

Vetus EQ/Velite EQ/Vetus EQ Pro/Vetus EQ Exp

Equine Ultrasound Image System

Service Manual (Advanced)

Version 1.0

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Revision History

The version number of this service manual is subject to update without notice due to software or technical specification changes. The following table lists the revision history.

Version	Date	Reason for Change
1.0	2022-08	Initial release

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Statement

- Before conducting product maintenance, familiarize yourself with this service manual and fully understand the content in it to ensure correct maintenance so as to avoid product damage and personal injuries.
- This service manual is based on the maximum configuration and therefore some contents may not apply to your product. For any doubts, contact the after-sales department of Mindray Animal Medical.
- Depending on the software version and optional configuration, the actual interfaces may be different from those in this service manual, and the operation interfaces of the purchased machine prevail.

Warranty Statements

Mindray Animal Medical warrants that components within the ultrasound system under warranty will be free from defects in workmanship and materials for the amount of time specified under Mindray Animal Medical's then-current warranty policy (please check with the Mindray Animal Medical Customer Service Department for the applicable warranty period for each system). Under this warranty, Mindray Animal Medical will repair or replace (at Mindray Animal Medical's option) any defective component at no charge for materials according to Mindray Animal Medical's then-current warranty policy. This warranty does not cover consumable items such as, but not limited to, traveling carrying case, acoustic gel, paper, disposable or one-off materials, and sampling materials.

Recommended preventative maintenance, as prescribed in the Service Manual, is the responsibility of the user, and is not covered by this warranty.

Mindray Animal Medical will not be liable for any incidental, special, or consequential loss, damage, or expense directly or indirectly arising from the use of its products. Liability under this warranty and the buyer's exclusive remedy under this warranty is limited to servicing or replacing the affected products, at Mindray Animal Medical's option, at the factory or at an authorized Distributor, for any product which shall under normal use and service appear to Mindray Animal Medical to have been defective in material or workmanship.

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This warranty is expressly in lieu of, and Mindray Animal Medical expressly disclaims, any other express or implied warranties, including any implied warranty of non-infringement, merchantability, or fitness for a particular purpose, and of any other obligation on the part of Mindray Animal Medical.

Damage to any product or parts through misuse, neglect, accident, or by affixing any non-standard accessory attachments or by any customer modification voids this warranty.

Mindray Animal Medical makes no warranty whatever in regard to trade accessories, such being subject to the

warranty of their respective manufacturers.

A condition of this warranty is that the equipment or any accessories which are claimed to be defective be returned, when authorized, to the appropriate Mindray Animal Medical affiliate. Please contact the Mindray Animal Medical Customer Service Department for appropriate details for your region.

Customer Service Department

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Conventions

This service manual describes the keys and menu items on the control panel, buttons in dialog boxes, and basic operations as follows:

- Keys, knobs, switches, and switching controls on the control panel or keyboard are in uppercase.
- Menu items and buttons are in boldface.
- To tap a menu item or button, move the cursor to the menu item or button and then press Set or tap the option on the touch screen.
- Cascaded menu items are joined by greater-than sign (>).

Safety

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

Meaning of Signal Words

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

Safety Precautions

Please read the following precautions carefully to ensure the safety of the animal 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. Otherwise, an explosion may occur.
--	--

Electric safety

 WARNING:	● 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 Animal Medical. ● Disconnect the AC power before you clean or uninstall the ultrasound machine, otherwise, electric shock may result.
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- When using peripherals not powered by the auxiliary output of the ultrasound system, or using peripherals other than permitted by Mindray Animal Medical, make sure the overall leakage current of peripherals and the ultrasound system meets the requirement of the local medical device electrical regulation (like enclosure leakage current should be no more than 500uA of IEC 60601-1), and the responsibility is held by the user.
- 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.
- 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.
- This system is not water-proof. If any water is sprayed on or into the system, electric shock may result.

⚠ CAUTION:

- 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.
- Avoid electromagnetic radiation when perform performance test on the ultrasound system.
- In an electrostatic sensitive environment, don't touch the device directly. Please wear electrostatic protecting gloves if necessary.

Mechanical safety

⚠ WARNING:

- When moving the system, you should first fold the LCD display, disconnect the system from other devices (including probes) and disconnect the system from the power supply.
- Do not subject the transducers to knocks or drops. Use of a defective probe may cause electric shock to the animal.

⚠ CAUTION:

- Do not expose the system to excessive vibration (during the transportation) to avoid device dropping, collision, or mechanical damage.
- Do not move the ultrasound system if the HDD indicator is green, sudden shake may cause the HDD in damage.

Personnel safety

Note:

- The user is not allowed to open the covers and panel of the system, neither device disassemble is allowed.

- To ensure the system performance and safety, only Mindray Animal Medical engineers or engineers authorized by Mindray Animal Medical can perform maintenance and check.
- Only technical professionals from Mindray Animal Medical or engineers authorized by Mindray Animal Medical after training can perform maintenance.

Others

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

Part I Service Scenarios

1 Installation

1.1 Site Preparations

1.1.1 Environment Requirement

	Operational Conditions	Storage and Transportation Conditions
Ambient temperature	0°C–40°C	–20°C to +55°C
Relative humidity	20%–85% (no condensation)	20%–95% (no condensation)
Atmospheric pressure	700 hPa to 1060 hPa	700 hPa to 1060 hPa

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

Note: Do not install the equipment in the following locations:

- Locations near heat generators
- Locations of high humidity
- Locations near flammable gas

1.1.2 Requirements of Power Supply

1.1.2.1 Power Supply Specifications

AC input of the main unit:

Voltage	100–240 V (adapter) 19 V DC (DC input of the main unit)
Power frequency	50/60 Hz (adapter)
Input power	2.0-1.0A (adapter)

Battery

Voltage	14.4 V (USB)
Battery capacity	6600 mAh (per battery)

1.1.2.2 Requirements of Regulator

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.

1.1.2.3 Grounding Requirements

The power cord of the system is a three-wire cable. The grounding protective terminal should be connected with grounding protective cable of the power supply system. Make sure that the protective grounding works normally.



WARNING:

DO NOT connect this system to outlets with the same circuit breakers and 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, the circuit breakers and fuses of the building's supply circuit may be tripped.

1.1.3 EMI Limitation

Ultrasound devices are susceptible to Electromagnetic Interference (EMI) from radio frequencies, magnetic fields, and transient in the air wiring. They also generate EMI. Possible EMI sources should be identified before the unit is installed.

These sources include: medical lasers, scanners, monitors, cauterizing guns, etc. 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.

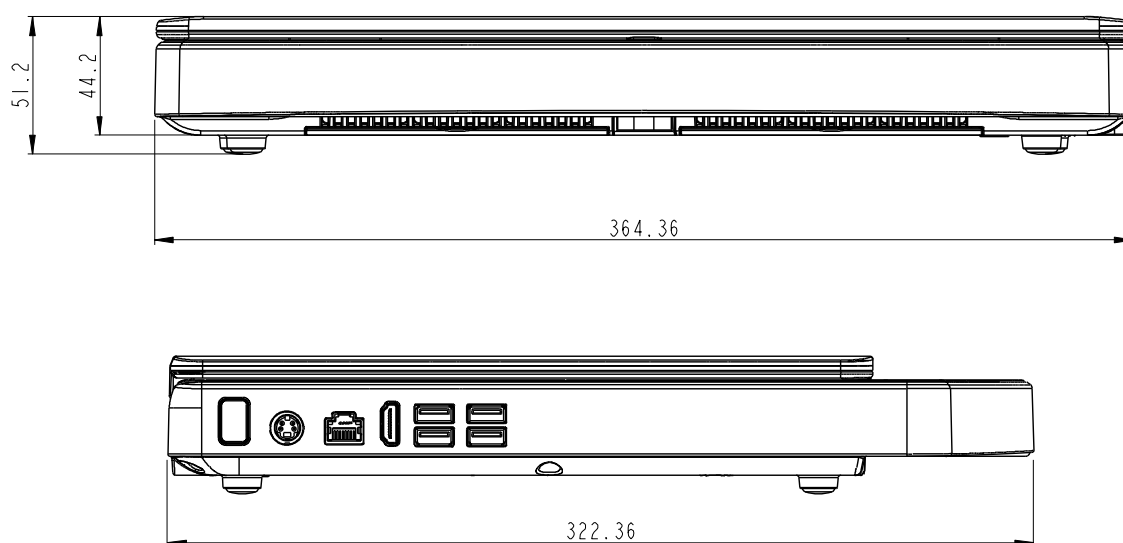
1.1.4 Packaging Specifications

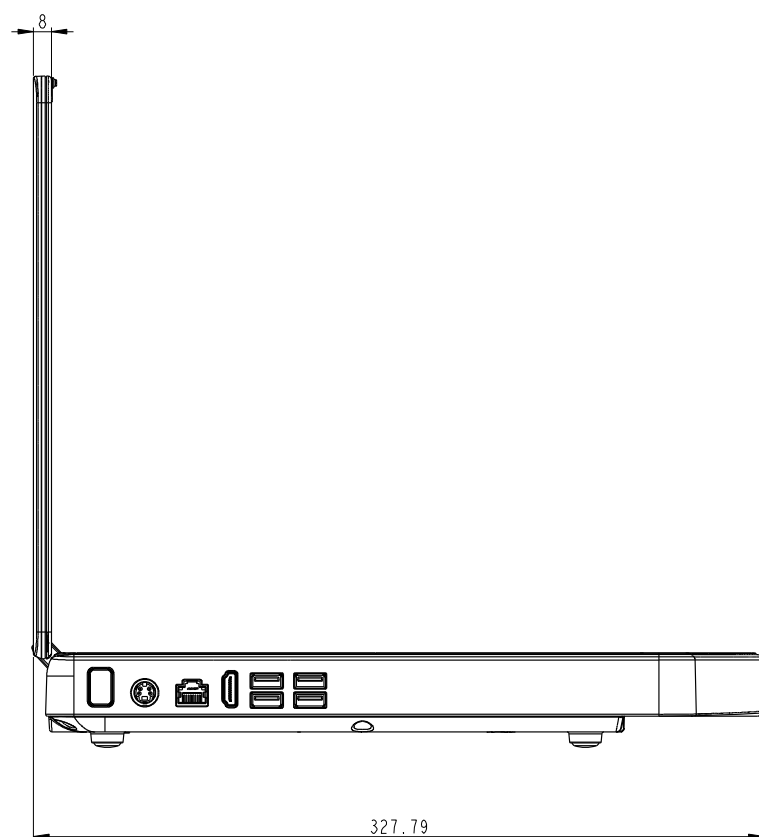
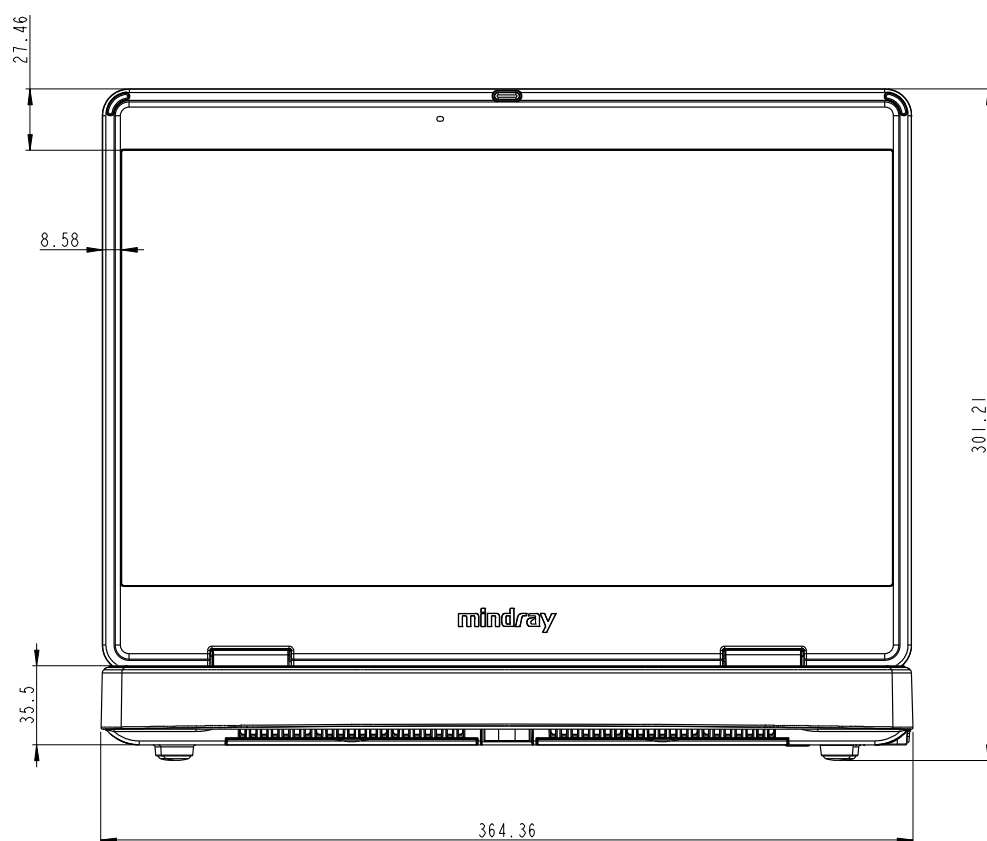
Item	Size	Weight
Main unit package	585mmx465mmx390mm	About 16.5 kg (full configuration)

1.1.5 Space Requirements

1.1.5.1 Physical Dimensions

Figure 1-1 Main unit

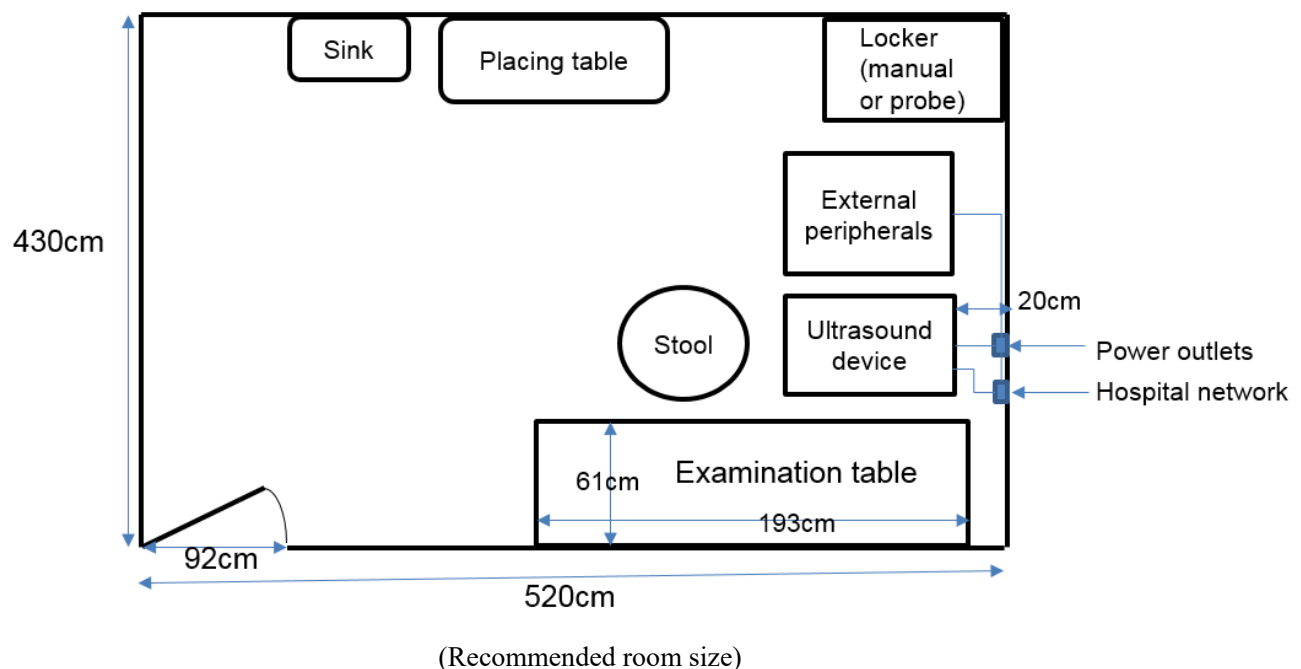




1.1.5.2 Space Requirements

Place the ultrasound equipment with the necessary accessories at a convenient position for operation.

1. Place the equipment in a room with good ventilation or having an air conditioning unit.
2. Maintain a generous – free air flowing space around the back and both sides of the system; failure may result due to increased rise in system operating temperature.
3. The brightness inside the room can be adjusted.
4. 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.
5. 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.



1.1.6 Network Requirements

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

Data transmission is allowed among 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 is recovered after the network resumed to normal condition. Confirm the network devices and network conditions before the installation.

- General information: default gateway IP address, and the other routers related information.
- DICOM application information: DICOM server name, DICOM port, AE title, channel quantity, and IP address.

1.1.7 Installation Confirmation

Confirm the following items before installation:

- Confirm the video format in the area or country where it is installed.

- Confirm the language of the area or country.
- Confirm power frequency of the area or country.
- Confirm the universal obstetrics formula and other measurement formula of the area or country.
- Confirm the preset values of the area or country that are different from the default values.
- Confirm the doctor's operation preferences.
- In accordance with general settings to configure the device properly in the area or country, please confirm the items above prior to the installation.

1.2 Installation

1.2.1 Unpacking

1.2.1.1 Unpacking Tool

Name	Type	No.	Remarks
Diagonal cutting pliers	N-206S	095-000077-00	/

1.2.1.2 Packing Box

For details about the size, weight, and other information about the main unit package, see Part I Service Scenarios: 1.1.4Packaging Specifications.

Figure 1-2 Outer package of the main unit



1.2.1.3 Check Before Unpacking

1. Before unpacking, check whether the package is intact. If the outer package is damaged, take pictures as evidence.
2. After unpacking, check whether the appearance of the equipment is intact. If no, provide feedback to the subsidiary or headquarters and keep related evidence.
3. Ensure sufficient space for unpacking the equipment and check the articles based on the packing list.

Note:

- Request equipment department personnel or hospital-recognized personnel and ultrasound department personnel to accompany the acceptance.
- Request related personnel to sign on the packing list after checking all articles listed on the packing list.
- The equipment fails the unpacking check in the following cases:
 - Damage during transportation

- **Incorrect label**
- **Inconsistency between the packing list and the product configurations specified in the contract**
- **Inconsistency between the packing list and actual articles, with accessories being absent**
- **Incomplete equipment parameters or functions, resulting in an installation failure due to faults and thereby an acceptance failure**
- **Equipment problems resolved by installation personnel to ensure successful installation**
- **Any of the above cases found in distributors before the equipment arrives at the final customer**

1.2.1.4 Unpacking the Main Unit

1. Cut the strapping band and open the upper cover of the carton.



Accessory box

2. Take out the upper cover.



3. Take out the backpack and foam.



4. Take out the shock insulator (not shown in the figure) and the main unit.



5. Take out other accessories.
6. Take out the probe.



1.2.1.5 Checking Articles

After unpacking, take out the packing list from the carton and check whether the actual articles conform to the packing list. If the actual articles do not conform to the packing list, for example, if some accessories are absent, contact the subsidiary or headquarters promptly and take pictures as evidence.

1.2.2 Transporting the Main Unit

1. Hold the main unit and the probe respectively with two hands. Do not shake the main unit upwards or downwards. Do not swing arms excessively to avoid colliding with other objects.

2. When placing the main unit on another object for transportation, fix the main unit onto the object using foam or other materials for protection against collision, and ensure a steady trip.

1.2.3 Installation of Whole Machine

1.2.3.1 Connecting the Power Cable

Insert the connector of the power adapter to the adapter port in the system. Use a three-wire power cable to connect the adapter to an external power supply.

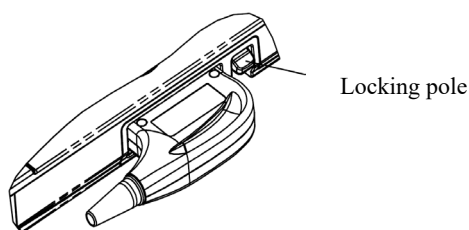
1.2.3.2 Connecting a Probe



WARNING:

The probes, cables and connectors should be in proper operating order and free from surface defects, cracks and peeling. Otherwise, electrical shock may result.

1. Keep the cable end of the probe to the right side of the system, and insert the connector into the port of the system, and then press in fully. See the figure below.
2. Toggle the locking lever to the top position.
3. Place the probe properly to avoid being treaded or wrapping with other devices. DO NOT allow the probe head to hang free.



1.2.4 Equipment Adjustment

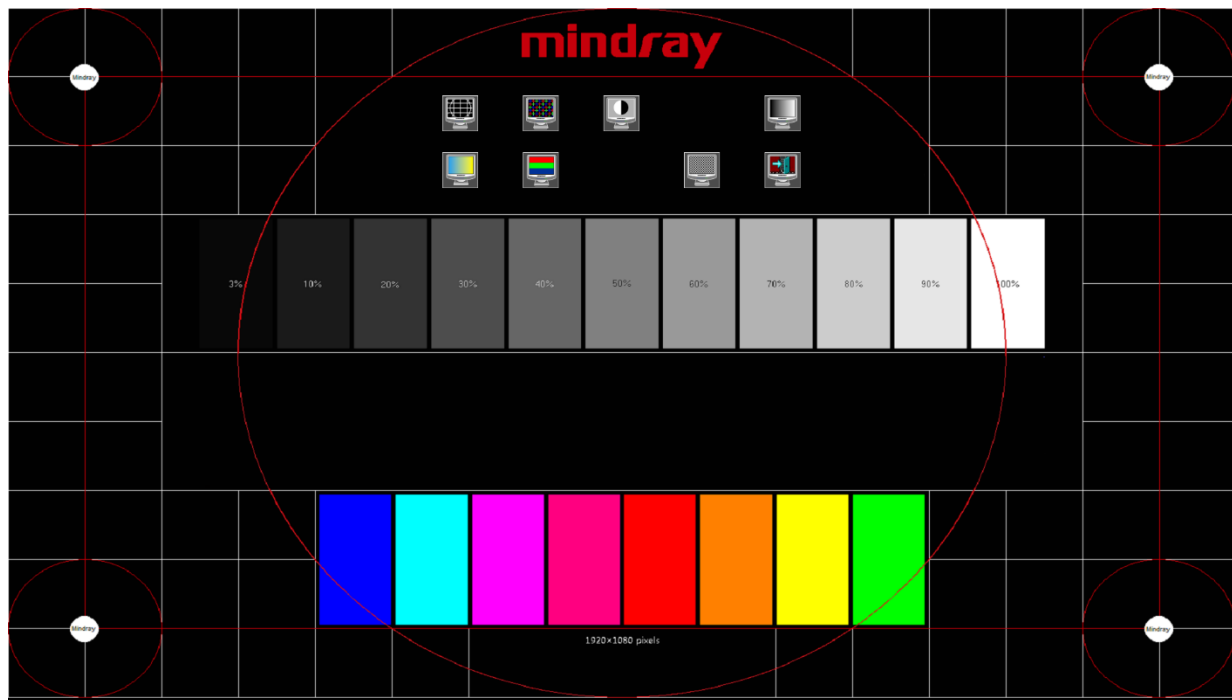
1.2.4.1 Brightness and Contrast

Monitor 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 output power have to be changed more often than necessary to compensate.

On the main screen, choose Setup > General > DISPLAY. Select LCD and TouchPanel and set the brightness and contrast of the display and touch screen. Alternatively, select Brightness auto adjustment, and the system will automatically adjust the brightness and contrast on the main screen and touch screen based on the ambient conditions.

1.2.4.2 Monitor Test

1. Log in as user Service. For details about login, see Part I Service Scenarios: 2.4.2 Logging In with the Service Account.
2. On the main screen, choose Setup > Maintenance > Setup. On the Set screen, tap Test Main Monitor. On the main monitor test screen, test the following items.



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 two screens. The test is passed if the black and white strips in the middle or around are clear, while the adjacent strips can be distinguished.
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 three screens. 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 screens of green, blue, red, black and white. Observe the LCD screen. Check the bright dot and dark dot on the black and white screens. Criterion for pass: bright dot quantity is 0; number of continuous dark dot pairs is ≤ 3 , and no continuous dark dot appears in the image area; there are no three or more than three continuous dark dot; dark dot defects number is ≤ 7 , and number of dark dots in the image area is ≤ 2 ; point flash defects is 0; space between fail points is ≥ 5 mm.

3. Tap Exit on the touch screen to return to the main monitor test screen.

1.2.5 Connecting Peripherals

1.2.5.1 Connecting a Footswitch

Directly connect the USB cable of the footswitch to an available USB port on the equipment.

Set the functions of the footswitch on the Key Config page. For details about the configuration method, see the user manual.

1.2.5.2 Connecting/Removing a USB Memory Device

⚠ WARNING: **DO NOT directly remove a USB storage device; otherwise, the USB storage device and/or the system may be damaged.**

When connecting a USB storage device to the ultrasound system via a USB port, you can hear a sound if it is connected successfully and the icon  will appear in the lower right corner of the screen.

To remove the USB storage device, move the cursor to the icon  in the lower right corner and press Set. On the Remove USB Device screen, select the storage device to be removed and click OK to securely remove the USB storage device. There will be a sound feedback when the USB storage device is being removed.

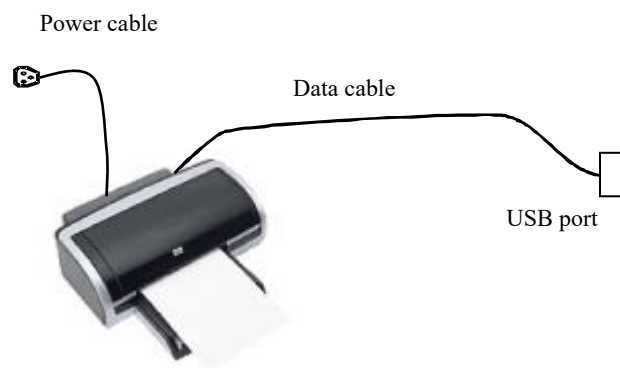
The system supports an external DVD R/W drive, which is connected to the ultrasound system via a USB port.

- Note:**
- **When connecting an external DVD R/W drive, connect the two cables of the drive to the ultrasound system if the drive provides two USB power cables. In this way, the DVD R/W drive can work normally.**
 - **If the USB flash drive cannot be identified, remove and reconnect it.**
 - **If it still cannot be identified after you try this workaround several times, replace the USB flash drive. If the problem persists, contact Mindray Animal Medical Customer Service Department or sales representative.**

1.2.5.3 Installing a Graph/Text Printer

- Note:** **If a driver needs to be installed for the connected printer, contact Mindray Animal Medical Customer Service Department or sales representative. See the accompanying manual of the printer for more details.**

As shown in the figure below, a graph/text printer has a power cable and a data cable. The power cable must be directly connected to a socket that is properly grounded.



The procedure is as follows:

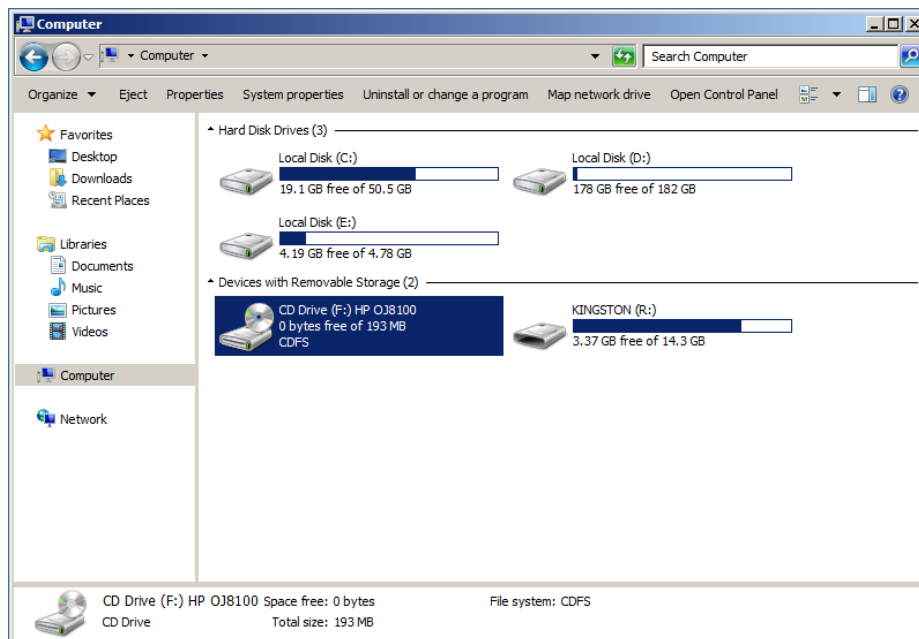
1. Connect the data cable of the printer to the USB port of the equipment.
2. Power on the equipment and the printer.
3. Choose Setup > Print to access the Print Service page.
 - a Select Report Print in the Service Type column.
 - b In the PROPERTY area, select a printer and set printing parameters.
 - c Click Save to save the settings.

1.2.5.4 Installing a Printer Driver

If a driver needs to be installed for the connected printer, proceed as follows:

1. Connect the data cable of the printer to the USB port of the equipment.
2. Power on the equipment and the printer.
3. Put the installation CD of the printer driver into the external CD-ROM drive connected to the ultrasound system.
4. Install the printer driver program. Choose Setup > Maintenance > Setup > Enter Windows. Enter the password and click OK. The system enters the following screen.

See Part I Service Scenarios: 2.4.3 Entering Windows for the password for entering Windows.



5. Double-click the drive to start installation. The following is an example of installing a printer driver for HP8100.

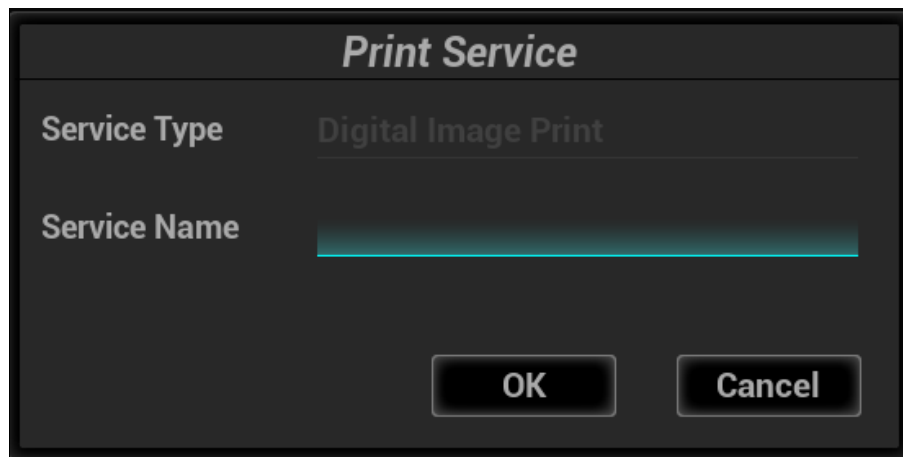


6. Perform installation as prompted. After installation, close all prompt windows and return to the Doppler software screen.
7. Click OK to save the settings.

1.2.5.5 Connecting a Graph/Text Printer

The system support digital video printers, including B/W printers and color printers.

1. Put the printer in a proper place.
2. Connect the power cable of the printer. Use a USB cable to connect between the USB port of the ultrasound system and the USB port of the printer.
3. Load a paper roll, and turn on the system and printer.
4. Configure the printing service as follows:
 - a Choose Setup > Print to access the Print Service page.
 - b Click Add Service to access the following page.



- c Select a printing service type and enter the service name manually.
- d Click OK to return to the page.
- e In the PROPERTY area, select a printer and set printing parameters.
- f Click Save to save the settings.

1.2.5.6 Connecting a Wireless Printer

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

The procedure is as follows:

1. Plug the printer power cord to an appropriate outlet.
2. Power on the equipment and the printer.
3. Connect the ultrasound system and the printer to the same network, and enable network access for the printer.
4. On the printing configuration screen, select a wireless printer and perform printing settings.

1.2.5.7 Connecting a Barcode Scanner

The system supports reading animal information such as animal ID through a barcode scanner.

- | | |
|--------------|--|
| Note: | <ul style="list-style-type: none"> ● After animal information is read from a barcode by using the barcode scanner, if the cases of letters are different from that on the barcode, click Caps Lock on the soft keyboard and scan the barcode again. ● The system does not support multilanguage input of barcodes. |
|--------------|--|

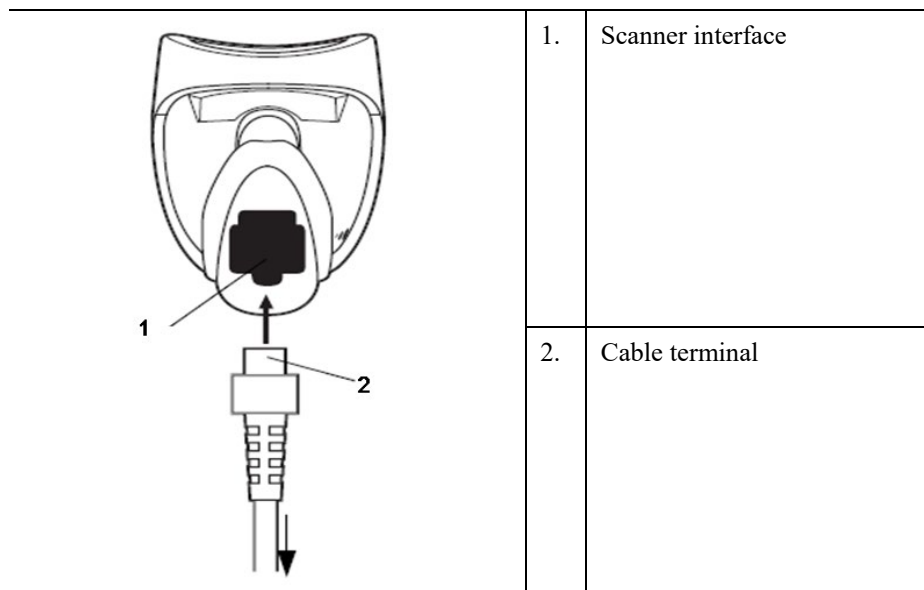
1.2.5.8 1D Barcode Scanner

1. The following figure shows the structure of the barcode scanner. Key components of the barcode scanner include the LED indicator, scan window, and scan trigger switch.



1.	LED indicator	The LED indicator is on in green upon a scan success. The LED indicator is on in red upon a scan failure.
2.	Scan window	Used to scan and receive barcodes.
3.	Scan trigger switch	Press the trigger switch to start scan.

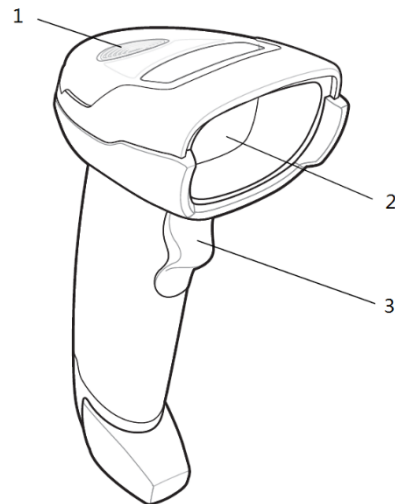
2. Properly insert the cable terminal into the bottom interface of the barcode scanner.
3. Connect the USB connector of the cable to the USB port on the main unit.



4. When the ultrasound equipment is running (without the need to install a driver program), press the scan trigger switch to scan barcode information. For other usage methods, see the barcode scanner manual.

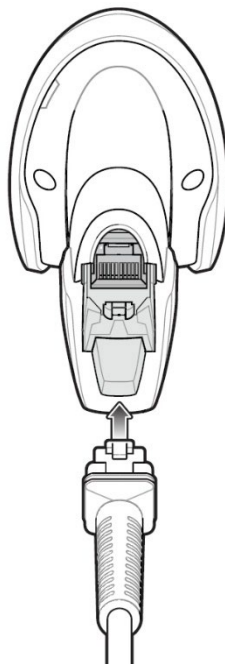
1.2.5.9 2D Barcode Scanner

1. Install the cable.
 - a The following figure shows the structure of the barcode scanner. Key components of the barcode scanner include the LED indicator, scan window, and scan trigger switch.

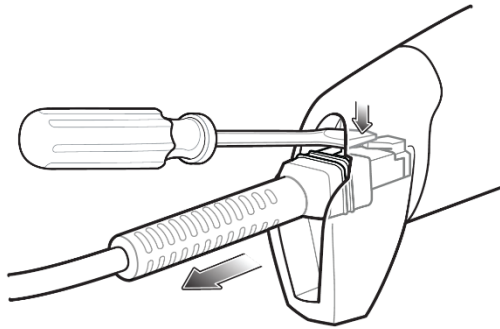


1.	LED indicator	The LED indicator is on in green upon a scan success. The LED indicator is on in red upon a scan failure.
2.	Scan window	Used to scan and receive barcodes.
3.	Scan trigger switch	Press the trigger switch to start scan.

- b Properly insert the cable terminal into the bottom interface of the barcode scanner.
- c Connect the USB connector of the cable to the USB port on the main unit.



- d When the ultrasound equipment is running (without the need to install a driver program), press the scan trigger switch to scan barcode information. For other usage methods, see the barcode scanner manual.
2. Disconnect the cable.
- a Use a flat-head screwdriver or a similar tool to press on the connector piece of the cable.



- b Slightly pull out the cable.

1.2.5.10 JADAK Scanner

Mindray Animal Medical ultrasound system is compatible with the HS-1M JDK-2413 and HS-1R JDK-2601 scanners.

Set the JADAK scanner as follows:

1. Power down the ultrasound system.
2. Use a proper cable to connect the scanner.
3. Insert the other end of the cable to the USB port of the ultrasound system.
4. Power up the ultrasound system.

1.2.5.11 Preconfiguring the HS-1M JDK-2413

Preconfigure the scanner through scanning. Ensure that the scanner cable is correctly connected before scanning. After successfully reads the barcode information, the scanner buzzes and the indicator blinks green.

1. Scan the following barcode to configure the scanner:



2. Scan the following QR code to enable the suffix function:



3. Scan the following QR code to set Enter as the suffix:



1.2.5.12 Restoring the Default Configuration of HS-1M JDK-2413

1. If the scanner malfunctions, scan the following barcode to restore the default configuration of the scanner:



2. Reconfigure the scanner based on the preceding preconfiguration procedure.

1.2.5.13 Preconfiguring the HS-1R JDK-2601

Preconfigure the scanner through scanning. Ensure that the scanner cable is correctly connected before scanning. After successfully reads the barcode information, the scanner buzzes and the indicator blinks green.

1. Scan the following barcode to configure the scanner:



2. Scan the following barcode to enable the suffix function:



Barcode



RFID

Note:

You can perform custom configuration for the JADAK scanner or contact Mindray Animal Medical engineers as required. This setup guide applies only to ultrasound products.

1.2.5.14 Restoring the Default Configuration of HS-1R JDK-2601

1. If the scanner malfunctions, scan the following barcode to restore the default configuration of the scanner:



2. Reconfigure the scanner as follows:

- a Scan the following barcode to configure the scanner:



- b Scan the following barcode to enable the suffix function:



Barcode



RFID

- c Scan the following barcode to disable the suffix function:



Barcode



RFID

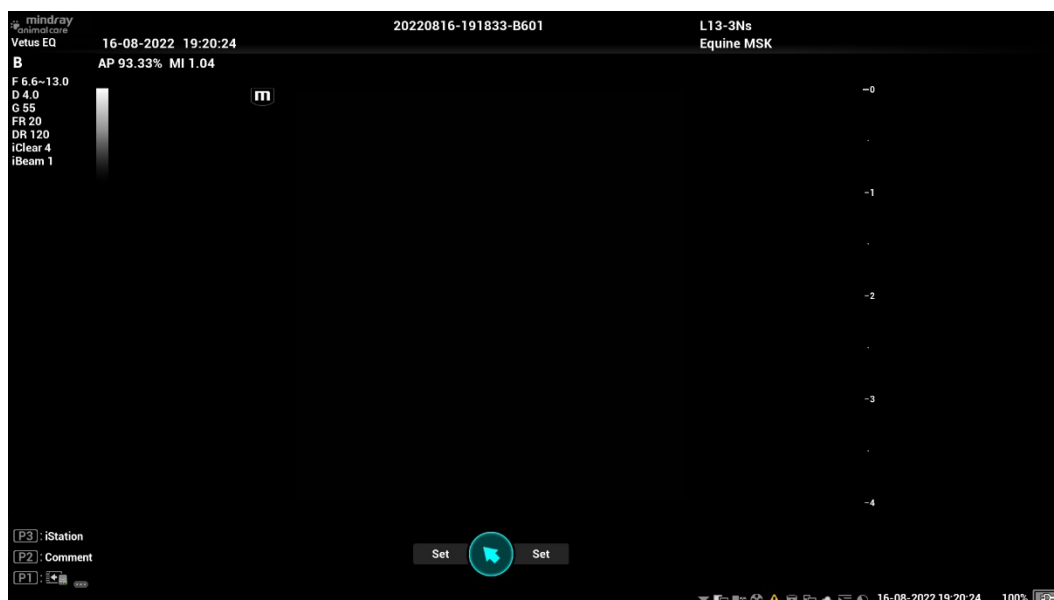
1.2.6 Software Setup

1.2.6.1 Running the System

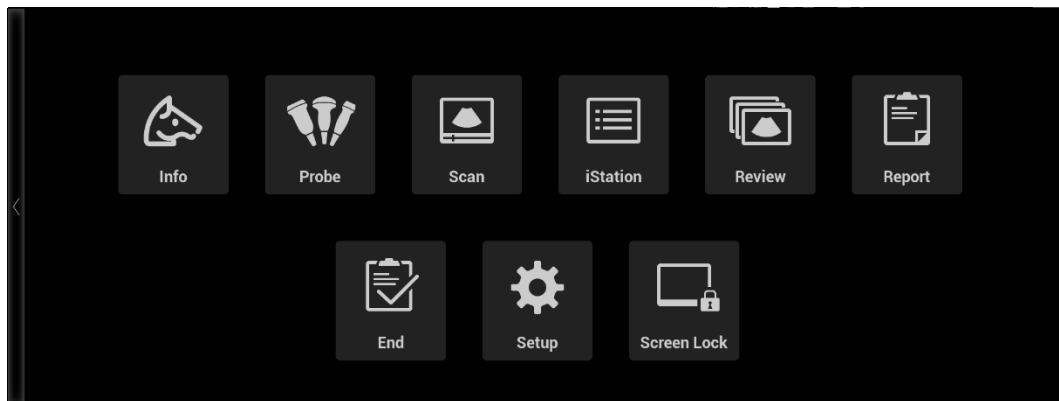
After powering up the system, the standby indicator on the control panel of the main unit is off, the battery indicator is displayed based on the battery status, and the disk indicator is displayed based on the disk access status. After you press the Power key during the power-up process, the battery level screen will display the equipment model and battery level, and turn off after displaying the information for 6s. The Part I Service Scenarios: [3.1.3Get Entire Device Started](#) screen will appear during the power-up process.

1.2.6.2 Accessing Doppler

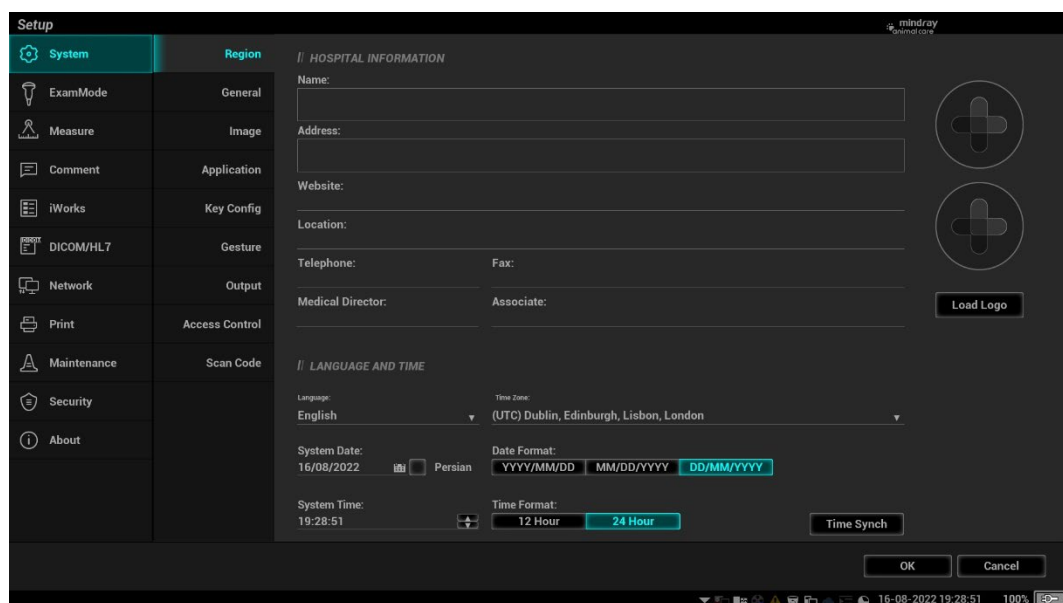
After power-up, the ultrasound system experiences a series of initialization actions (for about 1 minute) and directly enters the Doppler screen.



1.2.6.3 Setting Hospital Information



On the touch screen, tap Setup to access the setup screen.



On the setup screen, choose System > Region, enter the hospital name in Name and click OK.

1.2.6.4 Setting the System Date and Time

See Part I Service Scenarios: 1.2.6.4 Setting the System Date and Time. Access the Region screen and set the system date and time in System Time.

1.2.6.5 Setting the System Language

1. After the ultrasound system is started, select Setup on the touch screen to access the setup screen.
2. On the setup screen, choose System > Region > LANGUAGE and TIME and select the system language from the Language drop-down menu.
3. Click OK in the displayed dialog box.
4. Click Save to save the system language setting.

Restart the system as prompted.

1.2.6.6 Setting the Screensaver and Standby Mode

1. After the ultrasound system is started, select Setup on the touch screen to access the setup screen.
2. On the setup screen, choose System > General > Sleep and set the screen and standby options.

1.2.6.7 Setting the Video Format

1. After the ultrasound system is started, select Setup on the touch screen to access the setup screen.
2. On the setup screen, choose System > Output and set the video format.

1.2.6.8 Setting Custom Keys

1. After the ultrasound system is started, select Setup on the touch screen to access the setup screen.
2. On the setup screen, choose System > Key Config and set custom keys.

The procedure is as follows:

- a Select the desired key in the Key Function column on the left of the page.
- b Select a function in the Function area. The selected function is displayed on the right of the selected key.
- c Click Save.
3. Set auxiliary output functions.

The system provides auxiliary output function setting for the following three functions: "Save Single-Frame Image", "Save Clip(Retrospective)" and "Save Clip(Prospective)". When the corresponding user-defined key is pressed, the ultrasound system can perform multiple operations one by one as per the preset.

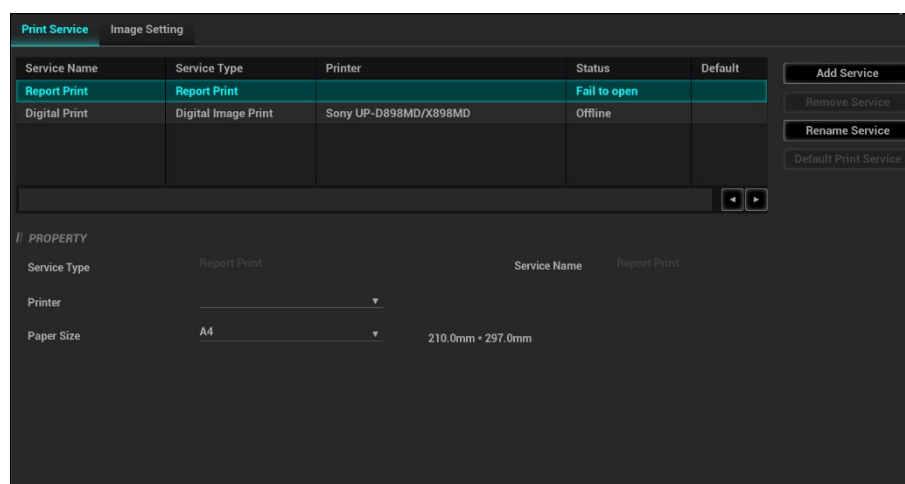
The procedure is as follows:

- a Set the Save Single-Frame Image custom key.
- b Click Add in the middle of the screen, then there will be "Function2: NULL" under the key function in the Key Function Field on the left side, and at the same time, the "Output" column on the right side will show the available auxiliary functions for current key.
- c Select "Send Image to DICOM Storage" in the "Output" column on the right side, and then the Function2 on the left side turns into "Send Image to DICOM Storage".
- d Click Add again, then there will be "Function3: NULL" under the key function in the Key Function Field on the left side.

Select "Send Image to USB Disk" in the "Output" column on the right side, and then the Function3 on the left side turns into "Send Image to USB Flash Drive".

1.2.6.9 Setting the Printer

1. After the ultrasound system is started, select Setup on the touch screen to access the setup screen.
2. On the setup screen, select Print to access the print setup screen.



Item	Description
Add Service	Click Add Service to add a print service.
Remove Service	Select a service and click Remove Service to delete the selected service.
Rename Service	Rename a selected service.
Default Print Service	Click Default Print Service to set the selected print service as the default one.
PROPERTY	Set service properties such as Service Type and Paper Size. The configuration varies according to the print service type. Available print service types include Report Print and Digital Image Print.

1.2.6.10 Setting the Footswitch

1. After the ultrasound system is started, select Setup on the touch screen to access the setup screen.
2. On the setup screen, choose System > Key Config. In the Key area, select Footswitch.
3. Select the desired key in the Key Function column on the left of the page.
4. Click to select a function in Function area. The selected function is displayed on the right of the selected key.
5. Click Save.

1.2.6.11 Setting the Barcode Scanner

1. After the ultrasound system is started, select Setup on the touch screen to access the setup screen.
2. On the setup screen, choose System > Barcode.
3. Select the corresponding tab and set related options.
 - 1D Barcode Scanner

Setup items are described as follows:

Item	Description
Item	After scanning a 1D barcode to obtain barcode data, match the regular expressions in descending order of priority as follows: animal ID, other IDs, animal name, sequence number, operator, and diagnostician. If any regular expression is matched, the system automatically fills the barcode data in the corresponding item on the animal information page. For example, scan a 1D barcode to obtain barcode data 123, match the regular expressions in the following order: animal ID, other IDs, animal name, sequence number, operator, and diagnostician. If the "other IDs" item is matched, the system automatically fills in the barcode data 123 to the "other IDs" editing box on the animal information page.
Regular expression	Preconfigure custom regular expressions in the "Regular expression" column based on the barcode format.
Add-on item	After this option is selected, you can add information about multiple operators or diagnosticians when obtaining operator or diagnostician information by scanning barcodes. For example, the 1D barcode data is operator or diagnostician information. Scan the barcode to obtain the operator or diagnostician information A. The system fills information A in the "Operator" or "Diagnostician" editing box on the animal information page. Scan another barcode to obtain the operator or diagnostician information B. The system appends information B to information A in the "Operator" or "Diagnostician" editing box on the animal information page.
Default item	If no default item is set, the scanned information is directly input after 2D and 1D match failures. If a default item is set, the system considers scanned information as the default item. For example, if the default item is set to animal ID and 2D and 1D match fail after barcode scanning, the scanned data is automatically displayed in the "Animal ID" editing box on the animal information page.
Move Up/Down	Move up or down the selected item.
Add/Delete	Add or delete the selected item. Only items that are set before delivery can be added or deleted.
Restore default	Restore the default values of items.
Worklist query	- If a worklist server is selected, the worklist server is queried based on scanned information. - If no worklist server is selected, a check is created on the animal information page based on the scanned information.
Default query item	- Select the default item for query on the worklist server. For example, if animal ID is selected, the worklist server is queried based on the animal ID in the barcode. - If no default query item is set, the worklist server is queried by animal ID, sequence number, and animal information in order. Note: If both 1D and 2D default items are configured, the matching priorities after barcode scanning is as follows: 2D, 1D, and default items.
Import/Export	Preconfigure barcodes by importing or exporting configuration files. For details, Mindray Animal Medical Customer Service Department or sales representative.

