Vetus E6/Vetus E6 Exp/Vetus E58/Vetus E62/Vetus E6 Elite/ Vetus E6 Super/Vetus E6S/Vetus E6 Pro/Vetus E6T/Vetus E6 Lite/PS8/Vetus E5/Vetus E5 Exp/Vetus E48/Vetus E52/Vetus E5 Elite/Vetus E5 Super/Vetus E5S/Vetus E5 Pro/Vetus E5T

Veterinary Diagnostic Ultrasound System

Operator's Manual

CE

For this Operator's Manual, the issue date is 2025-02.

IMPORTANT!

The system is veterinary use only.

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- all installation operations, expansions, changes, modifications and repairs of this product are conducted by Mindray Animal Medical 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.

NOTE:

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.

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- 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.

Important Information

- It is the customer's responsibility to maintain and manage the system after delivery.
- The warranty does not cover the following items, even during the warranty period:
  - Damage or loss due to misuse or abuse.
  - Damage or loss caused by Acts of God such as fires, earthquakes, floods, lightning, etc.
  - Damage or loss caused by failure to meet the specified conditions for this system, such as inadequate power supply, improper installation or environmental conditions.
  - Damage or loss due to use of the system outside the region where the system was originally sold.
  - Damage or loss involving the system purchased from a source other than Mindray Animal Medical or its authorized agents.

- This system shall not be used by persons other than fully qualified and certified medical personnel.
- DO NOT make changes or modifications to the software or hardware of this system.
- In no event shall Mindray Animal Medical be liable for problems, damage, or loss caused by relocation, modification, or repair performed by personnel other than those designated by Mindray Animal Medical.
- 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 Animal Medical shall not be liable for the results of diagnostic procedures.
- Important data must be backed up on external memory media.
- Mindray Animal Medical shall not be liable for loss of data stored in the memory of this system caused by operator error or accidents.
- This manual contains warnings regarding foreseeable potential dangers, but you shall also be continuously alert to dangers other than those indicated. Mindray Animal Medical 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.
- 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.

NOTE:

- If you find that the contents of the multi-language manuals 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.

Meaning 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.

Signal word	Meaning
NOTE	Indicates a potentially hazardous situation that, if not avoided, may result in property damage.
TIP	Important information that helps you to use the system more effectively.

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.
- Select [Items or Buttons]: move the cursor to the item or button and press the confirm button or use the soft button corresponding to the soft menu.
- [Items in menu] > [Items in submenu]: select a submenu item following the path.

Operator’s Manuals

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.

Contents

1 Important Information

1.1 Safety Precautions

Please observe the following precautions to ensure animal and operator's 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

- **Do not connect the three-wire cable of the system with a two-wire plug without protective grounding; otherwise, electric shock may result.**
- **Do connect the power plug of this system to wall receptacles that meet the ratings indicated on the rating nameplate. If adapters or multi-functional receptacles are used, it may cause the leakage current to exceed the safety requirement.**
- **In the environment that animal is 1.5 meters around, power the peripherals by isolation transformer complied with IEC 60601-1 or the power input of the same safety level.**
- **DO NOT use power supply of different phases to power peripherals, like power supply of air-conditioning.**
- **When using peripherals other than permitted by the Manufacturer, make sure the overall leakage current of peripherals and the ultrasound system meets the requirement of the local medical device electrical regulation (like enclosure leakage current should be no more than 500 μA of IEC 60601-1), and the responsibility is held by the user.**
- **Connect the grounding conductor before turning ON the system. Disconnect the grounding cable after turning OFF the system. Otherwise, electric shock may result.**
- **For the connection of power and grounding, follow the appropriate procedures described in this operator's manual. Otherwise, there is risk of electric shock. Do not connect the grounding cable to a gas pipe or water pipe; otherwise, improper grounding may result or a gas explosion may occur.**
- **Before cleaning the system, disconnect the power cord from the outlet. System failure and electric shock may result.**
- **This system is not water-proof designed. Do Not use this system in any place where water or any liquid leakage may occur. If any water is sprayed on or into the system, electric shock may result or the system may be damaged. If water is accidentally sprayed on or into the system, contact the Customer Service Department or your local distributor.**

- **DO NOT use a probe that has a damaged, scratched surface, or exposed wiring of any kind. Immediately stop using the probe and contact the Customer Service Department or your local distributor. There is risk of electric shock if using a damaged or scratched transducer.**
- **Do not allow the animal to contact the live parts of the ultrasound system or other devices, e.g. signal I/O ports. Electric shock may occur.**
- **The operator SHOULD NOT touch Signal Input Ports/Signal Output Ports and the animal at the same time.**
- **Do not use an aftermarket probe other than those specified by the manufacturer. The probes may damage the system causing a profound failure, e.g. a fire in the worst case.**
- **Do not subject the transducers to knocks or drops. Use of a defective transducer may cause an electric shock.**
- **Do not open the covers and front panel of the system. Short circuit or electric shock may result when the system hardware is exposed and powered on.**
- **Do not use the system with the animal when the system is being serviced or maintained.**
- **Do not use this system when any digital device such as a high-frequency electrotome, high-frequency therapeutic device or defibrillator is applied already. Otherwise, there is a risk of electric shock to the animal.**
- **Only use the ECG leads provided with the physiology module; otherwise, electric shock may be resulted.**
- **When moving the system, you should first fold the LCD display, disconnect the system from other devices (including probes) and disconnect the system from the power supply.**
- **Accessory equipment (analog or digital) connected to the ultrasound system must comply with the relevant IEC standards (e.g., IEC 62368-1 audio/video, information and communication 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 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. If you have any questions regarding these requirements, consult the Customer Service Department or your local distributor.**
- **Prolonged and repeated use of keyboards may result in hand or arm nerve disorders for some individuals. Observe the local safety or health regulations concerning the use of keyboards.**
- **When using intra-cavity transducers, do not activate the transducer outside the animal's body.**
- **It is not allowed for the operator to have contact with other animals and the electronic parts (such as the input/output terminal of the signal) of other devices that are connected to the system. Otherwise, it may produce the electrical shock to the animal.**
- **DO NOT block the cooling vent of the system.**
- **Do not expose the device to a magnetic resonance (MR) environment.**

⚠ CAUTION

- **Precautions concerning clinical examination techniques:**
  - **This system must be used only 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.**
- **Malfunctions due to radio wave:**
  - **If a radio wave emitting device 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) in the room placing the system.**

  - **If a person brings a device that generates radio waves near the system, ask him/her to immediately turn OFF the device.**
- **Precautions concerning movement of the system:**
  - **When you place the system on the mobile trolley and move them together, you must secure all objects on the mobile trolley to prevent them from falling. Otherwise you should separate the system from the mobile trolley and move them individually.**
    When you have to move the system with the mobile trolley upward or downward the stairs, you must separate them first and then move them individually.
  - **Object placed on the monitor may fall and injure an individual when moving.**
  - **Confirm that there is no peripheral device connected to the system before moving the system. Otherwise, peripheral device may fall and injure an individual.**
- **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 Customer Service Department or your local distributor.**
- **There is no risk of high-temperature burns during normal ultrasound examinations. It is possible for the surface temperature of the transducer to exceed the body temperature of an animal due to environmental temperature and exam type combinations. Do not apply the transducer to the same region on the animal for a long time. Apply the transducer only for a period of time required for the purpose of diagnosis.**
- **Do not use the system to examine a fetus for a long period of time.**
- **Except accessories that have been stated as sterile, the system and its accessories are not disinfected or sterilized prior to delivery. The operator is responsible for the cleaning and disinfection of probes and sterilization of biopsy brackets according to the manuals, prior to the use. All items must be thoroughly processed to completely remove harmful residual chemicals, which will not only harmful to the animal body, but also damage the accessory.**
- **It is necessary to end the current scan that is in progress and clear the current Animal Information field. Otherwise, new animal data may be combined with the previous animal data.**
- **Do not connect or disconnect the system's power cord or its accessories (e.g., a printer or a recorder) without turning OFF the system power first. This may damage the system and its accessories or cause electric shock.**
- **If the system is powered off improperly during operation, it may result in data damage of the system's hard disk or system failure.**
- **Do not use a USB memory device (e.g., a USB flash drive, removable hard disk) which has unsafe data. Otherwise, system damage may result.**
- **It is recommended to only use the video devices specified in this manual.**
- **Do not use gel, disinfectant, probes, probe sheath or needle-guided brackets that are not compatible with the system.**
- **Read the Acoustic Output Principle in the operation manual carefully before operating this system on clinical examination.**
- **The cover contains natural rubber that can cause allergic reactions in some individuals.**
- **Please use the ultrasound gel compliant with the relevant local regulations.**
- **DO NOT expose the system to excessive vibration through transportation. Mechanical damage may result.**
- **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:

- DO NOT use the system in the vicinity of strong electromagnetic field (such as a transformer), which may affect the performance of the system.
- Do not use the system in the vicinity of high-frequency radiation source (e.g. cellular phones), which may affect the performance of the system or even lead to failure.
- When using or placing the system, keep the system horizontal to avoid imbalance.
- To avoid damaging the system, do not use it in following environment:
  - 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.
- Turn ON the system only after the power has been turned OFF for a while. If the system is turned ON immediately after being turned OFF, the system may not be rebooted properly and could malfunction.
- Use the Freeze button to freeze an image or turn off the power of the system before connecting or disconnecting a probe.
- Remove the ultrasound gel from the face of the transducer when the examination is completed. Water in the gel may enter the acoustic lens and adversely affect the performance and safety of the transducer.
- You should properly back up the system to a secure external storage media, including system configuration, settings and animal data. Data stored to the system's hard drive may be lost due to system failure, improper operation or accident.
- Do not apply external force to the control panel. Otherwise, the system may be damaged.
- If the system is used in a small room, the room temperature may rise. Please provide proper ventilation and free air exchange.
- To dispose of the system or any part, contact the Customer Service Department or your local distributor. The manufacturer is not responsible for any system content or accessories that have been discarded improperly.
- Electrical and mechanical performance may be degraded due to long usage (such as current leakage or distortion and abrasion); the image sensitivity and precision may become worse too. To ensure optimal system operations, it is recommended that you maintain the system under the manufacturer service agreement.
- Refer replacing job to the manufacturer service engineers or engineers authorized by the manufacturer only.
- Do not turn OFF the power supply of the system during printing, file storage or invoking other system operations. An interrupted process may not be completed, and can become lost or corrupted.
- Ensure that the current exam date and time are the same as the system date and time.
- 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.

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

⚠ WARNING

- **The ultrasound probe is only for use with the specified ultrasound diagnostic system.**
- **The ultrasound probe must be used only by qualified professionals.**
- **Confirm that the transducer and probe cable are normal before and after each examination. A defective probe may cause electric shock to the animal.**
- **Do not subject the probe to shock. A defective probe may cause electric shock to the animal.**
- **Do not disassemble the probe to avoid the possibility of electric shock.**
- **Never immerse the probe connector into liquids such as water or disinfectant because the connector is not waterproof. Immersion may cause electric shock or malfunction.**
- **A transducer sheath must be installed over the transducer before performing examination.**
- **When using a probe, pay attention to the status of the ultrasound image. Do not use the probe to perform image acquisition when the image is frozen.**

⚠ CAUTION

- **When using the probe, wear sterile gloves to prevent infection.**
- **Please use the ultrasound gel compliant with the relevant local regulations. And manage the ultrasound gel properly to ensure that it does not become a source of infection.**
- **In normal diagnostic ultrasound mode, there is no danger of a normal-temperature burn; however, keeping the probe on the same region of the animal for a long time may cause such a burn.**
- **Do not use the carrying case for storing the transducer. If the carrying case is used for storage, it may become a source of infection.**
- **It is required to practice ALARA when operating ultrasound system. Minimize the acoustic power without compromising the quality of images.**
- **The probe and accessories supplied with it are not delivered disinfected or sterilized. Sterilization (or high-level disinfect) before use is required.**
- **Disposable components should be packaged sterile and for single-use only. Do not use if integrity of packaging violated or if expiration date has passed. Please use the disposable components compliant with the relevant local regulations.**
- **Please use the disinfection or sterilization solution recommended in this operator's manual; otherwise the manufacturer will not be liable for damage caused by other solutions. If you have any questions, please contact the Customer Service Department or your local distributor.**
- **Do not use pre-lubricated condoms as a sheath. Lubricant may not be compatible with the probe material and damage may result.**
- **The damage of the transducer may be caused by the contact of improper gel or cleaner:**
  - **DO NOT dip the transducer in the strong polar solution of ethanol, chloride of lime, ammonium chloride, acetone and formaldehyde.**
  - **DO NOT contact the transducer with solution or ultrasound gel containing oily medium such as mineral oil or lanoline.**

NOTE:

- Read the following precautions to prevent the probe from malfunction:
  - Before connecting or disconnecting the probe, freeze or turn off the system.

  - Clean and disinfect the probe before and after each examination.
  - After the examination, wipe off the ultrasound gel thoroughly. Otherwise, the ultrasound gel may solidify and the image quality would be degraded.
- Repeated disinfection will eventually damage the probe, please check the probe performance periodically.

1.2 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 animals 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).

NOTE:

- The following definition of the WEEE label applies to EU member states only: the use of this symbol indicates that waste electrical and electronic equipment must not be disposed of as unsorted municipal waste and must be collected separately. By ensuring that this system is disposed of correctly, you will help prevent bringing potential negative consequences to the environment and human health. For more detailed information with regard to returning and recycling this system, consult the distributor from whom you purchased the system.
- For system products, this label may be attached to the main unit only.

1.3 Parts that can be used within animal environment

- The ultrasound system
- Video printers

2 System Overview

2.1 Intended Use

It is intended for use in Abdomen, Cardiology, Reproduction, Small Parts and MSK exams for animals.

2.2 Safety Classifications

- According to the type of protection against electric shock:
  Class I equipment + internally powered 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 as IPX0
  – The probes are rated as IPX7
  – The foot switch (can be applied in the operating room) is rated as IPX8
  – The power adapter is rated as IP22
- 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
- According to the installation and use:
  Portable equipment
  Mobile equipment (when the system is installed on the mobile trolley)
- 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

2.3 Product Specifications

2.3.1 Power supply

- Power adapter:
  - Voltage: 100 - 240V~
  - Frequency: 50-60Hz
  - Current: 2.0A MAX.
- Battery:
  - Voltage: 14.4 V
  - Capacity: 6600 mAh (single battery)

2.3.2 Environmental Conditions

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

⚠ WARNING

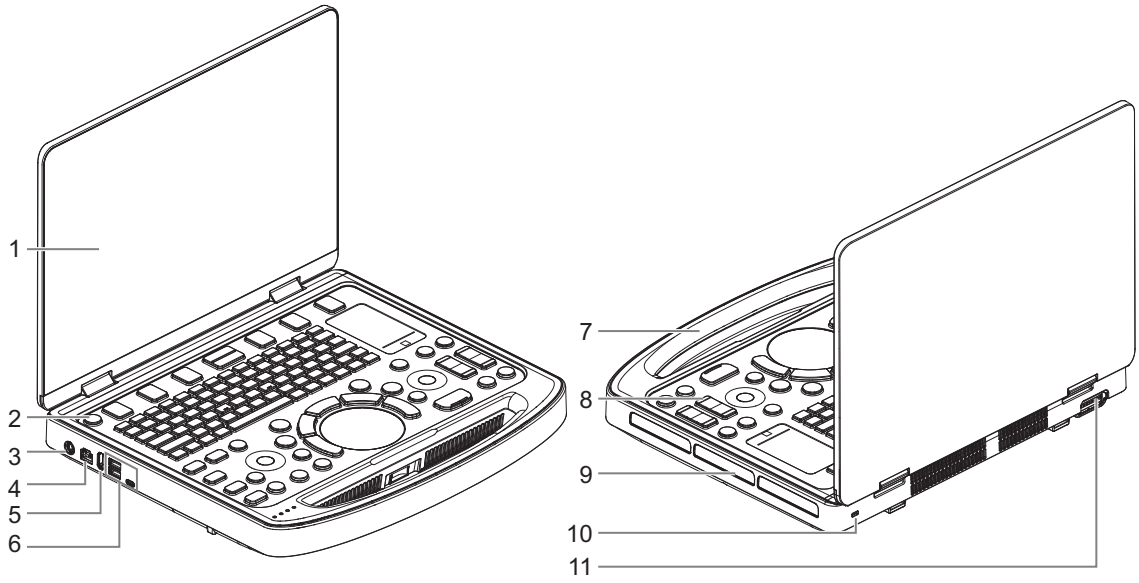
Do not use this system in conditions other than those specified.

2.3.3 Dimensions and Weight

- Dimensions (D×W×H, unit: mm): (330.0±5.0) × (370.1±5.0) × (45.0±3.0)
- Weight (including batteries): <4.0 kg

2.4 Introduction of Each Unit

Figure 2-1 Overview



No.	Item	Description
1.	Display	Displays the images and parameters during scanning.
2.	Power button/Power indicator	Used for turning on/ off the power. The indicator lights up when the system is powered on.
3.	S-Video output port	Used for connecting projector, ultrasound workstation video capture card, video printer, or LCD, etc.
4.	Network port	Used for connecting router, ultrasound workstation, server, etc.
5.	HDMI port	High definition multimedia interface. Used for connecting TV, projector, ultrasound workstation video capture card, etc.
6.	USB ports	Used for connecting storage devices such as USB disk, barcode reader, printer, footswitch, DVD recorder, etc.
7.	Handle	Used for carrying the system.
8.	Control Panel	Operator-system interface or control.
9.	Probe port	Sockets connecting probes and the main unit.
10.	Anti-theft lock	The anti-theft lock can be inserted into the lock, and tie the other end somewhere to prevent theft.
11.	Power input port	Connects the power adapter.

2.5 U-Bank Overview

⚠ WARNING

- **Only technical professionals from the manufacturer or engineers authorized by the manufacturer after training can perform batteries in the U-Bank installation and uninstallation.**
- **If you need to change the batteries in the U-Bank, please contact the Customer Service Department or sales representative.**

Specifications are as follows:

- Voltage: 19V DC
- Capacity: 26400 mAh

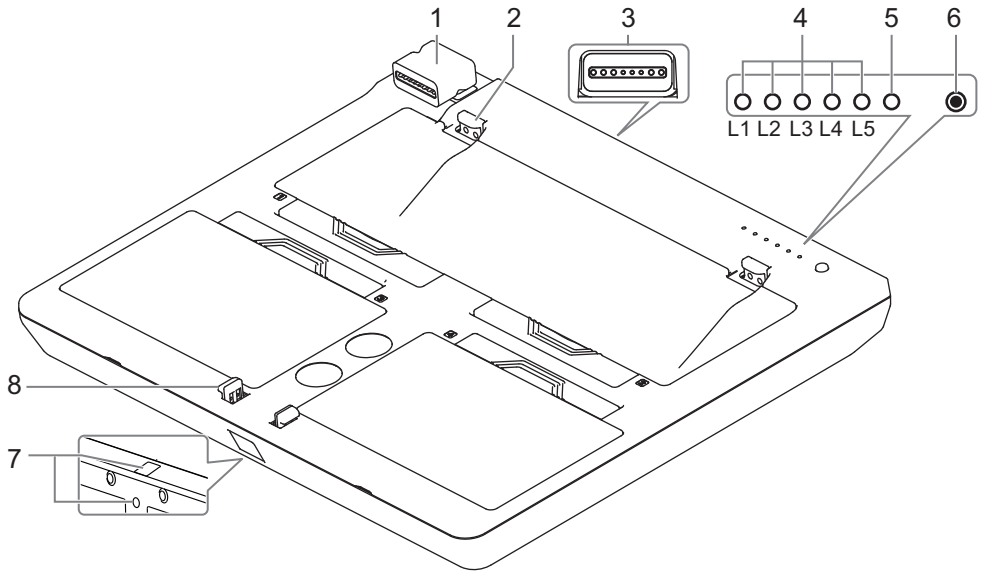
Under power off or standby status, charging time of the battery from capacity 0 to 100% takes about 5 hours.

U-Bank environmental conditions are as follows:

- Operating conditions
  - Ambient temperature: 0 °C ~ 35 °C
  - Relative humidity: 20% ~ 85% (no condensation)
  - Atmospheric pressure: 700 hPa ~ 1060 hPa
- Storage and transportation conditions
  - Ambient temperature: -20 °C ~ 55 °C
  - Relative humidity: 20% ~ 95% (no condensation)
  - Atmospheric pressure: 700 hPa ~ 1060 hPa

2.5.1 Parts and Names

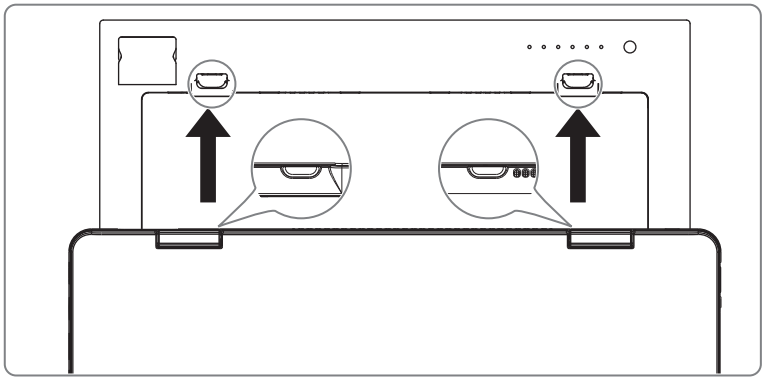
Figure 2-2 U-Bank



No.	Name	Description
1.	Power connector	Connects to the power input port of the system.
2.	Tabs	Used for fixing the U-Bank to the system.
3.	Charging input port	Connects the power adapter.
4.	Capacity indicators (L1~L5)	Indicates the power of the U-Bank. • The L1-L5 indicators remain on: fully charged or > 80%. • The L1-L4 indicators remain on: 60% < remaining capacity ≤ 80%. • The L1-L3 indicators remain on: 40% < remaining capacity ≤ 60%. • The L1-L2 indicators remain on: 20% < remaining capacity ≤ 40% • The L1 indicator remains on: 10% < remaining capacity ≤ 20% • The L1 indicator blinks: remaining capacity ≤ 10%
5.	Battery status indicator	Indicates the charge/discharge status of the U-Bank. • When the battery is charging: Not fully charged: the indicator lights in orange. Fully charged: the indicator lights in green. • When the battery is discharging: The remaining capacity ≥ 20%: the indicator lights in green. The remaining capacity < 20%: the indicator blinks in orange. The remaining capacity ≤ 5%: the indicator blinks in orange quickly. ***NOTE:*** When the U-Bank is charging or when you are pressing the power button, the indicator blinks in orange for 5s, and other indicators remain off. It indicates that the U-Bank may have malfunction. Please stop using the U-Bank and contact the Customer Service Department or sales representative.
6.	Power button	Used for checking the U-Bank power status.
7.	Detach levers	Used for detaching the U-Bank from the system. One is located at front side, and the other is located at the bottom. ***NOTE:*** Press the two levers at the same time to detach the U-Bank from the system. When the U-Bank is placed on a flat platform, just use the front lever to detach.

No.	Name	Description
8.	Lock/Release tabs	Used for fixing the U-Bank to the system. Release the U-Bank from the system by using the detach lever(s).

2.5.2 Installing the U-Bank



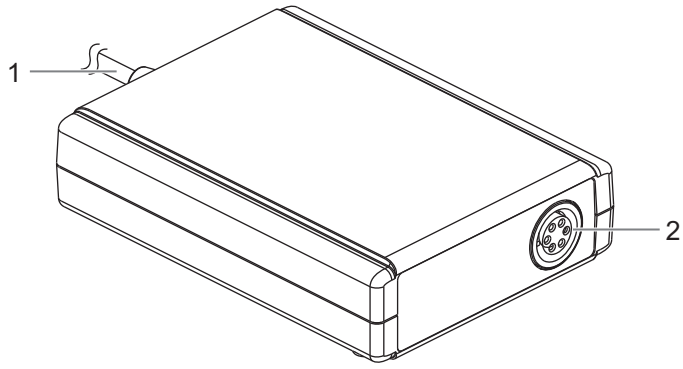
1. Place U-Bank to a flat and solid platform.
2. Align the grooves of the system with the tabs of U-Bank.
3. Push the system in the arrow direction as shown in the figure above until the system is locked in place.

TIP:

To remove the U-Bank from the system, press the detach lever of U-Bank and lift up slightly the system by holding the system's handle.

2.6 ECG Module Overview

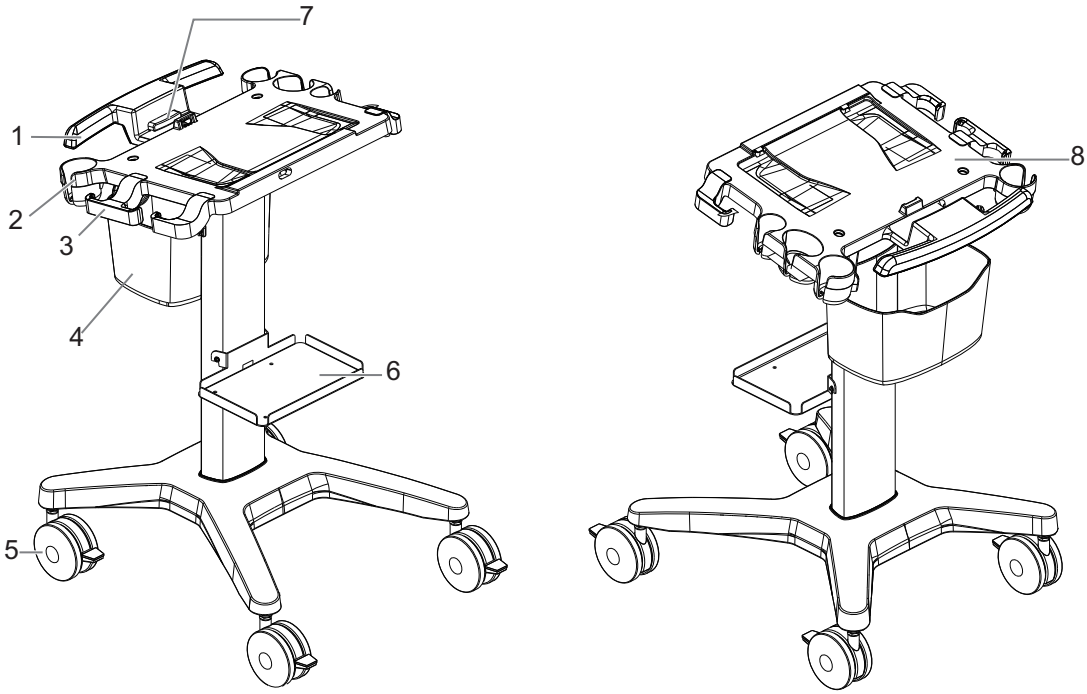
Figure 2-3 ECG module



No.	Name	Description
1.	USB cable	Connects to the USB port of the system. ***NOTE:*** • Ensure the system is powered off before connecting the ECG module. • The ECG module is only for use with the specified system.
2.	ECG lead port	Used for ECG signal input.

2.7 Trolley

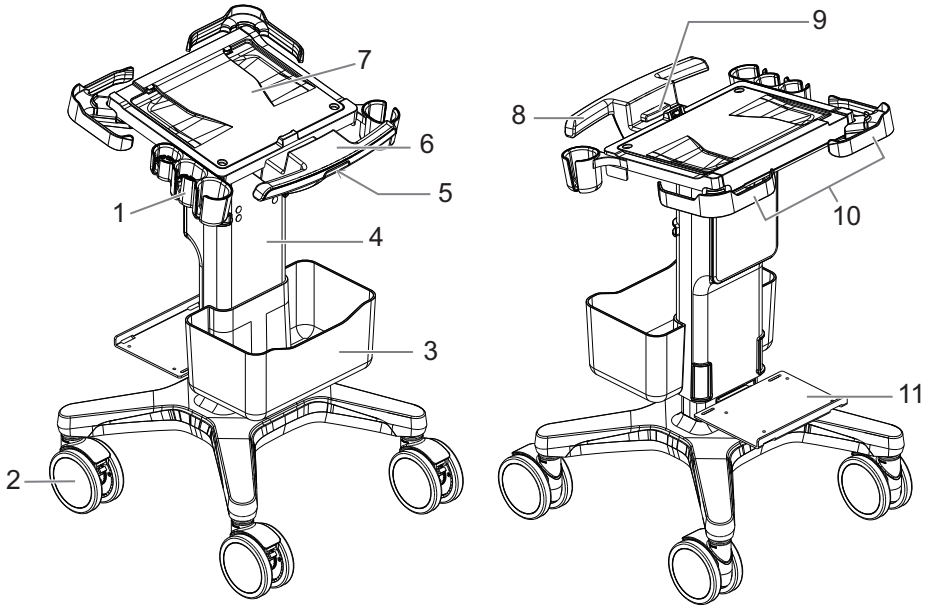
2.7.1 MT1 Trolley



No.	Item	Description
1.	Trolley handle	Used for moving the trolley.
2.	Probe holder	Used for placing probes temporarily.
3.	Cable hook	Manage cables.
4.	Storage box	Used for placing report or other stuff.
5.	Caster	Used for securing or moving the system.

No.	Item	Description
6.	Printer bracket	Used for placing the printer.
7.	Anti-theft lock	Used for releasing the main unit from the trolley.
8.	Main unit tray	Used for placing and fixing the main unit. You can remove the tray and install the U-Bank (purchased separately) instead. ***NOTE:*** Keep the main unit tray carefully for future use after it is removed from the trolley. Reinstall the main unit tray to the trolley if the U-Bank has been removed from the trolley.

2.7.2 MT3A Trolley

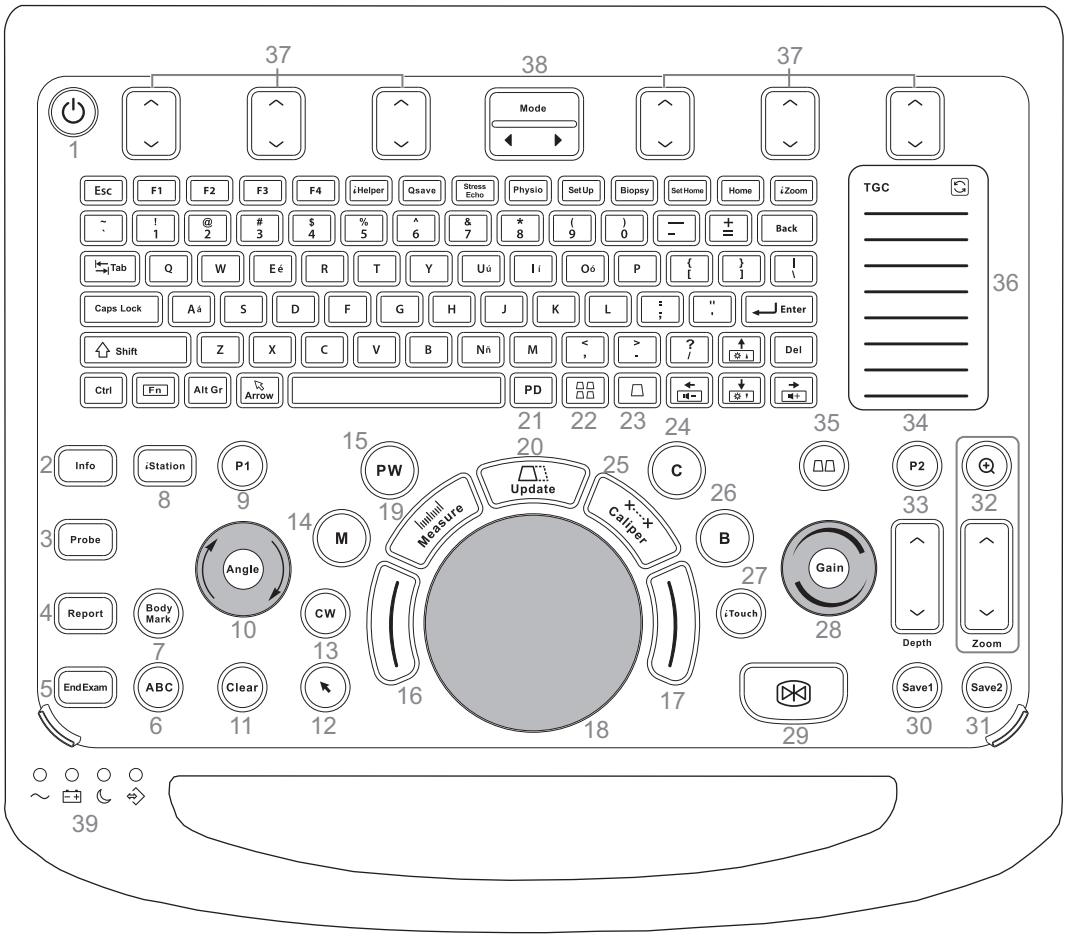


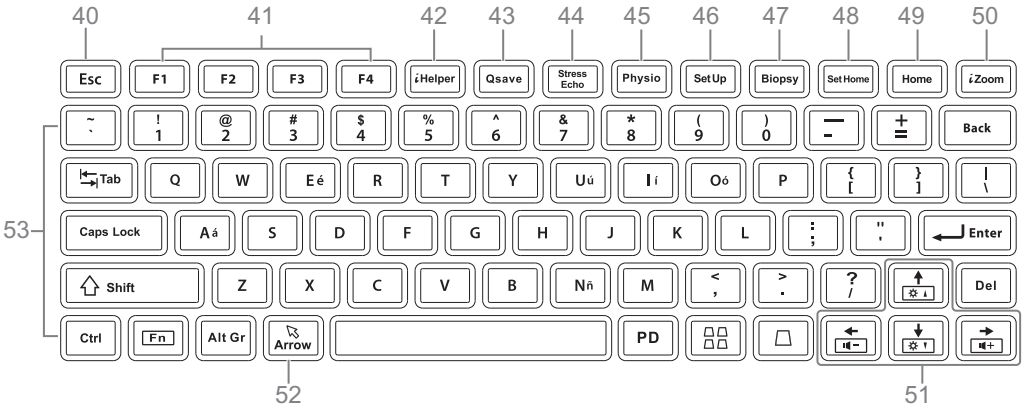
No.	Item	Description
1.	Probe holder	Used for placing probes temporarily.
2.	Caster	Used for securing or moving the system.
3.	Storage box	Used for placing report or other stuff.
4.	Lifting column	Used for adjusting the height of operation panel.
5.	Height lever	Used for adjusting the height of the stand.
6.	Tray release lever (located on the bottom of the handle)	Used for removing the main unit tray.

No.	Item	Description
7.	Main unit tray	Used for placing and fixing the main unit. You can remove the tray and install the U-Bank (purchased separately) instead. ***NOTE:*** Keep the main unit tray carefully for future use after it is removed from the trolley. Reinstall the main unit tray to the trolley if the U-Bank has been removed from the trolley.
8.	Protective handle	Used for moving the trolley and protecting the trolley from crash during moving.
9.	Anti-theft lock	Used for releasing the main unit from the trolley.
10.	Trolley handle	Used for ascending/descending the trolley or moving the trolley.
11.	Printer bracket	Used for placing the printer.

2.8 Control Panel

Figure 2-4 Control panel overview





No.	Name	English Name	Description
1.		Power button/Indicator	Turn on/turn off the system.
2.	**Info**	Animal information button	Press to enter the animal information screen.
3.	**Probe**	Probe/exam mode switch button	Press to switch probe and exam mode.
4.	**Report**	Report	Open/ close the exam report.
5.	**End Exam**	End exam button	Press to end an exam.
6.	**ABC**	Comments	Enter/exit the textual comment status.
7.	**Body Mark**	Body mark button	Press to enter/ exit the body mark mode.
8.	**iStation**	Animal data management system	Enter or exit animal information system.
9.	**P1**	User-defined button	Undefined button, set by the user in preset.
10.	**Angle**	Angle adjustment knob	Tap and slide to adjust angle.
11.	**Clear**	Clear button	Press to clear off the comments or measurement calipers on the screen.
12.		Cursor button	Press to show/hide the cursor.
13.	**CW**	CW mode button	Press to enter CW mode.
14.	**M**	M mode button	Press to enter the M mode.
15.	**PW**	PW mode button	Press to enter PW mode.
16.	/	Confirm key (left <Set> key)	Press to confirm the operation.
17.	/	Confirm key (right <Set> key)	
18.	/	Trackpad	To move the cursor; tap to confirm the operation.
19.	**Measure**	Measure button	Press to enter/exit application measurement.

No.	Name	English Name	Description
20.	**Update**	Update button	• Switching key: Press to change the currently active window. • Start or end capturing the image in iScape/Smart 3D.
21.	**PD**	Power mode button	Press to enter Power mode.
22.		Quad-window display	• Enter Quad mode in Non-Quad mode. • Press to switch among interfaces in Quad mode.
23.		Single-window button	Press to enter active window in Dual or Quad mode.
24.	**C**	Color mode button	Press to enter Color mode.
25.	**Caliper**	Caliper button	Press to enter/exit general measurement.
26.	**B**	B mode button	Press to enter B mode.
27.	**iTouch**	iTouch button	• Press to enter iTouch mode. • Long press to exit iTouch mode.
28.	**Gain**	Gain	Adjust the gain of the image in various modes.
29.		Freeze button	Press to freeze or unfreeze the image.
30.	**Save1**	Save1	Save images in a preset way.
31.	**Save2**	Save2	Save images in a preset way.
32.	**Zoom**	Zoom	Press to zoom in or out the image.
33.	**Depth**	Depth button	Adjust the depth parameter when the indicator is on.
34.	**P2**	User-defined button	Undefined button, set by the user in preset.
35.		Dual-split window button	• Press to enter the Dual mode from another mode. • Press to switch between the two windows in the Dual mode.
36.	**TGC**	TGC and functional interface	Move to adjust depth gain compensation. Tap  to reset all the TGC sliders.
37.		Soft menu adjustment buttons	Press to select the soft menu items displayed on the bottom of the screen.
38.	**Mode**	Soft menu display mode switch button	Press to switch the mode for the soft menu.
		Soft menu page up/ down button	Press to turn the soft menu page backwards/forwards.

No.	Name	English Name	Description
39.		AC power indicator	AC indicator • The indicator is green at AC supply. • The indicator is off when batteries are supplied without AC supply.
		Battery indicator	Battery status indicator. • Charging status: It illuminates in orange when batteries are charging; It illuminates in green when batteries are charged fully. • Discharging status: It illuminates in green color when the power of the batteries is sufficient; It illuminates in orange color for low battery power.
		Standby status indicator	Standby indicator. • Standby: blinking in orange. • Other status: light off.
		Hard disk read indicator	Hard disk status indicator. The indicator blinks in green when hard disk is running. The indicator is off on the other status. ***NOTE:*** DO NOT move the machine when the indicator blinking in green. Otherwise the hard disk may be damaged by sudden shake.
40.	**Esc**	Esc	Cancel the operation or exit the operation.
41.	**F1~F4**	User-defined buttons	Undefined button, set by the user in preset.
42.	**iHelper**	On-line help	Press to open or close the accompanying help documents.
43.	**QSave**	QSave	Save the current image parameters quickly.
44.	**Stress Echo**	Stress Echo	Press to enter Stress Echo mode.
45.	**Physio**	Physio	Press to enter or exit ECG or respiratory curve.
46.	**Setup**	Setup	Press to enter/ exit Setup.
47.	**Biopsy**	Biopsy	Press to enter biopsy.
48.	**Set Home**	Set home	Set home of comments.
49.	**Home**	Home	Activate the Home function: return to start position of comment.
50.	**iZoom**	iZoom	• Enter/exit full-screen zoom status. • Under iZoom status, switch zooming way.

No.	Name	English Name	Description
51.	/	Direction-control buttons	Moves the cursor one letter each time; or, select the ambient one in a selectable area.
52.	Arrow	Arrow comment button	Enter/exit the arrow comment status.
53.	/	Alphanumeric buttons	Enter characters.

Functions of button combinations

The system supports multi-language input using button combinations. Button combinations include <Shift>, <Alt Gr>, <Ctrl> and some alphabet buttons.

- <Shift> button

  <Shift> + button: enter the top left letter on the button.

  For the alphabet buttons (<A>~<Z>), press <Shift> + button to enter the current letter in a different case.
- <Alt Gr> button

  Combined with other letter buttons, <Alt Gr> can be used for entering other languages.

  Press <Alt Gr> and a letter button simultaneously. The letter in the top-right corner of the button is entered.
- <Ctrl> button combined buttons

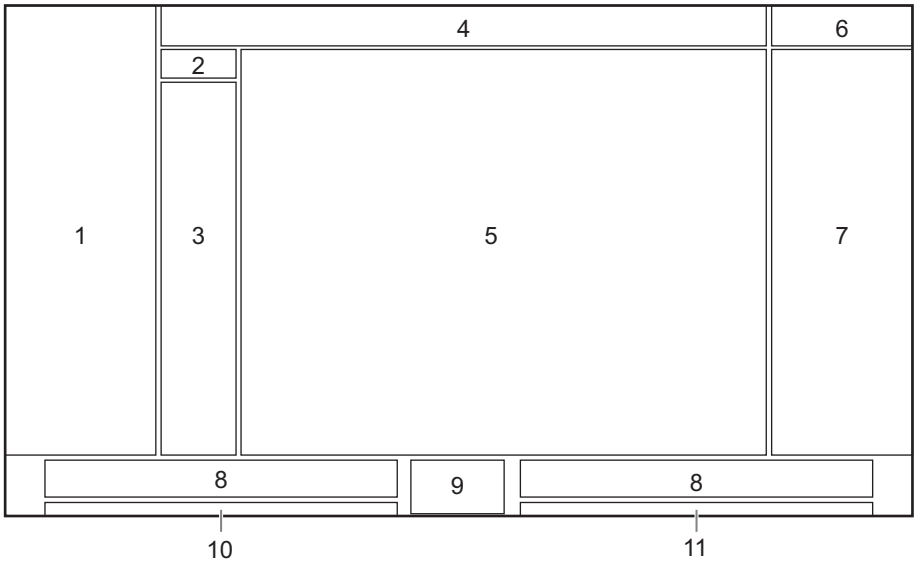
  In the iStation or Review screen, use <Ctrl> and <Set> to select more than one animal.
- <Fn> button

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

Button	Function
Fn+	Increase the audio volume.
Fn+	Decrease the audio volume.
Fn+	Increase the brightness of the screen.
Fn+	Decrease the brightness of the screen.

2.9 Monitor Display

Figure 2-5 Monitor Display



No.	Item	Description
1.	Menu Area	Includes the image menu, measurement menu, comment menu, body mark menu, and so on. The menu area consists of menu title, menu items and page-turning button.
2.	System Information Area	Displays the manufacturer's logo and product model.
3.	Parameters Area	Displays the image parameters for the active window. If there are more than one imaging modes, the parameters are displayed by each mode.
4.	Animal Information Area	Displays the hospital name, the exam time, animal information, the probe model, the exam mode, etc. To preset which kind of animal information is displayed, see the "*Setup*" chapter.
5.	Image Area	Displays the ultrasound images, ECG waveforms, probe mark (or active window mark), time line (in M or PW mode), coordinate axis (including depth, time, velocity/frequency), besides, the comments, bodymark, measurement calipers, color bar/grayscale bar are also displayed here.
6.	System Icons Area	Displays the relevant system icons, such as USB memory device, printer, network, and current system time, etc.

No.	Item	Description
7.	Clip board/ Thumbnails Area	Displays the thumbnail images stored under the current animal. • When there are more than one page images have been stored, you can turn to the next or preview page by ⌄ or ⌃ respectively. • Click to enter review screen.
8.	Soft Menu	The soft menu items displayed are corresponding to functions of soft menu controls (soft button) in the control panel.
9.	Hint (Trackpad and <Set> button function indications)	Displays the current functions of trackpad and <Set> buttons.
10.	Help Information Area	Displays various help information items or the progress bar in the current status.
11.	User-defined Buttons Area	Displays the functions for the user-defined buttons.

2.10 Symbols and Warning Labels

This system uses the symbols and warning labels listed in the following table to describe the important information and potential hazards.

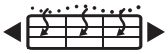
The warning labels use the same signal words as those used in the operator's manual. Read operator's manual carefully before using the system.

The general meaning assigned to geometric shapes, safety colors and contrast colors for safety signs are as follows:

Geometric shape	Meaning	Safety color	Contrast color	Graphical symbol color
	Prohibition	Red	White	Black
	Mandatory action	Blue	White	White
	Warning	Yellow	Black	Black

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

Symbol	Description
	Type-BF applied part
	Refer to instruction manual/booklet

Symbol	Description
	General warning sign
	Standby
	Transducer sockets
	Used for s-video output.
	Network port
	HDMI port
	USB port
	AC (Alternating current)
	Standby indicator
	Harddisk indicator
	Battery indicator
	Lock position
	Dust-proof mesh
	ECG lead port
	Equipotentiality
	Serial number
	Date of manufacture
	Manufacturer
	Main unit release button on the trolley

Symbol	Description
	Main unit tray release button on the trolley
	Maximum load for small storage bin on the MT3A trolley
	Maximum load for big storage bin on the MT3A trolley
	Maximum load for main unit tray on the MT3A trolley
	Power adapter bracket on the MT3A trolley
	Maximum load of MT1 trolley printer bracket
	Maximum load of MT1 trolley storage bracket
	Maximum load of MT1 trolley main unit tray
	CE marking
The following labels are available when the system works with the mobile trolley. 	**1.** Do not place the system with the mobile trolley 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. **2.** DO NOT sit on the trolley. **3.** When the casters are locked, DO NOT push the trolley.

3 Basic Operations

3.1 Dialog Box

User Interface Controls

A dialog box screen consists of title, tab pages, contents and buttons, etc.

- Title bar
  The title bar is used to give a description of the content and function of the screen.
- Tab page
  For some screens, the contents are distributed across several pages. Use the <Set> button to open/close the available pages.
- Content
  - Radio box: click to select the item.
  - Check box: click to check or uncheck the item.
  - Text box: enter characters manually via the keyboard.
  - Drop-down list box: click [▼] to show the list and select an item.
- Standard buttons
  When the operation of a screen is completed, click the [OK] or [Cancel] button to save or cancel the operation, and close the screen.

To reposition a dialog box

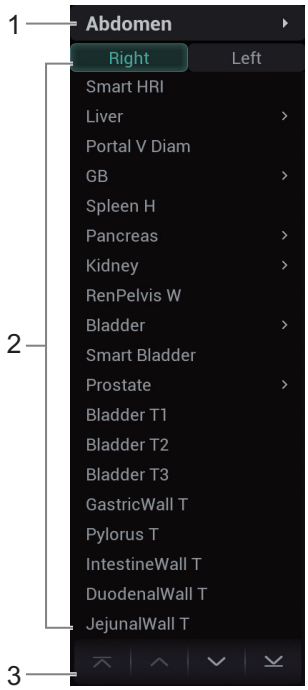
To reposition a dialog box which is not a full-screen dialogue box, perform the following procedure:

1. Use the trackpad to move the cursor onto the title bar of the dialog box.

   At this time the cursor becomes a ✣, then press <Set> button.
2. Position the rectangular graphic to the new desired location.
3. Release <Set> button, and the dialog box is moved to the desired position.

3.2 Image Menu

The menu area consists of menu title, menu items and page-turning button. As shown in figure below.



1. Menu title: Displays the menu name.
2. Menu item: Refers to the items on a menu. Items of measurement can be preset.
3. Page-turning buttons: When there are too many items in a menu, the items will be divided into more than one page. You can turn pages by page-turning buttons.

3.3 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 data of general measurements will be lost, but the data of application measurements will be stored in the reports.

Perform the following procedure:

1. Connect suitable probes to the system and press <Probe> on the control panel.
2. 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.

3.4 Imaging Mode

3.4.1 Switching Between Imaging Modes

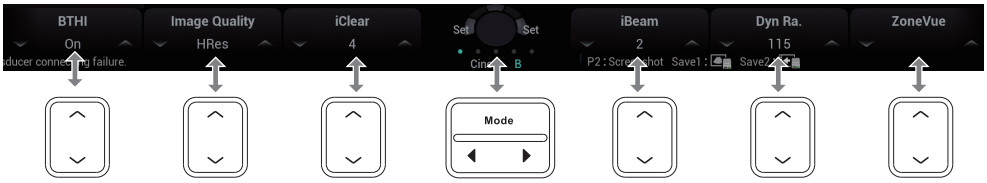
Switch between imaging modes according to the actual situation by using the imaging mode buttons on the control panel.

3.4.2 Image Adjustment

To adjust using the parameter menu (soft button)

The parameter menu items displayed are corresponding to functions of soft menu controls (soft button) in the control panel.

The parameter menu controls are located at the top of the control panel, shown in the following figure.



- Page-turning: Use the </> buttons on the control panel to turn pages.
- The soft menu items are operated respectively through the groups of soft menu controls.

To adjust using the control panel

Adjust using the trackpad, control panel button, knob or slider.

To adjust using trackpad function buttons

In some modes, you need to use both the trackpad and the trackpad function buttons to make adjustments.

1.	Left <Set> button
2.	Right <Set> button
3.	Current modes

For instance, in Color mode, use the trackpad and the trackpad function buttons to adjust the ROI size/ position.

1. Press the left/right <Set> button to switch between ROI size and ROI position.

2. Use the trackpad to adjust the ROI.

3.4.3 Quickly Saving Image Settings

Press <QSave> to access the image data saving dialog box. For details about user-defined button setting, see the Key Configuration section of the *Setup* chapter.

To save the image parameter adjustment

Click [Save] to save the current image values for the current exam mode of the particular probe.

To 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.

To restore the factory settings

The settings of the current exam mode and the probe can be restored to factory data by clicking [Restore].

To 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 button only one time.

3.5 Comments

Comments can be added to an ultrasound image to bring attention, annotate or communicate information observed during the examination. You can add comments to: zoomed image, cine review image, real-time image, frozen image. You can type the character as comments; insert the pre-defined comments from the comment library; insert arrow markers or add the trace.

⚠ WARNING

You must ensure that the entered comments are correct. Incorrect comments may lead to misdiagnosis.

3.5.1 Soft Menu Display in Comments

The system can be configured with comment text libraries. In comments status, you can enter the comment text using the screen menu.

To set the comment home location

Use the trackpad to move the cursor to the desired comment location and press <Set Home> on the keyboard.

To return the cursor to the home location

Press <Home> on the keyboard to return the cursor to the set home location.

To navigate through the comment libraries

To select the comment library, select [Library] on the soft menu to select (available libraries are linked to the exam modes configured for the current probe).

To Add/modify comment positions

Click [RT/LT] or [Sag/XS] to directly mark the position. Move the cursor onto the comment item to be modified, click [RT/LT] or [Sag/XS] to change the already-added comment position.

To change font size/arrow size

To change the font size of next input comment text, use [Font Size] button on the soft menu to select from Small, Medium and Large.

To change the arrow size, use [Arrow Size] button on the soft menu to select from Small, Medium and Large.

To display/hide comments

Select [Hide]/[Display] on the soft menu to display or hide the comments.

To Activate the Trace Status

Select [Trace] on the soft menu to enter trace commenting status.

3.5.2 Adding Comments

To add a text comment

Perform the following procedure:

1. Press <ABC> button, or press any alphanumeric button or the space bar enter the comment status.
2. Use the trackpad to move the cursor to the desired location for comments.
3. Do one of the following to add a comment:
   - Move the cursor over the desired comment text on the screen menu and press <Set>.
   - Type the alphanumeric characters through the keyboard.
     In the edit status, press <Enter> to move the cursor to the new line, and the location of the cursor is aligned with that of the first line.
4. Press <Set> or <Enter> button, or move the cursor to confirm the added comments text and exit the edit status.

To add an arrow

You can add an arrow to a location you want to highlight.

Perform the following procedure:

1. Press <Arrow> button 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 and change the orientation: use the trackpad to move the arrow to the desired position as well as change the orientation of the arrow.
   - To slightly change the orientation of the arrow: rotate the <Angle> knob to change the arrow's orientation (in increments of 15°).
   - To change the arrow size, use [Arrow Size] button on the soft menu to select from Small, Medium and Large.
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> button again to exit arrow comment status.

To add a trace

Perform the following procedure:

1. In comment status, select [Trace] on the soft menu to activate the trace function.
2. Use the trackpad to move the cursor to the desired position and press <Set> to confirm the start point.
3. Use the trackpad 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.
   - Press <Clear> to delete tracing.
4. Press <Set> to finish tracing.

3.5.3 Moving Comments

TIP:

If image size and position changed due to display format switching, then the position of the comment can be changed, too.

Perform the following procedure:

1. Move the cursor onto a comment and press <Set> to select it.
2. Use the trackpad to move the comment to the new position.
3. Press <Set> to anchor the comment in the new position, and the comment-moving operation is complete.

3.5.4 Editing Comments

To modify characters

Perform the following procedure:

1. In comment status, move the cursor onto the comment to be modified.
   - Press alphabetic buttons to enter the character to the cursor position directly.
   - Or, double press <Set> to enter comment editing status, and use the direction-control buttons to move the cursor to the desired location to insert/delete characters; you can either type characters by pressing the corresponding buttons 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 <Back> to delete the comment character or text on the left side of the cursor.
3. Press <Set> button, or move the cursor to confirm the added comments text and exit the edit status.

To modify arrows

Perform the following procedure:

1. Move the cursor on the arrow that needs to be modified. After the cursor becomes  , press <Set>.

   There is a frame around the arrow, indicating the arrow can be edited.
   - Move the cursor to change the arrow position.
   - Rotate the <Angle> knob to modify the arrow's direction.
2. Press <Set> button to complete the operation.

3.5.5 Deleting Comments

To delete comments characters, texts or arrows

Perform the following procedure:

1. Move the cursor onto the comment to be deleted.
2. Press <Set> to select the comment.
3. Press <Clear> to complete the deletion.

To delete a recently-added character, text or arrow

In comment status, press <Clear> to delete the latest added/modified comment unit.

To delete continuously

Press <Back> continuously to delete comment text one by one.

To erase all comments

NOTE:

- When no item is selected, press <Clear> will clear all comments and all measurements calipers.
- After powering off, the system will clear all comments on the image.

Long press <Clear> to delete all the comments.

3.5.6 Voice Comments

The system supports adding voice comment to the frozen images.

3.5.7 Voice Comment Panel

To perform voice comments adding, the function should be enabled, see the “General Setting” section in the Setup chapter to check “Enable Voice Response”.

No.	Name	Description
1.	Switch button	After the Audio Control function is enabled, click to toggle between Audio Control ( ) and Voice Annotation ( ).
2.	Play button	Click to play the recorded voice comment.
3.	Record button	Click to start the voice comment recording.
4.	Stop button	Click to stop the recording or review.
5.	Duration	Displays the time progress of recording or review.

Adding Voice Comments

Perform the following procedure:

1. Connect a microphone to the USB port of the system.
2. Acquire the necessary images and press <Freeze> to freeze the image.
3. Press <Cursor> to enable the cursor.
4. Click the Record button to start recording.

NOTE:

- In voice comment recording status, you can perform measurements, comments adding, body marks adding, print tasks and DICOM tasks.
- If you press <Freeze> during the recording course, the already recorded voice comment cannot be saved.

5. After the voice recording ends, click the Stop button to end recording.
6. Press the user-defined key for saving the image or cine.

Voice Comment Review

Click to open an image or cine file with voice comment, and during the image/cine review mode, voice comments are played as well.

3.6 Body Mark

NOTE:

After powering off, the system will clear all comments on the image.

The Body Mark feature is used for indicating the exam position of the animal and transducer position and orientation.

You can preset the system configured general body marks for each exam mode. The system supports the import of user-defined body marks.

3.6.1 Soft Menu Display in Body Mark

The body mark soft menu displays the settings for the current mode:

Library

Use [Library] on the soft menu to switch the body mark library. Corresponding body marks are shown on the left (available libraries are linked to the exam modes configured for the current probe).

User-defined body mark

Select [Custom] to enter the dialog box. You can import body mark graphs here.

You can import a user-defined body mark in BMP/PNG format of 140*140 (unit: pixel) in size.

Save Probe

If the probe mark direction and position is determined for the current body mark being added, click [Save Probe] to save the current probe mark direction and position for the body mark.

3.6.2 Adding Body Mark

Perform the following procedure:

1. Press <Body Mark> to enter the Body Mark status.
2. Use [Library] on the soft menu to select the body mark category.
3. Move the cursor over the desired body mark to highlight your choice and press <Set> to add the body mark.

   The body mark is highlighted in green solid frame at the bottom-left of the image.
4. Adjust the probe position and orientation marker:
   - Use the trackpad to position the probe marker.
   - Rotate the <Angle> knob to adjust the orientation.
   - Click [Save Probe] to save the current probe mark direction and position for the body mark.
5. Press <Set> to confirm the position and orientation of the probe marker and exit Body Mark mode.

3.6.3 Moving Body Marks

You can move the body mark graphics to any desired position within the image area.

NOTE:

In Dual-split mode, a body mark cannot be moved between the separate image windows.

Perform the following procedure:

1. Press <Cursor> and move the cursor onto the body mark. The cursor then becomes  , indicating you can move the Body Mark graphic to a new position.
2. Press <Set> to select the body mark.
3. Use the trackpad to move the Body Mark graphic to the desired position.
4. Press <Set> to anchor and confirm the new graphic position.

3.6.4 Deleting Body Marks

TIP:

- Preset returning, switching the exam mode/animal/probe will clear the body marks.
- Set if body mark is erased when the image is unfrozen, see the Application section of the *Setup* chapter.

Perform the following procedure:

1. Press <Cursor> and move the cursor onto the body mark, and the cursor becomes  .
2. Press <Clear> to delete the body mark.

3.7 Splitting Display

The system supports dual-split and quad-split display format. However, only one window is active.

The multi-window display can complete the image and mult-frame image comparison.

Dual-split

Select the <Dual> button to enter the dual-split mode, and use the <Dual> button to switch between the two images; select the B mode button or the <Single> button to exit.

Quad-split

Select the <Quad> button to enter the quad-split mode, and use the <Quad> button to switch among four images; select the B mode button or the <Single> button to exit.

3.8 Image Magnification

NOTE:

Zooming an image changes the frame rate which tends to change 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 filed.As a result, the MI may change.

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.

Perform the following procedure:

1. Press ⊕ to enter the sample volume definition status.
2. Use the trackpad to change the box size and position. Press <Set> to toggle between setting the size and position. After the sample volume is set, press the ⊕ button again to enter spot zoom status.
3. Use the <Zoom> button to change the magnification factor.

   The image magnification factor value will display in real time in the image parameter area. For example, “Z 1.40” indicates that the magnification factor is 1.4.
4. Press ⊕ again to exit spot zoom.

Pan Zoom

Perform the following procedure:

1. Use the <Zoom> button to directly enter the pan zoom status.

   Image-in-image is displayed.

2. Use the <Zoom> to change the magnification factor.

   The image magnification factor value will display in real time in the image parameter area. For example, “Z 1.40” indicates that the magnification factor is 1.4.

