

**Z6/Z6T/Z6S/Z6W/Z6Vet  
Z5/Z5BW/Z5T/Z5Vet**

**Diagnostic Ultrasound System**

**Service Manual**

**Revision 16.0**



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# Revision History

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

Revision	Date	Reason for Change
1.0	2012.03.20	Initial release
2.0	2011.09.01	1) A new model is added to the cover page. Z5/Z5BW/Z5T/Z5Vet; 2) 4.1 Hardware system overall structure: add hardware differences between Z5 series and Z6 series systems; 3) Add principle description of main board and probe board of Z5 series to 4.2; 4) Add material information of main board and probe board of Z5 series to 7.2 field replaceable unit; 5) Increase disassembly steps of speaker in 7.4.9; 6) Update Appendix A electrical safety inspection form and limit value requirement.
3.0	2013.04.17	Add FRU part number for HDD of different regions/types (CE/FDA/human/vet)
4.0	2013.6.24	Add "The attentions to the assembly/disassembly, otherwise the hard disk will be damaged" to Chapter 7.4.8.
5.0	2015.1.14	Section 7.2, add new main board FRU number and compatibility description.
6.0	2015.6.10	Section 7.2, add new HDD FRU numbers for Z5 Vet FDA and Z5 FDA.
7.0	2015.7	Section 2.1.3, add printer SONY UP-D898MD and SONY UP-X898MD
8.0	2015.8	Section 7.2, change HDD and Main board FRU numbers.
9.0	2015.1.14	Change the FRU number of the display assembly in chapter 7.2
10.0	2016.4.10	Add HDD number in chapter 7.2.
11.0	2016.8.9	Update the labels in 1.2.2.
12.0	2016.9.23	Update FRU number of main board, HDD and PC module due to COME module change matched with BayTrail.
13.0	2016.11.23	Update the log of Alarming and Abnormal Information in chapter 8.3
14.0	2018.8	Add part numbers of AC-DC board and DC-DC board in chapter 7
15.0	2018.9	Correct effective date of version 13.0 in the cover document.
16.0	2019.08	Add part number of PC Module Assembly and relevant comments in chapter 7






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## Applicable for

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

## Statement

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

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

## Responsibility on the Manufacturer Party

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

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

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

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



**WARNING:**

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

## Customer Service Department




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# 1 Preface

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

## 1.1 Meaning of Signal Words


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



Signal word	Meaning
 <b>DANGER</b>	Indicates death or serious injury may occur imminently in this hazardous situation if not avoided.
 <b>WARNING</b>	Indicates death or serious injury may occur potentially in this hazardous situation if not avoided.
 <b>CAUTION</b>	Indicates minor or moderate injury may occur potentially in this hazardous situation if not avoided.
<b>NOTE</b>	Indicates property damage may occur potentially in this hazardous situation if not avoided.

## 1.2 Meaning of Symbols



The meaning and location of the safety symbols and warning labels on the ultrasound machine are described in the following tables, please read them carefully before using the system.

### 1.2.1 Meaning of Safety Symbols

Symbol	Meaning	Location
	Type-BF applied part The ultrasound probes connected to this system are type-BF applied parts. The ECG module connected to this system is Type-BF applied part.	Above the IO panel





	Caution	On the rear panel
	Dangerous voltage	

## 1.2.2 Warning Labels



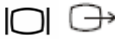







No.	Warning Labels	Meaning
1.		Please carefully read this manual before use device.
2.	<p>The following labels are available when the system works with the mobile trolley.</p> 	<p>a. Do not place the device on a sloped surface. Otherwise the device may slide, resulting in personal injury or the device malfunction. Two persons are required to move the device over a sloped surface.</p> <p>b. Do not sit on the device.</p> <p>c. DO NOT push the device. When the casters are locked.</p>

## 1.2.3 General Symbols

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


Symbol	Meaning	Location
	Equipotentiality	Power panel
	Power button	Upper right corner on the control panel
	Network port	IO panel
	USB port	




	Video output	
	Remote port	
VGA port 	VGA signal output	
	AC indicator	Lower left corner on the control panel
	Battery indicator	
	Standby indicator	Lower right corner on the control panel
	Hard disk indicator	
	Probe connector A	Rear panel
	Probe connector B	
	This product is provided with a CE marking in accordance with the regulations stated in Council Directive 93 / 42 / EEC concerning Medical Devices. The number adjacent to the CE marking (0123) is the number of the EU-notified body certified for meeting the requirements of the Directive.	


## 1.3 Safety Precautions

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


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


### 1.3.1 Electric safety

-  **WARNING:**
1. Do not 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.
  2. Do not use any cables other than the cables provided with the device by Mindray.
  3. Use the cable provided with this system to connect the printer. Other cables may result in electric shock.
  4. Disconnect the AC power before you clean or uninstall the ultrasound machine, otherwise, electric shock may result.
  5. 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.
  6. This system is not water-proof. If any water is sprayed on or into the system, electric shock may result.

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

### 1.3.2 Mechanical Safety

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

-  **CAUTION:**
1. Do not expose the system to excessive vibration (during the transportation) to avoid device dropping, collision, or mechanical damage.

2. When you place the system on the mobile trolley and move them together, you must secure all objects on the mobile trolley to prevent them from falling. Otherwise you should separate the system from the mobile trolley and move them individually. When you have to move the system with the mobile trolley upward or downward the stairs, you must separate them first and then move them individually.
3. Do not move the ultrasound system if the HDD indicator is green, sudden shake may cause the HDD in damage.

### 1.3.3 Personnel Safety

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

### 1.3.4 Other

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



# 2 Product Specifications

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## 2.1 Overview

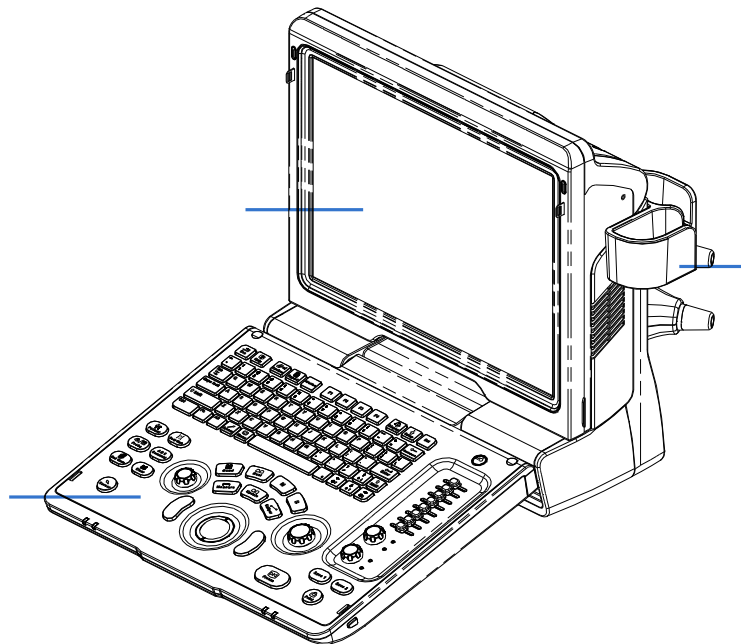
### 2.1.1 Intended Use

Z5 series and Z6 series are diagnostic ultrasound system, which are intended for use in clinical ultrasonic diagnosis.

