is stored in the directory: patient name + ID\exam type + exam time\image ID.

1. Set the user-defined key via the path: [Setup] → [System] → [Key Config].
Select a key in the Key Function field on the left side, and select "Save Image to USB disk" in the Output page of the Function field on the right side. Click [Save] to exit setup.
2. Press the user-defined key to save the image to the USB flash drive.

10.2.7 Quickly Exporting Cine File to USB Flash Drive

Use the user-defined key to quickly save the cine file to USB flash Drive directly (without saving to the hard disk).

The file is stored in the directory: X (USB flash drive name): patient name+ ID\exam type + exam time \ image ID.

1. Set the user-defined key through the path: [Setup]→ [System]→ "Key Config". Select a key in the Key Function page on the left side and select "Send Cine to USB disk" in the Output page of Function field on the right side. Click [Save] to exit preset page.
2. Scan and freeze the image
3. Press the user-defined key to save the cine to the USB flash drive.

10.2.8 Auxiliary Output Function

For the following three functions, the system provides auxiliary output function setting: "Save Image", "Save Clip(Retrospective)" and "Save Clip(Prospective)".When the corresponding user-defined key is pressed, the ultrasound system can perform multiple operations one by one as per the preset.

■ Save Image

- Send Image to DICOM Storage
- Send Image to DICOM Printer
- Save Image to USB disk
- Send Image to iStorage
- Send Image to Local Default Printer

■ Save Clip (Retrospective)/(Prospective):

- Send Cine to DICOM Storage
- Send Cine to USB disk
- Send Cine to iStorage

Setting method (take “Save Image” as an example, add the auxiliary functions “Send Image to DICOM Storage” and “Send Image to USB disk”):

1. Set the user-defined key through the path: [Setup]→ [System]→ [Key Config]. Select a key in the Key Function field on the left side and select “Save Image” in the Output page of Function field on the right side.
2. Click [New] in the middle part of the screen, then there will be “Function2: NULL” under the key function in the Key Function Field on the left side, and at the same time, “Output” column on the right side will show the available auxiliary functions for current key. Select “Send Image to DICOM Storage” in the “Output” column on the right side. Then the Function2 on the left side turns into “Send Image to DICOM Storage”.
3. Click [New] again, then there will be “Function3: NULL” under the key function in the Key Function Field on the left side. Select “Send Image to USB disk” in the “Output” column on the right side. Then the Function 3 on the left side turns into “Send Image to USB disk”.
4. Click [Save] to confirm.
5. Scan and freeze the image
6. Press the user-defined key, then the system will perform three steps: 1. Save the image to the local hard disk; 2. Send image to DICOM Storage server; 3. Send the image to USB disk.

Tips: repeat step 3 will continue adding auxiliary functions, you can add 6 functions at most.

10.2.9 Thumbnails

Stored images are displayed in the form of thumbnails on the screen:

- During image scanning, thumbnails of the current exam display in the bottom of the screen.
- In the iStation screen, the thumbnails of the current selected patient display at the bottom of the screen. When you move the cursor over a thumbnail, its name and format display.
- In the Review screen, the thumbnails refer to the images stored in the same exam. When you move the cursor over a thumbnail, its name and format display.
- In the Review screen, open an image to enter the image analyzing status. All the thumbnails belonging to the exam will be displayed on the bottom.

10.2.10 Image Review and Analysis

You can review and analyze stored images (only refer to images stored in the system default path).

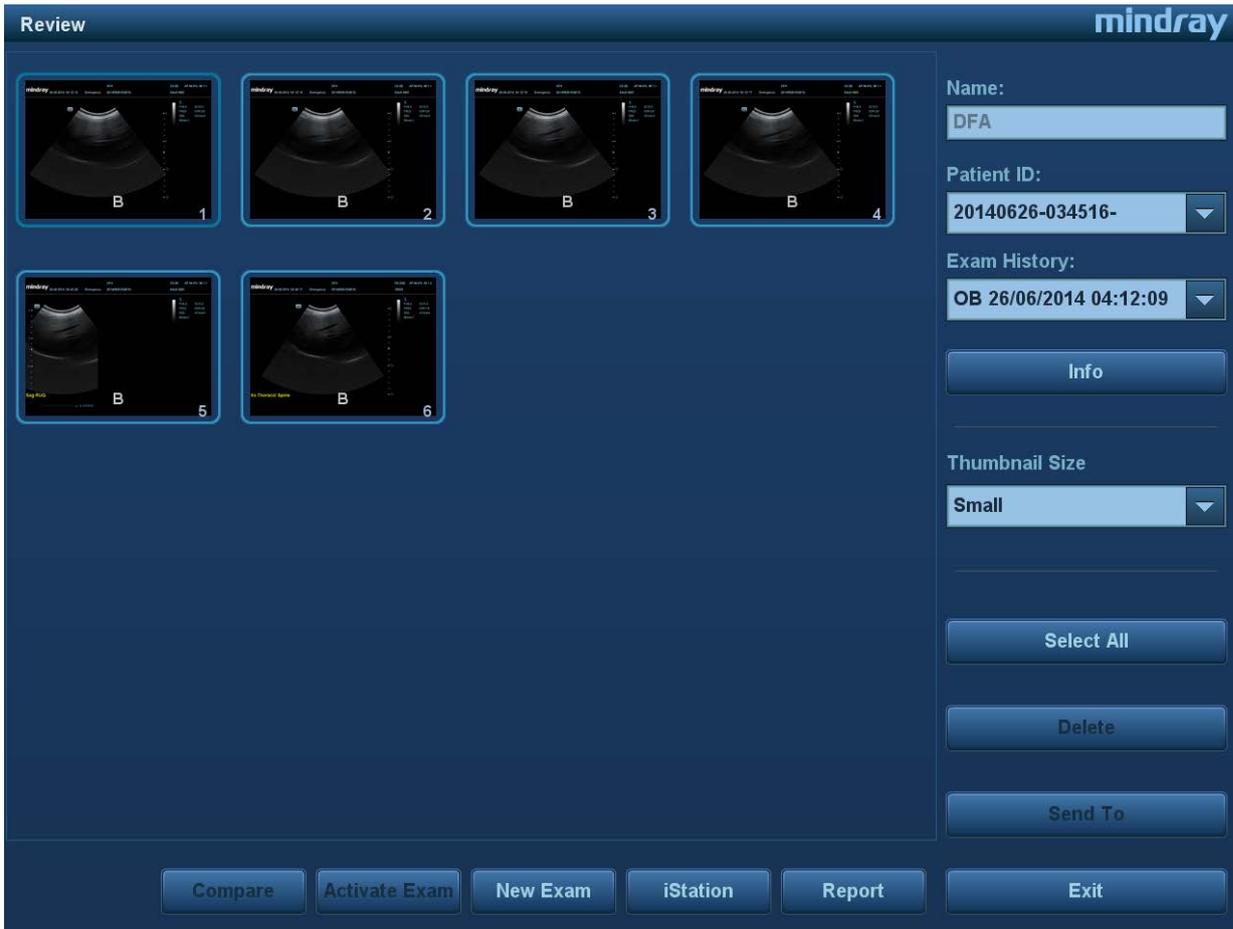
10.2.10.1 Review an Image

You can review all images stored in an exam, and send, delete or analyze the stored images.

■ To enter image review:

- During image scanning, saved image thumbnails display in the bottom of the screen. Move the cursor over a thumbnail and press <Set> twice to open the image. If the stored image is a cine file, double-click the thumbnail to enter the auto cine review.
- Press <Review> to enter the Review screen. Images of the current exam and the current patient are displayed.
- Select a patient's exam in the iStation screen and press <Review> or double-click the exam to enter the Review screen to review the images of the patient.
- Under touch screen mapping mode, touch  icon on the toolbar to enter review screen;
- If a saved image has been open from the main screen, under touch screen mapping mode, touch  and  icon on the toolbar or swipe the touch screen to review the image.

The Review screen is shown as follows:



- To exit Review:
 - Click [Exit] on the Review screen
 - Press <ESC> or press <Review> again.

Functions in the Review screen:

- Exam History:

You can select more than one exams of one patient in iStation screen to check the patient exam history.
- Info

Click to enter the Patient Info screen, you can review or edit the currently-selected patient's information.
- Report

Click to review or edit the currently-selected patient's report.
- Image operations

[Select All]: click to select all images in the thumbnail window.

[Deselect All]: after clicking [Select All], the button changes to [Deselect All]. Cancel all selections by clicking [Deselect All].

[Send To]: click to send the selected image to another location, DICOM server, MedTouch/MedSight devices, DVD recorder, printer, etc. Or select the image and click the  icon at the top right of the image.

[Delete]: click to delete the selected image.

[Image Compare]: image compare function. For details, see "6.5 Image Compare" chapter.
- Thumbnail Size

To change the thumbnail size.

- Other operations:
 - [New Exam]: click to create a new exam for the selected patient and open the Patient Info screen.
 - [Activate Exam]: activate the currently-selected exam (already ended) and enter the image scanning screen.
 - [iStation]: click to enter the iStation screen.
 - [Exit]: click to exit Review status and return to the main screen.

10.2.10.2 Image Analysis

In image analysis status, you can view, zoom, perform post-processing and measurements, add comments and perform cine (multi-frame) review for a stored image (FRM or CIN format). The operation steps are the same as those for real-time scanning. See the relevant sections for details.

- To enter image analysis:
 - In image scanning or freeze status, double-click a thumbnail stored in this exam to enter the image analysis status, or
 - In image review status, double-click the selected thumbnail to open the image.
- To exit image analysis:
 - Press <Freeze> to exit and enter real-time scanning status.
 - Click [Return] to exit image analysis and enter review status.

In image analysis status, the selected image is displayed on the screen and the thumbnails of the same exam are displayed on the thumbnail area. Turn pages and change the image display format using the buttons below the thumbnail.

- Other operations

You can perform cine review operations in image analysis status. For details, see “6 Display & Cine Review.”

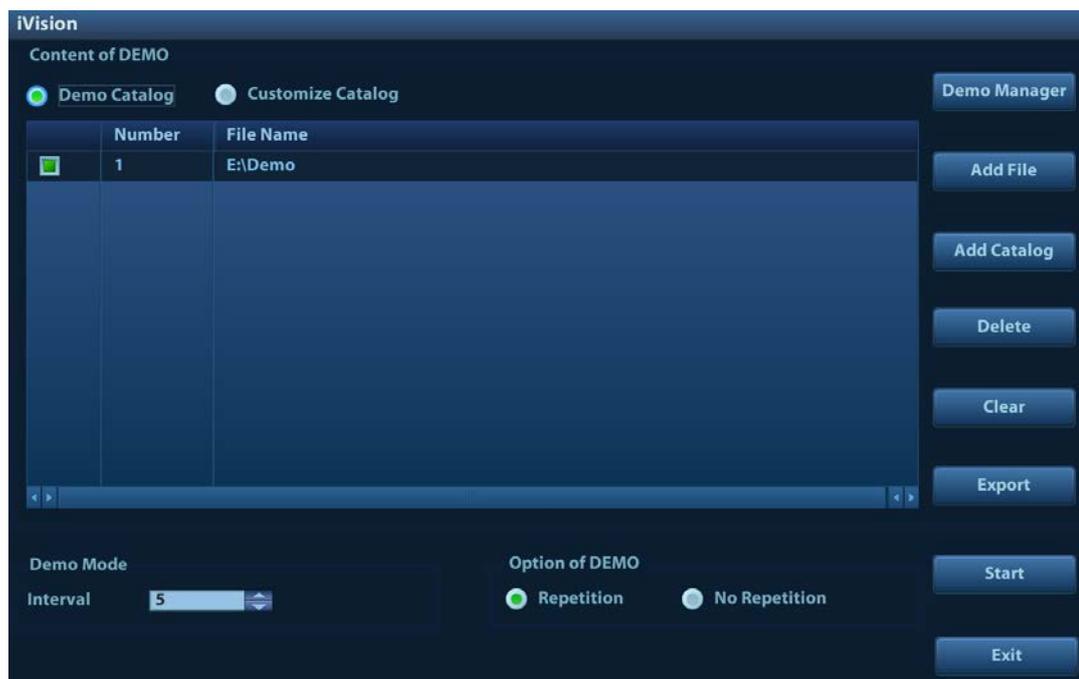
10.2.11 iVision

The iVision function is used to demonstrate the stored images. Image files are played one by one according to file names (including system-relevant and PC-compatible format images).

To perform image demonstration:

1. Enter the iVision screen:
Press the user-defined key for iVision (setting path: [Setup] → [System] → [Key Config.]
2. Add the contents to be played and select demo mode.
3. Select an item in the list and click [Start] to begin the demonstration.
4. Click [Exit] or press <ESC> to exit iVision status.

The iVision screen is shown as follows:



■ Demonstration item

Demonstration items are image files in formats supported by the system. You can add exam data from the patient database or system-supported image files and folders to the demonstration list. For files and folders in the demonstration list, the images in the directory and subdirectory are played one by one, and the system will automatically skip files that cannot be opened.

■ Demonstration catalog

There are two kinds of catalog: Demo Catalog and Customize Catalog.

- **Demo Catalog:** the demo catalog is a folder on the hard disk where the factory DEMO is stored. The system plays the images in this folder when performing demonstrations. The system supports importing, deleting or clearing the data in the demo catalog. Click [Demo Manager] to operate:
[>]: to import data into the demo catalog.
[<]: to delete selected data.
[<<]: to delete all data.
- **Customize Catalog:** the catalog of the displayed images is saved here. The system plays the images in the catalog when performing demonstrations. Operate the catalog or the files using the buttons on the right:
[Add File]: to add files to the file list.

[Add Catalog]: to add a catalog of files to the list.

[Delete]: to delete selected files or catalogs from the file list.

[Clear]: to clear all the files or catalogs in the file list.

[Export]: to export selected directories/files to external storage devices. Click [Export] to bring up the Browse dialog box, select the path and click [OK].

■ Demonstration mode

The system automatically plays all the image files in the list one by one.

The time interval between images played is the same and can be changed.

■ Demo options

You can choose whether to repeat the demonstration or exit after a demonstration is complete.

10.2.12 Sending Image Files

NOTE: Data saved this way can only be reviewed on the PC and cannot be restored to the ultrasound system. See “10.4.3 Patient Data View & Management” chapter for details about data backup.

■ On the image screen, select a stored image thumbnail and click  (Send To) in the top-right corner of the image. Or you can touch  icon on the touch screen under touch screen mapping mode (see “3.8.4 Touch Screen Operation” for details). The image can be sent to the external device, DVD recorder, MedTouch/MedSight devices, DICOM storage server, DICOM print server, system connected printer, etc.

■ In the iStation screen, click , or, in the Review screen, click [Send To] to send patient data to an external memory device. You can choose whether reports are exported with images. See the figure below.

See the figure below.



- For external memory devices (e.g., USB memory devices or DVD-RW) or iStorage:
 - a) PC format transfer: JPG/AVI, BMP/AVI, TIFF/AVI. Where a single-frame image is exported as JPG, TIFF or BMP, and the cine file is exported as AVI.
 - b) DCM format transfer: DCM (including single-frame DCM and multi-frame DCM).
 - c) Cine zoom mode can be changed.
 - d) You can also select whether to export reports and select the report type.
- For DICOM servers, select the DICOM Storage or Print server.

- For video printers, send images to the video printer connected to the system. For graph/text printers, send images to the default graph/text printer.
- For MedTouch/MedSight devices, single-frame image will be saved in PNG format, and multi-frame image will be saved in AVI format.

Note: if the transferred AVI file cannot be played normally on PC, please try to transfer the multi-frame cine file in MPEG format (set [Setup]->[General]->”AVI File Encode Format” to “MPEG” and try Send To function again) or use a VLC media player.

10.3 Report Management

You can create user-defined report templates using the UltraAssist tool and then import them into the ultrasound system to carry out specific measurements.

For details about this feature, see the UltraAssist manual.

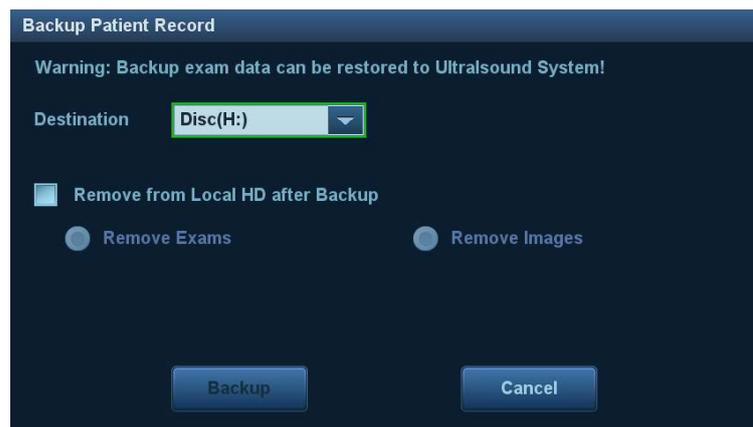
■ Report storage:

Exam reports are stored under the patient exam directory.

■ Importing, exporting and sending reports

- Import/export reports via Backup

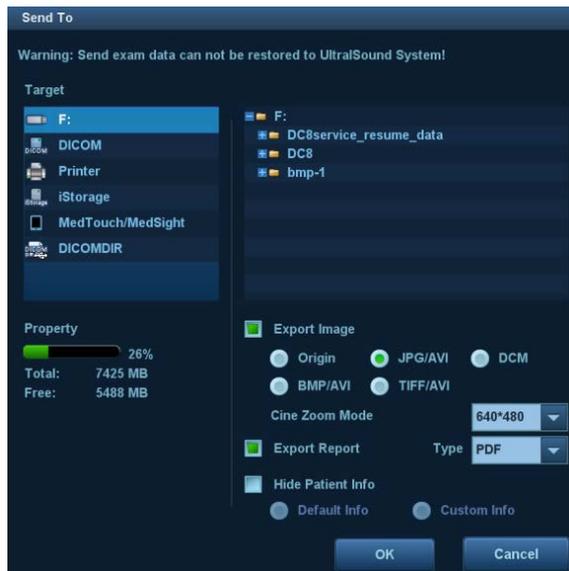
In the iStation screen, select patient data, then click  or  in the menu which appears to import or export patient information, images and reports from or to an external memory device. See the following figure:



You can select the destination, and select whether to remove local data.

- Export reports via Send To

In the iStation or Review screen, click [Send Exam] in the menu which appears to send patient data to an external memory device or iStorage. You can choose whether reports are exported with images. See the figure below.



To export reports:

- (1) Check “Export Report” on the screen.
- (2) Select the report type to be exported.
- (3) Click [OK] to confirm.

You can select the paper size for the report print in the path: [Setup] → [Print].

■ Report printing

Use a connected graph/text printer to print a report.

For details on report-related operations, see [Advanced Volume].

10.4 iStation - Patient Data Management

Patient data includes basic patient information, exam information, image files and reports. You can search, view, backup, send, restore or delete patient data in iStation.

- To Enter iStation
 - Press the <iStation> key on the control panel, or
 - Click [iStation] in the Patient Info screen, or
 - Click [iStation] in the Review screen.

The iStation screen is shown as follows:



The screenshot displays the iStation software interface. The main window is titled "iStation" and features a table of patient data. The table has five columns: ID, Name, Exam Type, Exam Date/Time, and Image. The data is as follows:

ID	Name	Exam Type	Exam Date/Time	Image
20140717-222505-	23	CARD	17/07/2014 22:25:10	1
20140715-215718-		CARD	15/07/2014 21:57:18	1
20140708-010537-		SMP	08/07/2014 01:05:37	1
20140626-034516-	DFA	OB	26/06/2014 04:12:09	6
20140626-034516-	DFA	CARD	26/06/2014 03:45:16	0
20140626-032159-		OB	26/06/2014 03:21:59	3
20140620-032412-	ABD	CARD	20/06/2014 03:24:29	0
20140618-010706-	16XX	ABD	18/06/2014 01:09:57	2
20140611-011205-	1112	OB	11/06/2014 01:12:12	3
20140609-215820-	1234	OB	09/06/2014 21:58:28	0
20140609-214646-		CARD	09/06/2014 21:46:46	3
20140609-204032-	1231	ABD	09/06/2014 20:40:40	3
20140609-090517-		SMP	09/06/2014 09:05:17	1
20140609-053532-		CARD	09/06/2014 05:35:32	0
20140606-093218-		CARD	06/06/2014 09:32:18	0
20140606-042133-	211	CARD	06/06/2014 04:21:33	0

On the right side of the interface, there is a control panel with the following elements:

- Keyword: [Text Input Field]
- Item: Name [Dropdown Menu]
- Data Source: HD(D:) [Dropdown Menu]
- Find in results
- Activate Exam [Button]
- New Exam [Button]
- Delete [Button]
- Send Exam [Button]
- Select All Exams [Button]
- Query/Retrieve [Button]
- Compare [Button]
- Exit [Button]

At the bottom left, there is a small thumbnail image of a medical scan.

10.4.1 Viewing Patient Information

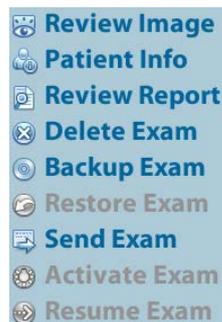
- Data Source
 - Select the patient data's data source; the system patient database is the default.
- Patient list
 - Display patient information, exam mode, number of images and cines, exam state, whether backed up or not.
- New Exam
 - After you select a patient data or exam in the iStation screen, click the [New Exam] to enter the Patient Info screen where you can select the exam mode and click [OK] to begin a new exam.
- Select All/Deselect All
 - Click [Select All] to select all the patient data listed. The button changes to [Deselect All].
 - Cancel all the selections by clicking [Deselect All].

10.4.2 Searching a Patient

1. Select the data source:
Click [Data Source]Select the patient data's data source; the system patient database is the default.
2. Set search conditions by Name, ID, DOB, Exam Date in the "Item" drop-down list.
3. Enter the keyword according to the "Item" selected..
4. When you select a patient in the patient list, images of this patient will be displayed at the bottom of the screen.

10.4.3 Patient Data View & Management

Select the desired patient information in the list. The following menu appears:

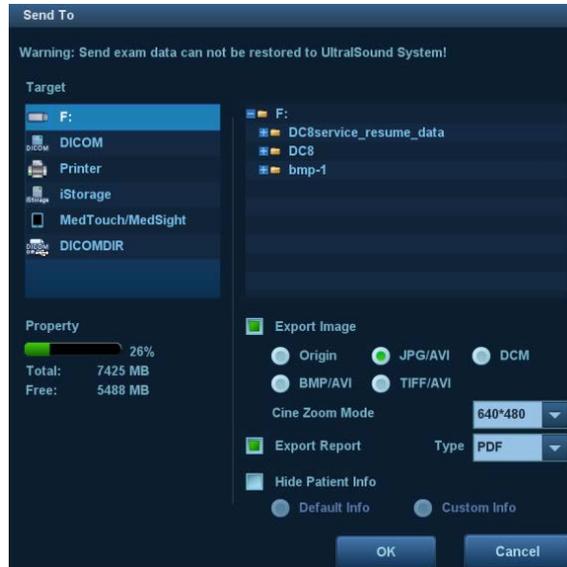


- Review an Image
Select a patient exam, click [Review Image] to enter the Review screen.
- Patient Information
Select a patient exam, click [Patient Info] to check the patient information for this exam.
- Review Report
After selecting a patient exam, click [Review Report] to view the report of this exam for this patient.
- Delete Exam
 - Select an exam record, click [Delete Exam] to delete the record. You cannot delete patient data which is being printed, exported or sent, or delete the current exam.
 - To delete an image, select the image first and then click  on the top right side. Or touch  on the toolbar on the touch screen in touch screen mapping status. See "3.8.4 Touch Screen Operation" for details
- Backup/Restore
You can back up the selected patient data to the system-supported media in order to view it on the ultrasound system, or restore patient data to the system from an external media.
 - [Backup Exam]: click to back up the selected patient data to the system-supported media.
 - You can select whether to remove images or the whole exam record from the system.
 - Original format: to back up the data in its original format.
 - DICOM format: you can change the cine compression mode and JPEG compression mode.
 - [Restore Exam]: click to import patient data from an external media.

■ Send Exams

The system supports sending data to external memory devices, print or iStorage. You can use this function to export the exam data to external devices (in PC data or DICOMDIR data format) and then import to PC or restore to the ultrasound system to review the data.

1. Select the patient record, click [Send Exam] in the menu to send exam data and images of the selected record.



2. Select target:

- DICOM: send data or images to the storage server or send images to DICOM printer.
- DICOMDIR: back up data in DICOMDIR format; change the cine compression mode and JPEG compression mode.
- USB storage device or DVD-RW/DVD+RW drive: send exam to USB storage device or DVD-RW/DVD+RW drive.
 - Report format can be selected.
 - Format transfer is available when sending images to USB device or disk. See “10.2.12 Sending Image Files” for details.
- Print: send image to the connected printer to print.

Press <Ctrl> or <Shift> with the <Set> key on the control panel to select more than one exam at a time.
- MedTouch/MedSight: send the exam to MedTouch/MedSight devices for review.

■ New Exam

After you select a patient data or exam in the iStation screen, click the [New Exam] to enter the Patient Info screen where you can select the exam mode and click [OK] to begin a new exam.

■ Select All/Deselect All

Click [Select All] to select all the patient data listed. The button changes to [Deselect All]. Cancel all the selections by clicking [Deselect All].

■ Activate an Exam

After selecting an exam which has been performed within 24 hours, click [Activate Exam] to activate the exam and load the basic patient information and measurement data to continue the exam.

If you want to select patient data in an external memory database to start a new exam or recover the exam, first allow the system to load the patient data to the system's patient database.

■ Continue an Exam

Select an exam that has been paused within 24 hours, click [Continue Exam] to activate the exam and load the basic patient information and measurement data to continue the exam.

If you want to select patient data in an external memory database, first allow the system to load the patient data to the system's patient database.

■ Recycle bin

The recycle bin is used to store deleted patient data, exam data and images.

To recover deleted patient data, click  in the bottom-right corner of the screen (when the button is gray, the operation is unavailable) to enter the Patient Recycle Bin screen.

(1) Select items to be recovered in the list. Select operations:

- Click [Restore Items] to restore the item to iStation.
- Click [Delete] to delete the item permanently. The item can never be restored again.
- Click [Restore All Items] to restore all the items to iStation.
- Click [Empty Recycle Bin] to empty the recycle bin. All the items can never be restored again.

(2) Click [Exit] to exit the Recycle Bin screen.

NOTE: If there are more than 200 records in recycle bin, the system will ask you to clear the bin or not. Mindray recommends you clear the recycle bin regularly.

10.5 iStorage

iStorage is used to save image files and measurement reports to the remote PC server.

Open “[Setup] → [Network]→[iStorage]” to set the iStorage settings (see “12.9.1 iStorage Preset” chapter for details).

1. Enter the iStation screen. Select one (or more than one) patient data or image in the local data source.
2. Click [Send Exam].
3. Select [iStorage] in the Send To dialog box and select the PC server on the right.
4. Select PC transfer format to send the report.
5. Click [OK] to start sending.

To use iStorage function, you need UltraAssist software in 2.0 version (with V1.0 network protocol); consult Mindray service engineer for details.

10.6 Print

10.6.1 Print Setting

For printer connection and driver installation, please refer to “3.7 Installing a Printer” chapter.

■ Print Service Setting

1. Open [Setup] → [Print] and select an existing printer service from the list.
2. Select the printer type in the Property box.
3. Set printing properties.
4. Click [Save] to confirm the setting and exit the preset page.

■ User-defined shortcut key for printing

To use the <Print> key on the system's control panel, you may need to:

1. Press the <F10 Setup> key to show the Setup menu. Click the [System] item to open the [System] screen, and click the [Key Config.] tab.
2. Click to select “Print” on the left. Click to select the desired print key on the right.
3. Click [Save] to exit the preset and make the settings effective. Press the <Print> key on the control panel to print.

■ Output settings:

Open [Setup] → [System] → [General], then select the video output mode: PAL or NTSC.

Open [Setup] → [System] → [General], then select the digital output mode: Full screen or stand area.

10.6.2 Image Printing

Image printing is mainly achieved by video printer. For DICOM image printing, see the DICOM chapter.

■ Modify a print service:

- (1) Select an existing printer service from the list.
- (2) Select the printer model, then set the properties in the Property box.
- (3) Click [Save] to complete.

■ Image print

1. Select the desired image in the iStation or Review screen.

2. Click the  icon on the top right side of the image, and select the printer in the dialog box which appears.
3. Click [OK] to start printing.

See the accompanying printer manuals for more details.

10.6.3 Report Printing

Both reports and images can be printed on a graph/text printer.

1. Press <Report> to enter the report dialog box.
2. Select [Print] on the touch screen to print the report.

See the accompanying printer manuals for more details.

10.7 Back Up Files using the DVD Drive

The system supports writing data to CD/DVD using the DVD-RW/DVD+RW drive and reading data from CD/DVD on the PC.

The system supports the following media: DVD+RW, DVD+R, CD-RW, CD-R, DVD-R and DVD-RW.

■ To write data to a CD/DVD:

- (1) Put a CD/DVD in the tray.
- (2) Select the data to be backed up. Select [Send Exam] or [Back up Exam] in the menu which appears. Select the target drive in the Send To or Back Up Patient Record dialog box.
- (3) Click [OK] or [Back up] to begin writing when the  symbol displays.
- (4) After the writing process is complete, click  to bring up the Disc Option dialog box, and select [Eject] to eject the CD/DVD.

Tip:

- Writing data using “Send To” supports the PC format transfer function, while CD/DVD writing using “Back Up” supports only system-relevant formats.
- The  symbol indicates that the input CD/DVD is damaged or contains data in an incorrect format.

You can check the data writing procedure in the patient task manager. For details, see “10.8 Patient Task Management.”

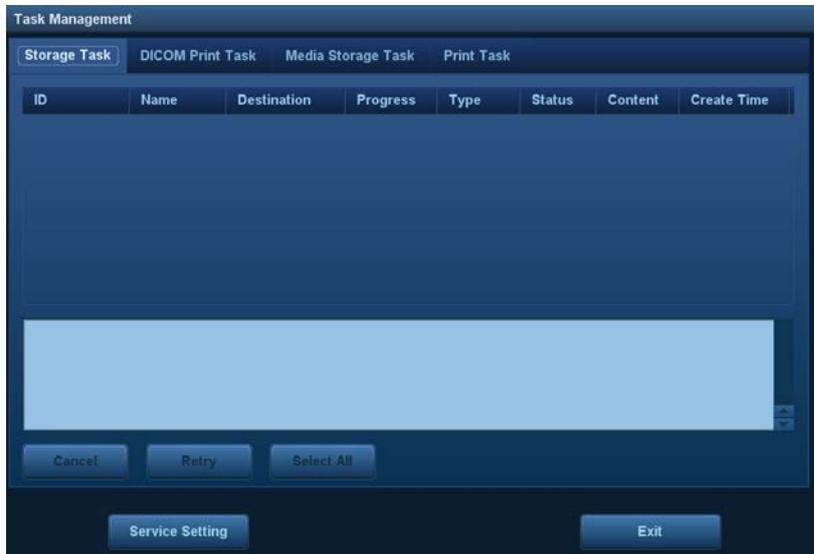


CAUTION:

During the backup process, if a CD/DVD is forcibly taken out or you perform other operations, the backup process will fail or the system may malfunction.

10.8 Patient Task Management

Click  in the bottom-right corner of the screen to bring up the following dialog box:



The system supports following types of task management:

- Storage Task: displays the DICOM storage task.
- DICOM Print Task: displays the DICOM print task.
- Media Storage Task:
 - DICOM media storage task (including disc and USB devices): in iStation screen, select the target exam and click [Send Exam], then click DICOMDIR in the menu which appears.
 - Back up task (system-relevant format): select the exam to be backed up in iStation and click [Back Up Exam].
 - Send to external devices (including disc and USB devices): select exam data or images in the iStation or Review screen. Click [Send Exam] or  for the image.
 - iStorage task: in iStation screen, select the target exam and click [Send Exam], then click iStorage in the menu which appears.
 - MedTouch/MedSight storage task:
 - In iStation screen, send exam to MedTouch/MedSight devices.
 - On review screen, iStation screen, thumbnail area, send the image(s) to MedTouch/MedSight devices.
- Print Task: displays image or report printing tasks.

In the Task Management dialog box, the patient ID, name, destination, progress, type, contents and task created time are displayed.

You can perform the following operations:

- Click [Delete] to delete the task.
 - Click [Retry] to retry the failed task.
 - Click [Select All] to select all the tasks.
- Task Status

When there are tasks underway, the task management icon displays as . Click the icon to check the process.

When tasks have failed, the task management icon displays as . Click the icon to check the reason for the failure.

When the task management icon displays as , it means no task is underway or has failed.

- **DICOM Service Setting**

On the Storage Task and DICOM Print Task page, click [Service Setting] to enter the DICOM service setting screen. For details, see the DICOM chapter.