3. Change the magnification factor to 1.00 by using the <Zoom> to exit pan zoom.

iZoom (Full-screen Zooming)

Perform the following procedure:

1. Press <iZoom> button on the keyboard to zoom in on the image.

   The zoom area includes the image area, parameter area, image banner, thumbnail area and so on.

2. Press <iZoom> button again to zoom in on the image area only.

3. Press <iZoom> button again to exit iZoom.

3.9 Freeze/Unfreeze the Image

Select the Freeze button to freeze a scanning image. In freezing mode, the probe stops transmitting acoustic power, and all images as well as the parameters are kept still.

After freezing an image, the system may enter cine review, measure, comment adding, or body mark mode, which is dependent upon preset.

Select the Freeze button in frozen mode to unfreeze the image, and the system continues image scanning.

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 <C> 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.

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> button on the control panel.
- Dual/quad splitting display mode (press the <Freeze> button 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, current active window is marked with a highlighted M.
– 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.

3.10 Cine Review

The system allows you to review and edit the images prior to the image frozen. This function is called as cine review. The magnified images can also be reviewed, 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 unit waveforms, if the detection of physiological unit waveforms is performed.

⚠ CAUTION

- **The cine memory must be cleared at the end of the current animal and the onset of the next new animal by selecting the End Exam button.**
- **Cine files stored in the system's hard drive shall contain animal information, to avoid the selection of an incorrect image file and potential misdiagnosis.**

3.10.1 Entering/Exiting Cine Review

To Enter Cine Review

- The system enters the manual cine review status once select the Freeze button to freeze the image.
- Open cine files in thumbnail, iStation or Review. The system enters automatic cine review status.

To Exit Cine Review

Select the Freeze button or the B Mode button, the system will return to image scanning and exit cine review.

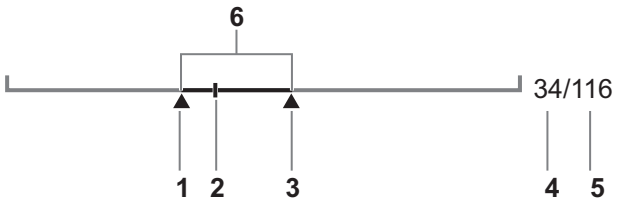
3.10.2 2D Cine Review

To Manually Review a Cine

Enter the cine mode in 2D imaging mode. Use the trackpad to view the cine.

If you move the playback mark to the left by using the trackpad, the review sequence is reversed to the image-storing sequence, thus the images are displayed in descending order. Whereas, if you move the playback mark to the right by using the trackpad, the review sequence is the same as the image-storing sequence, thus the images are displayed in ascending order. When you review images until the first or the last frame, further using the trackpad will display the last or first frame.

The cine progress bar at the bottom of the screen (as shown in the figure below):



1.	Start mark
2.	Playback mark
3.	End mark
4.	Current frame
5.	Total frames
6.	Auto review region

To Review all of Auto Review

Perform the following procedure:

1. In manual cine review status, select [Auto Play] (not selecting “Stop”) on the soft menu to activate auto cine review.
2. Reviewing speed: in auto cine review status, select [Auto Play] on the soft menu to adjust the review speed. When the speed is changed to 0, the system exits auto cine review.
3. In auto play status, select [Auto Play] to “Stop” or roll the trackpad to exit auto play.

To Set the Scope of Auto Review

You can set a segment of cine loop which can be reviewed automatically. After the auto review scope is set, the auto cine review can only be performed within this scope; but the manual cine review can be performed beyond this scope. When the cine file is saved, only the images within this scope are saved.

TIP:

You can perform cine review on each image window in the dual/quad splitting mode, and set auto review region for each window.

Perform the following procedure:

1. Set first frame: Manually review the images until the frame which you want to set it as start point, and then select [Set Begin] to set it as the start point.

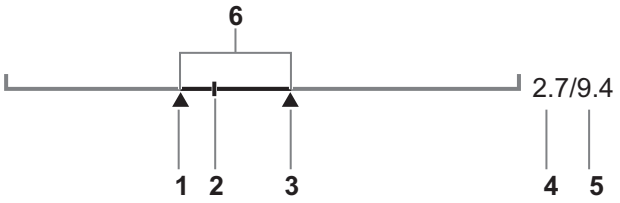
2. Set end frame: Manually review the images until the frame which you want to set it as end point, and then select [Set End] to set it as the end point.
3. Use the soft menu control to select [Auto Play] to set the value, then the system enters the auto cine status, and use this control to adjust speed.
4. Select [Auto Play] again or roll the trackpad to enter manual review status.
5. Select [Jump to First]/ [Jump to Last] to review the first or last image.

3.10.3 Cine Review in M/PW/CW/TVD Mode

Enter cine review in M mode, PW mode, CW mode, TVD mode, and then use the trackpad the cine images are displayed on the screen one by one.

Move the playback mark to the left by using the trackpad. The review progress slider moves to the left, the images moves to the right, and the earlier stored images are invoked. Whereas move the playback mark to the right by using the trackpad, the review progress slider moves to the right, and the images move to the left, the recently stored images are invoked. When the image goes to the first/last frame, the cine is played in loop with the trackpad moving left or right.

The cine progress bar at the bottom of the screen (as shown in the figure below):



1.	Start mark
2.	Playback mark
3.	End mark
4.	Time played
5.	Total time
6.	Auto review region

Cine review operations are the same as these of 2D mode.

TIP:

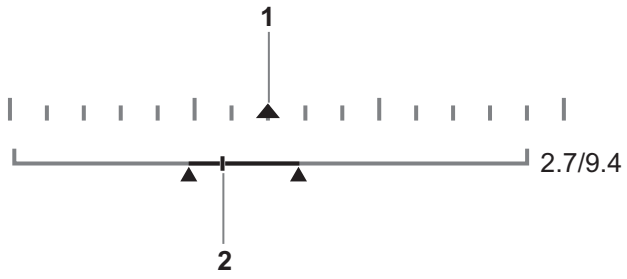
There is no audio when the spectrum is reviewed in manual status but audio synchronization can be realized in auto review status with speed of ×1.

3.10.4 Linked Cine Review

The linked cine review refers to review of the images captured at the same moment.

- B/Color/Power/TVI/TEI dual live

- B/B dual live
- B+M synchronization mode
- Duplex mode
- Triplex mode



1.	Frame synchronization mark
2.	Playback progress bar

The frame synchronization mark on the time mark of M/PW image indicates the corresponding 2D image and M/PW image. In statuses other than dual live status, you can only review images in the currently active window.

4 System Preparation

4.1 Move/Position the System

⚠ CAUTION

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.

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

Perform the following procedure:

1. Switch off the power, and pull out the power plug.
2. Disconnect all cables from off-board peripheral devices.
3. Place the system in a desired location.

   Leave at least 20cm at the back and both sides of the system.

4.2 Connecting the Power Cord

This system can work normally only when it is connected to the external power supply or the battery capacity is sufficient.

4.2.1 Connecting Power

Perform the following procedure:

1. Connect the connector of the power adapter to the adapter port in the system.
2. Use a three-wire cable to connect the adapter with the external power supply.

If you have any question about the power adapter, please contact the Customer Service Department or your local distributor.

NOTE:

- You must use the specified power adapter.

- Do not use this power adapter in the conditions other than those specified.

4.2.2 Powered by Batteries

When connected to the external power supply, the system is powered by the external power. The batteries inside it are in the charging status.

When disconnected from the external power supply, the system is powered by the batteries.

⚠ WARNING

- **The battery is inside the machine. Only the manufacturer technical professionals or engineers authorized by the manufacturer following training can perform battery installation and uninstallation.**
- **If you need to change the battery or buy a new one, contact the Customer Service Department or your local distributor.**
- **The replacement of lithium batteries by inadequately trained personnel could result in a HAZARD (such as excessive temperatures, fire or explosion).**
- **The lithium-ion battery has a service life of five years. Replace your battery when it reaches the end of its service life.**

Battery Performance

Under power off or standby 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.

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.

4.3 Power ON/OFF

⚠ 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 Customer Service

Department or your local distributor. If you use the system in a persistent improperly functioning state, you may harm the animal or damage the equipment.

4.3.1 Check before Powering ON

Check before the system is powered on:

- The temperature, relative humidity and atmospheric pressure meet the requirements of the operating conditions, for details see the *System Overview* chapter.
- There is no condensation.
- There is no distortion, damage or dirt on the system and peripheral devices.
  If any dirt is found, cleaning shall be performed, see the *System Maintenance* chapter.
- There are no loose screws on the monitor, control panel or the trolley.
- There is no cable damage (e.g., power cord). Maintain secure connections to the system at all times.
- The probes and probe cables are free from damage or stains.
  For details of probe cleaning and disinfection, see the *Probes and Biopsy* chapter.
- No miscellaneous odds and ends are attached or affixed to the control panel.
- 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.
- Probe cleaning and disinfection.
- The entire scanning environment and field must be clean.
- The locking mechanism of the casters (if there is a trolley) works normally.

4.3.2 Power the System ON

Press the power button to power the system on.

If access control has been set by the system administrator, you can access data in the system only after logging onto the system. For details, see the *Access Control* section in the *Setup* chapter.

You must log in again after system restart or dormancy.

To log onto the system

Perform the following procedure:

1. Select the login type, and user name in the drop-down list.
2. Enter the password and select [Login].

   When the user has logged onto the system,  is visible in the system status icon area of the screen.

To change users

Perform the following procedure:

1. To log out the current user and change to another user, click  in the system status icon area of the screen.

2. Select [Change User] to bring up the Login dialog box.
3. Select the login type, and user name in the drop-down list.
4. Enter the password and select [Login].

To modify password

General operators and administrators can modify the password.

Perform the following procedure:

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, and confirm the new password in the dialog box.
4. Click [OK] to exit.

To lock the system

Perform the following procedure:

1. Click the in the system status icon area 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.

4.3.3 Check the system after it is powered on

Check after the system is powered on:

- There are no unusual sounds or smells indicating possible overheating.
- There are no persistently displayed system error messages.
- There is no evident excessive noise, or discontinuous, absent or black items in the B mode image.
- 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 animal.
- The control panel buttons and knobs are fully functional.
- The screen displays normally depending on the system modes and image status.
- The date and time are displayed correctly.

⚠ WARNING

- **If you use a probe giving off excessive heat, it may burn the animal.**
- **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 the Customer Service Department or your local distributor.**

NOTE:

When you start the system or switch between transducers, you will hear clicking sounds – this is expected behavior.

4.3.4 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.

If you will not use the system for a long period of time, you shall:

- Disconnect the power adapter.
- Disconnect the mains power.
- Turn off powers of all peripherals connected to the system.

To power the system off

Perform the following procedure:

1. Press the power button to see the option:
   - Shutdown: to power the system off normally.
   - Standby: to enter standby status.
   - Cancel: to cancel the operation.
2. Select [Shutdown] to power the system off.

NOTE:

- Press and hold the power button for a long time and the system will power off without displaying the “Shutdown Confirm” screen. However, shutting down the system this way may destroy the data.
- DO NOT rush direct shutdown of the system. It may damage the data.
- After the system is upgraded, use [Shutdown] to power the system off to make the upgraded data effective.

4.3.5 Standby

NOTE:

- Power off the system if you will not use the system for a long period of time (including storage/ transportation condition), and you should not allow the system in standby status, otherwise the batteries will be out of power and permanently damaged.
- 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.

To enter standby

- Fully fold the LCD display and wait for 30 seconds, then the system enters the standby status.

- Set the time for screen saver and standby, see the *General* section in the *Setup* chapter. 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”.

To exit standby

Press the power button.

If you enter the standby mode by folding the display, you can exit the standby mode by unfolding the display.

4.4 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.

For details about adjustment, see the General section in the *Setup* chapter.

NOTE:

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

4.5 Connecting/Disconnecting a Probe

⚠ CAUTION

- **Use the Freeze button to freeze an image or turn off the power of the system before connecting/disconnecting the probe. Otherwise, system or probe failure may occur.**
- **When connecting or disconnecting a probe, place it in the proper position to prevent the probe from falling off or becoming damaged.**
- **Only use probes provided by the manufacturer. Aftermarket probes may result in damage or cause a fire.**

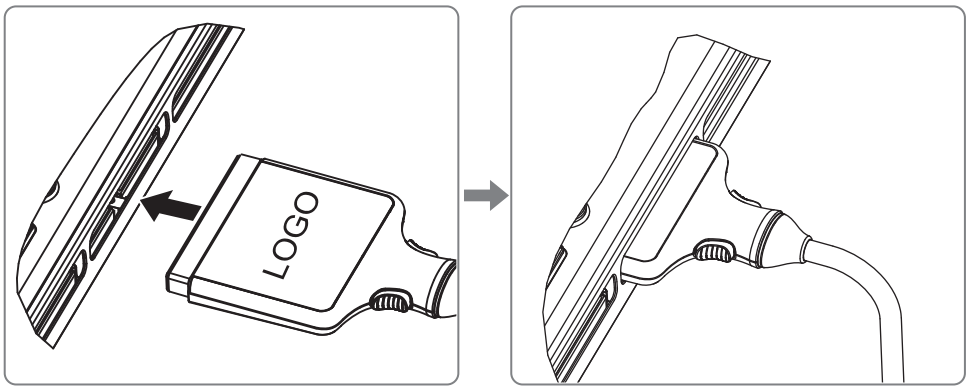
4.5.1 Connecting a Probe

⚠ 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.

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.

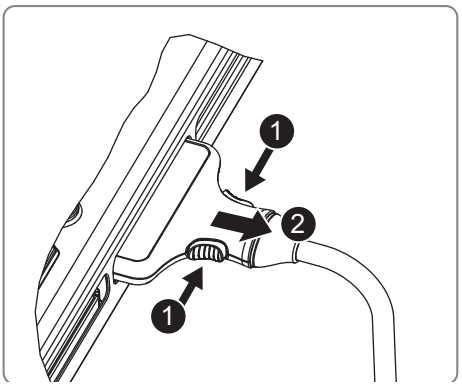


Perform the following procedure:

1. Keep the cable end of the probe to the front side of the system, insert the connector into the system port, then press in fully.
2. Place the probe connector with the manufacturer's logo face up; insert the connector into the system port, and then press in fully.

   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.

4.5.2 Disconnecting a Probe



Perform the following procedure:

1. Press and hold the two release buttons on the probe handle simultaneously.
2. Pull the transducer connector straight out.

4.6 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 USB symbol appears in the system status icon area of the screen.

To remove the USB device: click the USB symbol 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.

The system supports external DVD R/W drive. The DVD R/W drive is connected to the ultrasound system via USB port.

NOTE:

- When connecting an external DVD R/W drive, connect the two cables of the drive to the ultrasound system if the drive provides 2 USB power cables. In this way, the DVD R/W drive can work more normally.
- If the USB disk cannot be recognized by the system, please try disconnecting and then connecting again several times, or try another USB disk. If the problem still exists, please contact the Customer Service Department or your local distributor.

4.7 Connecting the Footswitch

The system supports USB port-type foot switches.

The function of the foot switch can be preset. For details, see the *Setup* chapter.

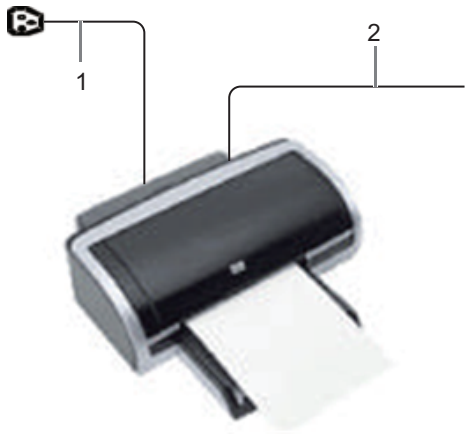
4.8 Installing a Printer

TIP:

- If the printer driver is required, please contact the Customer Service Department or your local distributor.
- Please refer to the accompanying manuals of the printers for more details.

4.8.1 Connecting a Graph/Text Printer

As shown in the figure below, a graph/text printer has a power cord and data cable. The power cord shall be directly connected to a wall receptacle as required.



1.	Power supply cable	Connect to power supply.
2.	Data cable	Connect to the USB port of this system.

Perform the following procedure:

1. Connect the data cable to USB port of the ultrasound device.
2. Power on the system and the printer.
3. Preset the default report printer and its attribute.

   Setting parameters of the print service, see the *Print Preset* section in the *Setup* chapter.

4.8.2 Connecting a Video Printer

The digital video printers that system supports consist of the B/W printers and color printers.

Perform the following procedure:

1. Place the printer appropriately.
2. Connect the power cord of the printer to a receptacle. Connect the USB port of the system to the USB port of the printer with USB cable.
3. Load a paper roll and turn on the system and printer.
4. Add a print service.

   Setting parameters of the print service, see the *Print Preset* section in the *Setup* chapter.

4.8.3 Connecting a Wireless Printer

The system supports the wireless graph/text printer for the report print.

Perform the following procedure:

1. Plug the printer power cord to an appropriate outlet.
2. Power on the system and the printer.

3. Make sure the ultrasound machine and the printer are connected to a same LAN, and turned on the W-LAN function of the printer.
4. Select “Report Print” from the printer list, select the printer, and set properties.

   Setting parameters of the print service, see the *Print Preset* section in the Setup chapter.
5. Select [OK] to exit the preset and make the settings effective.

5 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. The manufacturer is not responsible for the loss of preset data.

- To enter Setup:

  Press the <Setup> button on the keyboard to enter the setup menu.
- To exit Setup:
  - Select [OK] in the Setup menu. The parameter settings are saved.
  - Select [Cancel] in the Setup menu 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 soft keyboard.
  - 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.

5.1 System Preset

5.1.1 Region

Set the hospital name, language, time zone, time format and system date/time.

Item	Description
Hospital Information	To set the hospital-relevant information such as name, address, telephone, and so on.

Item	Description
Language	To select a language (input) for the system.
Load Logo	Import image for logo loading. ***NOTE:*** For a better display effect, please try to use an BMP image with 400*400 pixels and 8/24/32 bitdepth.
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 the confirm button, then increase or decrease the required value by clicking the icons on the right side.
Time Synch	To assign a time server and make the time of the ultrasound machine consistent with the server.

5.1.2 General

Set animal information, exam setup, animal management, storage, system dormancy, auxiliary output setting and so on.

Type	Item	Description
EXAM SETUP	Status after exam ends	To set the system status when an exam ends.
	Auto Screenshot of Report Page by Page	After selected, perform measure application and save single frame image, then end the animal exam, the system will save the report image in iStation.
	Sending/printing after End Exam	Select whether to automatically archive the exam data to the DICOM server for storage/print.
	Send SR after End Exam	Select whether to automatically send structure report to the DICOM server.
	Disable Recycle Bin	After checking this option, the deleted data will not go to the recycle bin. ***NOTE:*** After disabling the recycle bin, the deleted data cannot be recovered.
	Speed up the export of exams	Select whether to speed up the export of exams.
	Remind exams backup after	To set number of days to remind the operator of exam backup.
	Maximum number of exams to be kept	To set the maximum number of exams to be kept. If the actual number is larger than the preset number, the latest exam will replace the earliest exam. ***NOTE:*** The animal exams which exceed the preset maximum will be deleted and unrecoverable, it is recommended to perform animal data backup before enabling this function to avoid data loss.

Type	Item	Description
SCREEN SAVER	ScreenSaver	Select the different saver methods to the system. After enabling the screen saver, check “Select Picture” to select the image from the system. Or click [Preview] to select the image on your own; you can set the interval time for the screen saver slideshow in the drop-down list beside “Interval”. To set the waiting time before the system enters dormancy status in the drop-down list beside “Wait”. The system enters screen saver automatically if the system waiting time exceeds the screen saver already set.
	Standby	The system enters screen saver automatically if the system waiting time exceeds the screen saver already set and standby time.
	CoverOff-Standby	After folding down the monitor, the system enters standby mode automatically if the waiting time exceeds the CoverOff-Standby time.
DISPLAY	Brightness auto adjustment	To set the brightness/contrast of the main screen according to the conditions.
	LCD	To set the brightness and the contrast of the main screen, or restore to the default.

5.1.3 Image Preset

Controls are as follows:

Type	Item	Description
RESET CONFIG	Probe	To set the default probe model for the system from the drop-down list. The default parameters are applied to the new probe if checking “Use the default setting when start a new exam.”
	Image Size	Set the standard for saving the image or using the digital/graph printer.

Type	Item	Description
PARAMETER	Steer	To set the steer mode in B + Color + PW/CW imaging mode. • C&(PW/CW): select to adjust the sample volume in color mode and sample line in PW or CW mode together. • C/(PW/CW): select to adjust the sample volume in color mode and sample line in PW or CW 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+Color image is activated under B+Color+PW/CW mode.
	Uninterruptible image saving when reprocessing parameters are changed	Adjusting reprocessing parameters will not interrupt image/cine saving.
	Color And PW/CW Synchronize Invert	To set whether to invert Color Map and PW/CW spectrum synchronously
	Display Transducer SN	To set whether to display the transducer SN.
	B+Color+PW UnFreeze keeping PW	To set whether to retain PW images when unfrozen under B+Color+PW mode.
TISSURE TRACKING QA	Segment Model	To set the cardiac segment model: 16 or 17.

5.1.4 Application

Set the measurement ruler, measurement setting, left ventricular setting, comment setting and so on.

Measure Ruler

Controls are as follows:

Item	Description
Cursor Type	Type of cursor displayed on the measurement caliper and results window. Value options: • Number: the cursor always displays as "+" while different measurements are marked with numbers. • Symbol: the cursor displays sequentially in 8 symbols to identify different measurements.
Cursor Size	The size of the cursor.

Item	Description
Heart Beat	The number of cardiac cycles in the heart rate calculation. (In heart rate measurement, the number of cardiac cycles should match the preset number.)
Cursor Line Display	If unselected, the connecting line between the measuring ends will be hidden after measurement.
Ellipse Cross Line Display	If unselected, the measuring axis within the ellipse area will be hidden after measurement.
Clear results while deleting caliper	Unchecked. The image is unfrozen or the image mode is changed after the measurement is completed. The measurement results are saved if the caliper is cleared.

Unit Setting

To set the default measurement unit.

iMeasure

Set up the threshold value for prompt message in the displayed measurement/calculation value.

When the actual measurement/calculation value is within the range of threshold value, the corresponding prompt occurs after the measurement/calculation value in the result window.

TIP:

The prompt information provided by this function depends on the measurement behavior, and is only for reference during the diagnosis of a doctor. It is not responsible for the correctness of the diagnosis result.

LV Cube/Teichholz/Gibsom

Set the tools used in the Cube/Teichholz/Gibson study.

PW Measure

PW measure velocity displays absolute value.

All measurement results in PW mode are absolute values based on the unit of velocity after checking this item.

Comment

Set whether to clear comments and bodymark:

Item	Description
Clear comments while unfreezing image or changing probe/exam	To set whether to clear comments while unfreezing image or changing probe/exam.
Clear Bodymark upon unfreeze	To set whether to clear bodymark whiling unfreezing image.
Voice comment enabled	To set whether to enable voice comment feature.

Intelligent Input

Set to enable the Input Method Association.

ICA/CCA && RAR

Set the measurement properties of ICA, CCA, Renal A and Aorta.

Cardiac Formula

Set the surface area formula for Canine.

Trackpad Speed

Set the sensitivity of the trackpad.

5.1.5 Keyboard

Key function setting

To assign a function to a key:

1. Click to select a desired key. The system enters the function assignment page.
2. Click to select a function in each column.
3. Click [OK] 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.

Other Settings

Item	Description
Control Panel Brightness	To set the brightness for control panel key. ***NOTE:*** After the brightness value is set to “4”, the backlight of keys on the control panel are off, but the working indicator of the selected key is still on.
Key Volume	To set the key volume at 3 levels, 0 means no sound.

5.1.6 Output

Set the output format, the range and the resolution for the image.

Type	Item	Description
AVI ENCODE	Encode Quality	To set the image quality of unloaded AVI. The system unloads according to the settings. The higher the image quality is, the clearer the unloaded image is. The unloading speed become slower with the larger space.
	Operating System Compatibility	To set the unloading format of the AVI. The system unloads according to the settings. If checking “Mac OS”, saving CIN files to USB flash drive as “MP4 Video”.
	Send To Frame Rate	To set whether to enable/disenable compression of images.
	Analog Output Mode	To set the format to output/separate the video format: NTSC or PAL.
	Color Temperature	To set screen color temperature: Warm or Cold.
DIGITAL OUTPUT	Output Size	Select VGA, HDMI output image range.
	Resolution	Select VGA, HDMI output image resolution.
DVR OUTPUT	Output Size	Select DVR recording area.
	Max Frame Rate	Select DVR recording Max Frame Rate.

5.1.7 Access Control

The system supports two types of users: administrator and operator.

- Administrator

  The system administrator can access all function modules, and view all animal data, such as animal information, images and reports, etc. Only one administrator is configured by default. The administrator can add or delete operators.
- Operator

  The operator can only access the function modules with assigned privileges. The operator can only view exam information saved in the system and operated by him or herself, such as animal information, images and reports, etc.

To enable 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.

Open the “Access Control” page:

- If “Enable User Account Control” is selected, you must be authorized before accessing the data, and you can configure password policy and LDAP, and change password. If unselected, you can access all the data without authorization, and you cannot configure password policy and LDAP, and change password.
- If “Enable Emergency User” is selected, the administrator can edit privileges for emergency users. If unselected, the administrator cannot edit privileges for emergency users.

To add a user/assigning privilege

Turn on the access control function and log in to the system as Administrator before you add the user.

1. Click [Add] to bring up the dialog box.
2. Enter the user name and password, confirm password.
3. Select or deselect the check box from the privilege list.

   Users can only access the function module with assigned privilege.
4. Click [OK] to confirm the setting and exit the dialog box.

   The new user and the privilege will appear in the User List.

To delete a user

Turn on the access control function and log in to the system as Administrator before you delete the user.

Select the user to be deleted in the User List. Click [Delete] to delete the selected user.

To edit privilege

Turn on the access control function and log in to the system as Administrator before you edit privileges.

1. Select a user, click [Edit Privilege] to enter the “Edit user privilege” dialog box.
2. Select or deselect the check box from the privilege list.
3. Click [OK] to confirm the editing and exit the dialog box.

   The edited privileges will appear in the User List.

To 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.

1. Select the user name to be modified in User List.
2. Click [Change Password] to open the dialog box.
3. Enter current password, new password and confirm new password, then click [OK].

To configure password policy

Turn on the access control function and log in to the system as Administrator before you configure the password policy.

Click [Password Policy Config]:

Item	Description	Remark
Lockout Threshold	Set the maximum time that a user can input the wrong password. If you exceed the maximum times, your account will be locked.	For example, assume that the "Lockout Threshold" is set to 5, the "Reset Account Lockout Threshold after" is set to 60, and the "Lockout Duration" is set to 60. That is, a user inputs the wrong password for 5 times within 60 minutes, the account is locked, and the user can log in to the system only after 60 minutes. Other users with unlocked accounts can still log in to the system normally.
Reset Account Lockout Threshold after	Set the duration allowed for a user to continuously input the wrong password.	
Lockout Duration	Set the duration after an account is locked.	
Reset all lockout	Reset all locked accounts.	/
Enable strong password	Enable strong password to improve security. • If the strong password is enabled and you log in to the system with the account that is added before the strong password is enabled, the system prompts a warning message to inform you whether your password conforms to the password policy. The administrator can change password for administrator or operator. • If the strong password is enabled and you add a new user account, the system prompt an error message to inform you that the password is too weak, please modify the password according to the error message.	/

To manage LDAP privilege

Turn on the access control function and log in to the system as Administrator before you edit privileges for the LDAP (Lightweight Directory Access Protocol) users.

Click [LDAP Config]:

Item	Description
Service Address	Enter the server address in the field box after accessing the network
Test LDAP Server	To test whether the LDAP server is accessible. If the LDAP is accessible, the system prompts the following message "Server test succeeded."

Item	Description
Root DN	It is automatically displayed after the server is successfully tested.
Default Domain	The default domain is the DC name in the Root DN. For example, if DC=security1, then input “security1” in the field box of the “Default Domain”.
Days to keep cached password	Set days to keep the cached passwords in the local system. Users can log in to the server even without accessing the network within the setting days. • Empty: the passwords are kept in the local system permanently. • 0: no passwords are kept in the local system. • ≥1: for example, if it is set to 5, the passwords are kept in the local system for 5 days.
Member of filter/Privilege	• Enter the member name, and select or deselect privileges from the drop-down list of “Privilege”. • Click [Add], and the new members and privileges will appear in the Member of filter list. • Select a member to be deleted, and click [Delete]. • Select a member to be modified, modify the member name, and select or deselect privileges from the drop-down list of “Privilege”. Click [Modify], and the modified member name and privileges will appear in the Member of filter list.
Logon Test	**1.** Enter the User name and password in the field boxes of the Authentication test area. **2.** Click [Logon Test] to test whether the user is authenticated.
User field name	Select [Use user field name] to customize the user field name. After that, the members and privileges cannot be edited. Enter the user field name in the field box of the “User field name” (the user field names are configured in the LDAP server. For details, please refer to the LDAP server manual). The user field name corresponding to privileges are as follows: • iStation Access: 1 • Save Exam: 2 • Export Exam: 4 • Network Settings: 8 • Maintenance Menus: 16 • System Settings: 32 • Workflow Settings: 64 • Worklist Access: 128 ***NOTE:*** The privilege items can be combined randomly. For example, if user A is assigned with all the above 8 privileges, the user field name for user A is 1+2+4+8+16+32+64+128=255.

Auto lock machine

To set the waiting time before the system enters locked status in the drop-down list beside “Wait”.

The system will be locked automatically if the system waiting time exceeds the duration already set.

5.1.8 Scan Code Preset

Set the code parameters for barcode reader.

1-dimension barcode reader (1D)

Item	Description
Regular Expression	Set the regular expression according to the bar code format.
Append Options	The information of operator or diagnostician can be appended after selecting the check box. For example, after scanning a 1D barcode of an operator or diagnostician, the obtained data is A, and A will be displayed in “Operator” or “Diagnostician” item in Animal page automatically. After scanning a 1D barcode of an operator or diagnostician for a second time, the obtained data is B, and A will be appended by B in “Operator” or “Diagnostician” item in Animal page automatically.
Move Up/Down	Move up or Move down a selected item.
Add/Delete	Add or delete a selected item. (Only the default item can be added or deleted.)
Load default	Restore the parameter value to the default value.
Worklist Options	• Select “Worklist server” from the drop-down list, and the system searches the Worklist server according to the scanned data. • Select “No” from the drop-down list, and the system creates a new exam in the Animal page according to the scanned data.
Import/Export	Import and export configuration files to preset the barcode. For details, please contact the Customer Service Department or your local distributor.

2-dimension barcode reader (2D)

- General Analysis Mode

Item	Description
Scan Barcode Example	Input a barcode example, barcode example is separated by separators (the separator is used to set the start and end position of each item), and the barcode data is displayed in the following items in turn.
Age Unit	Select an age unit from the drop-down list of the “Age Unit”: Year, Month, or Day.
Male/Female	Input the customized gender symbol besides the Male and Female field box, such as Male (M) or Female (F).

- Advanced Analysis Mode
  Select “Advanced” from “Analysis Mode” drop-down list: user enters scan barcode example and regular expression and click [Match], the system will match scan barcode example with regular expression automatically, and if which is matched successfully, the scan item will display the barcode by separators.

5.2 Exam Mode Preset

You can assign available exam modes for probes.

Perform the following procedure:

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.

   – Click [>]: add a selected exam mode in the [Exam mode Library] to the [Probe and Exam mode] list.
   – Click [<]: add a selected exam mode in the [Probe and Exam Mode] to the [Exam Mode Library] list.
   – Click [>>]: add all exam modes in the library to the [Probe and Exam Mode] list.
   – Click [<<]: add all probe and exam modes in the library to the [Exam Mode Library] list.
   – 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 “√”.

5.3 Measurement Preset

“Exam Mode XX” on the upper left side refers to the currently configured exam mode. The configured general/application menus are only related to the current exam mode.

There are three kinds of measurement items.

Measurement

Results of measurements are directly obtained via the measurement tools, which are indicated by “” in the preset screen.

For example, “Distance” in the 2D general measurement.

On the touch screen, measurement tools are displayed using square button.

Calculation

Results of calculations are automatically derived by the system using other measured or calculated values as parameters, they are indicated by “” in the preset screen.

If all measurements related to a calculation tool are completed, the system will automatically calculate the result. If some measurement tools are performed again, the system will automatically update the calculation result using the latest measurement results.

On the touch screen, calculation tools are displayed using square button.

Study

A group of measurements and/or calculations for a specific clinical application, which are indicated by "🗀" in the preset screen.

Fold/unfold the study to hide/show the measurement or calculation items included.

On the touch screen, study items are displayed with an arrow indicating the tools to be selected.

5.3.1 General Measurement Preset

You can preset the General Measurement packages for 2D (B/Color/Power Mode), M Mode, or Doppler (PW/CW) Mode respectively.

Perform the following procedure:

1. Select the [Caliper] on the [Measure] page.
2. Select the [2D], [M] or [Doppler] tab to go to the corresponding preset menu.
   - [Available Items]: general measurement tools configured by the system in the current scanning mode which are available but not assigned yet.
   - [Selected Items]: displays the tools to be added to the menu.
3. Add/Remove the general measurement item using the following buttons:
   - [>]: To add the selected tool from the [Available Items] to the [Selected Items].
   - [>>]: To add all tools in the [Available Items] to the [Selected Items].
   - [<]: To remove the selected tool from the [Selected Items] to the [Available Items].
   - [<<]: To remove all tools from the [Selected Items] to the [Available Items]. You do not need to select any items before removing.
4. Set the default item.

   Select an item from the [Selected Items], then click [Default]. The item is marked with a √.

   The default item is activated automatically when entering this general measurement menu.
5. Adjust the item position.

   Select an item from the right column and click [Up]/[Down] to adjust the sequence in which the items are arranged in the corresponding general measurement menu (touch screen display).
6. Modify the properties of a measurement item.

   The following takes D trace as an example to show how to set the properties of a measurement tool.

   a. Select the [Doppler] tab to go to the corresponding preset menu.
   b. Select [D Trace] from the [Selected Items] and click [Property].

Descriptions of the attributes are shown in the following table:

Item	Description
Item Name & Result	Results obtained from D trace are listed. The selected items will be displayed in the results window after measurement. • If PV is selected, other results become deselected (except the temporary result “velocity”). • Some results, such as PS and ED, can be derived via a simple method (e.g., Velocity), but others, such as TAMAX, can only be derived via complicated methods such as Manual, Spline, Auto, etc. • Only Vel. is available in [Method] if only PS or ED is selected. • Methods for obtaining PS and TAMAX simultaneously (trace, spline and auto) should be chosen if both PS and TAMAX are selected (TAMEAN should use auto method).
Unit	Select the measurement unit. Click “Unit” column of each item to select.
CalcMethod	Select the measurement method for the tool. Click “CalcMethod” column of each item to select.

c. Click [OK] to confirm the setting.

7. Select the measurement sequence.

– [Repeat]: after the current measurement is completed, the system automatically activates the current tool again.

– [Next]: after the current measurement is completed, the system automatically activates the next tool in the menu.

– [None]: after the current measurement is completed, the cursor can be moved over the whole screen. And the cursor will automatically return to the menu of the corresponding measurement.

8. Click [OK] to confirm.

5.3.2 Application Measurement Preset

Measurement package preset

During measurement, the preset package displays on the touch screen. Items in the package can be preset and may belong to different application regions.

You may configure more than one measurement package for current exam mode. Under actual measurement status, switch the measurement library if necessary.

Click [Advanced] on the [Measure] page to enter the “Add New Package” page.

- [Available Items]: shows application packages configured in the system but not yet assigned to the current mode.
- [Selected Items]: shows application packages assigned to the current exam mode. If more than one package is assigned to the current exam mode.

Package editing includes Creating Packages, Add/Remove Items, Deleting Measurement Packages, Setting Default Packages, Adjusting Package Positions.

- Creating Packages: Click [New] and enter a name for the new package in the dialog box pop-up. Click [OK] to confirm, the new package displays in the [Available Items] list.
- Adding/Removing Packages: Add/remove the package by clicking [>], [>>], [<] and [<<].
- Deleting Packages: Select a package from the [Available Items] list, click [Delete]. To delete an item from [Selected Items], you need to move it to the [Available Items] first.
- Setting Default Packages: Select a package from the [Selected Items] list, then click [Default]. The default package is marked with a √.

  The default package displays when entering the [Measure] page.

  The measurement menu of the default package (corresponding to the exam mode) displays when entering the measuring status.
- Adjusting Package Positions: Select a package from the [Selected Items] and click [Move Up]/[Move Down] to adjust the sequence that the packages in the menu are arranged in.

Measurement menu preset

The following operations are available.

- Adding/Removing Items: Add/Remove the general measurement item using the [>], [>>], [<] and [<<].
- Setting Default Items: Select an item from the [Selected Items] list, click [Default]. The defaulted item is marked with a √.

  To deselect the default tool, select it and click [Default] or set another item as the default.

  If a particular item is set as the default item, it automatically displays the submenu of the study when entering this measurement menu.
- Adjusting Item Positions: Select an item from the [Selected Items], click [Move Up]/[Move Down].

  The order in the list is also the item position in the menu.

User-defined measurement/calculation/study

NOTE:

- Please ensure the correctness and validity of the defined formula, otherwise the manufacturer will not be liable for damage caused by improper definition of the formula.
- Trigonometric functions are in degrees, not radians.
- PI is accurate to 7 digits.
- Adding B-Hist or B-Profile to the study is not supported.
- Click [Export Custom] in the measurement preset window to export the user-defined measurement.

User-defined calculations are derived from arithmetic operations in which the parameters are measurement, calculation or study results obtained in measurement items which exist in the system or are user-defined.

Perform the following procedure:

1. Select the [Measure] tab page.
2. Click [New].

   The “Measurement Custom Wizard” dialog box appears.
3. Enter the Name in the “Measurement Custom Wizard” dialog box, then click [Next].
4. Set the user-defined attributes in the dialog box.
5. Click [Complete] to finish setting. The user-defined item is listed in the “Selected Items” menu and in the “User-defined” category of “Available Items.” An asterisk appears after the user-defined item for identification.

   In the meantime, the user-defined item will be added automatically to the “Selected Items” in the Report template. If the item is completed in an exam, the results will be displayed in the report.

To add a study

You can add or remove user-defined study items in the [Selected Items] column.

Perform the following procedure:

1. Select the [Measure] tab page.
2. Click [Add Study] on the right.
3. Enter the study name in the dialog box that appears.
4. Click [OK] and the item will be added to the “Selected Items.”
5. Select a measurement/calculation item from the “Available Items” and click [>] to add the item to the user-defined study.
6. Repeat the step 5 to add more items if necessary.
7. Move the cursor to click on the study and click [Property] on the right to edit the measure sequence.

To edit user-defined items

Select the target defined item in the “Available Items”, and click [Edit].

To remove user-defined items

- Remove Measurement/Calculation
  a. Select “User Defined” in the “Available Items”, and select the desired item.
  b. Click [Delete].
- Remove Study
  Select a user-defined study, click [<].

5.3.3 Report Preset

NOTE:

- Deleting is not supported in IMT, TTQA and Stress Echo reports.

- Watch the layout when setting the animal information layout of the report template. Do not set too many characters in one line; otherwise it may affect the display of the report.

To create report templates

Perform the following procedure:

1. Select the [Report] on the [Measure] page.
2. Click [New] to bring up the following dialog box.
3. Select template: click the drop-down list under “Application Region” to select the template and click [OK] to confirm the template layout and exit the dialog box.
4. Enter the name for the user-defined report template in the box after “Report Template Name”.
5. Click [Measurement] to select measurement results to be displayed in the report:
   a. Select an application category from the drop-down list beside “Available Items”.
   b. Select Measurement, Calculate, Study or All from the drop-down list beside “Available Items”. The corresponding items appear in the list.
   c. Use the [>] or [>>] buttons to add items to the “Selected” list.
      Only tools which appear in the right column and are completed in the ultrasound exam can be displayed in the report.
      In cardiac mode, if result items of only one formula are selected, only results of that one formula will be displayed after measurement. (For e.g., if only items suffixed with Teicholz are selected, not with Gibson or Cube, then only results suffixed with Teicholz after measurement are displayed.)
   d. Add the study.
      Click [Add Study] and enter the study name in the dialog box which appears, then click [OK].
      The new added study appears in the “Selected” list.
   e. Adjust the item position.
      Select an item from the “Selected” list, click [Up]/[Down] to adjust the position of the item in the list, as well as in the report template.
   f. Click [OK] to save the settings and exit the dialog box.
6. Set the module display in the report: click [Setting] to make a selection;
   – Tick the check box in front of the module name to display the module in the report;
   – Click [OK] to save the setting and exit.
7. Change the animal information layout in the report template:
   – Change the template used in the report layout: click [New Layout] to select another template.
   – Double click the information lines to be edited in “Report body”. The dialog box of font setting appears. Set the font size, font weight or hidden key words.
   – Double click the blank of a module in “Report Body”. The dialog box of editing the content appears. Select the content to be displayed at current position.
   – Press the left confirm button on the blank of a module in “Report Body”. Choose to add or delete the line, or add the table, etc.

8. Click [Save] to save the setting.
9. Click [Close] to quit the template.

To delete report templates

Perform the following procedure:

1. Select the [Report] on the [Measure] page.
2. Select the template to be deleted from the list.
3. Click [Delete] > [Yes] to delete the selected template.
4. Click [OK] to confirm the settings.

To edit report templates

Perform the following procedure:

1. Select the [Report] on the [Measure] page.
2. Select the template to be modified from the list.
3. Select [Edit] to enter the [Measurement Report Preset] dialog box.
4. Click [OK] to confirm the settings.

To set default templates

Perform the following procedure:

1. Select the [Report] on the [Measure] page.
2. Select a report template from the list.
3. Click [Default].
4. Click [OK] to confirm.

5.4 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.

5.4.1 Comment Configure

To add a user-defined item

Directly enter user-defined comment texts: posit the cursor in the field box above [Add Comment], enter the text comment through the soft keyboard, and then click [Add Comment]. Then the directly-entered comment will be added to the Selected Items.

To select available items

Perform the following procedure:

1. Select available items:
   a. Select a comment library in the drop-down list below “Application”.
   b. Select a comment type in the drop-down list below “Type”.

   All items will be displayed below “Available Items”.
2. Click [>], [>>], [<] and [<<] to add the item in Available Items on the left into Selected Items on the right.

TIP:

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.

To change positions 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.

5.4.2 Comment Group Define

To add user-defined group

Enter user-defined group name in the name text box below [Lists Name] through the soft keyboard, click [Add Group]. The entered group name will be added to the Group Lists.

To add comment items to the user-defined group

Perform the following procedure:

1. Select a user-defined comment group from the “Group Lists”.
2. Do one of following to add comment items:
   – Select a comment library in the drop-down list below “Application”: Select a comment item, click [>] to add it into Selected Items on the right; click [>>] to add all items into Selected Items on the right directly
   – Add user-defined comment item: Enter user-defined comment in the name text box above [Add Comment] through the soft keyboard, click [Add Comment]. The entered comment item will be added to the Selected Items.

To change positions of the selected items

Select an item and click [Up], [Down] button to change the position of the item.

To delete a comment item from the user-defined group

Select an item in the Selected Items, click [<].

TIP:

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.

5.5 iWorks Preset

You can customize the protocols and views in the iWorks preset screen.

5.5.1 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 "XXX_Copy1" is created with the copied views, which can be customized.
- Select a view with "Left", "Lt", "Right" or "Rt" in its name in the list on the left, and click [Copy L<>R]. The selected view is copied onto a new view in which bodymarks, annotations and measurement items are reversed to the opposite side.
- 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.

5.5.2 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.

5.5.3 Create a New Protocol

You can create user-defined protocols and customize the automated procedure.

Perform the following procedure:

1. In the iWorks preset screen, click [Add Protocol] to create a new protocol.

   Or, select an existing protocol and click [Copy] to customize the protocol based on the previous template.

2. Enter the protocol name, type and select the application region.

3. Click [Add View] to enter the view name and perform image settings.

   – In the measurement 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.
   – Select the checkbox of "Disable Protocol Body Marks" for body mark display settings.

5.6 Stress Echo Preset

5.6.1 Protocol Edit

You can create, edit, delete, copy, export and load the Stress Echo protocols using the Protocol Editor dialog box.

Item	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 Views	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.
Delete Protocol	Delete the protocol.
New stage	Create a stage for the current protocol.

To create a stress echo protocol

Perform the following procedure:

1. Click the [New Protocol] 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 Stage” in the Stage list.
   b. Enter a phase name.
   – Select “Auto Select”, the system jumps to Select Mode after retrospective acquisition.
   – Select the required option from the Clip Capture drop-down list.
   – Select the number of loops to acquire (per view in the selected phase) in the Loops list (for non-continuous stages).
   – Select the type: exercise or drug.
5. Click [OK] to save changes and quit.

To edit a stress echo protocol

Perform the following procedure:

1. Click a user-defined protocol on the Select Protocol screen.
2. Edit the protocol as described in the create protocol.

To delete a stress echo protocol

Click an user-defined protocol on the Select Protocol screen, click [Delete Protocol].

5.6.2 Maintenance

Item	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, 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.

5.7 DICOM/HL7

5.7.1 DICOM Local Preset

TIP:

- AE Title should be the same with 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 storage server should be Storage.
- The device name is random. If the server name is same with that in the DICOM server list, the information “the server added already exits”, click [OK] to retype the name.
- IP address should be the address of the remote server.

DICOM local preset items are described as follows:

Item		Description
Local Host DICOM service property	AE Title	Application Entity title.
	Port	Communication port, DICOM communication port.
	PDU	Maximum PDU data package size (not need to change), 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.
	DICOM output charasets	Select an character set for DICOM output according to the local PACS workstation.
	Transcoding elements	Set what DICOM element(s) will be transcoded.
	TLS Port	Set the TLS port.
	TLS Server Setting	Import the encryption key/certificate.
	TLS Client Setting	• After importing TLS certificates, and selecting Verify Certificate check box, the system verifies the effectiveness of the TLS function in the DICOM storage, print, and Worklist services. • Import trusted certificates, or delete certificates.
Server Setting	Device	Name of the device supporting DICOM services.
	IP Address	IP address of the server.
	Ping	You can ping the other machines after you entered the correct IP address. Besides, you can 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, please refer to the following chapters.
	Set DICOM Strategy	Click to enter the configure the strategy screen.
	Log Level	For engineer use only.
	Capture	

To add a server

Perform the following procedure:

1. Enter the server device name and IP address.
2. Click [Ping] to check the connection.
3. Click [Add] to add the server to the device list, and its name and address are displayed in the list.

To delete a server

Select a server in the device list, and then click [Delete].

To set a DICOM strategy

TIP:

- The DICOM strategy must be configured by qualified personnel with good knowledge of DICOM standards.
- The qualified personnel must ensure the validity of the DICOM strategy.

Perform the following procedure:

1. Click [Set DICOM Strategy].
2. Edit the DICOM strategy:
   - Add: Enter strategy name and description, and click [Add] to add a new strategy. Then the added strategy will be added to the Strategy List.
   - Delete: Select a strategy from the Strategy List, and click [Delete].
   - Update: Select a strategy from the Strategy List, re-enter strategy name or description, and click [Update].
3. Configure the item:

   Select a strategy name from the Strategy List, and assign strategy items to the selected strategy.
   - Add: Set the function from the drop-list box, enter the parameter 1 and parameter 2, and click [Add]. Then the added strategy item will be added to the Strategy Items List.
   - Delete: Select a strategy item from the Strategy Items List, and click [Delete].
   - Update: Select a strategy from the Strategy Items List, reselect the function or re-enter the parameter 1/2, and click [Update].
4. Import/Export strategy:
   - Import: Click [Import], browse the desired strategy file and operate according to the screen prompts to import.

     The imported file for DICOM strategy must be a *.xml file.
   - Export: Select a strategy from the Strategy List, click [Export] and then select the export path and type the file name.

     E drive is default, and the file type is *.xml.

5.7.2 DICOM Service Preset

The DICOM Service screen is used to set attributes for DICOM service.

When the system is configured with DICOM basic function module, and installed with DICOM modules, the corresponding preset can be found in DICOM Service screen.

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.

Perform the following procedure:

1. Click [Set DICOM Service] on the DICOM/HL7 screen.
2. Select the DICOM service tab to enter the corresponding settings screen.
3. Enter the correct AE Title, port, etc.
   - Click [Add] to add the service to the Service List.
   - 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.
   - Click to delete the selected service in the service list.
   - Select an item in the service list, click [Default] and you can see "Y" in the Default column.
4. Click [Verify] to verify that the two DICOM application entities are properly connected.

   If the verification is successful, the system displays "xxx Verify Succeed." Otherwise, it displays "xxx Verify Failed."

   If verification failed, possible causes may be: wrong IP address, not able to access IP address, remote DICOM server is not running, wrong port, incorrect application name.

Storage service preset

DICOM storage preset items are described as follows:

Item	Description
Device	After you set the server (s) in DICOM Preset screen, the name (s) will appear in the drop-down list, select the name of the storage server.
Service Name	Default is xxx-Storage, user-changeable.
AE Title	Application Entity title, here, it should be consistent with that of the storage server.
Port	DICOM communication port, 104 is default. Here, the port should be consistent with that of the storage server port.
Maximum Retries	Set the maximum retries (0-9). The default value is 3. If the DICOM task sending to the server fails, the retry times should be 3.
Interval Time(s)	Interval time.
Timeout	Refers to the amount of time after which the system will stop trying to establish a connection to the service.
TLS	Transport Layer Security. Select whether to encrypt the data during network transportation.
Cine Zoom Mode	Select the cine zoom mode during image file storage.
Compression Mode	Select the compression mode: original data (uncompressed), RLE (the image not compressed), JPEG, and JPEG2000.
Compression Ratio	Select the JPEG compression ratio: lossless, low, medium, and high. The compression ratio is inversely proportional to the image quality (reserved function).

Item	Description
Color Mode	Select the color mode. If you choose the mix or the grey, RLE/JPEG is unavailable. The image uses 24 bit when sending the image from the ultrasound device to the server; it depends on the image when choosing the mix. The image use 8 bit if the image is captured in color mode or the image has the tint. All images use 8 bit when choosing the grey.
Allow Multiframe	If SCP supports this function, then select it.
Max Frame Rate	Set the frame range of transferring cin file into DCM multi-frame file. It is editable to the user.
3D/4D	Set the 3D/4D image transfer mode. Set the transfer mode for the 3D/4D cine sending. • Normal: use the way that 2D image adopts to send; • Volume: use Enhanced US Volume Storage IOD to send; • Data source: used to obtain 3D/4D image for 4D Viewer.
SR Storage Option	To enable or disenable structured reporting sending.
Encapsulated PDF	Select if to encapsulate PDF format report in DICOM standard. It becomes available if SCP supports the function.
Doppler audio	Set to save the audio of PW mode.
Storage mode	Set the storage mode for image and cine file: • Parallel file: save the current file, and is ready for the storage of the next file. • Parallel frame: send the current frame, and is ready for sending the next frame.
Transducer Tracking	Files of images that are saved in DCM format through DICOM or DICOMDIR contain transducer serial number information.
Strategy Name	Set the DICOM strategy.

TIP:

- If the server software supports the compression algorithm, select JPEG, RLE, JPEG2000. Otherwise, original data should be used (RLE is the default method).
- 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/TVD mode (B image is frozen), the system will save/transfer the images files in frame rate of 6.

Print service preset

DICOM print preset items are described as follows:

Item	Description
Device	After you set the server (s) in DICOM Preset screen, the name (s) will appear in the drop-down list, select the name of the print server.
Service Name	Default is xxx-Print, user-changeable.
AE Title	Application Entity title, here, it should be consistent with that of the print server.
Port	DICOM communication port, 104 is default. Here, the port should be consistent with that of the print server port.
Maximum Retries	It starts retrying if it fails to send DICOM task to the server. The retry entry times should be this value.
Interval Time (s)	Reserved time.
Timeout	Refers to the amount of time after which the system will stop trying to establish a connection to the service.
TLS	Transport Layer Security. Select whether to encrypt the data during network transportation.
Copies	Refer to copies of printed files. You can select among 1 through 5, or directly enter the numeral.
Settings	The system supports RGB (color printing) and MONOCHROME2 (black and white printing). Please select the type the printer supports.
Film Orientation	Select between LANDSCAPE and PORTRAIT.
Priority	Specify printing task priority among HIGH, MED and LOW.
Film Size	Select film size among the selections listed in the drop-down list.
Display Format	Specify quantity of printed files, e.g. STANDARD\2, 3 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).

Item	Description
Magnification Type	Select how the printer magnifies an image to fit the film. • Replicate: interpolated pixels belong to duplicate 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.
Strategy Name	Set the DICOM strategy.

Worklist setting

DICOM service setting for Worklist is described as follows:

Item	Description
Device Name	After you set the server (s) in DICOM Server Setting screen, the name (s) will appear in the drop-down list, select the name of the Worklist server.
Service Name	Default is server-Worklist, and it can be modified.
AE Title	Application Entity title. It is consistent with that of the Worklist server.
Port	DICOM communication port, 104 by default. The port should be consistent with that of the Worklist server port.
Maximum Retries	Reserved feature.
Interval Time(s)	Reserved feature.
Timeout	Refers to time after which the system will stop trying to establish a connection to the service.
TLS	Transport Layer Security. Select whether to encrypt the data during network transportation.
Strategy Name	Set the DICOM strategy.
Remove Attributes(0)	Set what DICOM element(s) that will not be used in Worklist query.

MPPS preset

MPPS setting items are described as follows:

Item	Description
Device Name	After you set the server (s) in DICOM Server Setting, the name (s) will appear in the drop-down list, select the name of the MPPS server.
Service Name	Default is server-MPPS, and it can be modified.
AE Title	Application Entity title. It should be consistent with that of the MPPS server.
Port	DICOM communication port, 104 by default. The port should be consistent with that of the MPPS server.

Item	Description
Maximum Retries	It starts retrying if it fails to send DICOM task to the server. The retry entry times should be this value.
Interval Time(s)	Reserved feature.
Timeout	Refers to the amount of time after which the system will stop trying to establish a connection to the service.
TLS	Transport Layer Security. Select whether to encrypt the data during network transportation.

TIP:

Set the MPPS service as the default when using the MPPS.

Storage commitment setting

DICOM storage commitment setting items are described as follows:

Name	Description
Device Name	After you set the server (s) in DICOM Server Setting, the name (s) will appear in the drop-down list, select the name of the storage commitment server.
DICOM Service Name	Default is server-SC, and it can be modified.
AE Title	Application Entity title. Here, it should be consistent with that of the storage commitment server.
Port	DICOM communication port, 104 by default. Here, the port should be consistent with that of the storage commitment server port.
Maximum Retries	Reserved feature.
Interval Time(s)	Reserved feature.
Timeout	Refers to the amount of time after which the system will stop trying to establish a connection to the service.
Associated Storage Service	The associated storage server is preset before storage commitment, only after the exam is sent out, can storage commitment be created.
TLS	Transport Layer Security. Select whether to encrypt the data during network transportation.

Query/Retrieve

DICOM query/retrieve setting items are described as follows:

Item	Description
Device Name	Select the name of a device that can be added (including the local).
Service Name	Default is server-Query/Retrieve, and it can be modified.
AE Title	Application Entity title.Here, it should be consistent with that of the storage commitment server.

Item	Description
Port	DICOM communication port, 104 by default.Here, the port should be consistent with that of the storage commitment server port.
Maximum Retries	Reserved feature.
Interval Time(s)	Reserved feature.
Timeout	Refers to the amount of time after which the system will stop trying to establish a connection to the service.
TLS	Transport Layer Security. Select whether to encrypt the data during network transportation.

HL7 query service preset

The protocol version that the ultrasound system supports: V2.3, V2.4, V2.5, V2.6.

HL7 service setting for Worklist is described as follows:

Item	Description
Device Name	After you set the server (s) in DICOM Server Setting screen, the name (s) will appear in the drop-down list, select the name of the Worklist server.
Service Name	Default is server-HL7Query, and it can be modified.
AE Title	Application Entity title.here, it should be consistent with that of the HL7 server.
Port	DICOM communication port, 104 by default.Here, the port should be consistent with that of the HL7 server port.
Maximum Retries	Reserved feature.
Interval Time(s)	Reserved feature.
Timeout	Refers to the amount of time after which the system will stop trying to establish a connection to the service.
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 HL7 server port. For details of listen port setting, refer to settings in the server.

5.8 Network Preset

5.8.1 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.

Item	Description
Service Name	The name of the iStorage service.
IP Address	IP address of the iStorage service device.
Port	Port for transmitting.
Charset	Set the character set.

To add an iStorage service

Perform the following procedure:

1. Set the iStorage server properties as described above.
2. Click [Connect] to verify connection.
3. Click [Add] to add the service to the Service list.

To edit a network service

Perform the following procedure:

1. Select the service to be updated in the service list.
2. You can see properties in the Configure Service area.
3. Do one of the following to edit the network service:
   - Modify the properties and click [Update] to update the setting.
   - Click [Default] to set as the default service.
   - Click [Delete] to delete it from the service list.

5.8.2 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.

5.8.3 Router Setting

Set the route if the ultrasound system needs to be connected to the Internet and there are more than two access modes (for example, the ultrasound system can be connected to the Internet in wireless or wired mode).

Auto

After the Internet access mode is selected, the default gateway and DNS server will be automatically configured.

Perform the following procedure:

1. Select [Setup] > [Network] > [Router Setting] > [Auto].
2. Select the access mode from the drop-down list, and click [OK].

   NOTE:

   You need to select a specific access mode. You cannot select “None.”
3. Click [OK] to exit.

Static Routing

Manually configure the static route if the ultrasound system needs to access an LAN different from the same network segment, after setting up the Internet access mode on the [Auto] page.

5.8.4 E-Mail

Item	Description
Your Name	Input a user name.
Email Address	Input Email address of the user.
Max Email Size	Set the maximum image (cine) size.
Send Image Only	Select whether to send image only.
Hide Patient Information	Select whether to hide the patient information or not.
File Format	Select the file format to be sent.
Server Name	Input a SMTP server name.
Port	Input a SMTP server port.
Connection security	Select to encrypt the transmitting or not.
User Name	Input a SMTP server user name.
Password	Input a SMTP server password.

5.9 Print Preset

This screen is used to set up the printer and image printing.

5.9.1 Print Setting

Item	Description
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.
Property	Preset print service properties.

5.9.2 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.

5.10 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. Furthermore, you can set the factory preset, export the register data, and etc.

If you require other maintenance functions, please contact the Customer Service Department or your local distributor.

5.10.1 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).

To install and uninstall:

- Click [Install] to begin installing a disabled option.
- Click [Uninstall] to begin uninstalling a previously-installed option.

Please contact the Customer Service Department or your local distributor for details.