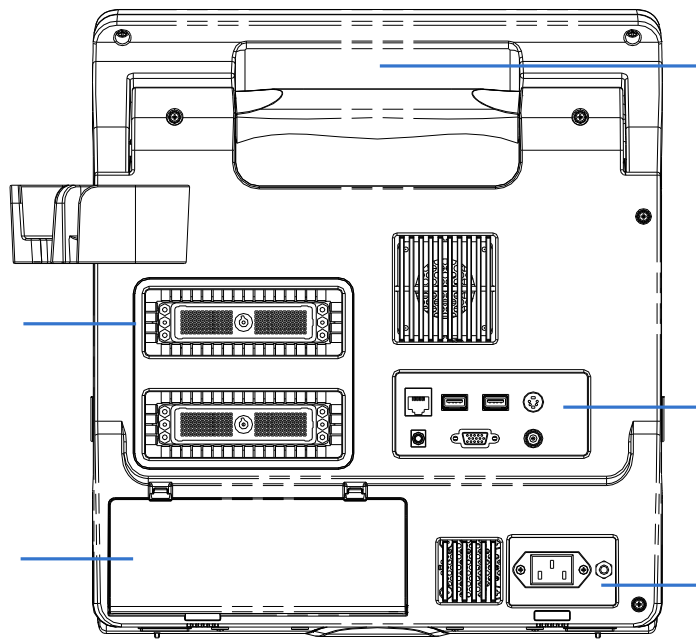
Z5 series include: Z5/Z5BW/Z5T/Z5Vet;

Z5 series include: Z6/Z6T/Z6S/Z6W/Z6Vet.

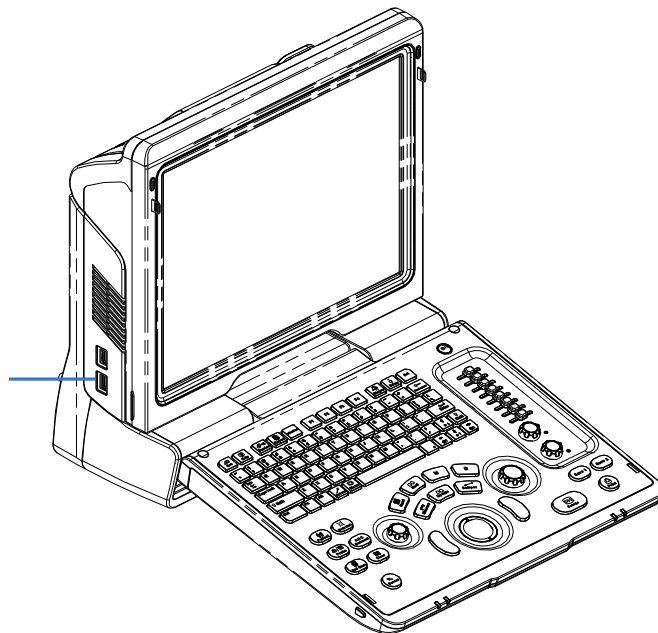
### 2.1.2 Introduction of Each Unit



Rear view:

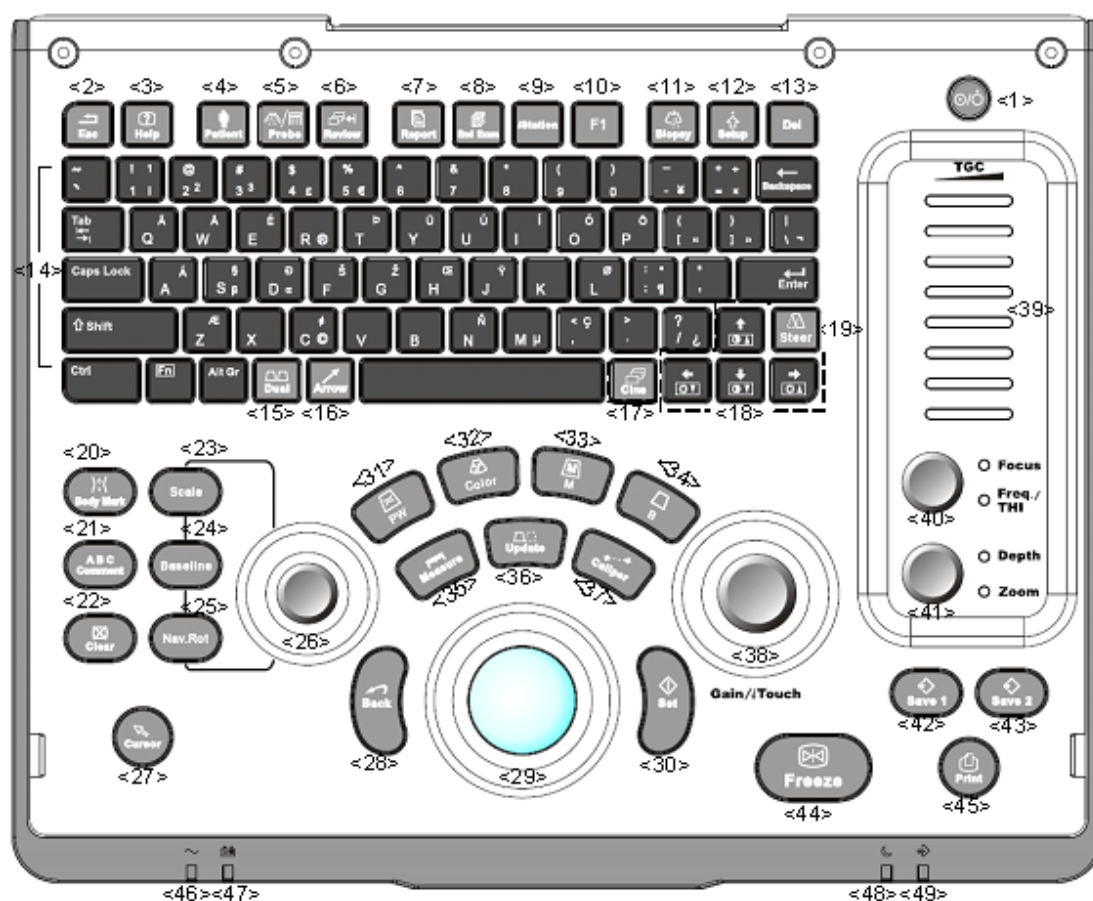


Left side:



No.	Name	Function
1	Probe holder	Sets the probe
2	Display	Displays the image and parameters
3	Control Panel	Man-machine interface for operation control, for details, please refer to “2.1.2.1 Control Panel”.
4	Handle	For lifting the machine
5	IO Panel	Signal input / output panel, for details, please refer to “2.1.2.2 IO Panel”.
6	Power supply panel	Signal input / output panel, for details, please refer to “2.1.2.3 Power Supply Panel”.
7	Probe sockets	Sockets connecting probes and the main unit
8	Battery cover	Covering battery
9	USB ports	For connecting USB device (2 ports)

### 2.1.2.1 Control Panel



No.	Name	Description	Function
1	/	Power button	Off: when system is turned off; Green: when system is turned on by pressing this button; Orange: when system is in standby.
2	Esc	Exit	Press to exit the current status to the previous status.
3	Help	/	Press to open or close the accompanying help documents.
4	Patient	Patient Information	Press to open/ exit patient information screen.
5	Probe	Probe switch	Press to switch Probe and Exam Type
6	Review	/	Press to review the stored images.
7	Report	/	Press to open or close the diagnosis reports.
8	End Exam	/	Press to end an exam.
9	iStation	/	Press to enter or exit the patient information management system.
10	F1	User-defined key	You can assign a function to the key.
11	Biopsy	/	Press to show or hide the biopsy guide line.
12	Setup	/	Press to open/close the setup menu.
13	Del	/	Press to delete the comment, etc.
14	/	Alphanumeric keys	Same as on PC
15	Dual	Dual-split screen	Press to enter Dual mode from non-Dual mode; Press to switch between windows in Dual mode.
16	Arrow	/	Press to enter or exit the arrow comment status.
17	Cine	Cine Review	Press to enter or exit the Cine Review status.
18	/	Direction key	To adjust display brightness or contrast when pressing with <Fn> key.
19	Steer		Press to open slant function for linear probe
20	Body Mark	/	Press to enter or exit the Body Mark status.
21	Comment	/	Press to enter or exit the character comment status.
22	Clear	/	Press to clear the comments or measurement calipers on the screen.
23	Scale	/	Press to adjust the Scale value
24	Baseline	/	Press to adjust the baseline value
25	Nav.Rot	/	Multifunction knob
26	/	/	Press to implement the different function with "Scale/Baseline/Nav.Rot" three keys.

