

**DC-33/DC-35/DC-36/DC-38/DC-39/DC-40/DC-41/DC-42/DC-43/DC-44/
DC-45/DC-40S/DC-40Pro/DC-40Exp/DC-40T**

Diagnostic Ultrasound System

Service Manual

Revision 10.0

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Revision History

Mindray may revise this publication from time to time without written notice.

| Revision | Date | Reason for Change |
|----------|-----------|---|
| 1.0 | 2016.2.20 | Initial release |
| 2.0 | 2016.4 | Update screenshots |
| 3.0 | 2016.8 | Update the labels in 1.2.2, update part number for Left cover assembly. |
| 4.0 | 2016.10 | Add 19-inch monitor FRU, support arm FRU in chapter 8. Add the description of the monitor in chapter 9.3.3 and 9.3.5. 3. Add the description on the trail and the promotion in chapter 10.1. Add the description in chapter 10.2. |
| 5.0 | 2017.2 | Update part number of top cover of left/right speakers in chapter 8. |
| 6.0 | 2017.11 | In chapter 8, add FRUs: USB cable and touch panel cable assembly |
| 7.0 | 2018.02 | In chapter 8, add FRU: Small keyboard assembly (Russia/2136 FRU) |
| 8.0 | 2018.10 | Add the installing, assembly/disassembly and troubleshooting description about the printer adapter. |
| 9.0 | 2019.4 | Update part number of wireless network card in FRU list |
| 10.0 | 2019.08 | Add PC Module Assembly and relevant comments in chapter 8 |

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Applicable for

This service manual is applicable for the service engineers, authorized service personnel and service representatives of this ultrasound system.

Statement

This service manual describes the product according to the most complete configuration; some of the content may not apply to the product you are responsible for. If you have any questions, please contact Mindray Customer Service Department.

Do not attempt to service this equipment unless this service manual has been consulted and is understood. Failure to do so may result in personnel injury or product damage.

Responsibility on the Manufacturer Party

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

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

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

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- Any Mindray product which has been subjected to misuse, negligence or accident;
- Any Mindray product from which Mindray's original serial number tag or product identification markings have been altered or removed;
- Any products of any other manufacturers.



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 injury of human health.

Customer Service Department

| | |
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1 Safety Precautions

This chapter describes important issues related to safety precautions, as well as the labels and icons on the ultrasound machine.

1.1 Meaning of Signal Words



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

| Signal word | Meaning |
|-----------------|--|
| ⚠DANGER | Indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury. |
| ⚠WARNING | Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury. |
| ⚠CAUTION | Indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury. |
| NOTE | Indicates a potentially hazardous situation that, if not avoided, may result in property damage. |








1.2 Symbols

The following tables provide location and information of the safety symbols and warning labels, please read carefully.

1.2.1 Meaning of Safety Symbols

























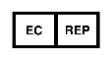
| Symbol | Meaning |
|---|--|
|  | Type-BF applied part The ultrasound transducers connected to this system are type-BF applied parts. The ECG module connected to this system is Type-BF applied part. |
|  | Caution. |


1.2.2 Warning Labels

| No. | Warning Labels | Meaning | Position |
|-----|--|--|--|
| 1. | <div> <div>a</div>  <div>d</div> <div>b</div>  <div>c</div>  </div> | <p>a. Do not place the system on a sloped surface. Otherwise the system may slide, resulting in personal injury or the system malfunction. Two persons are required to move the system over a sloped surface.</p> <p>b. Do not sit on the system.</p> <p>c. DO NOT push the system. When the casters are locked.</p> <p>d. Caution! please carefully read this manual before use system.</p> | On the right panel of the system |
| 2. |  | Beware of excessive stress exerted to the system. | On the top-left corner of the keyboard |
| 3. |  | Mind your hands. | Below the support arm of the control panel |
| 4. |  | Please do not lift the hanger or try to push the ultrasound system by using it. | Right/left panel of the system |
| 5. |  | Non-ionizing radiation | / |

1.2.3 General Symbols

This system uses the symbols listed in the following table, and their meanings are explained as well.

| Symbol | Description |
|---|--|
|  | Type-BF applied part |
|  | Caution |
|  | AC (Alternating current) |
|  | Equipotentiality |
|  | Power button |
|  | Foot switch |
|  | Transducer sockets |
|  | Network port |
|  | USB port |
| VGA  | Used for VGA output. |
| S-VIDEO |  Reserved, used for separate video output |
| |  Separate video input, reserved. |
| DVI-D  | DVI-D signal output |
|  | Remote control |
| AUDIO |  Stereo audio output. |
| |  Stereo audio input. |
|  | Battery Status Indicator |
|  | Hard disk status indicator |
|  | Standby status indicator |
|  | AC power supply status indicator |
|  | Microphone input jack |
|  | Dangerous voltage |
|  | Product serial number |
|  | Manufacture date |
|  | Authorized representative in the European Community |

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

1.3 Safety Precautions

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

⚠DANGER Do not operate this system in an atmosphere containing flammable or explosive gases such as anesthetic gases, oxygen, and hydrogen or explosive fluid such as ethanol because an explosion may occur.

1.3.1 Electric safety

⚠WARNING:

1. Connect the power plug of this system and power plugs of the peripherals to wall receptacles that meet the ratings indicated on the rating nameplate. Using a multifunctional receptacle may affect the system grounding performance, and cause the leakage current to exceed safety requirements. Use the power cord accompanied with the system provided by Mindray.
2. Disconnect the AC power before you clean or uninstall the ultrasound machine, otherwise, electric shock may result.
3. In maintenance or assembly/disassembly, make sure other cables are connected well before the battery connecting cable is connected, otherwise the system may be damaged due to hot-plug.
4. Do not use this system simultaneously with equipment such as an electrosurgical unit, high-frequency therapy equipment, or a defibrillator, etc.; otherwise electric shock may result.
5. This system is not water-proof. If any water is sprayed on or into the system, electric shock may result.

⚠CAUTION:

1. DO NOT connect or disconnect the system's power cord or its accessories (e.g., a printer or a recorder) without turning OFF the power first. This may damage the system and its accessories or cause electric shock.
2. Avoid electromagnetic radiation when perform performance test on the ultrasound system.
3. In an electrostatic sensitive environment, don't touch the device directly. Please wear electrostatic protecting gloves if necessary.
4. You should use the ECG leads provided with the ECG module. Otherwise it may result in electric shock.

1.3.2 Mechanical safety

- ⚠WARNING:**
1. Before moving the system, please hold the handle. If other parts of the system are held, it may cause damage due to the abnormal force. Do not push the system from the left/right side; otherwise, it may be toppled over.
 2. Do not subject the transducers to knocks or drops. Use of a defective probe may cause electric shock to the patient.

- ⚠CAUTION:**
1. Fasten and fully secure any peripheral device before moving the system, gently and carefully move the system to avoid falling over.
 2. Do not expose the system to excessive vibration (during the transportation) to avoid device dropping, collision, or mechanical damage.
 3. Please install the system on a flat plane with the four casters locked. Otherwise, damage may be resulted by accidental moving.
 4. Pay extra attention when moving the system on a sloping ground, do not move it on a more than 10°-sloped plane to avoid system toppling.
 5. Move the system **ONLY WHEN** the system is shut down or in standby status, otherwise the system hardware disk may be damaged.

1.3.3 Personnel Safety

- NOTE:**
1. The user is not allowed to open the covers and panel of the system, neither device disassemble is allowed.
 2. To ensure the system performance and safety, only Mindray engineers or engineers authorized by Mindray can perform maintenance.
 3. Only technical professionals from Mindray or engineers authorized by Mindray after training can perform maintenance.

1.3.4 Other

- NOTE:** For detailed operation and other information about the ultrasound system, please refer to the operator's manual.

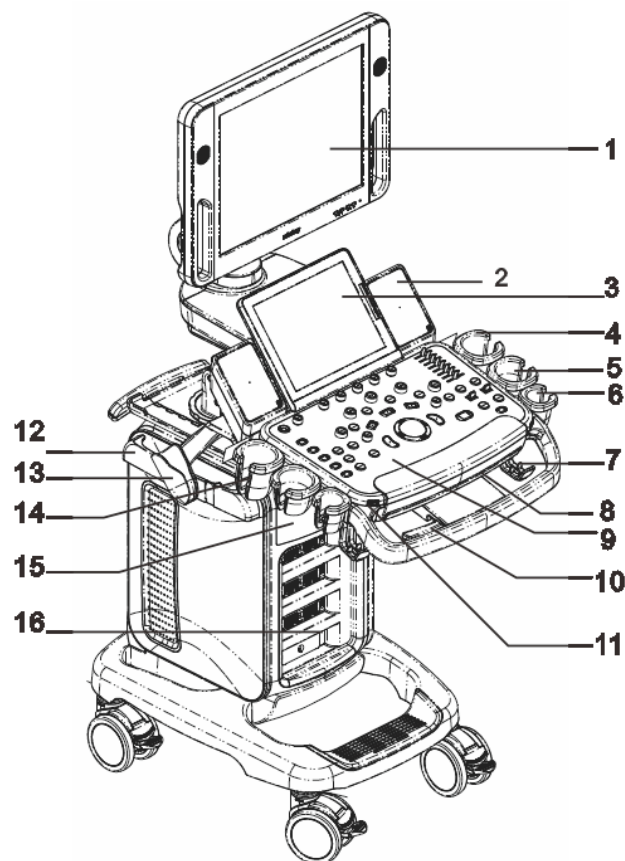
2 Specifications

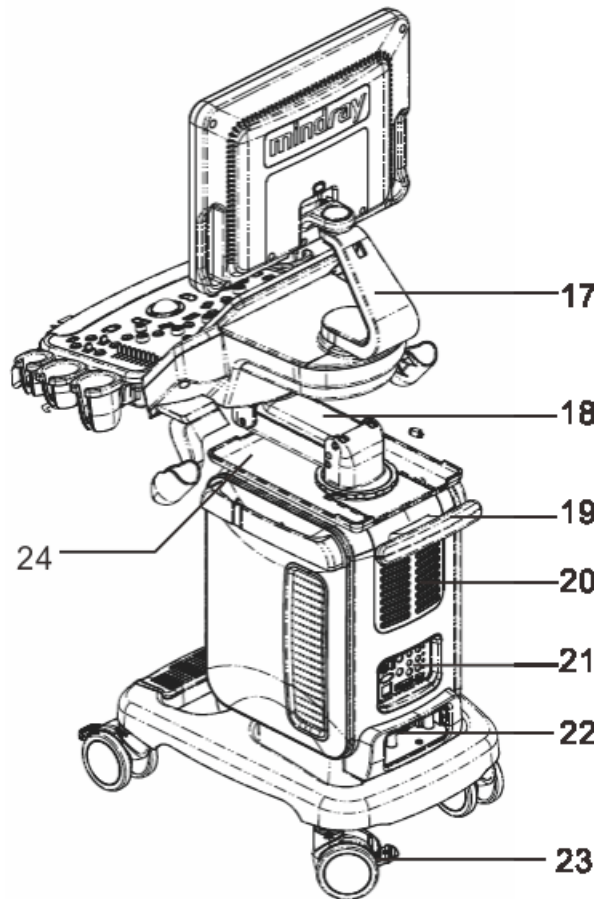
2.1 Overview

2.1.1 Intended Use

The DC-33/DC-35/DC-36/DC-38/DC-39/DC-40/DC-41/DC-42/DC-43/DC-44/DC-45/DC-40S/DC-40Pro/DC-40Exp/DC-40T series diagnostic ultrasound system is intended for use in clinical ultrasonic diagnosis.

2.1.2 Introduction of Each Unit





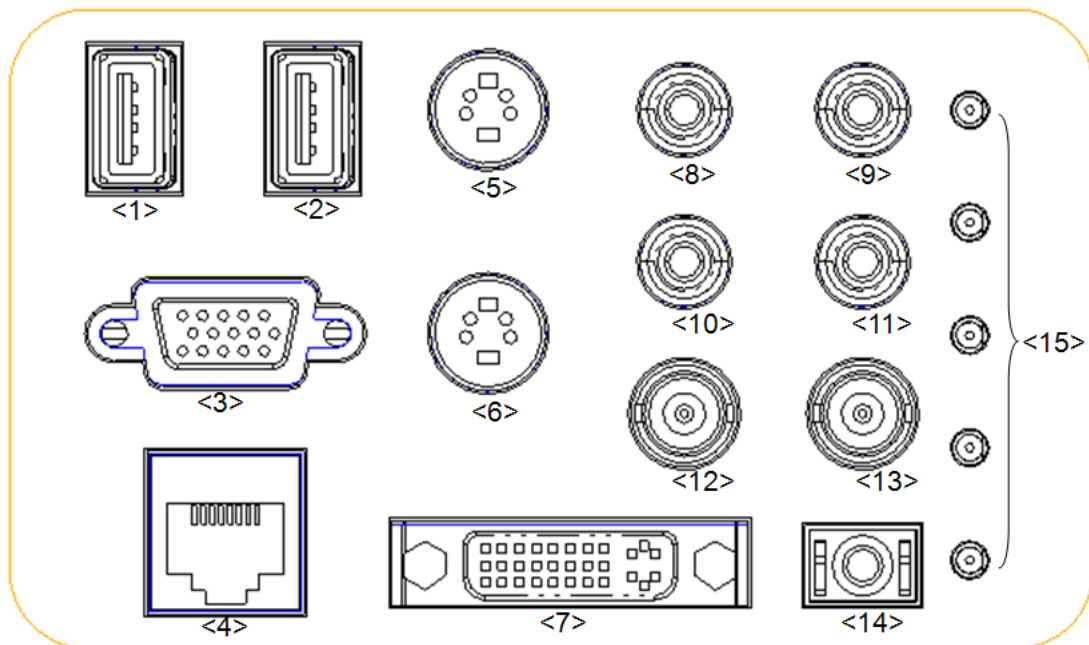
| No. | Name | Function |
|-----|----------------------------------|--|
| 1. | Monitor | Displays the images and parameters during scanning. (Support optional 15-inch or 17-inch monitor) |
| 2. | Speaker | Sound output. |
| 3. | Touch screen panel | Operator-system interface or control. |
| 4. | Ultrasound gel holder | Used for placing the ultrasound gel. |
| 5. | Probe holder | Used for placing the general probe (not including pencil probe or intra-cavity probe). |
| 6. | Pencil probe holder | Used for placing the pencil probe. |
| 7. | Probe cable hook | Used for fixing the probe cable. |
| 8. | Keyboard | Used for typing characters or entering some functions. |
| 9. | Main control panel | Operator-system interface or control. |
| 10. | Control panel adjusting lever | Used for lifting or swiveling the control panel. |
| 11. | USB_MIC port | USB/MIC port |
| 12. | Hanger | / |
| 13. | Intracavitary probe holder | Used for fixing the intracavitary probe. |
| 14. | Ultrasound gel holder/gel warmer | Used for placing the ultrasound gel or installing the gel warmer. |

2-2 Specifications

| No. | Name | Function |
|-----|------------------------------|--|
| 15. | Physio panel | Used for connecting the ECG leads and external ECG device. |
| 16. | Probe port | Sockets connecting transducers and the main unit. |
| 17. | Monitor supporting arm | Supports the monitor. |
| 18. | Control panel supporting arm | Supports the control panel, for adjusting the height of the panel. |
| 19. | Rear handle | Used for pushing and moving the system. |
| 20. | Cooling vent | / |
| 21. | I/O Panel | Interface panel used for inputting and outputting signals. |
| 22. | Power supply panel | Electrical port panel. |
| 23. | Caster lock | Lock the caster. The device keeps stable when four casters are locked. |
| 24. | Tray | Place the stuff or peripherals. |

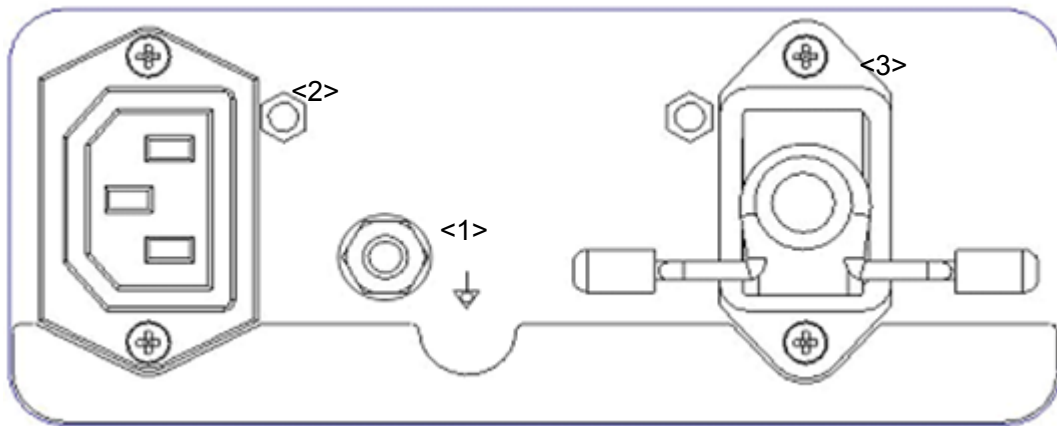
| |
|--|
| <p>NOTE: Do not overexert to push down or lift up the control panel when operate the control panel using adjusting lever.</p> |
|--|

2.1.2.1 I/O Panel



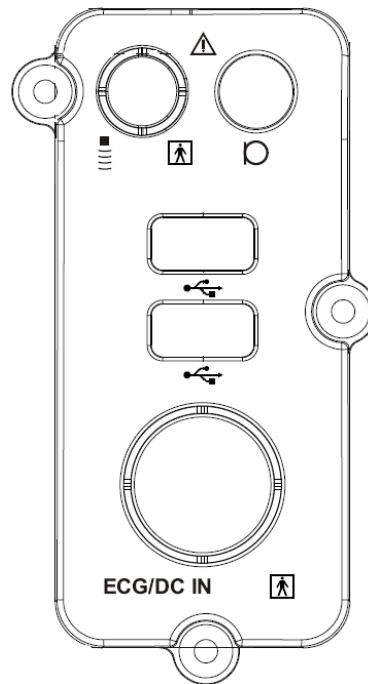
| No. | Symbol | Function |
|----------|-------------------------------|---|
| <1><2> | | USB port, used for connecting USB devices. |
| <3> | | VGA signal output; connects a monitor or projector. |
| <4> | | Ethernet interface. |
| <5> | | Separate video input (reserved). |
| <6> | | Separate video output. |
| <7> | | DVI signal output. |
| <8><9> | | Audio signal input port, left channel(reserved). |
| <10><11> | | Audio signal output port, right channel. |
| <12> | | Used for composite video input (reserved). |
| <13> | | Used for composite video output. |
| <14> | | Remote interface for connecting video printer. |
| <15> | Malfunction indication lights | Indicate the system's malfunction. |



2.1.2.2 Power Supply Panel



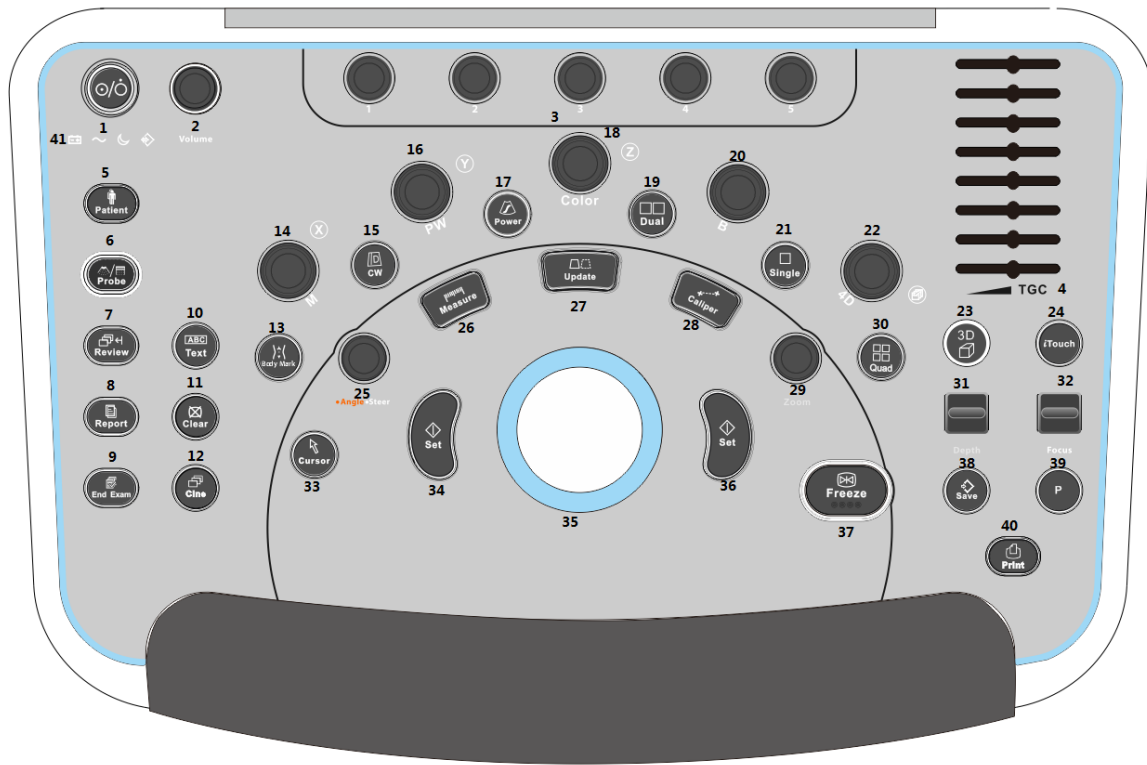
| No. | Name | Function |
|-----|------------------------|---|
| <1> | Equipotential terminal | Used for equipotential connection, balancing the protective earth potentials between the system and other electrical equipment. |
| <2> | AC Auxiliary Output | Power supply port for peripherals. |
| <3> | AC Input | AC power inlet. |

2.1.2.3 Physiological-signal Panel







| No. | Name | Function |
|-----|---|--|
| <1> | Pencil probe port | Pencil probe port (reserved). |
| <2> | Mic In port  | Use for connecting microphone to record vocal comments (reserved) |
| <3> | Two USB ports  | Used for connecting USB devices. |
| <4> | ECG lead signal input port/external ECG signal input port | Connects to ECG leads, to directly obtain patient electrocardiosignal/used for connecting the signal output port of ECG monitor. |

2.1.2.4 Control Panel



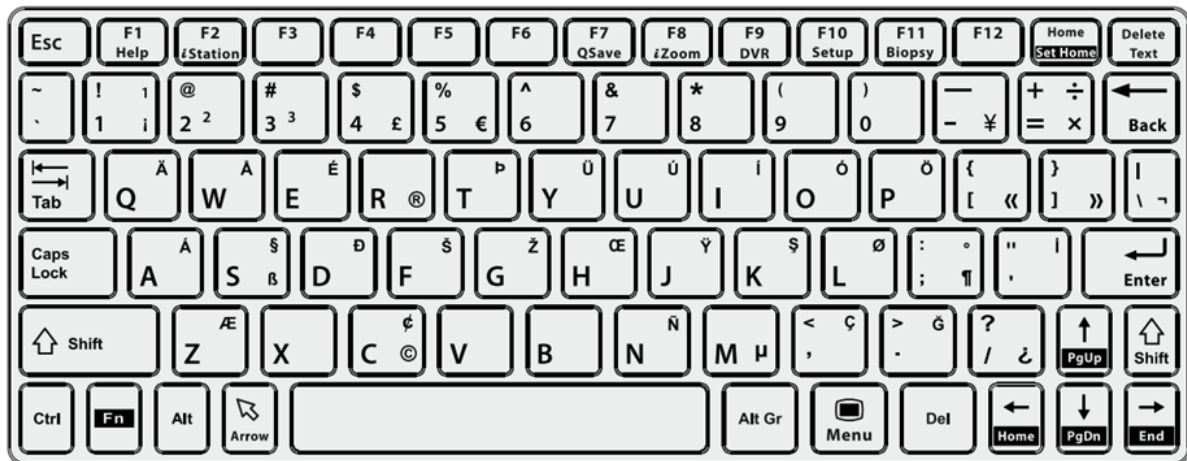
| No. | English Name | Description |
|-----|--------------|--|
| 1. | / | Power button Press the button to turn on the system, the system enters the work status and the indicator becomes green. |
| 2. | Volume | Adjust the volume. |
| 3. | / | Adjust the corresponding functions on the touch screen. |
| | / | |
| | / | |
| | / | |
| | / | |
| 4. | TGC | Slide to adjust the depth gain. |
| 5. | Patient | Enter/exit Patient Info screen. |
| 6. | Probe | Switch probe and exam mode. |
| 7. | Review | Review the stored images. |
| 8. | Report | Open/close the exam report. |
| 9. | End Exam | End the current exam. |
| 10. | Text | Enter/exit the textual comment status. |
| 11. | Clear | Clear the comments or measurement caliper. |
| 12. | Cine | Press to enter the Cine Review status from non-cine status when there is a multi-frame cine file playing. |

| No. | English Name | Description |
|-----|--------------|--|
| 13. | Body Mark | Enter/exit Body Mark. |
| 14. | M | Press to enter M mode, and rotate to adjust M mode gain. While in 3D/4D mode, rotate the knob to make the 3D image to rotate around X-axis. |
| 15. | CW | Enter CW mode. |
| 16. | PW | Press to enter PW mode, and rotate to adjust PW or CW gain. While in 3D/4D mode, rotate the knob to make the 3D image rotate around Y-axis. |
| 17. | Power | Enter Power mode. |
| 18. | Color | Press to enter Color mode, and rotate to adjust Color or Power gain. While in 3D/4D mode, rotate the knob to make the 3D image rotate around Z-axis. |
| 19. | Dual | Enter Dual mode in Non-Dual mode. Switch between the two display windows in the Dual mode. |
| 20. | B | Press to enter B mode, and rotate to adjust B mode gain. |
| 21. | Single | Enter single window in multiple window mode. |
| 22. | 4D | Press to enter 4D function and rotate to make the 3D image rotate. |
| 23. | 3D | Enter the 3D imaging function: Smart 3D or Static 3D. |
| 24. | iTouch | Optimize the image. |
| 25. | Angle/Steer | Adjust the angle. Adjust the steering of the probe. |
| 26. | Measure | Enter/exit the application measurement mode. |
| 27. | Update | Switching key: Press to change the currently active window. Start/stop image acquisition in iScape or 3D/4D mode. |
| 28. | Caliper | Enter/exit the general measurement mode. |
| 29. | Zoom | Rotate to enter the pan-zoom mode, and press to enter the spot-zoom mode. |
| 30. | Quad | Enter Quad mode in Non-Quad mode. Switch between the four display windows in the Quad mode. |
| 31. | Depth | Adjust the depth in real-time imaging. |
| 32. | Focus | Change the focus position. |
| 33. | Cursor | Show/hide the cursor. |
| 34. | Set | Confirm an operation. The function is same with the left-button of the mouse. |
| 35. | / | Move the trackball to change the cursor position. |
| 36. | Set | Confirm an operation. The function is same with the left-button of the mouse. |
| 37. | Freeze | Freeze/defreeze the image. |
| 38. | Save | Save the image; user-defined key. |

| No. | English Name | Description |
|-----|---|---|
| 39. | P | User-defined keys, functions of which can be defined in preset. |
| 40. | Print | Print: user-defined key. |
| 41. |  | Battery status indicator. Charging status: It illuminates in green when batteries are charged fully. Discharging status: It illuminates in green color when the power of the batteries is more than 20%; It illuminates in orange color for low battery power. |
| |  | AC indicator The indicator is on at AC supply. |
| |  | Standby indicator. Standby: blinking in orange. |
| |  | Hard disk status indicator. The indicator blinks in green when hard disk is running. |

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

Keyboard



Common functional keys

| No. | Key | Function |
|-----|------------|---|
| 1. | Enter | Confirm the entered data, or move the cursor to the top of the next row of the text or input field. |
| 2. | Esc | Cancel the operation or exit. |
| 3. | Tab | Jump to the next operable item. |
| 4. | Back space | Insert a space. |
| 5. | Caps Lock | Switch between upper/lowercase. |

| No. | Key | Function |
|-----|------------------------|--|
| 6. | Home | Activate the Home function: return to start position of the comment. |
| 7. | Delete Text | Delete all comments on the screen. |
| 8. | Direction-control keys | Move the cursor one letter each time, or, select the surrounding objects in the selectable area. |
| 9. | Del | Delete the character after the cursor |
| 10. | Back Space | Delete the character before the cursor |

Functions of the F1 to F12 keys

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

Functions of key combinations

The system supports multi-language input using key combinations. Key combinations include [Shift], [Alt Gr], [Ctrl], [Fn] and some alphabet keys.

- <Shift> key

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

For the alphabet keys (<A>~<Z>), press <Shift> + key to enter the current letter in a different case.

- [Alt Gr] key

Combined with other letter keys, [Alt Gr] can be used for entering other languages.

Press [Alt Gr] and a letter key simultaneously. The letter in the top-right corner of the key is entered.

- [Ctrl] key combined keys

On the iStation or Review screen, use <Ctrl> and <Set> to select more than one patient or more than one image.

- [Fn] key

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

| No. | Fn+ | Name | Function |
|-----|-----|-------|---|
| 1. | → | End | Move the cursor to the end of the row, or the rightmost side of an editable unit. |
| 2. | ← | Home | Home |
| 3. | ↑ | Pg Up | Turn pages upward. |

| No. | Fn+ | Name | Function |
|-----|------|----------|---|
| 4. | ↓ | Pg Dw | Turn pages downward. |
| 5. | Home | Set Home | Activate the Set Home function: set the start point of a comment. |

2.1.3 Peripherals Supported

| No. | Item | Model |
|-----|---------------------------------------|--|
| 1. | Graph / text printer | HP Deskjet Ink Advantage 2020hc HP Officejet Pro 8100 pantum p2200 |
| 2. | Digital Color Video Printer | SONY UP-D23/25MD |
| 3. | Digital Black and White Video Printer | SONY UP-D897 |
| 4. | Analog Black and White Video Printer | MITSUBISHI P93W-Z SONY UP-X898MD |
| 5. | Bar code reader | LS2208 |
| 6. | Footswitch | 971- SWNOM (two-pedal or three-pedal) FS-81-SP-2 (one-pedal) |

2.2 Specifications

2.2.1 Dimensions & Weight

Packaging dimensions:

- 1000mm (L)X660mm (W)X1440mm (H)

Main unit dimensions:

- 15-inch monitor: 780mm (L) X510mm (W) X (1127-1465) mm (H)
- 17-inch monitor: 780mm (L) X510mm (W) X (1127-1512) mm (H)

Net weight: 70Kg (without the battery)

2.2.2 Electrical Specifications

2.2.2.1 AC Input

| | |
|--------------------------|-----------|
| Voltage | 100—240V~ |
| Frequency | 50/60Hz |
| Power consumption | 600VA |

| | |
|-------------|-------------|
| Fuse | 250V~ T10AH |
|-------------|-------------|

2.2.3 Environmental Conditions

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

⚠Warning: Do not use this system in the conditions other than those specified

2.2.4 Monitor Specification

2.2.4.1 Main Monitor

| | |
|----------------------|---|
| Dimension | 15 inch 17 inch |
| Resolution | 1280×1024 (17-inch); 1024×768 (15-inch) |
| Visible angle | 120° left/right; 90° up/down |

2.2.4.2 Touch Screen

| | |
|----------------------|-------------------------------|
| Dimension | 10.4-inch |
| Resolution | 800×600 |
| Visible angle | 140° left/right; 110° up/down |

3 System Installation

3.1 Preparations for Installation

NOTE: Do not install the machine in the following locations:

Locations near heat generators;

Locations of high humidity;

Locations with flammable gases.

3.1.1 Electrical Requirements

3.1.1.1 Requirement of Regulated Power Supply

Power specification is showing in chapter 2.2.2. Due to the difference of the power supply stability of different districts, please advise the user to adopt a regulator of good quality and performance such as an on-line UPS.

3.1.1.2 Grounding Requirements

The power cable of the system is a three-wire cable, the protective grounding terminal of which is connected with the grounding phase of the power supply. Please ensure that the grounding protection of the power supply works normally.

⚠WARNING: **DO NOT connect this system to outlets with the same fuses that control the current of devices such as life-support systems. If this system malfunctions and generates an over current, or when there is an instantaneous current at power ON, fuses of the building's supply circuit may be tripped.**

3.1.1.3 EMI Limitation

Ultrasound machines are susceptible to Electromagnetic Interference (EMI) by radio frequencies, magnetic fields, and transient in the air wiring. They also generate a weak electromagnetic radiation. Possible EMI sources should be identified before the unit is installed. Electrical and electronic equipment may produce EMI unintentionally as the result of defect.

These sources include: medical lasers, scanners, monitors, cauterizing guns and so on. Besides, other devices that may result in high frequency electromagnetic interference such as mobile phone, radio transceiver and wireless remote control toys are not allowed to be presented or used in the room. Turn off those devices to make sure the ultrasound system can work in a normal way.

3.1.2 Installation Conditions

3.1.2.1 Space Requirements

Place the system with necessary peripherals in a position that is convenient for operation:

1. Place the system in a room with good ventilation or an air conditioner.
2. The door is at least 0.8m wide. The ultrasound machines can move into the room easily.
3. Leave at least 20cm clearance around the system to ensure effective cooling.
4. An adjustable lighting system in the room (dim/bright) is recommended.
5. Except the receptacle dedicated for the ultrasound system, at least 3-4 spare receptacles on the wall are available for the other medical devices and peripheral devices.
6. Power outlet and place for any external peripheral are within 2 m of each other with peripheral within 1 m of the unit to connect cables.

3.1.2.2 Networking Pre-installation Requirements

Both wireless and wired LAN are supported by this ultrasound system.

Data transmission is allowed between different departments or areas without network cable.

Network can be automatically connected after disconnection in case that the device is required to be moved, wireless transmission task can be recovered after the network resumed to normal condition. Confirm the network devices and network conditions before the installation.

1. General information: default gateway IP address, and the other routers related information.
2. DICOM application information: DICOM server name, DICOM port, channels, and IP address.

3.1.3 Confirmation before Installation

Perform the following confirmation before installing the system:

1. The video format used in the region or country where the system is installed.
2. The language used in the region or country where the system is installed.
3. The power voltage used in the region or country where the system is installed.
4. Obstetric formulae and other measurement formulae used in the region or country where the system is installed.
5. Other settings to be used in the region or country where the system is installed but different from the factory settings.
6. The doctor's habits of using the system.

Perform the confirmation above before installing the system. And set up the system to make it according with the usage of the region or country where the system is installed.

3.2 Unpacking

Unpacking tool: a pair of scissors

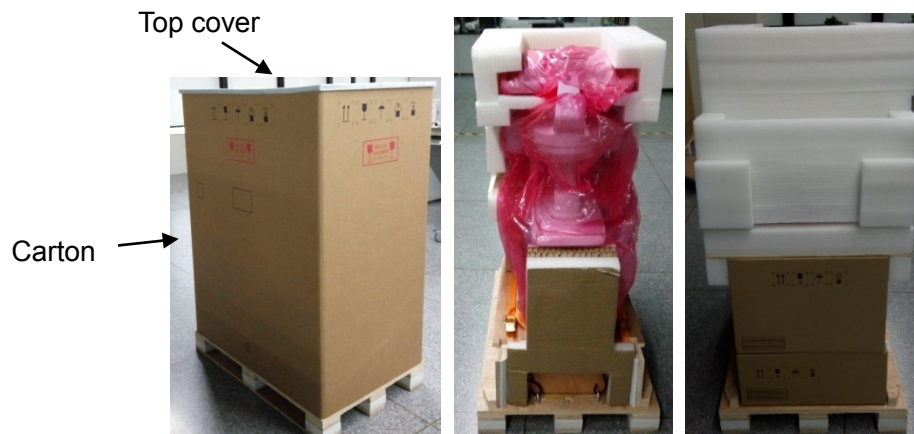
Installation duration: 2 persons, 10 minutes.

3.2.1 Unpacking Procedures

1. Cut off the packing belts.



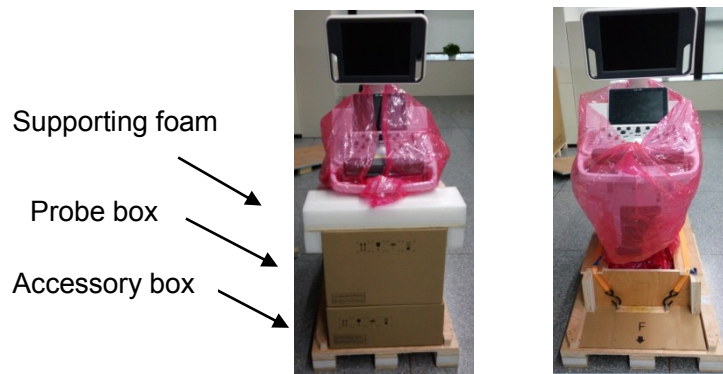
2. Remove the cover and the carton.



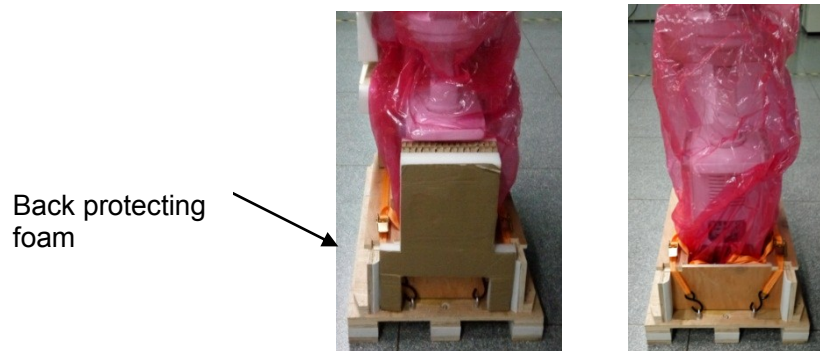
3. Remove the protective foam of the LCD.



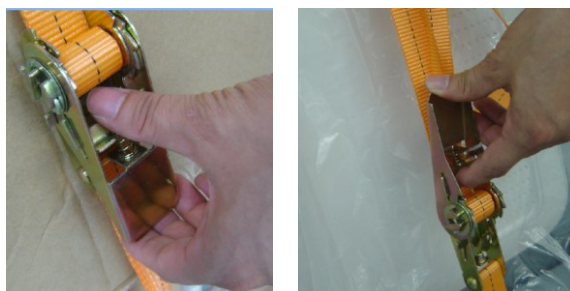
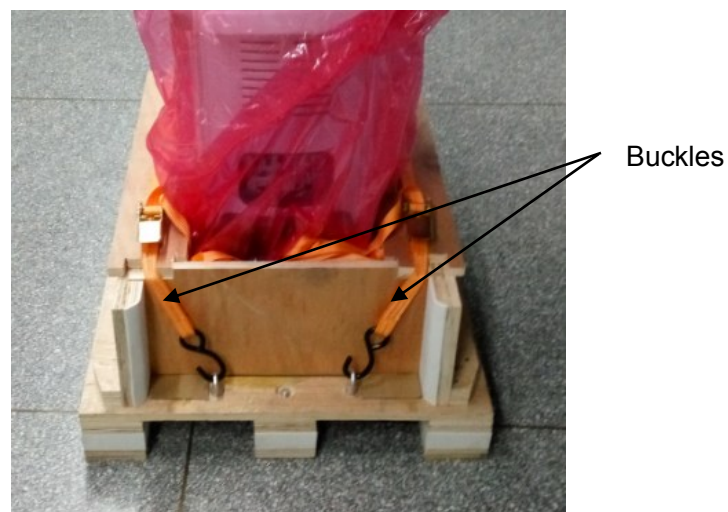
4. Remove the supporting foam, probe box and accessory box.



5. Remove the protective foam on the back.



6. Ratchet buckle



Note: press the buckle down with the thumb to make the spring tighten as shown in Figure 1. Pull the buckle upwards to tighten two buckles without losing force as shown in Figure 2.

7. Remove the blocking board and push the device along the slope.



3.2.2 Checking

1. Look at the package list to check the items in the container to ensure that items are not damaged, missed or wrongly supplied.
2. Ensure there is no damage, indentation or cracks occurring to the machine. If any of these happen, please contact Mindray Customer Service Department.

3.3 Installation of Main Unit

NOTE: To prevent the machine from damage, when you perform the following operations, please lock the casters if the machine doesn't to be moved

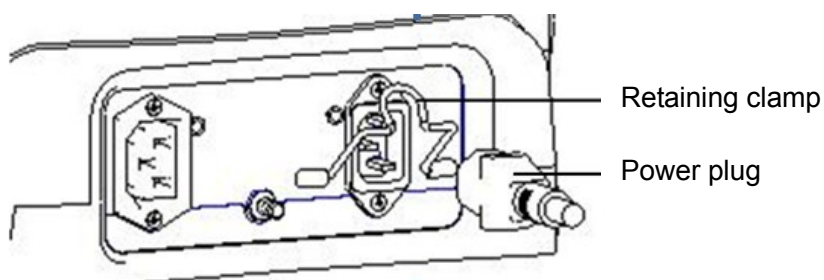
3.3.1 Open up the Monitor

Adjust the monitor from horizontal position to vertical position.

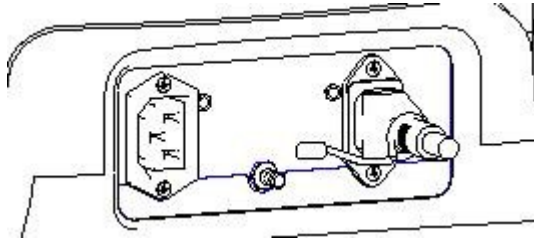
NOTE: Take care of your hands when adjust the monitor up and down.

3.3.2 Connecting the Power Cord

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



2. Push the retaining clamp downward, and lock the power cord, as shown in the figure below.



3. Plug the other end power plug into an appropriate power socket. The grounding terminal should be connected with a power grounding cable to ensure that protective grounding works normally.



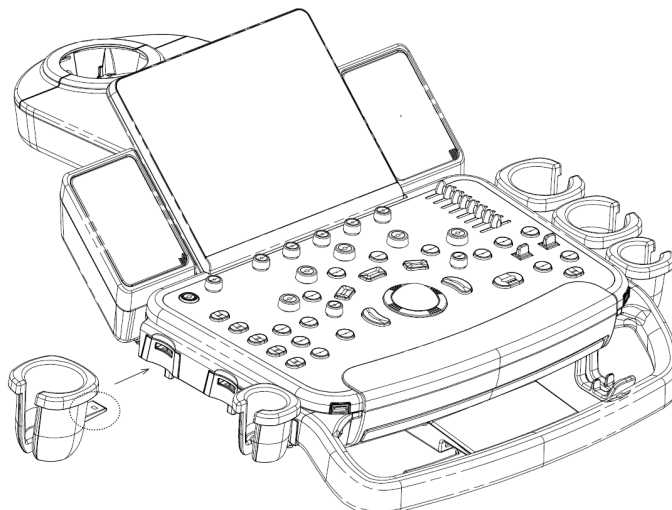
NOTE: Make sure to allow sufficient slack in the cable so that the plug will not be pulled out from the socket even if the system is moved slightly. If the plug is pulled out accidentally, data may be lost.

3.3.3 Connecting ECG

Connect the ECG cable to the corresponding interface on the physio panel under the control panel. See “2.1.2.3 Physiological-signal Panel” for details.

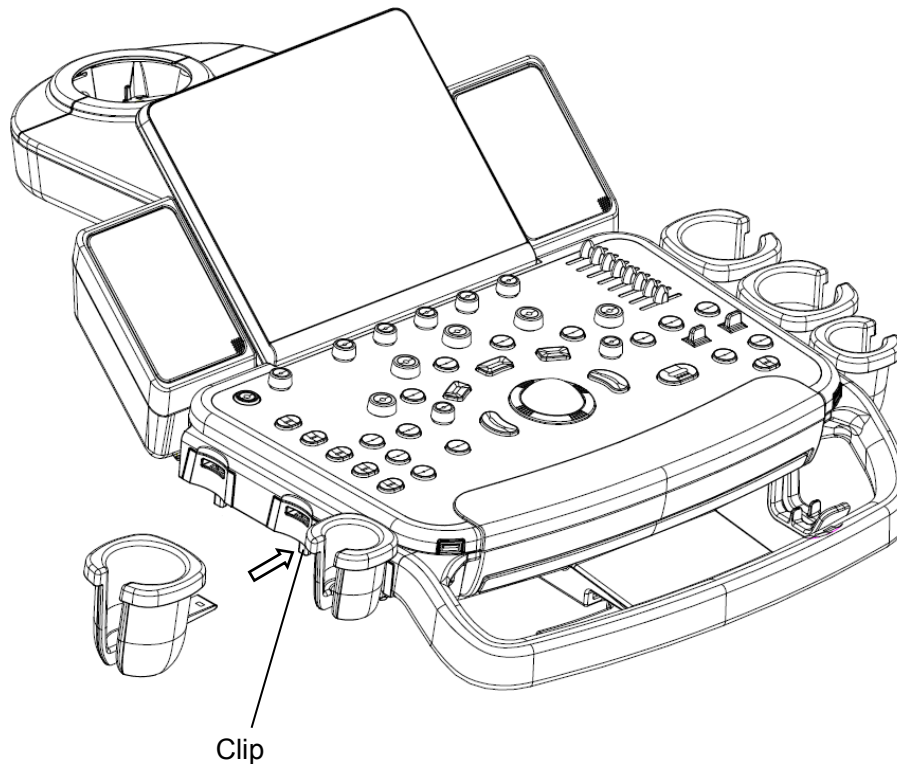
3.3.4 Installing Probe/Gel Holder

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



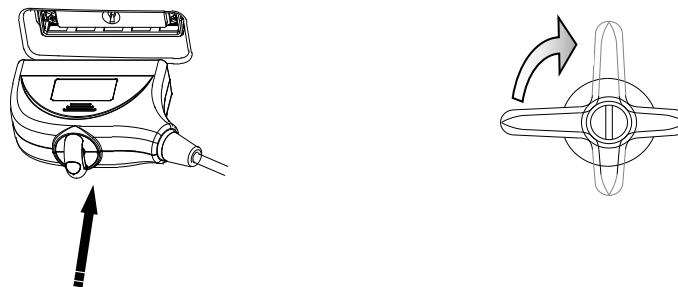
Uninstalling

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



3.3.5 Connecting the Transducer

1. Keep the cable end of the transducer to the right side of the system, and insert the connector into the socket of the system, and then press in fully. (Shown as the left figure)
2. Turn the lock handle 90° clockwise to lock it securely. (Shown as the right figure)

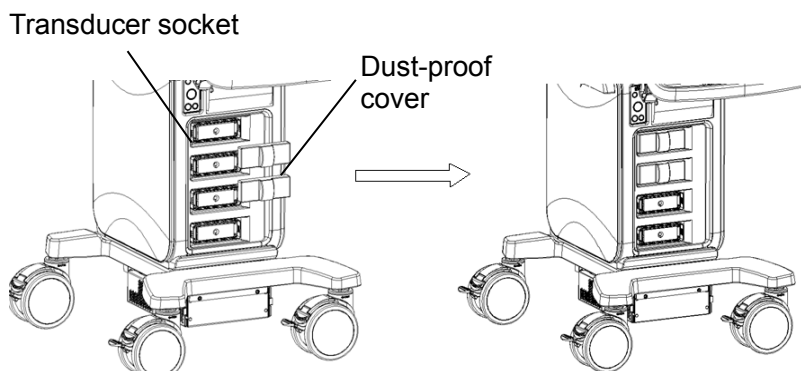


3. Place the probe properly to avoid being treaded or wrapping with other devices (use hanger or hooker). DO NOT allow the probe head to hang free.
4. Turn the lock handle 90° anticlockwise to unlock it, and then pull out the connector.

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

3.3.5.1 Using the Probe Dust-proof Cover

If a probe port is not used for a long period of time, please use the dustproof cover to protect the probe port from dust; otherwise bad contact may result.



3.4 Installing Peripherals

For the models of the supported peripherals, please refer to “0 Supported Peripherals”.

3.4.1 Connecting the Footswitch

1. Directly insert the USB plug of the footswitch to the system applicable USB ports.
2. Function setting: for details, please refer to “3.5.3 System Preset”.

3.4.2 Graph /Text printer

3.4.2.1 Connecting a Local 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. Connect the data cable with the USB port on the ultrasound system.
2. Plug the other end power plug into an appropriate outlet.
3. Power on the system and the printer.
4. Check the printer status:

- Enter [Setup]→[Print Preset]→“Printer Driver” page, printers that are installed automatically will be displayed in the list with the “Status” of “Ready”.

| Service Name | Service Type | Printer | Status |
|---------------|---------------------|----------------------|--------------|
| Report Print | Report Print | | Fail to open |
| Digital Print | Digital Image Print | Sony-UP-D897 | Fail to open |
| Analog Print | Analog Image Print | Black and White P... | N/A |

5. Return to “Print Service” page, and select “Report Print” in the list, and set attributes in the Property box under the screen:

- Select the printer model from the drop-down list right to the “Printer”;
- Set Paper Size.

The screenshot shows the 'Print Service' window with three tabs: 'Print Service', 'Printer Driver', and 'Image Setting'. The 'Print Service' tab is active, displaying a table of services and a 'Property' box below it.

| Service Name | Service Type | Printer | Status |
|---------------|---------------------|----------------------|--------------|
| Report Print | Report Print | | Fail to open |
| Digital Print | Digital Image Print | Sony-UP-D897 | Fail to open |
| Analog Print | Analog Image Print | Black and White P... | N/A |

Buttons on the right: Add Service, Remove Service, Rename Service.

Property

Service Type: Report Print Service Name: Report Print

Printer: [Dropdown menu]

Paper Size: A4 (210.0mm * 297.0mm)

Buttons at the bottom: Save, Cancel

6. Click [Save] to finish the installation.

Tips: Drivers of some popular printers have already been integrated in the system, and will be installed automatically. You need to check the following information to check if the auto-installation fails:

- Model of the connected printer is not displayed in the “Printer Driver” list;
- Click “Printer Driver”→[Add Printer]→[Add Local Printer], the system will prompts you to update the ppd file.

At this time, you need to install the printer driver manually as described in the following:

- a) Download the ppd file from the printer manufacturer's official website (contact service engineer if necessary), and copy the ppd file to the storage device (USB disk as an example).
- b) Connect the USB disk to the ultrasound system, click [Setup]→[Print Preset] "Printer Driver"→[Add Printer] to run the ppd file and finish the installation.

NOTE: All printer drivers integrated in the ultrasound system come from official website of each printer manufacturer (you can check models in the [Setup]→[Print Preset]→"Printer Driver"→[Printer Supported]).Printer drivers may not be updated in time due to software version and region limitation, consult printer manufacturer for details.

3.4.2.2 Add Network Printer

1. Make sure the target network printer and the ultrasound system are both connected into the same LAN.
2. Check the IP address of the network printer (for details, please refer to the accompanying documents of the printer).
3. Enter [Setup]→[Print Preset]→"Printer Driver" page, click [Add Printer] to enter the screen, type in the IP address of the network printer. (Port is 9100 in default).
4. Click [Verify Net Printer], the IP address, name and port information of the network printer will be displayed under the "Port" box. Change the port to match the verified printer information if necessary.
5. Click [OK] to enter the ppd installing screen:
 - Select PPD file from media: select the path from the external media and install.
 - Select PPD file from database: select the ppd. file integrated in the ultrasound system.
6. After the ppd. file is installed completely, enter the printer name to finish the installation.
7. After installation succeeds, the system returns to the "Printer Driver" page and displays the added network printer.

3.4.2.3 Installing a Wireless Printer

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

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

3.4.2.4 iStorage UltraAssist Print

The system supports printing by iStorage function. Before using this function, please make sure that the iStorage server has configured a defaulted printer, and the ultrasound system has configured an iStorage server.

1. Enter [Setup]→[Print Preset]→"Printer Driver" and check iStorage printer status, which should be AssistPrinter@IP address with "Ready" status.
2. Click "Print Service" to enter the screen, and select AssistPrinter@IP address to be the printer for the Report Print service.
3. Verify the status of the network connection.

Click the [Ping] button in the [Status] column of the iStorage printer list, and the system pops a dialog box to display whether the connection with the iStorage server is ready or not.

NOTE: Check if the iStorage printer is well connected with the server when the printing fails with the verification result being Ready,

4. Click [Save] .

3.4.2.5 Print Service

You can use a graph/ text printer to print report or images.

- To set the default report printer and its attribute:

In "[Setup]→[Print Preset]" screen, select the "Print Service", select "Report Print" column in the service list, set the items in the "Property" box.

- Report print:

Click [Print] in the report dialog box to print a report. Please refer to the accompanying manuals of the printers for more details.

3.4.3 Installing Analog Video Printer

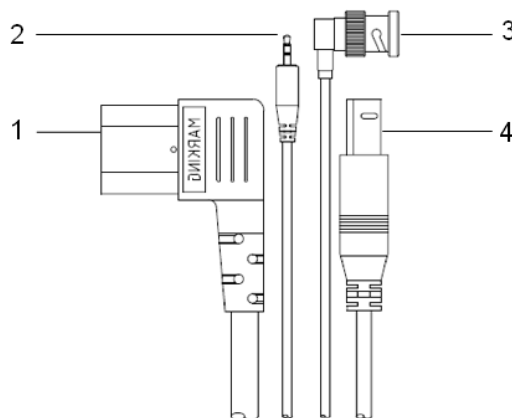
1. Plug the printer power cord to an appropriate outlet.
2. Put the printer in a proper place.
3. Cable connection:

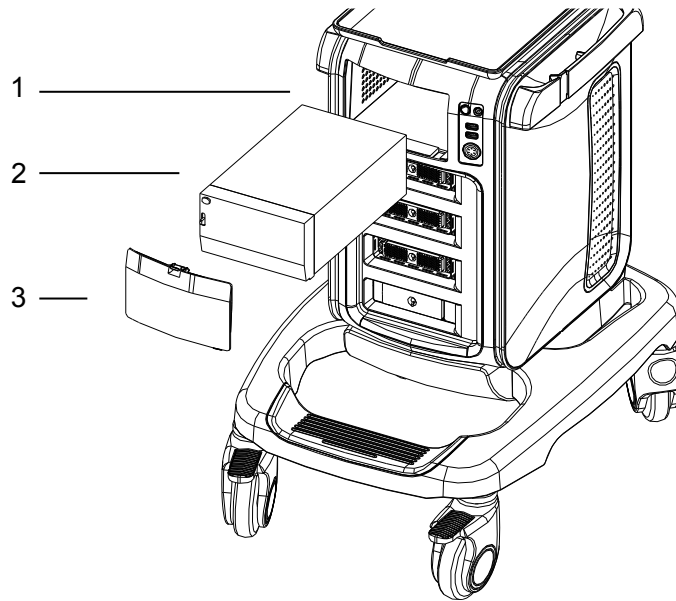
- B / W analog video printer

The printer compartment under the control panel provides the following cables:

- (1) power cord;
- (2) USB cable (used for connecting digital video printer);
- (3) video signal cable;
- (4) Remote control cable, as shown in the figure.