5.10.2 Exporting Setup Data

This function is used to write all setup data of the system into a disk for backup.

Perform the following procedure:

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].

5.10.3 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.

Perform the following procedure:

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.

5.10.4 Other Settings

Other preset settings are described as follows:

Item		Description
Setup	Export Log	Export the log.
	Self Test	Perform system self-test and restart the machine.
	Recover	To recover the system.
	Enter Windows	For password, please contact the Customer Service Department or your local distributor.
	Prepay Installment	Display the prepay installment information.
	Start/Stop WinProxy	Cursor debug interface.
	Touch Screen Calibration	To calibrate the touch screen.
	Enable Tracking	Enable the transducer and animal tracking function: • Find animals who used a transducer by transducer SN. After enabling the tracking function, you can set the maximum number of days the data can be retained.
	Fast Startup	To speed up the startup process.

If you have any questions, please contact the Customer Service Department or your local distributor.

5.11 Security

5.11.1 Drive Encryption/Secure Data Wipe

Encrypt the animal data stored in the hard disk. The system provides two encryption methods: Factory Default and User Define.

- Factory Default: the system is in factory state by default.
- User Define: add a user-defined password.

Perform the following procedure:

1. Select [User Define].
2. If no animal data are stored in the hard disk, click [Confirm], input the password and click [Confirm] to finish the password setting

   If the animal data are already stored in the hard disk, the system will pop-up prompts, follow the steps below:

   a. Click [OK].
   b. Click [Wipe]/[Secure Wipe] and operate according to the screen prompts to clear animal data.
   c. Select [User Define] again, and click [Confirm].
   d. Input the password and click [Confirm] to finish the password setting.

NOTE:

- If you want to switch to Factory Default, perform steps above again. The password is the same as that of the User Define.
- When you set password, multi-language and Chinese characters are not supported.
- [Security Wipe] has a higher security level but takes longer time than [Wipe].

5.11.2 Network Settings

Transmission encryption

After accessing the network, click [VPN Config] to enter the “VPN Config” dialog box.

Item	Description
Status	• No driver: click [SetupDriver] to enter the “TAP-Windows 9.21.2 Setup” interface, and do as instructed. • Ready: the VPN is ready for use. • Advance: VPN Advance Configuration • Connected: VPN is successfully connected. • Disconnected: VPN is disconnected. • Error: error connection.
Server IP	/
Group	/
User Name	/
Password	/
Hide characters	The password is displayed as *.
Connect/ Disconnect	Connect or disconnect VPN.

Item	Description
Advance	Enters the “VPN Advance Config” interface. • Reset: if the system does not respond after you click [Config], click [Reset]. • Config: enters the “OpenConnect-GUI VPN client” interface. For details about the settings, please refer to the TAP manual. ***NOTE:*** After exiting the “VPN Advance Config” interface, you need to reboot the system; otherwise, you cannot connect VPN normally.
Close	Close the “VPN Advance Config” interface.

5.11.3 Anti-Virus

The system provides the anti-virus software: Windows Defender. It can effectively prevent the ultrasound system from being attacked by virus, spyware, or other malware.

Windows Defender is already installed on the system.

5.12 System Information

This screen displays the system software version and other versions of devices. You cannot edit the information, only view them. The information varies depending on the system configurations and version.

6 Exam Preparation

You can start an animal exam in the following situations:

- New animal information: to start a new animal exam, animal information must first be entered.
- New exam: to start a new exam for animal 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, continue the exam with imported animal information and exam data.
- Continue an exam: to select an exam that has been paused, continue the exam with imported animal information and exam data.

6.1 Animal Information

6.1.1 New Animal Information

⚠ CAUTION

Before examining a new animal, use the End Exam button to end the exam of the previous animal, update the animal ID and information, to avoid mixing data of the next new animal.

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

1. Use the animal information button to enter the animal information page.

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

NOTE:

- Animal ID is generated automatically by the system after starting a new animal, and can be modified manually.The characters “\”, “*”, “?” are not permitted.
- You can either enter the animal’s date of birth manually; or click the calendar icon next to the input box to select the date, and click the confirm button to finish.
- The age 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.

2. Exam Type

- Select the exam type tab to enter exam-specific information.
- Input general information/operating Information

3. Functional buttons
   - [New Animal]: click to clear the current animal information in the animal information screen in order to input new animal information.
   - [New Exam]: click to clear the current exam information in order to create a new exam for the current animal.
   - [Pause Exam]: to pause the current exam due to some special causes or system power off.
   - [Cancel Exam]: to cancel the current exam.

     The cancelled exam can't be restored.
   - [Quick Register]: to save the animal information quickly and return to the main screen.
   - [OK]: click to save the animal data entered and exit the screen.
   - [Cancel]: click to cancel the animal data entered and exit the screen.

6.1.2 Retrieve Animal Information

iStation

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

1. Do one of the following to enter iStation screen:
   - Select the iStation button.
   - Select [iStation] in the Animal Info screen.
   - Select [iStation] in the Review screen.
2. Select the data source.

   Select the data source in the drop-down list of "Data Source".
3. Input the searching condition.

   The default condition is name. Select a searching condition from the drop-down list, enter a keyword or select the period in accordance with the condition selected.

   Select "Find in results", the system will search the keyword based on the existed searched results.
4. Select the desired animal information in the list, and the system pops up the shortcut menu.

Review Image	Click to enter the Review screen.
Animal Info	Click to enter the Animal Info screen.
Review Report	Enter diagnostic report screen.
Delete Exam	Delete the selected record.
Backup Exam	Click to back up the selected animal record to media supported.
Restore Exam	Click to import the animal data from an external media.
Send Exam	Click to send the selected animal data to external device, storage server or printer.

Activate Exam	Click to continue an exam that has been finished.
Resume Exam	Click to continue an exam that has been paused.
Annotation Exam	Click to add annotations to the selected exam, or view the history annotations of the selected exam.

5. Click [New Exam] to enter the Animal Info screen.

The corresponding animal information is also imported to the new exam simultaneously. After editing the animal information in the Animal Info screen, select [OK] to start a new exam.

Worklist/HL7 Enquiry

TIP:

Worklist is an optional function. Configure DICOM Basic and DICOM Worklist first.

When the DICOM basic package is configured and the Worklist server has been set, click [Worklist] in the Animal Info screen to query or import the animal data. For details, see the *DICOM/HL7* chapter.

6.2 Activate& Continue an Exam

6.2.1 Activate an Exam

In iStation screen, select a finished exam record, and click [Activate Exam] from the menu popped up; or, click [Active Exam] in iStation or Review screen to activate the exam.

NOTE:

- The system can automatically load the animal information and exam data to continue the exam.
- If you want to continue an exam which data lies in an external memory database, you have to first allow the system to load the animal data to the system's animal database.

6.2.2 Continue an Exam

In iStation screen, select a paused exam record, click [Resume Exam] from the menu popped up to continue the exam.

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

6.3 Pause & End an Exam

6.3.1 Pause an Exam

Sometimes, you have to stop an uncompleted exam due to some special causes.When the exam is paused, the system can begin other exams.

1. Use the animal information button to enter the animal information page.
2. Select [Pause Exam].

   If the system is powered off during scanning, the exam status turns “paused” after the system restart.

   When an exam is paused, the system will:

   – Save the exam-related images, reports and measurement data, modify the status as “Paused”.
   – Save the exam information, including report, imaging mode, exam mode, image parameters, operation mode, and imaging/measurement data and so on.

6.3.2 End an Exam

To end an exam, do one of the following:

- Use the End Exam button to finish the current exam.
- Select [New Animal] on the Animal Info screen to end the last animal exam and clear the animal information.
- Select [New Exam] on the Animal Info screen (or iStation screen, or Review screen) to end the last exam and clear the exam data.

7 Image Acquisition

⚠ WARNING

- **The images displayed in this system are only reference for diagnosis. The manufacturer 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 a diagnosis.**

TIP:

Operations for switching between different image modes and optimizing images, see the *Basic Operations* chapter.

7.1 B Mode

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

7.1.1 B-mode Image Scanning

Select the B mode button to enter B mode.

If the system is in other imaging mode, select the B mode button to return B mode.

Adjust parameters to optimize the image.

7.1.2 B-mode Image Parameters

Image Quality

Used for switching B/THI and adjusting the frequency. The real-time value of frequency is displayed in the image parameter area, and if harmonic frequency is used, “F H” is displayed as harmonic frequency value.

The system provides a THI function 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.

Please select the frequency according to the detection depth and current tissue features.

Gain

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

Depth

This function is used to adjust the display depth of sampling, the real-time value of which is displayed in the image parameter area.

Depth increase will cause a decrease in the frame rate.

TGC

The system compensates the signals from deeper tissue by segments to optimize the image.

There are 8-segment TGC sliders corresponding to the areas in the image.

Adjust the signal gain for the certain image area to get a balanced image.

Acoustic power

Refers to the power of ultrasonic wave transmitted by the probe, the real-time value of which is displayed in the upper left corner of the screen.

TIP:

You should perform exams according to actual situation and follow the ALARA Principle.

Scan range and FOV position

More information can be obtained without moving the probe or changing the sampling position.

TIP:

- The FOV position/range is available only for the convex and phased probes.
- When the scan range is adjusted to the widest, the FOV position cannot be changed.

Steer

To steer the beam the probe transmits.

TIP:

Steer is available only for linear probes.

Line Density

The function determines the quality and information of the image.

The higher the line density is, the higher the resolution becomes.

Dynamic Range

Adjusts contrast resolution of an image, compresses or expands gray display range.

The real-time dynamic range value is displayed on the image parameter area.

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

Smooth

This feature is used to reject the noise and smooth the image.

iClear

The function is used to enhance the image profile so as to distinguish the image boundary for optimization.

Persistence

Used to superimpose and average adjacent B images, so as to optimize the image and remove noises.

Rotation/Flip

This function provides a better observation for image display.

The “M” mark indicates the orientation of the image; the M mark is located on the top of the imaging area by default.

iBeam

This function is used to superimpose and average images of different steer angles to obtain image optimization.

TIP:

The phased probe does not support iBeam. iBeam is unavailable when ExFov is enabled.

Auto Merge

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.

TIP:

Only for linear probes.

Gray Map

Adjusting grayscale contras to optimize the image.

Tint Map

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

TSI

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

HD Scope

The image inside the ROI is clearer than these outside when the function is enabled.

The function is disabled in frozen state.

The optimize speed is ended when saving the image in real-time.

iTouch

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

It is available for all real-time imaging in B mode.

H Scale

Display or hide the width scale (horizontal scale).

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

Dual Live

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

Two pages of adjustable parameters are displayed on the soft menu as well; where, 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, parameters of the both windows are displayed.

It supports the magnification of the image.

LGC

Adjust the gain along the scan line to improve the lateral resolution of the image.

TIP:

The system provides several preset parameters for imaging.

Echo Boost

The contrast is increased and the noise is decreased with the clear boundary after generating the function.

TIP:

Use phased probe to activate the function in cardiac mode.

7.2 Color Mode

The Color mode is used to detect color flow, 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 is, the faster the flow speed becomes; while the darker the color is, the slower the flow speed becomes.

TIP:

In Color Mode, acoustic power is synchronous with that of B Mode. Adjustment of the depth or zoom to the B Mode image will lead to corresponding changes in Color Mode image.

7.2.1 Color Mode Image Scanning

Perform the following procedure:

1. Select a premium image during B mode scan, and adjust to place the area of interest in the center of the image.
2. Select the Color mode button to enter B+Color mode.
3. Use the trackpad and the confirm buttons to change position and size of the Region of Interest (ROI).
4. Adjust the image parameters during scan to obtain optimized images.

7.2.2 Color Mode Image Parameters

Color Gain

Refers to the overall sensitivity to flow signals. The real-time gain value is displayed in the image parameter area.

Increasing the gain will increase the flow signal presented as well as noise, while the signals may be missing when the gain is adjusted too low.

Image Quality

Refers to the transmitting frequency in Doppler mode of the probe, the real-time value of which is displayed in the image parameter area.

B/C Align

To set and constrain the maximum width of the B mode image to that of the Color ROI.

Dual Live

This function is used to display B image and Color image synchronously.

Steer

The feature is used to adjust the ROI of color flow with different angles with immobility of the probe.

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.

TIP:

Steer is available only for linear probes.

Line Density

The function determines the quality and information of the image.

The higher the line density is, the higher the resolution becomes.

Packet Size

This function is an indication of the ability to detect flow, which is used to adjust the accuracy of color flow.

The higher the sensitivity is, the more sensitive indication for low-velocity flow becomes.

Flow State

Refers to optimizing the various flow states.

Persistence

This function is to adjust the temporal smooth to optimize the image.

Smooth

This feature is used to reject the noise and smooth the image.

Scale

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

Aliasing may occur if low velocity scale is used and high velocities are encountered.

Low velocities may not be identified when a high velocity scale is used.

Baseline

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.

Invert

To set the display mode of the color flow, the color scale will be inverted when the function is activated.

TIP:

It is available only for linear probes.

Color Map

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

WF (Wall Filter)

It filters out low-velocity signals to provide effective information, and this function is used to adjust the filtered frequency. The real-time value (WF) is displayed in the image parameter area.

Smart Track

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.

TIP:

The linear probes for the Vascular exam supports the smart track.

Priority

This function is used to set levels of the flow display, to display the grayscale signal or color signal.

The color image is preferred with higher value; while grayscale signals are displayed with the lower value.

Velocity Tag

This function is used to mark the specified velocity range in flow to check the flow function or specific flow velocity value.

Enable this function, the green mark appears on the color scale. Use the trackpad and the confirm buttons to set the marking range and marking position.

HR Flow

Enhance tiny vessel display to analyze the blood supply of the vessel in pathological organ.

iTouch

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

7.3 Power Mode

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

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

TIP:

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.

7.3.1 Power Mode Image Scanning

Perform the following procedure:

1. Select a premium image during B mode or B+ Color scan, and adjust to place the area of interest in the center of the image.
2. Select the Power mode button to enter B+Power mode.
3. Use the trackpad and the confirm buttons to change position and size of the Region of Interest (ROI).
4. Adjust the image parameters during scan to obtain optimized images.

7.3.2 Power Mode Image Parameters

Because both are based on Doppler color imaging, the adjustments of Power mode are same with these of Color mode's. Hence, only the adjustments of Power mode are introduced.

Power Gain

Refers to the overall sensitivity to flow signals, and this function is used to adjust the gain in Power mode. The real-time gain value is displayed in the image parameter area.

Color Map

This feature indicates the display effect of power image. The maps in Power mode image are grouped into two categories: Power maps and Directional Power maps.

- The Power maps provide information of blood flow, which are highly sensitive to the low-velocity flows.
- The Directional Power maps provide information of flow direction.

Dynamic Range

This function is to adjust the transformation of echo intensity into color signal.

Increasing dynamic range will lead to higher sensitivity to low-power signals, thus enhances the range of signals to display.

7.4 M Mode

7.4.1 M Mode Image Scanning

Perform the following procedure:

1. Select a premium image during B mode or B+ Color scan, and adjust to place the area of interest in the center of the image.
2. Select the M mode button, and use the trackpad to adjust the sampling line.
3. Select the M mode button again or select the Update button to enter M mode, and then you can observe the tissue motion along with 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.

7.4.2 M Mode Image Parameters

Gain

To adjust the gain of M mode image, the real-time gain value is displayed in the image parameter area.

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

Display Format

To set the display format of B mode image and M mode image.

Adjust according to the actual situation and obtain a desired analysis through comparison.

Speed

This function is used to set the scan speed of M mode imaging, and the real-time speed value is displayed in the image parameter area.

Tint Map

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

Gray Map

Adjusting grayscale contrast to optimize the image.

Edge Enhance

This function is used to increase image profile, so as to distinguish the image boundary.

Larger edge enhance may lead to noise increase.

Dynamic Range

Adjusts contrast resolution of an image, compresses or expands gray display range. The real-time dynamic range value will be displayed on the image parameter area on the top of the screen.

M Soften

This feature is used to process the scan lines of M images to reject noise, making the image details to be clearer.

7.5 Color M Mode (CM)

To know the cardiac motion state, CM is overlaid with flow based on M mode, which is more sensitive to the instantaneous signal changes. Then, it shows the diagnosis information in detail.

7.5.1 CM Image Scanning

Perform the following procedure:

1. To enter CM mode:

   In B+Color, select the M mode button.

2. Adjust the image parameters to obtain optimized images.

7.5.2 CM Image Parameters

In CM mode, parameters that can be adjusted are in accordance with those in B, M and Color modes; please refer to relevant sections of B, Color and M mode for details.

The ROI size and position determine the size and position of the color flow displayed in the color M mode image.

7.6 Anatomical M Mode

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 animals 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).

⚠ 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.

7.6.1 Linear Anatomical M (Free Xros M)

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

Perform the following procedure:

1. Adjust the probe and image to obtain the desired plane in real-time B mode or M mode.

Or select the B mode cine file to be observed.

2. Select [Free Xros M] to enter Free Xros M mode.

   There are 3 M-mark lines available, each with a symbol of “A”, “B” or “C” at one end as identification.

3. Adjust the sampling line (single line or couple of lines) to obtain optimized images and necessary information.

   – Select [Show A], [Show B] or [Show C] to adjust the sampling line. The corresponding sampling line and the Free Xros M image appear on the screen. Then, activate the sampling line.
   – Select [Display Cur.] or [Display All] to select whether to display the image of the current M-mark line or all.

     You can choose to display the sampling line on the current image or all.
   – Press the confirm button to switch among the sampling lines and select the Cursor button to show the cursor.

4. Adjust the image parameters to obtain optimized images.

5. Select the B mode button to return to real-time B mode.

7.6.2 Free Xros CM (Curved Anatomical M-Mode)

In Free Xros CM mode, the distance/time curve is generated from the sample line manually depicted anywhere on the image. Free Xros CM is used for TVI and TEI modes.

⚠ CAUTION

Curved anatomical M image in the operator’s manual that it is provided for reference, not for confirming a diagnosis. Generally it should be compared with other device or make a diagnosis by non-ultrasonic methods.

TIP:

Only phased probe supports Free Xros CM.

Perform the following procedure:

1. In real-time 2D mode, adjust the probe and image to obtain the desired plane.

2. Select the user-defined button for “TDI” to obtain the image.

3. Select [Free Xros CM] to enter the mode.

4. Use the trackpad to define the start point of the sampling line on the 2D image.

   The cursor displays as +, and can be moved within the 2D image only.

5. Press the confirm button to fix the start point, and the digital number “1” is marked beside the point.

6. Define the next point using the trackpad and the confirm button (select [Undo] to cancel the current point and activate the preview point). The system updates the time-motion curve in real time, and each point is marked with a number in sequence.
7. Repeat Step 6 to finish the sampling line.
8. Double press the confirm button to finish the editing.
9. You can edit the curve if needed:
   a. After finishing the sampling line, select [Edit]. The cursor becomes the icon □.
   b. Move the cursor over the curve, press the confirm button to activate the spot.
   c. Move the cursor to change the shape of the curve.
   d. Double press the confirm button to finish the editing.

   NOTE:

   Select [Delete] to remove the curve, and select [Edit] to re-edit the curve.
10. Adjust the parameters to obtain the desired tissue of Free Xros CM image. Then, save the image.
11. Select the B mode button to exit.

7.6.3 Anatomical M Mode Parameters

In anatomical M mode, adjustable parameters are similar with these in M mode.

7.7 Spectral Doppler Mode

Spectral Doppler mode is used to provide blood flow velocity and direction utilizing a real-time spectral display. The horizontal axis represents time, while the vertical axis represents Doppler frequency shift.

PW (Pulsed Wave Doppler) mode provides a function to examine flow at one specific site for its velocity, direction and features; while CW (Continuous Wave Doppler) 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.

7.7.1 PW/CW Mode Image Scanning

Perform the following procedure:

1. Select a premium image during B mode or B+ Color (Power) scan, and adjust to place the area of interest in the center of the image.
2. Select the PW/CW mode button to adjust the sampling line.

   The sampling status will be displayed in the image parameter area.
3. Set the position of the sample line and the SVD by using the trackpad, and adjust the angle and SV size according to the actual situation.

4. Select the PW/CW mode button again or select the Update button to enter PW/CW mode and perform the examination.

   Observe and calculate the data based on B mode or Color mode image. You can also adjust the SV size, angle and depth in the real-time scan.

5. Adjust the image parameters to obtain optimized images.

7.7.2 PW/CW Mode Image Parameters

Gain

This function is intended to adjust the gain of spectrum map. The real-time gain value is displayed in the image parameter area.

PW Sampling Gate

Adjusts 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 which SV represents the size of the sampling gate, and SVD represents the sampling depth.

CW Focus Position

To adjust the focus position of CW mode. The real-time focus position value is displayed on the image parameter area in SVD.

Image Quality

Refers to the transmitting frequency in Doppler mode of the probe, the real-time value of which is displayed in the image parameter area.

Scale

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

To provide a much clearer color flow image.

Use low PRF to observe low-velocity flows, and use high PRF to observe high-velocity flows.

iTouch

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

Auto Calculation

This function is used to trace the spectrum and calculate the PW/CW mode image parameters. The results are displayed in the results window.

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.

- Auto Calculation Parameter: To set the calculation results to display.
- Auto Calculation Cycle: To set the heart cycle number for auto-calculation.

- Trace Area: To set the trace area of the Doppler wave in the spectrum map, applicable for auto calculation, V Max and V Mean display.
- Trace Smooth: To set the smooth level when tracing.
- Trace Sensitivity: This function is used to set the sensitivity of tracing in the spectrum.

Invert

This function is used to set the display manner of spectrum.

TIP:

It is available only for linear probes.

Speed

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

T/F Res

Adjusts for a balance between time resolution and spatial resolution.

WF (Wall Filter)

To display the image accurately, it adjusts the cut-off used in the wall filter, and filters out the flow noise which is produced by vessel wall vibration. The real-time value is displayed in the image parameter area.

Tint Map

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

Gray Map

Selects among post processing map curves to optimize grayscale images.

Display Format

Sets the display proportion of PW mode image and B mode image.

Duplex/Triplex

This function is used to set if B image or B+Color image (Power) is scanned synchronously.

HPRF

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 selective PW Doppler scale.

Baseline

Refers to the area where the velocity in zero in the spectrum. The map changes after being edited.

Angle

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 in the image parameter area.

Quick Angle

Adjusts the angle faster in increments of 60°, and the real-time value of which is displayed in the image parameter area.

Dynamic Range

The dynamic range conveys the information that being transformed from echo intensity to gray scale.

Audio

Adjusts the output audio in spectrum Doppler.

Steer

Adjusts the scan angle in PW mode, so as to change the angle between the transmitting beam and flow direction.

Obtain more information with immobility of the probe.

Values of steer angles vary with the probe.

TIP:

Steer is available only for linear probes.

7.8 TDI

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

There are 4 types of TDI mode available:

- Tissue Velocity Imaging (TVI): This imaging mode is used to detect tissue movement with direction and speed information. Generally the warm color indicates the movement towards the transducer, while the cool color indicates the movement away from the transducer.
- Tissue Energy Imaging (TEI): This imaging mode reflects the status of cardiac movement by providing the energy information, the larger the energy is, the brighter the color becomes.
- Tissue Velocity Doppler Mode (TVD): This imaging mode provides direction and speed information of the tissue.
- Tissue Velocity M Mode (TVM): This function assists to observe the cardiac motion through a direct angle.

7.8.1 TDI Mode Image Scanning

Perform the following procedure:

1. Select the user-defined button for “TDI” to enter the TDI mode.
   - In B or B+Color mode: to enter TVI Mode, parameters of TVI mode will be displayed on the soft menu.
   - In Power mode: to enter TEI Mode, parameters of TEI mode will be displayed on the soft menu.
   - PW mode: Select the user-defined button for “TDI” and then select the PW mode button or the Update button to enter TVD. The parameters of TVD are displayed on the soft menu.
   - M mode: Select the user-defined button for “TDI” and then select the M mode button or the Update button to enter TVM. The parameters of TVM are displayed on the soft menu.
2. Adjust the image parameters to obtain optimized images.
3. Select the user-defined button for “TDI” to exit from TDI mode and enter general imaging modes.

   Or, select the B mode button to return to B mode.

7.8.2 TDI Mode Image Parameters

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

This function is used for fast image optimization.

7.8.3 TDI Quantitative Analysis

⚠ CAUTION

TDI is provided for reference, not for confirming a diagnosis.

TIP:

- TDI quantitative analysis is an option.
- The current image (in frozen state) and the saved image can be used in the quantitative analysis.
- Only after the user chooses the image review, the quantitative analysis is available.If the user chooses the static image (only one frame), the quantitative analysis is not available.

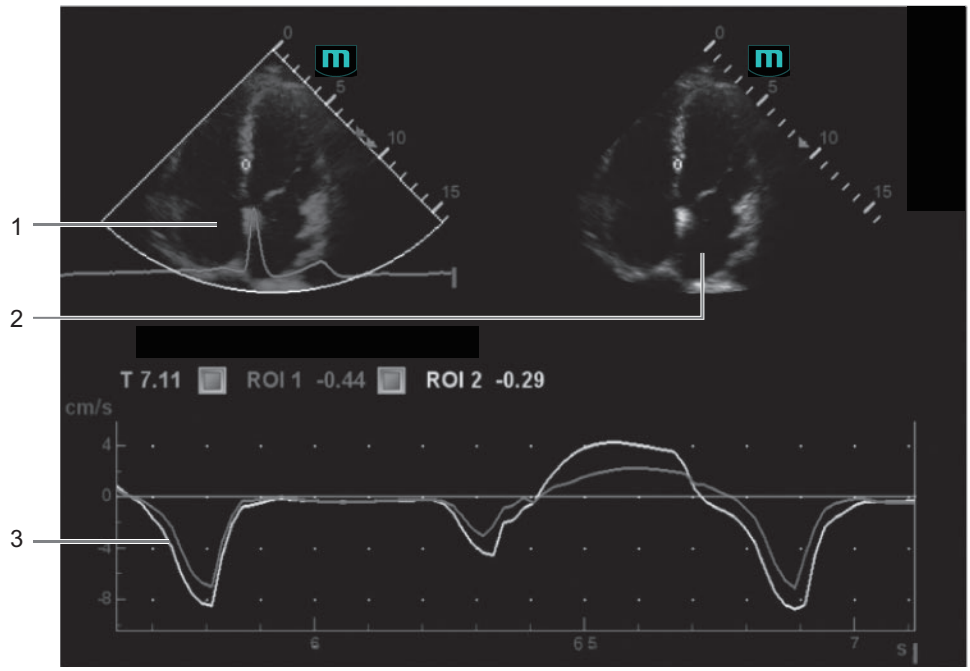
It is about analyzing the data of TVI imaging and measuring the velocity of the myocardium with the cardiac cycle.

Here are three types of curves to perform the quantitative analysis:

- Velocity-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 used commonly to evaluate how fast the tissue is deforming.

Figure 7-1 Quantitative analysis display (taking velocity-time curve as the example)



1.	TDI review	Sampling area: indicates the sampling position of the curve. The sampling lines are marked with color numbers. It can mark 8 ROIs at most.
2.	2D grey image review	• Use the trackpad; the images in TDI review window and 2D review window are reviewed synchronously, since the two images are frozen at the same time. • ROI movement is linked between the TDI (Tissue Doppler Imaging) review window and the 2D imaging reviewing window.
3.	Display analysis curve	• Y-axis represents the velocity (unit: cm/s) [in strain-time curve, Y-axis represents the strain (%); in strain-time curve, Y-axis represents the strain (unit: 1/s)]. • X-axis represents time (s); • Frame mark: a white straight line perpendicular to the X-axis, and can be moved left and right by using the trackpad. • Click the check box in front of the ROI to display or hide the analysis curve. • You can get the current X/Y axis value by moving the cursor onto one point on the curve; and if you press the confirm button at this time, the frame marker will move to the spot.

Perform the following procedure:

1. Scan the image with the moves of myocardium on, freeze the image and select the scan scope, or open the image which includes the myocardium moves already.

   NOTE:

   - The current image (in frozen state) and the saved image can be used in the quantitative analysis.
   - Only after the user chooses the image review, the quantitative analysis is available. If the user chooses the static image (only one frame), the quantitative analysis is not available.

2. Select [TDI QA] to enable the function.

3. Mark the interested myocardium area.

   One image can save 8 ROIs at most, and draw the corresponding curve in image area. Each ROI has different color; the corresponding curve is painted with each color.

   ROI settings:

   a. Review to the desired frame.

   b. Move the cursor to one cine review window.

   c. Select [Standard ROI]/[Ellipse ROI] to select a ROI method.

   The cursor moves into the review area (TDI review window or 2D grey review window.

   d. Add a ROI.

   When selecting “Standard ROI”: Add ROI automatically after capturing the area. ROI size is decided by “Standard Height/Width/Angle”.

   When selecting “Ellipse ROI”: Press the confirm button to confirm the start point, and use the trackpad and press the confirm button to confirm the next point; then use the trackpad to adjust the size and press the confirm button to complete the drawing.

   You can select the Clear button to remove the last ROI.

4. Select the curve: Select [Speed], [Strain] or [Strain Rate].

   For [Strain] or [Strain Rate], select [Strain Dist.] to select the corresponding value for Strain – Time curve or Strain Rate – Time curve.

   If needed, select [ROI Tracking] to enable the function. This function provides a motion compensated ROI as precise time-intensity information can be acquired using active tracking. It can enhance the calculation accuracy as reducing the impact of probe or animal respiratory movement.

   NOTE:

   Elliptical ROIs can be positioned in any manner that keeps their center within the image boundaries. In the case that part of the ROI is outside the image boundary, only data from within the image boundary is used for calculating the mean intensity value.

5. Adjust the curve display:

   – X Scale: Choose different value, so that the X scale display manner will be changed. This function can be used to track detailed tissue information.

   – Smooth: Adjust the smooth feature of the curves.

6. Save the curves, and export the curve data, parameter data.

   a. Select [Export].

The dialog box appears.

b. Select the storage path and type the file name.

E drive is default; and the file type is .CSV.

c. Select [OK] to complete the export.

After being exported successfully, the current screenshot file shows on the thumbnail area.

The exported data include:

– Current image;
– Analysis curve data;
– Analysis parameter.

7. Select [Exit] to exit the quantitative analysis.

7.9 iScape

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.

⚠ CAUTION

- **It is provided for reference, not for confirming a diagnosis.**
- **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.**

NOTE:

- 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.

NOTE:

Needle mark cannot be displayed in iScape imaging mode.

7.9.1 Basic Procedures for iScape Imaging

Perform the following procedure:

1. Connect an appropriate iScape compatible probe. Make sure there is enough coupling gel along the scan path.
2. Select [iScape] (it is available after enter Power/Color mode).
3. Optimize the 2D mode image:

   In the capture preparation status, select the corresponding imaging mode to optimize the image. Do measurement or add comment/bodymark to the image if needed.
4. Select [iScape] page tab to enter the iScape acquisition preparation status.
5. Select [Start Capture] or the Update button to begin the capture.

   The system enters into image review status when the acquisition is completed. You can perform operations such as parameter adjusting.
6. Scan slowly to obtain a single extended field of view image. You can also erase and retrace if the image is not satisfactory.
   - During image acquisition, none of the parameters are adjustable, and functions such as measurement, comments and body marks are not available.
   - A green box on the image indicating the boundary between the merged images and the unfinished images.
   - 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	/
Speed too high	Red	Moving speed of the probe is too high.

7. Do one of following to end image capture:
   - Select [Stop Capture] on the soft menu.
   - Select the Update button.
   - Wait until the acquisition completes automatically.

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

7.9.2 Image Review

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

7.9.3 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.
- If the image quality cannot satisfy the following criteria, you shall remove the image and capture it again.
  - 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.

7.9.4 Cine Review

Select [Review Cine] in panoramic image viewing status to enter cine reviewing mode. In cine reviewing mode, a 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:

- Use the trackpad to review the captured images frame by frame.
- Select [Auto Play] to start or end auto play.
- In auto play mode, select [Auto Play] on the soft menu to change the play speed. When the speed is “Stop”, the system exits auto play mode.
- Review to a certain image. Select [Set Begin] to set the start point. Review to another image. Select [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 soft menu 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.

7.10 iWorks (Auto Workflow Protocol)

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.

TIP:

The system provides different protocol events based on the different application regions.

Perform the following procedure:

1. Input the animal information.
2. Press <Cursor> to show the cursor, click [iWorks] on the menu to enter the protocol selection screen, and use the trackpad and <Set> to select the corresponding protocol to enter the status.

   After the system enters the iWorks screen, the available protocol is displayed on the right of the screen.
3. Perform the scanning and saving according to the screen prompt.
4. Perform measurements or add comments/body marks to the image according to the screen prompt.
5. After a view scanning is complete, press the user-defined save button to switch to the next view according to the screen prompt.
6. Repeat steps 3 to 5 to acquire all the necessary images.
7. After all views are finished, the system will prompt you to exit iWorks. Select [Yes] to exit.

7.10.1 View Operation

In iWorks status, you can perform view selection, repeat, replacement and delete operations using the soft menu.

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.

View Selection

Select [Prev]/[Next] to select the view to be scanned. The current view is surrounded by a solid frame.

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.

Repeat View

If necessary, select [Repeat] to insert another template of the current view. You can then perform an extra examination.

View Replacement

The previous image will be deleted and replaced by the new image.

Delete View

Select [Prev]/[Next] to select the view to be deleted. Select [Delete] to delete the selected view.

7.10.2 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: select [Suspend] to pause the current iWorks protocol. The system enters manual examination status.
- Return to iWorks: select [Resume iWorks] to return to automated status. You can continue the previous iWorks scan.

7.10.3 Insert

Insert is a specialized protocol event within iWorks. It assists with the workflow for documenting and measuring common pathological (disease) states that occurs outside a routine, normal examination.

1. Select [Insert] 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.

7.10.4 Create

The ultrasound system supports creating a user-defined iWorks protocol based on user's habits.

1. Select [Create] on the touch screen.
2. Select [Start] to start creating an iWorks protocol.

   During creating, the red button of REC on the screen is blinking.

   Select [New Group] to add more groups.

   Select [Pause] to pause the creating.

   Select [Continue] to continue the creating.
3. Select [Stop] to enter Protocol Setup and Review page.

   You can rename Groups, Views, or Protocols.

   Select type from the drop-down list as Sequence, Random, or Insert Protocol.

   Select [Save] to temporarily save the creating.
4. Select [Generate Protocol] to generate a user-defined iWorks protocol.

8 Strain Elastography

⚠ CAUTION

It is provided for reference, not for confirming a diagnosis.

It is produced based on the slight manual-pressure or human respiration in 2D real-time mode. The tissue hardness of the mass can be determined by the image color and brightness. Besides, the relative tissue hardness is displayed in quantitative manners.

8.1 Basic Procedure for Strain Elastography

Perform the following procedure:

1. Perform 2D scan to locate the region.
2. Select the Elasto button to enter the elastography mode.

   The system displays two dual B+E windows in real time. The left one is 2D image, and the right one is elasto image.
3. Adjust ROI according to the lesion size.

   Press <Set> to switch between the solid line and the dotted line status.

   – When the ROI box is solid line, use the trackpad to change its position.
   – When the ROI box is dotted line, use the trackpad to change the size.
4. Press the probe according to the experiences and actual situation.

   The screen displays the pressure curve in real-time:

   Where, the X-axis represents time and Y-axis represents pressure.
5. Adjust the image parameters to obtain optimized image and necessary information.
6. Press <B> or select the Elasto button again to exit, and then return to B mode.

8.2 Image Parameters

Smooth

Adjust the smooth feature of the Elasto image.

Opacity

Adjust the opacity feature of the Elasto image.

Invert

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

Display Format

Adjust the display format of ultrasound image and the Elasto image.

Select [H 1:1], [V 1:1], [Full] to adjust.

The system provides 3 types of display format:

- H 1:1: Right and left display (the real-time ultrasound image appears on the left, and the elasto image appears on the right);
- V 1:1: Up down display (the elasto image appears above, and the real-time ultrasound image appears below).
- Full: The elasto image only displayed.

Map

Select different maps for observation.

Strain mode

Affect the display effect of adjusting dynamic range.

Dynamic Range

Adjust contrast resolution of an image.

The real-time dynamic range value is displayed on the image parameter area in the upper left corner of the screen.

E Sensitivity

Increase the image palpability.

Strain Scale

Adjust the bar height of the pressure hint curve to keep the average height of the hint bar on proper position.

Map Position

Adjust the up/down position of the map.

8.3 Mass Measurement

Select the Measure button to enter measurement status.

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

9 Contrast Imaging

The contrast imaging is used in conjunction with ultrasound contrast agents to enhance imaging of blood flow and microcirculation. Injected contrast agents re-emit incident acoustic energy at a harmonic frequency much more efficient than the surrounding tissue. Blood containing the contrast agent stands out brightly against a dark background of normal tissue.

⚠ CAUTION

- **Set MI index by instructions in the contrast agent accompanied manual.**
- **Read contrast agent accompanied manual carefully before using contrast function.**

NOTE:

- Make sure to finish parameter setting before injecting the agent into the animal to avoid affecting image consistency. This is because the acting time of the agent is limited.
- The applied contrast agency should be compliant with the relevant local regulations.

9.1 Basic Procedures for Contrast Imaging

Perform the following procedure:

1. Select an appropriate probe, and perform 2D imaging to obtain the target image, and then fix the probe.
2. Enter Contrast mode: press <Cursor> to show the cursor, click [Contrast Imaging] on the menu in the top-left corner of the screen or press the user-defined Contrast button directly.
3. Adjust the acoustic power experientially to obtain a good image.

   Select [Dual Live] to be “On” to activate the dual live function. Observe the tissue image to find the target view.
4. Inject the contrast agent, and set [Timer 1] at “ON” to start the contrast timing. When the timer begins to work, the time will be displayed on the screen.
5. Observe the image, use the [Pro Capture] and [Retro Capture] or the user-defined button to save the images.

   Select the Freeze button to end the live capture.

Perform several live captures if there are more than one interested sections.

6. At the end of a contrast imaging, set [Timer 1] at “OFF” to exit the timing function.

   Perform steps 3-6 if necessary.

   For every single contrast imaging procedure, use [Timer 2] for timing.

   If necessary, activate destruction function by setting [Destruct] at “ON” to destruct the micro-bubbles left by the last contrast imaging; or to observe the reinfusion effect in a continuous agent injecting process.

7. Click [Exit] on the menu in the top-left part of the screen to exit contrast imaging mode.

   Press <B> button to return to B mode.

9.2 Left Ventricular Opacification

TIP:

LVO contrast imaging is an option.

Perform the following procedure:

1. Acquire ECG signal.
2. Select an appropriate probe and LVO exam mode.
3. Workflow of LVO is similar to abdomen contrast imaging, see “9.1 Basic Procedures for Contrast Imaging”.

9.3 Image Parameters

When entering contrast imaging mode, the screen displays the contrast image, and if [Dual Live] item on the soft menu is “ON”, both the contrast image (marked with “C”) and tissue image (marked with “T”) are displayed (the two window position can be changed).

Parameters in Contrast mode are similar to those in B mode, please refer to *B-mode Image Parameters* section for details; special Contrast imaging parameters are introduced in the following.

Timer

NOTE:

The starting time displayed may be inconsistent with the actual one due to system error or some other man-made mistakes; please check the agent-injecting time.

The two timers are used to record total time of contrast imaging and single time of one contrast exam.

After the image is frozen, Timer 1 is still timing, and after unfreezing the image, the corresponding time can be seen.

Timer 2 stops timing when one contrast exam is frozen, and after unfreezing the image, the Timer 2 is off.

Set [Timer 1] as “ON” to start the timing at the moment you inject the contrast agent. Here, the screen displays the times at the lower corner.

Micro-bubble Destruction

⚠ CAUTION

Use the contrast imaging according to the residual level of the micro-bubbles, using contrast imaging continuously may result in animal harm.

Destruct the micro-bubbles left by the last contrast imaging; or to observe the reinfusion effect in a continuous agent injecting process.

Select [Destruct] to enable the micro-bubble destruction function:

- DestructAP: Adjust the destruct acoustic power via the soft menu.
- Destruct Time: Adjust the destruct time via the soft menu.

Dual Live

In live mode or freeze mode, set [Dual Live] as “ON” to enable dual live function. Both the contrast mode and tissue mode are displayed. The THI and B image are displayed on the screen if the [Dual Live] is enabled.

TIP:

- In dual live mode, the screen displays the contrast image and tissue image
- In freeze mode, there displays only one cine review progress bar as the contrast image and tissue image are reviewed synchronously.

Mix Map

This function is to mix the contrast image with the tissue image, so that interested contrast regions can be located.

Use [Mix] to select different mixing mode.

- When dual live function is on, you can see the mixed effect on the contrast image.
- When dual live function is off, you can see the mixed effect on the full screen image.

Select the map through the [Mix Map] item.

iTouch

On contrast status, you can also get a better image effect by using iTouch function.

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

   The symbol of iTouch will be displayed in the image parameter area once press <iTouch>.

2. Select different levels of iTouch effect through [iTouch] on the soft menu.

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

High Frame Rate CEUS

This function is used to improve the frame rate (FR) for contrast imaging.

Select [HiFR CEUS] to turn on the function.

Mark Line

Select [Markline] to enable this feature. Mark lines appear on the tissue image and contrast image. Use trackpad to adjust the mark lines and mark the target with the larger circle.

9.4 Image Saving

- Live capture
  In live mode, you can save the interested images by selecting [Pro Capture] and [Retro Capture].
- Cine saving
  In live mode, select the Freeze button to enter cine review status.

9.5 Micro Flow Enhancement

MFE superimposes and processes multiple frames of contrast image during the cycle; it indicates tiny vessel structures in detail by recording and imaging microbubbles.

TIP:

- MFE imaging is available only for real-time imaging or cine file of auto review mode. If a MFE cine is reviewed manually, MFE effect cannot be displayed.
- In MFE status, transducer should be kept still.

Perform the following procedure:

1. During real-time scanning, select [MFE] to start MFE imaging.
2. Use [MFE Period] on the to select different imaging period suitable for current flow. Where, MAX is the maximum superimposing effect.

9.6 Contrast Imaging QA

⚠ CAUTION

Contrast Imaging QA images are provided for reference only, not for confirming a diagnosis.

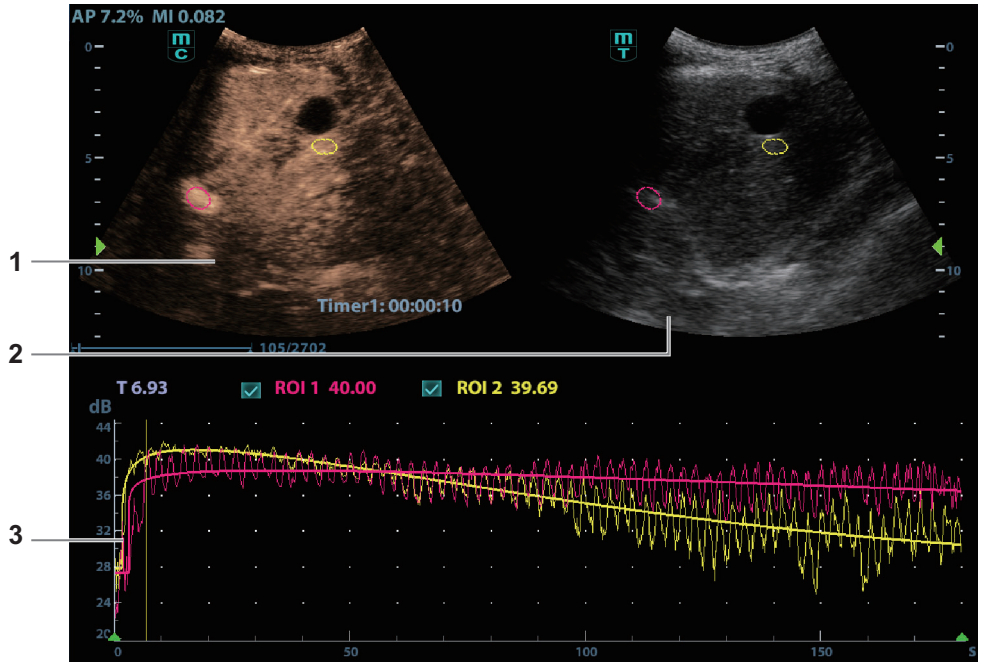
TIP:

- In case of inaccuracy of the data, do not adjust the depth and the pan-zoom when saving the cine.

- If the contrast signal inside the selected ROI does not meet the requirements of gamma fitting condition, that is the bulleting injection, curve fitting may not be available.

Contrast Imaging QA adopts time-intensity analysis to obtain perfusion quantification information of velocity flow. This is usually performed on both suspected tissue and normal tissue to get specific information of the suspected tissue.

Figure 9-1 Contrast QA Screen



1.	Contrast cineloop window	Sample area: indicates sampling position of the analysis curve. The sample area is color-coded, 8 (maximum) sample areas can be indicated.
2.	B cineloop window	Sample areas are linked in the contrast cineloop window and B cineloop window.
3.	Time-intensity curve	• Y axis represents the intensity (unit: dB), while X axis represents the time (unit: s). • Frame marker: a white line that is perpendicular to the X axis, can be moved horizontally left to right (right to left) by using the trackpad. • Click the check box beside the ROI to set if to hide or to display the QA curve. • You can get the current X/Y axis value by moving the cursor onto one point on the curve; and if you press <Set> at this time, the frame marker will move to the spot.

Perform the following procedure:

1. Perform image scanning, freeze the image and select a range of images for analysis; or select a desired cine loop from the stored images.

   The system set the starting time and ending time of the cine to be first frame and last frame of QA analysis range.

2. Review the image to a desired frame.
3. Select [Contrast QA] to activate the function.
4. Mark out the interested part (ROI).

   Up to 8 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 using that same color.

   a. Select the method for determining the shapes of the sample area: Trace ROI and Ellipse ROI.
      The cursor is evolved in the image review area.
   b. Move the cursor to position the caliper on the reference image at the start point. Press <Set> to fix the start point.

Trace ROI	Follow the steps below: **1.** Press <Set> to fix the starting point. **2.** Press <Set>, and move the cursor to depict the ROI. Press <Clear> to cancel the last point. The system automatically links the start point to the end point by drawing a straight line between them. **3.** When a suitable ROI has been drawn, confirm the ROI by double pressing <Set>.
Ellipse ROI	Follow the steps below: **1.** Move the cursor to position the caliper on the reference image at the start point. Press <Set> to fix the start point. **2.** Trace the outline of the desired ROI by moving the cursor. **3.** Press <Set> to fix the end point, and move the cursor to depict the ROI. When a suitable ROI has been drawn, confirm the ROI by pressing <Set>.

   – Press the Clear button to clear out the last ROI.
   – Select [Delete All] on the to clear out all ROIs.
     The corresponding traces for the deleted ROIs are erased from the plot.
   – Select [Copy ROI] to create a new ROI similar to the current or latest added ROI

5. Select [Motion Tracking] to enable the Motion Tracking function.

   This function provides a motion compensated ROI as precise time-intensity information can be acquired using active tracking. It can enhance the calculation accuracy as reducing the impact of probe or animal respiratory movement.

   Elliptical ROIs can be positioned in any manner that keeps their center within the image boundaries. In the case that part of the ROI is outside the image boundary, only data from within the image boundary is used for calculating the mean intensity value.

6. If necessary, select [Fit Curve] to perform curve fitting on the time-intensity curve, where color of the fitted curve is consistent with color of the current ROI curve.

   The system can calculate characteristic parameters according to curve fitting formula and data, display fit curve for time-intensity curve, and perform data analysis on time-intensity curve for data table.

– Select [Raw Curve] to hide/display raw curve.
– Select [Table Display] to check parameters:

Item	Description
GOF (Goodness of Fit)	Calculate the fit degree of the curve; range: 0-1, where 1 means the fit curve fits the raw curve perfectly.
BI (Base Intensity)	Basic intensity of no contrast agent perfusion status.
AT (Arrival Time)	Time point where contrast intensity appears, generally, the actual time value is 110% higher than the base intensity.
TTP (Time To Peak)	Time when the contrast intensity reaches peak value.
PI (Peak Intensity)	Contrast peak intensity.
AS (Ascending Slope)	Ascending slope of contrast, the slope between the start point of lesion perfusion to the peak.
DT/2	Time when the intensity is half the value of the peak intensity.
DS (Descending Slope)	Descending slope of the curve.
AUC (Area Under Curve)	To calculate the area under the time-intensity curves during contrast.
MTT (Mean Transition Time)	The mean time which a red blood cell (microbubble) needs to flow through the tissue mass.

You can set range for the fit curve. After the range is set, the system displays fit curve within the range only. Use the trackpad to the time-intensity curve to move the frame marker position.

a. Set starting point of the fit curve: Use the trackpad to select the starting time and select [Set Fit Start].
b. Set end of the fit curve: Use the trackpad to select the end time and select [Set Fit End].

7. Use [X Scale] on the to choose different value, so that the X scale display manner will be changed.

This function can be used to track detailed tissue information.

8. Save the curved image, export the data and do parameter analysis.

a. Select [Export].
b. Select the drive and enter the file name in the displayed window.
c. 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 the exporting is succeeded, an image is displayed in the thumbnail area of the screen.
Only data from the user selected image range is included in the exported trace file.

9. Select [Exit] to exit Contrast QA.

10 3D Imaging

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

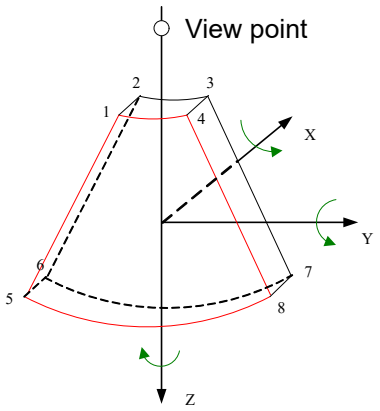
NOTE:

3D imaging is largely environment-dependent, so the images obtained are provided for reference only, not for confirming a diagnosis.

10.1 Overview

The ordinary 2D imaging has the limitations on viewing the overall structure and different planes of the target. However, 3D imaging can obtain the reference information by overall observation.

10.1.1 Terms

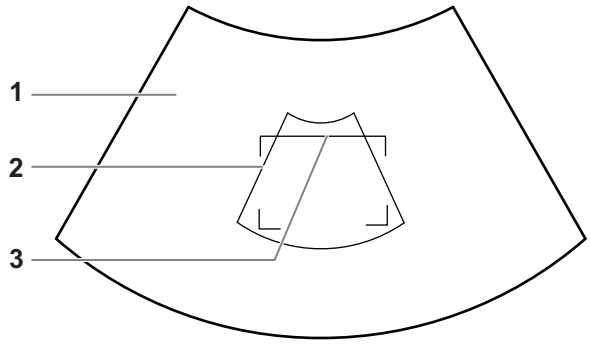


- Volume data: to obtain the data collection of three-dimensional object via the sequence reconstruction to two-dimensional object.
- 3D image Volume Rendering (VR): the 3D image on the screen.
- View point: the position for viewing volume data/3D image.
- MultiPlaner Rendering (MPR): a tangent plane of the 3D image that obtained by algorithm.Of which, XY-paralleled plane is C-plane, XZ-paralleled plane is B-plane, and YZ-paralleled plane is A-plane.YZ-paralleled plane is B-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 3D image (VR) by adjusting interesting region in MPR.

10.1.2 ROI and VOI

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



1.	2D image
2.	ROI
3.	Cut plane

Define the ROI and curved VOI:

NOTE:

- To define a ROI, please remove the useless data as to reduce the volume data and shorten the time for image storing, processing and reconstruction.
- Set ROI on the 2D image with the largest section area of the fetal face.
- Set ROI a little larger than the fetal head.

Perform the following procedure:

1. Press the right confirm button to toggle among setting the ROI position, size or curved VOI.

2. Use the trackpad to change the ROI size, position and curved VOI,

3. Press the left confirm button and use the trackpad to adjust VOI angle.

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

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

View	Curved VOI
R/L	At the right part of curved VOI
F/B	Displays as a dot
B/F	Displays as a dot

10.1.3 Render Mode

Surface

Set 3D image rendering mode as Surface.

This is helpful 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

Set Max as 3D image rendering mode, displays the maximum echo intensity in the observation direction.

This is helpful for viewing bony structures.

Min

Set Min as 3D image rendering mode. Display the minimum echo intensity in the observation direction.

This is helpful for viewing vessels and hollow structures.

X Ray

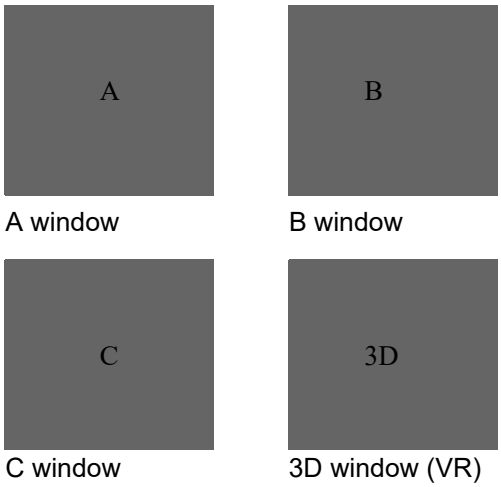
Set X-ray as 3D image rendering mode. Display the average value of all gray values in the ROI.

This is used for imaging tissues with different structure inside or tissues with tumor.

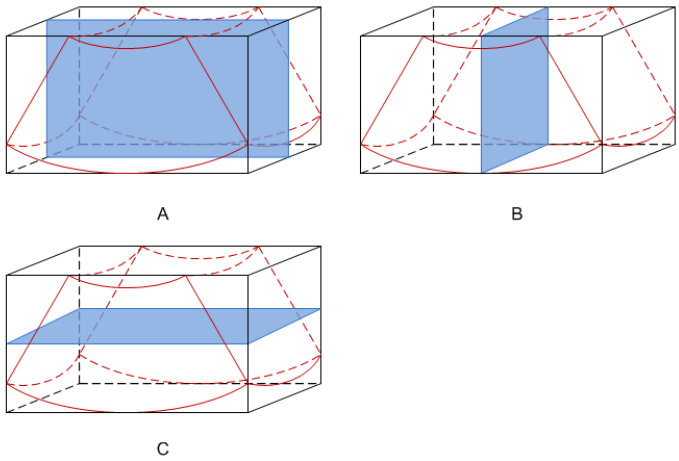
10.1.4 MPR

MPR represents three different views of 3D image.

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



A, B, C sectional images are corresponding to the following sections of 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 the figure A above.
- Section B: it is the horizontal section in fetal face up posture, as shown in the figure B above.
- Section C: it is the coronal section in fetal face up posture, as shown in the figure C above.

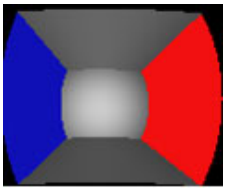
The upper part of the 3D image in the 3D window is corresponding to the orientation mark on the probe, if the fetal posture is head down (orientating the mother's feet), and the orientation mark is orientating the mother's head, then the fetus posture is head down in the 3D image, you can make the fetus head up by rotating the 3D image by selecting [180°].

⚠ CAUTION

The ultrasound images are provided for reference only, not for confirming a diagnosis. Please use caution to avoid misdiagnosis.

10.1.5 Wire cage

When you view a 3D image on the display monitor, it's sometimes difficult to recognize the orientation. The system displays a three-dimensional drawing to illustrate the orientation for help. Of which, the blue plane presents the image acquisition where started, while the red plane presents the image acquisition where ended. Besides, a yellow plane in the wire cage presents the position of the MPR.



10.2 Note before Use

The quality of images reconstructed in the freehand 3D mode is closely related to the fetal condition, angle of a B tangent plane and scanning technique. The following Smart 3D description uses the fetal face imaging as an example, the other parts imaging are same as 3D imaging.

NOTE:

- In accordance with the ALARA (As Low As Reasonably Achievable) principle, please try to short the sweeping time after a good 3D imaging is obtained.
- A region with qualified image in B mode may not be optimal for 3D imaging. E.g. adequate AF isolation for one section plane of 2D image doesn't mean the whole desired region is isolated by AF for 3D imaging.
- More practices are needed for a high success of qualified 3D imaging.
- Even with good imaging condition, to acquire an approving 3D image may need more than one scanning.

Angle of a B tangent plane

The optimum tangent plane to the fetal face 3D imaging is the sagittal section of the face. To ensure high image quality, you'd better scan maximum face area and keep edge continuity.

Image quality in B mode (2D image quality)

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

- High contrast between the desired region and the amniotic fluid surrounded.
- Clear boundary of the desired region.
- Low noise of the amniotic fluid area.

Scanning technique

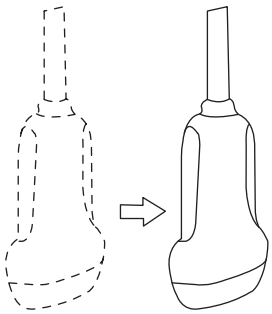
- Stability: body, arm and wrist must move smoothly, otherwise, the restructured 3D image distorts.
- Slowness: Move or rotate the transducer slowly. The speed of linear scan is about 2 cm/s and the rotation rate of the fan scan is about 10°/s ~ 15°/s.

- Evenness: move or rotate the transducer at a steady speed or rate.
- Method

  Capture images using Linear scan or Rocked scan.

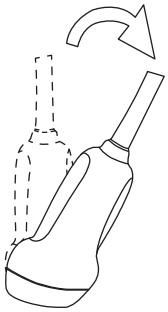
  – Linear scanning

    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 following figure.

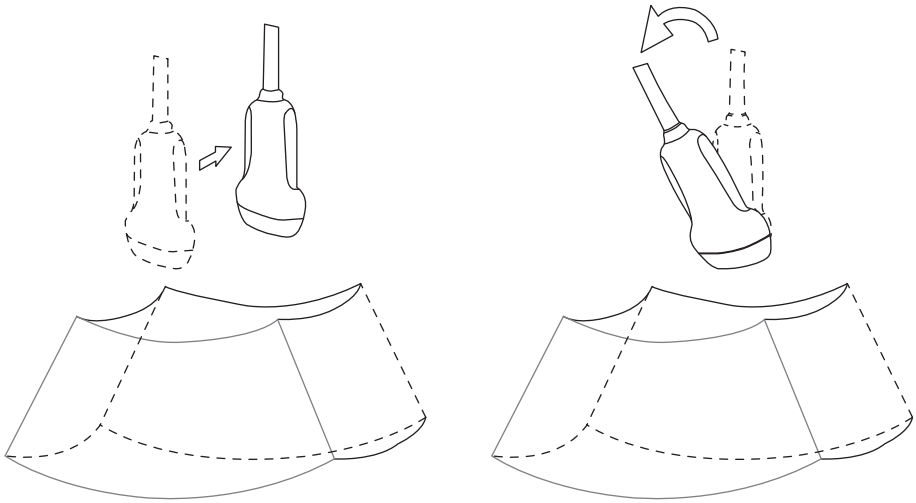


Scanning plane and probe movement

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.