"Normal" parsing mode

The barcode is comprised of the animal ID, other IDs, animal name, DOB, and other information.

Setup items are described as follows:

Item	Description
Barcode example	Enter a barcode and the system automatically separates the barcode into the list in the lower part based on separators, which set the start position and end position of different information items.
Parameters	- After an example barcode is entered, you can modify the animal ID, other IDs, animal name, DOB (including the year, month, and day), age, gender, and other fields. "Ignored item" is used to add a line of ignored item below the selected parameter to hide unimportant information fields in the barcode. - Set the start and end positions of each item by using separators. After entering a barcode example, select the barcode field separators. The separator drop-down list displays only the separators that have been entered in the barcode example. - Delete: To delete only information in the "Content" column of the selected item. - Restore default: Restore the default values of parameters. - Age unit: Select the corresponding age unit, which can be year, month, or day. - Enter the custom gender symbol behind the male and female dialog boxes, for example, male (M) and female (F). Note: Define the units of the DOB (year, month, and day) on the right. If the DOB is pure digits, the system will automatically calculate the animal's age based on the DOB provided by the animal.
Age unit	Select the corresponding age unit.
Male/Female	Enter the custom gender symbol.
Default item	If no default item is set, the scanned information is directly input after 2D and 1D match failures. If a default item is set, the system considers scanned information as the default item. For example, if the default item is set to animal ID and 2D and 1D match fail after barcode scanning, the scanned data is automatically displayed in the "Animal ID" editing box on the animal information page.
Move Up/Down	Move up or down the selected item.
Add/Delete	Add or delete the selected item. Only items that are set before delivery can be added or deleted.
Restore default	Restore the default values of items.
Worklist query	- If a worklist server is selected, the worklist server is queried based on scanned information. - If no worklist server is selected, a check is created on the animal information page based on the scanned information.

Item	Description
Default query item	- Select the default item for query on the worklist server. For example, if animal ID is selected, the worklist server is queried based on the animal ID in the barcode. - If no default query item is set, the worklist server is queried by animal ID, sequence number, and animal information in order. Note: If both 1D and 2D default items are configured, the matching priorities after barcode scanning is as follows: 2D, 1D, and default items.
Import/Export	Preconfigure barcodes by importing or exporting configuration files. For details, Mindray Animal Medical Customer Service Department or sales representative.

"Advanced" parsing mode

Scan a barcode consisting certain information of the hospital, enter a regular expression based on the barcode format, and click Match to match the scanned barcode with the regular expression. If they are matched successfully, the barcode information is displayed in multiple items in the item list below.

- Default item: If no default item is set, the scanned information is directly input after 2D and 1D match failures. If a default item is set, the system considers scanned information as the default item. For example, if the default item is set to animal ID and 2D and 1D match fail after barcode scanning, the system automatically fills the barcode data in the "Animal ID" editing box on the animal information page.
- Import/Export: Preconfigure barcodes by importing or exporting configuration files. For details, Mindray Animal Medical Customer Service Department or sales representative.

1.2.6.12 Connecting to the network

1. After the ultrasound system is started, select Setup on the touch screen to access the setup screen.
2. On the setup screen, choose System > Network.
3. Select the corresponding tab and set related options.
 - Set related transmission parameters and local IP address on the network setup screen.

Network transmission encryption:

After connecting to the network, click VPN Config to access the VPN Config screen.

Item	Description
Status	No driver installed: Click Install Driver to access the TAP-Windows 9.21.2 Setup screen and finish installation as prompted. - Ready: ready for VPN connection - Advanced: advanced VPN configuration - Connected: VPN connected successfully - Unconnected: VPN disconnected - Error: connection error
Server IP/group/user name/password	Enter the service name.
Hide characters	Password characters are displayed as asterisks (*).
Connect/Disconnect	Connect to or disconnect from the VPN.

Item	Description
Advanced	Access the VPN Advanced Config screen. - Reset: Click Reset if the system gives no response when you click Config. - Config: Access the OpenConnect-GUI VPN client screen. For details about the configuration screen, see the TAP manual. Note: After exiting from the VPN Advanced Config screen, restart the system to use the VPN function properly.
Close	Exit from the VPN configuration screen.

- iStorage preconfiguration

Item	Description
Service Name	Service name that is set
Port	Transmission port
IP Address	Device IP address
Connect	Click Connect to verify whether the device is connected.
Add	Click it to add a new service to the service list.
Update	Complete and save server settings or modifications.
Delete	Delete the selected service from the service list.

Set network properties as above and click Connect to verify whether the device is connected.

After connection, click Add to add the network service to the service list.

Select a service record in the service list. Properties of this service are automatically displayed in the Configure Service area. Modify the parameters and click Update to update settings.

- MedTouch/MedSight preconfiguration

You can set environment for MedTouch/MedSight here and then use the MedTouch/MedSight function on mobile phones or tablet computers. For details, see the MedTouch/MedSight manual.

- Remote maintenance

Select Remote Maintenance Permission to allow remote maintenance.

Click Upload Logs to Remote Server to upload logs to the server. Customer service engineers can obtain logs from the server for analysis.

View the task uploading progress on the Animal Task Manager screen.

1.2.6.13 Connecting to DICOM/HL7

Note:	- The DICOM Preset menu item is available only if DICOM basic is configured. - AE Title should be the same with the SCU AE Title preset in the server (PACS/RIS/HIS). - The local port should be the same with the one configured on the server.
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- If the currently entered name has already existed, the system will pop up: "The server name exists!" Click [OK] to enter another name.
- DICOM worklist can be configured only if DICOM basic is configured. If DICOM worklist is not configured, the worklist screen is unavailable.

1. After the ultrasound system is started, select Setup on the touch screen to access the setup screen.
2. Click DICOM/HL7 to open the setup screen.

Set DICOM service properties. Specifically, enter the AE title (application entity name of the ultrasound system), port, and package size based on the actual conditions.

3. Set the DICOM ServeInstall
 - a Enter the device name and the IP address.
 - b You can ping other machines to verify connection after entering the correct IP address by clicking [Ping].
 - c Click Add to add the server to the list if the connection works normally.
4. Click 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. For details about other usage methods, see the DICOM/HL7 configuration description in the user manual.

1.2.6.14 Capture network log

1. After the ultrasound system is started, select Setup on the touch screen to access the setup screen.
2. Click DICOM/HL7 to open the setup screen.
3. Click [Capture] to bring up Network capture dialog.
4. Click to select a network card from the interface list.
5. Click [Start Capture] to start capturing.

- Click [Close] to exit the dialog, the system will continue to capture the log.
- Click [Stop Capture] to end capturing.

6. Export the capture result to view the detailed information.

The file name of capture result is "netcapture.cap", and it will be exported with the log export.

For details about exporting, see "Part I Service Scenarios: 2.4.7.1 Export Log".

1.2.6.15 Setting User Permissions

1. After the ultrasound system is started, select Setup on the touch screen to access the setup screen.
2. On the setup screen, choose System > Access Control to open the user permission setup screen.
 - Access Control: Set user permission management information.

The system administrator can set whether a user needs to be authorized to access the data in the system.

Access can be authorized only by the system administrator.

If Enable User Permission Management is selected on the access control setup screen, access to system data needs to be authorized, and password policy configuration, LDAP configuration, and password modification are supported.

If Enable User Permission Management is not selected, all users can access all system data without the need to request for authorization. In this case, password policy configuration, LDAP configuration, and password modification are not supported.

If Enable Emergency User is selected, the administrator can edit emergency user permissions. If it is not selected, the administrator cannot edit emergency user permissions.

- Add Users and Assign Permissions

Log in as the system administrator. If not, you will be required to enter the administrator user name and password during the setting.

- Delete User

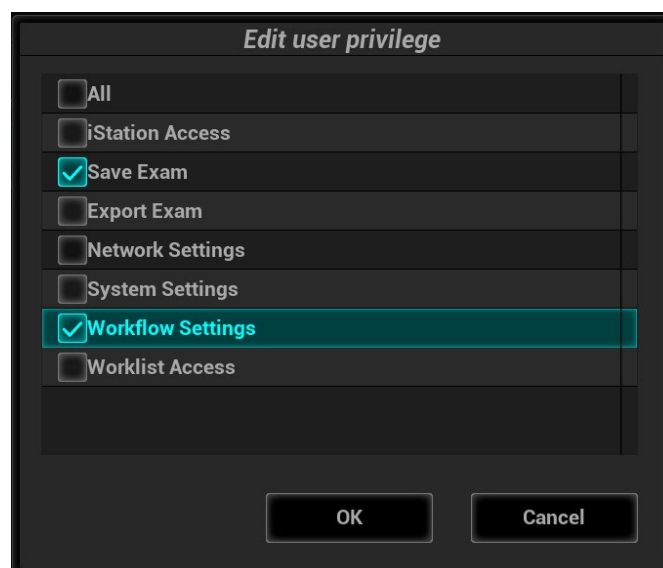
Log in as the system administrator. If not, you will be required to enter the administrator user name and password during the setting.

Select a user in the user list and click Delete to delete the selected user.

- Edit Permissions

Before editing user permissions, log in as the system administrator.

Select a user in the user list and click Edit Privilege to access the Edit user privilege dialog box.



Select or clear the check box corresponding to a permission item to add or delete permissions.

Click OK to confirm the settings and exit the dialog box.

- Modify Password

The system administrator can modify passwords of all users. The default administrator password is null. The system administrator can set administrator passwords. Operator users can modify only their own passwords.

Select a user name in the user list, click Modify Password to open the Modify Password dialog box. Enter a new password, confirm the new password, and click OK.

- Configure Password Policy

Before configuring password policies, log in as the system administrator.

Click Configure Password Policy.

Item	Description	Remarks
Locking threshold	Specifies the maximum number of consecutive times that a user can enter a wrong password. If this threshold is exceeded, the corresponding account will be locked.	For example, the locking threshold is set to 5, time for resetting locking threshold to 60 minutes, and locking period to 60 minutes. If the user enters a wrong password for more than 5 consecutive times within 60 minutes, the user will be locked for 60 minutes. During the locking period, the locked user cannot log in but other users can log in properly.
Time for resetting locking threshold	Specifies the duration that a user can enter a wrong password repeatedly.	
Locking period	Specifies the user locking period.	
Clear locking	Clears all locking information.	/
Enable strong password	Enhances password security by enabling strong password. - When a user created before this item is selected logs in, the system will prompt whether the current user password complies with the security policy. The administrator can reset operator passwords or administrator passwords in Access Control. - If the password of a user created after this item is selected does not comply with the security policy, the system will prompt the user to modify the password.	/

- LDAP permission management

Before assigning permissions through the LDAP server, log in as the system administrator.

Click LDAP Config.

Item	Description
Server Address	After connecting to the network, enter the server address in the Server Address editing box.
Test LDAP Server	Verify whether the server functions properly. If the server passes the test, the prompt "Server test successful" is displayed.
Root DN	The root DN is automatically displayed upon server test success.
Default Domain	The default domain is the DC name in the root DN. For example, if the DC name is security1 in the root DN, the default domain is security1.
Password Retention Period	This item specifies the number of days that an LDAP user password is retained locally. After this item is set, the user can log in to the server without connecting to the network during the password retention period. - If the value is null, the user password is permanently saved locally. 0: not to save the password locally. ≥ 1: The value 5 indicates saving the password locally for 5 days.

Item	Description
Group and Permission	• Add users: Enter the group name and add permissions for group users in the Permission drop-down box. Click Add, and the added group name and permissions will be displayed in the list above. • Delete users: Select a user in the user list and click Delete to delete the selected user. • Modify group name/edit permissions: Select a user in the user list, modify the group name or add/delete permissions from the Permission drop-down box, click Modify, and view the newly assigned permissions in the list above.
Verification Test	1 Enter the group user name and password in the User Name and Password editing boxes. 2 Click Login Test to verify whether the user can be authenticated. The screen will display the authentication result.
Enable Custom Properties	After custom properties are enabled, the group and permission list cannot be edited. Enter custom properties in the Custom Attribute editing box. Properties are set by the user on the LDAP server. For details, see the LDAP server manual. The mapping between the permission items and attribute values is as follows: • iStation control: 1 • Saving check: 2 • Export check: 4 • Network setup: 8 • Maintenance menu: 16 • System setup: 32 • Workflow setup: 64 • Worklist control: 128 Note: Permission items can be combined as required. For example, if all of the preceding eight permissions are assigned to user A, the attribute value of this user is $1+2+4+8+16+32+64+128=255$.

1.2.6.16 Setting Installment

When a user needs to purchase this product on installment, customer service engineers can perform installment settings and the system will automatically generate an installment password.

Note: Before setting, the engineer should log in to the system with the account Service.

1. Choose Setup > Maintenance > Setup > Installment, click Set Installment, and set the installment times in the Periods drop-down list and the installment payment interval in the Days drop-down list, as shown in the following figure.

The 'Set Installment' dialog box has a title bar 'Set Installment'. It contains three main sections: 'Periods' with a spinner set to 4, 'Days' with a spinner set to 30, and 'Password List' with a table. The table has two columns: 'Period' and 'Password'. Below the table are three buttons: 'Generate', 'Reset', and 'Save As'. At the bottom right are 'OK' and 'Cancel' buttons. A checkbox labeled 'Display Password' is unchecked.

Period	Password

2. Click Generate, select Display Password, and the Password List column shows the password automatically generated by the system, as shown in the following figure.

The 'Set Installment' dialog box is shown after clicking 'Generate'. The 'Periods' spinner is still 4, and 'Days' is 30. The 'Password List' table now contains three rows of generated passwords. The 'Display Password' checkbox is now checked. The 'Generate' button is disabled.

Period	Password
4	69466935
Pay Off	97661554
Global	43318537

The following takes the preceding figure as an example to describe the purposes of installment payment passwords.

The first installment is the down payment.

- a The payment is divided into four installments. The system generates four installment payment passwords and one pay-off password.
- b First installment payment password:

After the user pays the down payment, the installment dialog box appears upon startup. Enter this password in "Please enter installment payment password", and click Start to log in to the system.

Note: After the user pays the down payment and enters the first installment payment password at login, the system calculates the next installment payment time.

- c Second installment payment password:

The user pays the installment amount when the second installment is due.

When the installment is due, the system displays the installment payment dialog box at startup. Enter the installment payment password in "Please enter installment payment password", and click Start to log in to the system.

If the user prepays the amount of this installment: Tap Setup on the touch screen, choose Maintenance > Set > Advance Payment, select 2 in Periods, enter the installment payment password, and click OK to log in to the system. The system prompts the number of available days.

The use of the third and the fourth installment payment passwords is the same as that of the second one. After the fourth installment payment is finished, system login is no longer subject to installment restrictions.

- d Pay-off password: password used to pay the rest amount of the installment.

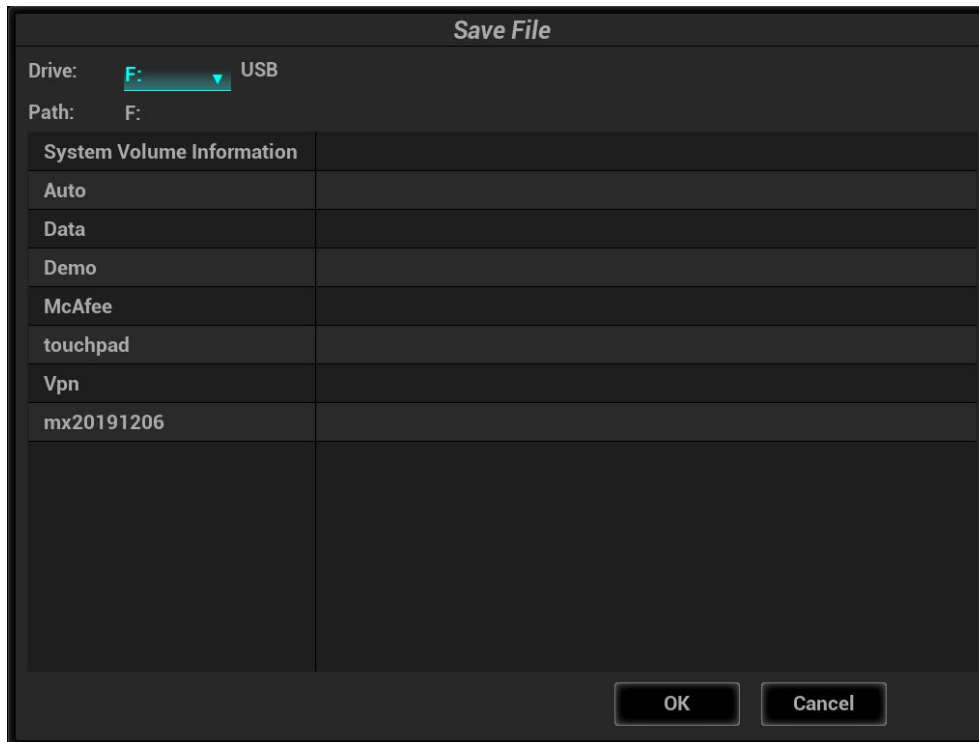
If the user chooses to pay the rest amount of the installment: choose Setup > Maintenance > Setup > Advance Payment, select Pay Off in Periods, enter the pay-off password, and click OK. Then system login is no longer subject to installment restrictions.

If the user chooses to pay the rest amount of the installment when the installment payment is due: The installment dialog box appears at startup when the installment is due. Enter this password in "Please enter pay-off password", and click Start to log in to the system. Then system login is no longer subject to installment restrictions.

- e Global password: used to protect the installment against tampering.

Note: The global password is displayed only once. Therefore, keep the global password properly. If the global password is lost, you cannot log in to the Doppler system as a customer service engineer or reset installment payment after setting installment payment and restarting the system.

3. Click Reset to reset the installment. Reset the installment times in the Periods drop-down list and the installment payment interval in the Days drop-down list, click Generate, and select Display Password. Then the system generates new installment payment passwords.
4. Connect a USB flash drive, click Save As, select a storage path, and click OK to save the password, as shown in the following figure.



5. Restart the system, select Log In as Customer Service Engineer, enter the global password, and click Login. In the account login dialog box, enter the customer service account and password and click Login. The system automatically enters the Doppler screen.
6. Tap Setup on the touch screen and choose Maintenance > Set > Installment. Click Set Installment. In the displayed dialog box, enter the global password and click Login. The system automatically enters the installment setup screen.
7. View the installment payment passwords.

Tap Setup on the touch screen and choose Maintenance > Set > Installment. Select Display Password and the Password List column shows the installment payment passwords generated by the system. Or

Open the password storage file suffixed with .txt, and view the installment payment passwords.

Note:

You are advised to record the installment payment passwords by taking pictures or in other ways.

1.2.6.17 Setting Security Policies

1. After the ultrasound system is started, select Setup on the touch screen to access the setup screen.
2. Choose Setup > Security.
3. Disk encryption/data clearing

Encrypt the animal data stored on the hard disks of the ultrasound system. The system provides two encryption modes:

- Factory settings: By default, the system enters the factory settings state upon startup.
- Custom: Add a custom password.
 - a Select Custom.
 - b If the system contains no animal data, click OK and enter the password.

If the system contains animal data, the system prompts you to clear the data. Set as follows:

Click OK to return to the setup screen. Click Clear and clear animal data as prompted. Select Custom, click OK, enter the password, and click OK.

Note:

- **Perform the preceding operations to switch back to the factory settings. The password is still the custom password and does not need to be reset.**
- **Multilanguage inputs and Chinese characters are not supported in passwords.**

4. Antivirus

The system provides Windows Defender antivirus software. The antivirus software can effectively protect the system against attacks from viruses, spyware, and other malicious software.

1.2.6.18 Connecting MedTouch/MedSight

You can set environment for MedTouch/MedSight here and then use the MedTouch/MedSight function on mobile phones or tablet computers. For details, see the MedTouch/MedSight manual.

2 Maintenance

2.1 Overview

The ultrasound system does not require regular preventative maintenance such as calibration or adjustments to the hardware and transducers. Periodic cleaning and quality inspection described in this chapter are recommended.

2.2 Maintenance

2.2.1 Tools, Measuring Instruments and Consumables

Table 2-1 List of tools and measuring instruments

Tool/Measuring Instrument	Quantity	Remarks
Plastic or resin container	1	For holding normal saline, capable of accommodating two ultrasound probes
Soft brush	1	About a toothbrush size, with a soft brush head
Small plastic pot	1	For holding soapsuds
Safety tester	1	See Part III Appendix: 3 Electrical Safety Maintenance.

Table 2-2 List of tools and measuring instruments

Consumable	Quantity	Remarks
Aluminum foil	About 1 m	/
Normal saline solution	About 1000 mL	Half of the container volume to immerse the probe (concentration 0.85–0.95%)
Mild soapsuds	About 400 mL	/
Dry soft cloth/cotton cloth	5	/

2.2.2 Regular Maintenance Items

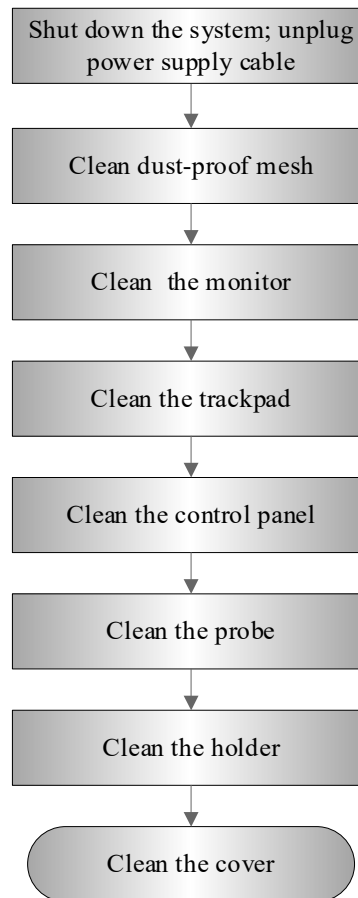
Table 2-3 Maintenance items and frequency

No.	Item	Recommended Frequency	Maintenance Personnel		Method
			Terminal User	Engineer	
1.	Cleaning the dust filters	1 time/month	•	•	

No.	Item	Recommended Frequency	Maintenance Personnel		Method
			Terminal User	Engineer	
2.	Cleaning the display	1 time/month	●	●	See Part I Service Scenarios: 2.2.3 Daily Maintenance.
3.	Cleaning the control panel	1 time/month	●	●	
4.	Cleaning the probe (head)	Each time after being used	●	●	
5.	Cleaning the probe cable and connector shell	1 time/month	●	●	
6.	Cleaning the shell	1 time/month	●	●	
7.	Cleaning the peripherals	1 time/month	●	●	
8.	Checking the probe surface	1 time/day	●	●	See Part I Service Scenarios: 2.3 Check.
9.	Checking the power cable and power plug	1 time/month	●	●	
10.	Checking the batteries	1 time per 3–6 months	●	●	
11.	Checking peripherals and accessories	1 time/year	●	●	
12.	Mechanical safety check	1 time/year	●	●	
13.	Electrical safety check	1 time/year		●	

2.2.3 Daily Maintenance

Figure 2-1 Cleaning flow



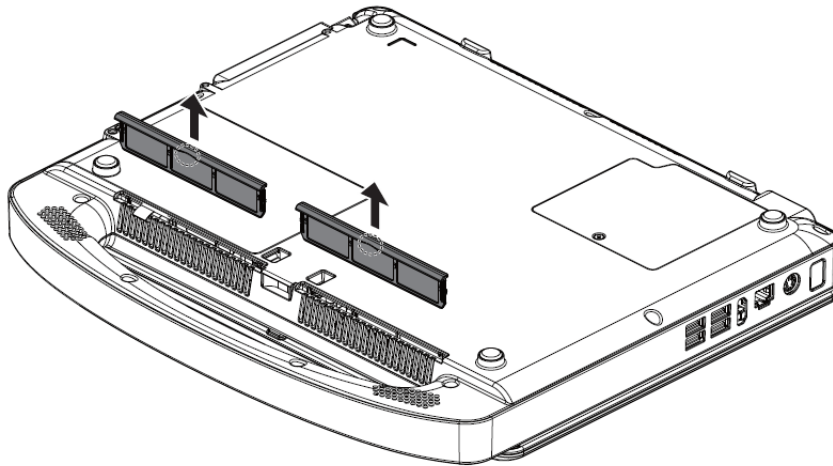
WARNING: Before cleaning the system, be sure to power down the system and remove the power cable. If you clean the system in the power-up state, an electric shock may be caused.

2.2.3.1 Cleaning the Dust Filters

Dust filters of the main unit

- Tool: soft brush
- Method:

Take off the dust filters on the side of the main unit.

**CAUTION:**

Clean all dust filters of the system periodically (once a month); otherwise, the system may be damaged. Cleaning times can be increased when the system is used in the open air or somewhere dust is more.

2.2.3.2 Clean the Display (Touch Screen)

Tool: dry soft cloth, clear water or wild soapsuds

Method: Clean the display and touch screen surface with a soft dry cloth. The display and touch screen with remaining stains can be wiped away using a cloth with a little clear water or wild soapsuds and then left for air drying.

2.2.3.3 Cleaning the Control Panel

Note:

- Keyboard on the control panel should be cleaned periodically, otherwise, keys maybe blocked by dirt and buzzer dings, keys don't work.
- The touch screen is cleaned in the same way as the control panel.

Tool: mild soapsuds, dry soft cloth

Method: Use a dry soft cloth to clean up the dust on the surface of the control panel (including keys and encoder). Use a dry soft cloth immersed with a little wild soapsuds to wipe away remaining stains, and then use another dry soft cloth to wipe up the control panel or leave it for air drying. If it is difficult to clean the control panel, remove the caps of the encoders, and then use mild soapsuds to clean off.

2.2.3.4 Probe cleaning

Note: The probe connector cannot be wiped up using a cloth immersed with water.

Tool: mild soapsuds, dry soft cloth

Method:

1. Use a dry soft cloth to wipe away the dust on the probe head, connector shell, and cable.
2. Wipe off the dust on the probe connector or terminal by using a soft brush.
3. Use a dry soft cloth immersed with a little wild soapsuds to wipe away the remaining dust or stains on the cable surface or connector shell, and then leave it for air drying.

2.2.3.5 Cleaning the Equipment Enclosure

Note: For exposed interfaces or sockets such as probe sockets and interfaces on the IO board and power panel, use a soft brush to slightly wipe off the dust. It is prohibited to use a cloth immersed with water to clean these items.

Tool: mild soapsuds, dry soft cloth

Method:

Use a dry soft cloth to wipe off the dust on the equipment enclosure (exposed part). Alternatively, use a dry soft cloth immersed with a little wild soapsuds to wipe away remaining stains, and then leave it for air drying.

2.2.3.6 Cleaning Peripherals

Clean actually configured peripherals and skip check items for those not configured.

Table 2-4 Peripheral cleaning list

No.	Item	Description
1	Color or black/white video printer	Use a soft dry cloth to clean off the dust and stains on the cover. Remove the cover to clean the inside of the printer. It is necessary to abide by the procedures in the user manual to clean the printer.
2	Graph/text printer	Use a soft dry cloth to clean off the dust and stains on the cover. Remove the cover to clean the inside of the printer. It is necessary to abide by the procedures in the user manual to clean the printer.
3	Footswitch	Use a dry soft cloth immersed with a little wild soapsuds to clean off the dust and stains on the keys and cables of the footswitch.
4	Barcode scanner	Use a dry soft cloth to clean the glass board of the scanner, and then clean off the dust on the cables and the support. If special cleaning is required, strictly follow the instructions in the scanner user manual.

2.2.4 Disinfecting the Main Unit

⚠ WARNING:

- Use only Mindray Animal Medical approved disinfectants and methods listed in this section to disinfect the main unit. Warranty does not cover damage caused by unapproved substances or methods.
- Do not mix disinfectants, as hazardous gases may result.
- We make no claims regarding the efficacy of the listed chemicals or methods as a means for controlling infection. For the method to control infection, consult your hospital's infection control officer or epidemiologist.

- ⚠ CAUTION:**
- Never immerse any part of the main unit in liquids or allow liquid to enter the interior.
 - Any contact of disinfectants with connectors or metal parts may cause corrosion.
 - Do not pour or spray any liquid directly on the main unit or permit fluid to seep into connections or openings.
 - If you spill liquid on the main unit, disconnect the power supply, dry the main unit, and contact your service personnel.
 - Never use abrasive materials (such as steel wool or silver polish), or erosive cleaners (such as acetone or acetone-based cleaners).
 - Dilute and use the disinfectants according to the manufacturer's instructions.
 - Check the system after disinfection. If there is any sign of damage, remove it from use.
 - Follow local regulations when selecting and using the disinfectant.
 - Disinfectants listed in this section are used for disinfecting the housing of the main unit and the monitor only, not for disinfecting the probes.
 - During cleaning, wear medical gloves to prevent infection.

2.2.4.1 Compatible Disinfectants

The following table lists compatible disinfectants.

Product Name	Manufacturer	Type
75% alcohol	/	Solution
99.5% isopropyl alcohol	/	Solution
SONO™ ULTRASOUND WIPES	Advanced Ultrasound Solutions Inc.	Wipe
Schulke mikroqid® Sensitive Wipes	Schulke	Wipe
Mikrobac Tissues	Bode Chemie GmbH	Wipe
Sani-Cloth® Plus	PDI	Wipe

2.2.4.2 Disinfection Procedures

Note:

The system has passed puncture test and leakage current test, and thus can be disinfected on power- on status: tap > bar in the left side of the touch screen to enter the Exam Main Menu screen and then select  to lock the system for 10 seconds to disinfect the system while the power is “On”

After cleaning, disinfect the system as follows.

1. Wear medical gloves to prevent infection.
2. Disinfect the main unit with disinfectant wipe or solution.

Follow the disinfectant manufacturer’s recommended contact time and method.

Only the areas highlighted in gray color as shown in the following figure can be disinfected.

Do not disinfect the top cover, bottom cover, side panels around the main unit, manufacturer logo, any visible sockets or interfaces (such as probe socket, ventilation holes, dust-proof cover, loudspeaker, sockets or interfaces in the IO panel and power supply panel).



3. Remove any residue with a water-moistened soft cloth on the main unit.
4. Wipe off water on the main unit using sterile cloth or gauze. Do not dry the main unit by heating.

2.3 Check

2.3.1 General Check

Table 2-5 General checklist

No.	Item	Method
1	Probe	1 Visual inspection: Check that the probe head is free from cracks and swelling. 2 Visual inspection: Check that the probe cable is free from aging and blistering. 3 Visual inspection: Check that the probe connector is not bent or damaged, or does not have missing pins.
2	Power cable and plug	1 Visual inspection: Check that the power cable is free from buckling, cracks, and aging. 2 Manual inspection: Check that the power plug is secured reliably and does not loosen or crack, and that the preventing strip of the power cable is effective.
3	Battery	Check the battery performance regularly. 1 Check whether the batteries can be charged properly during power-up. If the current battery level is 100% or the battery level increases after a period of time, the batteries can be charged properly. Generally, when the battery level is lower than 90%, it takes less than 5 minutes for the battery level to increase by 1%. When the battery level is higher than 90%, it takes a longer time for the battery level to increase by 1%. 2 After AC power is disconnected in the standby state, check whether the batteries can maintain the standby state based on the standby indicator.

2.3.2 System Function Check

System function check is an effective means to ensure product quality and can be performed when necessary. This check is optional during periodic maintenance.

Table 2-6 System function list

No.	Item	Method
1	B mode	Check the basic operations in B mode. Check the basic software and hardware controls which affect B-mode operation.
2	Color mode	Check the basic operations in Color mode. Check the basic software and hardware controls which affect color-mode operation.
3	Doppler mode	Check the basic operations in Doppler mode. Check the basic software and hardware controls which affect Doppler-mode operation.
4	M mode	Check the basic operations in M mode. Check the basic software and hardware controls which affects M-mode operation.

No.	Item	Method
5	Measurement (general 2D, M, and Doppler measurement, optional application measurement)	Scan the gray scale on body mark mode. Use controls to measure the accuracy of the distance and the area. Verify the measurement accuracy by employing the performance test.
6	Keyboard test	Test the keyboard to verify the keys on the keyboard.
7	LCD	Refer to LCD checking methods to check whether LCD display and parameters adjustment are normal.
8	Software menu testing	Test the display of software menus to ensure that the operation menus and interfaces can be accesses properly.

2.3.3 Checking Peripherals and Accessories

Skip relevant check items for modules or accessories not included in system configurations.

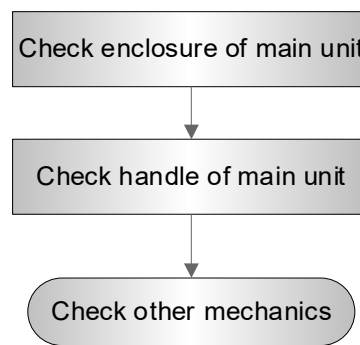
Table 2-7 Accessory and peripheral checklist

No.	Item	Method
1	Color or black/white video printer	Check whether the video printer works properly.
2	Graph/text printer	Check whether the graph/text printer works properly.
3	Footswitch	Check whether the footswitch implements preset functions according to procedures.
4	DVD-R/W	Check whether the DVD-R/W functions normally (write, read and pop-up).
5	Barcode scanner	Check whether the scanner functions normally and whether the outputs are correct.
6	DICOM	Check whether the DICOM functions normally by sending images to the DICOM server.

For details, see Part II General Information: 6.3 General Check.

2.3.4 Mechanical Safety Check

Mechanical safety check aims to check the mechanical strength and mechanical functions of the key components of the ultrasound system. Major check modes include visual inspection and operation check. If the check results are not up to standard, the system is abnormal. In this case, stop the system and take proper measures. The following figure shows the check flow.

Figure 2-2 Mechanical safety check flow

Following is the mechanical safety checklist:

No.	Item	Method	Tool
1.	Enclosure of the main unit	Visual inspection: Check that the enclosure does not crack.	/
2.	Handle of the main unit	1 Visual inspection: Check that the handle does not crack. 2 Turn the handle slightly and lift up the equipment. Ensure that the handle does not loosen and can bear forces properly.	None
3.	Other mechanical structures	Check that other mechanical structures are free from loosening parts, enclosure cracks, and exposed conductive parts.	None

2.3.5 Electrical safety check

Electrical safety check must be conducted by maintenance engineers with professional knowledge or skills, or those trained to possess the skills.

For details, see Part III Appendix: 1 Electrical Connection Diagram.

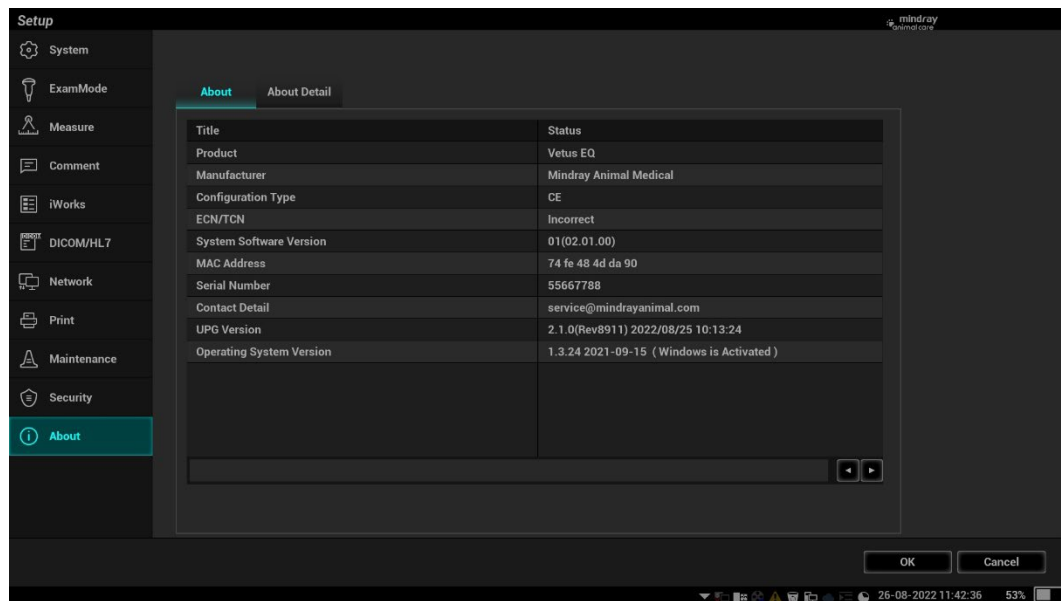
2.4 Software Maintenance

2.4.1 Viewing System Information

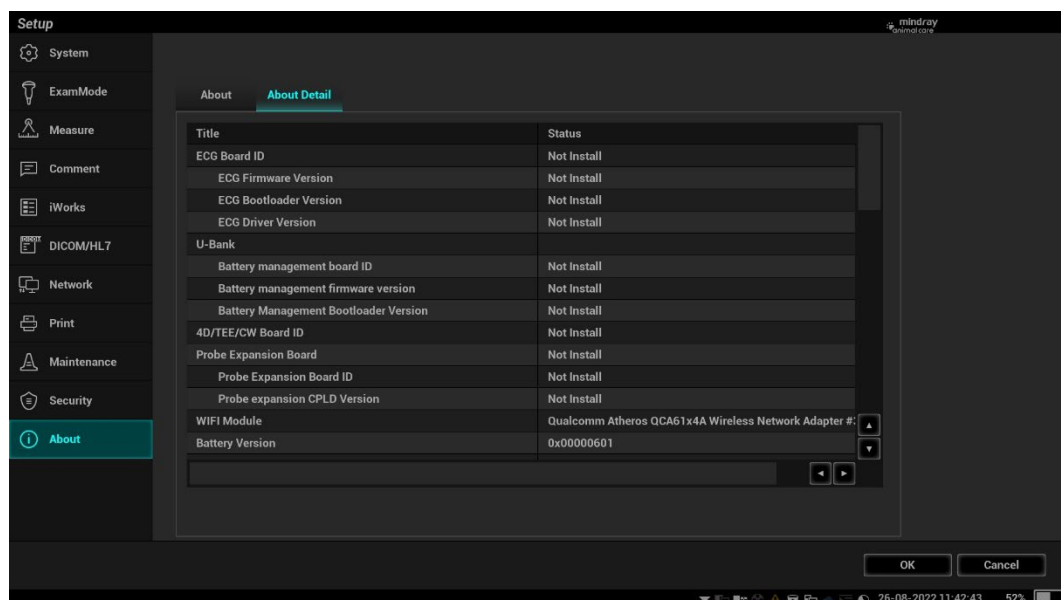
- Note:**
- Be sure to confirm the system information before and after the software maintenance.
 - If required, the system will ask the user to save the current system information.

After logging in as user Service, view the product configuration, software version, hardware boards, driver related information, and hardware configuration information on the system information screen. You can confirm the product information on this screen.

1. Log in with the Service account.
2. Press Setup and then click About to open the following screen.



3. The About Detail screen presents all hardware board information about the system.



2.4.2 Logging In with the Service Account

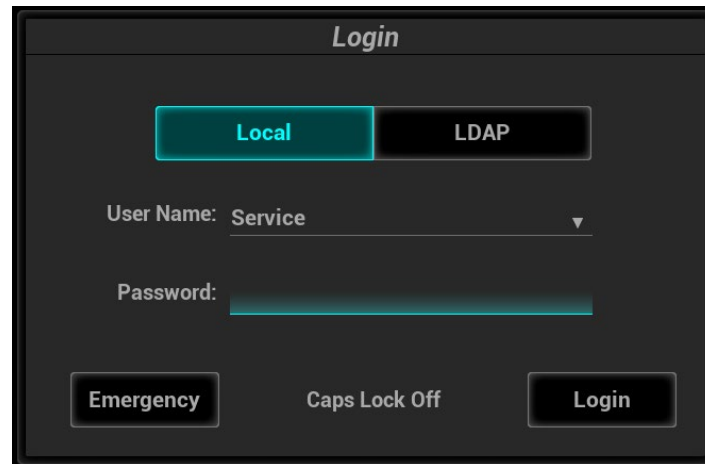
Note:

- Before maintenance, log in to the system as user Service.
- After clicking [Enable ms-settings], you can make settings for the operating system on Windows interface. After the settings, click [Disable ms-settings] on the maintenance screen to disable the function immediately. Otherwise, the performance or operation of the ultrasound system may be affected.

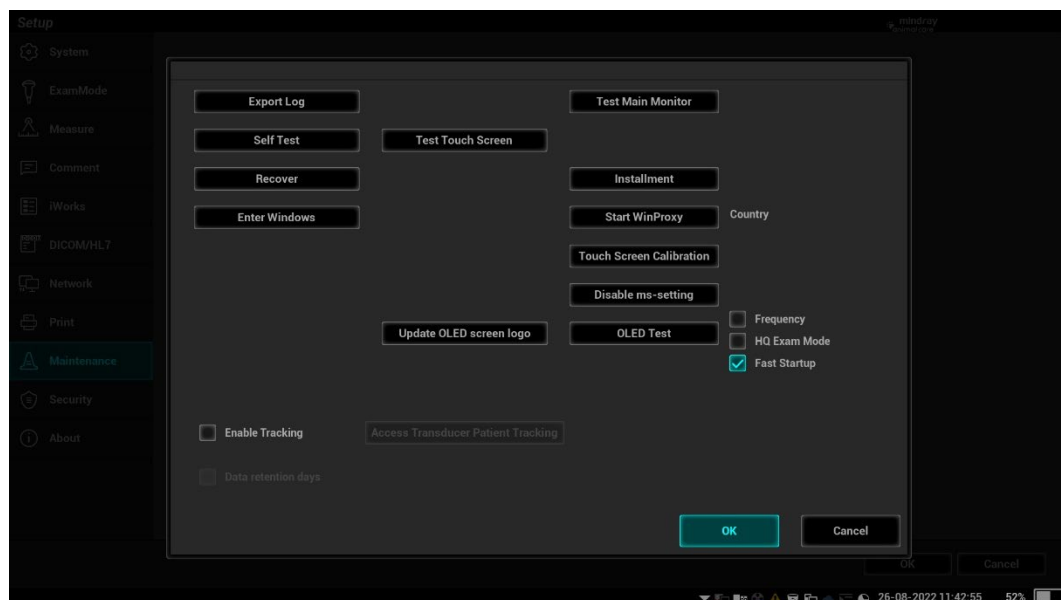
The login procedure is as follows:

1. Show the login dialog box in either of the following ways and log in to the system as user Service:
 - If access control is disabled, connect a keyboard to the USB port of the system, press Ctrl+/ to show the login dialog box, and log in as user Service.

- If access control is enabled, click the access control icon on the task bar of the main screen and then click Switch User. In the displayed login dialog box, enter 0755 in the password box to invoke the internal user account, and log in to the system as user Service.



2. Log in to the system as user Service and choose Setup > Maintenance > Set to access the maintenance menu.



2.4.3 Entering Windows

Tap Enter Windows to open the password making page (website: <http://ukmo.mindray.com/>). After login, click Make Pwd to enter the following password making page.

MAC Address : - - - - -

Serial NO. :

1. Type the device MAC address and serial number (see About) and click Make Pwd to generate the password for entering Windows from the device with the corresponding MAC address.

2. Access the maintenance menu and click Enter Windows. In the displayed dialog box, type the generated password to enter Windows.

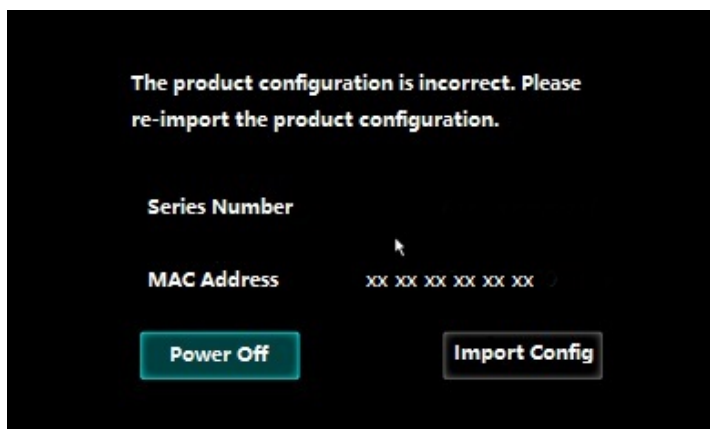
2.4.4 Importing the configuration file after the SSD or HDD is replaced

After replacing the SSD or HDD, it is required to import the configuration file to enter the ultrasound application at the first time powerup. The steps are as follows.

1. Before replacing the SSD or HDD, contact Mindray Animal Medical service engineer to download the configuration file from Mindray Animal Medical's internal platform.
2. On a computer, unzip the file obtained from Mindray Animal Medical to a USB flash drive and confirm the “Config.key” file is included.

名称	修改日期	类型
docs	2021-3-1 9:10	文件夹
Abdomen General Package.key	2021-3-1 9:10	KEY 文件
AutoEF.key	2021-3-1 9:10	KEY 文件
Cardiology Package.key	2021-3-1 9:10	KEY 文件
Config.key	2021-3-1 9:09	KEY 文件
CW.key	2021-3-1 9:10	KEY 文件
DICOM Basic.key	2021-3-1 9:10	KEY 文件

3. After replacing the SSD or HDD, Insert the USB flash drive into a USB port on the device. The system will prompt to import the product configuration file on startup.



4. Click [Import Config], browse the USB drive and select the “Config.key” file, then click [OK] to import. After the file has been successfully imported, a message will be displayed on the screen.

2.4.5 Software Recovery

For details, see the System Recovery Guide.

Note: After recovering the operating system, you need to reactivate Windows 10.

The Windows 10 operating system used by the ultrasound product has an OEM key. Therefore, the operating system will be automatically activated when the product is connected to the network.

View the network connection status of the product on the About screen. If the operating system is not activated after network connection, manually activate the Windows 10 operating system in either ways: online activation or activation by phone.

2.4.5.1 Online Activation

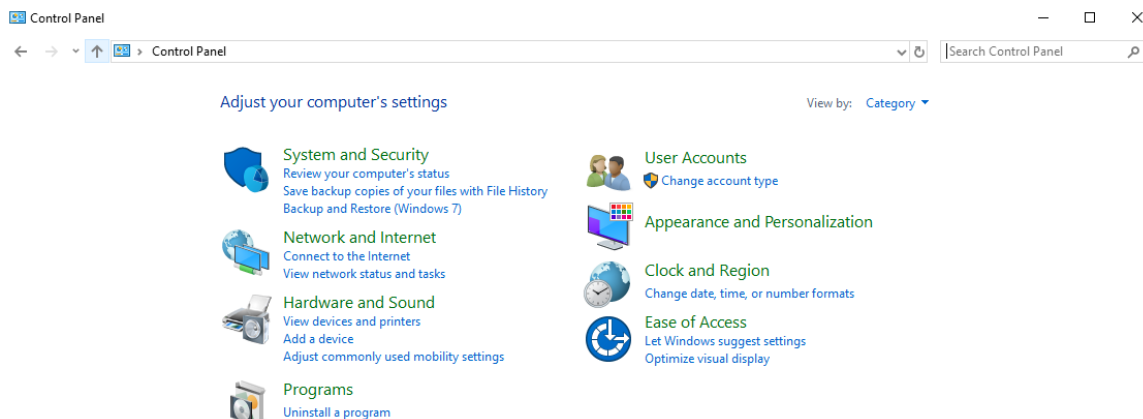
Make sure the ultrasound system is connected to the Internet.

Perform the following procedure:

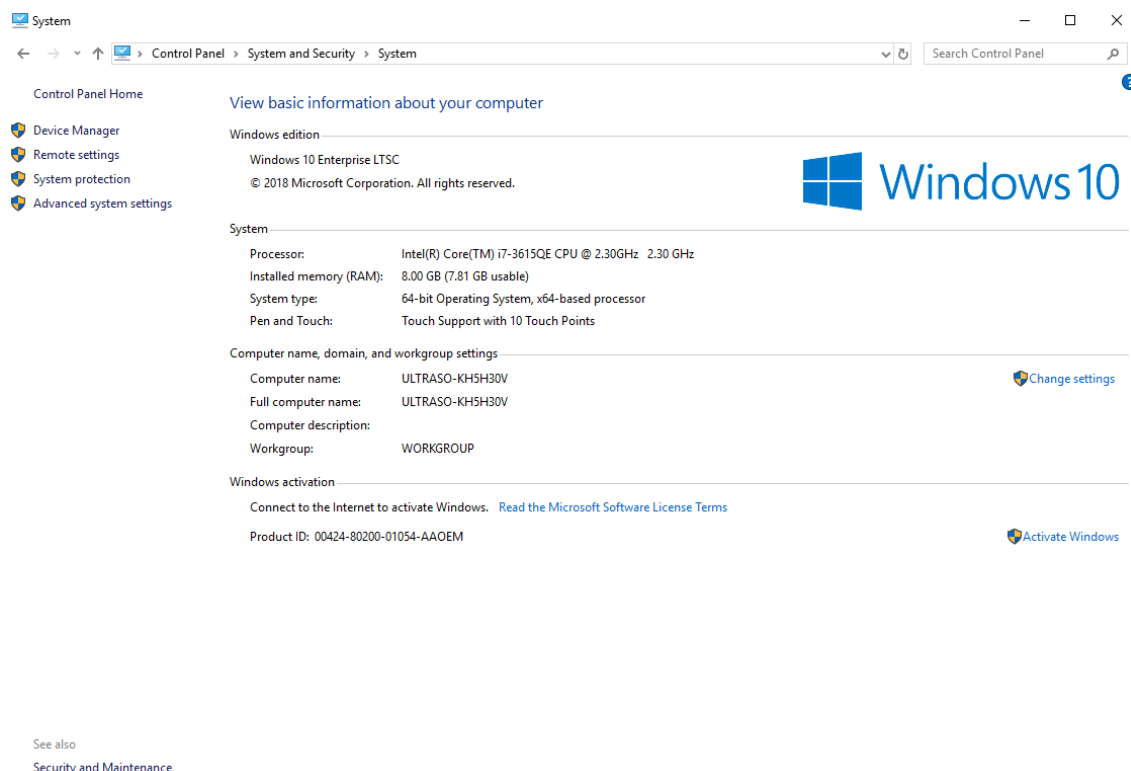
1. Go to [Setup] > [Maintenance] > [Setup] > [Enter Windows], and input the password.

For details, see 2.4.3 Entering Windows.

2. Input “Control Panel” in the address column in the pop-up Windows Explorer and press [Enter] key to display Control Panel.

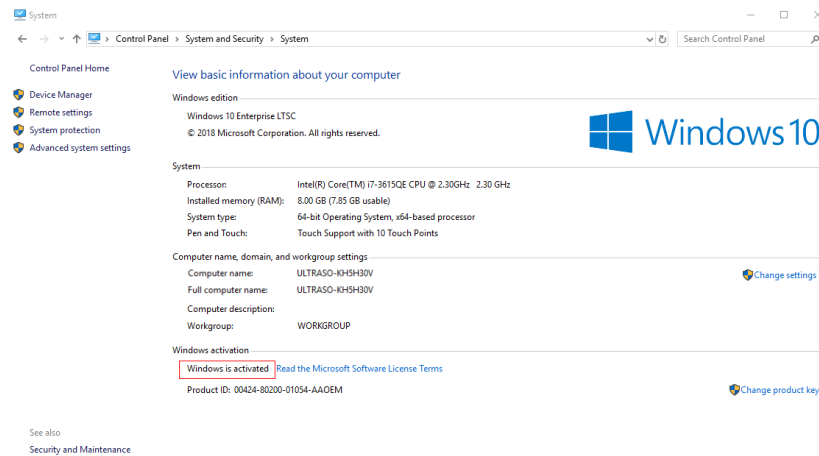


3. Select [System and Security] > [System].



4. If Windows 10 is not activated, close all the windows to return to the ultrasound screen.
5. Enter service mode. For details, see 2.4.2 Logging In with the Service Account.