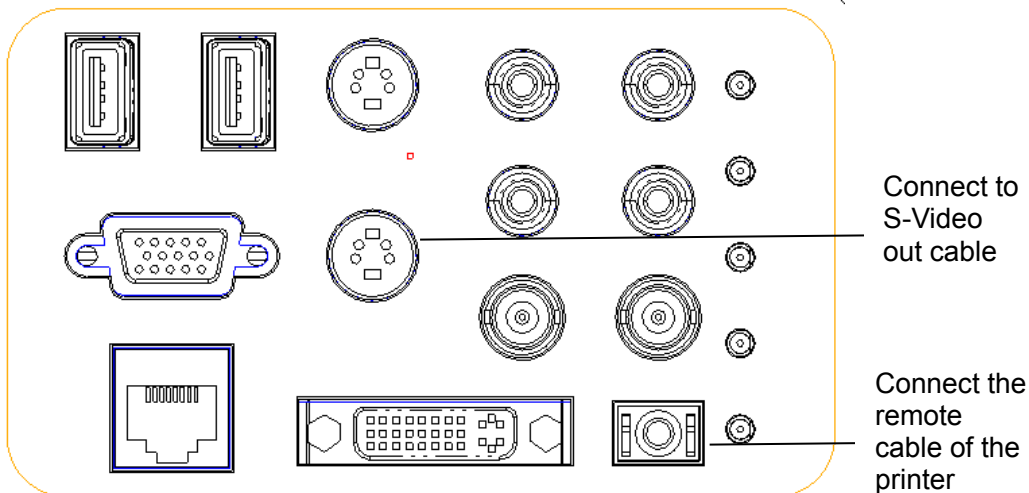
Connect the remote cable to the remote port of the printer, and video signal cable to VIDEO IN port of the printer.





1. Printer room window 2. Printer 3. Room cover

- Color analog video printer: use the I/O panel at the rear side of the machine to connect the printer, as shown in the following figure:



4. Load a paper roll, and turn on the system and printer.

5. Modify print service:

- Add a print service:

- (1) Open the [Setup]→[Print Preset]→[Print Service].
- (2) Click [Add Service] to enter the page.
- (3) Select the service type and enter the service name manually.
- (4) Click [OK] to return to the Printer Service page.
- (5) Select the printer model, and then you can set the properties in the Property box.
- (6) Click [OK] to complete the setting.

- Modify print service:

- (1) Select an existed printer service in the list.
- (2) Select the printer model, and then you can set the properties in the Property box.
- (3) Click [OK] to complete the setting.

3.4.4 Installing Digital Video Printer

1. Put the printer in a proper place.
2. Plug the printer power cord to an appropriate outlet.
3. Use a USB cable to connect between the USB port of the system and the USB port of the printer.
4. Load a paper roll, and turn on the system and printer.
5. See section “3.4.2 Graph /Text printer” for driver installation procedure (drivers of printers listed in the 2.1.3 chapter are installed already).
 - Add a print service:
 - (1) Open the [Setup]→[Print Preset]→[Print Service] screen.
 - (2) Click [Add Service] to enter the Print Service page.
 - (3) Select the service type and enter the service name manually.
 - (4) Click OK to return to the Printer Service page.
 - (5) Set printing properties.
 - (6) Click [OK] to complete the setting.
 - Modify print service:
 - (1) Select an existed printer service in the list.
 - (2) Select the printer model, and then you can set the properties in the Property box.
 - (3) Click [OK] to complete the setting.

3.4.5 Installing a Wireless Printer

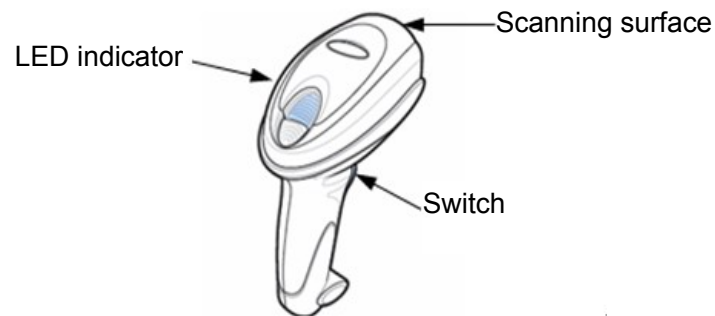
The system supports wireless graph/text printer for report printing.

1. Plug the printer power cord into an appropriate outlet.
2. Power the system and the printer on.
3. Make sure the ultrasound machine and the printer are connected to the same LAN, and turn the printer's W-LAN function on.
4. Add a wireless adapter, following the steps described in “Add network printer.” See chapter “3.4.2 Graph /Text printer” for details.
5. Open the [Setup]→[Print] page, select “Report Print” from the printer list, select the printer to be the wireless printer, and set properties.
6. Click [Save] to exit the preset and make the settings effective.

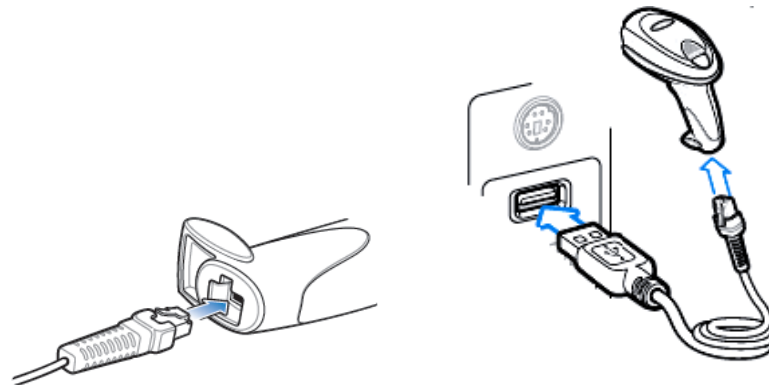
3.4.6 Installing Barcode Scanner

The system supports barcode reader to read the patient information (ID).

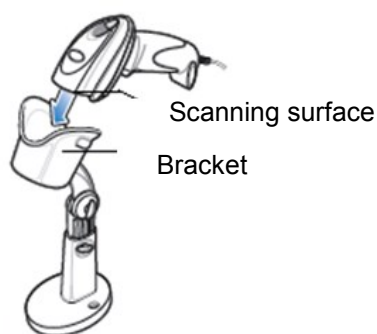
1. For structure of the scanner, see the figure below. The important parts are: LED indicator, scanning surface, and the switch.



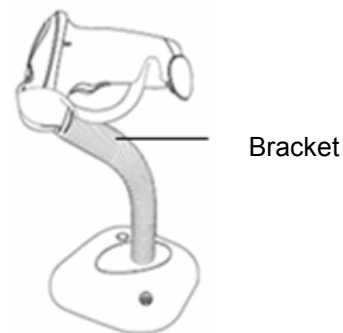
2. Connect the cable to the port on the scanner.



3. Connect the other end of the cable to the USB port on the ultrasound system.
4. When the ultrasound system is working, information scanning can be performed by pressing the switch on the scanner. For detailed operations, please refer to the operator's manual of the scanner.
5. Fix the scanner on the bracket (see the figure below) to avoid accidental falling.



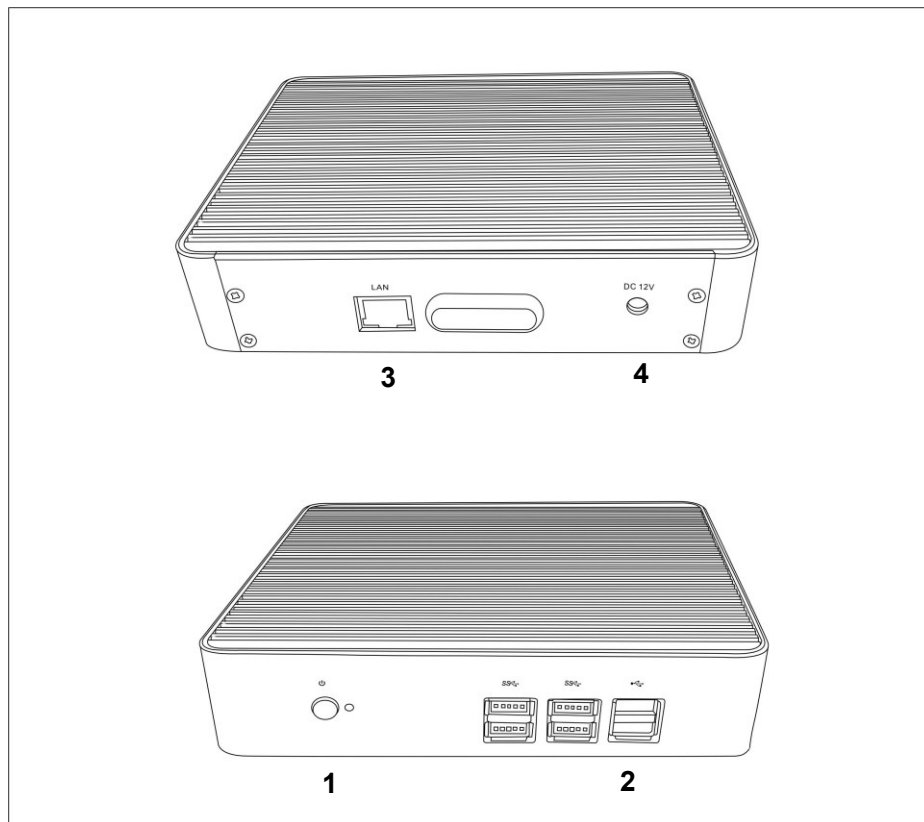
2D scanner



1D scanner

3.4.7 Installing Printer Adapter

- Overview



| No. | Name | Function |
|-----|--------------|--|
| 1. | Power Button | Powers on the printer adapter. |
| 2. | USB port | Connects the printer to the printer adapter. |
| 3. | Network port | Connects the printer adapter to the Ultrasound system. |
| 4. | Power inlet | Connects the printer adapter to power by using the auxiliary output port of the Ultrasound system. |

- Specification

- Power Supply

| | |
|------------|-----------------|
| Input: | 100-240 V~@0.6A |
| Frequency: | 50/60Hz |
| Output: | 12VDC@2.08A |

■ Environment

| | Operation | Storage and Transportation |
|----------------------|---------------------------|----------------------------|
| Ambient temperature | 0°C-40°C | -20°C-55°C |
| Relative humidity | 30%-85% (no condensation) | 20%-95% (no condensation) |
| Atmospheric pressure | 700hPa-1060hPa | 700hPa-1060hPa |

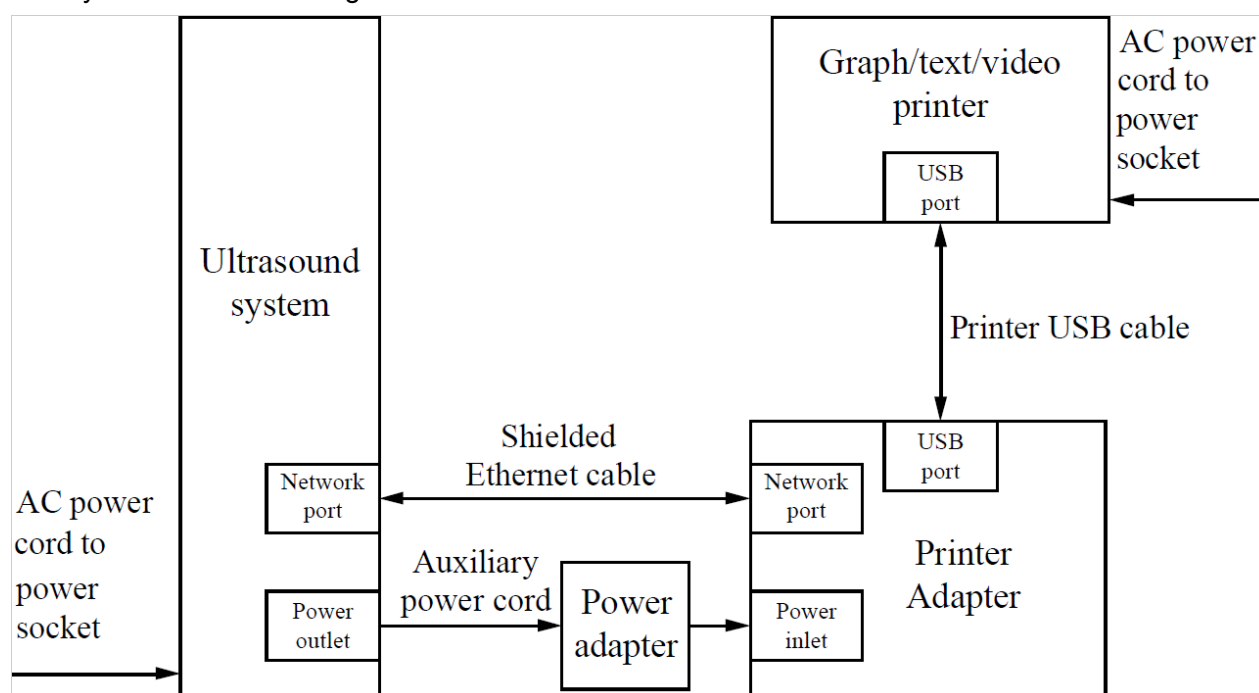
● System Connection

Note: A maximum of 6 text/graph printers can be connected to the printer adapter at the same time.

Before power on, perform the following steps:

1. Connect the printer adapter to the ultrasound system using Shielded Ethernet cable;
2. Connect the printer adapter to the ultrasound system using Auxiliary power cord together with the power adapter;
3. Connect the printer adapter to the graph/text/video printer using the USB cable.
4. Connect the ultrasound system and graph/text/video printer to the power sockets separately.

The system connection diagram is shown as follows:



● Power On

Note: Before power on, ensure that the Ultrasound system, printer adapter, and printers

are correctly connected and properly powered on.

When powering on the printer adapter, do not abnormally power off the printer adapter, which may cause device damage and malfunction.

1. Press the power button of the graph/text printer, and ensure that the printer works normally.
2. Press the power button on the control panel of the ultrasound system, and the imaging screen is displayed.
3. Press the power button of the printer adapter, and indicator of the button turns blue. (sometimes, the printer adapter is automatically powered on together with the Ultrasound system)

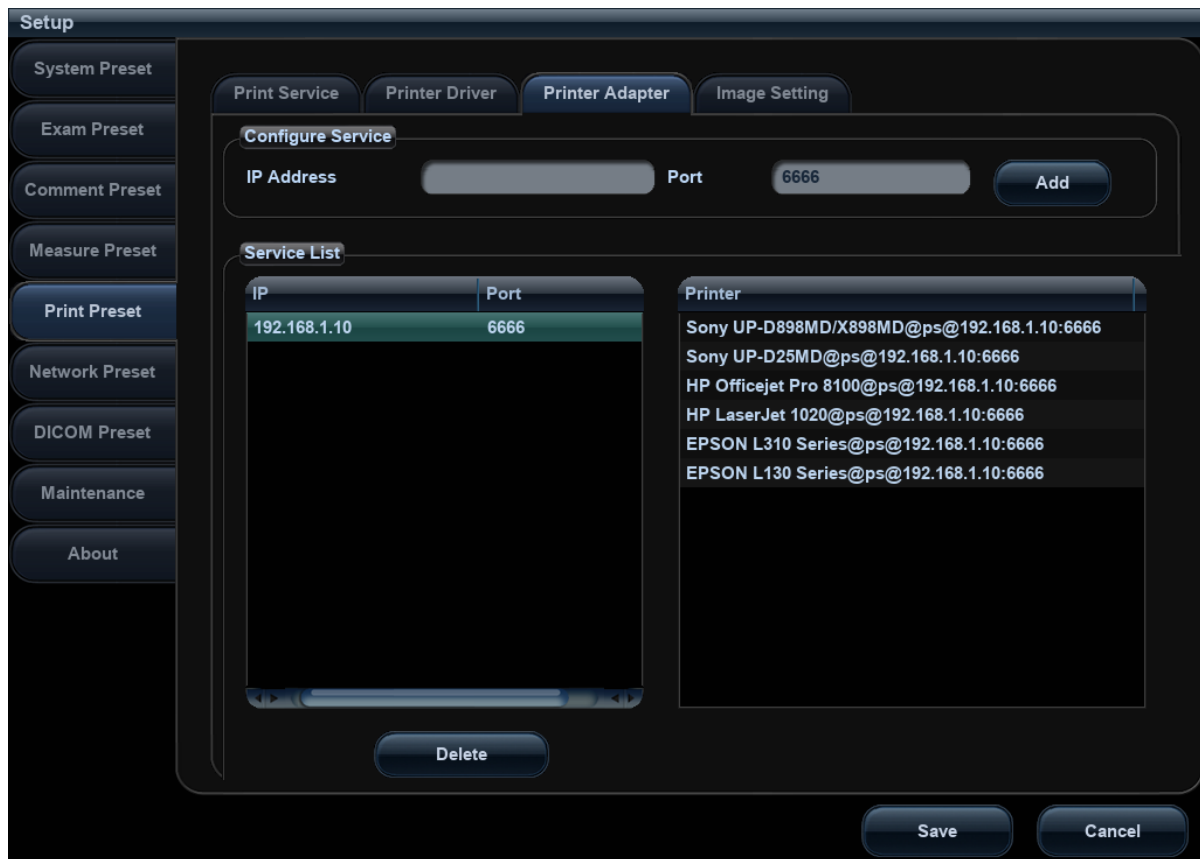
● Settings

■ Network Preset

The screenshot shows the 'Setup' window with a sidebar on the left containing buttons for 'System Preset', 'Exam Preset', 'Comment Preset', 'Measure Preset', 'Print Preset', 'Network Preset' (highlighted), 'DICOM Preset', 'Maintenance', and 'About'. The main area is titled 'Local TCP/IP' and contains a 'Network Property' section. This section has a 'Current Net Adapter' dropdown set to 'eth0' and two radio buttons for 'DHCP' and 'Static', with 'Static' selected. Below these are three rows of input fields: 'IP Address' (192.168.1.7), 'Subnet Mask' (255.255.255.0), and 'Gateway' (192.168.1.254). To the right of each input field is a placeholder 'XXX.XXX.XXX.XXX'. An 'Apply' button is located to the right of the Gateway field. At the bottom right of the window are 'Save' and 'Cancel' buttons.

1. Open the Network page via [Setup] → [Network Preset] → [Local TCP/IP].
2. Select Static;
3. Set the IP Address to any value from 192.168.1.1 to 192.168.1.200 (192.168.1.10 is excluded, because it belongs to the printer adapter);
4. Set the Subnet Mask to 255.255.255.0 and Gateway to 192.168.1.254;
5. Click [Save].

■ Printer Adapter Preset



1. Open the Printer Adapter page via [Setup] → [Print Preset] → [Printer Adapter].
2. Set the IP Address to 192.168.1.10 and Port number to 6666.
3. Click [Add], and the Printer Adapter name is displayed in the Service List.

■ Print Preset

For details about print service preset, please see chapter 3.4.2 to 3.4.6 for details.

Note: You can set the <Print> button to Digital Print or Analog Print via [Setup] → [System Preset] → [Key Config].

● Power Off

1. Press the power button on the control panel of the Ultrasound system (the printer adapter is automatically powered off together with the Ultrasound system).
2. Press the power button of the graph/text/video printer.

If the internet connection is abnormal, the Ultrasound system cannot control the power-off of the printer adapter, which may lead to abnormal power-off of the printer adapter and ultimately cause printing malfunction.

3.5 System Configuration

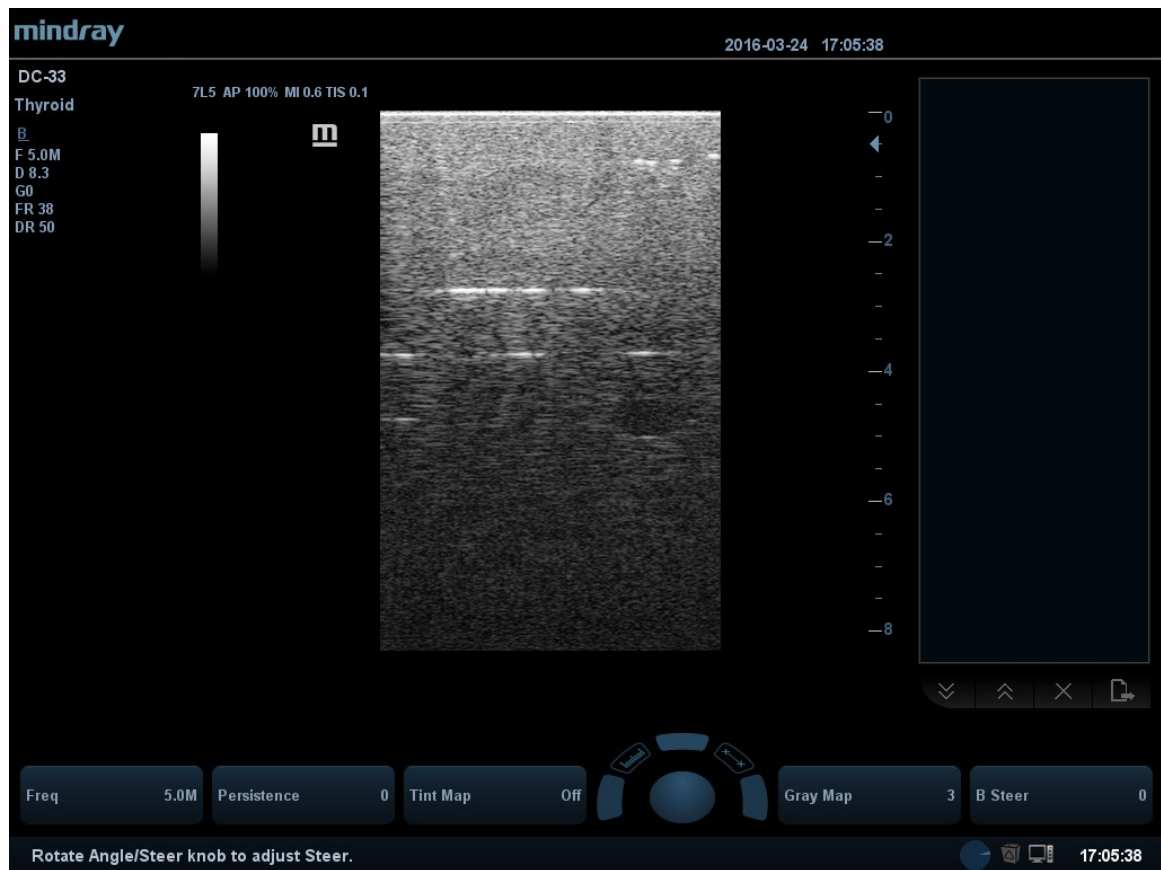
3.5.1 Running the System

Connect the AC power; make sure the ultrasound system and other optional devices are correctly connected.

When the AC power indicator on the control panel is light on (indicator \sim is in green), press the power button \odot/\odot on the control panel to turn on the system.

3.5.2 Enter Doppler

After system is turned on and wait for about 1 minute (for system initialization), it will enter into Doppler interface, see the figure below:



3.5.3 System Preset

1. Press <F10> on the keyboard to open the Setup menu.



2. The system displays the System Preset screen.

The "System Preset" screen is displayed, featuring a sidebar with navigation buttons: "System Preset", "Exam Preset", "Comment Preset", "Measure Preset", "Print Preset", "Network Preset", "DICOM Preset", "Maintenance", and "About". The main area has tabs for "Region", "General", "Image", "Application", "OB", "Key Config", and "Admin". The "General" tab is active, showing "Hospital Information" and "Language and Time" sections. The "Hospital Information" section includes fields for Name, Address, Telephone, Fax, Website, Location, Medical Director, and Associate, along with a "Load Logo" button and a medical logo icon. The "Language and Time" section includes fields for Language (English), Time Zone ((GMT+08:00) Beijing, Chongqing, Hong Kong, Urumqi), Date Format (YYYY/MM/DD, MM/DD/YYYY, DD/MM/YYYY), Time Format (12 Hour, 24 Hour), System Date (2016/03/24), and System Time (17:05:58). At the bottom right are "Save" and "Cancel" buttons. The system tray at the bottom right shows the time 17:05:58.

The following settings can be performed on the System Preset screen.

| No. | Item |
|-----|---|
| 1. | Region: preset the hospital name, date and time, and select the language. |
| 2. | Key Config: preset the function of user defined keys (Print, Save, P, F3, F4, F5, F6 and F12) and the footswitch, key lightness, key volume and trackball speed can be adjusted. You can also define the gesture. |
| 3. | General: preset the time in standby mode, set the brightness/contrast of the display. |

3.5.4 Print Preset

See chapter 3.4.2-3.4.6 for details.

3.5.5 Network Preset

Local TCP/IP

NOTE DO Not edit IP address in Network Preset page as the network task is executed, otherwise it fails. View if there is any undergoing task in task manager of the system.

This page is used for setting network property of the ultrasound system, which is also applicable for DICOM function.

Open the page via “[Setup]→[Network Preset]”.

The screenshot displays the 'Network Preset' interface. At the top, there are three tabs: 'Local TCP/IP' (selected), 'iStorage', and 'MedTouch/MedSight'. Below the tabs, the 'Network Property' section is visible. It includes a 'Current Net Adapter' dropdown set to 'wlan0', with radio buttons for 'DHCP' (selected) and 'Static'. Below these are input fields for 'IP Address', 'Subnet Mask', and 'Gateway', each followed by a placeholder 'XXX.XXX.XXX.XXX'. An 'Apply' button is located to the right of these fields. The 'Wireless Network Manager' section is below, featuring a table with columns: SSID, BSSID, Signal quality, Encrypt, and State. The table contains one entry: '5GHz' SSID, 'cc:34:29:91:a6:c8' BSSID, '8' Signal quality, and 'WPA-PSK-CCMP' Encrypt. Below the table, there are fields for 'Network SSID' (set to '5GHz'), 'Security' (set to 'WPA-PSK-CCMP'), and 'Password' (empty), followed by a 'Connect' button.

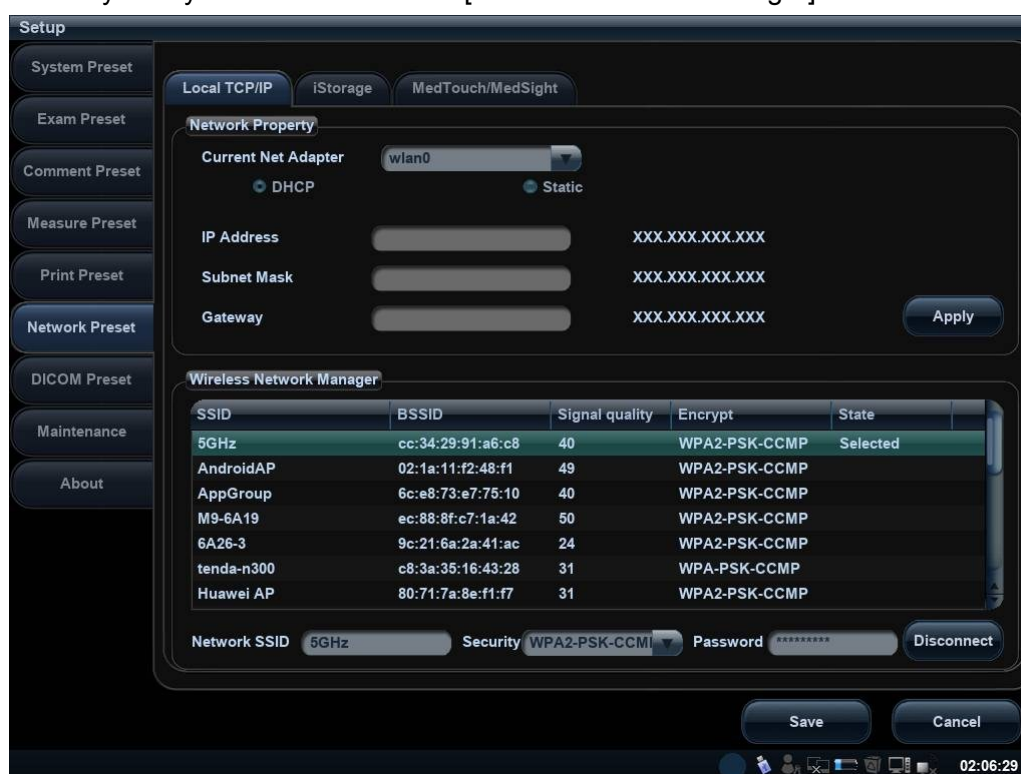
Local TCP/IP setting items are described as follows:

| Name | Description |
|-------------------------|---|
| Current Network Adapter | To choose the local connection or wireless adapter. |
| DHCP/ Static | DHCP/Static: If "DHCP" is selected, IP address will be automatically obtained from DNS server; if "Static" is selected (using static IP address), you need to enter the IP address. |
| IP Address | IP Address: IP address of the system should be at the same network segment with the service IP address. |
| Subnet Mask | Used to set different network segment. |
| Gateway | Used to set the gateway IP. |
| Apply | Click to make the settings effective. |


Note: The IP address of the system should not be occupied by other devices in the LAN, otherwise DICOM function will fail.

Wireless LAN

1. Press <Setup> to enter the Setup menu.
2. Enter [Network Preset] → [Local TCP/IP].
3. Select the wireless net adapter from the [Current Net Adapter] list, and the hotspots being searched by the system are listed in the [Wireless Network Manager] box.



4. Select the desired hotspot from the [Wireless Network Manager].
The data display in the [Network SSID] and [Security] control. If the hotspot wanted is not in the list, you can input the data manually in the controls and click [Connect].
When connecting an encrypted network, enter the password in the box on the left first.

5. If the connection is successful, the  will be displayed on the lower right corner of the screen.
6. If the user wants to disconnect the WiFi. Choose the selected address from Wireless Network Manager, and click [Disconnect] to disconnect the WiFi. The selected WiFi is disabled.

NOTE:

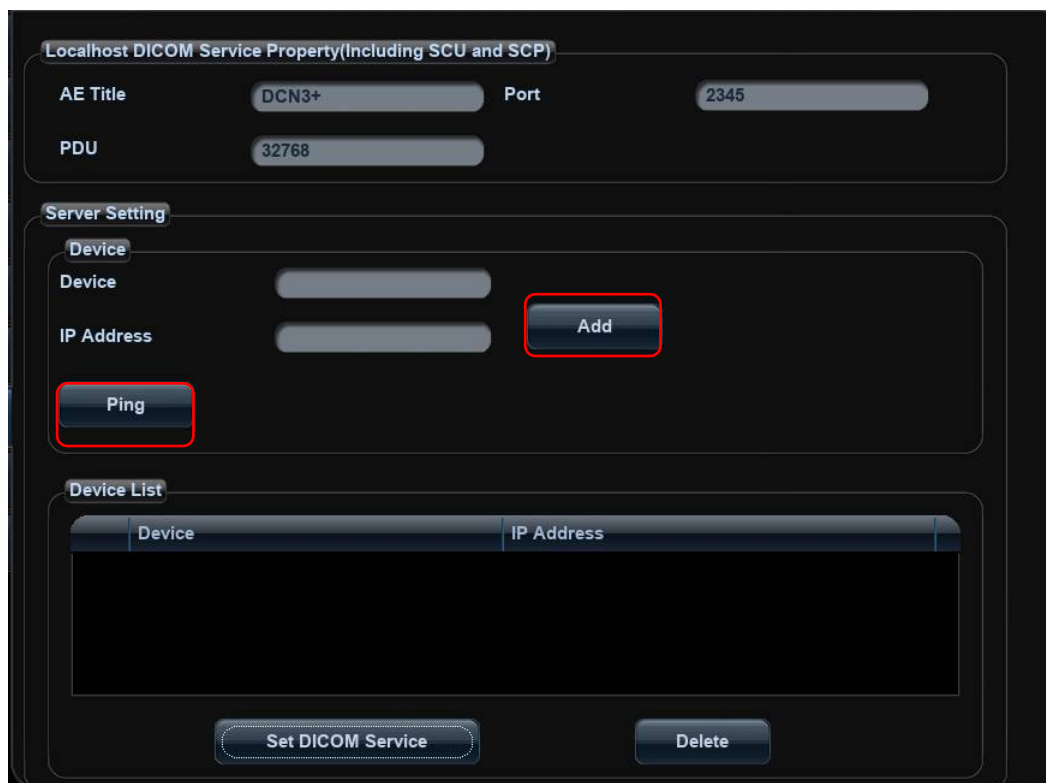
1. You can refresh the W-LAN network by switching the current adapter.
2. If the IP address displays as 0.0.0.0, this means that the network is abnormal, the reason may be failure disconnection or the system cannot obtain IP address.

3.5.6 DICOM/HL7 Preset

NOTE: Only if DICOM basic option is configured, [DICOM Preset] is available.

1. Click [DICOM Preset] to open the DICOM Preset screen. Enter the AE Title of the ultrasound system, port and PDU according to the actual situation.
2. DICOM Server Setting
 - 1) Enter the device name and the IP address.
 - 2) You can ping other machines to verify connection after entering the correct IP address by clicking [Ping].
 - 3) Click [Add] to add the server to the list if the connection works normally.

The following is an example:



The screenshot displays the DICOM Preset configuration interface. It is divided into three main sections:

- Localhost DICOM Service Property(Including SCU and SCP):** This section contains input fields for 'AE Title' (set to 'DCN3+'), 'Port' (set to '2345'), and 'PDU' (set to '32768').
- Server Setting:** This section includes a 'Device' label, an input field for the device name, an input field for the 'IP Address', and two buttons: 'Add' and 'Ping'. Both the 'Add' and 'Ping' buttons are highlighted with red rectangles.
- Device List:** This section features a table with two columns: 'Device' and 'IP Address'. The table is currently empty.

At the bottom of the interface, there are two buttons: 'Set DICOM Service' and 'Delete'.

- NOTE:**
1. AE Title should be the same with the SCU AE Title preset in the server (PACS/RIS/HIS).
 2. DICOM communication port should be the same with the one in the server.
 3. If the currently entered name has already existed, the system will pop up: "The server name exists!" Click [OK] to enter another name.

3. Click [Set DICOM Service].

When the system is configured with DICOM basic function module, and installed DICOM Worklist, MPPS, DICOM Structured Reporting and Query/ Retrieve modules, the corresponding preset settings can be found in DICOM Service screen.

The DICOM Service Setting is used to set properties of DICOM services as Storage, Print, Worklist, MPPS, Storage Commitment and Query/ Retrieve. The detailed information please refer to DICOM chapter in the operator's manual [Basic Volume].

NOTE: Only if DICOM basic option is configured, Worklist page is available.

3.5.7 Check System Information

In System Information screen, it displays the product configuration, the optional installation status, software version, hardware & boards, and driver related information. You can check the product information here.

1. Press <Setup>, and then click [System Info] to check system information.
2. On About Detail page, system hardware & board related information can be seen.

- | | |
|--------------|--|
| NOTE: | <ol style="list-style-type: none">1. Be sure to confirm the system information before and after the software maintenance.2. If necessary, please ask the user to save the current system information. |
|--------------|--|

4 Product Principle

4.1 General Structure of Hardware System

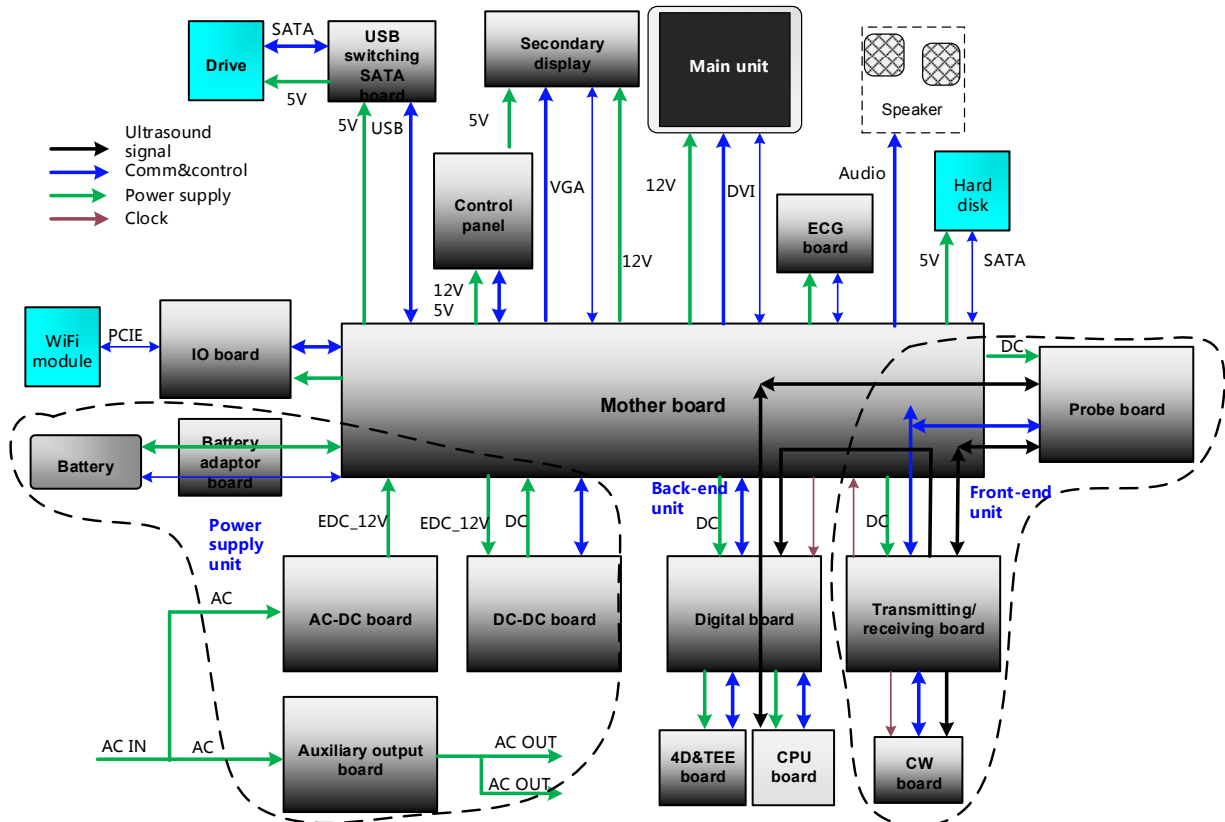


Figure 4-1 Schematic diagram of system hardware

The general structure of DC40's hardware system is shown in figure above. DC40 system hardware consists of each following part:

- Front end unit (probe board, CW (continuous wave) board, transmitting/receiving board);
- Back end unit (digital board, 4D&TEE board, IO board, motherboard);
- Control panel unit;
- Main display and touch screen;
- ECG unit (ECG board);
- Power supply unit (auxiliary output adaptor board, AC-DC board, DC-DC board, battery connecting board).

4.2 Ultrasound Front-end Unit

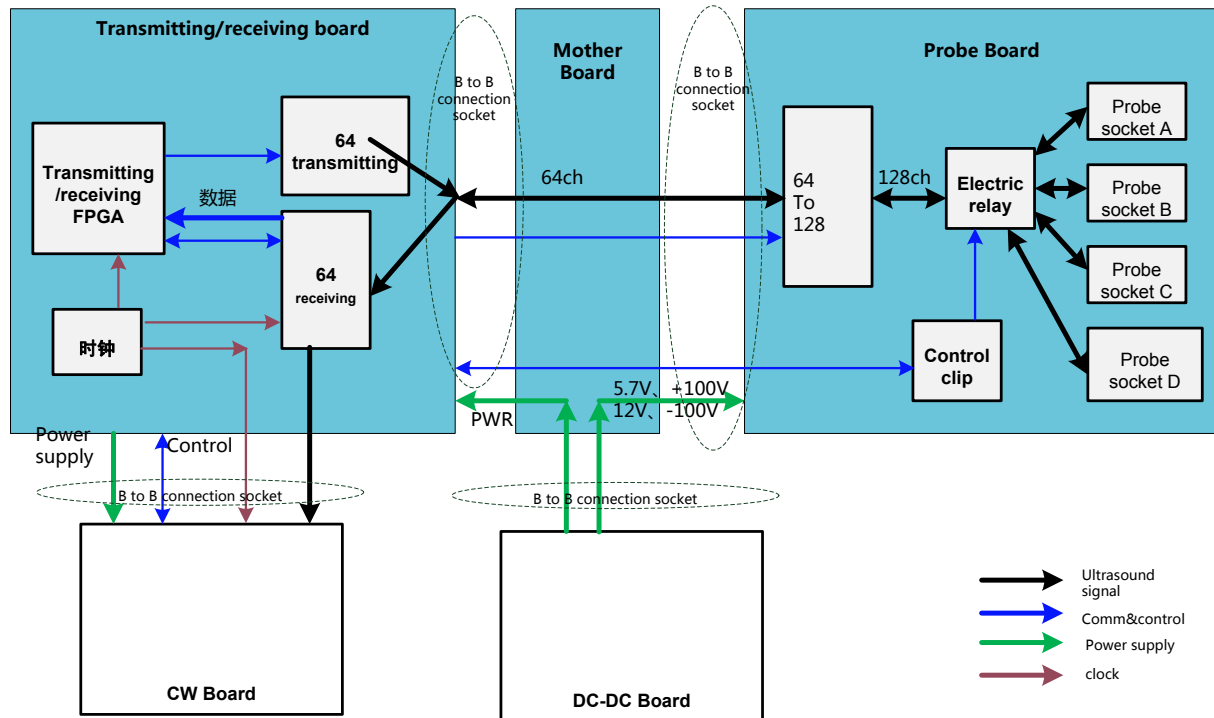


Figure 4-2 Schematic Diagram of Ultrasound System Front-end

Frontal-end unit mainly consists of:

- Probe board
- Transmitting/receiving board
- CW (continuous wave) board;

Probe board can be used for the switch among the probe socket, and the switch between 64-channel and 128-channel. The transmitting/receiving board completes 64-channel transmitting/receiving functions. The echo signal becomes beam-formed via the magnification and analogue-to-digital conversion (ADC). It sends to processing the signal via FPGA of digital board. CPU module of digital board processes the complete image signal.

For details of the boards, see the following chapters:

4.2.1 Probe Board

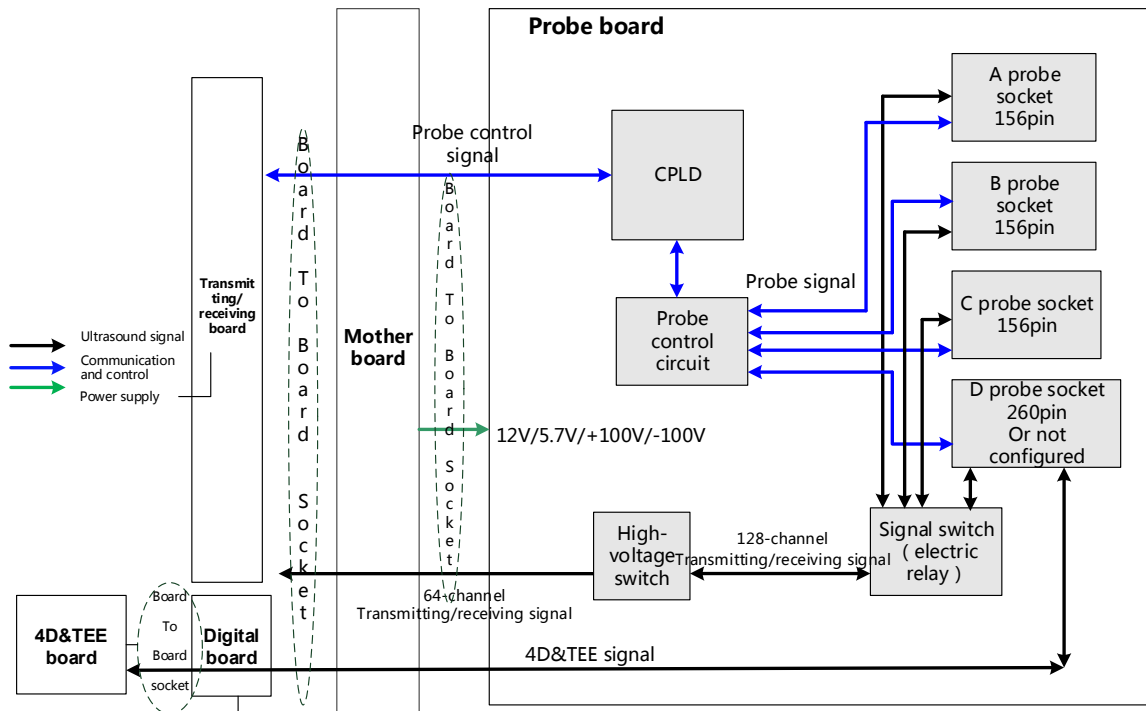


Fig 4-3 Schematic Diagram of the Probe Board

Function description:

- Support 192/128 array probe, 4D probe, phased array probe, bi-plane probe, and other nominal probes, etc.
- Probe board completes the switch between 64-channel and 128-channel.
- Implement the switch of 192 array probe within the probe. Probe board only supports 128-channel.
- Probe board contains three **156Pin** and **one 260pin** probe sockets.
- Support the retrieving of four probes' ID and the switch among four probe sockets. ID recognition and the circuit of probe switch are independent to each other.

4.2.2 Transmitting/Receiving Board

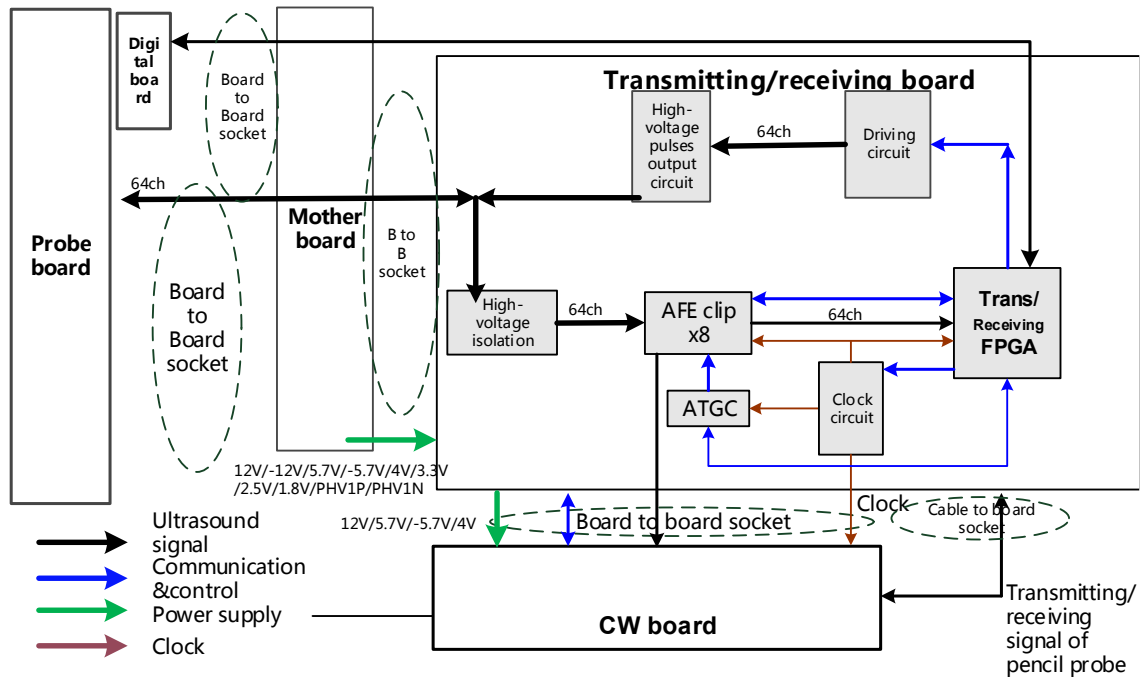


Figure 4-4 Principle Diagram of Transmitting/Receiving Board

The transmitting/receiving board is used for transmitting and receiving the signal.

- The system communicates with FPGA of transmitting/receiving board via the communication bus.
- It completes 64-channel transmitting pulse.
 - 64-channel transmission wave is formed according to scanning time sequence and control parameters.
 - 64-channel transmission wave is driven to produce 64-channel high-voltage transmission wave.
- It completes 64-channel receiving.
 - High-voltage isolation.
 - AFE clip completes the magnification of ultrasound echo signal and analogue-to-digital conversion (ADC).
 - ATGC module, the voltage gain control module.
 - The beam is formed via FPGA.
- Clock module, the clock source of the entire front-end is on the transmitting/receiving board. It sends to the corresponding board after the clock buffer distributes.

4.2.3 CW Board

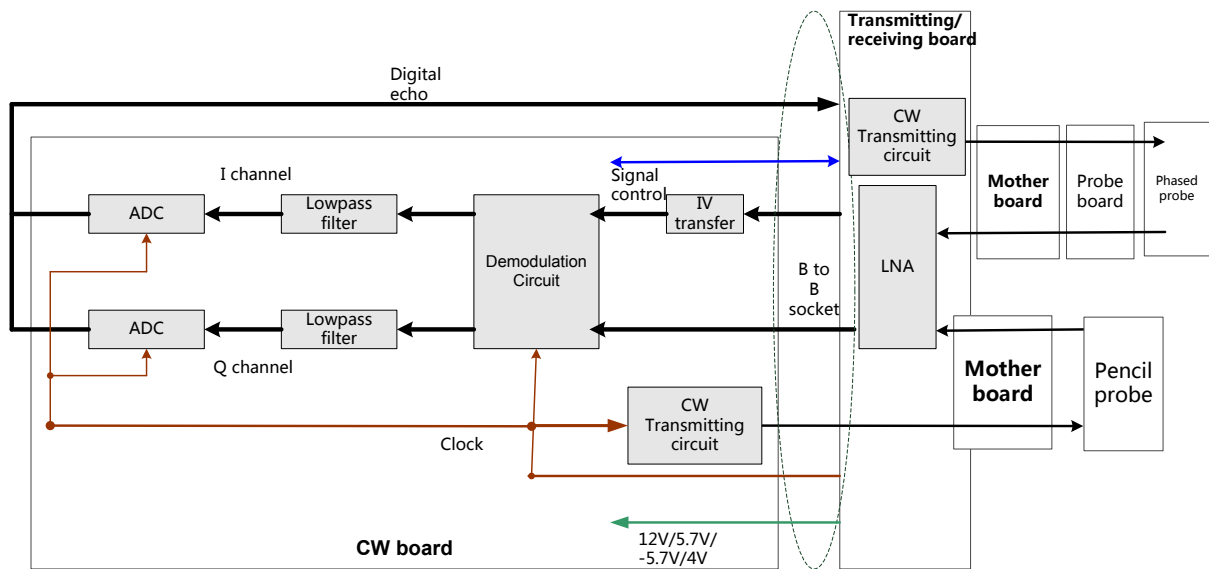


Fig 4-5 Principle Diagram of CW Board

Function:

- The echo signals that phased or pencil probes receive are magnified via amplification circuit (LNA) and I-channel and Q-channel signals are obtained after being demodulated via the quadrature demodulation. The signals filter the low-frequency and high-frequency signals and obtain the samplings via ADC. The digital samplings are processed via FPGA of the transmitting/receiving board.
- It transfers the digital signal into analog signal which also refers to the sine signal. The sine signal drives the pencil probe to make the transmission.
- Control signal port acquires the ID of CW board, the information of pencil probe in-place and the information of pencil probe ID, etc.
- The port of pencil probe is on the ECG board, connecting to the mother board socket via the cables, not related to ECG board.

4.3 Ultrasound Back-end Unit

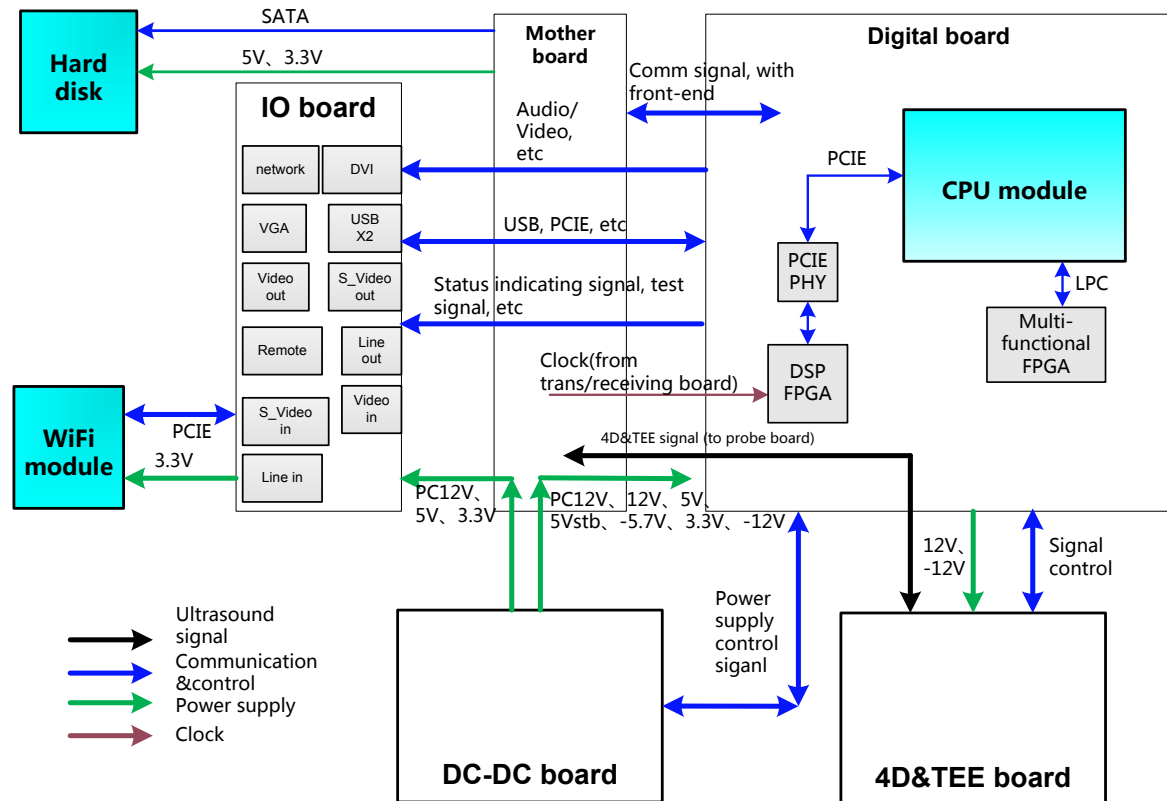


Figure 4-6 Diagram of Back-end Unit

The back-end unit consists of digital board, mother board, IO board 4D&TEE board, etc.