10.2.1 Smart 3D Image Acquisition

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.

Perform the following procedure:

1. Select the proper probe and exam mode; make sure there is sufficient gel on the probe for scanning.
2. Obtain a 2D image, and optimize the image if necessary.
3. Select the user-defined button for "3D" to enter Smart 3D imaging mode.
   - Adjust ROI size and position and the position of VOI.
   - Set the scan method and the movement of the probe.
4. Select the Update button to start 3D imaging.

   The system enters into 3D image review status when the acquisition is completed; or, you can finish the acquisition ahead by selecting the Freeze button or the Update button.
5. Exit Smart 3D
   - Select the Update button or the Freeze button to return to Smart 3D acquisition preparation status.
   - Or select the B button or the user-defined button for "3D" to exit the mode.

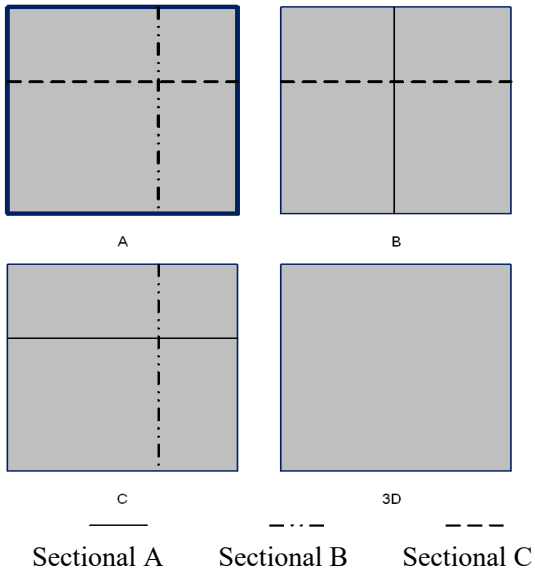
10.2.2 3D Image Viewing

MPR Viewing

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

- The color of window A is blue, and the color of the lines (representing section A) displayed in the other two windows is blue as well.
- The color of window B is yellow, and the color of the lines (representing section B) displayed in the other two windows is yellow as well.
- The color of window C is orange, and the color of the lines (representing section C) displayed in the other two windows is orange as well.

Positions of the other two sectional planes are indicated in the selected plane. You can use the to change the position.



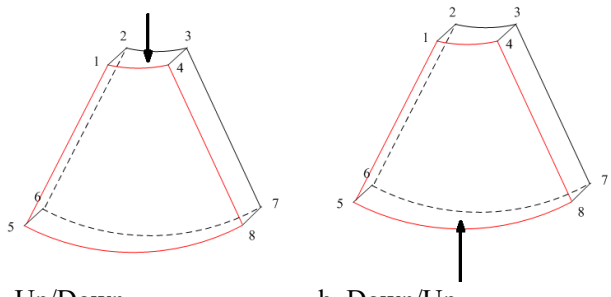
Window Display

Press <Single>/ <Dual>/ <Quad> to switch window display.

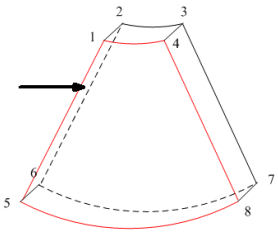
View Direction

The Region of Interest (ROI) contains the section of the volume you want to render. You can adjust the view direction of the ROI.

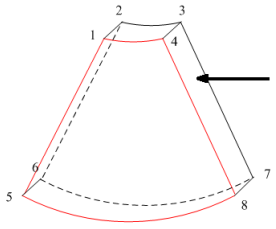
The system supports the observation of 3D image from 6 directions.



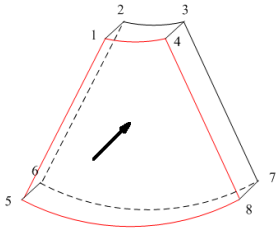
a. Up/Down b. Down/Up



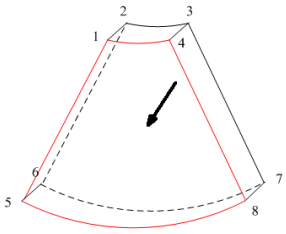
c. Left/Right



d. Right/Left



e. Front/Back



f. Back/Front

Select [Direction] to be [Up/Down], [Left/Right] or [Front/Back] to select the direction of the figure a, c and e.

Select [Flip] on the first page to observe by the converse direction of the current direction, which is equivalent of the 180° rotation of current VOI, as shown in the figure b, d, e and f.

Adjust VOI

Adjusting the VOI box size and position is to select the volume data needed to restructure the 3D image and improve the reconstruction effect.

- VOI On

  3D image (VR) image displays VOI information.

  a. In image viewing status, select [VOI] to be “On”.

  b. Select a desired section plane by selecting [A], [B] or [C] or [VR].

  c. Use the trackpad to adjust VOI position, size and curved VOI, and press the confirm button to toggle among the adjusting status.

- VOI Off

  3D image (VR) image displays ROI information.

  Select [VOI] to be “Off”, then the ROI image is displayed on the screen, use the trackpad to observe section images.

Accept VOI

This function is usually used for section image observation and to determine the relative position of the section image to the VR.

1. Set [VOI] to be “Fixed”.

2. Select a desired MPR image by selecting [A], [B] or [C].

3. Use the trackpad to view the current active section image, and the other section images change correspondingly.

In Accept VOI status, when the 3D image is active or the section image which is perpendicular to the view direction is active, center point of the 3D image displays, and you can adjust the position by using the trackpad.

Adjustment of Rendering Parameters

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

Select [VR] or [MPR] to select the VR parameters or MPR parameters.

- When [VR] is selected, adjust parameters of 3D image (VR).
- When [MPR] is selected, adjust parameters of sectional image.

You can adjust:

Item	Description
Threshold	Set the threshold for 3D image rendering. 3D image is rendered on the signal above thresholds by eliminating noise via the Threshold parameter. Lower threshold can eliminate lower range noises and echo, which will contribute to a clearer and smoother image. Available only in Surface rendering mode.
Opacity	Adjust the transparency value for 3D image rendering. It implies the transparency of the light. The higher the value is, the tougher the surface becomes. The lower the number is, the more transparent the gray scale information will be. Available only in Surface rendering mode.
Smooth	Set the smoothness of 3D image. ***NOTE:*** Insufficient smoothness can result in a fuzzy image; however, too much smoothness will lead to image distortion.
Brightness	Set the brightness of image. ***NOTE:*** The adjustment is for 3D (VR) and MPR.
Contrast	Set the contrast scale of the image. As long as the contrast becomes larger, the bright spot and dark spot on the image change as well. ***NOTE:*** The adjustment is for 3D (VR) and MPR.
Tint	Enable/disable tint map. The color of image change according the tint value.
Quick Rotation	Rotate the 3D image quickly.

Item	Description
iClear	Use the 3D self-adapation filter to strengthen the space continuity of the tissue structure, and provide speckle suppression, and improve the image contrast effect, so as to optimize the image data. Adjust iClear to optimize MPR image.
VR Refine	Optimize the signal-noise ratio and the contrast of VR image.
MagiClean	Reduce the noise and keep the boundary of the image more clearly. ***NOTE:*** Available only in Surface rendering mode.
Depth VR	Superimpose the tint map basic on the VR image to improve the stereoscopic sensation and the contrast of the image.
Thickness	Adjust the render thickness of MPR.

Reset Curve

Item	Description
Reset All	To reset the parameters, rendering rotation, VOI and image effect.

Render Mode

Set 3D image rendering mode.

The rendering manners can be applied to inversion mode.

Inversion

This function is to inverse the echo of the 3D image, so as to enhance observation for low-echo region, applicable for vessel, cyst and etc.

When the Inversion is turned on, the rendering mode parameters change into the corresponding inversion parameters.

Vessel shape is correct with the capture target. The vessel wall is smooth and clear.

Rotate the Image

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.

- Axial rotation

  Axial rotation is to rotate the 3D image around the X, Y or Z axis.

  Press the soft menu under the [X Axis], [Y Axis], [Z Axis] to make the image rotate.
- Auto Rotation

Perform the following procedure:

a. In 3D viewing mode, select the [Auto Rotation] tab on the screen, system enters into auto rotation preparation state.

b. Select [Direction] to set the auto rotation direction. Select [Step] to set the auto rotation increment.

c. Set Start position and End position:

Start position: use the trackpad to view to a certain position, select [Set Start].

End position: use the trackpad to view to a certain position, select [Set End].

d. Select [Play Mode] to set rotation mode.

Image Zooming

Adjust the zoom factor of 3D image, the section images will be zoomed in/out accordingly.

1. Switch the current window to 3D window.

2. Use <Zoom> to change the magnification factor.

Sync

This function is to switch the direction of the image to the direction that is perpendicular to the current active plane, so as to get a better observation.

Comments and Body Marks

Add comments and body marks to the MPR and VR.

The operations are the same with these in B mode.

Image Editing

Image cutting is a more elaborate function than VOI adjusting to optimize the 3D by clipping (removing) the part blocked the region of interests.

TIP:

- In image cutting status, image parameter can not be edited. There displays a cutting cursor + or an eraser cursor ◯, and the system enters “Accept VOI” status.
- The editing function is only available on 3D image.

Perform the following procedure:

1. Enter image editing status by pressing <Mode> to select the [Cut] tab.

2. Select an edit/erase tool:

Item	Description	Operation
Polygon	Allows you to trace a polygon on the image you want to cut.	Follow the steps below: **1.** Press the confirm button to position the start point. **2.** Move the cursor to set a region and press the confirm button to trace the region. When the start point and the end point coincide, the region is selected or you can press the confirm button twice to finish tracing. **3.** Move the cursor to the region you want to edit and press the confirm button again to edit.
Contour	Allows you to trace the portion of the image you want to cut.	Follow the steps below: **1.** Press the confirm button to position the start point. **2.** Move the cursor to trace the region. When the start point and the end point coincide, the region is selected or you can press the confirm button twice to finish tracing. **3.** Move the cursor to the region you want to edit and press the confirm button again to edit.
Rectangle	Displays a box which can be used to define the portion of the image you want to cut.	Follow the steps below: **1.** Press the confirm button to fix the rectangle position. **2.** Move the cursor to change the size, and press the confirm button again to finish rectangle drawing. **3.** Move the cursor to the region you want to edit and press the confirm button again to edit.

Item	Description	Operation
Line	Use a multi-point line to trace the boundary quickly.	Follow the steps below: **1.** Press the confirm button to position the start point and the system will display a reference line. **2.** Move the cursor to set the line orientation and press the confirm button to start drawing, press the confirm button when ends are necessary; press the confirm button twice to finish drawing. **3.** Move the cursor to the region you want to edit and press the confirm button again to edit.
Rubber	Applies to a boundary of the image.	Follow the steps below: **1.** Press the confirm button to position the start point. **2.** Use [Eraser Diam.] to adjust the eraser size if needed. **3.** Move the cursor to select the region, and press the confirm button when ends are required. You can repeat the step to erase all parts blocking the interesting region.
Eraser Diam.	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.	
Undo	To undo the last cut only.	/
Undo All	To undo all cuts since you entered image edit mode.	/

Image Saving

- Image saving

  In the 3D Review mode, select the Save button (with user-defined saving function) to save the current image and volume data to the animal information management system in the set format.
- Image review

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

10.3 3D Print

The system supports to export 3D facial and limb data to external storage devices. Users can view the 3D contour model of fetus on the external electronic devices at any time. Users can also send the 3D print file to the 3D printing vendor to print the entity model.

NOTE:

It can store, print, restart cine files which have been stored.

Perform the following procedure:

1. Obtains 3D single volume data. Select [3D Print].

The primary screen switches to the dual-window mode. The left window is VR and the right window is the grid model.

When you enter into 3D print for the first time, the system will automatically generate a grid model.

2. Select [Quality] to generate models with low, medium and high quality.

3. Select [Generate Mesh] and the system generate a grid model.

4. After the grid model is generated, the system supports simultaneous rotation, translation, and scaling of VR and grid models.

5. Select [File Format] to choose to export file format.

The following formats are supported:

– stl: STL Format
– obj: Stanford Polygon Format
– ply: Alias Wavefront Format
– off: Point Cloud Format
– 3mf: 3D Manufacturing Format

6. Select [Save Mesh to USB] and export the 3D print files.

NOTE:

- If you want to view the 3D print files on the mobile phone, please download and install “EMB3D” application program first.
- The Windows 10 computers supports to view 3D print files directly (except files in off format).

11 Physiological Unit Signal

The physiological unit signal waveform is used for checking ultrasound image in ultrasound exam (cardiac exam mainly).

⚠ WARNING

- **Do not use the physiological traces for diagnosis and monitoring.**
- **To avoid electric shock, the following checks shall be performed prior to an operation:**
  - **The ECG electrode cable must not be cracked, frayed or show any signs of damage or strain.**
  - **The ECG electrode cable must be correctly connected.**
  - **You must use the ECG leads provided with the physiological unit module. Failure to do so may result in electric shock.**
- **The ECG electrode cable must be connected to the system first. Only after the cable is connected to the system, can the animal be connected to the ECG electrodes. Failure to follow these instructions may subject the animal to electric shock.**
- **Do not place the ECG electrodes directly in contact the animal's heart; otherwise it may lead to stop of the animal's heartbeat.**
- **Do not use this system when any digital device such as a high-frequency electrotome, high-frequency therapeutic device or defibrillator is applied already.**
- **Conductive parts of electrodes and associated connectors for ECG should not contact other conductive parts including earth/grounding.**
- **Frequent trampling or squeezing on the cables may result in cable break-down or fracture.**
- **If an abnormality is detected in physio trace, check that the ECG leads are properly connected to the system.**
- **Display effect of respiratory curve depends on the animal breathing status. While a very slow or smooth breathing may lead to an inapparent respiratory curve, breathing in a large amplitude may cause an incomplete display of the respiratory curve. Display effect is linked to the connected parts of the body. Generally, signals by connecting to limbs are stronger than by connecting to the chest.**

11.1 ECG

11.1.1 Using the ECG Module

Perform the following procedure:

1. Connect the device and place ECG electrodes.

a. Turn off the power supply of the system, and connect the ECG module to the system.

b. Connect the ECG cable to the ECG module.

c. Turn on the power supply of the system.

d. Place the ECG electrodes on the animal's body.

2. Select <Physio> to enter physio operation interface.

3. Switch the imaging modes and display formats, adjusting the parameters to get an optimized image.

4. Parameter adjusting:

Select [ECG] to enable or disable ECG waveform curve. Adjust the [Speed], [ECG Gain], [Position] and [Invert].

5. Trigger:

Select the trigger mode, or select [Real & Trig] to set the trigger time, triggering delay time and image display format.

6. Freeze the triggering image and the curve, and then review them.

7. Select <Physio> to exit ECG mode, and remove ECG electrodes from the animal.

11.1.2 ECG Triggering

ECG triggering means that image scanning is activated at some time points of ECG signals, thus obtaining B images at these time points. The triggering image should be in 2D-mode.

When ECG triggering occurs, some marks (frame triggering mark) appear on the ECG waveform (relative R wave, the time for delay set), indicating the time points when the 2D images are captured.

TIP:

- The triggering mark is displayed in both freeze mode and live mode
- The marks in Dual trigger are in different colors.
- Triggering function is unavailable if the ECG trace is disappeared. Only the live 2D image can be triggered.
- No delay time or time interval shall be less than the time required to scan a single image.
- If the delay time is longer than a heart cycle, then the heart cycle in the delay time is omitted, that is to say no trigger is occurred when R waveform is detected in the duration.

Triggering Mode

There are three triggering modes available: Single, Dual, and Timer.

- Single Trigger: When an R waveform is detected, an image will be triggered after delay time T1. The time of T1 can be edited in single mode.
- Dual trigger: when an R waveform is detected, two images in two windows will be triggered respectively after delay time T1 and T2. The time of T1 and T2 can be edited in dual mode.
- Timer Trigger: an image will be triggered after a time interval.The time interval can be edited in triggering status.

The image triggering operation is described as follows (Take single trigger as an example):

1. Select exam mode.
2. Select [Trig Mode] to enable the trigger.
3. Select [Single].
4. Set the delay time (or use the T1 by default).

Real & Trigger

Select [Real & Trigger] to enable or disable the real trigger function.

After the [Real & Trigger] is enabled, two images are displayed respectively in two windows. One is triggered by ECG, and the other is non-triggered real time image.

11.2 Respiratory Wave

Perform the following procedure:

1. Connect the ECG lead and position the ECG electrodes.
2. Select <Physio> to enter physio operation interface.
3. Switch the imaging modes and display formats, adjusting the parameters to get an optimized image.
4. Parameter adjusting:
   a. Select [RESP].
   b. Adjust [Speed], [RESP Gain], [Position] and [Invert].
5. Exit Respiratory display mode, and remove ECG electrodes from the animal.
6. Select <Physio> to exit physio mode.

11.3 ECG Review

11.3.1 Review Principle

When an image is frozen, the ECG waveform where the image is triggered will be frozen at the same time. In the Dual triggering mode, the two window images are frozen at the same time. When images are reviewed with the ECG electrodes connected, the ECG trace is the reference for time.

After the images are frozen, all real time images are in the status of linked review.

11.3.2 Linked Review of Waveforms, M/D Images and 2D Images

If the physio unit signal, time curve and 2D image are frozen at the same time, the replay of them is displayed at the same time.

11.4 Parameter Description

The physio parameters are described as follows:

Parameter	Description
ECG Source	Select ECG source.
Gain	Set the amplitude of the trace.
Position	Set the vertical position of the both traces on the image display.
Speed	Change the speed of the physio trace.
T1	Set the delay time T1 in Single trigger or Dual trigger.
T2	Set the delay time T2.
Interval	Set the time interval for Timer.
Invert	Invert the display.

12 Tissue Tracking Quantitative Analysis

⚠ CAUTION

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

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

By tissue tracking QA function, the ultrasound system will scan each pixel position by frame within the cardiac cycle, and then use 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.

Tissue tracking quantitative analysis is an option.

12.1 Basic Procedures for Tissue Tracking QA

Perform the following procedure:

1. Open 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. Select [TTQA] to activate the function:

   – You can determine the image of interest by previewing the image.
   – Use [Cycle] to select and find the image of interest.

3. Select the corresponding section name and locate one frame image with good image effect by cine play. Use the cursor to set the reference point:

   – 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.

4. 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, select [Reload] 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.

5. Select [Start Tracking] to start the tracking function. Adjust the parameters if necessary.

   Select [Edit] on the soft menu to display the cursor. Use the trackpad and press the confirm button to re-select the trace reference points (inner dots of the curve). Move the cursor to the exact boundary position and press the confirm button again to set the right place. Select [Start Tracking] to start tracking again.

6. Select [Accept & Compute] to calculate and display the curve.

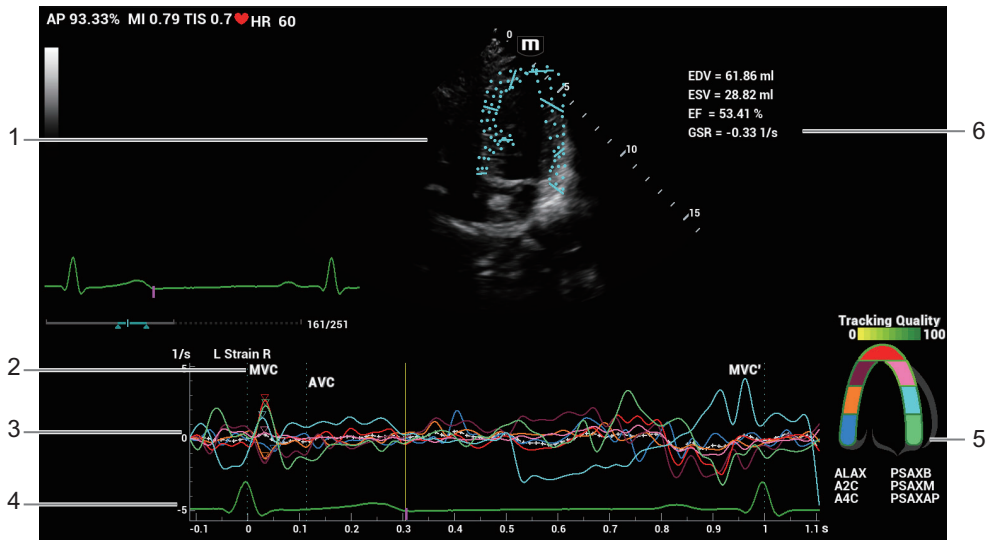
   Adjust the parameters if necessary.

7. Select [Bull's Eye] to see the result.

8. Select [Data Export] to export analyzed data.

9. Select [Exit] to exit.

12.2 Screen Display of Tissue Tracking QA



1.	Displays image used to generate trace curve	/
2.	Displays corresponding time of AVO (aortic valve open)/AVC (aortic valve close)/MVO (mitral valve open)/MVC (mitral valve close).	/

3.	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: X-axis represents time (s); Y-axis represents velocity (cm/s). • Displacement curve: X-axis represents time (s); Y-axis represents displacement (mm). • Strain curve: X-axis represents time (s); Y-axis represents deformation of the tissue (%). • Strain-rate curve: X-axis represents time (s); Y-axis represents strain by time (s^{-1}).
4.	Displays ECG trace	/
5.	Displays cardiac segmentation model, and each segment name is illustrated beneath the model.	• In the figure, ▽ marks the peak position of the curve. • Under tracking status, click on a segment in the cardiac segmentation model. The segment has “X” mark and its corresponding calculating is eliminated. • Select certain segment in the cardiac segmentation model, the segment will turns grey 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; and if you press the confirm button at this time, the frame marker will move to the spot. The segment boundary color indicates the tracking quality.

6.	Displays 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 (for short axis section): Fractional Area Change= (EDA — ESA)/EDA • EF (for long axis section): Ejection fraction • HR: Heart rate • Global strain of all segments. • Displays when strain rate curve is acquired. • Global strain rate of all segments. • Displays when strain rate curve rate is acquired. Also on Bull's Eye figure, the system displays TPSD value: Time to Peak Standard Deviation (TPSD): Where, standardized value of time to peak data: $\{TP_i \ \ i \in [1,N]\}$. (N is the number of time to peak data) Average value of standardized value of time to peak data: $\overline{TP}$, and the standard deviation is $TPSD = \sqrt{\frac{\sum_{1}^{N}\left(TP_i - \overline{TP}\right)^2}{N}}$

12.3 Select Image and Cardiac Cycle

You can select images with a better image quality so as to guarantee the analysis result.

Switch the cine file

1. Select [Review] to enter the review state.
2. Double-click the target file.
3. The system closes current displayed file and switch to the newly selected file.

Switch cardiac cycle within the cine file

Select [Circle] to select when opening a cine which includes multiple cardiac cycles.

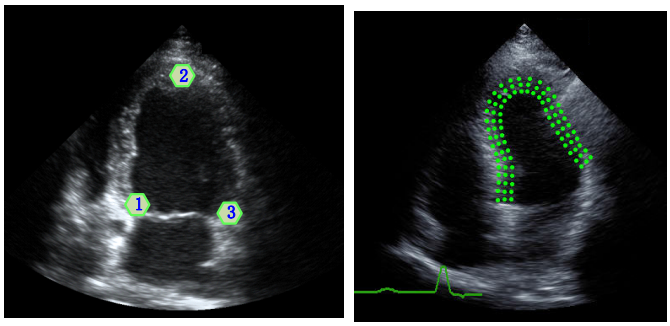
12.4 Myocardial Boundary Tracing

Tracing

The system provides 2 kinds of tracing method for 2 kind of sections. Long axis section (A4C, A2C, ALAX): 3-point method and manual tracing method are both available. Short axis section (PSAX B, PSAX M, PSAX AP): only manual tracing is available.

- 3-point method

  As shown in the following figure, after operation by pressing the confirm button to place 3 points on the image, the system generates the trace automatically.



- Manual trace method

  Press the confirm button and move the cursor by using the trackpad along the boundary to add the trace points gradually, after trace is finished, press the confirm button twice to finish tracing.

  NOTE:

  At least 6 points should be determined by you before the system generates automated trace. Press the confirm button to make the traces on the image clockwise or anticlockwise.

Retracing

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

During the tracing drawing, select the Clear button to clear already traced drawing.

Make fine adjustment to the trace

You can make fine adjustments to the trace after it is completed.

Perform the following procedure:

1. Under tracing curve adjusting status, the cursor turns into □.
2. Move the cursor to the editable point, press the confirm button.
3. Use the trackpad to drag the curve to desired position, press the confirm button again to set the point to the new position.
4. Repeat steps 2~3 above to finish all points that need adjustment.

TIP:

Under tracking status, select [Edit] to enter the status.

12.5 Basic Operations of TTQA

Switch among the operation controls

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

View Selection

Before tracing, select the corresponding buttons to select for the view.

- [A4C]: apical four chamber.
- [A2C]: apical two chamber.
- [ALAX]: apical long-axis view, also called 3-chamber view.
- [PSAX B]: short axis view of base section, short axis view of mitral valve.
- [PSAX M]: short axis view of base section, short axis view of papillary muscle.
- [PSAX AP]: short axis view of apex.

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]: select the next cycle.
- [Display Effect]: turns on/off the arrow vector graphical display of the myocardial movement.
- [Velocity Scale]: adjust the scale length of the velocity.
- [Display Style]: display the endometrial, the epicardium, the myocardial or all.
- [Tracking Cycles]: select the cycles to be tracked.
- [Average Cycles]: obtain the average parameter curves of the tissue.
- [Cycle Select]: select among different cycles.

Time Mark

According to the status of the current section, select the corresponding button to check the matching time.

- [AVO]: displays aortic valve open time.
- [AVC]: displays aortic valve closure time.
- [MVO]: displays mitral valve open time.

- [MVC]: displays mitral valve closure time.

Curve Display

Select [Parameter], the system provides different curves of different segments for observation.

- General
  - Speed 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 (cm).
- Long axis section
  - Volume: The X-axis represents time(s); the Y-axis represents volume (ml).
  - Strain curve (Longitudinal, Transversal): The X-axis represents time (s); the Y-axis represents strain deformation of the tissue (%).
  - Strain-rate curve (Longitudinal, Transversal): The X-axis represents time (s); the Y-axis represents strain by time (s^{-1}).
- Short axis section
  - Area curve: The X-axis represents time(s); the Y-axis represents area (cm2).
  - Strain curve (Radial, Circumferential): The X-axis represents time (s); the Y-axis represents strain deformation of the tissue (%).
  - Strain-rate curve (Radial, Circumferential): The X-axis represents time (s); the Y-axis represents strain by time (s^{-1}).
  - Circumferential Rotation curve: The X-axis represents time (s); the Y-axis represents rotation of the tissue (Deg).
  - Circumferential Rotation Rate curve: The X-axis represents time (s); the Y-axis represents rotation by time (Deg/s).

Torsion & Torsion Rate Curve

The system provides left ventricular torsion data based on short axis sections of PSAX AP and PSAX B. Torsion is acquired by calculating difference of apex and base of the heart.

Torsion = PSAX AP Rot. - PSA XB Rot.

- The X-axis represents time (s).
- The Y-axis represents tortion by time (Deg/s).

12.6 Bulleye

After tracking, the system can display Bull's Eye graph, so as to judge reverse movement or scope of myocardium.

1. Select [Bull's Eye] to turn on the function:

You can acquire:

- Time to peak value and peak value of the 17 segments (similar to 16 segments);
- Display measurement result EDV/ESV/EF/TPSD.

2. Use [Parameter] to see different parameter bull's eye graph.

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

12.7 Data Export

The system provides data exporting function, so that you can export calculation result for analysis (for instance, SPSS analysis).

Select [Data Export] to export analyzed data of each segment.

13 Stress Echo

Only the phased probes support stress echo function under the cardiac mode.

⚠ CAUTION

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

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 an animal 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 <Save> 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 <Save> 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.

13.1 Stress Echo Acquisition Procedure

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

Perform the following procedure:

1. Use the proper probe and cardiac-related exam mode, select <Stress Echo> to enter stress echo imaging.

   The system displays the “Select Protocol” window with the protocol selections.

2. Select the desired protocol and then select [OK].

   The system displays the real-time imaging screen.

   – If the Stress Echo manual ROI option is selected in the Maintenance dialog box, 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.

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> on the control panel to confirm the ROI.

   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 trackpad.

4. Press <Save> on the control panel to start acquisition.

   The system displays the Protocol window on 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.

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 <Save> on the control panel. The system goes to the next view for acquisition by default, saved views are marked with a green "√."
   – Use [Stages XXX] or [Views XXX] to select the stage and view for image acquisition (or reacquisition). Press <Save> to start acquisition.

     Views can be re-acquired until you select [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 <Save> on the control panel.

     The system displays a percentage marker below the selected stage indicating the progress of the continuous capture.
   – To halt saving acquired images for the selected stage, select [Pause] or select the Freeze button directly. The percentage stops increasing.
   – Select [Continue] or select the Freeze button again to continue.
   – To end the current acquisition, press <Save> on the control panel.
   – To select another continuous stage, select [Stages XXX].
   – 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, select [Stage Timer]/[Exam Timer] 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]. You can redisplay the real-time imaging screen to continue acquisition by selecting [Acquire].

8. To end the acquisition and review the acquired images, select [End Acquisition].

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

13.2 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> button according to tips in the trackpad hint area or select [Select] 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 [Stages XXX] or [Views XXX] 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.
   – Select [First/Last] or [Previous/Next] to display another loop in the current view.

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:

Selection	Description
Stages XXX	To select a stage.
Views XXX	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.

Selection	Description
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.
Speed decrease/Speed increase	Decreases or increases playback speed.
Text	Function that turns the screen graphic text “On” or “Off”. 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.

13.3 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).

13.3.1 Enter review mode

Select [Review/WMS] to enter review mode, and then select the label of the phase or view (for example, Rest or Long Axis), the system displays all loops that represent the selected phase or view.

To display phases for the selected view(s)

Perform the following procedure:

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.

2. 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 an “X” into each selected box, like ☒.

3. Select [Display Selected].

   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

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

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

Item	Description
Review/WMS	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. • Under [Text] “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. • Set [Text] to “On”, the system will select loops of first two views of the first two stages to display automatically. If you choose [Previous], then loops of the next two views of the first stages will be displayed. If you choose [Next], loops of the first two views in the 3rd and 4th stage will be displayed. 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).
Display Selected	Displays loops of all the stages and views selected.

13.3.2 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.

To assign a wall motion score (WMS):

1. Select a colored number.

The meanings and colors used in segments are listed in the table below.

Score	Meaning	Color
1	Normal	Green
2	Hypokinesis	Yellow
2.5	Severe Hypokinesis	Khaki
3	Akinesis	Blue
4	Dyskinesis	Red
5	Aneurysm	Purple

2. Use the trackpad 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 views:
  Select [Set All Normal].
- To assign a normal wall motion score (WMS) to the currently selected view:
  Select [Set Current Normal].

13.4 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 an animal examination.

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

13.5 Exiting the Stress Echo Feature

To exit the Stress Echo feature: Select [End SE exam].

13.6 Measurement and Report

Suspend the stress echo exam by selecting [Suspend Exam]. Press the measurement related buttons to enter cardiology measurement.

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.

You can enter indications or comments for display in Stress Echo reports.

To enter an indication:

1. Select the Report button to open the report.
2. Use the keyboard to enter text in the Indication dialog box and then select [OK].

14 Measurements and Report

14.1 Overview of Measurements

There are two kinds of measurement tools.

- General tools: basic measurement tools in General Measurement, such as the “distance” and “Area.”

  There are 2D (B/Color/Power), M and Doppler (PW/CW) general measurement tools
- Application tools: the measurement tools in Application Measurement. These items are classified and combined in clinical application packages.

⚠ WARNING

- **Be sure to measure areas of interest from the most optimal image plane to avoid misdiagnosis from inaccurate measurement values.**
- **To obtain accurate Doppler flow measurement values, make sure the transmitting beam is not perpendicular to the flow, otherwise false readings and potential misdiagnosis may result.**

⚠ 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, but the measurement data will be stored in the report.**
- **If the system is turned off or the End Exam button is selected during a measurement, the data not saved will be lost.**
- **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 a diagnosis.**
- **Select the proper animal image and measurement tools. Only qualified professionals can decide the appropriate measurements and results.**
- **Confine measurement calipers to the actual Region of Interest (ROI). Measurements that extend beyond the ROI will be incorrect.**
- **Before examining a new animal, it is necessary to end the current scan and delete the animal information and data. Failure to do so will result in new animal data being combined with the previous animal’s data.**
- **When the system is turned OFF or end the exam, all unsaved data are lost.**
- **Using the Clear button will clear the measurement caliper and all data in the result window, such as comments and body marks.**

- **The quality of the extended image constructed in iScape (panoramic imaging) is dependent on the skill of the operator. Extra attention should be paid during the iScape measurement since the results could be inaccurate.**
- **When the result of auto trace does not match the image exactly, perform the measurement manually.**

TIP:

- Most application tools use the general measurement method while measuring. Only the application measurement results are recorded in the report.
- The measurement tools listed in this manual are configured in the system. The application measurement packages provided in this system are generally different combinations of measurement tools.

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

14.1.1 Basic Operations and Buttons

Button Functions

The following descriptions for buttons and buttons are used during performing measurements:

Buttons	Basic Operations
Measure	To enter/exit the application measurement.
Caliper	To enter/exit the general measurement.
Left/right Set button	Press the confirm button to confirm and end the current operation during measurement.
Update	To switch between the fixed end and active end of the caliper during a measurement.
Clear	Short press: to return to the previous measurement step or delete the caliper backwards. Long press: to clear all measurement calipers on the screen and data in the results window.
Report	To enter/exit the report page.
Cursor	To show/hide the cursor.
Trackpad	To move the cursor. ***NOTE:*** You can also tap the trackpad to confirm and end the current operation during measurement.

Basic Measurement Procedures

Perform the following procedure:

1. Enter the animal information,
2. Select a proper exam mode.

3. Measurement preset.

   Before measuring, preset the following parameters:

   – Measurement Parameters Preset
   – General Measurement Preset
   – Application Measurement Preset
   – Report Preset

4. Select the Measure button or the Caliper button to start measurement.

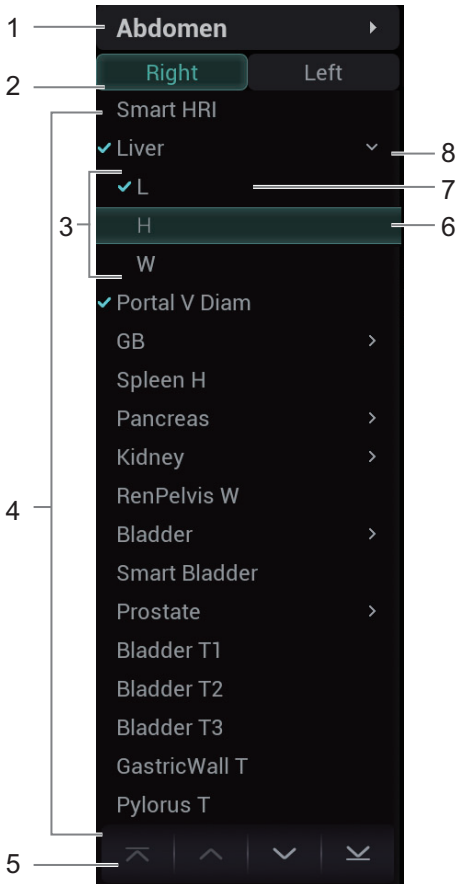
5. Select an item from the measurement menu to start.

6. View the exam report.

14.1.2 Measurement Menu

Select the Caliper/Measure button to enter the general/application measurement.

Take application measurement menu as example, measurement menu is shown as the following figure.



No.	Description
1.	Menu title

No.	Description
2.	Location
3.	Tools (submenu)
4.	Tools (main menu)
5.	Page turning button
6.	Current measurement tool/item
7.	Measured item
8.	Menu title (submenu)

TIP:

- The order of the measurement items can be preset.
- A measurement tool can be activated by selecting the item . It is described as “Select... in the measurement menu” in the following procedures.

Measurement Location

The location buttons are used to select the measurement locations.

- Side (Left/Right): belongs to items that contain measurements of left/right side parameters respectively.
- Location (Prox./Mid./Dist.): belongs to items that contain measurements of Proximal, Middle or Distal parameters.
- Location (Far/near): belongs to items that contain measurements of anterior or posterior parameters.
- Pole (U/M/L): belongs to items that contain measurements of upper, middle or lower parameters.

Measurement Tool

Select the item to select the tool.

TIP:

A performed application item/tool is marked with a “√.” (If one or some items in a submenu (extended menu) of a study are already performed, this study will be marked as measured.)

Measurement Mode

Use <Mode> to switch to other measurement menus available for other modes.

Measurement Library Switching

During application measurement, select the library list to select from the available measurement libraries under the current probe of the current exam mode.

Measurement Method

Some measurement tools have multiple methods to select.

Select "▼" on the right side of the item to select the method.

Adjust Frame

Select [Adjust Frame] to select an appropriate frame to perform measurements.

Edit Measurement Caliper

Perform the following procedure:

1. Select [Edit].
2. Select the measurement caliper by using the trackpad and the confirm button.
3. Move the pointer of the measurement caliper.

   The measurement is updated in the result window.

14.1.3 Measurement Caliper

A measurement caliper is a graphic consisting of several points and a straight line or curve drawn on the ultrasound image.

Fixed/Active End

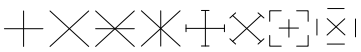
The ends of calipers can be active or fixed. The active end is called a Cursor.

Caliper Color

An active caliper appears green, while a fixed one appears white in the system default preset.

Caliper End Symbols

8 symbols are used as caliper ends, as shown in the figure below.



TIP:

The cursor type can be preset between Symbol and Number.

14.1.4 Results Window

The measurement window displays the conducted measurement's result and the engaging measurement in real time.

Results Display

- When viewing the results: If the results window is full, the oldest value will be replaced according to the "first in, first out" rule.

A maximum of 16 results can display in the results window and a maximum of two graphical results windows can display in the screen.

- To identify the measurement results, symbols or numbers are used in the numerical results window (B-histogram, B-profile) while “No:1” or “No:2” is used in the graphical results window.
- The result displays as digits when the value obtained is within the clinical range. If the value display is abnormal, perform the measurement again.

Moving the Results Window

To move the results window:

1. Place the cursor on the results window title and press the confirm button.
2. Move the cursor to place the results window in the desired position.
3. Press the confirm button to fix the results window.

14.1.5 Results Window Assignment

An application measurement result can be assigned to a general measurement item from the results window. The application item can be an existing item in the system or a new user-defined one.

NOTE:

Re-assignment for the assigned general result is not available.

Assigning an Existing Application Item

Perform the following procedure:

1. Move the cursor to a general measurement value in the results window. Press the confirm button and the matching list appears.

   Application items that meet the following requirements are displayed:

   – Contained in the current application package.
   – The item to be assigned and the assigner should use the same general measurement tool for the result.

   Application items in the current measurements that use the “Distance” method are listed as shown above.
2. Select an application item from the list, then press the confirm button.
3. The assigned value displays in the results window and is saved in the exam report.

Assigning a New Application Item

When no (desired) item displays in the matching list, you can create a new application item.

TIP:

Re-assignment for the assigned general result is not available.

Perform the following procedure:

1. Select [New] at the bottom of the matching list.
2. Type in the new name.
3. Click [OK] to assign the general result to the new item.

Exiting Result Assignment

Click other area or select [Cancel] in the matching list to exit.

Auto-Spectrum Calculation Assignment

Like a general measurement result, you can assign the auto-spectrum calculation results to an application item, using the same steps as described above.

NOTE:

The application item to assign should be an item using D trace in the current application package.

14.1.6 Cross-window Measurement

For linear probing, cross-window measurement is available in dual-B mode when the left and right windows are imaging with the same probe, depth and invert mode.

Under Free Xros M mode, you can perform cross-window measurement of time and HR.

14.2 2D General Measurements

14.2.1 Depth

Sectoral surface probe: the depth is the distance from the center of the sector to the cursor.

Convex array or linear array probe: the depth is the distance from the transducer surface to the measuring cursor in the direction of the ultrasonic wave.

TIP:

The real-time depth displays in the results window only before the confirm button is pressed to fix the starting point. The history value of the depth is not displayed in the results window.

Perform the following procedure:

1. Select [Depth] in the measurement menu.

   The cursor appears on the screen.
2. Move the cursor to the desired point.
3. Press the confirm button to set the measurement point and the result displays in the results window.

14.2.2 Distance

Measures the distance between two points on the image.

Perform the following procedure:

1. Select [Distance] in the measurement menu.

   The cursor appears on the screen.

2. Move the cursor to the starting point.

3. Press the confirm button to set the starting point.

4. Move the cursor to the end point.

   – Select the Clear button to cancel setting the starting point.
   – Select the Update button to switch between the fixed end and the active end of the caliper.

5. Press the confirm button to set the end point and the result displays in the results window.

14.2.3 Distance P-L

Measures the distance between two parallel line segments.

Perform the following procedure:

1. Select [Distance P-L] in the measurement menu.

   The cursor appears on the screen.

2. Move the cursor to the starting point.

3. Press the confirm button to set the starting point.

4. Move the cursor to the end point.

   – Select the Clear button to cancel setting the starting point.
   – Select the Update button to switch between the fixed end and the active end of the caliper.

5. Press the confirm button to set the end point and the result displays in the results window.

14.2.4 Angle

Measures the angle of two crossing planes on the image and the range is: 0° to 180°.

Perform the following procedure:

1. Select [Angle(2L)] / [Angle(3P)] in the measurement menu.

   The cursor appears on the screen.

2. Set two line segments as described in section 14.2.2 .

   The angle appears in the results window after setting the line segments.

14.2.5 Area & Circumference

Measures the area and circumference of a closed region on the image. Four measurement methods are available:

- Ellipse: fix an ellipse region by two equal-cut perpendicular axes.
- Trace: fix a closed region by free tracing.
- Spline: fix a spline curve by a series of points (12 points at most).
- Cross: fix a closed region with two axes perpendicular to each other. The starting point and the end point of the axes can both be fixed freely.

These four methods are also applicable to other measurement items and will not be repeated when mentioned below.

Ellipse

Perform the following procedure:

1. Select [Ellipse] in the measurement menu.

   The cursor appears on the screen.

2. Move the cursor to an area of interest.

3. Press the confirm button to set the starting point of the first axis of the ellipse.

4. Move the cursor to position the end point of the first axis of the ellipse.

   – Select the Update button to switch between the fixed end and the active end of the first axis.
   – Select the Clear button to cancel the start point of the first axis.

5. Press the confirm button to set the end point of the first axis of the ellipse.

   The second axis appears on the screen.

6. Moving the cursor will increase or decrease the ellipse from the fixed axis. Move the cursor to trace the area of interest as closely as possible.

   Or, select the Update button or the Clear button to return to the step before setting the first axis.

7. Press the confirm button to anchor the ellipse region.

   The measurement result will be displayed in the results window.

Trace

Perform the following procedure:

1. Select [Trace] in the measurement menu.

   The cursor appears on the screen.

2. Move the cursor to an area of interest.

3. Press the confirm button to fix the starting point.

4. Move the cursor along the target to trace the outline of the target.

To modify the trace line, rotate the Angle knob:

- Anticlockwise: to cancel a series of points.
- Clockwise: to resume a series of points. You may also resume the points by moving the cursor back.

5. Press the confirm button and the trace line will be closed with a straight line connecting the start and end points.

   The trace will also be closed when the cursor is very near to the starting point.

Spline

Perform the following procedure:

1. Select [Spline] in the measurement menu.

   The cursor appears on the screen.

2. Move the cursor to an area of interest.

3. Press the confirm button to set the first reference point of the spline.

4. Move the cursor along the area of interest and press the confirm button to anchor the second reference point.

5. Move the cursor again and a spline defined by three points of the first and second reference points and the active cursor appears on the screen.

6. Move the cursor along the edge of the target and set more reference points (12 at most) to make the spline approach the target region as closely as possible.

   To correct a previous point, select the Clear button.

7. Press the confirm button twice to anchor the last reference point.

   The spline is fixed and the results display in the results window.

Cross

Perform the following procedure:

1. Select [Cross] in the measurement menu.

   The cursor appears on the screen.

2. Move the cursor to an area of interest.

3. Press the confirm button to fix the starting point of the first axis.

4. Move the cursor to position the end point of the first axis and then press the confirm button.

   - Select the Update button to switch between the start point and the end point of the first axis.
   - Select the Clear button to cancel setting the starting point of the first axis.

5. Press the confirm button to set the end point of the first axis. The second axis (perpendicular to the first axis) of the cross appears on the screen.

6. Move the cursor and press the confirm button to fix the starting point of the second axis.

7. Move the cursor to the end point of the second axis.
   - Select the Update button to switch between the start point and the end point of the first axis.
   - Select the Clear button to cancel setting the starting point of the first axis.
8. Press the confirm button to set the end point of the second axis and fix the region.

   The results appear in the result window.

14.2.6 Smart Trace

Helps the operator to trace the contour of the target by automatically recognizing the margin of the target and measures the lengths of major axis and minor axis, area and circumference of the closed region.

TIP:

Smart Trace should be performed on frozen images.

Perform the following procedure:

1. After the image is frozen, select [Smart Trace] in the measurement menu.
2. Move the cursor to an area of interest.
3. Press the confirm button to fix the starting point.
4. Move the cursor along the target to trace the outline of the target.

   During tracing, you can move the cursor backwards to delete latest tracing. Or, you can press the confirm button to fix the traced contour.

   The faster the cursor moving speed, the bigger the cursor, and the lager the recognized area.
5. Press the confirm button twice and the trace line will be closed with a straight line connecting the start and end points.

   The trace will also be closed when the cursor is very near to the starting point.

14.2.7 Volume

Measures the volume of the target object.

Volume (3 Dist.)

For calculating the object's volume with 3 axes of two images scanned in the plane perpendicular to each other in B Mode. The calculation formula is as follows:

$$Volume(cm^3) = \frac{\pi}{6} \times D1(cm) \times D2(cm) \times D3(cm)$$

Where D1, D2 and D3 are the length of three axes of the target object.

Perform the following procedure:

1. Select [Volume] in the measurement menu.

   The cursor appears on the screen.

2. Here D1, D2 and D3 are the lengths of three axes of the target object.

   For detailed procedures, see “14.2.2 Distance”.

   Generally D1, D2 and D3 should belong to different scanning planes.

Volume (Ellipse)

To calculate the object’s volume by its horizontal section area. The calculation formula is as follows:

$$Volume(cm^3)=\frac{\pi}{6}\times a(cm)\times b^2(cm)$$

Where a is the length of the major axis of the ellipse while b the minor.

Perform the following procedure:

1. Select [Volume (Ellipse)] in the measurement menu.

   The cursor appears on the screen.

2. The procedure is similar to that of Ellipse in the area measurement.

3. For details, see “14.2.5 Area & Circumference”.

Volume (Ellipse Dist.)

To calculate the object’s volume by its horizontal and vertical section area. The calculation formula is as follows:

$$Volume(cm^3)=\frac{\pi}{6}\times a(cm)\times b(cm)\times m(cm)$$

Here a, b and m indicate the length of the major, minor and the third axis of the ellipse respectively.

Perform the following procedure:

1. Select [Volume (E+ Dist.)] in the measurement menu.

   The cursor appears on the screen.

2. Use the Ellipse method to measure the vertical section area.

   The procedure is similar to that of Ellipse in the Area measurement, see “14.2.5 Area & Circumference” for details.

3. Unfreeze the image. Rescan the area of interest perpendicular to the previous image.

4. Measure the length of the third axis with the Distance measurement method, see “14.2.2 Distance” for detailed procedures.

14.2.8 Double Dist.

Measures the lengths of line segments A and B perpendicular to each other.

Perform the following procedure:

1. Select [Double Dist.] in the measurement menu.

   The cursor appears on the screen.
2. Move the cursor to the measurement starting point.
3. Press the confirm button to set the starting point of the first line segment.
4. Move the cursor to position the end point of the first axis and then press the confirm button.
   - Select the Update button to switch between the start point and the end point of the first axis.
   - Select the Clear button to cancel setting the starting point of the first axis.
5. Press the confirm button to set the starting point of the first line segment. The second line segment perpendicular to the fixed line segment appears on the screen.
6. Move the cursor to the starting point of the second line segment.
7. Press the confirm button to set the starting point of the second line segment. Or, select the Update button or the Clear button to return to the last step.
8. Move the cursor to the end point of the second line segment. Then
   - Select the Update button to switch between the starting point and the end point of the second axis.
   - Select the Clear button to cancel setting the starting point of the second axis.
9. Press the confirm button to confirm the end point of the second line segment.

14.2.9 Parallel

Measures the distance between every two line segments of five parallel line segments, namely, four distances in total.

Perform the following procedure:

1. Select [Parallel] in the measurement menu.

   Two lines perpendicular to each other appear on the screen. The intersection is the starting point of the line segment.
2. Use the Angle knob to change the angle of the lines and press the confirm button to confirm.
3. Move the cursor to the starting point of the line segment.
4. Press the confirm button to confirm the starting point and the first line.
5. Move the cursor and press the confirm button to confirm the other four parallel lines when the last parallel line is set and the end point of the line that is perpendicular to the five parallel lines is confirmed.

During the measurement, press the confirm button twice to set the last parallel line and complete the measurement.

14.2.10 Curve Length

Measures the length of a curve on the image. Measurement methods available include Trace and Spline.

Trace

Perform the following procedure:

1. Select [Trace Len] in the measurement menu.

   The cursor appears on the screen.

2. Move the cursor to an area of interest.

3. Press the confirm button to fix the starting point.

4. Move the cursor along the target to trace the outline of the target.

   To modify the trace line, rotate the Angle knob:
   - Anticlockwise: to cancel a series of points.
   - Clockwise: to resume a series of points. You may also resume the points by moving the cursor back.

5. Press the confirm button to anchor the end point of the trace line.

Spline

Perform the following procedure:

1. Select [Trace Len (Spline)] in the measurement menu.

   The cursor appears on the screen.

2. Move the cursor to an area of interest.

3. Press the confirm button to fix the starting point.

4. Move the cursor along the target and press the confirm button to anchor the second, third, fourth, etc., points.

   A maximum of 12 points can be anchored.

   To correct a previous point, select the Clear button.

5. Press the confirm button twice to set the end point of the spline.

14.2.11 Ratio (D)

Measures the lengths of two line segments and then calculates their ratio.

Perform the following procedure:

1. Select [Ratio (D)] in the measurement menu. The cursor appears on the screen.

2. Measure the length of the two line segments, see “14.2.2 Distance” for detailed procedures.

   The results display in the results window after the measurement of the second line is completed.

14.2.12 Ratio (A)

Measures the area of two closed regions and then calculates their ratio. The methods are Ellipse, Trace, Cross and Spline.

Perform the following procedure:

1. Select [Ratio (A)] in the measurement menu.

   The cursor appears on the screen.

2. Measure the area of the two closed regions; you may select different measurement methods for each region, see “14.2.5 Area & Circumference” for details.

   Under elastography imaging mode, in B+E dual display mode, select [Sync] to On. Measurements on either of the two windows will be displayed in the other window.

14.2.13 B-Profile

Measures the gray distribution of ultrasonic echo signals on a line.

TIP:

The following operations are performed on Freeze images by default.

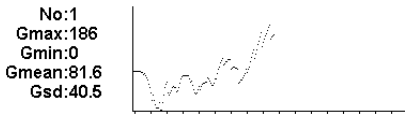
Perform the following procedure:

1. Select [B-Profile] in the measurement menu.

   The cursor appears on the screen.

2. Set a line segment, see “14.2.2 Distance” for detailed procedures.

   The result is shown in the figure below:



   Where

   – No: The number of the graph. Value: 1 or 2. The last two results will be displayed on the screen.
   – Gmax: The maximum gray.
   – Gmin: The minimum gray.
   – Gmean: The average gray.
   – Gsd: The variance of gray.

14.2.14 B-Hist.

Function: measures and counts the gray distribution of ultrasonic echo signals within a closed region. The methods to set a closed region are Ellipse, Trace, Spline and Rect. (Rectangle).

TIP:

The following operations are performed on Freeze images by default.

B-Hist. (Rectangle)

Rect. sets a rectangle with two points on the cross.

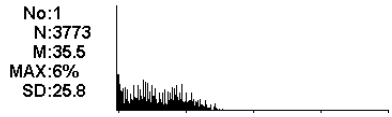
Perform the following procedure:

1. Select [B-Hist. (Rectangle)] in the measurement menu.

   The cursor appears on the screen.

2. Move the cursor to the first vertex of the rectangle, press the confirm button.

3. Move the cursor to the second vertex of the rectangle, press the confirm button. The result is shown in the following figure:



   Where

   – Horizontal axis: The gray of the image
   – The vertical axis: The gray distribution percentage.
   – No: The number of the graph. The last two results will be displayed on the screen.
   – N: The total pixel number in the area to be measured.
   – M: $M = \sum Di / N$;
   – MAX: MAX = the pixel number in the maximum gray/N×100%
   – SD: Standard deviation. $SD = (\sum Di^2/N-(\sum Di/N)2)^{1/2}$
     Di: the gray at each pixel point
     $\sum Di$: the total grays of all pixels.

B-Hist. (Ellipse/Trace/Spline)

For detailed procedures, see “14.2.5 Area & Circumference”.

14.2.15 Color Vel.

TIP:

- This measurement item is meant for a general estimation, not for accurate measurement.
- The following operations are performed on Freeze images by default.

Measures the velocity of blood flow on the Color Mode image.

Perform the following procedure:

1. Select [Color Vel.] in the measurement menu.

   The cursor appears on the screen.

2. Move the cursor to the point to be measured for blood flow velocity.

3. Press the confirm button to fix the point, a floating line is displayed in the direction parallel to the ultrasonic wave beam at that point.

   The compensation angle is currently 0°. You can change the angle (0°-80°) by rotating the Angle knob to align the floating line in the same direction as the blood flow at the point to be measured.

4. Press the confirm button to set the direction of the blood flow.

   The result displays in the results window.

14.2.16 Volume Flow

Measures blood flow through a vascular cross section per unit time.

For details, see “14.4.8 Volume Flow”.

14.2.17 IMT

IMT (Intima-Media Thickness) measures the distance between LI (Lumen-Intima) and MA (Media-Adventia).

TIP:

The IMT should be performed on frozen images.

14.2.18 Strain

Support making measurement and calculation of the strain in a region.

TIP:

Only elastography imaging supports this function.

Perform the following procedure:

1. Under Strain Elasto Mode, acquire the image and freeze. Select [Strain] in the measurement menu.

2. Adjust the circle size by rotating the Angle knob after select [Strain (Circle)]. Set the shell thickness and select whether to turn on the shadow function.

   – In B+E dual display Mode, select [Sync] on the touch screen to On. Measurements on either of the two windows will be displayed in the other window.
   – Use [Shell Thick] to set the mass shell size.

After the strain is measured, set [Shell Thick] to be more than 0 mm. The system extends from lesion A automatically according to the shell thick value.

3. Perform measurements.

   You may select different measurement methods for each region. For details, see “14.2.12 Ratio (A)”.

14.2.19 Strain Ratio

Measures the strain ratio in the image.

TIP:

- The Strain Ratio should be performed on frozen images.
- Only elastography imaging supports this function.

In the image, the region selected from lesions is defined as A, and the region selected from normal tissue is defined as B, where A' is the region extended from lesions and shell thick. Refers to the thickness of the mass shell.

Tissue strain is related to forces on the probe and tissue depth. It is recommended to use regions of the same depth and same area for comparison.

Perform the following procedure:

1. Under elastography imaging mode, acquire the image and freeze. Select [Strain Ratio] in the measurement menu.
2. Adjust the circle size by rotating the Angle knob after selecting [Strain Ratio (Circle)].
3. Set the shell thickness and select whether to turn on the shadow function.
   - In B+E dual display Mode, select [Sync] to “On”. Measurements on either of the two windows will be displayed in the other window.
   - Use [Shell Thick] to set the mass shell size.
4. Perform measurements.

   You may select different measurement methods for each region. For details, see “14.2.12 Ratio (A)”.

   After the strain ratio is measured, select [Shell Thick] to be more than 0 mm. The system extends from lesion A automatically according to the shell thick value. The results window will display the results: B/A’, B/Shell, A/Shell.

14.2.20 Strain Hist.

TIP:

The Strain-Hist. should be performed on frozen images.

Displays the strain ratio using the histogram.

Perform the following procedure:

1. Under elastography imaging mode, acquire the image and freeze. Select [Strain-Hist (Ellipse)] or [Strain-Hist. (Trace)] in the measurement menu.
2. Set the shell thickness and select whether to turn on the shadow function.
   - In B+E dual display mode, select [Sync] on the touch screen to “On”. Measurements on either of the two windows will be displayed in the other window.
   - Use [Shell Thick] to set the mass shell size.
3. Perform measurements.

   You can select between ellipse or trace method. For details, see “14.2.14 B-Hist.”

14.3 M General Measurements

14.3.1 Distance

Measures the distance between two points on the M Mode image.

Perform the following procedure:

1. Select [Distance] in the measurement menu.

   Two dotted lines perpendicular to each other appear on the screen.
2. Move the crossing point of the dotted lines to the measurement starting point and press the confirm button.
3. Move the crossing point to the end point. The crossing point can then only be moved in a vertical direction.
   - Select the Update button to switch between the fixed end and active end of the caliper.
   - Select the Clear button to cancel setting the starting point.
4. Press the confirm button to set the end point.

14.3.2 Time

Measures the time interval between two points on the M Mode image.

Perform the following procedure:

1. Select [Time] in the measurement menu.

   Two dotted lines perpendicular to each other appear on the screen.
2. Move the crossing point of the dotted lines to the measurement starting point and press the confirm button.
3. Move the crossing point to the measurement end point.

   The crossing point can only be moved in a horizontal direction.

– Select the Update button to switch between the fixed end and active end of the caliper.
– Select the Clear button to cancel setting the starting point.

4. Press the confirm button to set the end point.

14.3.3 Slope

Measures the distance and time between two points on the M Mode image and calculates the slope between the two points.

Perform the following procedure:

1. Select [Slope] in the measurement menu. Two dotted lines perpendicular to each other appear on the screen.
2. Move the crossing point of the dotted lines to the measurement starting point and press the confirm button.
3. Move the crossing point to the measurement end point.

   The crossing point is connected to the starting point by a dashed line.

   – Select the Update button to switch between the fixed end and active end of the caliper.
   – Select the Clear button to cancel setting the starting point.
4. Press the confirm button to set the end point.

14.3.4 Velocity

Measures the distance and time between two points on the M Mode image and then calculates the average velocity between the two points.

Perform the following procedure:

1. Select [Velocity] in the measurement menu.

   Two dotted lines perpendicular to each other appear on the screen.
2. Move the crossing point of the dotted lines to the measurement starting point and press the confirm button.
3. Move the crossing point to the end point. The crossing point can then only be moved in a vertical direction.