6. Navigate to [Setup] > [Maintenance] > [Setup] and click [Enable ms-setting].
7. Select [OK] > [Save] to exit and power off the system.
8. Power on the system. And redo the step 1 to step 3.
9. Click [Activate Windows]. It may take a while to activate Windows 10. After it is successfully activated, “Windows is activated” will be displayed on the screen as shown below.



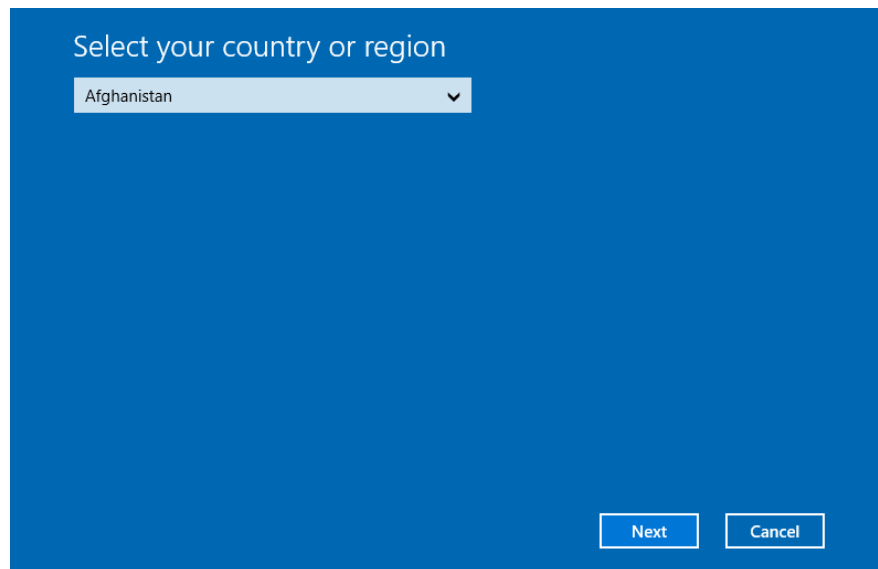
10. Close all the windows and run “BacktoDoppler” on the desktop to return to the ultrasound screen. Navigate to [Setup] > [Maintenance] > [Setup] and click [Disable ms-setting].
11. Select [OK] to exit and power off the system.

2.4.5.2 Phone Activation

If the ultrasound system is not connected to the Internet, activate Windows 10 by phone.

Perform the following procedure:

1. Go to [Setup] > [Maintenance] > [Setup] > [Enter Windows], and input the password.
For details, see 2.4.3 Entering Windows.
2. Input “cmd” in the address column in the pop-up Windows Explorer and press [Enter] key to display Control Panel.
3. Input “slui 4” in the DOS prompt and press [Enter] key. Phone activation wizard Menu will be displayed as below.

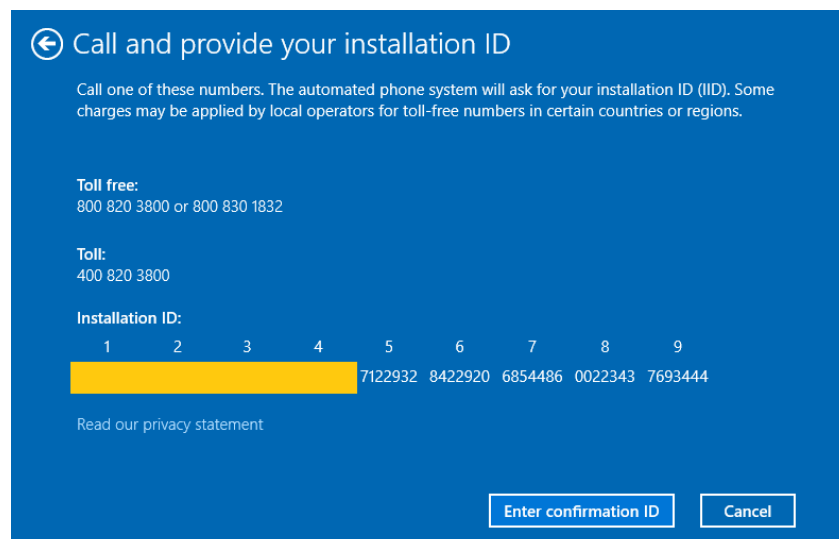


Select your country or region

Afghanistan ▼

Next Cancel

4. Select your country or region, and click **[Next]** to continue.



← Call and provide your installation ID

Call one of these numbers. The automated phone system will ask for your installation ID (IID). Some charges may be applied by local operators for toll-free numbers in certain countries or regions.

Toll free:
800 820 3800 or 800 830 1832

Toll:
400 820 3800

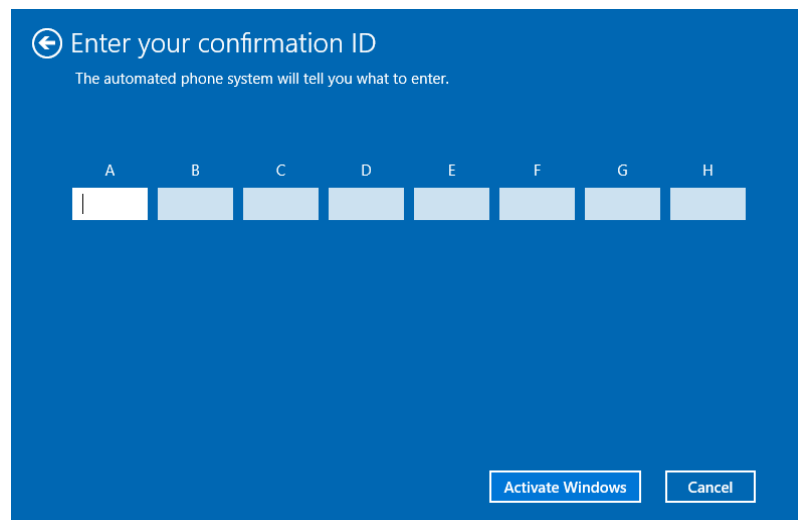
Installation ID:

1	2	3	4	5	6	7	8	9
				7122932	8422920	6854486	0022343	7693444

[Read our privacy statement](#)

Enter confirmation ID Cancel

5. Call one of the phone numbers displayed on above. Choose the proper option number according to the voice prompts, and enter the **Installation ID**. Then write down the **Confirmation ID** according to the voice prompts.
6. Click **[Enter confirmation ID]** to continue.



7. Input the **Confirmation ID** and click [**Activate Windows**] to finish the activation.

2.4.6 Self-Test

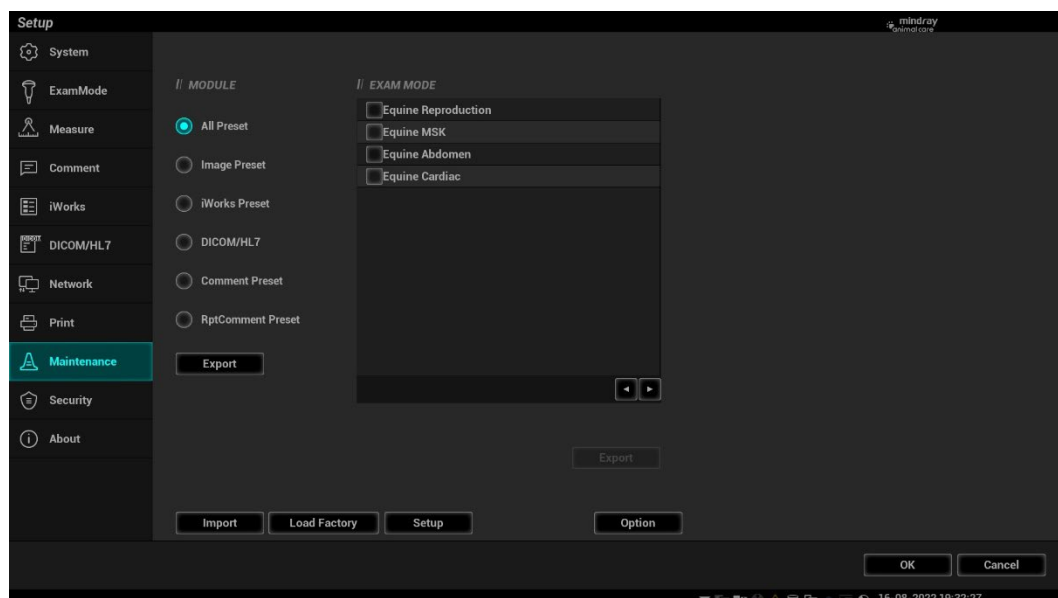
The self-test function is inherent in this series products and aims to test the connections of hardware boards and the running status of the system. According to the access permission and test content, there are three types of tests: production self-test, maintenance self-test and user self-test. This section focuses on maintenance self-test and user self-test content.

2.4.6.1 Maintenance Self-Test Procedure

Note:

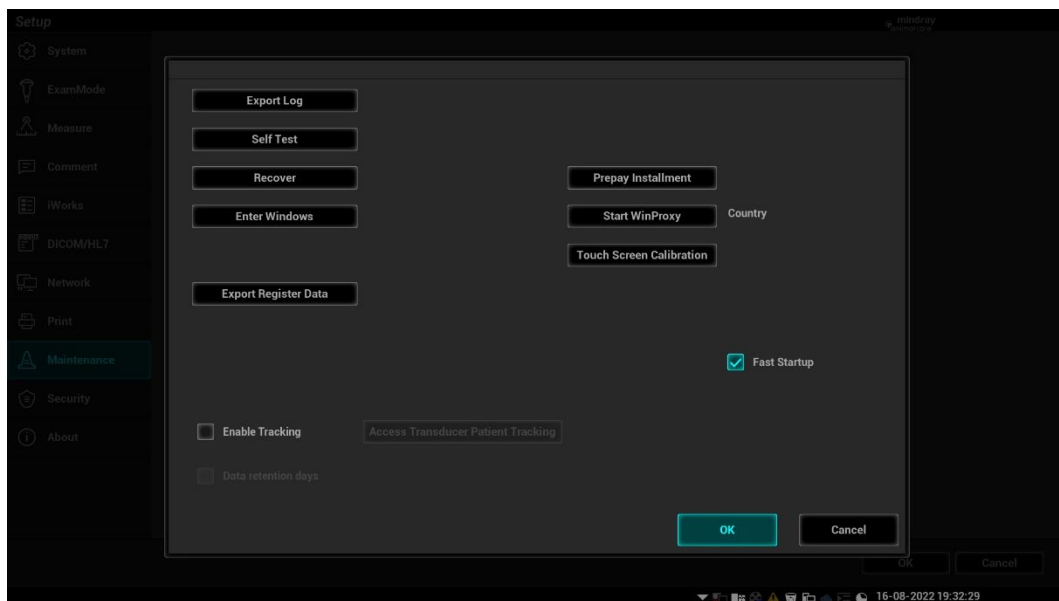
All tasks running on Doppler should be completed before entering system self test, otherwise the self test system fails to respond. It is recommended to start self-test software to perform the self-test after the system is started.

1. Switch to user Service and enter the password to log in.
2. Choose Setup > Maintenance > Set.

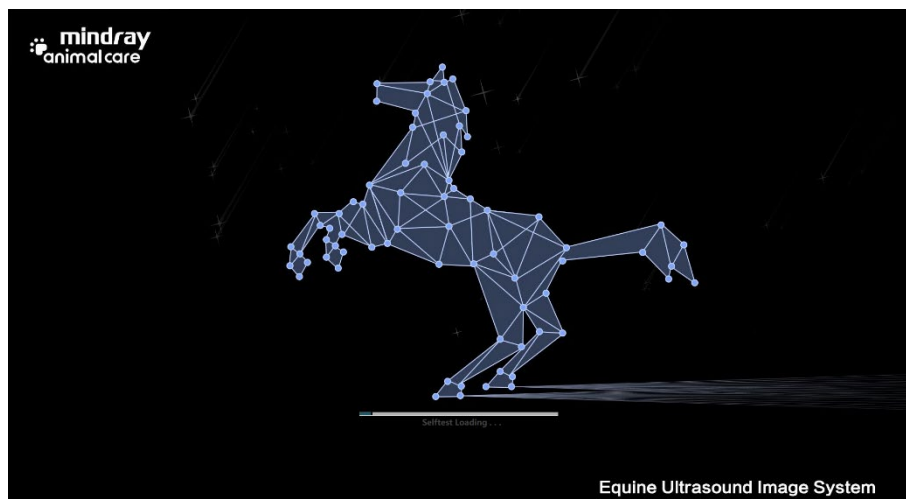


Click [**Self Test**] out of dialog box.

- If the current Doppler system is in Chinese, the Chinese self-test screen appears.
- If the current Doppler system is not in Chinese, the English self-test screen appears.



- The system self-test boot screen appears.



- Configure test items on the maintenance self-test screen. After configuration, click Start to enter the maintenance self-test state.

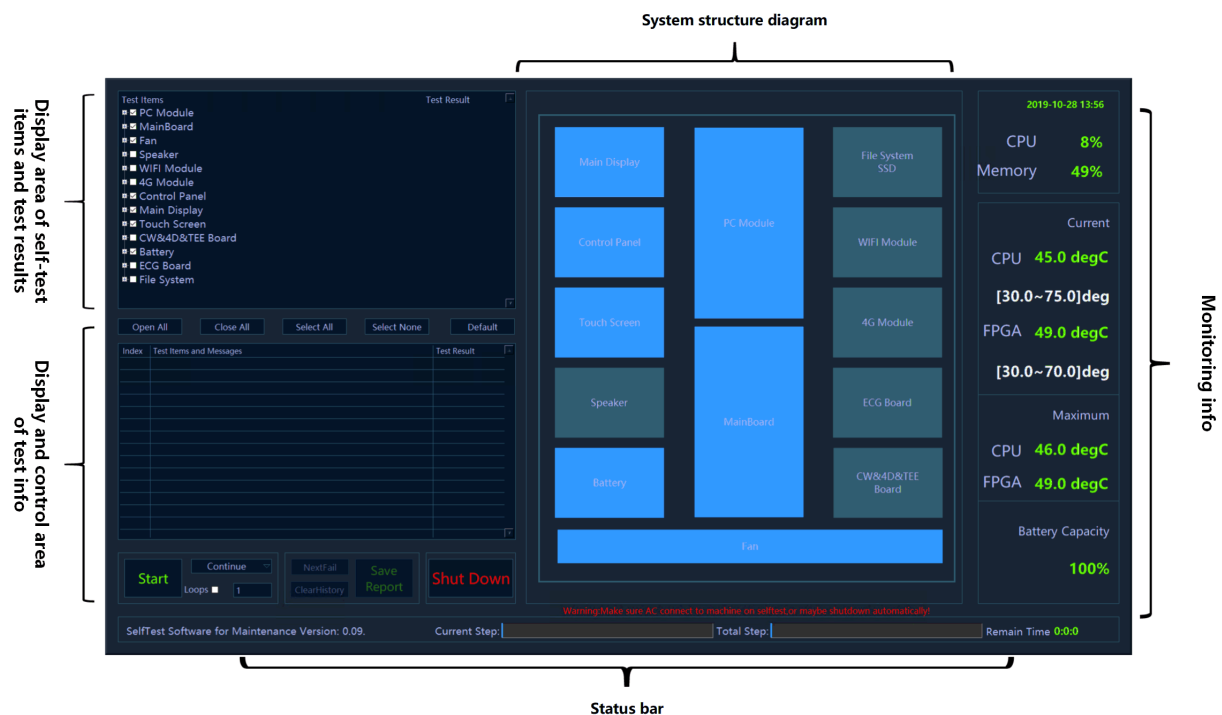
Button	Function
Unfold	Click Unfold to unfold all folded test items.
Fold	Click Fold to fold all unfolded test items.
Default	Click Default to select default test items. Selected test items are highlighted.
Select All	Click Select All to select all test items. All test items are highlighted.
Clear All	Click Clear All to clear all test items. All test items are deselected.
Continue/Stop	When Continue is selected, the program continues with subsequent test items even if a test item fails. When Stop is selected, the program stops the test once a test item fails.

Button	Function
Start	Click Start to test selected test items one by one and the button name changes to Stop. Click Stop during the test to stop the test. After the test ends, the Stop button changes to Start.
Next Fault	After the test ends, click Next Fault, and the program automatically searches for the next failed test item in the test information list and displays the test information about the located test item on the first line. If the program reaches the bottom, it re-starts to search from the top of the list.
Clear History	Click this button to clear the test data in the test items and test information and restore the system structure to the initial state.
Loop	It is used to control loop test. Tick the check box and type the times for loop test in the right box. The test will be performed according to the times typed. If the loop time is less than 1, it continues the loop test until the user stops testing or encounters the error.
Save Report	Click this button and the report export dialog box appears. Insert a removable storage device, select the corresponding logical drive letter, and click OK to save the test data to the root directory under the specified logical drive letter. This button is unavailable if no removable storage device is inserted.
Shut Down	Click this button to exit the program and shut down the system. If the test report is not saved, the system prompts whether to save the test report to a removable storage medium after you click this button.
System structure	Clicking a module in the system structure will deselect all other modules and highlight only the selected module. Continue to click other modules to add or remove modules.

Note: In the test item area, the test items are sorted by board into multiple parent test items. Each parent test item contains a plurality of sub-test items. Test items can be customized as required. If the check box before an item is selected (☒) , this item is added to the test list; otherwise, if the check box before an item is deselected (☐) , this item is not added to the test list. When a parent-test item is selected, all the sub test items of this item are selected by default; otherwise, when deselecting a parent test item, all the sub-tests of this item are deselected by default.

Note: The self-test screen is available in three types: production, maintenance, and user. The production self-test screen is similar to the maintenance self-test screen, and divided into five areas.

Figure 2-3 Maintenance self-test screen

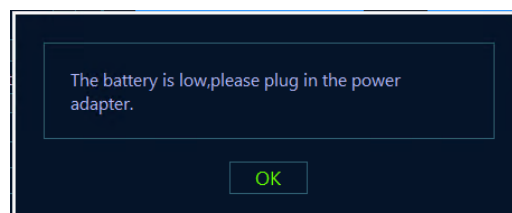


5. Self-test status display

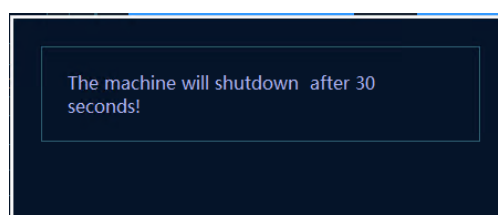
When the self-test program is running, the self-test software version is displayed in the lower left corner on the status bar: SelfTest Software for Maintenance Version: xx. The software version in the status bar becomes the name of current test during the test. The current test progress and overall test progress are displayed simultaneously on the status bar. In addition, a warning message appears in red on the status bar "Warning: Make sure AC connect to machine on selftest or maybe shutdown automatically!"

When the system is powered by the battery only:

- If the battery capacity is less than 10%, the self-test program prompts you to connect the power adapter.



- If the battery capacity is less than 6%, the self-test program prompts that the system will shutdown after 30 seconds.



Beyond that, the status bar shows the remaining time of the test.

Figure 2-4 Sketch map of the status bar

6. Monitoring information bar

The monitoring information bar shows the current time, CPU usage, memory usage, CPU temperature, and FPGA junction temperature in real time. The value ranges of the CPU temperature and FPGA junction temperature are displayed in white.

When the actual temperature exceeds the operating temperature range, the temperature appears in red on the status bar.

7. System block diagram

The color of the element in the system block diagram changes as the color of test result changes in the test process. If the test fails, the element becomes orange; if the test succeeds, it becomes green. If the color of the element keeps the same, it indicates the test is not proceeded.

8. Test information

The test result is displayed behind each test item. The test result is marked as PASS in green for a passed sub-test item, and as FAIL in red for a failed sub-test item. If a test item is not performed, it is marked as Skip in gray. If the board or component is not in position, the test item is marked as NaN in gray. If an error occurs during the test, the test item is marked as Error in red. The test result of a parent test item is the summary of the test results of all selected sub-test items. If the test result of any selected sub-test item is FAIL, the test result of the parent test item is FAIL. The test result of a parent test item is marked as PASS only if the test results of all sub-test items are PASS. See the following figure.

FIG 2-5 Test results

Test Items	Test Result
Control Panel	PASS
Control Panel USB Interconnection Test	PASS
Control Panel Key,Encoder,TGC,Trackball Function Test	PASS
Control Panel Key LED Test	PASS
Main Display	FAIL
Parameter Board I2C Communication Test	PASS
Parameter Board Calibration Test	FAIL
Main Screen Brightness Control Test	Skip
Main Screen Backlight Control Test	PASS
Draw Screen Board Communication Test	PASS
Light Sensor Test	PASS
Touch Screen	
CW&4D&TEE Board	
Battery	
ECG Board	

Click a test item and the test program will automatically index the test result of this test item and display the test result in the Messages table, as shown in the following figure.

Figure 2-6 Test results in the Messages table

Index	Test Items and Messages	Test Result
Z0802	Parameter Board Calibration Test	FAIL
	Parameter Board Calibration Test FAIL Parameter Board Calibration Test Fail; Checksum:0x16266; Target checksum:0x0 ***** Please check all the boards or modules as follow: Parameter Board.	
Z0804	Main Screen Backlight Control Test	PASS
	LCD monitor back light control test PASS.	
Z0206	Monitor Communication Test	PASS
	Monitor Communication Test PASS; SM Firmware Version:0x00000003; SM Firmware Build Time:Sep 3 2019;	
Z0805	Draw Screen Board Communication Test	PASS

All test items are automatically numbered in the format of ZXXYY, where XX indicates the sequence number of the level-1 test item where this test item belongs, and YY indicates the sequence number of the level-2 test item. For example, "Parameter board I2C communication test" is numbered Z0801, where 08 indicates that "Main display" is the eighth test item under the first-level directory, and 01 indicates that "Parameter board I2C communication test" is the first test item under "Main display".

2.4.6.2 User Self-Test

Start the system, tap Setup on the touch screen and choose Maintenance > Set > Installment.

Figure 2-7 User self-test screen

The user self-test screen is divided into three areas: test item area, monitoring information bar and status bar. The monitoring information bar and status bar function the same as the user interface. The test item area displays tested items but no test results.

Button	Description
Start/Stop	Click Start to test selected test items one by one and the button name changes to Stop. Click Stop during the test to stop the test. After the test ends, the Stop button changes to Start.
Test Report Save Path	The logical drive letter of the removable storage device (USB flash drive or removable hard disk) connected to the system is displayed. This check box is unavailable during the test. If there is no removable storage medium, click the control to remind the user of inserting the removable storage medium.
Save Report	Click this button to save the test data to the root directory under the specified logical drive letter. This button is unavailable during the test or if no logical drive letter is selected.
Shutdown	Click this button to exit the program and shut down the system. If the test report is not saved, the system prompts whether to save the test report to a removable storage medium after you click this button.

Start the test when entering user self test. After the test ends, the numbers of failed test items are displayed, if any. For example, if the "System voltage monitoring" test fails, only Z0210 is displayed. You can determine the test item corresponding to Z0210 in the appendix, which is "Program-controlled power voltage test for the PHV module".

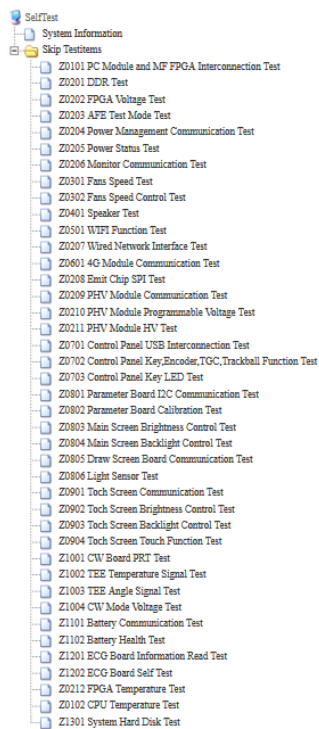
The PASS dialog box appears only if all test items are passed, as shown in the following figure.



2.4.6.3 Test Report

- Test report

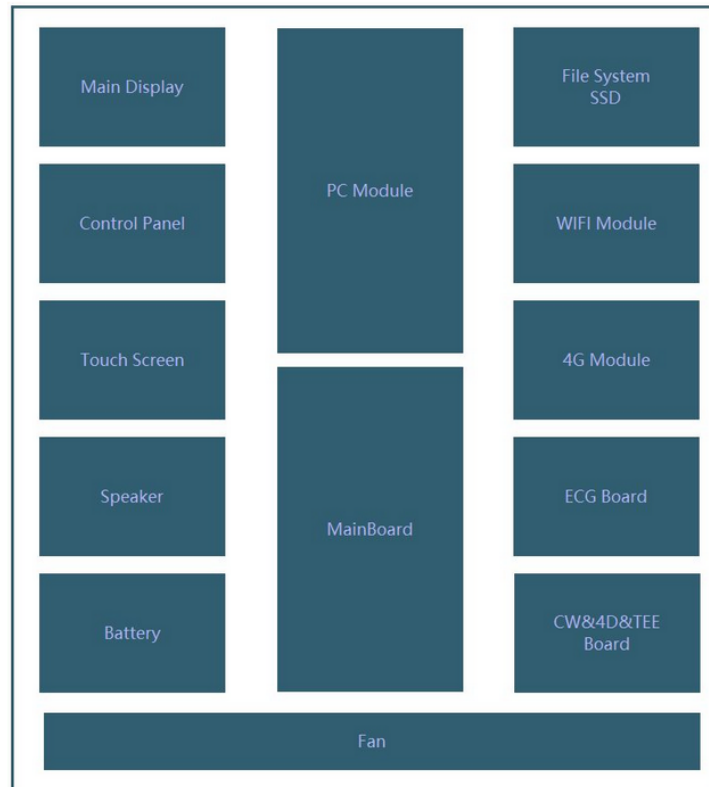
The test report is in HTML format and can be opened using Microsoft Internet Explorer. The following shows the maintenance self-test report.



Selftest Report

Test time: 2020-04-29 18:51:19

SelfTest Software for Maintenance Version: 0.25.



On the left side lie the test items. The items are classified according to test results. Click the test item on the left side, and the test data of the test item displays in the report.

The test information is displayed on the right, including:

- Report name
- Report generation time and software version
- Screenshot of the system structure diagram
- System information
- Maximum temperature
- Failed test items (this node is not displayed if there is no failed test item)
- Passed test items (this node is not displayed if there is no passed test item)
- Skipped test items (this node is not displayed if there is no skipped test item)

The following figure shows the data of a test item.

Z0204 Power Management Communication Test

Board/Module	Main Board
Test Result	PASS
Message	Power Management Communication Test PASS; EC firmware version:0x109; EC bootloader version:0x4; EC firmware build time:Dec 4 2019;

In the preceding figure, Z0204 indicates the index number of the test item.

Board/Module indicates the board or module that test item lies in.

Test Result indicates the result of the test item.

Message indicates the test information.

- Saving test data

The test report is named after the time and packaged into a .zip file.

The test report is saved in D:\VetU\Log\SelftestReport, where a maximum of 20 test reports can be saved.

- Non-loop test

For non-loop tests, the test results will be automatically compressed as a .zip file and saved in D:\VetU\Log\SelftestReport. A .zip file is a test report.

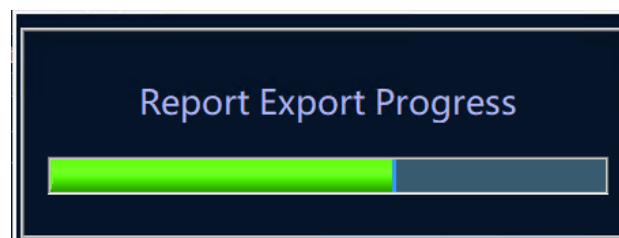
- Loop test

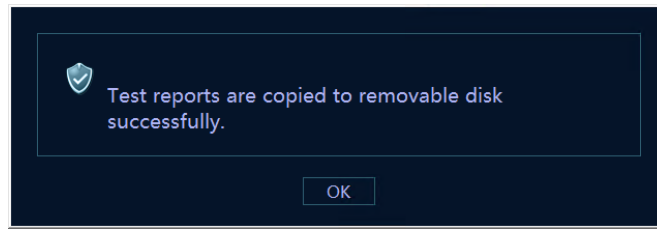
Click Save Report after a loop test ends and then the test result will be compressed as a .zip file and saved in D:\VetU\Log\SelftestReport. A .zip file contains N reports. The reports are under the *Test Result* Test Report Loop_N folder, where *Test Result* is PASS or FAIL and N indicates the loop count.

- Exporting test data

Note:	You cannot export data if no removable storage medium is available on the PC.
--------------	--

- Insert a USB flash drive or removable storage device into the USB port on the equipment.
- Specify the logical drive letter of the removable storage medium and click Save Report on the test screen to export the test data to the root directory under this drive letter. The folder is named Test Report. A success message appears if the test data is saved successfully.





- c For details about the self-test items, see Part III Appendix: 2Description of Self-Test Items.

2.4.7 Exporting and Viewing Logs

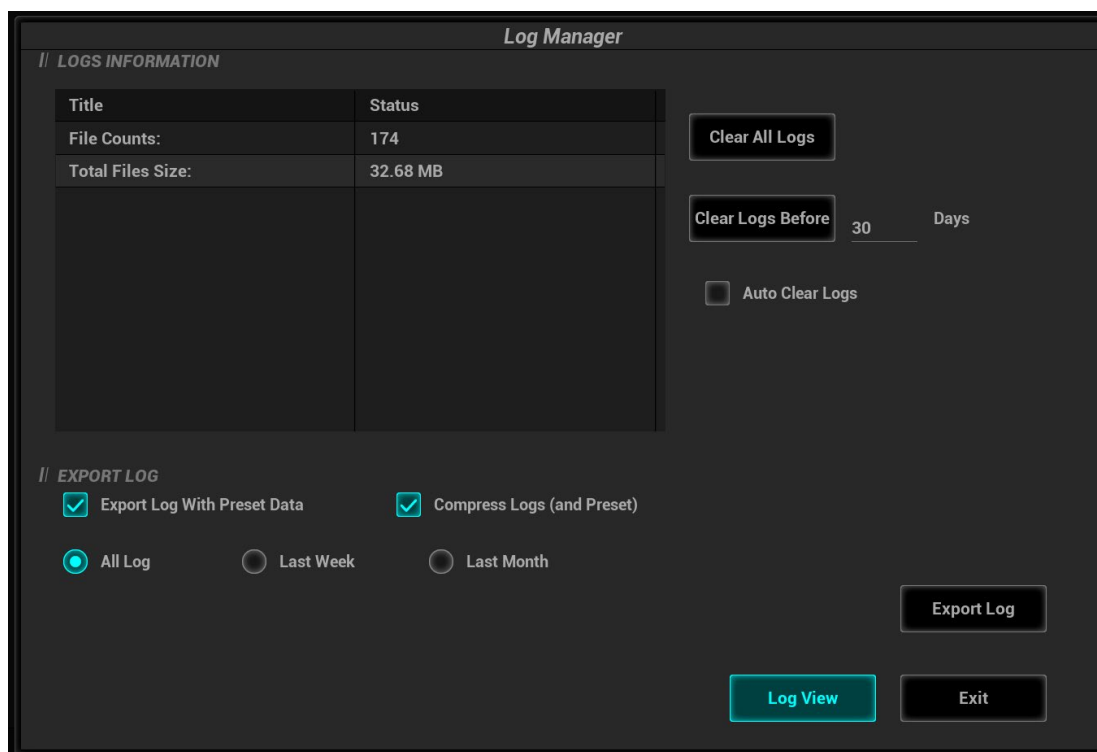
2.4.7.1 Export Log

Note: The log can be exported to the external USB storage device only. Make sure there is enough space for the storage and USB flash disk is plugged in properly before exporting.

1. Insert the USB disk to the machine;
2. On the maintenance screen, click Set. On the displayed screen, select Export Log to access the Log Manager screen.
3. Select the path on the browsing interface to save the log, and then click OK.
4. When the log is exported, the system prompts "Export succeed!", click OK to return to the Maintenance menu.

2.4.7.2 Log Browse

Log in to the system as user Service and choose Setup > Maintenance > Log Manager to access the maintenance menu.

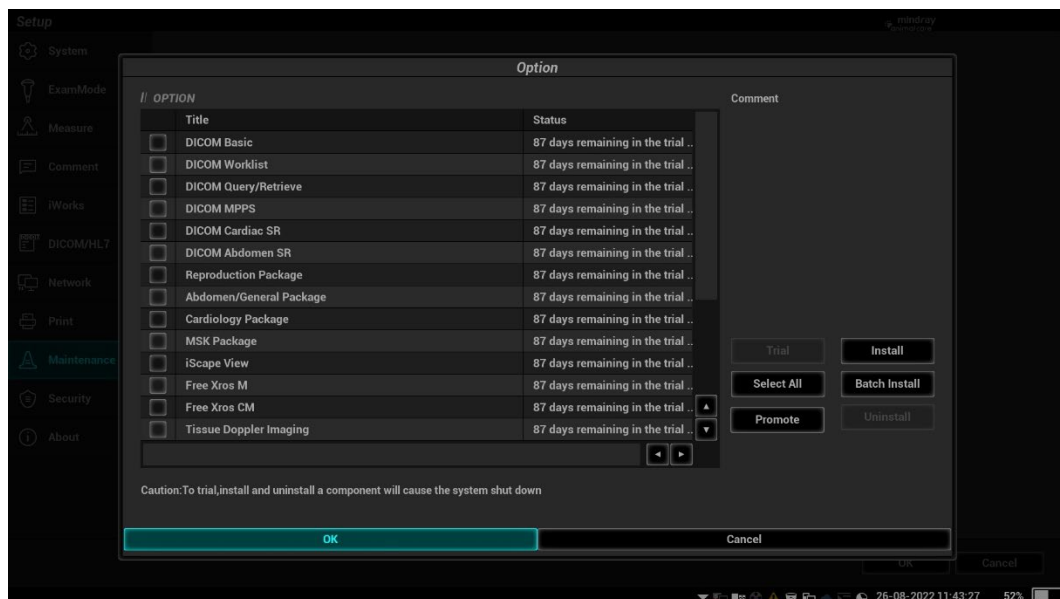


Type	Item	Description
Logs Information	/	Display the total number and total file size of logs
Export Log	Export Log With Preset Data	Set whether to export logs with preset data
	Compress Logs (and Preset)	Set whether to export logs with preset data in compressed format
	All Log	Tick to select all logs
	Last Week	Tick to select logs generated last week
	Last Month	Tick to select logs generated last month
	Export Log	Click to export selected logs. In the pop-up menu, you can rename the log file.
/	Clear All Logs	Click to delete all logs from the system
	Clear Logs Before	Input the number of days and click to delete logs generated before the entered number of days. Only the whole number ranging from 3 to 999 can be entered.
	Auto Clear Logs	Tick the check box, and input the number behind the item "Auto Clear Logs Before". Only the whole number ranging from 3 to 999 can be entered. After it is restarted, the system deletes logs generated before the entered number of days automatically.
	Log View	Click to view the latest 2000 error logs.

2.4.8 Optional Software Functions

2.4.8.1 Installing Optional Functions

1. Copy the configuration key file to a USB flash drive and insert the USB flash drive into the USB port on the equipment.
2. Log in with the Service account. Choose Setup > Maintenance > Option and select software function packages as required in the option list.



3. Click Install. In the displayed Open File dialog box, select the corresponding key file and click OK.
4. To install two or more components at a time, select the components and click Batch Install. In the displayed dialog box, browse the corresponding file path and then the system will install the components based on the matched key files under the folder.
5. The states of the selected components are Installed after the key files are installed. The corresponding function is activated.

Note: After installing all selected components, return to confirm the information.

2.4.8.2 Uninstalling Software Functions

Note: The uninstall function is exclusive to internal users. The customer service engineers must log in to the system with the account of Service, and then conduct the uninstall.

1. Log in with the Service account. Choose Setup > Maintenance > Option.
2. On the Option screen, select a software function package in the option list.
3. Click Uninstall. In the displayed confirmation dialog box, click OK.

Return to the system setup screen, the software function changes to the Not Install state.

2.4.8.3 Trying Optional Functions

1. Log in with the Service account. Choose Setup > Maintenance > Option.
2. On the Option screen, select a software function package in the option list.
3. Click Trial. In the displayed confirmation dialog box, click OK.

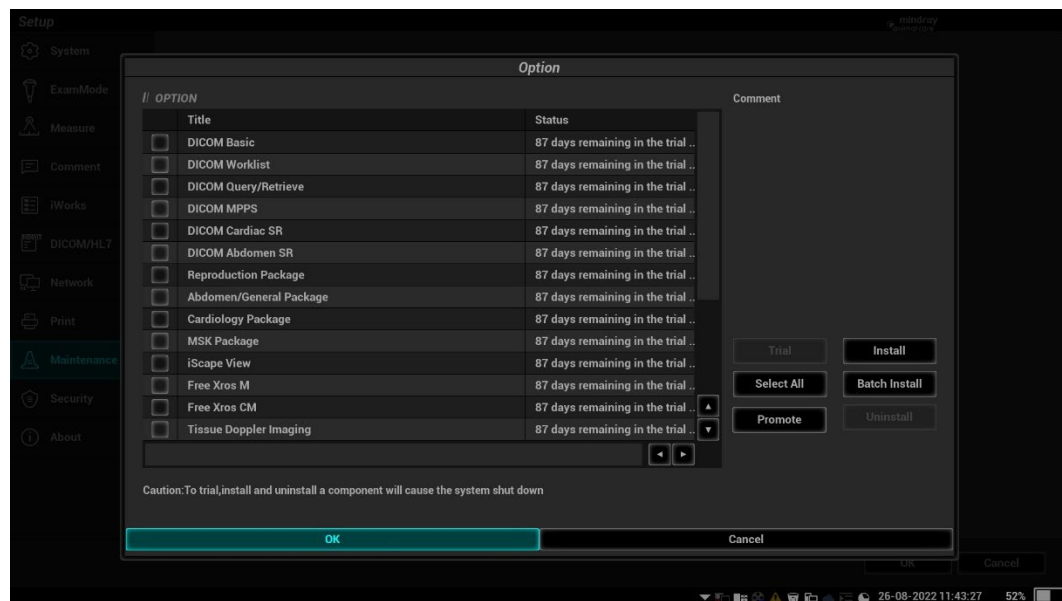
Note:

- If you log in to the system with a common account to activate a trial function, the validity period of the trial function is 90 days.
- If you log in to the system with the Service account to activate a trial function, the validity period of the trial function is 180 days.

- If a 90-day trial period is activated for an optional software function with a common account, you cannot activate the 180-day trial period for this function before the 90-day trial period expires.

2.4.8.4 Promoting Optional Functions

1. Log in with the Service account. Choose Setup > Maintenance > Option.
2. Click Promote.



The Promote function applies only to uninstalled software functions. The Promote function is unavailable for software functions that have been installed.

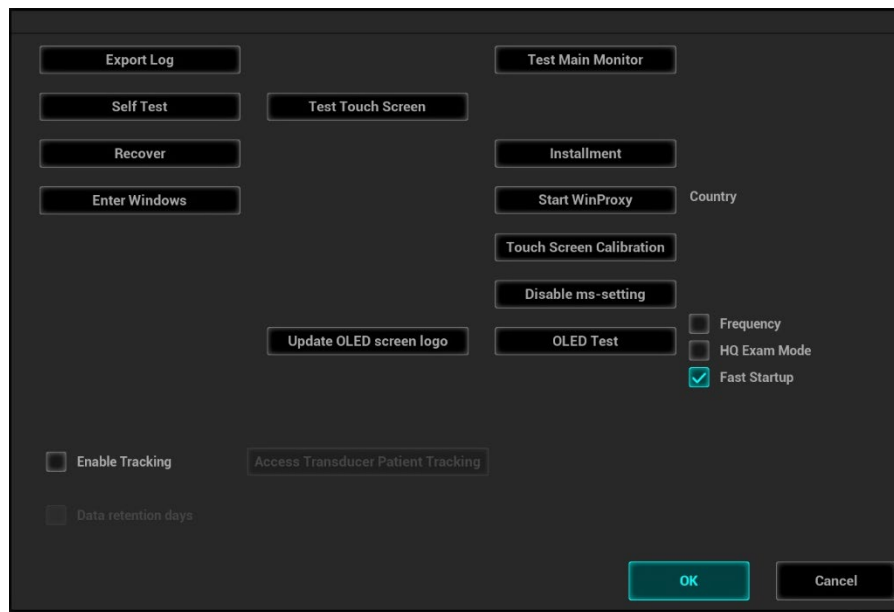
3. Select a software function.
4. Click OK.

Note:

If a software function has been put into trial use by using the Service account for a period of time before the promotion key is installed, the trial period is the value of 365 days minus the number of days elapsed after the software function has been activated by using the Service account.

2.4.9 Manage Settings

Choose Setup > Maintenance. On the maintenance screen, export, import, or restore factory settings for system setup data.

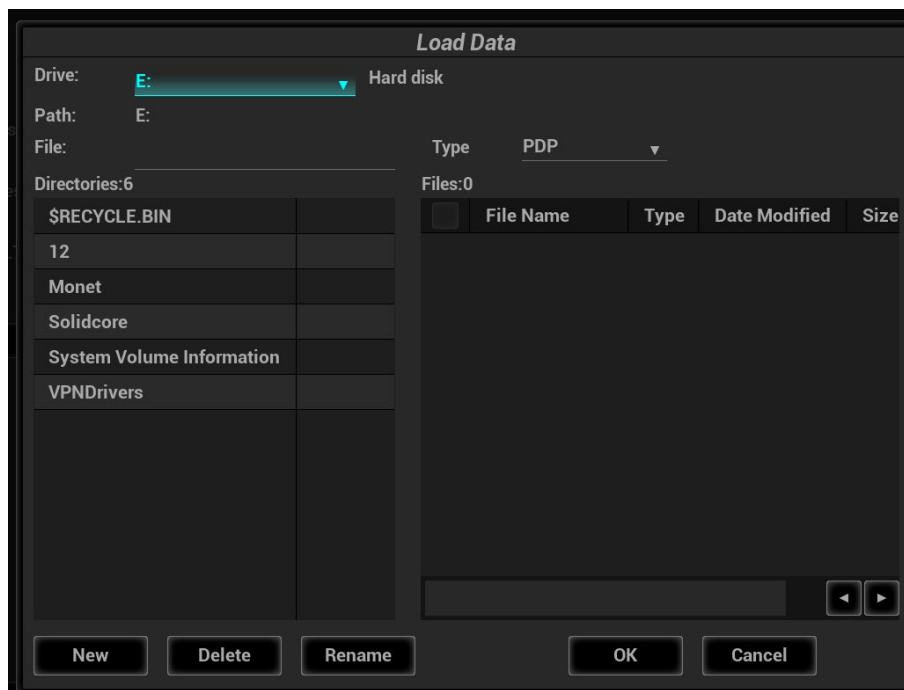


2.4.9.1 Backing Up Setup Data

1. On the setup data management screen, click Export to open the Export Data dialog box.
2. Select the path to save the data.
3. Click OK. A progress bar appears. All setup data will be exported to the specified location.

2.4.9.2 Restoring Setup Data

1. On the setup data management screen, click Import to open the Load Data dialog box.



2. Select the path to import the data. You can choose to import a part or all of the setup data.
3. Click OK. A progress bar appears. The setup data is imported to the specified path.

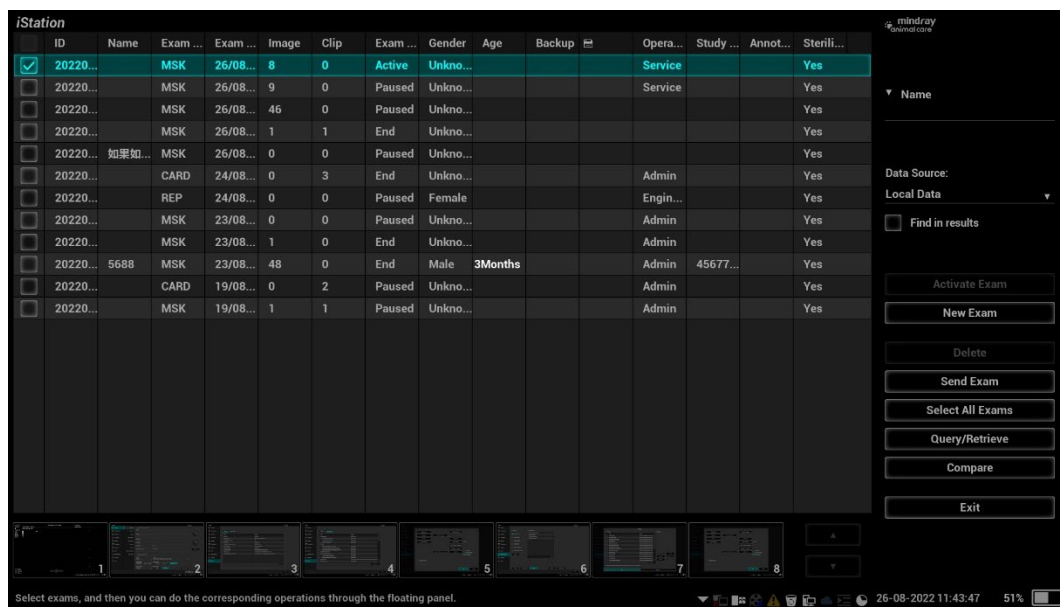
2.4.9.3 Restoring Factory Settings

Click Load Factory. This operation is not supported for region setup, access management, DICOM setup, and network setup (including iStorage) data.

2.4.10 Animal Data Management

2.4.10.1 Backing Up Animal Data

1. Tap iStation on the touch screen to open the iStation dialog box.



2. Click Select All Exams to select all data or select the target data one by one.
3. Select the information and click Back Up Exam. In the Back Up Animal Records dialog box, select the target storage device (recorder or USB flash drive) and click Backup to back up the selected data.
4. Select Encrypt When Back Up to USB. Enter the password in Password and Confirm Password and click Backup. A package named VetuU.7z is generated on the USB flash drive.

Note: Enter the backup password to open the file. The file cannot be opened if you forget the password. Therefore, keep the backup password properly.

2.4.10.2 Recovering Animal Data

1. Tap iStation on the touch screen to open the iStation dialog box.
2. Select the drive which contains the animal data. Click Select All Exams to select all data or select animal data one by one. Click Restore Exam to recover the animal data from the current drive to the animal database.

2.4.10.3 Deleting Animal Data

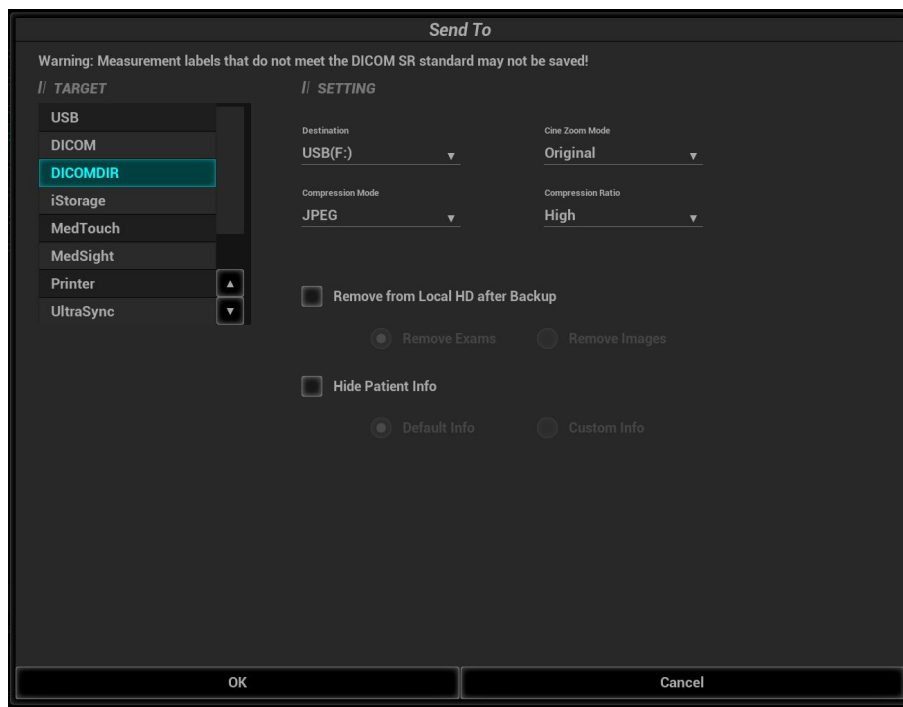
1. Tap iStation on the touch screen to open the iStation dialog box.
2. Select the drive which contains the animal data. Click Select All Exams to select all data or select animal data one by one. Click Delete to delete the selected animal data.

2.4.10.4 Sending Animal Data

The system supports sending animal exam data or images to another storage medium (DICOM or iStorage) or for printing, or sending the exam information to a removable storage medium. The exporting exam information can be reviewed on PC, but cannot be restored back to ultrasound system for review.

Select the animal record, click Send Exam in the menu to send exam data or images of the selected record.

1. Select a destination in Destination and set related sending parameters.

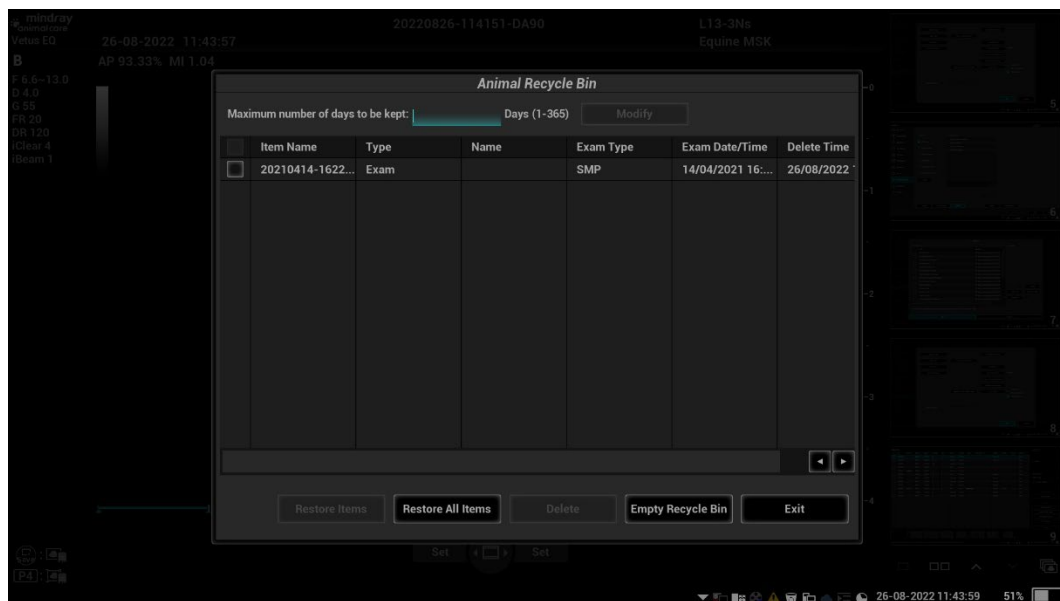


2.4.11 Recycle Bin Management

The recycle bin is used to store deleted animal data, exam data and images. The system supports recovering these data from the recycle bin before the recycle bin is cleared.

Perform the following steps to recover deleted animal data:

1. Click the recycle bin icon (unavailable when it appears gray) in the status area of the system to access the Animal Recycle Bin screen.



2. Select an item in the list.
3. Perform the following operations:
 - Click Restore Items to restore the selected item back to iStation.
 - Click Delete to delete the item permanently, and the item can never be restored again.
 - Click Restore All Items to restore all the items back to iStation.
 - Click Empty Recycle Bin to empty the recycle bin, and the cleared items can never be restored again.
 - Click Exit to exit the Animal Recycle Bin screen.