4.3.1 Digital Board & IO Board

The digital board diagram is shown below:

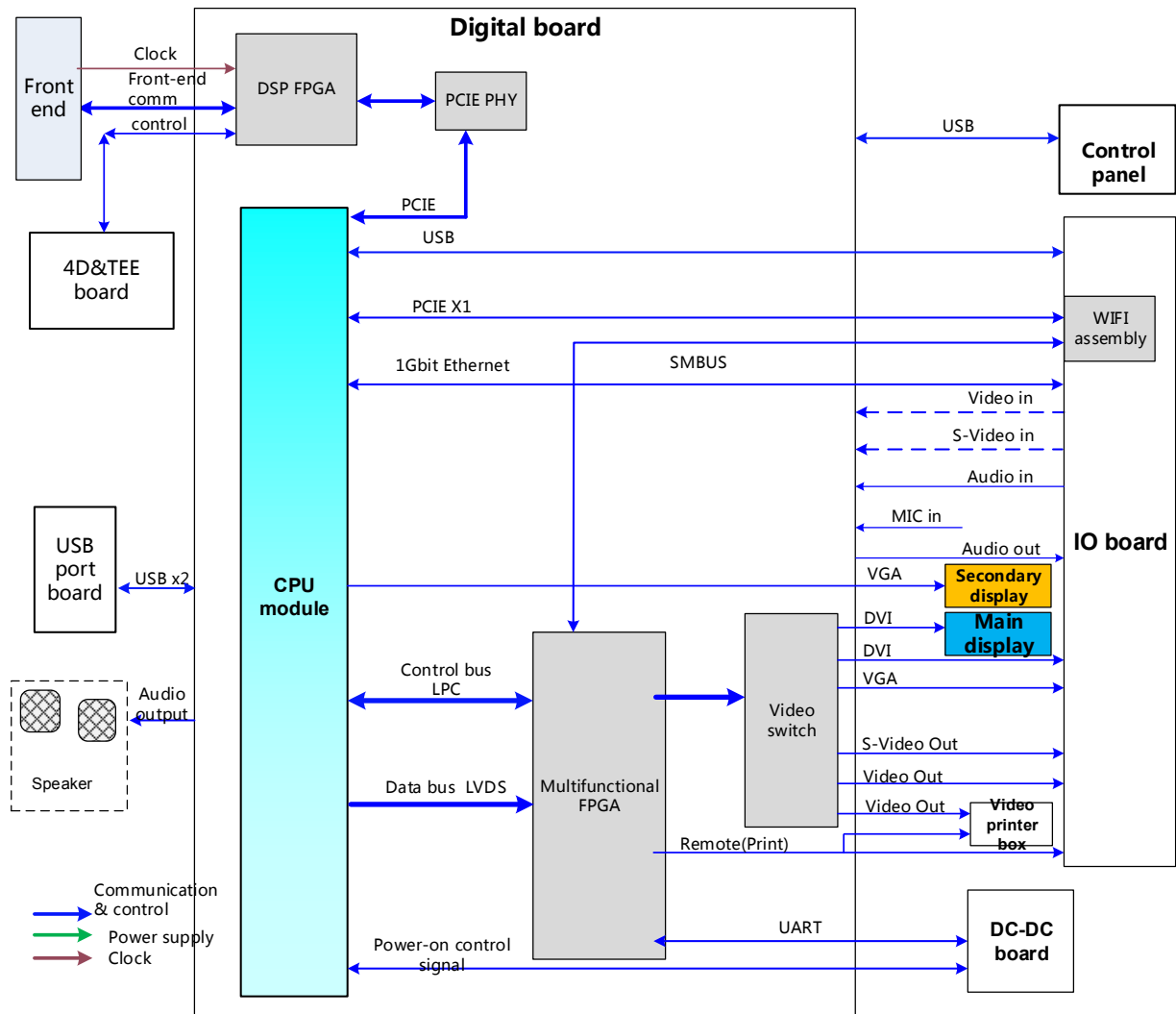
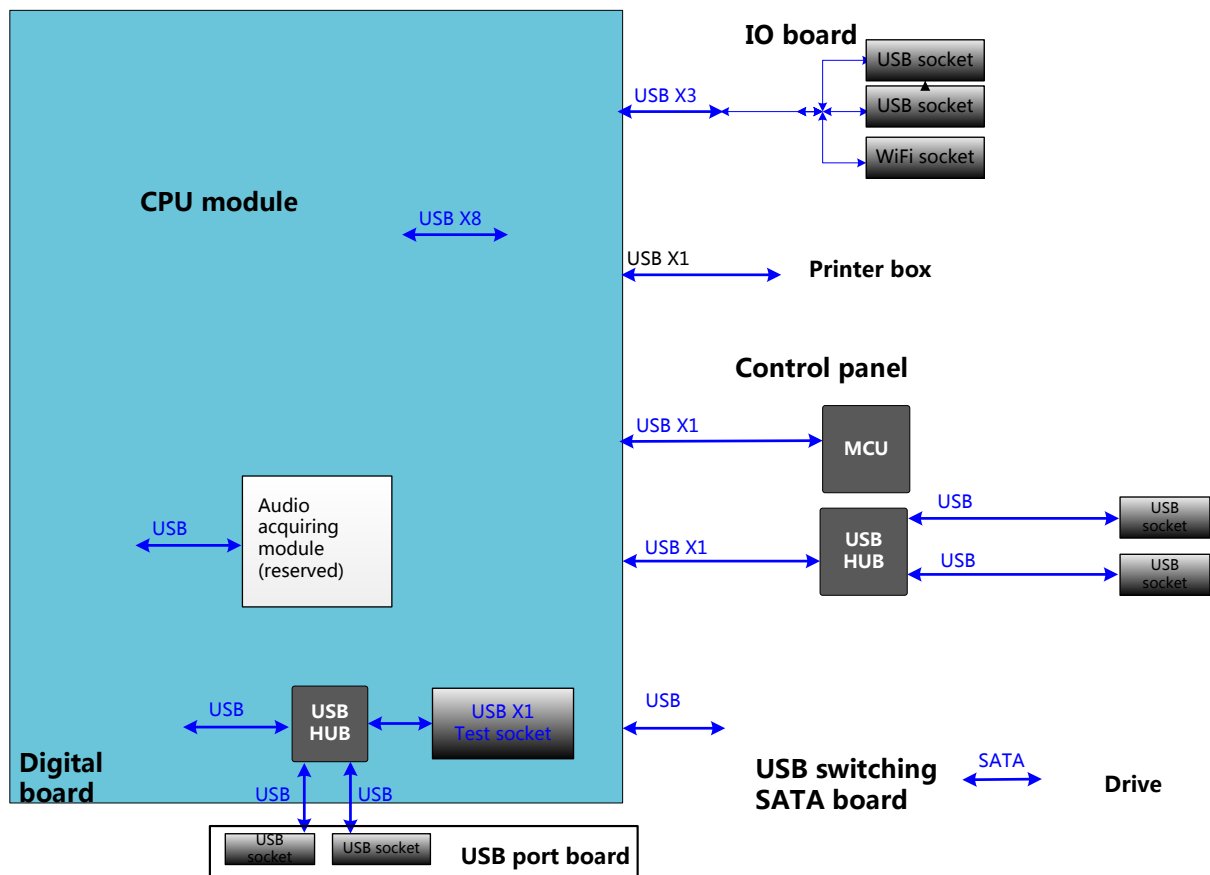


Figure 4-7 Digital Board Diagram

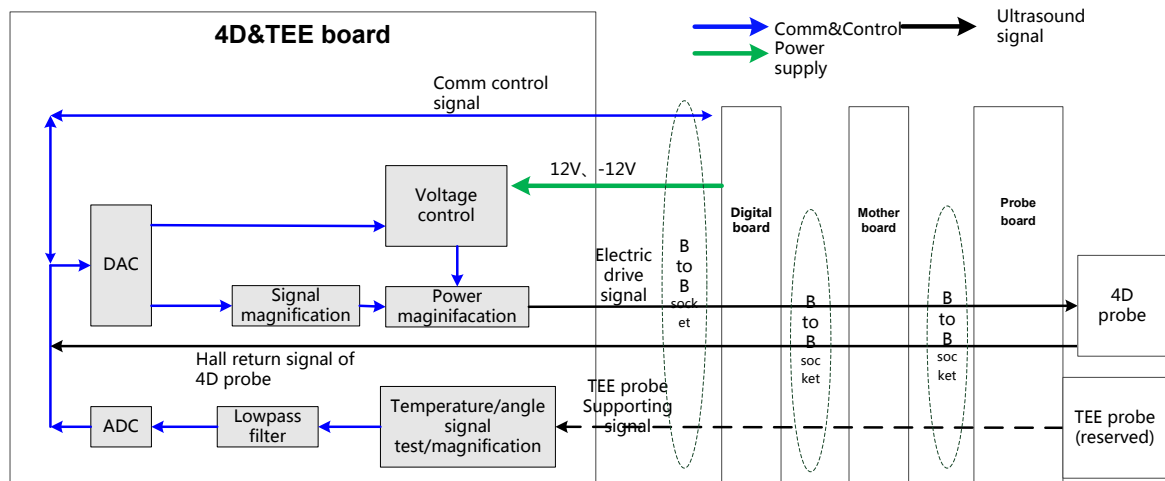
The function of digital board is described below:

- CPU module carrying, standard COM-E socket.
- DSP (digital signal processing) FPGA;
 - a) Processing the signals from B, C, D modes;
 - b) Packaging the data that have been processed based on the corresponding imaging modes, and sending to CPU module of digital board for further process.
 - c) CPU module to each board of the control bus on the front-end unit transmits via DSP FPGA.
- Multi-functional FPGA completes the video format transfer, back-end control, port extension, etc.
 - a) Display extension: it completes the video format, time sequence, video editing and filling from the LVDS to various port clips.
 - b) Digital video port: it is used for digital video compression, saving and other controls.
 - c) Back-end communication and control. Extension serial-port is used for supporting the battery management and MCU controlled by high-voltage. It uses LPC bus to complete via multi-functional FPGA.

- d) Video print control, supporting the connection to video print.
- e) 12C port, reading the display status from main monitor and secondary monitor, writing the parameters.
- Communication bus
 - a) PCIe×1, 2-channel, front-end data and control communication port, WiFi module supporting
 - b) LPC, multifunctional communication control and transfer extension of some communication ports.
- Back-end video processing, completing the extension of CPU module video output.
 - a) DVI, 2-channel, ports to main monitor and external monitor of IO board, 1024×768@60Hz resolution.
 - b) VGA, 2-channel, one of two channels is used as the display extension of external VGA port, 1024×768@60Hz resolution; another channel is used for secondary monitor that CPU module outputs, 1024×768@60Hz resolution.
 -) Composite Video: 1-channel input (reserved), 2-channel output, it is used for external video output and black/white printer, supporting P-standard/N-standard switch.
 - a) S-video, one-channel input (reserved), one-channel output; supporting P-standard/N-standard switch.
- Audio Processing
 - a) Audio. One-channel (reserved), one-channel output, left and right stereo.
 - b) Power magnification output, maximum power 12W on a single-channel, left/right stereo.
 - c) Support external MIC input.
- Port supporting
 - a) 1 Ethernet port.
 - b) 1 WiFi port, built-in.
 - c) Bluetooth port (USB, external).
 - d) Footswitch supporting, USB port.
 - e) Video print port, 2-channel, black/white and color.
 - f) SATA port, 1, hard disk.
 - g) USB port, external 6.



4.3.2 4D&TEE Board



Function:

- Magnifying the signal power driven by 4D and generating signals which meet the power standards to the desired position.
- Providing Hall signal of 4D probe return path.
- Magnifying and collecting the signal from TEE probe temperature and angle.

4.4 Control Panel Unit

Control panel carries the most of the user interaction operation of the main unit: imaging mode switching, parameter adjustment, operation order, etc.

Control panel's functions of DC-40 product:

- Power on/power off button
- Status indicators: including working status, AC in-place, battery status, standby status, hard disk reading/writing status.
- Alphanumeric keyboard. User-defined keys. Drawer-like: the backlight is on when drawing out; the backlight is off when pushing in.
- Trackball: including right/left keys.
- USB port.2 USB 2.0.
- Various function keys, encoder. It is decided on industry design. White and orange backlights. Four adjustable levels for backlight's brightness. Four adjustable levels for sound volume.
- 8 TGC sliders. Borrow TCG assembly from 2119.
- Provide the power supply to one gel heater: 12V@3A.
- Provide USB port to the touch screen.

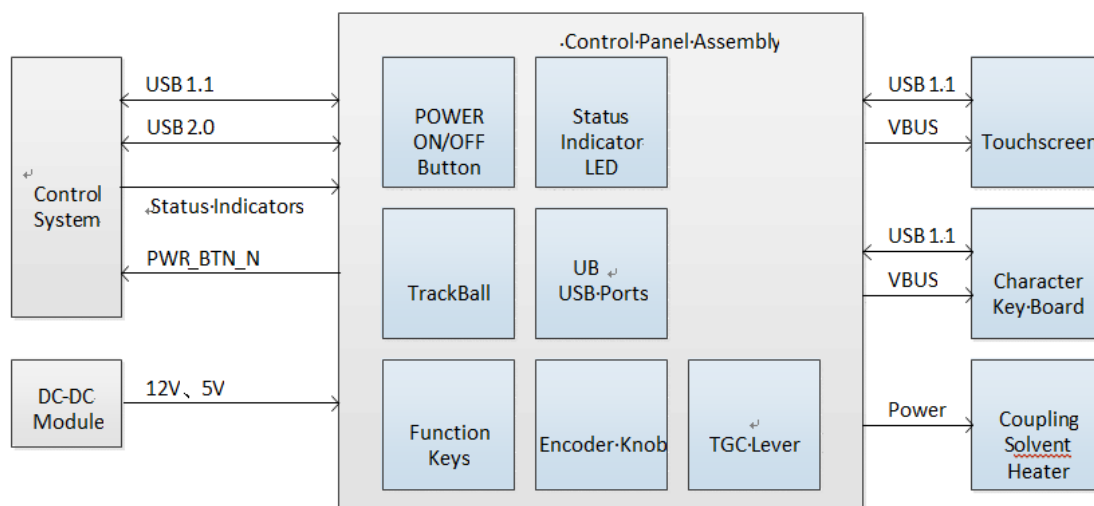


Fig 4-10 Principle Diagram of the Control Panel

4.5 ECG Unit

ECG unit includes the ECG board. ECG module is designed for monitoring ECG signals and displaying ECG waveforms, which serves as reference of ultrasound images. This module can synchronize with 2D images and color flow images in real-time display. The ECG signal, after been amplified, filtered, and sampled, will be uploaded to the digital board for R-wave testing, the tested ECG trigger signal will be uploaded to DSP FPGA of digital board through USB port.

This design ensures that the system can connect external ECG transducer which uses a compatible port with Mindray PM product. Besides, USB extend board is adopted in the ECG unit. USB signal from the digital board will be sent to USB adaptor board through cables. For the user's convenient, two USB port are designed on the USB adaptor board. ECG unit structure is shown as below:

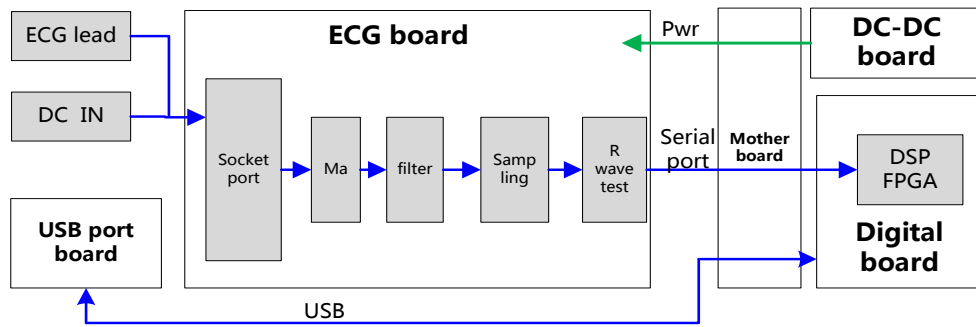


Fig 4-11 Principle Diagram of ECG Board

4.6 Display Unit

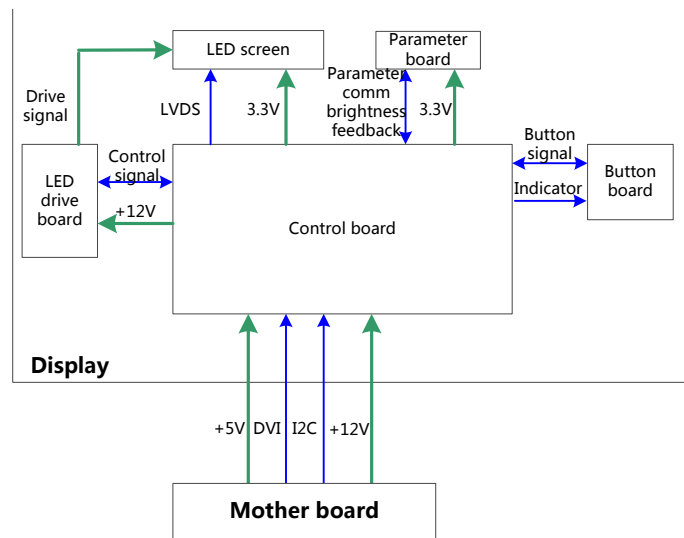


Fig 4-12 Principle Diagram of Main Monitor

The display unit consists of control board, LED driving board, LED, parameter board, key board, etc.

Function:

- The control board, as the main part of the display, transfers DVI input into LVDS signal to the LED screen, monitors other board or signals, meanwhile, it can communicate with the main system through I2C port. So it is convenient for the main system gathering/controlling information from the display.
- The drive board produces high voltage to illuminate backlight of LED which is adjusted by signal control switch and brightness.
- The parameter board memorizes the color temperature and gamma correction data, which can be used with LED screen. It completes the display consistency. The parameters of the control panel shall be updated in the first installation and the replacement of control panel/LED screen. It monitors the backlight brightness of LED screen as well. The control panel adjusts the backlight brightness of LED screen based on the current to make LED brightness stable in different temperatures.
- User operation will be received through key board, the control board displays the menu, so the user can adjust part of the display parameters.

4.7 Touch screen Unit

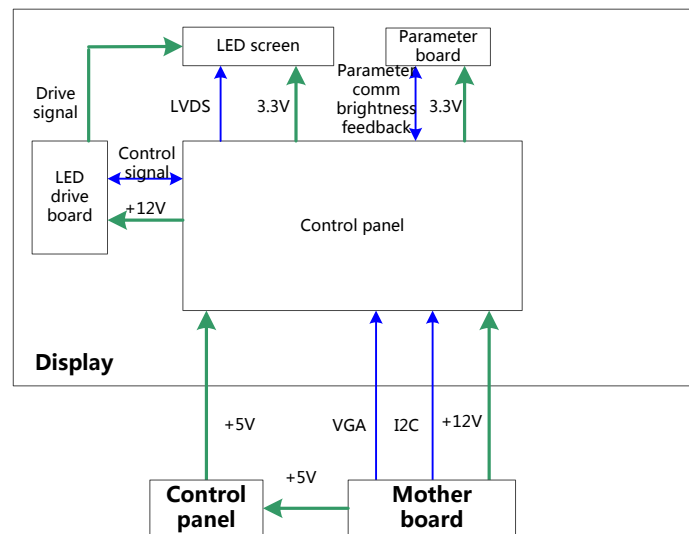


Fig 4-13 Principle Diagram of Secondary Monitor

The monitor shows auxiliary control interface of ultrasound application program and completes touch control with touch screen.

The functions of the secondary monitor:

- 10.4 inches; resolution: 800*600.
- Visual angle: not mandatory. It is equal to VA screen.
- Adjustable brightness and contrast: can be adjusted via communication software.
- Power supply: 12V±5%, 1Amax.
- The signal is VGA; the connector is HDMI.

The functions of the touch screen:

- It coordinates with display area.
- Projected capacitive. Supporting at least 2 touch spots.
- Power supply and the signal uses USB 1.1 standard. Used-definition of the connector.

Anti-glare of small matte.

4.8 Power Supply Unit

Power supply unit provides power to the system (front-end, back-end, peripherals, etc.). Power supply unit includes auxiliary output adaptor, AC-DC board, DC-DC board, battery module, etc.

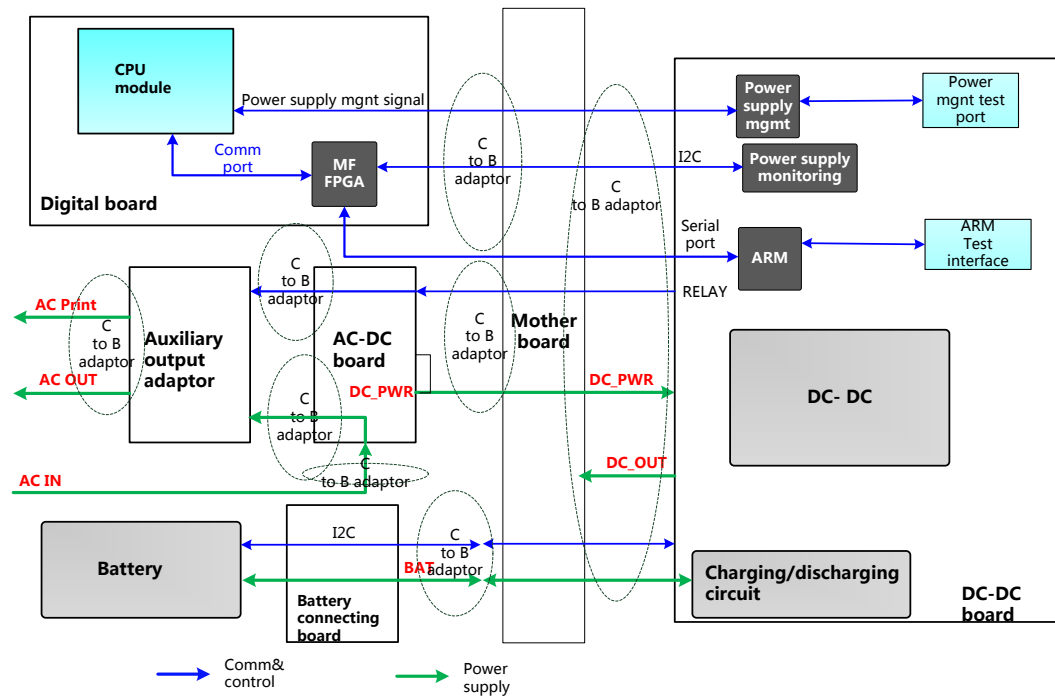


Figure 4-14 Diagram of Power Supply

Electric supply enters auxiliary output adaptor and AC-DC board.

Auxiliary output adaptor provides AC for the printer or other peripherals.

AC-DC board connecting to the mains supply, providing 12V to DC-DC board.

Power supply management, power on/power off logic, device status indicator, etc. DC-DC board includes charging management, voltage monitoring, battery management, program-controlled voltage control.

For details about the board of power supply unit, please refer to the following chapters.

4.8.1 Auxiliary Output Adaptor

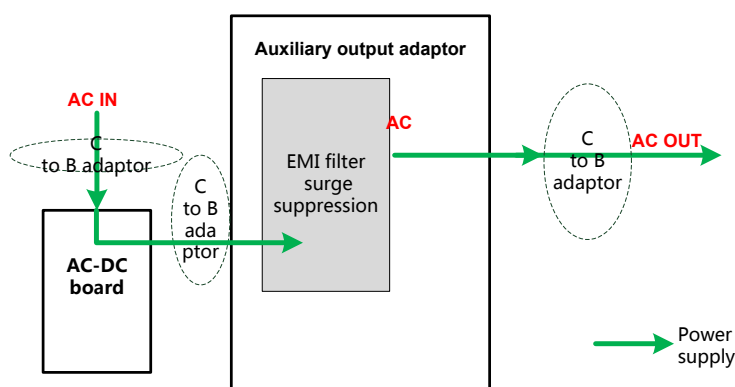


Figure 4-15 Diagram of Auxiliary Output Adaptor

Auxiliary output adaptor connects to AC input and provides the power to the peripherals.

4.8.2 AC-DC Board

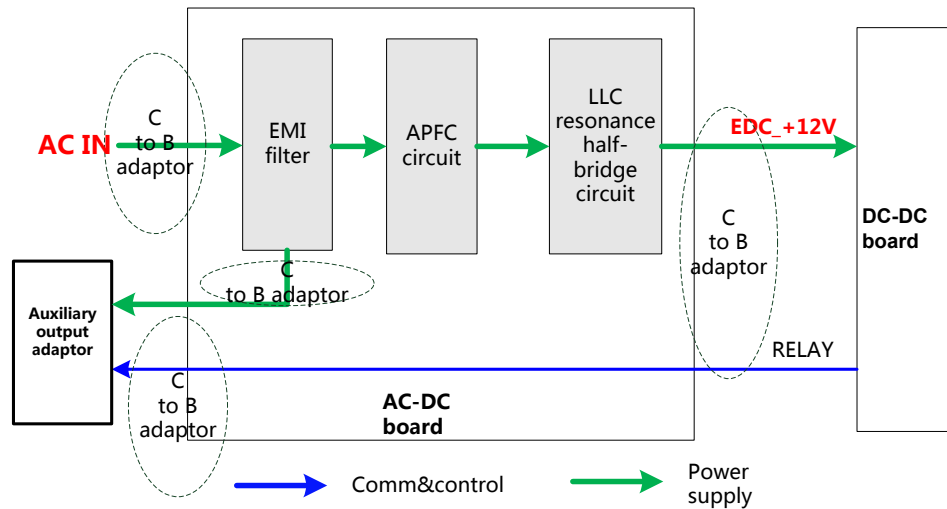


Figure 4-16 Diagram of AC-DC Board

Function:

- Mains supply entering AC-DC power supply board is filtered by EMI filter circuit. After completing the filter, APFC circuit works well. DC-DC board supplies the power while starting up.
- Using LLC resonance half-bridge to complete DC transfer, 12V output.

4.8.3 DC-DC Board

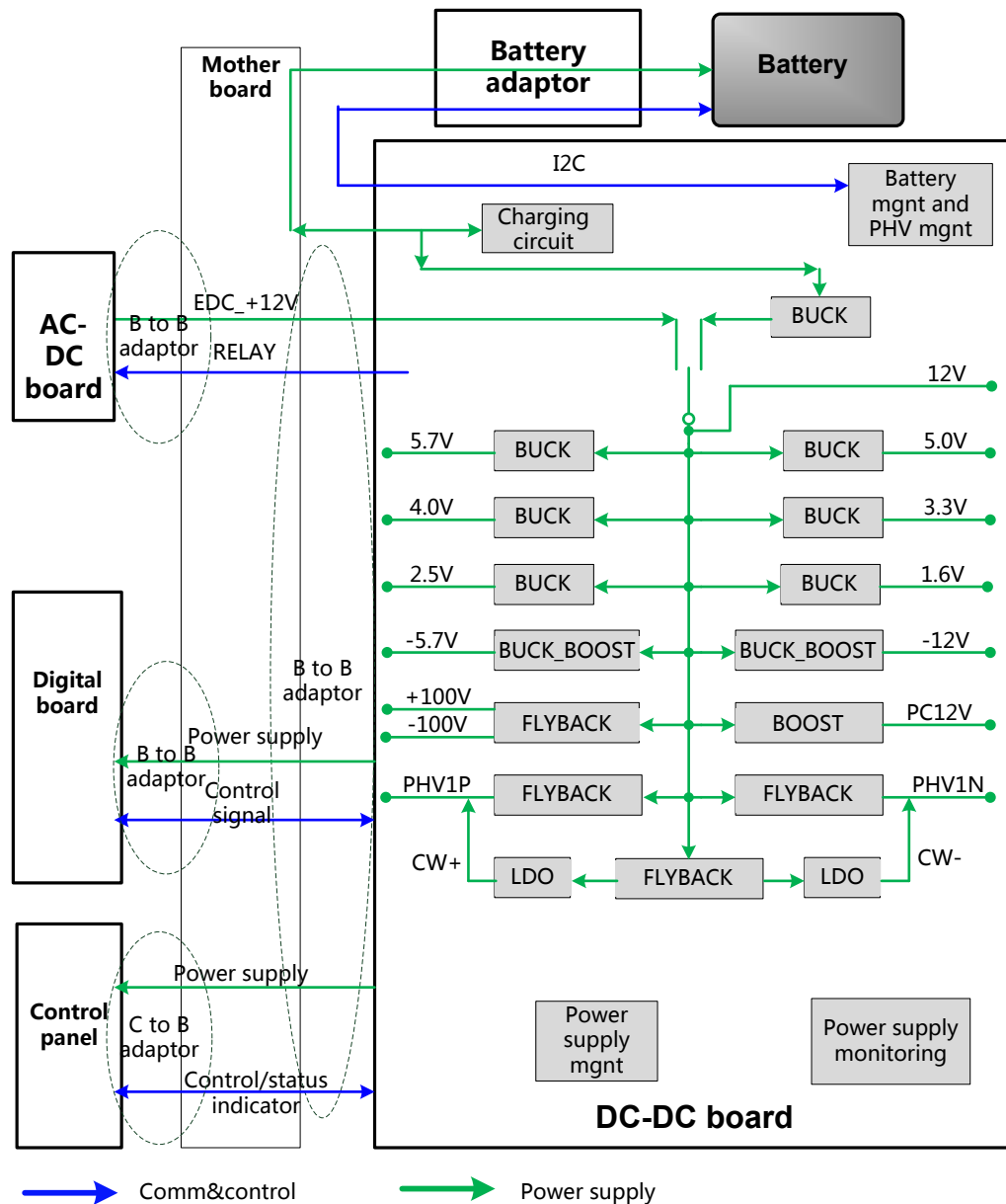


Figure 4-17 Diagram of DC-DC Board

Function:

- DC-DC board includes power supply management, battery management, PHV management, DC-DC power supply module, etc.
- After getting started up, the power supply module, except for the Standby module, outputs properly to supply power to various modules of back-end assembly. DC-DC board judges on the status information of CPU module, and based on the status information of FPGA and the battery.
- Charging circuit works well when starting up.
- If the device is equipped with the battery, the battery can power on the device. If AC connects to the device as well, AC provides the power at first.

- DC-DC board produces the transmitting power of the ultrasound device, including 2 adjustable PHVs and two ± 100 power supplies. The host sets the PHV voltage via the specific port.
- The board has the monitoring IC of the power supply. The host can obtain the output voltage of the specific power supply.
- The various modules on the board start working, but PHV and ± 100 V are still disabled. The microcontroller starts PHV and ± 100 V only after it receives the order from the host. The output voltage of PHV is set according to the host order.

4.8.3.1 System Power-on Control

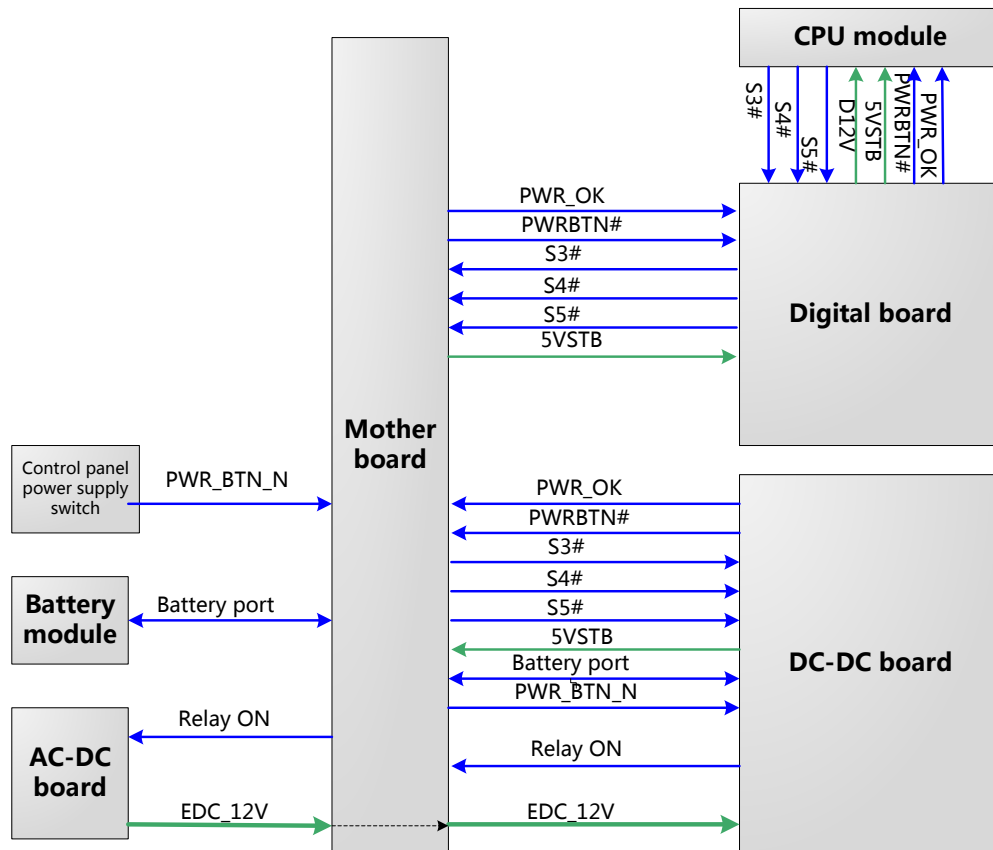


Figure 4-18 System Power-on Diagram

- The description of related controlling signals:

| No. | Control Signal | Description | Remarks |
|-----|------------------------|--|---------|
| 1. | PWR_BTN_N, PWR_BTN# | The pulse signal that power supply switch of the control panel produces is sent to CPU module via FPGA of the power supply management to start the device. | |
| 2. | S3# | CPU board output effectively represents that CPU system is in the standby status and keeps 5VSTB powered on when it is in standby via FPGA of the power supply management. | |
| 3. | S4# | CPU board output effectively represents that CPU system has been in the dormancy status. | |
| 4. | S5# | The signal is not used currently | |
| 5. | PWR_OK# | Sent out by power management FPGA to CPU board, indicates that the 12V is powered on. | |

| | | | |
|----|---------|--|--|
| 6. | EDC_12V | AC-DC sending to DC-DC to produce 3.3VSTB and 5VSTB power supply. The power supply keeps effective as long as the AC is connected. | |
|----|---------|--|--|

- Power supply of main unit/battery enables the start of device.
- Power supply produces 5VSTB and 3.3VSTB as the AC is connected.
- Unplug AC when shutting down the device. Power supply cuts off 5VSTB output, but only keeps the output of 3.3VSTB with the battery available. Only with power button pressed again, it's re-powered on.
- Unplug AC when the device is in standby. Batteries, for standby usage, provide the output of 5VSTB and 3.3VSTB.
- The process of power-on is shown below:

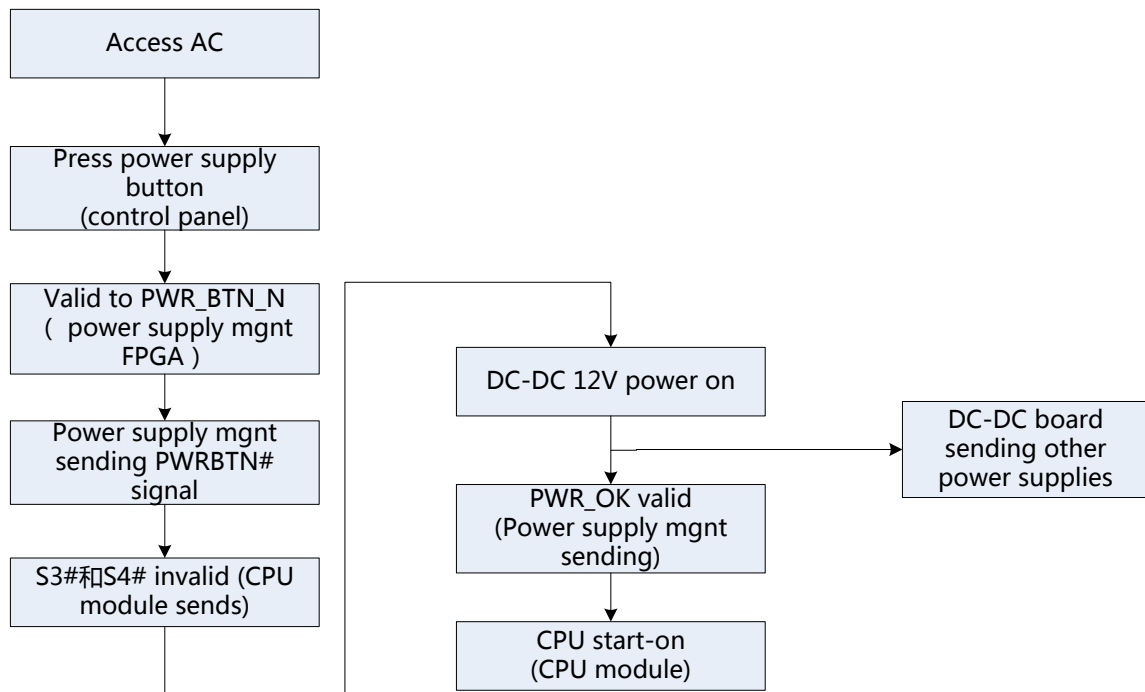


Figure 4-19 Diagram of System Power-on

4.9 Connection Diagram of the Device

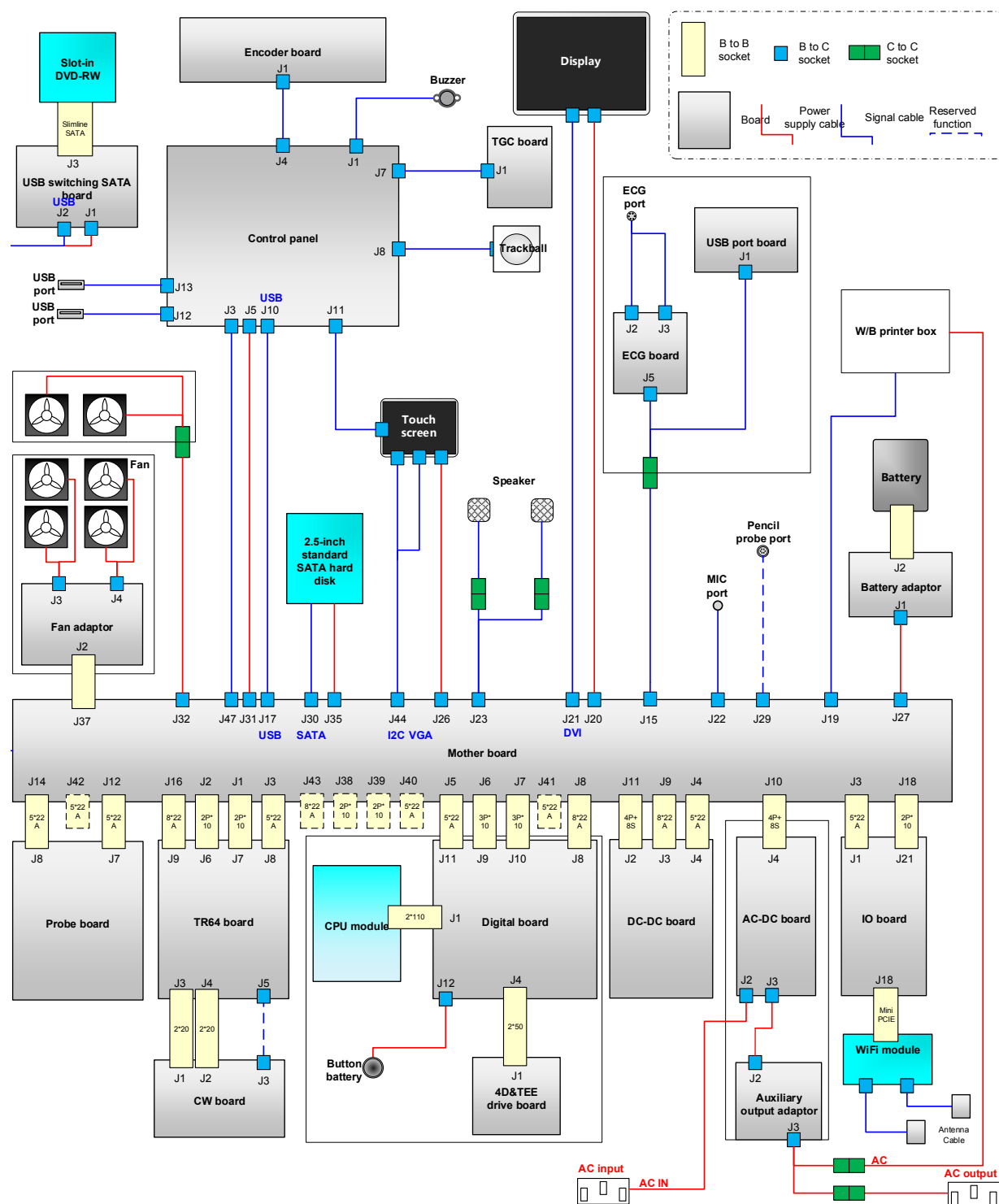


Figure 4-20 Connection Diagram of the Device

5 Function and Performance Checking Method

5.1 NOTE

The chapter supplies the detailed method for product main function and performance checking. This is used for referring or studying by engineer but not required.

5.2 System Running Status

5.2.1 Running Status

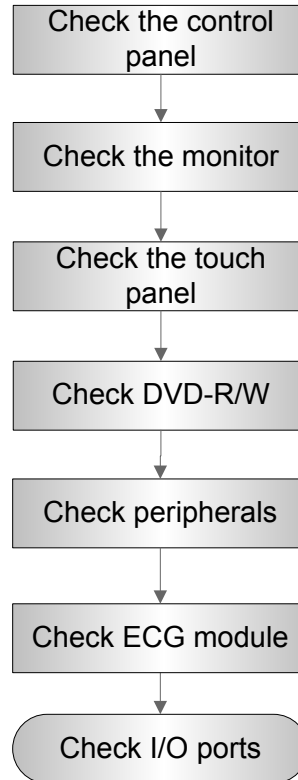
1. Normal power on/off operation (duration time is normal), no abnormal sounds or phenomena occur during normal operation.
2. After ultrasound system is turned on, the fan starts working and no abnormal sound when the fan is working.
3. Check if configuration, software version are normal through the [About] in preset menu.
4. Check if contrast and brightness of the monitor are normal.
5. Check if time and date are valid and correct.
6. Check if all status indicators are normal.
7. Check all log records with user, to confirm if there is any abnormality.

5.2.2 Working Condition

Check the ambient temperature and humidity to see if meet the requirement. The measurements related to safety features are particularly sensitive to humidity. If the insulation feature of the system deteriorates due to the increase of system service time or system malfunctions, the fluctuation range of measurement results are likely to increase with the increase of humidity.

5.3 General exam

5.3.1 Check Flow



5.3.2 Checking Content

5.3.2.1 Check Control Panel

| Procedure | Checking standard |
|--|--|
| Check all buttons, keys and knobs Follow the direction: left to right, and up to down. | All keys and knobs are effective. |
| Function checking of the trackball: Press the <Freeze> key to enter the Freeze status. Press <Measure> to enter into measure status, do vertical and horizontal measurement, or do other trackball operations. | The trackball can be rotated easily; the cursor responds sensitively, the rotation direction is the same as the direction of the cursor. |

5.3.2.2 Check the Monitor

| Procedure | Standard |
|---|---|
| Adjust LCD brightness Adjust LCD contrast Enter [Preset]->[General], click [Contrast/Brightness Load Factory] Monitor maintenance Log on as Service, click [Maintenance]->[Setup]->[Test Main Monitor] to check the monitor functions | Press "+", the brightness increases; and press "-", the brightness decreases. Press "+", the contrast increases; and press "-", the contrast decreases. Brightness/Contrast load factory values Click each functional button, the LCD responds correctly, the standard is as follows: <ol style="list-style-type: none">1. Light-spot: 0; flash point: 0.2. The adjoining dark spots are no more than 3 pairs, and there is no adjoining dark spot in image area.3. There is no adjoining dark spot of 3 or more than 3.4. The dark spots are no more than 7 and those in the image area are no more than 25. The distance between bad spots is no less than 5mm. NOTE: image area refers to rectangle when the background is black/right. |

5.3.2.3 Check Touch Panel

| Procedure | Standard |
|---|--|
| Check if keys on the touch screen of B/M/CW/Color basic modes can respond normally. Enter [Maintenance]->[System Preset]->[General Preset] to enter the touch screen contrast/brightness menu. | All keys function are effective. Press on the touch screen to adjust the values, real-time values will be displayed on the adjusting bar. |

5.3.2.4 Check DVD-R/W

| Procedure | Standard |
|--|--|
| Press [Eject] Use the optical disk drive to read and burning. | Disk can be normally ejected. Normal, no abnormal sounds. |

5.3.2.5 Check Peripherals

| Procedure | Standard |
|--|--|
| Footswitch: Connect the footswitch; check the functions of footswitch according to the functions listed in Key Config. (e.g. right key- image frozen, middle key- color print, left key- B/W print) | Press the freeze key (the right key), image is frozen, the freeze menu is displayed; press the key again, image is unfrozen. Press the print key (middle key), color printing starts. Press the print key (left key), B/W printing starts. |
| Video printer: Check if the video printer and ultrasound system are correctly connected. Then check the function of each key. | Press <Print> key, the printer begins to work, no image print deficiency or degradation. Switch video output port; repeat the step. |
| Text/graph printer: Check if the printer and ultrasound system are correctly connected. Then check the function of each key. | Press <Print> key, the printer begins to work, no print deficiency or degradation. |
| Barcode reader: Perform code bar scanning when the ultrasound system is running normally. | The bar code is correctly displayed on the screen. |

5.3.2.6 Check ECG Module

| Procedure | Standard |
|--|--|
| Confirm if the ECG module is configured, then: Set [ECG] as "On". | ECG trace is displayed; the heart icon is displayed at the upper right corner of the screen. The parameters [Speed], [ECG Gain] can be adjusted. ECG signal can be reviewed correctly. |

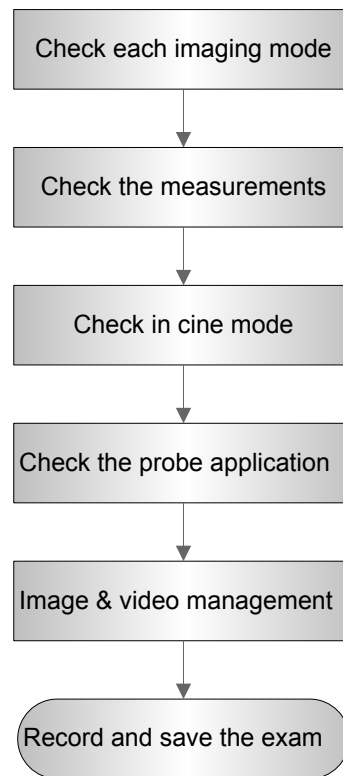
5.3.2.7 Check I/O Ports

| Procedure | Standard |
|---|---|
| Checking the main I/O ports: Besides the video/audio ports, USB ports, the other ports required to be checked including: VGA port; Connect external VGA/LCD monitor (with resolution supporting 1024*768) Network port; Other USB ports. | The contents displayed on the display are the same as those displayed on the ultrasound system display, no character and image loss, no color difference, no fluttering and flicking. Smooth communication. USB port data storage/accessing are normal. |

5.4 Function Checking

NOTE: A complete function inspection is described here, do the checking according to the actual system configuration.

5.4.1 Checking Flow



5.4.2 Content

5.4.2.1 Imaging Modes


1. B mode

- In B Mode scanning, the image parameter area in the upper left corner of the screen will display the real-time parameter values as follows:

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

- Parameters that can be adjusted to optimize the B Mode image are indicated in the following.

| Adjustment | Parameter |
|---------------------|---|
| Control panel | Gain, depth, TGC, iTouch, Zoom, Focus Position, Steer |
| Touch screen / menu | Tint map, line density, flip, persistence, image quality, focus, FOV, iClear, dynamic range, TSI, iBeam, H Scale, LGC, gray map |

| Procedure | Checking criteria |
|---|--|
| Press button. | Enter B mode image. B mode interface appears. |
| Gain adjustment G Rotate button | Gain increases with rotating the knob clockwise; Gain decreases with rotating the knob anticlockwise; |
| Depth adjustment D Poke <Depth> rod. | The depth of the image changes accordingly. Depth range varies depending upon the probe types. |
| TGC adjustment Adjust 8 sliders on the control panel | Push the slider right to increase the gain. The brightness of the area becomes brighter. Push the slider right to decrease the gain. The brightness of the area becomes darker. About 1.5s after the adjustment is finished, the TGC curve disappears. |
| iTouch Press <iTouch> button | Press <iTouch> on the control panel to enter the iTouch status, the symbol of which will be displayed in the image parameter area of the screen. Click [iTouch] on the image menu to adjust the gain in iTouch status among -12 through 12dB. Long press <iTouch> to exit iTouch mode. |
| Zoom Rotate <Zoom> button | Rotate clockwise to zoom in the image and vice versa. Roll the trackball to change the image position. Press <Zoom> to exit magnification status. |
| Acoustic power adjustment B image touch screen-[Acoustic power]. | The system offers 34 values to adjust the acoustic power. Acoustic power (AP) is displayed in real time in the upper part of the screen. |
| Focus B image touch screen-[Focus number] Use <Focus> deflector rod to adjust focus position. | Focus position/number adjustment The focus position icon  is displayed on the right side of the image. |
| Scan range and FOV position B image touch screen-[FOV]. | Image display adjustment [FOV] is on and move the trackball to adjust the scan range. |
| Frequency adjustment B image touch screen-[Image quality] | The real-time value of frequency is displayed in the image parameter area in the upper screen (fundamental wave-F, Harmonic frequency-H). Values of frequency vary depending upon the probe types. |
| Steer Use <Steer> deflector rod. | To steer the beam the probe transmits. |
| ExFov B image touch screen-[ExFov] | Click [ExFov] on the touch screen to enable/disable the function. |
| Line Density B image touch screen-[Line Density]. | The function determines the quality and information of the image. Levels of line density: UH/ H/ M/ L. |

| | |
|--|---|
| Dynamic Range B image touch screen-[Dynamic Range]. | The adjusting range of parameter is 30-180 dB in increments of 5 dB. |
| iClear B image touch screen-[iClear]. | The system provides 7 levels of iClear effects adjustment, <i>Off</i> represents iClear is disabled, and the bigger the value is the stronger the effect becomes. |
| Persistence B image touch screen-[Persistence]. | The system provides 7 level of persistence. The bigger the value is the stronger the effect becomes. |
| Rotation/Invert B image touch screen-[L/R Flip]/[U/D Flip]. | To invert the image horizontally or vertically. Image can be rotated by the angle of 0°, 90°, 180° and 270°. When the image is rotated in the angle of 90° or 270°, the depth scale is displayed on the upper part of the screen. The “M” mark indicates the direction of the image; the M mark is located on the top of the imaging area by default. |
| iBeam B image touch screen-[iBeam]. | The system provides 4 values of iBeam in B mode. iBeam is disabled when it is off. |
| Auto Merge B image touch screen-[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. Turn on or off the function through the [Auto Merge] item in the touch screen; |
| Gray Map B image touch screen-[Gray Map] | Adjust the gray from [Gray Map] on the touch screen; There are 8 different maps available. |
| Tint Map B image touch screen-[Tint Map] | Select the tint map from [Tint Map] on the touch screen. Turn on or off the tint map from [Tint Map] on the touch screen. |
| TSI B image touch screen-[TSI]. | Select TSI from [TSI] on the touch screen. The system provided 4 ways of optimization for specific tissues: general, muscle, fluid and fat. |
| HScale B image touch screen-[HScale] | Click [HScale] on the menu to display or hide the scale (HScale). |
| Dual live B image touch screen-[Dual live]. | Enable [Dual Live] on touch screen, and dual-split window of images are displayed on the screen. Two pages of adjustable parameters are displayed on the touch screen as well; where, shared parameters and left window parameters are displayed on the B(L) page, while right window parameters are displayed on the B(R) page. |
| LGC B image touch screen-[LGC]. | Images corresponding to four groups of parameters are displayed on the touch screen (from left to right). Click [LGC1-5] to adjust the parameters. |

2. M mode

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

| | | | | | |
|-----------|-----------|-------|--------|---------|-----------------|
| Parameter | F | D | G | V | DR |
| Meaning | Frequency | Depth | M Gain | M speed | M Dynamic Range |

- Parameters that can be adjusted to optimize the M Mode image are indicated in the following.

| | |
|---------------|--|
| Control Panel | Gain, Depth, TGC, Focus position |
| Touch Screen | Speed, Display Format, Gray Map, Dynamic Range, Tint Map, M Soften, Edge Enhance |

3. Color mode

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

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

- Parameters that can be adjusted to optimize the Color Mode image are indicated in the following.

| | |
|---------------|---|
| Control Panel | Gain, Depth, iTouch, Scale |
| Touch Screen | Invert, Baseline, B/C Wide, Dual Live, Image quality, Flow State, Priority, Packet Size, Map, Wall Filter, Line Density, Smooth, Persistence, Velocity Tag, steer |

4. Power mode

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

| | | | | |
|-----------|-----------|------------|-------------------|----------------------------|
| Display | F | G | WF | PRF |
| Parameter | Frequency | Power Gain | Power Wall Filter | Pulse Repetition Frequency |

5. PW/CW mode

The parameters will be displayed in the image parameter area on the left part of the screen as follows:

| | | | | | | | |
|------------|-----------|------|----------------------------|------------------|-------------|--------------------|-------|
| Display | F | G | PRF | WF | SVD | SV | Angle |
| Parameters | Frequency | Gain | Pulse Repetition Frequency | WF (Wall Filter) | SV Position | SV Size (only CW) | Angle |

- Parameters that can be adjusted to optimize the PW/CW Mode image are indicated in the following.

| | |
|---------------|---|
| Control Panel | Gain, iTouch, Baseline, PW Steer, Scale, Angle |
| Menu | Display Format, Invert, Duplex/ Triplex, Quick Angle, Wall Filter, Image Quality, Tint Map, Dynamic Range, Trace Area, Speed, SV, Gray Map, T/F Res, Auto Calc, Auto Calc Para, HPRF, Auto Calc cycle, Volume, A. power |

5.4.2.2 Basic Measurements

| Procedure | Standard |
|---|--|
| In B image mode: Press <Measure>: Press <Caliper> key | The system enters application measurements The system enters general measurement mode. Perform any 1-2 measurements (e.g., length, area), the results will display at the lower part of the image. |
| Press the same key again or press <Esc>. | Exits measurement. |
| Do the same operation in other image modes. | Application measurements are classified into different application packages, do the application measurements selectively. |

5.4.2.3 Cine Review

| Procedure | Standard |
|---|---|
| Press [Freeze] key to freeze an image, and the [Cine] key indicator lights on. The system automatically enters the manual cine status.(It has been set that when system enters into freeze mode, the default status is cine review.) Press <iStation> key, then click [Review]; or press <Review> key to open a cine file. | The system enters into cine review status The system enters into auto cine review status. |
| Roll the trackball | Manual cine review |
| Click [Auto Play] on the menu or soft menu. | Auto play function is turned on, adjust the soft menu button. The greater the value is, the quicker the speed is. When the value is 0, the system exits auto play mode. |

| | |
|---|--|
| Move the cursor onto the desired start point of the cine loop, click [Set First Frame] in the menu or soft menu to set the start point. | Set the start point of cine loop. |
| Move the cursor onto the desired end point of the cine loop, click [Set Last Frame] in the menu or soft menu to set the start point. | Set the end point of cine loop. |
| Click [Auto Play] again | Review region is confined to the set start point and end point. |
| Then press the [Cine] key again. | Cine review stops. |
| Press the <Freeze> key to unfreeze the image. Press <Cine> or <Esc> key. | Freeze indicator light is off; the system will return to image scanning and exit cine review. The images are still frozen but the system exits cine review. |

Auto review region

The diagram illustrates the 'Auto review region' as a horizontal bar. Inside the bar, there are three vertical markers: a triangle on the left labeled 'Start mark', a vertical line in the middle labeled 'Playback mark', and a triangle on the right labeled 'End mark'. A blue bracket above the bar spans from the Start mark to the End mark, labeled 'Auto review region'. On the right side of the bar, the text '205/266' is displayed, with a line pointing to it labeled 'Current frame'. Another line points to the right end of the bar labeled 'Total frames'.