- **Troubleshooting**

If a serious error occurs, such as network disconnection or operation timeout, the system can try to reconnect the network. The interval time and maximum retries can be set as desired. For details, see the DICOM chapter.

10.9 Administration

10.9.1 Access Setting

The system supports two types of users: system administrator and operator.

- **Administrator**

The system administrator can view all patient data, such as patient information, images and reports, etc.

- **Operator**

The operator can only view exam information saved in the system and operated by him or herself, such as patient information, images and reports, etc. The operator cannot view exam data operated by others.

10.9.2 Setting Access Control

The system administrator can preset the access controls, that is, whether an operator has the right to access data in the system.

Access control only can be set by the system administrator.

Setting access control:

1. Open the “Admin” page using the path: [Setup] → [System] → [Admin].
2. If  **Enable User Account Control** is selected, you must be authorized before accessing the data. If unselected, you can access all the data without authorization.

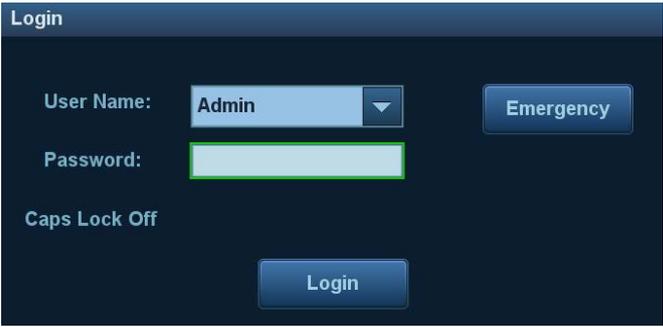
10.9.3 System Login

If access control has been set by the system administrator, you can access data in the system only after logging onto the system.

You must log in again after system restart or dormancy.

- **Logging onto the system:**

1. The following dialog box appears:



The image shows a 'Login' dialog box with a dark blue background. It contains the following elements: a 'User Name:' label followed by a drop-down menu showing 'Admin' and a small downward arrow; an 'Emergency' button to the right of the drop-down; a 'Password:' label followed by a text input field with a green border; a 'Caps Lock Off' indicator below the password field; and a 'Login' button at the bottom center.

2. Select the user name in the User Name drop-down list.

3. Enter the password and click [Log in].

■ To change users:

1. To log out the current user and change to another user, click  in the bottom-right corner of the screen to bring up the dialog box.

2. Click [Change User] to bring up the Login dialog box.

3. Enter the user name and password in the field box.

■ Lock the system

1. Click the  in the bottom-right corner of the screen to bring up the dialog box.

2. Select [Lock Machine] and the system is locked. You must log on before using the system.

10.9.4 Add/Delete Users

The system administrator can add and delete users, while the operator cannot.

Add a User

Turn on the access control function before you add the user.

1. Open the “Admin” page using the path: [Setup] → [System] → [Admin].

2. Click [Add] to bring up the dialog box.

3. Select the user type and enter the user name and password.

4. Click [OK] to confirm the setting and exit the dialog box. The new user will appear in the User List.

Delete a User

Turn on the access control function before you delete the user.

1. Open the “Admin” page using the path: [Setup] → [System] → [Admin].

2. Select the user to be deleted in the User List. Click [Delete] to delete the selected user.

10.9.5 Modify Passwords

The system administrator can modify all user passwords. The administrator password is empty by factory default. You can set this password.

An operator can only modify his/her own password. There are two ways to modify passwords: on the “Admin” page or in the “Session Manage” dialog box.

■ “Admin” page (administrators can modify the password)

1. Open the “Admin” page using the path: [Setup] → [System] → [Admin].

2. Select the user name to be modified in User List. Click [Change Password] to open the dialog box.

3. Enter the new password and confirm the password, then click [OK].

■ Session Manage page (general operators and administrators can modify the password).

When the user has logged onto the system,  is visible in the bottom-right corner of the screen.

1. Click  in the bottom-right corner to bring up the Session Manage dialog box where you can see the current user’s information.

2. If you want to modify the current password, click [Change Password] to bring up the Change Password dialog box.

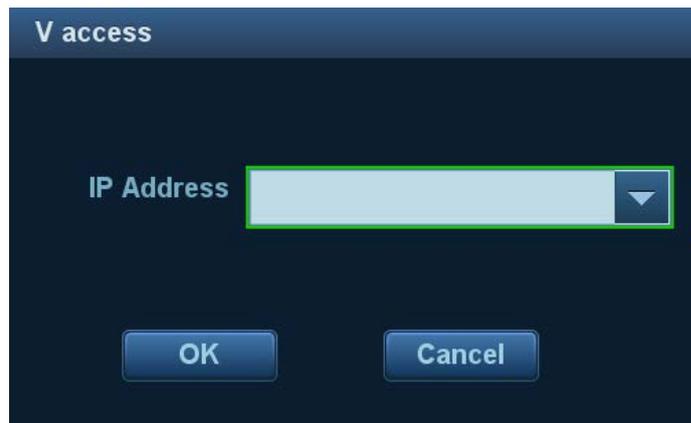
3. Enter both the previous and new passwords in the dialog box.

4. Click [OK] to exit.

10.10 V-Access

The ultrasound system can be used to log on to a remote server to check or modify patient data on the server.

1. Set the user-defined key via the path: [Setup] → [System] → [Key Config]. Select a key in the Key Function field on the left side, and select “V Access” in the Other page of the Function field on the right side.
2. Press the user-defined key to use the function.
3. The system brings up a dialog box for entering the IP address of the remote server.



4. Enter the IP address and click [OK].
5. Log on with the server account and password.
6. Check the data transferred and carry out operations as necessary.

11 DICOM/HL7

NOTE: Before using DICOM, read the DICOM CONFORMANCE STATEMENT electronic file provided with the device.

The chapter is restricted to the preset, connection verification and DICOM services of the DICOM-configured ultrasound machine, and does not include SCP configurations such as PACS/RIS/HIS.

The DICOM package is optional. For details, see “2.5.3 Options”.

This system supports the following DICOM functions:

- Verify Connectivity
- DICOM Storage
- DICOM Print
- DICOM Worklist
- MPPS (Modality Performed Procedure Step)
- Storage Commitment
- Query/Retrieve
- Structured Report
- DICOM Medium Storage (DICOMDIR Review)
- DICOM Task Management

DICOM Preset and Applications workflows are briefly described as follows:

1. DICOM preset (network property, DICOM local preset, server and service preset).
2. Verify connectivity (click [Verify] in corresponding screen).
3. Services application.
4. DICOM task management.

■ Terms

Abbreviations	Description
DICOM	Digital Imaging and Communications in Medicine
AE	Application Entity
MPPS	Modality Performed Procedure Step
PDU	Protocol Data Unit
SCU	Service Class User (DICOM client)
SCP	Service Class Provider (DICOM server)
SOP	Service-Object Pair

11.1 DICOM Preset

11.1.1 IP Preset

See “Appendix D Wireless LAN” for details.

11.1.2 DICOM Local Preset

1. Enter the DICOM local preset screen using the path: [Setup] → [DICOM/HL7].
2. Enter AE Title, Port and PDU according to the actual situation, then click [Save] to exit the screen. Setting items are introduced in the following.

Name		Description
DICOM Local	AE Title	Application Entity title.
	Port	DICOM communication port.
	PDU	Maximum PDU data package size, ranging from 16384 to 65536. If the value is less than 16384 or greater than 65536, the system automatically sets it to the value 32768.
Server Setting	Device	Name of the device supporting DICOM services.
	IP Address	IP address of the server.

Name	Description
Ping	You can ping other machines after entering the correct IP address. You can also select a server in the Device list to ping it.
Device List	Displays the added device.
Set DICOM Service	Provides server settings of DICOM service. For details, see the following chapters.
Add	Click to add servers to the Device List.
Delete	Click to delete selected servers from the device list.

■ Server setting procedure:

1. Enter the server device name and IP address. Click [Ping] to check the connection.
2. Click [Add] to add the server to the device list. Its name and address are displayed in the list.

Tip:

The AE Title should be the same as the SCU AE Title preset in the server (PACS/RIS/HIS). For example, if the AE Title of the server preset in the storage server is Storage, and the AE Title of the accepted SCU is preset as Machine, then in the figure above, the AE Title of Local should be Machine, and the AE Title of the storage server should be Storage.

11.1.3 Service Preset

The DICOM Service screen is used to set Storage, Print, Worklist, MPPS, Storage Commitment and Query/Retrieve attributes.

When the system is configured with the DICOM basic function module, and installed with DICOM Worklist, MPPS, DICOM structured reports and DICOM query/retrieve modules, the corresponding preset can be found in the DICOM Service screen.

To open the DICOM Service screen:

1. Press the <F10 Setup> key to show the Setup menu.
2. Select [DICOM/HL7] and click [Set DICOM Service] to open the DICOM Service preset screen.

11.1.3.1 Storage Service Preset

1. On the DICOM Service screen, click the [Storage] page tab to enter the Storage page.
2. Select a device and enter the correct AE Title, port, etc.
3. Click [Add] to add the service to the Service List.

DICOM Service mindray

Storage | Print | Worklist | MPPS | StorageCommitment | Query/Retrieve | HL7Query

Configure the New Service

Device: **server** Service Name: **server-Storage** AE Title: Port: **104**

Maximum Retries: **3** Interval Time(Sec): **15** Timeout(Sec): **15**

Cine Zoom Mode: **Original** Compression Mode: **Uncompressed** Compression Ratio: **Lossless**

Color Mode: **Color** Allow Multiframe Max Framerate: **35** 3D/4D: **Normal**

SR Storage Option: **Not Store SR** Encapsulated PDF

Add **Cancel** **Update**

Service List

	Device	Service Name	AE Title	Port	Default
1	server	server-Storage		104	N

Delete **Default** **Verify** Verification is required!

Exit

DICOM storage preset items are described as follows:

	Name	Description
Configure New Service	Device	After setting the servers in the DICOM Preset screen, the names will appear in the drop-down list. Select the name of the storage server.
	Service Name	The default is xxx-Storage, user-changeable.
	AE Title	Application Entity title. It should be consistent with that of the storage server.
	Port	DICOM communication port, 104 is the default. The port should be consistent with that of the storage server port.
	Maximum Retries	Set the maximum retries.
	Interval Time(s)	Interval time for the system to retry a connection.
	Timeout	Refers to the amount of time after which the system will stop trying to establish a connection to the service.
	Cine Zoom Mode	Select the cine zoom mode during image file storage.
	Compression Mode	Select the compression mode: uncompressed, RLE, JPEG and JPEG2000.
	Compression Ratio	Select the JPEG compression ratio: lossless, low, medium and high.
	Color Mode	Select the color mode.
	Allow Multiframe	If SCP supports this function, select it.
	Max. Frame Rate	Set the frame range for transferring cine files to DCM multi-frame files.
	3D/4D	/
	Service List	SR Storage Option
Encapsulated PDF		Select whether to encapsulate PDF format reports in DICOM standard.
Add		Add the DICOM service to the service list.
Cancel		Click to cancel parameter setting.
Update		Select an item in the service list, change the parameters in the above area, and click [Update] to update the item in the service list.
Delete		Click to delete the selected service from the service list.
Service List	Default	Select an item in the service list. Click [Default] and you will see "Y" in the Default column.
	Verify	Click to verify that the two DICOM application entities are properly connected.

Tip: RLE, JPEG and JPEG2000 are not supported by all SCPs. Refer to the SCP's DICOM CONFORMANCE STATEMENT electronic file to check whether SCP supports it or not. Do not select these compression modes if the storage server does not support them.

- Images of PW/M/TVM/TVD mode (B image is not frozen) and images other than PW/M/TVM/TVD mode: if "Max Frame rate" is not "Full" and the actual frame rate is larger than the set value, the system will save the image files in a frame rate of the set value, and transfer in a frame rate of B mode.

- Images of PW/M/TVM/TV mode (B image is frozen), the system will save/transfer the images files in frame rate of 6.

11.1.3.2 Print Service Preset

1. On the DICOM Service screen, click the [Print] page tab to enter the Print page.
2. Select a device and enter the correct AE Title, port, etc.
3. Click [Add] to add the service to the Service List.

DICOM print preset items are described as follows:

Name		Description
Configure New Service	Device	After setting the servers in the DICOM Preset screen, the names will appear in the drop-down list. Select the name of the print server.
	Service Name	The default is xxx-Print, user-changeable.
	AE Title	Application Entity title. It should be consistent with that of the print server.
	Port	DICOM communication port, 104 is the default. The port should be consistent with that of the print server port.
	Maximum Retries	Set the maximum retries.
	Interval Time(s)	Interval time for the system to retry a connection.
	Timeout	Refers to timeout during association establishment.

	Name	Description
Print Properties	Copies	See copies of printed files. You can select from 1 to 5, or directly enter the number.
	Settings	The system supports RGB (color printing) and MONOCHROME2 (black and white printing). Please select the type the printer supports.
	Film Orientation	Select from between LANDSCAPE and PORTRAIT.
	Priority	Specify printing task priority from HIGH, MED and LOW.
	Film Size	Select film size from the selections listed in the drop-down list.
	Display Format	Specify the quantity of printed files, e.g., STANDARD\3, 2 indicates 6 images are printed for each page.
	Medium Type	Specify print medium: Paper, Clear Film, Blue Film. Select Blue Film or Clear Film for black and white printing; select Paper for color printing.
	Trim	Specify whether you want a trim box to be printed around each image on the film: Yes or No.
	Configuration Info	Enter configuration information in the field.
	Min. Density	Enter the minimum density of the film.
	Max. Density	Enter the maximum density of the film.
	Destination	Specify where the file is exposed: MAGAZINE (stored in the magazine) or PROCESSOR (exposed in the processor).
	Magnification Type	Select how the printer magnifies an image to fit the film. Replicate: interpolated pixels belong to duplicates of adjacent pixels) Bilinear: interpolated pixels are generated from bilinear interpolations between adjacent pixels Cubic: interpolated pixels are generated from cubic interpolations between adjacent pixels None: without interpolation.
	Add	Add the DICOM service to the service list
	Cancel	Click to cancel parameter preset.
Update	Select an item in the service list, change the parameters in the above area, and click [Update] to update the item in the service list.	
Service List	Delete	Click to delete the selected service from the service list.
	Default	Select an item in the service list. Click [Default] and you will see "Y" in the Default column.
	Verify	Click to verify that the two DICOM application entities are properly connected.

11.1.3.3 DICOM Worklist Preset

1. On the DICOM Service screen, click the [Worklist] page tab to enter the Worklist page.
2. Select a device and enter the correct AE Title, port, etc.
3. Click [Add] to add the service to the Service List.

The DICOM Worklist service parameters are similar to those described in DICOM Storage Preset. See “11.1.3.1 Storage Service Preset” for details.

11.1.3.4 MPPS Preset

1. On the DICOM Service screen, click the [MPPS] page tab to enter the MPPS page.
2. Select a device and enter the correct AE Title, port, etc.
3. Click [Add] to add the service to the Service List.

The DICOM MPPS service parameters are similar to those described in DICOM Storage Preset. See “11.1.3.1 Storage Service Preset” for details.

11.1.3.5 Storage Commitment Preset

1. On the DICOM Service screen, click the [Storage Commitment] page tab to enter the Storage Commitment page.
2. Select a device and enter the correct AE Title, port, etc.
3. Click [Add] to add the service to the Service List.

A special setting item for the DICOM Storage Commitment service is the Associated Storage Service, as described in the following. Other parameters are similar to those described in DICOM Storage Preset. See “11.1.3.1 Storage Service Preset” for details.

Name	Description
Associated Storage Service	The associated storage server should be preset before storage commitment. Storage commitment can only be created after the exam is sent out.

11.1.3.6 Query/Retrieve Preset

1. On the DICOM Service screen, click the [Query/Retrieve] page tab to enter the Query/Retrieve page.
2. Select a device and enter the correct AE Title, port, etc.
3. Click [Add] to add the service to the Service List.
4. Click [Exit] to confirm the preset and exit the page.

The DICOM Query/Retrieve service parameters are similar to those described in DICOM Storage Preset. See “11.1.3.1 Storage Service Preset” for details.

11.1.3.7 HL7Query Preset

HL7 protocol, enacted by Health Level Seven organization in 1987, is a 7th layer (application layer) based on the OSI model (Open System Interconnection) released by ISO (International Standard Organization). HL7 is used to rule and manage communications between HIS/RIS system and devices, as well as reduce the intercommunication cost.

The following HL7 protocol versions are supported in the ultrasound system: V2.3, V2.4, V2.5 and V2.6.

1. On the DICOM Service screen, click the [HL7Query] page tab to enter the HL7Query preset page.
2. Select a device and enter the correct AE Title, port, etc.
3. Click [Add] to add the service to the Service List.

Two special setting items for the HL7Query service are the Listen Port and Listen Mode, as described in the following. “Verify” function is not available under HL7Query preset. Other parameters are similar to those described in DICOM Storage Preset. See “11.1.3.1 Storage Service Preset” for details.

Name	Description
Listen Mode	This function enables the ultrasound system to use the listen port for data receiving.
Listen Port	Port for ultrasound system to receive data after the listen mode function is activated. Here, the port should be consistent with that of the Worklist server port. For details of listen port setting, refer to settings in the server.

11.1.3.8 Other Settings

You can configure different type of DICOM services in different scenarios. See “12.1.7 Admin” chapter for details.

11.2 Verify Connectivity

To verify connectivity (not essential), click the [Verify] button on the Storage, Print, Worklist, MPPS, Storage Commitment and Query/Retrieve pages respectively.

If the verification is successful, the system displays “xxx Verify Succeed.” Otherwise, it displays “xxx Verify Failed.”

If verification failed, possible causes may be:

- The ultrasound machine cannot communicate normally with the server. Check that the cable is properly connected, or, Check that the IP of the server is configured in the same segment as that of the ultrasound machine, or, Check that the network adapter, router, exchanger and HUB are working normally.
- The server does not support the verification. If the connection is normal, it can be concluded that the server does not support the verification.
- The server supports the verification, but this function is not activated. Please check that the verification function is activated.

Tip:

Not all SCPs can support verification. See the SCP properties to confirm whether the SCP can support this service. If not, the verification will not be successful.

11.3 DICOM Services

If all the DICOM presets on the DICOM Service Preset screen are completed, you are ready for the Storage, Print, Worklist (HL7 Query), MPPS, Storage Commitment and Query/Retrieve applications.

11.3.1 DICOM Storage

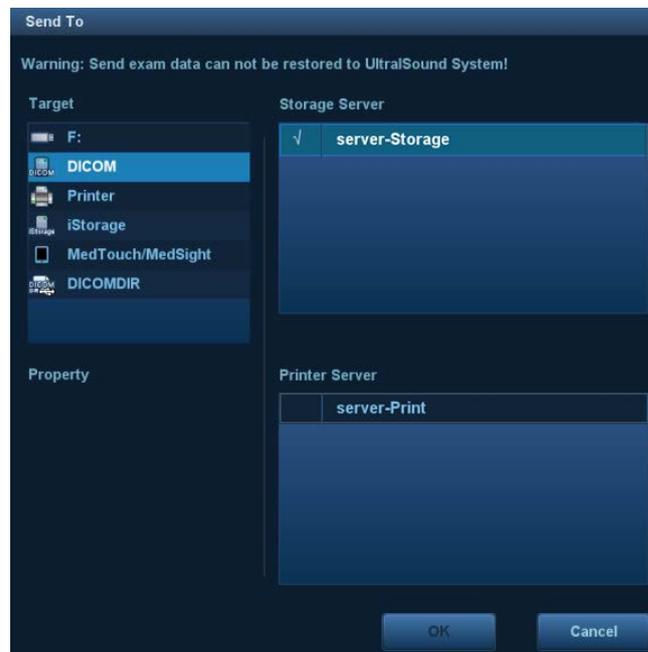
DICOM Storage is used to send images to the DICOM storage server for storage.

■ Send images on iStation/Review/main screens

(1) Select images

- Press <iStation> on the control panel to open the iStation screen. Click to select a patient or an exam record in the list. Thumbnails are displayed in the thumbnail area in the lower part of the screen, then click to select a thumbnail or several thumbnails. Or
- Press <Review> on the control panel to enter the Review screen. Click to select a thumbnail or several thumbnails. Or
- On the main screen, select a thumbnail or several thumbnails.

(2) Click  in the top-right part to bring up the following dialog box.



(3) Click to select “DICOM” in the Target box on the left side, then select the DICOM storage server in the Storage Server box on the right side.

(4) Click [OK] to start sending.

■ To send images using a shortcut key

You can save single-frame images or multi-frame images to a DICOM server while saving to hard drive using a shortcut key. The procedure is as follows:

(1) Define the key. For details, see “10.2.8 Auxiliary Output Function”.

(2) Set a default storage server:

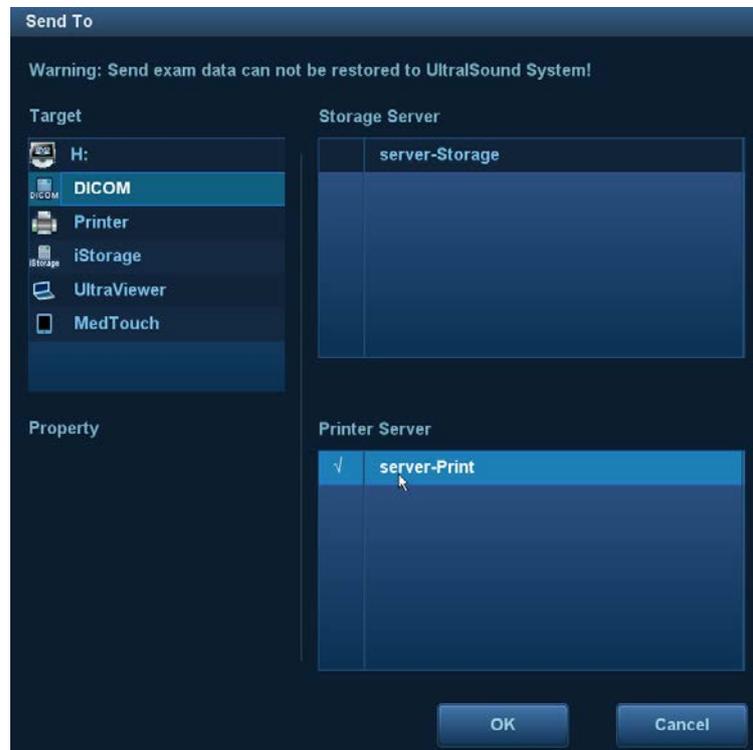
- a) Enter the DICOM Service Preset screen via “[Setup]→ [DICOM Preset] → [Set DICOM Service].”
- b) Select a storage server in the Service List and click [Default]. You will see “Y” marked in the Default column.

- c) Click [Exit] to exit the page and return to the Setup menu, then click [Save] on the Setup menu to make the preset take effect.
- (3) Press the key to send to DICOM storage.
- To send images to storage after an exam ends
 - (1) Open “[Setup]→ [System] → [General]” and then check  in the Patient Info area.
 - (2) Set a default storage server.
 - a) Enter the DICOM Service Preset screen via “[Setup]→ [DICOM Preset] → [Set DICOM Service].”
 - b) Select a storage server in the Service List and click [Default]. You will see “Y” in the Default column.
 - c) Click [Exit] to exit the page and return to the Setup menu, then click [Save] on the Setup menu to make the preset take effect.
 - (3) After finishing the presets, perform image scanning. Each time <End Exam> is pressed on the control panel, the system will send the image to the default DICOM storage server for storage.

11.3.2 DICOM Print

DICOM Print is used to send images to the DICOM print server for printing.

- Print images on iStation/Review/main screens
 1. Select images. Operations are the same as for DICOM storage.
 2. In the Send To dialog box, select a DICOM print server. (For the dialog box, see DICOM Storage).



3. Click [OK] to begin printing.
- To send images using a shortcut key

You can send single-frame images to a DICOM print server while saving to hard drive using a shortcut key.

1. Define the short key. For details, see “10.2.8 Auxiliary Output Function”.
 2. Set a default printer server.
 - a) Enter the DICOM Service Preset screen via “[Setup]→ [DICOM Preset] → [DICOM Service].”
 - b) Click [Print] to open the Print page.
 - c) Select a Print server in the Service List and click [Default]. You will see “Y” marked in the Default column.
 - d) Click [Exit] to exit the page and return to the Setup menu, then click [Save] on the Setup menu to make the preset take effect.
 3. Press Key1 (defined as the shortcut key for Save Image to Hard Disk and Send to DICOM Printer). The system captures the current screen and sends it to the print server.
- To print images for storage after an exam ends
- (1) Open “[Setup]→ [System] → [General]” and then check  in the Patient Info area.
 - (2) Set a default print server.
 - a) Enter the DICOM Service Preset screen via “[Setup]→ [DICOM Preset] → [DICOM Service].”
 - b) Click [Print] to open the Print page.
 - c) Select a Print server in the Service List and click [Default]. You will see “Y” marked in the Default column.
 - d) Click [Exit] to exit the page and return to the Setup menu, then click [Save] on the Setup menu to make the preset take effect.
 - (3) After finishing the presets, perform image scanning. Each time <End Exam> is pressed on the control panel, the system will send the image to the default DICOM print server for printing.

11.3.3 DICOM Worklist

For details, see “4.1.2.2 Worklist”.

11.3.4 MPPS

MPPS is used to send exam state information to the configured server. This facilitates the other systems in obtaining the exam progress in time.

The status information is described as follows:

- When you begin an exam or send images during an exam, the system sends “Active” status information to the MPPS server.
- When the exam is complete, the system sends “End” status information to the MPPS server.
- When a paused exam is continued, the system sends “Active” status information to the MPPS server.
- When an exam is canceled, the system sends “Canceled” status information to MPPS server.

11.3.5 Storage Commitment

Storage commitment is used to confirm whether the images or structured reports are successfully stored on the DICOM storage server.

Before using storage commitment, set the associated storage service.

- Storage commitment after sending images on the iStation screen.

1. Open the iStation screen.

2. Select an exam (a suspended exam or an inactive exam) (images are stored in the exam record). Click the [Send Exam] button in the menu which appears to open the Send To dialog box.
3. Click to select "DICOM" in the Target box on the left side, then select the DICOM storage server in the Storage Server box on the right side.
4. Click [OK] to start sending. The system will send all the images stored in the exam record to the storage server. Meanwhile, it will send storage commitment to the storage commitment server.

■ To send storage commitment after an exam ends

1. Open [Setup] → [System] → [General], then check  Sending/printing after End Exam in the Patient Info area.
2. Set the default storage server and storage commitment server.
 - a) Enter the DICOM Service Preset screen via "[Setup] → [DICOM Preset] → [Set DICOM Service]."
 - b) Set a default server in the Storage page and set an associated storage service in Storage Commitment page.
 - c) Click [Exit] to exit the page and return to the Setup menu, then click [Save] on the Setup menu to make the preset take effect.
3. After finishing the presets, perform image scanning. Each time <End Exam> is pressed on the control panel, the system will send the image to the default DICOM storage server for storage and send storage commitment to the storage commitment server.

If images are successfully sent to the storage server, the storage commitment server will return information about the successful image storage. In the iStation screen, you will see a

tick "√" marked in the list below .

Tip:

Storage commitment is confined to the whole exam. Not each image sending can be indicated.

NOTE: Multi-frame storage is not allowed if "Allow Multiframe" is not selected ([Setup] → [DICOM/HL7] → [Set DICOM Service] → "Storage"). For example, even if there is a multi-frame file in the exam to be sent, only single-frame image storage will be performed. After the storage is complete, there is no "√" marked in the list below  in the iStation screen.

11.3.6 Query/Retrieve

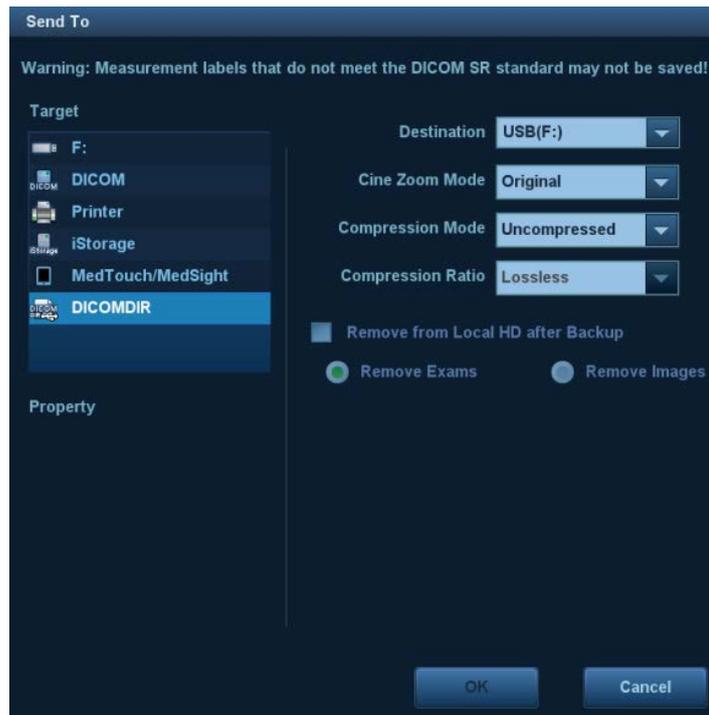
The query/retrieve function is used to query and retrieve patient exam records in a designated server. After setting the DICOM query/retrieve server, you can perform the query/retrieve function in the iStation screen.

1. Open the iStation screen: press <iStation> on the control panel.
2. Click [Query/Retrieve] to open the screen.

3. Select the server in the “Server and Service” area (both the source and the destination).
4. Enter the query information, such as Patient ID, Patient Name, Accession #, Exam Date or key words.
Click [Clear] to empty the entered query information.
5. Click [Query]. The system performs the query and lists the results in the patient (source) list.
You can perform further queries based on the results by entering new query information.
6. Select one or more patient records according to the actual situation.
Click [Select All] to select all the patient records in the list.
Click [Deselect All] to deselect all the patient records in the list.
7. Click [Retrieve] to retrieve the patient records in the DICOM query/retrieve server to the local machine.
8. Click [Exit]. The retrieved patient records are listed in the iStation screen.

11.4 DICOM Media Storage

Patient data in the ultrasound system can be saved on external media in DCM format, while DCM files can be accessed in the ultrasound system.



Media Storage

1. Select patient records in the iStation screen.
2. Click [Send Exam] in the menu which appears to open the dialog box.
3. Select the destination to “DICOMDIR” and DICOM Format as well as compression mode.
4. Click [OK] to begin the storage.

If the backup is successful, a tick will appear in the Backup list in the iStation screen. If not, there will be no tick.

There must be no DICOMDIR/DCMIMG/IHE_PDI files on the external storage media of the same name as the one being backed up. Otherwise, the backup cannot proceed. Ensure there is enough storage space, or the backup may fail due to shortage of space.

Data Restore

After the DICOM format data are saved to external media, restore the data to the ultrasound system.

1. Connect the external media containing DCM files to the system.
2. In iStation, review the data stored on the external media.
3. Select the data to be restored in iStation.
4. Click  on the iStation screen.

NOTE: Only system-accessible media can be selected.

11.5 Structured Report

DICOM OB/GYN Structured reports, Cardiac Structured reports, Vascular Structured reports and Breast Structured reports are supported by this system. They can be sent together with the exam only.

- Send images and structured reports for storage in the iStation screen
 - (1) Select “Attach SR when store images” or “Only Store SR” on the DICOM Storage preset page. For details, see “11.1.3.1 Storage Service Preset.”
 - (2) Create new patient information or load scheduled patient information.

- (3) Perform measurements.
- (4) Save the images.
- (5) End the exam.
- (6) Open the iStation screen, select the patient exam, and click the corresponding [Send Exam] button in the menu which appears in order to open the Send To dialog box.
- (7) Click to select "DICOM" in the Target box on the left side, then select the DICOM storage server in the Storage Server box on the right side.
- (8) Click [OK]. Check for the result in the DICOM Task Management dialog box. After successful storage of both the image and structured report, you will see the storage commitment mark "√" in the list below  in the iStation screen.

The structured report can be sent automatically. For details, see "11.3.1 DICOM Storage."

■ Back up structured report

When recording or storing exams that have structured reports to external media (DICOMDIR), the structured reports can be backed up together.

NOTE: Only the PACS system from the Medstreaming company (<http://www.medstreaming.com/default.aspx>) supports sending self-defined measurements by DICOM SR.

11.6 DICOM Task Management

DICOM Task Management is used for viewing task progress or managing tasks after sending images for storage, printing or media storage. For details, see "10.8 Patient Task Management."

12 Setup

The Setup function is designed to set the configuration parameters of operating the system and maintaining user workflow setup data. The setup data of the user and system are stored to the hard drive, and should be backed up to CD/DVD or USB memory device.