Note:

If there are more than 200 records in the recycle bin, the system prompts you to clear the recycle bin at next startup. You are advised to clear the recycle bin based on the preceding steps.

3 Repair

3.1 System Diagnosis and Support

3.1.1 Indicator

Table 3-1 Status indicators on the control panel

Status Indicator	Icon	Status definition and description
Power-up indicator		The indicator is off when the system is shut down. When this key is pressed, the indicator blinks green first, then blinks orange, and finally blinks green and orange alternately. After the system is started, the indicator is steady green.
Battery status indicator		1 It illuminates in orange when batteries are charging. 2 It illuminates in green when batteries are charged to full capacity. 3 It illuminates in green when the batteries are discharged and the battery level is higher than 20%. 4 It blinks in orange when the batteries are discharged and the battery level is lower than 20%. 5 It blinks fast in orange when the batteries are discharged and the battery level is lower than 5%. 6 It becomes off when the batteries are not charged or discharged.
Standby status indicator		The standby status indicator blinks orange when the system enters standby state. The indicator is off in other states.
Disk indicator		The indicator blinks in green during disk read/write operations. The indicator becomes off when no read/write operations are ongoing.

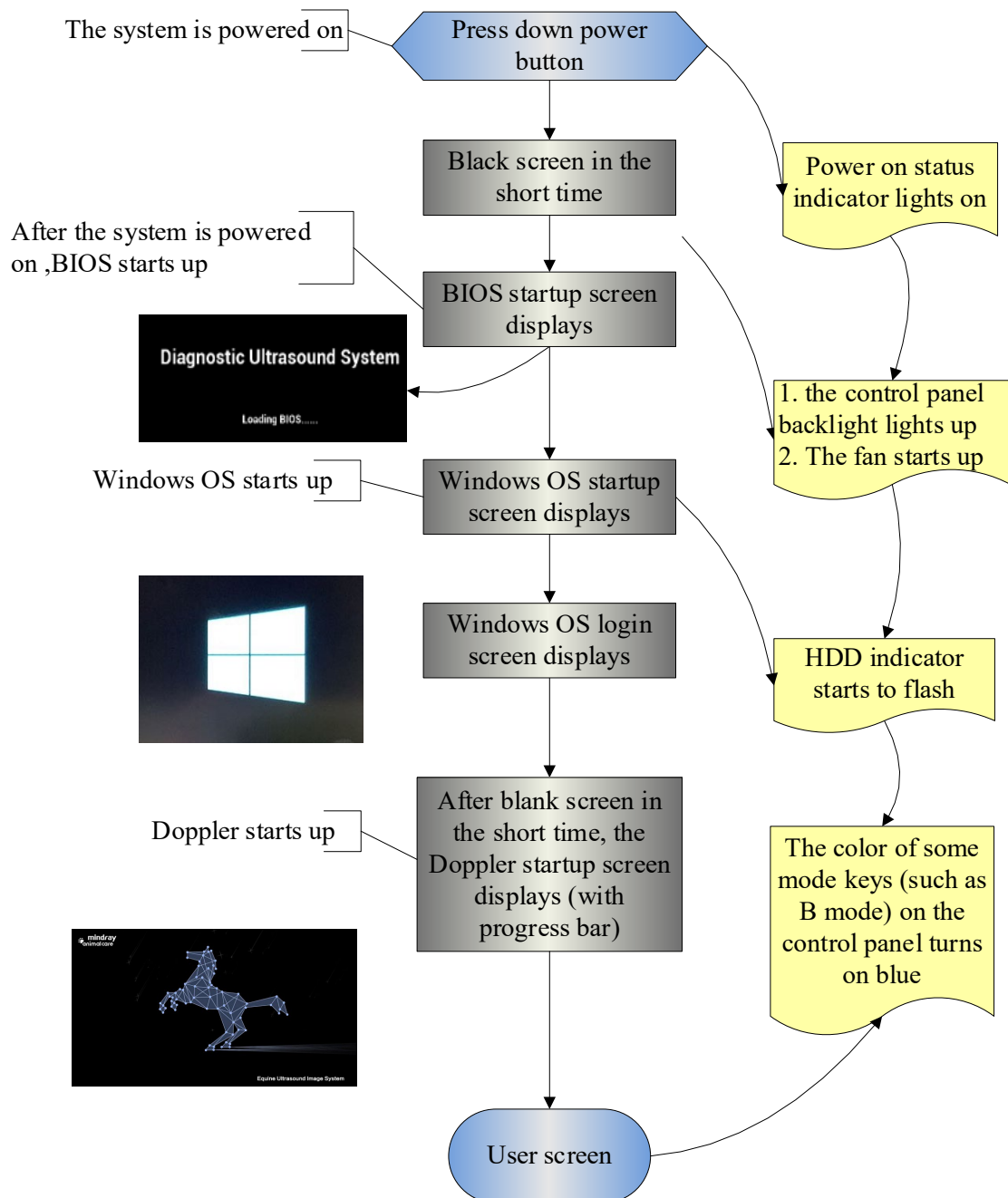
Status Indicator	Icon	Status definition and description
Battery status indicator	/	Indicates the charge/discharge status of the U-Bank. - When the battery is charging: Not fully charged: the indicator lights in orange. Fully charged: the indicator lights in green. - When the battery is discharging: The remaining capacity $\geq 20\%$: the indicator lights in green. The remaining capacity $< 20\%$: the indicator blinks in orange. The remaining capacity $\leq 5\%$: the indicator blinks in orange quickly.

3.1.2 System Status Indicator

System status	Status definition and description	Access	Exit
Scanning	The indicator is green in power-up state. The Freeze key is white or off.	Press the Freeze key to enter or exit the scanning state.	
Frozen	The indicator is green in power-up state. The Freeze key is orange.	Press the Freeze key to enter or exit the frozen state.	
Standby	The standby indicator blinks orange. The battery status indicator is on when the system is standby and powered by batteries. For details, see Part I Service Scenarios: 3.1.1 Indicator.	- Press the power button and choose to enter the standby state on the status selection screen that is displayed. - The system automatically switches from the screen-saver state to the standby state when being left unattended for the specified time.	The system restores to the frozen status after restarting by pressing the power button.

System status	Status definition and description	Access	Exit
Screen-saver status	The brightness of the display remains unchanged. When the system is in the screensaver state, the string "Mindray Animal Medical" is displayed cyclically. The backlight of the control panel is off. The system is frozen. Hardware system of ultrasound imaging is in sleep mode.	The system automatically switches from the frozen state to the screen-saver state when being left unattended for the specified time.	When you press any keys on the control panel, the system would return to the frozen status. The brightness and the backlight of the control panel restore to previous status.
Shutdown	The system is shut down (with AC input). For details about the battery indicator status, see related descriptions.	Press the power button for a short time, and then the system is turned off by choosing from the status popped on the screen	Start the system by pressing the power button.

3.1.3 Get Entire Device Started



3.1.3.1 System Power-Up Process in the Case of AC Power Input

Operation	Description
Insert the power plug into line voltage.	The battery indicator is on (with batteries available). The disk indicator and standby indicators are off.
Press the power button on the main control panel.	The power-up indicator on the main control panel becomes steady on after blinking for a short period of time.
The system is powered up.	1: The control panel backlight is on. 2: The fan starts to run.

Operation	Description
After HDD initialization and logic configuration, the PC enters the BIOS stage.	A black screen is displayed for 1s.

3.1.3.2 BIOS Startup Process

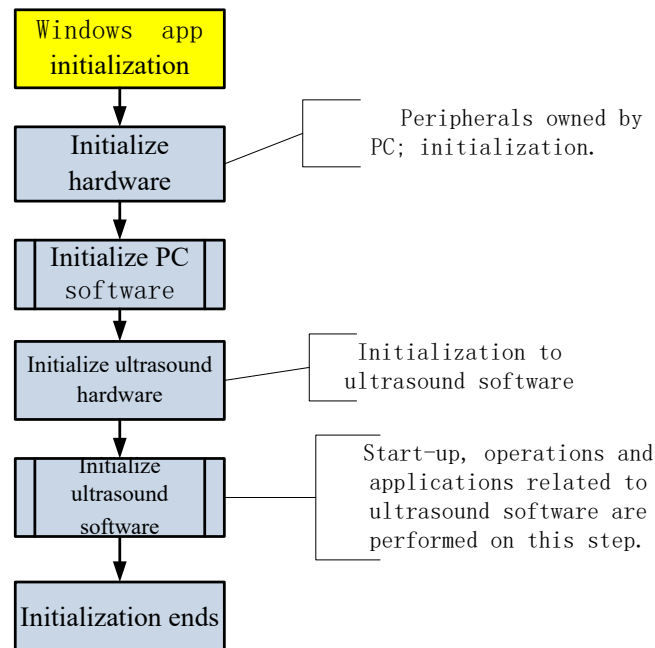
Operation	Description
Self-test at startup	A black screen appears and disappears fast.
Initialization, system settings recording, and provision of the resident program library	The BIOS startup screen is displayed.
Operating system loading	The BIOS screen is displayed during operating system loading. After the operating system is loaded, a black screen appears and then the Windows boot screen appears.

3.1.3.3 Window Boot Process

Operation	Description
Boot program loading	The monitor appears in blank screen now, and it disappears fast.
Detection and hardware configuration	The monitor appears in blank screen now, and it disappears fast.
Kernel loading	Windows icon
User login	Ditto
Doppler startup	The Doppler startup animation is displayed, excluding the progress bar.

3.1.3.4 Doppler Startup Process

Figure 3-1 Startup process



3.1.4 Alarm and Exception Information

The ultrasound system is equipped with the alarm function. When a fault occurs, the system displays an alarm dialog box and generates a system log. The log file is stored in D:\VetU\Log.

Note: In a log record, ******* indicates the time, for example: 2011-6-12 14:15:15

3.1.4.1 Battery Faults

Alarm Message	Log Record	Recommended Action
Battery communication error. The battery level cannot be displayed properly or the current battery cannot be used.	Battery3.2.3.2 I2C error	Check the battery connection or replace the battery.
Battery error. Batteries cannot be charged and discharged properly.	*** battery break	Replace the battery.

The health status information about batteries embedded into the main unit is presented on the screen displayed after you choose Setup > System Info. The following table describes the status information.

Battery Health Status	Determining Condition	Status Description
GOOD	The batteries are free from damage and recoverable faults. The full charge capacity of batteries (FCC) is greater than 40% of the rated capacity.	The batteries are in good conditions and function properly.

Battery Health Status	Determining Condition	Status Description
WEAK	The batteries are free from damage and recoverable faults. The full charge capacity of batteries (FCC) is less than 40% of the rated capacity. The number of cyclical recharging times of batteries is less than 300.	Fully charge batteries and then discharge them to partially recover the battery capacity.
REPLACED	The batteries are free from damage and recoverable faults. The full charge capacity of batteries (FCC) is less than 40% of the rated capacity. The number of cyclical recharging times of batteries is greater than 300.	The battery capacity deteriorates gradually after batteries are being used for a long time. Continuous use will compromise the power performance and standby duration of batteries. Therefore, remind users to replace batteries in a timely manner.
INVALID	Unrecoverable damage occur on batteries.	If a battery encounters permanent damage, remind the user to replace the battery immediately.
PROTECTED	Batteries encounter recoverable faults.	If batteries encounter recoverable faults, the batteries will resume normal after a period of time. If the problem persists, contact Mindray Animal Medical Customer Service Department.

3.1.4.2 Abnormal System Voltage

Alarm Message	Log Record	Recommended Action
The battery life is about to run out. Replace the battery as soon as possible.	*** System Monitor: Power supply alert! [XXX], Current voltage: [VVV] V, Limit voltage:[LLL]~[HHH]V	Replace the coin battery.
None	"Date" "Time" "Errorcode": System Monitor:Power supply alert! [XXX], Current voltage error.	If the system detects that a voltage is abnormally high or low, replace the main board.

3.1.5 Temperature Error

Alarm Message	Log Record	Recommended Action
"Errocode" FPGA temperature warning! Shut down in xx seconds. "Errocode" FPGA Temperature Alert! Shut down after xx Seconds	"Date" "Time" "Errocode": System Monitor:Temperature alert! [XXX], Current temperature: [VVV] C, Limit temperature:[LLL]~[HHH]C.Current fan speed [SSS] rpm, [SSS] rpm, [SSS] rpm, [SSS] rpm, [SSS] rpm. [XXX] indicates the monitoring point name, [VVV] indicates the current value (monitored value), [LLL]~[HHH] indicate the upper and lower limits (upper and lower thresholds of the monitoring point), and [SSS] indicates the fan speed.	Replace the fan.
"Errocode" CPU Temperature Alert! Shut down after xx Seconds	"Date" "Time" "Errocode": System Monitor:Temperature alert! [XXX], Current temperature: [VVV] C, Limit temperature:[LLL]~[HHH]C.Current fan speed [SSS] rpm, [SSS] rpm, [SSS] rpm, [SSS] rpm,[SSS] rpm. [XXX] indicates the monitoring point name, [VVV] indicates the current value (monitored value), [LLL]~[HHH] indicate the upper and lower limits (upper and lower thresholds of the monitoring point), and [SSS] indicates the fan speed.	Replace the fan.

3.1.6 Fan Error

Alarm Message	Log Record	Recommended Action
"Errocode" System Fan requires maintenance, please contact the service!	"Date" "Time" "Errocode": System Monitor: Fan alert ! [XXX], Current speed: [VVV] rpm, Lower Limit speed: [LLL] rpm. [XXX] indicates the fan number, [VVV] indicates the current value, and [LLL] indicates the threshold.	Replace the fan

3.1.7 Key Error

Alarm Message	Log Record	Recommended Action
"Errocode" [XXX] button; it may be blocked. "Errocode" [YYY] key may be stuck, please confirm. [YYY] indicates the key silkscreen.	"Date" "Time" "Errocode": System Monitor:Key stuck alert! [YYY] key is stuck!	

3.1.8 PHV Error

Alarm Message	Log Record	Recommended Action
Transmitting voltage error and the image does not appear, please restart the device. "Errocode" Transmit voltage error. The image cannot be displayed correctly. Please try to reboot the machine.	"Date" "Time" "Errocode": System Monitor:HV supply alert! [XXX], Current voltage: [VVV] V, Limit voltage:[LLL]–[HHH]V. [XXX] indicates the monitoring point name, [VVV] indicates the current value (monitored value), [LLL]–[HHH] indicate the upper and lower limits (upper and lower thresholds of the monitoring point).	Shut down the system and then start it again to check whether the system resumes normal. Alternatively, replace the main board.
	"Date" "Time" "Errocode": System Monitor:PHV hardware over voltage protection.	
	"Date" "Time" "Errocode": System Monitor:HV supply alert! [XXX] Voltage protect.	
	"Date" "Time" "Errocode": System Monitor:[XXX] over current or over power protect.Current voltage: [VVV] V,current: [AAA] A,Upper Limit Current: [HHA] A,Upper Limit Power: [HHW] W. [XXX]: monitoring point name [VVV]: current voltage [AAA]: current [HHA]: upper threshold of current [HHW]: upper threshold of power	

3.1.9 Error Code List

Error code	Overview	Monitoring Point Name	Module
V1000	Power monitoring	5VSTB	Main board
V1001	Power monitoring	P12V	Main board
V1002	Power monitoring	D5V	Main board
V1003	Power monitoring	D3V3	Main board
V1004	Power monitoring	D0V95	Main board
V1005	Power monitoring	AP1V5	Main board
V1006	Power monitoring	AP2V1	Main board
V1007	Power monitoring	AP3V6	Main board
V1008	Power monitoring	AP5V5	Main board
V1009	Power monitoring	AN5V6	Main board
V1010	Power monitoring	AN11V7	Main board

Error code	Overview	Monitoring Point Name	Module
V1011	Power monitoring	DSP_Vccaux	Main board
V1012	Power monitoring	DSP_Vccint	Main board
T1000	Temperature monitoring	FPGA	Main board
T006	Temperature monitoring	CPU temperature	CPU module
F1001	Fan monitoring	FAN1_TACH_CON	Main board
F1002	Fan monitoring	FAN2_TACH_CON	Main board
F1003	Fan monitoring	FAN3_TACH_CON	Main board
F1004	Fan monitoring	FAN4_TACH_CON	Main board
F1005	Fan monitoring	FAN5_TACH_CON	Main board
F1006	Fan Control	FAN_BATTERY0	Main board
F1007	Fan Control	FAN_BATTERY1	Main board
E012	Operating error	Key_Stuck	Control panel
P001	Program-controlled voltage	PHV1P	Main board
P002	Program-controlled voltage	PHV1N	Main board
P003	Program-controlled voltage	PHV2P	Main board
P004	Program-controlled voltage	PHV2N	Main board
P005	Program-controlled voltage	PHV1P_PHV2P	Main board
P006	Program-controlled voltage	PHV1N_PHV2N	Main board
P009	Program-controlled voltage	HVP	Main board
P010	Program-controlled voltage	HVN	Main board
P014	Program-controlled voltage	PHV_OVP_H	Main board
P016	Program-controlled voltage	PHV1P_VP	Main board
P017	Program-controlled voltage	PHV1N_VP	Main board
P018	Program-controlled voltage	PHV2P_VP	Main board
P019	Program-controlled voltage	PHV2N_VP	Main board
P024	Program-controlled voltage	PHV1P_OPP_OCP	Main board
P025	Program-controlled voltage	PHV1N_OPP_OCP	Main board
P026	Program-controlled voltage	PHV2P_OPP_OCP	Main board
P027	Program-controlled voltage	PHV2N_OPP_OCP	Main board
P1003	Program-controlled voltage	HV_OPP_OCP	Main board
P1004	Program-controlled voltage	PHV_HV_PF_N	Main board
P1001	Program-controlled voltage	CWP	Main board
P1002	Program-controlled voltage	CWN	Main board
P1020	Program-controlled voltage	CWP_VP	Main board
P1021	Program-controlled voltage	CWN_VP	Main board

3.1.10 Self-Test

The self-test function is inherent in this series products and aims to test the connections of hardware boards and the running status of the system. According to the access permission and test content, there are three types of tests: production self-test, maintenance self-test and user self-test.

For details about the self-test procedure, see Part I Service Scenarios: 2.4.6 Self-Test. For details about the description of self-test items, see Part III Appendix: 2 Description of Self-Test Items.

3.1.11 Logs

The log framework of this product mainly includes the following four process logs, respectively corresponding to four configuration files. See the following table.

Log Name	Log Description
Doppler_log_volumerender.properties	3D/4D process record
Doppler_log_backupapp_volumerender.properties	3D/4D background process record
Doppler_log_backupapp.properties	Background Doppler
Doppler_log_properties	Doppler log

The following table describes the major logs.

Log Name	Log Description	Remarks
Crash	Dump information about software crash	A crash log is generated upon software crash, including the assertion information and dump file.
Dcmlog	DICOM log	
PenriLog	Details about peripherals: multi-functional monitoring and more accurate peripheral information with redundancy information removed	
Appmon.txt	Appmon process log. The Appmon process manages the Doppler process.	
XX_Back_Log	Background process log	
Xx_Log	Operation log recording user operations, error information, and alarm information	The corresponding log is generated after the Doppler process is started. After the Doppler process is started normally, an operation log is written in response to this function. Error logs are recorded upon problems.

Log Name	Log Description	Remarks
Peri_State	Peripheral status log recording system hardware information and other alarm information	Running status information about related peripherals is recorded after the Doppler process is started.
VetU_Log_Backend_State	Backend status log	
TEMPORARY_Log.log	Unimportant logs containing massive information	For example, incomplete display of characters of a control or thread creation information
VetU_ERROR_Log	Error log	Error information in main logs is extracted to this file, including startup and shutdown information.
LargeBuffDump	Large file memory related log	Large memory log

3.2 Troubleshooting

Note: Deal with the error based on the site situation.

3.2.1 System Power-up Failure

3.2.1.1 Involved Modules or Boards

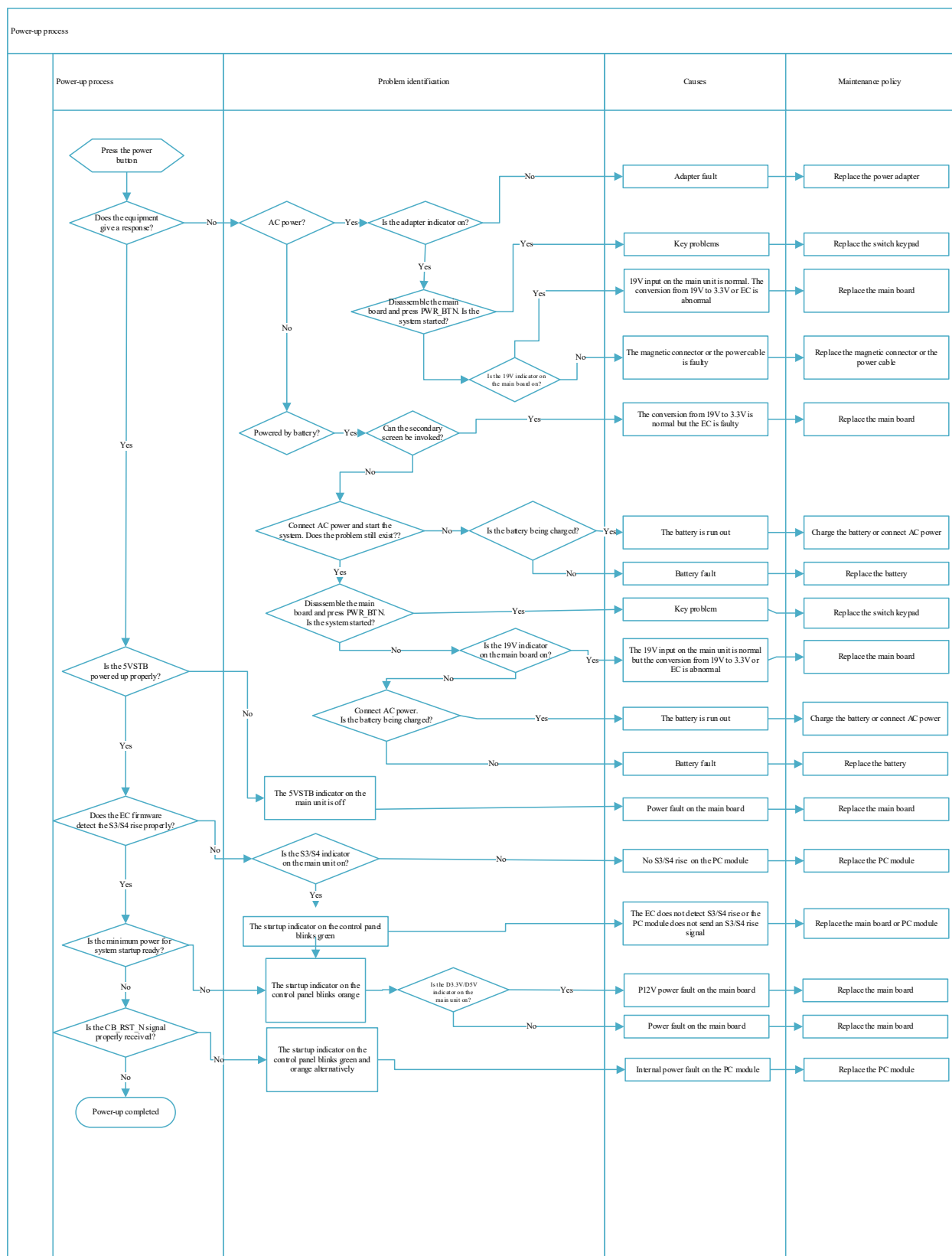
No.	Description	Remarks
1.	Power adapter	/
2	Switch button board	/
3	Main board	/
4	PC module	/

3.2.1.2 Information to Be Collected

No.	Information to Be Collected	Remarks
1.	Power indicator	This indicator is on the adapter. If it is on, the 19 V output is normal. If it is off, the output is abnormal or the indicator is faulty.
2	19 V indicator	This indicator is on the main board.
3	5VSTB indicator	This indicator is on the rear side of the main board and visible after the SSD card cover is removed.

No.	Information to Be Collected	Remarks
4	S3/S4 indicator	This indicator is on the rear side of the main board and visible after the SSD card cover is removed.
5	Switch button indicator	The switch button backlight has three states: blinking in green, blinking in orange, or blinking in green and orange alternately.

3.2.1.3 Troubleshooting Flow



3.2.2 System Startup Failure

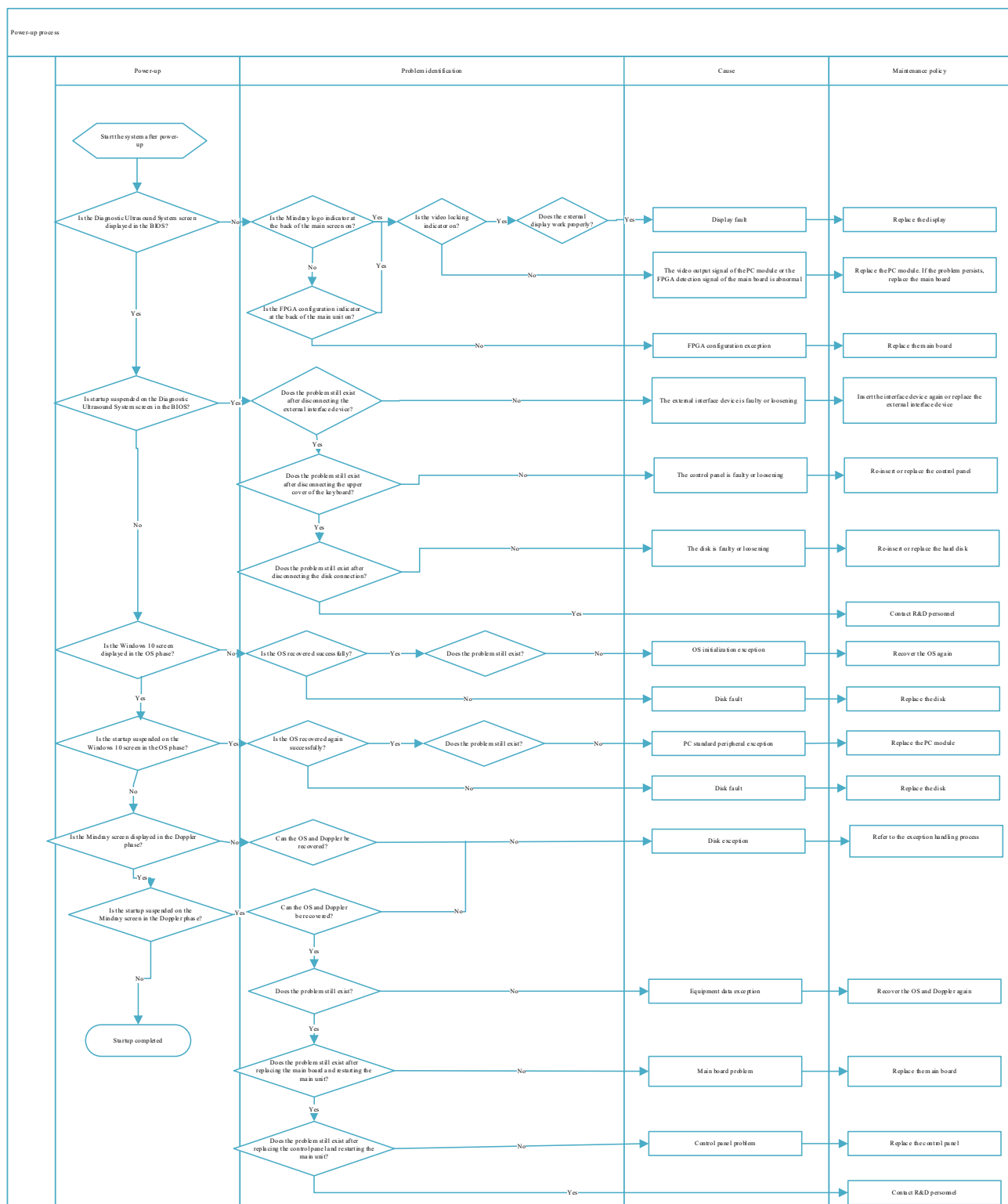
3.2.2.1 Involved Modules or Boards

No.	Description	Remarks
1.	Main board	/
2	SSD/Hard disk	/
3	PC assembly	/

3.2.2.2 Information to Be Collected

No.	Information to Be Collected	Remarks
1.	Mindray Animal Medical backlight on the rear side of the main display	Mindray Animal Medical logo on the equipment
2	FPGA configuration indicator on the rear side of the main board	This indicator is on the rear side of the main board.
3	Startup screen	Startup failure screen

3.2.2.3 Troubleshooting Flow



3.2.3 Image Related Faults

Fault 1: no echo or weak echo

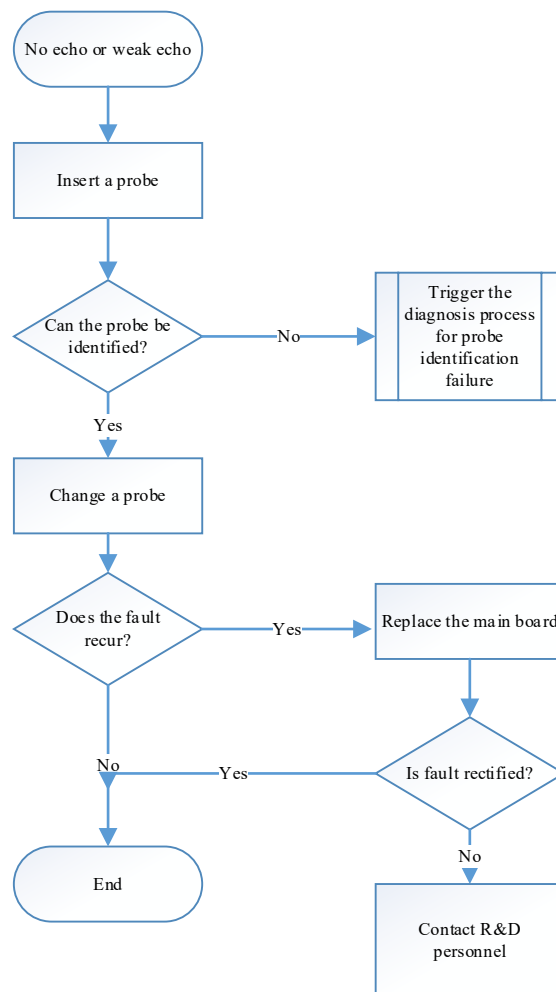
3.2.3.1 Involved Modules or Boards

No.	Description	Remarks
1.	Probe board	/
2	Main board	/

3.2.3.2 Information to Be Collected

No.	Information to Be Collected	Remarks
1.	Image feature, including dark stripes and noise	/
2	The imaging features of various probes	/

3.2.3.3 Troubleshooting Flow



Fault 2: white stripe or black stripe

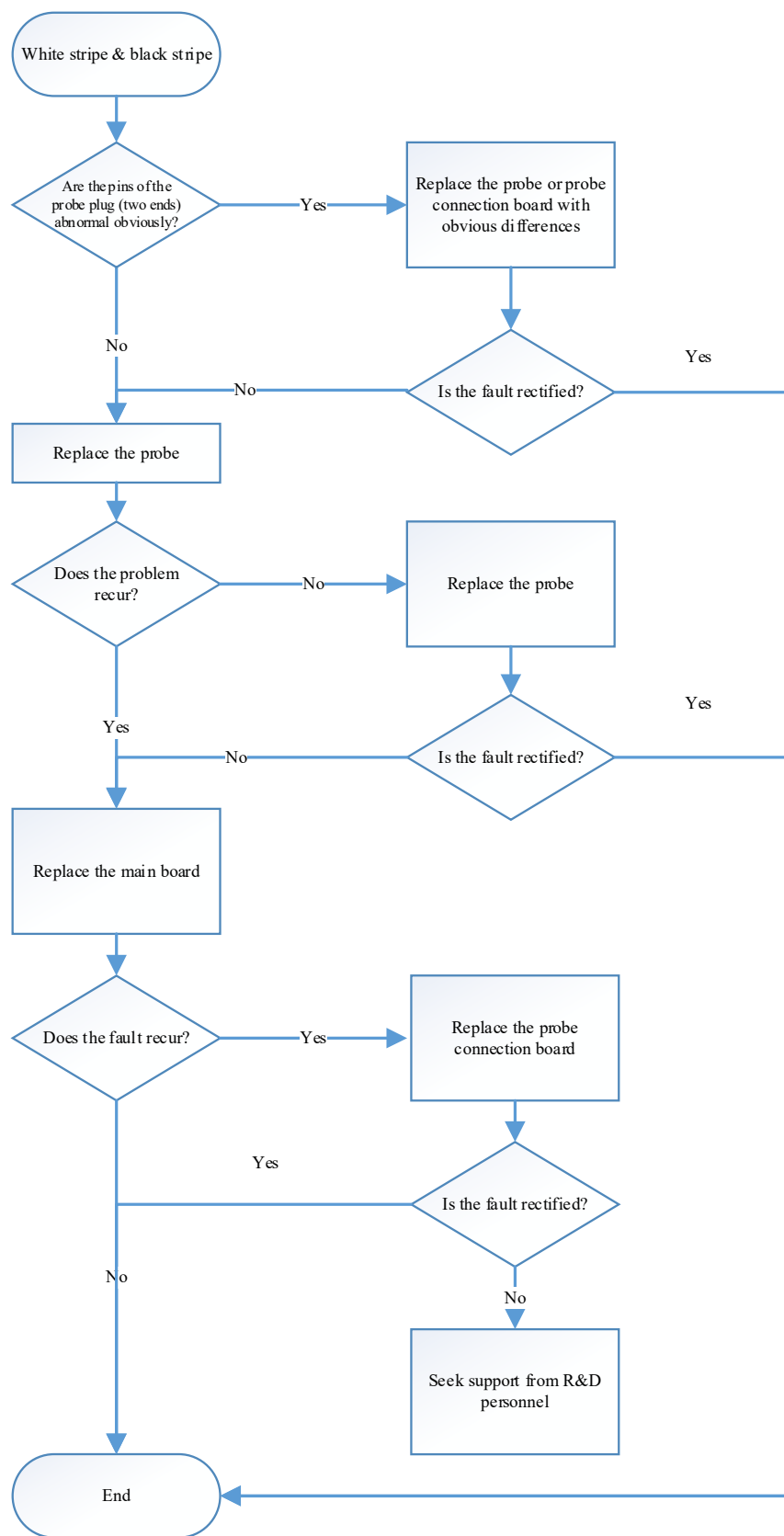
3.2.3.4 Involved Modules or Boards

No.	Description	Remarks
1.	Probe	/
2	Main board	/
3	Probe connection board	/
4	Probe extender	/

3.2.3.5 Information to Be Collected

No.	Information to Be Collected	Remarks
1.	Whether pins of the probe socket are bent	/

3.2.3.6 Troubleshooting Flow



3.2.4 Probe Identification Failure

3.2.4.1 Involved Modules or Boards

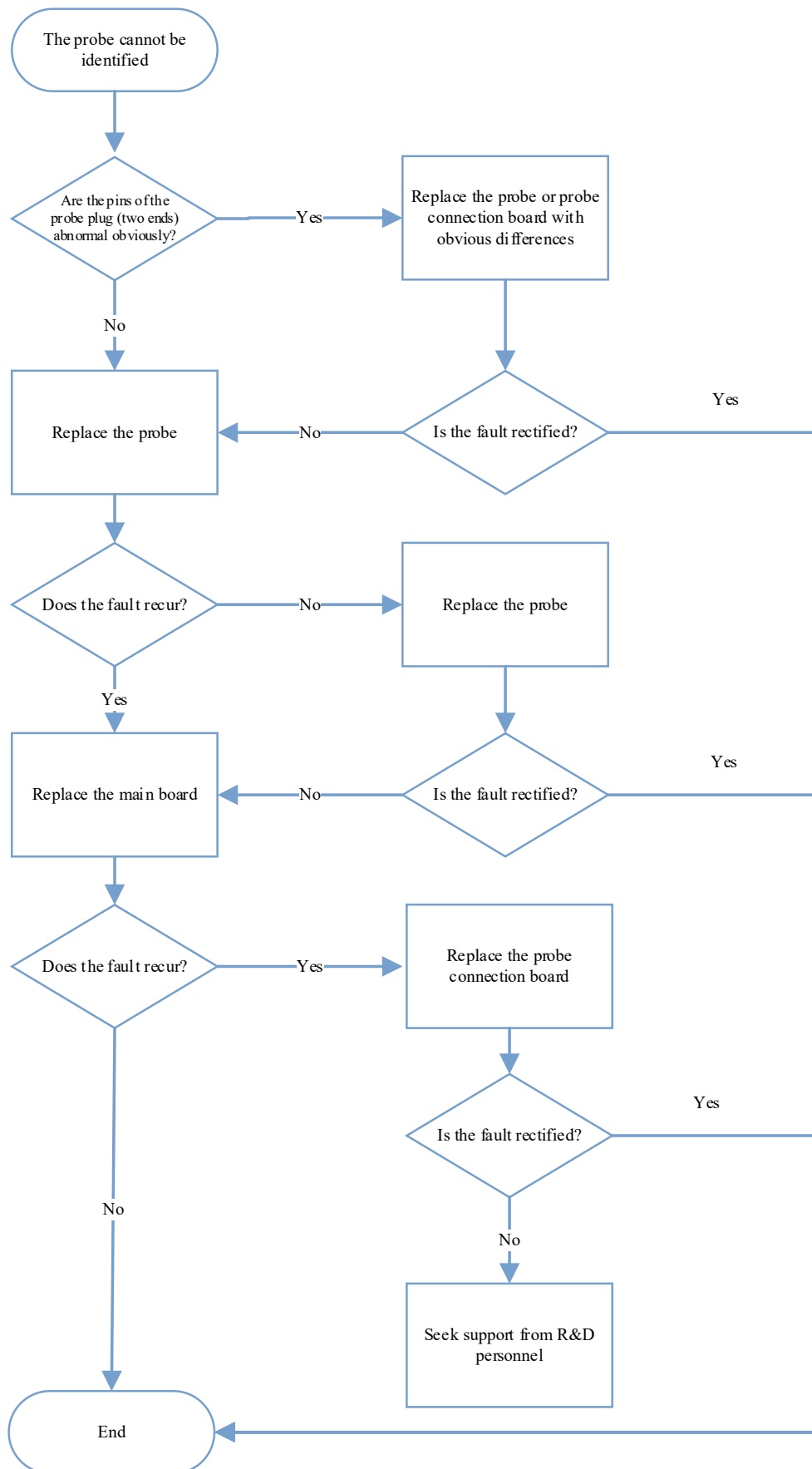
No.	Description	Remarks
1.	Probe	/
2	Main board	/
3	Probe extender	/
4	Probe port	/

3.2.4.2 Information to Be Collected

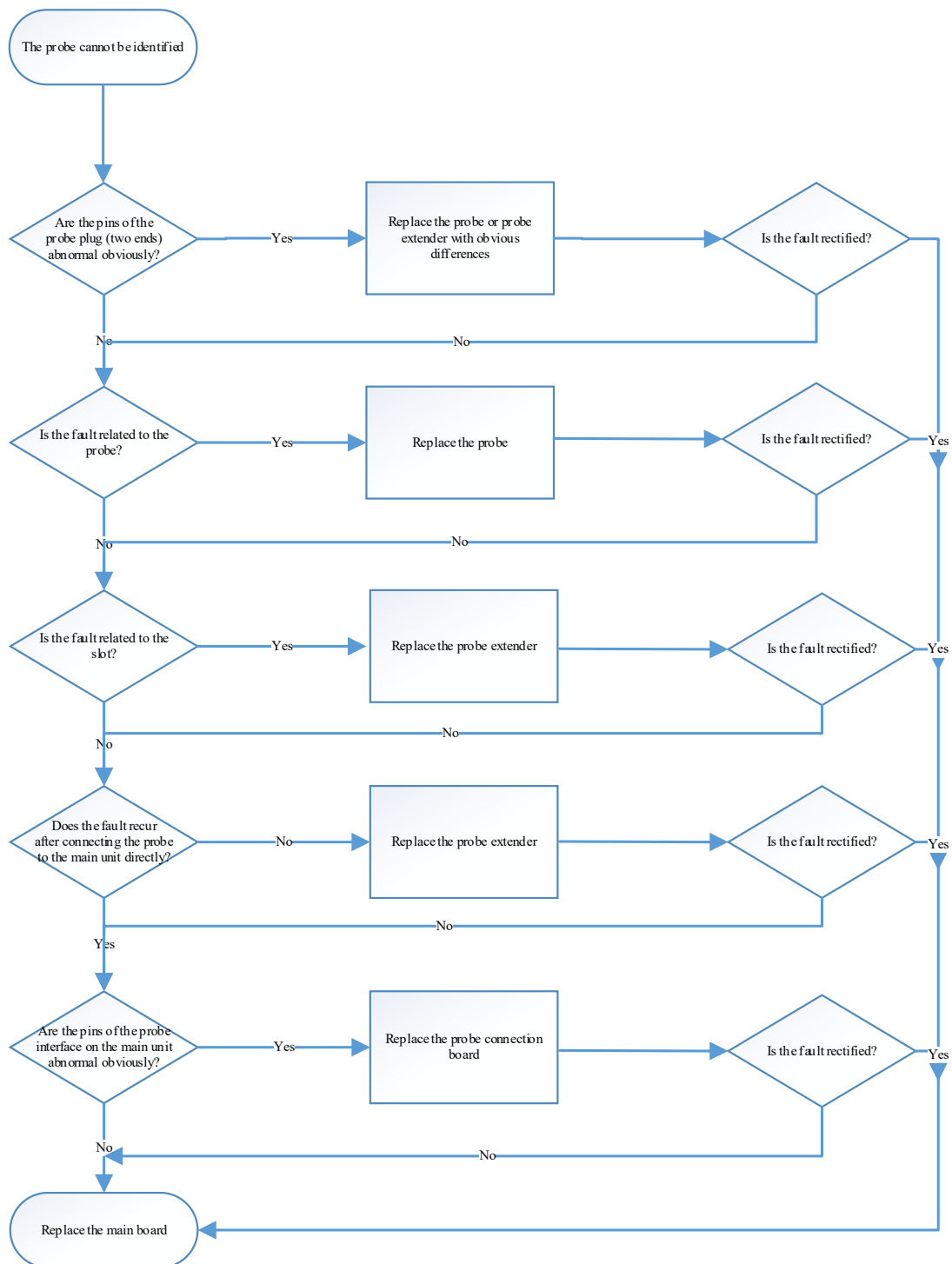
No.	Information to Be Collected	Remarks
1.	Whether pins of the probe socket are bent	/
2	Whether pins of the probe connection board are bent	/
3	Probe extender	/
4	Main board	/

3.2.4.3 Troubleshooting Flow

Troubleshooting flow with the presence of a probe extender:



Troubleshooting flow with the absence of a probe extender:



3.2.5 Troubleshooting of Control Panel

3.2.5.1 Involved Modules or Boards

No.	Description	Remarks
1	Control panel	/
2	Touchscreen	/
3	Switch button board	/

3.2.5.2 Information to Be Collected

No.	Information to Be Collected	Remarks
1	Backlight of the control panel	Check whether the control panel is powered on normally
2	Key sound of the control panel	Check whether the buzzer works normally
3	Response to general function keys on the control panel	/
4	Touch on the touchscreen	Check whether the keypad board or control panel assembly is faulty
5	Response to trackpad operations	/

3.2.5.3 Troubleshooting of Control Panel

No.	Fault Description	Cause Analysis	Measure
1	Buzzer alarming	Key blocked	Check the control panel for key block
2	Some or individual keys fail to work properly	Control panel PCBA or silicone keys failed	Replace the control panel assembly or replace only the silicone keyboard or silicone keys
3	Only the touchscreen cannot display	Touchscreen or touchscreen line failed	Replace the touchscreen or touchscreen line
		Control panel PCBA	Enter Windows and check whether the control panel can be recognized If not, replace the control panel PCBA

No.	Fault Description	Cause Analysis	Measure
4	The touch sensitive function of the touchscreen failed	Touch mapping error	Restore touch mapping through mapping corrections of Doppler
		Touch sensitive function or touch line failed	Replace the touchscreen assembly or touch line

3.2.6 Troubleshooting of LCD Display

3.2.6.1 Involved Modules or Boards

No.	Description	Remarks
1	Display	Both
2	Mainboard	
3	PC module	

3.2.6.2 Information to Be Collected

No.	Information to Be Collected	Remarks
1	Backlight of the display	Much brighter in the darkness
2	Display status via HDMI external display device	/
3	Video lock light of the mainboard	On means the video source output from the PC is not locked, and Off means the video source input is normal
4	Screen display	

3.2.6.3 Troubleshooting of Display

No.	Fault Description	Cause Analysis	Measure
1	Control panel powered on normally, and the operation function buttons have a response No display (blank screen) on the LCD Normal display on HDMI external display device	LCD screen failed	Replace the LCD

No.	Fault Description	Cause Analysis	Measure
2	Control panel powered on normally, and the operation function buttons have a response No display (blank screen) on the LCD Normal display on HDMI external display device	Mainboard failed	Replace the mainboard
3	Control panel powered on normally, and the operation function buttons have no response No display (blank screen) on the LCD No display on HDMI external display device. The video lock light is off	Mainboard failed	Replace the mainboard
4	Control panel powered on normally, and the operation function buttons have no response No display (blank screen) on the LCD No display on HDMI external display device. The video lock light is on, and the touchscreen displays	It is very likely that the mainboard failed	Preferentially replace the mainboard
5	Control panel powered on normally, and the operation function buttons have no response. No display (blank screen) on the LCD No display on HDMI external display device. The video lock light is on, and the touchscreen displays	PC Module failed	Replace the PC Module
6	The inserted AC screen displays normally, but the gesture or touchscreen does not display	Screen board failed	Replace the main display
7	The inserted AC screen does not display, and the gesture or touchscreen does not display	Screen board failed	Replace the main display
8	Only one screen can display	The board below the no-display screen or corresponding screen is abnormal	Replace the main display assembly

4 Update

4.1 Upgrading the Operating System and Ultrasound Application Software

4.1.1 Obtaining the Software

Contact Mindray Animal Medical to learn information about later versions available for the equipment, and obtain the software from the TDP platform.

4.1.2 Upgrade Method

The upgrade method is the same as software recovery. For details, see the System Recovery Guide.

4.2 Upgrading Software Functions

4.2.1 Software Function List

Software Configuration			Installation Prerequisite
Special imaging	iScape View	/	/
	Free Xros M	/	/
	Free Xros CM	/	/
	Tissue Doppler Imaging	/	Cardiology package should be configured.
	TDI QA	/	TDI should be configured.
	Smart 3D	/	/
DICOM	DICOM Basic	Including Verify (SCU, SCP), task management, DICOM storage, DICOM print, DICOM storage commitment, DICOM media storage (including DICOM DIR) etc	/
	DICOM Worklist	/	DICOM Basic should be configured.
	DICOM MPPS	/	DICOM Basic should be configured.
	DICOM Query/Retrieve	/	DICOM Basic should be configured.

Software Configuration			Installation Prerequisite
Optional application software packages	DICOM Cardiac SR	/	DICOM Basic should be configured.
	DICOM Abdomen SR	/	DICOM Basic should be configured.
	Abdomen/General Package	/	/
	Reproduction Package	/	/
	Cardiology Package	/	/
	MSK Package	/	/
Miscellaneous	AutoEF	/	Cardiology package should be configured.
	iNeedle	/	/
	iWorks	/	/
	iVocal	/	iVocal microphone should be configured.
	DVR Module	/	/

4.2.2 Upgrade Method

For the details, see Part I Service Scenarios: 2.4.8.1 Installing Optional Functions.

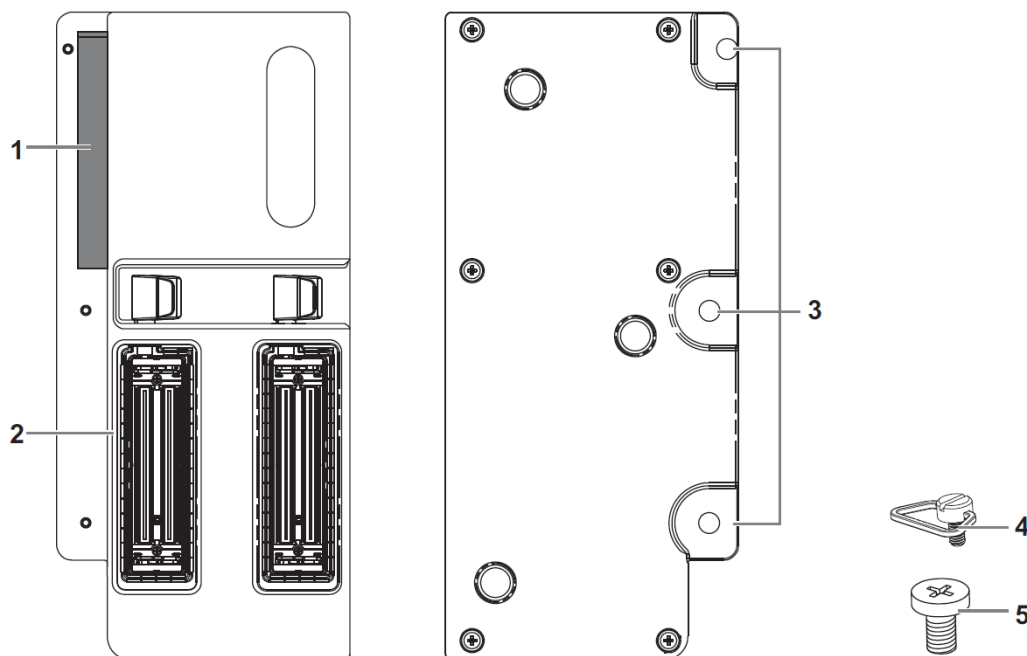
4.3 Upgrading Hardware Functions

4.3.1 Hardware Function List

No.	P/N	Description	Picture	Remarks	Installation Reference
1	115-067777-00	Dual Probe Extend Module(FRU)		Installed at the probe socket on the right of the main unit	
2	115-068005-00	Li-ion battery(FRU)		Only one battery is configured for the main unit.	See Part II General Information: 5.2.2 Battery.
3	115-067749-00	Wi-Fi module		Used for wireless network connection	See Part II General Information: 5.2.3 SSD Card.

4.3.2 Upgrade Method

4.3.2.1 Upgrading the Dual Probe Extend Module



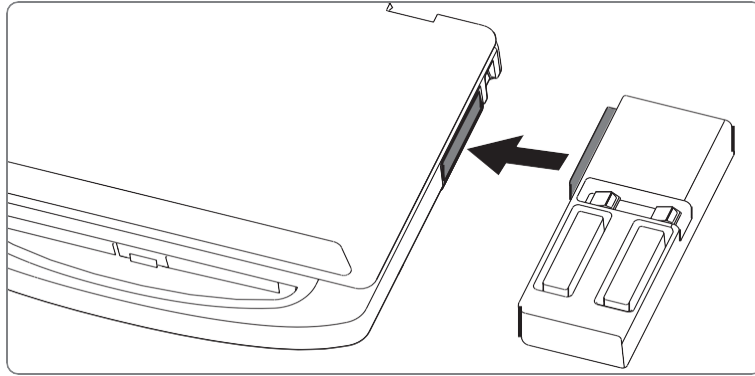
No.	Name	Description
1.	Connector	Connects to the probe port of the main unit, and extends the probe port to two.
2.	Probe port	To extend ports for connecting probes, the middle one is a docking port.
3.	Fixing screw holes (×3)	To fix the module to the main unit using the supplied screws.
4.	Handle screws (×3)	To fix the module to the main unit.
5.	Flat head screws with cross recess (×3)	To fix the module to the main unit. NOTE: If you want to use U-Bank and Dual-Probe extend module at the same time, please use theses screws to fix the module.