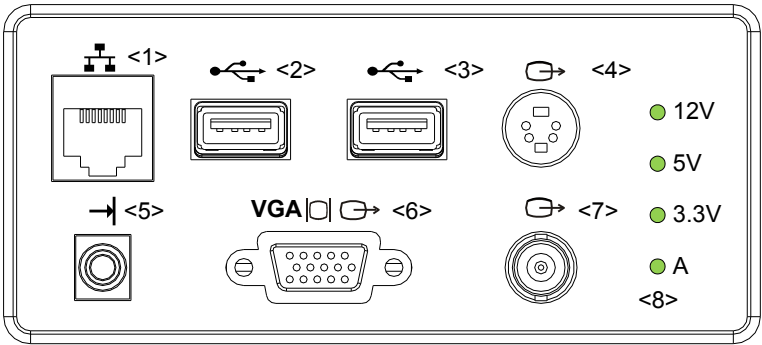


No.	Name	Description	Function
27	Cursor	/	Press to show the cursor.
28	Back	/	Press to return to the previous operation or to delete the last project
29	/	Trackball	Roll the trackball to change the cursor position.
30	Set	/	Press to confirm an operation.
31	PW	/	Press to enter the PW mode
32	Color	/	Press to enter the color mode
33	M	/	Press to enter the M mode.
34	B	/	Press to enter the B mode
35	Measure	/	Press to enter/ exit Application Measurement
36	Update	/	Measurement status: press to switch between the fixed and active end of the caliper; Multi-imaging mode: press to change the currently active window.
37	Caliper	/	Press to enter/ exit Measurement
38	Gain/ iTouch	/	Rotate: to adjust B or M gain Press: to enter/ exit iTouch
39	TGC	/	Move to adjust time gain compensation.
40	Focus Freq./THI	/	Press: to switch between Focus and Freq./THI; Rotate: to adjust corresponding parameter
41	Depth Zoom	/	Press: to switch between Depth and Zoom; Rotate: to adjust corresponding parameter
42	Save 1	/	Press to save, user-defined key
43	Save 2	/	Press to save, user-defined key
44	Freeze	/	Press to freeze or unfreeze the image.
45	Print	/	Press to print: user-defined key.
46	/	Indicator 1	AC indicator AC supply: light green; Battery supply: light off.
47	/	Indicator 2	Battery status indicator Charging: light in orange Full: light in green Discharge (electricity >20%): light in green Discharge (electricity <20%): blinking in orange Discharge (electricity <5%): blinking in orange rapidly Non-charge/ discharge: light off

No.	Name	Description	Function
48	/	Indicator 3	Standby indicator Standby: blinking in orange Other status: light off
49	/	Indicator 4	HDD status indicator Read/ write: blinking in green Other status: light off NOTE: DO NOT move the machine when the indicator blinking in green. Otherwise the HDD may be damaged by sudden shake.

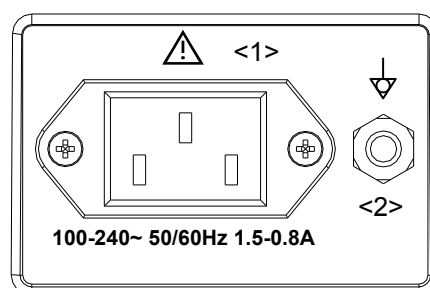
### 2.1.2.2 IO Panel

The IO panel is on the back of the main system.



No.	Symbol	Function
1		Network port
2		USB ports
3		
4		Separate video output, connecting video printer or monitor
5		Remote control port
6		VGA signal output
7		Composite video output
8	/	Power indicator

### 2.1.2.3 Power Supply Panel



No.	Name	Function
1	Power inlet	AC power inlet
2	Equipotential terminal	Used for equipotential connection, that balances the protective earth potentials between the system and other electrical equipment.

### 2.1.3 Peripherals Supported

Name	Model
Footswitch	971-SWNOM (2-pedal, USB port) SP-997-350 (3-pedal, USB port)
Black / white video printer	Analog: SONY UP-897MD, MITSUBISHI P93W-z Digital: SONY UP-D898MD, SONY UP-X898MD
Color video printer	Analog: SONY UP-20, MITSUBISHI CP910E Digital: HP Photosmart plus B210A
Graph/ text Printer	HP series Tested: HP deskjet 1280, HP Laserjet CM1015, HP officejet 6000, HP officejet J3608 all-in-one
External DVD R/W	SE-S224Q
Barcode scanner	SYMBOL LS2208-SR
Wireless network card	EDUP EP-MS150N11N series

<b>NOTE:</b>	If the ultrasound system can not recognize the SONY UP-X898MD and SONY UP-D898MD printers automatically, you may need to change the settings on the printer: push <PUSH ENTER> to enter the main menu and select [DIGITAL]->[DRIVER], and select [897].
--------------	---

## 2.2 Specifications

### 2.2.1 Dimensions and Weight

Dimensions:

Fold: 378mm (H) ×190mm (D) ×415mm (W)

Unfold: 396mm (H) ×476mm (D) ×415mm (W)

Net weight: ≤8.8Kg (including battery, no probe holder)

### 2.2.2 Electrical Specifications

<b>Voltage</b>	100-240V~
<b>Current</b>	1.5-0.8A
<b>Frequency</b>	50/60Hz±3Hz

### 2.2.3 Environmental Conditions

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

<b>⚠Warning :</b>	<b>Do not use this system in the conditions other than those specified</b>
-------------------	--

### 2.2.4 Monitor Specification

<b>Voltage</b>	12V
<b>Dimension</b>	15 inch
<b>Resolution</b>	1024×768
<b>Adjustable angle</b>	≤30 degree

# 3 System Installation

---

## 3.1 Preparations for Installation

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

Locations near heat generators;

Locations of high humidity;

Locations with flammable gases.

### 3.1.1 Electrical Requirements

#### 3.1.1.1 Requirement of Regulated Power Supply

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

#### 3.1.1.2 Grounding Requirements

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

**⚠WARNING:** DO NOT connect this system to outlets with the same 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.

#### 3.1.1.3 EMI Limitation

Ultrasound machines 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. Electrical and electronic equipment may produce EMI unintentionally as the result of defect.

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

## **3.1.2 Installation Condition**

### **3.1.2.1 Space Requirements**

Place the system with the necessary accessories at a proper position for convenient use.

1. Place the system in a room with good ventilation or having an air conditioning unit.
2. Leave at least 20cm clearance around the system to ensure effective cooling.
3. A combination lighting system in the room (dim/bright) is recommended.
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.