**CAUTION:**

When the preset data is changed, be sure to save the preset data according to the methods described in this chapter. Mindray is not responsible for the loss of preset data.

- To enter Setup:
Press the <F10 Setup> key on the keyboard to enter the setup menu.
- To exit Setup:
Select [Save] in the Setup menu. The parameter settings are saved.
Select [Cancel] in the Setup menu or press <ESC> to close the Setup menu.
When you change the system language and click [OK] in the Setup menu, the system automatically shuts down to make the modification effective.
- Basic operations
The commonly-used setting types are:
 - Text box: position the cursor over the corresponding field box. Enter the desired value using the keyboard or soft keyboard on the soft menu.
 - Radio button: click the button to select an item.
 - Check box: click the checkbox to select one or more options.
 - Drop-down list: click the arrow beside the list to select an item.

12.1 System Preset

The system automatically enters the [System] screen after you enter Setup.



Page	Description
Region	To set the hospital name, language, time zone, time format and system date/time.
General	To set patient information, exam setup, patient management, storage, system dormancy, display and so on.
Image	To set general parameters in imaging modes.
Application	To set the measurement ruler, measurement setting, follicle method, comment setting and so on.
OB	To set the relevant information regarding the fetal gestational age, fetal growth formula and fetal weight.
Key Config.	To assign functions to the foot switch and user-defined keys.
Admin	To set the user account control relevant information.
Scan Code	To set the code parameters for barcode reader.

12.1.1 Region

Open the Region page via [Setup] → [System] → [Region].

Item	Description
Hospital Information	To set the hospital-relevant information such as name, address, telephone, and so on.
Language	To select a language (input) for the system. Available languages are Chinese, English, French, German, Italian, Portuguese, Russian, Spanish, Polish, Czech, Turkish, Norwegian, Serbian, Finnish (can be entered only), Danish (can be entered only), Icelandic (can be entered only), Swedish (can be entered only) and Hungarian (can be entered only).
Load Logo	Import image for logo loading. <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> <p>NOTE: For a better display effect, please try to use an image with 400*400 pixels.</p> </div>
Time Zone	To select the time zone.
Time Format	To select the time format.
Date Format	To set the date format.
System Date	To set the date for the system.
System Time	Move the cursor over the corresponding field and enter the time manually using the keyboard, or, move the cursor over the time segment and press <Set>, then increase or decrease the required value by clicking the icons on the right side.
Time Sync	To assign a time server and make the time of the ultrasound machine consistent with the server.

12.1.2 General

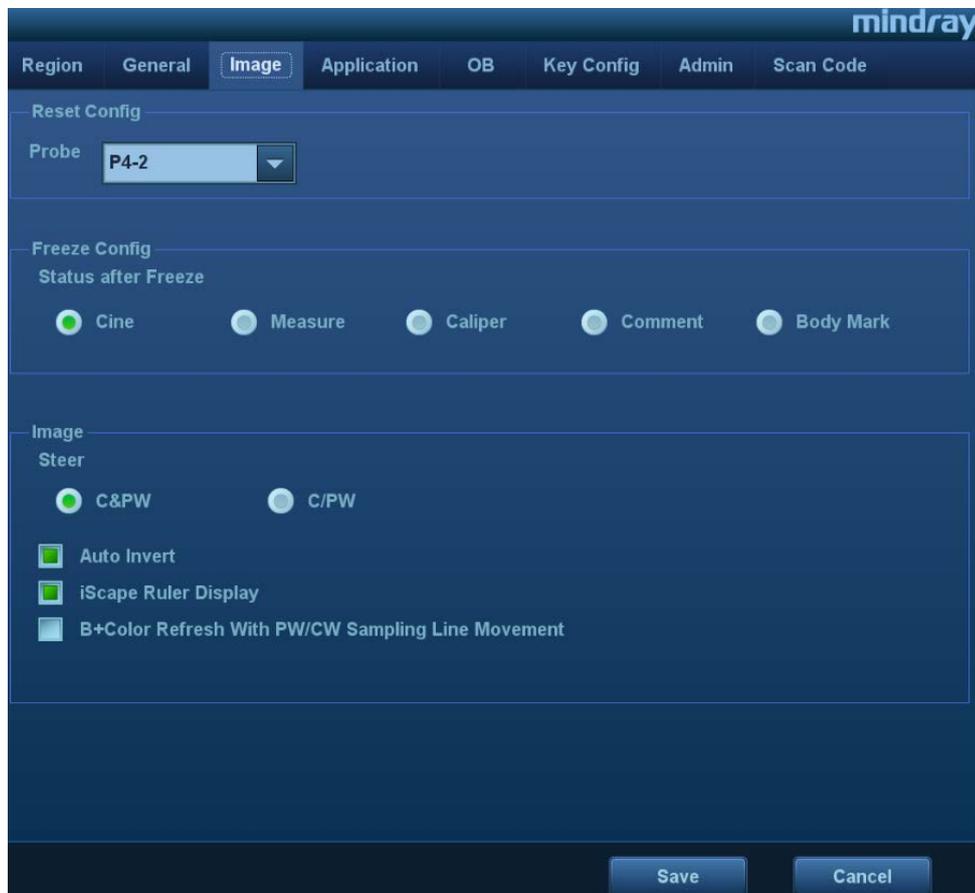
Open the page via [Setup] → [System] → [General].

Type	Item	Description
Patient Info	Info displays in an image banner	To select whether to display the available patient information items on the screen.
	H&W Unit	To set the unit for patient height and weight.
	Surface Formula	To set the surface formula.
Exam Setup	Status after exam ends	To set the system status when an exam ends.
	Sending/printing after End Exam	Select whether to automatically archive the exam data to the DICOM server for storage/print.
Storage	Image size	To set the size for a stored image or text/digital printer printing.
	AVI File Encode Format	Set the code format for AVI transfer. When using the Send To function, the system transfer the image by settings (see “10.2.12 Sending Image Files” for details.)
	Digital Output	To set the size for VGA and HDMI output.

Type	Item	Description
	Analog Output Mode	To select the format for analog signal (video output/ S-Video) output: NTSC or PAL.
	Clip Length	To set the cine length and heart cycle.
	Prospective Cine Length	To set the cine length for prospective live capture.
	Retrospective Cine Length	To set the cine length for retrospective live capture.
Display	Brightness/Contrast Load Factory	To set whether to restore factory settings.
	Touch screen preset	After selection, the system restores the touch screen settings back to factory.
Screen Saver		To select a system dormancy type.
	Enable Screensaver	After the screen saver function is enabled, click [Browse] to select the figure used for the screen saver and click [Preview] to see the effect.
	Enable Standby	To set the delay before the system enters dormancy/standby status in the drop-down list beside "Wait."

12.1.3 Image Preset

Open the page via [Setup] → [System] → [Image].



Type	Item	Description
Reset Config.	Probe	To set the default probe model for the system.
Freeze Config.	Status after Freeze	To set the system status after the image is frozen.
Image	Steer	To set the steer mode in B + Color + PW imaging mode. C&PW: select to adjust the sample volume in color mode and sample line in PW mode together. C/PW: select to adjust the sample volume in color mode and sample line in PW mode separately.
	Auto Invert	The spectrum can automatically invert when the color flow is steered to a certain angle, thus accommodating the operator's wish to distinguish the flow direction.
	iScape Ruler Display	To set whether to display the iScape ruler in iScape imaging mode.
	B+Color Refresh with PW/CW Sampling Line Movement	To set whether to turn on the function that when moving PW/CW sampling line, B image is activated under B+Color+PW/CW mode.

12.1.4 Application

Open the page via [Setup] → [System] → [Application]. On this page, you can set the measurement ruler and relevant information. For details, see the Operator's Manual [Advanced Volume]

12.1.5 OB Preset

Open the page via "[Setup] → [System] → [OB]." On this page, you can set the gestational age formula, fetal growth formula, fetal weight formula and relevant information. For details, see the Operator's Manual [Advanced Volume].

12.1.6 Key Configuration

Open the page via "[Setup] → [System] → [Key Config.]"



■ Key function setting

You can set the functions for <Save>, <Print>, user-defined keys (including F3, F4, F5, F6, F12 and P) and two-finger gesture. See “3.8.4 Touch Screen Operation” for details about two-finger gesture operation.

To assign a function to a key:

- Click to select the desired key in the Key Function column on the left side of the page.
- Click to select a function in the Function area. You can see the available functions selected on the right side.
- Click [Save] to complete the function setting.

■ Foot switch function setting

You can assign a function to the left/middle/right key of the foot switch. The method is similar to setting key functions. See the steps above.

■ Other Settings

Item	Description
Key Volume	To set the key volume at 3 levels, 0 means no sound.
Key Brightness	To set the brightness for the keys.
Trackball Speed	To set the speed of the trackball when moving the trackball.

12.1.7 Admin

Open the page via “[Setup] → [System] → [Admin].”

12.1.7.1 Access Control

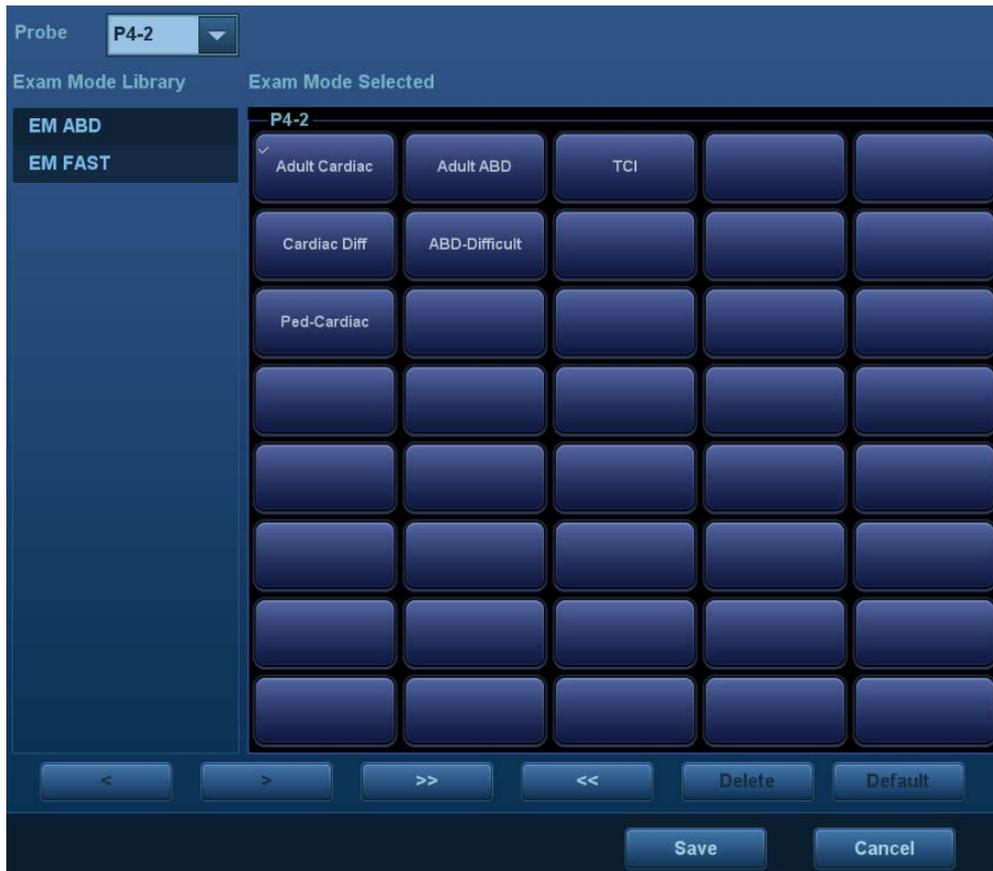
For access control details, see “10.9 Administration.”

12.1.8 Scan Code Preset

See “Appendix B Barcode Reader” chapter for details.

12.2 Exam Mode Preset

Open “[Setup] → [Exam Mode]” to enter the screen.



You can assign available exam modes for probes.

1. To select a probe, move the cursor over the Probe column and select the probe model using the drop-down list.
2. Select/delete exam modes:

On the left side, you can view all the available exam modes in the exam library for the probe. On the right side of the screen, you can view the current exam modes assigned to the probe.

- Select the exam from the Exam Library on the left and click [>] to add it to the Exam Mode Selected.
- Click [<<] to delete all exam modes in the Exam Selected area.
- To delete an exam supported by the current probe, first select the exam and then click [<] to delete it.
- Click [Delete] to delete a user-defined exam in the Exam Mode Library area.
- Click [Default] to set a selected exam mode as the default exam mode. The default exam mode is marked by a “√” in the top-left corner.

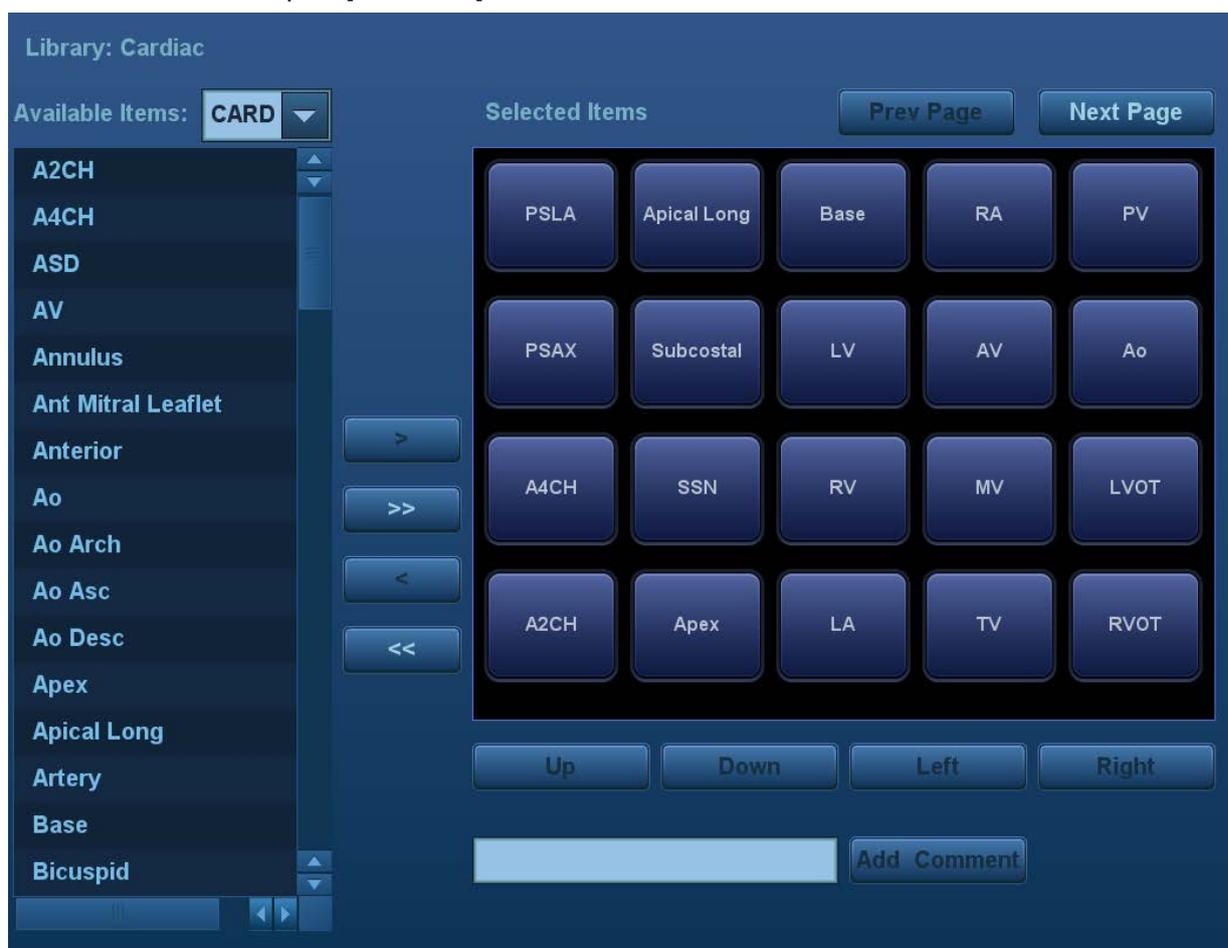
12.3 Measurement Preset

For details about Measurement Preset, see the [Advanced Volume].

12.4 Comment Preset

You can preset the custom comments library for current exam mode. The comments in the library are provided by the system or user-defined ones.

1. Select "<F10 Setup>->[Comment]" to enter Comment Preset:



2. Add comments: directly enter user-defined comment texts, or select comment texts for the comment library.
 - Directly enter user-defined comment texts: posit the cursor in the field box above [Add Comment], enter the text comment through the keyboard, and then click [Add Comment]. Then the directly-entered comment will be added to the Available Items and Selected Items.
 - Select available items: First select a comment library in the drop-down list beside "Available Items", all items will be displayed below "Available Items".
 - Click [>] to add the item in Available Items on the left into Selected Items on the right.
 - Click [>>] to add all items in Available Items on the left into Selected Items on the right.
3. Change position of the selected items: select an item on the right side box and click [Up], [Down], [Left] or [Right] button to change the position of the item.
4. Withdraw or delete a user-defined comment:
 - Withdraw an item (from the library or user-defined) in the Selected Items list: Select an item in Selected Items list, and click [<] to withdraw it to the Available Items list.

Click [<<] to withdraw all items in Selected Items.

- Delete a user-defined item in the Available Items box:

Select a user-defined item in the Available Items box, and click [<].

You can only delete the user-defined items rather than the items in the system library.

After a user-defined item is deleted, it will not be available.

5. After you customize comments, click [Save] to confirm and exit the screen.

12.5 iWorks Preset

For details, see “Appendix C iWorks.”

12.6 Stress Echo Preset

For details, see “5.12.5 Maintenance and Protocol”.

12.7 DICOM/HL7 Preset

For details, see “11.1 DICOM Preset.”

12.8 Print Preset

This screen is used to set up the printer and image printing.

Click [Print] in the preset menu to enter.

■ Printer setting

The printer settings include print service and print driver.



Service Name	Service Type	Printer	Status	Default
Report Print	Report Print		Fail to open	

Buttons: Add Service, Remove Service, Rename Service, Add Printer, Default Print Service

Property

Service Type: Report Print Service Name: Report Print

Printer: [Dropdown]

Paper Size: A4 210.0mm * 297.0mm

● Print Service Setting

- Add Service: click to begin adding print services.
- Remove Service: click to delete the selected print service.
- Rename Service: click to rename the selected print service.
- Default print service: click to set the selected print service as the default one.
- Property: to preset print service properties.

For details about adding printers, see “3.7 Installing a Printer.”

■ Image Settings

Click [Image Setting] to enter the page, you can set the brightness, contrast and saturation of image printing, or you can use the default values.

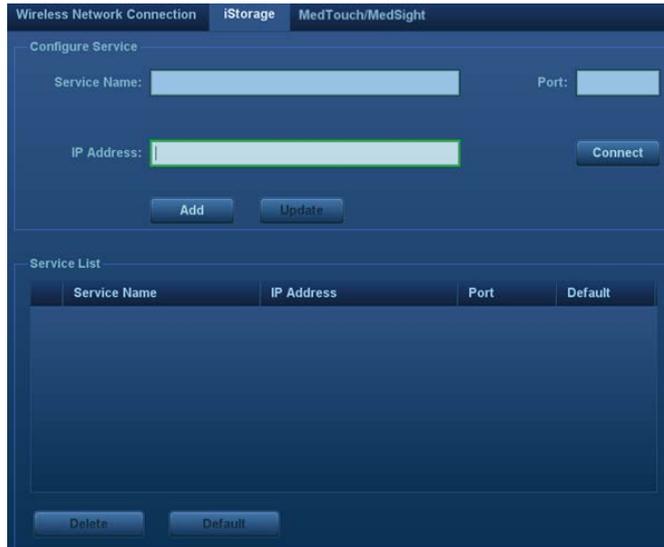
12.9 Network Preset

Parameters for transferring are set here. For details of local IP setting, see “Appendix D Wireless LAN”.

12.9.1 iStorage Preset

You can send exam data or images to the iStorage server and perform analysis using UltraAssist. For details about this feature, see the UltraAssist manual.

- The iStorage screen is as follows:



Name	Description
Service Name	The name of the iStorage service.
IP Address	IP address of the iStorage service device.
Port	Port for transmitting.
Connect	Click to verify connection.
Add	Click to add the Network service to the service list.
Update	To save the changed parameters.
Delete	Click to delete the selected service from the service list.

- Add an iStorage service
 1. Set the iStorage server properties as described above.
 2. Click [Add] to add the service to the Service list.
- Modify a network service
 1. Select the service to be updated in the service list.
 2. You can see properties in the Configure Service area.
 3. Modify the parameters and click [Update] to update the setting.

12.9.2 Wireless Network Connection

You can set DC-60 system as a hotspot. When other devices (with available wireless network function) are connected to the DC-60 system, DICOM, iStorage and network print function can be implemented this way.

- Turn on hosted network function:
 1. Select [Wireless Network Connection] page in Network Preset screen.
 2. Confirm the Wi-Fi is enabled: you see [Disable Wifi] in the screen.
 3. Enter the name and password for this hotspot in the Hosted Network box.
 4. Click [Start] to enable the function.
 5. Use other devices to search and connect to this network.

12.9.3 MedTouch/MedSight Preset

You can set environment for MedTouch/MedSight here and then use the MedTouch/MedSight function by mobile phone or tablet computers. See MedTouch/MedSight manual for details.

12.10 Maintenance

In the Setup menu, select [Maintenance] to enter the screen.

The [Maintenance] function is designed for you to import or export user data, restore factory setting and export log. You may also execute self-test and option installation/trial through the maintenance menu.

If you require other maintenance functions, please contact Mindray Customer Service Department or sales representative.

12.10.1 Option

The system enters the Option page after entering the Maintenance screen. In the Option list, the system lists all the system-supported options and their installation status (not installed or installed).

- Install and uninstall
 - Click [Install] to begin installing a disabled option.
 - Click [Uninstall] to begin uninstalling a previously-installed option.

Please contact the Mindray Customer Service Department or a sales representative for details.

12.10.2 Exporting Setup Data

This function is used to write all setup data of the system into a disk for backup. The format of the data file is .PDP.

You can select 3 types of preset data to export from the system:

- General module preset data: including “All Preset”, “Image Preset”, “iWorks Preset” and “DICOM/HL7” data.
- Exam mode related preset data, including all image setting, comment and body mark setting and measurement setting data.

Procedures:

1. Select the target module.
2. Click [Export] to open the [Export Data] screen.
3. Select the path to save the data.
4. Select the exported file and type as PDP and click [OK].

12.10.3 Importing Setup Data

This function is used to import the existing setup data to the setup data memory of the system. The system will reset and operate according to the setup preferences that were imported.

Procedures:

1. Click [Import] to open the Load Data screen.
2. Select the imported file.
3. Click [OK], a progress bar will appear and the setup data is imported to the specified path.
4. To restore the factory setup data, click [Load Factory] on the right side of the screen.

You can use [Export All], [Import All], or [Load Factory] at the bottom of the screen to export/import all setup data of the system or restore all factory setup data of the system. The operating methods are the same as those mentioned above.

12.10.4 Other Settings

Item		Description
Load Factory		Local factory default settings.
Option		You can trial each option for 3 months at most. Each option can only be trialed once.
Setup	Export Log	Export the log.
	Self-Test	Perform system self-test and restart the machine.
	Recover	Recover the ultrasound system (including Operating System and Doppler).
	Enter Windows	For this function, you need a one-time password, please contact the service engineer or your agent.

If you have any questions, please contact the service engineer or your agent.

12.11 System Information

Click [About] on the Setup menu to enter the system information screen.

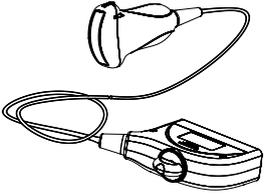
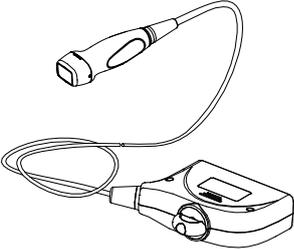
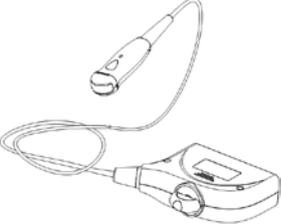
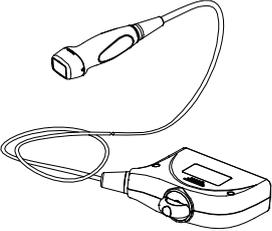
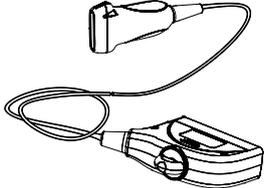
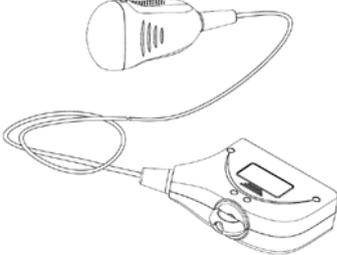
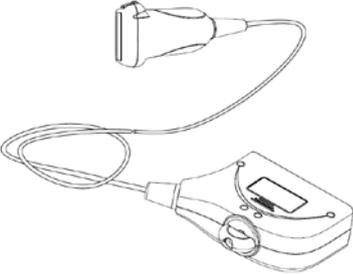
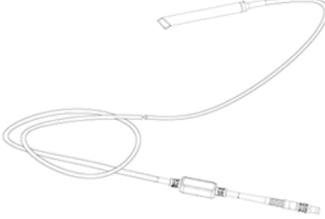
This screen displays the system software version, WLAN module FCC version and versions of other modules. You cannot edit the information, only view them. The information varies depending on the system configurations and version.

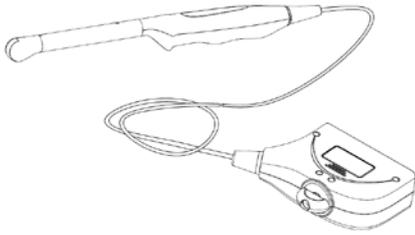
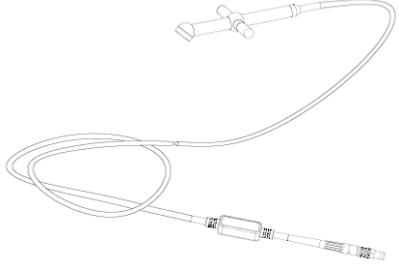
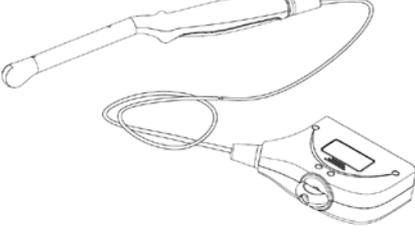
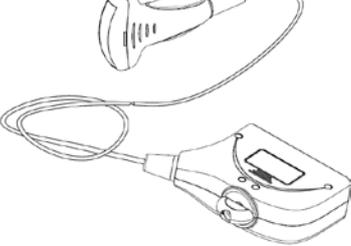
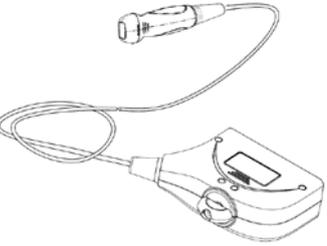
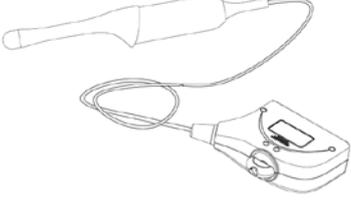
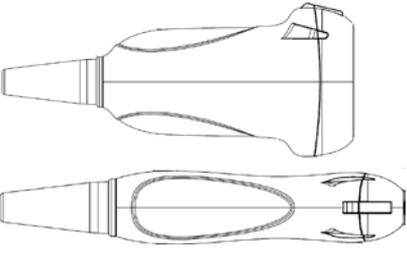
13 Probes and Biopsy

13.1 Probes

NOTE: For details of storage times and conditions for disinfected probes and brackets, refer to the Technical standard for Disinfection of Medical and Health Structures.

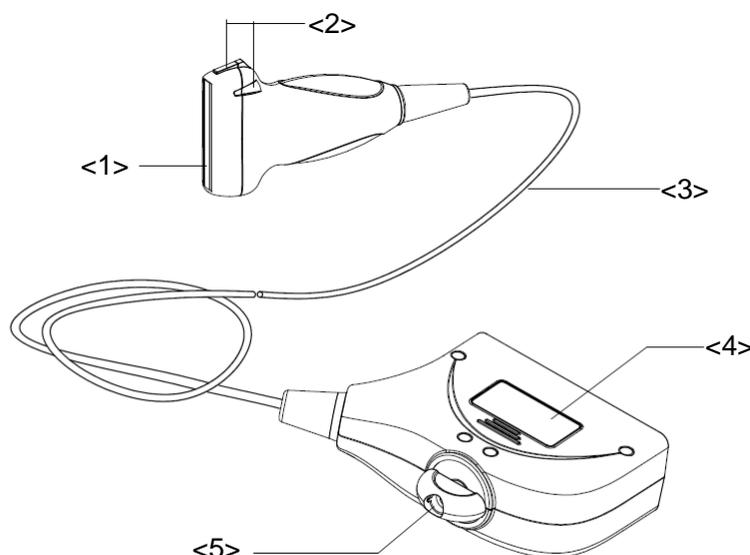
The system supports the following probes:

3C5A		P4-2	
6C2		P7-3	
7L4A		D7-2E	
L14-6NE		CW5s	

V11-3		CW2s	
V11-3B		C6-2	
P10-4E		DE10-3E	
L9-3E		7L4B	

13.1.1 Probe Functions by Part

The basic structures and corresponding functions of probes are basically the same.



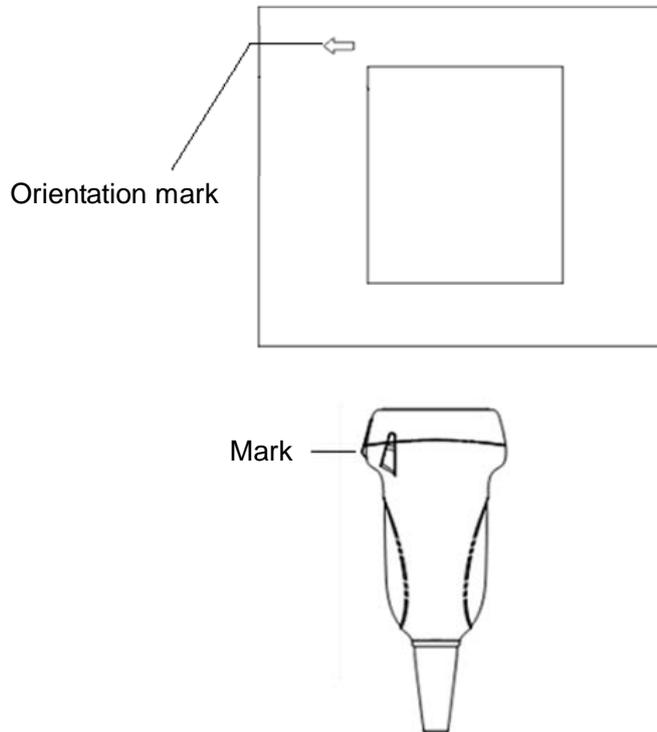
No.	Name	Function
<1>	Probe head	Converts the electrical signal to an ultrasonic signal, focusing the sound beams in a given direction while it receives the reflected ultrasonic signal and converts it to an electrical signal for transmission over the cable. The lens on the surface is the acoustic lens. Apply ultrasound gel to the acoustic lens for correct operation.
<2>	Needle-guided bracket fixing tabs and grooves	Provides mounting support for the needle-guided bracket.
<3>	Probe cable	Transmits electrical signals between the probe body and connector.
<4>	Probe connector	Connects the probe and cable to the ultrasound diagnostic system.
<5>	Lock handle	Locks the connector to the ultrasound diagnostic system.

Tip:

The probes' structure, marked <2> in the figure above, may vary depending on the corresponding needle-guided brackets.