Note:

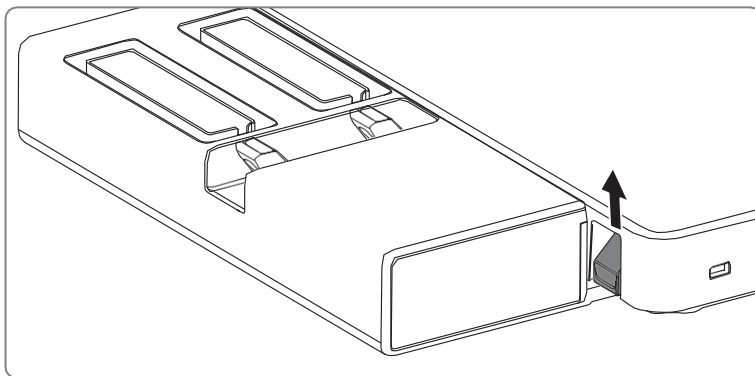
- Perform the plug and unplug of this module. To reduce the wastage of probe module, the operation should be conducted under frozen status of the system.
- If you use this module to connect a probe, the image quality may be degraded.

- Only use the screws provided with the module, and do not mix different types of screws.
- After fixing the module using handle screws, fold the handles parallel to the bottom of the main unit.

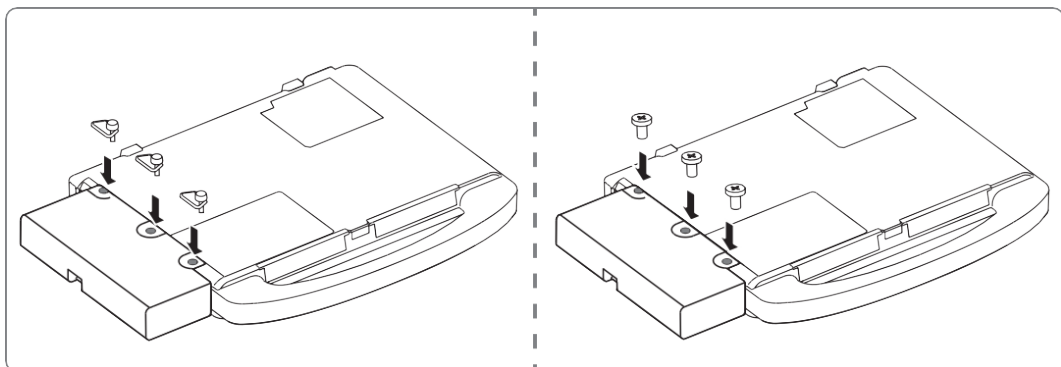
1. Insert the connector to the probe port of the main unit.



2. Toggle the locking lever of the main unit to the top position.



3. Use three screws with the same type only to fix the module to the main unit.

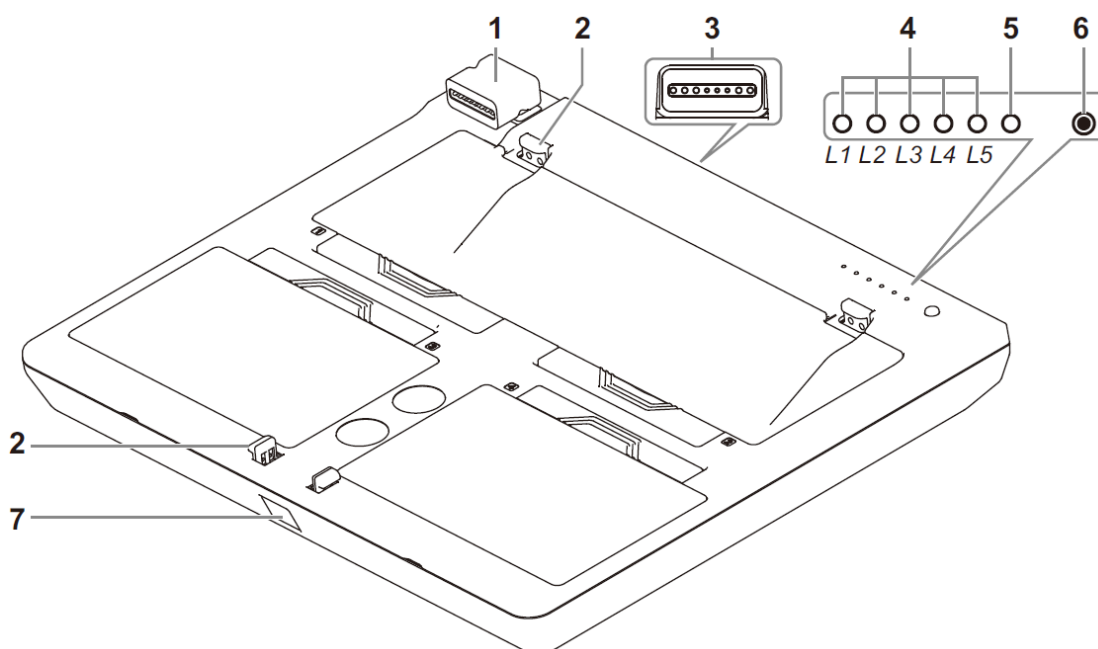


4.3.2.2 U-Bank Overview

⚠ WARNING:

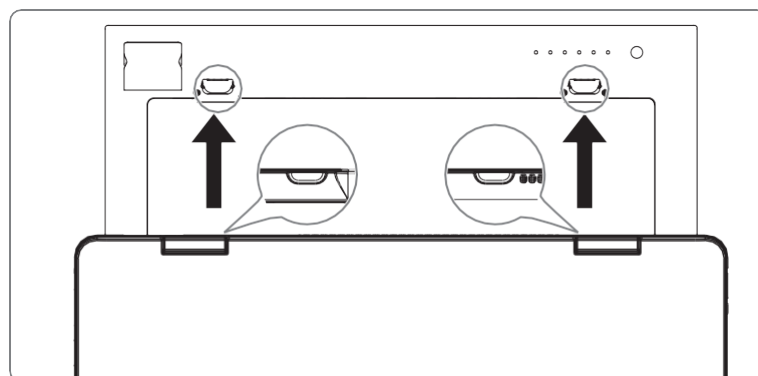
- Only technical professionals from Mindray Animal Medical or engineers authorized by Mindray Animal Medical after training can perform batteries in the U-Bank installation and uninstallation.

- If you need to change the batteries in the U-Bank, please contact your sales representative.



No.	Name	Description
1.	Power connector	Connects to the power input port of the system.
2.	Tabs	Used for fixing the U-Bank to the system.
3.	Charging input port	Connects the power adapter.
4.	Capacity indicators (L1~L5)	Indicates the power of the U-Bank. • The L1-L5 indicators remain on: fully charged or > 80%. • The L1-L4 indicators remain on: 60% < remaining capacity ≤ 80%. • The L1-L3 indicators remain on: 40% < remaining capacity ≤ 60%. • The L1-L2 indicators remain on: 20% < remaining capacity ≤ 40% • The L1 indicator remains on: 10% < remaining capacity ≤ 20% • The L1 indicator blinks: remaining capacity ≤ 10%
5.	Battery status indicator	Indicates the charge/discharge status of the U-Bank.

		- When the battery is charging: Not fully charged: the indicator lights in orange. Fully charged: the indicator lights in green. - When the battery is discharging: The remaining capacity $\geq 20\%$: the indicator lights in green. The remaining capacity $< 20\%$: the indicator blinks in orange. The remaining capacity $\leq 5\%$: the indicator blinks in orange quickly. NOTE: When the U-Bank is charging or when you are pressing the power button, the indicator blinks in orange for 5s, and other indicators remain off. It indicates that the U- Bank may have malfunction. Please stop using the U- Bank and contact the Mindray Animal Medical service engineers or your sales representative.
6.	Power button	Used for checking the U-Bank power status.
7.	Detach lever	Used for detaching the U-Bank from the system.

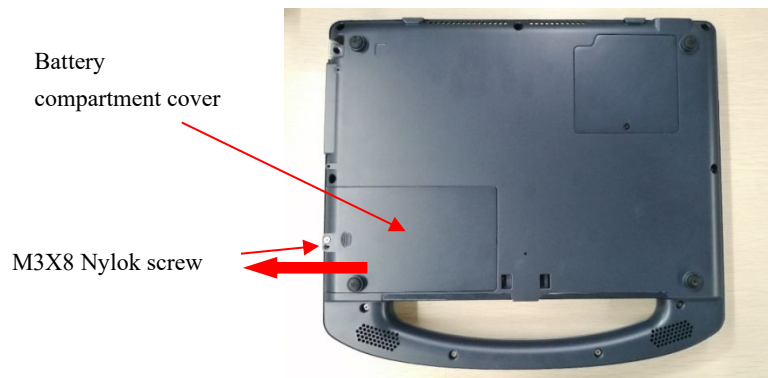


1. Place U-Bank to a flat and solid platform.
2. Align the grooves of the system with the tabs of U-Bank.
3. Push the system in the arrow direction as shown in the figure above until the system is locked in place.

4.3.2.3 Upgrading the Battery

Note: Install the battery when the system is shut down.

1. Remove an M3X8 Nylok screw from the battery compartment cover and then take off the battery compartment cover along the direction indicated by the arrow.

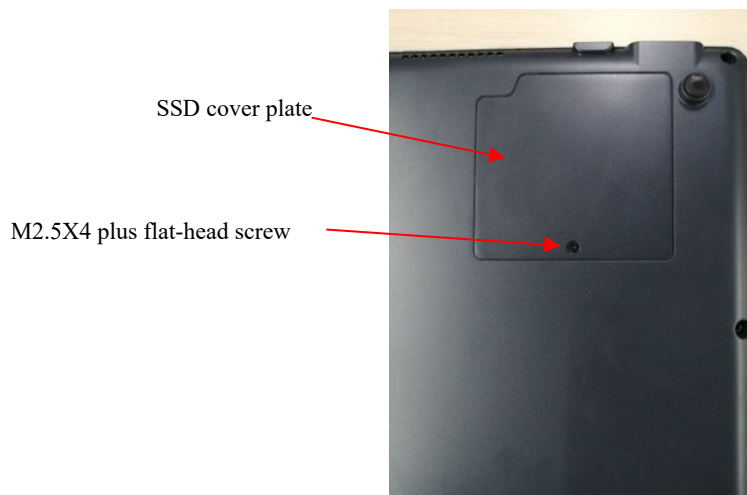


2. Install the battery in the battery compartment and then install the battery compartment cover.



4.3.2.4 Upgrading the Wi-Fi Module

1. Remove the M2.5X4 plus flat-head screws from the cover plate of the bottom case of the equipment, and then take off the SSD cover plate.



2. Install the Wi-Fi module at the socket, tighten the screws of the Wi-Fi module, and connect the two Wi-Fi antennas.



4.4 Upgrading the Probe and Biopsy Bracket

For details about the information, PN, and warranty number of the probe and puncture trestle supported by this product, see Part II General Information: 3 Probe and Needle-guided Bracket.

Part II General Information

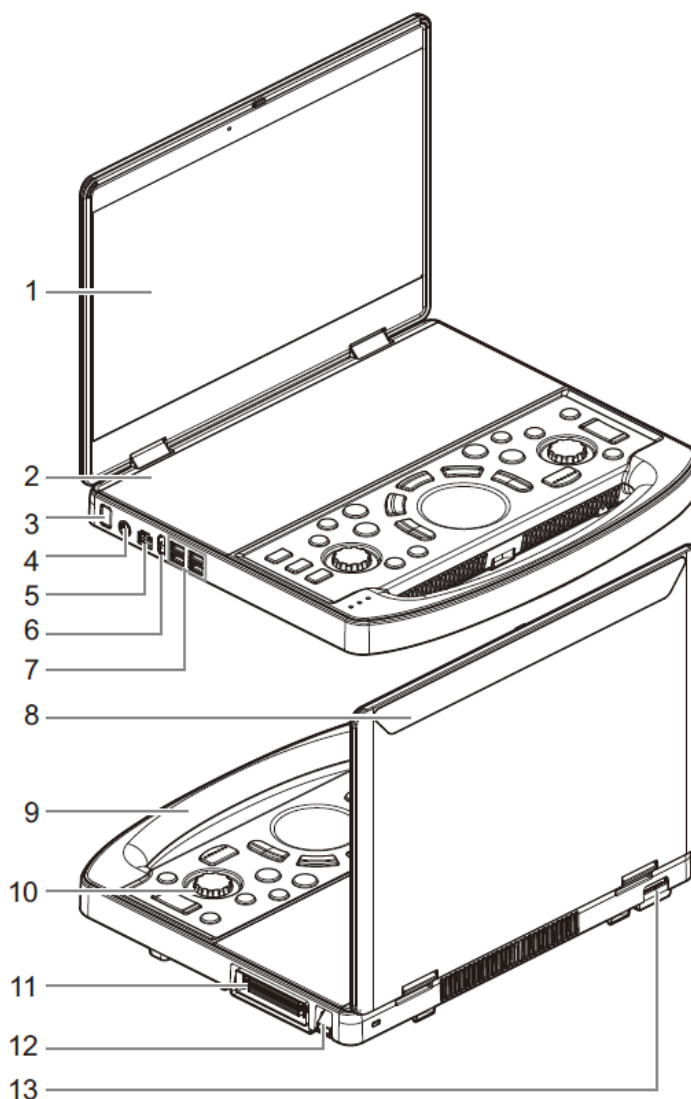
1 Product Specifications

1.1 Product Overview

1.1.1 Intended Use

It is intended for use in Abdomen, Cardiology, Reproduction and Musculoskeletal exams for Equine.

1.1.2 System Appearance



No.	Name	Description
1	LCD	Shows the images and parameters during scanning.
2	Touch screen	Serves as a man-machine interface for operations and control.

No.	Name	Description
3	Power button/indicator	Powers up or down the system. The indicator is on after the system is powered up.
4	S-VIDEO interface	S-Video signal output
5	Network interface	Connecting to the network
6	HDMI port	Outputs HD multimedia signals.
7	USB port	Connects USB devices (4 pcs).
8	Secondary screen	Presents the battery level information, AC status, and equipment model. Note: The remaining time in the battery level information may vary according to the actual operation mode.
9	Handle	Used for moving the equipment.
10	Control panel	Serves as a man-machine interface for operations and control.
11	Probe port	Connects a probe to the main unit or connects a probe extender.
12	Probe locking switch	Locks/Unlocks the probe to/from the main unit. : locked symbol : unlocked symbol
13	Power input port	Connects a power adapter.

1.2 Technical Specifications

1.2.1 Physical Specifications

- Dimensions (D × W × H): 322±5 mm × 364±5 mm × 44±3 mm
- Weight: < 4.0 kg (including the embedded battery)

1.2.2 Electrical Specifications

- Voltage: 100 V to 240 V AC
- Frequency: 50/60 Hz
- AC input power: input current for the main unit: 2.0 A - 1.0 A
- Battery of the main unit: 14.4 V DC

1.2.3 Environmental Specifications

- Operational Conditions
 - Ambient temperature: 0°C to 40°C
 - Relative humidity: 20% to 85% (no condensation)

- Atmospheric pressure: 700 hPa to 1060 hPa
- Storage and Transportation Conditions
 - Ambient temperature: -20°C to 55°C
 - Relative humidity: 20% to 95% (no condensation)
 - Atmospheric pressure: 700 hPa to 1060 hPa

1.2.4 Display Specifications

1.2.4.1 Main Display

- 15.6-inch display
- Up/Down angle of view: ≥ 170 degrees, anti-dazzle
- Left/Right angle of view: ≥ 170 degrees, anti-dazzle
- Resolution: 1920×1080
- The brightness of the main display may be adapted according to the ambient brightness.
- The backlight of the display is linked in the auto adaptation state.
- The contrast of the main display may be manually adjusted.
- The opening-closing angle of the display is no less than 180 degrees.

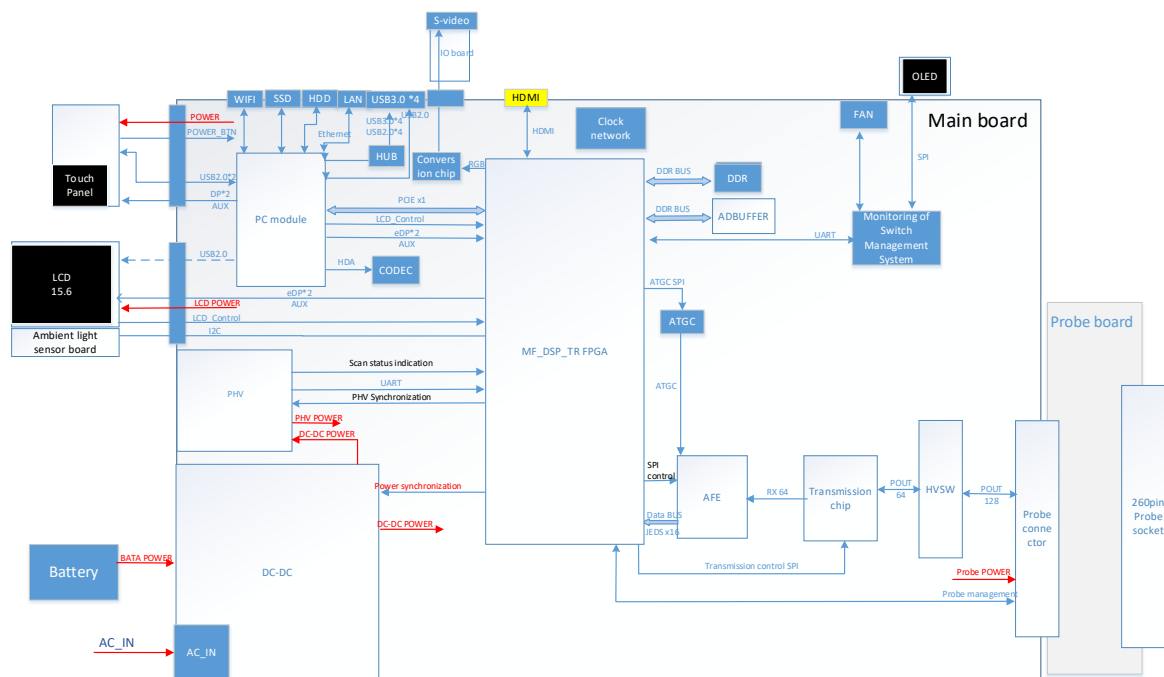
1.2.4.2 Touch Screen

- Size: 12.3 inches
- Resolution: 1920×720
- Hardness: $\geq 2H$ (2H pencil, pressure 1N/45°)
- Touch panel size: 70 ± 1 mm (diameter)

2 Product Principle

2.1 General Structure of Hardware System

Figure 2-1 Schematic diagram of the hardware system



The preceding figure shows the composition of the hardware system, which mainly comprises the following units:

- Main board:
 - DC-DC module: DC-DC circuit for supplying power and charging/discharging the battery
 - PHV module: PHV circuit for providing PHV and HV power for the transmit circuit
 - Backend functional circuit: implementing audio, video, IO interface, and other functions
 - FPGA module: implementing video processing, IO interface control, transmit/receive control, and signal processing
 - Transmit/receive channel: 64 channels
 - HV switch module: implementing adaption between 64 channels and 128 channels
 - Probe related control interface
 - Power management (EC): power management and control for starting or shutting down the main unit
 - System monitoring (SM): power and fan monitoring for the main system

- Probe board: connecting the probe to the main unit
- COME module (or PC module): Doppler running platform
- Main display module: 15.6" display capable of sensing the brightness of ambient light.
- Image screen: showing the equipment model and the battery level of the main unit and U-Bank.
- Touch screen: 12.3-inch touch screen for adjusting system parameters.
- Control panel: enabling key operations for the entire main unit. It is the signal input of the main unit.
- DC connection board: connecting the magnetic adapter to the main unit.
- S-Video connection board: implementing the S-Video interface function.

2.2 Main Board

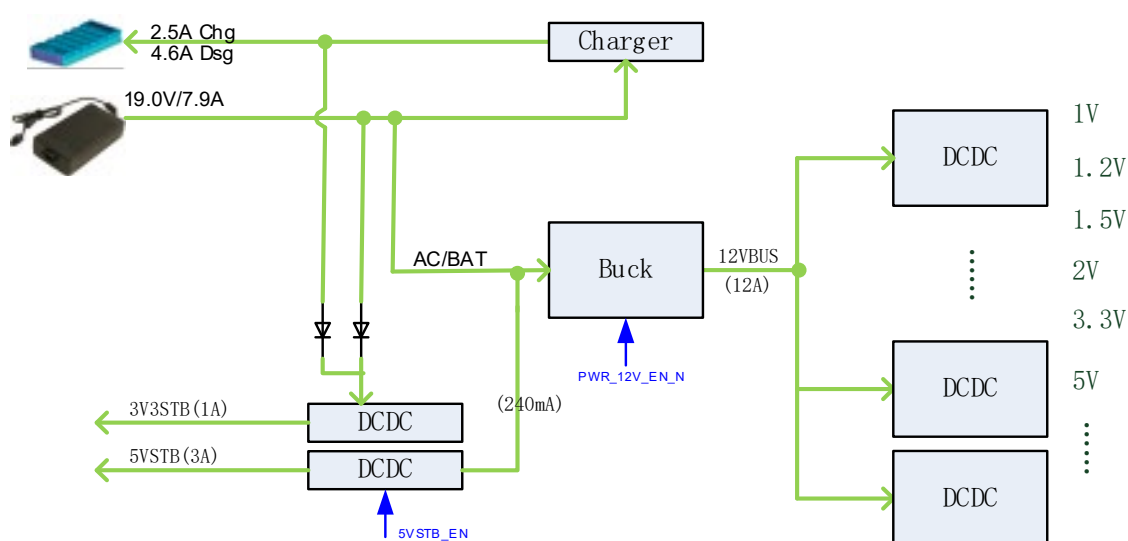
The main board consists of three parts: power supply, frontend, and backend.

2.2.1 Power Supply

The power supply comprises two parts: PHV and DCDC.

2.2.1.1 DCDC Power Supply

Figure 2-2 Block diagram of the DCDC power supply

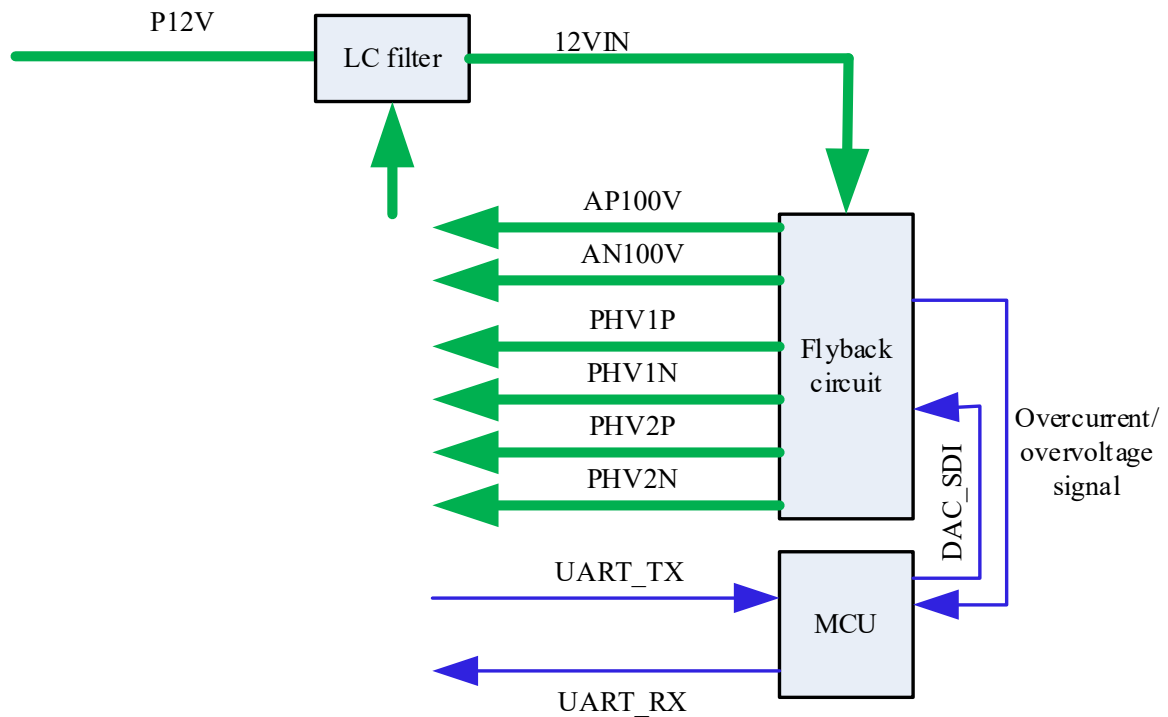


Function description:

- The DCDC power supply provides power when the main unit stands by or is powered up.
- The DCDC power supply provides battery charge and discharge circuits.

2.2.1.2 PHV Power Supply

Figure 2-3 Block diagram of the PHV power supply

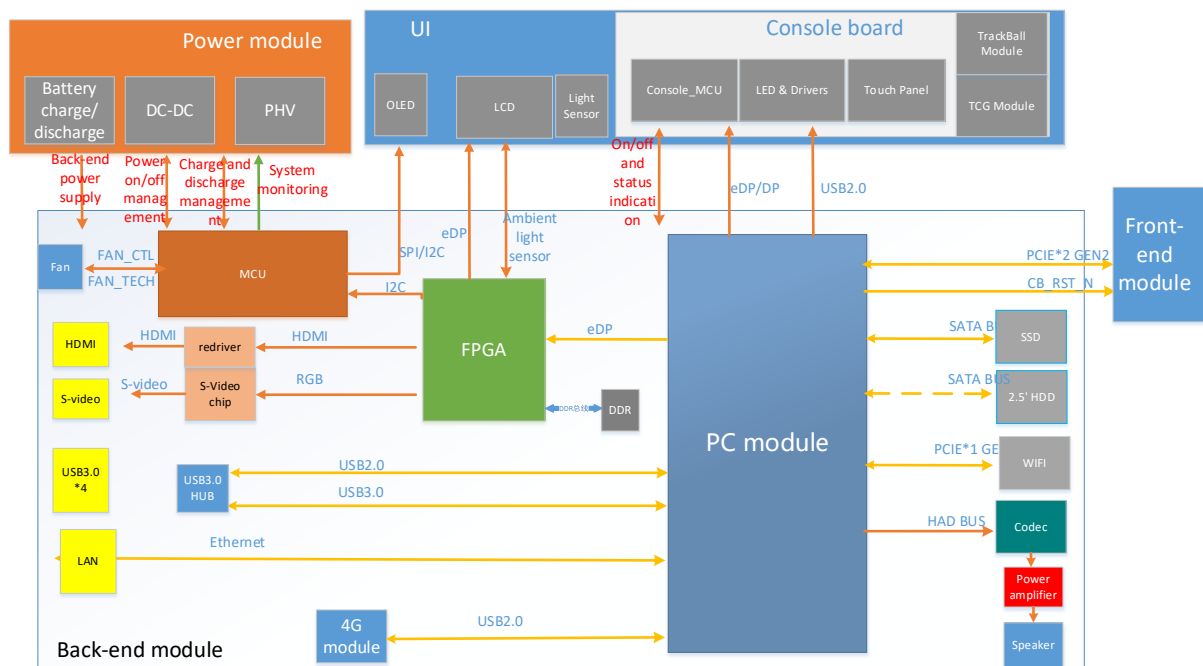


Function description:

- The PHV power supply provides power to the transmit circuit and has six output channels: AP100V, AN100V, PHV1P, PHV1N, PHV2P, and PHV2N.
- Power is output by the PHV and then supplied to the transmit circuit after filtering.

2.2.2 Backend

The backend consists of the PC module and related circuits on the main board.

Fig 2-4 Block diagram of the backend

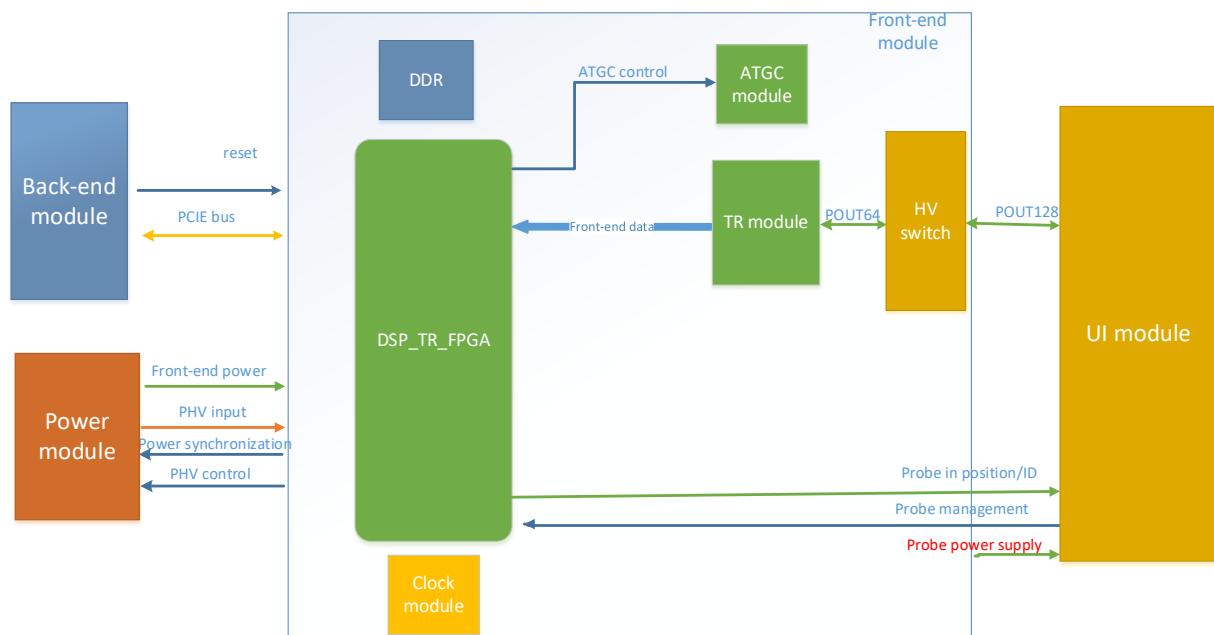
Function description:

Circuit Unit	Function
Power-on/off control	Controlling the startup and shutdown of the system. A power indicator is provided.
System monitoring	Battery management, fan control, voltage detection, battery indicator control, voltage detection, and temperature detection
Wireless network adapter	Wi-Fi and Bluetooth functions
Wired network	Supporting 10/100/1000M adaptive wired network.
USB port	Providing four external USB 3.0 ports.
SATA interface	- SSD, m.2 type 2.5" standard disk interface
HDMI	Providing an HDMI interface and supporting 1920 × 1080 HD output.
S-Video	Providing a standard S-Video interface and supporting NTSC and PAL.
Audio	Audio codec, power amplification, supporting 4-ohm 2W stereo speaker.
FPGA	Connecting between the industrial control board and the ultrasound functional circuit.
Control panel interface	Connecting the control panel, 12.3-inch touch screen display.
LCD interface	Connecting the LCD display and image screen board and supporting ambient light detection.

Circuit Unit	Function
Ultrasound related functional circuit	• Transmit/Receive control • Probe control • 4D and TEE probe control (reserved function) • PHV control

2.2.3 Frontend of the Main Board

Figure 2-5 Block diagram of the frontend system of the main board



The main board frontend provides the following functions:

- Control FPGA, implementing transmit/receive control, ATGC adjustment, and probe management for 64 channels
- Clock circuit
- Transmit circuit, transmitting pulses to send 5-level signals
- HV switch circuit, implementing expansion from 64 channels into 128 channels
- AFE, receiving echo signals
- ATGC circuit (time gain compensation)

2.3 Probe Board

- Supporting nominal probes including 192/128-element probe, phased array probe, and dual-plane probe
- Connecting between the main unit and the probe
- Switching to 192-element mode inside the probe (only 129 channels are supported on the probe board)

2.4 Magnetic Connection Board and IO Interface Board

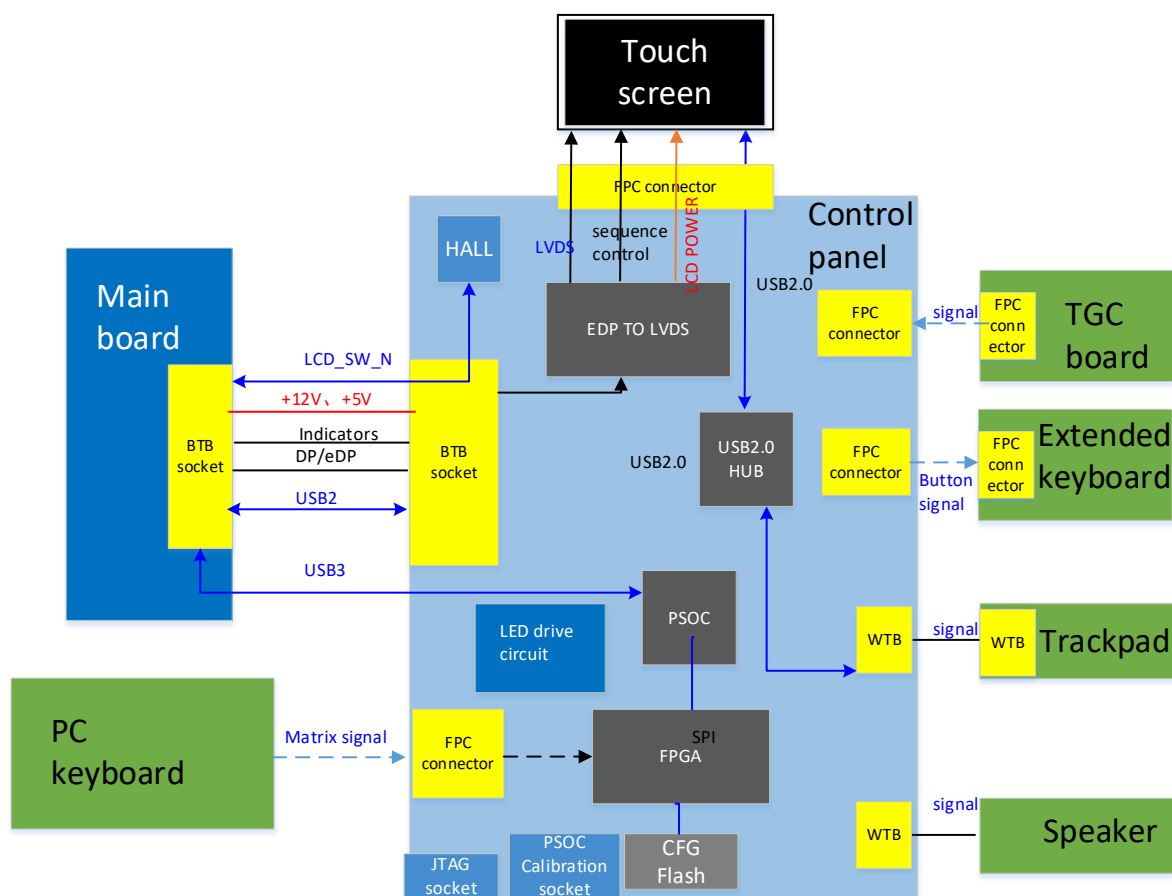
The two boards are mainly used for conversion, that is, providing the S-Video interface and magnetic adapter interface for the main unit. It connects to the main board through the WTB cable.

2.5 Control Panel

The control panel comprises two boards and one display.

No.	Board	Function Description
1	Control panel	Trackpad, custom function keys, backlight control, system status indicator, encoder, and buzzer
2	Switch button board	Power-on/off and cover opening detection, with partial power-on/off status indication functions
3	Touch screen	12.3-inch LED display, working with the main display for operation control and supporting the touch function

Fig 2-6 Block diagram of the control panel

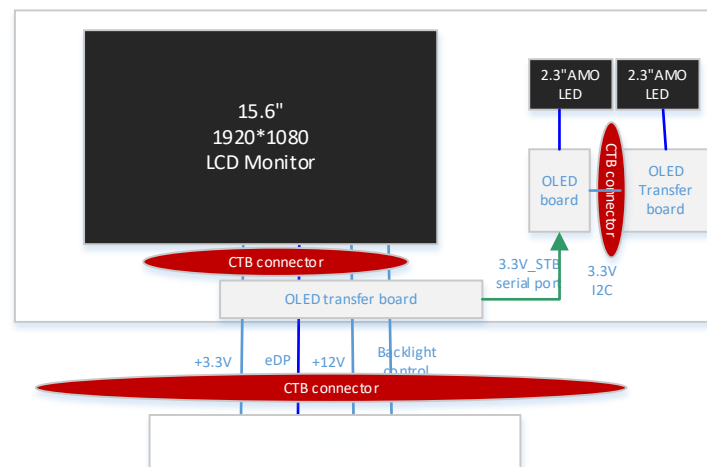


The preceding figure shows the block diagram of the control panel. The function modules are described as follows:

- The PSOC+FPGA solution is adopted for main control of the control panel.
- The control panel implements key functions and LED drive, and confirms indicator conditions based on UI requirements.
- The control panel supports the touch screen.
- The PSOC of the control panel communicates with the main unit through a USB port. The main unit provides a USB port.
- The FPGA of the control panel employs the AS configuration mode.
- Trackpad.
- The PSOC debugging interface and FPGA/JTAG interface on the control panel should be convenient for debugging.
- The control panel contains the AC status indicator, battery status indicator, and disk status indicator. Indicator details are confirmed based on UI requirements.

2.6 Main Display Unit

Figure 2-7 Block diagram of the display



The display unit consists of the LED display, two 2.3" AMOLED display cables, secondary screen conversion board, secondary screen board, and OLED conversion board.

- Function description:
- The secondary screen conversion board stores color temperature and gamma correction data, and works with the LCD screen to ensure display consistency. Related parameters in the control board should be updated at initial installation or upon control board/LCD screen replacement.
- The main board FPGA will correct video signals output by the industrial control board based on information in the secondary screen conversion board, and then drive the LED display. The display brightness and power are also controlled by the main board FPGA.
- The secondary screen board is used to light up the two 2.3" AMOLED displays. It also integrates the MCU to implement display and power control, and the ambient light sensor to detect the brightness of the ambient light. Moreover, it integrates the distance sensor to support waking up the display through touching or short-distance gesture.
- The OLED conversion board converts AMOLED display and power signals from the secondary screen board. It also integrates the distance sensor.

2.7 Battery Package

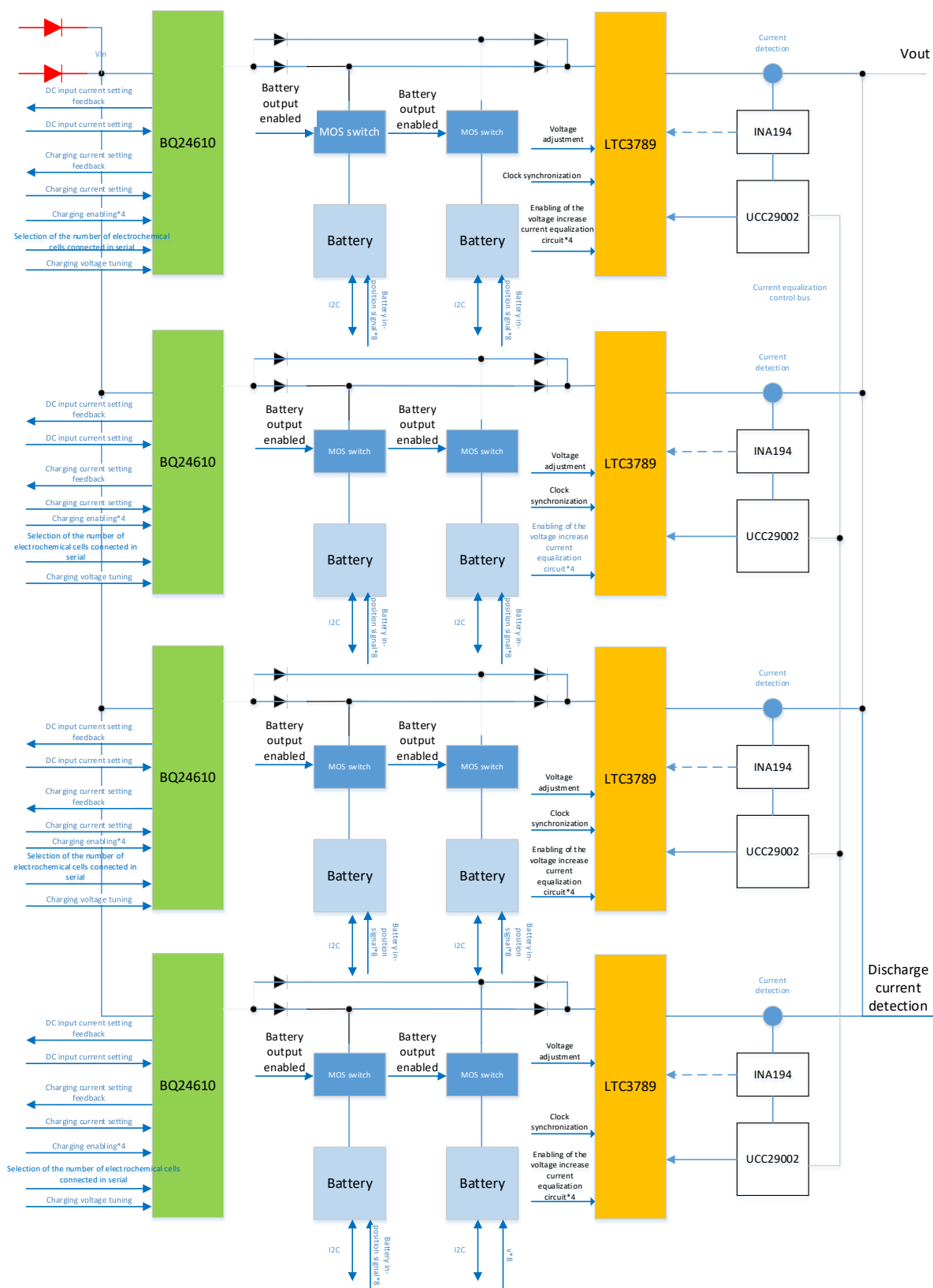
2.7.1 Battery Management Board

The battery management board implements the following functions:

1. Switching between AC power and battery power automatically, with AC power prioritized
2. Battery charge and battery level management
3. AC status and battery status indication
4. Working with the main unit system to identify the status of the main unit system, thereby implementing auxiliary output control and low standby power consumption of the U-Bank battery

The following figure shows the block diagram of the U-Bank battery management board.

Figure 2-8 Block diagram of the U-Bank battery management board



2.7.2 Key and Indicator Board

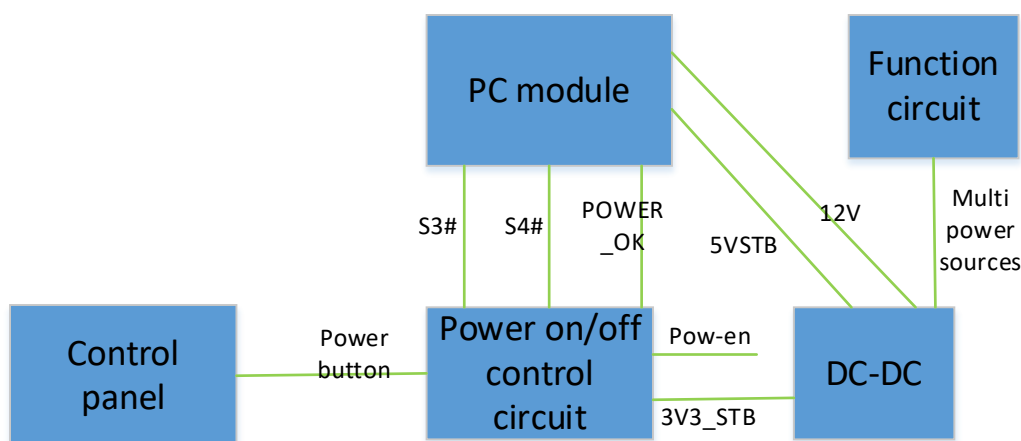
The key and indicator board is used to indicate the battery level and control the fan of the battery package.

2.7.3 Battery Magnetic Connection Board

The battery magnetic connection board connects to the magnetic interface of the main unit to power the main unit.

2.8 System Power-up Control

Figure 2-9 System power-up control

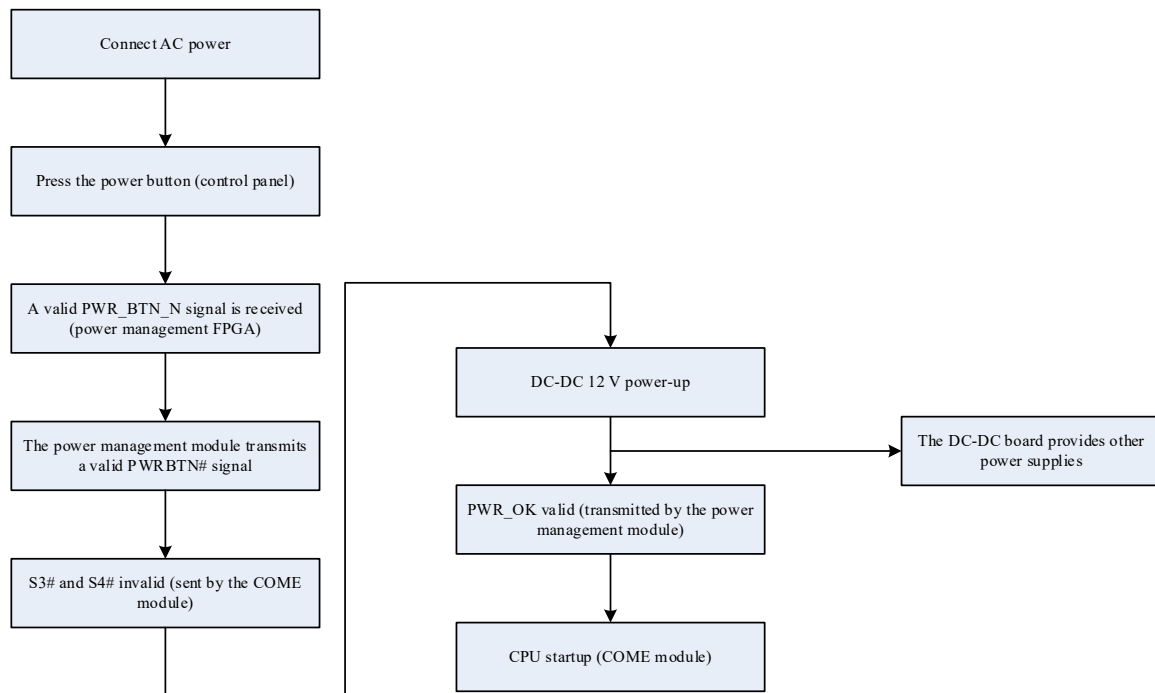


The following table describes related control signals.

No.	Control Signal	Description	Remarks
	PWR_BTN_N PWR_BTN#	Pulse signal generated by the power button on the control panel. It is transmitted to the CPU board through the power management FPGA to trigger the startup process.	
	S3#	Output signal of the CPU board. A valid signal indicates that the CPU system is in the standby state (S4# is a high level). This signal enables 5VSTB to be in the power-up state in standby mode through the power management FPGA.	
	S4#	Output signal of the CPU board. A valid signal indicates that the CPU system is in the dormancy state.	
	S5#	This signal is not used currently.	
	PWR_OK#	Signal sent by the power management FPGA to the CPU board to indicate that 12 V power has been connected.	

- The system can be started regardless of whether being powered by the main unit or battery.
- The power supply generates 5VSTB and 3.3VSTB only if there is AC input.
- If AC power is disconnected in the shutdown state, the power management FPGA will turn off 5VSTB output and retains only 3.3VSTB if a battery is present. The system is powered up only after you press the power button.
- If AC power is disconnected in the standby state, the battery, if available, provides 5VSTB and 3.3VSTB for the system.
- The following figure shows the power-up process.

Figure 2-10 System power-up process



2.9 Power-up Process of the Main Unit

The following figure shows the startup process of the main unit, and the power and display conditions in different phases.

3 Probe and Needle-guided Bracket

3.1 Probe

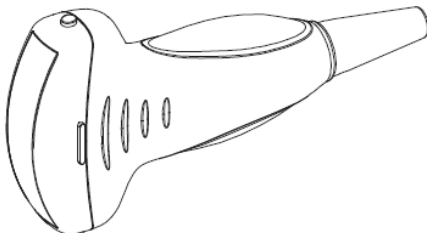
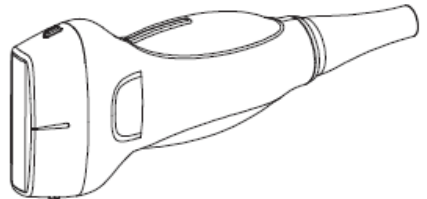
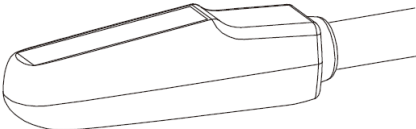
Image	Model	Info		Remarks
	C5-1s	Probe Type	Convex	
		Applicable Needle-guided Bracket	NGB-022, A: LPUBKG60	
		P/N	120-018879-00	C5-1s Ultrasonic Transducer(Ukraine)
			120-018876-00	C5-1s Ultrasonic Probe(FDA)
			120-018877-00	C5-1s Ultrasonic Probe(CE)
			120-018878-00	C5-1s Ultrasonic Probe(CFDA)
	L13-3Ns	Probe Type	Linear	
		Applicable Needle-guided Bracket	NGB-053	
		P/N	120-022466-00	L13-3Ns Ultrasonic Probe(Vet/CE)
			120-022467-00	120-022467-00
		Applicable Needle-guided Bracket	NGB-011	

Image	Model	Info		Remarks
	P4-2s	P/N	120-021932-00	P4-2s Ultrasonic Probe(Vet/FDA)
			120-021934-00	P4-2s Ultrasonic Probe(Vet/CE)
		Probe Type	Phased array	
		Applicable Needle-guided Bracket	NGB-011	
	6LE5Vs	P/N	120-021932-00	P4-2s Ultrasonic Probe(Vet/FDA)
			120-021934-00	P4-2s Ultrasonic Probe(Vet/CE)
		Probe Type	Linear	
		Applicable Needle-guided Bracket	/	
		P/N	120-018915-00	6LE5Vs Ultrasonic Probe(Vet/FDA)
			120-018917-00	6LE5Vs Ultrasonic Probe(Vet/CE)

3.2 Needle-guided Brackets

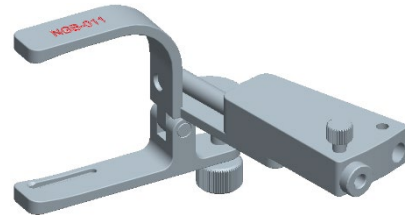
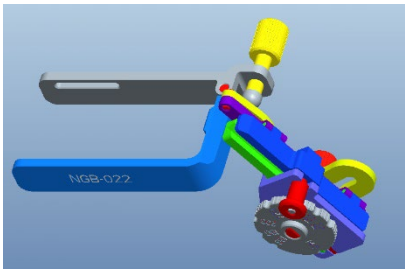
Image	Model	Info		Remarks
	NGB-011	Type	Metal/needle detachable	
		Biopsy Angle/Depth	11° and 23°	
		Applicable Biopsy Needle	13G, 15G, 16G, 18G, and 20G	
		P/N	120-001182-00	NGB-011 Needle-guided Bracket/VET

Image	Model	Info		Remarks
			120-001183-00	NGB-011 Needle-guided Bracket/VET
	NGB-022	Type	Metal/needle detachable	
		Biopsy Angle/Depth	25°, 35°, and 45°	
		Applicable Biopsy Needle	14G, 16G, 18G, 20G, and 22G	
		P/N	120-002907-00	NGB-022 Needle-guided Bracket/VET
	NGB-053	Type	Metal/needle detachable	
		Biopsy Angle/Depth	40°, 50°, and 60°	
		Applicable Biopsy Needle	11G to 23G	
		P/N	120-013602-00	NGB-053 Needle-guided Bracket

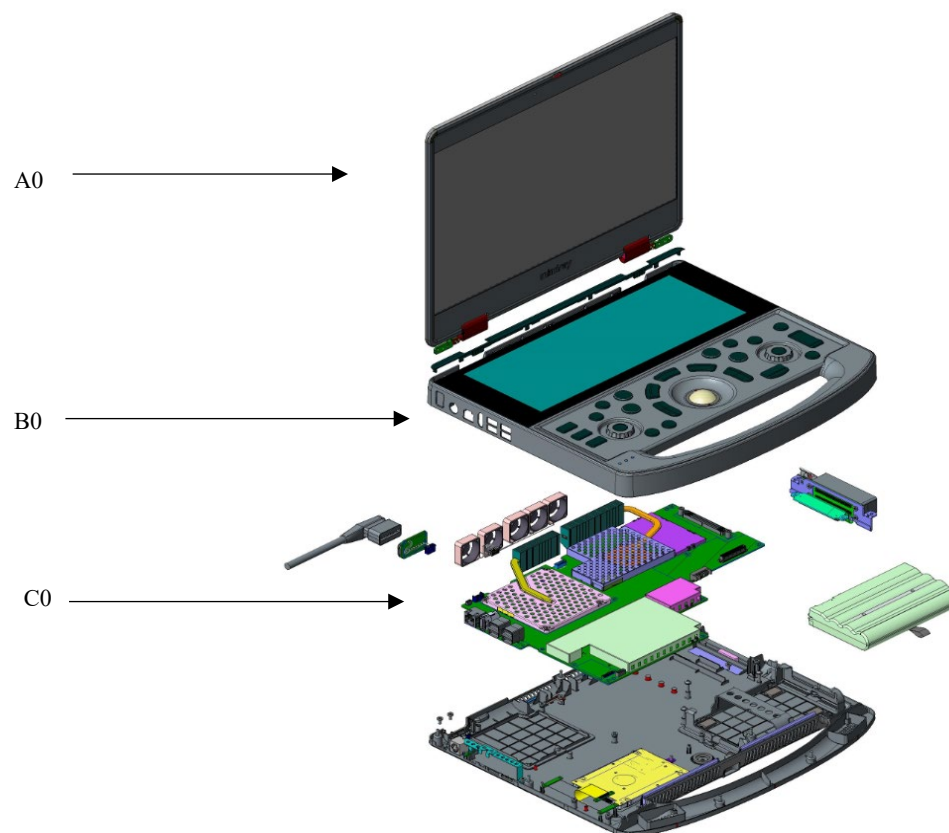
4 Field Replaceable Unit

This chapter lists the details of the Field Replaceable Units (FRU) of the system. Please refer to the explosive view and the FRU table below.