5.4.2.4 Probe Switching

| Procedure | Standard |
|---|--|
| Press <Freeze> key→ connect the probe to the system→ press <Freeze> key→ press <Probe> key to select the probe. | Connect a convex probe to probe socket A, and then connect a linear probe to probe socket B, the operator can select probe A or probe B as the active probe. |
| Press <Freeze> key→ disconnect the probe→ connect another probe to the port | The system can recognize the newly connected probe in no time. |

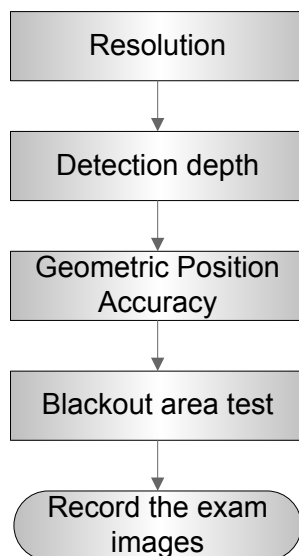
5.4.2.5 Patient Information Management

| Procedure | Standard |
|---|---|
| Press <Save> (the function already set) during image scanning | Image will be saved to the patient database, and a thumbnail will be displayed at the right part of the screen. |
| Open [Setup] →[System Preset]→"General", then check "Send/Print Image after End Exam" in the Patient Management area. Press <End Exam> during image scanning | The system automatically sends the images of the exam to the default DICOM storage server or print server. |
| ● Press <Review> key. | ● The system enters into image review mode. |

| | |
|--|--|
| <ul style="list-style-type: none"> Click [Exit] on the Review screen; or, press <Review> again, or, press <Esc> key | <ul style="list-style-type: none"> The system exits image review mode. |
| <ul style="list-style-type: none"> Click [iVision] on the other menu; or press user-defined iVision key. Select the contents to be demonstrated, and select the demo mode in the iVision screen. Then select an item already added to the list and click [Start] When the demonstration is finished, click [Exit] or press <Esc>. | <ul style="list-style-type: none"> Open iVision screen: Demonstration begins. Image files are played according to file names one by one (including the image of system-relevant and PC-compatible format). The system exits the demonstration. |
| Press <iStation> key to enter patient information management (iStation page) | <p>The saved patient information (images) can be found, and the patient information can be:</p> <ul style="list-style-type: none"> Backed up/ Restored Sent (To DICOM or USB disk etc.) |

5.5 Performance Test

5.5.1 Test Process



5.5.2 Test Content

NOTE: The image used here is only for reference, stick to the image effect in the real situation.

Requirements:

1. Display: set the contrast and brightness at the clinical application value (or the default status)
2. Operation environment: dark room, simulating the clinical application environment.
3. Scanning techniques: contact the probe with the acoustic window of the phantom, no spacing nor pressing.

Tips:

For the testing phantoms, please refer to Appendix B.

KS107BD is low frequency phantom and used when Probe focus frequency is less than 4MHZ;
KS107BG is high frequency phantom and used when Probe focus frequency is more than 5MHZ;

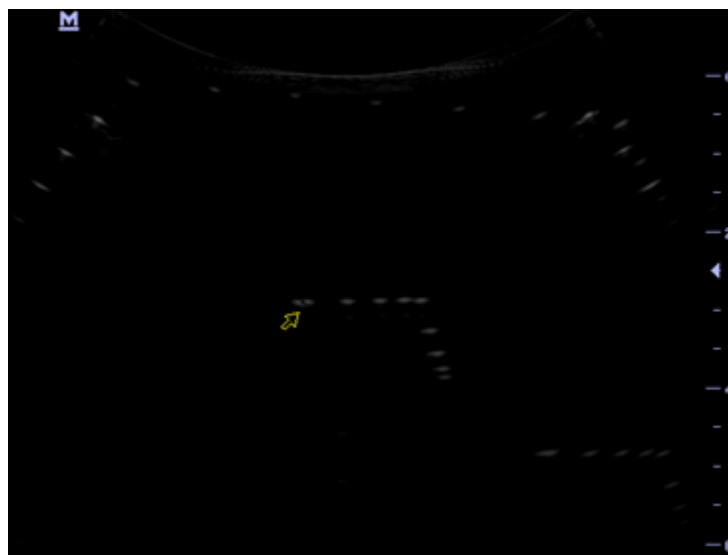
5.5.2.1 Resolution

■ transverse resolution

Test Step:

1. Cover the scan surface of the phantom with water or couple gel, gently contact the probe with the scan surface, making the transverse resolution testing targets to be displayed around the midline of the image.
2. Adjust the focus point focuses at the position where the transverse resolution testing targets are displayed.
3. Adjust parameters like gain, dynamic range, TGC, making the background tissue unseen, just displaying the target image clearly.
4. In condition that the transverse resolution testing targets are horizontally displayed, record the minimal distance of two targets that can be clearly recognized.
5. Repeat the operation above for the transverse resolution testing targets at other depths.

As shown in figure below.

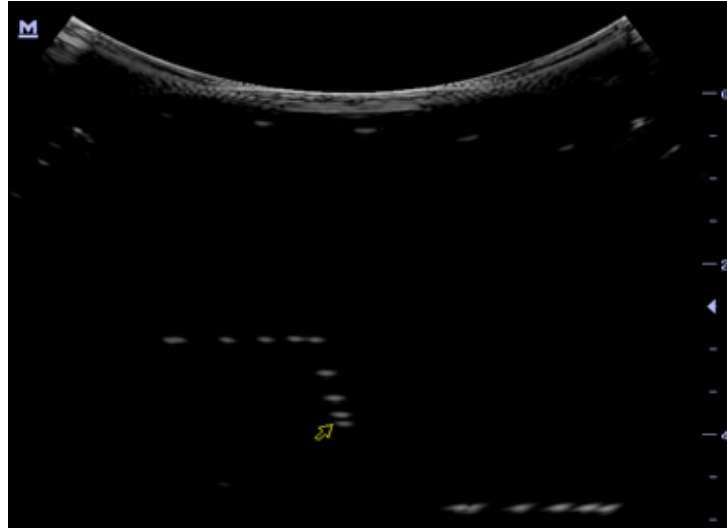


■ Axial resolution

Test Step:

1. Cover the scan surface of the phantom with water or couple gel, gently contact the probe with the scan surface, making the longitudinal resolution testing targets to be displayed around the midline of the image.

2. Adjust the focus point focuses at the position where the longitudinal resolution testing targets are displayed.
3. Adjust parameters like gain, dynamic range, TGC, making the background tissue unseen, just displaying the target image clearly.
4. Record the minimal distance of two longitudinal resolution testing targets that can be clearly recognized.
5. Repeat the operation above for the longitudinal resolution testing targets at other depths.



NOTE:

1. When using the convex probe, keep the transverse resolution testing targets to be displayed near the midline.
2. When using a linear probe with steer function, do not turn on the steer function when perform the transverse resolution test.
3. Zoom in the region where the targets located if necessary.
4. The diameter of the target point at a certain depth is equal to the transverse resolution at the depth.

5.5.2.2 Maximum Depth

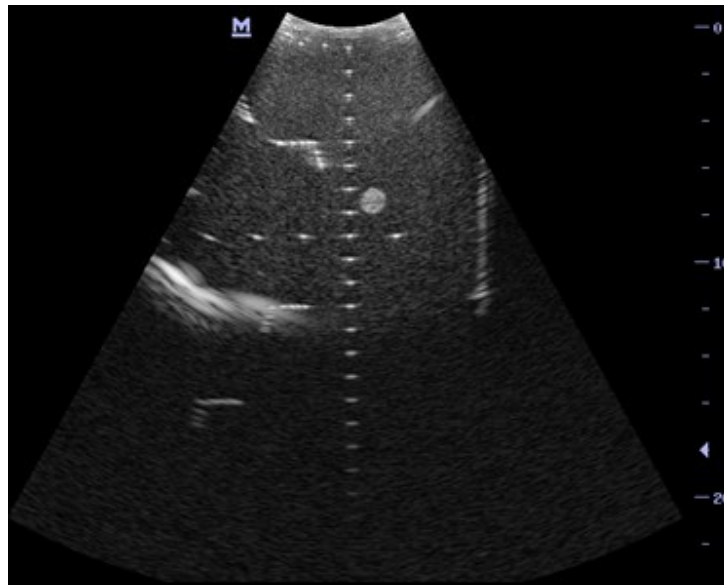
Test Step:

1. Cover the scan surface of the phantom with water or couple gel, gently contact the probe with the scan surface
2. Set the system display depth according to the expected maximum available depth of the probe in use.
3. Adjust the focus point to the deepest, and AP at the maximum value.
4. Set gain, contrast, TGC at a greater value, but no halation nor defocus is allowed.
5. Record the depth of the furthest target (the target can be seen clearly).

NOTE:

1. Increasing the gain will also increase the noise, and echo may be covered.
2. When using a linear probe, please completely contact the probe with the scan surface, no side clearance is allowed.
3. When using a convex or phased-array probe, make the axis targets to be displayed at the middle of the scanning image.
4. When system is not frozen, the fast field target information may be similar to that of the noise, do not use this target.

As shown in figure below.



5.5.2.3 Geometric positioning accuracy

Longitudinal geometric positioning accuracy

Test Step:

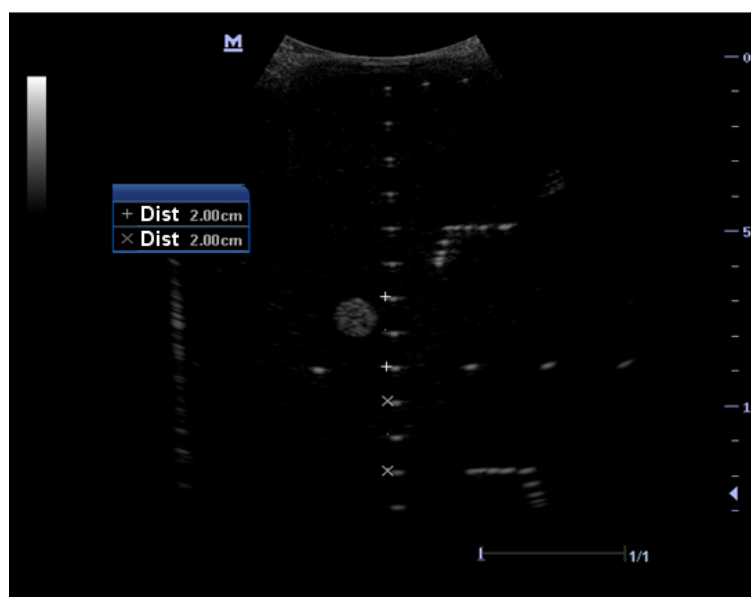
1. Do adjustments as the way in testing the maximum depth.
2. Record the distance by 20mm each segment on the longitudinal targets line using the measurement caliper;
3. Select the value with the greatest error (to 20mm), calculate the accuracy using the formula below

$$\text{Geometric Position Accuracy (\%)} = \left| \frac{\text{Measured value} - \text{Actual distance}}{\text{Actual distance}} \right| \times 100$$

NOTE:

1. The measurement caliper should be positioned at the upper edge of the target, not the middle nor the lower edge.
2. The scanning plane should be vertical to the target line, that means the scanning plane is parallel with the cross-section of the phantom

As shown in figure below.



■ Transverse geometric positioning accuracy

Test Step:

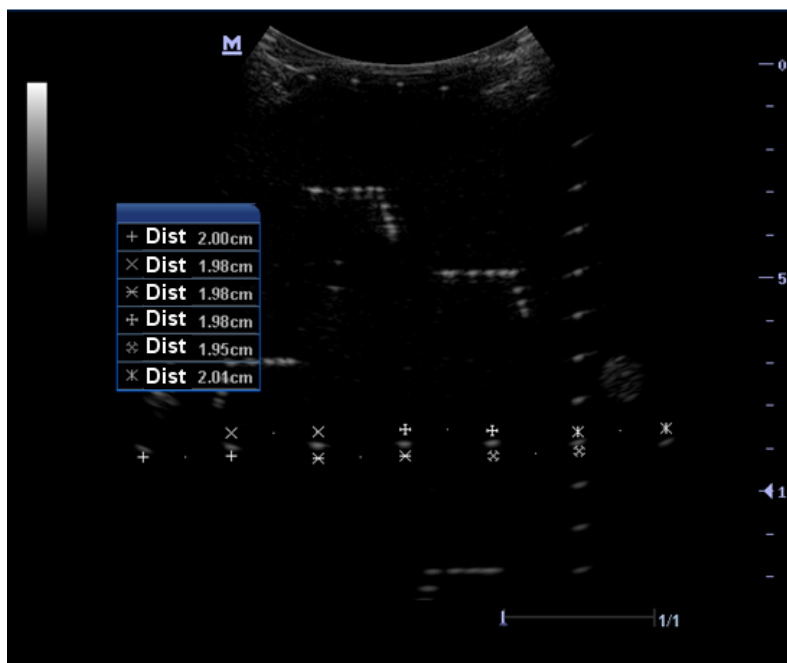
1. Cover the scan surface of the phantom with water or couple gel, gently contact the probe with the scan surface
2. Adjust the depth, making the transverse targets to be displayed in the image.
3. Adjust the focus point to be posited beside the transverse targets (the standard is not clear)
4. Adjust parameters like gain, TGC, making each transverse targets to be clearly displayed.

5. Record the distance by 20mm each segment on the transverse targets line by using the measurement caliper
6. Select the value with the greatest error (to 20mm), calculate the accuracy by using the formula below

$$\text{Geometric Position Accuracy (\%)} = \left| \frac{\text{Measured value} - \text{Actual distance}}{\text{Actual distance}} \right| \times 100$$

- NOTE:**
1. When using a linear probe, record the transverse distance by segment.
 2. When using a convex probe, all transverse targets should be displayed integrally in an image.
 3. The measure caliper should be posited at the upper side or lower side of the target center.

As shown in figure below.



5.5.2.4 Blackout Area

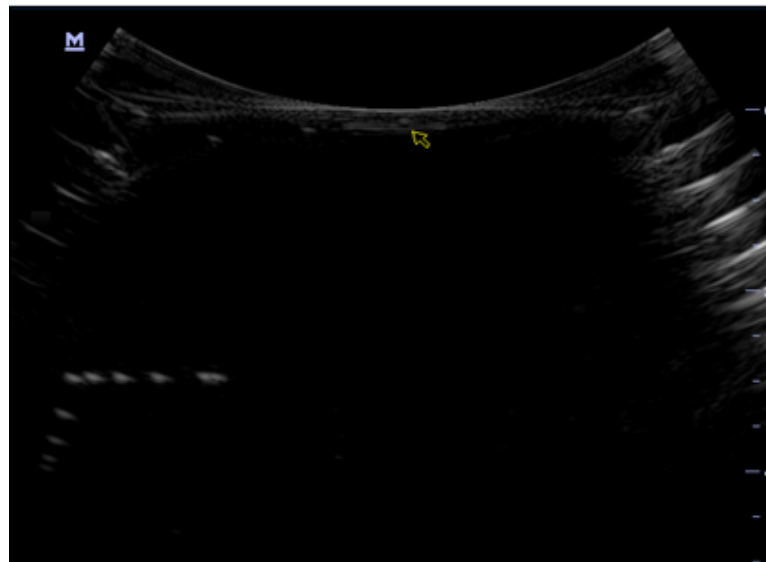
Test Step:

1. Cover the scan surface of the phantom with water or couple gel, gently contact the probe with the scan surface
2. Adjust the depth at a lower value, and set the focus at the nearest place to the scan surface.
3. Decrease the value of parameters like AP, Gain until the background noise just can be seen.
4. Record the smallest depth of the target that can be seen clearly, that value is the blackout area value.

NOTE:

1. When using a linear probe, please completely contact the probe with the scan surface, no side clearance is allowed.
2. For convex probe, the targets in the blackout area should be positioned on the midline of the scanning plane.

As shown in figure below.



6 Software Installation & Maintenance

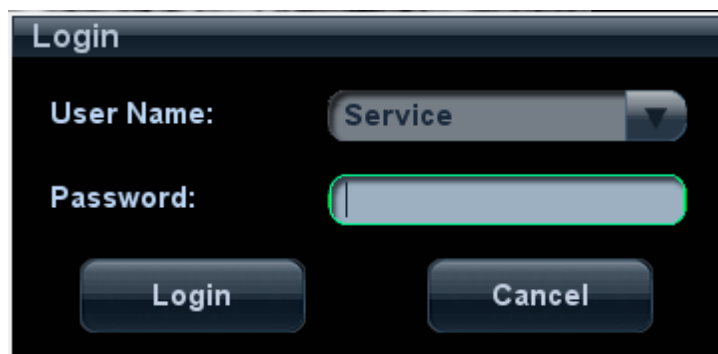
! WARNING: DO NOT detach a USB storage device directly; otherwise, the ultrasound system or the USB device and/ or data stored in the device may be damaged.

6.1 Entering Maintenance Interface

Note: Before the maintenance operation, the engineer should login the system as “Service”.

Procedure:

1. When **Access Control** is disabled: press [ctrl]+[/] to pop up the Login dialogue box, select **Service** as the user name.



2. When **Access Control** is enabled, press [ctrl]+[/] on the login dialogue box to show the internal users, and select **Service** to login.



3. Select [Preset]->[Maintenance] to log in the system.

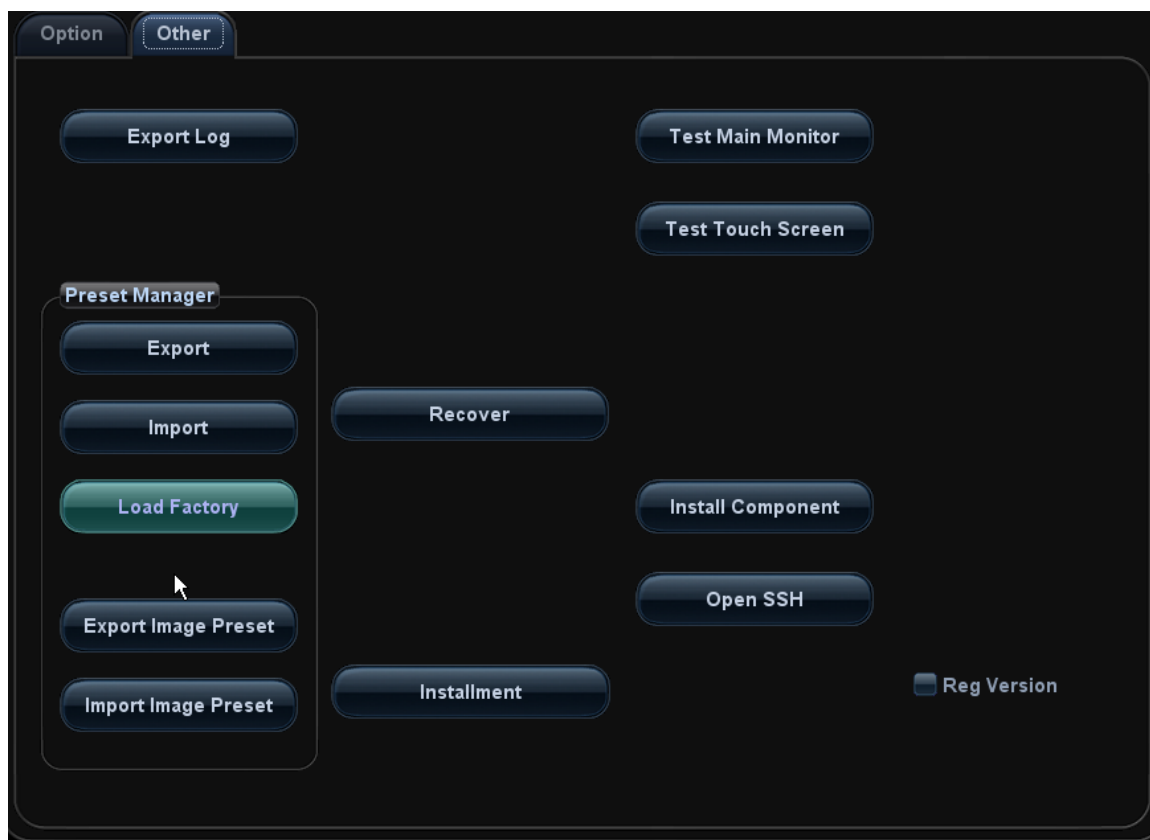


6.2 Advanced-Parameter Configuration (Reg Version) and Normal Configuration

1. Log in the system with the account of **Service** and select [Preset]->[Maintenance]. Press <ctrl+shif+F> and check [Reg version], and then click [Save]. The device is ready to reboot. The Reg version interface appears.



2. Log in the system with the account of **Service** and select [Preset]->[Maintenance]. Press <ctrl+shif+F> and uncheck [Reg version], and then click [Save]. The device is ready to reboot. The normal version interface appears.



6.3 Setting the Installment

If the customer needs to purchase the product in an installment plan, the service engineer can set the installment and the system generates the password.

Note: Before setting, the engineer should login the system with the account of **Service**.

1. Press <Setup>, click [Maintenance]-> [Other]-> [Installment]. Click [Set installment], select the Periods (times of the installment) and Days (time interval) from the drop-down list, as shown in figure below.



2. Click [Generate] and select [Display Password]. The generated passwords display in the list.



Take figure above as an example:

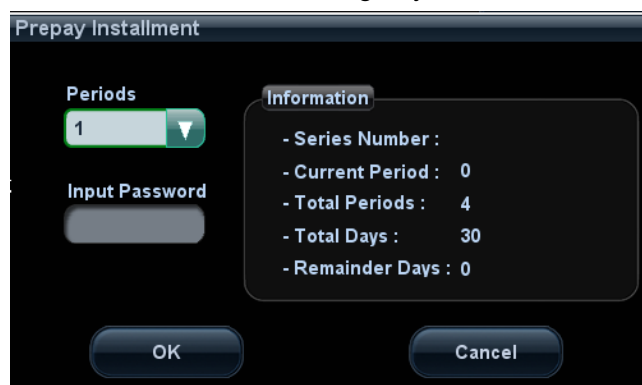
Note: the first time installment is the down payment.

- a) The system creates each 4 installment password for 4 times installment.
- b) First installment password:

After the user pays off the down payment, the installment dialog box appears after turning on the device. Enter this password and click [Start] to log in the system.

Note: after the user pays off the down payment and enters the first installment password, the system starts to calculate next installment time.

- c) Second installment password:
 - Installment due. The user pays off the amount of this period installment.
The installment dialog box appears after turning on the device when installment is due. Enter this password and click [Start] to log in the system.
 - The user prepays the amount of this period installment.
Press <Setup>. Select [Maintenance]->[Other]->[Prepay Installment], Choose [Period 2] in "Periods" list, and then enter the password. Then, click [OK] to log in the system. The system reminds the user of the remaining days.



The using of the third and the fourth installment password is identical with that of the second one. After the fourth installment, the system is not limited.

- d) Payoff password: it is the password with which the user pays off the rest amount of the installment.
 - The user prepays the rest amount of the installment.
Press <Setup>. Select [Maintenance]->[Other]->[Prepay Installment], Choose [Payoff] in "Periods" list, and then enter the password. Then, click [OK] to log in the system. The system will not be limited.
 - Installment due. The user pays off the rest amount of the installment.

The installment dialog box appears after turning on the device when installment is due. Enter this password in “Pay Off Password” list, and click [Start] to log in the system. The system is no longer limited to the installment.

3. Click [Reset] to reset the installment. Set the times of the installment in [Periods] and lick [Generate], and select [Display Password], the system generates the new passwords.
4. Click [Save As] to select the directory, and then click [OK].
5. Click [OK].
6. Restart the system and the installment function takes effect.

■ View the installment password

Press <Setup>, click [Maintenance]-> [Other]-> [Installment] and select [Display Password], the password list displays the generated passwords.

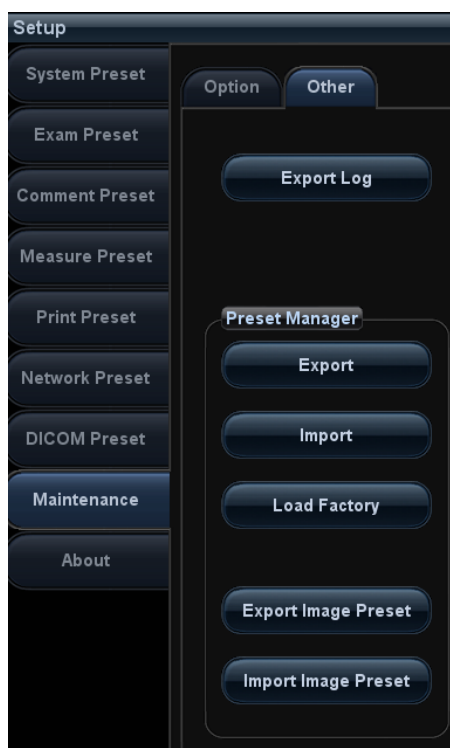
6.4 System Restoration

Refer to recovery guide for details.

6.5 Data Backup and Management

6.5.1 Manage Settings

Select [Preset]->[Maintenance]. Export and import system preset data or load factory as needed.



6.5.1.1 Back up the Setup Data

1. Click [Export] to open the [Export Data] dialogue box on [Preset Data Management] interface.
2. Select the path to save data.
3. Click [OK]. A progress bar appears and the setup data of the selected item is exported to the specified path.

6.5.1.2 Restore the Setup Data

1. Click [Export] to open the [Export Data] dialogue box on [Preset Data Management] interface.
2. Select the path to save the data.
3. Click [OK], a progress bar will appear and the setup data is imported to the specified module.

Note: If selecting [Load Factory], the settings are restored to the factory defaults, except for region preset, admin, DICOM preset and network preset.

6.5.2 Patient Data Backup and Restoration

6.5.2.1 Patient Data Backup

1. Press [iStation] on the control panel to open the iStation interface;
2. Click [Select All] to select all the data or select the target data one by one;
3. Select the information, click [Backup Exam] to pop up the "Backup Patient Record" interface, select the target storage device (recorder or USB disk), click [Backup], the data will be backed up.

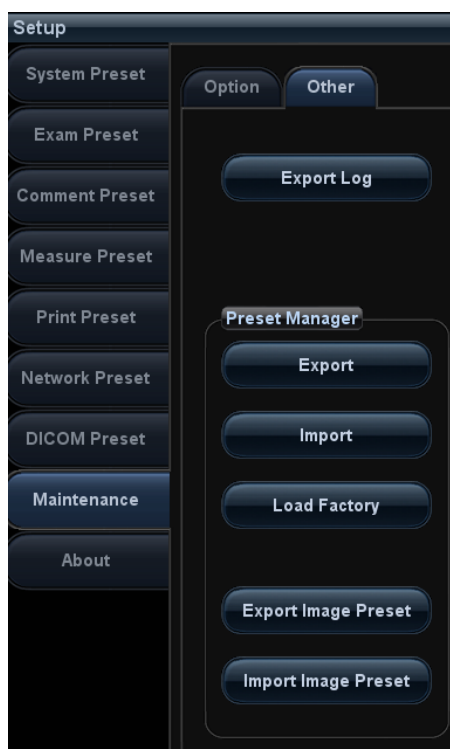
6.5.2.2 Patient Data Restoration

1. Press [iStation] on the control panel to open the iStation interface;
2. Select the drive which contains the patient data, click [Select All] to select all the data or select the target data one by one, and click [Restore Exam] to restore the patient data from the current drive to the patient database.

6.6 Log Maintenance

6.6.1 Export Log

1. Plug the USB device to the ultrasound system.
2. Click [Export Log] on the Maintenance menu.



1. Select the path to save the log, and click [OK].



2. When the log is exported, the system prompts **Export succeed!**, click [OK] to return to Maintenance menu.

Note:

The log is only available to be exported to the external USB device, please ensure that the USB device is connected properly to the ultrasound system before exporting the log.

6.7 Introduction on HDD Partition Data

- ◆ The entire capacity of the system $\geq 1\text{TB}$, the details are shown as follows:

| Blocks(G) | system | Notes |
|------------|--------|-------|
| 100 | Linux | C: |
| ≥ 700 | Linux | D: |
| 100 | Linux | E: |

◆ Data distribution in each drive is shown as follows:

1. D drive

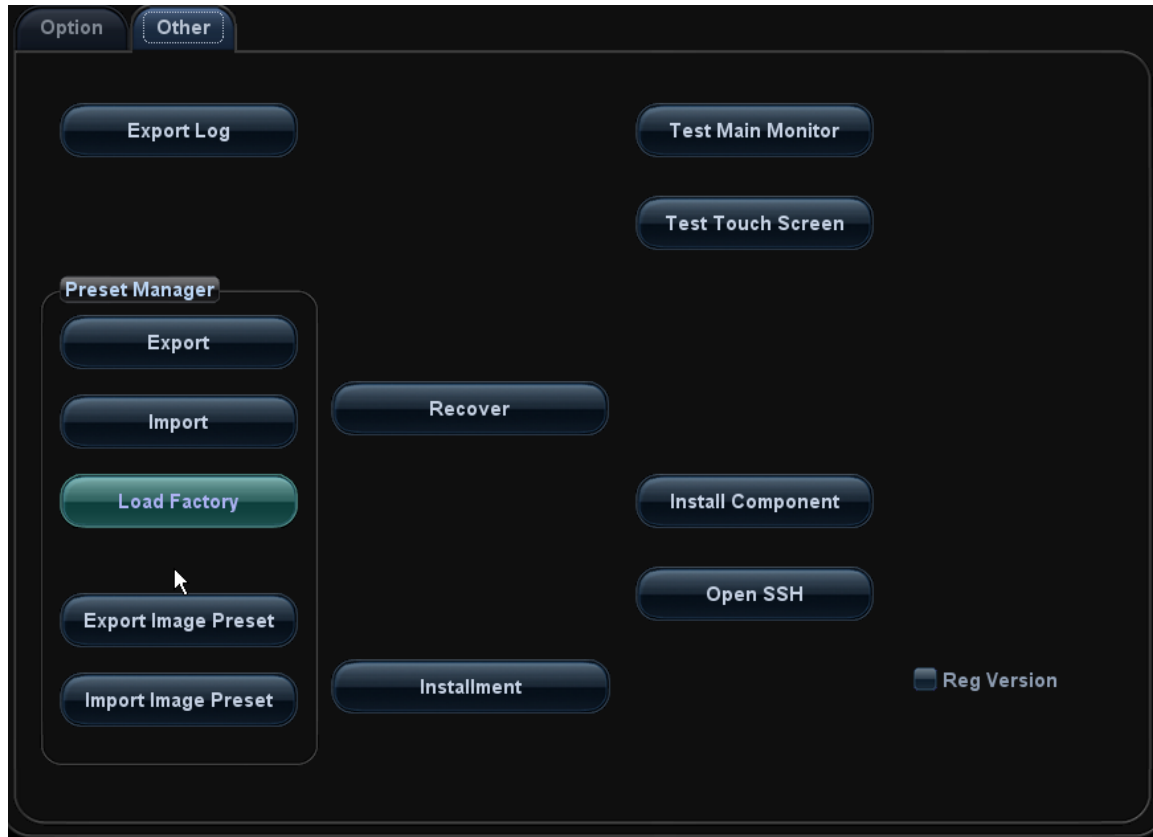
| Data directory of Drive D | | Data | Description |
|---------------------------|--------------|-------------|--------------------------|
| lost+found | | | |
| D:\DCN3Plus 或 DCN3PlusReg | \log | \DcmLog | DICOM log |
| | | \Operation | Operation Log |
| | | \SystemStat | Power-on/power-off log |
| | | \PeriLog | Peripherals log |
| | \PATIENTDATA | \ | Patient database path |
| | \Preset | \Current | User preset data |
| | \temporary | \ | Temporary file directory |

2. E drive

| Directory structure of saved data in E Drive. | | Data | Description |
|---|-------------|------|---------------------------|
| lost+found | | | |
| E:\DCN3Plus | Demo | | iVision default Demo path |
| E:\DCN3Plus or DCN3PlusReg | PatientBack | | Patient data backup |

6.8 Others

You can add printer driver by [Install Component] and [Open SSH] on maintenance page. For details, please contact Mindray Customer Service Department.



7 Adjustments

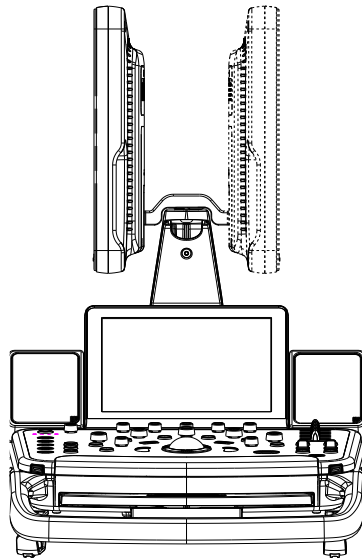
7.1 Monitor Adjustment

7.1.1 Position Adjustment

Gently hold the two handles on the side of the display when adjusting its position.

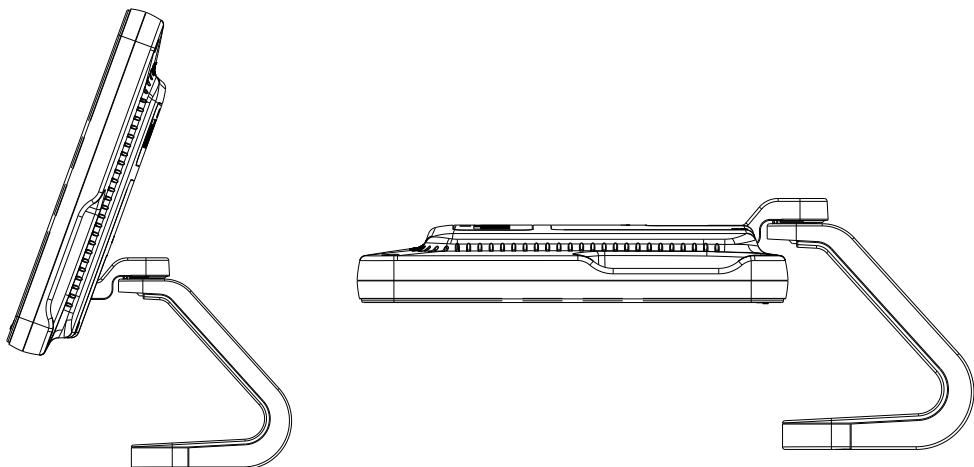
Rotate left/right

The display can be rotate to left or right within the range of $\pm 90^\circ$.



Tilt the display

The display can be tilted for 20° backward and to the horizontal position forward. In the process of transportation or moving the system, keep monitor in the horizontal position, shown as follows:



7.1.2 Brightness and Contrast Adjustment

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

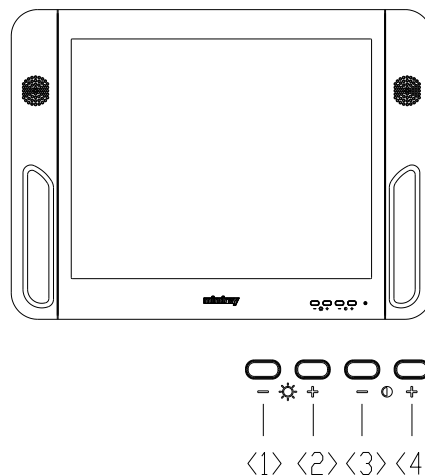
The adjusting buttons are shown as follows:

Brightness adjustment:

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

Contrast adjustment:

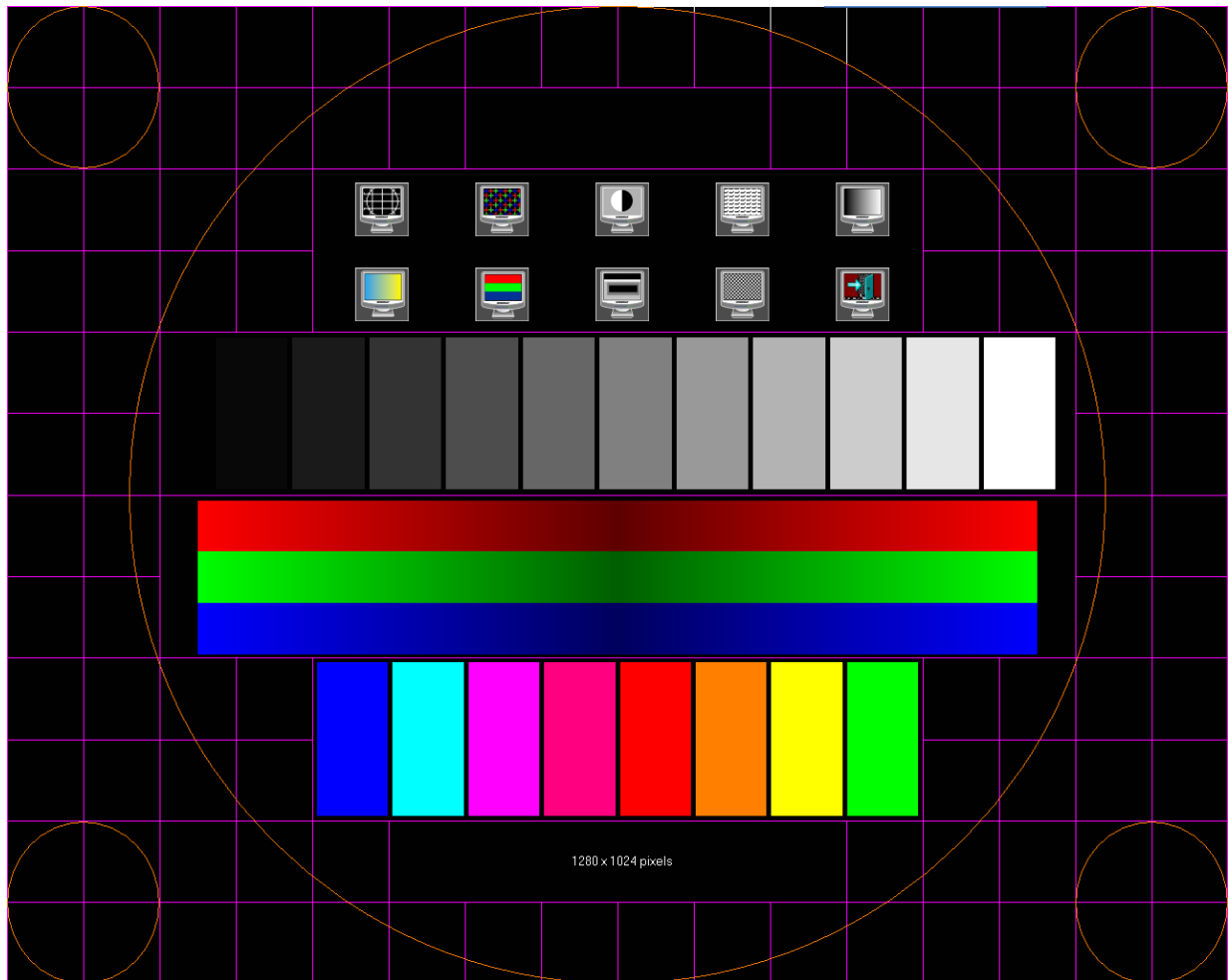
<3>, <4> refer to the contrast control keys with a moon marked at the top. Key <3>, marked with a “-” on the top, can be used to decrease the contrast, while key <4>, marked with a “+” on the top, can be used to increase the contrast.



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

7.1.3 Monitor Test

1. Log on as the "Service"; refer to chapter 6.1 for details.
2. Press the [F10] key on the keyboard to enter setup menu, and click [Maintenance] to enter the screen.
3. Click [Setup] and select [Test Main Monitor] to enter the screen:



| No. | Item | Description |
|-----|------------|---|
| 1. | Contrast | The screen displays a white strip in the middle while the above and below are black, if the boundary of black and white is clear, the test is passed; |
| 2. | Resolution | Press [Set] to switch between the 2 interfaces, and it's required that the black and white strips in the middle or around are clear, while the adjacent strips can be distinguished to pass the test; |
| 3. | AshRank | Images of different gray rank levels can be distinguished easily with a smooth transition, and the brightness transition can also be obtained from the images. Gray rank of low level is not obviously lean to red or green, and then the test is passed. |
| 4. | ColorRank | Images of different color rank levels can be distinguished easily with a smooth transition, and the brightness transition can also be obtained from the images. |
| 5. | Colorful | If different kinds of color graphics appear on the screen where the color and the word of each graphics are consistent, test is passed. |
| 6. | focus | Press [Set] to switch among the 3 interfaces, if the images are clear with letters and characters easy to be recognized and there is no ambiguous display or variance among them, the test is passed; |

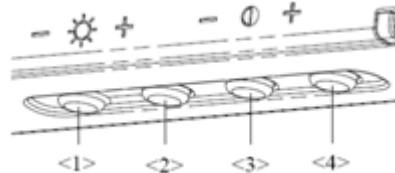
| | | |
|----|----------|--|
| 7. | BadPoint | Press [Set] to enter pure color interfaces of green, blue, red, black and white. Observe the LCD screen. Check bright point and dark point in the black and white interfaces. Criterion for pass: bright point number is 0; number of continuous dark point pair is ≤ 3 , and no continuous dark point appears in the image area; there are no three or more than three continuous dark point; dark point defects number is ≤ 7 , and number of dark points in the image area is ≤ 2 ; point flash defects is 0; space between fail points is $\geq 5\text{mm}$. |
|----|----------|--|

- Click [OK] on the touch screen or press [ESC] on the keyboard to return to the main screen interface.

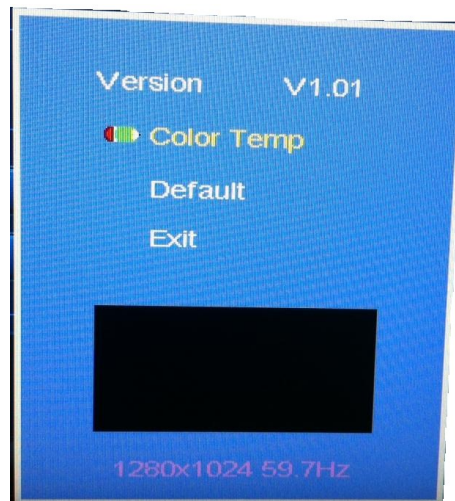
7.1.4 Monitor Parameter Setting

NOTE: After changing the main monitor, parameter loading should be performed to match the monitor and the system.

The parameters of the main monitor include color temperature. Information of loading Default parameters are introduced here:



- Press <1> and <4> key on the monitor as shown in the figure for more than 3 seconds to enter the screen.



- Press <1> or <2> to select Default, the cursor is on the Default position, press <4> to enter the parameter automated loading, and it takes about 3 seconds to finish.
- Color temperature is default to be 11000K, and adjustment is not recommended.
- After all settings are finished, move the cursor to Exit or press <3> to exit the menu.

7.2 Touch Screen Adjustment

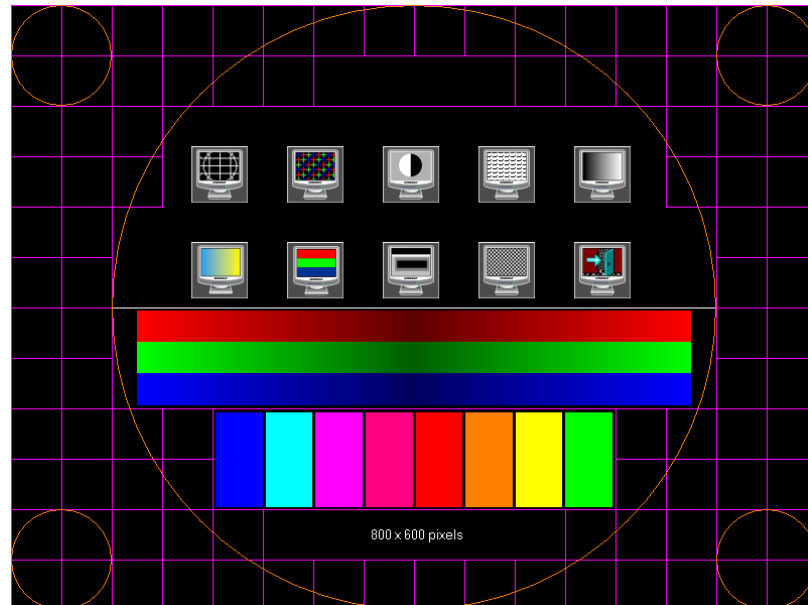
7.2.1 Touch Screen Brightness and Contrast Adjustment

NOTE: Avoid operating under direct sunlight, or the touch screen could be blocked. Do not place anything on the touch screen, or the screen view will be blocked.

Open the screen through the path: [Setup]->[System]->[General], and select touch screen Brightness/Contrast to perform the adjustment.

7.2.2 Touch Screen Test

1. Log on as the "Service"; refer to chapter 6.1 for details.
2. Press the [F10] key on the keyboard to enter setup menu, and click [Maintenance] to enter the screen.
3. Click [Setup] and select [Test Touch Screen] to enter the screen, test methods are the same as in main screen test.



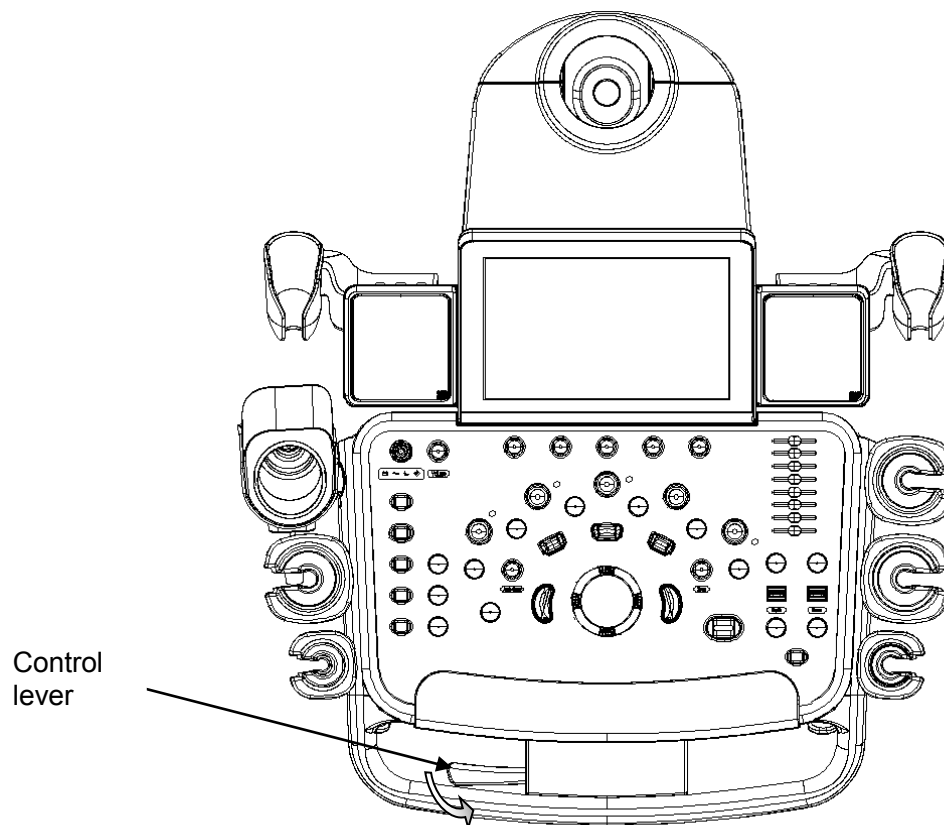
The difference is that in the touch screen test, you should click the touch screen rather than press [Set] in the main screen test; and click the corresponding icon on the touch screen rather than the main screen.

NOTE: After changing the 10.4 inch LCD screen, parameter setting must be performed before using.

7.3 Control Panel Adjustment

Control Panel Position Adjustment

Press the control lever downwards for about 30° to rotate the control panel $\pm 45^\circ$. Press the lever downwards for about 60° to move the control panel upwards or downwards.



Key backlit brightness adjustment

In the [System Preset]→[Key Config] page, you can adjust key backlit brightness and volume.

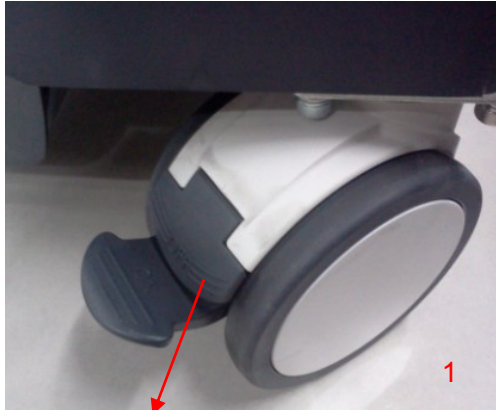
Functional keys setting

In the [System Preset]→[Key Config] page, you can preset functions for keys of <Print>, <Save>, <P>, <F3>, <F4>, <F5>, <F6>, <F12>, for example, you can preset save image to hard drive function of F3.

7.4 Caster Adjustment

There are four braking casters of the main unit, as shown in the figure: tread the 2 “On” button downwards by foot to lock the caster, tread the 1 “Off” button downwards by foot to release the caster. When locking or releasing the casters, move the casters if necessary.