13.1.2 Orientation of the Ultrasound Image and the Probe Head

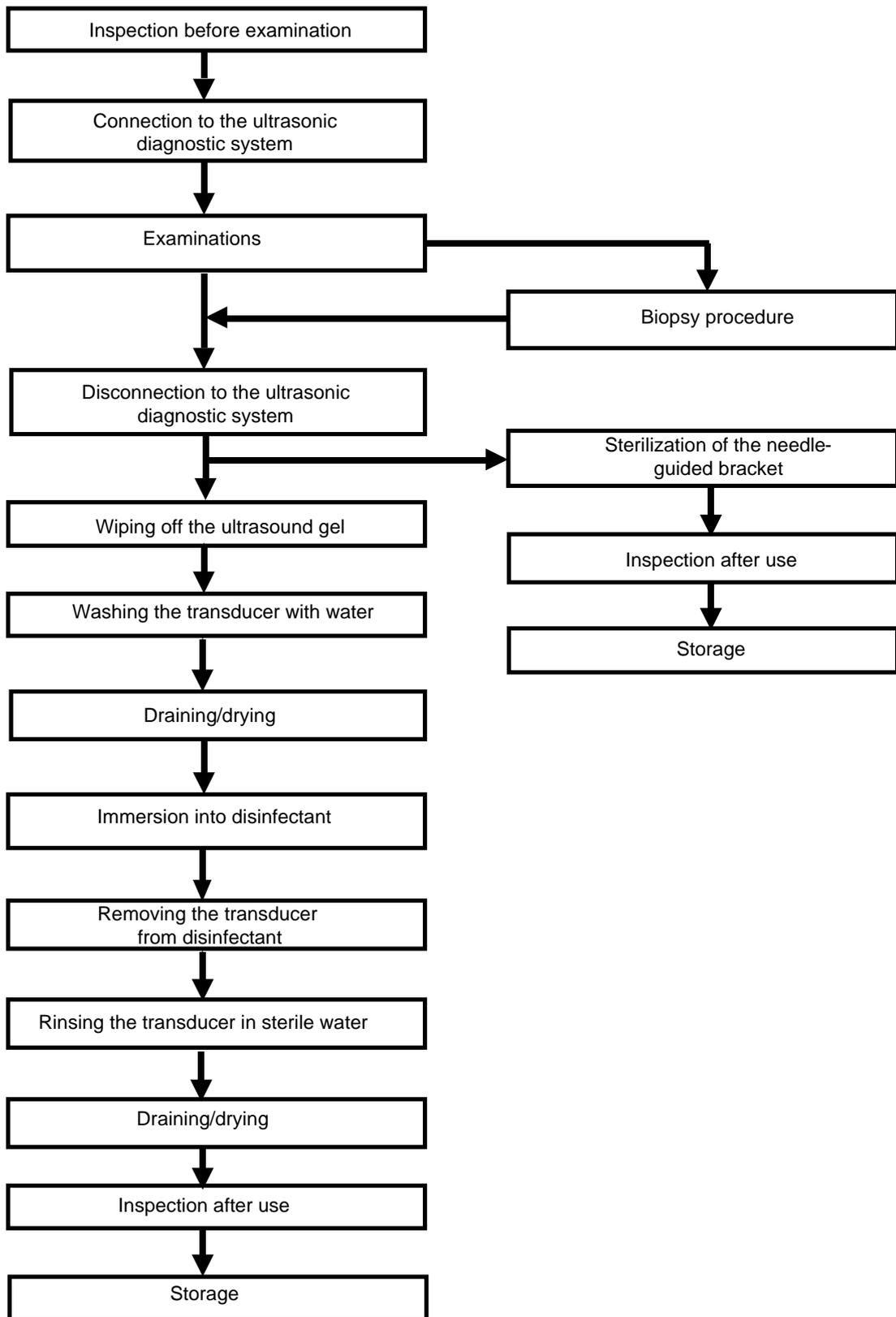
The orientation of the ultrasound image and the probe are shown below. The “Mark” side of the ultrasound image on the monitor corresponds to the mark side of the probe. Check the orientation prior to the examination (using a linear probe as an example).



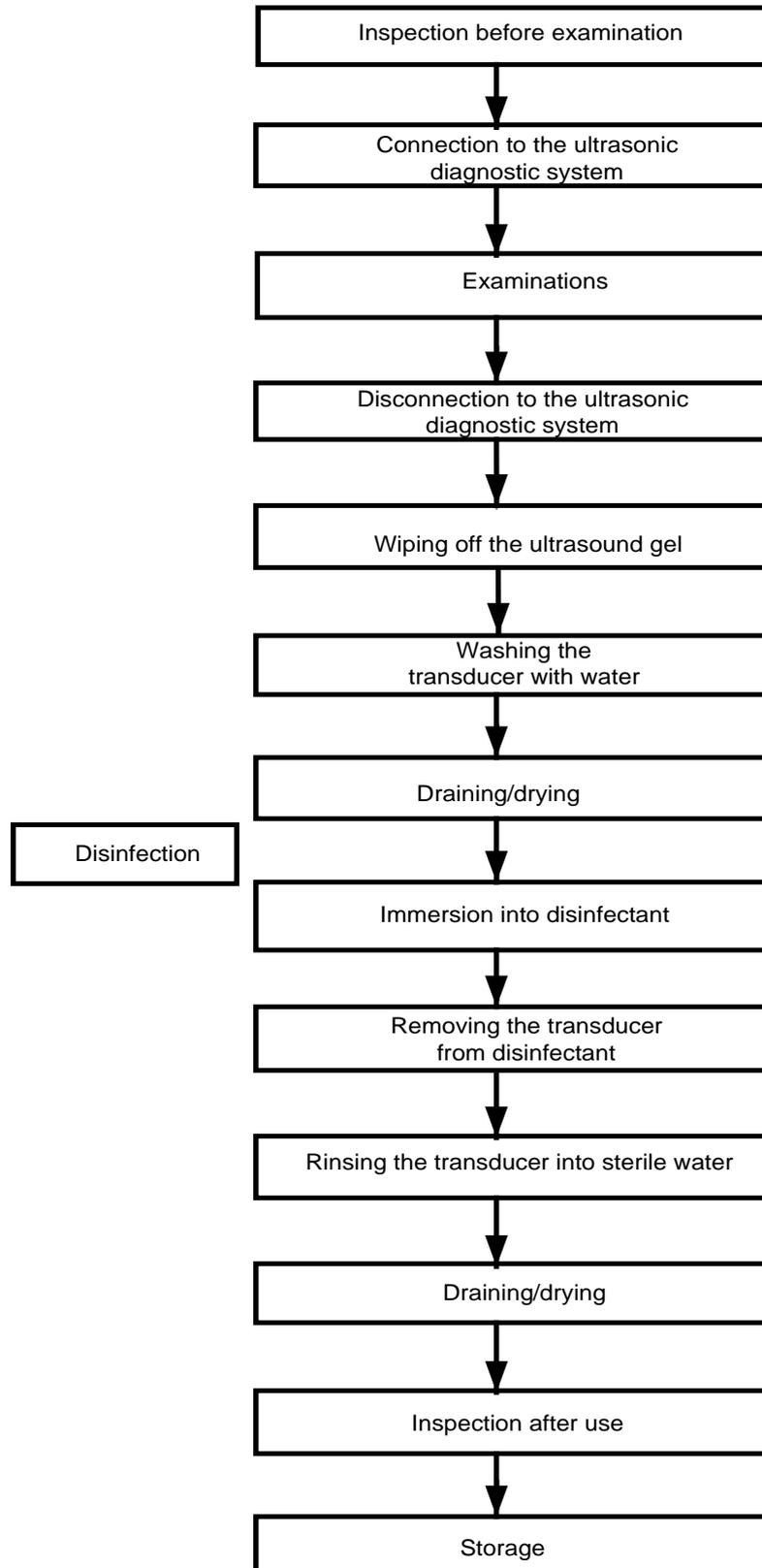
13.1.3 Operating Procedures

This section describes the general procedures for operating the probe. The proper clinical technique to use for operating the probe should be selected on the basis of specialized training and clinical experience.

Operating procedures (with biopsy function):



Operating procedures (with no biopsy function):



⚠️ WARNING: Disinfect the probe and sterilize the needle-guided bracket before and after an ultrasound-guided biopsy procedure is performed. Failure to do so may cause the probe and the needle-guided bracket to become sources of infection.

13.1.4 Wearing the Probe Sheath

A legally-marketed probe sheath must be installed over the probe before performing intra-cavitary and intra-operative examinations. Protective barriers may be required to minimize disease transmission. Probe sheaths are available for use in all clinical situations where infection is a concern.

To order probe sheaths, contact:

CIVCO Medical Instruments Co.

102 First Street South, Kalona, IA 52247-9589 USA Tel: 1-319-656-4447

E-mail: info@civco.com

<http://www.civco.com>

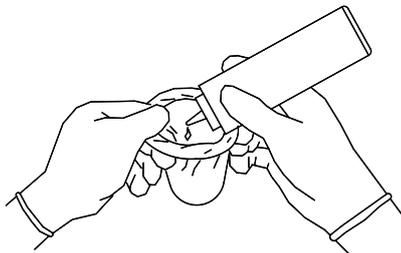


CAUTION:

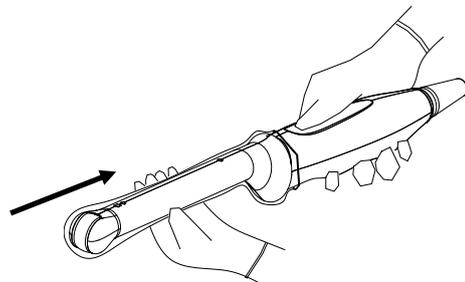
1. Be sure to cover the probe with a new (unused) probe sheath to prevent infection during examination. If the probe sheath packaging is open or broken, the probe sheath may not be sufficiently sterilized. **DO NOT** use the probe sheath in such circumstances.
2. The cover contains natural rubber latex and talc that can cause allergic reactions in some individuals.
3. **DO NOT** use an expired probe sheath. Before using a probe sheath, verify whether the term of validity has expired.

Method (for reference only):

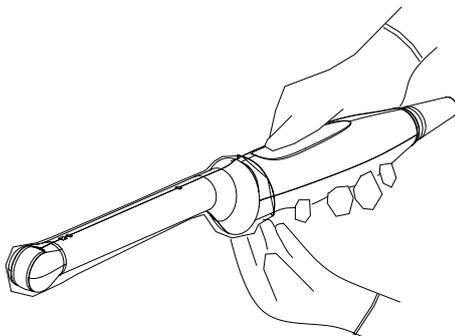
1. Place an appropriate amount of gel inside the sheath or on the probe acoustic lens. Poor imaging may result if no gel is used.



2. Insert the probe into the sheath. Be sure to use a proper sterile technique. Pull the cover tightly over the probe acoustic lens to remove wrinkles and air bubbles, taking care to avoid puncturing the sheath.



3. Secure the sheath with the enclosed elastic bands.



4. Inspect the sheath to ensure there are no holes or tears.

13.1.5 Probes Cleaning and Disinfection

After completing each examination, clean and disinfect (or sterilize) the probes as required. When biopsy procedures have been performed, be sure to sterilize the needle-guided bracket. Fail to do so may result in the probe and the needle-guided bracket to becoming sources of infection. Please follow the instructions in the manual for cleaning.

⚠️ WARNING: Never immerse the probe connector into liquid such as water or disinfectant. Immersion may cause electrical shock or malfunction.

⚠️ CAUTION:

1. When performing cleaning and disinfection of the probe to prevent infection, wear sterile gloves.



2. After disinfection, rinse the probe thoroughly with sterile water to remove all chemical residues. Chemical residues on the probe may be harmful to the human body.

3. No cleaning and disinfecting may result in the probe becoming a source of infection.

NOTE:

1. After the examination, wipe off the ultrasound gel thoroughly. Otherwise, the ultrasound gel may solidify and degrade the image quality of the transducer.
2. DO NOT make the probe to become overheated (more than 55°C) during cleaning and disinfections. High temperature may cause the probe to become deformed or damaged.

Cleaning

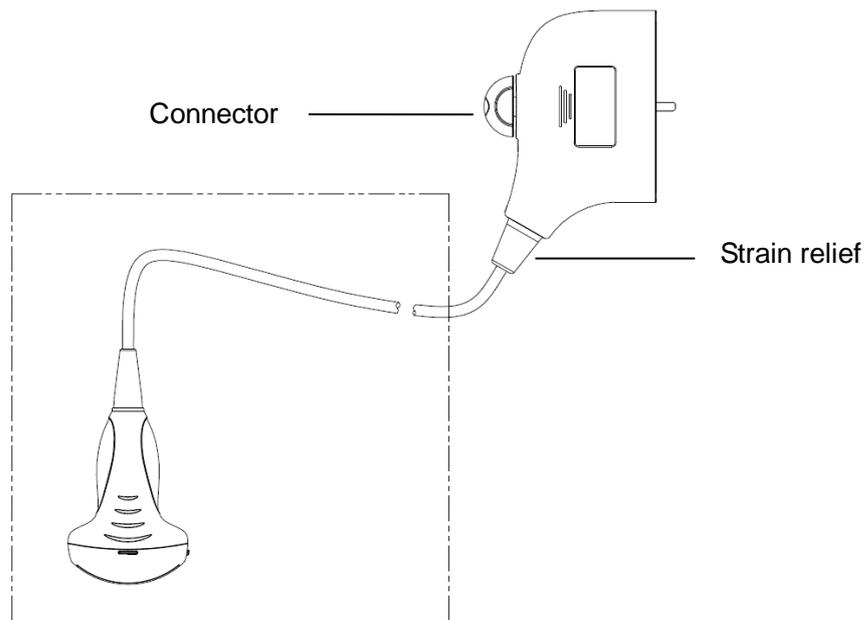
Please refer to the instructions in the manual and follow your hospital policy and procedures for cleaning.

1. Disconnect the probe from the system.
2. Wear sterile gloves to prevent infection.
3. Wash the transducer with clean water or soapy water to remove all the foreign matters, or, wipe the transducer with a soft ethyl carbamate sponge. Avoid using a brush, because it may damage the transducer.
4. Dry the transducer using a sterile cloth or gauze after rinsing. Do not dry the transducer by heating it.

Disinfecting with Sprays or Wipes

⚠️ CAUTION: Use protective eyewear when disinfecting using sprays.

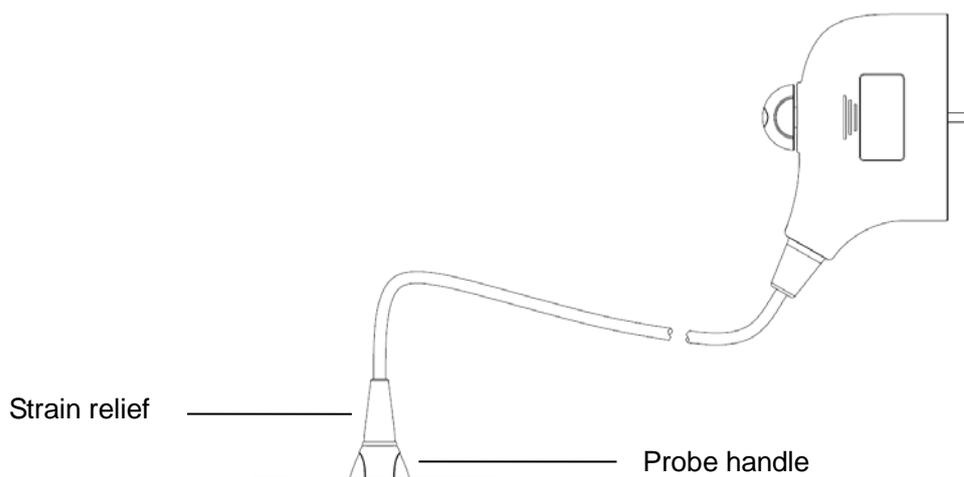
1. Wear sterile gloves to prevent infection.
2. After you have finished cleaning, wipe or spray the transducer with a disinfectant. Follow the disinfectant manufacturer's recommended contact time and mode.
3. Remove any residue with a water-moistened soft cloth on the transducer.
4. Wipe off water on the transducer using sterile cloth or gauze after washing.



NOTE: Observe the graph here carefully to perform disinfection. Do not spray the strain relief on the connector end or the connector.

Disinfecting by Immersion

1. Wear sterile gloves to prevent infection.
2. Clean the transducer before disinfecting it. MINDRAY recommends the following solutions to disinfect the transducer.
 - Refer to the instructions provided by the chemical manufacturer concerning concentration of the disinfectant solution, method of disinfection and dilution and cautions during use. Do not soak the transducer connector or the cable near it into water or any solution.
 - Soak the transducer into the disinfectant solution for the shortest time the manufacturer recommends (for example, the shortest time recommended by the manufacturer for soaking Cidex OPA is 12 minutes).
 - Follow local regulations when selecting and using the disinfectant.
3. Rinse the transducer with plenty of sterile water (about 2 gallons) for at least 1 minute to remove all chemical residues on it. Or, follow the rinsing method recommended by the disinfectant manufacturer to rinse the transducer.
4. Wipe off the water on the transducer with sterile cloth or gauze after rinsing it. Do not dry the transducer by heating.



NOTE:

1. Observe the graph here carefully to immerse the transducer. Only soak parts of the transducer below the strain relief.
2. Repeated disinfection will eventually damage the probe, please check the probe performance periodically.

Compatible Disinfectants

For the disinfectants information, please refer to Disinfectant Quick Reference.

13.1.6 Environment

Working condition

Use the probes in the following ambient conditions:

Probe	Ambient temperature	Relative humidity	Atmospheric pressure
6C2	0°C-40°C	30%~85%RH (no condensation)	700hPa~1060hPa
7L4A	0°C ~ 40°C	30% ~ 85%RH (no condensation)	700hPa ~ 1060hPa
3C5A	0°C ~ 40°C	30% ~ 85%RH (no condensation)	700hPa ~ 1060hPa
D7-2E	10°C ~ 40°C	25% ~ 90%RH (no condensation)	700hPa ~ 1060hPa
L14-6NE	0°C ~ 40°C	30% ~ 85%RH (no condensation)	700hPa ~ 1060hPa
V11-3	0°C ~ 40°C	30% ~ 85%RH (no condensation)	700hPa ~ 1060hPa

Probe	Ambient temperature	Relative humidity	Atmospheric pressure
V11-3B	0°C ~ 40°C	30% ~ 85%RH (no condensation)	700hPa ~ 1060hPa
L9-3E	0°C ~ 40°C	20% ~ 85%RH (no condensation)	700hPa ~ 1060hPa
C6-2	0°C ~ 40°C	20% ~ 85%RH (no condensation)	700hPa ~ 1060hPa
P4-2	0°C ~ 40°C	30% ~ 85%RH (no condensation)	700hPa ~ 1060hPa
P7-3	10°C ~ 40°C	30% ~ 85%RH (no condensation)	700hPa ~ 1060hPa
7L4B	0°C ~ 40°C	20% ~ 85%RH (no condensation)	700hPa ~ 1060hPa
P10-4E	0°C ~ 40°C	30% ~ 85%RH (no condensation)	700hPa ~ 1060hPa
DE10-3E	18°C ~ 30°C	30% ~ 85%RH (no condensation)	700hPa ~ 1060hPa
CW2s	0°C ~ 40°C	30% ~ 85%RH (no condensation)	700hPa ~ 1060hPa
CW5s	0°C ~ 40°C	30% ~ 85%RH (no condensation)	700hPa ~ 1060hPa

Storage and transportation Condition

When all examinations for the session have been completed, confirm that the probe is in good condition. After disinfecting the probe, confirm that the probe is in good condition and stored in a suitable place.

Store and transport the probes in the following ambient conditions:

Probe	Ambient temperature	Relative humidity	Atmospheric pressure
6C2	-20°C ~ 55°C	30%~95%RH (no condensation)	700 hPa~1060 hPa
7L4A	-20°C ~ 55°C	30%~95%RH (no condensation)	700 hPa~1060 hPa

Probe	Ambient temperature	Relative humidity	Atmospheric pressure
3C5A	-20°C ~ 55°C	30%~95%RH (no condensation)	700 hPa~1060 hPa
D7-2E	-10°C ~ 60°C	30%~95%RH (no condensation)	700 hPa~1060 hPa
L14-6NE	-20°C ~ 55°C	30%~95%RH (no condensation)	700 hPa~1060 hPa
V11-3	-20°C ~ 55°C	30%~95%RH (no condensation)	700 hPa~1060 hPa
V11-3B	-20°C ~ 55°C	30%~95%RH (no condensation)	700 hPa~1060 hPa
L9-3E	-20°C ~ 55°C	20%~95%RH (no condensation)	700 hPa~1060 hPa
C6-2	-20°C ~ 55°C	20%~95%RH (no condensation)	700 hPa~1060 hPa
P4-2	-20°C ~ 55°C	30%~95%RH (no condensation)	700 hPa~1060 hPa
P7-3	-20°C ~ 55°C	30%~95%RH (no condensation)	700 hPa~1060 hPa
7L4B	-20°C ~ 55°C	20%~95%RH (no condensation)	700hPa~1060 hPa
P10-4E	-20°C ~ 55°C	30%~95%RH (no condensation)	700 hPa ~ 1060 hPa
DE10-3E	-10°C ~ 50°C	30%~95%RH (no condensation)	700 hPa ~ 1060 hPa
CW2s	-20°C ~ 55°C	30%~95%RH (no condensation)	700 hPa ~ 1060 hPa
CW5s	-20°C ~ 55°C	30%~95%RH (no condensation)	700 hPa ~ 1060 hPa

1. To prevent the probe from being damaged, DO NOT store it where it may be exposed to:

- Direct sunlight or X-rays
- Sudden changes in temperature
- Dust

- Excessive vibration
 - Heat generators
2. When the probe is sent to the MINDRAY Customer Service Department or a sales representative for repair, be sure to disinfect it and keep it in the carrying case to prevent infection.
 3. Sterilize the carrying case as necessary.

13.2 Biopsy Guide



WARNING:

The person performing biopsy procedures must understand diagnostic ultrasound thoroughly and have been adequately trained, otherwise the patient may suffer consequences.

In the situations listed below, the biopsy needle may fail to penetrate the target. Incorrect biopsy may cause various consequences for the patient.

- Using a needle-guided bracket other than that provided.
- Mounting the needle-guided bracket incorrectly.
- Using a biopsy needle that is unsuitable for the type of biopsy being performed.
- Using a biopsy needle that is unsuitable for the needle guide.

Before and after a biopsy procedure is performed, confirm that the needle-guided bracket is normal. Manually confirm that the parts of the needle-guided bracket do not slip or move from their proper positions. If the needle-guided bracket is used when parts are not securely and correctly installed, the patient may be injured. If an abnormality is found on the needle-guided bracket, immediately stop using it and contact the MINDRAY Customer Service Department or a sales representative.

DO NOT use a needle-guided bracket while scanning is performed. The needle may advance in an incorrect direction and possibly injure the patient.

Never perform a biopsy during image scanning.

DO NOT freeze an image while performing a biopsy procedure.

During biopsy procedures, the needle may deviate from the desired course due to tissue characteristics or the type of needle. In particular, needles with small diameters may deviate to a greater degree.

Disinfect the probe and sterilize the needle-guided bracket before and after each ultrasound-guided biopsy procedure is performed. Failure to do so may cause the probe and the needle-guided bracket to become sources of infection.

The needle mark displayed on the ultrasound image does not indicate the actual position of the biopsy needle. Therefore, it should only be used as a reference. Always monitor the relative positions of the biopsy needle during procedures.

Adjust the needle mark before the biopsy procedure is performed.

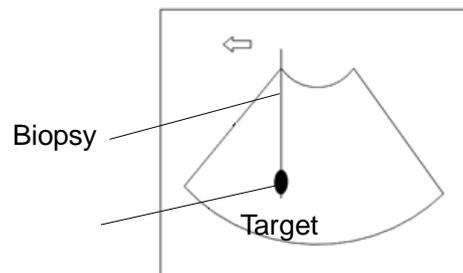
When performing biopsy procedures, only use sterile ultrasound gel that is certified as safe and manage the ultrasound gel properly to ensure that it does not become a source of infection.

When performing an operation involving biopsy, wear sterile gloves.

Image of the biopsy target and the actual position of the biopsy needle:

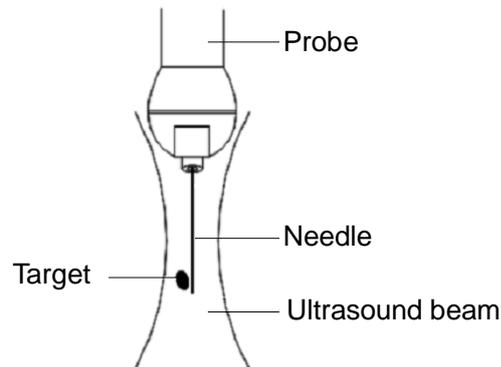
Diagnostic ultrasound systems produce tomographic plane images with information about particular thicknesses in the thickness direction of the probe. (That is to say, the information shown in the images consists of all the information scanned in the thickness direction of the probe.) Therefore, even though the biopsy needle appears to have penetrated the target object in the image, it may not actually have done so. When the biopsy target is small, dispersion of the ultrasound beam may lead to the image deviating from the actual position. Be aware of this.

The target object and biopsy needle appear in the image as shown in the figures below (for reference only):



The biopsy needle appears to reach the target object in the image

Dispersion of the ultrasound beam



The biopsy needle may not have actually entered the target object even though it appears to have done so in the image. To avoid this, note the points below:

- **Do not rely only on the needle tip in the image. Pay careful attention to the fact that when the biopsy needle enters the target object or comes into contact with it, the object should shift slightly.**

Before performing the biopsy, evaluate the size of the object and confirm whether the biopsy can be carried out.

13.2.1 Needle-Guided Brackets

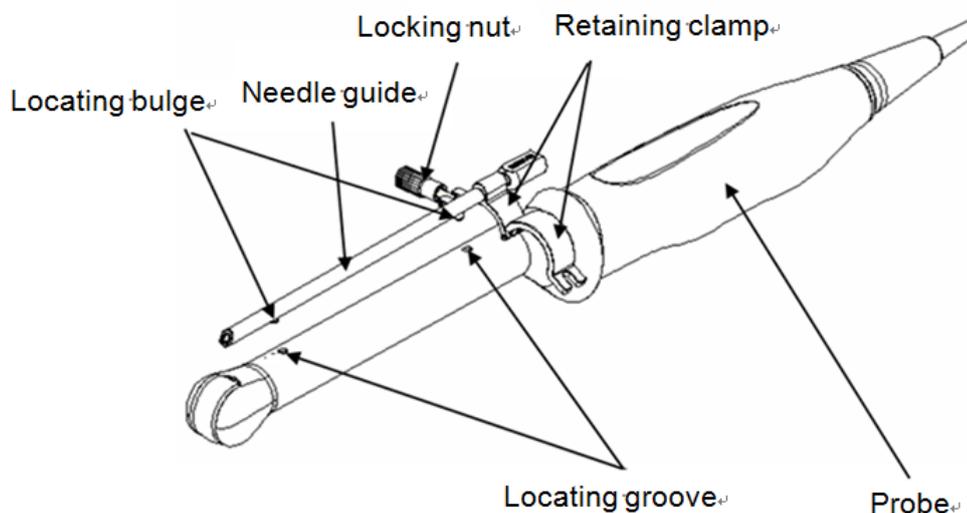
Needle-guided brackets are available for purchase as optional accessories and are used in combination with the probe. Some probes have corresponding needle-guided brackets and needles. To order needle-guided brackets, contact the MINDRAY Customer Service Department or a sales representative.

For biopsy or treatment, ultrasound-guided biopsy procedures can be performed using the probe together with a needle-guided bracket (optional accessory) and a biopsy needle (provided by the user).

Names of Parts

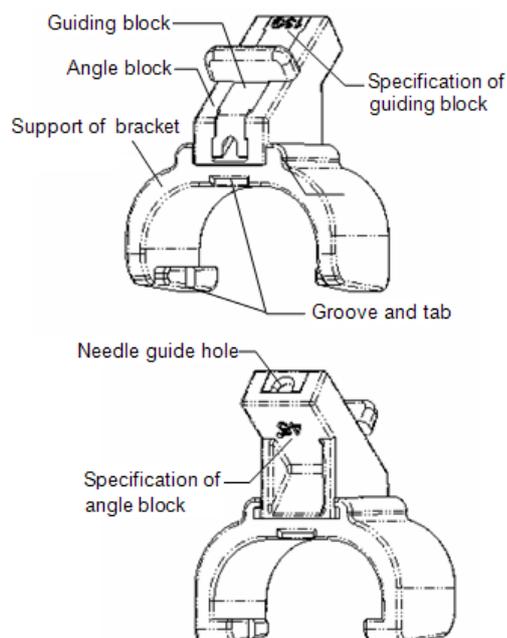
This section describes the parts and corresponding functions of each needle-guided bracket. Here, we take a corresponding probe as an example.

■ NGB-004

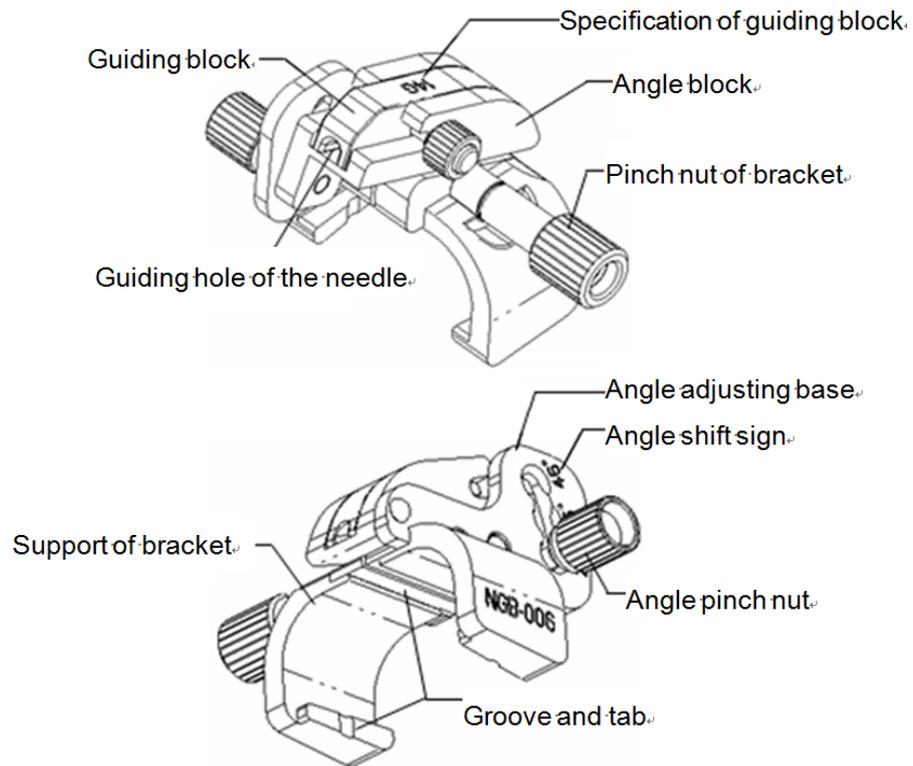


■ NGB-006

Plastic needle-guided bracket:

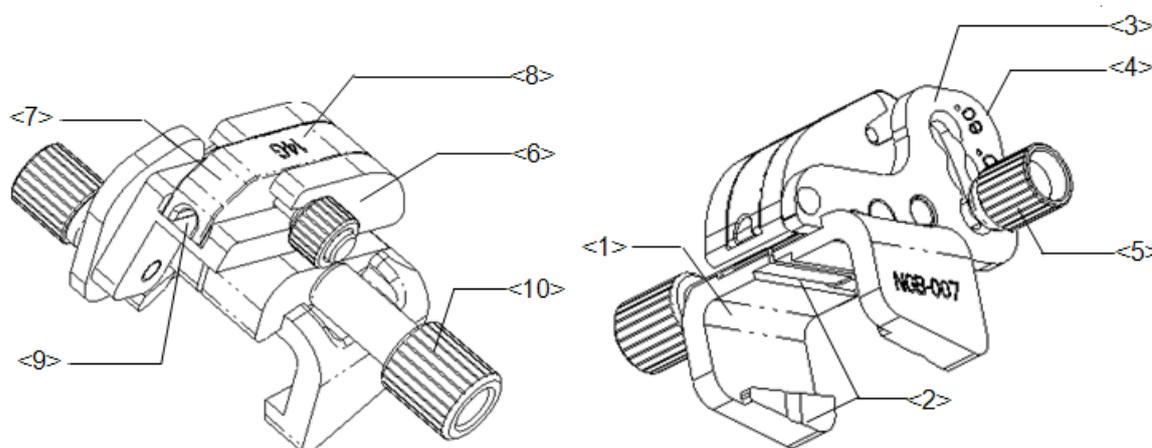


Metal/needle detachable needle-guided bracket:



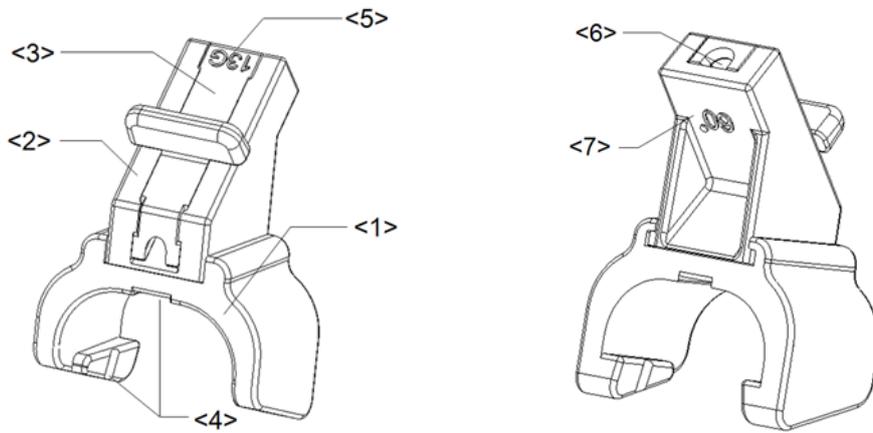
■ NGB-007

Metal/needle detachable needle-guided bracket:



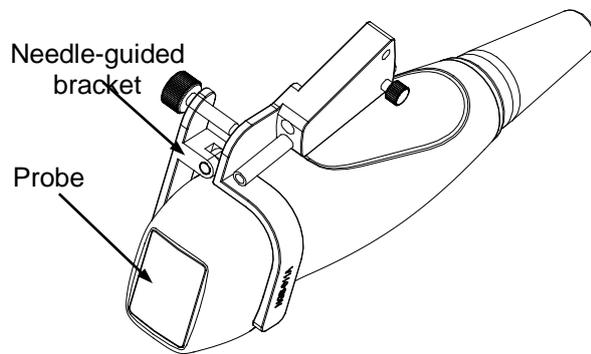
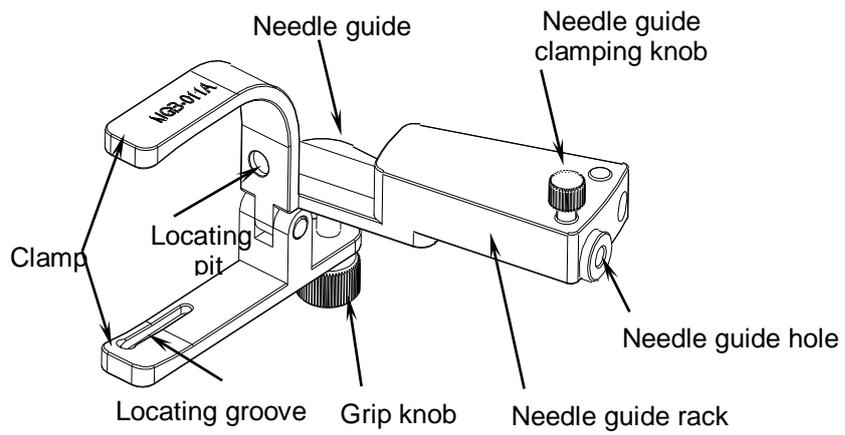
No.	Name	Description
<1>	Support for needle-guided bracket	Used for installing the needle-guided bracket on the probe.
<2>	Tab and groove for the needle-guided bracket	Corresponding to the tab and groove of the probe.
<3>	Angle-adjusting base	There are 3 types of angles available for adjustment.
<4>	Angle shift sign (40°, 50°, 60°)	Corresponding to the biopsy angle (40°, 50° and 60°).
<5>	Angle pinch nut	Used for fixing the angle lock at a chosen angle.
<6>	Angle block	Used for determining the angle of the biopsy. Different specifications of blocks can be used.
<7>	Guiding block	Used for installing biopsy needles. There are five guiding block specification for different biopsy needles.
<8>	Guiding block specification (14G)	Matched with the corresponding biopsy needle (14G).
<9>	Needle guide hole	Used for installing the biopsy needle.
<10>	Needle-guided bracket pinch nut	Used for locking the needle-guided bracket and the probe.