   – Select the Update button to switch between the fixed end and active end of the caliper.
   – Select the Clear button to cancel setting the starting point.
4. Press the confirm button to set the end point.

14.3.5 HR

Measures the time interval of n ($n \leq 8$) cardiac cycles on the M Mode image and calculates the heart rate.

The number of cardiac cycles “n” can be preset, see the *Setup* chapter.

⚠ CAUTION

During the measurement, the number of cardiac cycles between the measurement start and end points must be exactly the same as preset. Otherwise, misdiagnosis may occur.

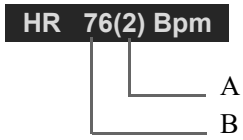
Perform the following procedure:

1. Select [HR] in the measurement menu.

   Two dotted lines perpendicular to each other appear on the screen.

2. Select n cardiac cycles.

   The HR result in the results window displays the measured heart rate value and the preset number of cardiac cycles, as shown in the figure below.



A	Number of Cardiac Cycles
B	Heart Rate

14.3.6 HR (R-R)

Measures the time interval between the R peaks of n (n≤8) cardiac cycles on the ECG image and calculates the heart rate.

The number of cardiac cycles “n” can be preset, see the *Setup* chapter.

⚠ CAUTION

During the measurement, the number of cardiac cycles between the measurement start and end points must be exactly the same as preset. Otherwise, misdiagnosis may occur.

Perform the following procedure:

1. Select [HR (R-R)] in the measurement menu.

   Two dotted lines perpendicular to each other appear on the screen.

2. Move the cursor onto the starting R peak point and press the confirm button.

3. Move the cursor onto the end R peak point and press the confirm button.

14.4 Doppler General Measurements

14.4.1 Time

Measures the time interval between two points on the Doppler image.

The operations are similar to the Time measurement in M Mode, see “14.3.2 Time” for details.

14.4.2 HR

Measures the time interval between n (n≤8) cardiac cycles on the Doppler Mode image and calculates the number of heart beats per minute (BPM).

The operations are similar to the Heart Rate measurement in M Mode, see “14.3.5 HR” for details.

14.4.3 HR (R-R)

Measures the time interval between R peaks of n (n≤8) cardiac cycles on the ECG image and calculates the number of heart beats per minute (BPM).

The operations are similar to the Heart Rate (R-R) measurement in M Mode, see “14.3.6 HR (R-R)” for details.

14.4.4 D Velocity

Measures the velocity, pressure gradient and correction angle of a certain point on the Doppler spectrum.

TIP:

The real-time velocity displays in the results window only before the confirm button is pressed to fix the starting point. The history value of the velocity is not displayed in the results window.

Perform the following procedure:

1. Select [Vel.] in the measurement menu.

   The cursor appears on the screen.

2. Move the cursor to the point to be measured for velocity.

3. Press the confirm button and the result displays in the results window.

14.4.5 Acceleration

Measures the velocities of two points and their time interval on the Doppler image, and calculates the acceleration, pressure gradient, velocity difference and correction angle.

Perform the following procedure:

1. Select [Acceleration] in the measurement menu.

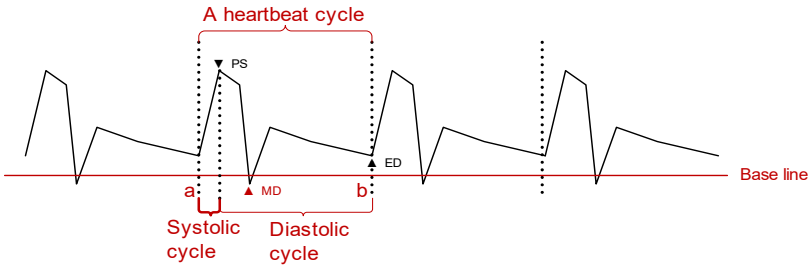
   The cursor appears on the screen.

2. Move the cursor to the first point to be measured for velocity.
3. Press the confirm button to fix the first point.
4. Move the cursor to the second point to be measured for velocity.
5. Press the confirm button to fix the second point. The results display in the results window.

14.4.6 Trace

Measures clinical indices using spectral Doppler tracing. Measurement methods available are Manual Trace, Auto Trace, Spline Trace.

A sketch of a Doppler spectrum is shown below:



NOTE:

When doing the trace, please set systolic starting time as the starting point and diastolic ending time as end point. That is, by tracing the Doppler spectrum from systolic to diastolic to calculate indices.

Spline Trace

Perform the following procedure:

1. Select [Spline Trace] in the measurement menu.
2. Move the cursor to the starting point to be measured and press the confirm button to fix the point.
3. Move the cursor along the edge of the desired region. Continue to fix the second, third, etc., point (50 points at most) of the spectrum.
4. Press the confirm button twice to anchor the last reference point. Or the measurement ends automatically when there are 50 reference points.

Manual Trace

Perform the following procedure:

1. Select [Manual Trace] in the measurement menu.

   The cursor appears on the screen.

2. Move the cursor to the starting point to be measured, and press the confirm button to fix the starting point.
3. Move the cursor around the object to draw a trace line overlapping the spectrum as much as possible
4. Press the confirm button to anchor the end point of the trace line.

Auto

Perform the following procedure:

1. Select [Auto Trace] in the measurement menu.

   The cursor appears on the screen.
2. Move the cursor to the starting point to be measured, and press the confirm button to fix the starting point.
3. Move the cursor to anchor the end point of the trace line, and press the confirm button.

   The system will draw a trace line overlapping the spectrum automatically, and recognize a complete cardiac cycle to calculate.

Auto-Spectrum Calculation

You can also acquire the above results by auto calculation, which calculates the recent cardiac cycles.

Perform the following procedure:

1. Select [Auto Calc.] in the PW image menu to activate it.

   The system traces automatically and displays the results on the screen.
2. Select [Auto Calc. Param.] in the PW image menu. You can select the parameters to be calculated.
3. Select [Auto Cardiac Cycle] in the PW image menu. You can select the cycle number to be calculated.
4. If necessary, you can edit the LOVT spectrum manually:
   a. Select the Freeze button to freeze the image.
   b. Select the Cursor button to activate the cursor.
   c. Move the cursor to the spectrum tracing line and press the confirm button.
5. Move the cursor to trace a line, the calculation results display in real time.

Result parameters

The results obtained from Trace are:

Parameters	Descriptions	
PS	Peak Systolic Velocity	The highest velocity of the red blood cells crossing the sample volume.
ED	End-Diastolic Velocity	Measures the blood velocity at the end of the cardiac cycle.

Parameters	Descriptions	
MD	Min-Diastolic Velocity	Minimum absolute Velocity in the diastolic cycle.
Vel.	Velocity	Flow velocity
Average velocity	/	The average flow velocity in the whole traced Doppler spectrum. TAMAX (Time Averaged Maximum Velocity): $\mathrm{TAMAX}(cm/s)=\int_{Ta}^{Tb}V(t)dt\Big/(T_b-T_a)$ Where V(t) is the maximum velocity TAMEAN (Time Averaged Mean Velocity): Obtained by auto-spectrum calculation. $\mathrm{TAMEAN}(cm/s)=\int_{Ta}^{Tb}V(t)dt\Big/(T_b-T_a)$ Where V(t) is the mean velocity.
PPG	Peak Pressure Gradient	The corresponding pressure gradient of the peak systolic velocity. PPG (mmHg) = 4 × PS (m/s)^2
Average Pressure Gradient	/	The average pressure gradient in the whole traced Doppler spectrum. MPG: Maximum Pressure Gradient. $\mathrm{MPG}(mmHg)=\int_{Ta}^{Tb}4(V(t))^2\,dt\Big/(T_b-T_a)$ Where V(t) is the peak systolic velocity. MMPG: Mean velocity Mean Pressure Gradient. (Obtained during auto-spectrum calculation.) $\mathrm{MMPG}(mmHg)=\int_{Ta}^{Tb}4(V(t))^2\,dt\Big/(T_b-T_a)$ Where V(t) is the mean systolic velocity.
VTI	Velocity-Time Integral	Velocity-time integral. The integral of the product of Doppler instantaneous velocity and the total time interval. $VTI(m)=\int_{T_a}^{T_b}V(t)dt$
AT	Acceleration Time	The time of the blood velocity accelerating from the end of diastole to the systolic peak. This is usually the time interval between the end of the first cardiac cycle and the peak of the next cardiac cycle. Choose the first peak when two peaks exist in the systolic cycle.
DT	Deceleration Time	Deceleration Time.
HR	Heart Rate	Calculates the heart rate per minute by measuring the time interval of one cardiac cycle.

Parameters	Descriptions	
S/D	/	PS/ED S/D (No unit) = PS (m/s) / ED (m/s)
D/S	/	ED/PS. D/S (No unit) = ED (m/s) / PS (m/s)
PI	Pulsative Index	Pulsatility index. PI (No unit) = |(PS (m/s) - ED (m/s)) / TAMAX (m/s)|
RI	Resistive Index	Resistance index.RI (No unit) = |(PS (m/s) - ED (m/s)) / PS (m/s)|
θ	/	The correction angle is the spectrum angle during measurement, which is a result obtained from a non trace measurement tool and is usually displayed together with the spectral measurement results.
PV	Peak Velocity	The peak velocity in systolic or diastolic cycles (with no difference), which is the highest velocity of the red blood cells that cross the sample volume. It can be used to examine the venous vessel.

NOTE:

- In the formulae above, T means time, the unit is s; V means the velocity at each point during T, the unit is cm/s; a is the traced starting point, while b is the traced end point.
- The above parameters are all the information obtained in Trace, while in application the system only displays part of them according to the operation and preset.

14.4.7 PS/ED

Measures the Peak Systolic (PS) velocity and End Diastolic (ED) velocity on the Doppler spectrum, and calculates their resistance index (RI), S/D and correction angle.

Perform the following procedure:

1. Select [PS/ED] in the measurement menu.

The cursor appears on the screen.

2. Move the cursor to the Systolic Peak and press the confirm button to fix the point.

3. Move the cursor to the Diastolic End and press the confirm button to fix the point.

14.4.8 Volume Flow

Measures blood flow through a vascular cross section per unit time.

Perform the following procedure:

1. Select [Volume Flow] in the measurement menu. The submenu displays.

– Select [Vas. Area] to select the method for calculating the area: dist. or trace.
– Select [PW Scope] to select the scope to be traced.

2. Measure the vascular area.
3. Select [TAMEAN] or [TAMAX] to calculate the volume flow.

Item		Description	Methods or formulae
Vas Area	Dist.	Obtain the area by measuring the vascular diameter.	Vas. Area = π × Vas Diam $(cm)^2$/ 4
	Trace	Obtain the area using the trace method.	Area in 2D General Measurements
TAMEAN		Vol Flow(Area) - TAMEAN	Vol Flow(A) (ml/min) = |Vas TAMEAN (cm/s)| × Vas. Area (cm^2) × 60 (s) Vas. TAMEAN - Time Averaged Mean Velocity, obtained from the Vas. Trace measurement.
TAMAX		Vol Flow(Area) - TAMAX	Vol Flow(A) (ml/min) = |Vas TAMAX (cm/s)| × Vas Area (cm^2) × 60 (s) Vas. TAMAX - Time Averaged Maximum Velocity, obtained from the Vas. Trace measurement.

14.4.9 Velocity Ratio

Measures two D velocity values on one or two spectrums and calculate the ratio to analyze the flow information.

Perform the following procedure:

1. Select [Ratio (Vel)] in the measurement menu.

   The cursor appears on the screen.
2. Move the cursor and press the confirm button to obtain two velocity values.
3. The system calculates the ratio automatically.

   Where

$$Vel\ Ratio(\ Nounit\ ) = \left| \mathrm{Vel}1(\ cm\ /\ s\ ) / \mathrm{Vel}2(\ cm\ /\ s\ ) \right|$$

14.4.10 VTI Ratio

Measures two VTI values on the spectrum and calculate the ratio.

Perform the following procedure:

1. Select [Ratio (VTI)] in the measurement menu.

   The cursor appears on the screen.
2. Move the cursor to obtain VTI1 and VTI2 values using the trace method.

3. The system calculates the ratio automatically.

   Where

$$\text{VTI Ratio}(\ Nounit\ ) = \left| \text{VTI 1}(\ cm\ ) / \text{VTI 2}(\ cm\ ) \right|$$

14.5 Smart Bladder

NOTE:

- Smart Bladder must be used with convex-wide probe.
- Smart Bladder is available in Single/Dual B imaging mode.

Function: measure the volume of the urine in the bladder.

1. Select an appropriate probe and exam mode.
2. Scan and obtain the transverse section image of the bladder.
3. Press <Freeze> to freeze the image and select [Smart Bladder] in the measurement menu.

   Two diameters d1 and d2 (perpendicular to each other by default) are recognized by the system.
4. If the current result is satisfactory, select [Accept Result] or press <Set> to save the result.

   Or, if the result is not satisfactory:

   a. Select [Auto Detect] to update the result.
   b. Select [Accept Result] to save the result.
5. Press <Freeze> to unfreeze the image.
6. Select [Smart Bladder]. Scan and obtain the longitudinal section image of the bladder.

   The diameter d3 is recognized by the system automatically.
7. If the current result is satisfactory, select [Accept Result] or press <Set> to save the result.

   Or, if the result is not satisfactory:

   a. Select [Auto Detect] to update the result.
   b. Select [Accept Result] to save the result.

   The measurement results will be displayed in the results window.

14.6 Auto HRI Measurement (Smart HRI)

Smart HRI is an auto measurement method for Hepatorenal Index (HRI). HRI is the brightness ratio of liver to right renal cortex. The procedure is as follows:

1. Scan the proper image.
2. Select the Smart HRI measurement item from the menu.

3. The system positions the ROI of Liver (marked by L) and the ROI of right renal (marked by RC) automatically. The measurement results are displayed on the screen

   If necessary, move the ROI or use <Angle> to adjust the size of the ROI. Press <Update> to switch ROIs.

4. Press <Set> to confirm the measurement.

14.7 Abdomen Measurements

Used for measurements of abdominal organs and large abdominal vessels.

Perform the following procedure:

1. Select the abdomen exam mode.
2. Select the desired imaging mode.
3. Start the scan and obtain the required image.
4. Select the Measure button to enter the Application Measurements.
5. Select the desired measurement tool from the measurement menu to perform the measurement.

14.8 Reproduction Measurements

Used for animal reproduction related parameters.

Perform the following procedure:

1. Select the reproduction exam mode.
2. Select the desired imaging mode.
3. Start the scan and obtain the required image.
4. Select the Measure button to enter the Application Measurements.
5. Select the desired measurement tool from the measurement menu to perform the measurement.

14.8.1 Multi-fetus Exam

The system allows multi-fetus examination.

NOTE:

Ensure that the Fetus displayed in the multi-fetus measurement menu is the one on which you are intended to perform the measurements.

Perform the following procedure:

1. Set the number of fetuses in [Gestations] via [Animal Info] > [REP].

If the [Gestations] is set to a value larger than 1, the [Fetus] widget displays in the reproduction measurement menu.

You can switch among [Fetus A], [Fetus B] …etc via the widget.

2. Perform measurement to the fetus respectively.

   The measurement results in the result window are marked with fetus label A, B...

3. In the Reproduction report, select [Fetus A], [Fetus B]…etc to switch among results of different fetuses.

14.8.2 Testis

Function: measures the Testis L, Testis H and Testis W.

TIP:

Needs to be measured on the left and right sides respectively.

Perform the following procedure:

1. Select [Testis] in the measurement menu.
2. Use the Distance measurement method in 2D General Measurements to measure the Testis L, Testis H and Testis W.

14.8.3 Epididymis

Function: measures the Epididymis L, Epididymis H and Epididymis W.

NOTE:

Needs to be measured on the left and right sides respectively.

Perform the following procedure:

1. Select [Epididymis] in the measurement menu.
2. Use the Distance measurement method in 2D General Measurements to measure Epididymis L, Epididymis H and Epididymis W.

14.8.4 Mass

Function: measures the Mass L, Mass W and Mass H, as well as measuring the Nip.-Mass Dist. and Skin-Mass Dist. Up to 10 masses can be measured.

Taking Mass1 as an example, the procedure is as follows:

1. Select [Mass1] in the measurement menu.
2. When measuring breast masses, select [Position] to record the mass position.
3. Select [Side: X] to record the mass side.

4. Use the Distance tool in the 2D General Measurement to measure Mass1 L, Mass1 W and Mass1 H.
5. Use the Distance tool in the 2D General Measurement to measure the Nip.-Mass Dist. and Skin-Mass Dist.

   The measurements are recorded in the report.

14.9 Cardiology Measurements

Used for left ventricle function measurements and measuring main artery and vein parameters, etc.

NOTE:

- The heartbeat of the traced spectrum in VTI measurement should be equal to that preset, otherwise the obtained HR (Heart Rate) will be incorrect.
- Some application items in the measurement preset library (and matching list in the results assignment) are displayed different from those in the measurement menu and results window.
  In the preset library (and matching list in the results assignment), the item is followed with the word indicating the mode or location.

Perform the following procedure:

1. Select the cardiology exam mode.
2. Select the desired imaging mode.
3. Start the scan and obtain the required image.
4. Select the Measure button to enter the Application Measurements.
5. Select the desired measurement tool from the measurement menu to perform the measurement.

14.9.1 MV ALL

Measure M wave of mitral valve anterior leaflet.

Perform the following procedure:

1. Select the [MV ALL] in the measurement menu.
2. Move the cursor, press the confirm button to fix points D, E, F, A and C in turn. Corresponding character symbol will display at the right side of the point.
3. After D point and E point are fixed, MV D-E Amp and MV D-E Slope values are acquired.
4. MV E-F Slope value is acquired by fixing F point.
5. MV E Amp, MV A Amp and MV A-C Interval values are acquired by fixing A point and C point.
6. You can end measurement in advance by pressing the confirm button twice on point E, F, A or C.

14.9.2 AutoEF

Measure the diastole and diastole planes automatically.

TIP:

- Only cardiac exam mode supports this function.
- Recommend to connect ECG. Capture the cine of standard A2C and A4C planes, and select cardiac cycles which have the clear plane of the cardiac muscle and less interference to perform AutoEF measure.

Perform the following procedure:

1. Select the [AutoEF] in the measurement menu.
2. In apical two-chamber view, measure the following parameters:
   - Left ventricular endocardium at end-diastolic, the EDV (A2C) is obtained automatically.
   - Left ventricular endocardium at end-systolic, the ESV (A2C) is obtained automatically.
3. In apical four-chamber view, measure the following parameters:
   - Left ventricular endocardium at end-diastolic, the EDV (A4C) is obtained automatically.
   - Left ventricular endocardium at end-systolic, the ESV (A4C) is obtained automatically.

   If the weight has already been entered, the SV, EF, SI, EDV Index and ESV Index are calculated.
4. Select the HR source: ECG, HR(R-R) measurement or entered.

   ECG obtains the HR automatically. If ECG is not connected, it should start HR on the menu.

   The CO and CI are calculated automatically using the entered weight value.

14.9.3 Left Ventricular Function

This group of studies estimates the Left Ventricular (LV) diastolic and systolic capabilities using a series of clinical indices measured on the B or M image. As well as calculating the left ventricular volume and end diastole and end systole, they may calculate the following indices (not all indices are calculated in every study, see the Study Results table for each study for reference).

NOTE:

- The HR value entered manually should be within the range 1~999.
- Left Atrium (LA) Simpson has the same calculation method as LV Simpson.

S-P Ellipse

Perform the following procedure:

1. Select [S-P Ellipse] in the measurement menu.
2. In apical long-axis view at end-diastole, measure the following parameters:
   - LVLd apical
   - LVAd apical

The EDV value is then calculated.

3. In apical long-axis view at end-systole, measure the following parameters:

   – LVLs apical
   – LVAs apical

   The ESV value is then calculated.

   The system calculates the SV and EF.

   If the weight has already been entered, the SI, EDV Index and ESV Index are calculated.

4. Select the HR source: HR(R-R) measurement, ECG or entered.

   The CO and CI are calculated automatically using the entered weight value.

B-P Ellipse

Perform the following procedure:

1. Select [B-P Ellipse] in the measurement menu.
2. In left ventricular short-axis view, measure the following parameters:

   – At end diastole: LVIDd
   – At end systole: LVIDs

3. In short-axis view at mitral valve level, measure the following parameters:

   – At end diastole: LVAd sax MV
   – At end systole: LVAs sax MV

4. In apical long-axis view, measure the following parameters:

   – LVAd apical, the EDV is calculated
   – LVAs apical, the ESV is calculated

   The system calculates the SV and EF after the LVAs apical has been measured.

   If the weight has already been entered, the SI, EDV Index and ESV Index are calculated.

5. Use the menu to select the HR source: ECG, HR(R-R) measurement or entered.

   The CO and CI are calculated automatically using the entered weight value.

Bullet

Perform the following procedure:

1. Select [Bullet] in the measurement menu.

   In apical long-axis view, measure the following parameters:

   – At end diastole: LVLd apical
   – At end systole: LVLs apical.

2. In short-axis view at mitral valve level, measure the following parameters:

   – At end diastole: LVAd sax MV, the EDV is calculated

– At end systole: LVAs sax MV, the ESV is calculated

The system calculates the SV and EF.

If the weight has already been entered, the SI, EDV Index and ESV Index are calculated.

3. Use the menu to select the HR source: ECG, HR(R-R) measurement or entered.

   The CO and CI are calculated automatically using the entered weight value.

Mod.Simpson

Perform the following procedure:

1. Select [Mod.Simpson] in the measurement menu.
2. In apical long-axis view, measure the following parameters:
   – At end diastole: LVLd apical
   – At end systole: LVLs apical
3. In short-axis view at mitral valve level, measure the following parameters:
   – At end diastole: LVAd sax MV
   – At end systole: LVAs sax MV
4. In short-axis view at papillary muscle level, measure the following parameters:
   – At end diastole: LVAd sax PM, the EDV is calculated
   – At end systole: LVAs sax PM, the ESV is calculated

   The system calculates the SV and EF.

   If the weight has already been entered, the SI, EDV Index and ESV Index are calculated.
5. Use the menu to select the HR source: ECG, HR(R-R) measurement or entered.

   The CO and CI are calculated automatically using the entered weight value.

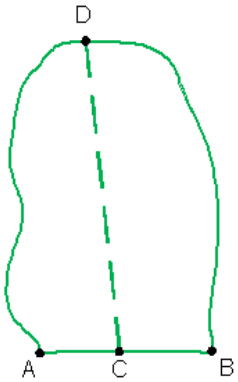
Simpson single plane measurement (measure apical A2C or A4C only)

Perform the following procedure:

1. Select [Simpson] in the measurement menu.
2. Measure the endocardium.

   The endocardium can be measured using trace, spline or auto, click items on the menu to select the method.

Methods	Operations
Trace	Trace the endocardium along the edge of the target area using a method similar to Trace method in 2D Area measurements, then set the long axis.
Spline	Set reference points (up to 12) along the edge of the endocardium using a method similar to Spline method in 2D Area measurements, then set the long axis.

Methods	Operations
Auto	Follow the steps below: **1.** Set points A and B using the trackpad and the confirm button, where A: Left ventricular interventricular septal and mitral valve junction; B: Left ventricular wall and mitral valve junction; **2.** After setting A and B, the cursor will be automatically displayed at point D (where is considered as the apical part by system detecting). After point D is set, the long axis (line segment CD) and the line that traces the endocardium are displayed. Where C: Midpoint of A and B. D: Apical part of left ventricle.  **3.** You can do the following operations: Adjust the long axis: Move the cursor on the long axis (which turns yellow), then press the confirm button; Move the cursor to adjust point D (with point C unchanged) after the cursor changes to ✣. Adjust the trace line: Move the cursor to position the cursor on the trace line (which turns yellow), and then press the confirm button; Move the cursor along the endocardium edge to adjust the line after the cursor changes to ✣. **4.** Press the confirm button outside the line to confirm the adjustment.

– Measure the left ventricular endocardium at end-diastolic and set the long axis, the EDV is obtained.
– Measure the left ventricular endocardium at end-systolic and set the long axis, the ESV is obtained.

The system calculates the SV and EF.

If the weight has already been entered, the SI, EDV Index and ESV Index are calculated.

3. Use the menu to select the HR source: ECG, HR (R-R) measurement or entered.

The CO and CI are calculated automatically using the entered weight value.

Simpson Bi-plane measurement

⚠ CAUTION

When using Simpson to measure LV function, be sure to keep the apical four-chamber view and apical two-chamber view perpendicular. Otherwise the measurement result will be incorrect.

Perform the following procedure:

1. Select [Simpson] in the measurement menu.
2. In apical two-chamber view, measure the following parameters:
   - Left ventricular endocardium at end-diastolic and set the long axis, the EDV(A2C) is obtained
   - Left ventricular endocardium at end-systolic and set the long axis, the ESV(A2C) is obtained
3. In apical four-chamber view, measure the following parameters:
   - Left ventricular endocardium at end-diastolic and set the long axis, the EDV(A4C) is obtained
   - Left ventricular endocardium at end-systolic and set the long axis, the ESV(A4C) is obtained

   If the weight has already been entered, the SV, EF, SI, EDV Index and ESV Index are calculated.
4. Select the HR source: ECG, HR(R-R) measurement or entered.

   The CO and CI are calculated automatically using the entered weight value.

LV (2D)

TIP:

- In the [Setup] > [System] > [Application] screen, you can set the method for the Cube/Teichholz/ HR study.
- Select [Property] in [Setup] > [Measure] to select formula for LV measurement by selecting result items: Cube, Teichholz or Gibson.

Taking the method using LVIDd, LVIDs, HR as an example.

Perform the following procedure:

1. Select [LV (2D)] in the measurement menu.
2. Measure LVIDd in 2D or M mode.

   The LVIDd and EDV are obtained.
3. Measure the LVIDs in 2D or M mode.
   - The LVIDs and ESV are obtained.
   - The system calculates the SV, EF and FS.
4. Using the menu to select the HR source: ECG, HR(R-R) measurement or entered.

   If the weight has already been entered, the SI, CO, CI, EDV Index and ESV Index are calculated.

The MVCF is calculated if the LVET is measured.

14.9.4 Left Ventricular Mass (LV Mass)

Estimates the Index of Left Ventricular Mass (LV Mass-I) by calculating the LV Mass.

$$\text{LV MASS-I (No unit)} = \text{LV Mass (g)} / \text{Body Surface Area } (m^2)$$

LV Mass (Cube)

Perform the following procedure:

1. Select [LV Mass (Cube)] in the measurement menu.
2. At end diastole, measure the following parameters:
   - IVSd
   - LVIDd
   - LVPWd

   The LV Mass (Cube) is calculated.

   If the weight has already been entered, the LV Mass-I(Cube) is calculated.

LV Mass (A-L)

Perform the following procedure:

1. Select [LV Mass (A-L)] in the measurement menu.
2. In long-axis view at end diastole, measure the LVLd apical.
3. In short-axis view at papillary muscle level at end diastole, measure the following parameters:
   - Endocardium area: LVAd sax Endo
   - Epicardium area: LVAd sax Epi

   The LV Mass (A-L) is calculated.

   If the weight has already been entered, the LV Mass-I(A-L) is calculated.

LV Mass (T-E)

Perform the following procedure:

1. Select [LV Mass (T-E)] in the measurement menu.
2. In short-axis view at papillary muscle level at end diastole, measure the following parameters:
   - Endocardium area: LVAd sax Endo
   - Epicardium area LVAd sax Epi
3. Measure a and d.

   The LV Mass (T-E) is calculated.

   If the weight has already been entered, the LV Mass-I(T-E) is calculated.

14.9.5 Mitral Valve Area (MVA)

The Mitral Valve Area (MVA) can be calculated using two methods: pressure half time (PHT) or velocity-time integral (VTI).

The MVA Calculation by PHT method should be performed in CW mode.

$$\text{MVA (PHT)} (cm^2) = 220 / \text{MV PHT (ms)}$$

14.9.6 AVA (VTI)

The Aortic Valve Area (AVA) can be calculated by velocity-time integral (VTI). The measurements should be performed on 2D and Doppler images

14.9.7 LA Vol

LA Vol. (Left Atrium Volume) used to estimate the size of the left atrium.

LA Vol(A-L)

Estimates the Left Atrium Volume using area and length.

LA Vol (Simp)

Estimates the left atrium volume using the Simpson method. Performed at apical two-chamber view and apical four-chamber view.

14.9.8 LV Tei Index

The LVIMP (Left Ventricular Index of Myocardial Performance) is used to analyze the integrative ventricular diastolic and systolic capabilities.

14.9.9 RVSP

The RVSP (Right Ventricular Systolic Pressure) measures the right ventricular systolic pressure.

Perform the following procedure:

1. Select [RVSP] in the measurement menu.
2. Measure the TR Vmax in Doppler mode.

   The TR PGmax is calculated.
3. Select [RAP] in the [RVSP] sub-menu and select (or enter) the pressure in the dialog box which appears, as shown in the figure below:

   The range of input values is [0, 50.0 mmHg].
4. Click [OK] after selecting (or entering) the pressure. The RAP is obtained.

   RVSP is calculated.

14.9.10 PAEDP

The PAEDP (Pulmonary Artery End Diastolic Pressure) measures the pulmonary artery end diastolic pressure.

14.9.11 RVIMP

The measurement of RVIMP (Right Ventricular Index of Myocardial Performance) is similar to that of LVIMP.

14.9.12 Qp/Qs

Flow ratio of pulmonary circulation and systemic circulation.

14.9.13 PISA

The PISA (Proximal Isovelocity Surface Area) is used in the quantitative analysis of the mitral valve regurgitation (PISA MR), aortic valve regurgitation (PISA AR), tricuspid valve regurgitation (PISA TR) and pulmonary valve regurgitation (PISA PR) in color mode.

The PISA measurement procedure is as follows:

1. Start PISA and move the semicircular caliper by using the trackpad.
2. Fix the center of the semicircular caliper by pressing the confirm button.
3. Adjust the radius length orientation of the semicircular caliper by using the trackpad.
4. Press the confirm button to fix the caliper.

PISA MR

Mitral valve regurgitation (PISA MR) needs to be measured in Color and Doppler modes.

Perform the following procedure:

1. Enter color mode and adjust the color map until the aliasing appears.
2. Select [PISA MR] in the measurement menu.
3. Measure MR Rad using the PISA caliper.

   Input MR Als.Vel.
4. Measure the MR spectrum using Trace to obtain:

   – MR Vmax
   – MR VTI

   The MR Flow, MR Flow Rate and MR EROA are calculated automatically.

   If the MV SV is measured, the MR Fraction will be calculated automatically.

PISA AR

Aortic valve regurgitation (PISA AR) needs to be measured in Color and Doppler modes.

Operating procedures is the same as the PISA MR measurement.

PISA TR

Tricuspid valve regurgitation (PISA TR) needs to be measured in Color and Doppler modes.

Operating procedures are the same as the PISA MR measurement.

PISA PR

Pulmonary valve regurgitation (PISA PR) needs to be measured in Color and Doppler modes.

Operating procedures are the same as the PISA MR measurement.

14.10 Small Parts Measurements

Used for small parts such as the animal superficial and musculoskeletal.

Perform the following procedure:

1. Select the small parts exam mode.
2. Select the desired imaging mode.
3. Start the scan and obtain the required image.
4. Select the Measure button to enter the Application Measurements.
5. Select the desired measurement tool from the measurement menu to perform the measurement.

14.11 Vascular Measurements

Vascular measurements are mainly used for carotid, cerebral, upper and lower extremity vessels.

Perform the following procedure:

1. Select the vascular exam mode.
2. Select the desired imaging mode.
3. Start the scan and obtain the required image.
4. Select the Measure button to enter the Application Measurements.
5. Select the desired measurement tool from the measurement menu to perform the measurement.

14.11.1 ICA/CCA (PS)

Function: measures the flow velocity ratio between ICA and CCA to calculate the stenosis.

Perform the following procedure:

1. Select [ICA/CCA (PS)] in the measurement menu or the touch screen.

2. Measure the PS value of the ICA and CCA in Trace, and the system calculates the stenosis. Where, the ICA value adopts the maximum PS value of proximal, middle and distal and the CCA adopts the latest measured value after changing the Prox./Mid./Dist. attribute (the default CCA adopts the distal PS value).

14.11.2 IMT

NOTE:

The IMT measurement is available on frozen (or history) linear array images only.

TIP:

- Make sure that you select the correct vessel wall (Near/Far) before the IMT measurement. Otherwise the intima may be recognized incorrectly due to different algorithms that are applied in near/far wall recognition.
- To achieve a good trace result, try to place the ROI box parallel with the vessel and adjust the box size to reduce unwanted interference.

IMT (Intima-Media Thickness) measures the distance between LI (Lumen-Intima) and MA (Media-Adventia).

The IMT values at 4 positions: CCA (Common Carotid Artery), ICA (Internal Carotid Artery), ECA (External Carotid Artery) and Bulb (Bulbillate) need to be measured here.

Perform the following procedure:

1. Enter the IMT exam mode, scan and freeze the image (or review a historic image).
2. Select [IMT] in the measurement menu and enter the IMT measurement.
3. Select the side (Left/Right), angle and vessel wall (Near/Far).
4. Select an item such as [ICC, IMT], and the ROI box displays on the screen.
   - It appears as  when Near is selected
   - It appears as  when Far is selected
5. Move the ROI box to the desired position, then press <Set>. Two auto trace lines appear in the box.

   While the ROI box is green, you can:
   - Adjust the size of the ROI box.
   - Trace manually

     Move the cursor to a trace line. The trace line turns yellow. Press <Set>.

     Move the cursor along the interface of the vessel. Press <Set> to confirm the trace after re-adjusting.
   - Erase the trace lines inside the box by pressing <Clear>. (Long press <Clear> to clear all measurement calipers on the screen.)

6. Press <Set> outside the box to confirm the adjustment result after the manual trace is complete. The results are recorded in the IMT report.

   The system calculates:
   – IMT Max.
   – IMT Min.
   – IMT Mean
   – IMT SD
   – IMT ROI Length
   – IMT Measure Length
   – IMT Quality Index

   The Quality Index indicates the reliability of one measurement. Manual trace or re-scan of an image with clear endocardium edges is recommended if the Quality Index value is small.

   For multiple measurements on the same side, vessel and angle, the system calculates the following parameters in the report:

   – Average Mean IMT
   – Average Max IMT
   – Standard deviation

   It also provides the Composite Mean IMT, which is an overall mean value of all IMT mean values derived from the measured items.

14.12 Report

The report records measurement results, which are automatically saved by the system after each measurement.

14.12.1 Viewing Current Report

Select the Report button to enter the report dialog box. The default report of the current exam appears.

- Each measurement contains the latest values and a final value.
- The report only displays results of tools that are displayed in the report template by default and are completed, as shown in the figure above.
- Select [Previous] or [Next] to switch between pages if the report has more than one page.
- After viewing, select the Freeze button, or select [Cancel] or [OK] to exit the report page.

Editing Measurement Data

⚠ CAUTION

Input appropriate data when editing the measurement values, otherwise misdiagnosis may occur.

NOTE:

- Only measurement values are editable while calculation values are not.

- After a measurement value is modified, the average value of the tool and the corresponding calculation value will be updated automatically.

The measurement values in the text boxes are editable. Move the cursor to the text box and press the confirm button.

The modified value(s) is/are underlined.

The final value displays in the [Value] column. Select an option ([Last], [Avg], [Max] or [Min]) from [Method] to determine the method in which the final value is calculated.

Entering Ultrasound Remarks

In the [Comments] box, enter the corresponding information.

You can also save or load the comments.

- Save comment: enter information in the Comments box and then select [Save Comment] to save current information in the report comment database.
- Load comment: select [Load Comment] to open the dialog box to check history saved comment information. You can select related information to add to current report comment or select the location of the comments.

Selecting Images

Images saved for the current exam can be added to the report.

Perform the following procedure:

1. Select [Add Picture] on the report page.
   - Left Column: Images saved for the current exam.
   - Right Column: Images selected to add to the report.
2. Select the image.
   - Add/Remove the image by using [>], [>>], [<] and [<<].
   - Select an image in the right column and select [Move Up] or [Move Down] to adjust the sequence in which the images are arranged in the report.
3. Select [OK] to confirm.

Analyzing Report Data

You can preset and edit anatomy information for the Vascular report.

Perform the following procedure:

1. Select [Analyze].
2. Select or enter anatomy descriptions.

   Use the [Previous]/[Next] buttons to switch between pages.
3. Select [OK] to confirm. Analysis information displays after the measurement values in the report.

14.12.2 Viewing History Reports

NOTE:

History reports can be viewed, but cannot be edited.

If more than one exam is performed for an animal, an [Exam] drop-down list appears in the top-right part on the report.

Perform the following procedure:

1. Select previous exams from the [Exam] drop-down list.
2. According to the exam mode, select a proper template from the [Report Type].

   Make sure the template matches the exam mode, otherwise the measurement result will not display correctly.
3. View the history report.

14.12.3 Report Setting

Select [Setting] to generally change the report display.

Item	Description	
Measurement	Show all measurement results	Display all measurement results of each item for printing.
	Show all fetus data in one report	After clicking it, the report chooses and prints the multi-fetus data simultaneously.
Ultrasound Image	Select the ultrasound image to be printed. Then, set the image layout for printing. If checking “Ink-Saving Mode”, the ultrasound image is printed in white background.	
Analyze	Select to print the added analysis.	
Comments	Select to print the comment column.	
Simple Mode	If it is selected, the report will be displayed in a compact layout.	
Ink-Saving Mode	If it is selected, the printing background color is white. If it is deselected, the printing background color is black.	
Text Enhancement Mode	If it is selected, characters on probe parameter area, animal information area and image parameter area will be printed in bold.	
Font Size	Set the font size for report viewing screen.	
Print Font Size	Set the font size for report preview screen and for printed report.	

Item	Description	
Method	2D/M/D Mode	Select the method in which the final value is calculated for 2D/M/D mode. Follow the steps below: **1.** Select the method for the corresponding imaging mode. **2.** Save the method settings by using the following buttons: • [Apply]: Save the selected methods to the current exam only. • [Save As Default]: Save the selected methods to all the exams. ***NOTE:*** The sign "*" means methods for the same mode are not the same.

14.12.4 Printing Reports

Select [Print] to print the report.

Or select [Preview] to preview the report. On the preview page, you can:

- Select [Print].
- Select [Prev Page] or [Next] to view the previous or next page.
- Select a zoom ratio from the drop-down list.
- Select [Close] to exit the preview.

14.12.5 Save/Load Report

After the report template is edited, the history report archived in the system will change at the same time. The user may print or export the current report to make a copy in advance.

TIP:

The function is disenabled for anonymous animal.

Save report

Perform the following procedure:

1. Under report status, select [Save Report].

2. Select the path to save:

– Local: click [Save] to save the information in the current report to local.
Select [Load Report] to view the reports saved locally.

– Other Medium: if “Export Editable Document” is selected, an editable document will be exported. Click [Save], and enter the name of the file to be exported in the displayed dialog box, then click [OK] to export the report to the external storage device.

  You can also create, delete and rename the export directory.

  The exported report can be read and edited on the PC.

Load Report

Select [Load Report] to bring up the history report dialog box, click to select a report to export or print.

15 Animal Data Management

An exam record consists of all information and data of one exam.

An exam record consists of the following information:

- Animal basic information and exam data
- Image files
- Report

NOTE:

- DO NOT use the internal hard drive for long-term image storage. Daily backup is recommended. External storage media is recommended for archiving images.
- The system animal database space is limited, please back up or clear animal data in time.
- Selecting the compressed format to export the image may cause image distortion.
- The manufacturer is not responsible for lost data if you DO NOT follow suggested backup procedures.

15.1 Storage Media

System supported memory media including:

- System hard disk
- USB memory devices: USB flash drive, removable USB hard disk
- Optical disk.

15.2 Image File Formats

The system supports file formats which belong to the system and file formats which are PC-compatible.

System-relevant formats

- Single-frame image file (FRM)

  Refers to single-frame static image files not to be compressed; you can perform measurements and comments adding on this type of files.
- 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.

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 files
  Multi-frame export format.
- DICOM files
  DICOM standard files format, single-frame or multi-frame format, used to record animal information and images; you can only open DCM files to view rather than to edit.

15.3 Saving Images and Cines

15.3.1 Storing an image

To save a single-frame image to the system quickly

Select the user-defined button for “Save Image” to save the image.

- The image format is FRM in the imaging interface.
- When a dialog box is displayed on the current screen, select the user-defined button to save the screen.

To save a full screen image to the system quickly

Select the user-defined button for “Full Screen” to save the image.

The full screen image is saved to the default path with the default name. The thumbnail of this image will appear in the thumbnail area on the screen. When you move the cursor onto the thumbnail, its file name with suffix will be displayed.

To save images to a USB flash drive

Select the user-defined button for “Save Image to USB Disk” to save the image to the USB flash drive.

15.3.2 Storing a Cine

To save a cine in real-time mode (Live capture)

Live capture refers to saving the images or cines in image scanning status; after the storage, the system continues image scanning.

Live capture can be divided into 2 kinds: retrospective and prospective.

- Retrospective saving is to save the specified images before the current moment; to save the images stored in the cine memory to the system hard disk.

- Prospective saving is to save the specified images later than the current moment; to save the images to both the cine memory and the system hard disk.

The live capture time can be set in “Cine” tab page.

In imaging mode, select [Pro Capture] / [Retro Capture].

TIP:

- Select the Save button again or the Freeze button to stop saving.
- When a saving is completed, a thumbnail displays in the Thumbnail area.

To save a cine in frozen mode

In frozen mode, select [Pro Capture] / [Retro Capture].

After the cine is successfully saved, there is a thumbnail displayed on the screen.

To export cine file to a USB Flash Drive

Use the user-defined button to export the cine to the USB flash drive (not saved to the local path).

The file is stored in the directory: X (USB flash drive name): animal name+ ID\exam type + exam time \ image ID.

1. Perform the scan and freeze the image.
2. Select the user-defined button for “Send Cine to USB Disk” to save the images to the USB flash drive.

15.3.3 Setting Cine Length

NOTE:

The system ends up saving if the cine length goes beyond the maximum value.

Prospective Cine Length for Live capture

Prospective cine duration: set the time that the user selects [Prospective] as the start time. The system proceeds saving the cine.

Select [Cine] tab, and use [Time (Pro)] to adjust it.

You can set the cine file length in “General Preset” in the *Setup* chapter.

- With the ECG disabled: select [Cine] tab, and use [Time (Pro)] to adjust it.
- With the ECG enabled: select [Cine] tab. Select [Saving type (Post)] to choose the type of the saving time and the cardiac cycles. Use [Time (Post)] or [Cycle (Post)] to adjust it.

Retrospective Cine Length for Live capture

Retrospective cine duration: set the time that user selects [Retro] when playing the first frame of the image. It also refers to saving the cine or cycles retrospectively.

- With the ECG disabled: select [Cine] tab, and use [Time (Retro)] to adjust it.
- With the ECG enabled: select [Cine] tab. Select [Saving type (Retro)] to choose the type of the saving time and the cardiac cycles. Use [Time (Retro)] or [Cycle (Retro)] to adjust it.

Freeze storage setting

The first frame of the image starts when selecting the Freeze button at the first time. The system saves the cine in the auto review scope retrospectively.

Select the Freeze button to freeze the image. Use [Time (Retro)] to set the cine time of retrospective saving in frozen status under Cine page, or mark the start frame in the auto review scope to set the cine time of retrospective saving in frozen status.

TIP:

It is only available to save the cine retrospectively in the frozen status.

15.4 Image File Process

15.4.1 Thumbnails

The stored images or cineloops are displayed in the form of thumbnails on the screen:

- During image scanning, thumbnails of the current exam display in the Clip board/Thumbnails Area of the screen.
- In the iStation screen, the thumbnails of the current selected animal display at the bottom of the screen. When you move the cursor onto a thumbnail, its name and format will display.
- In the Review screen, the thumbnails refer to the images stored in the same exam. When you move the cursor onto a thumbnail, its name and format will display.

  In the Review screen, open images to enter the image analyzing status, all the thumbnails belong to the exam are displayed.

15.4.2 Image Review

You can review all images stored in an exam, and send, delete or analyze the stored images.

- During image scan, saved image thumbnails will display on the right of the screen. Move the cursor onto a thumbnail, and press the confirm button twice to open the image; if the stored image is a cine file, double-click the thumbnail to enter the auto cine review.
- To enter image review:
  - Select the Review button to enter review page. Images of the current exam and the current animal are displayed.
  - Select an exam of an animal in the iStation screen, then select [Review] or double-click the exam to enter the Review screen to review the images of the animal.

15.4.3 Image Compare

Image Compare in Review Mode

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 mode image, you can select at most 2 images

Perform the following procedure:

1. Select [Compare] in iStation screen or Review screen.
2. Select the images for comparison.

   Select the image, and the icon ☆★ appears on the image, which indicates the image is to be compared.

   If select the wrong image, click the image again to cancel the selection.

   – Select image size display on “Thumbnail Size” bar to display more images at a time.
   – Image compare of different exams for the same animal: Select “all” in the drop-down list of “Exam History” to see all exam files, then you can select different images of different exams to compare.
3. Repeat the steps above to add the image to be compared.

   There is “Display” column you can filter the images by selecting “All Items”, “Selected”, “Unselected”.

   Select [Clear Selected] to clear all selected images.
4. Select [OK] to enter image comparison.
5. Switch the multi-frame cine among the windows to review (single-frame image cannot be reviewed).

   – Select the Dual button to toggle between the two images.
   – Select the Quad button to switch among 3-4 images.

   The window with the highlighted “M” mark is the current activated window.

   You can select the image to be reviewed at synchronous time when the multi-frame image is reviewed by using [Sync Play].
6. Save the image if necessary.
7. Select [Return] on the screen or select the Freeze button to exit image compare.

Frame Compare

TIP:

Cine compare can only be performed for B/C mode image only. The image on dual/quad window cannot be compared.

Perform the following procedure:

1. Freeze the image in B/C mode, select [Frame Compare] to enter frame comparison mode.
2. Review the images of different image windows (cine replaying can't be performed for single-frame image file), select the Update button or the Dual button to switch the active image window.
3. Save the image if it is necessary.

   Measurements, adding comments and body marks are allowed.
4. Select [Frame Compare] again to return to image frozen status; select the Freeze button to enter real-time imaging.

15.4.4 Image Analysis

In the image analysis status, you can view, zoom, perform post processing and measurements, add comments and perform cine review for a stored image (FRM or CIN format). The operation steps are the same as those for real-time scanning; please refer to relevant sections for details.

1. To enter image analysis:
   - In the image scanning or freeze status, double-click a thumbnail stored in this exam to enter the image analysis status; or
   - In the image review status, double-click the selected thumbnail to open the image.

   You can perform cine review operations in image analysis status.
2. To exit the image analysis:
   - Select the Freeze button to exit and enter the real-time scan status.
   - Select [Return] to exit from the image analysis to the 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.

15.4.5 Sending Image File

NOTE:

Data saved this way can only be reviewed on the PC and cannot be restored to the ultrasound system.

Perform the following procedure:

1. Do one of the following to bring up the "Send To" screen:
   - In the main screen, select a stored image thumbnail and select ⊕ on the upper right corner of the image.
   - In the iStation screen, select a stored image thumbnail and select ⊕ on the upper right corner of the image.
   - In the Review screen, select a image and select [Send To].
2. Select from the destination.

If the transferred AVI file cannot be played normally on PC, please try to transfer the multi-frame cine file in MP4 format and try Send To function again, or use a VLC media player.

Image files sent to MedTouch/MedSight will be transferred to .png (.avi) format.

15.5 Report Management

15.5.1 Report storage

The exam reports are stored under the directory of the exam of the animal.

15.5.2 Importing, exporting and sending a report

Import/export report via Backup

In iStation screen, select animal data, select [Restore Exam] or [Backup Exam] in the popped up menu to import or export animal information, images and reports from or to an external memory device.

Perform the following procedure:

1. Select animal data, and select [Restore Exam] or [Backup Exam].
2. Select the destination.
3. Select whether to remove from local HD after Backup:
   - If “Remove Exams” is selected, the animal information and images are removed.
   - If “Remove Images” is selected, only the animal images are removed.
4. Select whether to hide the animal information.
5. Select whether to encrypt backup exams for USB only: input the password and confirm password in the field box. Select [Backup], a “VetM.7z” compressed package is backed up to the USB device, and you need to input the password to open the package.

   NOTE:

   - If the password is forgotten, you cannot open the backup package.
   - The password cannot be multi-language or Chinese characters.

Export report via Send To

In the iStation or Review screen, select [Send Exam] or [Send To] to send animal data to an external memory device (USB disk or disc) or network storage, you can choose if reports are exported.

Perform the following procedure:

1. Check “Export Report” on the screen.
2. Select report type to be exported.
3. Select [OK] to confirm.

   The size of the report can be set for the report print, see the *Setup* chapter.

15.6 Animal Data Management (iStation)

The animal data include basic animal information, exam information, image files and reports.You can search, view, backup, send, restore, delete or export animal data in iStation.

Do one of the following to enter iStation:

- Select <iStation> button.
- Select [iStation] on the Animal Info screen.

15.6.1 Searching an Animal

Perform the following procedure:

1. Select the data source.

   Select [Data Source] to select the data source of animal data, the system animal database is default.

2. Set search conditions in the “Item” drop-down list.

3. Enter the key word. The matching animal information is displayed in the animal list.

4. When you select an animal in the animal list, the images of this animal will be displayed at the bottom of the screen.

15.6.2 Animal Data View and Management

Select the desired animal information in the list.

Item	Description
Review an image	Select an exam of an animal, select [Review Image] to enter Review screen.
Animal Information	Select an exam of an animal, select [Animal Info] to check the animal information of this exam.
Review Report	After you select an exam of an animal, select [Review Report] to view the report of this exam for this animal.
Delete Exam	• Select the animal record. Select [Delete Exam] to delete the exam. However, you cannot delete animal data being printed, exported or sent, or delete the current exam. • To delete an image, select the image and select .
Backup Exam	You can back up the selected animal data to the system-supported media in order to view it on PC, or restore the animal data to the system from an external media. The exam after being backed up can be restored to the system for another review. Click to back up the selected animal data to the system-supported media. • Original format: to back up the data in original format. • DICOM format: you can change the cine compression mode, and JPEG compression mode. • You can select whether to remove images or the whole exam record from the system.

Item	Description
Restore Exam	Import the animal data from an external media.
Send Exam	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 animal record, select [Send Exam] in the menu to send exam data or images of the selected record. **2.** Select from the destination, and set related settings.
Annotation an exam	Select an exam and select [Annotation Exam] to add annotation. In the popped-up screen, you can also review the history annotations for the selected exam.

15.7 Recycle Bin

The recycle bin is used to store deleted animal data, exam data and images.

The system supports recovery of these data from the recycle bin.

Select in the System status icon area of the screen (when the button is gray, the operation is unavailable) to enter the Animal Recycle Bin screen.

To recover the deleted animal data

NOTE:

If the capacity of the recycle bin exceeds 200. The system reminds the user to clean. Follow the procedures below to clean the recycle bin.

Perform the following procedure:

1. Select items to be recovered in the list.

2. Select operations:

- Select [Restore Items] to restore the item back to iStation.
- Select [Delete] to delete the item permanently, and the item can never be restored again.
- Select [Restore All Items] to restore all the items back to iStation.
- Select [Empty Recycle Bin] to empty the recycle bin and all items can never be restored again.
- Select [Exit] to exit the recycle bin.

To set maximum number of days or deleted data to be kept in the recycle bin

NOTE:

The animal exams which exceed the preset maximum will be deleted and unrecoverable, it is recommended to perform animal data backup before enabling this function to avoid data loss.

Perform the following procedure:

1. Input the desired number besides “Maximum number of days to be kept”.

   If the input box is left blank, the feature will not be enabled.

   Only the whole number ranging from 1 to 365 can be input.

2. Select [Modify].

15.8 iStorage

TIP:

To use iStorage function, you need UltraAssist software in 2.0 version (with V1.0 network protocol); consult the Customer Service Department or your local distributor for details.

Network storage is used to save image files and measurement reports to the remote PC server.

For network storage setting, see the *Setup* chapter.

1. Enter iStation screen, select one (or more than one) animal data or image in the local data source.
2. Select [Send Exam].
3. Select [iStorage] in the “Send To” dialog box, and select the PC server of the right side.
4. Select PC transfer format and check whether to send report.
5. Select [OK] to start sending.

15.9 u-Link (applicable for CE region only)

u-Link is used to connect the ultrasound system with software applications which support the u-Link protocol.

15.10 Print

For printer connection, see the *System Preparation* chapter.

For user-defined button for printing and video output settings, see the *Setup* chapter.

15.10.1 Image Print

For DICOM image printing, see the *Setup* chapter. Video printer is applied in image print service.

Perform the following procedure:

1. Select the desired image in iStation or Review screen.
2. Select ⊕ icon on the upper right side of the image, and select the printer in the popped up dialog box.
3. Select [OK] to start printing.

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

15.10.2 Report Printing

Both reports and images can be printed on a graph/text printer.

1. Select the Report button to enter the report dialog box.
2. Select [Print] to print the report.

15.11 Back up Files using the DVD Drive

⚠ 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.

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.

The system supports writing data to CD/DVD using the DVD-RW/DVD+RW drive and reading data from CD/DVD on the PC.

Perform the following procedure:

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 Animal Record dialog box.
3. Select [OK] or [Back up] to begin writing when the  symbol displays.
4. After the writing process is complete, select  to bring up the Disc Option dialog box, and select [Eject] to eject the CD/DVD.

15.12 Animal Task Management

Select  in the system status icon area of the screen to bring up the Task Management dialog box.

In the Task Management dialog box, the ID, name, destination, progress, type, contents and task created time are displayed.

You can perform the following operations:

- Select [Cancel] to delete the task.
- Select [Retry] to retry the failed task.
- Select [Select All] to select all the tasks.

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] for the image.
- iStorage task: In iStation screen, select the target exam and select [Send Exam], then click iStorage in the menu which appears.
- MedTouch/MedSight storage task:
  - In iStation screen, send exam to MedTouch/MedTouch devices.
  - In Review screen, iStation screen, thumbnail area, send the image(s) to MedTouch/MedSight devices.

Print Task

Displays image or report printing 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, select [Service Setting] to enter the DICOM service setting screen. For details, see the *Setup* 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 *Setup* chapter.

16 DICOM/HL7

NOTE:

Before using DICOM, please read the electronic file DICOM CONFORMANCE STATEMENT along with the device.

TIP:

The DICOM package is optional, so the description here is only applicable for the system configured with the DICOM package.

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

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. For detailed information about DICOM presets, see the *Setup* chapter.

16.1 DICOM Storage

DICOM Storage is used to send images (single-frame or multi-frame) or structured report to the DICOM storage server for storage.

16.1.1 Send images on iStation/Review/Main Screen

Perform the following procedure:

1. Do one of the following to select images:
   - Select <iStation> to enter the iStation page. Click to select an animal or an exam record in the list. Thumbnails are displayed in the thumbnail area in the lower part of the screen, and then click to select a thumbnail or the cine. Or, select an exam or exams from the animal list (there should be images for this exam).
   - On the main screen, select a thumbnail or the cine.
2. Select in the top-right part or [Send To] to bring up 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, and click [OK].

16.1.2 To send images using a shortcut button

You can save single-frame images or multi-frame images to a DICOM server while saving to hard drive using a shortcut button.

TIP:

To define the shortcut button, for details see the *Setup* chapter.

Start the ultrasound exam scan. Select the user-defined button to send the image or the cine to DICOM storage.

16.1.3 To send images to storage after an exam ends

TIP:

To preset Sending/printing after End Exam, for details see the *Setup* chapter.

Start the ultrasound exam scan. Select the End Exam button to send the image or the cine to DICOM storage automatically.

16.1.4 Encapsulate PDF

Encapsulate PDF refers to the PDF file is encapsulated in DICOM IOD.

Encapsulated PDF is sent by following the procedures below:

- Send in the unit of single exam.
- The exam with the state of End, Cancel or Stop cannot be sent as encapsulated PDF.
- Check “Encapsulate PDF” in the storage service preset.
- If there is an exam result in the report template, this type of exam should be performed.

Sending the exam or archiving the exam can send the encapsulated PDF file.

16.1.5 Unload DCM file

The image can be unloaded to DCM format and send to the storage media, iStorage.

Perform the following procedure:

1. Select the image, and click ⊕.
2. Select “Target” > “iStorage” to export the image in DCM format.
3. Select [OK] to send DCM format file to the external media.

16.2 DICOM Print

DICOM Print is used to send images to the DICOM print server for printing.

Print images on iStation/Review/Main screen

Perform the following procedure:

1. Do one of the following to select images:
   - Select <iStation> to enter the iStation page. Click to select an animal or an exam record in the list. Thumbnails are displayed in the thumbnail area in the lower part of the screen, and then click to select a thumbnail. Or, select an exam or exams from the animal list (there should be images for this exam).
   - Select the Review button to enter the Review screen. Click to select a thumbnail.
   - On the main screen, select a thumbnail or the cine.
2. Select ⊕ in the top-right part or [Send To].
3. Click to select “DICOM” in the Target box on the left side, then select the DICOM print server on the right side, and click [OK].

To send images to DICOM Print after an exam ends

TIP:

Preset Sending/printing after End Exam, for details see the *Setup* chapter.

Start the scan and obtain the image. Each time [End Exam] is selected, the system will send the image to the default DICOM print server for printing.

16.3 Worklist

When the DICOM basic package is configured and the Worklist server has been set, select [Worklist] in the “Animal Info” screen to query or import the animal data.

Perform the following procedure:

1. Select the Animal Information button to enter the animal information page.

2. Select [Worklist] to enter the Worklist page.
3. Guarantee the data source: after select the service type, select the Worklist server from the corresponding server.
4. Input the searching condition.
5. Select [Query]. The scheduled animals, which meet the criteria, are displayed in the lower part of the screen.
   - After the first query, you can perform the second query based on the preview results.The scheduled animals in the list will update in real time.
   - Select the keyword type, enter the keywords and then select [Query] to search.
   - To reset the criteria, select [Clear] button.
6. Select the desired animal from the list.
   - Select [Start Exam], the animal information is imported into the system and then an exam is started.
   - Select [Transfer], the animal information is imported into the "Animal Info" screen and it is opened. After you edit the animal information in the "Animal Info" screen, select [OK] to start a new exam.
   - Select [Show Detail] to see details of animal data.
7. Select [Exit] to exit.

16.4 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.

After you preset the Worklist server and MPPS server, if the system obtains the animal information from Worklist server to begin the exam, it will send exam status information to MPPS server of when the exam is undergoing or ended. If the sending fails, the system resends automatically.

16.5 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

If images are successfully sent to the storage server, the storage commitment server will return to the information about the successful image storage. In the iStation screen, you will see a tick "√" marked in the list below  .

NOTE:

Multi-frame storage is not allowed if "Allow Multiframe" is not selected (About "Allow Multiframe" setting, see the *Setup* chapter). 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 of the iStation screen.