RELEASING



OFF


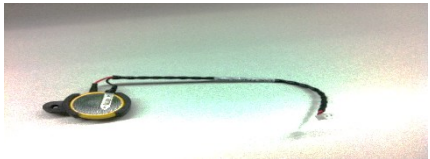
LOCKING

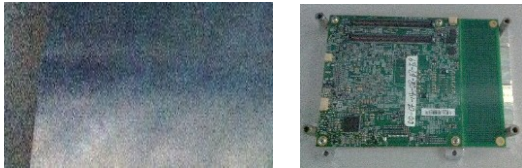
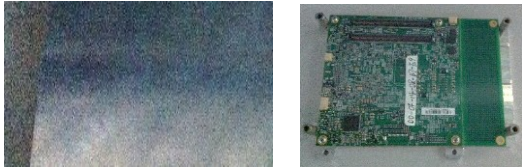



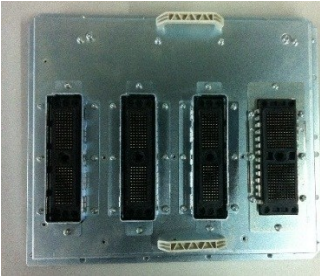
ON



8 Field Replaceable Unit




The detailed information of Field Replaceable Unit is as follows:





| No . | Classifi cation | Part description | Order Number | Figure | Comments | Applicable models | Disassembly |
|------|-------------------|----------------------------------|---------------|---|---|-------------------|-------------------|
| 1. | Main unit related | Digital Board Assembly(2136 FRU) | 115-038154-00 |  | Please indicate the software version when you apply | DC-40 series | Refer to 9.3.20 |
| 2. | | Li-ion Battery Assembly | 115-015310-00 |  | Installed on the digital board | DC-40 series | Refer to 9.3.20.2 |



| | | | | | | | |
|----|--|-------------------------------|---------------|--|---|--------------|-------------------|
| 3. | | PC Module Assembly(213 6 FRU) | 115-038155-00 |  | Including heat sink; CPU Module with 115-038155-00 has been discontinued. If it is out of stock, please use 115-038155-01 to order and restore the latest Doppler software and compatible OS as well after replacement. | DC-40 series | Refer to 9.3.20.1 |
| 4. | | PC Module Assembly(213 6 FRU) | 115-038155-01 |  | Including heat sink; CPU Module with 115-038155-00 has been discontinued. If it is out of stock, please use 115-038155-01 to order and restore the latest Doppler software and | DC-40 series | Refer to 9.3.20.1 |


| | | | | | | | |
|----|--|------------------------------------|---------------|---|---|--------------|-----------------|
| | | | | | compatible OS as well after replacement. | | |
| 5. | | Transmit & Receive Board(2136 FRU) | 115-038200-00 |  | Please indicate the software version when you apply | DC-40 series | Refer to 9.3.19 |
| 6. | | Probe Board Assembly (2136 FRU) | 115-038156-00 |  | | DC-40 series | Refer to 9.3.12 |


| | | | | | | | |
|----|--|-----------------------------|---------------|--|---|--------------|-----------------|
| 7. | | Mother Board Assembly(2136) | 115-035614-00 |  | | DC-40 series | Refer to 9.3.24 |
| 8. | | IO assembly(2136 FRU) | 115-038201-00 |  | wireless card port specification: MiniPCIE. for OS v1.1.9 or lower version.Including IO label, Please select and paste the corresponding label referring to its original component | DC-40 series | Refer to 9.3.16 |


| | | | | | | | |
|-----|--|---|-------------------|--|--|--------------|-----------------|
| 9. | | IO assembly(2136/wireless card port M.2) | 115-038201-01 |  | wireless card port specification: M.2. for OS v1.1.11 or higher version. Including IO label, Please select and paste the corresponding label referring to its original component | DC-40 series | Refer to 9.3.16 |
| 10. | | Inlet Fan | 115-015308-00 |  | Located in the bottom of the main box | DC-40 series | Refer to 9.3.14 |
| 11. | | Small Fan Assembly(FRU) | 801-2120-00031-00 |  | Outlet Fan, Located in the top of the main box | DC-40 series | Refer to 9.3.23 |

| | | | | | | | |
|-----|--|---------------------|---------------|--|-------|--------------|-----------------|
| 12. | | Tray-B | 043-002324-00 |  | Big | DC-40 series | Refer to 9.3.10 |
| 13. | | Tray-S | 043-002325-00 |  | Small | DC-40 series | Refer to 9.3.10 |
| 14. | | Castor | 115-015314-00 |  | | DC-40 series | Refer to 9.3.28 |
| 15. | | Main Cable Assembly | 009-006249-00 |  | | DC-40 series | Refer to 9.3.26 |

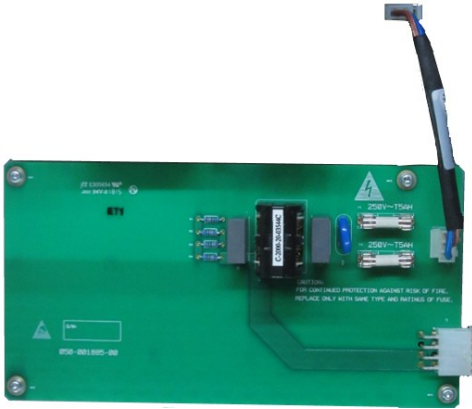


| | | | | | | | |
|-----|--|--------------------|---------------|--|---|--------------|-----------------|
| 16. | | DVD assembly(2136) | 115-035706-00 |  | | DC-40 series | Refer to 9.3.4 |
| 17. | | HDD(DC-33/C E/FRU) | 115-037953-00 |  | Do not include the bracket and cable, When applying, please remark: Software version, Serial number of unit | DC-33 | Refer to 9.3.17 |
| 18. | | HDD(DC-35/C E/FRU) | 115-037954-00 | | Do not include the bracket and cable, When applying, please remark: Software version, Serial number of unit | DC-35 | Refer to 9.3.17 |
| 19. | | HDD(DC-36/C E/FRU) | 115-037955-00 | | Do not include the bracket and cable, When applying, please remark: Software version, Serial number of unit | DC-36 | Refer to 9.3.17 |


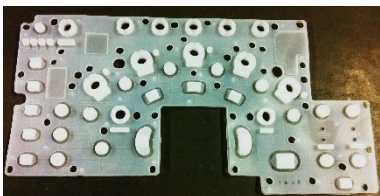

| | | | | | | | |
|-----|--|-----------------------|---------------|---|---|-------|-----------------|
| 20. | | HDD(DC-38/C E/FRU) | 115-037956-00 | | Do not include the bracket and cable, When applying, please remark: Software version, Serial number of unit | DC-38 | Refer to 9.3.17 |
| 21. | | HDD(DC-39/C E/FRU) | 115-037957-00 | | Do not include the bracket and cable, When applying, please remark: Software version, Serial number of unit | DC-39 | Refer to 9.3.17 |
| 22. | | HDD(DC-40/C E/FRU) | 115-037958-00 | | Do not include the bracket and cable, When applying, please remark: Software version, Serial number of unit | DC-40 | Refer to 9.3.17 |
| 23. | | HDD(DC-41/C E/FRU) | 115-037959-00 |  | Do not include the bracket and cable, When applying, please remark: Software version, Serial number of unit | DC-41 | Refer to 9.3.17 |





| | | | | | | | |
|-----|--|--------------------|---------------|---|---|-------|-----------------|
| 24. | | HDD(DC-42/C E/FRU) | 115-037960-00 | | Do not include the bracket and cable, When applying, please remark: Software version, Serial number of unit | DC-42 | Refer to 9.3.17 |
| 25. | | HDD(DC-43/C E/FRU) | 115-037961-00 | | Do not include the bracket and cable, When applying, please remark: Software version, Serial number of unit | DC-43 | Refer to 9.3.17 |
| 26. | | HDD(DC-44/C E/FRU) | 115-037962-00 | | Do not include the bracket and cable, When applying, please remark: Software version, Serial number of unit | DC-44 | Refer to 9.3.17 |
| 27. | | HDD(DC-45/C E/FRU) | 115-037963-00 |  | Do not include the bracket and cable, When applying, please remark: Software version, Serial number of unit | DC-45 | Refer to 9.3.17 |

| | | | | | | | |
|-----|--|--------------------------|---------------|---|---|-----------|-----------------|
| 28. | | HDD(DC-40S/ CE/FRU) | 115-037964-00 | | Do not include the bracket and cable, When applying, please remark: Software version, Serial number of unit | DC-40S | Refer to 9.3.17 |
| 29. | | HDD(DC-40 Pro/CE/FRU) | 115-037965-00 | | Do not include the bracket and cable, When applying, please remark: Software version, Serial number of unit | DC-40 Pro | Refer to 9.3.17 |
| 30. | | HDD(DC-40 Exp/CE/FRU) | 115-037966-00 | | Do not include the bracket and cable, When applying, please remark: Software version, Serial number of unit | DC-40 Exp | Refer to 9.3.17 |
| 31. | | HDD(DC-40T/ CE/FRU) | 115-037967-00 |  | Do not include the bracket and cable, When applying, please remark: Software version, Serial number of unit | DC-40T | Refer to 9.3.17 |





| | | | | | | | |
|-----|----------------------|---------------------------------------|---------------|---|--|--------------|-----------------|
| 32. | | Main-base Assembly(213 6) | 115-035795-00 |  | | DC-40 series | Refer to 9.3.27 |
| 33. | Power supply related | AC-DC Power Board | 115-015306-00 |  | | DC-40 series | Refer to 9.3.22 |
| 34. | | DC-DC Power Board Assembly(213 6 FRU) | 115-038202-00 |  | | DC-40 series | Refer to 9.3.21 |

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|-----|-----------------------|--|---------------|---|--|--------------|-------------------|
| 35. | | Power Auxiliary Output Link Board | 115-015307-02 |  | Including AC-AC inverter cable | DC-40 series | Refer to 9.3.22.1 |
| 36. | | Power input assembly package (2136 FRU) | 115-038157-00 |  | Including power label, Please select and paste the corresponding label referring to its original component | DC-40 series | Refer to 9.3.18 |
| 37. | Control panel related | Top Cover of Keyboard Assembly(2136 FRU) | 115-038148-00 |  | Do not include trackball, buzzer, encoders and TGC board | DC-40 series | Refer to 9.3.7.7 |

| | | | | | | | |
|-----|--|---|-------------------|--|------------------------|--------------|------------------|
| 38. | | Small keyboard assembly(2136 FRU) | 115-038149-00 |  | | DC-40 series | Refer to 9.3.11 |
| 39. | | Small keyboard assembly (Russia/2136 FRU) | 115-052165-00 | | | | |
| 40. | | Control panel silica gel keys | 049-000590-00 |  | | DC-40 series | Refer to 9.3.7.7 |
| 41. | | Buzzer | 801-2300-00008-00 |  | Including buzzer cable | DC-40 series | Refer to 9.3.7.4 |

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|-----|--|-------------------------|---------------|---|--|--------------|------------------|
| 42. | | 2123 Encoder Board PCBA | 051-001471-00 |  | One board contains all encoders | DC-40 series | Refer to 9.3.7.1 |
| 43. | | Encoder signal wires | 009-003635-00 |  | Connect the Encoder board and top cover of keyboard assembly | DC-40 series | Refer to 9.3.7.1 |
| 44. | | Small Encoder Cap | 043-003977-00 |  | | DC-40 series | Refer to 9.3.7.1 |
| 45. | | Big Encoder Cap | 043-003978-00 |  | | DC-40 series | Refer to 9.3.7.1 |


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|-----|--|---------------------|-------------------|---|--|--------------|------------------|
| 46. | | TGC Board | 801-2119-00029-00 |  | | DC-40 series | Refer to 9.3.7.3 |
| 47. | | TGC Silica | 801-2119-00034-00 |  | | DC-40 series | Refer to 9.3.7.3 |
| 48. | | STC connecting line | 2108-20-65853 |  | Connect the TGC board and top cover of keyboard assembly | DC-40 series | Refer to 9.3.7.3 |
| 49. | | TGC Cap | 043-004910-00 |  | | DC-40 series | Refer to 9.3.7.3 |




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| 50. | | trackball assembly(213 6) | 023-001236-00 |  | | DC-40 series | Refer to 9.3.7.2 |
| 51. | | Trackball connecting cable | 009-004599-00 |  | Connect the trackball and top cover of keyboard assembly | DC-40 series | Refer to 9.3.7.2 |
| 52. | | Single Speaker | 115-015309-00 |  | | DC-40 series | Refer to 9.3.8 |
| 53. | | Top cover of left speaker | 043-008096-00 |  | | DC-40 series | Refer to 9.3.8 |




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|-----|-----------------|----------------------------------|---------------|--|--|--------------|------------------|
| 54. | | Top cover of right speaker | 043-008097-00 |  | | DC-40 series | Refer to 9.3.8 |
| 55. | | Soft jacket(2136) | 043-006968-00 |  | | DC-40 series | Refer to 9.3.7.6 |
| 56. | | USB cable | 009-002536-00 |  | | DC-40 series | Refer to 9.3.7.5 |
| 57. | Monitor related | Touch Screen Assembly(DC-33/FRU) | 115-037983-00 |  | | DC-33 | Refer to 9.3.7.8 |

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| 58. | | Touch Screen Assembly(DC-35/FRU) | 115-037984-00 |  | | DC-35 | Refer to 9.3.7.8 |
| 59. | | Touch Screen Assembly(DC-36/FRU) | 115-037985-00 | | | DC-36 | Refer to 9.3.7.8 |
| 60. | | Touch Screen Assembly(DC-38/FRU) | 115-037986-00 | | | DC-38 | Refer to 9.3.7.8 |
| 61. | | Touch Screen Assembly(DC-39/FRU) | 115-037987-00 | | | DC-39 | Refer to 9.3.7.8 |

| | | | | | | | |
|-----|--|----------------------------------|---------------|--|--|-------|------------------|
| 62. | | Touch Screen Assembly(DC-40/FRU) | 115-037988-00 |  | | DC-40 | Refer to 9.3.7.8 |
| 63. | | Touch Screen Assembly(DC-41/FRU) | 115-037989-00 | | | DC-41 | Refer to 9.3.7.8 |
| 64. | | Touch Screen Assembly(DC-42/FRU) | 115-037990-00 | | | DC-42 | Refer to 9.3.7.8 |
| 65. | | Touch Screen Assembly(DC-43/FRU) | 115-037991-00 | | | DC-43 | Refer to 9.3.7.8 |

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| 66. | | Touch Screen Assembly(DC-44/FRU) | 115-037992-00 |  | | DC-44 | Refer to 9.3.7.8 |
| 67. | | Touch Screen Assembly(DC-45/FRU) | 115-037993-00 | | | DC-45 | Refer to 9.3.7.8 |
| 68. | | Touch Screen Assembly(DC-40S/FRU) | 115-037994-00 | | | DC-40S | Refer to 9.3.7.8 |
| 69. | | Touch Screen Assembly(DC-40 Pro/FRU) | 115-037995-00 | | | DC-40 Pro | Refer to 9.3.7.8 |

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|-----|--|--------------------------------------|---------------|--|---|--------------|------------------|
| 70. | | Touch Screen Assembly(DC-40 Exp/FRU) | 115-037996-00 |  | | DC-40 Exp | Refer to 9.3.7.8 |
| 71. | | Touch Screen Assembly(DC-40T/FRU) | 115-037997-00 | | | DC-40T | Refer to 9.3.7.8 |
| 72. | | Monitor Assembly(2136 15 inch) | 115-038144-00 |  | | DC-40 series | Refer to 9.3.1 |
| 73. | | Monitor Assembly(2136 17 inch) | 115-038145-00 |  | Optional. Support maintenance and upgrade. If you upgrade the monitor from 15 inch to 17 inch, you need replace the monitor arm assembly together | DC-40 series | Refer to 9.3.2 |

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|-----|--|-------------------------------------|---------------|---|---|--------------|------------------|
| 74. | | Monitor Assembly(213 6 19 inch) | 115-044283-00 |  | Optional. Support maintenance and upgrade. If you upgrade the monitor to 19 inch, you need replace the monitor arm assembly together | DC-40 series | Refer to 9.3.3 |
| 75. | | Monitor arm assembly(213 6 15 inch) | 115-038146-00 |  | Including Damping axis. Support maintenance | DC-40 series | Refer to 9.3.5.2 |
| 76. | | Monitor arm assembly(213 6 17 inch) | 115-038147-00 |  | Optional. Including Damping axis. Support maintenance and upgrade. Please replace the monitor arm assembly if you upgrade the monitor from 15 | DC-40 series | Refer to 9.3.5.1 |





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|-----|--------|-------------------------------------|---------------|---|-----------------|--------------|------------------|
| | | | | | inch to 17 inch | | |
| 77. | | Monitor arm assembly(213 6 19 inch) | 115-033336-00 |  | | DC-40 series | Refer to 9.3.5.3 |
| 78. | | arm support cover | 043-005457-00 |  | | DC-40 series | Refer to 9.3.5 |
| 79. | Others | Left cover assembly(213 6 FRU) | 115-041710-00 |  | | DC-40 series | Refer to 9.3.12 |

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|-----|--|--------------------------------|---------------|---|--|--------------|-----------------|
| 80. | | Right cover assembly(2136 FRU) | 115-038151-00 |  | | DC-40 series | Refer to 9.3.12 |
| 81. | | Front cover assembly(2136) | 115-035617-00 |  | | DC-40 series | Refer to 9.3.12 |
| 82. | | Back cover assembly(2136) | 115-035620-00 |  | | DC-40 series | Refer to 9.3.16 |
| 83. | | top cover (2136) | 043-006920-00 |  | | DC-40 series | Refer to 9.3.25 |

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|-----|--|----------------------------------|---------------|---|---|--------------|-----------------|
| 84. | | Back handle(2136) | 044-000864-00 |  | | DC-40 series | Refer to 9.3.25 |
| 85. | | Main unit pedal(2136) | 043-006967-00 |  | | DC-40 series | Refer to 9.3.28 |
| 86. | | left intracavitary probe holder | 115-037784-00 |  | Optional. Support maintenance and upgrade | DC-40 series | Refer to 9.3.6 |
| 87. | | right intracavitary probe holder | 115-037785-00 |  | Optional. Support maintenance and upgrade | DC-40 series | Refer to 9.3.6 |

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|-----|--|-------------------------------|---------------|--|--|--------------|-------------------|
| 88. | | portable bag | 048-001035-00 |  | Optional. Support maintenance for 4D probe | DC-40 series | N/A |
| 89. | | 4D assembly (2136 FRU) | 115-038143-00 |  | Optional. Support maintenance and upgrade | DC-40 series | Refer to 9.3.20.1 |
| 90. | | Wlan card material kit(2136) | 115-037783-00 |     | wireless card port specification: MiniPCIE. for OS v1.1.9 or lower version. | DC-40 series | Refer to 9.3.16 |

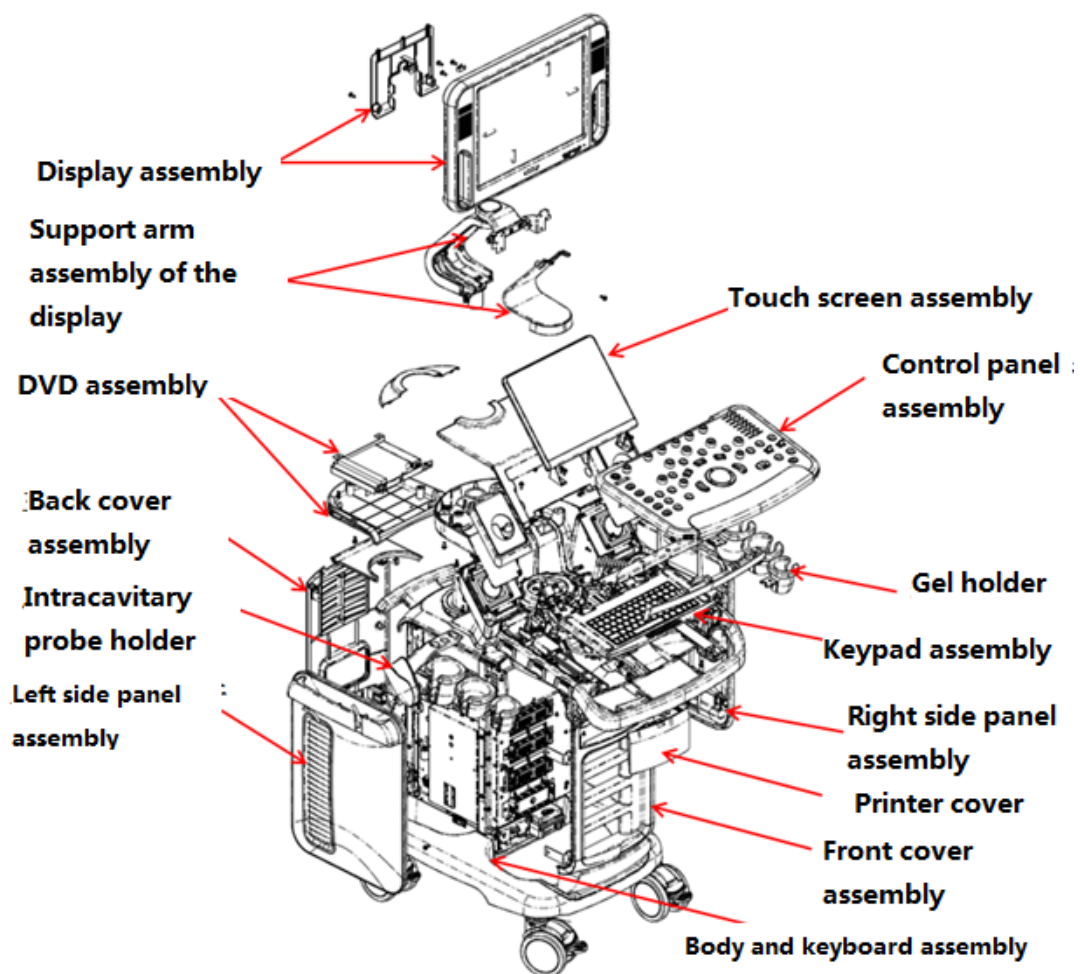
| | | | | | | | |
|-----|--|-------------------------------|---------------|---|--|--------------|-----------------|
| 91. | | Wlan card material kit(2148) | 115-057730-00 |  | wireless card port specification: M.2. for OS v1.1.11 or higher version | DC-40 series | Refer to 9.3.16 |
| 92. | | CW Module Kit | 115-012416-00 |  | Optional. Support maintenance and upgrade | DC-40 series | Refer to 9.3.19 |
| 93. | | Pen probe upgrading kit | 115-021634-00 |  | Optional. Support upgrade pen probe function | DC-40 series | |

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|-----|--|------------------------------|---------------|---|---|--------------|-----------------|
| 94. | | pen probe cable | 009-002540-00 |  | Optional. Support maintenance and upgrade | DC-40 series | |
| 95. | | ECG Module Kit(2136 for CE) | 115-037585-00 |  | Optional. Including DC-IN wire and IEC lead wire. Support maintenance and upgrade | DC-40 series | Refer to 9.3.13 |
| 96. | | ECG Module Kit(2136 for FDA) | 115-037584-00 |  | Optional. Including DC-IN wire and AHA lead wire. Support maintenance and upgrade | DC-40 series | Refer to 9.3.13 |
| 97. | | lithium-ion Battery Pack | 115-018409-00 |  | Optional. Support maintenance and upgrade | DC-40 series | Refer to 9.3.15 |
| 98. | | USB cable | 009-002560-00 | | | DC-40 series | |

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|-----|--|----------------------------------|---------------|--|--|--------------|--|
| 99. | | Touch panel cable assembly | 009-003631-00 | | | DC-40 series | |
|-----|--|----------------------------------|---------------|--|--|--------------|--|


9 Structure and Assembly/Disassembly

9.1 Structure of the Complete System



9.2 Preparation

9.2.1 Tools Required

| Name | Type | No. | Remarks |
|-----------------------------------|---------|---------------|---|
| Cross-headed screwdriver | 107*75 | / | M2 |
| Cross-headed screwdriver | 107*75 | 0000-10-10884 | M3, M4 |
| Flat-headed screwdriver | 101*100 | 095-000073-00 | / |
| Inner hexagon spanner | TL-4mm | 0000-10-10862 | M4 |
| Inner hexagon spanner | TL-5mm | 095-000029-00 | M5 |
| Inner hexagon spanner | TL-5mm | 095-000104-00 | M6 |
| Open-ended spanner | 8# | 042-007605-00 |  |
| Diagonal cutting pliers | N-206S | 095-000077-00 | / |
| Anti-electrostatic glove: 1 pair. | / | / | / |

9.2.2 Engineers Required

Only technical professionals from Mindray or engineers authorized by Mindray after training can perform the maintenance and the check.

9.2.3 Requirements

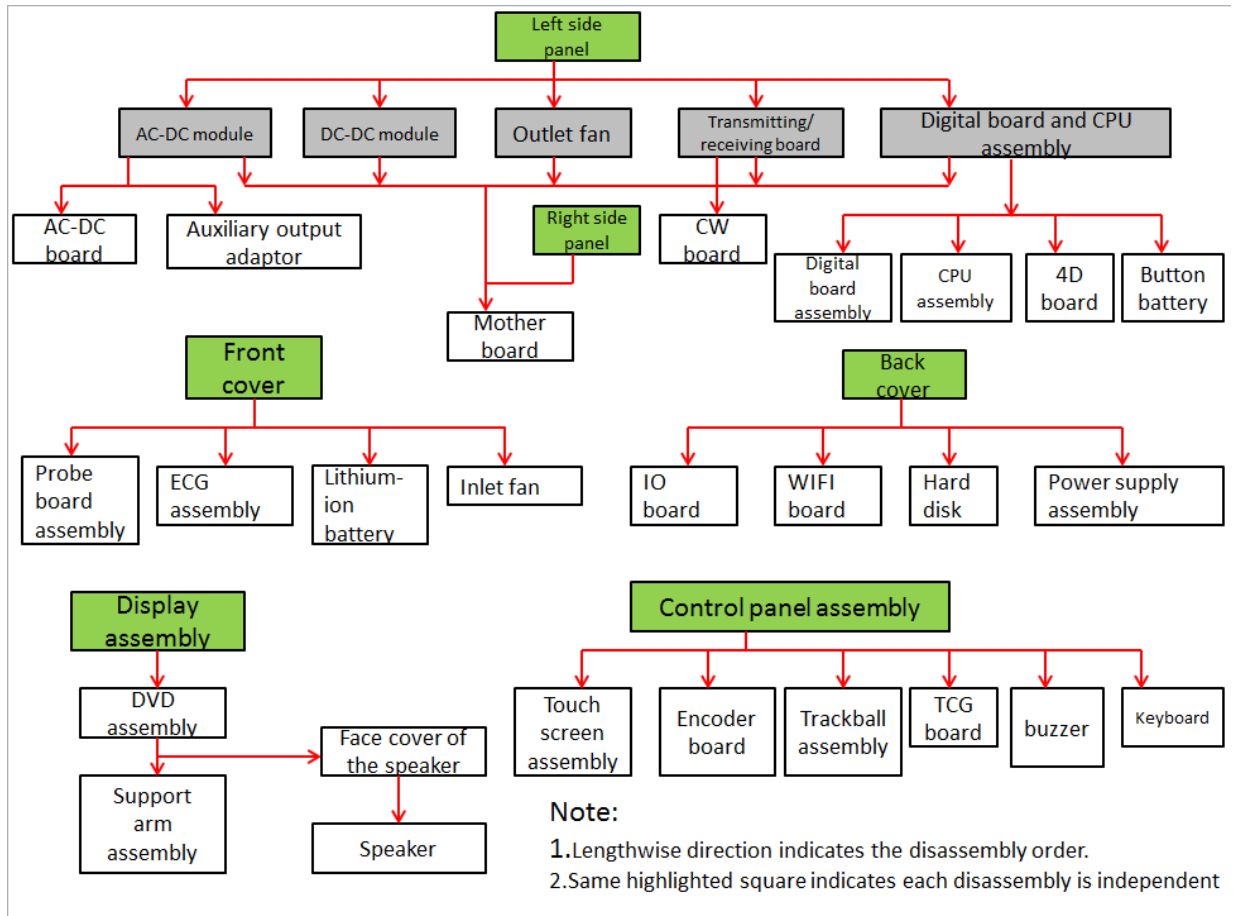
You should perform the following preparations before the disassembling of ultrasound device.

1. Stop the scanning and the image capture, power off the system and disconnect the system from the AC power supply, then pull out AC power cables.
2. Lock the casters to prevent the device from moving in the disassembly.
3. Prepare the tools required.

9.3 Assembling/Disassembling

This section describes the disassembling and the assembling of the main modules and hardware boards. The assembling is the inverse process of the disassembling if not mentioned in particular.

Sketch



Note: The illustration of disassembly is provided for reference only, and the concrete picture depends on the actual model.

9.3.1 15-inch Display

The disassembly tool: cross-headed screwdriver (M3, M4)

1. Unscrew screws (M4X12 * 2) , and remove the cable cover of the display;



2. Unscrew screws (M4X12 * 3). Remove the power supply cable of the display and unplug the signal cable.



3. Unscrew screws (M4X12 * 6), and remove the monitor assembly upwards.



| | |
|--------------|--|
| Note: | The metal part lies in the hole of the plastic part. The damage of the monitor's back cover may occur if removed by force. |
|--------------|--|

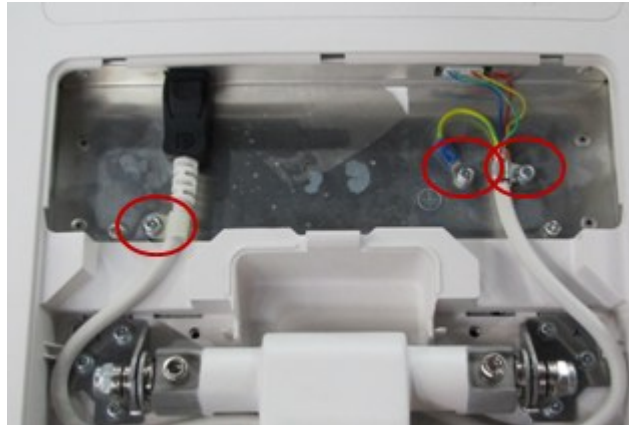
9.3.2 17-inch Display

The disassembly tool: cross-headed screwdriver (M3, M4)

1. Unscrew screws (M4X12 * 2), and remove the cable cover of the display;



2. Unscrew screws (M4X12 * 3). Remove the power supply cable of the display and unplug the signal cable.



3. Unscrew screws (M4X12 * 6), and remove the monitor assembly upwards.



| | |
|--------------|--|
| Note: | The metal part lies in the hole of the plastic part. The damage of the monitor's back cover may occur if removed by force. |
|--------------|--|

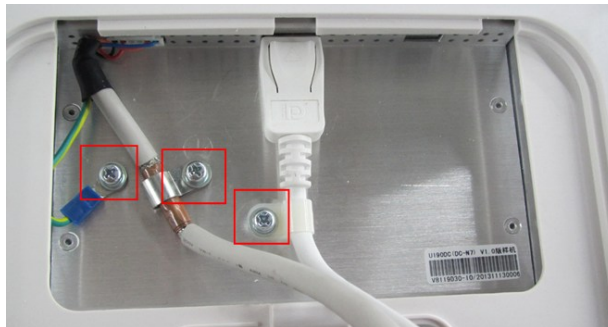
9.3.3 19-inch Display

The disassembly tool: cross-headed screwdriver (M3, M4)

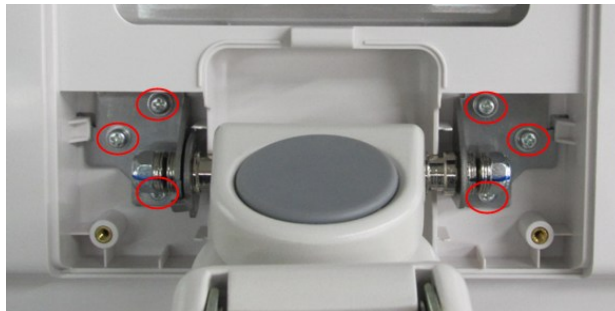
1. Unscrew two M4X12 screws, and remove the display cable cover;



2. Unscrew three M4 X 12 screws. Remove the power supply cable of the display and unplug the signal cable.



3. Unscrew six M4X12 screws, and remove the display assembly upwards.

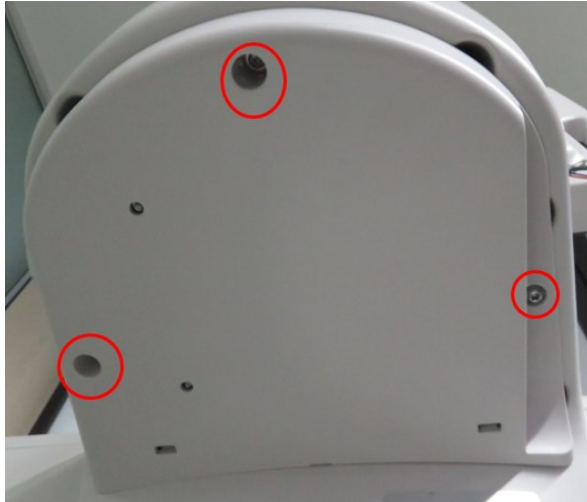


NOTE: The metal part is inserted in the hole of the plastic part. The damage of the display's rear cover may occur if removed by force.

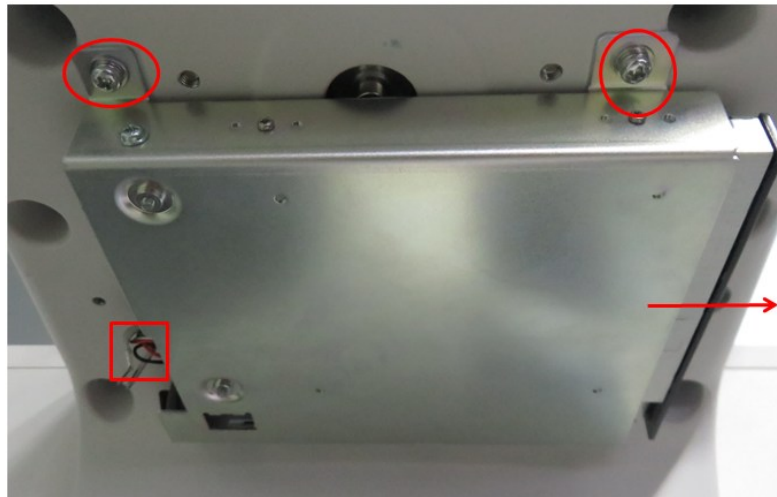
9.3.4 DVD Assembly

The disassembly tool: cross-headed screwdriver (M3, M4).

1. Unscrew screws (M4X12 * 3) on the DVD decoration cover, and remove the cover.



2. Unscrew screws (M4X12 * 2) on the DVD bracket and unplug DVD cable. Remove the DVD towards the arrow's direction.



9.3.5 Support Arm Assembly of the Monitor

9.3.5.1 Support Arm Assembly of the Monitor (17-inch)

The disassembly tool: cross-headed screwdriver (M3, M4), flat-headed screwdriver, inner hex spanner (M4).

1. Remove display. Refer to Chapter 9.3.2.
2. Unscrew screws (M4X12 * 2) and remove the cable fixture.



Note: The procedures are applied to the device configured with 17-inch display.

3. Unscrew the screw (M4X12 * 1).



4. Hold the top of the support arm cover, and remove it upwards.

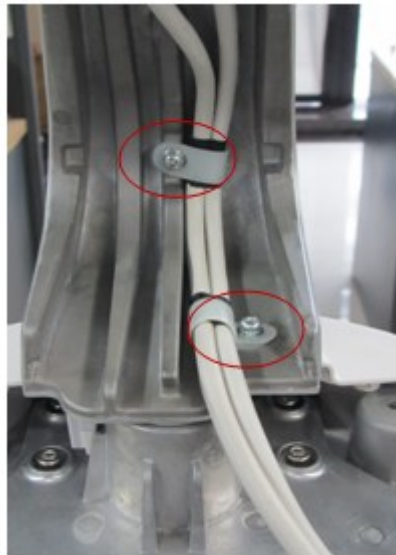


5. Pry off the cover marked on the figure below with a flat-headed screwdriver to release the (left /right) claspers of the support arm and take off the support arm forward.



Note: DO NOT pry the cover too hard, otherwise the support arm cover may be damaged.

6. Remove combination screws (M4X12 * 2) fixing the two cable clips to release the cable.



7. Remove DVD module as described in 9.3.3 chapter.
8. Remove an M5x20 hexagon socket head cap screw on the base of the side control panel, pull out the support arm assembly upward.



9.3.5.2 Support Arm Assembly of the Monitor (15-inch)

The disassembly tool: cross-headed screwdriver (M3, M4)

1. Remove display. Refer to Chapter 9.3.1.
2. Remove the top of the support arm and screws. Refer to steps 3-6 in Chapter 9.3.4.1.
3. Pull the cable out of the hole in the arm;
4. Remove DVD assembly. Refer to Chapter 9.3.3.



5. Unscrew screw (M5X20) as described in step 8 in chapter 9.3.4.1 and then take out the support arm assembly.

9.3.5.3 Support Arm Assembly of the Monitor (19-inch)

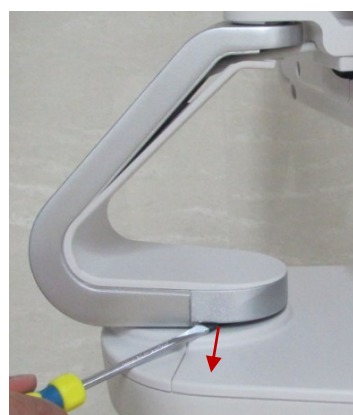
1. Unscrew one M4 X 12 screw.



2. Hold the head of support arm cover, and move outside.



3. Pry off the position marked on the figure below by a slotted screwdriver to release the (left /right) clasps of the support arm and take off the support arm forward.

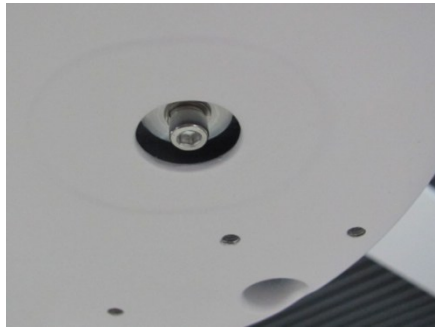


NOTE: DO NOT pry the cover too hard, otherwise the support arm cover may be damaged.

4. Remove the M4x12 screws fixing the two cable clips to release the cable.



5. Remove a M5x20 screw on the base of the minor panel, take off the support arm assembly upward.



9.3.6 Intra-cavity Probe Holder and Disassembly of Contact Part

The disassembly tool: cross-headed screwdriver (M3, M4).

1. Unscrew combination screws (M4X12 * 2) from intra-cavity probe holder, and remove the probe holder.



2. Unscrew combination screws (M4X12 * 2) from switching part, and remove the part.



9.3.7 Control Panel Assembly

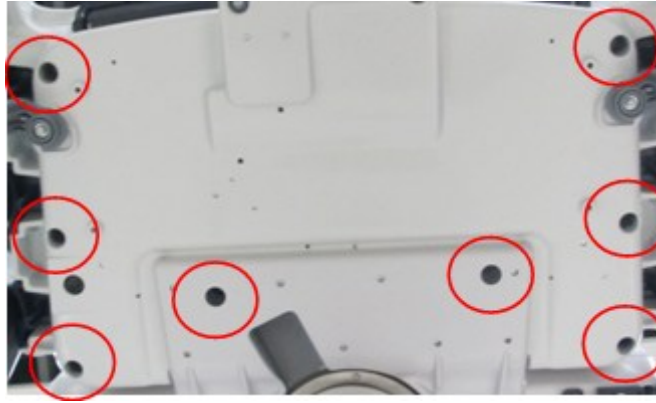
The disassembly tool: cross-headed screwdriver (M3, M4), diagonal cutting pliers, anti-electrostatic glove.

1. Remove the holders on both sides. Press the clips inwards. Lift the holders to both sides to remove them.

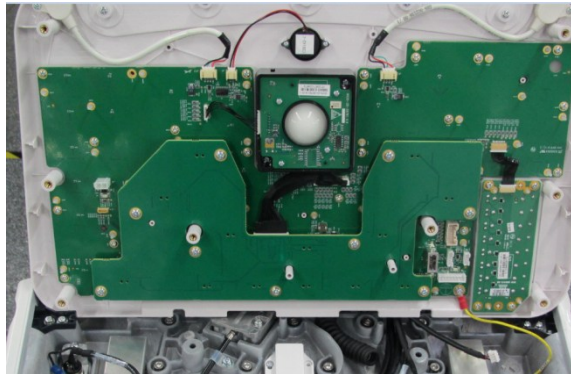


Press inwards to release.

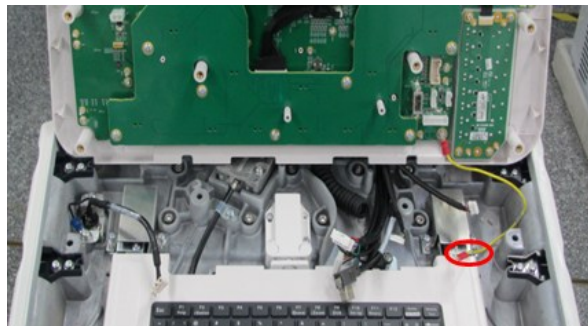
2. Unscrew combination screws (M4X12 * 8) on the control panel assembly.



3. Lift the upper cover up around the margin. Disconnect all plugs on the upper cover assembly. The control panel assembly and the main unit fall apart then.



4. Unscrew combination screw (M3X8 * 1) on the cast-aluminum base to remove the control panel assembly.



Operate the following procedures to remove the control panel assembly.

9.3.7.1 Encoder Assembly

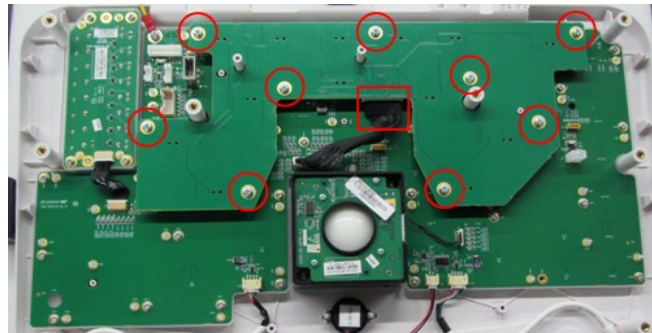
The disassembly tool: cross-headed screwdriver (M3, M4), anti-electrostatic glove

1. Remove five big encoder caps and eight small encoder caps.



Note: To avoid incorrect installation, please take notice of the size of caps.

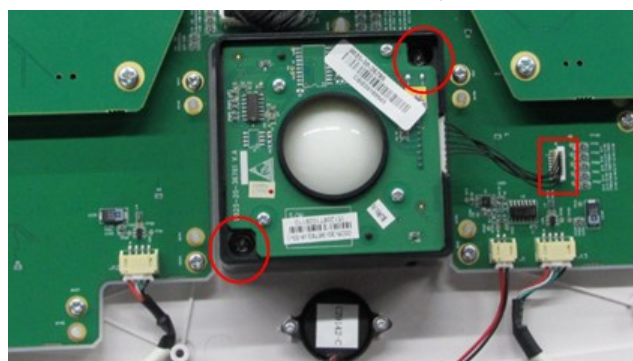
2. Unscrew tapping screws (PT4 X 10 * 9) from the encoder board. Disconnect the plug connecting the encoder to the keyboard to remove the encoder assembly.



9.3.7.2 Trackball

The disassembly tool: cross-headed screwdriver (M3, M4), anti-electrostatic glove

Unscrew combination screws (M3X8 * 2) fixing the trackball. Disconnect the plug connecting the trackball and the keyboard to remove the trackball assembly.



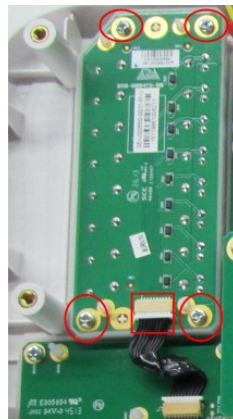
9.3.7.3 TCG Board

The disassembly tool: cross-headed screwdriver (M3, M4), anti-electrostatic glove

1. Remove eight caps of TCG sliders.



2. Unscrew tapping screws (PT3 X 10 * 4) fixing TCG board. Disconnect the plug connecting TCG board to keyboard to remove TCG board and the silicon.



9.3.7.4 Buzzer

The disassembly tool: cross-headed screwdriver (M2).

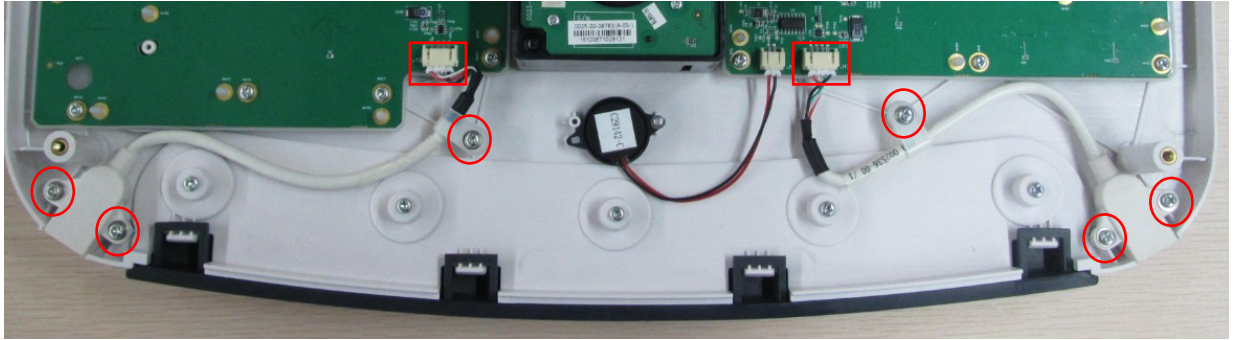
Unscrew tapping screws (PT2 X 6 * 2) and gaskets to remove the buzzer. Disconnect the plug of the buzzer to remove it.



9.3.7.5 USB Cable

The disassembly tool: cross-headed screwdriver (M3, M4), anti-electrostatic glove

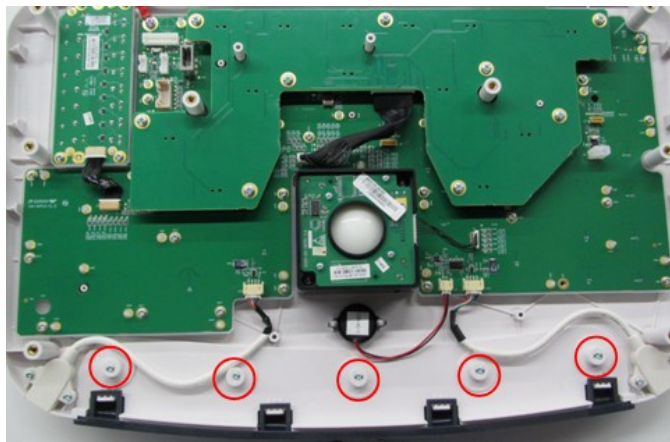
Unscrew tapping screws (PT3 X 10 * 2) from USB and the M3 X 8 combination screw from the clip. Disconnect USB cables to remove them (one cable on each side).



9.3.7.6 Support Mat

The disassembly tool: cross-headed screwdriver (M3, M4), anti-electrostatic glove

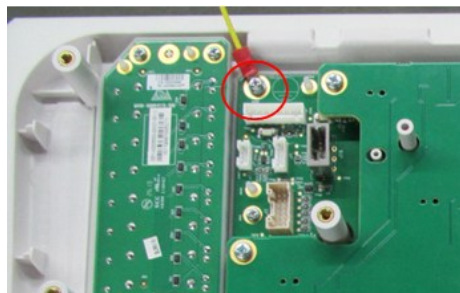
Unscrew tapping screws (PT3 X 10 * 5) from the support mat to remove it.

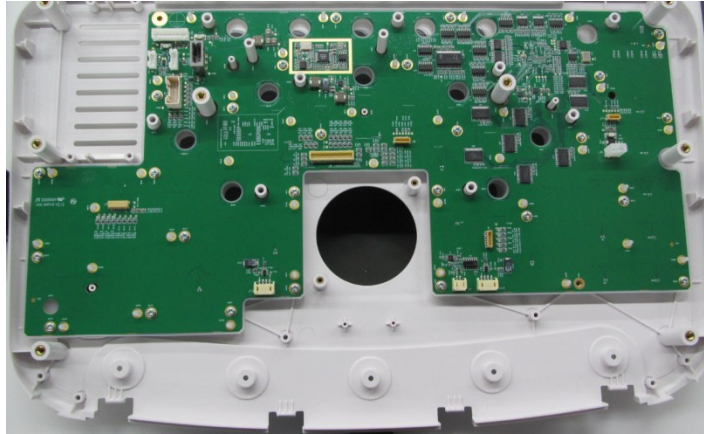


9.3.7.7 Upper Cover of the Keyboard, Control Panel Board, Silicon Buttons of the Control Panel

The disassembly tool: cross-headed screwdriver (M3, M4), anti-electrostatic glove

1. Remove the encoder assembly, trackball assembly, TGC board and the buzzer.
2. Unscrew combination screw (M3 X 8 * 1) from the grounding cable. Remove the upper cover of the keyboard and the control panel board.





9.3.7.8 Touchscreen Assembly

The disassembly tool: cross-headed screwdriver (M3, M4).

Unscrew combination screws (M4 X 12 * 4) from the touch screen assembly; disconnect the plug to remove the touch screen assembly.



Note: The cables lie behind the rear cover of the touchscreen. Be careful of the cables when removing the assembly.

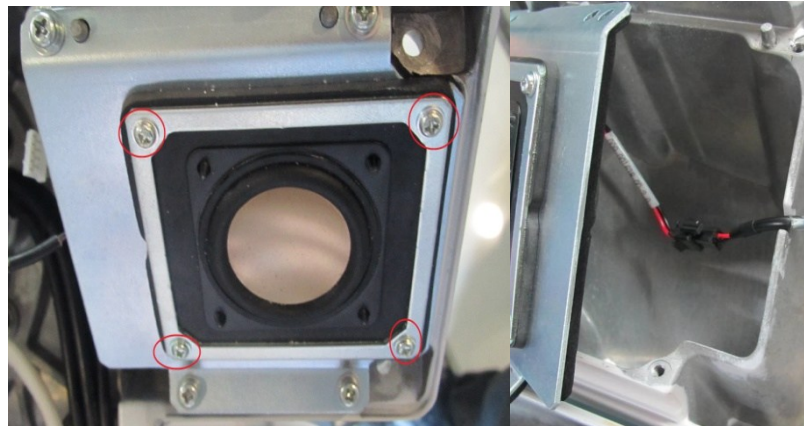
9.3.8 Face Cover Assembly of the Speaker/Speaker Assembly

The disassembly tool: cross-headed screwdriver (M3, M4).

1. Unscrew screws (M4 X 12 * 2) on the face cover of the left speaker, and remove the face cover forward. The procedures of both face covers of the speakers are the same.



2. Unscrew combination screws (M3 X 8 * 4) fixing the left speaker assembly. Unplug the cables connecting the speaker to the main unit, and remove the speaker assembly. (Right speaker is similar)



Note: To avoid incorrect installation, please take notice of the position of the speakers.

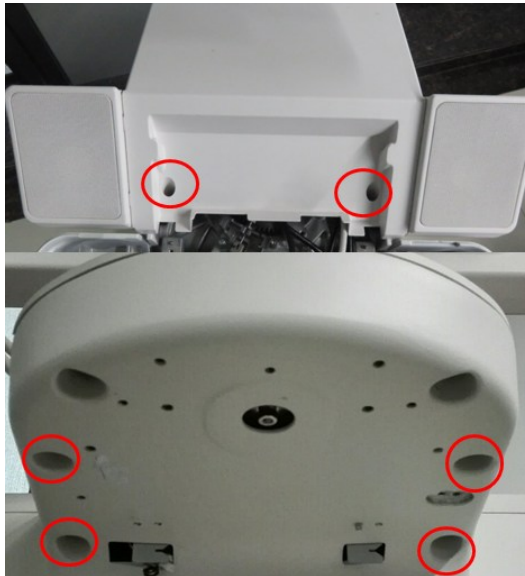
9.3.9 Main/Side Control Panel Assembly

The disassembly tool: cross-headed screwdriver (M3, M4), inner hexagon spanner (M6), sharp nose pliers, flat nose pliers.

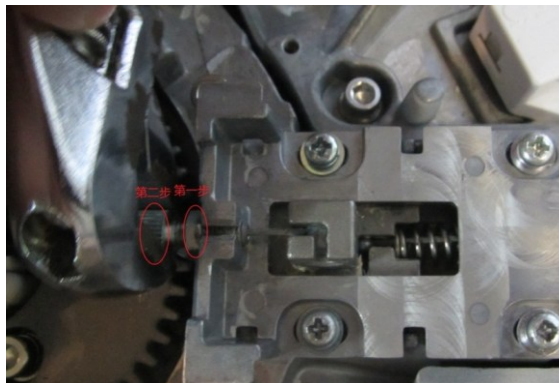
1. Remove the holders on both sides and then remove the control panel assembly, please refer to step 1-4 in section 9.3.4.
2. Unscrew combination screws (M4 X 12 * 4) from the touch screen assembly to remove the touch screen assembly.



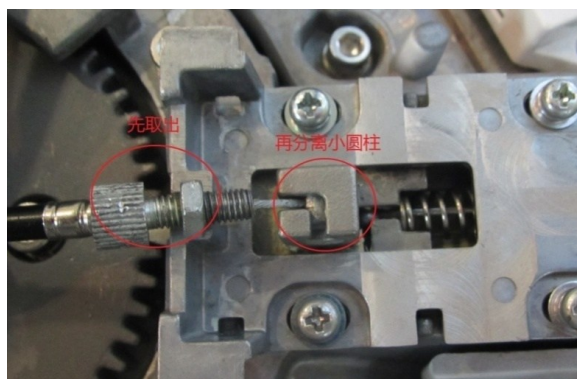
3. Unscrew DVD assembly and the face covers of speakers. Refer to the first step of 9.3.3 and 9.3.7
4. Remove combination screws (M4 X 12 * 6) fixing the cover of the side panel, and take off the side panel cover.



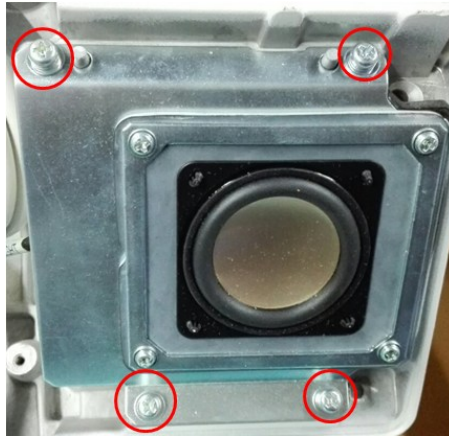
5. Untighten the screw, and then remove the bolt. Take the guide cable out of the slot.



6. Disassemble the two parts as shown in the following figure. Take the cylinder-shaped part out of the dragline. The dragline and the arm fall apart then.



7. Unscrew screws (M4 X 12 * 4) around the loudspeaker.



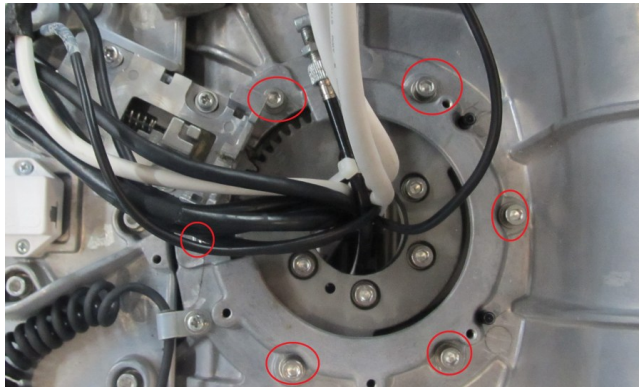
8. Remove the cover of the loudspeaker. Disconnect the black plugs. The loudspeakers appear symmetrical.



9. Remove the cable clasp.



10. Remove screws (M6 X 20 * 6) on the flange plate to take out the main and side control panel base.



9.3.10 Tray

1. Rotate the flange plate.



2. Lift the flange plate upwards, and pull the tray out towards arrow's direction.



9.3.11 Keypad Assembly

The disassembly tool: cross-headed screwdriver (M3, M4).

1. To extend the keypad.
2. Unscrew screws (M4 X 12 * 4) to remove the keypad.



9.3.12 Probe Board Assembly

The disassembly tool: cross-headed screwdriver (M3, M4).

1. Push the screwdriver tip at the clasp on middle part of right side panel's lower position and lift the right side panel upwards to remove it.



Note: Hold the base and the front/back cover, and pull the rib out when installing. Press the covers down until they are in place. Be careful of clasp not pressing the cables.

2. Follow the procedures of step 1 to remove left side panel.



3. Unscrew screws (M4 X 8 * 2) fixing the front cover, and remove the front cover upwards.



4. Unscrew screws (M4 X 8 * 12). Hold two plastic handles on the probe board. Pull the probe board assembly out.

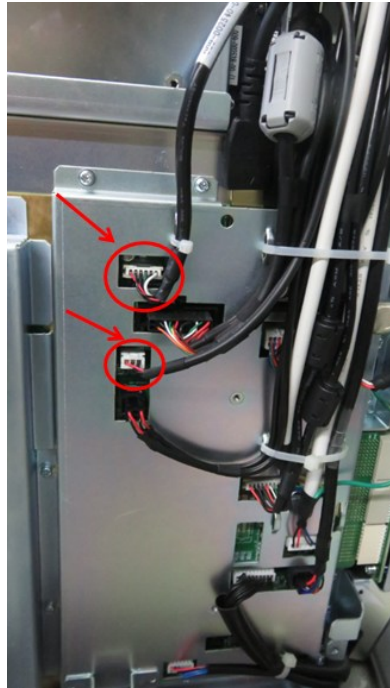


- | | |
|--------------|--|
| Note: | <ol style="list-style-type: none"> 1. Because of the socket of the probe board lying on the right side, please use even strength when pulling out it. 2. There are two bolts on the probe board assembly. Snap the assembly into place after inserting the bolts, and then fix the screws. |
|--------------|--|

9.3.13 Disassembling ECG Assembly

The disassembly tool: cross-headed screwdriver (M3, M4), diagonal cutting pliers.

1. Refer 9.3.11 from step 1 to step 3. Remove the left and right side panels and the front cover.
2. Unplug the signal cable connecting ECG assembly to mother board and MIC cable, and release the clasp.



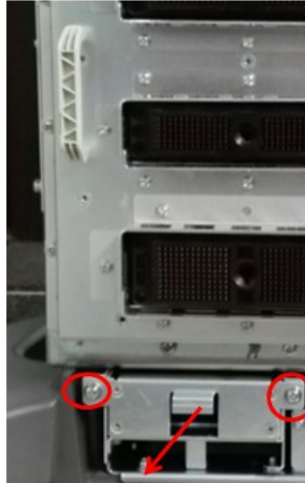
3. Unscrew screws (M4 X 12 * 3) fixing the assembly of front output panel, and pull the assembly of front output panel out.



9.3.14 Inlet Fan

The disassembly tool: cross-headed screwdriver (M3, M4).

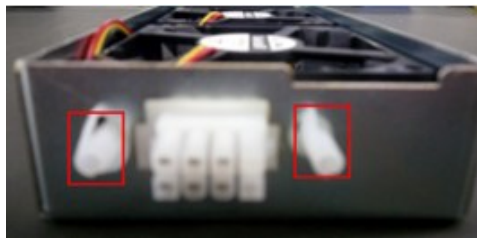
1. Follow step 1 to step 3 in 9.3.11 to remove the left/right side panels and the front cover.
2. Unscrew screws (M4 X 12 * 2) fixing the frame of the fan. Hold the metal handle to pull the fan assembly out.