Plastic/needle detachable needle-guided bracket:

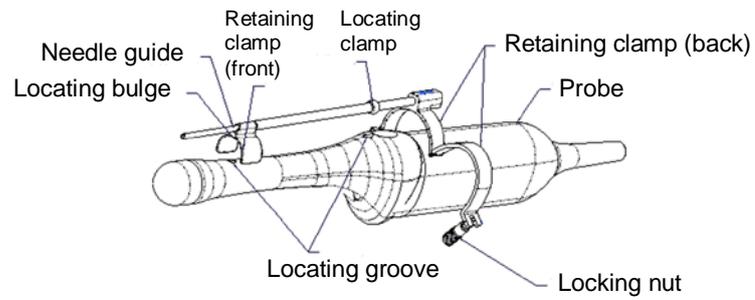


No.	Name	Description
<1>	Support for needle-guided bracket	Used for installing the needle-guided bracket on the probe.
<2>	Angle block	Used for determining the angle of the biopsy. There are three angle block specifications.
<3>	Guiding block	Used for installing biopsy needles. There are five guiding block specification for different biopsy needles.
<4>	Tab and groove for the needle-guided bracket	Corresponding to the tab and groove of the probe.
<5>	Guiding block specification (13G)	Matched with the corresponding biopsy needle (13G).
<6>	Biopsy needle guiding hole	Used for installing the biopsy needle.
<7>	Angle block specification (60°)	The corresponding biopsy angle is 60°.

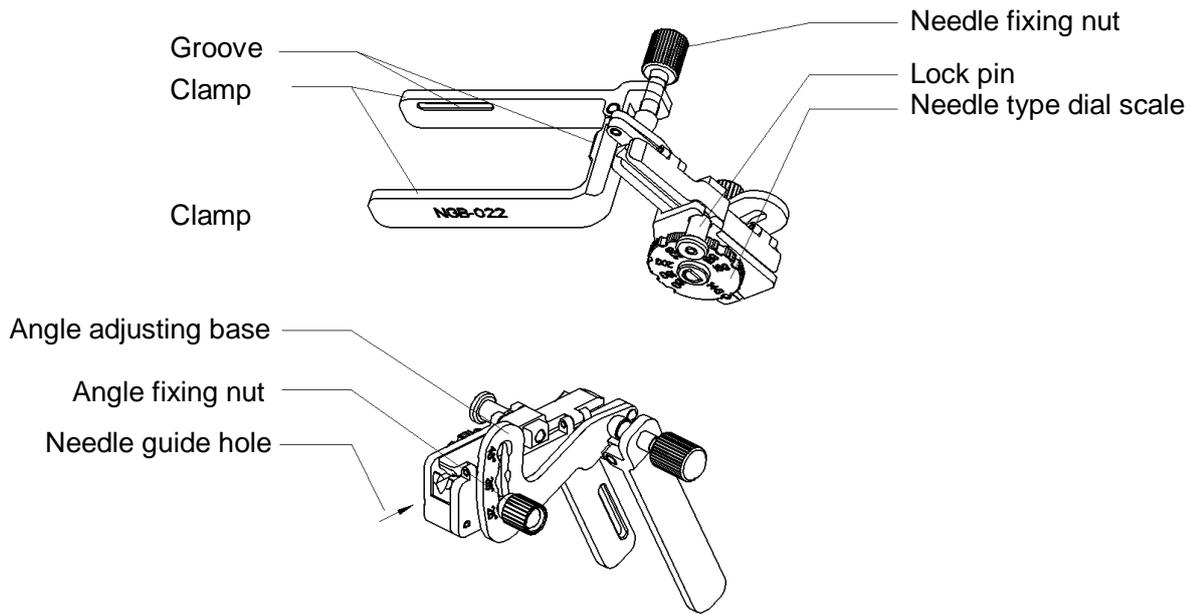
■ NGB-011



■ NGB-021



■ NGB-022



13.2.2 Basic Procedures for Biopsy Guiding

1. Select the correct needle-guided bracket and needle and install them properly. For details, see "13.2.3 Needle-Guided Bracket Inspection and Installation."
2. Verify the biopsy guide line.
3. Press <F11 Biopsy> on the keyboard or touch [Biopsy] on the touch screen to enter the biopsy.
Tip:
 - If the current probe has no corresponding bracket, or the image is frozen and the guide line was hidden before the image was frozen, then you cannot enter the Biopsy menu.
 - Before entering the Biopsy menu, the system will display the prompt "Please verify guidelines before biopsy."
4. Use touch screen controls to select the bracket and guide line according to the actual situation.
5. In the Biopsy menu, touch [Verify] to enter the Verify menu to verify the guide line. After verification, click [Save] to save the parameter setting. Then click [Exit] to return to the Biopsy status.
Tip:
 - If you changed the probe or needle-guided bracket during the biopsy, verify the guide line again.
 - When exiting the Verify menu without saving, the system will display the prompt "Data have changed. Do you want to save the changes?" Click [Yes] to save the setting and return to the Biopsy status.
6. Scan to locate the target. Center the target in the electronic guidezone path.
7. Direct the needle into the area of interest for specimen.
8. After extracting the biopsy sample is complete, gently remove the probe from the body.
To exit Biopsy: press <F11 Biopsy>.
9. Disassemble the items and properly dispose of these items as required.



DANGER

Failure to match the guidezone displayed to the guide may cause the needle to track a path outside the zone.

It is extremely important that when using the adjustable angle biopsy guides, the angle displayed on the screen matches the angle set on the guide, otherwise the needle will not follow the displayed guidezone and this could result in repeated biopsies or patient injury.

13.2.3 Needle-Guided Bracket Inspection and Installation

13.2.3.1 Inspection of the Needle-Guided Bracket

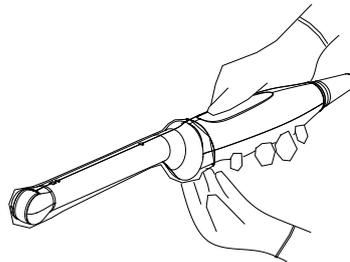
Be sure to perform inspections before and after using the needle-guided bracket. If an abnormality is found on the needle-guided bracket, immediately stop using it and contact the MINDRAY Customer Service Department or a sales representative.

1. Sterilize the needle-guided bracket before and after use.
2. Confirm that the needle-guided bracket is free from damage, deformation, stripping, malfunction, loose or missing parts.
3. Confirm that the needle-guided bracket is securely mounted in the correct position.

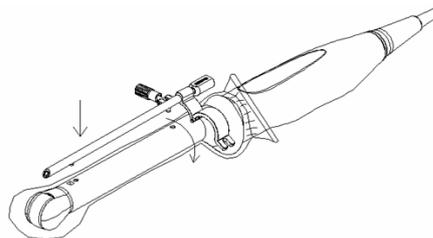
13.2.3.2 Installing the Needle-Guided Bracket

■ NGB-004

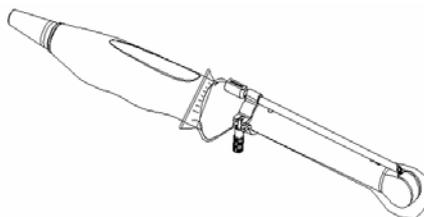
- (1) Put the sterile probe sheath on.



- (2) Open the retaining clamp, align the needle-guided bracket with the probe to align the locating bulge on the needle guide with the locating grooves on the probe, then turn the retaining clamp to align it with the probe (see the figure below).



- (3) When the retaining clamp is turned to the correct position, the locking nut will lock the retaining clamp and the needle-guided bracket is then mounted in the correct position.



■ NGB-006

Metal/needle detachable needle-guided bracket:

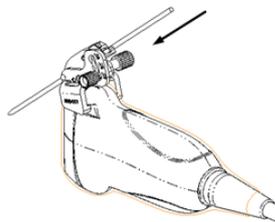
- (1) Put the sterile probe sheath on.
- (2) Hold the probe in one hand, select the correct needle-guided bracket and hold it with the other hand. Match the groove and tab with the tab and groove of the probe respectively. Mount the bracket onto the probe.



- (3) Screw the pinch nut of the needle-guided bracket to ensure that the needle-guided bracket is properly installed on the probe.
- (4) Select a suitable guiding block and push it into the groove above the angle block, then clamp it tightly.

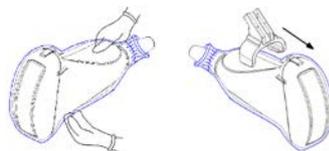


- (5) Screw the block's nut to secure the block.
- (6) Insert a biopsy needle with the same specification as that of the guiding block into the guiding block hole.

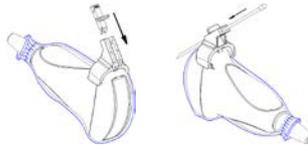


Plastic needle-guided bracket:

- (1) Put on the sterile transducer sheath.
- (2) Hold the transducer by one hand, select proper needle-guided bracket, and hold it with the other hand, and align the narrow end of tab of the needle-guided bracket with the groove of the transducer, then push the needle-guided bracket forward, making the tabs and the groove of the needle-guided bracket to match with the grooves and tab of the transducer.



- (3) Check manually to confirm that the needle-guided bracket is securely installed on the transducer.
- (4) Select a proper guiding block and push it into the groove above the angle block, and clamp it tightly.
- (5) Insert a biopsy needle with the same specification as that of the guiding block into the hole of the guiding block.



■ NGB-007

Metal/needle detachable needle-guided bracket:

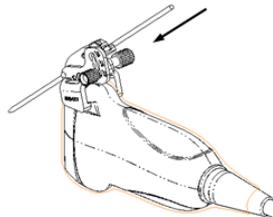
- (1) Put the sterile probe sheath on.
- (2) Hold the probe in one hand, select the correct needle-guided bracket and hold it with the other hand. Match the groove and tab with the tab and groove of the probe respectively. Mount the bracket onto the probe.



- (3) Screw the pinch nut of the needle-guided bracket to ensure that the needle-guided bracket is properly installed on the probe.
- (4) Select a suitable guiding block and push it into the groove above the angle block, then clamp it tightly.

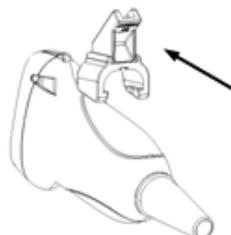


- (5) Screw the block's nut to secure the block.
- (6) Insert a biopsy needle with the same specification as that of the guiding block into the guiding block hole.

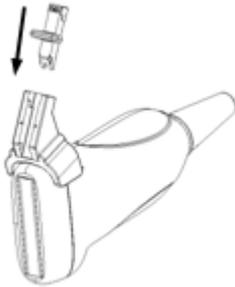


Plastic needle-guided bracket:

- (1) Put the sterile probe sheath on.
- (2) Hold the probe in one hand, select the correct needle-guided bracket and hold it with the other hand. Align the tab at the narrow end of the needle-guided bracket with the groove of the probe, then push the needle-guided bracket forward, so the tabs and grooves of the needle-guided bracket align with the grooves and tabs of the probe.



- (3) Check manually to confirm that the needle-guided bracket is securely installed on the probe.
- (4) Select a suitable guiding block and push it into the groove above the angle block, then clamp it tightly.



- (5) Insert a biopsy needle with the same specification as that of the guiding block into the guiding block hole.

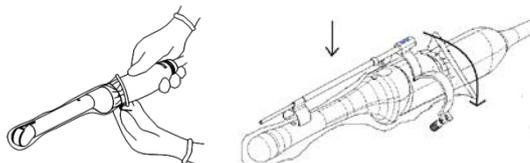


■ NGB-011

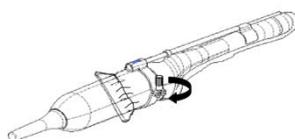
- (1) Connect the locating groove on the clamp with the two raised edges on the probe head and align the locating pit of the clamp with the convex point on the probe head.
- (2) Turn the grip knob at the tail of the needle-guided bracket tightly.

■ NGB-021

- (1) Put the sterile transducer sheath on.
- (2) Loosen the retaining clamp, align the needle-guided bracket with the transducer to align the locating clamp on the needle guide with the locating grooves on the transducer, then press the retaining clamp (front) to align the locating clamp and the locating bulge on the front retaining clamp with the corresponding groove.



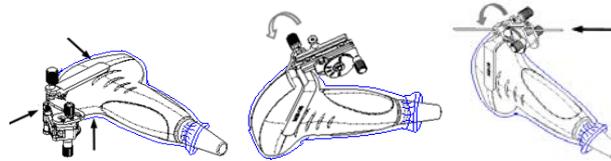
- (3) Screw the retaining clamp to align it with the transducer structure. When the clamp is turned to the correct position, the locking nut will lock the retaining clamp and the needle-guided bracket is then mounted in the correct position.



■ NGB-022

- (1) Put on the sterile transducer sheath.

- (2) Hold the transducer by one hand, select the proper needle-guided bracket, and hold it with the other hand. Match the groove of the bracket with the tab of the transducer. Amount the bracket onto the transducer.



- (3) Screw the pinch nut of the needle-guided bracket to confirm that the needle-guided bracket is properly installed on the transducer.
- (4) Adjust the dial scale to the required needle type shift, and then screw the needle fixing nut to lock the dial scale. (To adjust the dial scale you have to loose the needle fixing nut first.)
- (5) Pull the lock pin and close the V-shaped cover to fix the lock pin in the groove of the needle type adjusting base, so as to install the needle into the guiding hole.



CAUTION:

Ensure that all guide parts are properly fixed prior to performing a biopsy.

13.2.4 Biopsy Menu/Guideline Verification

Adjusting the needle mark is necessary before each biopsy procedure.

1. Confirm that the needle-guided bracket has been installed securely in the correct position.
2. Prepare a container filled with sterile water.
3. Place the head of the probe in the sterile water and place a biopsy needle in the needle guide.
4. When the biopsy needle appears on the image, confirm that the biopsy needle is displayed at almost the same position as the selected needle mark.



WARNING:

Prior to each biopsy procedure, be sure to verify the guide line.

If the needle is not consistent with the guide line, DO NOT perform the biopsy procedure.

NOTE:

You can perform guide line verification on a single live B/C image, and all biopsy-irrelevant operations are forbidden.

Biopsy Guideline

Press <F11 Biopsy> to enter Biopsy or touch [Biopsy] on the touch screen.

- Select the biopsy bracket angle/guide line

If the needle-guided bracket supports more than one biopsy angle, select the angle/guideline by touching the [Kit: NGB-XXX-XX] on the touch screen (last two letters are angle or the guide line).

- Select the guide line dot size

Touch [Dot Size] to select the dot size from Small, Medium and Big.

Tip:

- The guide line is a dotted line which consists of two kinds of dots. The distance between two dots is depth-dependent. Move the cursor over the big dot and a numeral, representing the biopsy depth, is displayed.

- The biopsy guidezone adjusts along with image adjustments, such as image inversion/rotations, zoom and depth changes.
 - When the imaging depth and area are changed, the guide line is adjusted.
 - Exit
 - Touch [Biopsy Kit XXX] to be OFF or press <F11 Biopsy>.
- Tips: in real-time status, press <F11 Biopsy> to exit biopsy status; in frozen status, press <F11 Biopsy> to hide/show the guide line if biopsy function is enabled.

Verification

Touch [Verify] to open the Biopsy Verify menu.

- Adjust the guide line position

Rotate the knob under [Position] on the touch screen to change the position of the guide line.
- Adjust the angle

Rotate the knob under [Angle] on the touch screen to change the guide line angle.
- Save the verified settings

After the position and angle of the guide line are adjusted, touch [Save] and the system saves the current guide line settings. If biopsy is entered again, the displayed Position and Angle are the verified value.
- Restore the factory default settings

Touch [Load Factory] and the position and angle of the guide line are restored to the factory default settings.
- Exit biopsy verify status

Touch [Exit] and the system exits the guide line verification status.

NOTE: For biopsies performed with a biplanar probe, verification is performed on the first guide line. The other guide lines move together with the first one in parallel.

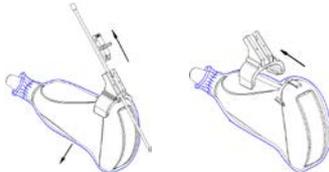
13.2.5 Removing the Needle-Guided Bracket

- NGB-004

Hold the probe in your left hand. Unscrew the locking nut with your right hand to open the retaining clamp, then raise the needle-guided bracket to separate the locating bulge from the locating grooves.
- NGB-006

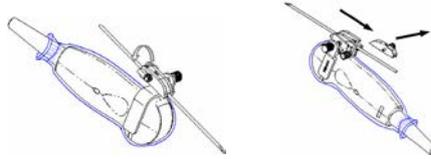
Plastic needle-guided bracket:

 - (1) Remove the guiding block slightly along the direction of the needle's tail.
 - (2) Separate the residual part of the needle-guide bracket and the transducer from the needle.
 - (3) Remove the support of needle-guided bracket from the transducer.

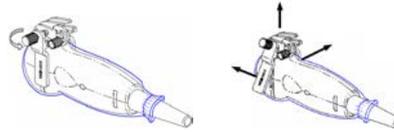


Metal needle-guided bracket:

- (1) Screw the nut of the guiding block and remove the guiding block slightly along the direction of the needle's tail.



- (2) Separate the residual part of the needle-guide bracket and the transducer from the needle.
- (3) Screw the pinch nut of the bracket, and remove the needle-guided bracket from the transducer.



■ NGB-007

Metal needle-guided bracket:

- (1) Loosen the guiding block's nut and slightly move the guiding block in the direction of the needle's tail.
- (2) Separate the residual part of the needle-guide bracket and the probe from the needle.
- (3) Loosen the bracket's pinch nut and remove the needle-guided bracket from the probe.

Plastic needle-guided bracket:

- (1) Slightly move the guiding block in the direction of the needle's tail.
- (2) Separate the residual part of the needle-guide bracket and the probe from the needle.
- (3) Remove the needle-guided bracket support from the probe.

■ NGB-011

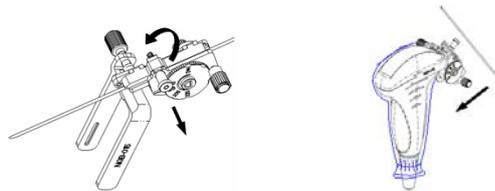
Hold the probe and the needle-guided bracket, then open the grip knob of the needle-guided bracket.

■ NGB-021

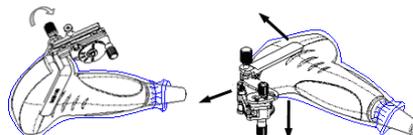
Hold the transducer in your left hand and unscrew the locking nut with your right hand to loosen the retaining clamp. Lift the needle-guided bracket to separate the locating clamp/bulge from the locating grooves.

■ NGB-022

- (1) Pull the lock pin and open up the V-shaped cover to expose the needle.



- (2) Separate the bracket and the transducer from the needle.
- (3) Screw the pinch nut to release the needle-guided bracket.



- (4) Separate the bracket and the transducer.

13.2.6 iNeedle (Needle Visualization Enhancement)

During a biopsy, the metal needle attached to the probe pierces the tissue at a certain angle. Due to the needle's acoustic impedance, the ultrasonic beam cannot penetrate the metal needle and a reflecting boundary is formed. As in Figure 1, if the deflection angle is very large, the needle display is not clear.

In deflected ultrasound transmission, the beam direction is perpendicular to the needle direction and the reflection direction is the same as the needle, as shown in Figure 2, meaning the needle display in the ultrasound image is very clear. The system provides additional deflection transmission that is approximately perpendicular to the metal needle when the normal transmission (perpendicular to the transducer surface) is being processed. The deflection angle can be chosen by the user.

iNeedle is an option.

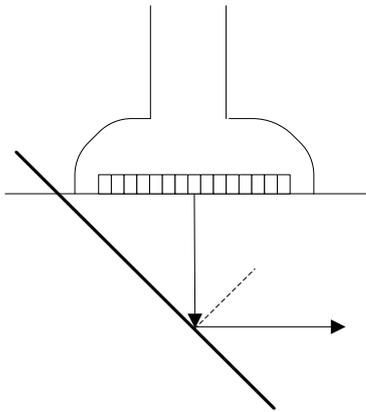


Figure 1

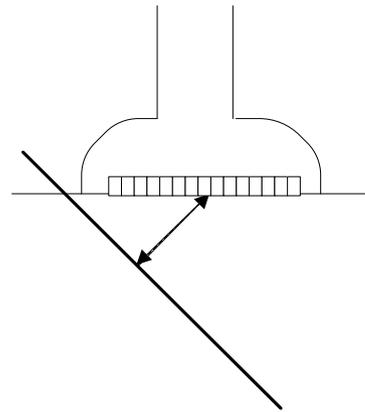


Figure 2

To enter/exit iNeedle

■ To enter iNeedle

Touch the [iNeedle] item on the B page on the touch screen.

Or, assign a user-defined key for entering iNeedle.

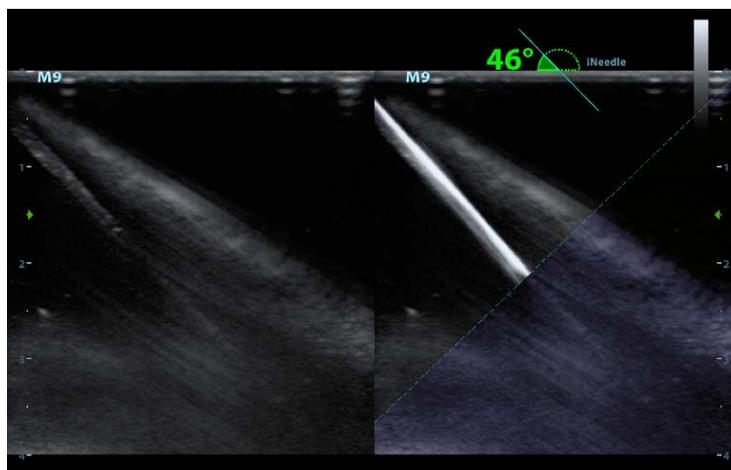
■ Open iNeedle in Biopsy status

1. Perform scanning and locate the target, press <F11 Biopsy> to enter the screen.
2. Touch [iNeedle] to enter the status. Available adjusting parameters are displayed in the menu.

■ To exit iNeedle

Press the user-defined key or touch [iNeedle] to exit the status and enter B mode.

■ Best angle indication



In iNeedle mode, recommended needle angle is given on the top of the screen. As shown in the above figure, the current recommended angle is 46° to the horizontal plane.

Needle Steer

Description This function adjusts the biopsy needle angle by changing the steer angle of the scan line. The iNeedle region changes correspondingly.

Operation Use [Needle Steer] on the touch screen to adjust the angle, in increments of 10° .
Or rotate the <Angle/Steer> knob, in increments of 2° .

B/iNeedle

Description This function is used to display the B image and iNeedle image synchronously.

Operation To turn the function on or off, touch [B/iNeedle] on the touch screen.

Tip: iZoom (full-screen magnification) is available in iNeedle status.

Verify

To verify the biopsy guide line, see “13.2.4 Biopsy Menu/” chapter for details.

13.2.7 Clean and Sterilize the Needle-Guided Bracket

Cleaning

Follow the cleaning instructions in the manual.

1. Wear sterile gloves to prevent infection.
2. Wash the needle-guided bracket with water or soapy water to remove all external material. Or, clean the needle-guided bracket with a urethane sponge.
3. After washing, dry the needle-guided bracket using sterile cloth or gauze.

Sterilization

1. Wear sterile gloves to prevent infection.
2. Clean the needle-guided bracket before sterilizing it. MINDRAY recommends the following solution or sterilizing system for sterilizing the needle-guided bracket.
3. Follow local regulations when selecting and using disinfectant.

■ Glutaraldehyde-based sterilant:

Chemical name	Trade name	Procedures
Glutaraldehyde (2.2-2.7%)	Cidex Activated Glutaraldehyde Solution	Refer to the instructions provided by the solution manufacturer for details. Soak the transducer in the activated solution for 10 hours (20-25°C)

The plastic bracket NGB-007 can be sterilized using Cidex Activated Glutaraldehyde Solution at least 233 times (10 hours per time) before its safety and performance is affected.

■ Hydrogen Peroxide and Peroxyacetic Acid based sterilant:

Trade Name	Chemical Name	Procedures
Minnicare® Cold Sterilant	22% Hydrogen Peroxide 4.5% Peroxyacetic Acid	Dilute the sterilant with sterilized purified water (1:20). Immersion time: 11 hours. Temperature: 20°C-25°C. Refer to the instructions provided by the solution manufacturer for details.

The plastic bracket NGB-007 can be sterilized using Minncare COLD STERILANT at least 245 times (11 hours per time) before its safety and performance is affected.

- Refer to the instructions provided by the chemical manufacturer concerning concentration of the solution, and disinfection and dilution methods. Note that glutaraldehyde disinfectant solution requires an activating solution.
- Rinse the needle-guided bracket thoroughly with sterile water to remove all chemical residues from it.
- After rinsing, dry the needle-guided bracket with sterile cloth or gauze.

■ STERRAD 100S low-temperature hydrogen peroxide gas plasma sterilization system

Chemical name	Trade name	Procedures
Hydrogen peroxide gas plasma	Hydrogen peroxide vapor	Refer to the instructions provided by the solution producer for details.

- Refer to the STERRAD 100S sterilizing system's instructions provided by the manufacturer for operation instructions and cautions.
- The STERRAD 100S low-temperature hydrogen peroxide gas plasma sterilization system is available for metal needle-guided brackets.

■ High-pressure steam sterilization (only applicable for metal guided brackets)
Autoclaving (moist heat) 121°C for 20 minutes.

NOTE: 1. Repeated sterilization may degrade the safety and performance of the needle-guided bracket.
2. High-pressure steam/immersion sterilization does not affect a bracket's life duration. The life duration is affected by the bracket's daily application. Please check the appearance of the bracket before use.

13.2.8 Storage and Transportation

1. Do not use the carrying case for storing the needle-guided bracket. If the carrying case is used for storage, it may become a source of infection.
2. Between examinations, keep the needle-guided bracket in a sterile environment.
3. If the needle-guided bracket is sent to your MINDRAY representative for repair, be sure to disinfect or sterilize it and keep it in the carrying case to prevent infection.
4. Sterilize the carrying case as necessary.
5. Store or transport the needle-guided bracket under the following ambient conditions:
 - Ambient temperature: -20°C to 55°C
 - Relative humidity: 20% to 85% (no condensation)

13.2.9 Disposal

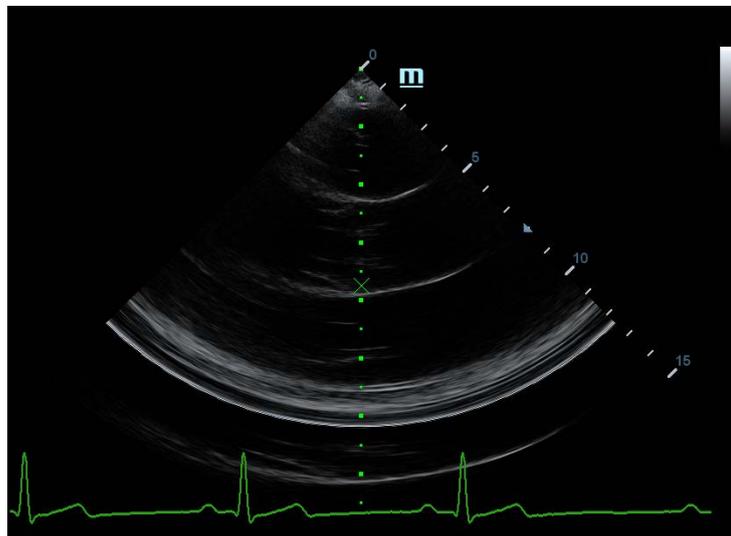
Be sure to sterilize the needle-guided bracket before disposing of it.
Contact your MINDRAY representative when disposing of this device.

13.3 Middle Line

Middle Line helps to locate and observe the focus point of lithotripsy wave during lithotripsy treatment. By means of providing information for the lithotripsy machine as well as a tool for watching the procedure of lithotripsy in real-time, you can adjust the intension and frequency of the lithotripsy wave through lithotripsy machine.

NOTE: This function in the ultrasound system is for lesion (stone) location and observation only. For details, please refer to lithotripsy machine accompanying manuals.

- To enter the mode: touch [Middle Line] in the biopsy tab or preset a shortcut key for middle line function (for details, see “12.1.6 Key Configuration”). Press the user-defined key to turn on the function.



- The middle line is a vertical dotted line located in the middle of the screen, the position and direction of which cannot be changed.
- There is a mark icon of “x” located on the middle line which can be moved up and down along the line by rolling the track ball.
- To use the Middle Line function of the ultrasound system:
 - a) Use the trackball to change the mark position and by adjusting lithotripsy machine tools or patient posture to locate the stone center at the mark.
 - b) Read the depth of the mark by observing the depth caliper on the right of the image.
 - c) After the stone is located, refer to lithotripsy machine manuals to perform the lithotripsy.
- The depth of the mark is displayed in the image parameter area of the screen.

14 DVR Recording

NOTE: Strictly observe the procedures described here for performing recording and replaying operations. Failure to do so may result in data loss or system malfunction.

Set the PAL or NTSC during setup. This should be consistent with that on the DVR.

Accidental exposure to strong electromagnetic fields may result in image and data loss. Check that the recording was successful as soon as possible. Mindray is not responsible for any data loss.

The DVR can be used to record and replay video and audio stored on DVD or hard disk. Operating procedures may vary with different types of DVR, see the DVR accompanying manuals for details.

Recording is to record videos/audios arises from the examination and store them into DVD or hard disc of the DVR device.