Storage commitment after sending images on the iStation screen

Select the image, the cine or the data, and send it, see "16.1 DICOM Storage".

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 automatically after an exam ends

TIP:

- Preset Sending/printing after End Exam, for details see the *Setup* chapter.
- Set the default storage server, and click "Storage Commitment" to connect to the storage server, see the *Setup* chapter.

Start the scan and obtain the image. Select the End Exam button each time; the system will send the image to the default DICOM storage server for storage and send storage commitment to the storage commitment server.

Storage commitment is confined to the whole exam. Not each image sending can be indicated.

16.6 Query/Retrieve

The query/retrieve function is used to query and retrieve animal 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. Select the iStation button to enter iStation screen.
2. Select [Query/Retrieve] to open Query/Retrieve screen.
3. Select the server in the "Server and Service" area (both the source and the destination) and query level.
4. Enter the query information.

   Select [Clear] to empty the entered query information.
5. Select [Query]. The system performs the query and lists the results in the animal (source) list.

   You can perform further queries based on the results by entering new query information.
6. Select one or more animal records according to the actual situation.
   - Select [Select All] to select all the animal records in the list.
   - Select [Deselect All] to deselect all the animal records in the list.
7. Select [Retrieve] to retrieve the animal records in the DICOM query/retrieve server to the local machine.

8. Select [Exit]. The retrieved animal records are listed in the iStation screen.

16.7 DICOM Media Storage (DICOMDIR Review)

Animal data in the ultrasound system can be saved on external media in DCM format, while DCM files can be accessed in the ultrasound system.

DICOM media storage and DICOMDUR review should meet the following conditions:

- There is a DVD disk in the ultrasound device, and it works well.
- File system format of CD/ DVD optical file should be ISO 9660, and the optical disk should not be damaged.
- File system format of DVD optical file should be UDF, and the optical disk should not be damaged.
- Normally read/write data from the USB ports on the ultrasound system.
- File system format of removable device (USB flash drive) is FAT32 and the media should not be damaged.

Media Storage

Perform the following procedure:

1. Select animal records in the iStation screen.
2. Select [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. You can select to delete the exam or the image after the backup, and select to hide animal information.
4. Select [OK]. The image from the current exam is sent to the external storage media in DICOM format.

   If the backup is successful, a tick will appear in the Backup list in the iStation screen. If not, there will be no tick.

TIP:

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.

Media review

Perform the following procedure:

1. Connect the external media with DCM files to the system.
2. Select the data source in iStation screen, and the visible data will be shown.
3. If there are several types of data on the media, the system will ask you to select the format. Then, select [DICOMDIR].

Data Restore

NOTE:

Only system-accessible media can be selected.

After the DICOM format data are saved to external media, restore the data to the ultrasound system.

Connect the external media containing DCM files to the system.

1. In the iStation screen, review the data stored on the external media.
2. Select the data to be restored in iStation.
3. Select [Restore Exam] in the iStation screen.

16.8 Structured Report

The Structured Report (SR) can be sent with meeting the following procedures:

- DICOM structured report installed with the corresponding exam mode.
- The state of the SR should be “Cancel” or “Stop”.
- Set the SR storage option to “Attach SR When Store Images” or “Only Store SR”, see the *Setup* chapter.

Perform the following procedure:

1. Click to select an animal or an exam record in the list in the iStation screen, and select [Send Exam] in the iStation page.
2. Select DICOM in the storage server list, select a server in the “Storage Server” list.
3. Select [OK], the status of sending task can be viewed in task management.

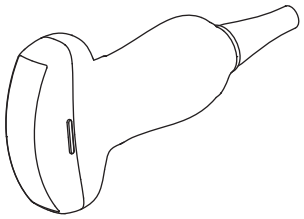
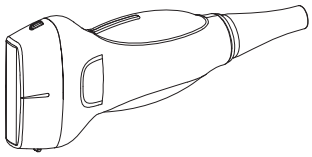
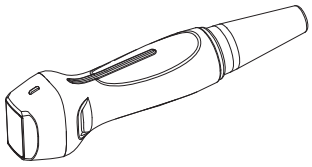
   After successful storage of both image and structured report; you can see the storage commitment mark “√” in the list below  in the iStation screen.

NOTE:

Only the PACS system from the Medstreaming company (http://www.medstreaming.com/default.aspx) supports sending self-defined measurements by DICOM SR.

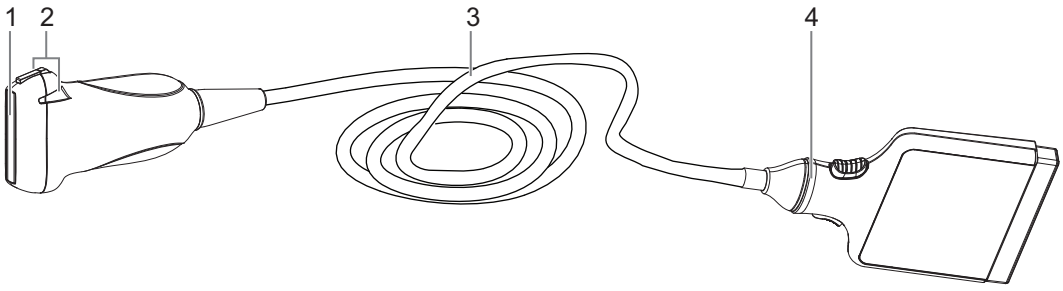
17 Probes and Biopsy

17.1 Probes

Probe model	Probe Type	Probe Figure
C6-1m	Convex	
L14-3m	Linear	
L13-3m	Linear	
P4-2m	Phased	
P8-2m	Phased	
P10-4m	Phased	
mC11-3m	Convex	

17.1.1 Probe Functions by Part

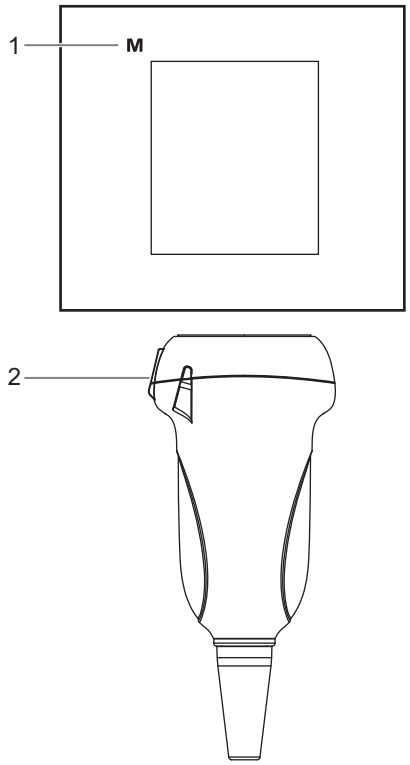
The basic structures and corresponding functions of probes are basically the same; take the following probe as an example.



No.	Item	Description
1.	Probe head	Converts the electrical signal into an ultrasonic signal, focusing the sound beams in a given direction; meanwhile, it receives the reflected ultrasonic signal and converts it into an electrical signal for transmission over the cable. The lens on the surface is the acoustic lens. Apply ultrasound gel on the acoustic lens for correct operation.
2.	Needle-guided bracket fix tabs and grooves	Provides mounting support of the needle-guided bracket. ***NOTE:*** This structure of probes in the figure above may vary with the matched needle-guided brackets.
3.	Probe cable	Transmits electrical signals between the probe body and connector.
4.	Probe connector	Connects the probe and cable to the ultrasonic diagnostic system.

17.1.2 Orientation of the Ultrasound Image and the Probe Head

The orientation of the ultrasound image and the probe are shown as below. The “M” side of the ultrasound image on the monitor corresponds to the mark side of the probe. Check the orientation before the examination (Using a linear probe as an example).



1.	Orientation mark
2.	Mark

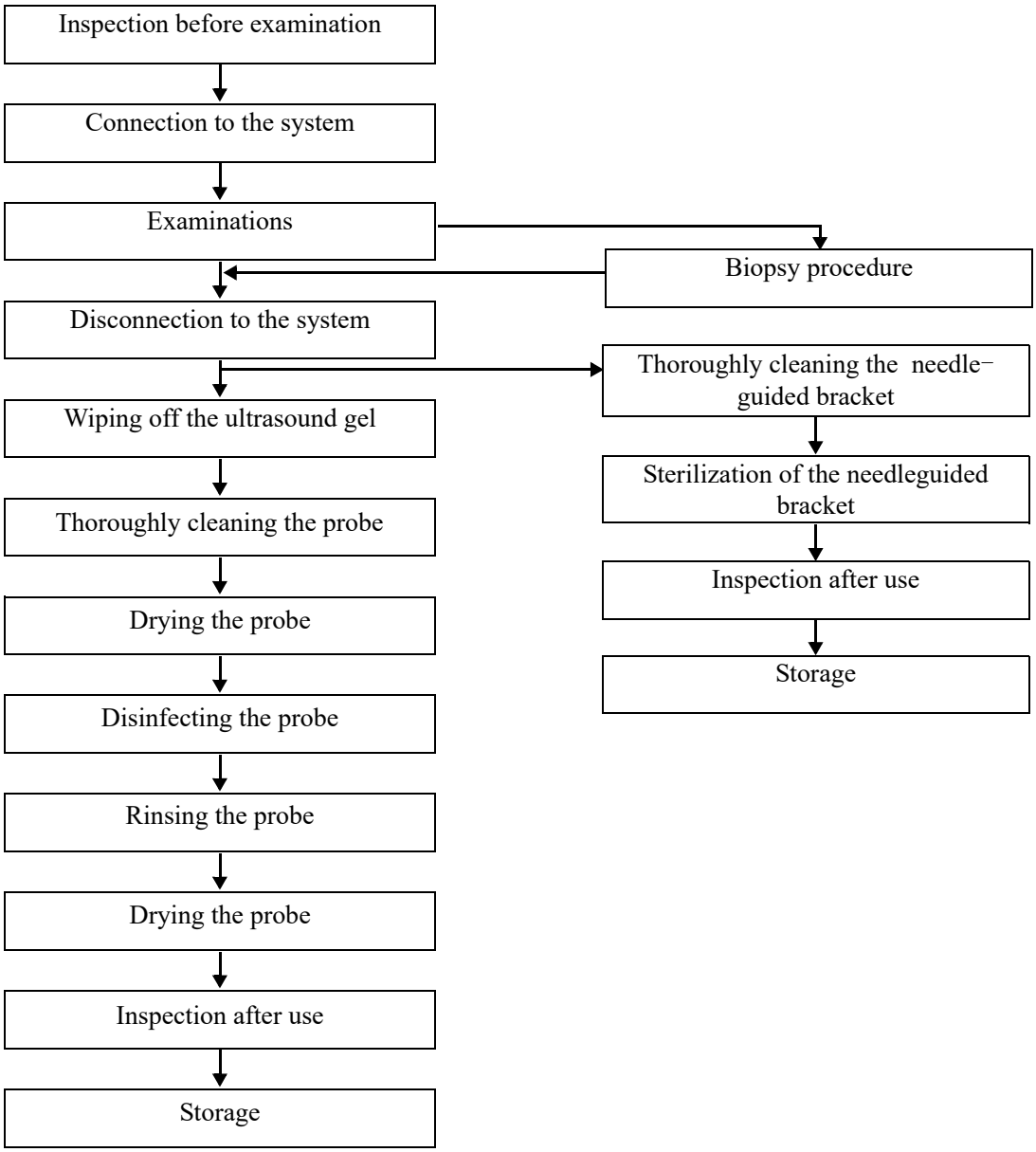
17.1.3 Procedures for Operating

⚠ WARNING

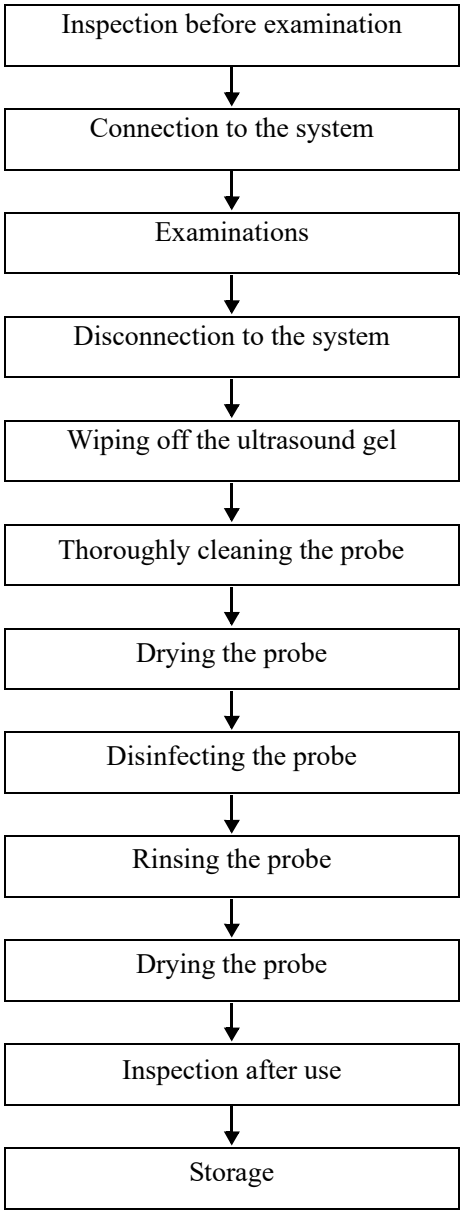
Disinfect the probe and sterilize the needle-guided bracket before and after an ultrasound-guided biopsy procedure is performed. Failure to do so may cause the probe and the needle-guided bracket becomes a source of infection.

This section describes general procedures for operating the probe. The proper clinical technique to be used for operating the probe should be selected on the basis of specialized training and clinical experience.

Procedures for operating (with biopsy function)



Procedures for operating (with no biopsy function)



17.1.4 Wearing the Probe Sheath

⚠ CAUTION

- **Be sure to cover the probe with a new (unused) probe sheath to prevent infection during examination. If the package of a probe sheath is open or broken, the sterilization of the probe sheath may not be sufficient. DO NOT use such a probe sheath.**
- **The cover contains natural rubber latex and talc that can cause allergic reactions in some individuals.**
- **DO NOT use an expired probe sheath. Before using a probe sheath, verify whether the term of validity has expired.**

A legally marketed probe sheath must be installed over the probe before performing intra-cavitary and intra-operative examination. Protective barriers may be required to minimize disease transmission. Probe sheaths are available for use with all clinical situations where infection is a concern.

To order probe sheath, contact:

CIVCO Medical Instruments Co.

102 First Street South, Kalona, IA 52247-9589 USA

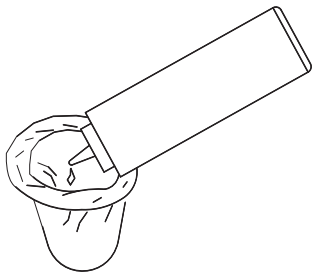
Tel: 1-319-656-4447

E-mail: info@civco.com

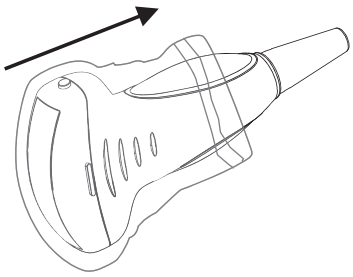
http://www.civco.com

Perform the following procedure to install the probe sheath:

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; make sure to use proper sterile technique. Pull cover tightly over probe acoustic lens to remove wrinkles and air bubbles, and taking care to avoid puncturing the sheath.



3. Secure the sheath with the enclosed elastic bands.

4. Inspect the sheath to ensure there is no hole or tear.

17.1.5 Probes Cleaning and Disinfection

Before and after completing each examination, clean and disinfect 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

- **No cleaning and disinfecting may result in the probe becoming a source of infection.**
- **Please follow the disinfectant manufacturer's manual for performing cleaning and disinfection, including preparing sterile water and cleaning and disinfection time.**

NOTE:

- After the examination, wipe off the ultrasound gel thoroughly. Otherwise, the ultrasound gel may solidify and degrade the image quality of the probe.
- 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.
- Observe the graph here carefully to immerse the probe. Only soak parts of the probe below the strain relief.
- Repeated disinfection will eventually damage the probe, please check the probe performance periodically.

Cleaning and Disinfection Overview

Cleaning and disinfection refer to two distinct processes. According to the Centers for Disease Control and Prevention (CDC) "Guideline for Disinfection and Sterilization in Healthcare Facilities" (2008):

- Cleaning is the removal of visible soil (e.g. organic and inorganic material) from objects and surfaces and normally is accomplished manually or mechanically using water with detergents or enzymatic products. Thorough cleaning is essential before high-level disinfection and sterilization because inorganic and organic material that remains on the surfaces of instruments interfere with the effectiveness of these processes.
- Disinfection describes a process that eliminates many or all pathogenic microorganisms, except bacterial spores.
  - Low-Level Disinfection—Destruction of most bacteria, some viruses, and some fungi. Low-level disinfection will not necessarily inactivate Mycobacterium tuberculosis or bacterial spores.
  - High-Level Disinfection (HLD)—Destruction/removal of all microorganisms except bacterial spores.

Selecting a Microbicidal Method

Probes can be divided into three categories based on their intended use. Some probes may fall into more than one category (e.g. probes use for biopsy procedures). When selecting a disinfectant, determine the required level of disinfection based on intended use and possibility of cross-contamination.

- Contacts intact skin: Probes that only come into contact with clean, intact skin are considered noncritical devices and require cleaning after every use. Cleaning may be followed by a low-level disinfectant spray or wipe.
- Contacts mucous membranes and non-intact skin: This category includes all endocavity probes - intravaginal, transrectal, and transesophageal (TEE) and probes use for biopsy procedures. These semi-critical probes must be cleaned with an appropriate cleaner after use followed by high-level disinfection.

Cleaning

Please refer to the instructions in the manual and follow your hospital policy and procedures for cleaning.

Perform the following procedure:

1. Wear a pair of gloves to prevent infection.
2. Disconnect the probe from the system. If the sheath is used, take off the sheath and discard it.
3. Wipe off the ultrasound gel or other visible dirt on the surface of the probe by using a damp piece of disposable lint-free soft cloth or tissue.
4. Choose an appropriate cleaning agent including mild detergents, enzymatic cleaners and specially designed enzymatic sponges.
5. Immerse the probe fully in the cleaning fluid for at least 1 minute or according to manufacturer's instructions. Lightly mechanical clean the probe with a piece of lint-free soft cloth or soft sponge until no dirt is visible. When necessary, clean the seams or biopsy guide features by using disposable cotton swabs. Avoid using a brush to wash the lens because it may damage the probe.
6. Rinse the probe thoroughly by using a large amount of clean water (about 7.5 L/2 gallons) at room temperature for about 30 s to remove the residual dirt and cleaning solvent. Repeat the rinsing operation twice.
7. Dry the probe by wiping with a piece of disposable lint-free soft cloth or tissue.

   Do not dry the probe by heating.
8. Inspect the probe. If visible dirt still exists, repeat the preceding steps to wash the probe until it is all clean.
9. Check whether the probe has defects such as peeling, rifts, bumps, cracks, or liquid spill. If such defects exist, the probe has reached the end of its service life. In this case, stop using it and contact the Customer Service Department or your local distributor.

Low-level disinfection of a non-critical probe

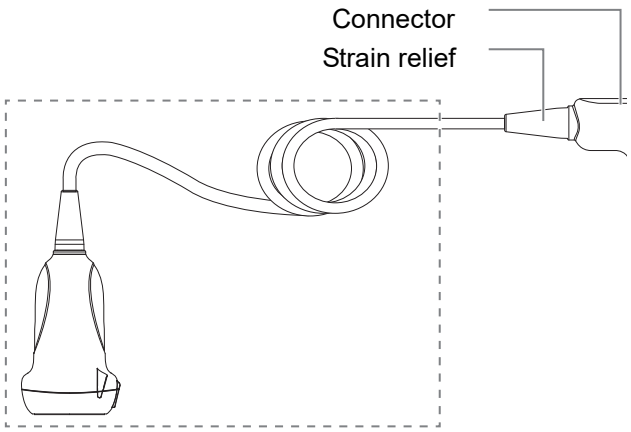
⚠ CAUTION

Use protective eyewear when disinfecting using sprays.

Perform the following procedure:

1. Wear a pair of gloves to prevent infection.
2. Clean the probe thoroughly in accordance with the cleaning procedure before disinfection.
3. Disinfect the probe by using an appropriate low-level disinfectant. Follow the disinfection agent manufacturer's instructions for preparation and use of the disinfectant.
   - Wipes: Wipe all the surface of the probe according to the wiping duration specified in the operator's manual provided by the manufacturer.
   - Spray: Spray the disinfectant directly on the surface of the probe or spray the disinfectant on a piece of disposable lint-free soft cloth and wipe the probe according to the wiping duration in the operator's manual provided by the manufacturer.

   Observe the graph here carefully to perform disinfection. Do not spray the strain relief on the connector end or the connector.



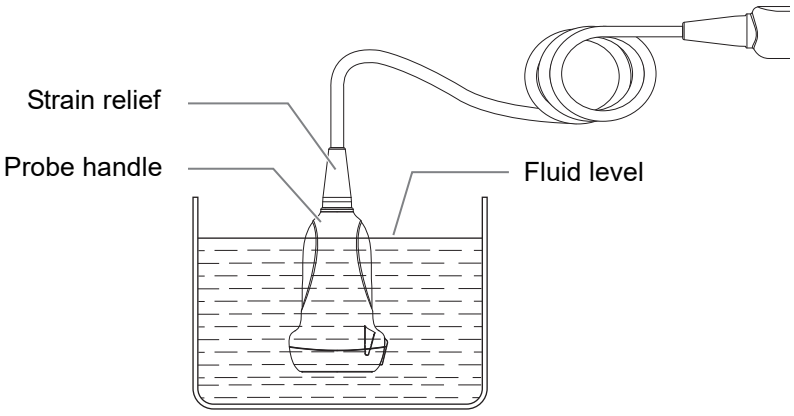
4. Wipe away the residual disinfectant on the probe by using a piece of lint-free soft cloth soaked with clean water. Wipe three times. Or rinse the probe thoroughly by using a large amount of clean water (about 7.5 L/2 gallons) at room temperature.
5. Dry the probe by wiping with a piece of disposable lint-free soft cloth. Do not dry the probe by heating.
6. Check whether the probe has defects such as peeling, rifts, bumps, cracks, or liquid spill. If such defects exist, the probe has reached the end of its service life. In this case, stop using it and contact the Customer Service Department or your local distributor.
7. Store the probe in a cool, clean and dry environment. And repeat the cleaning and disinfection process before the next use.

High-level disinfection of a semi-critical probe

Perform the following procedure:

1. Wear a pair of gloves to prevent infection.
2. Clean the probe thoroughly in accordance with the cleaning procedure before disinfection.
3. Disinfect the probe by using an appropriate high-level disinfectant or system. For how to use a high-level disinfectant or system, see the operator's manual provided by the manufacturer. Prepare a disinfectant by using sterile distilled or softened water when necessary.
   - Soaking: Immerse the probe head in the disinfectant and shake the probe appropriately to remove any bubbles on the probe surface. For details about the probe immersion duration, see the operator's manual provided by the manufacturer.

     Observe the graph here carefully to immerse the probe. Only soak parts of the probe below the strain relief.



   - Wiping: Use a market disinfection wipe product or sterile disposable lint-free soft cloth wetted with disinfection spray and wipe all surfaces of the probe for a duration according to the manufacturer instructions.
4. Rinse the probe thoroughly by using a large amount of clean water (about 7.5 L/2 gallons) at room temperature for about 30 s to remove the residual disinfectant. Repeat the operation twice. Or follow the disinfectant manufacturer's instructions regarding rinsing.
5. Dry the probe by wiping with a piece of clean disposable lint-free soft cloth. Do not dry the probe by heating.
6. Check whether the probe has defects such as peeling, rifts, bumps, cracks, or liquid spill. If such defects exist, the probe has reached the end of its service life. In this case, stop using it and contact the Customer Service Department or your local distributor.
7. Store the probe in a cool, clean and dry environment. And repeat the cleaning and disinfection process before the next use.

Compatible Cleaners and Disinfectants

For the detailed information about cleaners and disinfectants, see *Recommended Transducer Cleaner and Disinfectant*.

17.1.6 Cleaning the probe cable and connector

NOTE:

Do not use cloth with water to clean the probe connector.

Perform the following procedure:

1. Wipe out the dust attached to surface of probe connector and cable.
2. Use soft brush to brush the dust inside probe connector gently.
3. Remained stain or dust attached to surface of cable or surface of connector should be washed out by cloth with a little soapy water, and then air-dry.

17.1.7 Probe Environmental Conditions

Table 17-1 Probe Environmental Conditions

Probe Model	Conditions	Ambient temperature	Relative humidity (no condensation)	Atmospheric pressure
C6-1m	Operating	0°C to 40°C	20% to 85%RH	700hPa to 1060hPa
	Storage and transportation	-20°C to 55°C	20% to 95%RH	700hPa to 1060hPa
L14-3m	Operating	0°C to 40°C	20% to 85%RH	700hPa to 1060hPa
	Storage and transportation	-20°C to 55°C	20% to 95%RH	700hPa to 1060hPa
L13-3m	Operating	0°C to 40°C	20% to 85%RH	700hPa to 1060hPa
	Storage and transportation	-20°C to 55°C	20% to 95%RH	700hPa to 1060hPa
P4-2m	Operating	0°C to 40°C	30% to 85%RH	700hPa to 1060hPa
	Storage and transportation	-20°C to 55°C	30% to 95%RH	700hPa to 1060hPa
P8-2m	Operating	0°C to 40°C	30% to 85%RH	700hPa to 1060hPa
	Storage and transportation	-20°C to 55°C	30% to 95%RH	700hPa to 1060hPa
P10-4m	Operating	0°C to 40°C	30% to 85%RH	700hPa to 1060hPa
	Storage and transportation	-20°C to 55°C	30% to 95%RH	700hPa to 1060hPa
mC11-3m	Operating	0°C to 40°C	30% to 85%RH	700hPa to 1060hPa
	Storage and transportation	-20°C to 55°C	30% to 95%RH	700hPa to 1060hPa

17.1.8 Storage and Transportation

When all examinations for the day 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

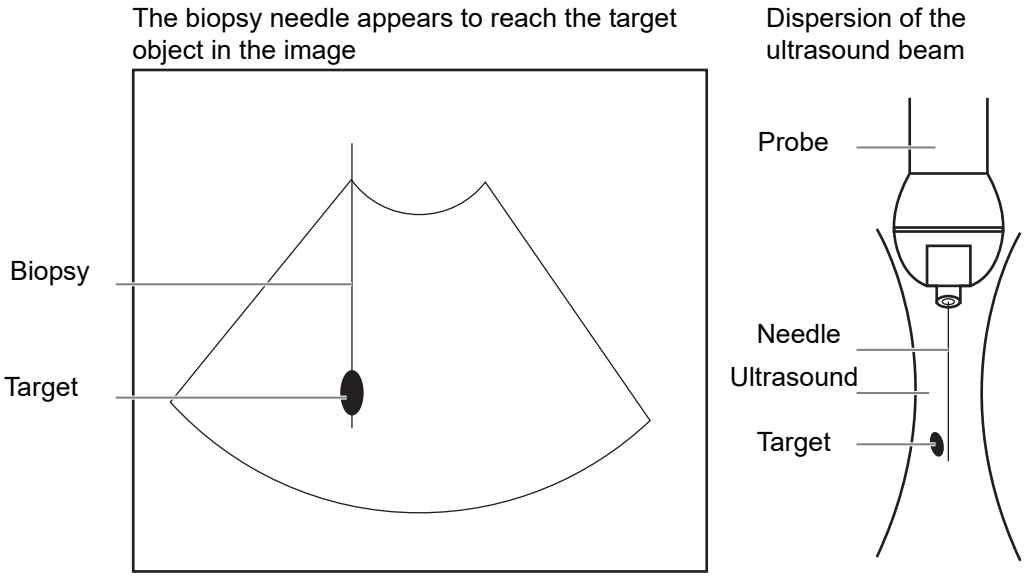
- To prevent the probe from being damaged, DO NOT store it in locations where it may be exposed to:
  - Direct sunlight or X-rays
  - Sudden changes in temperature
  - Dust
  - Excessive vibration
  - Heat generators
- When the probe is sent to the Customer Service Department or your local distributor for repair, be sure to disinfect it and keep it in the carrying case to prevent infection.

17.2 Biopsy Guide

⚠ WARNING

- **The person performing biopsy procedures must understand diagnostic ultrasound thoroughly and have been trained adequately, otherwise, side effects may be caused to the animal.**
- **In situations listed below, the biopsy needle may fail to penetrate the target. The incorrect biopsy may cause various side effects in the animal.**
  - **Use a needle-guided bracket other than that provided.**
  - **Mount the needle-guided bracket incorrectly.**
  - **Use a biopsy needle that is unsuitable for the type of biopsy being performed.**
  - **Use 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 off or move from their proper positions. If the needle-guided bracket is used when parts are not securely and correctly installed, the animal may be injured. If an abnormality is found on the needle-guided bracket, immediately stop using it and contact the Customer Service Department or your local distributor.**
- **Needle guided brackets are required to verified before each biopsy. If the verification fails, it indicates that the needle-guided brackets are out of service life.**
- **Disposable brackets are packaged sterile and are single-use only, and the method of sterilization is irradiation. Do not use if the sterile packaging is open or broken, and do not reuse or resterilize the disposable brackets.**
- **DO NOT use a needle-guided bracket when scanning is performed. The needle may advance in an incorrect direction and possibly injure the animal.**
- **Never perform a biopsy during image scanning.**
- **DO NOT freeze an image while performing biopsy procedure.**
- **During biopsy procedures, the needle may deviate from the desired course due to the tissue characteristics or the type of needle. In particular, needles of small diameters may deviate to a greater degree.**
- **Disinfect the probe and sterilize needle-guided bracket before and after each ultrasound-guided biopsy procedure is performed. Fail to do so may cause the probe and the needle-guided bracket 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 the procedures.**
- **Adjust the needle mark before the biopsy procedure is performed.**
- **When performing biopsy procedures, use only sterile ultrasound gel that is certified to be safe. And manage the ultrasound gel properly to ensure that it does not become a source of infection.**
- **When performing the operation concerning 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 of a certain thickness in the thickness direction of the probe. (That is to say, the information shown in the images consist all the information scanned in the thickness direction of the probe.) So, even though the biopsy needle appears to have penetrated the target object in the image, it may not actually have done so. When the target for biopsy is small, dispersion of the ultrasound beam may lead to image deviate from the actual position. Pay attention to this.
  If the target object and the biopsy needle appear in the image as shown in the figures below (For reference only):



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.**

17.2.1 Needle-guided Brackets Available

Table 17-2 Needle-guided Brackets Available

Needle-guided Bracket Model	Biopsy angle/depth (±1°)	Applicable Biopsy Needle
NGB-007 plastic/needle detachable metal/needle detachable	40°, 50°, 60°	Metal: 14G, 16G, 18G, 20G, 22G Plastic: 13G, 15G, 16G, 18G, 20G
NGB-011 metal/needle non-detachable	11°, 23°	13G, 15G, 16G, 18G, 20G
NGB-018 metal/needle detachable	15°, 25°, 35°	14G, 16G, 18G, 20G, 22G
NGB-055 Metal-needle detachable	25°, 35°, 45°	14G, 16G, 18G, 20G, 22G

NOTE:

We do not offer the biopsy needle; please purchase it according to your own needs.

17.2.2 Needle-Guided Bracket Inspection and Installation

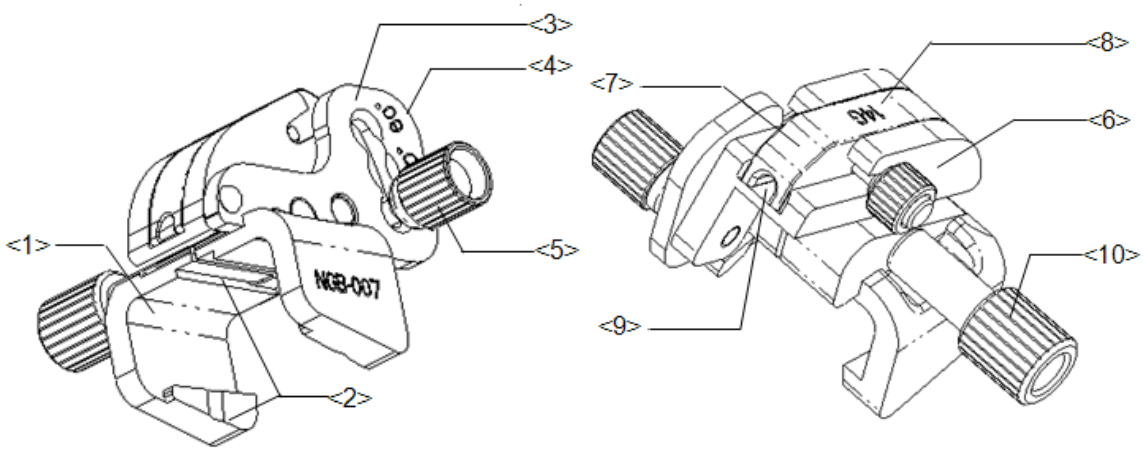
A needle-guided bracket is available for purchase as an optional accessory; it is used in combination with the probe. Some of the probes have matched needle-guided bracket and needles. To order needle-guided brackets, contact the Customer Service Department or your local distributor.

For biopsy or treatment, ultrasound-guided biopsy procedures can be performed using the probe in combination with a needle-guided bracket (optional accessory) and a biopsy needle (provided by the user).

Be sure to perform inspections before and after use of the needle-guided bracket. If an abnormality is found on the needle-guided bracket, immediately stop using it and contact the Customer Service Department or your local distributor.

- Sterilize the needle-guided bracket before and after use.
- Put on the sterile probe sheath before installing to the probe.
- Confirm that the needle-guided bracket is free of damage, deformation, stripping, malfunction, loose, or missing parts.
- Confirm that the needle-guided bracket is securely mounted in the correct position.
- Select the proper needle according to the specification above, and adjust the needle shift to the same specification of the selected needle.

NGB-007 Metal/needle detachable needle-guided bracket



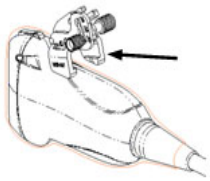
1.	Support for needle-guided bracket
2.	Tab and groove for the needle-guided bracket
3.	Angle-adjusting base
4.	Angle shift sign
5.	Angle pinch nut
6.	Angle block
7.	Guiding block
8.	Guiding block specification
9.	Needle guide hole
10.	Needle-guided bracket pinch nut

Perform the following procedure:

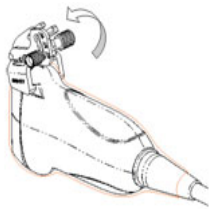
1. Install the needle-guided bracket:

a. Put on the sterile probe sheath.

b. 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.



c. Screw the pinch nut of the needle-guided bracket to ensure that the needle-guided bracket is properly installed on the probe.

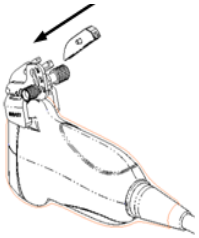


2. Adjust the needle angle to the proper shift as required:

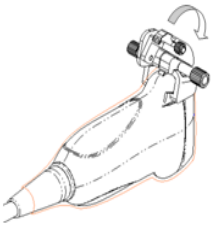
   a. Loosen the angle pinch nut.
   b. Adjust the angle block to the desired level.
   c. Tighten the angle pinch nut.

3. Install the guiding block

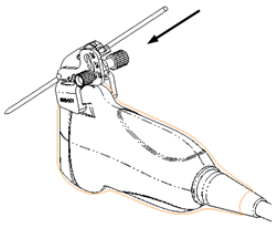
   a. Select a suitable guiding block and push it into the groove above the angle block, then clamp it tightly



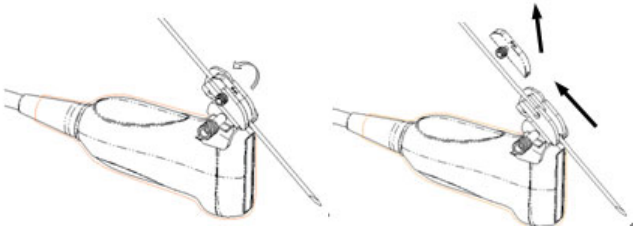
   b. Screw the block's nut to secure the block.



   c. Insert a biopsy needle with the same specification as that of the guiding block into the guiding block hole.



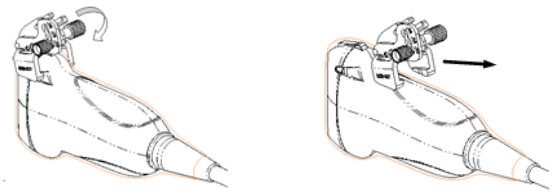
4. Release the needle from the bracket:



a. Screw the nut of the guiding block and remove the guiding block slightly along the direction of the needle's tail.

b. Separate the residual part of the needle-guide bracket and the probe from the needle.

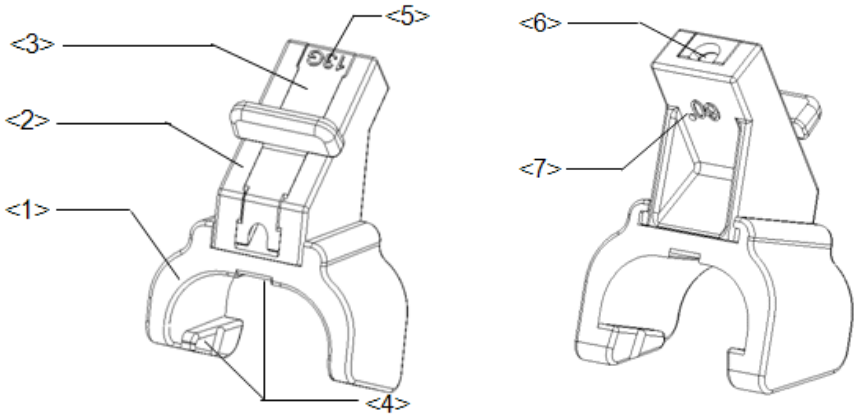
5. Remove the needle-guided bracket:



a. Unscrew the Needle-guided bracket pinch nut, and remove the needle-guided bracket from the probe.

b. Separate the probe and the needle-guided bracket.

NGB-007 Plastic/needle detachable needle-guided bracket



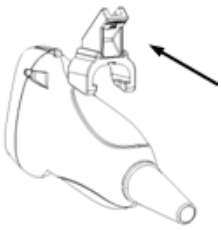
1.	Support of needle-guided bracket
2.	Angle block
3.	Guiding block
4.	Groove and tab of the needle-guided bracket
5.	Specification of guiding block
6.	Guiding hole of the biopsy needle
7.	Specification of angle block

Perform the following procedure:

1. Install the needle-guided bracket:

a. Put on the sterile probe sheath.

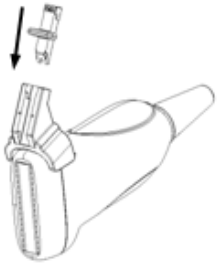
b. Hold the probe by one hand, select the proper needle-guided bracket, and hold it with the other hand. Align the narrow end tab of the needle-guided bracket with the groove of the probe, then push the needle-guided bracket forward, making the tabs and the grooves of the needle-guided bracket to match with the grooves and tabs of the probe.



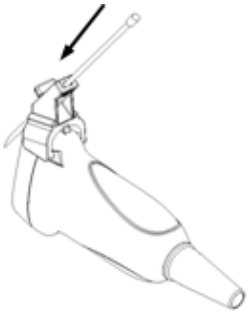
c. Check manually to confirm that the needle-guided bracket is securely installed on the probe.

2. Install the guiding block:

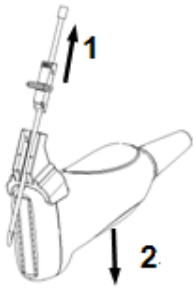
a. Select a proper guiding block and push it into the groove above the angle block, and clamp it tightly.



b. Insert a biopsy needle with the same specification as that of the guiding block into the hole of the guiding block.



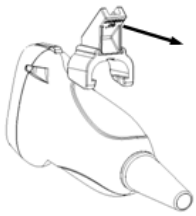
3. Release the needle from the bracket:



a. Remove the guiding block slightly along the direction of the needle's tail.

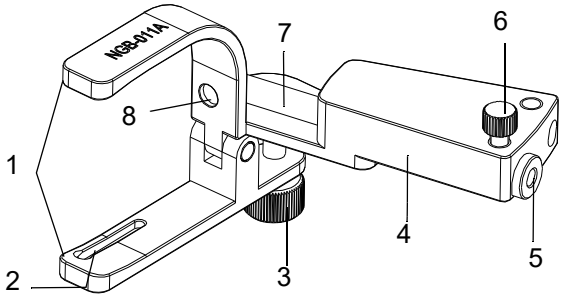
b. Separate the residual part of the needle-guide bracket and the probe from the needle.

4. Remove the needle-guided bracket:



Remove the support of needle-guided bracket from the probe.

NGB-011 Metal-needle undetachable needle-guided bracket



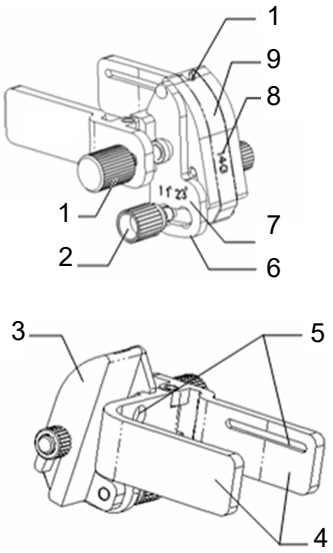
1.	Clamp
2.	Locating groove
3.	Grip knob
4.	Needle guide rack
5.	Needle guide hole
6.	Needle guide clamping knob
7.	Needle guide
8.	Locating pit

Perform the following procedure:

1. Install the needle-guided bracket:
   a. Put on the sterile probe sheath.
   b. 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.
   c. Turn the grip knob at the tail of the needle-guided bracket tightly.
2. Remove the needle-guided bracket:

   Hold the probe and the needle-guided bracket, then open the grip knob of the needle-guided bracket.

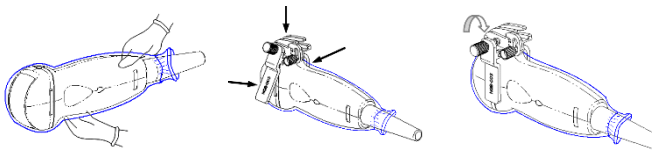
NGB-018 Metal-needle detachable needle-guided bracket



1.	Pinch nut of bracket
2.	Angle pinch nut
3.	Angle block
4.	Clamp
5.	Groove
6.	Angle-adjusting base
7.	Angle shift sign
8.	Guiding block specification
9.	Guiding block
10.	Needle guide hole

Perform the following procedure:

1. Install the needle-guided bracket:



a. Put on the sterile probe sheath.

b. Select a suitable needle-guided bracket and match the groove to the tab of the probe. Mount the bracket onto the probe.

c. Screw the pinch nut of the needle-guided bracket to ensure that the needle-guided bracket is properly installed on the probe.

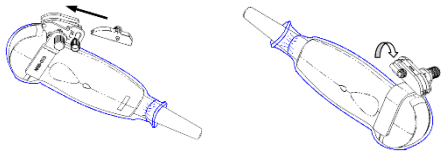
2. Adjust the needle angle to the proper shift as required:

a. Loosen the angle pinch nut.

b. Adjust the angle block to the desired level.

c. Tighten the angle pinch nut.

3. Install the guiding block:

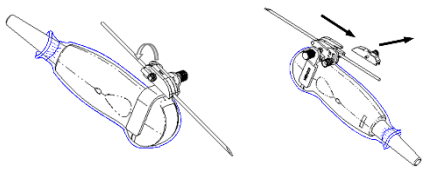


a. Select a suitable guiding block and push it into the groove above the angle block

b. Screw the block's nut to secure the block.

c. Insert a biopsy needle with the same specification as that of the guiding block into the guiding block hole.

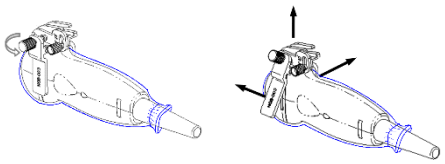
4. Release the needle from the bracket:



a. Loosen the guiding block's nut and slightly move the guiding block in the direction of the needle’s tail.

b. Separate the residual part of the needle-guide bracket and the probe from the needle.

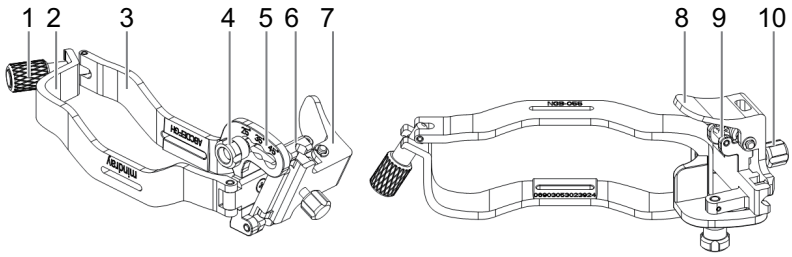
5. Remove the needle-guided bracket:



a. Screw the pinch nut to release the needle-guided bracket

b. Separate the bracket and the probe.

NGB-055 Metal-needle detachable needle-guided bracket



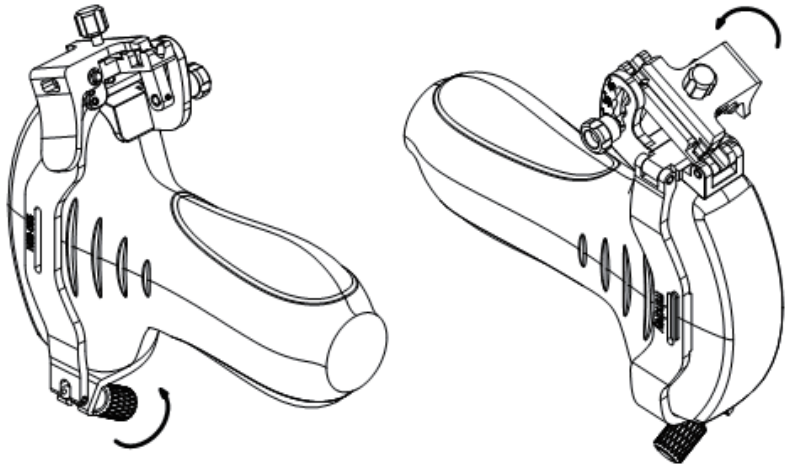
1.	Left and right locking nuts
2.	Right clamp
3.	Left clamp
4.	Angle locking nut
5.	Angle adjusting base
6.	Angle adjusting block
7.	Needle clamping cover
8.	Needle pressing plate
9.	Torsion spring of the needle clamping cover
10.	Needle-shape adjusting nut

Perform the following procedure:

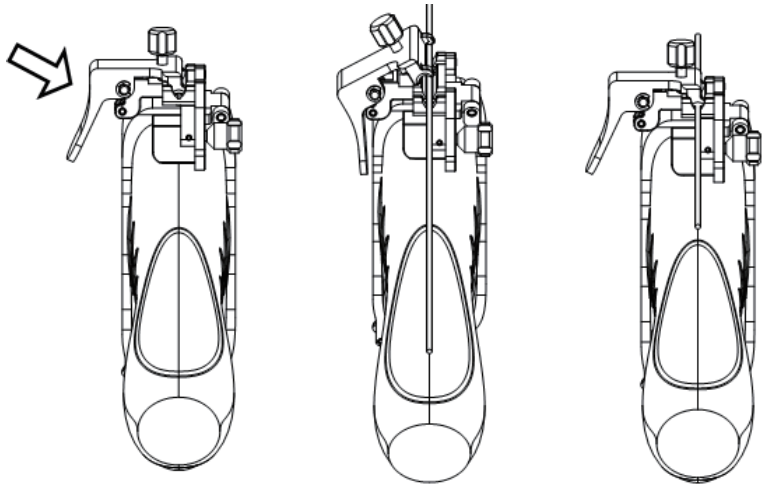
1. Install the needle-guided bracket.

a. Put on the sterile probe sheath.

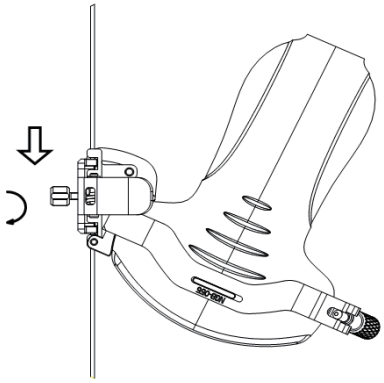
b. Hold the probe with one hand, and hold the bracket with the other hand. Match the inside of the bracket with the outside of the probe, and mount the bracket onto the probe. Rotate the locking nuts at the left and right sides to fix the position of the bracket and the probe. Tighten the needle adjusting nut snugly in the direction shown in the following figure.



c. Hold the probe, and press the needle pressing plate to separate it from the needle-guided V-shaped guiding block. Then, put the needle into the V-shaped guiding block.

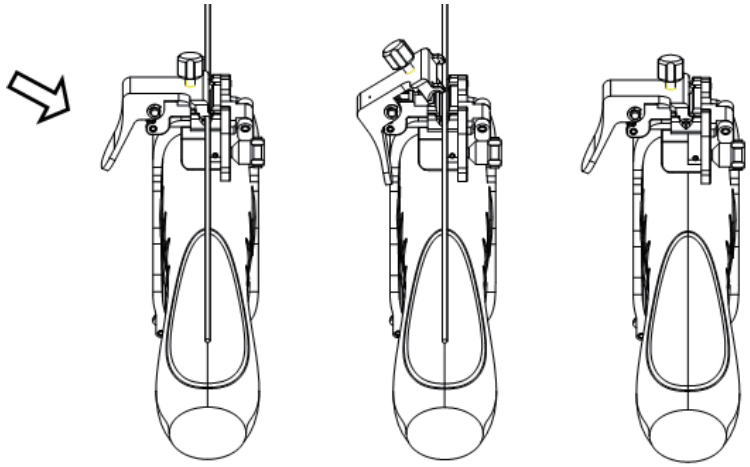


d. Hold the probe, and release the needle pressing plate at the same time. Adjust the needle-shape adjusting nut manually (following the direction of the arrow), so that the needle moves smoothly and vertically under the force of gravity.

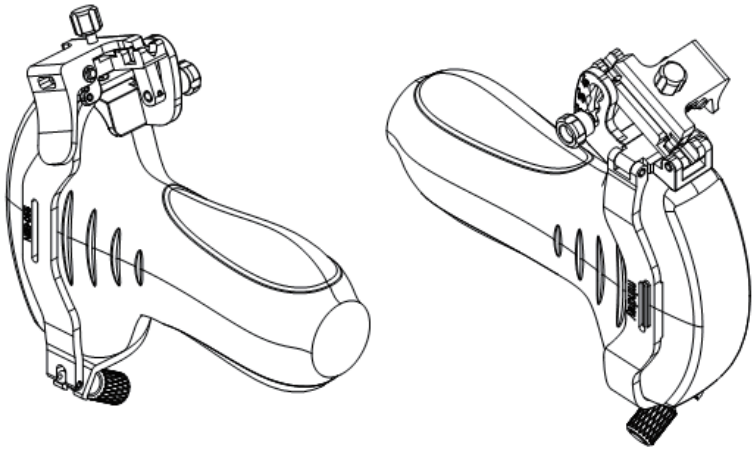


2. Removing Needle-Guided Bracket.

a. Hold the probe, and press the needle pressing plate to separate it from the needle. Separate the probe and the needle-guided bracket from the needle.



b. Rotate the locking nuts at the left and right sides (following the direction of the arrow) to separate the needle guided-bracket from the probe. Hold the probe and take out the bracket.



17.2.3 Verifying the Biopsy Guide Line

⚠ 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.

Adjusting the needle mark is necessary before each biopsy procedure.

Perform the following 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.
5. Enter Biopsy.
   - Select the biopsy bracket angle/guide line: If the needle-guided bracket supports more than one biopsy angle, select the angle/guideline by using [Biopsy Kit].
   - Select the guide line dot size by using [Dot Size].

   NOTE:

   - 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.
6. Select [Verify] in the Biopsy menu to open the Biopsy Verify menu.
   - Adjust the guide line position: Use [Position] to change the position of the guide line.
   - Adjust the angle: Use [Angle] to change the guide line angle.
   - Save the verified settings: After the position and angle of the guide line are adjusted, select [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: select [Load Factory] and the position and angle of the guide line are restored to the factory default settings.
   - Exit biopsy verify status: select [Exit] and the system exits the guide line verification status.

17.2.4 Starting the biopsy procedure

⚠ DANGER

- **Ensure that all guide parts are properly fixed prior to performing a biopsy.**
- **If you changed the probe or needle-guided bracket during the biopsy, verify the guide line again.**
- **Failure to match the guide zone 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 guide zone and this could result in repeated biopsies or animal injury.**

Perform the following procedure:

1. Select the correct needle-guided bracket and needle and install them properly.
2. Enter the biopsy.

   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.

3. Select the bracket and guide line according to the actual situation.

   Select [Verify] to enter Biopsy Verify menu to fine tune the guide line if needed.

4. If available, use iNeedle function to help enhance the needle visualization when the needle display is not clear.

   iNeedle is an option.

   a. Select [iNeedle].
      The parameters that can be adjusted appear on the menu:
      [B/iNeedle]: select to display B image and iNeedle image synchronously.
      [Needle Dir.]: select to adjust the needle direction display according to actual direction of needle insertion. The iNeedle affecting region changes correspondingly.
   b. Select [iNeedle] again to exit.

5. Scan to locate the target. Center the target in the electronic guidezone path.

6. Direct the needle into the area of interest for specimen.

7. After extracting the biopsy sample is complete, gently remove the probe from the body.

8. Exit the Biopsy menu.

9. Disassemble the items and properly dispose of these items as required.

17.2.5 Clean and Sterilize the Needle-Guided Bracket

⚠ CAUTION

- **Needle-guided brackets whose name starts with NGB are reusable, and need thorough cleaning and sterilization before and after each biopsy.**
- **Follow local regulations when selecting and using the disinfectant.**
- **Repeated sterilization may degrade the safety and performance of the needle-guided bracket. Before use, please check whether the needle-guided bracket has defects such as deformation and rusting. If such defects exist, the bracket has reached the end of its service life. In this case, stop using it and contact the Customer Service Department or your local distributor.**
- **It is recommended to use immersion sterilization for plastic needle-guided brackets and high-pressure steam sterilization for metal needle-guided brackets.**
- **For detailed operations about the cleaning solvent, sterilant and high-temperature steam sterilizer, see the respective operator's manuals provided by the manufacturer.**

NOTE:

Disposable components are packaged sterile and are single-use only. Do not use if integrity of packaging is violated or if expiration date has passed. Please use the disposable components compliant with the relevant local regulations.

Cleaning

Perform the following procedure:

1. Wear a pair of gloves to prevent infection.
2. After use, immerse the needle-guided bracket in distilled water immediately to prevent dirt from drying. Wipe the entire surface of the needle-guided bracket by using a piece of disposable lint-free soft cloth to remove coarse dirt.
3. Prepare a cleaning solvent (enzymatic or neutral pH detergent, e.g., liquinox, MetriZyme) by using distilled or softened water in accordance with the operator's manual provided by the manufacturer.
4. Detach all the detachable parts of the needle-guided bracket and immerse the needle-guided bracket and all its parts fully in the cleaning solvent for at least 1 minute or a period specified by the manufacturer.
5. Immerse the needle-guided bracket and all its parts fully in the cleaning solvent. Wipe and wash the surface and connecting parts of the needle-guided bracket gently by using a soft brush until no dirt is visible. Place the needle-guided bracket inside an ultrasonic cleaner and perform ultrasonic cleaning for 3–5 minutes.
6. Rinse the needle-guided bracket thoroughly by using a large amount of distilled or softened water (about 2 gallons) at room temperature for about 30 s to remove the residual dirt and cleaning solvent. Repeat the operation twice.
7. Wipe away the water on the needle-guided bracket by using a piece of disposable lint-free soft cloth.
8. Inspect the needle-guided bracket. If visible dirt still exists, repeat the preceding steps to wash the bracket until it is all clean.

Sterilization with a sterilant

Perform the following procedure:

1. Wear a pair of gloves to prevent infection.
2. Clean thoroughly in accordance with the cleaning procedure before sterilization.
3. Prepare a sterilant by using sterile distilled water when necessary.

Table 17-3 Recommended sterilization solution

Chemical name	Trade name	Procedures
Glutaraldehyde (2.4%)	Cidex Activated Dialdehyde Solution (applicable for FDA region)	Refer to the instructions provided by the solution manufacturer for details.
22% Hydrogen Peroxide 4.5% Peroxyacetic Acid	Minncare liquid disinfectant (applicable for Canada region)	Refer to the instructions provided by the solution manufacturer for details.
Glutaraldehyde (2.6%)	Metricide	Refer to the instructions provided by the solution manufacturer for details.

4. Immerse the needle-guided bracket fully in the sterilant and shake the bracket appropriately to remove any bubbles on the surface. Use a syringe to draw an appropriate amount of sterilant and inject the sterilant into the hole to remove the bubbles inside the hole if necessary.

   For details about the immersion duration, see the operator's manual provided by the manufacturer.

5. After sterilization, wash the needle-guided bracket thoroughly by using a large amount of sterile distilled water (about 2 gallons) at room temperature for about 30s to remove the residual sterilant. Repeat the operation twice.

6. Dry the needle-guided bracket by using a piece of sterile disposable lint-free soft cloth.

7. Store the needle-guided bracket in a cool, clean and dry environment.

High-pressure steam sterilization

High-pressure steam sterilization is preferred for the metal guided brackets.

NOTE:

For FDA region, the sterilizer and accessories should be cleared by FDA for the intended sterilization cycle.

Perform the following procedure:

1. Wear a pair of gloves to prevent infection.

2. Clean thoroughly in accordance with the cleaning procedure before sterilization.

3. Package the needle-guided bracket in accordance with the sterilization requirements of surgical instruments.

4. Place the packaged needle-guided bracket inside a high-temperature steam sterilizer and perform sterilization. The sterilization parameters are 121 °C and 30 minutes for a gravity displacement steam sterilizer and are 132 °C and 4 minutes for a dynamic-air-removal steam sterilizer.

5. Take out the sterilization package after sterilization and dry it in an oven at 60 °C for 20 minutes to 30 minutes.

   Keep the sterilization package together with other sterilized surgical instruments in a sterile item storage area.

17.2.6 Storage and Transportation

- 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.
- Between examinations, keep the needle-guided bracket in a sterile environment.
- If the needle-guided bracket is sent to the Customer Service Department or your local distributor for repair, be sure to disinfect or sterilize it and keep it in the carrying case to prevent infection.
- Sterilize the carrying case as necessary.
- Store or transport the needle-guided bracket under the following ambient conditions:
  - Ambient temperature: -20 °C to 55 °C
  - Relative humidity: 20% to 95% (no condensation)

– Atmospheric pressure: 700 hPa to 1060 hPa

17.2.7 Disposal

Be sure to sterilize the needle-guided bracket before disposing of it.