### **3.1.2.2 Network Environment**

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

Data transmission is allowed between different departments or areas without network cable. Network can be automatically connected after disconnection in case that the device is required to be moved, wireless transmission task can be recovered after the network resumed to normal condition. Confirm the network devices and network conditions before the installation.

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

### **3.1.2.3 Confirmation before Installation**

Please confirm the following items before installation:

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

Please confirm the items above prior to the installation training, and do the system settings according to the universal setting of installed region or country.

## **3.2 Unpacking**

Tools Required: None.

3-2 System Installation

Installation duration: 1 person, 0.5 hour.

### 3.2.1 Unpacking

1. Use the scissor to clip the 2 rubber belts as follows:



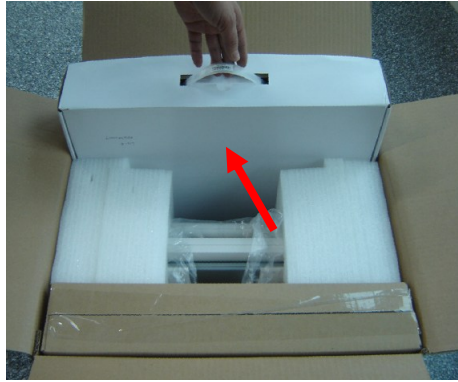
2. Use a knife to open the tapes:



3. Take out the operation manual:



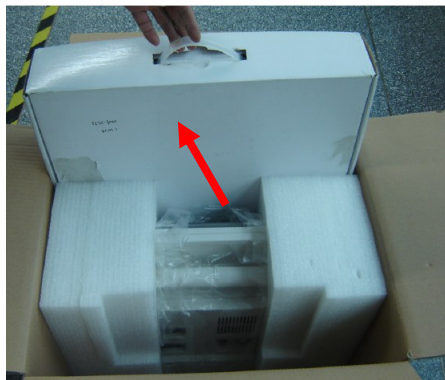
4. Take out the probe box 1:



5. Take out the accessory box:



6. Take out the probe box2, as follows (the box is below the accessory box):

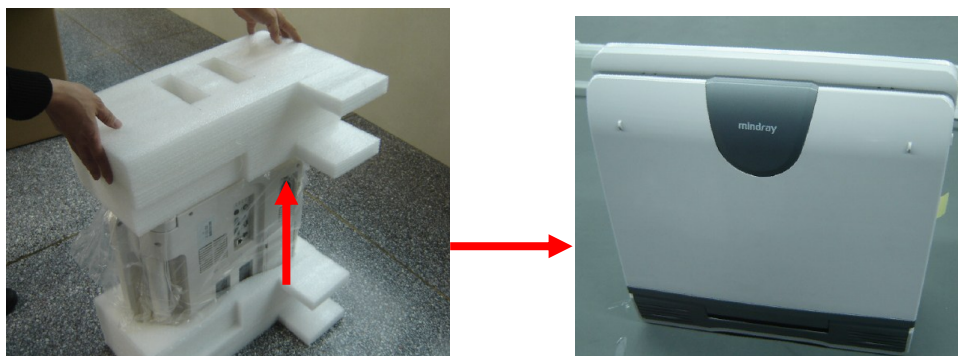


7. Hold the handle tightly and pull the machine with the surrounding foam:



8. Remove the surrounding protective foam to take out the main system.





### 3.2.2 Checking

1. After unpacking, check the objects in the container with the package list to see if anything is in short supply or is wrong.
2. Inspect and make sure there is no damage to the machine, no indentation, no cracks.

## 3.3 Installation of Main Unit

### 3.3.1 Installing Battery

As shown in the following figure.

1. Open the battery cover and put the battery near the bay (Note that the battery shall be put in correct direction).
2. Push the battery into the battery bay ①, and push to the right side as ② until it's tightly locked.
3. Close the battery cover.

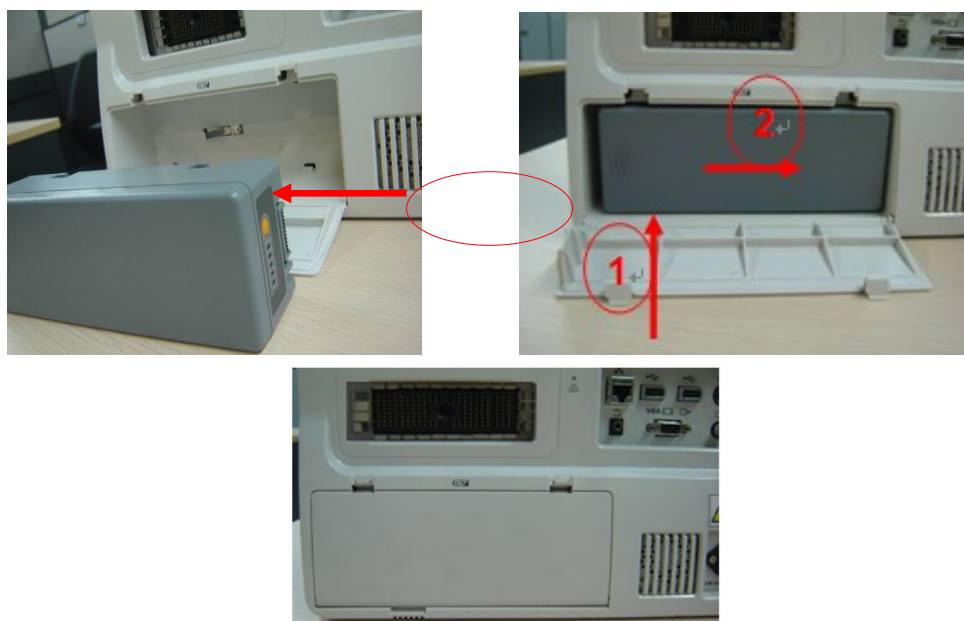


Figure 3-1 Installing Battery

### 3.3.2 Control Panel Adjusting

Press the ① lock buttons on the both sides of the control panel as illustrated in the following picture, open the control panel.



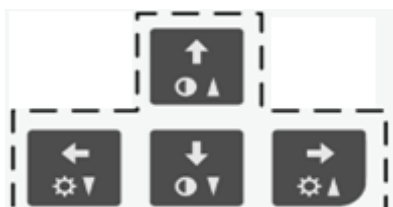
Figure 3-2 Control Panel Adjustment

### 3.3.3 Display Adjusting

1. Open the display as described in 3.3.2
2. Put the finger into the bottom of the display and pull the display to tilt the display (30 degrees max.)
3. Tear off the screen protective film.



Figure 3-3 Open and tilt the display



Press <Fn>+ directional keys to adjust brightness and contrast.

- Brightness Adjustment:

『←』『→』refer to the brightness control keys; press <Fn>+ 『←』 to decrease the brightness; and press <Fn>+ 『→』 to increase the brightness.

- Contrast adjustment:

『↓』, 『↑』 refer to the contrast control keys; press <Fn>+ 『↓』 to decrease the contrast; and press <Fn>+ 『↑』 to increase the contrast.

- Restore the factory default settings

Open the page via “Setup <F10>→General” and restore the brightness/contrast to factory default setting.

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

### 3.3.4 Installing Probe Holder

Fix the probe holder hanger into the groove in the right side and the rear-right side of the main unit, and push downwards to confirm the installation.