Recording procedures with DVR:

1. Connect the DVR recorder to the ultrasound system and insert an available DVD disc, make sure there is memory in the hard disc.
2. Do output setting via “[Setup]→ [System] → [General]”.
3. Start the ultrasound exam and acquire images.
 - To record: click begin recording related key on the DVR control panel to begin the recording.
 - To stop: click stop recording related key on the DVR control panel to stop the recording.

15 Acoustic Output

This section of the operator's manual applies to the overall system, including the main unit, probes, accessories and peripherals. This section contains important safety information for device operators pertaining to acoustic output and how to control patient exposure through use of the ALARA (as low as reasonably achievable) principle. This section also contains information regarding acoustic output testing and real-time output display.

Read this information carefully before using the system.

15.1 Concerns with Bioeffects

Diagnostic ultrasound is recognized as being safe. There have been no reports of injuries to patients caused by diagnostic ultrasound.

However, it cannot be stated categorically that ultrasound is 100% safe. Studies have revealed that ultrasound with extremely high intensity is harmful to body tissues.

Diagnostic ultrasound technology has made a great leap forward during the last several years. This rapid advance has generated concerns about the potential risk of bioeffects when new applications or diagnostic technologies become available.

15.2 Prudent Use Statement

Although there are no confirmed biological effects on patients caused by exposure from present diagnostic ultrasound instruments, the possibility exists that such biological effects may be identified in the future. Thus ultrasound should be used in a prudent manner to provide medical benefit to the patient. High exposure levels and long exposure times should be avoided while acquiring the necessary clinical information.

15.3 ALARA Principle (As Low As Reasonably Achievable)

The ALARA principle must be practiced when using ultrasound energy. Practicing ALARA ensures that the total energy level is controlled below a low enough level at which bioeffects are not generated while diagnostic information is being accumulated. The total energy is controlled by output intensity and total radiation time. The output intensity necessary for examinations differs depending on the patient and the clinical case.

Not all examinations can be performed with an extremely low level of acoustic energy. Controlling the acoustic level at an extremely low level leads to low-quality images or insufficient Doppler signals, adversely affecting the reliability of the diagnosis. However, increasing the acoustic power more than necessary does not always contribute to an increase in the quality of the information required for diagnosis, rather increasing the risk of generating bioeffects.

Users must take responsibility for the safety of patients and utilize ultrasound deliberately. Deliberate use of ultrasound means that the output power of ultrasound must be selected based on the ALARA principle.

Additional information regarding the concept of ALARA and the possible bioeffects of ultrasound is available in a document from the AIUM (American Institute of Ultrasound Medicine) entitled "Medical Ultrasound Safety."

15.4 MI/TI Explanation

15.4.1 Basic Knowledge of MI and TI

Mechanical Bioeffect and Thermal Bioeffect

The relationship of various ultrasound output parameters (frequency, acoustic pressure and intensity, etc.) to bioeffects is not fully understood at present. It is recognized that two fundamental mechanisms may induce bioeffects. One is a thermal bioeffect involving tissue absorption of ultrasound, and another is a mechanical bioeffect based on cavitations. Thermal Index (TI) gives the relative index of temperature increase by thermal bioeffect, and Mechanical Index (MI) gives the relative index of mechanical bioeffect. TI and MI indices reflect instantaneous output conditions. They DO NOT consider the cumulative effects of the total examination time. TI and MI models contain practical simplifications for complex bioeffect interactions. The operator must be aware that the actual worst case temperature rise may be up to several times higher than the displayed TI value.

■ MI (Mechanical Index)

The mechanical bioeffects are the result of compression and decompression of insonated tissues with the formation of micro bubbles that can be referred to as cavitations.

MI is an index that shows the possibility of cavitation generation based on acoustic pressure, and the value at which the peak rarefactional acoustic pressure is divided by the square root of the frequency. Therefore, the MI value becomes smaller when the frequency is higher or the peak rarefactional acoustic pressure is lower, and it becomes more difficult to generate the cavitations.

$$MI = \frac{P_r, \alpha}{\sqrt{f_{awf}} \times C_{MI}}$$

$$C_{MI} = 1 \text{ (MPa} / \sqrt{\text{MHz}} \text{)}$$

For the frequency 1 MHz and the peak rarefactional acoustic pressure 1 MPa, MI becomes 1. It is possible to consider MI as one threshold of cavitation generation. It is particularly important to keep the MI value low when both gases and soft tissues exist together, such as with lung exposure in cardiac scanning and bowel gas in abdominal scanning.

■ TI (Thermal Index)

The TI is determined by the ratio of the total acoustic power to the acoustic power required to raise the tissue temperature by 1°C. In addition, because the raise in temperature can be greatly different according to tissue structures, TI is divided into three kinds: TIS (Soft-tissue Thermal Index), TIB (Bone Thermal Index) and TIC (Cranial-bone Thermal Index).

TIS: Thermal index related to soft tissues, such as abdominal and cardiac applications.

TIB: Thermal index for applications such as fetal (second and third trimester) or neonatal cephalic (through the fontanel) applications, in which the ultrasound beam passes through soft tissue and the focal region is in the immediate vicinity of bone.

TIC: Thermal index for applications such as pediatric and adult cranial applications, in which the ultrasound beam passes through bone near the beam entrance into the body.

Although the output power is automatically controlled for the selected applications, high TI values should be kept to a minimum or avoided in obstetric applications. WFUMB (World Federation for Ultrasound in Medicine and Biology) guidelines state that temperature increases of 4°C for 5 minutes or more should be considered as potentially hazardous to embryonic and fetal tissue.

The smaller the MI/TI values, the lower the bioeffects.

15.4.2 MI/TI Display

TI and MI values are displayed in the top part of the screen in real time. The operator should monitor these index values during examinations and ensure that exposure time and output values are maintained at the minimum amounts required for effective diagnosis.

NOTE: If a value of MI or TI exceeds 1.0, the ALARA principle must be practiced.

The display precision is 0.1.

Display accuracy of MI is $\leq 14.7\%$, and TI is $\leq 28.5\%$.

15.5 Acoustic Power Setting

■ Acoustic power adjustment

Click the [A.power] on the soft menu to adjust the acoustic power percentage. Its value is displayed on the corresponding item, as well as at the top of the screen. The greater the acoustic power percentage, the greater the current acoustic output. When the image is frozen, the system stops transmitting acoustic power.

■ Default acoustic power setting

Selection of diagnostic applications is the most important factor in controlling ultrasound output. The permissible level of intensity of ultrasound differs depending on the region of interest. For fetal examinations, in particular, much care must be exercised.

Within this system, imaging setups can be created using the ultrasound output set by you.

Once you set the preset settings, the system's default setting values may be changed and invalid. The user is responsible for any change to the default settings.

■ Adjusting range

Initial power: 3.2% to 100%*

Definition of 100%: the maximum acoustic power of a probe determined by the increase in probe surface temperature in the selected mode and the acoustic power restrictions specified by the FDA.

Default settings of the acoustic power value refer to the best image quality for the probe. The larger the acoustic power value, the better the image quality.

NOTE: This system automatically returns to the settings whenever changes are made to the values (when you turn on the power, switch between probes, press <End Exam>, or select OK or Cancel in the Setup menu). In the factory default settings, the Acoustic Output is limited to below 100%. Following the ALARA restriction, you are allowed to increase the acoustic power under FDA 510(k) Guidance-Track 3 limits and to set it in the image preset screen.

The system's acoustic output has been measured and calculated in accordance with IEC60601-2-37: 2007, FDA 510(K) GUIDANCE, Acoustic Output Measurement Standard for Diagnostic Ultrasound Equipment (NEMA UD-2 2004) and the Standard for Real-Time Display of Thermal and Mechanical Acoustic Output Indices on Diagnostic Ultrasound Equipment (AIUM and NEMA UD-3 2004).

15.6 Acoustic Power Control

A qualified operator may use the system controls to limit the ultrasound output and to adjust the quality of the images. There are three categories of system controls relating to output. They are:

- Controls that have direct effect on the output
- Controls that indirectly control the output
- Controls that are receiver controls

■ Direct controls

It is possible to control, if necessary, the acoustic output with the “A.power” item on the soft menu or the corresponding knob at the bottom of the soft menu. In this case, the maximum value of the acoustic output never exceeds an MI of 1.9 and an $I_{SPTA,3}$ of 720 mW/cm² in any mode of operation.

■ Indirect controls

The controls that indirectly affect output are the many imaging parameters. These are operating modes, frequency, focal point positions, overall depth and PRF.

The operating mode determines whether the ultrasound beam is scanning or non-scanning. Thermal bioeffect is closely connected to M mode, Doppler and Color mode. Acoustic attenuation of tissue is directly related to probe frequency. The focal point is related to the active aperture of the probe and beam width. For higher PRF (pulse repetition frequency), the more output pulses occur over a period of time.

■ Receiver controls

The receiver controls (for example, gain, dynamic range and image post-processing, etc.) do not affect output. These controls should be used, when possible, to improve the image quality before using controls that directly or indirectly affect output.

15.7 Acoustic Output

15.7.1 Derated Ultrasonic Output Parameters

In order to determine the relevant Ultrasonic Output Parameters, a method is used which allows for the comparison of ultrasound systems which operate at different frequencies and are focused at different depths. This approach, called “derating” or “attenuating”, adjusts the acoustic output as measured in a water tank to account for the effect of ultrasound propagation through tissue. By convention, a specific average intensity attenuation value is used, which corresponds to a loss of 0.3 dB/cm/MHz. That is, the ultrasound intensity will be reduced by 0.3 dB/MHz for every centimeter of travel from the probe. This can be expressed by the following equation:

$$I_{atten} = I_{water} \times 10^{(-0.3/10 \times f_c \times z)}$$

Where I_{atten} is the attenuated intensity, I_{water} is the intensity measured in a water tank (at distance z), f_c is the center frequency of the ultrasound wave (as measured in water) and z is the distance from the probe. The equation for attenuating pressure values is similar except that the attenuation coefficient is 0.15 dB/cm/MHz, or one-half the intensity coefficient. The intensity coefficient is double the pressure coefficient because intensity is proportional to the square of pressure.

The attenuation coefficient chosen, 0.3 dB/cm/MHz, is significantly lower than any specific solid tissue in the body. This value was chosen to account for fetal examinations. In early trimester ultrasound fetal examinations, there may be a significant fluid path between the probe and the fetus, and the attenuation of fluid is very small. Therefore the attenuation coefficient was lowered to account for this.

15.7.2 Limits of Acoustic Output

In accordance with the FDA Track 3 requirements, the derating (or attenuated) approach was incorporated into the FDA Acoustic Output Limits, as listed below. The maximum acoustic output level from any probe in any operating mode is expected to fall below these limits.

FDA Maximum Acoustic Output Limits for Track 3 (Attenuated Values)

Application	$I_{spta.3}$ (mW/cm ²)	$I_{sppa.3}$ (W/cm ²)	or	MI
Regions (except eyes)	≤ 720	≤ 190		≤ 1.9

15.7.3 Differences between Actual and Displayed MI and TI

In operation, the system will display the Acoustic Output Parameters Thermal Index (TI) or Mechanical Index (MI) (or sometimes both parameters simultaneously) to the operator. These parameters were developed as general indicators of risk from either thermal or mechanical action of the ultrasound wave. They serve to indicate to the operator whether a particular system setting increases or decreases the possibility of Thermal or Mechanical effect. More specifically, they were designed to assist in the implementation of the ALARA principle. As an operator changes a given system control, the potential effect of the change in output is indicated. However, the Thermal Index is not the same as the raise in temperature in the body, for several reasons. First of all, in order to provide a single display index, a number of simplifying assumptions had to be made. The biggest assumption was the use of the attenuating formula described above, which is much lower than the actual value for most tissues within the body. Scanning through muscle or organ tissue, for example, will produce much higher attenuation than 0.3 dB/cm/MHz. Significant simplifications were also made for the thermal properties of tissue. Therefore, scanning through highly-perfused tissue, such as the heart or vasculature, will produce significantly less thermal effect than that suggested by the Thermal Index.

Similarly, the Mechanical Index was derived to indicate the relative possibility of mechanical (cavitation) effects. The MI is based on the derated peak rarefactional pressure and the center frequency of the ultrasound wave. The actual peak rarefactional pressure is affected by the actual attenuation caused by tissue in the path between the probe and the focal point. Again, all solid tissues within the body have higher attenuation than the prescribed 0.3 dB/cm/MHz value, and therefore, the actual peak rarefactional pressure will be lower. Further, the actual peak rarefactional pressure will change depending on the region of the body being scanned.

For these reasons, the TI and MI displays should only be used to assist the operator in implementing ALARA at the time of the patient examination.

15.8 Measurement Uncertainty

The total estimated measurement uncertainty (where the total uncertainty includes uncertainties in hydrophone response, measurement, calculation and positioning) are:

I_{spta}	28.5%
I_{sppa}	28.5%
Center frequency (f_c)	2%
Total power (W)	28.5 % (5.1% for Scan-mode and Combined-mode)
Rarefactional pressure (pr)	14.7%

15.9 References for Acoustic Power and Safety

1. "Bioeffects and Safety of Diagnostic Ultrasound" issued by AIUM in 1993
2. "Medical Ultrasound Safety" issued by AIUM in 1994
3. "Acoustic Output Measurement Standard for Diagnostic Ultrasound Equipment, Revision 3" issued by AIUM/NEMA in 2004
4. "Standard for real-time display of thermal and mechanical acoustic output indices on diagnostic ultrasound equipment, Revision 2" issued by AIUM/NEMA in 2004
5. "Information for Manufacturers Seeking Marketing Clearance of Diagnostic Ultrasound Systems and Transducers" issued by FDA in 2008
6. "Medical electrical equipment – Part 2-37: Particular requirements for the safety of ultrasonic medical diagnostic and monitoring equipment" issued by IEC in 2007

16 EMC Guidance and Manufacturer's Declaration

The system complies with the EMC standard IEC 60601-1-2: 2014.

Intended Environments: HOME HEALTHCARE ENVIRONMENT (except for near active HF SURGICAL EQUIPMENT and the RF shielded room of an ME SYSTEM for magnetic resonance imaging).

- WARNING:**
1. The use of unapproved accessories may diminish system performance.
 2. Use of components, accessories, probes, and cables other than those specified may result in increased emission or decreased immunity of system.
 3. Operation of system, in the case that the patient physiological signal is lower than the minimum amplitude or value specified in the product specifications, results may not be obtained (results can be obtained when the HR is in the range of 30-250 bmp or when the QRS wave amplitude is between 0.5-5 mV.)
 4. Use of this equipment adjacent to or stacked with other equipment should be avoided because it could result in improper operation. If such use is necessary, this equipment and the other equipment should be observed to verify that they are operating normally.
 5. Use of accessories, transducers and cables other than those specified or provided by the manufacturer of this equipment could result in increased electromagnetic emissions or decreased electromagnetic immunity of this equipment and result in improper operation.
 6. Portable RF communications equipment (including peripherals such as antenna cables and external antennas) should be used no closer than 30 cm (12 inches) to any part of the system, including cables specified by the manufacturer. Otherwise, degradation of the performance of this equipment could result.

- NOTE:**
- 1 The system needs special precautions regarding EMC and needs to be installed and put into service according to the EMC information provided below.
 - 2 Other devices may interfere with this system even though they meet the requirements of **CISPR**.
 - 3 Preventing conducted RF immunity. Due to technological limitations, the conducted RF immunity level are limited to 3Vrms level, conducted RF interference above 3Vrms may cause wrong diagnosis and measurements. We suggest that you position system further from sources of conducted RF noise.
 - 4 Portable and mobile RF communications equipment can affects system. See tables 1, 2, 3, and 4 below.

If the system is operated within the electromagnetic environment listed in Table 2 and Table 3, the system will remain safe and will provide the following basic performances:

- Imaging;
- Doppler acoustic spectral displaying;
- Taking measurements;
- Patient information;
- Date/time information.

TABLE 1

GUIDANCE AND MINDRAY DECLARATION—ELECTROMAGNETIC EMISSIONS		
The system is intended for use in the electromagnetic environment specified below. The customer or the user of system should assure that it is used in such an environment.		
EMISSIONS TEST	COMPLIANCE	ELECTROMAGNETIC ENVIROMENT—GUIDANCE
RF emissions CISPR 11	Group 1	The 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 emissions CISPR 11	Class B	The system is suitable for use in all establishments including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes
Harmonic Emissions IEC 61000-3-2	Class A	
Voltage Fluctuations/ Flicker Emissions IEC 61000-3-3	Compliance	

TABLE 2

GUIDANCE AND MINDRAY DECLARATION—ELECTROMAGNETIC IMMUNITY			
The system is intended for use in the electromagnetic environment specified below. The customer or the user of system should assure that it is used in such an environment.			
IMMUNITY TEST	IEC 60601 TEST LEVEL	COMPLIANCE LEVEL	ELECTROMAGNETIC ENVIRONMENT-GUIDANCE
Electrostatic Discharge(ESD) IEC 61000-4-2	±8 kV contact; ±15 kV air	±8 kV contact; ±15 kV air (±8kV air for Touch screen and control panel)	the environmental humidity should be at least 55% before using.
Electrical fast Transient / burst IEC 61000-4-4	±2 kV for power supply lines; ±1 kV for input/output lines	±2 kV for power supply lines; ±1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV line(s) to line(s); ±2 kV line(s) to earth	±1 kV line(s) to line(s); ±2 kV line(s) to earth	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, Short interruptions and voltage variation on power supply input voltage IEC 61000-4-11	0 % UT; 0,5 cycle At 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315° 0 % UT; 1 cycle 70% UT for 25/30 cycle at 0° 0 % UT; 250/300 cycle	0 % UT; 0,5 cycle At 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315° 0 % UT; 1 cycle 70% UT for 25/30 cycle at 0° 0 % UT; 250/300 cycle	Mains power quality should be that of a typical commercial or hospital environment. If you require continued operation during power mains interruptions, it is recommended that our product be powered from an uninterruptible power supply or a battery.
Power frequency (50/60 HZ) magnetic field IEC 61000-4-8	30 A/m	30 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
NOTE: U_T is the A.C. mains voltage prior to application of the test level.			

TABLE 3

GUIDANCE AND MINDRAY DECLARATION—ELECTROMAGNETIC IMMUNITY			
The system is intended for use in the electromagnetic environment specified below. The customer or the user of system should assure that it is used in such an environment.			
IMMUNITY TEST	IEC 60601 TEST LEVEL	COMPLIANCE LEVEL	ELECTROMAGNETIC ENVIRONMENT-GUIDANCE
Conducted RF IEC 61000-4-6	3 Vrms 0,15 MHz – 80 MHz 6 Vrms in ISM and amateur radio bands between 0,15 MHz and 80 MHz	3 Vrms 0,15 MHz – 80 MHz 6 Vrms in ISM and amateur radio bands between 0,15 MHz and 80 MHz	Portable and mobile RF communications equipment should be used no closer to any part of system, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance $d = 1.2 \times \sqrt{P}$
Radiated RF IEC 61000-4-3	10 V/m 80MHz - 2.7GHz	10 V/m 80MHz - 2.7GHz	$d = 1.2 \times \sqrt{P}$ 80 MHz to 800 MHz $d = 2.3 \times \sqrt{P}$ 800 MHz to 2.7GHz Where, P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m).
Proximity fields from RF wireless communications equipment IEC 61000-4-3	27 V/m 380–390 MHz	27 V/m	Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, should be less than the compliance level in each frequency range. Interference may occur in the vicinity of equipment marked with the following symbol: 
	28 V/m 430–470 MHz, 800–960 MHz, 1700–1990 MHz, 2400–2570 MHz	28 V/m	
	9 V/m 704–787 MHz, 5100–5800 MHz	9 V/m	
<p>Note 1 At 80 MHz and 800 MHz, the higher frequency range applies.</p> <p>Note 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.</p>			
<p>a Field strengths from fixed transmitters, such as base stations for radio (cellular /cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which system is used exceeds the applicable RF compliance level above, system should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the system.</p> <p>b Over the frequency range 150kHz to 80MHz, field strengths should be less than 3V/m.</p>			

TABLE 4

RECOMMENDED SEPARATION DISTANCES BETWEEN PORTABLE AND MOBILE RF COMMUNICATION DEVICE AND THE SYSTEM			
The system is intended for use in an electromagnetic environment in which radiated RF disturbance are controlled. The customer or the user of system can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communication equipment (transmitters) and system as recommended below, according to the maximum output power of the communication equipment.			
Rated Maximum Output power of Transmitter (W)	Separation Distance According to Frequency of Transmitter (m)		
	150kHz -80MHz $d=1.2\sqrt{P}$	80MHz-800MHz $d=1.2\sqrt{P}$	800MHz-2.7GHz $d=2.3\sqrt{P}$
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 transmitters at a maximum output power not listed above, the recommended separation distanced in meters (m) can be determined using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.			
If system image distortion occurs, it may be necessary to position system further from sources of conducted RF noise or to install external power source filter to minimize RF noise to an acceptable level.			
Note 1 At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.			
Note 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			

Cable sample

No.	Name	Cable length (m)	Shield or not	Remarks
1	Power input	2.5m	Not shielded	/
2	SIP/SOP	<3.0m	Shielding	/
3	ECG cable	4.0m	Shielding	/
4	Probe Cable	<3.0m	Shielding	/
5	Footswitch Cable	2.9m	Shielding	/

17 System Maintenance

Routine system maintenance shall be carried out by the user. System maintenance after the warranty has expired is the full responsibility of the owner/operator.

The responsibility for maintenance and management of the product after delivery resides with the customer who has purchased the product.

If you have any questions, please contact the Mindray Customer Service Department or a sales representative.



WARNING:

1. Only an authorized Mindray service engineer can perform maintenance which is not specified in this operator's manual.
2. For the sake of system performance and safety, perform periodical checks of the system.

17.1 Daily Maintenance

You are responsible for daily maintenance.

17.1.1 Cleaning the System



WARNING:

1. Before cleaning the system, be sure to turn off the power and disconnect the power cord from the outlet. Cleaning the system while the power is "On" may result in electric shock.
2. DO NOT directly spray solution onto the monitor, system control panel or hard surfaces that are under pressure or pumped. Ingress fluid leakage into the monitor or system can damage the monitor or system, causing possible electric shock or system failure.



CAUTION:

Do not spill water or other liquids into the system while cleaning. This may result in malfunction or electric shock.

NOTE:

1. DO NOT use hydrocarbon glass cleaner or cleaner for OA (Office Automation) equipment to clean the monitor. These substances may cause deterioration of the monitor.
2. Clean the control panel periodically, otherwise the button may become blocked with dirt and the system will buzz while the button has no effect.

■ Cleaning the probe cover and connector:

- Tools: mild soapy water, soft dry cloth, soft brush
- Method:
 - a) Wipe away dust attached to the surface of the probe head, connector and cable.
 - b) Use a soft brush to gently brush away dust from inside the probe connector.
 - c) Remaining stains or dust attached to the surface of the cable or connector should be wiped away using a cloth with a little soapy water and then air dried.

Refer to chapter “13.1.5 Probes Cleaning and Disinfection” for cleaning and disinfection for the probes.

NOTE: Do not use a wet cloth to clean the probe connector.

■ Cleaning the probe cable

- a) Use a soft dry cloth to wipe away stains from the probe cable.
- b) If the stains are difficult to remove, use a soft cloth dipped in a mild detergent and then let the cable air dry.

■ Cleaning holders

- Tools: soft dry cloth, soapy water, soft brush
- Method:

The surface of the power button should be cleaned with a soft dry cloth. Remaining stains should be wiped away using a cloth with clean or soapy water (NOTE: the cloth should not be made too wet, as this may cause electric shock) and the surface left to air dry.

- a) Use a soft dry cloth to wipe away dust attached to the inside, outside and gaps in the probe holder or gel holder. Use a soft brush to brush away dust or stains from the small intra-cavity probe holder or its gap.
- b) Remaining stains on the inside and outside of the holder should be wiped away using a cloth with a little soapy water and then air dried.
- c) Gel warmer: remove the gel warmer after pulling out the power supply cable. Use a soft dry cloth to wipe away dust attached to the inside and outside, then brush away dust in the gel warmer or brush stains with a little soapy water and then air dry.

■ Cleaning the monitor and the touch screen

- Tool: soft dry cloth, clean or soapy water
- Method:

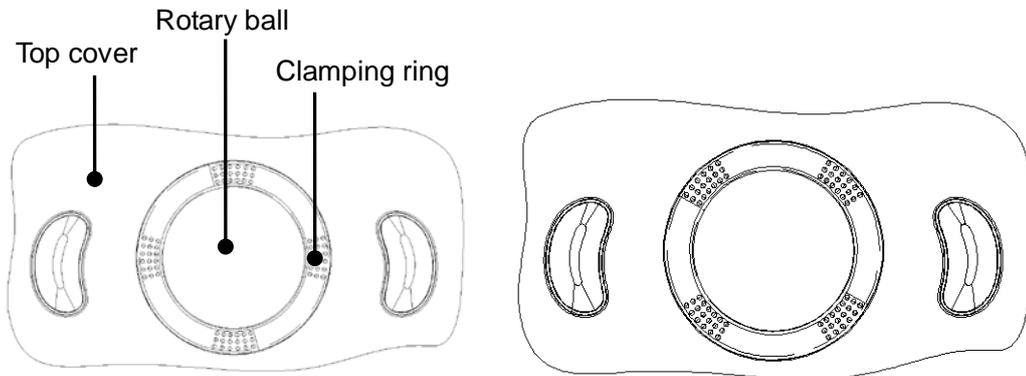
The surfaces of the monitor and touch screen should be cleaned with a soft dry cloth. Remaining stains should be wiped away using a cloth with a little clean or soapy water and then air dried.

■ Cleaning the trackball

- Tools: paper, dry cloth, mild soapy water
- Method:

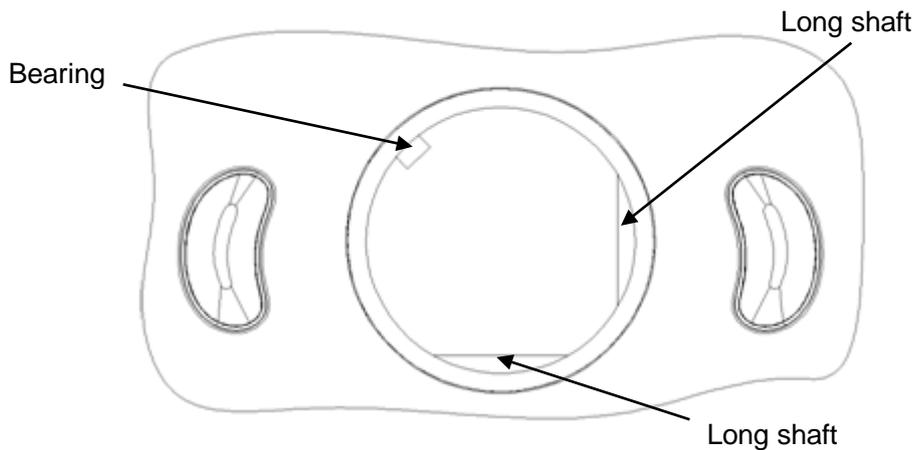
1. Disassembling the trackball:

Press the bulges on the clamping ring using both hands and turn the ring about 35° clockwise until it lifts. Take out the ring and the rotary ball. Be careful not to drop the ball. See the figure below.



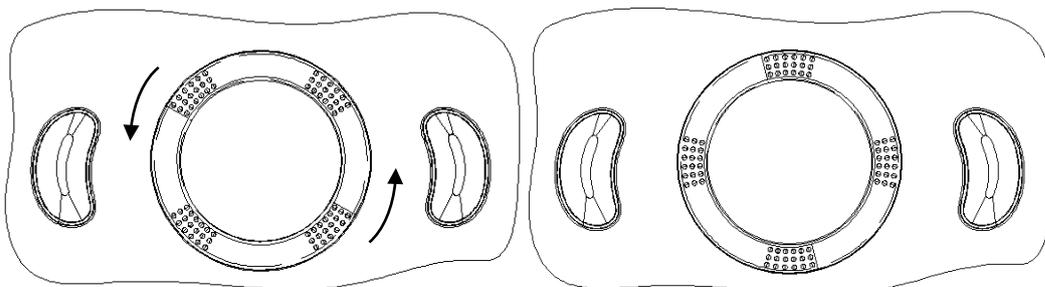
2. Cleaning

Clean the two long shafts, the bearing and the rotary ball with a clean soft dry cloth or paper.



3. Installing the trackball

Put the rotary ball back in the trackball mechanism and put the clamping ring back in. Turn the ring counterclockwise until the bulges are flush with the top cover and the ring clicks and locks, meaning the ring is secured. See the figure below.



■ Cleaning the main panel

- Tools: soft dry cloth, soapy water
- Method:

Use a soft dry cloth to clean the surface of the control panel (including the keystrokes, encoders and sliders). If the control panel is dirty, moisten the soft cloth with a little mild soapy water and wipe away any stains. Use another soft dry cloth to remove any moisture and allow all hard surfaces to completely air dry. If the control panel is difficult to clean, disassemble the encoder caps first and then clean it with mild soapy water.

NOTE: The keyboard on the control panel should be cleaned periodically, otherwise the keys may become blocked with dirt and when the buzzer rings the keys will not work.

■ Cleaning the cover

- Tools: soft dry cloth, soapy water
- Method:

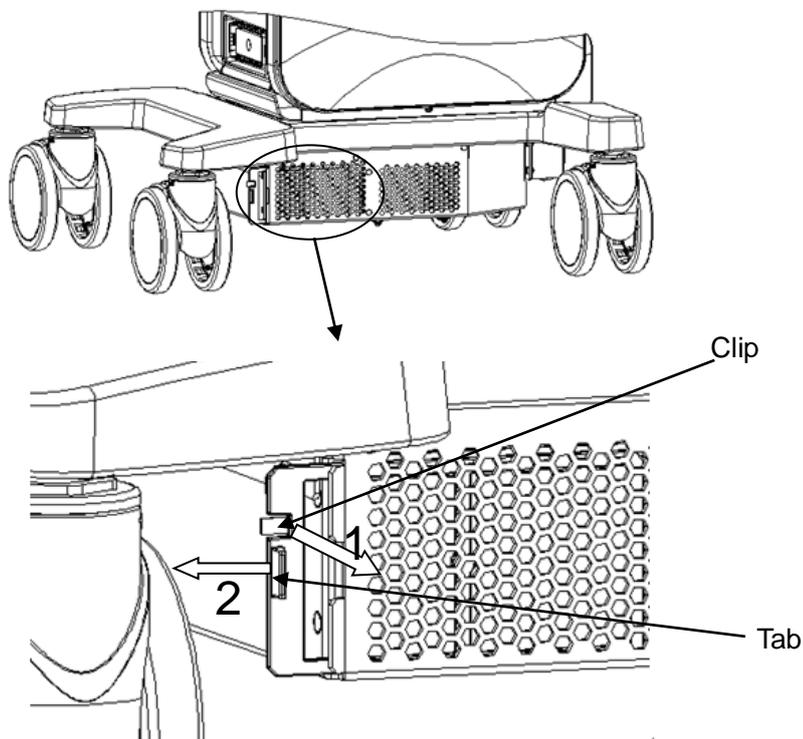
Use a soft dry cloth to clean the system's cover. If the system is dirty, moisten the soft cloth with mild soapy water, wipe away any stains, then air dry.

■ Clean the dust-proof cover

- Tools: soft brush
- Method:

a) Disassemble the dustproof cover before cleaning.

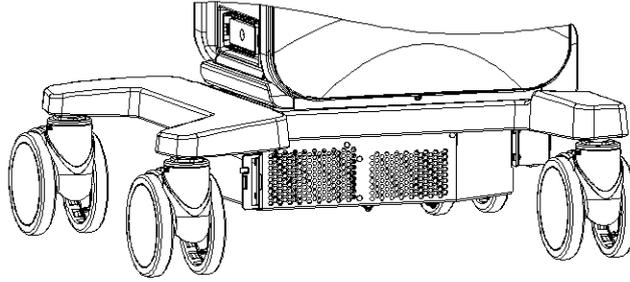
System's dustproof cover: use one hand to pull the dust proof clip in the direction of arrow 1 and use the other hand to pull the dust proof cover in the direction of arrow 2 at the same time.



Probe port dustproof cover: Pull it out.

- b) Clean with a soft brush and then wipe away the dust.
- c) Assemble the dustproof covers.

Insert the dustproof clasp into the slot on the main unit, push the dustproof clasp inward until it is fixed in the slot.



⚠ CAUTION: Please clean all the system's dustproof covers periodically (once per month). Failure to do so may result in system damage. Cleaning times can be increased when the system is used in the open air or somewhere more dusty.

NOTE: Use a soft brush to brush away dust attached to all visible sockets or interfaces (such as probe sockets, sockets or interfaces in the IO panel and power supply panel). Do not use a cloth and water.