Contact the Customer Service Department or your local distributor when disposing of this device.

17.3 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.

Turn on the Middle Line function in the biopsy tab or preset a shortcut button for middle line 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 "×" located on the middle line which can be moved up and down along the line.
- To use the Middle Line function of the ultrasound system:
  a. Change the mark position and by adjusting lithotripsy machine tools or animal posture to locate the stone center at the mark.
  b. Read the depth of the mark by observing the depth caliper on the screen.
  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.

18 DVR Recording

NOTE:

- Strictly observe the procedures described here to perform the recording and replaying operations; otherwise it may result in data loss or system malfunction.
- Set the PAL or NTSC in the setup and this shall be consistent with that in the DVR.
- Accidental exposure to strong electromagnetic fields or mishandling of the video cassette may result in image and data loss, so check if the recording is successful as soon as possible. We are not responsible for any data loss.

The system provides built-in DVR recording function. You can use the DVR to record and replay videos and audios that can be stored in DVD disc or hard disc.

The recorded video is AVI format; you can save it in the hard disk drive, burn to the DVD or export to the USB disk.

When the built-in DVR is in normal status, the  displays at the lower right corner of the screen.

18.1 Start Recording

After recording, the system will save the recording file automatically, you can select to save in local disk, U disk or optical disk.

Perform the following procedure:

1. Perform ultrasound exams, select appropriate views and adjust parameters to prepare for recording.
2. Click  to open the dialog box and select desired recording type: Hard disk/USB/CDRO.
3. Click [Close] to enter recording status.
4. Press the user-defined key for “DVR” and click [OK] to start recording, and the DVR icon displays as  in recording status.

   During the recording process, you can perform imaging mode switching, comments adding, body mark adding and measurements.
5. Press the user-defined key for “DVR” again to stop recording, the DVR icon in the lower right corner turns into data transfer status  .

– If USB/CDROM is selected, the system sends the recorded file to the target storage media (USB disk or DVD optical disk drive) in the meantime.
– If “Hard disk” is selected, the system saves the file to the path: D:\AppData\DVR.

In the animal task management screen, click [Media Storage Task] tab to check transferring status.

18.2 Send Image

The system also supports exporting recorded images that are saved in the local disk.

Perform the following procedure:

1. Click to open the dialog box, and click [Local Video Management] to enter the managing dialog box.

   Click [Rename] to rename the video file.

2. Select the destination and the target file, click [Send] to send the file to the selected path. During sending progress, the icon displays as .

18.3 DVR Video Replay

You can replay the video and audio record.

18.3.1 Replay on PC

Connect the USB disk or optical disk with the file to the PC, open the file directly.

18.3.2 Replay on the ultrasound system

Perform the following procedure:

1. Click to open the dialog box and select desired playing type: Hard disk/USB/CDROM.
2. Click [Play] to open the dialog box.
3. Select the path and name for the file and then click [OK] to replay the file, or double-click the file name directly.

19 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 Customer Service Department or sales representative.

⚠ WARNING

- **Only an authorized service engineer can perform maintenance not specified in this manual.**
- **For the sake of the system performance and safety, you should perform periodical checks for the system.**

19.1 Daily Maintenance

You are responsible for daily maintenance.

No.	Item	Recommended Frequency
1.	Clean the probes	After each use
2.	Clean the holders	1 time per month
3.	Cleaning the machine shell	1 time per month
4.	Cleaning the monitor	1 time per month
5.	Clean the control panel	1 time per month
6.	Clean the trackpad	1 time per month
7.	Clean the dust-proof cover	1 time per month
8.	Clean the ECG cable	1 time per month
9.	Cleaning the ultrasound gel heater	1 time per month
10.	Clean peripherals	1 time per month
11.	Check the probes	1 time per day
12.	Check the power cord and plug	1 time per month

No.	Item	Recommended Frequency
13.	Check the appearance	1 time per month
14.	Check the battery	1 time per 3–6 months
15.	Check the mechanical safety	1 time per year
16.	Check the functions of peripherals and optional accessories	1 time per year

19.1.1 Cleaning the System

⚠ WARNING

- **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.**
- **DO NOT directly spray solution onto the monitor, system control panel or hard surfaces that is 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 liquid into the system while you perform the cleaning. Otherwise it may result in malfunction or electric shock.

Cleaning probes

For details about cleaning the probe head, probe cable, and probe socket, refer to the accompanying cleaning and disinfection guide.

Cleaning holders

NOTE:

Clean the holders periodically.

Tools: soft dry cloth, soapy water, soft brush.

Remaining stains should be wiped away using a cloth with clean or soapy water and the surface left to air dry.

Perform the following procedure:

1. Use a soft dry cloth to wipe away dust attached to the inside, outside and gaps in the probe holder.
2. 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.

Cleaning the machine shell

NOTE:

- Use a soft brush to gently remove the dust from naked interfaces or sockets (such as probe sockets, IO panels). Do not use a water cloth.
- Clean the machine shell periodically.

Tools: mild soapy water, and dry soft cloth

Use a dry soft cloth to wipe the dirt off the machine shell (the exposed part).

Or, use with a dry soft cloth dipped in a small amount of mild soapy water to remove stains, and air dry the shell.

Cleaning the monitor

NOTE:

- 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.
- Clean the monitor and the screen periodically.

Tool: soft dry cloth, mild soapy water

The surfaces of the monitor should be cleaned with a soft dry cloth. Remaining stains should be wiped away using a cloth with a little soapy water and then air dried.

Cleaning the control panel

NOTE:

Clean the control panel and keyboard periodically; otherwise the dirt in the gaps between keys will jam the keys, causing long beeping of the buzzer and malfunction of keys.

Tools: mild soapy water, and dry soft cloth

Use a dry soft cloth to wipe the dust from the surface of the control panel (including keys and encoder). Or, dip a soft cloth with a small amount of mild soapy water to scrub away stubborn stains, and then use another soft cloth to dry or air dry the control panel. If it is difficult to clean the control panel, remove the encoder cap and clean the control panel with mild soapsuds.

Cleaning the dust-proof cover

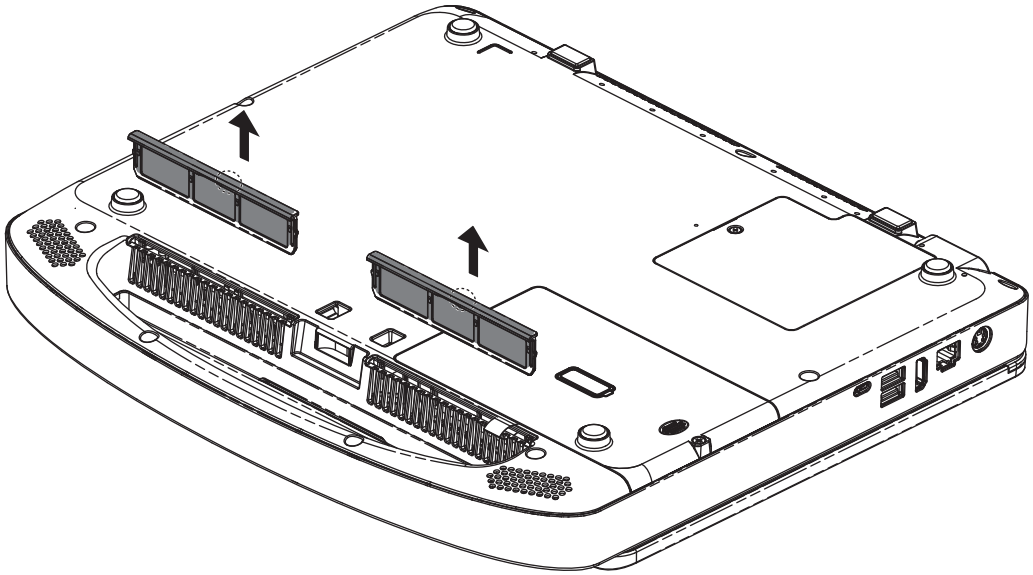
NOTE:

Please clean all dust-proof covers of the system periodically; otherwise, system damage may result. Cleaning times can be increased when the system is used in the open air or somewhere dust is more.

Tool: soft brush

Perform the following procedure:

1. Pull out the dust-proof cover.
2. Cleaning: with soft brush and then wipe off the dust.
3. Assemble dust-proof covers. Insert the dust-proof cover into the slot of the main unit.



Cleaning the peripherals

NOTE:

Clean the peripherals periodically.

Do the cleaning maintenance according to your actual peripheral configuration; items which are not configured can be skipped.

Content	Description
Color and B/W video printer	First wipe off dust or stain attached to the cover of printer with soft dry cloth, then clean the inside of printer. Be sure to do the cleaning maintenance according to the operation manual if necessary.
Graph / text printer	First wipe off dust or stain attached to the cover of printer with soft dry cloth, then clean the inside of printer. Be sure to do the cleaning maintenance according to the operation manual if necessary.
Footswitch	Use soft dry cloth with a little mild soap water to wipe off the dust or stain attached to the pedals or cable of foot switch.
Barcode reader	First use soft dry cloth to wipe off dust attached to glass panel of the reader, then the dust or strain attached to cable and bracket.

19.1.2 Disinfecting the Main Unit

⚠ WARNING

- **Before disinfecting the system, be sure to turn off the power and disconnect the power cord from the outlet. Disinfecting the system while the power is "On" may result in electric shock.**
- **Use only the manufacturer approved disinfectants and methods listed in this section to disinfect the main unit. Warranty does not cover damage caused by unapproved substances or methods.**
- **Do not mix disinfectants, as hazardous gases may result.**
- **We make no claims regarding the efficacy of the listed chemicals or methods as a means for controlling infection. For the method to control infection, consult your hospital's infection control officer or epidemiologist.**

⚠ CAUTION

- **Never immerse any part of the main unit in liquids or allow liquid to enter the interior.**
- **Any contact of disinfectants with connectors or metal parts may cause corrosion.**
- **Do not pour or spray any liquid directly on the main unit or permit fluid to seep into connections or openings.**
- **If you spill liquid on the main unit, disconnect the power supply, dry the main unit, and contact your service personnel.**
- **Never use abrasive materials (such as steel wool or silver polish), or erosive cleaners (such as acetone or acetone-based cleaners).**
- **Dilute and use the disinfectants according to the manufacturer's instructions.**
- **Check the system after disinfection. If there is any sign of damage, remove it from use.**
- **Follow local regulations when selecting and using the disinfectant.**
- **Disinfectants listed in this section are used for disinfecting the housing of the main unit and the monitor only, not for disinfecting the probes or the trolley.**
- **During cleaning, wear medical gloves to prevent infection.**

Compatible Disinfectants

The following table lists compatible disinfectants.

Product Name	Manufacturer	Type
75% Medical alcohol	/	Solution
70% Isopropyl alcohol	/	Solution
3% Hydrogen peroxide	/	Solution
0.5% Sodium hypochlorite	/	Solution
SONO™ ULTRASOUND WIPES	Advanced Ultrasound Solutions Inc.	Wipe
VIREX II 256	Diversey, Inc	Solution
protex ultra disinfectant wipes	Parker Laboratories, Inc.	Wipe
Sani-Cloth® BLEACH	Professional Disposables International Inc	Wipe
Super Sani-Cloth®	Professional Disposables International Inc	Wipe

Product Name	Manufacturer	Type
Sani-Cloth® Plus	Professional Disposables International Inc	Wipe

Disinfection Procedures

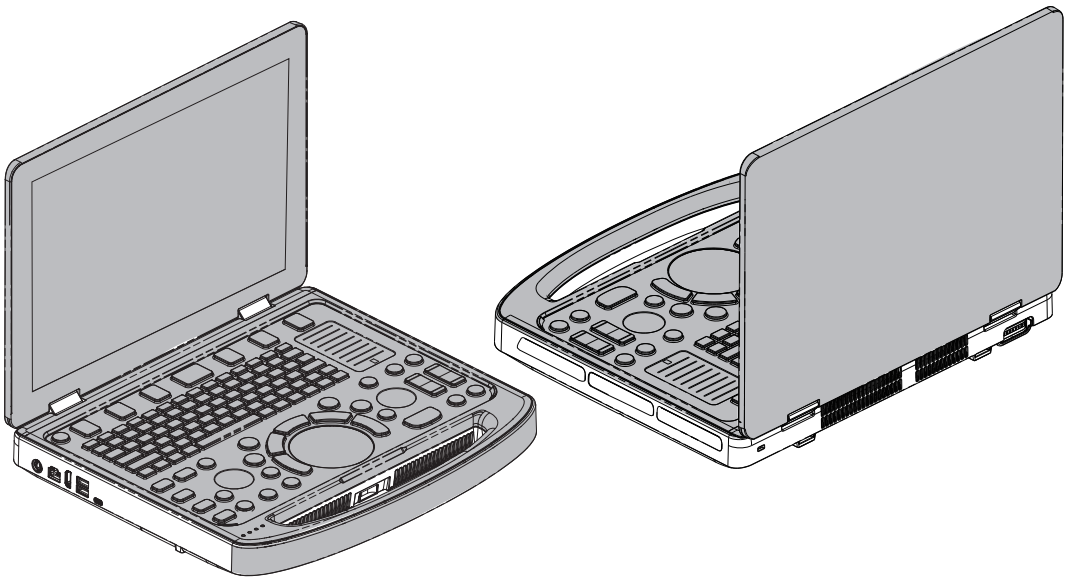
After cleaning, disinfect the system as follows.

1. Wear medical gloves to prevent infection.
2. Disinfect the main unit with disinfectant wipe or solution.

   Follow the disinfectant manufacturer's recommended contact time and method.

   Only the areas highlighted in gray color as shown in the following figure can be disinfected.

   Do not disinfect the bottom cover, side panels around the main unit, any visible sockets or interfaces (such as probe socket, ventilation holes, dust-proof cover, loudspeaker, sockets or interfaces in the IO panel and power supply panel).



3. Remove any residue with a water-moistened soft cloth on the main unit.
4. Wipe off water on the main unit using sterile cloth or gauze. Do not dry the main unit by heating.

19.1.3 Common inspections

Checking the Probe

⚠ WARNING

- **Check the Probe periodically.**
- **The outer surface of the portions of TRANSDUCER ASSEMBLY which is intended to be inserted into a PATIENT should be checked to ensure that there are no unintended rough surfaces, sharp edges or protrusions which may cause harm.**

- 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.

Checking the Power Cable and Plug

NOTE:

Check the power cable and plug periodically.

Visually check to confirm that there are no wrinkles, cracks or deterioration, and no cracks or expansion on the surface of the adapter.

Manually check to confirm that there is no looseness or rupture. The connection of the plug is reliable.

Checking Appearance

NOTE:

Check the appearance periodically.

Check if there are any cracks in the covers:

- Ultrasound system covers.
- Probe appearance.
- External appearance of the ECG lead.

19.1.4 Inspection of Peripherals and Optional Functions

NOTE:

Perform mechanical safety checks regularly.

If there are no modules or optional accessories in the system configuration, skip the relevant inspections.

No.	Content	Method
1.	Color or black and white video printer	Check whether the output of the video printer is normal.
2.	Graphic printer	Check whether the output of the graphic printer is normal.
3.	Footswitch	Check whether the footswitch implements the configured functions according to the program.
4.	External DVD Recorder	Check if DVD-R/W is working properly (burning, reading and ejecting).
5.	Bar code scanner	Check whether the scanner works normally and the output is correct.

No.	Content	Method
6.	DICOM	Check whether DICOM works normally. Send pictures and other data to DICOM server for verification.
7.	ECG	Check the user's basic operations and verify the implementation of functions of the ECG module.

19.1.5 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.

19.2 System Function Inspection

This inspection is an effective method to ensure product quality. When necessary, perform this inspection. Regular maintenance is not required.

No.	Content	Method
1.	B mode	Check the basic operations of the B mode. Check some of the basic software and hardware that affects operations related to the B mode.
2.	Color mode	Check the basic operations of the color mode. Check some of the basic software and hardware that affects operations related to the color mode.
3.	Doppler mode	Check the basic operations of the Doppler mode. Check some of the basic software and hardware that affects operations related to the Doppler mode.
4.	M mode	Check the basic operations of the M mode. Check some of the basic software and hardware that affects operations related to the M mode.
5.	Measurement (2D, M, Doppler routine measurement; application measurement is optional)	Perform gray scale image scanning on the mannequin, use the measurement control to verify the accuracy of distance and area calculation. and verify the measurement accuracy based on the performance test results.
6.	Keyboard test	Perform keyboard tests to verify that all control keys are working properly.
7.	Custom key test	Verify that the user-defined functions of custom keys work properly.
8.	Display	To check whether the display function and parameter adjustment of the display are normal, see the display test method.
9.	Software menu check	Check the software menu display function, and verify that users can access various operation menus and screens normally.

19.3 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.

No.	Failure	Cause	Measure
1.	The power button indicator is lit up, but the image is blank.	The interval between turning off and restarting the system is too short - wait at least 20 seconds.	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 back to the factory defaults.
2.	The monitor displays the characters but no images.	The transmission power, overall gain or TGC controls are improperly set.	Adjust the transmission power, 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.
3.	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.
4.	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.

A Barcode Reader

The system supports logging animal data by using the barcode reader.

⚠ CAUTION

Ensure the information acquired by barcode reader is consistent with the actual information.

TIP:

The reader does not support decoding of Multi-language.

A.1 1-D Barcode Reader

The laser transmitted by SYMBOL LS2208 is Class 2 laser.

⚠ WARNING

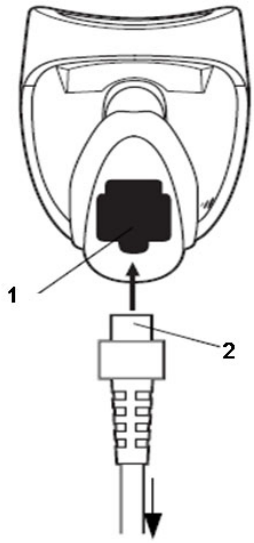
Class 2 laser adopts low power, visible LED. DO NOT stare into beam because of unknown hazards of transient radiation provided by class 2 laser.

There are 2 operation modes for 1-D barcode readers:

- 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.

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.

A.1.1 Setting Up the Reader



1.	Cable interface port
2.	Interface cable modular connector

Perform the following procedure:

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.

A.1.2 Setting

The reader has factory settings, refer to the following table for parameter defaults:

Parameter	Defaults	Parameter	Defaults
1-D Symbologies		Interleaved 2 of 5 (ITF)	
UPC/EAN		Interleaved 2 of 5 (ITF) Enable	Enable
UPC-A	Enable	Set Lengths for I 2 of 5	14
UPC-E	Enable	I 2 of 5 Check Digit Verification	Disable
UPC-E1	Disable	Transmit I 2 of 5 Check Digit	Disable
EAN-8/JAN 8	Enable	Convert I 2 of 5 to EAN 13	Disable
EAN-13/JAN 13	Enable	Codabar (NW - 7)	
Bookland EAN	Disable	Codabar	Enable
Decode UPC/EAN/JAN Supplementals (2and 5 digits)	Ignore	Set Lengths for Codabar	5 to 55
UPC/EAN/JAN Supplemental Redundancy	10	CLSI Editing	Disable
Transmit UPC-A Check Digit	Enable	NOTIS Editing	Disable
Transmit UPC-E Check Digit	Enable		
Transmit UPC-E1 Check Digit	Enable	2-D Symbologies	
UPC-A Preamble	System Character	PDF417	Enable
UPC-E Preamble	System Character	MicroPDF417	Disable
UPC-E1 Preamble	System Character	Code 128 Emulation	Disable
Convert UPC-E to A	Disable	Data Matrix	Enable
Convert UPC-E1 to A	Disable	Maxicode	Enable
EAN-8/JAN-8 Extend	Disable	QR Code	Enable
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		

Parameter	Defaults	Parameter	Defaults
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		

The reader supports some user-defined functions as introduced below.

For more details, please contact the SYMBOL reader agents, or the Customer Service Department or your local distributor.

Volume setting

Scan the following barcode to set the volume parameter.

- Low Volume:

Low Volume

- Medium Volume:

Medium Volume

- High Volume:

High Volume

Code 93 and codabar scanning

- To enable or disable Code 93, scan the appropriate barcode below.

Enable Code 93

- To enable Codabar, 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

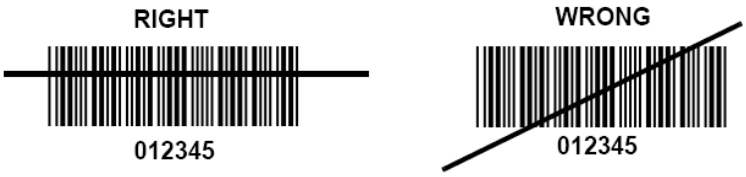
9

A.1.3 Scanning in Hand-Held Mode

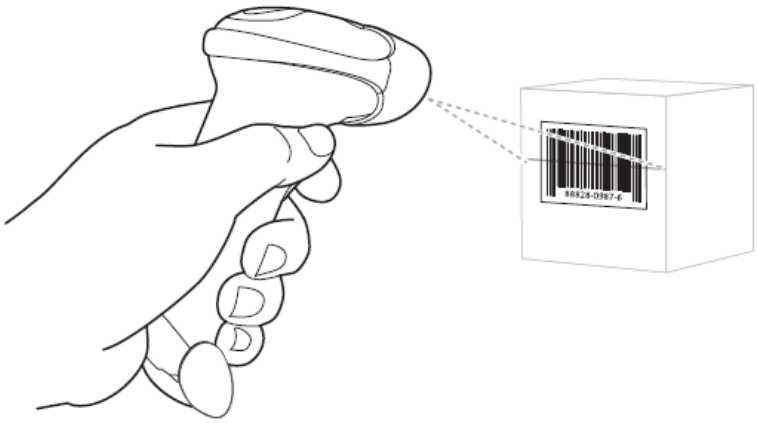
Perform the following procedure:

1. Ensure all connections are secure.
2. Aim the reader at the barcode. Press the trigger.

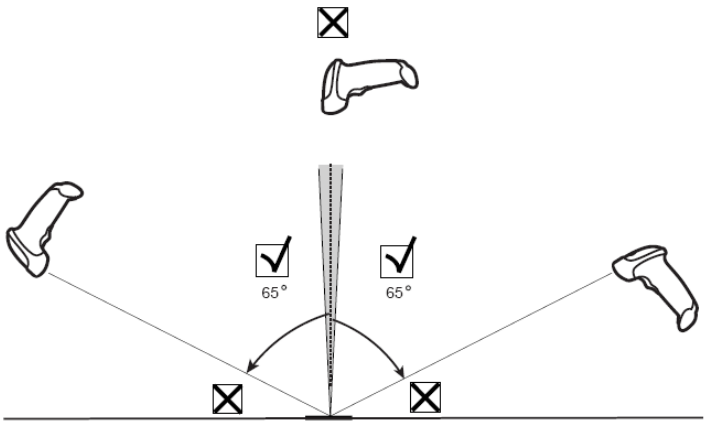
   Ensure the scan line crosses every bar and space of the symbol, see the figure below.



3. Upon successful decode, the reader beeps and the LED turns green.

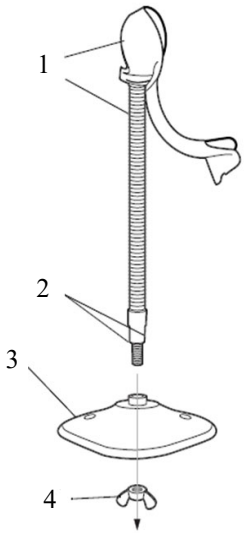


Do not hold the reader directly over the barcode. Laser light reflecting directly back into the reader from the barcode is known as specular reflection. This specular reflection can make decoding difficult. You can tilt the reader up to 55° forward or back and achieve a successful decode.



A.1.4 Scanning in Hands-Free Mode

Assembling the Intellistand



1.	One piece scanner “cup” with flexible neck
2.	Flat areas
3.	Stand base
4.	Wingnut

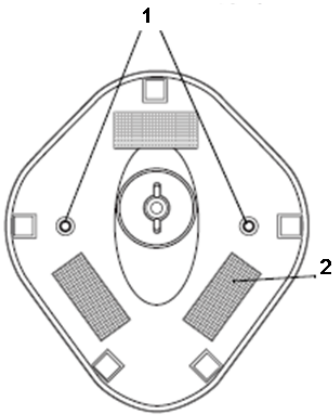
Perform the following procedure:

1. Unscrew the wingnut from the bottom of the one piece scanner “cup”.
2. Fit the bottom of the neck piece into the opening on the top of the stand base.
3. Tighten the wingnut underneath the base to secure the cup and neck piece to the base.

   Before tightening the wingnut under the base, ensure that the flat areas on the flexible neck fit securely in the grooves in the base.
4. Bend the neck to the desired position for scanning.

Mounting the Stand (optional)

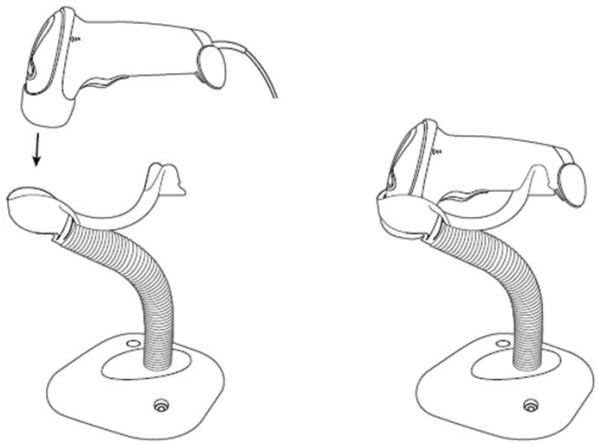
You can attach the base of the reader’s stand to a flat surface using two screws or double-sided tape (not provided).



1.	Two screw-mount holes	For Screw Mount, follow the steps below: **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
2.	Double-side tap areas (3 places, dimensions: 1”×2”)	For Tape Mount, follow the steps below: **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.

Perform Scanning in Hands-Free Mode

When the reader is seated in the scanner 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.



A.2 2D Barcode Reader (Take DS4608 as an example)

SYMBOL DS4608 is classified as “EXEMPT RISK GROUP” according to IEC 62471:2006 and EN 62471:2008.

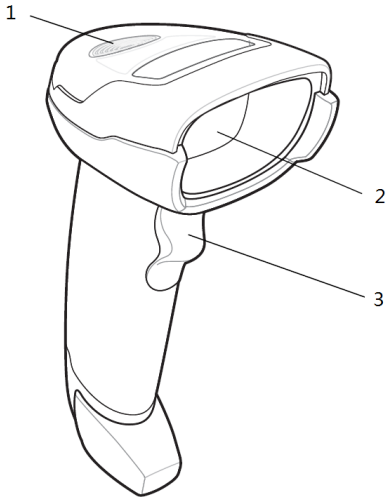
⚠ WARNING

DO NOT stare into beam emitted by SYMBOL DS4608 for more than 10 s.

The 2-D barcode reader supports hand-held operation mode.

Hand-held mode: press the trigger to decode.

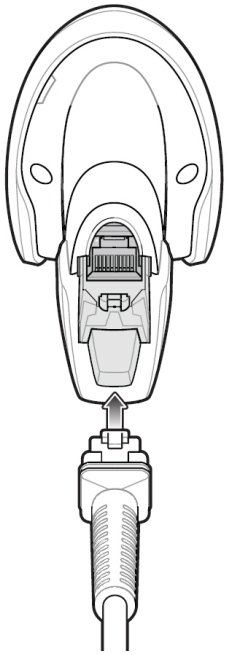
A.2.1 Overview



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.

A.2.2 Setting Up the Digital Imager Reader

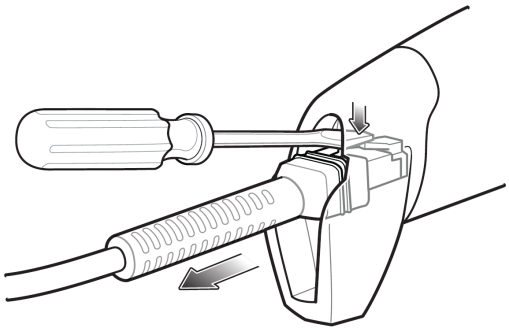
Installing the Interface Cable



Perform the following procedure:

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.

Removing the Interface Cable



Perform the following procedure:

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.

A.2.3 Setting

The reader has factory settings, refer to the following table for parameter defaults:

Parameter	Defaults	Parameter	Defaults
1-D Symbologies		Interleaved 2 of 5 (ITF)	
UPC/EAN		Interleaved 2 of 5 (ITF) Enable	Enable
UPC-A	Enable	Set Lengths for I 2 of 5	14
UPC-E	Enable	I 2 of 5 Check Digit Verification	Disable
UPC-E1	Disable	Transmit I 2 of 5 Check Digit	Disable
EAN-8/JAN 8	Enable	Convert I 2 of 5 to EAN 13	Disable
EAN-13/JAN 13	Enable	Codabar (NW - 7)	
Bookland EAN	Disable	Codabar	Enable
Decode UPC/EAN/JAN Supplementals (2and 5 digits)	Ignore	Set Lengths for Codabar	5 to 55
UPC/EAN/JAN Supplemental Redundancy	10	CLSI Editing	Disable
Transmit UPC-A Check Digit	Enable	NOTIS Editing	Disable
Transmit UPC-E Check Digit	Enable		
Transmit UPC-E1 Check Digit	Enable	2-D Symbologies	
UPC-A Preamble	System Character	PDF417	Enable
UPC-E Preamble	System Character	MicroPDF417	Disable
UPC-E1 Preamble	System Character	Code 128 Emulation	Disable
Convert UPC-E to A	Disable	Data Matrix	Enable
Convert UPC-E1 to A	Disable	Maxicode	Enable
EAN-8/JAN-8 Extend	Disable	QR Code	Enable
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		

Parameter	Defaults	Parameter	Defaults
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		

The reader supports some user-defined functions as introduced below.

For more details, please contact the SYMBOL reader agents, or the Customer Service Department or your local distributor.

Volume setting

Scan the following barcode to set the volume parameter.

- Low Volume

Low Volume
(2)

- Medium Volume

Medium Volume
(1)

- High Volume

*High Volume
(0)

Code 93 and codabar setting

- To enable Code 93, scan the appropriate barcode below.

*Enable Code 93

(1)

- To enable Codabar, scan the appropriate barcode below

*Enable Codabar

(1)

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

(1)

*Disable Code 39 Full ASCII

(0)

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

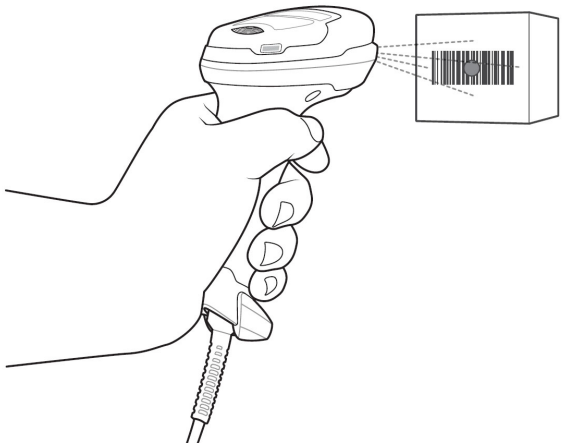
8

9

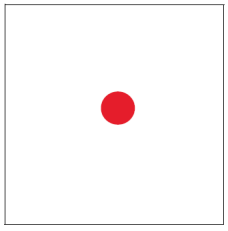
A.2.4 Scanning in Hand-Held Mode

Perform the following procedure:

1. Ensure all connections are secure (see the appropriate host chapter.)
2. Aim the digital imager reader at the barcode.

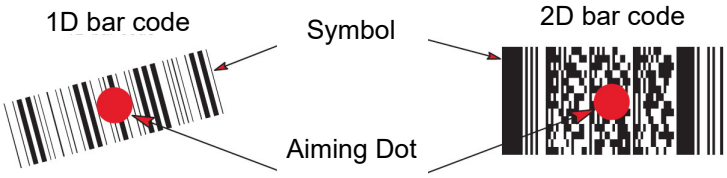


3. When the digital imager reader senses movement, in its default Auto Aim trigger mode, it projects a red LED dot which allows positioning the barcode within the field of view.



If necessary, the digital imager reader turns on its red LEDs to illuminate the target barcode.

4. Center the symbol. Be sure the entire symbol is within the rectangular area formed by the illumination LEDs.

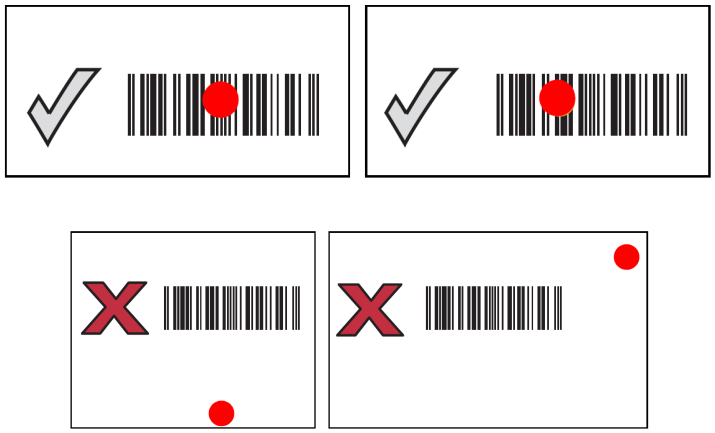


5. Hold the trigger until the digital imager reader beeps, indicating the barcode is successfully decoded.

   Steps 2 - 4 above may be required to repeat on poor quality or difficult barcodes.

   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 dot not centered. The top examples in show acceptable aiming options, while the bottom examples cannot be decoded.



A.3 JADAK Barcode Reader

A.3.1 Supported Barcode Reader Model

The Ultrasound System supports the following barcode readers: HS-1M JDK-2413 and HS-1R JDK-2601.

TIP:

Users can customize the JADAK barcode reader based on specific requirements or contact the Customer Service Department or your local distributor. This configuration guide is applicable for the Ultrasound System only.

A.3.2 Setting Up the JADAK Barcode Reader

Perform the following procedure:

1. Turn off the power to the Ultrasound System.
2. Connect the appropriate interface cable to the barcode reader.
3. Plug the other end of the cable into a free USB port on the Ultrasound system.
4. Once the imager has been fully connected, power on the Ultrasound System.

A.3.3 HS-1M JDK-2413 Configuration

The barcode reader is configured through scanning the barcode. Ensure that the barcode reader is properly connected to the Ultrasound System before scanning. After the barcode is successfully scanned, the barcode reader buzzes, and the green indicator is On.

Configuration before use

Perform the following procedure:

1. Scan the following 1-D barcode to configure the barcode reader:

2. Scan the following 2-D barcode to enable the suffix:

3. Scan the following 2-D barcode to set the suffix to Enter:

Reset the barcode reader

Perform the following procedure:

1. If the barcode reader is in malfunction, scan the following 1-D barcode to reset to default settings.

2. Follow the configuration steps above to reconfigure the barcode reader.

A.3.4 HS-1R JDK-2601 Configuration

The barcode reader is configured through scanning the barcode. Ensure that the barcode reader is properly connected to the Ultrasound System before scanning. After the barcode is successfully scanned, the barcode reader buzzes, and the green indicator is On.

Configuration before use

Perform the following procedure:

1. Scan the following 1-D barcode to configure the barcode reader:

2. Scan the following 1-D barcode to enable the suffix:

For scanning Barcode

For scanning RFID

Reset the barcode reader

Perform the following procedure:

1. If the barcode reader is in malfunction, scan the following 1-D barcode to reset to default settings.

2. Follow the following steps to reconfigure the barcode reader:

   a. Scan the following 1-D barcode to configure the barcode reader:

   b. Scan the following 1-D barcode to enable the suffix:

For scanning Barcode

For scanning RFID

c. Scan the following 1-D barcode to disable the prefix:

For scanning Barcode

For scanning RFID

A.4 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.

B 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 animal 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.

NOTE:

Make sure the safety analyzer is authorized and complies with the requirements of IEC 60601-1. Follow the analyzer manufacturer's instructions.

B.1 Power Cord Plug

B.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.

Test Item	Acceptance Criteria
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.

B.2 Device Enclosure and Accessories

B.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.).

B.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.

B.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

B.4 Protective Earth Resistance

1. Plug the analyzer probes into the device’s protective earth terminal and the protective earth terminal of the AC power cord.

2. Test the earth resistance with a current of 25 A.
3. Verify the resistance is less than the limits.

LIMITS

ALL COUNTRIES R = 0.2 Ω Maximum

B.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 ANSI/AAMI ES60601-1:
  - 300 µA in Normal Condition.
  - 1000 µA in Single Fault Condition.
- For IEC 60601-1:
  - 500 µA in Normal Condition.
  - 1000 µA in Single Fault Condition.

B.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 ANSI/AAMI ES60601-1
  - 100 µA in Normal Condition.
  - 300 µA in Single Fault Condition.
- For IEC 60601-1:
  - 100 µA in Normal Condition.
  - 500 µA in Single Fault Condition.

B.7 Animal Leakage Current

Animal 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 Animal 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 µA in Normal Condition.
- 500 µA in Single Fault Condition.

B.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 µA.

B.9 Animal Auxiliary Current

Animal 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 Animal 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 μA in Normal Condition.
- 500 μA in Single Fault Condition.

C Wireless LAN

The system provides wireless net adapter configuration, so as to assist information query and unlimited network service.

⚠ WARNING

- **Use the wireless LAN function prudently 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:

Disconnection may be caused if the devices connected excess the router capacity (please refer to settings of the router, generally it should be ≤5.)

DO NOT connect devices other than specified into the LAN.

Medical devices within the same LAN may interfere with each other, the operator should be cautious. (Do not connect devices that may cause strong interference. For example, life-supporting devices should not be connected in the same LAN.)

Other non-medical devices in the same frequency band may cause interference, please be cautious.

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 IEEE 802.11 ac/a/b/g/n.
  - Maximum transmission speed 300 Mbps.
  - 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.

C.1 Use the Wireless Feature

Perform the following procedure:

1. Select the Cursor button to show the cursor, click  in the bottom bar to open the wireless network manager.
2. Move the cursor to the target network and press the confirm button to select it, then click [Connect] to connect to the network.
3. When connecting an encrypted network, enter the password in the box first. You can select to hide password characters or not.
4. The system tries to connect and the wireless manager icon turns into  . The icon turns into  or  after successful connection.
5. Click [Refresh] to refresh the “Wireless Network Connection” list.

C.2 IP Configure

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.
- 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.

IP config is used for setting local network parameters, which is also applied to DICOM connection.

Perform the following procedure:

1. In Wireless network manager screen, click [IP Config] to open the configuration page.
   – If “DHCP” is selected, the IP address will be automatically obtained from the DNS server.
   – 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.
2. Click [OK] to save current setting. Click [Cancel] to exit.

D 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.

NOTE:

- THIS "iScanHelper" IS FOR REFERENCE OR TUTORIAL PURPOSES ONLY, AND THE MANUFACTURER SHALL NOT BE LIABLE FOR DAMAGES AND/OR OTHER UNDESIRABLE CONSEQUENCES IN ANY KIND THAT MAY OCCUR TO THE ANIMALS OR THE USERS BY USING THE SOFTWARE.
- Animal species diversity and individual differences should be considered during study. Knowledge of anatomy will help a lot to our study. Canines are taken as examples unless otherwise specified.

D.1 Use iScanHelper for Reference

Perform the following procedure:

1. Perform ordinary scanning procedure.
2. Select the user-defined button for "iScanHelper" to enter iScanHelper status.
3. Select the desired view name in the section selecting box.
4. Perform scanning according to information displayed on the help information area.
5. Select the user-defined button again to exit.

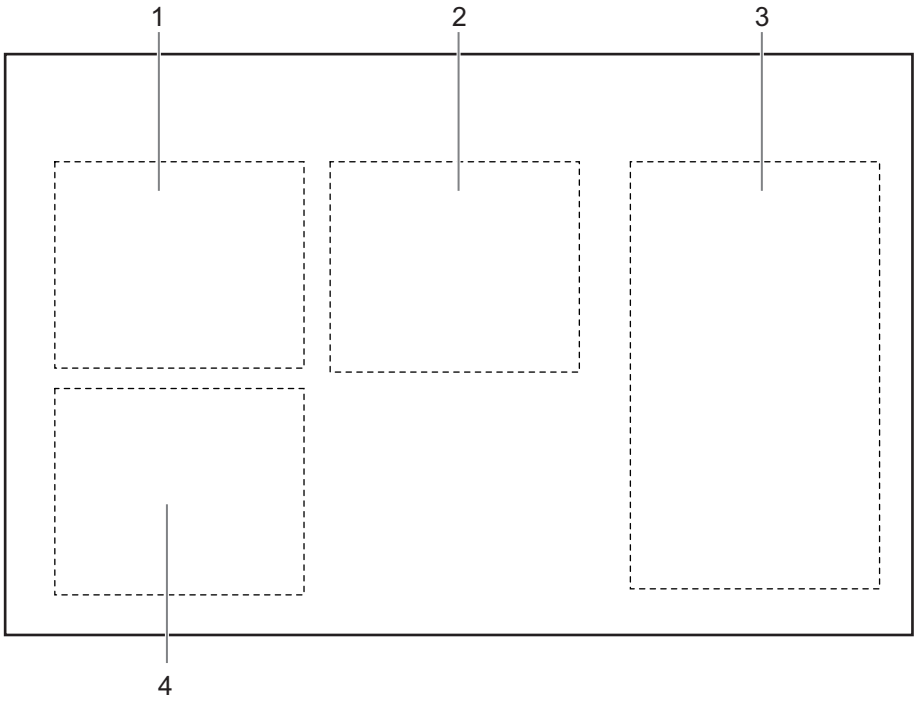
D.2 Use iScanHelper for Learning or Training

Perform the following procedure:

1. Switch to the exam modes that support iScanHelper.
2. Select the user-defined button for "iScanHelper" to enter iScanHelper status.

3. Learn and practice views by system defaulted sequence according to the information displayed on help information area; or select unfamiliar views to practice.
4. Select the user-defined button again to exit iScanHelper.

D.3 Basic Screen and Operation



1.	Ultrasonic image	It is used to compare with images scanned by the operator.
2.	Anatomic graphic	Related anatomical tissue information are provided here.
3.	Scanning tips	You can read tissue related anatomical information and adjacent tissue information here.
4.	Scanning picture	Ordinary scanning tips can be observed here, including posture, probe mark, probe swing/sweep techniques.

D.4 Measurement, Comments, and Body Mark

Switching probe or exam, measurement, comments and the body mark are unavailable under iScanHelper status.

E 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).

Perform the following procedure:

1. Select the user-defined button for “iVision” to enter the iVision screen.
2. Add the contents to be played and select demo mode.
3. Select an item in the list and then select [Start] to begin the demonstration.
4. Select [Exit] to exit iVision status.

E.1 Demonstration item

Demonstration items are image files in formats supported by the system. You can add exam data from the animal 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.

E.2 Demonstration catalog

There are two kinds of catalog: Demo Catalog and Customize Catalog.

E.2.1 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.

Select [Demo Manager] to operate:

- [>]: to import data into the demo catalog.
- [<]: to delete selected data.
- [<<]: to delete all data.

E.2.2 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].

E.3 Demonstration mode

The system automatically plays all the image files in the list one by one.

The time interval between images played is same and can be changed.

E.4 Option of Demo

You can choose whether to repeat the demonstration or exit after a demonstration is completed.

F EMC Guidance and Manufacturer's Declaration

The system complies with the EMC standard IEC 60601-1-2:2014+A1:2020.

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

- **The use of unapproved accessories may diminish system performance.**
- **Use of components, accessories, probes, and cables other than those specified may result in increased emission or decreased immunity of system.**
- **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.)**
- **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.**
- **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.**
- **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.**
- **Other devices may interfere with this equipment even though they meet the requirements of CISPR.**
- **Use of portable or mobile communications devices can degrade the performance of the equipment.**
- **Portable and mobile RF communications equipment could affect system. See below tables.**
- **The system should be away from RFID, MRI, diathermy, and electrocautery testing, wireless power transfer, 5G cellular and security equipment (such as electromagnetic anti-theft system and metal detector). If the devices are near and are interfered by the concealed and undiscovered RF transmitter (for example, scanning mode changes or image disturbances affecting diagnosis), the user should immediately take mitigation measures, such as redirecting, repositioning or shielding the RF transmitter.**

- **This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:**
  - **Reorient or relocate the receiving antenna.**
  - **Increase the separation between the equipment and receiver.**
  - **Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.**
  - **Consult the dealer or an experienced radio/TV technician for help.**

  Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

  The device has been evaluated to meet general RF exposure requirement. The device can be used in portable exposure condition without restriction.
- **This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.**

NOTE:

The system needs special precautions regarding EMC and needs to be installed and put into service according to the EMC information provided below.

If the system is operated within the electromagnetic environment listed in Table F-2, Table F-3, Table F-4, Table F-5, and Table F-6, 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 F-1

GUIDANCE AND MINDRAY ANIMAL MEDICAL 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	
NOTE: The probes P8-2Ts which integrated in the system was declared to the category of CISSPR11 Group1 Class A. The EMISSIONS characteristics of the equipment make it suitable for use in industrial areas and hospitals (CISPR 11 class A). If it is used in a residential environment (for which CISPR 11 class B is normally required) the equipment might not offer adequate protection to radio-frequency communication services. The user might need to take mitigation measures, such as relocating or re-orienting the equipment.		

Table F-2

GUIDANCE AND MINDRAY ANIMAL MEDICAL 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; ±2 kV, ±4 kV, ±8 kV, ±15 kV air	±8 kV contact; ±2 kV, ±4 kV, ±8 kV, ±15 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast Transient / burst IEC 61000-4-4	±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	±0,5 kV, ±1 kV line(s) to line(s); ±0,5 kV, ±1 kV, ±2 kV line(s) to earth	±0,5 kV, ±1 kV line(s) to line(s); ±0,5 kV, ±1 kV, ±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% U_T; 0,5 cycle At 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315° 0% U_T; 1 cycle 70% U_T for 25/30 cycle at 0° 0% U_T; 250/300 cycle	0% U_T; 0,5 cycle At 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315° 0% U_T; 1 cycle 70% U_T for 25/30 cycle at 0° 0% U_T; 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 F-3

GUIDANCE AND MINDRAY ANIMAL MEDICAL 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**
Conduced RF IEC 61000-4-6	3 Vrms 0,15 MHz – 80 MHz 6 Vrms in ISM[a] 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 $d = 1.2 \times \sqrt{P}$ $d = 2 \times \sqrt{P}$
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). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey[b], should be less than the compliance level in each frequency range[c]. Interference may occur in the vicinity of equipment marked with the following symbol: 
Note 1: At 80 MHz and 800 MHz, 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.			

Table F-3

GUIDANCE AND MINDRAY ANIMAL MEDICAL 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**

a: The ISM (industrial, scientific, and medical) bands between 150 kHz and 80 MHz are 6,765 MHz to 6,795 MHz; 13,553 MHz to 13,567 MHz; 26,957 MHz to 27,283 MHz; and 40,66 MHz to 40,70 MHz. The amateur radio bands between 0,15 MHz and 80 MHz are 1,8 MHz to 2,0 MHz, 3,5 MHz to 4,0 MHz, 5,3 MHz to 5,4 MHz, 7 MHz to 7,3 MHz, 10,1 MHz to 10,15 MHz, 14 MHz to 14,2 MHz, 18,07 MHz to 18,17 MHz, 21,0 MHz to 21,4 MHz, 24,89 MHz to 24,99 MHz, 28,0 MHz to 29,7 MHz and 50,0 MHz to 54,0 MHz.

b: Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the device is used exceeds the applicable RF compliance level above, the device should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the device.

c: Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

Table F-4

GUIDANCE AND MINDRAY ANIMAL MEDICAL 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 ENVIROMENT – GUIDANCE**
Proximity magnetic fields IEC 61000-4-39	8 A/m 30 kHz CW	8 A/m 30 kHz CW	/
	65 A/m 134,2 kHz Pulse modulation 2,1 kHz	65 A/m 134,2 kHz Pulse modulation 2,1 kHz	
	7,5 A/m 13,56 MHz Pulse modulation 50 kHz	7,5 A/m 13,56 MHz Pulse modulation 50 kHz	

Table F-5 Test specifications and minimum distances

Recommended separation distances between portable and mobile RF communications equipment and system						
The system is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of system can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the system as recommended below, according to the maximum output power of the communications equipment. Portable and mobile radio communications equipment (e.g. two-way radio, cellular/ cordless telephones and similar equipment) should be used no closer to any part of this system, including cables, than determined according to the following method:						
Test frequency (MHz)	**Band(MHz)**	**Service**	**Modulation**	**Maximum power (W)**	**Distance (m)**	**Immunity test level (V/m)**
385	380 - 390	TETRA 400	Pulse modulation 18Hz	1.8	0.3	27
450	430 -470	GMRS 460 FRS 460	FM ±5 kHz deviation 1 kHz sine	2	0.3	28
710 745 780	704 - 787	LTE Band 13,17	Pulse modulation 217 Hz	0.2	0.3	9
810 870 930	800 - 960	GSM 800/900, tetra 800, iDEN 820, CDMA 850, LTE Band 5	Pulse modulation 18 Hz	2	0.3	28
1720 1845 1970	1700 -1990	GSM 1800, CDMA 1900, GSM 1900, DECT, LTE Band 1, 3, 4, 25, UMTS	Pulse modulation 217 Hz	2	0.3	28
2450	2400 -2570	Bluetooth, WLAN, 802.11 b/g/n, RFID 2450, LTE Band 7	Pulse modulation 217 Hz	2	0.3	28

Table F-5 Test specifications and minimum distances

Recommended separation distances between portable and mobile RF communications equipment and system						
The system is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of system can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the system as recommended below, according to the maximum output power of the communications equipment. Portable and mobile radio communications equipment (e.g. two-way radio, cellular/ cordless telephones and similar equipment) should be used no closer to any part of this system, including cables, than determined according to the following method:						
Test frequency (MHz)	**Band(MHz)**	**Service**	**Modulation**	**Maximum power (W)**	**Distance (m)**	**Immunity test level (V/m)**
5240	5100 -5800	WLAN, 802.11 a/n	Pulse modulation 217 Hz	0.2	0.3	9
5500						
5785						

Table F-6

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**			
	150kHz -80MHz Out ISM and amateur radio bands $d=1.2\sqrt{P}$	**150kHz -80MHz in ISM and amateur radio bands** $d=2\sqrt{P}$	**80MHz-800MHz** $d=1.2\sqrt{P}$	**800MHz-2.7GHz** $d=2.3\sqrt{P}$
0.01	0.12	0.2	0.12	0.23
0.1	0.38	0.64	0.38	0.73
1	1.2	2	1.2	2.3
10	3.8	6.4	3.8	7.3
100	12	20	12	23

Table F-6

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**			
	150kHz -80MHz Out ISM and amateur radio bands	**150kHz -80MHz in ISM and amateur radio bands**	**80MHz-800MHz**	**800MHz-2.7GHz**
	d=1.2 $\sqrt{P}$	**d=2** $\sqrt{P}$	**d=1.2** $\sqrt{P}$	**d=2.3** $\sqrt{P}$

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 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.

Table F-7 Cable sample

No.	Name	Cable length (m)	Shield or not	Remarks
1.	AC inlet cable for the main unit	2.5	Not shielded	/
2.	Power cable for adapter	1.5	Not shielded	/
3.	ECG Lead	1	Shielded	/
4.	ECG Module connecting cable	2.9	Shielded	/
5.	Foot-switch control cable	2.9	Shielded	/
6.	Probe cable	<3.0	Shielded	All probe cables

Radio Regulatory Compliance

RF parameter

Features	2.4GHz	5GHz
Frequency Rage	2412MHz - 2483.5MHz	5.15 - 5.25GHz 5.25 - 5.35GHz 5.47 - 5.725GHz 5.725 - 5.850GHz
Modulation	DSSS and OFDM	OFDM
Output Power	≤20dBm	

NOTE:

Keep a distance of at least 20cm away from the monitor when Wi-Fi function is in use.

Wireless Specification

The wireless QoS (Quality of Service) related parameters are as follows:

No.	Item	Specifications
1.	Data rate	802.11a: up to 54 Mbps @ 5 GHz 802.11b: up to 11 Mbps @ 2.4 GHz 802.11g: up to 54 Mbps @ 2.4 GHz 802.11n: up to 300 Mbps @ 2.4 GHz and 5 GHz
2.	Data security	WPA/WPA2
3.	Vision Distance Communications	The ultrasound diagnostic system can be connected within 3 meters of the wireless network, and the system can perform the following operations and realize its intended use: • Support DICOM transferring patient data through the wireless network (Wi-Fi). • Support the remote network storage of patient data to the PC server (iStorage). • Support MedSight, the interaction between the ultrasound system and mobile terminal, the ultrasound data management, and data query and browsing. • Support MedTouch, the interaction between the ultrasound system and mobile terminal, and data query and browsing; Users can adjust the parameters of the ultrasound system.
4.	Application-layer delay	≤10 seconds

No.	Item	Specifications
5.	Application-layer reliability	If the connection fails, the user will be prompted by the Wi-Fi icon.
6.	System capacity	When the ultrasound system is used as the hotspot AP, no more than 1 access device is allowed.
7.	System anti-interference	It is allowed to coexist with multiple Wi-Fi devices.
8.	Network interruption alarm	•  : Wireless signal not connected •  : Strong wireless signal •  : Normal wireless signal •  : Weak wireless signal • If DICOM or other data transfer fails, a window will pop up for alarm and LOG recording.
9.	Coexist & EMC test process	Wi-Fi function is not affected when the system is imposed with radiation interference complied with AAMI TIR69:2017 &IEC60601-1-2:2014 standard.

G Measurement References

G.1 Abbreviations for the Measurements

G.1.1 Abdomen Measurements

2D Mode

Abbreviation	Description
Renal L	Renal Length
Renal H	Renal Height
Renal W	Renal Width
Cortex	Renal Cortical Thickness
Adrenal L	Adrenal Length
Adrenal H	Adrenal Height
Adrenal W	Adrenal Width
CBD	Common bile duct
Portal V Diam	Portal Vein Diameter
CHD	Common hepatic duct
GB L	Gallbladder Length
GB H	Gallbladder Height
GB wall th.	Gallbladder wall thickness
Panc. duct	Pancreatic duct
Panc. head	Pancreatic head
Panc. body	Pancreatic body
Panc. tail	Pancreatic tail
Spleen L	Spleen Length
Spleen W	Spleen Width
Spleen H	Spleen Height
Spleen V Diam	Spleen vein Diam

Abbreviation	Description
Spleen A Diam	Spleen artery Diam
Aorta Diam. H	Aorta Diameter Height
Aorta Diam. W	Aorta Diameter Width
Aorta Aneurysm H	Aorta Aneurysm Height
Aorta Aneurysm W	Aorta Aneurysm Width
Aorta Aneurysm L	Aorta Aneurysm Length
Aorta Bif.	Aorta Bifurcation
Iliac Diam.	Iliac Diameter
Pre-BL L	Pre-void Bladder Length
Pre-BL H	Pre-void Bladder Height
Pre-BL W	Pre-void Bladder Width
Post-BL L	Post-void Bladder Length
Post-BL H	Post-void Bladder Height
Post-BL W	Post-void Bladder Width
Hepatic Lesion1~3 Elas.	Hepatic Lesion1~3 Elastography
LSM	Liver Stiffness Measurement
Renal Vol.	Renal Volume
Pre-BL Vol.	Pre-void Bladder Volume
Post-BL Vol.	Post-void Bladder Volume
Mictur. Vol.	Micturated Volume

Doppler Mode

Abbreviation	Description
Ren. A Org.	Renal Artery Origin
Arcuate A	Arcuate Artery
Segment A	Segmental Artery
Interlobar A	Interlobar Artery
Renal A	Renal Artery
M Renal A	Main Renal Artery
Renal V	Renal Vein
CrMA	Cranial Mesenteric Artery
CaMA	Caudal Mesenteric Artery
C Hepatic A	Common Hepatic Artery
Hepatic A	Hepatic Artery

Abbreviation	Description
Splenic A	Splenic Artery
CaVC	Caudal Vena Cava
CaVC Reflux	Caudal Vena Cava Reflux
Portal V	Portal Vein
M Portal V	Main Portal Vein
Hepatic V	Hepatic Vein
Lt Hepatic V	Left Hepatic Vein
Rt Hepatic V	Right Hepatic Vein
M Hepatic V	Middle Hepatic Vein
Splenic V	Splenic Vein
CrMV	Cranial Mesenteric Vein
CaMV	Caudal Mesenteric Artery
SMA/Ao	Ratio of Superior Mesenteric Artery PS and Abdominal Aorta PS

G.1.2 Reproduction Measurements

Abbreviation	Description
CRL	Crown Rump Length
GS	Gestational Sac Diameter
HD	Head Diameter
BD	Body Cavity Diameter
GS-H	Gestational Sac Diameter Horizontal
GS-V	Gestational Sac Diameter Vertical
CRL	Crown Rump Length
TD	Trunk Diameter
BPD	Biparietal Diameter
VL	Vitreous Body Length

G.1.3 Cardiology Measurements

2D Mode

Abbreviation	Description
LA Diam	Left Atrium Diameter
LA Major	Left Atrium Major Diameter

Abbreviation	Description
LA Minor	Left Atrium Minor Diameter
RA Major	Right Atrium Major Diameter
RA Minor	Right Atrium Minor Diameter
LV Major	Left Ventricular Major Diameter
LV Minor	Left Ventricular Minor Diameter
RV Major	Right Ventricular Major Diameter
RV Minor	Right Ventricular Minor Diameter
LA Area	Left Atrium Area
RA Area	Right Atrium area
LV Area(d)	Left Ventricular area at end-diastole[*1]
LV Area(s)	Left Ventricular area at end-systole[*1]
RV Area(d)	Right Ventricular area at end-diastole[*2]
RV Area(s)	Right Ventricular area at end-systole[*2]
LVAd sax MV	Left Ventricular Area at Mitral Valve level at End-diastole in Short-axis view
LVAs sax MV	Left Ventricular Area at Mitral Valve level at End-systole in Short-axis view
LVAd apical	Left Ventricular Long-axis Area at End-diastole in apical view
LVAs apical	Left Ventricular Long-axis Area at end-systole in apical view
LVAd sax Epi	Left Ventricular Epicardial Area at Papillary Muscle level at end-diastole in Short-axis view
LVAd sax Endo	Left Ventricular Endocardial Area at Papillary Muscle level at end-diastole in Short-axis view
LVIDd	Left Ventricular Internal Diameter at end-diastole[*3]
LVPWd	Left Ventricular Posterior wall thickness at end-diastole[*3]
LVIDs	Left Ventricular Internal Diameter at end-systole
RVDd	Right Ventricular Diameter at end-diastole
RVDs	Right Ventricular Diameter at end-systole
LVPWs	Left Ventricular Posterior wall thickness at end-systole
RVAWd	Right Ventricular Anterior wall thickness at end-diastole
RVAWs	Right Ventricular Anterior wall thickness at end-systole
IVSd	Interventricular Septal Thickness at end-diastole
IVSs	Interventricular Septal Thickness at end-systole
LVLd apical	Left Ventricular Long-axis Length at End-diastole in apical view
LVLs apical	Left Ventricular Long-axis Length at End-systole in apical view
Ao Diam	Aorta Diameter

Abbreviation	Description
Ao Arch Diam	Aorta Arch Diameter
Ao Asc Diam	Ascending Aorta Diameter
Ao Desc Diam	Descending Aorta Diameter
Ao Isthmus	Aorta Isthmus Diameter
Ao st junct	Aorta ST Junction Diameter
Ao Sinus Diam	Aorta Sinus Diameter
Duct Art Diam	Ductus Arteriosus Diameter
Pre Ductal	Previous Ductal Diameter
Post Ductal	Posterior Ductal Diameter
ACS	Aortic Valve Cusp Separation
LVOT Diam	Left Ventricular Outflow Tract Diameter
AV Diam	Aorta Valve Diameter
AVA	Aortic Valve Area
PV Diam	Pulmonary Valve Diameter
LPA Diam	Left Pulmonary Artery Diameter
RPA Diam	Right Pulmonary Artery Diameter
MPA Diam	Main Pulmonary Artery Diameter
RVOT Diam	Right Ventricular Outflow Tract Diameter
MV Diam	Mitral Valve diameter
MVA	Mitral Valve Area
MCS	Mitral Valve Cusp Separation
MV EPSS	Distance between point E and Interventricular Septum when mitral valve is fully open
TV Diam	Tricuspid Valve Diameter
TVA	Tricuspid Valve Area
CaVC Diam(Insp)	Caudal Vena Cava Inspiration Diameter
CaVC Diam(Expir)	Caudal Vena Cava Expiration Diameter
CrVC Diam(Insp)	Cranial Vena Cava Inspiration Diameter
CrVC Diam(Expir)	Cranial Vena Cava Expiration Diameter
LCA Diam	Left Coronary Artery
RCA Diam	Right Coronary Artery
VSD Diam	Ventricular Septal Defect Diameter
ASD Diam	Atrial Septal Defect Diameter
PDA Diam	Patent Ductus Arteriosus Diameter
PFO Diam	Patent Oval Foramen Diameter

Abbreviation	Description
PEd	Pericardial Effusion at diastole
PEs	Pericardial Effusion at systole
HR	Heart Rate
Diastole	End-diastolic Left Ventricular Measurement
Systole	End-systolic Left Ventricular Measurement
RA Vol(A4C)	Right Atrium Volume (4-chamber)
AutoEF	Automatic measuring of the diastolic and systolic sectional planes
RAP	Right Atrium Pressure
LA/Ao	Left Atrium Diameter/Aorta Diameter
MPA/Ao	Main Pulmonary Artery Diameter/Aorta Diameter
MV T	Mitral Valve Thickness
RPADd	Right pulmonary artery diameter (diastolic)
RPADs	Right pulmonary artery diameter (systolic)
LV SI	Left Ventricular Sphericity Index SI = L/D = LV Length/LVIDd = LVLd apical/LVIDd
RAA Index	Right Atrial Area Index RAA Index = RAA / BSA = RA Area / $(0.101*W^{2/3})$

*1 means: The system automatic calculates FAC value.