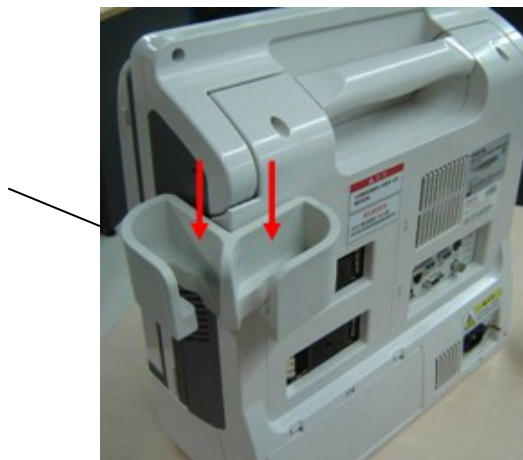
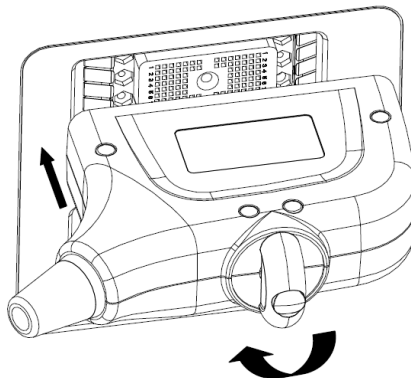


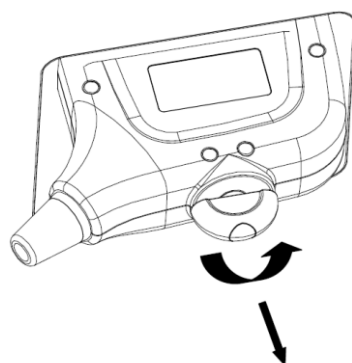
Figure 3-4 Installing the Probe Holder

### 3.3.5 Connecting a Probe

1. Check the probe connector, if it is not open, Turn the locking lever anticlockwise to open it.
2. Keep the cable toward probe holder and insert the connector into the port.
3. Turn the locking lever 90° clockwise in the horizontal position to lock the probe connector.
4. Place the probe properly to avoid being trod or wrapping with other devices. DO NOT allow the probe head to be hung freely.



5. To disconnect the probe, turn the locking lever 90° anticlockwise and pull the probe straight out.



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

## 3.4 Installing Peripherals

For the models of the supported peripherals, please refer to “2.1.3 Supported Peripherals”.

### 3.4.1.1 Footswitch Installation

1. Connecting: Take 971-SWNOM as an example: insert the USB connector to the system available USB ports (on the left and rear of the machine).then the footswitch can be used directly.
2. For settings of footswitch, please refer to 3.5.3 system preset.



Figure 3-5 Footswitch connection

### 3.4.2 Video Printer Installation

#### ◆ Analog video printer:

1. Connect one end of the signal line to the Video In interface of the printer, and the other to the video output port in the ultrasound system IO panel.
2. Connect the Remote control line to the Remote interface in the ultrasound system IO panel.
3. Insert the power cord to a power supply receptacle that is well grounded.



**Figure 3-6 Installing Analog Video Printer**

◆ Digital Video Printer

1. Connect one terminal of the data cable of the video printer to the USB port of the ultrasound system and the other terminal to the video input port of the video printer;
2. Insert the power cord to a power supply receptacle that is well grounded.
3. Please refer to 3.5.4 for the driver installation. And you need not install the driver of the printer listed in section “2.1.3”.

### 3.4.3 Installing a Graph / Text Printer

A graph / text printer is configured with power cord and data cable, and is connected to the system via the USB port. The connection method is described as follows:



1. Connect the data cable to the USB port in the ultrasound system.
2. Plug the power plug into a power supply receptacle that is well grounded.
3. Please refer to 3.5.4 for the driver installation. And you need not install the driver of the printer listed in section “2.1.3”.

### 3.4.4 Installing External DVD-R/W

1. Connect the USB cable connector of the external DVD recorder to the USB port in the ultrasound system;

2. Connect the power supply adapter plug of the DVD recorder to an appropriate receptacle that is well grounded.



Figure 3-7 Installing External DVD-R/W

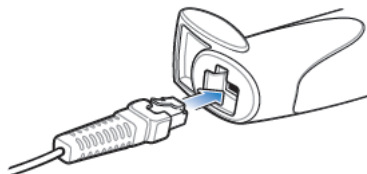
### 3.4.5 Installing Barcode Scanner

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

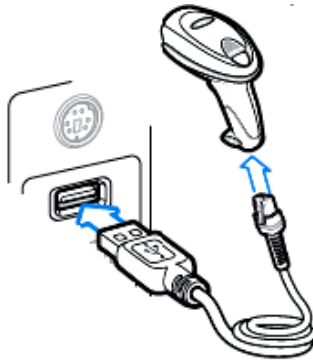
1. For structure of the scanner, see the figure below. The important parts are: LED indicator, scanning surface, and the switch.



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



3. Connect the other end of the cable to the USB port on the ultrasound system.



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



2D scanner



1D scanner

## 3.5 System Configuration

### 3.5.1 Power ON / OFF

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

When the AC indicator is green, you can turn on the power button (located at the upper right corner of the system) to initiate the system. After being normally rebooted, it will display image interface. Or press the power button directly when the battery is of sufficient capacity.

### 3.5.2 Enter Doppler

After the system is powered on after initiation (about 30S), it enters Doppler directly:





### 3.5.3 System Preset

1. Press the <Setup> key to enter the [Setup] menu.



2. Click <System Preset> to enter the screen as follows:

#### ◆ Region



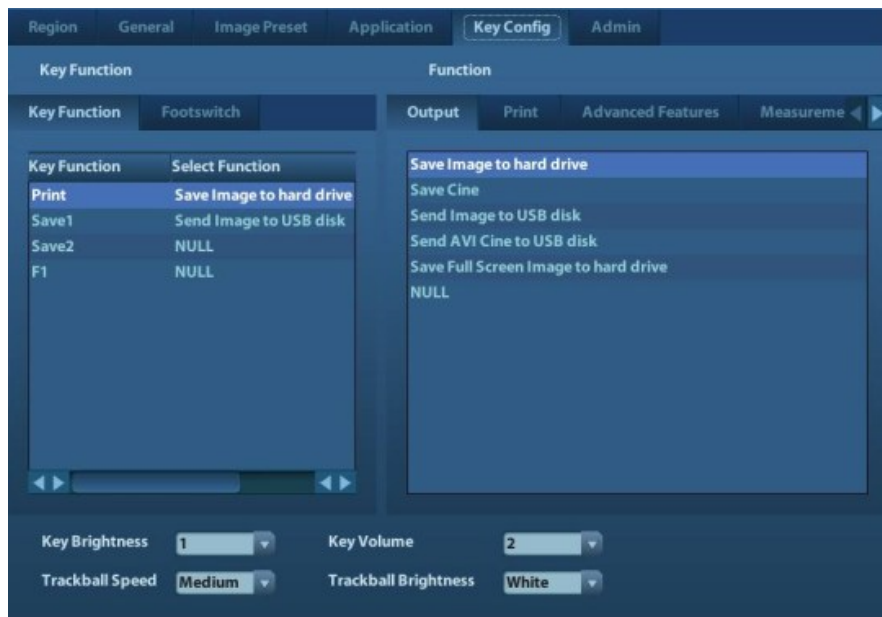
In the Region page, set the system language, date format, date, time and hospital related information, etc.

#### ◆ General

Click <System Preset> to enter:

In this page, set the time of standby, brightness/contrast and color temperature of display, etc.