■ **Cleaning the peripherals**

Carry out cleaning maintenance according to your actual peripheral configuration. Items which are not configured can be skipped.

Content	Description
Color and B/W video printer	Wipe away dust or stains on the printer cover with a soft dry cloth, then clean the inside of the printer. Carry out cleaning maintenance according to the operation manual if necessary.
Graph/text printer	Wipe away dust or stains on the printer cover with a soft dry cloth, then clean the inside of the printer. Carry out cleaning maintenance according to the operation manual if necessary.
Foot switch	Use a soft dry cloth with a little mild soapy water to wipe away dust or stains attached to the foot switch pedals or cable.
Barcode reader	Use a soft dry cloth to wipe away dust from the glass panel of the reader, then wipe away dust or stains from the cable and bracket. See Appendix B Barcode Reader for details.

17.1.2 Checking the Probe

- Visually check to confirm that there are no cracks or expansion of the probe head.
- Visually check to confirm that there is no deterioration or erosion of the probe cable.
- Visually check to confirm that none of the connector pins are bent, destroyed or falling off.

17.1.3 Checking the Power Cable and Plug

- Visually check to confirm that there are no wrinkles, cracks or deterioration.
- Manually check to confirm that there is no looseness or rupture. The connection of the plug is reliable.

17.1.4 Checking Appearance

Check if there are any cracks in the covers:

- Ultrasound system covers
- Probe appearance
- External appearance of the ECG lead

17.1.5 System Hard Drive Backup

To prevent deterioration or loss of data stored in the system hard drive (including patient info data, preset data, etc.), create a backup copy of the hard drive at regular intervals.

17.2 Troubleshooting

If any persistent system malfunction is experienced, e.g., an onscreen error message, blank imaging screen, absent menus, see the table below. If the failure cannot be resolved, contact the Mindray Customer Service Department or a sales representative.

■ Troubleshooting Table

No.	Failure	Cause	Measure
1	After the AC power input is connected, the power indicator does not light up.	Abnormal power system or incorrect connection of the power cord.	Check that the system is plugged in.
			Check that the plug has not become loose or dislodged from the back of the system.
2	The power indicator of the monitor is lit up, but the image is blank.	The interval between turning off and restarting the system is too short.	Turn off the system and wait at least 1 minute, then restart the system.
		The monitor brightness or contrast may be improperly set.	Adjust the monitor brightness and contrast.
3	The monitor displays the characters and menus but no images.	The frequency (image quality parameter), overall gain or TGC controls are improperly set.	Adjust the frequency, gain or TGC control.
		Check that a probe is connected and/or fully connected.	Ensure proper probe connection.
		The system is in freeze status.	Unfreeze the image.
4	The image quality is degraded	The exam mode is incorrect.	Select an appropriate exam mode.
		The image post-processing settings are incorrect.	Adjust the image post-processing settings or reset post-processing to the default values.
		The image presets are inappropriate.	Reset the factory default presets.
5	The button does not respond and the system is buzzing	There is dirt blocking the button	Check the control panel for the blocked button and press it several times to release it.
			Clean the button.

Appendix A iScanHelper

By providing the referential information, such as, the ultrasonic image, the anatomic graphic, scanning pictures/other scanning tips or diagnosis comments, the system helps the doctors to operate the scanning by iScanHelper. Furthermore, it is a good platform for the self-learning and training of ultrasound scanning technique for doctors. The system also plays a role in the assistant software system in fulfilling training and education.

Tips: iScanHelper feature is available under abdominal, urological and small parts exam modes.

NOTE: THIS "iScanHelper" IS FOR REFERENCE OR TUTORIAL PURPOSES ONLY, AND THE MANUFACTURER WILL NOT BE LIABLE FOR DAMAGES AND/OR OTHER UNDESIRABLE CONSEQUENCE IN ANY KIND THAT MAY OCCUR TO THE PATIENT OR THE USERS BY USING THE SOFTWARE.

A.1 Enter/ Exit

■ Enter

Press the user-defined key for entering iScanHelper (setting path: [Setup] (F10) → [System] → [Key Config.]).

■ Exit

Press the user-defined key again to exit iScanHelper.

A.2 Use iScanHelper for Reference

1. Perform ordinary scanning procedure.
2. Press the user-defined key for entering iScanHelper to enter iScanHelper status.
3. Rotate the trackball to move the cursor onto the target view name in the view selecting box and then press <Set>.
4. Perform scanning according to information displayed on the help information area.
You can zoom in a single window in the help information area to see the window more clearly. For details, please refer to "A.4.3 Single/quad-window Display".
5. Press the user-defined key for entering iScanHelper again to exit.

A.3 Use iScanHelper for Learning or Training

1. Switch to the exam modes that support iScanHelper.
2. Press the user-defined key for entering iScanHelper to enter iScanHelper status.
3. Learn and practise views by system defaulted sequence according to the information displayed on help information area; or select unfamiliar views to practise.
You can zoom in a single window in the help information area to see the information. For details, please refer to "A.4.3 Single/quad-window Display".
4. Press the user-defined key for entering iScanHelper again to exit iScanHelper.

A.4 Basic Screen and Operation

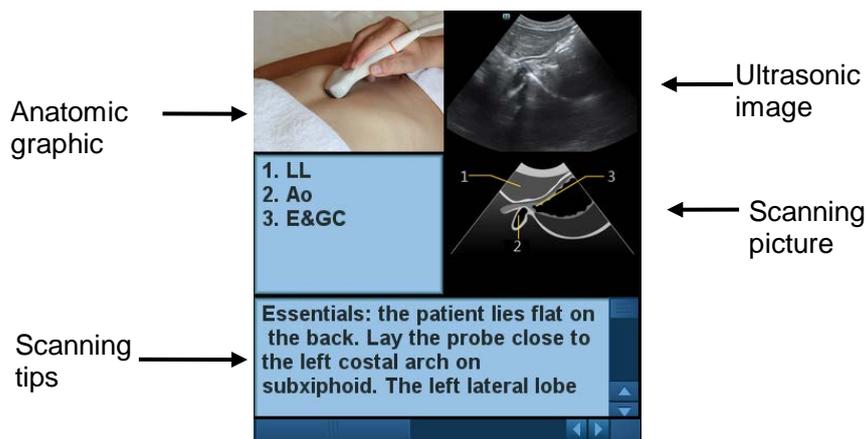


A.4.1 View Selecting Area

Rotate the trackball to move the cursor onto the target view and press <Set>, related information will be displayed on the help information area.

A.4.2 Help Information Area

Help information area displays on the lower right corner of the screen, providing ultrasonic image, anatomic graphic, scanning picture and scanning tips.



- Ultrasonic image
It is used to compare with images scanned by the operator.
- Anatomic graphic
Related anatomical tissue information are provided here.
- Scanning picture
Ordinary scanning tips can be observed here, including posture, probe mark, probe swing/sweep techniques.

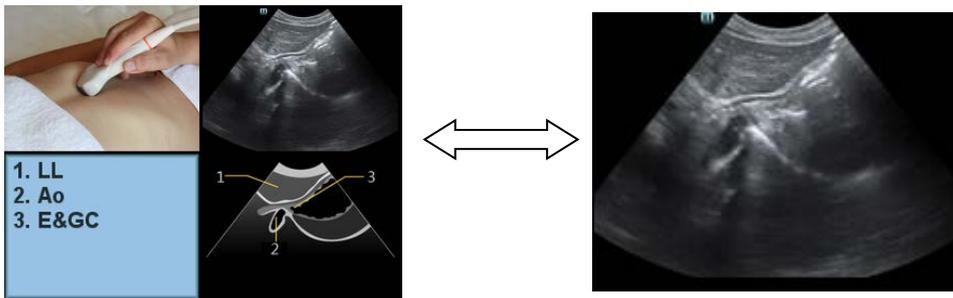
- Scanning tips

You can read tissue related anatomical information and adjacent tissue information here.

A.4.3 Single/quad-window Display

You can zoom in the anatomic graphic, ultrasonic image as well as scanning picture to view those information more conveniently.

Press <Cursor> to obtain the cursor. Move the cursor on the anatomic graphic, the ultrasonic image or scanning tips. Double-click <Set> to go to the single window of each of them. Double-click single window again to return to quad-window display.



A.5 Measurement, Comments, and Body Mark

Switching probe or exam, measurement, comments and the body mark are unavailable under iScanHelper status.

Appendix B Barcode Reader

The product supports two kinds of readers for logging data as patient ID: 1-D barcode reader (SYMBOL LS2208) and 2-D barcode reader (SYMBOL DS6707). The laser transmitted by the two readers is Class 2 laser.

WARNING: Class 2 laser adopts low power, visible LED. DO NOT stare into beam because of unknown hazards of transient radiation provided by class 2 laser.

CAUTION: Ensure the information acquired by barcode reader is consistent with the actual information.

There are 2 operation modes:

Hand-held mode: press the trigger to decode.

Hands-free mode: seat the reader in the stand to enter the mode, the reader decodes automatically.

Note: the reader does not support decoding of Multilanguage.

B.1 1-D Barcode Reader

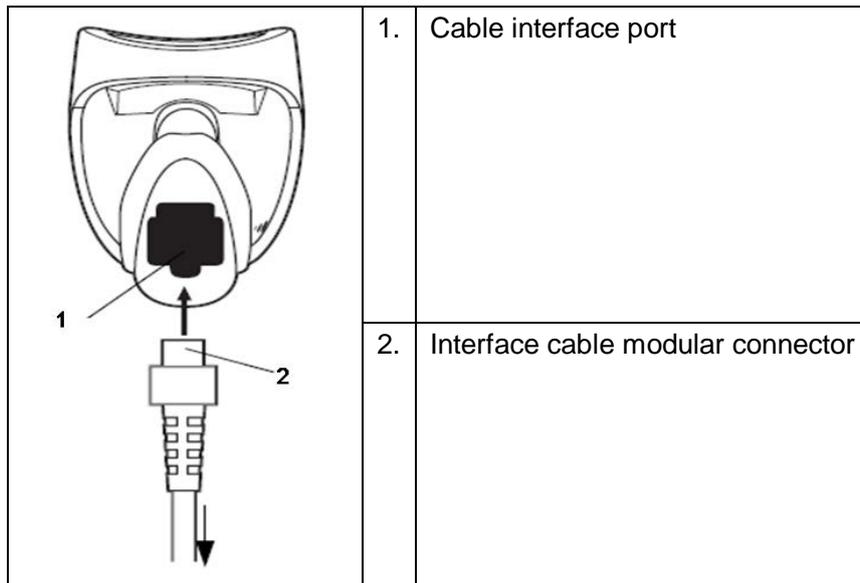
B.1.1 Overview



1.	LED	Green: A barcode was successfully decoded. Red: A data transmission error or reader malfunction occurred.
2.	Scan window	Scan the barcode.
3.	Trigger	Press to decode

B.1.2 Setting Up the Reader (Take LS2208 as an example)

1. Plug the interface cable modular connector into the cable interface port on the bottom of the reader handle, and ensure the connector is properly secured.
2. Connect the other end of the interface cable to the host.



B.1.3 Setting

The reader has factory settings; please refer to A.4 for details.

The reader supports some user-defined functions as introduced below.

For more details, please contact the SYMBOL reader agents or Mindray Customer Service Department.

■ Volume setting:

Scan the following barcode to set the volume parameter.



Low Volume



Medium Volume



High Volume

■ code 93 and codebar scanning:

To enable or disable Code 93, scan the appropriate barcode below.



Enable Code 93

To enable Codebar, scan the appropriate barcode below.



Enable Codabar

■ code 39 full ASCII scanning:

Code 39 Full ASCII is a variant of Code 39 which pairs characters to encode the full ASCII character set. To enable or disable Code 39 Full ASCII, scan the appropriate barcode below.



Enable Code 39 Full ASCII



Disable Code 39 Full ASCII

■ I 2 of 5 symbols setting:



I 2 of 5 - One Discrete Length

Select this option to decode only I 2 of 5 symbols containing a selected length. Select the length using the numeric barcodes below. For example, to decode only I 2 of 5 symbols with 8 characters, scan **I 2 of 5 - One Discrete Length**, then scan **0** followed by **8**.



0



1



2



3



4



5



6



7



8



9

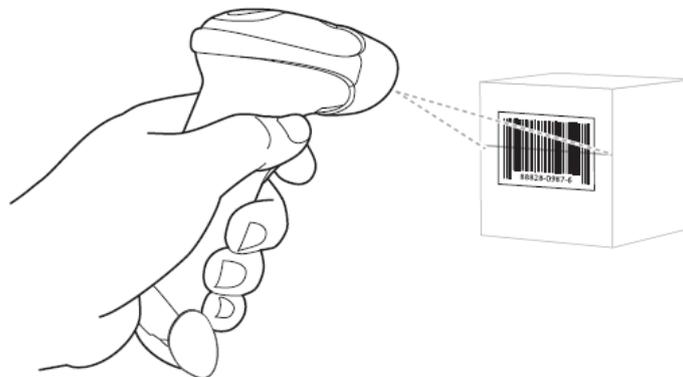
B.1.4 Scanning in Hand-Held Mode

1. Ensure all connections are secure.
2. Aim the reader at the barcode. Press the trigger.

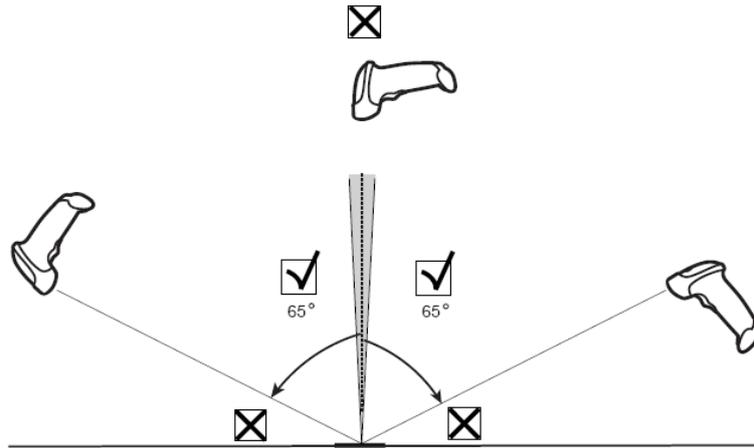
Note: Ensure the scan line crosses every bar and space of the symbol, see the figure below.



3. Upon successful decode, the reader beeps and the LED turns green.

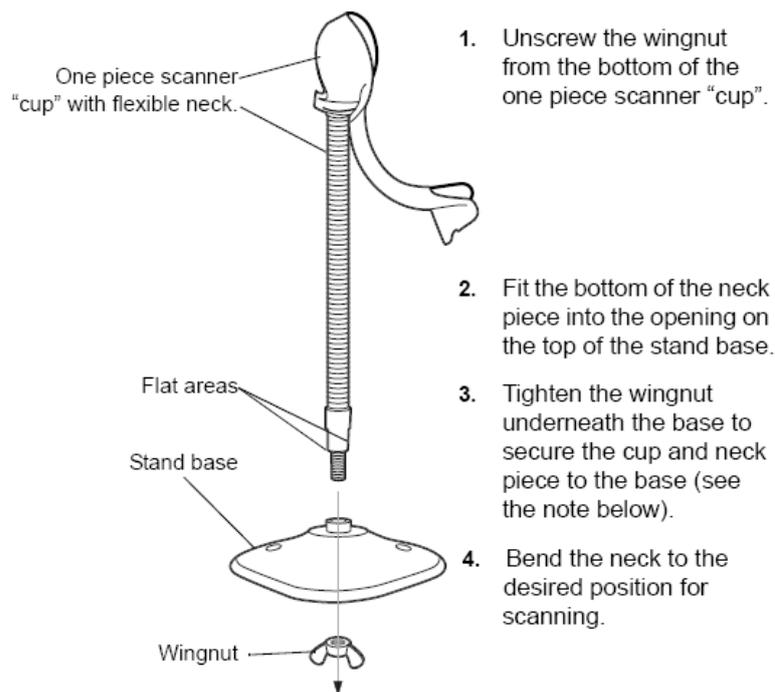


Tips: Do not hold the reader directly over the barcode. Laser light reflecting *directly* back into the reader from the barcode is known as specular reflection. This specular reflection can make decoding difficult. You can tilt the reader up to 55° forward or back and achieve a successful decode



B.1.5 Scanning in Hands-Free Mode

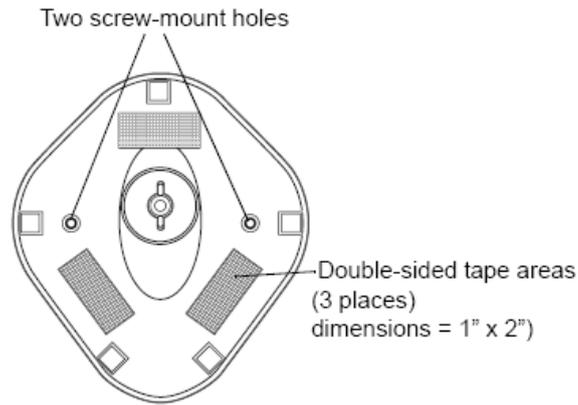
B.1.5.1 Assembling the Intellistand



NOTE Before tightening the wingnut under the base, ensure that the flat areas on the flexible neck fit securely in the grooves in the base.

B.1.5.2 Mounting the Stand (optional)

You can attach the base of the reader's stand to a flat surface using two screws or double-sided tape (not provided).



■ **Screw Mount**

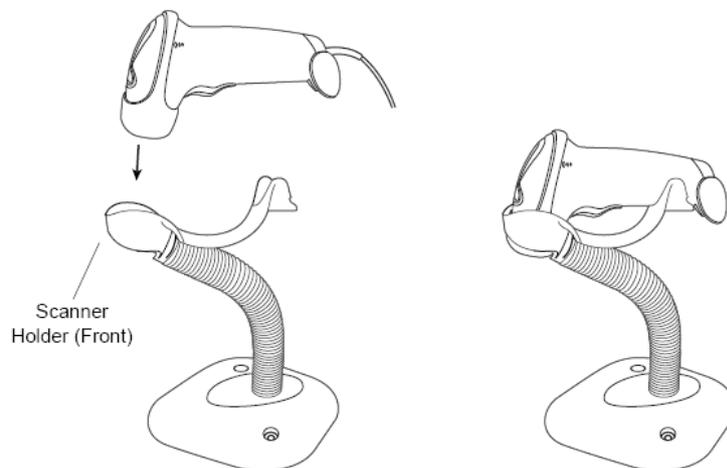
1. Position the assembled base on a flat surface.
2. Screw one #10 wood screw into each screw-mount hole until the base of the stand is secure

■ **Tape Mount**

1. Peel the paper liner off one side of each piece of tape and place the sticky surface over each of the three rectangular tape holders.
2. Peel the paper liner off the exposed sides of each piece of tape and press the stand on a flat surface until it is secure.

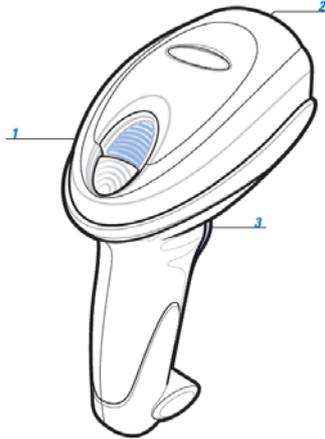
B.1.5.3 Scanning in Hands-Free Mode

When the reader is seated in the stand's "cup", the reader's built-in sensor places the reader in hands-free mode. When you remove the reader from the stand it operates in its normal hand-held mode.



B.2 2-D Barcode Reader (Take DS6707 as an example)

B.2.1 Overview

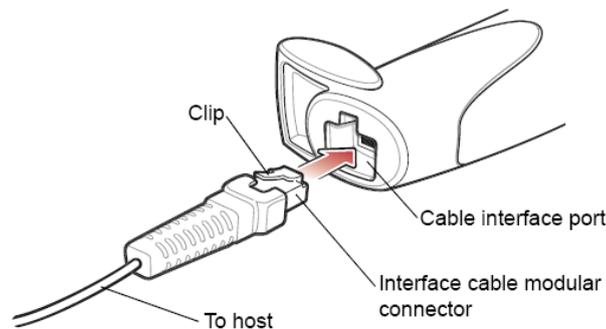


1.	LED	Green: A barcode was successfully decoded. Red: A data transmission error or reader malfunction occurred.
2.	Scan window	Scan the barcode.
3.	Trigger	Press to decode

B.2.2 Setting Up the Digital Imager Reader

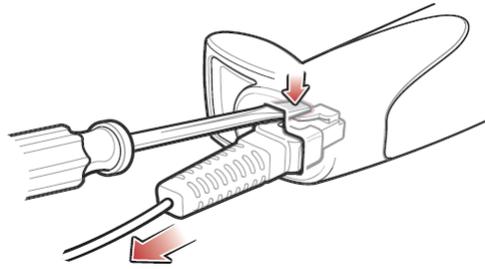
B.2.2.1 Installing the Interface Cable

1. Plug the interface cable modular connector into the cable interface port on the bottom of the reader handle and ensure the connector is properly secure.
2. Connect the other end of the interface cable to the host



B.2.2.2 Removing the Interface Cable

1. Using the tip of a screwdriver or some other tools with a sharp head, depress the cable's modular connector clip.



2. Carefully slide out the cable.

B.2.3 Setting

The reader has factory settings; please refer to A.4 for details.

The reader supports some user-defined functions as introduced below.

For more details, please contact the SYMBOL reader agents or Mindray Customer Service Department.

- Volume setting:

Scan the following barcode to set the volume parameter.



Low Volume
(02h)



Medium Volume
(01h)



High Volume
(00h)

- code 93 and codebar setting

To enable Code 93, scan the appropriate barcode below.



Enable Code 93
(01h)

To enable Codebar, scan the appropriate barcode below.



Enable Codabar
(01h)

■ code 39 full ASCII setting

Code 39 Full ASCII is a variant of Code 39 which pairs characters to encode the full ASCII character set. To enable or disable Code 39 Full ASCII, scan the appropriate barcode below.



Enable Code 39 Full ASCII
(01h)



Disable Code 39 Full ASCII
(00h)

■ I 2 of 5 symbols setting



I 2 of 5 - One Discrete Length

Select this option to decode only I 2 of 5 symbols containing a selected length. Select the length using the numeric barcodes below. For example, to decode only I 2 of 5 symbols with 8 characters, scan **I 2 of 5 - One Discrete Length**, then scan **0** followed by **8**.



0



1



2



3



4



5



6



7



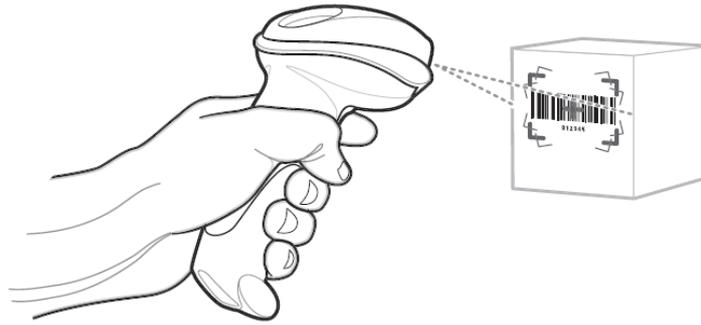
8



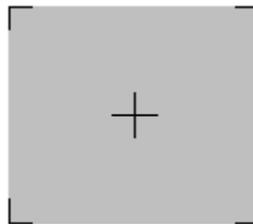
9

B.2.4 Scanning in Hand-Held Mode

1. Ensure all connections are secure (see the appropriate host chapter.)
2. Aim the digital imager reader at the barcode.

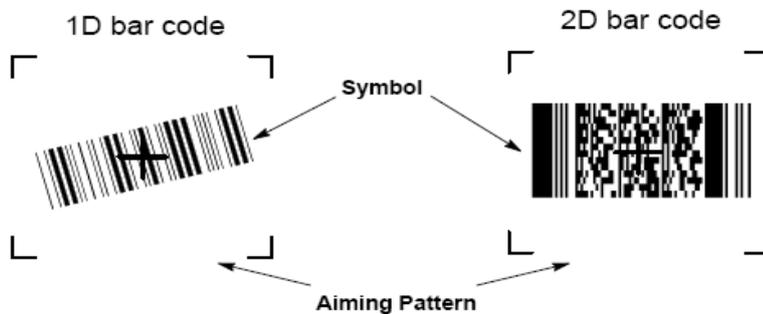


- When the digital imager reader senses movement, in its default **Auto Aim** trigger mode, it projects a red laser aiming pattern which allows positioning the barcode or object within the field of view.



If necessary, the digital imager reader turns on its red LEDs to illuminate the target barcode.

- Center the symbol in any orientation within the aiming pattern. Be sure the entire symbol is within the rectangular area formed by the brackets in the pattern.



- Hold the trigger until the digital imager reader beeps, indicating the barcode is successfully decoded.

Note: Steps 2 - 4 may be required to repeat on poor quality or difficult barcodes.

Tips: Hold the digital imager reader between two and nine inches (depending on symbol density) from the symbol, centering the aiming pattern cross hairs on the symbol.

The aiming pattern is smaller when the digital imager reader is closer to the symbol and larger when it is farther from the symbol. Scan symbols with smaller bars or elements (mil size) closer to the digital imager reader, and those with larger bars or elements (mil size) farther from the digital imager reader.

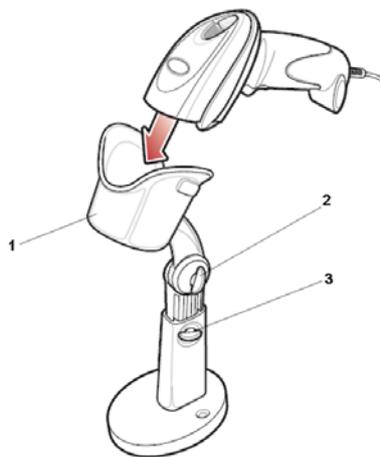
The digital imager reader can also read a barcode presented within the aiming pattern but not centered. The top examples in show acceptable aiming options, while the bottom examples cannot be decoded.



B.2.5 Scanning in Hands-Free Mode

The optional Intellistand adds greater flexibility to scanning operation. When the digital imager reader is seated in the stand's "cup," the digital imager reader's built-in sensor places the digital imager reader in hands-free mode. When the digital imager reader is removed from the stand it operates in its normal hand-held mode.

- Use the Intellistand's adjustment knobs to adjust the height and angle of the digital imager reader.



1.	Reader holder (cup)
2.	Angle adjustment knob
3.	Height adjustment knob

B.3 Setting in Ultrasound System

1. Press <F10 Setup> to enter the Setup menu.
2. Select [System]- [General].

The screenshot shows the 'Scan Code' configuration screen. At the top, there are navigation tabs: Region, General, Image, Application, OB, Key Config, Admin, and Scan Code. The 'Scan Code' tab is selected. Below the tabs, there are three main sections:

- Bar Code Reader:** A dropdown menu is set to '1D'.
- Input Patient Data mode:** Two radio buttons are present: 'Only Patient ID' (which is selected) and 'Combination item'.
- Barcode Data:** A large empty text input field.

Below these sections is a table for defining the 'Start' and 'End' positions for various data items:

	Start	End	
Patient ID	[Dropdown]	[Dropdown]	
Other ID	[Dropdown]	[Dropdown]	
First name	[Dropdown]	[Dropdown]	
Last name	[Dropdown]	[Dropdown]	
Middle name	[Dropdown]	[Dropdown]	
Age	[Dropdown]	[Dropdown]	Unit: [Years]
Birth(Year)	[Dropdown]	[Dropdown]	
Birth(Month)	[Dropdown]	[Dropdown]	
Birth(Day)	[Dropdown]	[Dropdown]	
Gender	[Dropdown]	[Dropdown]	Male [] Female []

At the bottom of the screen, a note reads: "Note: If the barcode does not contain the information of any item, configure the Start and End position as "0"

Setting items are described as follows:

Parameter	Description
Bar Code Reader	Select type: 1D or 2D.
Input Patient Data mode	Select the mode for inputting patient data. Only Patient ID: only patient ID is acquired from barcode reader. If this function is selected, patient ID can be acquired via barcode reading in Patient, Worklist or QR screen. Combination Item: patient ID, patient name and other information can be acquired from barcode.(available only in 2-D reader)
Barcode Data	When 2-D reader is adopted, you should first scan a sample barcode here and then set the parts definition for the information.

Parameter	Description
Patient ID Patient Name Age Birth Gender	Set the start and end position of each item. Note: 1. Length of birth month and data are of 2 letters. 2. If one item of information is not included in the barcode, set the start and end position of the item to be 0 respectively.

B.4 Parameter Defaults

Refer to the following table for parameter defaults of LS2208 and DS6707.

Parameter	Defaults
1-D Symbologies	
UPC/EAN	
UPC-A	Enable
UPC-E	Enable
UPC-E1	Disable
EAN-8/JAN 8	Enable
EAN-13/JAN 13	Enable
Bookland EAN	Disable
Decode UPC/EAN/JAN Supplementals (2and 5 digits)	Ignore
UPC/EAN/JAN Supplemental Redundancy	10
Transmit UPC-A Check Digit	Enable
Transmit UPC-E Check Digit	Enable
Transmit UPC-E1 Check Digit	Enable
UPC-A Preamble	System Character
UPC-E Preamble	System Character
UPC-E1 Preamble	System Character
Convert UPC-E to A	Disable
Convert UPC-E1 to A	Disable
EAN-8/JAN-8 Extend	Disable
UCC Coupon Extended Code	Disable
Code 128	
Code 128	Enable
UCC/EAN-128	Enable
ISBT 128	Enable
Code 39	
Code 39	Enable
Trioptic Code 39	Disable
Convert Code 39 to Code 32 (Italian Pharmacy Code)	Disable
Code 32 Prefix	Disable
Set Length(s) for Code 39	2 to 55
Code 39 Check Digit Verification	Disable
Transmit Code 39 Check Digit	Disable
Code 39 Full ASCII Conversion	Disable
Buffer Code 39	Disable
Code 93	
Code 93	Enable
Set Length(s) for Code 93	4 to 55
Interleaved 2 of 5 (ITF)	
Interleaved 2 of 5 (ITF) Enable	Enable
Set Lengths for I 2 of 5	14
I 2 of 5 Check Digit Verification	Disable
Transmit I 2 of 5 Check Digit	Disable

Parameter	Defaults
Convert I 2 of 5 to EAN 13	Disable
Codabar (NW - 7)	
Codabar	Enable
Set Lengths for Codabar	5 to 55
CLSI Editing	Disable
NOTIS Editing	Disable
2-D Symbologies	
PDF417	Enable
MicroPDF417	Disable
Code 128 Emulation	Disable
Data Matrix	Enable
Maxicode	Enable
QR Code	Enable

B.5 Maintenance

Cleaning the exit window is the only maintenance required. A dirty window can affect scanning accuracy.

- Do not allow any abrasive material to touch the window.
- Remove any dirt particles with a damp cloth.
- Wipe the window using a tissue moistened with ammonia/water.
- Do not spray water or other cleaning liquids directly into the window.

Appendix C iWorks (Auto Workflow Protocol)

C.1 Overview

The main objective of ultrasound workflow automation (iWorks) is to speed up exam times and reduce the excessive number of user interface manual key strokes that can lead to repetitive strain injuries over time. It automates a clinical workflow in common exam protocols in a logical “step by step” manner. It also prevents missing important parts of examinations as well as decreasing exam times.

A Protocol Event contains series workflow events (annotation comments, body marks and measurements) and image modal commands to assist the user in routine ultrasound examinations.

The system provides different protocol events based on the different application regions.

iWorks is an option.

C.2 Normal iWorks Basic Procedure

1. Enter the patient information.
2. Touch [iWorks] on the touch screen or press the user-defined key for iWorks to enter the protocol selection screen, and touch the corresponding protocol button to enter the status.
3. After the system enters the iWorks screen, the available protocol is displayed on the bottom of the screen. Perform the scanning and saving according to the screen prompt.
Perform measurements or add comments/body marks to the image according to the screen prompt.
4. After a view scanning is complete, press the user-defined save key (usually <Save1> or <Save2>) to switch to the next view according to the screen prompt.
5. Repeat step 3 and step 4 to acquire all the necessary images.
 - If a pathology is discovered, touch [Insert] to select a protocol outside of the normal routine to start scanning.
 - Touch [Repeat] to add a copy of the selected view to work on if necessary.
 - Touch [Next] or [Previous] to skip to a particular view you are interested in.
 - Touch [Replace] to delete images and operations for the selected view and restart operations on that view.
 - Touch [Delete] to delete the currently activated view.
 - Touch [Suspend] to start a manual scan when an unusual or atypical workflow is required, and touch [Resume iWorks] to restart the iWorks procedure.
6. After all views are finished, the system will prompt you to exit iWorks. Touch [Yes] to exit.