FAC=((LV Area(d)- LV Area(s))/ LV Area(d))*100%

*2 means: The system automatic calculates RV FAC value.

RV FAC=((RV Area(d)- RV Area(s))/ RV Area(d))*100%

*3 means: The system automatic calculates RWT value.

RWT=(LVPWd(cm)×2)/LVIDd(cm)

M Mode

Abbreviation	Description
LA Diam.	Left Atrium Diameter
LVIDd	Left Ventricular Internal Diameter at end-diastole
LVPWd	Left Ventricular Posterior wall thickness at end-diastole
LVIDs	Left Ventricular Internal Diameter at end-systole
RVDd	Right Ventricular Diameter at end-diastole
RVDs	Right Ventricular Diameter at end-systole

Abbreviation	Description
LVPWs	Left Ventricular Posterior wall thickness at end-systole
RVAWd	Right Ventricular Anterior wall thickness at end-diastole
RVAWs	Right Ventricular Anterior wall thickness at end-systole
IVSd	Interventricular Septal Thickness at end-diastole
IVSs	Interventricular Septal Thickness at end-systole
Ao. Diam.	Aorta Diameter
Ao. Arch Di-am.	Aorta Arch Diameter
Ao. Asc. Di-am.	Ascending Aorta Diameter
Ao. Desc. Diam.	Descending Aorta Diameter
Ao. Isthmus	Aorta Isthmus Diameter
Ao. ST Junct.	Aorta ST Junction Diameter
Ao. Sinus Diam.	Aorta Sinus Diameter
LVOT Diam.	Left Ventricular Outflow Tract Diameter
ACS	Aortic Valve Cusp Separation
LPA Diam.	Left Pulmonary Artery Diam-eter
RPA Diam.	Right Pulmonary Artery Diameter
MPA Diam.	Main Pulmonary Artery Diameter
RVOT Diam.	Right Ventricular Outflow Tract Diameter
MV E Amp.	Amplitude of the Mitral Valve E wave
MV A Amp.	Amplitude of the Mitral Valve A wave
MV E-F Slope	Mitral Valve E-F slope
MV D-E Slope	Mitral Valve D-E slope
MV D-E Amp	Amplitude of the Mitral Valve DE wave
MCS	Mitral Valve Cusp Separation
MV EPSS	Distance between point E and the interventricular septum
PEd	Pericardial Effusion at dias-tole
PEs	Pericardial Effusion at systole
LVPEP	Left Ventricular pre-ejection period
LVET	Left Ventricular Ejection Time
RVPEP	Right Ventricular Pre-Ejection Period
RVET	Right Ventricular Ejection Time
HR	Heart Rate
Diastole	End-diastolic Left Ventricular Measurement
Systole	End-systolic Left Ventricular Measurement
MAPSE	Mitral Annular Plane Systolic Excursion

Abbreviation	Description
TAPSE	Tricuspid Annular Plane Systolic Excursion
MV ALL	M wave measurement of mitral valve anterior leaflet
LA/Ao	Left Atrium Diameter/Aorta Diameter
LVPEP/LVET	Left Ventricular pre-ejection period/Left Ventricular Ejection Time
Vp	color M-mode flow propagation velocity

Doppler Mode

Abbreviation	Description
MV Vmax	Mitral Valve Maximum Velocity
MV E Vel.	Mitral Valve E-wave Velocity
MV A Vel.	Mitral Valve A-wave Velocity
MV E VTI	Mitral Valve E-wave Velocity-Time Integral
MV A VTI	Mitral Valve A-wave Velocity-Time Integral
MV VTI	Mitral Valve Velocity-Time Integral
MV AccT	Mitral Valve Acceleration Time
MV DecT	Mitral Valve Deceleration Time
IVRT	Mitral Valve Isovolumic Relaxation Time
IVCT	Mitral Valve Isovolumic Con-traction Time
MV E Dur.	Mitral Valve E-wave Duration
MV A Dur.	Mitral Valve A-wave Duration
LVOT Vmax	Left Ventricular Outflow Tract Maximum Velocity
LVOT VTI	Left Ventricular Outflow Tract Velocity-Time Integral
LVOT AccT	Left Ventricular Outflow Tract Acceleration Time
AAo Vmax	Ascending Aorta Maximum Velocity
DAo Vmax	Descending Aorta Maximum Velocity
AV Vmax	Aorta Valve Maximum Velocity
AV VTI	Aorta Valve Velocity-Time Integral
LVPEP(Doppler)	Left Ventricular Pre-Ejection Period
LVET(Doppler)	Left Ventricular Ejection Time
AV AccT	Aorta Valve Acceleration Time
AV DecT	Aorta Valve Deceleration Time
RVET(Doppler)	Right Ventricular Ejection Time
RVPEP(Doppler)	Right Ventricular Pre-Ejection Period
TV Vmax	Tricuspid Valve Maximum Velocity

Abbreviation	Description
TV E Vel.	Tricuspid Valve E-wave Flow Velocity
TV A Vel.	Tricuspid Valve A-wave Flow Velocity
TV VTI	Tricuspid Valve Velocity-Time Integral
TV AccT	Tricuspid Valve Acceleration Time
TV DecT	Tricuspid Valve Deceleration Time
TV A Dur.	Tricuspid Valve A-wave Duration
RVOT Vmax	Right Ventricular Outflow Tract Maximum Velocity
RVOT VTI	Right Ventricular Outflow Tract Velocity-Time Integral
PV Vmax	Pulmonary Valve Maximum Velocity
PV VTI	Pulmonary Valve Velocity-Time Integral
PV AccT	Pulmonary Valve Acceleration Time
PR DecT	Pulmonary Artery Regurgatation Deceleration Time
MPA Vmax	Main Pulmonary Artery Maximum Velocity
RPA Vmax	Right Pulmonary Artery Maximum Velocity
LPA Vmax	Left Pulmonary Artery Maximum Velocity
PVein S Vel.	Pulmonary Vein S-wave Flow Velocity
PVein D Vel.	Pulmonary Vein D-wave Flow Velocity
PVein A Vel.	Pulmonary Vein A-wave Flow Velocity
PVein A Dur.	Pulmonary Vein A-wave Duration
PVein S VTI	Pulmonary Vein S-wave Velocity-time Integral
PVein D VTI	Pulmonary Vein D-wave Velocity-time Integral
PVein DecT	Pulmonary Vein Deceleration Time
CaVC Vel. (Insp.)	Caudal Vena Cava Inspiration Maximum Velocity
CaVC Vel. (Expir.)	Caudal Vena Cava Expiration Maximum Velocity
CrVC Vel. (Insp.)	Cranial Vena Cava Inspiration Maximum Velocity
CrVC Vel. (Expir.)	Cranial Vena Cava Expiration Maximum Velocity
MR Vmax	Mitral Valve Regurgitation Maximum Velocity
MR VTI	Mitral Valve Regurgitation Velocity-Time Integral
MS Vmax	Mitral Valve Stenosis Maximum Velocity
dP/dt	Rate of Pressure change
AR Vmax	Aortic Valve Regurgitation Maximum Velocity
AR VTI	Aortic Valve Regurgitation Velocity-Time Integral
AR DecT	Aortic Valve Regurgitation Deceleration Time
AR PHT	Aortic Valve Regurgitation Pressure Half Time
AR Ved	Aortic Valve Regurgitation Velocity at end-Diastole

Abbreviation	Description
TR Vmax	Tricuspid Valve Regurgitation Maximum Velocity
TR VTI	Tricuspid Valve Regurgitation Velocity-Time Integral
PR Vmax	Pulmonary Valve Regurgitation Maximum Velocity
PR VTI	Pulmonary Valve Regurgitation Velocity-Time Integral
PR PHT	Pulmonary Valve Regurgitation Pressure Half Time
PR Ved	Pulmonary Valve Regurgitation Velocity at end-Diastole
VSD Vmax	Ventricular Septal Defect Maximum Velocity
ASD Vmax	Atrial Septal Defect Maximum Velocity
PDA Vel(d)	Patent Ductus Arteriosus Velocity at End-diastole
PDA Vel(s)	Patent Ductus Arteriosus Velocity at End-systole
Coarc. Pre-Duct.	Coarctation of Pre-Ductus
Coarc. Post-Duct.	Coarctation of Post-Ductus
AV/TV/MV/PV HR	Heart Rate
RAP	Right Atrium Pressure
Hepatic V S Vel.	Hepatic Vein Systolic Peak Velocity
Hepatic V D Vel.	Hepatic Vein Diastolic Peak Velocity
MV E/A	Mitral Valve E-Vel./A-Vel.
MVA(PHT)	Mitral Valve Orifice Area (PHT) MVA(PHT) (cm^2) = 220 / MV PHT (ms)
TV E/A	Tricuspid Valve E-Vel./A-Vel. TV E/A=TV E Vel(cm/s)/TV A Vel(cm/s)
TVA(PHT)	Tricuspid Valve Orifice Area (PHT) TVA(PHT)=220/TV PHT(cm^2)
A/Ar	MV A Dur / PVein A Dur

TDI Mode

Abbreviation	Description
MV A'(medial)	Mitral Valve medial Late diastolic motion
MV S'(medial)	Mitral Valve medial Systolic motion
MV A'(lateral)	Mitral Valve lateral Late diastolic motion
MV S'(lateral)	Mitral Valve lateral Systolic motion
MV ARa(medial)	Mitral Valve medial AcceleRation Rate
MV DRa(medial)	Mitral Valve medial DeceleRation Rate
MV ARa(lateral)	Mitral Valve lateral AcceleRation Rate

Abbreviation	Description
MV DRa(lateral)	Mitral Valve lateral DeceleRation Rate
MV E'(lateral)	Mitral Valve lateral Early diastolic motion
MV E'(medial)	Mitral Valve medial Early diastolic motion*1
MV S'(medial)	Mitral Valve medial Systolic motion
MV E'(medial)	Mitral Valve medial Early diastolic motion
MV A'(medial)	Mitral Valve medial Late diastolic motion
MV ARa(medial)	Mitral Valve medial Acceleration Rate
MV DRa(medial)	Mitral Valve medial Deceleration Rate
MV S'(lateral)	Mitral Valve lateral Systolic motion
MV E'(lateral)	Mitral Valve lateral Early diastolic motion*2
MV A'(lateral)	Mitral Valve lateral Late diastolic motion
MV ARa(lateral)	Mitral Valve lateral Acceleration Rate
MV DRa(lateral)	Mitral Valve lateral Deceleration Rate
MV E'/A'(medial)	MV medial E-Vel./A-Vel.*3
ATa(medial)	MV medial E-wave Acceleration Time
DTa(medial)	MV medial E-wave Deceleration Time
MV E'/A'(lateral)	MV lateral E-Vel./A-Vel.*4
MV E/E'(medial)	Used to estimate the diastolic function of left ventricular*5
MV E/E'(lateral)	Used to estimate the diastolic function of left ventricular*6
MV E/E'(medial+lateral)	Used to estimate the diastolic function of left ventricular*7
ATa(lateral)	MV lateral E-wave Acceleration Time
DTa(lateral)	MV lateral E-wave Deceleration Time
TV a'(lateral)	Tricuspid Valve lateral Late diastolic motion
TV a'(medial)	Tricuspid Valve medial Late diastolic motion
TV e'(lateral)	Tricuspid Valve lateral Early diastolic motion*2
TV e'(medial)	Tricuspid Valve medial Early diastolic motion
TV s'(lateral)	Tricuspid Valve lateral Systolic motion
TV s'(medial)	Tricuspid Valve medial Systolic motion

- *1 means:

$$E/E'(lateral)(Nounit)=\frac{\text{MV E Vel}(cm/s)}{E'(lateral)(cm/s)}$$

- *2 means:

$$E / E'(medial + lateral)(Nounit) = \frac{\text{MV E Vel}(cm/s)}{\left(E'(medial)(cm/s) + E'(lateral)(cm/s)\right)/2}$$

- *3 means:

$$\text{E'/A'(medi al)(Nounit)} = \frac{\text{E'(medial)}}{\text{A'(medial)}}$$

- *4 means:

$$\text{E'/A'(late ral)(Nounit)} = \frac{\text{E'(lateral l)}}{\text{A'(lateral l)}}$$

- *5 means:

$$\text{MV E/E'(media l)(Nounit)} = \frac{\text{MV E Vel}}{\text{MV E'(medial)}}$$

- *6 means:

$$\text{MV E/E'(later al)(Nounit)} = \frac{\text{MV E Vel}}{\text{MV E'(lateral)}}$$

- *7 means:

$$E/E'(medial + lateral)(Nounit) = \frac{\text{MV E Vel}(cm/s)}{\left(MVE'(medial)(cm/s) + MVE'(lateral)(cm/s)\right)/2}$$

MV ALL

Abbreviation	Description
MV D Point	End of systolic, immediately before the opening of the Mitral Valve.
MV E Point	The anterior leaflet of the mitral valve opens, it peaks at E.
MV F Point	Lowest point of the initial diastolic closing.
MV A Point	In atria systole, blood is propelled through the mitral orifice and the mitral leaflets reopen. The peak of this phase of mitral valve motion is indicated as A.
MV C Point	Complete closure occurs after the onset of the ventricular systole.
MV E Amp	Amplitude of the Mitral Valve E wave to C point
MV D-E Amp	Distance between the onset of the opening of the mitral valve at D and the maximum opening of the anterior mitral valve leaflet at E.
MV D-E Slope	The rate of change that exists between two point (D, E).
MV E-F Slope	The rate of change that exists between two point (E, F).
MV A Amp	Amplitude of the Mitral Valve A wave to C point

Abbreviation	Description
MV A-C Interval	The time interval between the A point and the C point.

AutoEF

Abbreviation	Description
LVLd (A2C)	Left ventricular long-axis length at end diastole (A2C)
LVAd (A2C)	Left ventricular long-axis area at end diastole (A2C)
LVLs (A2C)	Left ventricular long-axis length at end systole (A2C)
LVAs (A2C)	Left ventricular long-axis area at end systole (A2C)
LVLd (A4C)	Left ventricular long-axis length at end diastole (A4C)
LVAd (A4C)	Left ventricular long-axis area at end diastole (A4C)
LVLs (A4C)	Left ventricular long-axis length at end systole (A4C)
LVAs (A4C)	Left ventricular long-axis area at end systole (A4C)
EDV (A2C/A4C/BP)	End-diastolic Left Ventricular Volume
EDV Index (A2C/A4C/BP)	End-diastolic Left Ventricular Volume Index
ESV (A2C/A4C/BP)	End-systolic Left Ventricular Volume
ESV Index A2C/A4C/BP)	End-systolic Left Ventricular Volume Index
SV (A2C/A4C/BP)	Stroke Volume
SI (A2C/A4C/BP)	SV Index
EF (A2C/A4C/BP)	Ejection Fraction
CO (A2C/A4C/BP)	Cardiac Output
CI (A2C/A4C/BP)	Cardiac output index

Study Tools of Left Ventricular Function

Abbreviation	Description
SV	Stroke Volume
CO	Cardiac Output
EF	Ejection Fraction
SI	SV Index
CI	Cardiac output index
FS	Fractional Shortening
MVCF	Mean Velocity of Circumferential Fiber Shortening
LVLd apical	Left Ventricular Long-axis Length at End-diastole in apical view

Abbreviation	Description
LVAd apical	Left Ventricular Long-axis Area at End-diastole in apical view
LVLs apical	Left Ventricular Long-axis Length at End-systole in apical view
LVAs apical	Left Ventricular Long-axis Area at end-systole in apical view
HR	Heart Rate
EDV(SP Ellipse)	End-diastolic Left Ventricular Volume*1
ESV(SP Ellipse)	End-systolic Left Ventricular Volume *2
EDV Index(SP Ellipse)	End-diastolic Left Ventricular Volume Index
ESV Index(SP Ellipse)	End-systolic Left Ventricular Volume Index
SV(SP Ellipse)	Stroke Volume
CO(SP Ellipse)	Cardiac Output
EF(SP Ellipse)	Ejection Fraction
SI(SP Ellipse)	SV Index
CI(SP Ellipse)	CO Index
LVIDd	Left Ventricular Internal Diameter at End-diastole
LVIDs	Left Ventricular Internal Diameter at End-systole
LVAd sax MV	Left Ventricular Area at Mitral Valve level at End-diastole in Short-axis view
LVAs sax MV	Left Ventricular Area at Mitral Valve level at End-systole in Short-axis view
LVAd apical	Left Ventricular Long-axis Area at End-diastole in apical view
LVAs apical	Left Ventricular Long-axis Area at end-systole in apical view
EDV(BP Ellipse)	End-diastolic Left Ventricular Volume*3
ESV(BP Ellipse)	End-systolic Left Ventricular Volume *4
EDV Index(BP Ellipse)	End-diastolic Left Ventricular Volume Index
ESV Index(BP Ellipse)	End-systolic Left Ventricular Volume Index
SV(BP Ellipse)	Stroke Volume
CO(BP Ellipse)	Cardiac Output
EF(BP Ellipse)	Ejection Fraction
SI(BP Ellipse)	SV Index
CI(BP Ellipse)	CO Index
LVLd apical	Left Ventricular Long-axis Length at End-diastole in apical view
LVLs apical	Left Ventricular Long-axis Length at End-systole in apical view
LVAd sax MV	Left Ventricular Area at Mitral Valve level at End-diastole in Short-axis view
LVAs sax MV	Left Ventricular Area at Mitral Valve level at End-systole in Short-axis view

Abbreviation	Description
HR	Heart Rate
EDV(Bullet)	End-diastolic Left Ventricular Volume *5
ESV(Bullet)	End-systolic Left Ventricular Volume *6
EDV Index(Bullet)	End-diastolic Left Ventricular Volume Index
ESV Index(Bullet)	End-systolic Left Ventricular Volume Index
SV(Bullet)	Stroke Volume
CO(Bullet)	Cardiac Output
EF(Bullet)	Ejection Fraction
SI(Bullet)	SV Index
CI(Bullet)	CO Index
LVLd apical	Left Ventricular Long-axis Length at End-diastole in apical view
LVLs apical	Left Ventricular Long-axis Length at End-systole in apical view
LVAd sax MV	Left Ventricular Area at Mitral Valve level at End-diastole in Short-axis view
LVAs sax MV	Left Ventricular Area at Mitral Valve level at End-systole in Short-axis view
LVAd sax PM	Left Ventricular Area at Papillary Muscle level at end-diastole in short axis view
LVAs sax PM	Left Ventricular Area at Papillary Muscle level at end-systole in short axis view
EDV(Mod.Simpson)	End-diastolic Left Ventricular Volume *7
ESV(Mod.Simpson)	End-systolic Left Ventricular Volume *8
EDV Index(Mod.Simpson)	End-diastolic Left Ventricular Volume Index
ESV Index(Mod.Simpson)	End-systolic Left Ventricular Volume Index
SV(Mod.Simpson)	Stroke Volume
CO(Mod.Simpson)	Cardiac Output
EF(Mod.Simpson)	Ejection Fraction
SI(Mod.Simpson)	SV Index
CI(Mod.Simpson)	CO Index
A2Cd	Left ventricular long-axis length at end diastole in A2C view
A2Cs	Left ventricular long-axis length at end systole in A2C view
A4Cd	Left ventricular long-axis length at end diastole in A4C view
A4Cs	Left ventricular long-axis length at end systole in A4C view
EDV(A2C/A4C)	End-diastolic Left Ventricular Volume (A2C/A4C) *9
EDV (BP)	End-diastolic Left Ventricular Volume (BP) *10

Abbreviation	Description
ESV(A2C/A4C)	End-systolic Left Ventricular Volume (A2C/A4C)*11
ESV (BP)	End-systolic Left Ventricular Volume (BP)*12
EDV Index (A2C/A4C/BP)	End-diastolic Left Ventricular Volume Index (A2C/A4C/BP)
ESV Index (A2C/A4C/BP)	End-systolic Left Ventricular Volume Index (A2C/A4C/BP)
Diastole	End-diastolic Left Ventricular Measurement
Systole	End-systolic Left Ventricular Measurement
LVIDd	Left Ventricular Internal Diameter at End-diastole
LVIDs	Left Ventricular Internal Diameter at End-systole
IVSd	Interventricular Septal Thickness at End-diastole
LVPWd	Left Ventricular Posterior Wall Thickness at End-diastole
IVSs	Interventricular Septal Thickness at End-systole
LVPWs	Left Ventricular Posterior Wall Thickness at End-systole
EDV	End-diastolic Left Ventricular Volume
ESV	End-systolic Left Ventricular Volume
EDV Index	End-diastolic Left Ventricular Volume
ESV Index	End-systolic Left Ventricular Volume
MVCF	Mean Velocity of Circumferential Fiber Shortening

- *1 means:

$$\text{EDV(SP Ellipse)}(ml)=\frac{8}{3\pi}\times\frac{\text{LVAd apical}(cm^2)^2}{\text{LVLd apical}(cm)}$$

- *2 means:

$$\text{ESV(SP Ellipse)}(ml)=\frac{8}{3\pi}\times\frac{\text{LVAs apical}(cm^2)^2}{\text{LVLs apical}(cm)}$$

- *3 means:

$$\text{EDV(BP Ellipse)}(ml)=8/3\pi\times\text{LVAd apical}(cm^2)\times\text{LVAd sax MV}(cm^2)/LVIDd(cm)$$

- *4 means:

$$\text{ESV(BP Ellipse)}(ml)=8/3\pi\times\text{LVAs apical}(cm^2)\times\text{LVAs sax MV}(cm^2)/LVIDs(cm)$$

- *5 means:

$$\text{EDV(ml)}= 5/6\times\text{LVLd apical(cm)}\times\text{LVAd sax MV}(cm^2)$$

- *6 means:

$$\text{ESV(ml)= 5/6×LVLs apical(cm)×LVAs sax MV(cm}^2\text{)}$$

*7 means:

$$EDV[\,mL\,] = \frac{\text{LVLd apical}[\,cm\,]}{9} \times \left(\begin{array}{l} 4 \times \text{LVAdsax MV}[\,cm^2\,] + 2 \times \text{LVAd} \\ \text{sax PM}\ [\,cm^2\,] + \sqrt{\text{LVAdsax MV}[\,cm^2\,] \times \text{LVAdsax PM}[\,cm^2\,]} \end{array} \right)$$

- *8 means:

$$ESV[\,mL\,] = \frac{\text{LVLsapical}[\,cm\,]}{9} \times \left(\begin{array}{l} 4 \times \text{LVAssax MV}\,[\,cm^2\,] + 2 \times \text{LVAs} \\ \text{sax PM}\ [\,cm^2\,] + \sqrt{\text{LVAssax MV}[\,cm^2\,] \times \text{LVAssax PM}[\,cm^2\,]} \end{array} \right)$$

- *9 means:

$$\text{EDV}(ml) = \pi \times \frac{\text{LVLd apical}(cm)}{20} \times \sum_{i=1}^{20} r_i^{\,2}(cm)$$

  – LVLd apical: Left Ventricular Long-axis Length at End-diastole in apical view, i.e. the long-axis length obtained in measurement.
  – r_i: Radii obtained from diastolic measurement

- *10 means:

$$\text{EDV}(ml) = \pi \times MAX\{LVLd_{2i}(cm), LVLd_{4i}(cm)\} \Big/ 20 \times \sum_{i=1}^{20} (r_{2i}(cm) \times r_{4i}(cm))$$

- *11 means:

$$\text{ESV}(ml) = \pi \times \frac{\text{LVLs apical}(cm)}{20} \times \sum_{i=1}^{20} r_i^{\,2}(cm)$$

- *12 means:

$$\text{ESV}(ml) = \pi \times MAX\{LVLs_{2i}(cm), LVLs_{4i}(cm)\} \Big/ 20 \times \sum_{i=1}^{20} (r_{2i}(cm) \times r_{4i}(cm))$$

Calculate the LV volume on the apical 2-chamber view image:

$$\text{EDV2}(ml) = \pi \times LVLd_{2i}(cm) \Big/ 20 \times \sum_{i=1}^{20} r_{2i}^{\,2}(cm)$$

$$\text{ESV 2}(ml) = \pi \times LVLs_{2i}(cm) \Big/ 20 \times \sum_{i=1}^{20} r_{2i}^{\,2}(cm)$$

Calculate the LV volume on the apical 4-chamber view image:

$$\text{EDV 4}(ml) = \pi \times LVLd_{4i}(cm) \Big/ 20 \times \sum_{i=1}^{20} r_{4i}^{\,2}(cm)$$

$$\text{ESV } 4(ml) = \pi \times {}^{LVLs_{4i}(cm)}\!/_{20} \times \sum_{i=1}^{20} r_{4i}{}^{2}(cm)$$

$LVLd_{2i}$ – Left ventricular long-axis length at end diastole at apical two-chamber view, which is the long-axis length obtained by EDV(A2C) measurement

$LVLd_{4i}$ – Left ventricular long-axis length at end diastole at apical four-chamber view, which is the long-axis length obtained by EDV(A4C) measurement

$LVLs_{2i}$ – Left ventricular long-axis length at end systole at apical two-chamber view, which is the long-axis length obtained by ESV(A2C) measurement

$LVLs_{4i}$ – Left ventricular long-axis length at end systole at apical four-chamber view, which is the long-axis length obtained by ESV(A4C) measurement

r_{2i} – Radii obtained by EDV(A2C) or ESV(A2C) at apical two-chamber view

r_{4i} – Radii obtained by EDV(A4C) or ESV(A4C) at apical four-chamber view

Study Tools of Left Ventricular Mass - LV Mass (Cube)

Abbreviation	Description
IVSd	Interventricular Septal Thickness at End-diastole
LVIDd	Left Ventricular Internal Diameter at End-diastole
LVPWd	Left Ventricular Posterior Wall Thickness at End-diastole
LV Mass (Cube)	Left Ventricular Mass
LV MASS-I (Cube)	Index of Left Ventricular Mass

*1 means:

$$\text{LV Mass(Cube)} = 1.05 \times [(\text{IVSd} + \text{LVIDd} + \text{LVPWd})^3 - \text{LVIDd}^3]$$

Study Tools of Left Ventricular Mass - LV Mass (A-L)

Abbreviation	Description
LVAd sax Epi	Left Ventricular Epicardial Area at Papillary Muscle level at end-diastole in Short-axis view
LVAd sax Endo	Left Ventricular Endocardial Area at Papillary Muscle level at end-diastole in Short-axis view
LVLd apical	Left Ventricular Long-axis Length at End-diastole in apical view
LV Mass (A-L)	Left Ventricular Mass*1
LV MASS-I (A-L)	Index of Left Ventric-ular Mass
LVAd sax Epi	Left Ventricular Epicardial Area at Papillary Muscle level at end-diastole in Short-axis view

Abbreviation	Description
LVAd sax Endo	Left Ventricular Endocardial Area at Papillary Muscle level at end-diastole in Short-axis view
a	Semi-major axis from widest minor axis radius to apex
d	Truncated semi-major axis from widest minor axis radius to mitral annulus plane
LV Mass (T-E)	Left Ventricular Mass*2
LV MASS-I (T-E)	Index of Left Ventric-ular Mass

- *1 means:

$$\text{LV Mass(g)} = 1.05 \times 5/6 \times (\text{LVAd sax Epi}(\text{cm}^2) \times (\text{LVLd apical}(\text{cm}) + \text{t}(\text{cm})) - \text{LVAd sax Endo}(\text{cm}^2) \times \text{LVL}(\text{cm}))$$

Where

$$\text{t (cm)} = \sqrt{(\text{LVAd sax Epi}(\text{cm}^2)/\pi)} - \sqrt{(\text{LVAd Sax Endo}(\text{cm}^2)/\pi)}$$

- *2 means:

$$\text{LV Mass(g)} = 1.05\pi \times \{(b+t)^2 \times [\frac{2(a+t)}{3} + d - \frac{d^3}{3(a+t)^2}] - b^2 \times (\frac{2a}{3} + d - \frac{d^3}{3a^2})\}$$

Where units of a, b, d, t are cm.

a: Semi-major axis from widest minor axis radius to apex

d: Truncated semi-major axis from widest minor axis radius to mitral annulus plane

t: Thickness of the myocardium

$$\text{t (cm)} = \sqrt{(\text{LVAd sax Epi}(\text{cm}^2)/\pi)} - \sqrt{(\text{LVAd Sax Endo}(\text{cm}^2)/\pi)}$$

b: Short axis radius, usually measured where the radius is largest.

$$\text{b(cm)} = \sqrt{(\text{LVAd Sax Endo}(\text{cm}^2)/\pi)}$$

Mitral Valve Area (MVA)

Abbreviation	Description
LVOT Diam.	Left Ventricular Outflow Tract Diameter
LVOT VTI	Left Ventricular Outflow Tract Velocity-Time Integral
MV VTI	Mitral Valve Velocity-Time Integral
MVA(VTI)	Mitral Valve Area*1

*1 means:

$$MVA(VTI)(cm^2) = \frac{\pi \times |LVOT\ VTI(cm)| \times LVOT\ Diam(cm^2)^2}{4 \times |MV\ VTI(cm)|}$$

Study Tools of AVA (VTI)

Abbreviation	Description
LVOT Diam.	Left Ventricular Outflow Tract Diameter
LVOT VTI	Left Ventricular Outflow Tract Velocity-Time Integral
AV VTI	Aortic Valve Velocity-Time Integral
AVA(VTI)	Aortic Valve Area*1

*1 means:

$$AVA(VTI)(cm^2) = \frac{\pi \times |LVOT\ VTI(cm)| \times LVOT\ Diam(cm^2)^2}{4 \times |AV\ VTI(cm)|}$$

Study Tools of LA Vol

Abbreviation	Description
LA apical	Left Atrium Diameter
LAA(A2C)	Left Atrium Area at apical 2-chamber view
LAA(A4C)	Left Atrium Area at apical 4-chamber view
LA Vol(A-L)	Left Atrium Area*1
LA Vol Index (A-L)	Left Atrium Area
LA Vol.(A2C)	Left Atrium Volume at apical 2-chamber view
LA Vol.(A4C)	Left Atrium Volume at apical 4-chamber view
LA Vol. Index (A2C/ A4C)	Left Atrium Volume Index

*1 means:

$$LA\ Vol(A-L)(ml) = \frac{8\pi}{3} LAA(A4C)(cm^2) \times LAA(A2C)(cm^2) \Big/ LA\ apical(cm)$$

Study Tools of LV Tei Index

Abbreviation	Description
MV C-O Dur.	Mitral Valve Close-Open Duration

Abbreviation	Description
LVET	Left Ventricular Ejection Time
LV Tei Index	Left Ventricular Index of Myocardial Performance*1

*1 means:

$$\text{LV TEI(Nounit)} = \frac{\text{MV C - O dur(s) - LVET(s)}}{\text{LVET(s)}}$$

Study Tools of RVSP

Abbreviation	Description
TR Vmax	Tricuspid Valve Regurgitation Maximum Velocity
RAP	Right Atrium Pressure
TR PGmax	Tricuspid Valve Regurgitation Pressure Gradient
RVSP	Right Ventricular Systolic Pressure*1

*1 means:

$$\text{RVSP(mmHg)} = RAP(mmHg) + 4 \times (TR\,V\ \max(m/s))^2$$

Study Tools of PAEDP

Abbreviation	Description
PR Ved	Pulmonary Valve Regurgitation Velocity at end-Diastole
RAP	Right Atrium Pressure
PR PGed	Pulmonary Valve Regurgitation Pressure Gradient at end-Diastole
PAEDP	Pulmonary Pressure at end-Diastole*1

*1 means:

$$\text{PAEDP(mmHg)} = RAP(\,mmHg\,) + 4 \times (\,PR\,Ved(\,m/s\,))^2$$

Study Tools of RVIMP

Abbreviation	Description
TV C-O Dur.	Tricuspid Valve Close-Open Duration
RVET	Right Ventricular Ejection Time

Abbreviation	Description
RV Tei Index	Right Ventricular Index of Myocardial Performance*1

*1 means:

$$\text{RV TEI(Nounit)} = \frac{\text{TV C - O dur(s) - RVET(s)}}{\text{RVET(s)}}$$

Study Tools of Qp/Qs

Abbreviation	Description
RVOT Diam.	Right Ventricular Outflow Tract Diameter
LVOT Diam.	Left Ventricular Outflow Tract Diameter
RVOT VTI	Right Ventricular Outflow Tract Velocity-Time Integral
LVOT VTI	Left Ventricular Outflow Tract Velocity-Time Integral
RVOT SV	Right Ventricular Outflow Tract Stroke Volume
RVOT CO	Right Ventricular Outflow Tract Cardiac Output
RVOT SI	Right Ventricular Outflow Tract SV Index
RVOT CI	Right Ventricular Output Tract CO Index
RVOT Vmax	Right Ventricular Outflow Tract Maximum Velocity
RVOT Vmean	Right Ventricular Outflow Tract Minimum Average Velocity
RVOT PGmax	Right Ventricular Outflow Tract Maximum Pressure Gradient
RVOT PGmean	Right Ventricular Outflow Tract Average Pressure Gradient
LVOT SV	Left Ventricular Outflow Tract Stroke Volume
LVOT SI	Left Ventricular Outflow Tract SV Index
LVOT CO	Left Ventricular Outflow Tract Cardiac Output
LVOT CI	Left Ventricular Output Tract CO Index
LVOT Vmax	Left Ventricular Outflow Tract Maximum Velocity
LVOT PGmax	Left Ventricular Outflow Tract Maximum Pressure Gradient
LVOT Vmean	Left Ventricular Outflow Tract Average Velocity
LVOT PGmean	Left Ventricular Outflow Tract Minimum Pressure Gradient
Qp/Qs	Flow ratio of Pulmonary circulation and Systemic circulation*1
Qp-Qs	Flow difference of Pulmonary circulation and Systemic circulation*1

*1 means:

$$Qp(ml) = \text{RVOT SV(ml)} = \pi(\text{RVOT Diam(cm)}/2)^2 \times \text{RVOT VTI(cm)}$$

$$Qs(ml) = \text{LVOT SV(ml)} = \pi(\text{LVOT Diam(cm)}/2)^2 \times \text{LVOT VTI(cm)}$$

$$Qp/Qs(Nounit) = \frac{\text{RVOT SV}(ml)}{\text{LVOT SV}(ml)}$$

$$Qp - Qs(Nounit) = \text{RVOT SV}(ml) - \text{LVOT SV}(ml)$$

Study Tools of PISA

Abbreviation	Description
MR Rad	Mitral Valve Stenosis Radius
MR VTI	Mitral Valve Regurgitation Velocity-Time Integral
MR Als.Vel.	Mitral Valve Regurgitation Aliasing Maximum Velocity
MR Vmax	Mitral Regurgitation Maximum Velocity
MR Flow	Mitral Regurgitation Flow*1
MR Flow Rate	Mitral Regurgitation Flow Rate*2
MR Fraction	Mitral Valve Regurgitation Fraction*3
MR EROA	Mitral Valve Effective Regurgitant Orifice Area*4
AR Rad.	Aortic Valve Stenosis Radius
AR VTI	Aortic Valve Regurgitation Velocity-Time Integral
AR Als.Vel.	Aortic Valve Regurgitation Aliasing Maximum Velocity
AR Vmax	Aortic Regurgitation Maximum Velocity
AR Flow	Aortic Regurgitation Flow*5
AR Flow Rate	Aortic Regurgitation Flow Rate*6
AR Fraction	Aortic Valve Regurgitation Fraction*7
AR EROA	Aortic Valve Effective Regurgitant Orifice Area*8
TR Rad.	Tricuspid Valve Stenosis Radius
TR VTI	Tricuspid Valve Regurgitation Velocity-Time Integral
TR Als.Vel.	Tricuspid Valve Regurgitation Aliasing Maximum Velocity
TR Vmax	Tricuspid Regurgitation Maximum Velocity
TR Flow	Tricuspid Regurgitation Flow*9
TR Flow Rate	Tricuspid Regurgitation Flow Rate*10
TR Fraction	Tricuspid Valve Regurgitation Fraction*11
TR EROA	Tricuspid Valve Effective Regurgitant Orifice Area*12
PR Rad.	Pulmonary Valve Stenosis Radius
PR VTI	Pulmonary Valve Regurgitation Velocity-Time Integral

Abbreviation	Description
PR Als.Vel.	Pulmonary Valve Regurgitation Aliasing Maximum Velocity
PR Vmax	Pulmonary Regurgitation Maximum Velocity
PR Flow	Pulmonary Regurgitation Flow*13
PR Flow Rate	Pulmonary Regurgitation Flow Rate*14
PR Fraction	Pulmonary Valve Regurgitation Fraction*15
PR EROA	Pulmonary Valve Effective Regurgitant Orifice Area*16

- *1 means:

$$\text{MR Flow(ml)} = \frac{2\pi \text{MR Rad(cm)}^2 \times \text{MR Als.Vel(cm/s)}}{\left|\text{MRV max(cm/s)}\right|} \times \left|\text{MR VTI(cm)}\right|$$

- *2 means:

$$\text{MR Flow Rate(ml/s)} = 2\pi \text{MR Rad(cm)}^2 \times \text{MR Als.Vel(cm/s)}$$

- *3 means:

$$\text{MR Fraction (Nounit)} = \frac{\text{MR Flow(ml)}}{\text{MV SV(ml)}} \times 100\%$$

- *4 means:

$$\text{MR EROA(cm)}^2 = \frac{2\pi \text{MR Rad(cm)}^2 \times \text{MR Als.Vel(cm/s)}}{\left|\text{MRVmax(cm/s)}\right|}$$

- *5 means:

$$\text{AR Flow(ml)} = \frac{2\pi \text{AR Rad(cm)}^2 \times \text{AR Als.Vel(cm/s)}}{\left|\text{ARV max(cm/s)}\right|} \times \left|\text{AR VTI(cm)}\right|$$

- *6 means:

$$\text{AR Flow Rate(ml/s)} = 2\pi \text{AR Rad(cm)}^2 \times \text{AR Als.Vel(cm/s)}$$

- *7 means:

$$\text{AR Fraction (Nounit)} = \frac{\text{AR Flow(ml)}}{\text{AV SV(ml)}} \times 100\%$$

- *8 means:

$$\text{AR EROA(cm)}^2 = \frac{2\pi \text{AR Rad(cm)}^2 \times \text{AR Als.Vel(cm/s)}}{\left|\text{ARVmax(cm/s)}\right|}$$

- *9 means:

$$\text{TR Flow(ml)} = \frac{2\pi\text{TR Rad(cm)}^2 \times \text{TR Als.Vel(cm/s)}}{\left|\text{TRV max(cm/s)}\right|} \times \left|\text{TR VTI(cm)}\right|$$

- *10 means:

$$\text{TR Flow Rate(ml/s)} = 2\pi\text{TR Rad(cm)}^2 \times \text{TR Als.Vel(cm/s)}$$

- *11 means:

$$\text{TR Fraction (Nounit)} = \frac{\text{TR Flow(ml)}}{\text{TV SV(ml)}} \times 100\%$$

- *12 means:

$$\text{TR EROA(cm)}^2 = \frac{2\pi\text{TR Rad(cm)}^2 \times \text{TR Als.Vel(cm/s)}}{\left|\text{TRVmax(cm/s)}\right|}$$

- *13 means:

$$\text{PR Flow(ml)} = \frac{2\pi\text{PR Rad(cm)}^2 \times \text{PR Als.Vel(cm/s)}}{\left|\text{PRV max(cm/s)}\right|} \times \left|\text{PR VTI(cm)}\right|$$

- *14 means:

$$\text{PR Flow Rate(ml/s)} = 2\pi\text{PR Rad(cm)}^2 \times \text{PR Als.Vel(cm/s)}$$

- *15 means:

$$\text{PR Fraction (Nounit)} = \frac{\text{PR Flow(ml)}}{\text{PV SV(ml)}} \times 100\%$$

- *16 means:

$$\text{PR EROA(cm)}^2 = \frac{2\pi\text{PR Rad(cm)}^2 \times \text{PR Als.Vel(cm/s)}}{\left|\text{PR Vmax(cm/s)}\right|}$$

G.1.4 Small Parts Measurements

2D Mode

Abbreviation	Description
Thyroid L	Thyroid Length
Thyroid H	Thyroid Height
Thyroid W	Thyroid Width
Isthmus H	Isthmus height
Testis L	Testicular Length

Abbreviation	Description
Testis H	Testicular Height
Testis W	Testicular Width
Epididymis L	Epididymis Length
Epididymis W	Epididymis Width
Epididymis H	Epididymis Height
Breast Mass1~10 L	Mass Length
Breast Mass1~10 W	Mass Width
Breast Mass1~10 H	Mass Height
Nip.-Mass 1~10 Dist.	Distance between nipple and mass
Skin-Mass 1~10 Dist.	Distance between skin and mass
Thyroid Mass 1-3 d1-3	Thyroid mass
Testicular Mass 1-3 d1-3	Testicular mass
THY Mass1~3 Strain	Thyroid Mass Strain
THY Nodule1~3 Strain	Thyroid Nodule Strain
THY Mass1~3 Elas.	Thyroid Mass Elastography
THY Nodule1~3 Elas.	Thyroid Nodule Elastography
Breast Mass1~10 Elas.	Breast Mass Elastography
Thyroid Vol.	Thyroid Volume
Testicular Vol.	Testicular Volume
THY Mass1~3 Strain Ratio	Thyroid Mass Strain Ratio
THY Nodule1~3 Strain Ratio	Thyroid Nodule Strain Ratio
THY Mass1~3 Elas. Ratio	Thyroid Mass Elastography Ratio
THY Nodule1~3 Elas. Ratio	Thyroid Nodule Elastography Ratio
Breast Mass1~10 Elas. Ratio	Breast Mass Elastography Ratio

Doppler Mode

Abbreviation	Description
STA	Superior Thyroid Artery
ITA	Inferior Thyroid Artery
Testicular A	Testicular Aorta

Abbreviation	Description
Testicular V	Testicular Vein
Epididymis A	Epididymis Aorta
Epididymis V	Epididymis Vein

G.1.5 Vascular Measurements

2D Mode

Abbreviation	Description
CCA IMT	Common Carotid Artery IMT
Bulb IMT	Bulbillate IMT
ICA IMT	Internal Carotid Artery IMT
ECA IMT	External Carotid Artery IMT
Stenosis D	Stenosis Diameter
Stenosis A	Stenosis Area
IMT	Intima-Media Thickness

Doppler Mode

Abbreviation	Description
CCA	Common Carotid Artery
Bulb	Bulbillate
ICA	Internal Carotid Artery
ECA	External Carotid Artery
Vert. A	Vertebral Artery
Innom. A	Innominate Artery
Subclav. A	Subclavian Artery
Axill. A	Axillary Artery
Brachial A	Brachial Artery
Ulnar A	Ulnar Artery
Radial A	Radial Artery
Subclav. A	Subclavian Artery
Axill. V	Axillary Vein
Cephalic V	Cephalic Vein
Basilic V	Basilic Vein

Abbreviation	Description
Ulnar V	Ulnar Vein
Radial V	Radial Vein
C.Iliac A	Common Iliac Artery
Ex.Iliac A	External Iliac Artery
CFA	Common Femoral Artery
SFA	Superficial Femoral Artery
Pop. A	Popliteal Artery
TP Trunk A	Tibial Peroneal Trunk Artery
Peroneal A	Peroneal Artery
P.Tib. A	Posterior Tibial Artery
A.Tib. A	Anterior Tibial Artery
Dors.Ped. A	Dorsalis Pedis Artery
C.Iliac V	Common Iliac Vein
Ex.Iliac V	External Iliac Vein
Femoral V	Femoral Vein
Saph. V	Great Saphenous Vein
Pop. V	Popliteal Vein
TP Trunk V	Tibial Peroneal Trunk Vein
Sural V	Sural Vein
Soleal V	Soleal Vein
Peroneal V	Peroneal Vein
P.Tib. V	Posterior Tibial Vein
A.Tib. V	Anterior Tibial Vein
ACA	Anterior Cerebral Artery
MCA	Middle Cerebral Artery
PCA	Posterior Cerebral Artery
AComA	Ant.communicating br.
PComA	Post.communicating br.
BA	Basilar Artery
IIA	Internal Iliac Artery
DFA	Deep Femoral Artery
Ba V	Basilar Vein
Brachial V	Brachial Vein
IIV	Internal Iliac Vein
CFV	Common Femoral Vein

Abbreviation	Description
SFV	Superficial Femoral Vein
DFV	Deep Femoral Vein
SSV	Small Saphenous Vein
C.Iliac V Reflux	Common Iliac Vein Reflux
Ex.Iliac V Reflux	External Iliac Vein Reflux
Femoral V Reflux	Femoral Vein Reflux
Saph. V Reflux	Great Saphenous Vein Reflux
Pop. V Reflux	Popliteal Vein Reflux
TP Trunk V Reflux	Tibial Peroneal Trunk Vein Reflux
Sural V Reflux	Sural Vein Reflux
Soleal V Reflux	Soleal Vein Reflux
Peroneal V Reflux	Peroneal Vein Reflux
P.Tib. V Reflux	Posterior Tibial Vein Reflux
A.Tib. V Reflux	Anterior Tibial Vein Reflux
IIV Reflux	Internal Iliac Vein Reflux
CFV Reflux	Common Femoral Vein Reflux
SFV Reflux	Superficial Femoral Vein Reflux
DFV Reflux	Deep Femoral Vein Reflux
SSV Reflux	Small Saphenous Vein Reflux
ASP	Ankle Systolic Pressure
BSP	Brachial Systolic Pressure

G.2 References

G.2.1 General Measurements

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MPG

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PI

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D/S

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Volume Flow(Area)-TAMAX

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G.2.2 GA Formulae and References

GA Formulae and Reference for Dog

Dog's standard GA is 65 days.

It is recommended to measure Dog CRL and Dog GS when the dog's GA is less than 40 days, and to measure Dog HD and Dog BD when the dog's GA is greater than 40 days.

- Dog CRL: GA (day) = 3 × Dog CRL (cm) + 27
- Dog GS: GA (day) = 6 × Dog GS (cm) + 20
- Dog HD: GA (day) = 15 × Dog HD (cm) + 20
- Dog BD: GA (day) = 7 × Dog BD (cm) + 29
- Dog HD&BD: GA (day) = 6 × Dog HD (cm) + 3 × Dog BD (cm) + 30

Reference: Dominique Penninck and Marc-André d'Anjou, "Atlas of Small Animal Ultrasonography", Blackwell Publishing, 2008, Chapter 13 FEMALE REPRODUCTIVE TRACT, Page 406

GA Formulae and Reference for Cat

Cat's standard GA is 61 days.

- Cat BD: GA (day) = 11 × Cat BD (cm) + 21
- Cat HD: GA (day) = 25 × Cat HD (cm) + 3

Reference: Dominique Penninck and Marc-André d'Anjou, "Atlas of Small Animal Ultrasonography", Blackwell Publishing, 2008, Chapter 13 FEMALE REPRODUCTIVE TRACT, Page 406

GA Formulae and Reference for Equine (Horse)

Equine's standard GA is 330 days.

- Equine GS-H: GA (day) = (Equine GS-H (cm) + 0.55) / 0.15
- Equine GS-V: GA (day) = (Equine GS-V (cm) + 0.10) / 0.14

EDD(Horse) = 330 – GA

Reference: F.S. Pipers, DVM, PhD; W. Zent, DVM; R. Holder, DVM; A. Asbury, DVM. Ultrasonography as an adjunct to pregnancy assessments in the mare. JAVMA, Vo; 184, No.3, February 1, 1984.

GA Formulae and Reference for Bovine

Bovine's standard GA is 285 days.

It is recommended to measure Bovine CRL when the bovine's GA is less than 50 days, and to measure Bovine TD and Bovine HD when the bovine's GA is greater than 50 days.

- Bovine CRL: GA (day) = ln(Bovine CRL (cm)) × 16.73 + 27.5
- Bovine TD: GA (day) = ln(Bovine TD (cm)) × 37.21 + 39.7
- Bovine HD: GA (day) = ln(Bovine HD(cm)) × 45.23 + 37.7

Reference: PRACTICAL APPLICATION OF ULTRASOUND IN BOVINE EMBRYO TRANSFER. W. E. Beal. Department of Animal and Poultry Sciences. Virginia Tech, Blacksburg, VA 24061.

GA Formulae and Reference for Ovine

Ovine's standard GA is 145 days.

It is recommended to measure Ovine CRL when the ovine's GA is between 20 and 40 days, and to measure Ovine BPD when the ovine's GA is greater than 40 days.

- Ovine CRL: GA (day) = 14.05 + 1.16 × Ovine CRL (cm) - 0.012 × (Ovine CRL (cm))2
- Ovine BPD: GA (day) = 21.4 + 18.5 × Ovine BPD (cm)

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G.2.3 Cardiology Measurements

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Roelandt, Joseph, Practical Echocardiology, vol. 1 of Ultrasound in Medicine Series, ed. Denis White, Research Studies Press, 1977, p. 124.

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Schiller, N.B., et al., “Recommendations for Quantification of the LV by Two-Dimensional Echocardiography,” J Am Soc Echo, Sept.-Oct., 1989, Vol. 2, No. 5,p. 364.

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Folland, E.D., et al., “Assessment of Left Ventricular Ejection Fraction and Volumes by Real-Time, Two-Dimensional Echocardiography,” Circulation, October 1979, Vol. 60, No.4, pp. 760-766

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G.2.4 Smart Parts Measurements

Thyroid Vol (k= 0.479)

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G.2.5 Vascular Measurements

Stenosis D

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H 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 operators of the device, pertaining to acoustic output and how to control animal exposure through use of the ALARA (as low as reasonably achievable) principle. Also this section contains information regarding the acoustic output testing and the real-time output display.

Read this information carefully before using the system.

H.1 Concerns with Bioeffects

Diagnostic ultrasound is recognized as being safe. In fact, there have been no reports of injuries to animals caused by diagnostic ultrasound.

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.

H.2 Prudent Use Statement

Although there are no confirmed biological effects on animals caused by exposures 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 animal. High exposure levels and long exposure times should be avoided while acquiring necessary clinical information.

H.3 ALARA Principle (As Low As Reasonably Achievable)

It is required to practice ALARA 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 animal 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 quality of information required for diagnosis, rather increasing the risk of generating bioeffects.

Users must take responsibility for the safety of animals and utilize ultrasound deliberately. Deliberate use of ultrasound means that output power of ultrasound must be selected based on ALARA.

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) title “Medical Ultrasound Safety”.

H.4 MI/TI Explanation

H.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 presently. It is recognized that two fundamental mechanisms may induce bioeffects. One is a thermal bioeffect with tissue absorption of ultrasound, and another one 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, so they DO NOT consider the cumulative effects of the total examination time. TI and MI models contain practical simplifications to complex bioeffects interaction. Then the operator should 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 may be referred to as cavitations.

MI is an index that shows the possibility of the cavitations generation based on acoustic pressure, and the value in which the peak-rarefactional acoustic pressure is divided by the square root of the frequency. Therefore MI value becomes smaller when the frequency is higher or the peak-rarefactional acoustic pressure is lower, it becomes difficult to generate the cavitations.

$$MI = \frac{P_{r,\alpha}}{\sqrt{f_{awf}} \times C_{MI}}$$

C_{MI} = 1 (MPa /$\sqrt{MHz}$)

For the frequency 1 MHz and the peak rarefactional acoustic pressure 1 MPa, MI becomes 1. It is possible to think MI to be one threshold of the cavitations generation. Especially, it is important to keep MI value to be low when both gases and the soft tissues exist together, for such as lung exposure in cardiac scanning and bowel gas in abdominal scanning.

TI (Thermal Index)

TI is determined by the ratio of the total acoustic power to the acoustic power required to raise the tissue temperature by 1 degree C. In addition, because the temperature rises is greatly different according to tissue structures, TI is divided 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), in which the ultrasound beam passes through soft tissue and a 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 increase of 4 degree C for 5 min or more should be considered as potentially hazardous to embryonic and fetal tissue.

The smaller the MI/TI values, the lower the bioeffects.

H.4.2 MI/TI Display

TI and MI values are displayed in the upper 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 needed for effective diagnosis.

NOTE:

If there is a value of MI or TI exceeds 1.0, you must be careful to practice the ALARA principle.

The display precision is 0.1.

Real-time Display accuracy: MI within ± 28.5%, TI within ± 38.7%

H.5 Acoustic Power Setting

Acoustic power adjustment

Use the [A.power] to adjust the acoustic power percentage, and 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 setting of acoustic power

Selection of diagnostic applications is the most important factor for 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.

In this system, imaging setups can be created using the ultrasound output set by you.

Once you perform preset settings, default setting values of the system may be changed and invalid. It is the user's responsibility for any change to the default settings.

Adjusting range

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 acoustic power value refer to the best image quality of the probe. The larger the acoustic power value, the better the image quality.

In this product, to obtain optimum images for applications under the requirements of safety and ALARA principle, we set the factory default values of acoustic power in all exam modes for a better image quality. The user can make adjustments according to the imaging effect in practical use.

NOTE:

This system automatically returns to the settings whenever changes are made to the values (when you turn on the power, switch between probes, end the exam, or select OK or Cancel in the Setup menu). In the factory default settings, the Acoustic Output is limited 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 acoustic output of the system has been measured and calculated in accordance with IEC 60601-2-37: 2015, FDA 510(K) GUIDANCE, IEC 62359: 2017, Ultrasonics-Field characterization-Test methods for the deter mination of thermal and mechanical indices related to medical diagnostic ultrasonic fields.

H.6 Acoustic Power Control

The 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 relative to output. They are,

- Controls that have direct effect on the output
- Controls that indirectly control output
- Controls that are receiver controls

Direct controls

It is possible to control, if necessary, the acoustic output with the "A.power" item. 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/cm^2 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 active aperture of probe and beam width. For the 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.) won't affect output. These controls should be used, when possible, to improve the image quality before using controls that directly or indirectly affect output.

H.7 Acoustic Output

H.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 intensity of ultrasound 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), fc 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.

Although 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 case.

H.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: Regions (except eyes)	$I_{spta.3}$ (mW/cm$^{2)}$ ≤ 720	$I_{sppa.3}$ (W/cm^2) ≤ 190 or MI ≤ 1.9
Application: Ophthalmic	$I_{spta.3}$ (mW/cm$^{2)}$ ≤ 50	MI≤ 0.23

H.7.3 Differences between Actual and Displayed MI and TI

In operation, the system will display to the operator the Acoustic Output Parameters Thermal Index, TI, or Mechanical Index, MI (or sometimes both parameters simultaneously). 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 setting of the system 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 will be indicated. However, the Thermal Index is not the same as temperature rise in the body, for several reasons. First of all, in order to provide a single display index to you, 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. There were also significant simplifications 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 proscribed 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 upon 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 animal examination.

H.8 References for Acoustic Power and Safety

- “Bioeffects and Safety of Diagnostic Ultrasound” issued by AIUM
- “Medical Ultrasound Safety” issued by AIUM
- Marketing Clearance of Diagnostic Ultrasound Systems and Transducers
- Medical electrical equipment-Part 2-37: Particular requirements for the basic safety and essential performance of ultrasonic medical diagnostic and monitoring equipment issued by IEC in 2015
- IEC 62359, Ultrasonics-Field characterization-Test methods for the determination of thermal and mechanical indices related to medical diagnostic ultrasonic fields, 2017

I Declaration of Conformity

Hereby, Shenzhen Mindray Animal Medical Technology Co., Ltd. declares that the radio equipment type Vetus E6 series Veterinary Diagnostic Ultrasound System is in compliance with Directive 2014/53/EU.

The full text of the EU declaration of conformity is available at the following internet address:

Site Location	QR Code
https://ims.mindrayanimal.com/pub/detail.aspx?tid=14&rid=22232	