3. Unscrew 8 screws fixing the fan.



4. Press the socket pin inside to remove the inlet fan assembly.



9.3.15 Disassembling Battery Assembly

The disassembly tool: cross-headed screwdriver (M3, M4)

1. Follow step 1 to step 3 in 9.3.11 to remove the left/right side panels and the front cover.
2. Unscrew screws (M3 X 8 * 2) to remove the battery assembly. Pull the battery out to remove it.



9.3.16 IO Board/WIFI Board

The disassembly tool: cross-headed screwdriver (M3, M4).

1. Follow step 1 and step 2 in 9.3.11 to remove left and right side panels.
2. Unscrew screws (M4 X 12 * 2) fixing the rear cover, and remove the rear cover.

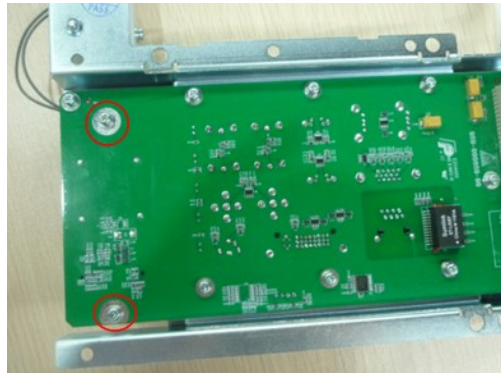


3. Unscrew screws (M4 X 12 * 5). Hold IO board assembly to lift it upwards.



| | |
|--------------|---|
| Note: | Aim the hole at the bolt in the process of installation. To avoid the damage to the pins, snap the socket into place. |
|--------------|---|

4. Unscrew screws (M3 X 8* 2) on WIFI shield, and remove the shield.



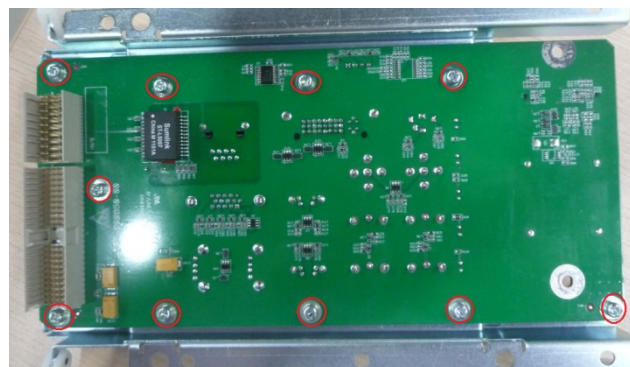
5. Reveal the tape of the antenna cables, and disconnect two plugs of the antenna cables.



6. Flick the elastic sheet up with two fingers, and remove WIFI board.



7. Unscrew screws (M3 X 8 * 10) to remove IO board.



9.3.17 Hard Disk

Note: Please follow the procedures below in case of any damage to the hard disk.
Do not hold the face of the hard disk board, please hold the edge of the hard disk.
Use the handle screwdriver to tighten the screws, and do not use torque driver.
Torsion force is:

- M3: 4-6kgf.cm
- M4: 6-8kgf.cm

The disassembly tool: cross-headed screwdriver (M3, M4)

1. Refer 9.3.11 from step 1 to step 2. Remove the left and right side panels and the back cover.
2. Unplug the power supply cable connecting hard disk assembly to the mother board and the plug of SATA signal cable.



3. Unscrew screws (M4 X 12 * 3) fixing the hard disk to remove the hard disk assembly.



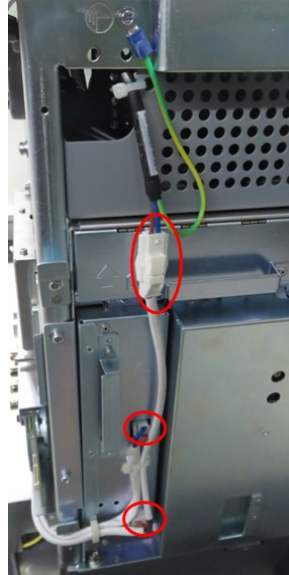
4. Pull the power supply cable of the hard disk and SATA signal plug out. Unscrew screws (M4 X 4 * 4) on two sides to remove the hard disk.



9.3.18 Power Input Assembly

The disassembly tool: cross-headed screwdriver (M3, M4)

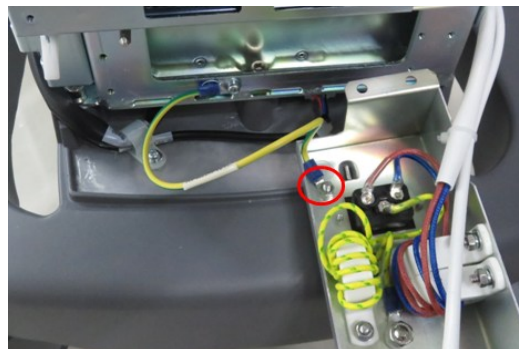
1. Refer 9.3.11 from step 1 to step 2 and 9.3.15 step 2. Remove the left and right side panels and the back cover.
2. Disconnect the power supply input assembly and AC-DC assembly. Unplug three plugs of the printer cables.



3. Unscrew screws (M4 X 12 * 4) to open the power input assembly.



4. Unscrew power supply input assembly and the grounding cable to remove the power supply input assembly.



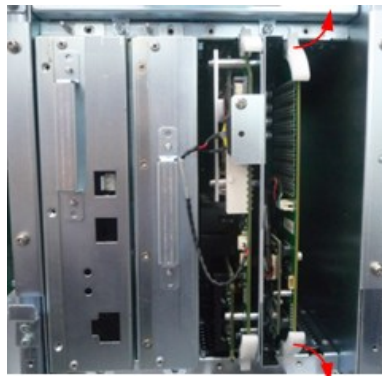
9.3.19 Transmitting/Receiving Board and CW Board

The disassembly tool: cross-headed screwdriver (M3, M4), anti-electrostatic glove

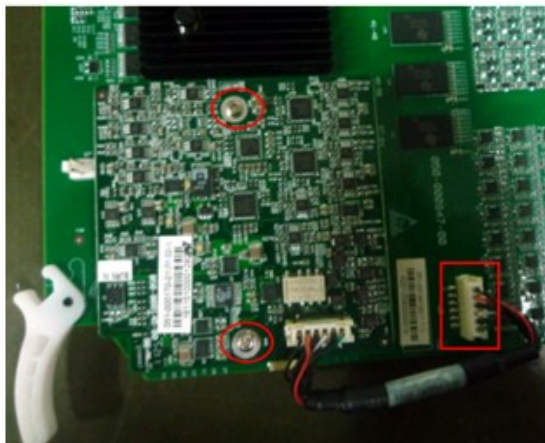
1. Follow step 1 in 9.3.11 to remove left side panel.
2. Unscrew screws (M4 X 12 * 4) (two screws on top and bottom) on the shield of the main unit, and then remove the shield.



3. Push two plastic spanners out. The board becomes loose. Then, pull the transmitting/receiving board and CW board out.



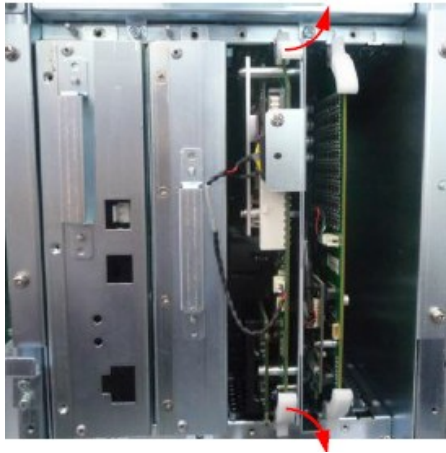
4. Disconnect the plugs of the cables. Unscrew screws (M3 X 8 * 2) to remove the CW board. The left board is the transmitting/receiving board.



| | |
|--------------|--|
| Note: | Aim at the top and bottom guide ways when installing. Push the board in until the clasps hold the guide ways. Press the clasp down to complete the installation. |
|--------------|--|

9.3.20 Digital Board and PC Module

Push two plastic spanners out with two hands to remove digital board and PC module.



Operate the following procedures to the digital board and PC module.

9.3.20.1 Disassembly of PC Module and 4D&TEE Board

The disassembly tool: cross-headed screwdriver (M3, M4)

1. Unscrew screws (M3 X 30 * 4). Use the hands to hold the edge of the CPU metal board. lift the PC assembly upwards to remove it.



2. Unscrew cross-headed screws (M3 X 8 * 3) to remove 4D&TEE board.



| | |
|--------------|---|
| Note: | Be careful of installing 4D&TEE board. Do not install it with the force. Tighten the screws when the board is in place. |
|--------------|---|

9.3.20.2 Connecting Cable of the Lithium-ion Battery

The disassembly tool: cross-headed screwdriver (M3, M4)

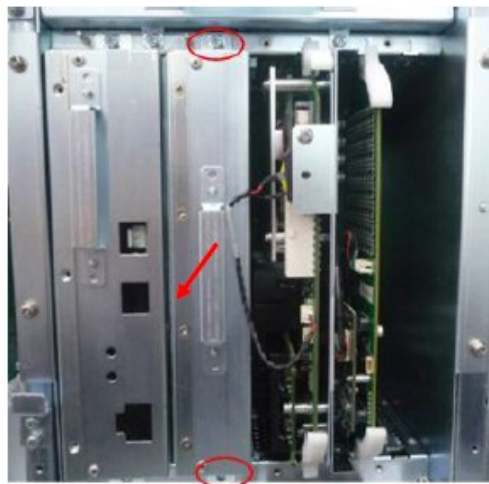
Unscrew one PT4X10 screw to pull the plug of the battery connecting cable.



9.3.21 DC-DC Board Assembly

The disassembly tool: cross-headed screwdriver (M3, M4)

1. Refer to 1-2 step of 1.3.18.
2. Unscrew screws (M4 X 12 * 2). Hold the metal handle of DC-DC board to pull the assembly out.



| | |
|--------------|---|
| Note: | In case of the back socket damage, aim at the top and bottom guide ways to push the board in. |
|--------------|---|

9.3.22 AC-DC Assembly

The disassembly tool: cross-headed screwdriver (M3, M4)

1. Follow step 1 in 9.3.11 to remove left side panel.
2. Disconnect two plugs. Unscrew screws (M4 X 12 * 2). Hold the metal handle of AC-DC assembly to pull the assembly out.



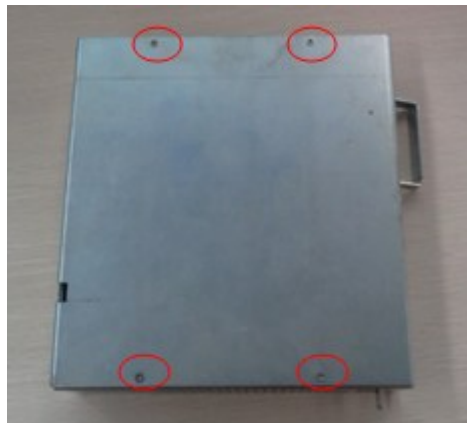
Note: In case of the back socket damage, aim at the top and bottom guide ways to push the board in.

Operate the following procedures on the AC-DC assembly:

9.3.22.1 AC-DC Board Auxiliary Output Adaptor

The disassembly tool: cross-headed screwdriver (M3, M4).

1. Unscrew screws (M3 X 8 * 4) on AC-DC cover, and screws (M3 X 8 * 3) on both sides.

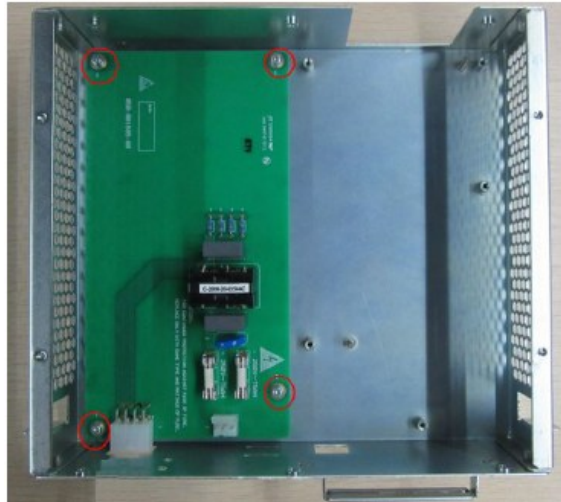


2. Unscrew screws (M3 X 8 * 5) to remove AC-DC board.



AC-AC inverter board connecting cable

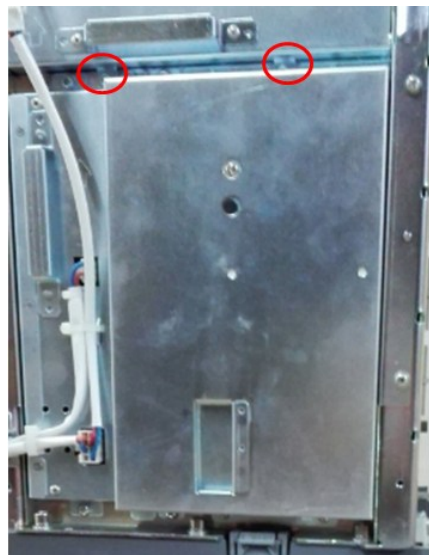
3. Unscrew screws (M3 X 8 * 4) to remove auxiliary output adaptor.



9.3.23 Outlet Fan

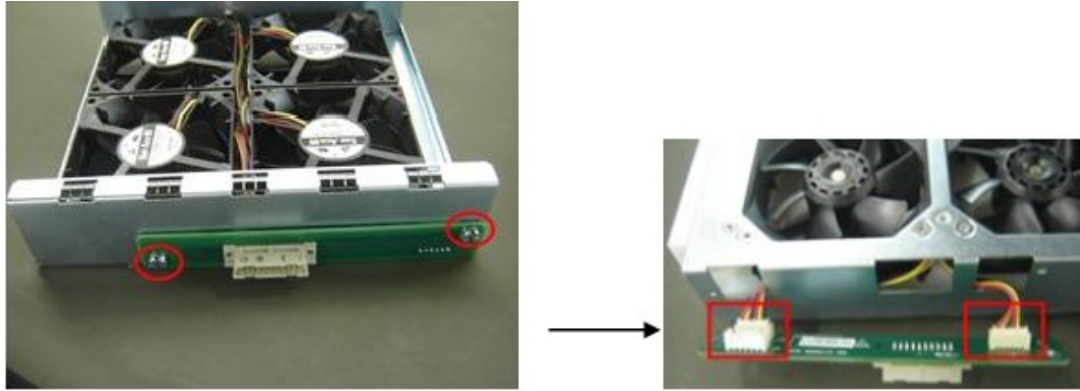
The disassembly tool: cross-headed screwdriver (M3, M4).

1. Follow step 1 in 9.3.11 to remove left side panel.
2. Unscrew screws (M4 X 12 * 2). Hold the metal handle of outlet fan assembly to pull the assembly out.



| |
|--|
| <p>Note: In case of the back socket damage, push in steadily in the installation.</p> |
|--|

3. Unscrew screw threads (M3 * 2) on the fans to remove the fan adaptor. Disconnect two plugs connecting to the fan.



4. Unscrew 16 screws on the outlet fan assembly. Any pairs of the outlet fans can be removed (two outlet fans form a pair, and 2 pairs in total).



9.3.24 Mother Board

The disassembly tool: cross-headed screwdriver (M3, M4).

1. Unscrew left side panel, right side panel, front cover assembly and probe board assembly. Refer to 1 to 4 steps in 9.3.11.
2. Remove the I/O module and the rear cover. Refer to step 1 in 9.3.15.
3. Unscrew the transmitting/receiving board, digital board, PC assembly, DC-DC board assembly and AC-DC assembly. Refer to the step 1-3 in 9.3.18, 9.3.19, 9.3.20 and 9.3.21.
4. Unscrew one M4 X 12 grounding screw on the right side of the device.



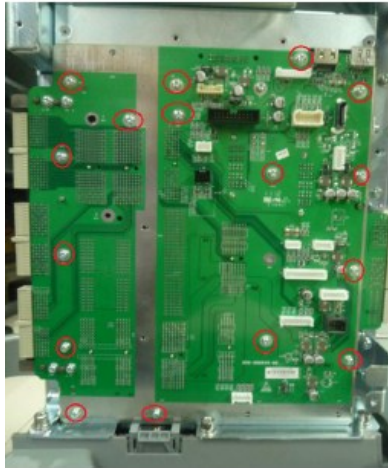
5. Unscrew screws (M3 X 8 * 4) to remove the shield of mother plate.



6. Unscrew screws (M3 X 8 * 6) to remove the shield of the mother board upwards. Be careful with the electronics on the mother board.



7. Unscrew screws (M3 X 8 * 16) to pull the mother board out.



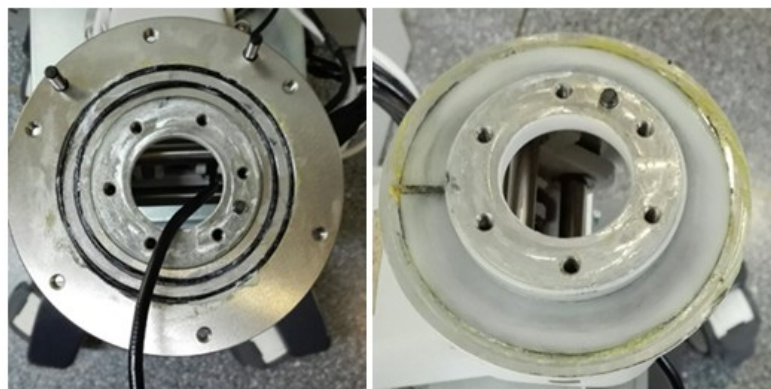
9.3.25 Support Arm Assembly of the Keyboard

The disassembly tool: cross-headed screwdriver (M3, M4), inner hex wrench (M4, M5).

1. Unscrew the base of side control panel. Refer to 9.3.8.
2. Unscrew hexagon socket head cap screws (M5 * 5) to remove the gear plate and POM mat.



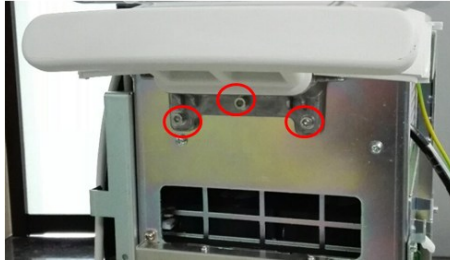
3. Rotate the plate. Lift the plate upwards to remove it.



4. Remove the flange plate. Refer to 9.3.9. Remove it along the support arm.
5. Refer 9.3.11 from step 1 to step 3 and step 2 in 9.3.15. Remove the left/right side panels, the front cover and the back cover.
6. Unscrew screws (M4 X 12 * 4) to remove top cover of the main unit.



7. Unscrew hexagon socket head cap screws (M5 * 3) to remove the back handle of the main unit.



8. Unscrew screws (M6 * 6) to remove the support arm of the keyboard.



9.3.26 Cable of the Main Unit

The disassembly tool: cross-headed screwdriver (M3, M4), inner hex wrench (M4, M5).

1. Unscrew the display cables and the top cover of the keyboard. Refer to 1 to 6 in 1.3.4 and 1 to 4 in 1.3.6.
2. Unscrew the side panel cover and the speaker plug. Refer to 1 to 4 in 1.3.8 and 7 to 8 in 1.3.8.
3. Remove the right side panel. Unplug the cable plugs of the main unit. Refer to 1 step in 1.3.11 and the fifth step in 1.3.23.
4. Unscrew two M3 screws to remove the cable shield cover of the keyboard's support arm.



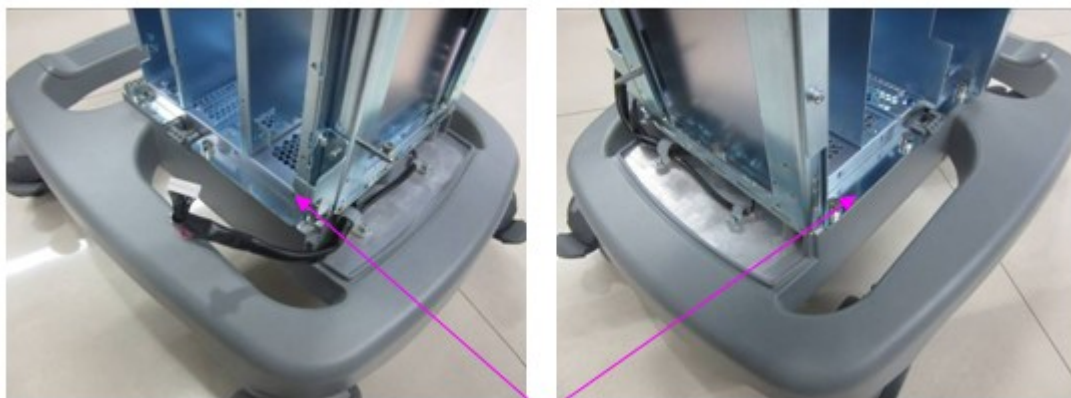
5. Pull the cables of the main unit downward to remove them.



9.3.27 Base Assembly of the Main Unit

The disassembly tool: cross-headed screwdriver (M3, M4), inner hex wrench (M4, M5).

1. Remove display, refer to 9.3.1 or 9.3.2.
2. Remove support arm assembly of the monitor, refer to 9.3.4.
3. Remove control panel, refer to 9.3.8.
4. Remove support arm assembly of the keyboard, refer to 9.3.24.
5. Unscrew mother plate assembly. Refer to 1.3.23.
6. Remove the assembly of power supply input. Refer to 1.3.17.
7. Unscrew seven M6 screws to remove the main unit so that you can remove the base assembly of the main unit.



M6 screws

9.3.28 Caster

The disassembly tool: open-ended spanner.

1. Lock four casters of the device (step the caster "ON" downwards). Incline the device for 30 degrees.



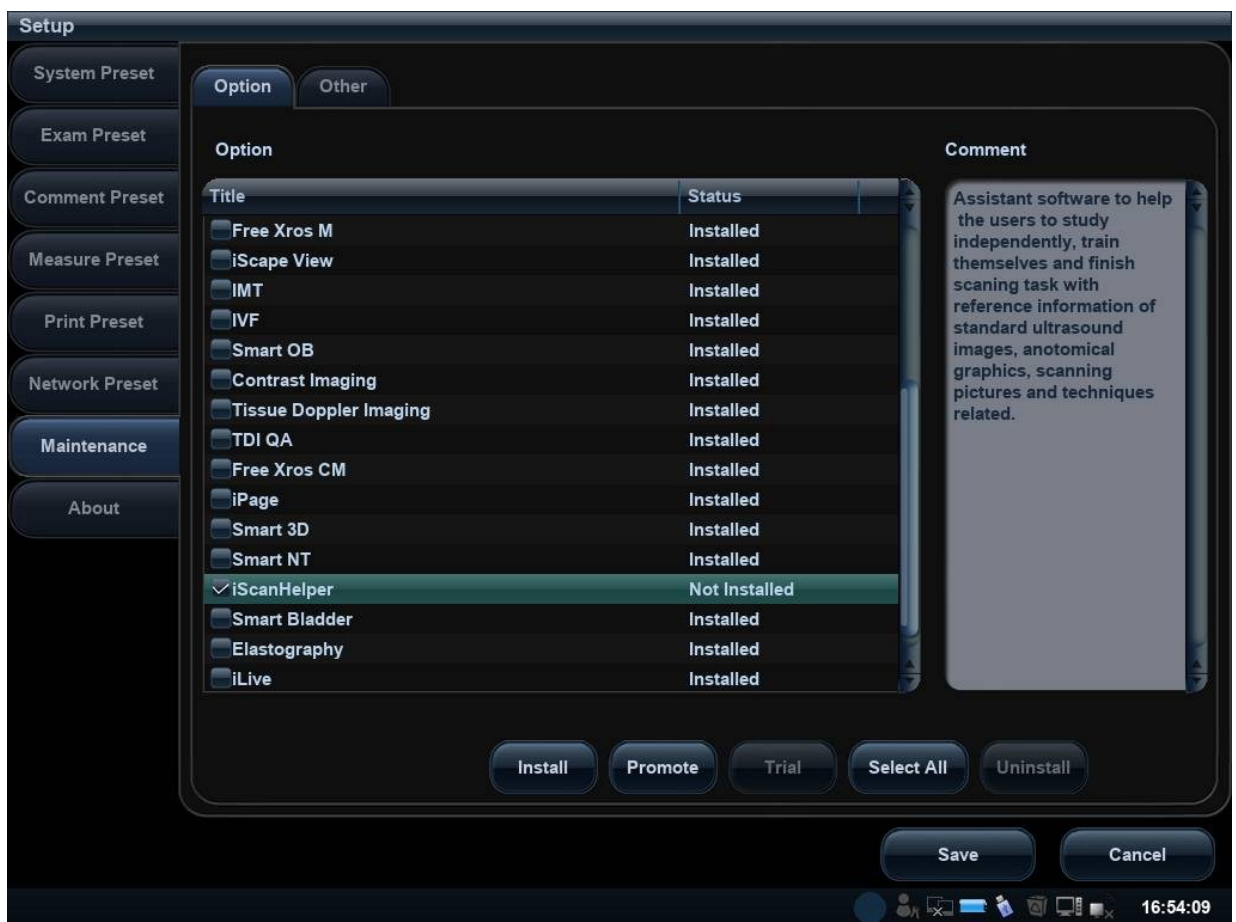
2. Use the open-ended spanner to hold the caster, and untighten the screw clockwise to remove the caster.



10 Options Installation

10.1 Installation of Software Options

1. Copy optional key file to USB flash disk and plug USB flash disk to the port.
2. Open **Setup** menu. Select [Maintenance]->[Option]. Select the software package to be installed from the list.



3. Click [Install]. Select key file from the dialog box, and then click [OK].
4. The options become **Installed** after the key files are installed. The corresponding function is activated after returning from preset.

Note: After all modules are installed, please go to the previous interface to confirm.

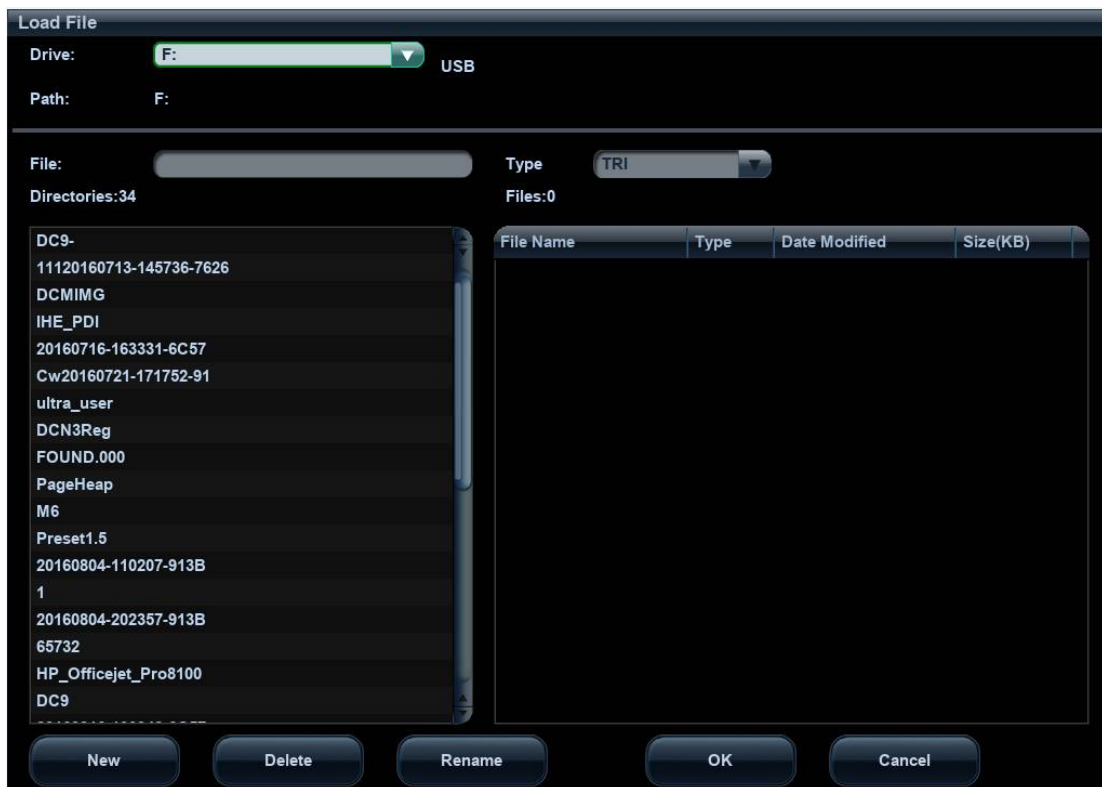
Trial: select the corresponding software package, and then click [Trial].

Note: for each component, you can activate trial version only once. The trial lasts 180 days for each

key.

Promote

1. Click [Promote]. The following image appears:



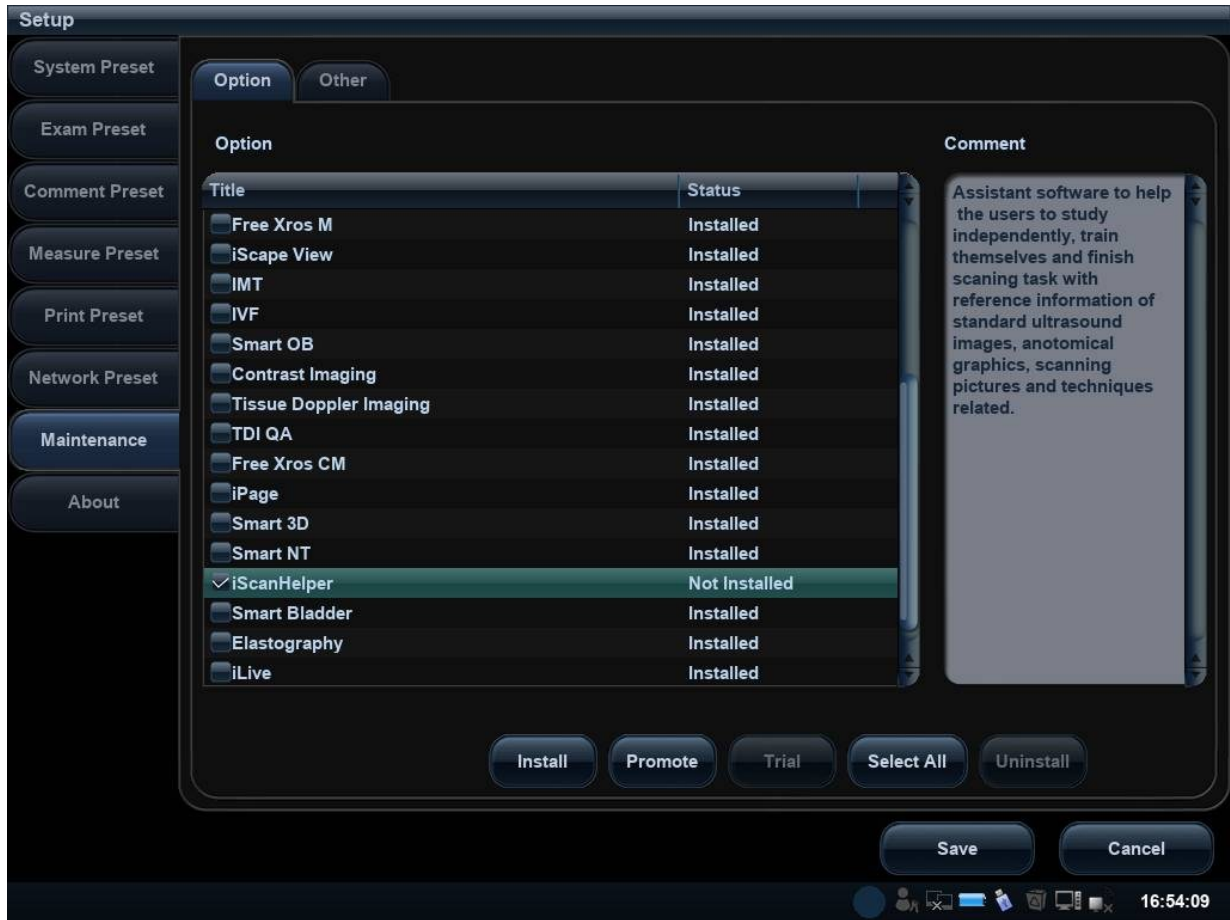
Note: the promotion function is only applied to the uninstalled key. If the optional key is installed, the promotion function is disabled.

2. Select the key to be promoted.
3. Click [OK] to complete the promotion.

Note: it is unavailable to use promotion for multiple optional keys. For the optional key which is promoted, it can also be installed. The promotion lasts 365 days for each key.

Uninstalling

4. Select the software package to be uninstalled from option list.
5. Click [Uninstall] and it pops up the [Confirm] dialogue box. Click [OK];







Return to the system preset interface. The option status changes into **Uninstalled**.

Note:

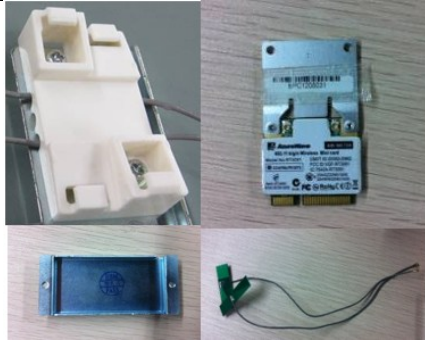


The uninstalling function is exclusive to internal users. The service engineers must log in the system with the account of **Service**, and then conduct the uninstallation.

10.2 Installation of Hardware Optional Function

Hardware configuration list that the product supports is displayed below:

| No. | Material Description | Material No. | Material and pictures | Installation reference |
|-----|------------------------------------|---------------|--|------------------------|
| 1. | Monitor Assembly(2136 15 inch) | 115-038144-00 |  | Refer to 9.3.1 |
| 2. | Monitor Assembly(2136 17 inch) | 115-038145-00 |  | Refer to 9.3.2 |
| 3. | Monitor Assembly(2136 19 inch) | 115-044283-00 |  | Refer to 9.3.3 |
| 4. | Monitor arm assembly(2136 15 inch) | 115-038146-00 |  | Refer to 9.3.5.2 |
| 5. | Monitor arm assembly(2136 17 inch) | 115-038147-00 |  | Refer to 9.3.5.1 |

| | | | | |
|-----|------------------------------------|---------------|--|-------------------|
| 6. | Monitor arm assembly(2136 19 inch) | 115-033336-00 |  | Refer to 9.3.5.3 |
| 7. | ECG Module Kit(2136 for CE) | 115-037585-00 |  | Refer to 10.2.1 |
| 8. | lithium-ion Battery Pack | 115-018409-00 |  | Refer to 9.3.14 |
| 9. | CW Module Kit | 115-012416-00 |  | Refer to 9.3.18 |
| 10. | 4D assembly (2136 FRU) | 115-038143-00 |  | Refer to 9.3.19.1 |

| | | | | |
|-----|-------------------------------|---|--|-----------------|
| 11. | Wlan card material kit(2136) | 115-037783-00 |  | Refer to 9.3.15 |
| 12. | Wlan card material kit(2148) | 115-057730-00 |  | Refer to 9.3.15 |
| 13. | 115-024667-01 | The material package of the ultrasound gel holder |  | Refer to 10.2.2 |

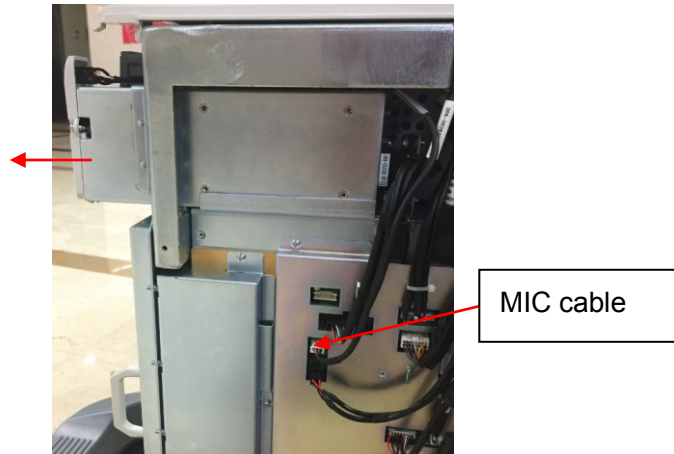
10.2.1 Update Front Output Panel for ECG Assembly

The disassembly tool: cross-headed screwdriver (M3, M4), diagonal cutting pliers.

1. Follow step 1 to step 3 in *Chapter 9.3.11* to remove the left/right side panels and the front cover.
2. Remove screws (M4 X 12 * 3);



3. Unplug MIC cable and pull front output panel outwards to remove the panel.



4. Assemble the ECG assembly; refer to 9.3.12.

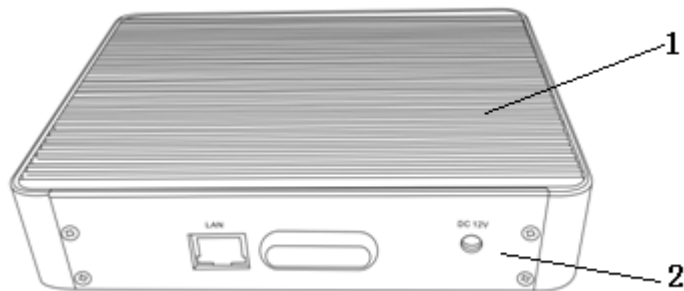
10.2.2 Ultrasound Gel Holder

Disassembly Tools Required: None

Unplug the holder cable. Push the holder clasp inwards use one hand and use the other hand to pull out the holder.

10.2.3 Printer Adapter

10.2.3.1 Structure of the Entire System



| No. | Name |
|-----|----------------------------|
| 1. | Printer adapter cover |
| 2. | Printer adapter rear cover |

10.2.3.2 Tools Required

| Name | Type | No. | Remarks |
|--------------------------|--------------------|-----|--|
| Cross-headed screwdriver | Type-2 screwdriver | / | Assembly and disassembly of the M2.5 flat-headed screws. |

10.2.3.3 Engineers Required

Only technical professionals from Mindray or engineers authorized by Mindray after training can perform the maintenance and the check.

10.2.3.4 Requirements

You should perform the following preparations before disassembling the ultrasound device.

1. Power off the printer adapter, disconnect all the AC power, and pull out the auxiliary power cables.
2. Put the printer adapter in a stable place.
3. Prepare the tools required.

10.2.3.5 Assembling/Disassembling

Tools required: type-2 screwdriver

Unscrew the four M2.5 flat-headed screws and remove the rear cover of the printer adapter, as shown in the following figure:








The disassembled printer adapter is shown as follows:



11 System Diagnosis and Support

11.1 General Status Indicator

11.1.1 The Status Indicators of the Control Panel

| Status indicators | Icon | Status definition and indicators |
|--|---|---|
| Power-on status indicator |  | The indicator is not on when the system is turned off; Press the POWERBTN button, the indicator blinks in green when the system is powered on. After power on, the indicator is green. |
| Battery status indicator |  | Indicate the status of battery: it's off when the machine has no battery ,the other status: It illuminates in orange when battery is being charged; It illuminates in green when battery is charged to full capacity; The battery discharges with more than 20% capacity, the indicator is green. The battery discharges with less than or equal 20% capacity, the indicator blinks in orange. The battery discharges with less than or equal 5% capacity, the indicator blinks in orange quickly. When the battery is in non-charge/discharge status, the indicator is off (not including the situation with 100% capacity). |
| AC indicator |  | The indicator is on green when the ultrasound system is connected to the AC power supply. The indicator is off only when batteries supplied. |
| Hard disk indicator |  | The indicator light blinks in green when the hard disk is reading or writing. The indicator is off automatically in other situations. |
| W-LAN status icon (Software interface) |  | The icon turns green when W-LAN is open and wireless signal can be used. |

11.1.2 The Status Indicator of the Power on the IO Board


| Status indicators | Icon | Status definition and indicators |
|--|----------|--|
| Digital board power supply D+12V status indicator | 12V | Power on, and indicator is on (green), which indicates D+12V output of the main unit box power module is normal. |
| Digital board power supply D+5V status indicator | 5V | Power on, and indicator is on (green), which indicates D+5V output of the main unit box power module is normal. |
| Digital board power supply D+3V3 status indicator | 3.3V | Power on, and indicator is on (green), which indicates D+3V3 output of the main unit box power module is normal. |
| PC LVDS indicator | PC_LV DS | The indicator is on(orange) ,which indicates LVDS signal output by CPU module is normal. It's off ,which indicates FPGA or CPU module malfunction. |
| PHV_OP indicator | PHV_O P | The indicator is on(orange) ,which indicates PHV over current protection is opened. It's off ,which indicates PHV is normal. |

11.1.3 The Status of Whole Machine

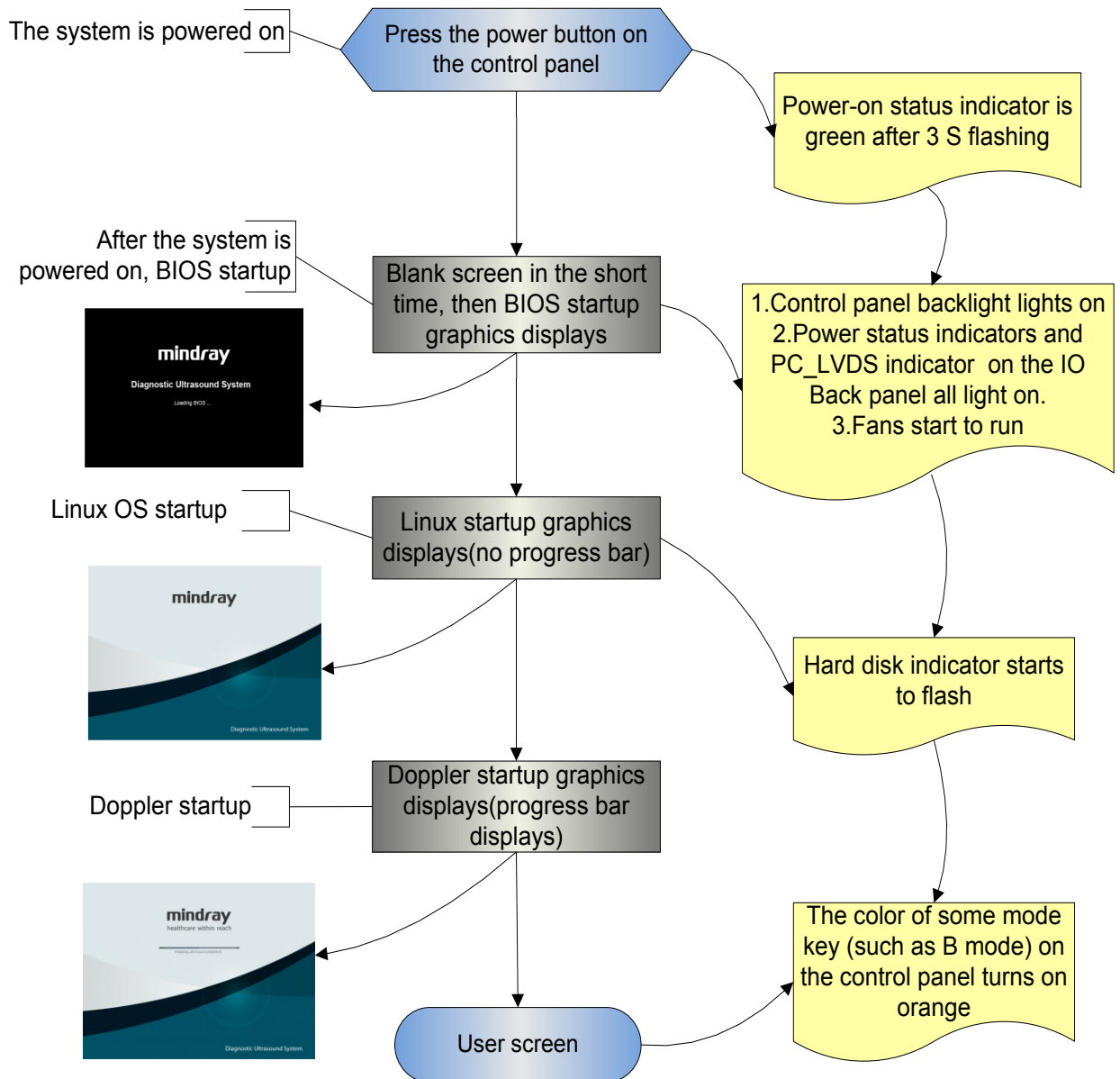
| Status of whole machine | Status definition and indicators | To enter | To exit |
|-------------------------|---|---|---|
| Scanning status | The Power-on status indicator turns on green; The [Freeze] key is white or light off. | Entering or exiting the scanning status by the [Freeze] key | |
| Freezing status | The Power-on status indicator turns on green, and the [Freeze] key is orange | Entering or exiting the freezing status by the [Freeze] key | |
| Screen-saver status | The brightness of the monitor is 0%, “mindray” is rotating on the display as default and the backlight of the control panel is off. The main unit is frozen. The OS is in screen-saver status. Ultrasound hardware imaging system is in the dormancy mode | There is no operation for the time set at first, and then the system would enter into the screen-saver status from the freezing status automatically. | When you press any key on the control panel, the system would return to the freeze status, both the brightness and the backlight of the control panel restore to the previous status. |

| | | | |
|------------------|--|---|---|
| Power-off status | The system is on the power-off status, when connected the AC power supply, the AC indicator is on, else refer to the instruction of “Battery status indicator” | Press the power button for a short time, and then the system is turned off by choosing from the status popped on the screen | Starting the system by pressing the power button for a short time |
|------------------|--|---|---|

11.1.4 Status Indicator of Gel Warmer

| Status indicator | Icon | Status definition and description |
|---|---|---|
| Ultrasound gel warmer Double-color indicator |  <p>Locates in the right of the warming control switch</p> | <p>1. Green: the gel warmer is powering and working normally; 2. Orange: abnormal working status.</p> |

11.2 Whole System Start-up Process



11.2.1 Complete System Start-up Process

11.2.1.1 Powered on by AC

| Basic Procedures | Phenomenon |
|---|--|
| The original status: Finishing loading 3.3VSTB, then finishing loading 5VSTB. | no indication |
| | The AC status indicator on the control panel lights on, but the indicators of HDD and standby are off. |
| Press the power button, the power management sends the power-on request to CPU. | The Power-on status indicator on the control panel flashes continuously. |

| | |
|--|--|
| CPU responds to request. Power management opens the power supply. | The Power-on status indicator on the control panel lights for a long time. |
| The power has been power on. | 1: The control panel backlight lights on. 2: The power status indicators on the IO panel all light on. 3: Fans start to run. |
| After finishing HDD initialization and logic configuration, PC enters into BIOS stage. | PC_LVDS indicator lights on, There are data output and images displaying on the monitor. |

11.2.1.2 Powered on by Battery

| Basic Procedures | Phenomenon |
|---|--|
| The original status: finishing loading 3.3VSTB | no indication |
| Finishing loading 5VSTB | The battery indicator on the control panel lights on, but the indicators of HDD, standby and AC status are off. |
| The power management send the power-on request to CPU | The Power-on status indicator on the control panel flashes continuously. |
| CPU responds to request, Power management opens the power supply. | The Power-on status indicator on the control panel lights for a long time. |
| The power has been power on | 1: The control panel backlight lights on. 2: The power status indicators on the IO panel all light on. 3: Fans start to run. |
| After finishing HDD initialization and logic configuration, PC enters into BIOS stage | PC_LVDS indicator lights on, There are data output and images displaying on the monitor. |

11.2.2 BIOS Start-up Process

The start-up process of BIOS is a black-box operation, and the primary description is as following:

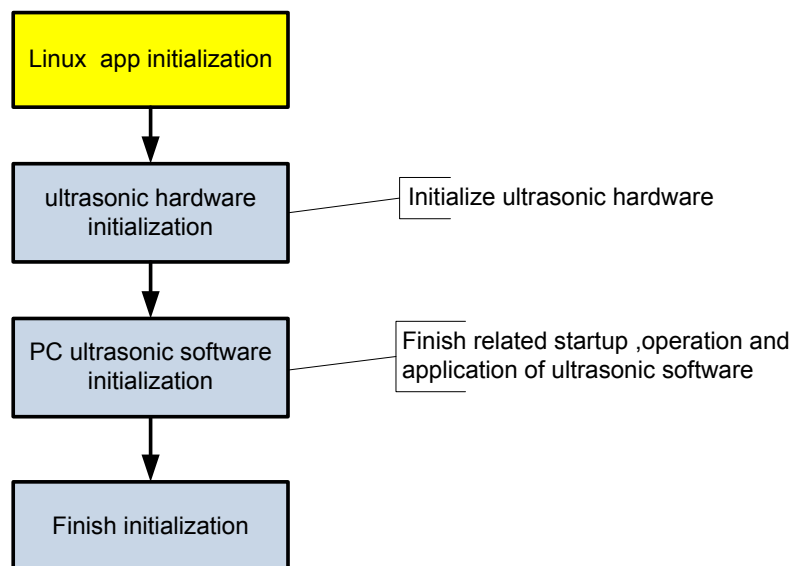
| Basic Procedures | Basic phenomenon |
|--|---|
| Self-test after the system power-on | The LCD is blank screen, and the time of the course is short. |
| Initialization& Recording the settings of system& Providing the resident program library &Loading the operation system | Linux boot screen displays. |

11.2.3 Linux Start-up Process

| Basic Procedures | Basic phenomenon |
|--|--|
| Guiding the course of program loading &The course of testing and HDD configuration | The LCD is black screen now, and the time of the course is short. |
| The course of the internal core loading &The course of logging on | The Linux boot screen appears |
| Starting DOPPLER | The Doppler boot screen appears, and simultaneously progress bar displays the related information. |

11.2.4 Doppler Start-up Process

11.2.4.1 Start-up Process



11.2.4.2 Details

◆ Now, DOPPLER starting is in increments of 20dB, and the detailed course is as following:

| Basic Procedures | Sub-procedures | Basic phenomenon | Description |
|--------------------------------|---------------------------|--|---|
| Linux APP initialization | | Display Linux boot screen with no progress bar | The progress bar does not appear unit in increments of 7. |
| PC hardware initialization | | Display Linux boot screen with no progress bar | |
| The PC software initialization | Peripheral initialization | Display Linux boot screen with no progress bar | |
| | Platform initialization | Display Linux boot screen with no progress bar | The total |
| | GUI initialization | There is progress bar appearing on | |

| | | | |
|------------------------------------|----------------------------|--|--|
| | | the Doppler boot screen, and tips under the progress bar are: and tips under the progress bar are: Initializing hardware... Loading system preset... Loading common exam preset... Loading exam preset... Initializing locale... | increments are 7, and tips are displayed one by one. |
| PC HDD initialization | | Initializing gui... | The total increment is 1 |
| Ultrasonic software initialization | GUI initialization | Initializing gui... | |
| | Platform initialization | Initializing gui... | The total increment is 1 |
| | Peripheral initialization | Initializing ultrasound peripheral... | |
| | Imaging initialization | Initializing ultrasound image... | The total increments are 2 |
| | Application initialization | Initializing ultrasound application... | The total increment is 1 |
| Finishing initialization | | Initialization completed... | The total increment is 1 |

◆ The configuration files of the course are as following:

| Tips | Related operation | The corresponding increments |
|--------------|---|------------------------------|
| No prompt | Attach the path to configuration files Initialize display, the main window, sound and the USB representative Turn on the bus device BackboneDev and LPC Initialize the time and the processing function of Multilanguage Initialize peripheral file system, network and the driver Enumerate peripheral ports Config timer, Initialize soft interruption, construct maintenance server and config static data of the system Config system font Load layout information Initialize UI management, and Initialize UI mark standard library | In increments of 7. |
| Initializing | When loading boot-trap graphic, 7 refreshing | |

| | | |
|--|--|---------------------|
| hardware... | progress bars will display Release factory package of configuration data Maintain the data server | |
| Loading system preset... | Generate the server of local setting and system setting | In increments of 1. |
| Loading common exam preset... | Generate general data management of the exam mode | In increments of 1. |
| Loading exam preset... | Generate measure preset, peripheral and network, KMP package of images and the preset server of the network storage | In increments of 4. |
| Initializing locale... | Set related information of the zoom, languages, font library and input Construct widget factory Config the GUI layer Set menu items Initialize function library Construct UICenter | In increments of 1. |
| Initializing gui... | Config the application layer Initialize the keyboard. Construct the user account control management, and remote desktop management | In increments of 1. |
| Initializing ultrasound peripheral... | Config the file dialogue box Initialize printing library Monitor battery and system inspection handshaking Load printing mark Construct low power consumption Construct the USB management and writing management Initialize video replay device | In increment of 1. |
| Initializing ultrasound image... | Create ECG RD thread. Set the virtual machine device, and initialize the virtual machine Construct object trees of the front-end and the back-end (ultrasys and so on) | In increments of 2. |
| Initializing ultrasound application... | Add function package of measure menu Register the application interface of measure patient | In increments of 1. |
| Initialization completed... | The architecture of patient information management (UPatientApp) | In increments of 1. |
| Hide boot-trap graphic | | |

11.3 Warning and Abnormal Information

The machine has alarm function. When the malfunction exists in the machine, an alarm dialog box will be popped up, and the LOG file generated will be saved in the system log, which will be in the directory of D: \DCN3\Log\. The detailed description of alarm information is as follows:

NOTE: In the LOG: *** refers to the time, in the format as 2012-6-12 14:15:15.