C.3 iWorks OB Procedure

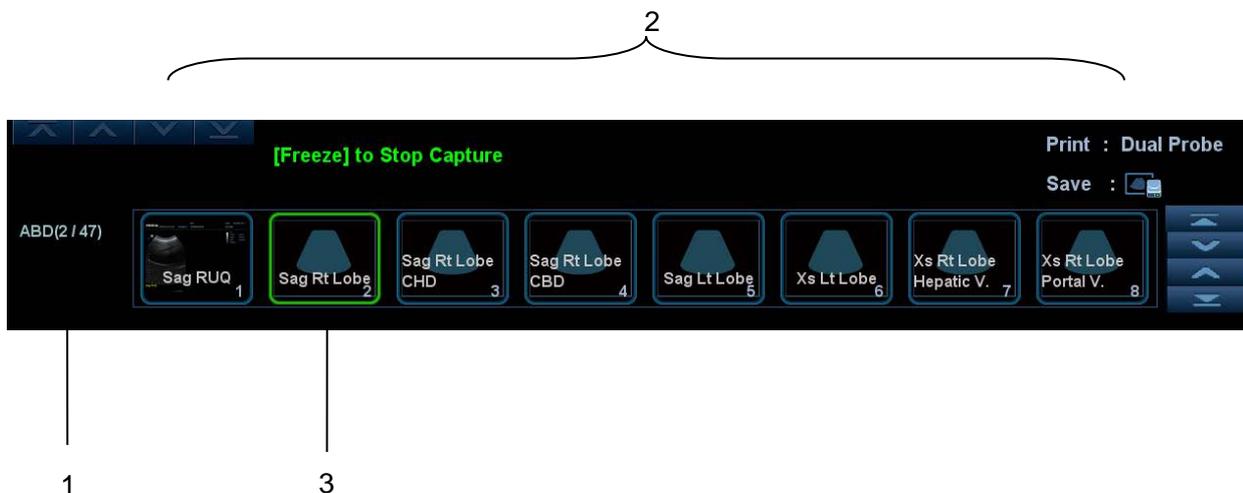
iWorks OB is a variation on the “iWorks” feature. iWorks is based on protocol events occurring in a linear “step by step” succession. iWorks OB accommodates protocol events that occur in a “random” or non-linear manner.

1. Enter the patient information.
 2. Touch [iWorks] on the touch screen to enter the protocol selection screen, and touch the corresponding protocol button to enter the status.
 3. After the system enters the iWorks screen, four categories of available views are displayed on the left part of the screen.
 4. Navigate the menu and press the knob to select a view (after pressing the knob, the view will be highlighted).
 5. Scan and save according to the screen prompt.
 6. Perform measurements or add comments/body marks to the image according to the screen prompt.
 7. Repeat step 4 and step 5 to acquire all the necessary images.
 - If a pathology is discovered, touch [Insert] to select a protocol outside of the normal routine to start scanning.
 - Touch [Repeat] to add a copy of the selected view to work on if necessary.
 - Touch [Next] or [Previous] to skip to a particular view you are interested in.
 - Touch [Replace] to delete images and operations for the selected view and restart operations on that view.
 - Touch [Delete] to delete the currently activated view.
- Touch [Suspend] to start a manual scan when an unusual or atypical workflow is required, and touch [Resume iWorks] to restart the iWorks procedure.
8. After all views are finished, the system will prompt you to exit iWorks. Touch [Yes] to exit.

C.4 Screen Display

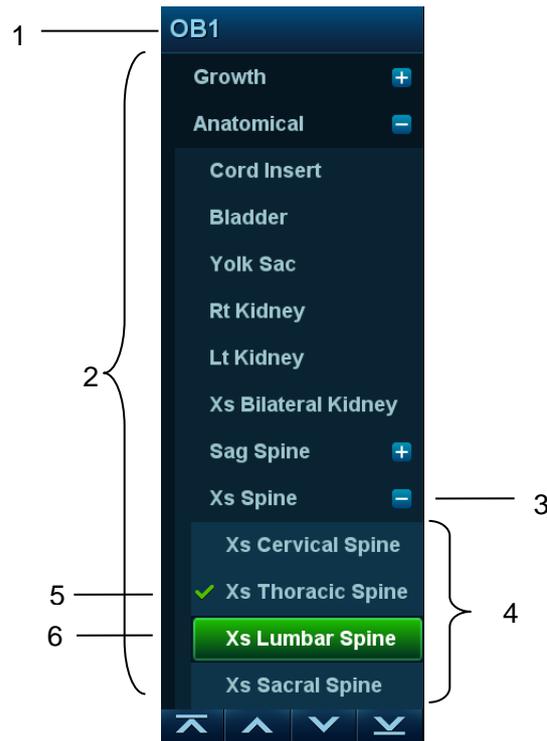
■ Normal iWorks

For automated protocols of vascular, small parts, cardiac, abdomen and gynecology application regions, the monitor displays the following screen:



Name	Description
1	Displays the protocol name and the number of views contained. There may be prompt information here to indicate the following operation.
2	Displays the view steps in the protocol.
3	The current active view, with a solid green frame around the image.

■ iWorks OB



Name	Description
1	Displays the protocol name.
2	Displays the different types of views based on different attributes.
3	Current view type.
4	Contained views of the current type.
5	Completed view, with a green “√” on the left.
6	The current active view, with a solid green frame around the image.

C.5 View Operation

In iWorks status, you can perform view selection, repeat, replacement and delete operations using the touch screen.



For some views, the system switches to the relevant imaging modes if necessary.

The comment for the current view has been automatically added to the bottom-left corner of the image, ready for you to scan the specified anatomy.

C.5.1 View Selection

Touch [Previous]/[Next] to select the view to be scanned. The current view is surrounded by a solid green frame.

C.5.2 View Operation

In the current active view, you can perform image scanning, measurements, and adding comments and body marks, etc. Operations are the same as those for manual operation. See the relevant chapters for details.

C.5.3 Repeat View

If necessary, touch [Repeat] to insert another template of the current view. You can then perform an extra examination.

C.5.4 View Replacement

The previous image will be deleted and replaced by the new image.

C.5.5 Delete View

Touch [Previous]/[Next] to select the view to be deleted. Touch [Delete] to delete the selected view.

C.6 Check Undone Section

You can quickly check and select an undone view using [Undone Section] on the touch screen.

Touch [Undone] on the screen to enter the selecting dialog box on the touch screen and touch the desired view to enter the status.

C.7 Manual Examination

Suspend - Exit the protocol so the user can run the system manually. This is used when an unusual or atypical workflow is required.

You can run the system manually if necessary.

- Start manual examination: touch [Suspend] to pause the current iWorks protocol. The system enters manual examination status.
- Return to iWorks: touch [Resume iWorks] to return to automated status. You can continue the previous iWorks scan.

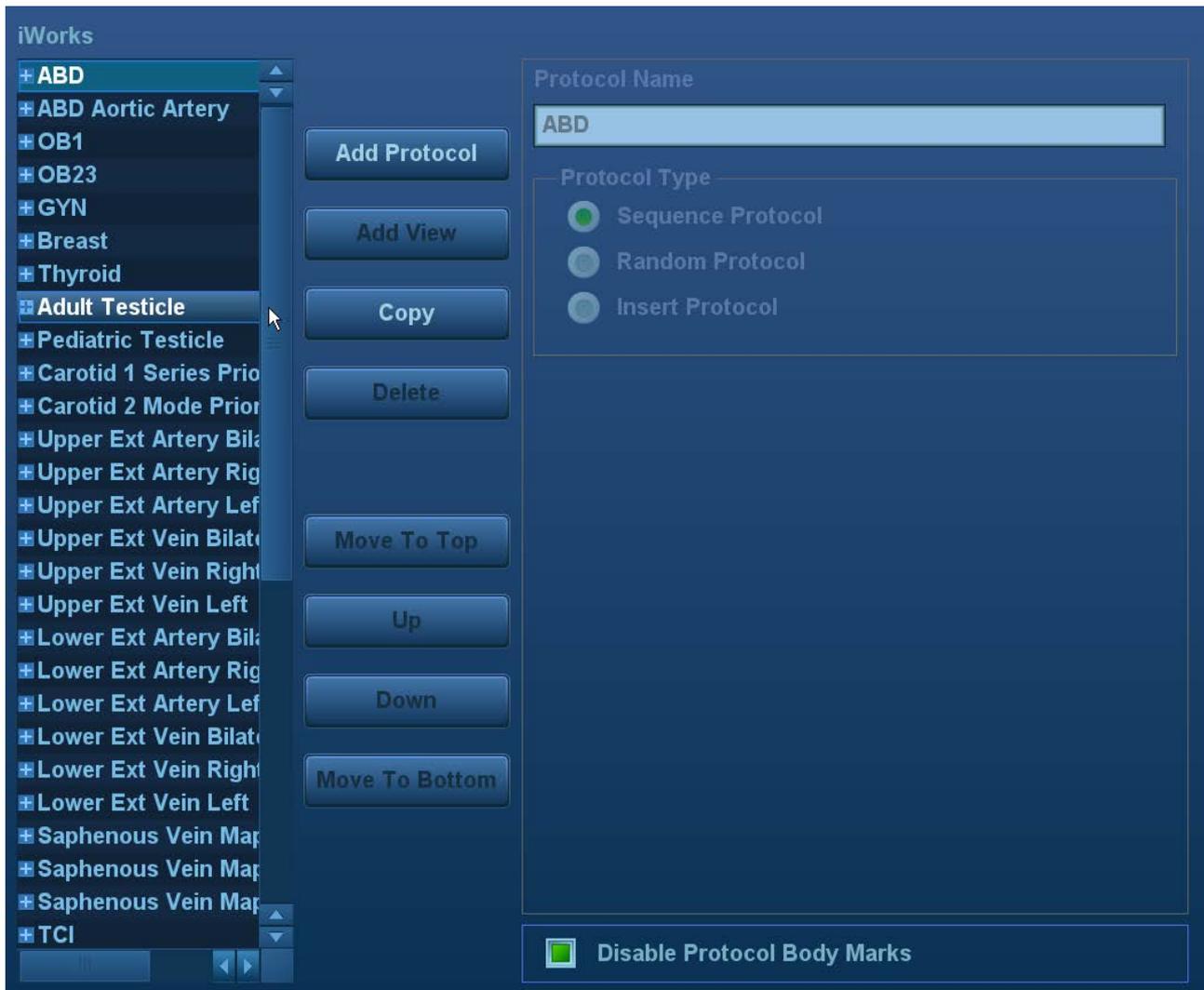
C.8 Insert

Insert is a specialized protocol event within iWorks and iWorks OB. It assists with the workflow for documenting and measuring common pathological (disease) states (i.e. Mass, Cyst, Stenosis, Thrombus) that occurs outside a routine, normal examination.

1. Touch [Insert] on the touch screen to enter the status.
2. Select the necessary protocol and the system adds the protocol events to the current protocol.
3. Perform measurements or add comments/body marks to the image if necessary.

C.9 iWorks Setting

Enter the iWorks preset screen using the path: “[Setup] → [iWorks].” Here you can customize the protocols and views:



C.9.1 Protocol Management

- Click to select the protocol in the list. The protocol type can be checked on the right.
- Click [Add Protocol] to create a new protocol. It can be customized.
- Click to select a protocol in the list on the left and click [Copy]. A protocol named “copy of XXX” is created with the copied views, which can be customized.
- Click [Delete] to delete a user-defined protocol.
- Click [Up] or [Down] to move the selected protocol.
- Click [Move to Top]/[Move to Bottom] to move the selected protocol to the top or bottom of the list.

C.9.2 View Management

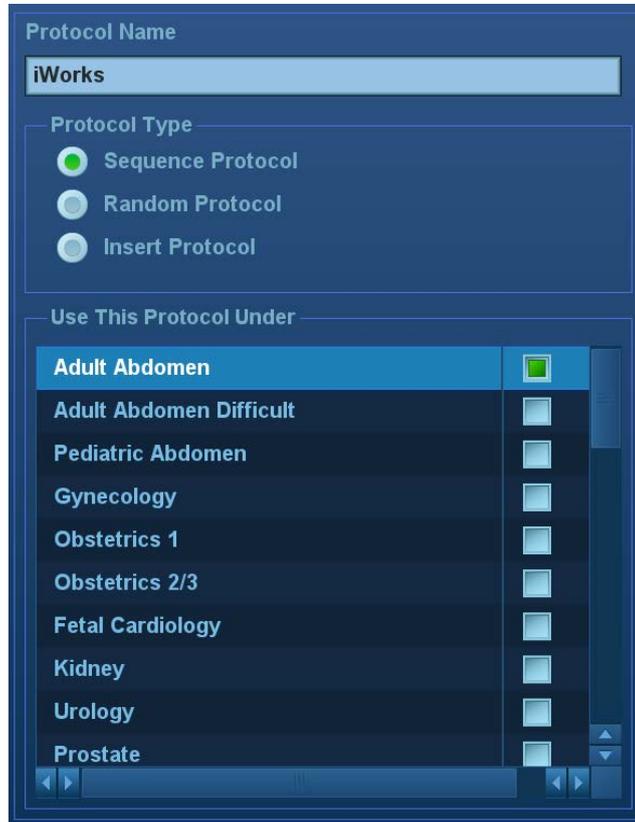
- Click to select the views in the list. The image, annotation, body mark and measurement settings can be checked on the right.
- Click to select a user-defined protocol in the list. Click [Add View] to add a view template to the protocol.

C.9.3 Create New Protocol

You can create user-defined protocols and customize the automated procedure.

1. In the iWorks preset screen, click [Add Protocol] to create a new protocol. Enter the protocol name, type and select the application region.

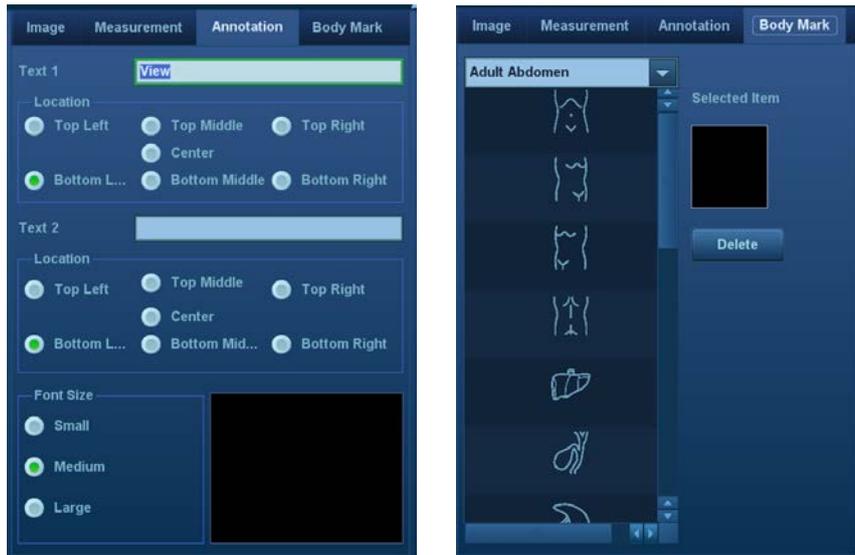
Or, select an existing protocol and click [Copy] to customize the protocol based on the previous template.



2. Click [Add View] to enter the view name and perform image settings as shown in the following figure.



3. Add comments, body marks and perform measurement settings, as shown in the following figure:



In the image setting, if “Measurement on next section” is selected, the system will save two section images after finishing the section operation. One of the two sections will include the measurement result.

4. Select the checkbox for body mark display settings.



5. Click [Save] to complete the setting and exit.

Appendix D Wireless LAN

The system provides wireless net adapter configuration, so as to assist information query and unlimited network service.

WARNING

It is prohibited to use the wireless LAN function in an airplane, as this may violate the relevant provisions in the aviation regulations.

Use the wireless LAN function prudently in emergency ambulances (or other vehicles) as other devices or communication signals may be interfered with.

Use the wireless LAN function prudently in OR/ICU/CCU as it may interfere with other devices.

When the wireless LAN function is turned on, the ultrasound system may suffer interference from other equipment, even if that other equipment complies with CISPR EMISSION requirements.

Keep at least 20 cm away from the ultrasound system when the wireless LAN function is in use.

NOTE: For a better wireless LAN transmission effect, please take the following settings:

- SSID>80% with stable WLAN network;
- Wireless router and the server are in the same network segment;
- Router setting:
 - Wireless standard 802.11n
 - Maximum transmission speed $\geq 300M$
 - Use AP (access point) setting;
 - Number of the devices connected to the same router ≤ 5 .
- Target server setting:
 - Network is stable and not under overloading state (e.g. high CPU/memory usage, fast HDD speed, limited HDD space);
 - Level other than the highest level of firewall is adopted;
 - Operating system is Win8 or higher versions and it supports a Gigabit Ethernet.

■ Use the Wireless feature

1. Press <Cursor> to show the cursor, click  in the bottom bar to open the wireless network manager.
2. Roll the trackball and press <Set> to select the target network, click [Connect] to connect to the network.

When connecting an encrypted network, enter the password in the box first. You can select to hide password characters or not.

3. The system tries to connect and the wireless manager icon turns into . The icon turns into  or  after successful connection.



■ IP Config

Note: When the system background is processing network task (DICOM sending for example), please do not enter network setting to change the IP, otherwise the background task may fail. You can check if there are tasks undergoing in the task manager.

IP config is used for setting local network parameters, which is also applied to DICOM connection.

1. In Wireless network manager screen, click [IP Config] to open the page:



- If "DHCP" is selected, the IP address will be automatically obtained from the DNS server.
 - Click [Refresh] to check current IP address.
 - If "Static" is selected (using a static IP address), enter the IP address.
 - IP address of the system should be in the same network segment with the server.
 - Subnet Mask: set different network segment.
 - Gateway: set the gateway IP.
2. Click [Apply] to save current setting. Click [Close] to exit.

Note: If the IP address displays as 0.0.0.0, this means that the network is abnormal. The reason for the failure may be disconnection or the system cannot obtain the IP address.

Appendix E Battery



WARNING: The battery is inside the machine. Only Mindray technical professionals or engineers authorized by Mindray following training can perform battery installation and uninstallation.

If you need to change the battery or buy a new one, contact your sales representative.

E.1 Overview

Battery is an option.

When the system is working, the battery charges when its capacity is not full. The indicator turns green when the capacity is full.

- Under power on status, charging time of the battery from capacity 0 to 100% takes less than 4 hours.

NOTE: Power off the system if it will not be used for a long period of time (including storage/transportation condition). Do not leave the system in standby status, otherwise the batteries will be discharged and permanently damaged.

The battery cannot support the ultrasound system in normal operation, only in standby.

If it is necessary to move the ultrasound system in a hurry, first put the system into standby mode, pull out the power plug to put the machine in standby status during moving, then press the power button to exit standby once the machine is in the target position and reconnect the AC power.

E.2 Battery Status Indicator

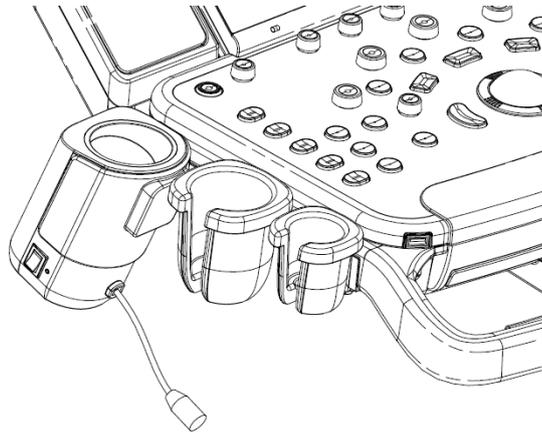
The battery status indicator is located in the bottom-right corner of the screen, indicating the battery capacity.

- : Indicates the battery capacity is nearly empty.
- : Indicates the battery capacity is full.

Appendix F Ultrasound Gel Warmer

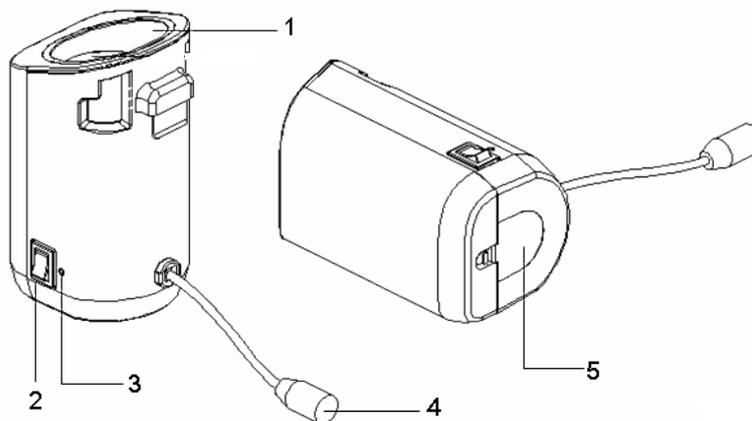
Ultrasound gel warmer is a system option used for heating the ultrasound gel.

F.1 Overview



As shown in the figure above, the warmer is installed on the left side of the control panel, where the ultrasound gel is positioned.

F.2 Structure



No.	Name	Function
1.	Ultrasound gel box	Used for positioning the ultrasound gel.
2.	Warming control switch	Set the gel warmer to the temperature of 37°C/40°C, or turn off.
3.	Status indicator	Working normally: green. Failure: blink in orange.
4.	Power cable	Connects to the power socket under the control panel.
5.	Bottom cover	/

F.3 Specifications

■ Power supply

Voltage	12 V ⁻⁻⁻⁻
Power consumption	12 W

■ Environmental conditions

	Operating conditions	Storage and transportation conditions
Ambient temperature	0°C~40°C	-20°C~55°C
Relative humidity	30%~85% (no condensation)	20%~95% (no condensation)
Atmospheric pressure	700hPa~1060hPa	700hPa~1060hPa

F.4 Function and Requirement

The ultrasound gel warmer can heat the ultrasound gel to about $40 \pm 1^\circ\text{C}$ at the most.

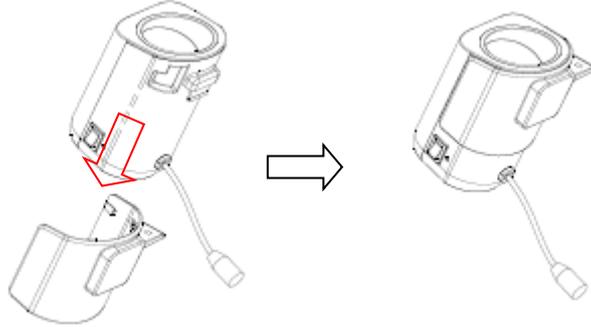
When the gel is placed inside the warmer, the time it takes to heat from an ambient temperature of 18°C to 28°C should be no more than 0.5 hours.

The ultrasound gel warmer can work continuously over 12 hours.

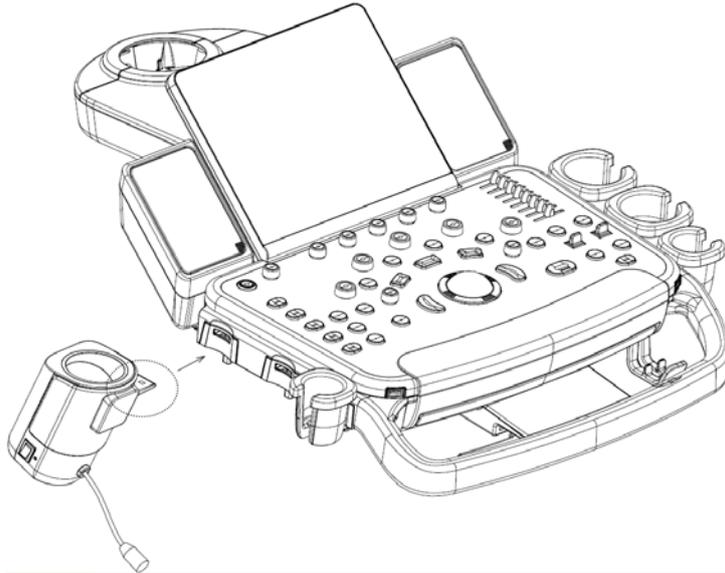
NOTE:	1. When the ambient temperature is higher than the required temperature of the warmer, the warmer does not function.
	2. The warmer can only heat one bottle of gel at a time.

F.5 Install the Warmer

1. As shown in the figure below, install the gel warmer into the gel holder on the control panel.



2. Align the buckle of the holder to the slot at the side of the control panel and then insert the buckle into the slot, push the warmer in the direction of the arrow until the buckle clicks and locks. Connect the power cable to the power socket under the control panel.

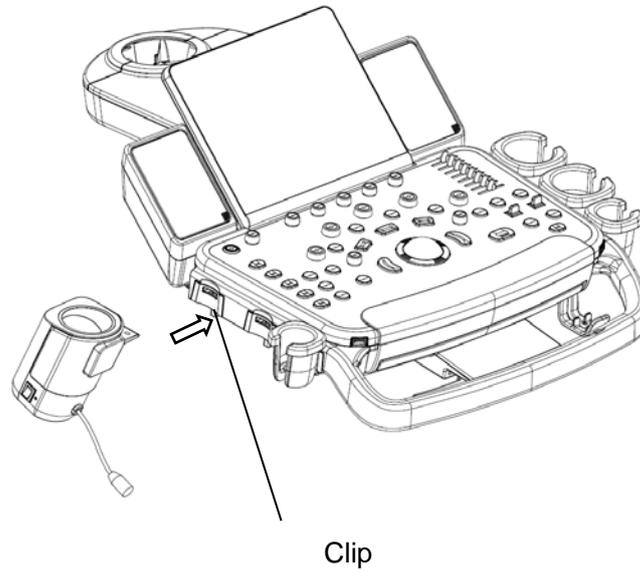


3. Insert the warmer's power plug into the jack on the back of the control panel.
4. Put the gel inside the warmer, and press the warming control switch, the gel warmer starts to work. There are three levels on the switch:
 - II: sets the warmer to 40°C
 - I: Sets the warmer to 37°C.
 - O: turn the warmer off.

NOTE: If the status indicator is off or blinks in orange after connecting the power cord, it means the gel warmer is not working normally, please turn it off and contract the service engineer.

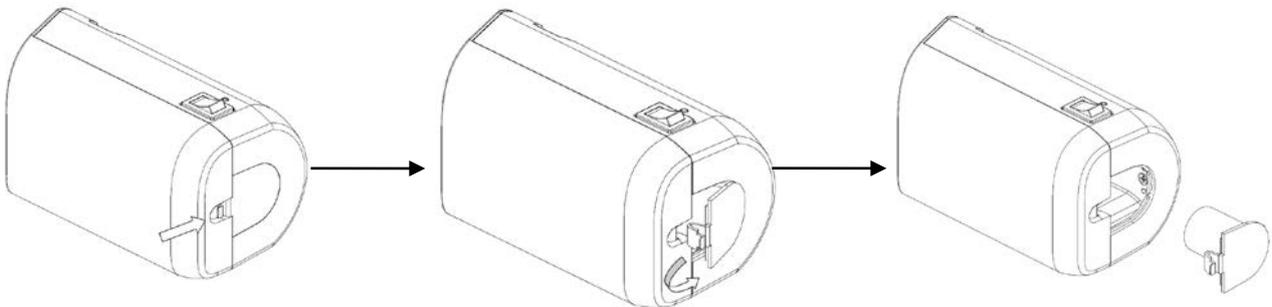
F.6 Remove the Warmer

1. Pull out the power cable from the control panel jack.
2. As shown in the above figure, press the clip in the direction of the arrow to remove the warmer.



F.7 Cleaning

1. Press the clasp on the bottom cover to release the cover.



2. Remove and clean the cover.

Appendix G Electrical Safety Inspection

The following electrical safety tests are recommended as part of a comprehensive preventive maintenance program. They are a proven means of detecting abnormalities that, if undetected, could prove dangerous to either the patient or the operator. Additional tests may be required according to local regulations.

All tests can be performed using commercially-available safety analyzer test equipment. These procedures assume the use of a 601PROXL International Safety Analyzer or equivalent safety analyzer. Other popular testers which comply with IEC 60601-1 and are used in Europe, such as Fluke, Metron or Gerb, may require modifications to the procedure. Follow the analyzer manufacturer's instructions.

An electrical safety inspection should be periodically performed every two years. The safety analyzer is also an excellent troubleshooting tool for detecting abnormalities in line voltage and grounding, as well as total current loads.

G.1 Power Cord Plug

G.1.1 The Power Plug

Test Item		Acceptance Criteria
The power plug	The power plug pins	No broken or bent pins. No discolored pins.
	The plug body	No physical damage to the plug body.
	The strain relief	No physical damage to the strain relief. No plug warmth when device is in use.
	The power plug	No loose connections.
The power cord		No physical damage to the cord. No deterioration to the cord.
		For devices with detachable power cords, inspect the connection with the device.
		For devices with non-detachable power cords, inspect the strain relief at the device.

G.2 Device Enclosure and Accessories

G.2.1 Visual Inspection

Test Item	Acceptance Criteria
The enclosure and accessories	No physical damage to the enclosure and accessories.
	No physical damage to meters, switches, connectors, etc.
	No residue of fluid spillage (e.g., water, coffee, chemicals, etc.).
	No loose or missing parts (e.g., knobs, dials, terminals, etc.).

G.2.2 Contextual Inspection

Test Item	Acceptance Criteria
The enclosure and accessories	No unusual noises (e.g., rattles inside the case).
	No unusual smells (e.g., burning or smoky smells, particularly from ventilation holes).
	No taped notes that may suggest device deficiencies or operator concerns.

G.3 Device Labeling

Check that the labels provided by the manufacturer or the healthcare facility are present and legible.

- Main unit label
- Integrated warning labels

G.4 Protective Earth Resistance

- Plug the analyzer probes into the device's protective earth terminal and the protective earth terminal of the AC power cord.
- Test the earth resistance with a current of 25 A.
- Verify the resistance is less than the limits.

■ LIMITS

ALL COUNTRIES R = 0.2 Ω Maximum

G.5 Earth Leakage Test

Run an Earth Leakage test on the device being tested before performing any other leakage tests.

The following outlet conditions apply when performing the Earth Leakage test.

- normal polarity (Normal Condition);
- reverse polarity (Normal Condition);
- normal polarity with open neutral (Single Fault Condition);
- reverse polarity with open neutral (Single Fault Condition).

■ LIMITS

For UL60601-1:

- 300 μ A in Normal Condition.
- 1000 μ A in Single Fault Condition.

For IEC60601-1:

- 500 μ A in Normal Condition.
- 1000 μ A in Single Fault Condition.

G.6 Enclosure Leakage Test

The following outlet conditions apply when performing the Enclosure Leakage test.

- normal polarity (Normal Condition);
- reverse polarity (Normal Condition);
- normal polarity with open neutral (Single Fault Condition);
- reverse polarity with open neutral (Single Fault Condition);
- normal polarity with open earth (Single Fault Condition);
- reverse polarity with open earth (Single Fault Condition).

■ LIMITS

For UL60601-1:

- 100 μ A in Normal Condition.
- 300 μ A in Single Fault Condition.

For IEC60601-1:

- 100 μ A in Normal Condition.
- 500 μ A in Single Fault Condition.

G.7 Patient Leakage Current

Patient leakage currents are measured between a selected applied part and mains earth. All measurements have a true RMS only.

The following outlet conditions apply when performing the Patient Leakage Current test.

- normal polarity (Normal Condition);
- reverse polarity (Normal Condition);
- normal polarity with open neutral (Single Fault Condition);
- reverse polarity with open neutral (Single Fault Condition);
- normal polarity with open earth (Single Fault Condition);
- reverse polarity with open earth (Single Fault Condition).

■ LIMITS

For BF  applied parts:

- 100 μ A in Normal Condition.
- 500 μ A in Single Fault Condition.

G.8 Mains on Applied Part Leakage

The Mains on Applied Part test applies a test voltage, which is 110% of the mains voltage using a limiting resistance, to selected applied part terminals. Current measurements are then taken between the selected applied part and earth. Measurements are taken with the test voltage (110% of mains) on applied parts in the normal and reverse polarity conditions.

The following outlet conditions apply when performing the Mains on Applied Part test.

- Normal Polarity;
- Reversed Polarity.

■ LIMITS

- For BF  applied parts: 5000 μ A.

G.9 Patient Auxiliary Current

Patient Auxiliary currents are measured between any selected Applied Part connector and the remaining Applied Part connectors. All measurements may have a true RMS response.

The following outlet conditions apply when performing the Patient Auxiliary Current test.

- normal polarity (Normal Condition);
- reverse polarity (Normal Condition);
- normal polarity with open neutral (Single Fault Condition);
- reverse polarity with open neutral (Single Fault Condition);
- normal polarity with open earth (Single Fault Condition);
- reverse polarity with open earth (Single Fault Condition).

■ LIMITS

For BF  applied parts,

- 100 μ A in Normal Condition.
- 500 μ A in Single Fault Condition.

NOTE: Make sure the safety analyzer is authorized and complies with the requirements of IEC61010-1. Follow the analyzer manufacturer's instructions.