- Level 0 represent the main Assembly of the system, and the whole system is divided into 6 Assembly.
- Level X represent the main parts of Level 0 Assembly.
- Level X-1 represent the sub-parts of Level X.

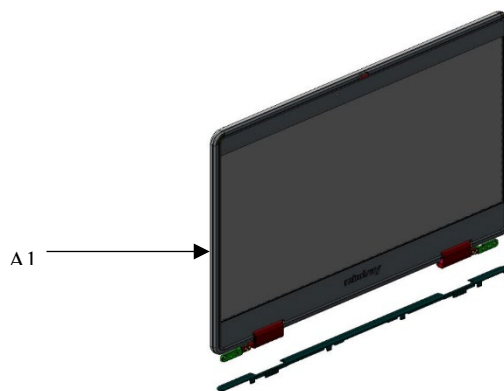
If order number is provided in the table, which means the part is an FRU and can be ordered; if the order number is not provided in the table, which means the part is not an FRU and cannot be ordered.

4.1 Explosive View



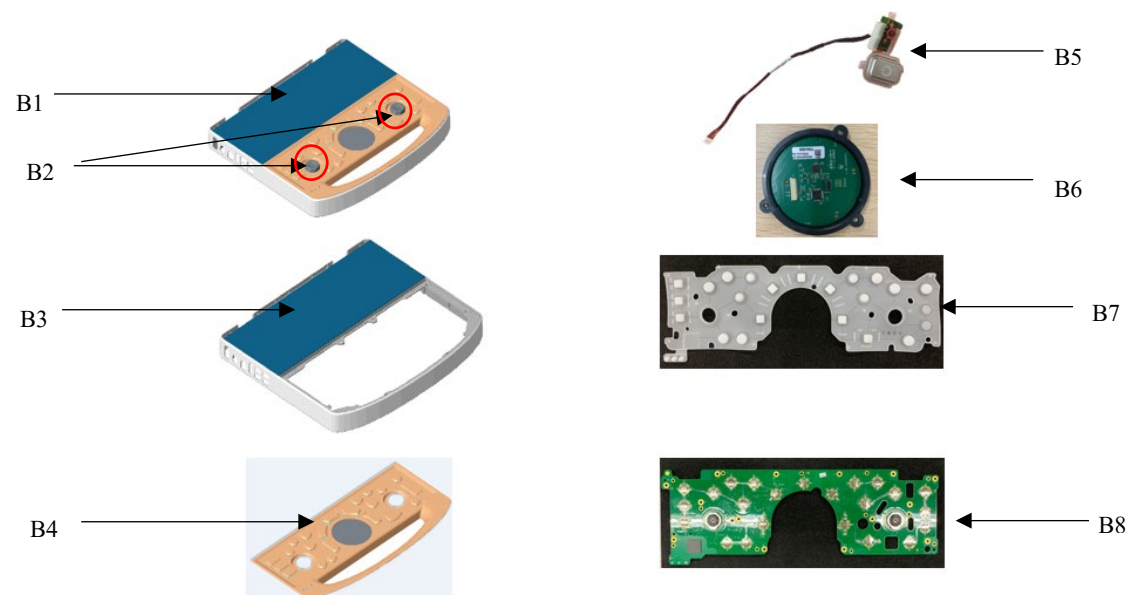
4.2 Assembly Explosive View

4.2.1 Monitor Assembly (A0)



No.	Order Number	Part Name	Qty.	Remark
A1	115-067739-00	LCD Assembly(Gray/FRU)	1	Include Wi-Fi and 4G module antenna. After replacing the LCD Assembly, log in to the system as Service user and choose Setup > Maintenance > Setup > Update OLED Logo.

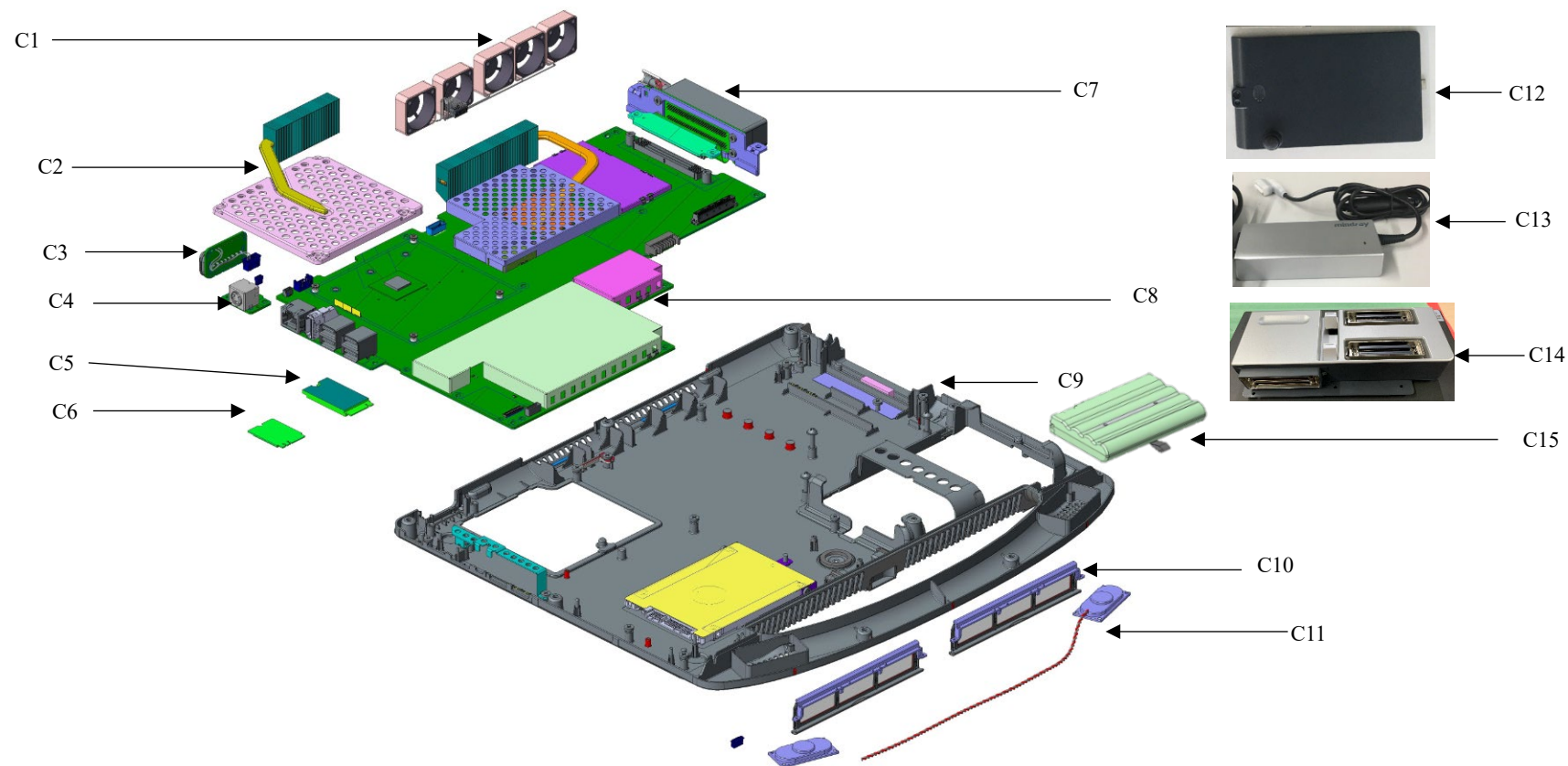
4.2.2 Control Panel Assembly (B0)



No.	Order Number	Part Name	Qty.	Remark
B1	115-00300A-00	Control Panel Assembly(AU05/FRU)	1	Include touch screen, main control panel, silicon Overlay, Key, but without touch pad
B2	043-012383-00	Encoder Knob	2	

No.	Order Number	Part Name	Qty.	Remark
B3	115-00299A-00	Touch screen Assembly(FRU)	1	
B4	115-069360-00	POC Control Panel Cover(Gray)	1	
B5	115-067743-00	Power Button Assembly(With cable/FRU)	1	With the power button and the connecting cable
B6	115-068060-00	Touch Pad(POC/FRU)	1	
B7	049-001657-00	Silicon Overlay (FRU)	1	
B8	115-067853-01	Control Panel PCBA(FRU)	1	

4.2.3 Main Unit Assembly (C0)



No.	Order Number	Part Name	Qty.	Remark
C1	115-067746-00	Fans Assembly(FRU)	1	
C2	115-067852-00	PC Module(FRU)	1	
C3	115-068057-00	Magnetic Power Socket(FRU)	1	
C4	115-068058-00	S-video Interface Board(FRU)	1	
C5	115-00302A-00	SSD(AU05/128 GB/FRU)	1	
C6	115-067749-00	Wi-Fi Module	1	Optional
C7	115-068053-00	Probe Board Assembly (FRU)	1	
C8	115-068055-01	Main Board Assembly(FRU)	1	
C9	115-067750-00	Bottom Cover Assembly(FRU)	1	
C10	115-068059-00	Dustproof Filter(FRU)	2	
C11	115-067747-00	Speaker Assembly(With Cable/FRU)	1	
C12	115-067751-00	Battery Chamber Cover(FRU)	1	
C13	022-000412-00	AC Adapter(FRU)	1	
C14	115-067777-00	Dual Probe Extend Module(FRU)	1	
C15	115-068005-00	Li-ion battery(FRU)	1	
	115-071555-00	Li-ion battery(FRU-FDA)	1	

4.2.4 Cable and Accessories (D0)



D1



D2

No.	Order Number	Part Name	Qty.	Remark
D1	009-003704-00	Adapter power cord(China,2.5M)		
	009-003703-00	Adapter power cord(Europe,2.5M)		
	009-003701-00	Adapter power cord(U.K,2.5M)		
	009-005417-00	Brazil Adapter power cord (3.5M)		
	009-003702-00	Adapter power cord(USA,2.5M)		
	009-004941-00	Adapter power cord(Australian ,2.5M)		
	009-010943-00	UL power cords (India, 6A, 3.5m)		
	009-003699-00	Adapter power cord(Brazil, 2.5M)		
D2	115-068076-00	Control Panel to Main Board Cable(FRU)		

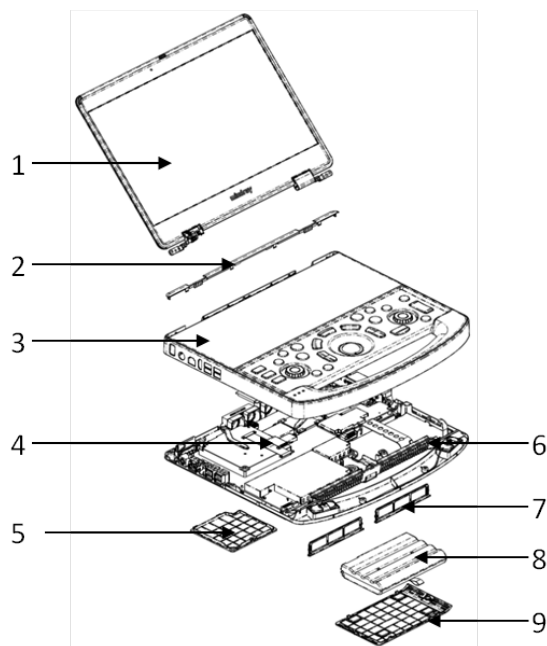
No.	Order Number	Part Name	Qty.	Remark
/	115-080706-00	Portable Battery Package(Two Cell)		
	115-080709-00	Portable Battery Package(Two Cell-FDA)		
/	115-080707-00	Portable Battery Package		
	115-080708-00	Portable Battery Package(FDA)		
/	048-00012A-00	Backpack		

5 Structure and Assembly/Disassembly

5.1 System Structure

5.1.1 Main Unit

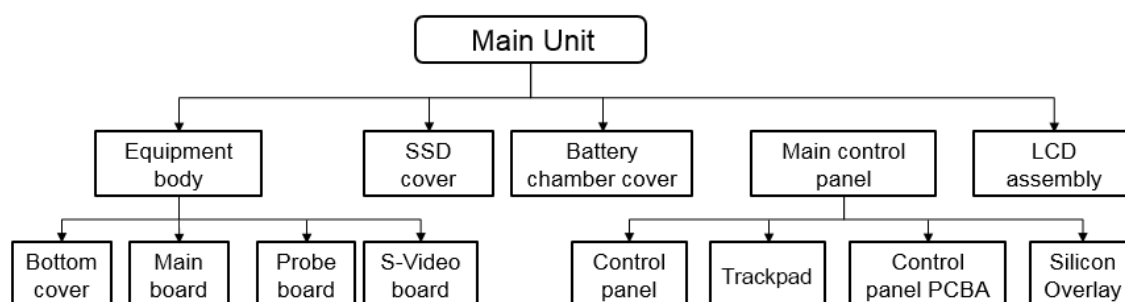
Figure 5-1 Explosive view of the main unit



No.	Name	No.	Name
1	LCD	6	Equipment body
2	Spindle cover	7	Dustproof Net
3	Control panel	8	Li-ion battery
4	Control Panel to Main Board Connecting Cable	9	Battery Chamber Cover
5	SSD cover plate		

5.2 Assembly/Disassembly of the Main Unit

This section describes the assembly and disassembly processes of major components and hardware boards. The assembly process is the inversed disassembly process unless otherwise specified.

Figure 5-2 Assembly/Disassembly process

5.2.1 Preparations

5.2.1.1 Tools Required

Name	Type	No.	Remarks
Crosshead screwdriver	107 × 75	/	M2
Crosshead screwdriver	107 × 75	0000-10-10884	M3
Flathead screwdriver	No. 56Φ6.0X200	095-000074-00	
Diagonal cutting pliers	N-206S	095-000077-00	/
ESD gloves: 1 pair	/	/	/

5.2.1.2 Personnel Requirement

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

5.2.1.3 Disassembly Requirements

Make the following preparations before disassembling the ultrasound equipment.

1. Stop scanning and image capture, shut down the system, disconnect the AC power supply, and remove the AC power cable.
2. To avoid scratching the surface of the equipment, prepare a soft workbench that is clean without sundries.
3. Prepare the tools required.

5.2.2 Battery

Note: You are advised to remove the battery first, and then remove other parts when the power is down.

1. Remove an M3X8 Nylok screw from the battery compartment cover and then take off the battery compartment cover along the direction indicated by the arrow.

Battery compartment cover

M3X8 Nylok screw



2. Pull the battery pull tab and take out the battery.

Battery

Battery pull tab



5.2.3 SSD Card

1. Remove the M2.5X4 plus flat-head screws from the SSD cover plate, and then take off the SSD cover plate.

SSD cover plate

M2.5X4 plus flat-head screw



2. Pull up the 4G and network adapter antenna buckles.

Antenna buckle



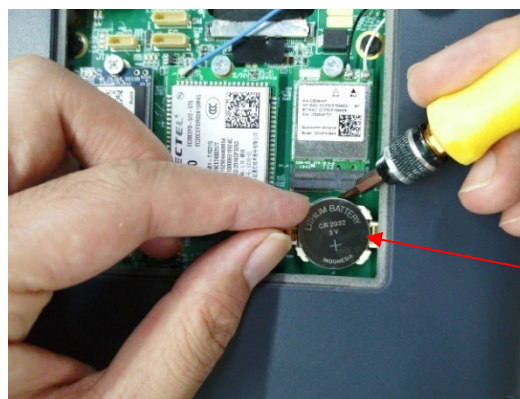
3. Remove the LCD signal cable with the black pull tab.

LCD signal cable



4. Remove the button battery.

Insert a flathead screwdriver into the gap between the button battery and the plastic cover. The button battery ejects automatically.

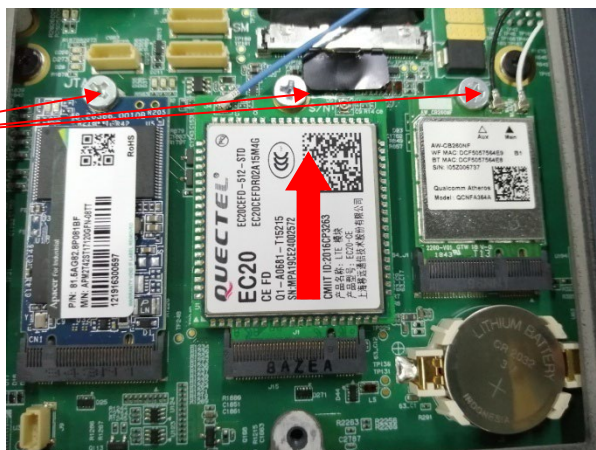


Button battery

5. Remove the SSD card, 4G card, and Wi-Fi card.

Remove the three M3X5 cross recessed flathead screws and take off the three cards along the direction indicated by the arrows.

M3X5 cross recessed
flathead screw



5.2.4 LCD and Keyboard Cover

1. Remove the spindle cover.

Insert a flathead screwdriver into the gap between the edge of the spindle cover and the keyboard cover, and pull out the spindle cover.

Spindle cover



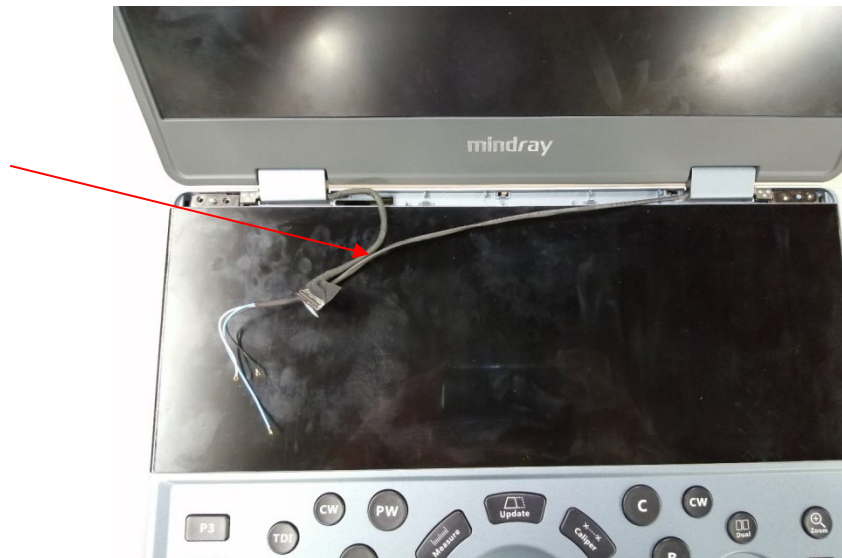
2. Detach the LCD.

Use a crosshead screwdriver to remove the four M3X5 cross recessed flathead screws from the damping axis, remove the signal cable softly, and then detach the LCD.

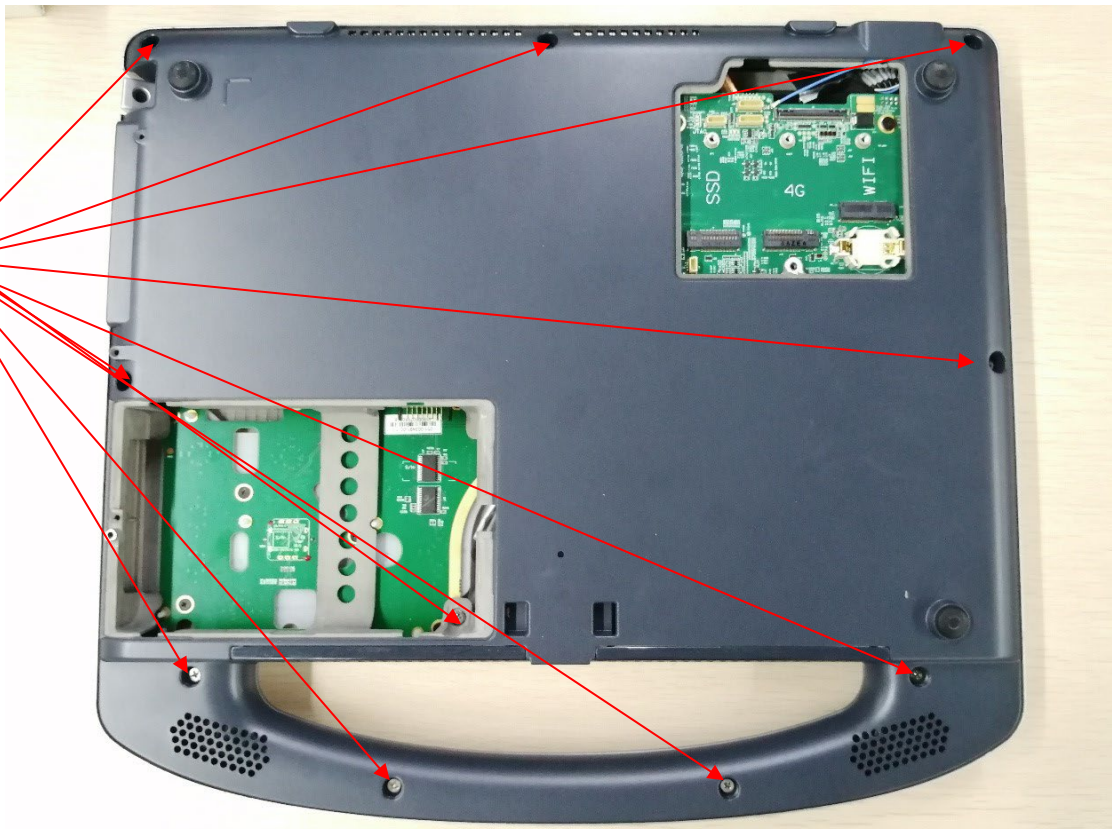
M3X5 cross recessed
flathead screw



LCD signal cable

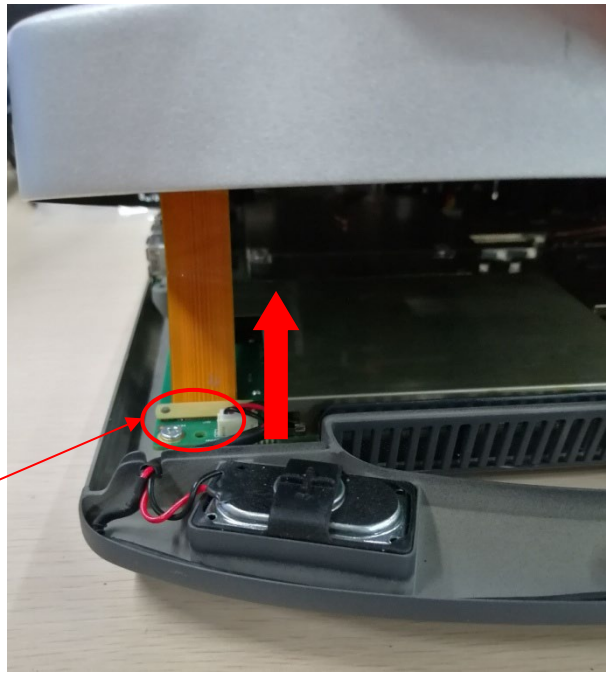


3. Remove the screws fixing the bottom case to the keyboard cover.
Use a crosshead screwdriver to remove the 10 M3X8 Nylok screws on the bottom case.

M3X8 Nylok
screw

4. Remove the FPC flat cable between the main board and the control panel.
Lift the keyboard cover softly. When the FPC flat cable between the main board and the control panel is visible, remove the flat cable from the interface on the main board to detach the keyboard cover.

FPC flat cable between
the main board and the
control panel

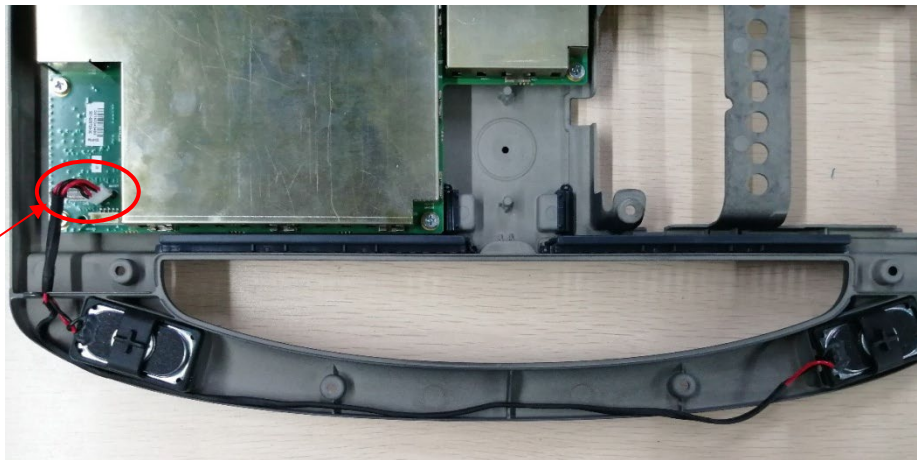


5.2.5 Equipment body

1. Speaker

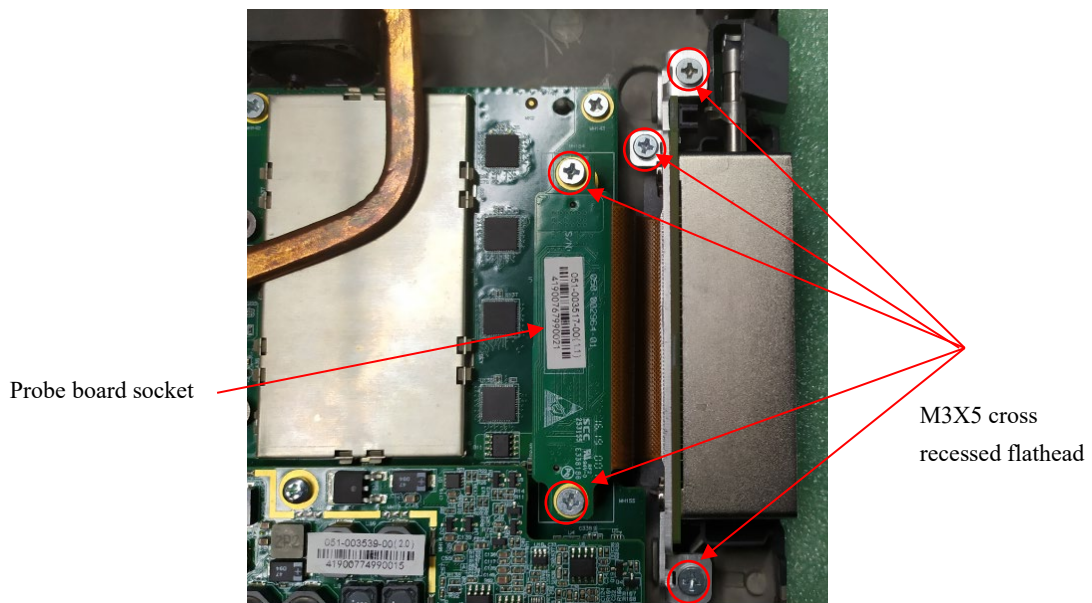
Put the detached equipment body on a table and remove the speaker cable to detach the speaker.

Speaker cable



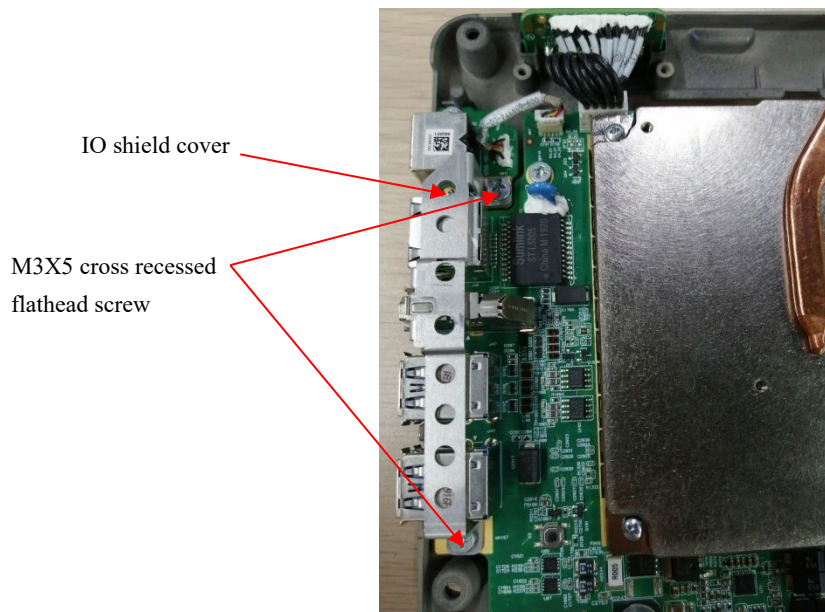
2. Probe board

Use a screwdriver to remove the 5 M3X5 cross recessed flathead screws and lift the probe board socket upwards vertically.



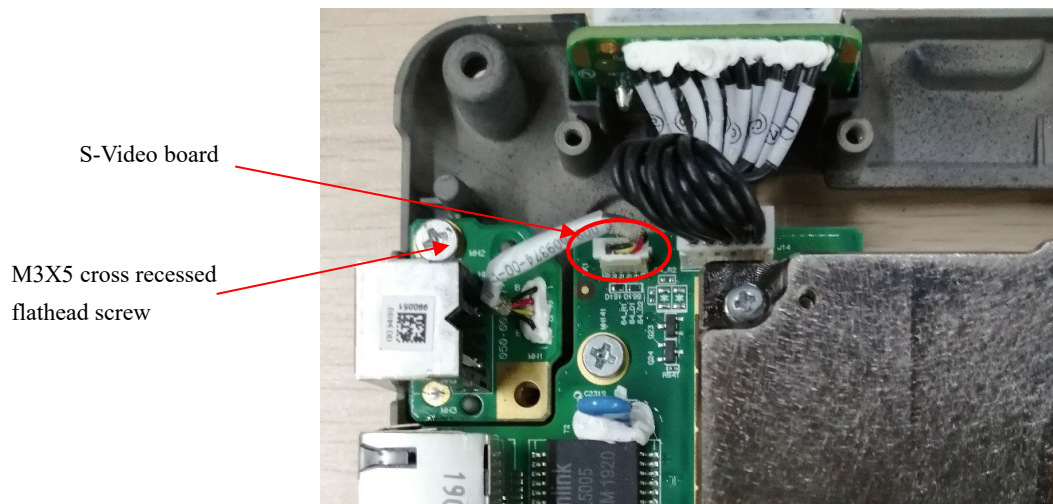
3. IO shield cover

Use a screwdriver to remove the two M3X5 cross recessed flathead screws and take off the IO shield cover.



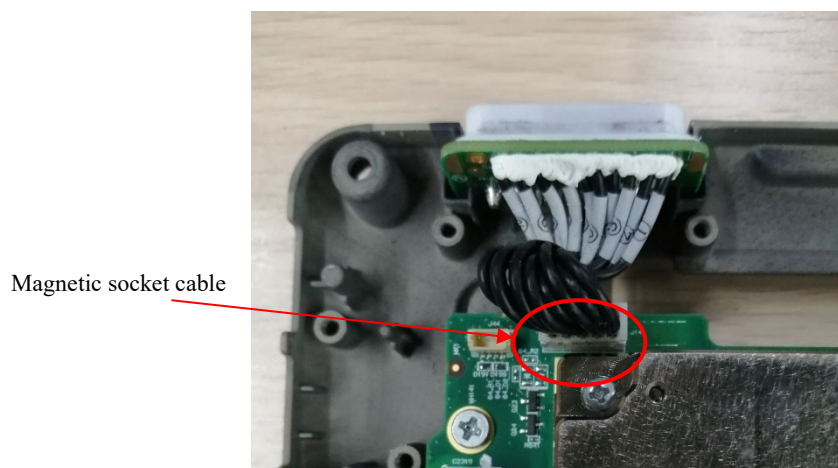
4. S-Video board

Use a screwdriver to remove the M3X5 cross recessed flathead screw and remove the S-Video board cable.



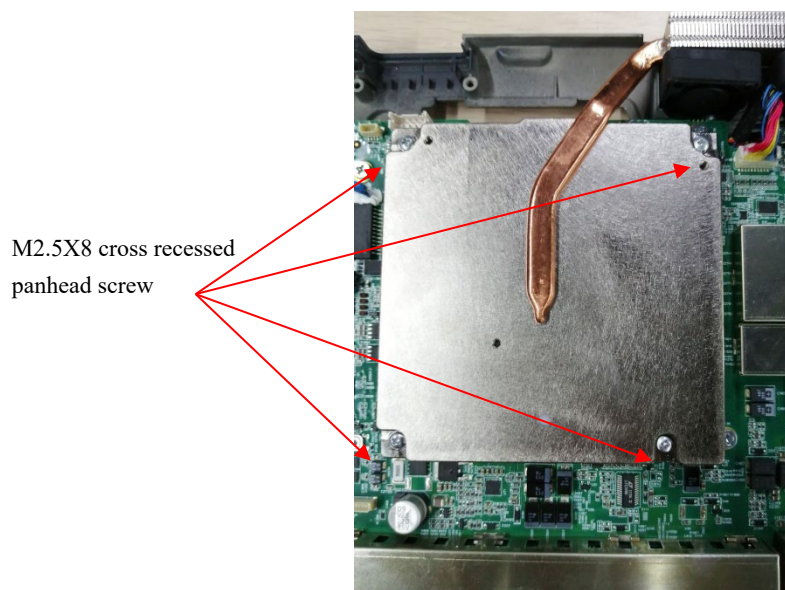
5. Magnetic socket

Remove the magnetic socket cable to take off this component.



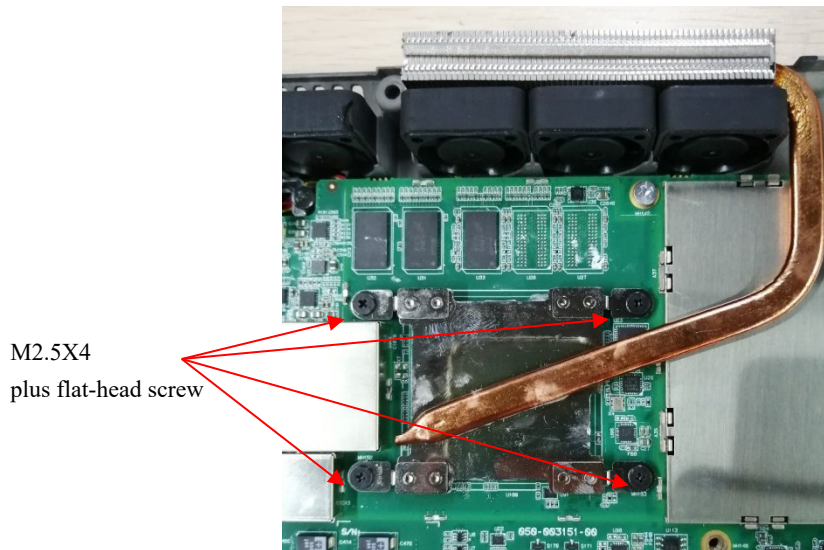
6. PC module radiator

Use a screwdriver to remove the four M2.5X8 cross recessed panhead screws and lift the PC module radiator upwards vertically.



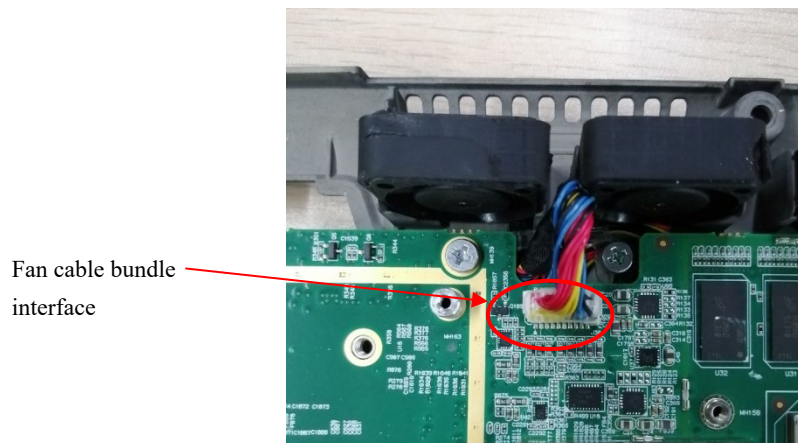
7. FPGA module radiator

Use a screwdriver to remove the four M2.5X4 plus flat-head screws. The FPGA contact surface is coated with thermally conductive silicon and therefore is adhesive. Insert a flathead screwdriver into the gap on the contact surface and take off the FPGA module radiator slowly.



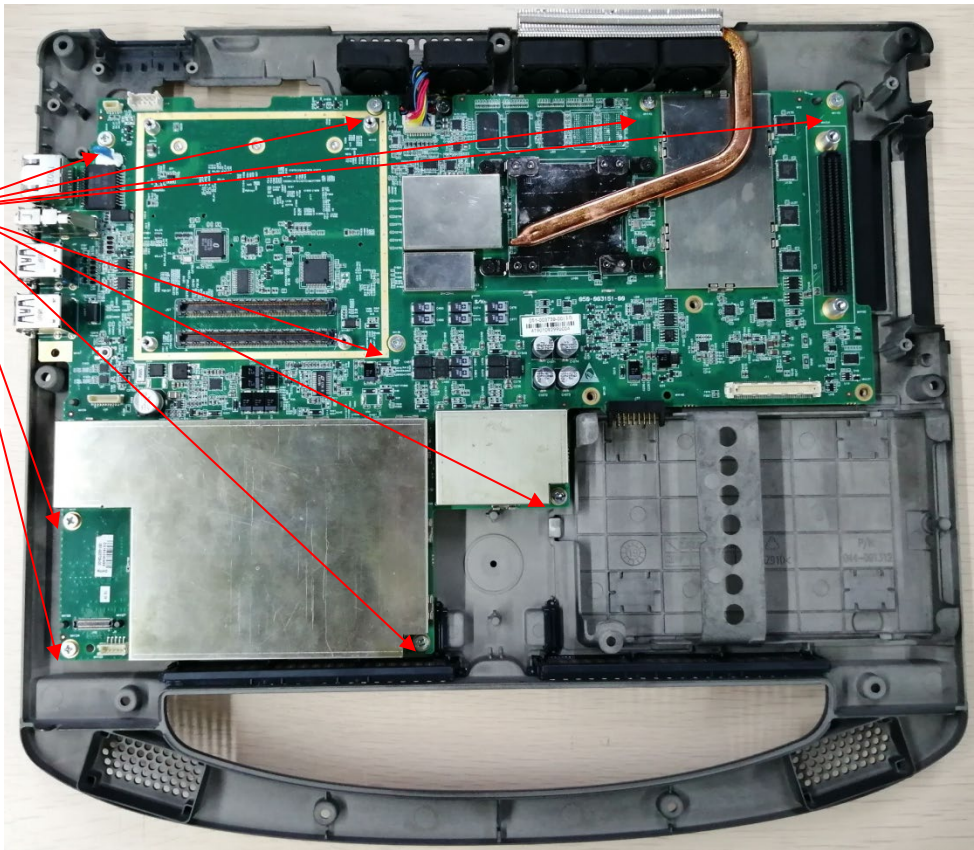
8. Main board PCBA

- a Remove the fan cable bundle from the interface.



- b Use a screwdriver to remove the nine M3X5 cross recessed flathead screws and take off the main board PCBA.

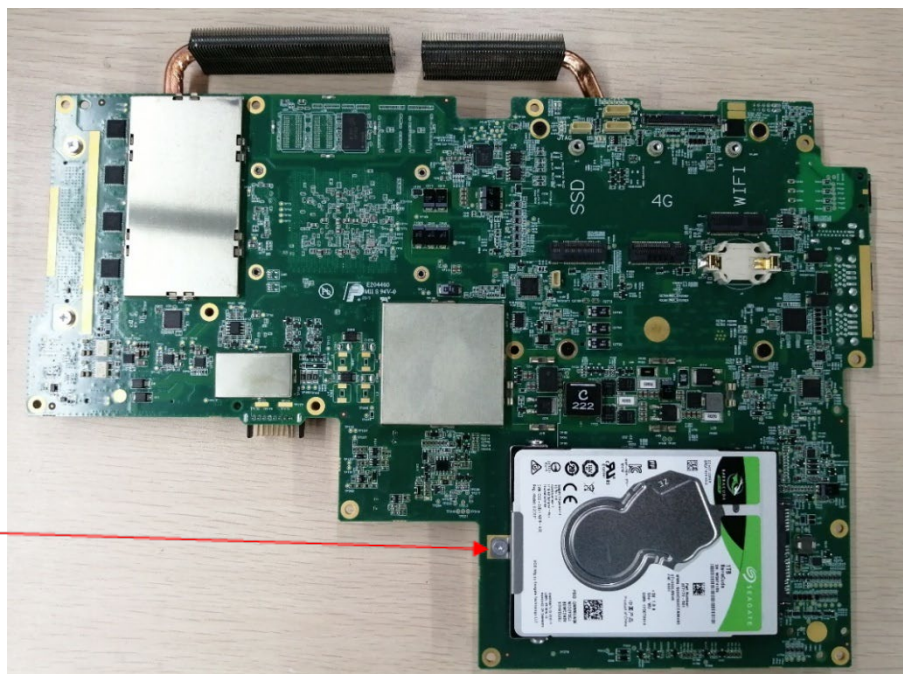
M3X5 cross recessed
flathead screw



9. Hard disk drive

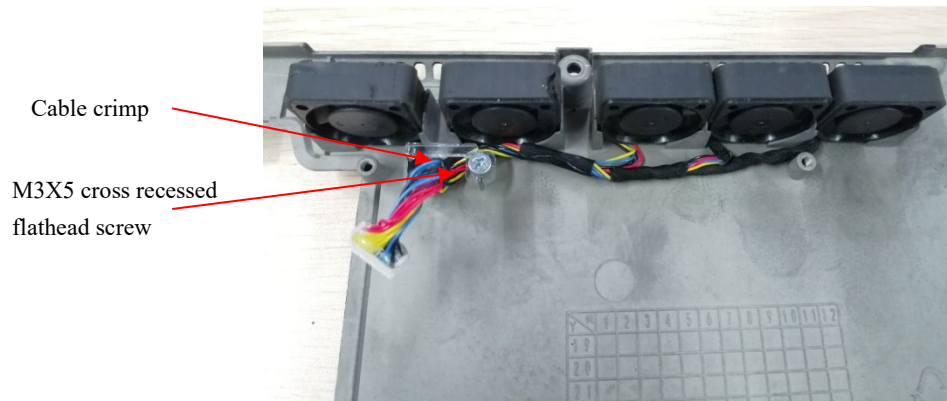
Use a screwdriver to remove the M3X5 cross recessed flathead screw and take off the hard disk drive.

M3X5 cross recessed
flathead screw



10. Fan

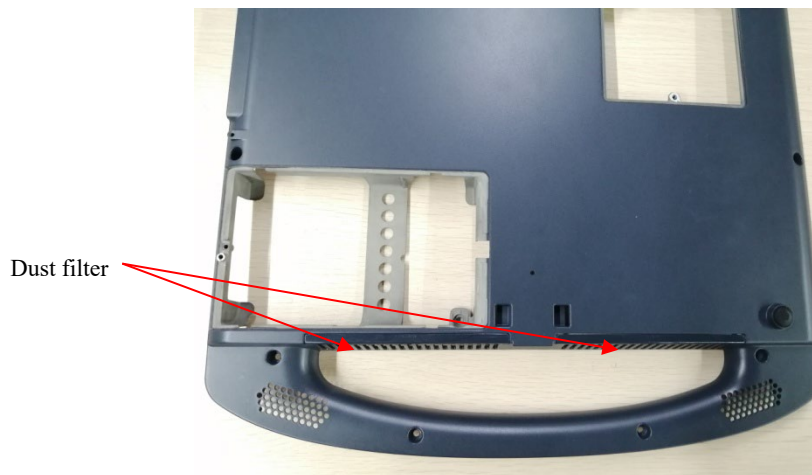
- a Use a screwdriver to remove the M3X5 cross recessed flathead screw and take off the cable crimp.



- b. Pull out the five fans upwards vertically one by one.

5.2.6 Dust Filter

Remove the two dust filters with a flathead screwdriver.

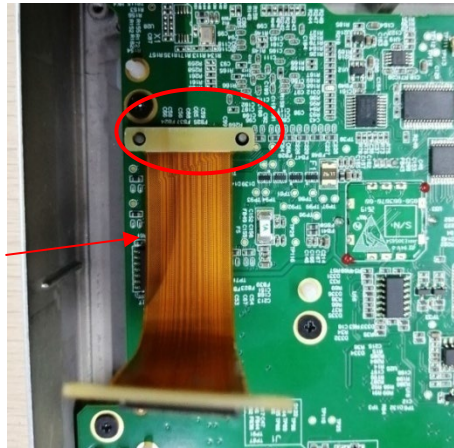


5.2.7 Control Panel

1. Remove the control panel. Refer to step 3 to 4 in 5.2.4.
2. Control panel cable

Remove the FPC flat cable between the main board and the control panel upwards vertically from the interface on the control panel.

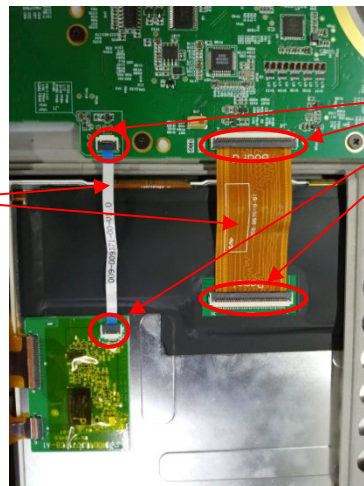
FPC flat cable between
the main board and the
control panel



3. Cable between the control panel and the touch screen

Open the cable crimps and take off the two cables connected between the control panel and the touch screen.

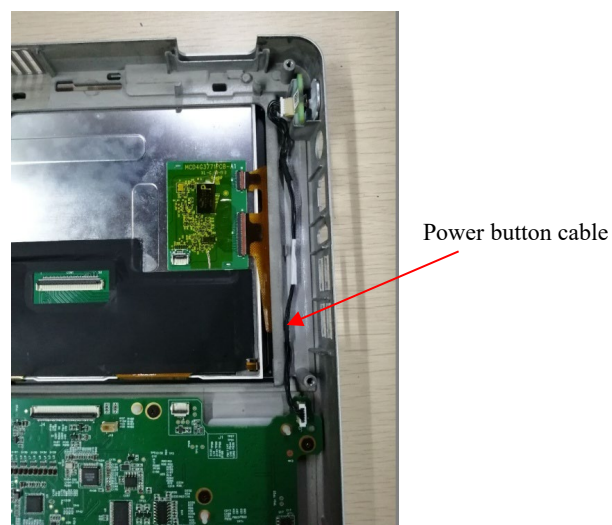
Cable between the control panel
and the touch screen



Cable crimp

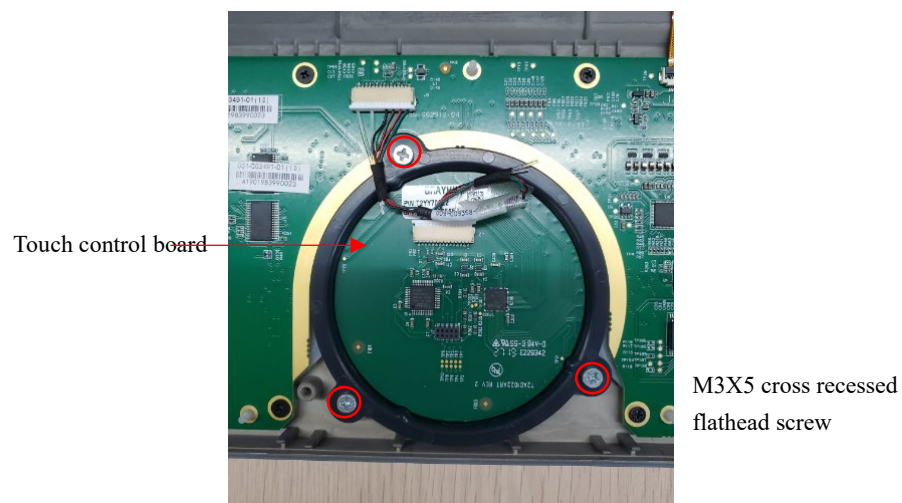
4. Power button

Pull out the power keypad and remove the power button cable from the interface.



5. Trackpad

Use a screwdriver to remove the two M3X5 cross recessed flathead screws and pull out the touch control board cable from the interface downwards horizontally.



6. Rotary encoder button

Pull out the two rotary encoder buttons.