11.3.1 Battery Alarm

| Alarm Tips | LOG Record | Measure |
|---|---|---|
| Alarming! Illegal operating battery! Lead to permanent damage!(id10642) | Battery Hot Plug | Stop the illegal operation. |
| Battery communication error! Battery may not be used or battery power may not be displayed correctly (id7330) | Battery I2C error | Check the battery connection or replace the battery |
| Battery temperature is too high; please connect to AC power supply or shut down! Otherwise the system shuts down automatically after 60s!(id7333) | Battery temperature is out of range temp, Battery temperature is: xx centigrade | check if the heat radiating condition around is normal. |
| Battery voltage is too low; please connect to AC power supply or shut down! Otherwise the system shuts down automatically after 60s!(id7336) | battery voltage is low, battery volt is xx V | Check the battery connection or replace the battery |
| Battery error! Battery cannot be used!(id7476) | battery break | replace the battery |
| Battery voltage is too low, please connect to AC power supply or shut down! Otherwise the system shuts down automatically after 60s!(id4298) | Low battery power, battery power is XX | Input AC, check if the battery charging is normal, and it can be used when full of power. Or replace the battery |
| Battery life is approaching, please replace with new battery!(id7420) | battery cycle is XX, please change the battery | Replace the battery |
| None | Battery I2C error, Shutdown State | Check the battery connection to confirm the malfunction module with I2C. Or replace the battery. |
| None | Battery Hot Plug, Shutdown State | Stop the illegal operation. |

11.3.2 The Voltage of System Power Alarm

| Alarming tips | LOG record | Measure |
|---|--|--|
| Real time clock battery life is approaching, please replace with new battery!(id8577) | *** System Monitor: Power supply alert! [VBAT], Current voltage: [VVV] V, Limit voltage:[LLL]~[HHH]V | The VBAT voltage is too low, replace the button battery. |
| none | <p>*** System Monitor: Power supply alert! [XXX], Current voltage: [VVV] V, Limit voltage: [LLL]-[HHH] V.</p> <p>[XXX] represents voltage name, [VVV] represents the current value, and [LLL]-[HHH] represents the lower and upper limits.</p> <p>The voltage names respectively are:</p> <p>AD+12V、A-12V、A-5V、AD+2V5、AD+1V8、D+1V5、D+1V2</p> | DC-DC power board or else power loads malfunction |

11.3.3 Temperature Alarm

| Alarming tips | LOG record | Measure |
|---|---|--|
| Main board temperature alert(id2614), Shut down XX (XX means inversion timing, starting from 60S) | <p>*** System Monitor: Temperature Alert! [XXX], Current temperature: [VVV] °C, Limit temperature: [LLL]-[HHH] °C.</p> <p>[XXX] refers to the temperature name, [VVV] refers to the current value, [LLL]~ [HHH] refers to the upper and lower limits.</p> <p>Temperature names are: ADC thermal sensor, Multi FPGA thermal sensor</p> | Check the fan log D: \DCN3\Log \Perilog (if the fan stops working)/check if the heating condition is normal. |
| None | <p>***: System Monitor: Temperature Alert! [CPU thermal sensor] , Current temperature: [VVV] degree, Limit temperature: [LLL] degree</p> <p>[VVV] refers to the current value.[LLL]refers to the first level limit.</p> | <p>CPU over-temperature (level 1)</p> <p>The measure is the same as above</p> |
| CPU temperature alert (id1218) Shut down XX (XX means inversion timing, starting from 60S) | <p>***: System Monitor: Temperature Alert! [CPU thermal sensor] , Current temperature: [VVV] degree, Limit temperature: 100 degree</p> <p>[VVV] refers to the current value.[LLL]refers to the second level limit.</p> | <p>CPU over-temperature (level 2)</p> <p>The measure is the same as above</p> |
| Power board temperature | *** System Monitor: Temperature Alert! [Power thermal sensor], Current temperature: [VVV] °C, Limit | Check the fan log D: \DCN3\Log |

| | | |
|---|--|---|
| alert(id3125), Shut down XX (XX means inversion timing, starting from 60S) | temperature: [LLL]-[HHH] °C. [VVV] refers to the current value, [LLL]~ [HHH] refers to the upper and lower limits. | \Perilog(if the fan stops working)/check if the heating condition is normal. |
|---|--|---|

11.3.4 Fan Alarm

| Alarming tips | LOG record | Measure |
|--|---|---|
| Ventilator requires maintenance, please contact to the service engineer! (id7340) | <p>*** System Monitor: Fan alert! [XXX], Current speed : [VVV] rpm, Limit speed: [LLL] rpm</p> <p>[XXX] refers to the fan name, [VVV] refers to the current value, [LLL] refers to the limit value.</p> <p>Fan names are:</p> <p>Top Fan 0,1,2,3 (refers to outlet fans)</p> <p>Bottom Fan 0,3(refers to inlet fans)</p> <p>Fan locations are shown as follows:</p> | Replace the fan/connect the cable again/remove the malfunction |

11.3.5 PHV Alarm

| Alarming tips | LOG record | Measure |
|--|--|---|
| None | <p>*** +100V Power supply voltage error, the voltage is [LLL]V ,normal region is 95.000V to 105.000V</p> <p>[LLL] refers to the voltage</p> | <p>a) Turn off the system and replace the probe to confirm if the probe is normal;</p> <p>b) If the probe is normal, try to replace the probe board.</p> <p>c) Replace the DC-DC board.</p> |
| | <p>*** -100V Power supply voltage error, the voltage is [LLL]V ,normal region is -95.000V to -105.000V</p> <p>[LLL] refers to the voltage</p> | |
| Alarm! High-voltage transmission is abnormal, and images can't display normally!(id7379) | <p>*** [XXX] supply voltage error, [XXX] is [LLL] V (upper limit is 80.000V</p> <p>[XXX] refers to the high-voltage name, they are: PHV0, PHV1 (PHV0 is +PHV, PHV1 is -PHV) [LLL] refers to the current value.</p> | Try to replace the probe. |

| | | |
|--|---|---|
| <p>Alarm!</p> <p>High-voltage transmission is abnormal, and images can't display normally!(id7379)</p> | <p>+PHV 为 0:</p> <p>***UBatteryPortMonitor::PhvWarn:PHVprotect,PHV1P:[LLL]V,PHV1N:[LLL]V</p> <p>-PHV 为 0:</p> <p>***UBatteryPortMonitor:PhvWarn:PHVprotect,PHV1P:[LLL]V,PHV1N:[LLL]V。</p> | <ol style="list-style-type: none"> 1. Turn off the system and cut the AC power, then restart the system to confirm if the system can recover; 2. The system can't recover: a).If -PHV-OCP appears, replace the TR board. b). If -PHV-OCP doesn't appear, replace the DC-DC board. |
| | | <p>If it still does not recover after restarting the machine, replace the DC-DC board.</p> |
| / | <p>*** PHV over current protect!</p> <p>***</p> <p>UBatteryPortMonitor::PhvWarn:PHVprotect,PHV1P:[LLL]V,PHV1N:[LLL]V</p> | -PHV-OCP: over current protect. |
| / | <p>*** PHV over voltage protect!</p> <p>*** UBatteryPortMonitor::PhvWarn: PHV protect,PHV1P:[LLL]V,PHV1N:[LLL]V</p> | PHV-OVP: over voltage protect |

11.3.6 Gel Warmer Alarm

| Alarm tips | Potential Causes | Recommended Action |
|---|--|--|
| Green indicator is off | Damage of internal component or abnormality in microcontroller program. | Unplug and reconnect the power cord to observe if the green light is on; if not, change a new gel warmer. |
| The status indicator blinks in orange in a frequency of 0.5Hz. | The gel warmer is not able to heat due to the damage of internal components. | Unplug and reconnect the power cord to observe if the orange light blinks in frequency of 0.5Hz; if yes, change a new gel warmer. |
| The status indicator blinks in orange in a frequency of 2Hz. | Overheating protection due to damage of internal components. | Disconnect the power cord and wait about 10 minutes for the cooling of the gel warmer, reconnect the power cord, start to heat, wait about 10 minutes before the gel warmer becoming warm, and observe if the orange light blinks in frequency of 2 Hz; if yes, change a new gel warmer. |
| The status indicator lights in green, but the gel warmer is not warm at all | Failure in the internal electrical connection. | Disconnect and reconnect the power cord, start to heat, wait about 10 minutes and touch the gel warmer to see if it is warm; if not, replace a new gel warmer. |

11.3.7 Other Alarms

| Alarming tips | LOG record | Measure |
|--|---|---|
| "SystemConfiguration.ini" can't be opened, please check the HDD data!(id9256) | None | Reinstall the system software |
| ADT7462 initialization is abnormal!(id9094) | ***System Monitor: ADT7462 initialization error: | Reinstall the system software/check if the drive is normal/check if digital board is normal |

12 Care & Maintenance

12.1 Overview

These procedures in this chapter are recommended.

12.1.1 Tools, Measurement Devices and Consumables

Table 12-1 Tools and Measurement Devices

| Tool/Measurement Devices | Qty. | Remarks |
|----------------------------|-------|--------------------------------|
| Resin or plastic container | 1 pcs | Can accommodate two probes |
| Soft brush | 1 pcs | About a toothbrush size |
| Small plastic basin | 1 pcs | Used to fill the soapy water |
| Safety test analyzer | 1 pcs | Refer to appendix A |
| Inner hexagon wrench | 1pcs | Inner hexagon wrench 6 # |
| Solid wrench | 1pcs | With opening diameters of 36mm |
| Cross-headed screwdriver | 1pcs | 105 X100 |

Table 12-2 Consumable List

| Consumable | Qty. | Remarks |
|-----------------------------|---------------|---|
| Aluminum foil | About 1 meter | |
| Physiological saline | About 1000ml | Filling a half container Immerging the whole probe (referring to appendix A). (concentration 0.85 ~ 0.95%) |
| Mild soapy water | About 400ml | |
| Dry soft cloth/cotton cloth | About 5 pcs | |

12.1.2 Care and Maintenance Items

Table 12-3 Maintenance Items and Frequency

| NO. | Maintain content | Frequency | Method |
|-----|---|------------------------|-------------------------|
| 1. | Clean dust-proof covers | Once a month | Referring to12.2.1 |
| 2. | Clean monitor and touch screen | Once a month | Same as the above |
| 3. | Clean trackball | Once a month | Same as the above |
| 4. | Clean control panel / minor panel | Once a month | Same as the above |
| 5. | Clean probes (the head) | Every time after using | Same as the above |
| 6. | Clean probe cable and the surface of connector | Once a month | Same as the above |
| 7. | Clean holders (including probe holder and gel holder) | Once a month | Same as the above |
| 8. | Clean cover | Once a month | Same as the above |
| 9. | Clean peripherals | Once a month | Referring to12.2.2 |
| 10. | Check surface of probes | Once a day | Referring to12.3.1 |
| 11. | Check power cable , plug and circuit breaker | Once a month | Same as the above |
| 12. | Check battery | Once a year | Same as the above |
| 13. | Check function of peripherals and options | Once a year | Referring to12.3.3 |
| 14. | Mechanical safety inspection | Once a year | Referring to12.3.4 |
| 15. | Electrical safety inspection | Once per two years | Referring to appendix A |

12.2 Cleaning

12.2.1 Clean the System

12.2.1.1 Flow of Cleaning

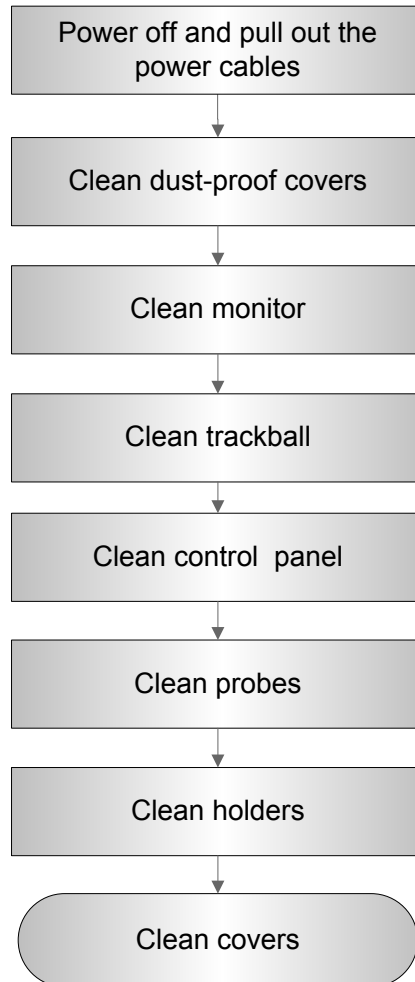


Fig 12-1 Cleaning maintenance flow

⚠WARNING: Before cleaning the system, be sure to turn off the power and disconnect the power cord from the outlet. If you clean the system while the power is “On”, it may result in electric shock.

12.2.1.2 Content

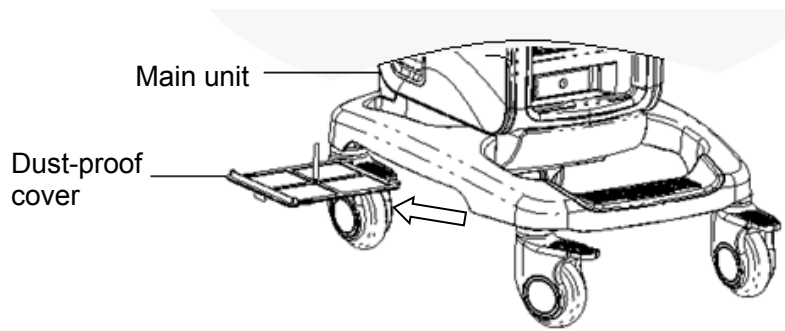
1. Clean dust-proof covers

- Tool: Soft brush

- Method:

- a) Disassemble dust-proof cover before cleaning.

System dust-proof cover: Grab the lower side of the dust net frame, and then pull out the net.



Probe port dust-proof cover: there is a probe port dust-proof cover at the front of the system, Pull it out.

- b) Cleaning: with soft brush and then wipe off the dust.
- c) Assemble dust-proof covers.

Input the dust-proof clasp into the slot of the main unit, push the dust-proof inward until the dust-proof clasp is blocked in the slot.

⚠CAUTION: Please clean all dust-proof covers of the system periodically (1 time per month); otherwise, system damage may result. Cleaning times can be increased when the system is used in the open air or somewhere dust is more.

2. Clean Monitor

- Tool: soft dry cloth ,clear water or soapy water
- Method:

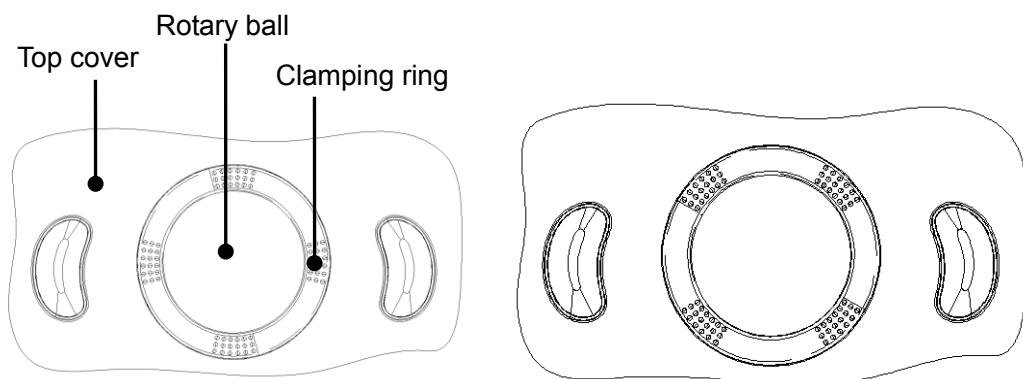
Surface of monitor and touch screen should be cleaned with soft dry cloth directly. Remained stain should be washed out by cloth with a little clear water or soapy water, and then air-dry the surface.

3. Cleaning the trackball

- Tools: paper, dry cloth, mild soapy water
- Method:

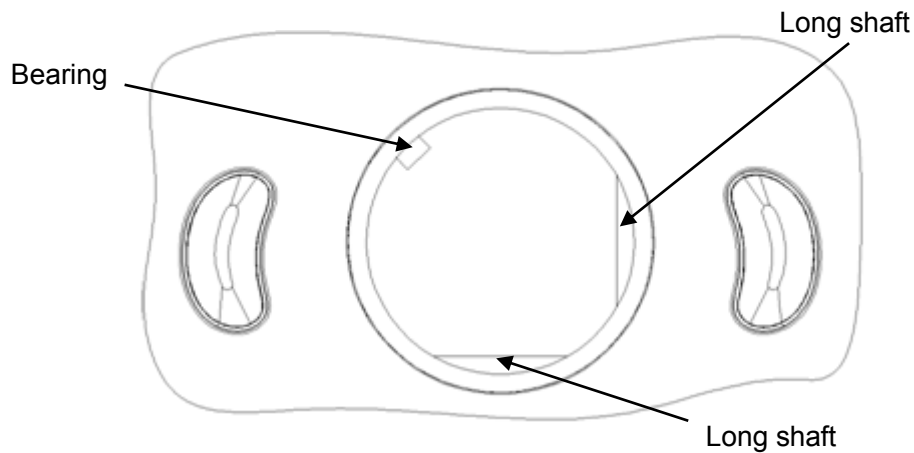
- a) Disassembling the trackball:

Press the bulges on the clamping ring using both hands and turn the ring about 35° clockwise until it lifts. Take out the ring and the rotary ball. Be careful not to drop the ball. See the figure below.



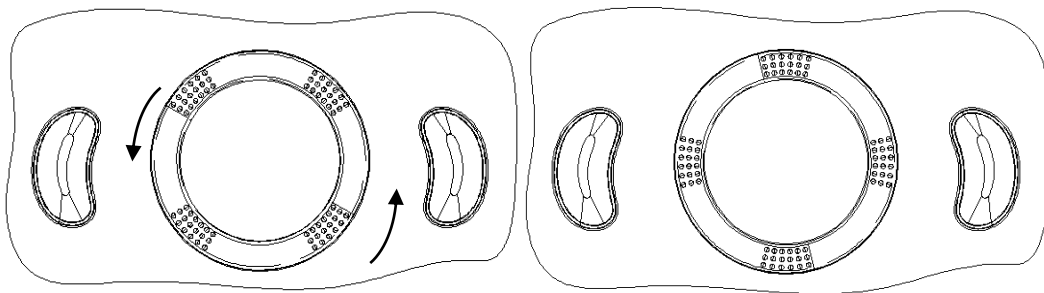
b) Cleaning

Clean the two long shafts, the bearing and the rotary ball with a clean soft dry cloth or paper.



c) Installing the trackball

Put the rotary ball back in the trackball mechanism and put the clamping ring back in. Turn the ring counterclockwise until the bulges are flush with the top cover and the ring clicks and locks, meaning the ring is secured. See the figure below.



4. Clean Control Panel

- Tools: dry soft cloth, soapy water
- Method:

Use dry soft cloth to clean the surface of control panel (including keystrokes, encoders and sliders). If the control panel is dirty, moisten the soft cloth with a little mild soapy water and wipe off any stains. Use another dry soft cloth to remove any moisture and allow all hard surfaces to completely air-dry. If it is difficult to clean the control panel, disassemble the encoder caps first and then use mild soapy water to clean it.

NOTE: The control panel should be cleaned periodically; otherwise, keys maybe blocked by dirt and buzzer dings, keys don't work.

5. Clean Probe

- Tools: mild soapy water , dry soft cloth, soft brush
- Method:

- a) Wipe out the dust attached to surface of probe head, connector and cable with dry soft cloth.

- b) Use soft brush to brush the dust inside probe connector gently.
- c) 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.

NOTE: Don't use cloth with water to clean the probe connector.

6. Clean Holders

- Tool: dry soft cloth , soapy water, soft brush
- Method:
 - a) Use dry soft cloth to wipe off the dust attached to inside, outside or gap of probe holder or gel holder. As to small intra-cavity probe holder or its gap, use the soft brush to brush the dust or stain.
 - b) Remained stain attached to inside, outside of holder should be washed out by cloth with a little soapy water after it was taken out, and then install the holder after air-dry.

7. Clean Cover

- Tools: dry soft cloth, soapy water
- Method:

Use dry soft cloth to clean the cover of the system. If the system is dirty, moisten the soft cloth with mild soapy water and wipe off any stains, then air-dry.

Note: Be sure to use soft brush to brush the dust attached to all the sockets or interfaces which can be seen (such as probe sockets, sockets or interfaces in IO panel and power supply panel),not the cloth with water.

12.2.2 Clean the Peripherals

Do the cleaning maintenance according to your actual peripheral configuration; items which are not configured can be skipped.

Table 12-4 Peripherals Cleaning List

| No. | Content | Description |
|-----|-----------------------------|---|
| 1. | 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 is necessary. |
| 2. | 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 is necessary. |
| 3. | Foot switch | 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. |
| 4. | Bar code scanner | First use soft dry cloth to wipe off dust attached to glass panel of scanner, then the dust or strain attached to cable and bracket. Be sure to do the especial cleaning maintenance according to the operation manual if is necessary. |

12.3 Checking

12.3.1 General check

Table 12-5 General check list

| No. | Content | Method |
|-----|-----------------------------|---|
| 1. | Probe | a) Visually check to confirm that there is no crack and expansion to probe head. b) Visually check to confirm that there is no deterioration or desquamation to probe cable. Visually check to confirm that there is no bend, destroyed or falling off pins to the connector |
| 2. | Power supply cable and plug | a) Visually check to confirm that there is no wrinkles, crack or deterioration b) Manually check to confirm that there is no looseness or rupture to cable. The connection of plug is reliable and the retaining clamp of power supply cable is effective. |
| 3. | Battery | Check the battery periodically : a) Check if battery can be charged normally when power-on: That the current capacity is 100% or capacity increases after a short time indicates that the battery can be charged normally. It takes less than 2 minutes to increase 1% capacity when the total capacity is less than 90% and it takes more time when the capacity is more than 90%. b) Disconnect the system from the AC power supply to confirm if the system can maintain normal work status in the battery power supply. |

12.3.2 System Function Check

The system function checking is not required during Preventive Maintenance. Engineer or Customer may use it as part of their product Quality Assurance Program tests.

Table 12-6 System function list

| No. | Content | Method |
|-----|----------------------|---|
| 1. | B mode | Verify basic operation of B mode. Check basic software and hardware controls affecting B mode operations. |
| 2. | Color mode | Verify basic operation of Color mode. Check basic software and hardware controls affecting Color mode operations. |
| 3. | Doppler mode (PW/CW) | Verify basic operation of Doppler mode. Check basic software and hardware controls affecting Doppler mode operations. |
| 4. | M mode | Verify basic operation of M mode. Check basic software and hardware controls affecting M mode operations. |

| No. | Content | Method |
|--|---|--|
| 5. | Measurement (2D, M, Doppler general measurement, optional applied measurement) | Scanning gray scale imaging on phantom, verify distance and area accuracy with measurement control. Verify measurement accuracy by performance test. |
| 6. | Keyboard test | Operate keyboard test to verify if all control keys can work normally. |
| 7. | LCD | Verify LCD display function and parameters adjustment. Refer to that of LCD checking. |
| 8. | Software menu check | Verify software menu display function: if each operation menu and page can be accessed. |
| Remark: Please refer to 5.4~5.5 for details. | | |

12.3.3 Peripherals and Options Check

If the system is not configured with any module or peripheral, the corresponding items checking can be skipped.

Table 12-7 Options, Peripherals and Accessories Check list

| No. | Content | Method |
|--|-----------------------------|--|
| 1. | Color and B/W video printer | Check if the output of video printer is normal. |
| 2. | Graph / text printer | Check if the output of graph / text printer is normal. |
| 3. | Foot switch | Check if the foot switch can implement the set functions according to the program. |
| 4. | DVD-R/W | Check if DVD can work normally (write, read and pop). |
| 5. | Bar code scanner | Check if the scanner can work normally and the output content is right. |
| 6. | DICOM | Check if DICOM can work normally and send pictures and other data to DICOM server. |
| 7. | ECG module | Check basic operations and verify the implementation of ECG functions. |
| Remark: Please refer to 5.3 for details. | | |

12.3.4 Mechanical Safety Inspection

Mechanical safety inspection is mainly used to check mechanical strength and mechanical function of the key assembly of ultrasonic system. The mode of test evaluation mainly is: Perform the evaluation by means of visual check and operating check, if the check result cannot pass, the system is in abnormal status now. Stop using the system and adopt proper measures. The test flow is as following:

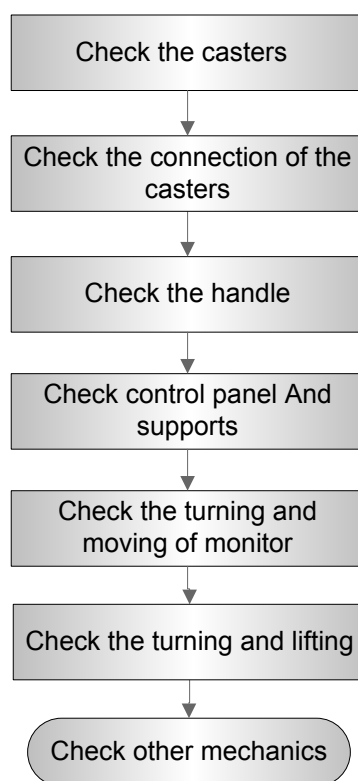


Fig 12-4 Mechanical Safety Inspection Flow

Table 12-8 Mechanical Safety Check

| NO. | Item | Method | Tool |
|-----|------------------------------------|---|--------------|
| 1. | Caster | 1. Visually check to confirm there is no any crack. 2. Operate the casters to confirm the locking and releasing functions are normal. | none |
| 2. | Connection of the caster | a) Visually check to confirm that there is no skewness and the connecting studs are free of breakage or falling off. b) Check with the wrench to make sure that there is no looseness between the caster and the base connection stud. | Solid wrench |
| 3. | Handle | 1. Visually check to confirm there is no any crack. 2. Hold the handle to push the ultrasound machine, and then pull it gently to confirm that the handle is free of looseness. | none |
| 4. | Control panel and support assembly | Check by hand to confirm that the support assembly is normal and the control panel is free of skewness and looseness. | none |
| 5. | Fixing and rotating | a) Visually check to confirm if any inclination happened to the monitor. | none |

| NO. | Item | Method | Tool |
|-----|-------------------------------|---|---|
| | mechanism of the monitor | b) Manually operate the monitor to make sure the monitor can be rotated around its central pivot point or tilted for the optimum viewing angle normally, no abnormal sound exists. | none |
| | | c) Remove the rear cover of the control panel and neck cover of the monitor, check by a wrench to confirm that the fixing screw are free of looseness; Visually check to confirm that the cables are not scratched or clipped out that the core can be seen. | Cross-headed screwdriver, inner hexagonal wrench 6# |
| 6. | Turning and lifting mechanism | <ol style="list-style-type: none"> 1. Hold the height adjusting handle under the control panel to move it to the end of the adjustable height , make sure that control panel can go up and down normally without abnormal sounds or phenomena 2. Hold the height adjusting handle to move it to the middle of the adjustable height, make sure that the control panel can turn smoothly without abnormal sounds or phenomena. | none |
| 7. | Other mechanics | Check to confirm that there is no looseness to other mechanical parts, no crack to cover and no conductive parts show in sight. | none |

12.3.5 Electrical Safety Inspection

Only technical professionals or engineers after training can perform electric safety inspection.
Please refer to appendix A: Electrical Safety Inspection for details.


13 Troubleshooting of Regular Malfunctions

13.1 Troubleshooting When System Can't Be Powered on

13.1.1 Module or Board Related

| No. | Descriptions | Remarks |
|-----|--|---------|
| 1 | Battery Li-ion 14.8V 6600mAh LI34I002A | |
| 2 | AC-DC board | |
| 3 | DC-DC board assembly | |
| 4 | CPU module | |

13.1.2 Key Points Supporting Troubleshooting

| No. | Key Points Supporting Troubleshooting | Remarks |
|-----|---------------------------------------|---|
| 1 | AC power indicator | Located on control panel ~ |
| 2 | Power-on status indicator | Backlight of the power button  |
| 3 | Three Power indicators | 12V, 5V, 3.3V, located on IO board |

13.1.3 Troubleshooting When System Can't Be Powered on

| No. | Fault Description | Cause Analysis | Measure |
|-----|--|---|---------------------|
| 1 | Fail to start up when powered by the battery only, but can start up normally by AC power supply. After the machine is powered on, battery alarm appears. | Internal battery fails; Related board or module of the other power system is in normal status | Replace the battery |
| 2 | No AC input, Fail to start up when powered by the battery; The power-on status indicator flash then turn off, battery indicator flash, succeeding in start up when AC input and battery can charge up normally | Battery is out of power | Charge up |

| | | | |
|---|--|-------------------|------------------------------|
| 3 | The AC input is normal ,AC power indicator remains off; Power indicators on IO board: off | AC-DC board fails | Replace AC-DC board |
| 4 | AC power indicator: ON; Power-on status indicator: off after power button pressed Power indicators on IO board: off | DC-DC board fails | Replace DC-DC board assembly |
| 5 | AC power indicator: ON; Power-on status indicator: blinks after power button pressed Power indicators on IO board: off | CPU module fails | Replace CPU module |
| 6 | AC power indicator: ON; Power-on status indicator: blinks and turns on after pressing power button Power indicator on IO board: 5V off or 3.3V off | DC-DC board fails | Replace DC-DC board assembly |

13.2 Troubleshooting When System cannot be started up

13.2.1 Module or Board Related

| No. | Descriptions | Remarks |
|-----|--------------|---------|
| 1 | CPU module | |
| 2 | HDD | |

13.2.2 Key Points Supporting Troubleshooting

| No. | Key Points Supporting Troubleshooting | Remarks |
|-----|---|---------|
| 1 | Character and progress status during the starting of the system | |
| 2 | Alarm and prompts during the starting of the system | |
| 3 | Backlight status of control panel during power on the control panel | |

13.2.3 Troubleshooting When System cannot be Started

| No. | Fault Description | Cause Analysis | Measure |
|-----|--|---|--------------------|
| 1 | Control panel backlight normal; LCD blank displaying “No signal”; | System powers on normally, enter BIOS self-checking but BIOS screen cannot display. | Replace CPU module |

| | | | |
|---|---|--|--|
| | no output when connecting external display with VGA interface | CPU module failure. | |
| 2 | BIOS start-up graphics is normally displayed, but it cannot be kept on | CPU module failure | Replace CPU module |
| 3 | Enters BIOS start-up graphics. No LINUX start-up graphics displayed, With the system prompts for abnormality (e.g. Installer can't find files, please check it and try again) | Cannot find operating system, the HDD or OS in HDD may be damaged. | First restore LINUX and Doppler, or else replace the hard disk. |
| 4 | LINUX start-up graphics displays; Graphics disappears to blank screen and system makes no response to control panel input. | Fail to load the operating system, the HDD or OS in HDD may be damaged. | First restore LINUX and Doppler, or else replace the hard disk. |
| 5 | LINUX start-up graphics displays; Blank screen with a cursor, can response to control panel input | Fail to load the Doppler software, the HDD or OS in HDD may be damaged. | First restore Doppler, or else replace the hard disk. |
| 6 | Doppler software start-up graphics displays but cannot continue | Fail to load the Doppler software, the HDD or Doppler software in HDD may be damaged. | First restore Doppler, or else replace the hard disk. |
| 7 | After being turned on or during in use, the monitor displays "GRUB loading please wait....." | The input device cannot be detected. Maybe the control panel defects or bad connection between the control panel and the host. | Confirm if the connection between control panel and the host is OK or replace the control panel. |

13.3 Troubleshooting for Image Displaying

13.3.1 Module or Board Related

| No. | Descriptions | Remarks |
|-----|---------------------------------------|---|
| 1 | DC-DC board assembly | |
| 2 | Transmitting and receiving board PCBA | Transmitting and receiving physical channel are 64. |

| | | |
|---|----------------------|--|
| 3 | Probe board assembly | |
|---|----------------------|--|

13.3.2 Key Points Supporting Troubleshooting

| No. | Key Points Supporting Troubleshooting | Remarks |
|-----|--|---|
| 1 | Image features, including dark strips and noise | The following table shows the image features and the related description. |
| 2 | Image features when contact occurs between different types of probe connect to the same probe sockets. | |
| 3 | Imaging features when probe connect to different probe socket. | Maybe some probe switching relays are damaged. |

13.3.3 Troubleshooting for Image Displaying

| No. | Failure Description | Cause Analysis | Measure |
|-----|--|--|---|
| 1 | No image echo in the ultrasonic image region, but probe can be recognized. (PHV_OP indicator is on). | PHV over current protects; Malfunction on the transmitting and receiving board, DC-DC board or probe board. | Malfunction probability on the transmitting and receiving board is bigger than that of DC-DC board PCBA. The third is probe board. Replace the related board to confirm the malfunction. (If the system cannot restore after being broken off the power and turned on, the malfunction is on TR board.) |
| 2 | Dark strips on B image | Probe malfunction, e.g. array damage. Confirm it by connecting another probe. | Replace the transducer. |
| | | If several similar dark strips appear in the image. | Replace the transmitting and receiving board |
| | | If dark strips appear, also after replacing the probe socket, dark strips disappear or change the place. | Replace the probe board assembly. |
| 3 | Noise on the B image | Probe malfunction, e.g. array damaged, lens with air bubbles or cable shielding damaged etc. Confirm it by connecting another probe. | Replace the probe. |
| | | Other electrical equipments working in the same electrical network may cause interference to the system. e.g. Some ripple wave on the image. | Confirm the cause of failure by turning off all electrical equipments around working in the electrical network or connecting to the system. E.g. charger of electric bicycle, charger of MP3, timing switch of |

| | | | |
|--|--|--|--|
| | | | fan, elevator, ultrasound work station, TV set. Etc. |
|--|--|--|--|

13.4 Probe Socket System Related Malfunction Troubleshooting

13.4.1 Module or Board Related

| No. | Descriptions | Remarks |
|-----|----------------------|---------|
| 1 | Probe board assembly | |
| 2 | 4D&TEE board | |

13.4.2 Key Points Supporting Troubleshooting

| No. | Key Points Supporting Troubleshooting | Remarks |
|-----|--|---------|
| 1 | Probe recognition of all models of probes when connecting on the same or different ports | |
| 2 | Probe board ID of the system information | |

13.4.3 Probe Socket System Related Malfunction Troubleshooting

| No. | Failure Description | Cause Analysis | Measure |
|-----|---------------------------|--|-----------------------------------|
| 1 | Probe can't be recognized | This probe can't be recognized when connected to all probe sockets, while reorganization of other probes is normal. Probe malfunction. | Replace the transducer. |
| | | This probe can't be recognized when connected to a certain socket. Probe board malfunction. | Replace the probe board assembly. |
| | | No probe can be recognized on any probe port; Probe board ID can't be read correctly by the system information; Probe board malfunction. | Replace probe board assembly. |

13.5 IO System Related Malfunction Troubleshooting

13.5.1 Module or Board Related

| No. | Descriptions | Remarks |
|-----|------------------------|---------|
| 1 | Digital board assembly | |
| 2 | CPU module | |
| 3 | IO board | |

13.5.2 Key Points Supporting Troubleshooting

| No. | Key Points Supporting Troubleshooting | Remarks |
|-----|---|---|
| 1 | Working condition of control panel | Confirm if main USB device is functional since the control panel is connected by internal USB cable |
| 2 | Working condition of each USB port and USB device | Refer to USB Fig 13-1 Distribution diagram of USB ports |
| 3 | Working condition of Video, S-video and VGA ports | |
| 4 | Printing condition of video printer | Check if output of connected video printer is normal |

13.5.3 IO System Related Malfunction Troubleshooting

| No. | Failure Description | Cause Analysis | Measure |
|-----|---|---|--|
| 1 | Monitor displays normally; No video printer output when press <Print> on control panel; Image printing can be performed by operating the printer directly | Remote printing control failure; As video print control signal is generated directly by the digital board, the malfunction may be caused by digital board or cable connection failure. | Check the cable connection, and if the cable is connected well, then replace the digital board assembly. |
| 2 | Monitor displays normally; No video printer output when press <Print> on control panel; Image printing can't be | The printer is OK, Video output malfunction, connect the printer to the other Video port, if neither of the two port works, then the malfunction may be on the digital board. | Replace the digital board assembly |

| | | | |
|---|---|--|---|
| | performed by operating the printer directly | If only Video port output on the IO board is abnormal, the malfunction is on the digital board. | Replace the digital board assembly |
| | | If video printer inside cannot work normally, but the VIDEO port on the IO board is normal. The malfunction may be the signal cable or port. | Replace the signal connecting cable. |
| 3 | No sound on the two speakers | Malfunction is on the digital board | Replace the digital board assembly |
| 4 | Only one speaker has no sound. | Malfunction on speaker | Replace the speaker |
| 5 | Microphone is abnormal. | If there is no something wrong with Microphone, the malfunction may be on digital board. | Replace digital board assembly. |
| 6 | USB device can't be recognized by USB port | Other USB port connected devices work normally. The two USB ports on the IO board can't be used, USB HUB malfunction on the IO board. | Replace IO board. |
| 7 | Network is disconnected or abnormal | First, check if it was caused by network or problem with setting , if no, malfunction on CPU module (at high rate) or IO board | Replace the IO board or CPU module to confirm the reason. |
| 8 | WIFI cannot be recognized. | Check the 3.3V indicator on the IO board, if it is darker than the indicators around or off, then the malfunction is on the digital board. | Replace the digital board assembly. |
| | | First, check if it was caused by network or problem with setting , if no, malfunction on the WIFI board or digital board | Replace the WIFI board or digital board assembly to confirm the reason. |

13.6 Control Panel Malfunction Troubleshooting

13.6.1 Module or Board Related

| No. | Descriptions | Remarks |
|-----|--------------------------------|---------|
| 1 | Top Cover Assembly of Keyboard | |
| 2 | Encoder Assembly | |
| 3 | Trackball | |
| 4 | TGC board | |

13.6.2 Key Points Supporting Troubleshooting

| No. | Key Points Supporting Troubleshooting | Remarks |
|-----|--|---|
| 1 | Backlight of control panel | To confirm if the control panel is powered normally |
| 2 | Key volume of the keys on control panel. | To confirm if the buzzer works normally. |
| 3 | Function key operation response on the control panel | |
| 4 | Trackball operation response | |
| 5 | TGC slider bar operation response | It can be confirmed the malfunction is on the slider potential device or on the control panel PCBA. |
| 6 | Encoder operation response | It can be confirmed the malfunction is on encoder or on the control panel PCBA. |

13.6.3 Control Panel Malfunction Troubleshooting

| No. | Failure Description | Cause Analysis | Measure |
|-----|---|---|--|
| 1 | Buzzer alarms | Key blocked | Check the control panel for key block |
| 2 | Part of the keys can't be used normally | Malfunction may be on control panel or Silicon key | Confirm there is no key block first, then replace the top cover assembly of keyboard |
| 3 | Trackball can't be used normally | Dust or foreign object blockage in the groove. | Remove the trackball and clean the groove. |
| | | Trackball speed and response time in the system preset are not correct. | Set the trackball speed and response time to a proper value. |
| | | Trackball performance degraded. | Replace the trackball. |
| 4 | All keys of control panel are normal, Single encoder is failure. | Encoder malfunction | Replace encoder assembly |
| 5 | All keys of control panel are normal, Single slider of TGC is failure. | TGC board malfunction | Replace TGC board |
| | All sliders of TGC are failure. | Control panel malfunction | Replace top cover assembly of keyboard |

13.7 LCD and Display Malfunction Troubleshooting

13.7.1 Module or Board Related

| No. | Descriptions | Remarks |
|-----|------------------------|---------|
| 1 | Monitor assembly | |
| 2 | Digital board assembly | |
| 3 | CPU module | |
| 4 | IO board | |

13.7.2 Key Points Supporting Troubleshooting

| No. | Key Points Supporting Troubleshooting | Remarks |
|-----|--|---|
| 1 | Display assembly status indicator | Located at the lower right corner of the display. |
| 2 | Backlight of the display | The effect is evident in a darker environment. |
| 3 | Video output port such as VGA, DVI on the IO board | Need to connect with a display. |
| 4 | The display displaying status | Blank screen, or the screen warns "No Signal", or snowflakes are displayed on the screen. |
| 5 | 10.4 inch touch screen assembly displaying status | Blank screen, or the screen warns "No Signal", or snowflakes are displayed on the screen. |

13.7.3 Display Related Troubleshooting

| No. | Failure Description | Cause Analysis | Measure |
|-----|--|--|---|
| 1 | Control panel can be powered normally; Blank screen; Display indicator flashes in yellow. Displays normally with external LCD connecting by VGA port on IO board. | Monitor malfunction | Replace monitor assembly. |
| 2 | Control panel can be powered normally; The color of some mode key turns on orange. Blank screen; Display indicator is off. | May be the power line connection of display is not good. Or monitor malfunction | Check the connection or replace monitor assembly. |

| | | | |
|---|--|--|--|
| 3 | Control panel can be powered normally; The color of some mode key turns on orange. Warns “No Signal”; Display indicator is yellow. | The signal cable of monitor is not connected well. | Check the connection. |
| 4 | Control panel can be powered normally and no key indicator turns on orange. Warns “No Signal”; PC LCDS indicator on IO panel is off. Display indicator is yellow. | No signal input, the malfunction may be on CPU module. | Replace CPU module to confirm the malfunction. |

13.8 ECG Module Related Troubleshooting

13.8.1 Module or Board Related

| No. | Descriptions | Remarks |
|-----|------------------------|---------|
| 1 | ECG board | |
| 2 | Digital board assembly | |


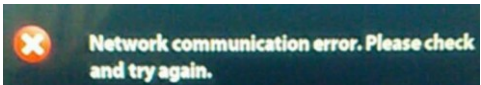
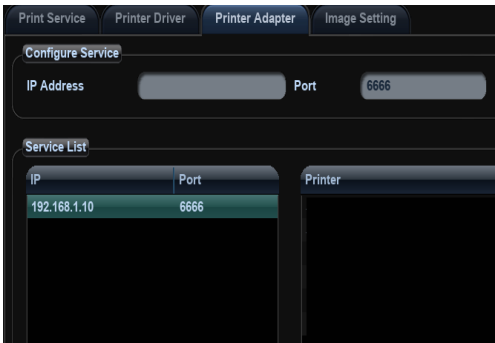
13.8.2 Key Points Supporting Troubleshooting

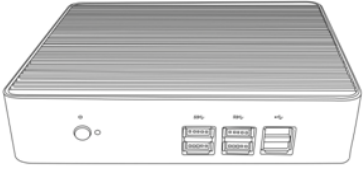
| No. | Key Points Supporting Troubleshooting | Remarks |
|-----|---------------------------------------|---------|
| 1 | ECG waveform characteristic | |

13.8.3 ECG module Related Troubleshooting

| No. | Failure Description | Cause Analysis | Measure |
|-----|---|---|--|
| 1 | ECG related function can't be opened. | ECG function can't be opened, this means ECG port serial port communication is abnormal. The malfunction may be on the ECG cable, or on the ECG module, or on the Digital board ECG serial port related circuit. Generally speaking, ECG module malfunction possibility is big. | Check the ECG cable and Replace ECG module or Digital board assembly to find the reason. |
| 2 | Open the corresponding function, and the waveform is displayed as a line or the waveform is abnormal. | ECG leads are abnormal or ECG module is abnormal. | Replace ECG leads or ECG module to find the reason. |

13.9 Printer Adapter Related Troubleshooting

| Failure Description | Cause Analysis | Measure |
|--|--|---|
| <p>The following icon is displayed at the bottom right corner of the ultrasound system.</p>  | <p>The ultrasound system and the printer adapter are not properly connected.</p> | <p>Connect the ultrasound system to the printer adapter again using Ethernet cables. Check whether the indicator on the printer adapter flashes normally after power-on, and whether the Ethernet cable is correctly connected.</p> |
| | <p>The printer adapter are not normally powered on.</p> | <p>Connect the auxiliary power cable and the power adapter again. Check whether the indicator of the printer adapter turns blue and the indicator of the power adapter turns green after power-on.</p> |
| <p>The following message is displayed, and the printing fails.</p>  | <p>The IP address of the ultrasound system is not correct.</p> | <p>Enter [Preset]->Network Preset] page to check whether the TCP/IP address is correctly set according the user manual.</p> |
| | <p>Errors occur when the printer adapter runs.</p> | <p>Disconnect and connect the power adapter, power on the printer adapter again, and verify whether the printing is normal after 1 minute.</p> |
| | <p>The printer adapter is not initialized.</p> | <p>After powering on the printer adapter, wait for at least 1 minute to ensure that the printer adapter is normally initialized.</p> |
| <p>The printer list fails to be displayed in the [Preset]->[Print Preset]->[Printer Adapter] page.</p>  | <p>Errors occur when the printer adapter runs.</p> | <p>Disconnect and connect the power adapter, power on the printer adapter again, and verify whether the printing is normal after 1 minute.</p> |
| | <p>The text/graph or video printers are incorrectly connected and abnormally powered on.</p> | <p>Ensure that the printers are correctly connected to the printer adapter, and they are normally powered on.</p> |

| | | |
|---|--|--|
| <p>The indicator on the printer adapter turns orange, and the printing fails.</p>  | <p>Errors occur when the printer adapter runs.</p> | <p>Disconnect and connect the power adapter, power on the printer adapter again, and verify whether the printing is normal after 1 minute.</p> |
|---|--|--|

Appendix A Electrical Safety

Inspection

The following electrical safety tests are recommended as part of a comprehensive preventive maintenance program. They are a proven means of detecting abnormalities that, if undetected, could prove dangerous to either the patient or the operator. Additional tests may be required according to local regulations.

All tests can be performed using commercially available safety analyzer test equipment. These procedures assume the use of a 601PRO_{XL} International Safety Analyzer or equivalent safety analyzer. Other popular testers complying with IEC 60601-1 used in Europe such as Fluke, Metron, or Gerb may require modifications to the procedure. Follow the instructions of the analyzer manufacturer.

The consistent use of a safety analyzer as a routine step in closing a repair or upgrade is emphasized as a mandatory step if an approved agency status is to be maintained. The safety analyzer also proves to be an excellent troubleshooting tool to detect abnormalities of line voltage and grounding, as well as total current loads.

ELECTRICAL SAFETY INSPECTION

1- Power Cord Plug

TEST PROCEDURE

◆ The Power Plug

| | |
|---------------------|--|
| The Power Plug Pins | No broken or bent pin. 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 for device in use. |
| The Power Plug | No loose connections. |

◆ The Power Cord

| | |
|----------------|---|
| The Power Cord | <p>No physical damage to the cord. No deterioration to the cord.</p> <p>--For devices with detachable power cords, inspect the connection at the device.</p> <p>--For devices with non-detachable power cords, inspect the strain relief at the device.</p> |
|----------------|---|

ELECTRICAL SAFETY INSPECTION

2- Device Enclosure And Accessories

TEST PROCEDURE

◆ Visual Inspection

| | |
|-------------------------------|--|
| 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 physical damage to probe head (e.g., crack) |
| | No loose or missing parts (e.g., knobs, dials, terminals, etc.). |

◆ Contextual Inspection

| | |
|-------------------------------|---|
| The Enclosure and Accessories | No unusual noises (e.g., a rattle 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. |

ELECTRICAL SAFETY INSPECTION

3- Device Labeling

TEST PROCEDURE

Check the labels provided by the manufacturer or the healthcare facility is present and legible.

- *Main Unit Label*
- *Integrated Warning Labels*
- *Slope and High Voltage Caution Label*
- *Don't Stress Label*

ELECTRICAL SAFETY INSPECTION

4- Protective Earth Resistance

VOERVIEW

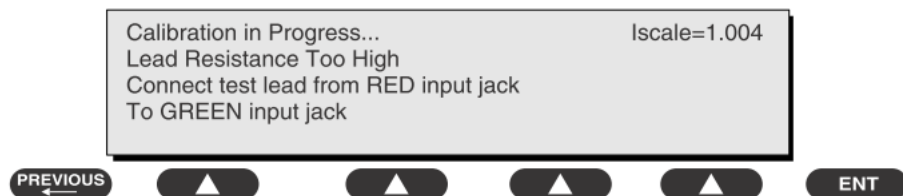
Protective Earth Resistance is measured using the RED test lead attached to the DUT Protective Earth terminal or Protective Earth Metal enclosure or equipotential terminal. Select the test current by pressing SOFT KEY 3 to toggle between 1AMP, 10AMP, and 25AMP. The front panel outlet power is turned off for this test.

The following conditions apply: L1 and L2 Open.

TEST PROCEDURE

◆ Prepare

- 1) First select the test current that will be used for performing the Protective Earth Resistance test by pressing AMPERES (SOFT KEY 3).
- 2) Connect the test lead(s) between the RED input jack and the GREEN input jack.
- 3) Press CAL LEADS. The 601PRO will measure the lead resistance, and if less than 0.150 Ohms, it will store the reading and subtract it from all earth resistance readings taken at the calibrated current.



- 4) If the calibration fails, the previously stored readings will be used until a passing calibration has occurred.

◆ Warning

During Earth Resistance testing, the DUT must be plugged into the 601PRO front outlet. If the DUT fails Earth Resistance, discontinue tests and label the device defective.

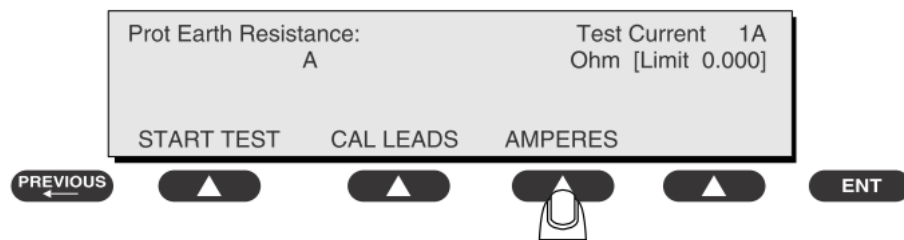
◆ Perform the Test

- 1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601PRO front panel outlet.

ELECTRICAL SAFETY INSPECTION

4- Protective Earth Resistance

- 2) Attach the 601PRO RED input lead to the device's Protective Earth terminal or an exposed metal area.
- 3) Press shortcut key 3. The Protective Earth Resistance test is displayed.
- 4) Press SOFT KEY 3 to select a test current (1AMP, 10AMP, or 25AMP). The selected test current is displayed in the upper right corner of the display.



- 5) Press START TEST to start the test. The test current is applied while resistance and current readings are taken. This takes approximately 5 seconds.
- 6) Press the print data key at any time to generate a printout of the latest measurement(s).

◆ NOTE

When "Over" is displayed for Ohms, this signifies that a valid measurement was not obtained because either an open connection was detected or that the measurement was not within range. Readings greater than 9.999 Ohms will be displayed as Over.

◆ Failure

Once it reaches the limitation, stop using equipment. Check the protective earth connection between Protective Earth terminal and Protective Earth Metal enclosure and equipotential terminal; Retest and inform the Customer Service Engineer for analysis and disposal if still fail.

LIMITS

ALL COUNTRIES R = 0.2Ω Maximum

ELECTRICAL SAFETY INSPECTION

5- Earth Leakage Test

OVERVIEW

Run an Earth Leakage test on the device being tested before performing any other leakage tests.

Leakage current is measured the following ways:

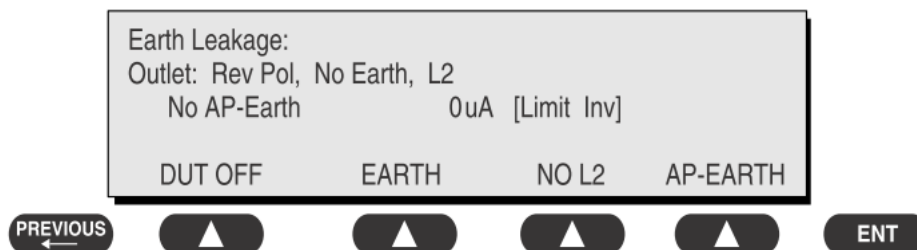
- ◆ Earth Leakage Current, leakage current measured through DUT outlet Earth
- ◆ Earth Leakage Current AP-EARTH (ALL Applied Parts connected to Earth), leakage current measured through DUT outlet Earth

There is no need to attach a test lead; the 601PRO automatically connects the measuring device internally.

TEST PROCEDURE

◆ Perform the Test

- 1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601PRO front panel outlet, and turn on the device.
- 2) Attach the device's applied parts to the 601PRO applied part terminals if applicable.
- 3) Press shortcut key 4. The Earth Leakage test appears on the display, and the test begins immediately:



- SOFT KEY 1 toggles the DUT outlet Polarity from Normal to Off to Reverse.
 - SOFT KEY 2 toggles the DUT outlet from Earth to No Earth.
 - SOFT KEY 3 toggles the DUT outlet from L2 to No L2.
 - SOFT KEY 4 toggles the AP to Earth to No AP to Earth.
- 4) Press the print data key at any time to generate a printout of the latest measurement.

ELECTRICAL SAFETY INSPECTION

5- Earth Leakage Test

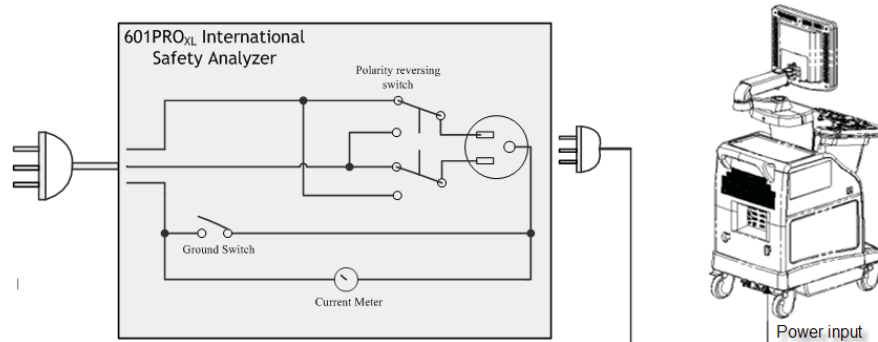


Figure 1 Earth leakage test

◆ Failure

Check any short-circuits of the Y capacitor on power unit. Replace a new one if any portion defective.

Check any broken of the Power Unit. Replace a new one if any portion defective.

Inspect mains wiring for bad crimps, poor connections, or damage.

Test the wall outlet; verify it is grounded and is free of other wiring abnormalities. Notify the user or owner to correct any deviations. As a work around, check the other outlets to see if they could be used instead.

Change another probe to confirm if the fail is caused by console.

Inspect mains wiring for bad crimps, poor connections, or damage.

If the leakage current measurement tests fail on a new unit and if situation cannot be corrected, submit a Safety Failure Report to document the system problem. Remove unit from operation.

If all else fails, stop using and inform the Customer Service Engineer for analysis and disposal.

LIMITS

| | |
|--------------|-------------------------------------|
| UL60601-1: | 300 μ A Normal Condition |
| | 1000 μ A Single Fault Condition |
| IEC60601-1:: | 500 μ A Normal Condition |
| | 1000 μ A Single Fault Condition |

ELECTRICAL SAFETY INSPECTION

6- Patient Leakage Current

OVERVIEW

Patient leakage currents are measured between a selected applied part and mains earth. All measurements may have either a true RMS or a DC-only response.

TEST PROCEDURE

◆ Prepare

Perform a calibration from the Mains on Applied Part menu.

The following outlet conditions apply when performing this test:

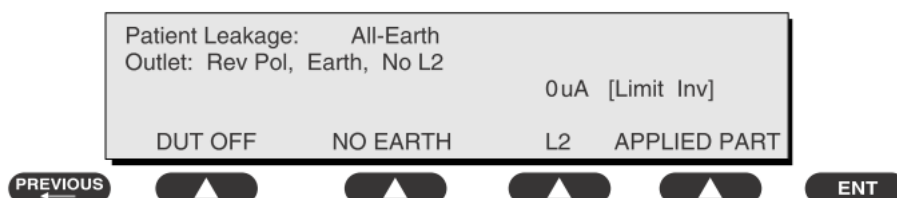
| | |
|--|---------------------------------------|
| Normal Polarity, Earth Open, Outlet ON | Normal Polarity, Outlet ON |
| Normal Polarity, L2 Open, Outlet ON | Reversed Polarity, Outlet ON |
| Reversed Polarity, Earth Open, Outlet ON | Reversed Polarity, L2 Open, Outlet ON |

◆ Warning

If all of the applied parts correspond to the instrument type, the applied parts will be tied together and one reading will be taken. If any of the applied parts differ from the instrument type, all applied parts will be tested individually, based on the type of applied part. This applies to Auto and Step modes only.