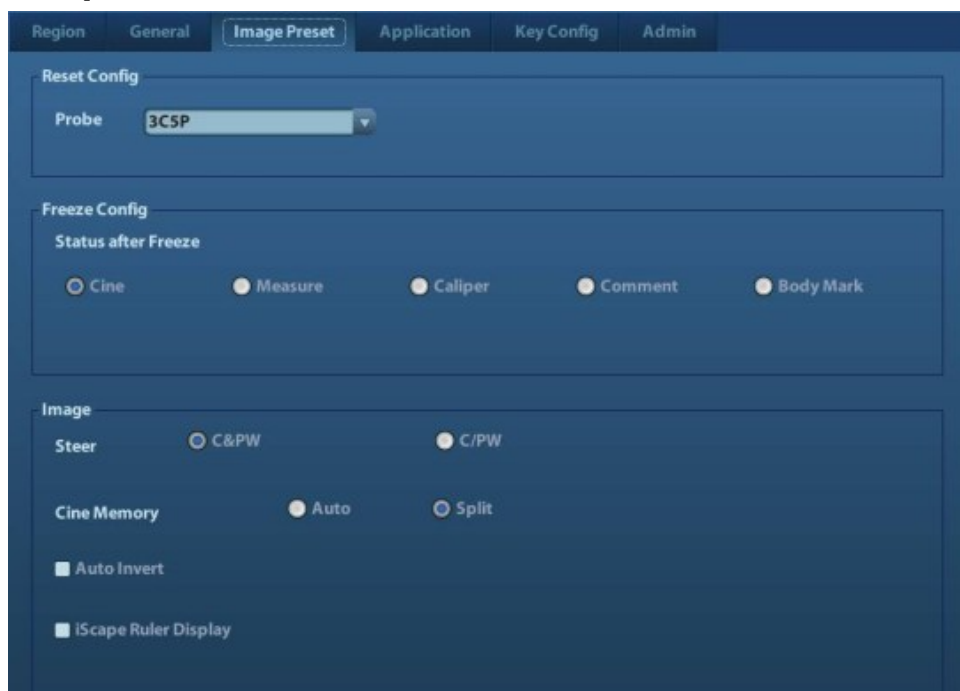
#### ◆ Key Config



- 1) Function of keyboard keys F1 and the footswitch keys (left, mid, right) are user-defined.
- 2) Key brightness, key volume, trackball backlight and trackball sensitivity can be adjusted.

#### ◆ Image Preset

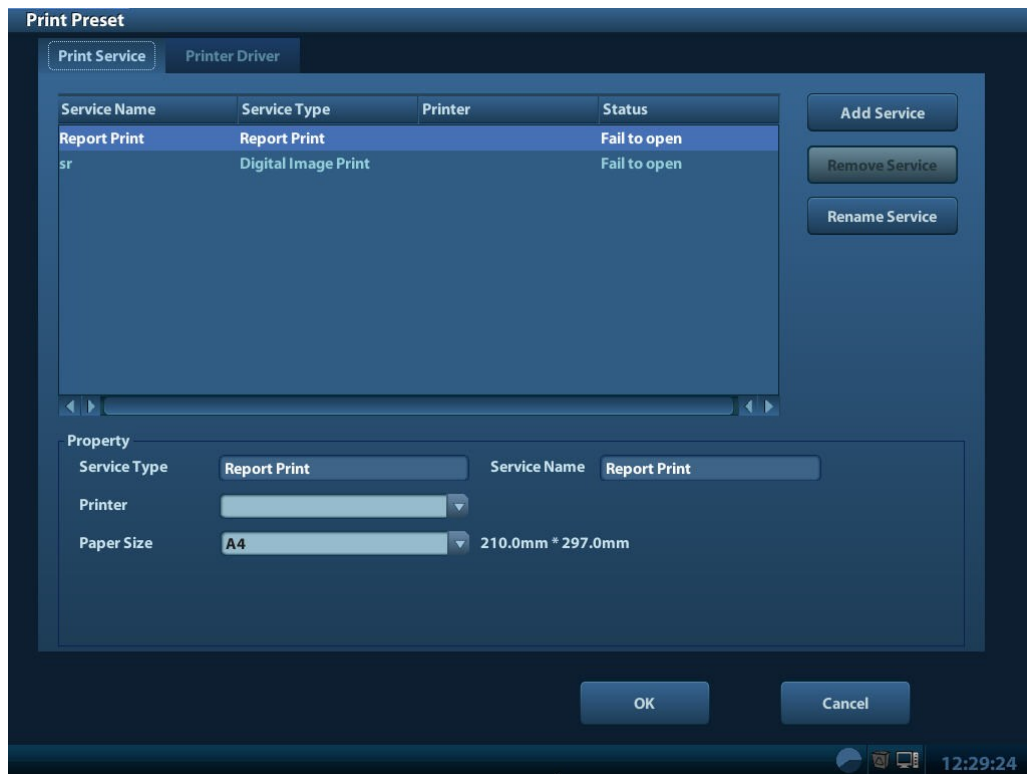
Click [Image Preset] to enter:



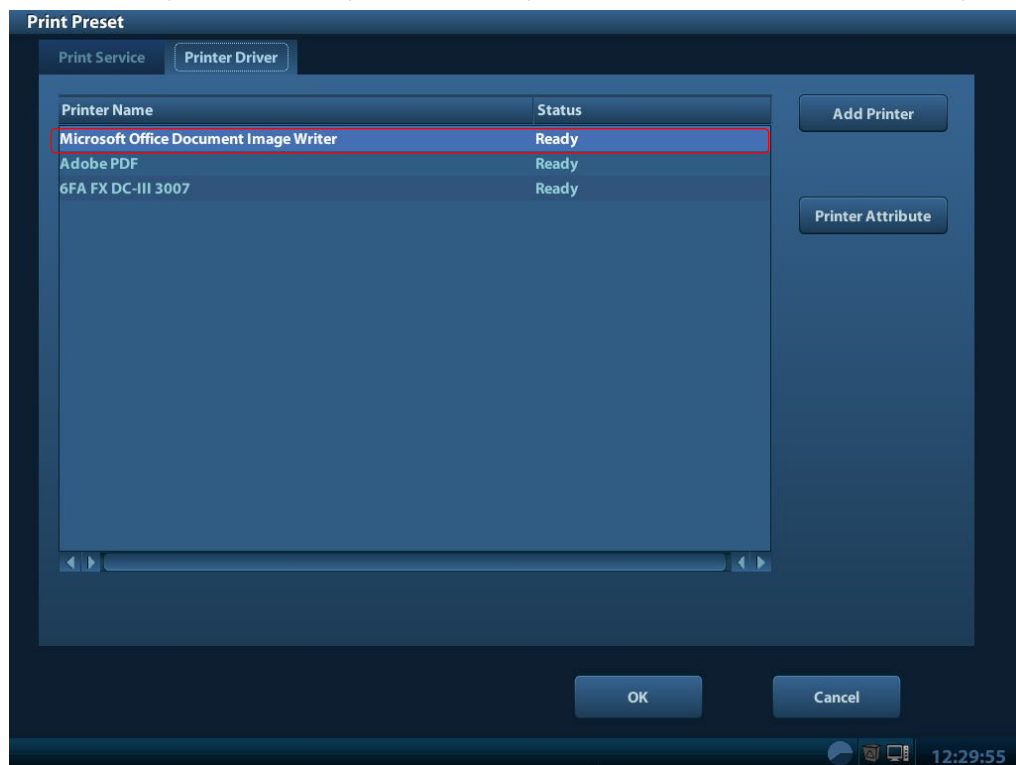
General image parameters can be set in this page.