Rotary encoder button

7. Control panel PCBA

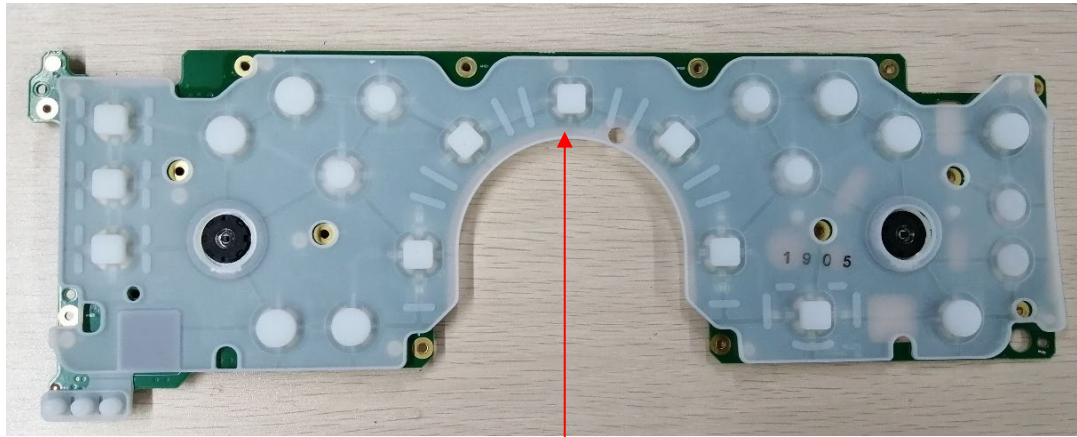
Use a screwdriver to remove the 14 M2.5X4 plus flat-head screws and take off the control panel PCBA.



M2.5X4 plus flat-head screw

8. Silicon keyboard

The silicon keyboard needs to be manually detached as the silicon columns of the silicon keyboard are embedded into the control panel.



Silicon keyboard

9. Key

Take off the keys on the keyboard cover.

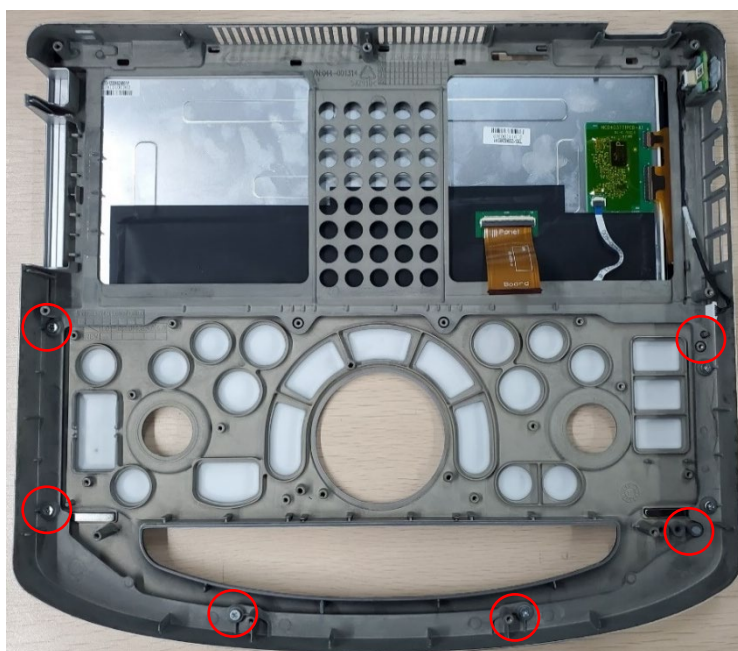


10. POC control panel upper cover

Use a screwdriver to remove the 6 M3X5 plus flat-head screws and take off the POC control panel upper cover from the bottom side.

M3X5 plus

flat-head screws



6 Function and Performance Check

6.1 Description

This chapter describes how to check major functions and performance of the product. The check methods are only for reference and do not need to be performed on a regular basis.

6.2 Checking System Status

6.2.1 Operating Status

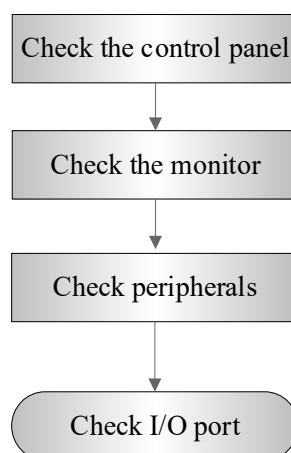
1. The ultrasound equipment is started and shut down properly (startup and shutdown time within the normal range), and runs properly without abnormal sound or symptoms.
2. After the ultrasound system is started, the fan starts working, and no abnormal noise is heard when the fan is working.
3. Check whether basic system information including the product configuration and software version is normal on the About screen.
4. Check whether the contrast and brightness of the monitor are normal.
5. Check whether the time and date are valid and correct.
6. Check whether all status indicators are normal.
7. Check all log records with the user to confirm whether there are any abnormalities.

6.2.2 Operating Environment

Check the ambient temperature and humidity. 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 in humidity.

6.3 General Check

6.3.1 Check Flow



6.3.2 Check Items

6.3.2.1 Control Panel

Procedure	Acceptance Criteria
1. Check the buttons, keys and knobs. Perform the check from left to right and from up down.	All keys and knobs are effective.
2. Check the functionality of the trackpad. - Press Freeze key to enter the frozen state and use the trackpad. - Press Measure to enter the measurement state. Measure the vertical distance and horizontal distance or perform other trackpad operations.	The trackpad works smoothly and responds quickly to cursor movement. The sliding direction of the trackpad is consistent with the movement direction of the cursor.

6.3.2.2 Display

Procedure	Acceptance Criteria
Adjust the brightness of the display.	Brightness adjustment Auto adjustment: Choose Setup > System > General > DISPLAY and click Brightness auto adjustment.
Adjust the contrast of the display.	Choose Setup > System > General > DISPLAY and click the plus sign to increase the contrast or the minus sign to decrease the contrast.

Procedure	Acceptance Criteria
Perform display maintenance. Log in to the system as user Service. Choose Setup > Maintenance > Setup > Test Main Monitor. On the displayed screen, test the performance of the system.	Click the function buttons to perform the test and the display responds properly. The defective pixel detection criteria are as follows: - The number of bright dots is 0 and the number of flash dots is 0. - The adjoining dark dots are no more than 3 pairs, and there are no adjoining dark dots in the image area. - The number of three consecutive dark dots is less than or equal to 0 pairs. - The dark dots are not more than 7 and those in the image area are not more than 2. - The distance between invalid dots is not less than 5 mm. Note: The image area is within the rectangular frame on the black/white screen.

6.3.2.3 Peripherals

Procedure	Acceptance Criteria
Footswitch: Check that the footswitch connects to the USB port properly. On the Key Config menu, check the configuration of the footswitch. For example, the right key freezes the image, the middle key enables color printing, and the left key enables black/white printing.	- When you step on the freeze switch (right key), the image is frozen and the Freeze menu appears. When you step on the freeze switch again, the image is unfrozen. - When you step on the print switch (middle key), color printing starts. - When you step on the print switch (left key), black/white printing starts.
Video printer: Check that the video printer connects to the ultrasound equipment properly and check the functional keys.	When you press the print key, the printer starts printing and the printed images are free from defects or degradation. Switch to another video output port and repeat the preceding step.
Graph/text printer: Check that the graph/text printer connects to the ultrasound equipment properly and check the functional keys.	When you press the print key, the printer starts printing and the printed graphs/texts are free from defects or degradation.
Barcode scanner: Scan any barcode when the system works properly.	The barcode information is displayed on the image screen instantly and consistent with the barcode data.

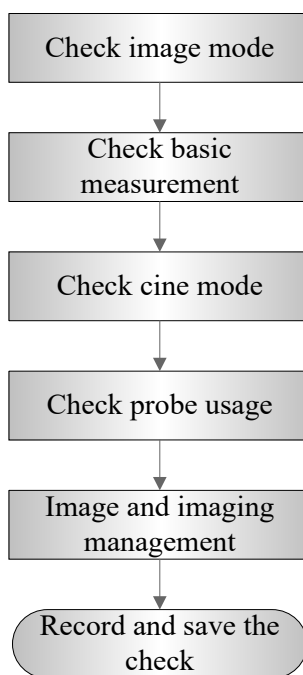
6.3.2.4 I/O Interface

Procedure	Acceptance Criteria
Check the major I/O interfaces. The video/audio interfaces and USB ports have been verified in peripheral check.	- The content presented on the VGA/LCD display is consistent with that presented on the display of the main unit. The characters and images are displayed completely and stably without color cast, jitter, or flickering. - The network connection and communication are normal. - USB storage and read/write are normal.

6.4 Function Check

Note: This section lists the system check items when functions are complete and details key items. If a software function is not configured, skip the corresponding check item.

6.4.1 Check Flow



6.4.2 Check Items

6.4.2.1 Imaging Mode

- B Mode

In B mode scan, the image parameter area on the screen displays the real-time parameter values as follows:

Item	F	D	G	FR	DR	TSI	iClear	iBeam	iTouch	Zoom	Echo Boost
Description	Frequency	Depth	Gain	Frame rate	B Dynamic Range	Tissue Specific Imaging	Displayed when the corresponding functions are enabled				

The following parameters can be adjusted during B Mode imaging.

Adjustment	Item
Control panel	Gain, Depth, iTouch, Zoom, and Focus Position
Touch screen	TGC, Tint Map, Line Density, U/D Flip, Persistence, Rotation, L/R Flip, Image Quality, Focus Number, FOV Position, Frequency, iClear, Dynamic Range, FOV Range, TSI, Dual Live, iBeam, H Scale, ExFov, LGC, Gray Map, A. Power, PW Steer, Echo Boost, Smooth, Optimize Speed, HD Scope, and Zoom

Control panel

Procedure	Acceptance Criteria
Press the B parameter button.	The system enters the B mode and the B-mode screen appears.
Gain control G Turn the Gain knob.	The gain is increased when the knob is turned clockwise. The gain is decreased when the knob is turned anticlockwise.
Depth control D Press the Depth locking lever.	The image depth changes accordingly. The adjustable depth values vary according to the probe type.
iTouch Press iTouch.	The iTouch mark appears in the image parameter area to automatically adjust the image effect.
Image zooming Turn the Zoom knob and set Zoom value on the touch screen to adjust the zooming times.	Use the trackpad and the position of the zoomed-in image changes. Press Zoom. The system exits the zooming mode and the current window resumes to the state before entering the zooming mode.
Press B and then Dual.	1 The system enters the Dual B mode and the right image is activated. 2 Press again to switch to the internal active window.
Press B (quad split mode).	1 Press the key four times and four B images appear, of which three are frozen and one is active. 2 Press again to switch to the internal active window in the four-window mode.
Press B.	In multi-window mode, the system enters the single-window mode (B mode). The operations in other imaging modes are similar.

Adjustment on the touch screen:

Procedure	Acceptance Criteria
Frequency adjustment Touch screen > Image Quality	During adjustment, the frequency is displayed in the image parameter area on the right of the screen in real time (fundamental wave—F; harmonic—H). The frequency range varies according to the probe.
Focus Touch screen > Focus Number	The focus position/number can be adjusted. The focus area symbol  is displayed on the right of the image in real time.
Dynamic range Touch screen > Dynamic Range	The dynamic range can be adjusted and displayed in the image parameter area on the right of the screen in real time. A larger dynamic range contributes to a darker image, lower contrast, and more noise.
Line density Touch screen > Line Density	The line density can be adjusted. A higher line density contributes to a higher image resolution but lower frame rate.
iClear Touch screen > iClear	Press Set or the parameter button for adjustment. The system provides 5 levels of iClear effects adjustment, off represents no iClear is turned on, and the bigger the value the stronger the effect.
Touch screen > U/D Flip Touch screen > Rotation	The system supports up/down and left/right flipping. The system supports rotation by an angle of 0°, 90°, 180°, or 270°. When the image is rotated in an angle of 90° or 270°, the depth scale is displayed on the upper part of the screen. The M mark indicates the orientation of the image; the M mark is located right above the imaging area by default.
Optimize Speed	Tap Optimize Speed to adjust the speed on the touch screen. The TSI value is 1540 in image parameter area.
HD Scope	Tap [HD Scope] on the touch screen, the ROI appears. The image inside the ROI is clearer than the outside. When the ROI box is solid line, use the trackpad to change its position. When the ROI box is dotted line, use the trackpad to change the size.

- M mode

In M mode scan, the image parameter area on the screen displays the real-time parameter values as follows:

Items	F	D	G	V	DR
Description	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.

Adjustment	Items
Control panel	Gain, TGC, Depth, Focus Position
Touch screen	Display Format, M Soften, Tint Map, Speed, iClear, and Dynamic Range

- Color mode

In Color mode scan, the image parameter area on the screen displays the real-time parameter values as follows:

Items	F	G	WF	PRF
Description	Frequency	Color Gain	Color Wall Filter	Pulse repetition rate

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

Adjustment	Items
Control panel	Gain, Depth, and iTouch
Touch screen	Image Quality, Line Density, Persistence, Smooth, Sensitivity, B/C Wide, Velocity Tag, Flow State, WF, Invert, Dual Live, Scale, Tint Map, Priority, Baseline, Map, PW Steer, and TGC

- Power mode

In Power mode scan, the image parameter area on the screen displays the real-time parameter values as follows:

Item	F	G	WF	PRF
Description	Frequency	Power Gain	Power Filter	Pulse repetition rate

- PW Doppler Mode

In PW mode scan, the image parameter area on the screen shows the real-time parameter values as follows:

Item	F	G	WF	PRF	SVD	SV	Angle
Description	Frequency	Gain	WF (Wall Filter)	Pulse repetition rate	SV depth	SV Size (Only PW)	Angle

Parameters that can be adjusted to optimize the PW mode image are indicated in the following.

Adjustment	Items
Control panel	Gain, Depth, and iTouch

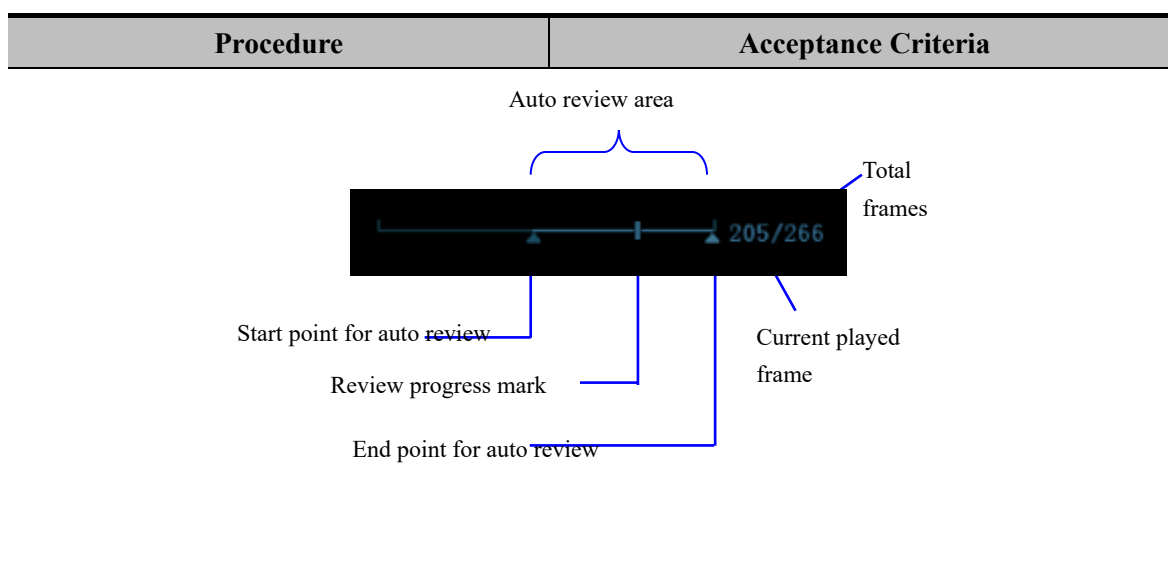
Adjustment	Items
Touch screen:	Tint Map, HPRF, Auto Calc, Image Quality, Trace Area, Duplex/Triplex, Dynamic Range, Impact, WF, Quick Angle, Invert, SV, Speed, Scale, Angle, Baseline, PW Steer, Audio, Display Format, Trace, Auto Calc, T/F Res, Calc Cycle, and A. Power

6.4.2.2 Basic Measurement

Procedure	Acceptance Criteria
In B imaging mode - Press Measure. - Press Caliper.	- The system enters the application measurement mode. - The system enters the normal measurement mode. Click any one or two measurement items (such as length and area), and the measurement or calculation results are displayed below the image in real time.
Press Caliper or Measure again.	The system exits the corresponding measurement state.
Perform similar operations in other imaging modes.	The application measurement function maps different application software packages. Perform operations selectively.

6.4.2.3 Cine Review

Procedure	Acceptance Criteria
- Press Freeze to freeze the image, and the system enters the manual review state automatically. (Prerequisite: Set Status after Freeze to Cine.) - Tap iStation on the touch screen and then Review to open a cine file.	The system enters the cine review state. The system enters the auto review state.
Use the trackpad.	Perform cine review manually.
Tap Auto Review on the touch screen to adjust the review speed.	Auto review is enabled. Use this key to change the auto cine review speed. A greater speed value contributes to a higher review speed, and a smaller speed value indicates a lower review speed. Tap Auto Review again. The system exits the auto review mode when the speed is displayed as Stopped.
Move the cursor to the start position (or image frame) for review and tap Set Begin on the touch screen.	Set the start position for auto review.
Move the cursor to the end position (or image frame) for review and tap Set End on the touch screen.	Set the end position for auto review.
Turn the Auto Review knob.	Cine review is performed according to the specified start and end positions.
Press Freeze again to unfreeze the image.	The freeze indicator is off. The image is unfrozen. The system returns to the scan state and exit cine review.



6.4.2.4 Probe Identification and Switching

Procedure	Acceptance Criteria
Press Freeze and insert the probe. Press Freeze and tap Probe on the touch screen.	The ultrasound equipment can identify the connected probe properly.
Press Freeze, remove the probe, and insert another probe.	The ultrasound equipment can immediately identify the new probe type.

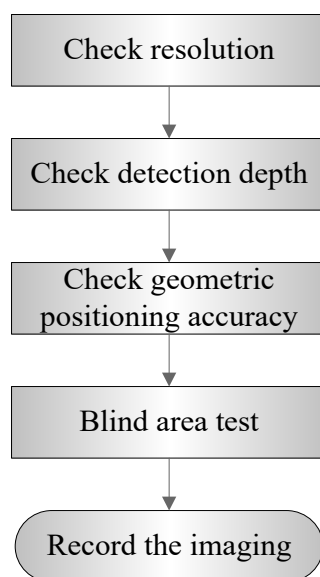
6.4.2.5 Image Management

Procedure	Acceptance Criteria
During image scan, press Save (preset to Save Single-Frame Image).	The system stores the current single-B image to the animal database and displays the thumbnail of the stored image on the right of the screen.
Choose Setup > System > General and select Sending/printing Image after End exam in the animal management area. Tap End on the touch screen during the scan.	The system automatically sends the entire check image to the connected default DICOM storage server or print server.
- Tap Review on the touch screen. - Tap Exit on the image review screen, or tap Review again.	- The system enters image review mode. - The system exits image review mode.
- Press the user-defined key for iVision on the control panel. - On the iVision screen, add the content to be played and select the demo mode. Select an item in the list and click Start. - Click Exit.	- The iVision screen appears. - The system starts image review. Image files are played according to file names one by one (including the image of system-relevant and PC-compatible format). - The system exits image review.

Procedure	Acceptance Criteria
Tap iStation to access the animal information management screen.	The stored image corresponding to the animal ID can be viewed. You can perform the following operations on the image: • Back up (or recover) • Send (to DICOM or USB flash drive)

6.5 Performance Test

6.5.1 Test Procedure



6.5.2 Test content

Note: The following figure is only used for reference in the testing, and the actual image effect depends on the specific system.

Requirements:

- Display: set the brightness and contrast values to clinical (or default) status;
- Ambient: dark room to simulate actual clinical using;
- The probe surface should contract with the acoustic window without separation or pressing.

Note:

- For details about the phantoms required for the test, see Part III Appendix: 4Phantom Usage Illustration.
- Phantom KS107BD, low frequency, used when center frequency of the probe $\leq 4\text{MHz}$;
- Phantom KS107BG, high frequency, used when center frequency of the probe $\geq 5\text{MHz}$;

6.5.2.1 Transverse resolution

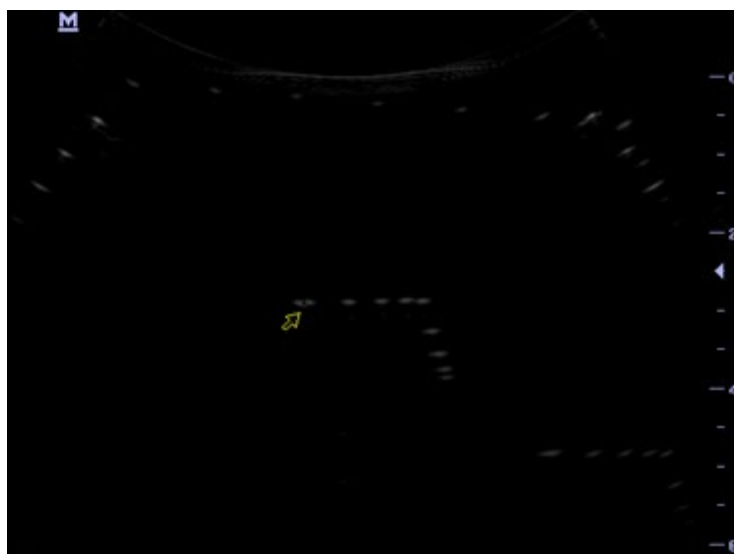
Note:

- For convex probe, keep the transverse resolution targets near the central line of the scanning plane.
- For linear array probe with Steer function, DO NOT turn on Steer when testing the transverse resolution.
- Magnify (zoom) the targets for observation if necessary.
- Distance between the left and right edges of a target point at a certain depth indicates the transverse resolution at this depth also.

Test procedure:

1. Place the probe head gently on the acoustic window of the phantom which is covered by water or medical ultrasonic couplant, and make sure the transverse resolution targets are displayed in the center of the image.
2. Focus to the transverse resolution target group.
3. Adjust the gain, dynamic range, TGC etc, make sure only the target line is displayed clearly on the image with no tissue image in the background.
4. Read the separation between two target points that can be distinguished clearly, while keeping the transverse target group horizontal.
5. Repeat upper steps at other depth.

Image effect is show in the figure below:

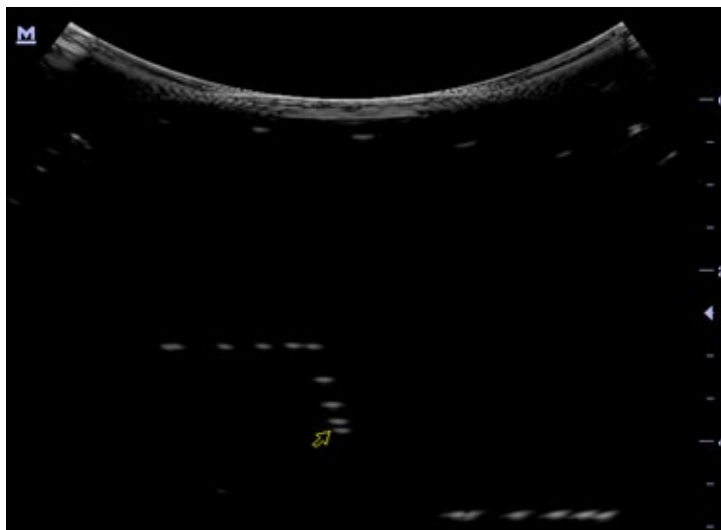


6.5.2.2 Axial resolution

Test procedure:

1. Place the probe head gently on the acoustic window of the phantom which is covered by water or medical ultrasonic couplant, and make sure the axial resolution targets are displayed in the center of the image.
2. Focus to the axial resolution target group.
3. Adjust the gain, dynamic range, TGC etc, make sure only the target line is displayed clearly on the image with no tissue image in the background.

4. Read the distance between two target points that can be separated clearly.
5. Repeat upper steps at other depth.



6.5.2.3 Maximum detection depth

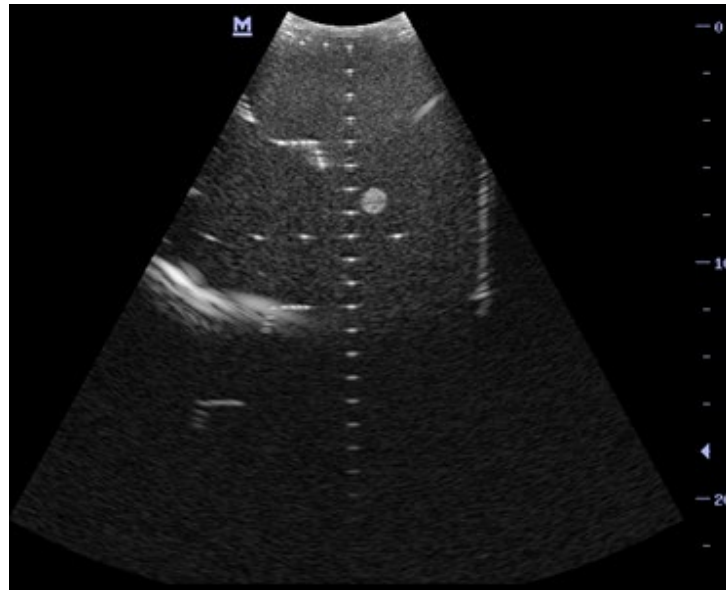
Note:

- An overlarge gain may result in large noise and submergence of the echo signal.
- For linear array probe, the probe surface should be perfectly fit with the acoustic window on the phantom without any inclination during scan.
- For convex and phased probe, make sure the axial target group is placed in the central of the scanning plane which keeps the justice of the interfering effect.
- In non-freeze mode, a distant target may be similar to a noise dot which should be discarded.

Test procedure:

1. Place the probe gently on the phantom surface which is covered by water or medical ultrasonic couplant.
2. Set displaying depth (according to the max depth of the current probe);
3. Adjust the Focus to the deepest, set AP value to largest.
4. Increase Gain, Contrast, TGC, but make sure that no halos or defocusing appears.
5. Record the depth of the most distant target line which is imaged clearly.

Image effect is show in the figure below:



6.5.2.4 Axial Geometric Positioning Accuracy

Note:

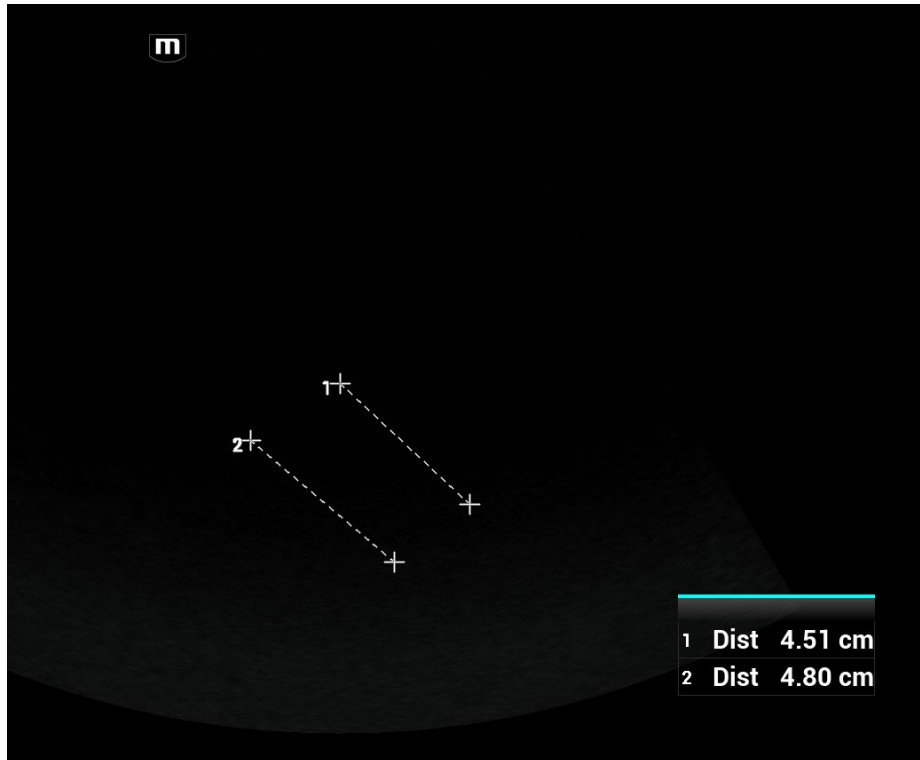
- Measuring cursor should be placed on the top edge of the target image, not in the middle or bottom edge.
- Scanning plane should be perpendicular to each target line, in other words, scanning plane should be parallel to phantom section plane.

Test procedure:

1. Adjusting steps are the same with the Maximum Detection Depth.
2. Record the separation values with measuring caliper in step of 20 mm on the axial target group.
3. Select all measurement values deviating largely from 20 mm, and calculate the error by the following formula.

$$\text{Geometric positioning accuracy (\%)} = \left| \frac{\text{value} - \text{actual D}}{\text{actual D}} \right| \times 100$$

Image effect is show in the figure below:



6.5.2.5 Lateral Geometric Positioning Accuracy

Note:

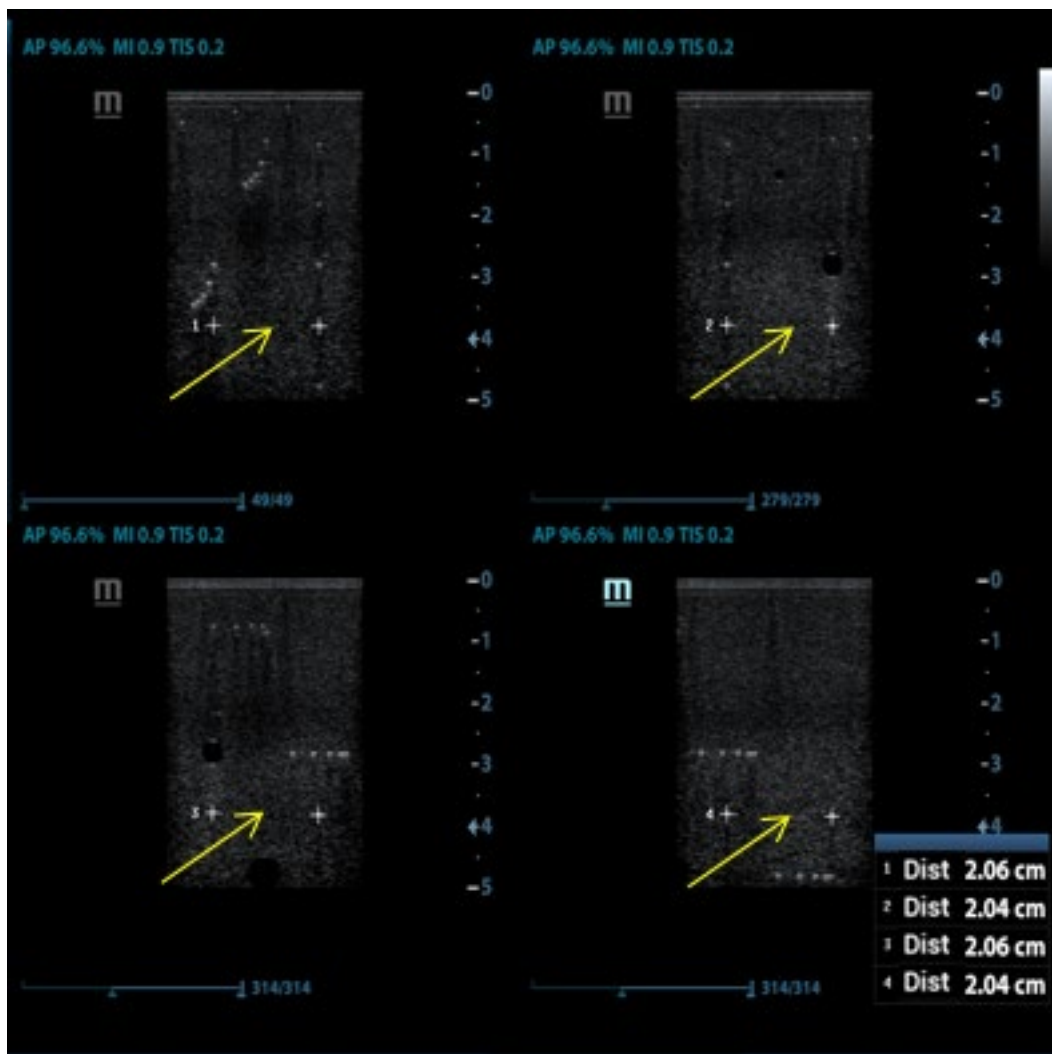
- For linear array probes, the lateral interval can be read section by section.
- For convex array probes, all lateral targets must be displayed at a time.
- The measurement scale should be placed above or under the center of the target to be measured.

Test procedure:

1. Place the probe gently on the acoustic window of phantom which is covered by water or medical ultrasonic couplant.
2. Adjust display depth, to make horizontal groups display in the image.
3. Adjust focus to be in horizontal groups (no explicit standard).
4. Adjust gain, TGC and etc. to make horizontal groups display clearly.
5. Use caliper to measure horizontal target distance by step of 20 mm.
6. Select all measurement values deviating largely from 20 mm, and calculate the error by the following formula.

$$\text{Geometric positioning accuracy (\%)} = \left| \frac{\text{value} - \text{actual D}}{\text{actual D}} \right| \times 100$$

Image effect is show in the figure below:



6.5.2.6 Blind area

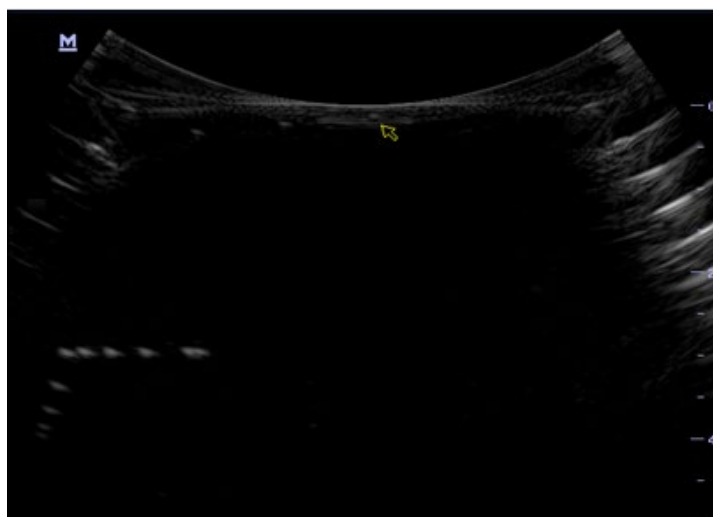
Note:

- For linear array probes, the probe surface should be perfectly fit with the acoustic window on the phantom without any inclination.
- For convex array probes, the targets in the blind area to be observed must be on the central line of the scan plane.

Test procedure:

1. Place the probe gently on the phantom surface which is covered by water or gel.
2. Decrease the display depth and move the focus to the shallowest target.
3. Reduce the AP and Gain values until the background noise is perceivable.
4. Observe the depth of the shallowest target that can be clearly imaged, that is, the blind area value.

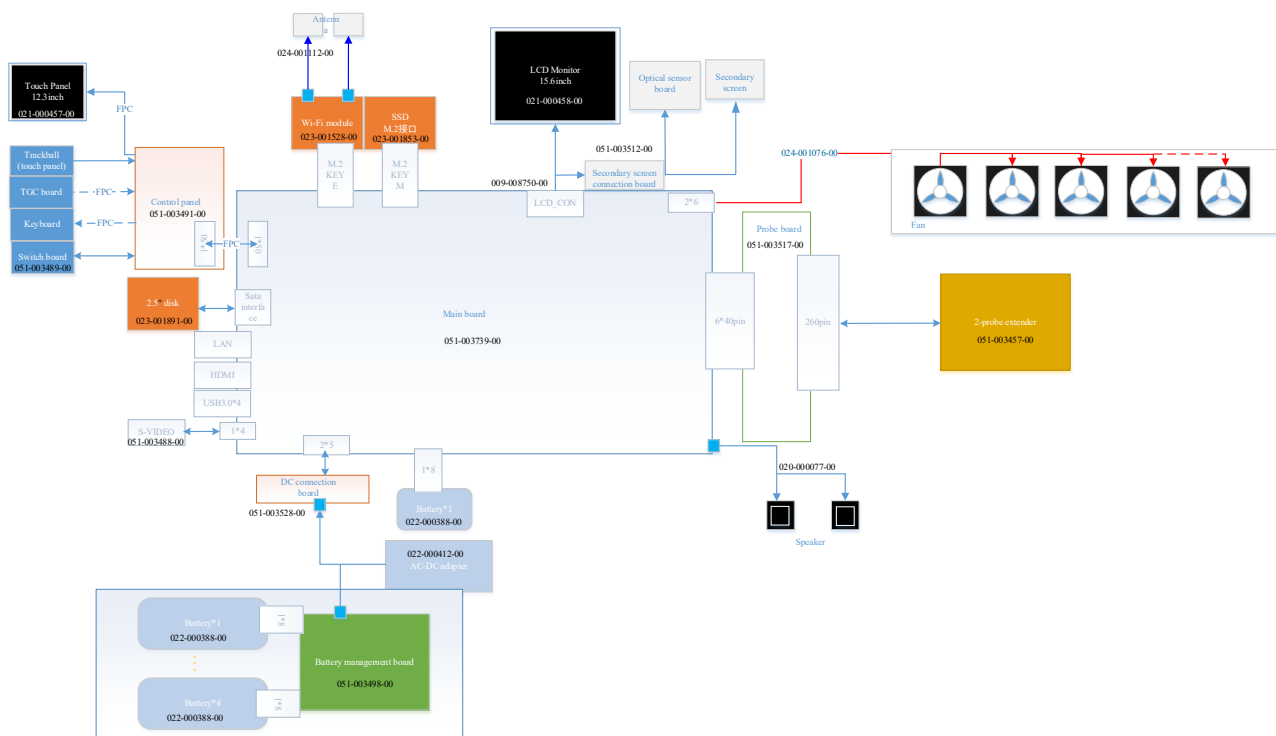
Image effect is show in the figure below:



Part III Appendix

1 Electrical Connection Diagram

Figure 1-1 Internal connections of the main unit and U-Bank



2 Description of Self-Test Items

2.1 Z0101 Test of Communication Between PC Module and MF FPGA

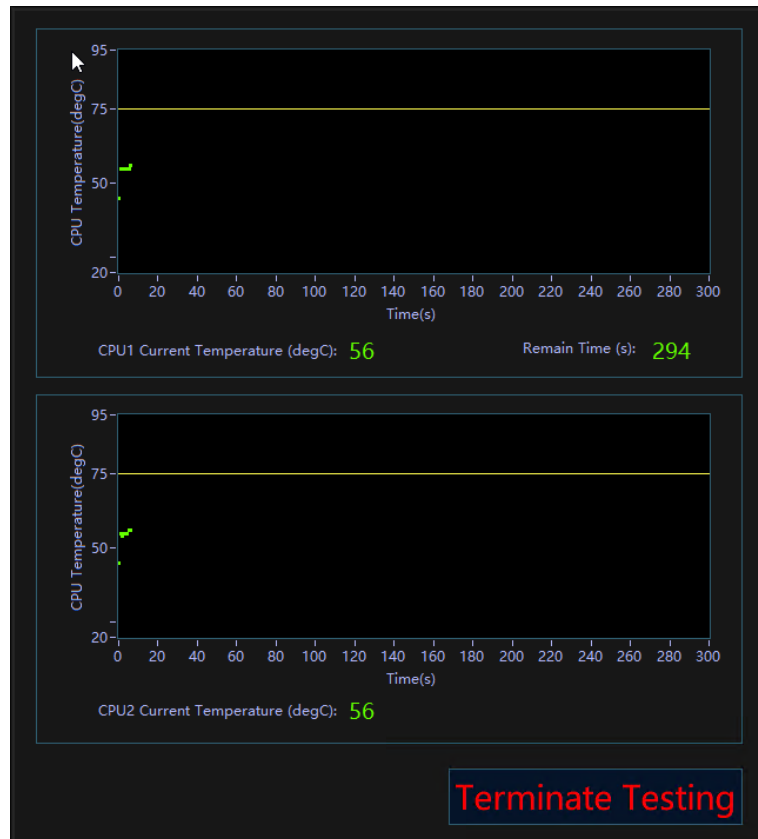
- Upper-level test item
None
- Test content
Verify whether the PCIe bus between the PC module and the FPGA is normal.
- Test failure analysis
Check whether Windows device manager identifies the ultrasound backbone device. If not, the drive is not correctly installed.

If the test result is Error, the drive malfunctions.

If the test result is FAIL, the communication between the PC module and the DSP FPGA is abnormal.
- Troubleshooting suggestion
 - a If the drive cannot be identified, recover the equipment.
 - b If the test result is Error, restart the equipment and re-perform the self-test. If the problem persists, recover the equipment.
 - c If the test result is FAIL, replace the main board.

2.2 Z0102 CPU Temperature Test

- Upper-level test item
None
- Test content
With the test software accelerating the workload, monitor whether the CPU temperature can meet the standard in 5 minutes. Click Terminate Testing to finish the test in the process.



- Test failure analysis

If the test result is NaN, the maintenance personnel end the test during the test process.

If the test result is FAIL, the CPU temperature is too high.

- Troubleshooting suggestion

First check whether the air inlets and dust filters are blocked, whether the fans are blocked, and whether the CPU radiator and heat-conducting cream are in good contact. If the test result is still FAIL, replace the PC module.

2.3 Z0201 DDR Full-Space Read/Write Test

- Upper-level test item

None

- Test content

Perform a full-space read/write test for the class-3 DDRs mounted to the multifunctional FPGA. The program will respectively distinguish the cache DDR (for transmitting intermediate processing results of the FPGA), scan buffer DDR (for transmitting scan control frames), and IQ buffer DDR (for transmitting IQ data).

- Test failure analysis

If the test result is Error, the drive malfunctions.

If the test result is FAIL, the connections between the FPGA and the mounted DDRs are abnormal.

- Troubleshooting suggestion

- a If the test result is Error, restart the equipment and re-perform the self-test. If the problem persists, recover the equipment.
- b If the test result is FAIL, replace the main board.

2.4 Z0202 FPGA Pressure Test

- Upper-level test item

Communication Test Between PC Module and MF FPGA

- Test content

Read the core voltage of the FPGA and the IO voltage from the register.

- Test failure analysis

If the test result is Error, the drive malfunctions.

If the test result is FAIL, the operating voltage of the multifunctional FPGA is abnormal.

- Troubleshooting suggestion

- a If the test result is Error, restart the equipment and re-perform the self-test. If the problem persists, recover the equipment.
- b If the test result is FAIL, replace the main board.

2.5 Z0203 AFE Test Mode Test

- Upper-level test item

Communication Test Between PC Module and MF FPGA

- Test content

Enter the system test mode, write data to the AFE globally, and write the delay RAM. Read the data from the channel delay storage and locate the specific channel and AFE chip.

- Test failure analysis

If the test result is Error, the drive malfunctions.

If the test result is FAIL, the AFE chip is faulty.

- Troubleshooting suggestion

- a If the test result is Error, restart the equipment and re-perform the self-test. If the problem persists, recover the equipment.
- b If the test result is FAIL, perform the self-test again. If the test result is still FAIL, replace the main board.

2.6 Z0204 Power Management Module Communication Test

- Upper-level test item

Communication Test Between PC Module and MF FPGA

- Test content

Test whether the communication serial port UART between the EC ARM and the FPGA is normal. Read the firmware compilation time, firmware version, and boot program version.

- Test failure analysis

If the test result is Error, the drive malfunctions.

If the test result is FAIL, the serial ports of the EC ARM and the multifunctional FPGA are faulty.

- Troubleshooting suggestion

a If the test result is Error, the logic of the multifunctional FPGA is wrong. In this case, restart the equipment and re-perform the self-test. If the problem persists, recover the equipment.

b If the test result is FAIL, replace the main board.

2.7 Z0205 Power Status Test

- Upper-level test item

Power Management Module Communication Test

- Test content

Check whether the voltage of the main board of the machine is normal.

- Test failure analysis

If the test result is Error, the drive malfunctions.

If the test result is FAIL, the voltage of the main board is abnormal.

- Troubleshooting suggestion

a If the test result is Error, restart the equipment and re-perform the self-test. If the problem persists, recover the equipment.

b If the test result is FAIL, replace the main board.

2.8 Z0206 Communication Monitoring Test

- Upper-level test item

Communication Test Between PC Module and MF FPGA

- Test content

Test whether the UART communication between the multifunctional FPGA and the SM ARM is normal. Read the SM ARM firmware version and compilation time.

- Test failure analysis

If the test result is Error, the drive malfunctions.

If the test result is FAIL, the UART of the SM ARM and the serial port of the multifunctional FPGA are faulty.

- Troubleshooting suggestion

a If the test result is Error, restart the equipment and re-perform the self-test. If the problem persists, recover the equipment.

b If the test result is FAIL, replace the main board.

2.9 Z0207 Network Port Test

- Upper-level test item
None
- Test content
The program prompts you to ensure that the network cable is connected. After connecting the network cable, the program first judges whether a wired network adapter exists and then whether the Ethernet functions properly.
- Test failure analysis
If the program prompts that no network adapter is available, the Ethernet adapter is not identified.
If the program prompts that no network cable is connected, the network cable is not identified after being connected.
If the program prompts the test result as FAIL, the Ethernet malfunctions.
- Troubleshooting suggestion
 - a If the program prompts no network adapter is available, check whether the network adapter driver is installed.
 - b If the program prompts that no network cable is connected, check whether the network cable is connected properly.
 - c If the test result is NaN, replace the main board.

2.10 Z0208 RF Chip SPI Test

- Upper-level test item
Communication Test Between PC Module and MF FPGA
- Test content
Turn on the RF chip. Read the register of the RF chip through SPI to judge whether the written data is consistent with the received data.
- Test failure analysis
If the test result is Error, the drive malfunctions.
If the test result is FAIL, the SPI interface of the RF chip is abnormal.
- Troubleshooting suggestion
 - a If the test result is Error, restart the equipment and re-perform the self-test. If the problem persists, recover the equipment.
 - b If the test result is FAIL, replace the main board.

2.11 Z0209 PHV Module Communication Test

- Upper-level test item
Communication Test Between PC Module and MF FPGA
- Test content

Test the UART communication between the multifunctional FPGA and the PHV Arm. Read the PHV firmware version and build version.

- Test failure analysis

If the test result is Error, the drive malfunctions.

If the test result is FAIL, the communication between the multifunctional FPGA and the PHV serial port fails.

- Troubleshooting suggestion
 - a If the test result is Error, restart the equipment and re-perform the self-test. If the problem persists, recover the equipment.
 - b If the test result is FAIL, replace the main board.

2.12 Z0210 Program-Controlled Power Voltage Test for the PHV Module

- Upper-level test item

PHV Module Communication Test

- Test content

On the multifunctional FPGA, set four levels for the PHV program-controlled voltage. Read and check whether the voltage values at the four levels are within the specified range.

- Test failure analysis

If the test result is Error, the drive malfunctions.

If the test result is FAIL, the PHV voltage setting is improper.

- Troubleshooting suggestion
 - a If the test result is Error, restart the equipment and re-perform the self-test. If the problem persists, recover the equipment.
 - b If the test result is FAIL, replace the main board.

2.13 Z0211 Fixed High Voltage Test for PHV Module

- Upper-level test item

PHV Module Communication Test

- Test content

Enable the fixed power voltage ± 100 (HV voltage) for the PHV board. Obtain the monitored board voltage through the UART of the PHV ARM and check whether the voltage is within the specified range.

- Test failure analysis

If the test result is Error, the drive malfunctions.

If the test result is FAIL, the fixed high voltage does not meet the requirements.

- Troubleshooting suggestion
 - a If the test result is Error, restart the equipment and re-perform the self-test. If the problem persists, recover the equipment.
 - b If the test result is FAIL, replace the main board.

2.14 Z0212 FPGA Temperature Test

- Upper-level test item
Communication Test Between PC Module and MF FPGA
- Test content
The PC reads the FPGA core temperature through the PCIe bus.
- Test failure analysis
If the test result is Error, the drive malfunctions.
If the test result is FAIL, the FPGA core temperature is too high.
- Troubleshooting suggestion
 - a If the test result is Error, restart the equipment and re-perform the self-test. If the problem persists, recover the equipment.
 - b If the test result is FAIL, check whether the fans are blocked, whether the FPGA radiator is properly assembled, and whether the heat-conducting cream and radiator are in good contact.

2.15 Z0301 Fan Speed Test

- Upper-level test item
Communication Monitoring Test
- Test content
Read the fan speed through the UART of the SM ARM and judge whether the current fan speed meets the requirements.
- Test failure analysis
If the test result is Error, the drive malfunctions.
If the test result is FAIL, the fans are blocked (do not rotate), or a fault is detected on the main board.
- Troubleshooting suggestion
 - a If the test result is Error, restart the equipment and re-perform the self-test. If the problem persists, recover the equipment.
 - b If the test result is FAIL, check whether the fans rotate properly. If so, replace the main board.

2.16 Z0302 Fan Speed Adjustment Test

- Upper-level test item
Communication Monitoring Test
- Test content

Set the fan speed to 50% through the UART of the SM ARM and read the current rotation speed. Then set the fan speed to 100% and read the current rotation speed to check whether the fan speed is as set.

- Test failure analysis

If the test result is Error, the drive malfunctions.

If the test result is FAIL, the fans are blocked (do not rotate) or the speed adjustment circuit on the main board malfunctions.

- Troubleshooting suggestion
 - a If the test result is Error, restart the equipment and re-perform the self-test. If the problem persists, recover the equipment.
 - b If the test result is FAIL, check whether the fans are blocked. If not, replace the main board.

2.17 Z0401 Speaker Test

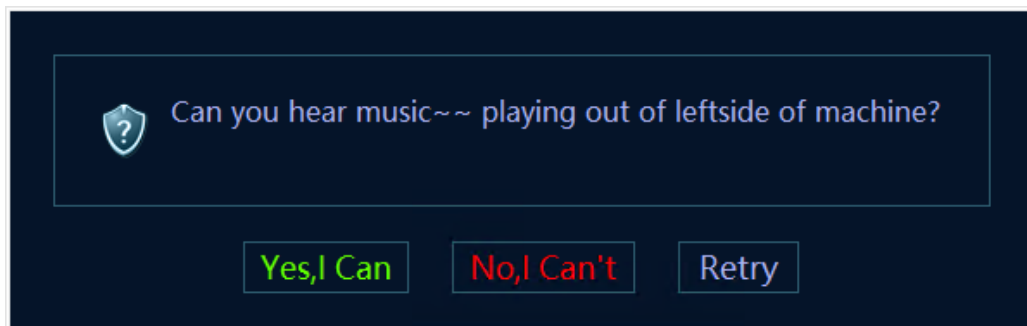
- Upper-level test item

None

- Test content

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

During the test, the program will display a dialog box on the left and right sides, asking whether the tester can hear the music from the left and right speakers. If not, click Retry to replay the music. If the tester does not hear the music after the music is played for several times, click No, I Can't. If the tester can hear the music, click Yes, I Can.



- Test failure analysis

If the test result is FAIL, the audio module or speaker is faulty.

- Troubleshooting suggestion

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

2.18 Z0501 Wireless Function Test

- Upper-level test item

None

- Test content

Check whether a network adapter exists and then check whether an SSID list can be searched.

- Test failure analysis

If the program prompts that no wireless device is detected, no wireless network adapter is identified.

If the program prompts that the wireless function test fails, no Wi-Fi hotspot is detected.

- Troubleshooting suggestion
 - a If the program prompts that no wireless device is detected, check whether the wireless network adapter is installed reliably and ensure that the wireless network adapter is not disabled in Network Connection.
 - b If the program prompts that the wireless function test fails, check whether a Wi-Fi hotspot is available. If so, replace the wireless network adapter.

2.19 Z0601 4G Module Communication Test

- Upper-level test item

None

- Test content

Test whether the operating system can identify the 4G module device.

- Test failure analysis

If the test result is NaN, the 4G module device is not detected.