◆ Perform the Test

- 1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601PRO front panel outlet, and turn on the device.
- 2) Attach the applied parts to the 601PRO's applied part terminals.
- 3) Press shortcut key 6. The Patient Leakage test is displayed, and the test begins immediately.



- 4) Press APPLIED PART (SOFT KEY 4) at any time to select the desired applied part leakage current.

ELECTRICAL SAFETY INSPECTION

6- Patient Leakage Current

- 5) Modify the configuration of the front panel outlet by pressing the appropriate SOFT KEY on the 601PRO.
- 6) Press the print data key at any time to generate a printout of the latest measurement.

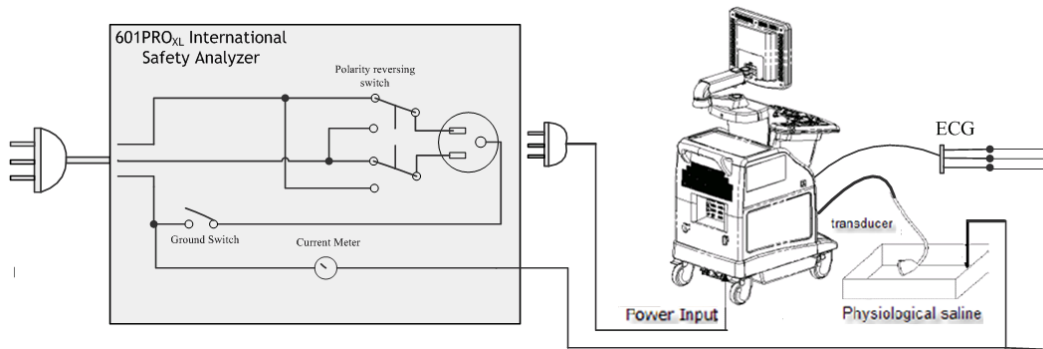


Figure 2 patient leakage Current

◆ NOTE

- 1, In addition to Probes ,Patient leakage current test should be perform if ECG or PCG parts used;
- 2, If the current test standard being used does not include Patient Leakage DC readings, or the DC option is not enabled, then DC readings will not be available through the APPLIED PART SOFT KEY selections. Refer to Chapter 8, Standards and Principles.

◆ Failure

- Check any broken of the Applied parts. Replace any defective one.
- Check any broken of the ECG/PCG module if used, Replace any defective one.
- Check any broken of the Power Unit. Replace a new one if any portion defective.
- Inspect wiring for bad crimps, poor connections, or damage.
- Test the wall outlet; verify it is grounded and is free of other wiring abnormalities. Notify the user or owner to correct any deviations. As a work around, check the other outlets to see if they could be used instead.
- Change another probe to confirm if the fail is caused by console.
- Inspect wiring for bad crimps, poor connections, or damage.
- If the leakage current measurement tests fail on a new unit and if situation can not be corrected, submit a Safety Failure Report to document the system problem. Remove unit from operation.
- If all else fails, stop using and inform the Customer Service Engineer for analysis and disposal.

LIMITS

ELECTRICAL SAFETY INSPECTION

6- Patient Leakage Current

All countries

For BF ECG input and transducer

100 μ A Normal Condition

500 μ A Single Fault Condition

ELECTRICAL SAFETY INSPECTION

7- Mains on Applied Part Leakage

OVERVIEW

The Mains on Applied Part test applies a test voltage, which is 110% of the mains voltage, through 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) to applied parts in the normal and reverse polarity conditions as indicated on the display.

The following outlet conditions apply when performing the Mains on Applied Part test.

Normal Polarity;

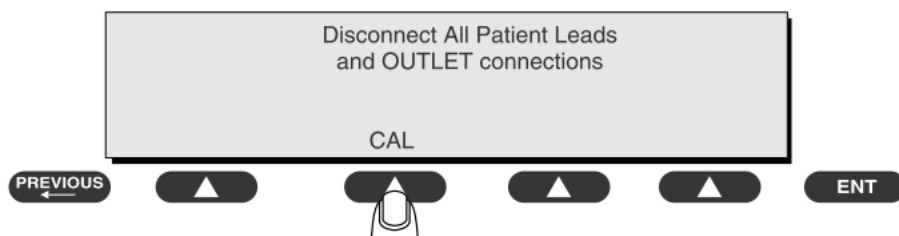
Reversed Polarity

TEST PROCEDURE

◆ Prepare

To perform a calibration from the Mains on Applied Part test, press CAL (SOFT KEY 2).

- 1) Disconnect ALL patient leads, test leads, and DUT outlet connections.
- 2) Press CAL to begin calibration, as shown:



If the calibration fails, the previously stored readings will be used until a passing calibration has occurred. Also, the esc/stop key has no effect during calibration.

- 3) When the calibration is finished, the Mains on Applied Part test will reappear.

◆ Warning

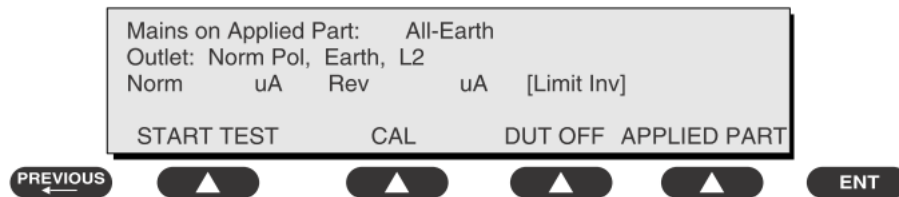
- 1) A 2-beep-per-second signal indicates high voltage present at the applied part terminals while a calibration is being performed.
- 2) High voltage is present at applied part terminals while measurements are being taken.

ELECTRICAL SAFETY INSPECTION

7- Mains on Applied Part Leakage

◆ Performance

- 1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601
- 2) Attach the applied parts to the 601PRO applied part terminals.
- 3) Attach the red terminal lead to a conductive part on the DUT enclosure.
- 4) Press shortcut key 7. The Mains on Applied Part test is displayed.



- 5) Select the desired outlet configuration and applied part to test using the appropriate SOFT KEYS:
- 6) Press START TEST (SOFT KEY 1) to begin the test.
- 7) Press the print data key to generate a printout of the latest measurement.

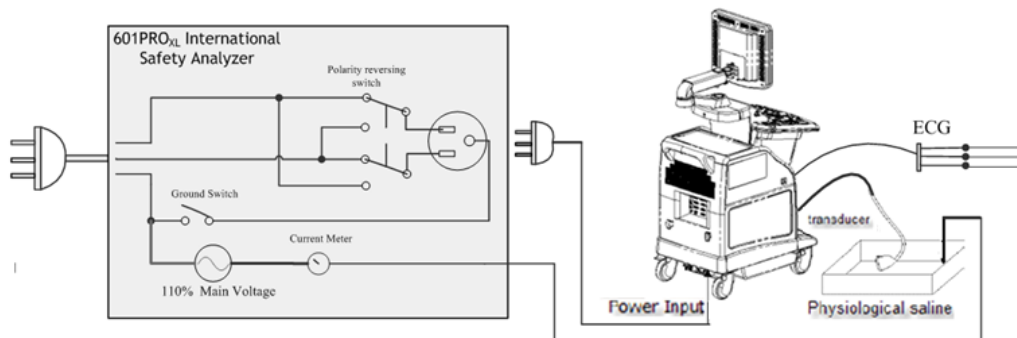


Figure 3 Mains on Applied part leakage

◆ NOTE

1, In addition to Probes ,Patient leakage current test should be perform if ECG or PCG parts used;

2, If all of the applied parts correspond to the instrument type, the applied parts will be tied together and one reading will be taken. If any of the applied parts differ from the instrument type, all applied parts will be tested individually, based on the type of applied part. This applies to Auto and Step modes only.

◆ Failure

Check any broken of the Applied part. Replace any defective one.

Check any broken of the ECG/PCG module if used, Replace any defective one.

ELECTRICAL SAFETY INSPECTION

7- Mains on Applied Part Leakage

Check any broken of the Power Unit. Replace a new one if any portion defective.

Inspect wiring for bad crimps, poor connections, or damage.

Test the wall outlet; verify it is grounded and is free of other wiring abnormalities. Notify the user or owner to correct any deviations. As a work around, check the other outlets to see if they could be used instead.

Change another probe to confirm if the fail is caused by console.

Inspect wiring for bad crimps, poor connections, or damage.

If the leakage current measurement tests fail on a new unit and if situation can not be corrected, submit a Safety Failure Report to document the system problem. Remove unit from operation.

If all else fails, stop using and inform the Customer Service Engineer for analysis and disposal.

LIMITS

All countries:

For BF ECG input and transducer:

5000 μ A

ELECTRICAL SAFETY INSPECTION

8- Patient Auxiliary Current

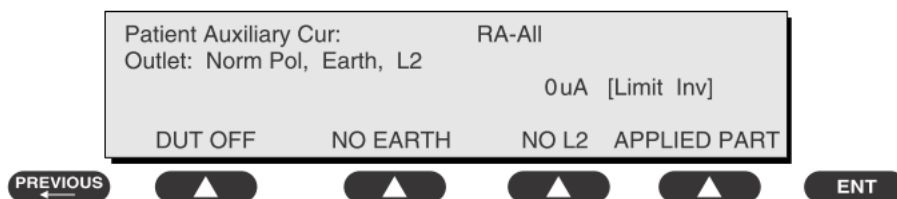
overview

Patient Auxiliary currents are measured between any selected ECG jack and the remaining selected ECG jacks. All measurements may have either a true RMS or a DC-only response.

TEST PROCEDURE

◆ Prepare

- 1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601PRO front panel outlet, and turn on the device.
- 2) Attach the patient leads to the 601PRO ECG jacks.
- 3) Define the Lead Types from the View Settings Option (refer to: Lead Type Definitions in Section 5 of this chapter).
- 4) Press shortcut key 8. The Patient Auxiliary Current test is displayed, and the test begins immediately. Display values are continuously updated until another test is selected.



- 5) Press SOFT KEYS 1-4 to select leakage tests
- 6) Press APPLIED PART (SOFT KEY 4) at any time to select the desired applied part leakage current:
- 7) Modify the configuration of the front panel outlet by pressing the appropriate SOFT KEY on the 601PRO:
- 8) Press the print data key at any time to generate a printout of the latest measurement.

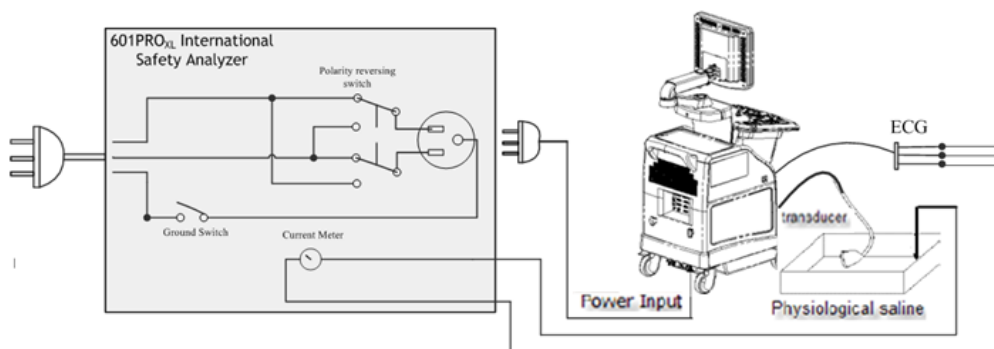


Figure 4 patient Auxiliary Current

ELECTRICAL SAFETY INSPECTION

8- Patient Auxiliary Current

◆ NOTE

If the current test standard being used does not include Patient Auxiliary Current DC readings, or the DC option is not enabled, then DC readings will not be available through the APPLIED PART SOFT KEY selections.

◆ Failure

Check any broken of the AC cable. Replace a new one if any portion defective.

Check any broken of the enclosure. Replace any defective part.

Inspect wiring for bad crimps, poor connections, or damage.

Test the wall outlet; verify it is grounded and is free of other wiring abnormalities. Notify the user or owner to correct any deviations. As a work around, check the other outlets to see if they could be used instead.

Change another probe to confirm if the fail is caused by console.

Inspect wiring for bad crimps, poor connections, or damage.

If the leakage current measurement tests fail on a new unit and if situation can not be corrected, submit a Safety Failure Report to document the system problem. Remove unit from operation.

If all else fails, stop using and inform the Customer Service Engineer for analysis and disposal.

LIMITS

All countries

For BF ECG input and transducer

100 μ A Normal Condition

500 μ A Single Fault Condition

ELECTRICAL SAFETY INSPECTION FORM

(Class I equipment)

Overall assessment:

- | | |
|---|-----------------------------------|
| <input type="checkbox"/> Scheduled inspection | Test item: 1, 2, 3 |
| <input type="checkbox"/> Unopened repair type | Test item: 1, 2, 3 |
| <input type="checkbox"/> Opened repair type, not modify the power part including transformer or patient circuit board | Test item: 1, 2, 3, 4, 5 |
| <input type="checkbox"/> Opened repair type, modify the power part including transformer or patient circuit board | Test item: 1, 2, 3, 4, 5, 6, 7, 8 |

| | | | | | |
|-----------------------------------|-----------------------------------|-----------------------------|-----------|-----------------------------|--|
| Location: | | | | Technician: | |
| Equipment: | | | | Control Number: | |
| Manufacturer: | | Model: | | SN: | |
| Measurement equipment /SN: | | | | Date of Calibration: | |
| INSPECTION AND TESTING | | | | Pass/Fail | Limit |
| 1 | Power Cord Plug | | | | |
| 2 | Device Enclosure and Accessories | | | | |
| 3 | Device Labeling | | | | |
| 4 | Protective Earth Resistance | | Ω | | Max 0.2 Ω |
| 5 | Earth Leakage | Normal condition(NC) | ____μA | | Max: NC: 300μA(refer to UL60601-1) * NC: 500μA(refer to IEC60601-1) * SFC: 1000μA |
| | | Single Fault condition(SFC) | ____μA | | |
| 6 | Patient Leakage Current | Normal condition(NC) | □BF____μA | | Max: BF applied part: NC:100μA, SFC: 500μA |
| | | Single Fault condition(SFC) | □BF____μA | | |
| 7 | Mains on Applied Part Leakage | | □BF____μA | | Max: BF applied part: 5000μA |
| 8 | Patient Auxiliary Leakage Current | Normal condition(NC) | □BF____μA | | Max: BF applied part: NC:100μA, SFC: 500μA |
| | | Single Fault condition(SFC) | □BF____μA | | |

NOTE:

The equipment which sell to America shall comply with the requirement of UL60601-1, others shall comply with the requirement of IEC60601-1.

Name/ Signature: _____

Date: _____

Appendix B Phantom Usage

Illustration

Targets Disposal of Phantom KS107BD

A1—A5: Axial resolution target group B: Blind-area target group

C: Longitudinal target group D: Horizontal target group

E: Mimic tumor F: Mimic sac (diam 10mm) and stone

G Mimic sac (diam 6mm)

4. Line Target System

There are 8 groups of nylon line targets disposed as shown in the figure.

1. A1—A5:

Axial and lateral resolution target group. The distances between the horizontal branch and the acoustic window are 30, 50, 70, 120 and 160mm, the center horizontal distances between two adjacent lines of A1 and A2 groups are 1, 5, 4, 3, 2mm, A3~A5 groups are 5, 4, 3, 2mm. The center longitudinal distances between two adjacent lines of the longitudinal branches are 4, 3, 2, 1mm.

2. B:

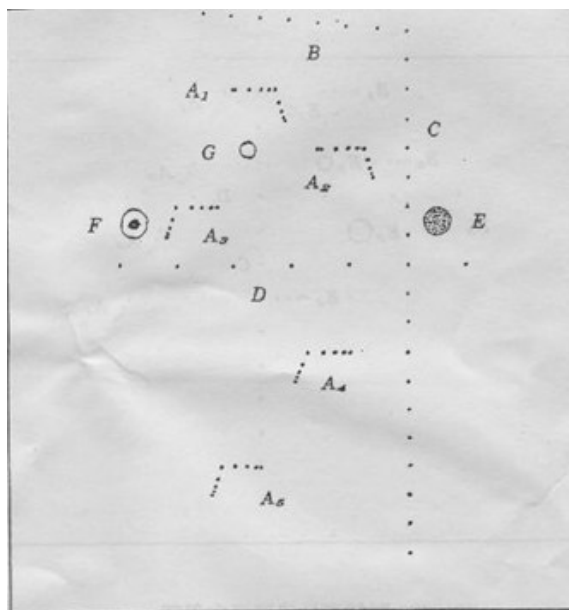
Blind-area target group. Center horizontal distance of adjacent lines is 10mm, distances to the acoustic window are 10, 9, 8, 7, 6, 5, 4, 3mm.

3. C:

Longitudinal target group. 19 target lines with a 10mm center distance between adjacent lines.

4. D:

Horizontal target group. 7 target lines with a 20mm center distance between adjacent lines.



Targets disposal- KS107BD

- A1——A4 Axial resolution target group
- B1——B4 Lateral resolution target group
- C Longitudinal target group
- D Horizontal target group
- E1——E3 Mimic sacs with diameters of 2, 4, 6mm

4. Line Target System

There are 8 groups of line targets disposed in TM material as shown in the figure.

1. A1——A4:

Axial resolution target group. The upmost lines in each target locate at the depth of 10, 30, 50, 70mm, the center longitudinal distances of each group (from the top down) are 3, 2, 1, 0.5mm, and the horizontal distance is 1mm.

2. B1——B4:

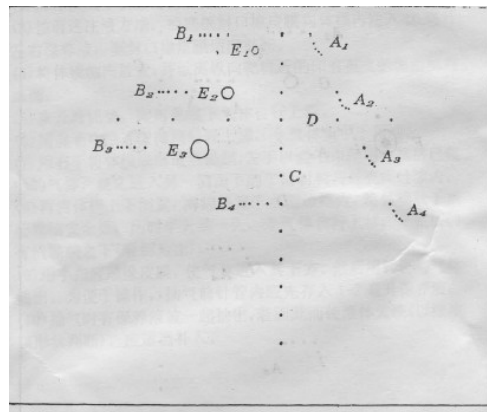
Lateral resolution target group. Locate at a depth of 10, 30, 50, 70mm, with a center horizontal distance of 4, 3, 2, 1mm in each group.

3. C:

Longitudinal target group. 12 target lines with a 10mm center distance between adjacent lines.

4. D:

Horizontal target group. Locate at a depth of 40mm, with a 20mm center distance between adjacent lines.



Appendix C Description of Self Test Items

C.1.1 Z0101 Hard Disk Verify Test

Top test item

N/A

Test content

Traverse all hard disk files from Doppler installation directory, compare and verify the files with the archived hard disk data.

Analysis to test failure

The information “*Failed to open the result file*” indicates there is no verification file. The information “*The failed CRC: current verification value (verify failed file path; correct verification value)*” indicates the hard disk data is corrupted.

Suggestion to failure test

Restore the hard disk data; replace the file under DCN7 directory in C local disk with the *CRC_Result.txt* from the restore package.

C.1.2 Z0201 PC Module and MF FPGA Interconnection Test

Top test item

N/A

Test content

Test LPC interface communication between PC module and MF FPGA.

Analysis to test failure

Check whether *Windows* device manager recognizes *Ultrasound MultiFunction Device*. It cannot be recognized only with the drive not being installed properly.

The drive goes wrong if the test result appears *Error*.

PC module and DSP FPGA has communication error if the test result is *FAIL*.

Suggestion to failure test

Restore the device (OS+doppler) if the drive is not recognized.

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to replace CPU if the test result appears *FAIL*.

C.1.3 Z0202 MF FPGA and System Monitor

Interconnection Test

Top test item

Communication self test between PC Module and MF FPGA

Test content

Test the Smbus communication between the MF FPGA and ADT7462.

Analysis to test failure

The drive goes wrong if the test result appears *Error*.

The error between MF FPGA and ADT7462 occurs if the test result appears *FAIL*.

Suggestion to failure test

Restart the device to perform the self-test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to replace PC carrier board if the test result appears *FAIL*.

C.1.4 Z0203 Back End Voltage Monitor Test

Top test item

MF FPGA and system monitor interconnection test

Test content

Read VCC5V, VDD1V8, VDD2V5, VDD1V2, VDDN5V7 and voltage value of button battery via ADT7462, and decide whether it meets the requirement.

Analysis to test failure

The drive goes wrong if the test result appears *Error*.

The voltage value does not meet the requirement if the test result appears *FAIL*.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to replace button battery if VDDBAT voltage appears *FAIL*.

It is recommended to replace the PC carrier board if the other voltages appear *FAIL*.

C.1.5 Z0204 System Temperature Test

Top test item

MF FPGA and system monitor interconnection test

Test content

Read temperature values of PCT1, PCT2 and PCT3 via ADT7462 drive and read temperature values of four CPUs via bottom drive. Decide whether they meet the requirements.

Analysis to test failure

The drive goes wrong if the test result appears *Error*.

The temperature value does not meet the requirement if the test result appears *FAIL*.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to check the fan condition first and then replace PC module or PC carrier board if the test result is *FAIL*.

Z0205 Fan Speed TestTop test item

MF FPGA and system monitor interconnection test

Test content

Read rotational speed values of six monitoring fans via ADT7462, and decide whether they meet the requirements. The fans on the top are respectively named fan 10, fan 11 and fan 12. The fans at the bottom are respectively named fan 00, fan 01 and fan 02.

Analysis to test failure

The drive goes wrong if the test result appears *Error*.

The rotational speed of the fan does not meet the requirement if the test result appears *FAIL*.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*, which indicates the error of the drive occurs. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to repair the fan, which does not meet the requirement of rotational speed if the test result appears *FAIL*.

C.1.6 Z0206 Speaker Test

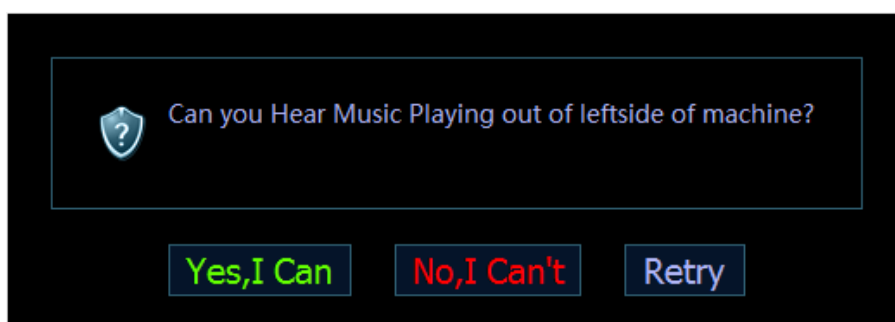
Top test item

N/A

Test content

Play the music by pressing the speaker from left or right. Test whether audio clip, amplifier circuit or speaker function works well.

The dialog box appears from either left or right side to inquire the audibility of the speaker. If it is inaudible, click [Retry] to re-play the track of the music. If it fails after couple of times of retry, click [No, I Can't]. If it is audible, click [Yes, I Can].



Analysis to test failure

The audio module or the speaker does not work well if the test result appears *FAIL*.

Suggestion to failure test

It is recommended to check the speaker and wire material, and audio module. Then, replace CPU.

C.1.7 Z0207 Microphone Interface Test

Top test item

N/A

Test content

Test whether microphone interface on the device works well. First, the program informs to plug in the microphone. The sound waves appear on the screen as the sound arrives at the microphone. Only with the wave exceeds the exact value, does it pass through the test.

Analysis to test failure

If the test result appears NaN, it indicates the microphone is not plugged in well or the circuit is not in the place.

The microphone's interface goes wrong if the test result appears *FAIL*.

Suggestion to failure test

Ensure the microphone works well first. The sound waves appear on the screen if the sound arrives at the microphone. The interface does not work if the sound waves do not appear on the screen. It is recommended to replace the PC carrier board.

C.1.8 Z0208 Network Interface Test

Top test item

N/A

Test content

The program informs to plug in the network cable. The program decides the existence of the wired network adapter, and then decides whether the Ethernet works well.

Analysis to test failure

The Ethernet cannot be recognized if the information "*No network adapter found*" appears.

The network cable cannot be recognized if the information "*No network cable plugged in*" appears.

Ethernet does not work well if the test appears *FAIL*.

Suggestion to failure test

Please check the installation of the network drive if the information "*No network adapter found*" appears.

Please check the network cable if the information "*No network cable plugged in*" appears.

It is recommended to replace PC carrier board if the test result appears *FAIL*.

C.1.9 Z0209 WIFI Function Test

Top test item

N/A

Test content

Decide whether the wireless network adapter exists, and then search for SSID list.

Analysis to test failure

The wireless network adapter is not recognized if the information "*No wireless device found*" appears.

Fail to find wireless hotspots if the information "*Wireless function test fails*" appears.

Suggestion to failure test

Check whether the connection of wireless network adaptor is fixed well and wireless network adaptor is not forbidden if the information "*No wireless device found*" appears.

Check whether there is WIFI hotspot if the information "*WIFI Function test FAIL*" appears. If there is a hotspot, replace the wireless network adaptor.

C.1.10 Z0301 Front End Voltage Monitor Test

Top test item

MF FPGA and system monitor interconnection test

Test content

Read A12_ACDC, DP3V3, AP2V1, DP5V, AP5V7, N12V, N5V7, AP2V9, STB5V, AP3V8 on DC-DC board and AP1V4's voltage value via ADT7462, and decide whether they meet the requirements.

Analysis to test failure

The drive goes wrong if the test result appears *Error*.

The voltage value does not meet the requirement if the test result appears *FAIL*.

Suggestion to failure test

Restart the device to perform the self-test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to replace DC-DC board if the test result is *FAIL*.

C.1.11 Z0401 DSP FPGA and TRA Interconnection Test (Control Interface)

Top test item

PC module and DSP FPGA interconnection test

Test content

Test whether the control interface communication between DSP FPGA and XCVER of TRA FPGA works well via reading the register.

Analysis to test failure

The drive goes wrong if the test result appears *Error*.

The connection error between DSP FPGA and TRA FPGA occurs if the test result is *FAIL*.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to change TRA board if the test result is *FAIL*.

C.1.12 Z0402 TRA AFE SPI Interface Test

Top test item

DSP FPGA and TRA FPGA communication self test (control interface)

Test content

Test whether the control interface communication between TRA FPGA and AFE's SPI works well via reading the register.

Analysis to test failure

The drive goes wrong if the test result appears *Error*.

SPI between TRA FPGA and AFE has communication error if the test result is *FAIL*.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to change TRA board if the test result is *FAIL*.

C.1.13 Z0403 TRA AFE Test Mode

Top test item

TRA AFE SPI test

Test content

Enter system test mode, write the data to TRA AFE, input delay RAM, re-read the data from delay-channel memory to locate the channel and AFE clip.

Analysis to test failure

The drive goes wrong if the test result appears *Error*.

AFE clip goes wrong if the test result is *FAIL*.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*, which indicates the logic error of DSP FPGA occurs. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to change TRA board if the test result is *FAIL*.

C.1.14 Z0404 TRA Transmission and Reception Function

Test

Top test item

TRA AFE test mode

Test content

Test the coherence of 64 channels in transmitting and receiving: one channel transmits 2 V 1 M PHV1 waveform each time, and analyzes whether the waveform is PHV1, and compares the signal-to-noise ratio of this channel with others'.

Analysis to test failure

The drive goes wrong if the test result appears *Error*.

The waveform that the channel transmits is incorrect if the information "Open circuit of transmitting and receiving channel: XXX" appears.

The transmission of this channel affects other channels if the information "Short circuit of transmitting and receiving channel" appears.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to replace TRA board if the test result is *FAIL*.

C.1.15 Z0405 DSP FPGA and TRA Interconnection Test

(Data Interface)

Top test item

DSP FPGA and TRA FPGA communication self test (control interface)

Test content

Test whether XCVÉR data interface between TRA FPGA on the main board and DSP FPGA works well.

Analysis to test failure

The drive goes wrong if the test result appears *Error*.

XCVÉR data interface on the connection of TRA FPGA-DSP FPGA goes wrong if the test result is *FAIL*.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to replace TRA board if the test result is *FAIL*.

C.1.16 Z0501 PC Module and DSP FPGA Interconnection

Test

Top test item

N/A

Test content

Test whether PCIe interface communication between PC module and DSP FPGA works well.

Analysis to test failure

Check whether *Windows* device manager recognizes *Ultrasound Backbone Device*. If the drive is not installed properly, it cannot be recognized.

The drive goes wrong if the test result appears *Error*.

PC module and DSP FPGA has communication error if the test result is *FAIL*.

Suggestion to failure test

It is recommended to restore the device (OS+doppler) if the drive is not recognized.

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to replace engine board if the test result is *FAIL*.

C.1.17 Z0502 DSP FPGA DDRIII Test

Top test item

PC module and DSP FPGA interconnection test

Test content

Perform read and write tests for entire space of four types DDRs of DSP FPGA. The program displays the test results of DSP buffer DDR (transmitting DSP processing result data), SCAN buffer DDR (transmitting scan control frame), IQ buffer DDR (transmitting IQ data) and Gather buffer DDR (collecting data).

Analysis to test failure

The drive goes wrong if the test result appears *Error*.

The connection error between FPGA and plug-in DDR occurs if the test result is *FAIL*.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to replace engine board if the test result is *FAIL*.

C.1.18 Z0503 ATGC Function Test

Top test item

TRA AFE test mode

Test content

Control a channel to transmit 2 V waveform. Collect the waveform that AFE receives as setting ATGC to max, min and medium value. Decide whether the amplitude of waveform changes as ATGC increases according to the analysis on RMS value.

Analysis to test failure

The drive goes wrong if the test result appears *Error*.

The circuit of ATGC gain adjustment goes wrong if the test result is *FAIL*.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to replace engine board if the test result is *FAIL*.

C.1.19 Z0601 MF FPGA and PHV ARM Interconnection Test

Top test item

Communication self test between PC Module and MF FPGA

Test content

Test whether UART communication between DSP FPGA and PHV ARM works well. Send the order through PHV serial port drive, and re-read the data via the port.

Analysis to test failure

The drive goes wrong if the test result appears *Error*.

UART interconnection between FPGA and PHV ARM goes wrong if the test fails.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to change PHV power supply board if the test result is *FAIL*.

C.1.20 Z0602 PHV Board CW Mode Test

Top test item

MF FPGA and PHV ARM interconnection test

Test content

Adjust the voltage of CW mode linearly, and set four voltage values. Read PHV1P and PHV1N voltage values respectively via PHV serial port.

Analysis to test failure

The drive goes wrong if the test result appears *Error*.

The voltage value of CW mode does not meet the requirement if the test result is *FAIL*.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to replace PHV power supply board if the test result is *FAIL*.

C.1.21 Z0603 PHV Board PHV Mode Test

Top test item

MF FPGA and PHV ARM interconnection test

Test content

Adjust PHV voltage linearly, and set five voltage values. Read PHV1P, PHV1N, PHV2P and PHV2N voltage values respectively via PHV serial port.

Analysis to test failure

The drive goes wrong if the test result appears *Error*.

The voltage value of PHV mode does not meet the requirement if the test result appears *FAIL*.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to replace PHV power supply board if the test result is *FAIL*.

C.1.22 Z0604 PHV Board HV Test

Top test item

MF FPGA and PHV ARM interconnection test

Test content

Read positive and negative 100 V high-voltage value via PHV serial port drive.

Analysis to test failure

The drive goes wrong if the test result appears *Error*.

The positive and negative 100 V does not meet the requirement if the test result is *FAIL*.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to replace PHV power supply board if the test result is *FAIL*.

C.1.23 Z0701 DSP FPGA and CPLD Interconnection Test

Top test item

PC module and DSP FPGA interconnection test

Test content

Test whether SPI interface communication between DSP FPGA on engine board and CPLD on probe board works well

Analysis to test failure

The drive goes wrong if the test result appears *Error*.

Interconnection between DSP FPGA and CPLD goes wrong if the test result is *FAIL*.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to change probe board if the test result is *FAIL*.

C.1.24 Z0801 Control Panel USB Interconnection Test

Top test item

N/A

Test content

Test USB communication between control panel and main unit works well via reading internal USB disk drive.

Analysis to test failure

The drive goes wrong if the test result appears *Error*.

The communication between control panel and main unit goes wrong if the test result is *FAIL*.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to replace control panel if the test result is *FAIL*.

C.1.25 Z0802 Control Panel Key, Encoder, TGC, Trackball

Function Test

Top test item

USB communication test of control panel

Test content

Test whether the control panel keys, encoders, TGCs, trackball, backlight LEDs and indicating LEDs on the keyboard work well, and read board ID, keyboard FPGA version and program version.


Test description

The keyboard test interface is shown as follows:




As shown in the figure above, click [Start] to perform the keyboard test. The controls on the simulation keyboard correspond with those on the real keyboard assembly.

As for the button, the button on the simulation keyboard blinks while pressing the corresponding button on real keyboard. The button is being tested if it continues blinking. The test of the button is finished if its color changes.

As for the trackball, the cursor moves as rolling the trackball on the keyboard. Meanwhile, the icon  on the simulation keyboard blinks, which indicates that the system receives data from the trackball and the trackball has been tested already.

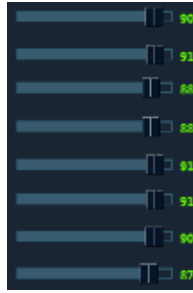


The encoder rotation test: the icon  on the simulation keyboard corresponds to the encoder on the real keyboard. When the user rotates the encoder towards one exact direction, the corresponding dark green ball around the encoder on the simulation keyboard will rotate to the same direction. The encoder panel turns to white when pressing the encoder.

Encoder button test: encoder panel turns to white when pressing the encoder.

All orange controls indicate that all keys have the corresponding orange indicators.

TGC test: 8 TGC sliders on the keyboard correspond to controls on the simulation keyboard. When moving TGC sliders on the keyboard, the corresponding controls on the simulation keyboard move as well.



Keyboard backlight test: when the simulation keyboard starts the initialization, all dual-color lights highlight in green on the keyboard. The dual-color backlight automatically becomes orange when a key is tested after being pressed.

If the various controls on the keyboard work well, click [Key is OK]; otherwise, click [Key is Bad].

Suggestion to failure test

Replace the trackball if the trackball does not respond.

Replace TGC board if TGC slider does not respond.

Replace the keyboard if the key does not respond.

C.1.26 Z0803 Control Panel Key LED Test

Top test item

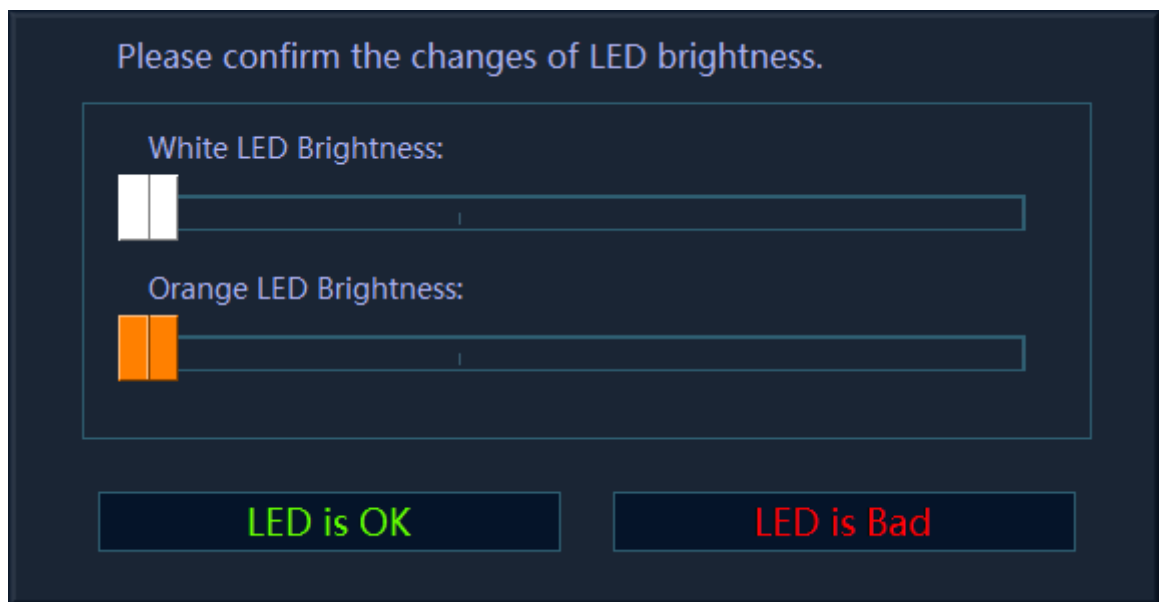
USB communication test of control panel

Test content

The system automatically adjusts the color of LED (white and orange) and the brightness of trackball. The user can identify the changes.

Test description

The following dialog box appears when performing test. The system changes the brightness of LED (white and orange) and trackball respectively and check whether the brightness of LED on the keyboard change accordingly. If LED brightness of the keyboard keeps identical as configured, click “LED is OK” to exit the dialog box. If not, click “LED is Bad” to exit the dialog box.



Suggestion to failure test

Replace the control panel if LED brightness does not respond.

C.1.27 Z0901 Primary LCD Monitor I2C Interconnection

Test

Top test item

Communication self test between PC Module and MF FPGA

Test content

Test whether I2C communication serial port between MF FPGA and primary LCD monitor works well. The test generates primary LCD monitor's saver, and then restores it. Primary LCD monitor's brightness decreases, and then returns back. Read the hardware and software versions of primary LCD monitor.

Analysis to test failure

The drive goes wrong if the test result appears *Error*.

The interconnection between DSP FPGA and primary LCD monitor goes wrong if the test result is *FAIL*.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

Check whether the connecting material between primary LCD monitor and main unit is fixed well, and then replace primary LCD monitor if the test result is *FAIL*.

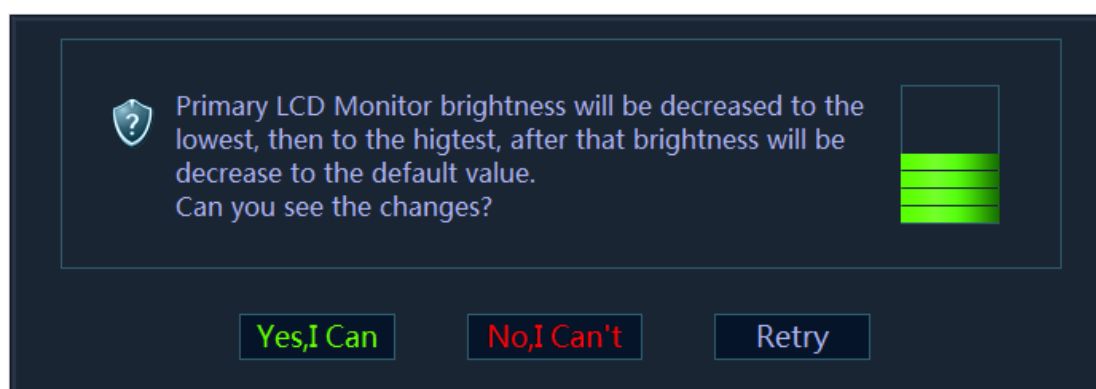
C.1.28 Z0902 Primary LCD Monitor Brightness Control Test

Top test item

I2C communication test of primary LCD monitor

Test content

The dialog box appears when performing the test. The program controls the brightness of primary LCD monitor via I2C interface. The brightness goes down to the lowest, and then goes up to the highest, then gets back to normal. If backlight changes, click "Yes, I Can", otherwise click "No, I Can't". If the user clicks "Retry" the system will repeat the procedure mentioned above.



Analysis to test failure

The drive goes wrong if the test result appears *Error*.

Brightness control of LCD monitor goes wrong if the test result is *FAIL*.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to replace primary LCD monitor if the test result is *FAIL*.

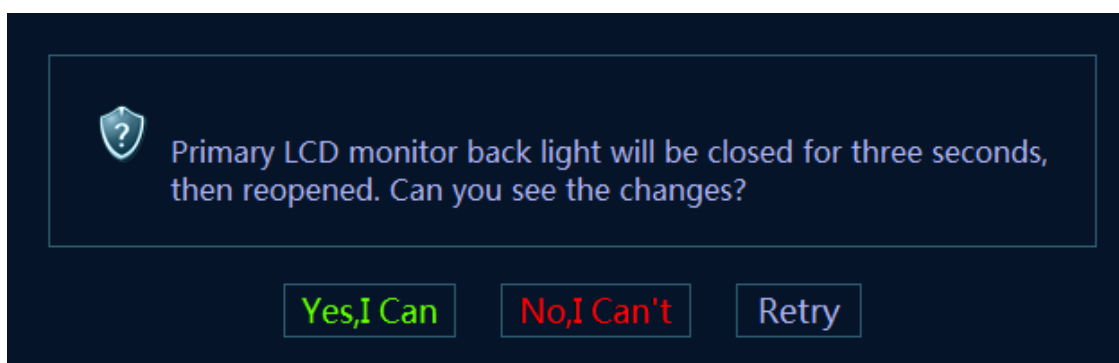
C.1.29 Z0903 Primary LCD Monitor Backlight Control Test

Top test item

I2C communication test of primary LCD monitor

Test content

The dialog box appears when performing the test. The program turns the backlight of primary LCD monitor off for 3 seconds, and then goes back to normal. If backlight changes, click "Yes, I Can", otherwise click "No, I Can't". If the user clicks "Retry" the system will repeat the procedure mentioned above.



Analysis to test failure

The drive goes wrong if the test result appears *Error*.

Backlight control of primary LCD monitor goes wrong if the test fails.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to replace primary LCD monitor if the test result is *FAIL*.

C.1.30 Z1001 Secondary LCD Monitor I2C Interconnection Test

Top test item

Communication self test between PC Module and MF FPGA

Test content

Test whether I2C communication serial port between MF FPGA and secondary LCD works well. The test generates secondary LCD's saver, and then returns back. Secondary LCD's brightness decreases, and then returns back. Read the hardware and software versions of secondary LCD.

Analysis to test failure

The drive goes wrong if the test result appears *Error*.

The interconnection between MF FPGA and secondary LCD goes wrong if the test result is *FAIL*.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

Check whether the connecting material between secondary LCD and main unit is fixed well, and then replace main monitor if the test result is *FAIL*.

C.1.31 Z1002 Secondary LCD Monitor Brightness Control

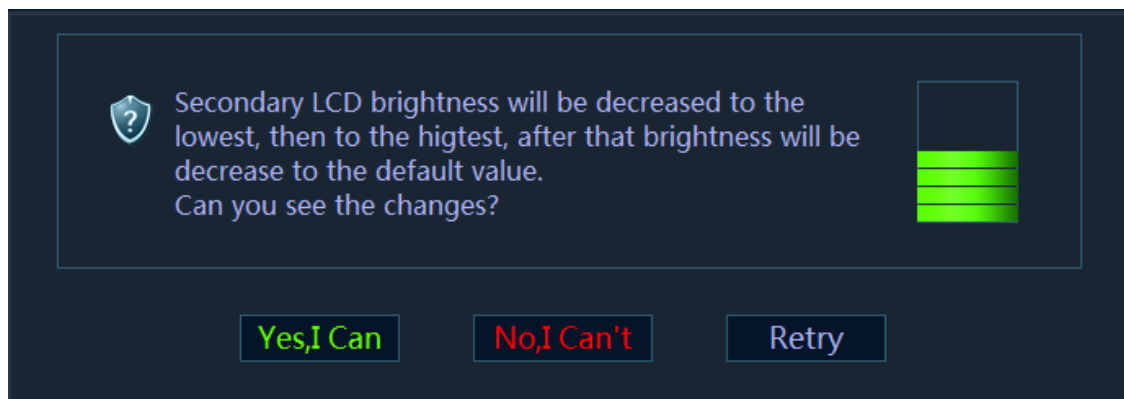
Test

Top test item

I2C communication test of secondary LCD monitor

Test content

The dialog box appears when performing the test. The program controls the brightness of secondary LCD monitor via I2C interface. The brightness goes down to the lowest, and then goes up to the highest, then gets back to normal. If backlight changes, click "Yes, I Can", otherwise click "No, I Can't". If the user clicks "Retry" the system will repeat the procedure mentioned above.



Analysis to test failure

The drive goes wrong if the test result appears *Error*.

Brightness control of secondary LCD monitor goes wrong if the test result is *FAIL*.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to replace secondary LCD monitor if the test result is *FAIL*.

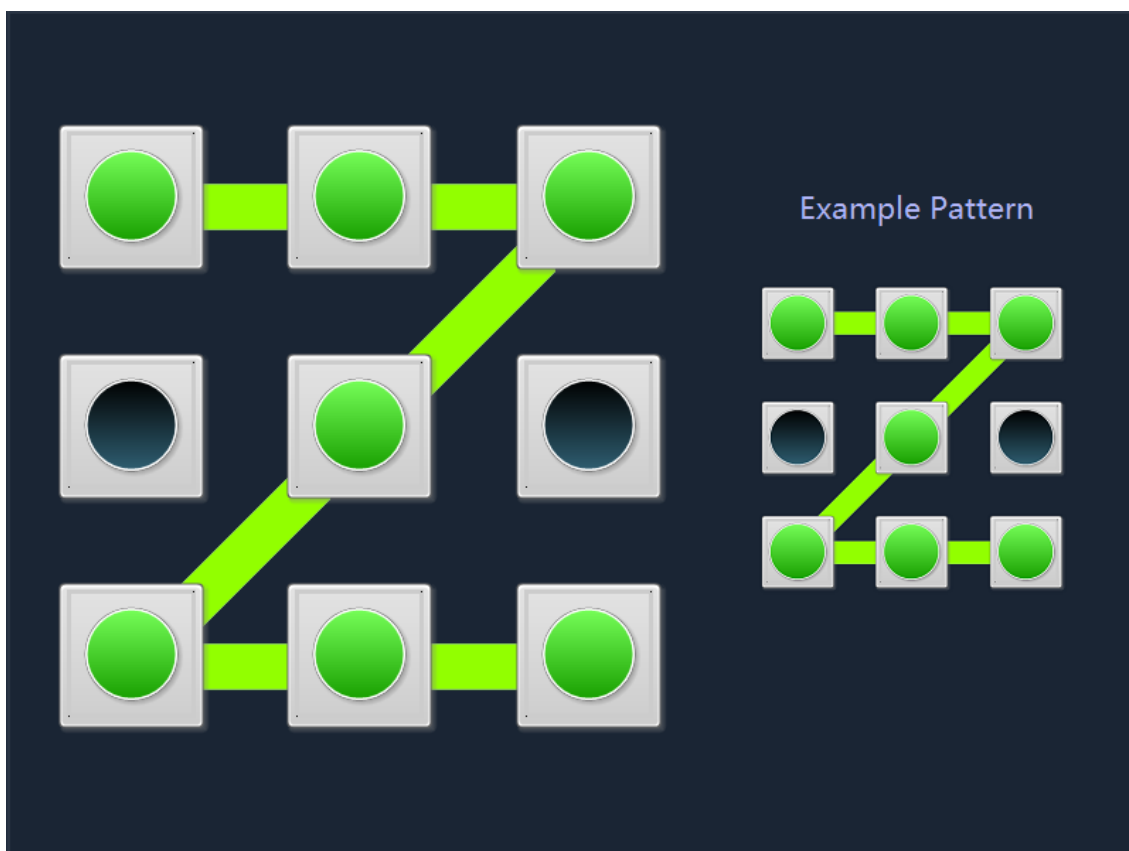
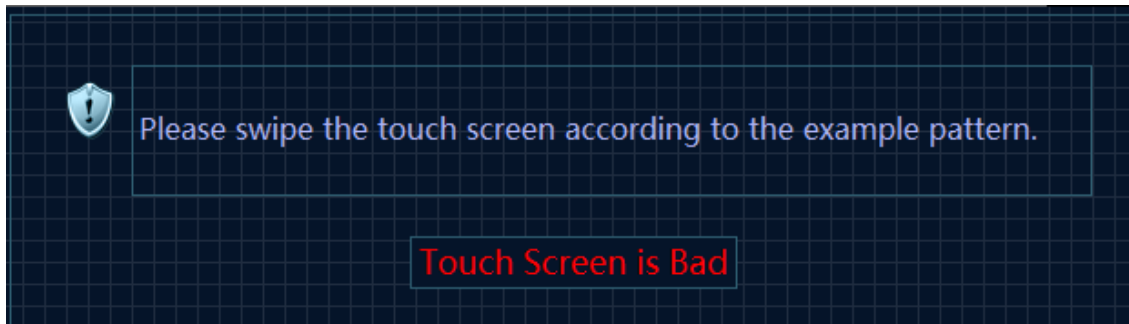
C.1.32 Z1101 Touch Screen Function Test

Top test item

Communication self test between PC Module and MF FPGA

Test content

The following dialog box appears on primary LCD monitor when performing the test. It requires the manual operation to flick according to the example pattern.



If the flicking works well, the program passes, and then exits the test. If the flicking fails to work, click "Touch Screen is Bad".

Analysis to test failure

The touch screen does not work if the test result is *FAIL*.

Suggestion to failure test

Confirm the drive of the touch screen is installed properly.

Then confirm whether connecting material between the touch screen and main unit is fixed well.

It is recommended to replace touch screen.

C.1.33 Z1201 Mini CW Board ID Test

Top test item

DSP FPGA and TRA FPGA communication self test (control interface)

Test content

The program reads the signal in the place to decide whether mini CW board is in the place. Then, read CW board's ID. SPI interface communication between TRA board and mini CW board works well if it appears non-0 and non-F.

Analysis to test failure

The drive goes wrong if the test result appears *Error*.

Mini CW board is not in the place if the information "*Mini CW board is not in the place*" appears or the circuit is not in the place.

The interconnection between mini CW board and TRA board goes wrong if the test fails.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to replace mini CW board if the test result is *FAIL*.

C.1.34 Z1301 DSP FPGA and 4D&TEE Board

Interconnection Test

Top test item

PC module and DSP FPGA interconnection test

Test content

The program checks 4D probe is not plugged in, and then read the signal in the place to decide whether 4D&TEE board is in the place, then read 4D&TEE board's ID. The interconnection between DSP FPGA and 4D&TEE board works well if it appears non-0 and non-F.

Analysis to test failure

The drive goes wrong if the test result appears *Error*.

Mini 4D&TEE board is not in the place if the information "4D&TEE board is not in the place" appears or the circuit is not in the place.

The interconnection between DSP FPGA and 4D&TEE board goes wrong if the test fails.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to replace 4D&TEE board if the test result is *FAIL*.

C.1.35 Z1302 4D&TEE Board Driver Circuit Test

Top test item

Communication test between DSP FPGA and 4D&TEE board

Test content

Set DA output sine signals of Sin+ drive circuit and Sin- drive circuit. After being magnified, AD collects the signal to decide the frequency and the amplitude. Set output cosine signals of Cos+

drive circuit and Cos- drive circuit. After being magnified, AD collects the signal to decide the amplitude.

Analysis to test failure

The drive goes wrong if the test result appears *Error*.

The drive circuit goes wrong if the information “*The test of XXX drive circuit fails*” appears.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to replace 4D&TEE board if the test result is *FAIL*.

C.1.36 Z1303 4D&TEE Board Programmable Voltage Test

Top test item

Communication test between DSP FPGA and 4D&TEE board

Test content

Set programmable voltage PVPP, NVPP to output the related voltage (set 5 voltage points). After being magnified, AD collects the voltage value to decide the amplitude.

Analysis to test failure

The drive goes wrong if the test result appears *Error*.

If the test appears *FAIL*, it shows the theoretic voltage values of PVPP and NVPP and the collected voltage values. Decide which part of the power supply signal goes wrong.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to replace 4D&TEE board if the test result is *FAIL*.

C.1.37 Z1304 TEE Temperature Signal Test

Top test item

Communication test between DSP FPGA and 4D&TEE board

Test content

Read the value of TEE temperature signal. The collecting of the TEE temperature works well if the value keeps stable.

Analysis to test failure

The drive goes wrong if the test result appears *Error*.

The interconnection of TEE temperature signal goes wrong if the test appears *FAIL*.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to replace 4D&TEE board if the test result is *FAIL*.

C.1.38 Z1305 TEE Angel Signal Test

Top test item

Communication test between DSP FPGA and 4D&TEE board

Test content

Read the value of TEE temperature signal. The collecting of the TEE angel signal works well if the value keeps stable.

Analysis to test failure

The drive goes wrong if the test result appears *Error*.

The interconnection of TEE angel signal goes wrong if the test appears FAIL.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to replace 4D&TEE board if the test result is *FAIL*.

C.1.39 Z1401 DSP FPGA and ECG Board Interconnection

Test

Top test item

PC module and DSP FPGA interconnection test

Test content

The program decides whether ECG is in the place, sends orders via ECG serial port, judges the returned data, and parses Bootloader version, board ID and software version.

Analysis to test failure

The drive goes wrong if the test result appears *Error*.

ECG board is not in the place if the information “*ECG board is not in the place*” appears or the circuit is not in the place.

The communication between ECG board and main board goes wrong if the information “*Failed to read the data on ECG board*”.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to replace ECG board if the test result is *FAIL*.

C.1.40 Z1402 ECG Board Self Test

Top test item

Communication test between DSP FPGA and ECG board.

Test content

ECG sends self test order via ECG serial port when it is in the place and analyzes the self test result, and decides the status for A/D, Flash, DRAM, CPU, Watchdog, Voltage 33.

Analysis to test failure

The drive goes wrong if the test result appears *Error*.

ECG board goes wrong if the test result is *FAIL*.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to replace ECG board if the test result is *FAIL*.

C.1.41 Z1501 MF FPGA and SM ARM Interconnection Test

Top test item

Communication self test between PC Module and MF FPGA

Test content

Test whether UART communication between MF FPGA and battery management ARM works well. Send the order through SM serial port drive, and re-read the data via the serial port.

Analysis to test failure

The drive goes wrong if the test result appears *Error*.

UART interconnection between MF FPGA and battery management's ARM goes wrong if the test fails.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to replace the battery management board if the test result is *FAIL*.

C.1.42 Z1502 Battery I2C Interconnection Test

Top test item

Communication test between MF FPGA and battery management ARM

Test content

Read the position of battery via SM serial port, and test whether I2C interface communication between battery and battery management ARM works well.

Analysis to test failure

The drive goes wrong if the test result appears *Error*.

The interconnection between left battery and battery management ARM goes wrong if the test result is *FAIL*.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to replace the battery, and then replace battery management board if the test result is *FAIL*.

C.1.43 Z1503 Battery Test

Top test item

I2C interconnection self test of battery

Test content

Read the voltage, temperature, current, volume and charging times, etc., of the battery via SM serial port.

Analysis to test failure

The drive goes wrong if the test result appears *Error*.

The interconnection between the battery and battery management ARM goes wrong if the test result is *FAIL*.

Suggestion to failure test

Restart the device to perform the self test if the test result appears *Error*. It is necessary to restore the device (OS+doppler) if *Error* re-appears.

It is recommended to replace the battery if the test result is *FAIL*.