### 3.5.4 Print Preset

1. Press <Setup> and click [Print Preset] to set video printer, graph/text printer parameters:



2. After connecting the local printer, Click “Printer Driver”, the system will display the printer name and status (Ready) automatically which already installed printer driver successfully.



3. Return “Printer Service” page, Select the corresponding service from the printer list and increase the service.

The system integrates drivers of HP printers, after HP printers are connected, drivers will be installed automatically (about 10s). If auto installation fails, icon will display on the right lower corner of the screen to warn you that manual installation is necessary. The driver installation method is as follows:

- a) Download the ppd file from HP official website (contact R&D engineer if necessary), and copy the ppd file to the storage device (USB disk as an example).
- b) Connect the U disk to the USB port nearside the control panel of ultrasound system, click the icon to pop up the screen, select the U disk to run the ppd file and finish the installation.

◆ Add network printer

1. In “Printer Driver” screen, click [Add Network Printer] to pop up the screen, enter the necessary information (IP address, shared printer name, server name, domain name and password).

**Step 1 of install net printer**

Printer Device Path

IP Address

Shared Printer Name

User And Password

User name

Workgroup

Password

2. After successful connection, the newly added network printer name will be shown in the printer driver list.

- NOTE:**
1. Before connect the network printer, make sure the ultrasound system and the printer are in the same network domain, and the network is working normally.
  2. The IP address and the server name should be valid, e.g. [\\10.2.40.123](#) or [\\5-HP](#), otherwise, the system will fail to connect.
  3. If the server has set accessing limitation, the system will prompt a dialogue box to identify the user. Enter the correct user name, domain name and password, and then click [OK].

## 3.5.5 Network Preset

### 3.5.5.1 Network Preset

Open “[Setup]→[Network Preset]” to enter the screen.

**Network Property**

Current Net Adapter: eth0

☐ DHCP ☒ Static

IP Address: XXX.XXX.XXX.XXX

Subnet Mask: XXX.XXX.XXX.XXX

Gateway: XXX.XXX.XXX.XXX

Apply

- 1) Please select the network type according the actually status, Select “DHCP”, click [OK].
- 2) Or, select “Static”, and input the IP address, subnet mask and gateway, then click [OK].

Name	Description
Current Network Adapter	To select the network connection mode
DHCP / Static	If "DHCP" is selected, IP address will be automatically obtained from DNS server; if "Static" is selected (using static IP address), you need to enter the IP address.
IP Address	IP address of the system should be at the same network segment with the server IP.
Subnet Mask	Used to set different network segment.
Gateway	Used to set the gateway IP.

### 3.5.5.2 DICOM Preset

**NOTE:** Only if DICOM basic option is configured, [DICOM Local], [DICOM Server], [DICOM Service] are available.

1. Click [DICOM Preset] to open the DICOM preset screen.

#### ➤ DICOM Setting

Enter the AE Title of the ultrasound system, port and PDU according to the actual situation, and then click [OK] to exit the screen.

- NOTE:**
1. AE Title should be the same with the SCU AE Title preset in the server (PACS/RIS/HIS).
  2. DICOM communication port in the ultrasound system should be the same with the one in the server.

#### ➤ DICOM Server Setting

- 1) Enter the device name and the IP address.
- 2) You can ping other machines to verify connection after entering the correct IP address. Also you can check the connection of the already added server in the list.

- 3) If connection is successful, click [Add] to add the service to the Service list.

**NOTE:** If the currently entered name has already existed, the system will pop up: “The server name exists!” Click [OK] to enter another name.

2. Click [DICOM Service] to open the DICOM Service screen.

The screenshot shows the 'DICOM Service' configuration window. At the top, there are tabs for 'Storage', 'Print', 'Worklist', and 'StorageCommitment'. The 'Storage' tab is active. Below the tabs is the 'Configure the New Service' section. It contains several input fields: 'Device' (a dropdown), 'Service Name' (a text field), 'AE Title' (a text field), 'Port' (a text field with '104' entered), 'Color Mode' (a dropdown with 'Color' selected), 'Compression Mode' (a dropdown with 'Uncompressed' selected), 'Compression Ratio' (a dropdown with 'Lossless' selected), 'Allow Multiframe' (a checked checkbox), and 'Max Framerate' (a dropdown with '35' selected). There is an 'Advanced Preset' button to the right of these fields. Below the configuration fields are three buttons: 'Add', 'Cancel', and 'Update'. Below these is the 'Service List' section, which contains a table with the following columns: 'Device', 'Service Name', 'AE Title', 'Port', and 'Default'. The table is currently empty. At the bottom of the window are four buttons: 'Delete', 'Default', 'Verify', and 'Verify Undo'.

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

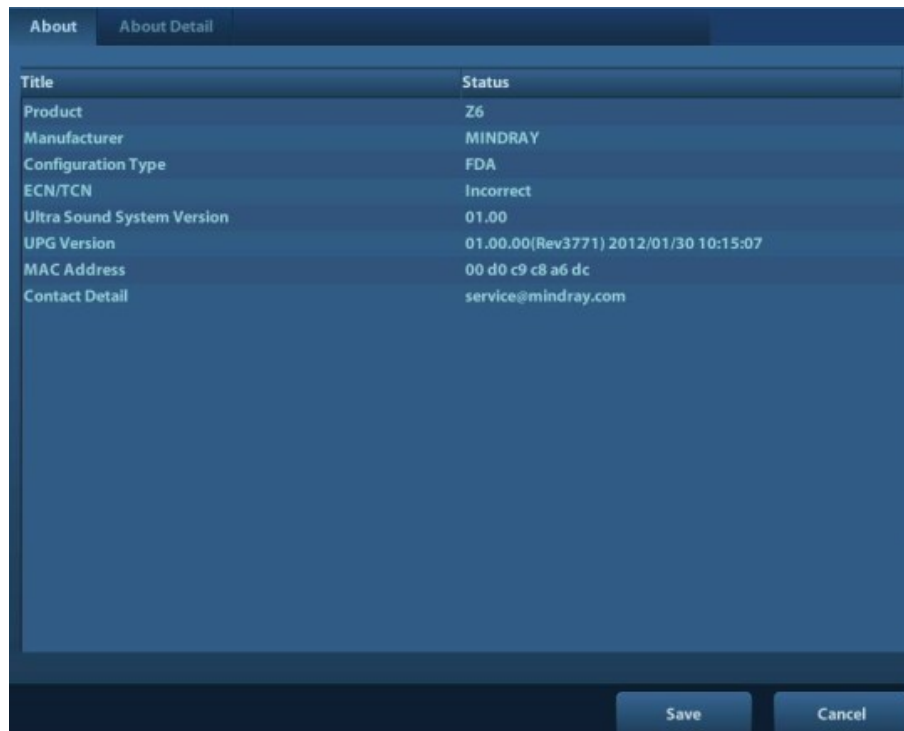
The DICOM Service Setting is used to set properties of DICOM services as Storage, Print, Work list, MPPS, Storage Commitment and Query/ Retrieve.

**NOTE:** DICOM Work list can be configured only after DICOM Basic is configured, and if DICOM Work list function is not configured, the “Work list” page is not accessible.