- Troubleshooting suggestion

If the test result is NaN, check whether the 4G module driver is installed. If not, install it, restart the equipment, and perform the test again. If the test result is still NaN, replace the 4G module. If the problem persists, replace the main board.

2.20 Z0701 Control Panel USB Communication Test

- Upper-level test item

None

- Test content

Perform read/write through the internal USB driver to test whether the USB communication between the control panel and the main unit is normal. Read the logic and firmware version.

- Test failure analysis

If the test result is Error, the drive malfunctions.

If the test result is FAIL, the communication between the control panel and the main unit is abnormal.

- Troubleshooting suggestion

- a If the test result is Error, restart the equipment and re-perform the self-test. If the problem persists, recover the equipment.

- b If the test result is FAIL, replace the control panel.

2.21 0702 Function Self-Test for Keys, Encoder, and Trackball

- Upper-level test item

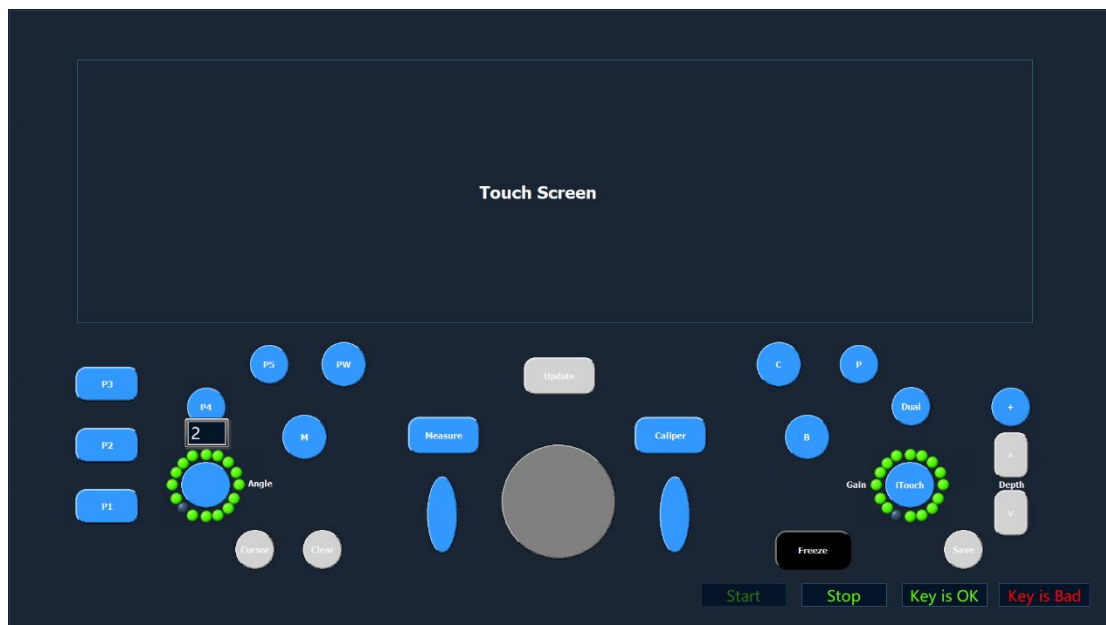
Control Panel USB Communication Test

- Test content

Test whether the keys on the control panel, encoder, trackpad, key backlight LED, and indication LED function properly. Read the board ID, keyboard FPGA version, and program version, and detect key-stuck problems.

- Test Description

Before the test, the software will detect the hardware ID of the touchpad of the current product. If the hardware ID indicates a touchpad, the control panel UI appears as a touchpad. If no trackpad ID is detected, the software prompts that no trackpad is detected. Click OK and the UI of the bedside edition is displayed by default. The control panel test interface is shown as follows:



2.22 Z0703 Key and Trackball LED Self-Test

- Upper-level test item

Control Panel USB Communication Test

- Test content

The program adjusts the brightness of the white and blue LEDs. Then manually judge the changes.

- Test Description

The following dialog box appears during the test. The program changes the brightness of the white and blue LEDs. Check whether the LED brightness changes accordingly on the control panel. If the brightness of the keyboard LEDs is the same as configured, click "LED is OK" to exit the dialog box. If not, click "LED is Bad" to exit the dialog box. The control panel LED test interface is shown as follows:



- Troubleshooting suggestion

If the brightness of the LEDs does not change, replace the control panel.

2.23 Z0801 Parameter Board I2C Communication Test

- Upper-level test item

Communication Test Between PC Module and MF FPGA

- Test content

Read data on the LCD through the I2C bus. Judge whether it is not 0 or not F, and then parse the LCD model, panel serial number, and LCD version.

- Test failure analysis

If the test result is Error, the drive malfunctions.

If the test result is FAIL, the connection between the multifunctional FPGA and the parameter board is abnormal.

- Troubleshooting suggestion

a If the test result is Error, restart the equipment and re-perform the self-test. If the problem persists, recover the equipment.

b If the test result is FAIL, check whether the cable connections between the parameter board and the main unit are reliable. If so, replace the parameter board.

2.24 Z0802 Parameter Board Data Check Test

- Upper-level test item

Parameter Board I2C Communication Test

- Test content

Read the data of the parameter board and calculate the data check. Compare the calculated data with the stored data.
- Test failure analysis

If the test result is Error, the drive malfunctions.

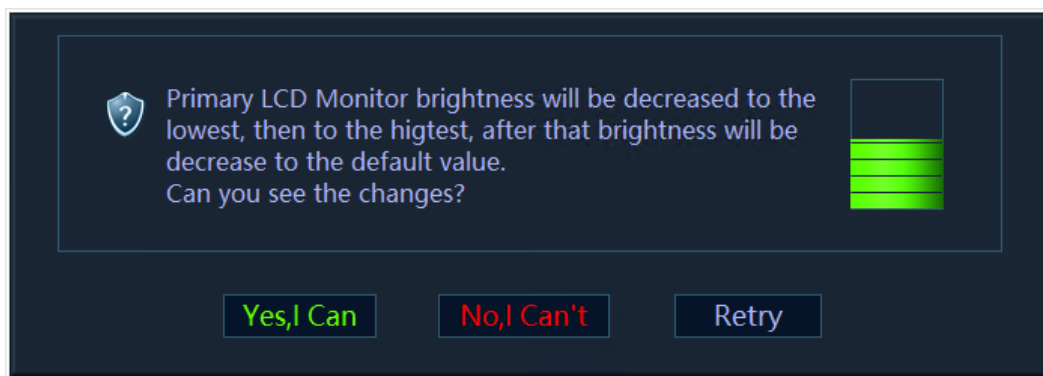
If the test result is FAIL, the data stored by the parameter board is abnormal.
- Troubleshooting suggestion
 - a If the test result is Error, restart the equipment and re-perform the self-test. If the problem persists, recover the equipment.
 - b If the test result is FAIL, replace the LCD.

2.25 Z0803 Bright Control Test for the Main Display

- Upper-level test item

Parameter Board Data Check Test
- Test content

The following dialog box appears during the test. The program controls the brightness changes of the main display through the I2C bus. Change the brightness to the lowest, then the highest, and finally normal. If you can perceive the changes, click Yes, I Can; otherwise, click No, I Can't. Click Retry to repeat the preceding procedure.



- Test failure analysis

If the test result is Error, the drive malfunctions.

If the test result is FAIL, brightness control for the main display is abnormal.
- Troubleshooting suggestion
 - a If the test result is Error, restart the equipment and re-perform the self-test. If the problem persists, recover the equipment.
 - b If the test result is FAIL, replace the main display. If the problem persists, replace the main board.

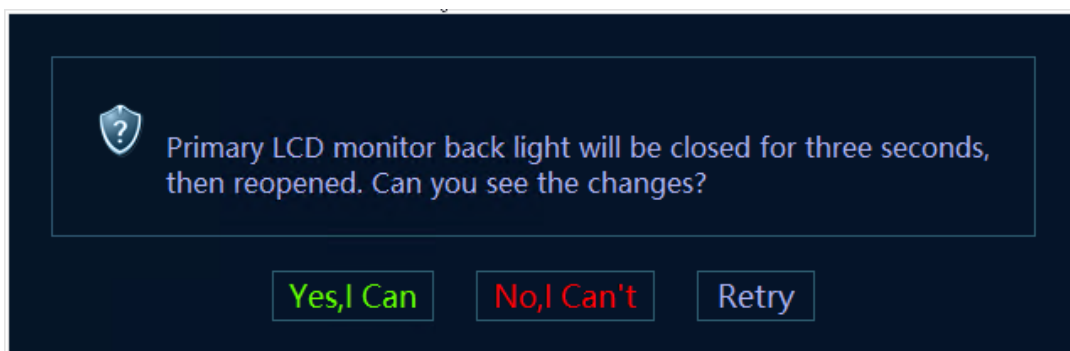
2.26 Z0804 Backlight Control Test for the Main Display

- Upper-level test item

Communication Test Between PC Module and MF FPGA

- Test content

The following dialog box appears during the test. The program turns off the backlight for 3 seconds and then resumes the backlight. If you can perceive the changes, click Yes, I Can; otherwise, click No, I Can't. Click Retry to repeat the preceding procedure.



- Test failure analysis

If the test result is Error, the drive malfunctions.

Backlight control of primary LCD monitor goes wrong if the test fails.

- Troubleshooting suggestion

a If the test result is Error, restart the equipment and re-perform the self-test. If the problem persists, recover the equipment.

b If the test result is FAIL, replace the main board.

2.27 Z0805 Secondary Screen Board Communication Test

- Upper-level test item

Communication Monitoring Test

- Test content

The SM ARM reads the firmware version and compilation time of the secondary screen board through the UART, to check whether the communication is normal.

- Test failure analysis

If the test result is Error, the drive malfunctions.

If the test result is FAIL, the communication between the SM ARM and the secondary screen board is abnormal.

- Troubleshooting suggestion

- a If the test result is Error, restart the equipment and re-perform the self-test. If the problem persists, recover the equipment.
- b If the test result is FAIL, check whether the cables are normal. If so, replace the secondary screen control board. If the problem persists, replace the main board.

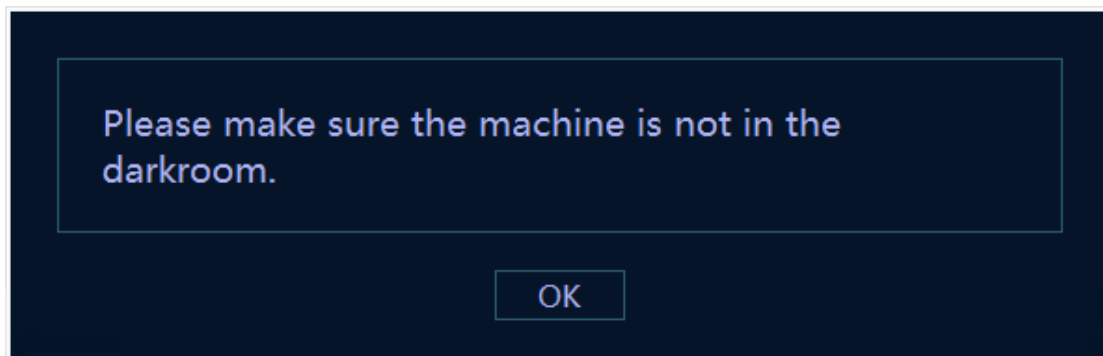
2.28 Z0806 Optical Sensor Test

- Upper-level test item

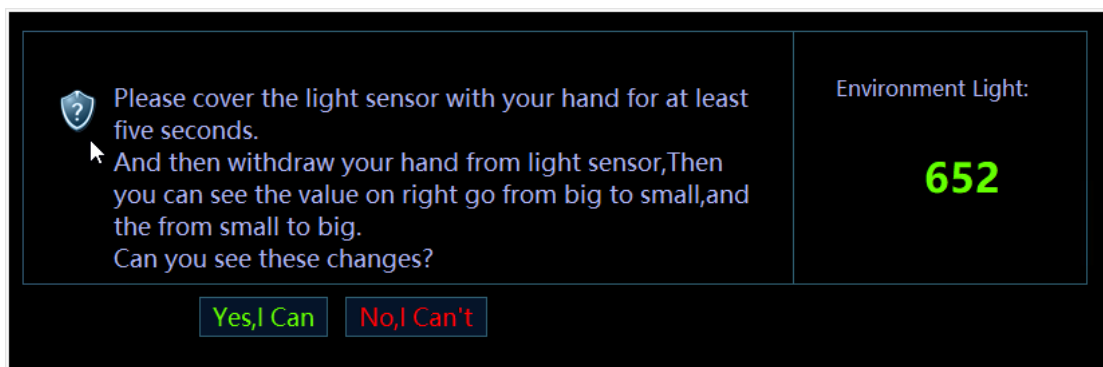
Communication Test Between PC Module and MF FPGA

- Test content

The following dialog box appears during the test. Ensure that the equipment is not in a dark room environment during the self-test. Otherwise, the test requirements are not met.



Completely cover the optical sensor at the top of the screen with your hand for at least 5s. If the value displayed on the screen becomes smaller, take off your hand from the optical sensor and check whether the value displayed on the screen becomes greater. If the preceding procedures are normal, click Yes, I Can; otherwise, click No, I Can't. See the following figure.



- Test failure analysis

If the test result is Error, the drive malfunctions.

If the test result is FAIL, the optical sensor is faulty.

- Troubleshooting suggestion

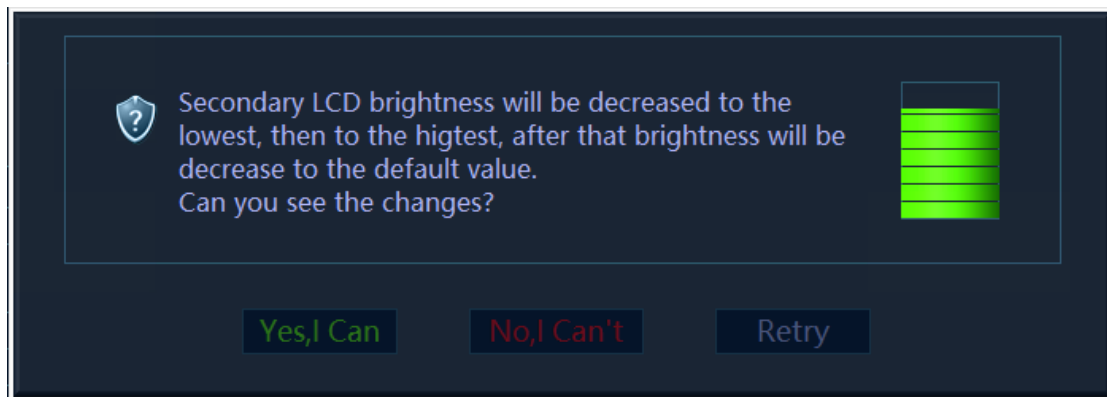
- a If the test result is Error, restart the equipment and re-perform the self-test. If the problem persists, recover the equipment.
- b If the test result is FAIL, check whether the cables are connected reliably for the optical sensor. If so, replace the secondary screen control board, to which the optical sensor is integrated.

2.29 Z0901 Touch Screen Communication Test

- Upper-level test item
None
- Test content
Test whether the operating system can identify the touch screen.
- Test failure analysis
If the test result is FAIL, it indicates the operating system cannot recognize the touch screen device.
- Troubleshooting suggestion
If the test result is FAIL, check whether the cable connections are normal. If so, replace the touch screen.

2.30 Z0902 Brightness Control Test for the Touch Screen

- Upper-level test item
Touch Screen Communication Test
- Test content
The following dialog box appears during the test. The program adjusts the duty ratio to adjust the brightness of the LCD. Change the brightness to the lowest, then the highest, and finally normal. If you can perceive the changes, click Yes, I Can; otherwise, click No, I Can't. Click Retry to repeat the preceding procedure.



- Test failure analysis
If the test result is Error, the drive malfunctions.
If the test result is FAIL, brightness control for the touch screen is abnormal.
- Troubleshooting suggestion
 - If the test result is Error, restart the equipment and re-perform the self-test. If the problem persists, recover the equipment.
 - If the test result is FAIL, check whether the cable connections are normal. If so, replace the touch screen.

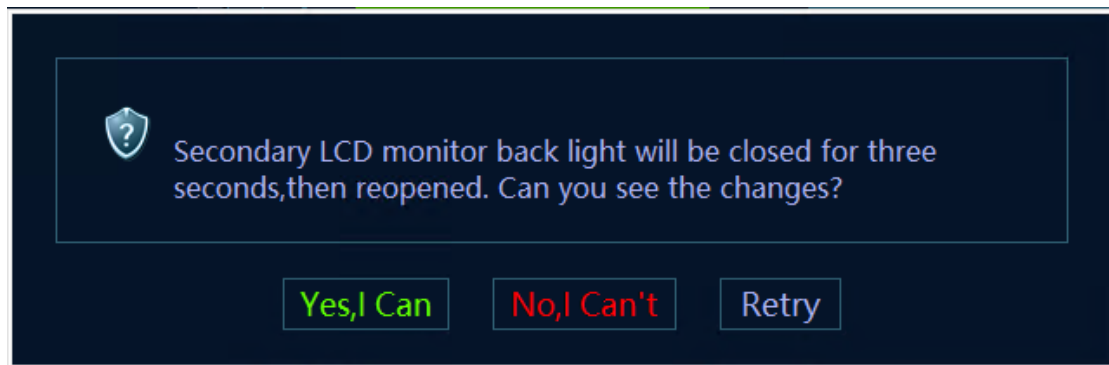
2.31 Z0903 Backlight Control Test for the Touch Screen

- Upper-level test item

Touch Screen Communication Test

- Test content

The following dialog box appears during the test. The program turns off the backlight for 3 seconds and then resumes the backlight. If you can perceive the changes, click Yes, I Can; otherwise, click No, I Can't. Click Retry to repeat the preceding procedure.



- Test failure analysis

If the test result is Error, the drive malfunctions.

If the test result is FAIL, backlight control for the touch screen is abnormal.

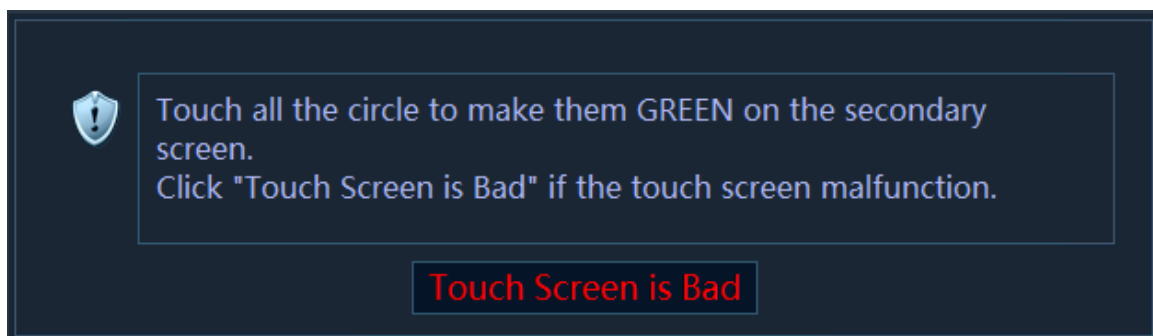
- Troubleshooting suggestion

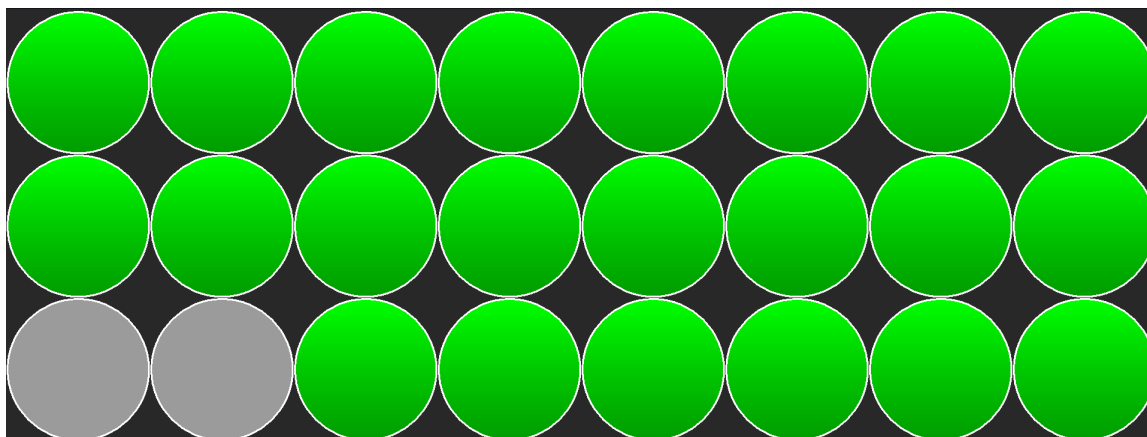
- If the test result is Error, restart the equipment and re-perform the self-test. If the problem persists, recover the equipment.
- If the test result is FAIL, check whether the cable connections are normal. If so, replace the touch screen.

2.32 Z0904 Touch Function Test for the Touch Screen

- Test content

The dialog box appears on the primary monitor when performing the test. It has to change the circle on the touch screen into green manually.





The program passes the test automatically if all circles turn into green. If the touch screen malfunctions during the test, click Touch Screen is Bad.

- Test failure analysis

None

- Troubleshooting suggestion

- If the touch screen does not work at all, the touch screen driver is abnormal. In this case, reinstall the system.
- If the touch screen malfunctions partially, check whether the cable connections are normal. If so, replace the touch screen.

2.33 Z10014D/TEE/CW Board In-Position Test

- Upper-level test item

Communication Test Between PC Module and MF FPGA

- Test content

Read the in-position signal of the 4D/TEE/CW board through the FPGA and obtain the board ID.

- Test failure analysis

If the test result is Error, the drive malfunctions.

If the test result is NaN, the 4D/TEE/CW board is faulty, the in-position status detection circuit is faulty, or the board is not properly installed.

- Troubleshooting suggestion

- If the test result is Error, restart the equipment and re-perform the self-test. If the problem persists, recover the equipment.
- If the test result is NaN, reassembly the CW board. If the test result is still NaN, replace the 4D/TEE/CW board. If the problem persists, replace the main board.

2.34 Z1002 TEE Temperature Signal Test

- Upper-level test item

4D/TEE/CW Board In-Position Test

- Test content

Read the value of the TEE temperature signal. If a value can be sampled, TEE temperature signal collection is normal.

- Test failure analysis

If the test result is Error, the drive malfunctions.

If the test result is FAIL, the TEE temperature signal collection link is faulty.

- Troubleshooting suggestion
 - a If the test result is Error, restart the equipment and re-perform the self-test. If the problem persists, recover the equipment.
 - b If the test result is FAIL, replace the 4D/TEE/CW board.

2.35 Z1003 TEE Angle Signal Test

- Upper-level test item

4D/TEE/CW Board In-Position Test

- Test content

Read the value of the TEE angle signal. If a value can be sampled, TEE angle signal collection is normal.

- Test failure analysis

If the test result is Error, the drive malfunctions.

If the test result is FAIL, the TEE angle signal collection link is faulty.

- Troubleshooting suggestion
 - a If the test result is Error, restart the equipment and re-perform the self-test. If the problem persists, recover the equipment.
 - b If the test result is FAIL, replace the 4D/TEE/CW board.

2.36 Z1004 CW Mode Pressure Test

- Upper-level test item

4D/TEE/CW Board In-Position Test

- Test content

On the FPGA, set the PHV2 pressure and set four levels for the CW voltage. Read and check whether the voltage values at the four levels are within the specified range.

- Test failure analysis

If the test result is Error, the drive malfunctions.

If the test result is FAIL, the prompted voltage does not meet the requirements.

- Troubleshooting suggestion
 - a If the test result is Error, restart the equipment and re-perform the self-test. If the problem persists, recover the equipment.
 - b If the test result is FAIL, replace the CW board. If the test result is still FAIL, replace the main board.

2.37 Z1101 Battery Communication Test

- Upper-level test item
Communication Monitoring Test
- Test content
The program detects whether the battery is in position through the I2C interface of the SM ARM. If the battery is detected, it reads the version and battery serial number.
- Test failure analysis
 - a If the test result is Error, the drive malfunctions.
 - b If the test result is NaN, the interconnection between the battery and the SM ARM is faulty.

2.38 Z1102 Battery Health Status Test

- Upper-level test item
Battery Communication Test
- Test content
The program reads the battery voltage, temperature, capacity, and charge/discharge cycle count through the I2C interface of the SM ARM, and determines the current status of the battery based on read parameters. Battery states include GOOD, WEAK, and REPLACED.
- Troubleshooting suggestion
 - a If the test result is Error, restart the equipment and re-perform the self-test. If the problem persists, recover the equipment.
 - b It is recommended to replace the battery if the test result is FAIL.

2.39 Z1201 ECG Board Information Test

- Upper-level test item
None
- Test content
The program controls the PC module to read the firmware version, boot program version, and compilation date of the ECG board through the USB port.
- Test failure analysis
If the test result is NaN, the USB interconnection between the ECG board and the PC module is abnormal.
- Troubleshooting suggestion
 - a If the test result is NaN, check whether the USB port malfunctions. If not, check whether the ECG driver is installed. If both check items are normal, replace the ECG board.

2.40 Z1202 ECG Board Self-Test

- Upper-level test item
ECG Board Information Test

- Test content

The program controls the PC module to read the ECG board register through the USB port and check the A/D collection and Voltage33 power status.

- Test failure analysis

If the test result is Error, the drive malfunctions.

- a If the test result is FAIL, the ECG board is faulty.

- Troubleshooting suggestion

- b If the test result is Error, restart the equipment and re-perform the self-test. If the problem persists, recover the equipment.

- c If the test result is FAIL, replace the ECG board.

3 Electrical Safety Maintenance

The following electrical safety tests are considered a part of the comprehensive maintenance process and major means to detect exceptions. If the test is not performed, the animal or operator may be endangered. Perform additional tests based on the actual conditions.

All tests can be performed using a commercial safety analysis tester. The following tests are performed using the 601 pro series safety tester or an equivalent. Other mainstream testers such as Fluke, Metro and Gerb must comply with the requirements of the IEC 60601-1. Follow the instructions of the tester vendor and make adjustments as required during the test.

After the product is maintained or upgraded, test the product periodically using a safety analyzer to ensure that the product remains in the inspected state. The safety analyzer is considered a good troubleshooting tool in checking abnormal line voltage, grounding, and total current load.

Electrical safety check	
1-Power plug	
Test process	
◆ Power plug	
Power plug pins	No damage or bent pins, and no discolored (rusty) pins
Plug	No physical damage
Molded part	The molded part is free from physical damages and the plug is not heated during use.
Power plug	No loosening
◆ Power cable	
Power cable	No physical damage or aging Check the connection for devices with detachable power cables Check the molding part for devices with undetachable power cables

Electrical safety check	
2- Equipment shell and accessories	
Test process	
◆ Visual inspection	
Shell and accessories	No physical damage
	The switch, connector, and dashboard are free from physical damages.
	There are no overflowing liquid residues, such as water, coffee, and chemicals.
	The probe is free from physical damages, such as cracks or swelling on the probe head.
	No parts such as buttons, knobs and terminals are loosening or missing.
◆ Associated check	
Shell and accessories	No abnormal sound, such as cracks inside the machine
	No abnormal swells, such as the smell of scorch or smoke from the air vent
	No voice prompts regarding equipment bugs or precautions for the operator
3-Equipment labels	
Test process	
Check whether labels provided by the equipment vendor are complete and legible. ➤ <i>Labels on the main unit</i> ➤ <i>General warning labels</i> ➤ <i>Slope and HV caution labels</i> ➤ <i>No-press labels</i>	

Electrical safety check

4-Ground leakage current test

Overview

Before performing other leakage current tests for the device, perform the ground leakage current test.

Measure the leakage current as follows:

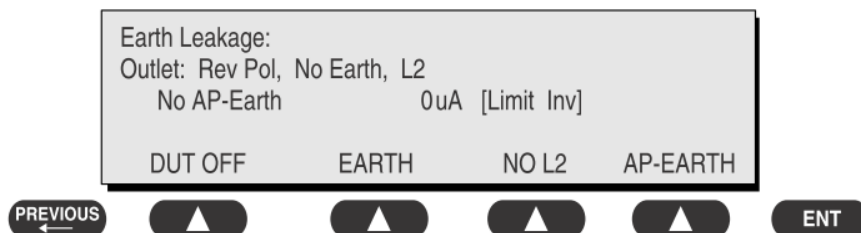
- ◆ Measure the ground leakage current from the ground terminal of the DUT.
- ◆ Measure the ground leakage current of the applied part (all grounded applied parts) from the ground terminal of the DUT.

No test lead needs to be connected. The 601 PRO tester will automatically connect to the internal measurement device.

Test process

◆ Running the test

- 1) On the main panel, insert the DUT plug into the auxiliary output interface on the front panel of the 601 PRO tester when there is no power on the output end, and then turn on the DUT.
- 2) Connect the applied part of the device to an available applied part terminal of the 601 PRO tester.
- 3) Press 4. The ground leakage current test appears on the screen and the test begins.



- Soft key 1 implements switching between the positive and negative polarities of the DUT.
 - Soft key 2 implements DUT output switching between the ground and a single fault state (no ground).
 - Soft key 3 implements switching between DUT output switching with L2 and without L2.
 - Soft key 4 implements switching between applied part grounded and application part not grounded.
- 4) Press the print key to print the latest measurements.

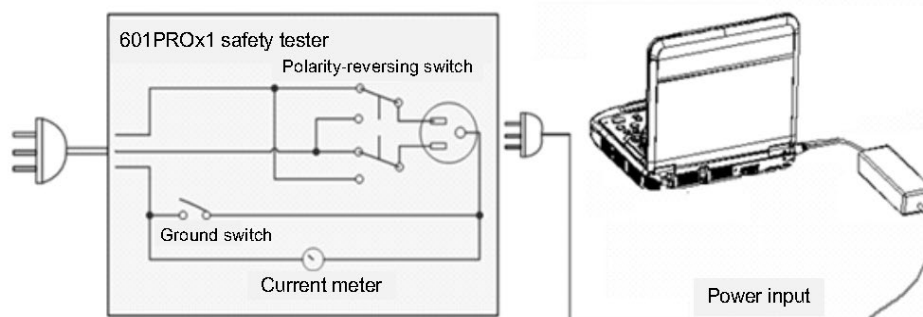


Figure 1 Ground leakage current test

◆ Fail

Electrical safety check

4-Ground leakage current test

Check the short circuit conditions of the Y capacitor of the power module. If the Y capacitor partially fails, replace it.

Check the damage of the power module. If it partially fails, replace it.

Check whether major cables are bent, in good contact, or damaged.

Test the current output on the wall. Check that the ground is good and no cable exceptions occur. Notify the user or owner to correct related deviations. Check whether any surrounding operating power output can be used for substitution.

Replace the probe to check whether the failure is caused by the main console.

If the leakage current test on the new unit fails and the problem cannot be rectified, submit a safety failure report to prove the system problem and remove this unit.

If the test fails on other units, stop using the device and notify customer service engineers to analyze or handle the problem.

Limit

IEC 60601-1: 500 μ A (normal condition)
1000 μ A (single fault)

Electrical safety check

5-Animal leakage current test

Overview

The animal leakage current test aims to test the leakage current between the available applied part and the ground. All measurements can adopt the RMS value.

Test process

◆ Preparations

Calibrate the menu of the major applied part.

The following output conditions are required for 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

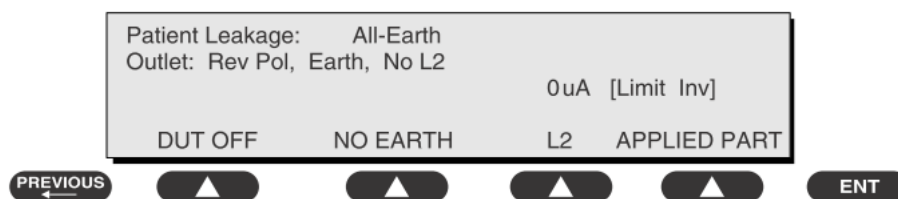
Electrical safety check

5-Animal leakage current test

If all applied parts pertain to the same anti-shock type, connect all applied parts and obtain a single measurement value. If the applied parts pertain to different anti-shock types, test all applied parts respectively by type in auto or step mode.

◆ Running the test

- 1) On the main panel, insert the DUT plug into the auxiliary output interface on the front panel of the 601 PRO tester when there is no power on the output end, and then turn on the DUT.
- 2) Connect the applied part of the device to an available applied part terminal of the 601 PRO tester.
- 3) Press 6. The animal leakage current test appears on the screen and the test begins.



- 4) Press PLIED PART (soft key 4) to select the required applied part leakage current.
- 5) Press the corresponding soft key on the panel of the 601 PRO tester to modify the output configurations of the tester front panel.
- 6) Press the print key to print the latest measurements.

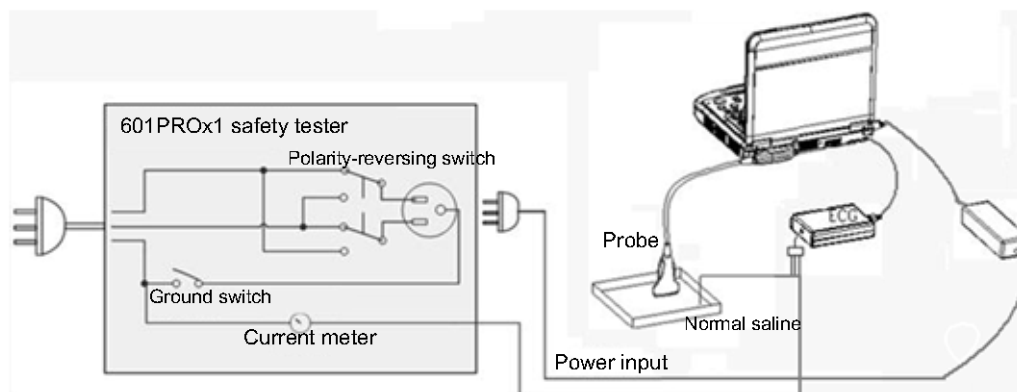


Figure 2 Animal leakage current test

◆ NOTE

Except the probe, if the device uses ECG or PCG, the animal leakage current should be tested. If the adopted current test standard does not incorporate the DC value of the animal leak current, or the DC option is unavailable, the measured DC value cannot be obtained through the PLIED PART soft key.

◆ Fail

Check whether the applied parts are damaged and replace the failed part.
 Check whether the ECG or PCG is damaged and replace the failed part.
 Check whether the power unit is damaged. If it partially fails, replace the corresponding part.
 Check whether major cables are bent or damaged, or connected unreliably.

Electrical safety check

5-Animal leakage current test

Test the current output on the wall. Check that the ground is good and no cable exceptions occur. Notify the user or owner to correct related deviations. Check whether any surrounding operating power output can be used for substitution.

Replace the probe to check whether the failure is caused by the main console.

If the leakage current test on the new unit fails and the problem cannot be rectified, submit a safety failure report to prove the system problem and remove this unit.

If the test fails on other units, stop using the device and notify customer service engineers to analyze or handle the problem.

Limit

All countries

Applicable to the ECG input and probe of the BF type device:

100 μ A (normal condition)

500 μ A (single fault)

Electrical safety check

6-Animal leakage current under the condition of applied parts plus mains voltage

Overview

Animal leakage current test under the condition of applied parts plus mains voltage: In the case of applied parts plus 110% mains voltage, select the applied part terminal by limiting the impedance value. The leakage current test is performed between the selected applied part and the ground.

Under the displayed normal polarity and reversed polarity conditions, measure the leakage current for the applied part plus 110% mains voltage.

The following output conditions are required for this test:

Normal Polarity;

Reversed Polarity

Test process

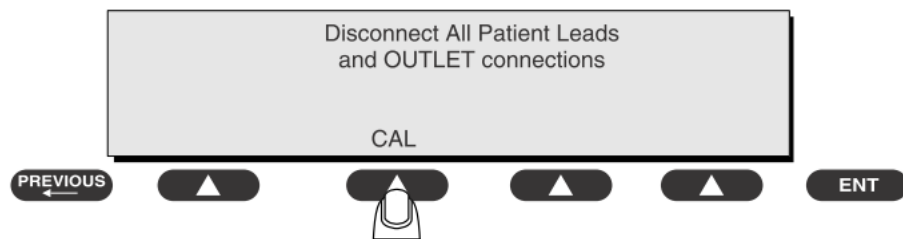
◆ Preparations

Press CAL (soft key 2) to perform calibration for the test of major applied parts.

- 1) Disconnect all animal leads and test the output connection between the leads and the DUT.
- 2) Press CAL to start calibration, as shown in the following figure:

Electrical safety check

6-Animal leakage current under the condition of applied parts plus mains voltage



If the calibration fails, the saved value is used until an acceptable calibration value appears. The Esc/Stop key is invalid during calibration.

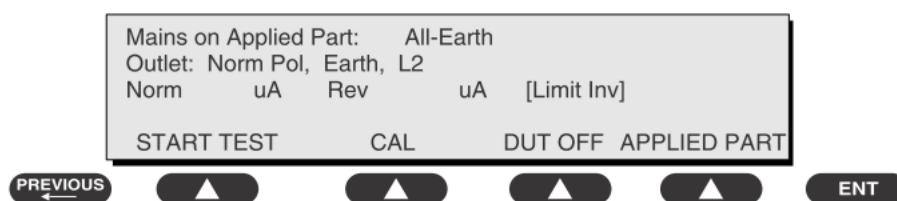
- 3) After the calibration is complete, the animal leakage current test under the condition of applied parts plus mains voltage appears on the screen.

◆ WARNING

- 1) If two beeps per second are generated during the calibration, high voltage occurs on the applied part terminal.
- 2) High voltage may occur on the applied part terminal during the measurement test.

◆ Running the test

- 1) On the main panel, insert the DUT plug into the auxiliary output interface on the front panel of the 601 PRO tester when there is no power on the output end.
- 2) Connect the applied part of the device to an available applied part terminal of the 601 PRO tester.
- 3) Press 7. The animal leakage current test under the condition of applied parts plus mains voltage appears on the screen.



- 4) Press a proper soft key to select the required applied part test and output configurations.
- 5) Press START TEST (soft key 1) to start the test.
- 6) Press the print key to print the latest measurements.

Electrical safety check

6-Animal leakage current under the condition of applied parts plus mains voltage

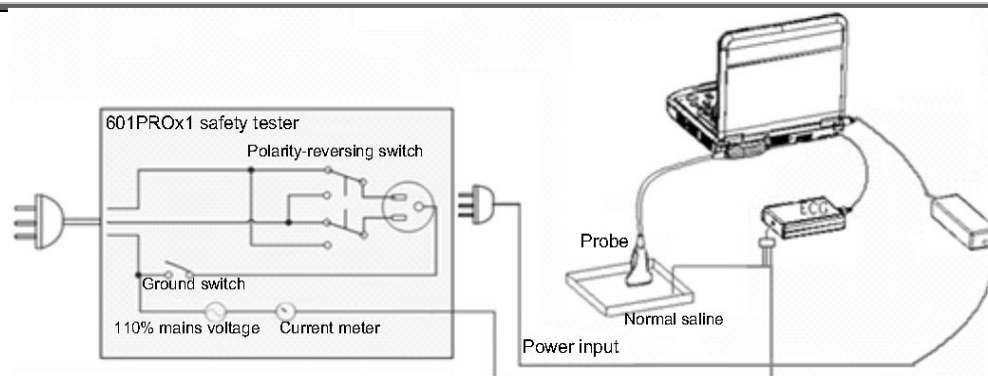


Figure 3 Leakage current on the major applied part

◆ NOTE

- 1) Except the probe, if the device uses ECG or PCG, the animal leakage current should be tested.
- 2) If all applied parts pertain to the same mechanical type, connect all applied parts and obtain a single measurement value. If the applied parts pertain to different mechanical types, test all applied parts respectively by type in auto or step mode.

◆ Fail

Check whether the applied parts are damaged and replace the failed part.

Check whether the ECG or PCG is damaged and replace the failed part.

Check whether the power unit is damaged. If it partially fails, replace the corresponding part.

Check whether major cables are bent or damaged, or connected unreliably.

Test the current output on the wall. Check that the ground is good and no cable exceptions occur. Notify the user or owner to correct related deviations. Check whether any surrounding operating power output can be used for substitution.

Replace the probe to check whether the failure is caused by the main console.

If the leakage current test on the new unit fails and the problem cannot be rectified, submit a safety failure report to prove the system problem and remove this unit.

If the test fails on other units, stop using the device and notify customer service engineers to analyze or handle the problem.

Limit

All countries

Applicable to the ECG input and probe of the BF type device:

5000 μ A

Electrical safety check

7-Animal auxiliary current test

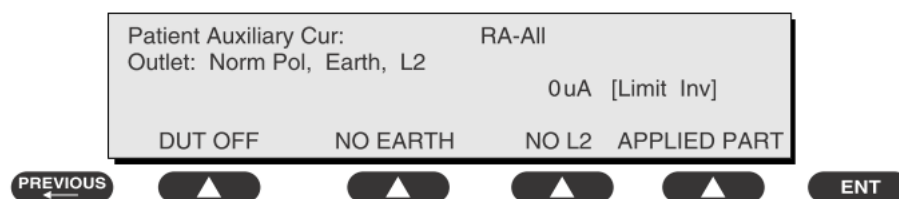
Overview

The animal auxiliary current test is performed between the selected ECG slot and remaining ECG slots. All measurements can adopt the RMS value or DC value.

Test process

◆ Preparations

- 1) On the main panel, insert the DUT plug into the auxiliary output interface on the front panel of the 601 PRO tester when there is no power on the output end.
- 2) Connect the animal lead to an ECG slot on the 601 PRO tester.
- 3) Define the lead type in setup options.
- 4) Press 8. The animal auxiliary current test appears on the screen and the test begins. The displayed value keeps updated until another test is selected.



- 5) Press soft keys 1 to 4 to select a leakage current test.
- 6) Press PLIED PART (soft key 4) to select the required applied part leakage current.
- 7) Press the corresponding soft key on the panel of the 601 PRO tester to modify the output configurations of the tester front panel.
- 8) Press the print key to print the latest measurements.

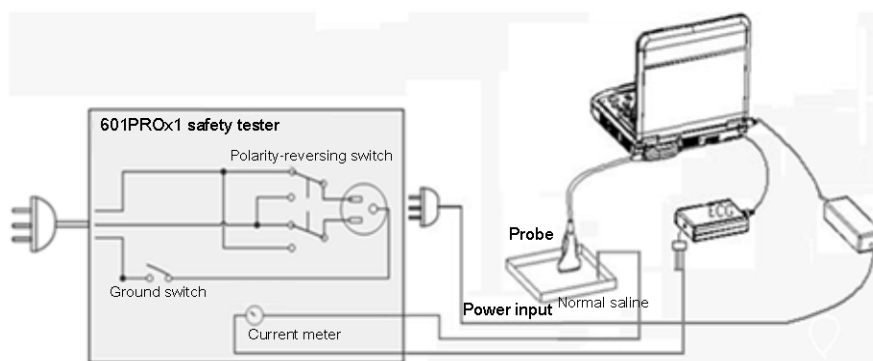


Figure 4 Animal auxiliary current test

◆ NOTE

Electrical safety check

7-Animal auxiliary current test

If the adopted current test standard does not incorporate the DC value of the animal auxiliary current, or the DC option is unavailable, the DC value cannot be obtained through the PLIED PART soft key.

◆ Fail

Check whether the AC cable is damaged. If it partially fails, replace it.

Check whether the shell is damaged and replace the failed part.

Check whether major cables are bent or damaged, or connected unreliably.

Test the current output on the wall. Check that the ground is good and no cable exceptions occur. Notify the user or owner to correct related deviations. Check whether any surrounding operating power output can be used for substitution.

Replace the probe to check whether the failure is caused by the main console.

If the leakage current test on the new unit fails and the problem cannot be rectified, submit a safety failure report to prove the system problem and stop using the device.

If the test fails on other units, stop using the device and notify customer service engineers to analyze or handle the problem.

Limit

All countries

Applicable to the ECG input and probe of the BF type device:

100 μ A (normal condition)

500 μ A (single fault)

Electrical safety checklist

Class I Equipment

Overview:

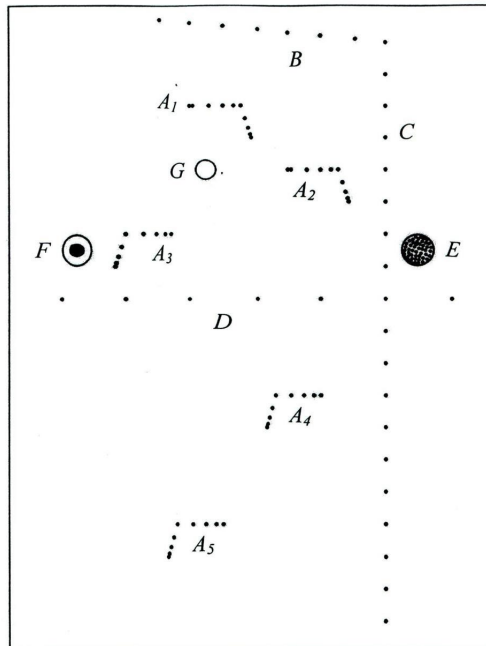
- | | |
|--|--|
| ☐ Periodic check | Test items: 1, 2, and 3 |
| ☐ Maintenance without disassembly | Test items: 1, 2, and 3 |
| ☐ Maintenance with disassembly but not modifying the power part (including the transformer or animal circuit board) | Test items: 1,2, 3, 4, and 5 |
| ☐ Maintenance with disassembly and modifying the power part (including the transformer or animal circuit board) | Test items: 1, 2, 3, 4, 5, 6, 7, and 8 |

Position				Engineer	
Device				Code	
Manufacturer		Model		SN	
Measurement Device/SN				Calibration Date	
Check and Test				Pass/Fail/NA	Remarks
1.	Power plug				
2	Equipment shell and accessories				
3	Equipment labels				
4	Earth leakage current	Normal condition (NC)	____ μ A		Limit NC: 500 μ A SFC: 1000 μ A
		Single fault condition (SFC)	____ μ A		
5*	Patient current leakage	Normal condition (NC)	☐ BF ____ μ A		Limit BF application type NC: 100 μ A SFC: 500 μ A
		Single fault condition (SFC)	☐ BF ____ μ A		
6*	Leakage current on the major applied part		☐ BF ____ μ A		Limit BF application type 5000 μ A
7*	Patient auxiliary current	Normal condition (NC)	☐ BF ____ μ A		Limit NC:10 μ A SFC: 50 μ A
		Single fault condition (SFC)	☐ BF ____ μ A		

Name: _____ Date/Signature: _____

4 Phantom Usage Illustration

4.1 Ultrasound Phantom Model KS107BD



A1-A5: Axial-Lateral Resolution Target String Group

B: Dead Zone Target Group

C: Vertical Distance Target Group

D: Horizontal Distance Target Group

E: Hyperechoic(tumor-like) Target

F: Anechoic (Cyst-like, 10 mm in diameter) and stones-like Target

G: Anechoic (Cyst-like, 6 mm in diameter) Target

The detail introduction of 11 target groups is as following:

1. A1-A5: Axial-Lateral Resolution Target String Group,

The distances between the Lateral branch of the groups and the acoustic window are 30mm, 50mm, 70mm, 120mm and 160mm respectively. Group A1 and A2 have the adjacent target horizontal interval 1mm, 5mm, 4mm, 3mm, 2mm from left to right sequence. Groups A3-A5 are 5mm, 4mm, 3mm, 2mm. The vertical target string branch has the adjacent target target vertical interval 4mm, 3mm, 2mm, 1 mm from up to down sequence for all groups of this series.

2. B: Dead Zone Target Group,

The adjacent target string lateral intervals are 10mm. The distance of the target strings to the acoustic window are respectively 10mm, 9mm, 8mm, 7mm, 6mm, 5mm, 4mm, 3mm.

3. C: Vertical Distance Target Group,

This target group includes 19 strings, with the adjacent string interval is 10mm.

4. D: Horizontal Distance Target Group,

This target group includes 7 strings, with adjacent string interval is 20mm.

5. E: Hyperechoic(tumor-like) Target,

Hyperechoic target(tumor-like), is located between 70-80 mm in depth, with a 10 mm diameter cylindrical shape. The cylinder axis is parallel to the target string.

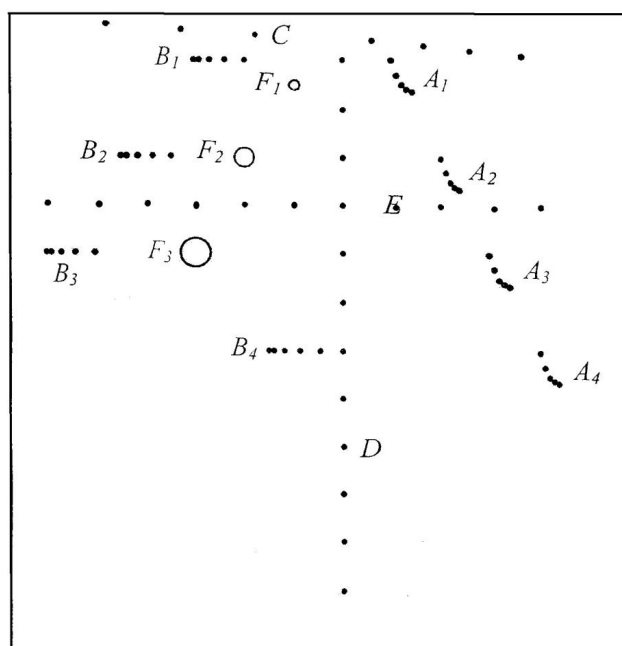
6. F: Anechoic (Cyst-like, 10 mm in diameter) and stones-like Target,

Cyst-like cylindrical shape target, is located between 70-80 mm in depth, with 10 mm in diameter of the cylinder. The axial is parallel to the target string. Stones mimicking target is located in the center of the cyst target with irregular shape, among which the maximum size is of about 4-6 mm.

7. G: Anechoic (Cyst-like, 6 mm in diameter) Target,

Anechoic (cyst-like) target, is located between 47-53mm in depth, with a 6mm diameter cylindrical shape. Its cylinder axis is parallel to the target string.

4.2 Ultrasound Phantom Model KS107BG



A1-A4: Axial Resolution Target String Group

B1-B4: Lateral Resolution Target String Group

C: Dead Zone Target Group

D: Vertical Distance Target Group

E: Horizontal Distance Target Group

F1-F3: Anechoic (Cyst-like target, diameter: 2 mm, 4mm, 6mm) Target Group

The detail introduction of 14 target groups is as following:

1. A1-A4: Axial Resolution Target String Group,

The top strings of each target group are at the depth of 10mm, 30mm, 50mm, 70mm. The vertical distances between adjacent strings in each target group are 3mm, 2mm, 1mm, 0.5mm respectively. The horizontal distances between adjacent are 1mm.

2. B1-B4: Lateral Resolution Target String Group,

The depth of this target string are at 10mm, 30mm, 50mm, 70mm for B1-B4 group respectively. The horizontal distance of adjacent strings in each group are 4mm, 3mm, 2mm, 1mm respectively.

3. C: Dead Zone Target Group,

The adjacent target string lateral intervals are 10mm. The distance of the target strings to the acoustic window are 4mm, 3mm, 2mm respectively.

4. D: Vertical Distance Target Group,

This target group includes 12 strings, with the adjacent string interval is 10mm.

5. E: Horizontal Distance Target Group,

This target group includes 6 strings, with adjacent string interval are 20mm.

6. F1-F3: Anechoic (Cyst-like target, diameter: 2 mm, 4mm, 6mm) Target Group,

Cyst-like cylindrical shape target, is imbedded in the TM material with diameter of 2mm, 4mm, 6mm. Their axials are parallel to the target string, with location at the depth of 15mm, 30mm, 45mm.