### 3.5.6 System Information

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

1. Press the <Setup> and click [System Info].



2. Click [About Detail] to check the detailed board information.

3. Click [Save] to export the information in the format of "\*.TXT"; click [Exit] to return to the Setup menu.

- |              |   |
|--------------|---|
| <b>NOTE:</b> | 1. Be sure to confirm the system information before and after the software maintenance. |
|              | 2. Ask the user to save the current system information if necessary.                    |

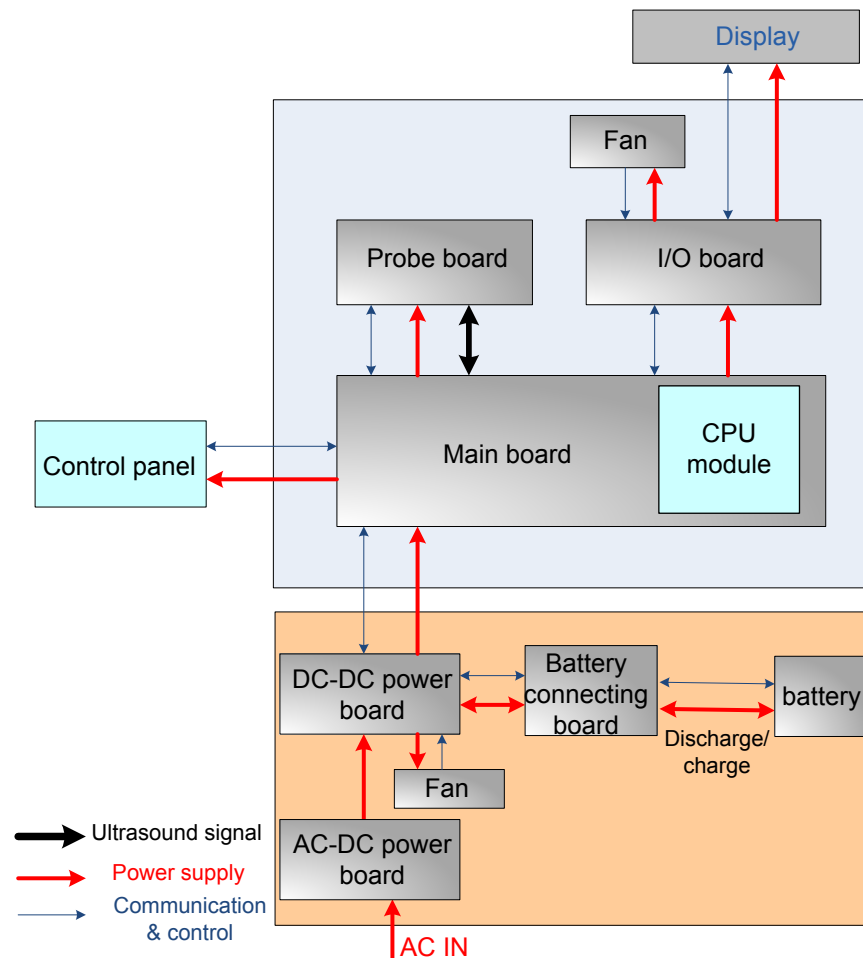




# 4 Hardware Principle

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## 4.1 General Structure of Hardware System



**Figure 4-1 Schematic Diagram of System**

As a portable black-and-white ultrasonic product, the system supports two probe slots. The difference between Z5 series and Z6 series is as follows.

Different Items	Z6 Series	Z5 Series	Remarks
Main board	64 transmitting/ receiving channels	32 transmitting/ receiving channels	Using the same PCB, different BOM Distinguishing system software by the board ID
Probe Board	Supporting 128-array, 192-array and bi-planar probes by using 156-pin probe port.	Supporting 80-array probe by using 96-pin probe port.	Probe boards of two series products are totally different, but the consistent interface definition of the main board.

The detailed structure of hardware system is in the figure above, and they can be divided into 4 modules:

- Main unit module
- Power supply module
- Monitor module
- Control panel module

The detailed description of 4 modules will be in the following:

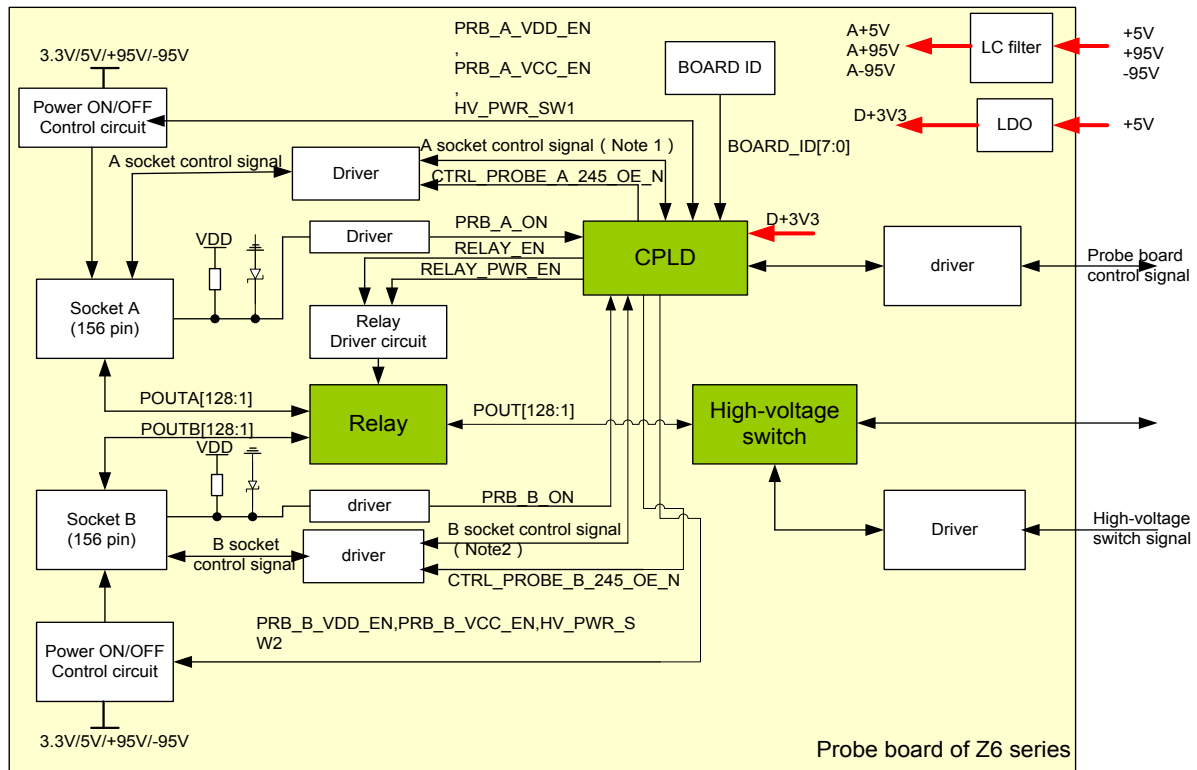
## 4.2 Main Unit

The main unit mainly involves 3 boards:

- Probe board
- Main board
- IO board

## 4.2.1 Probe Board

### 4.2.1.1 Probe Board of Z6 Series



Note:

1.A socket control signal:  
 PROBE\_A\_SPI\_CLK/CLK  
 PROBE\_A\_SPI\_CS/nLE  
 PROBE\_A\_SPI\_DIN/DATA0  
 PROBE\_A\_SPI\_DOUT/DP\_SWITCH  
 PROBE\_A\_SPI\_nWP/DATA1  
 PROBE\_A\_SPI\_SEL

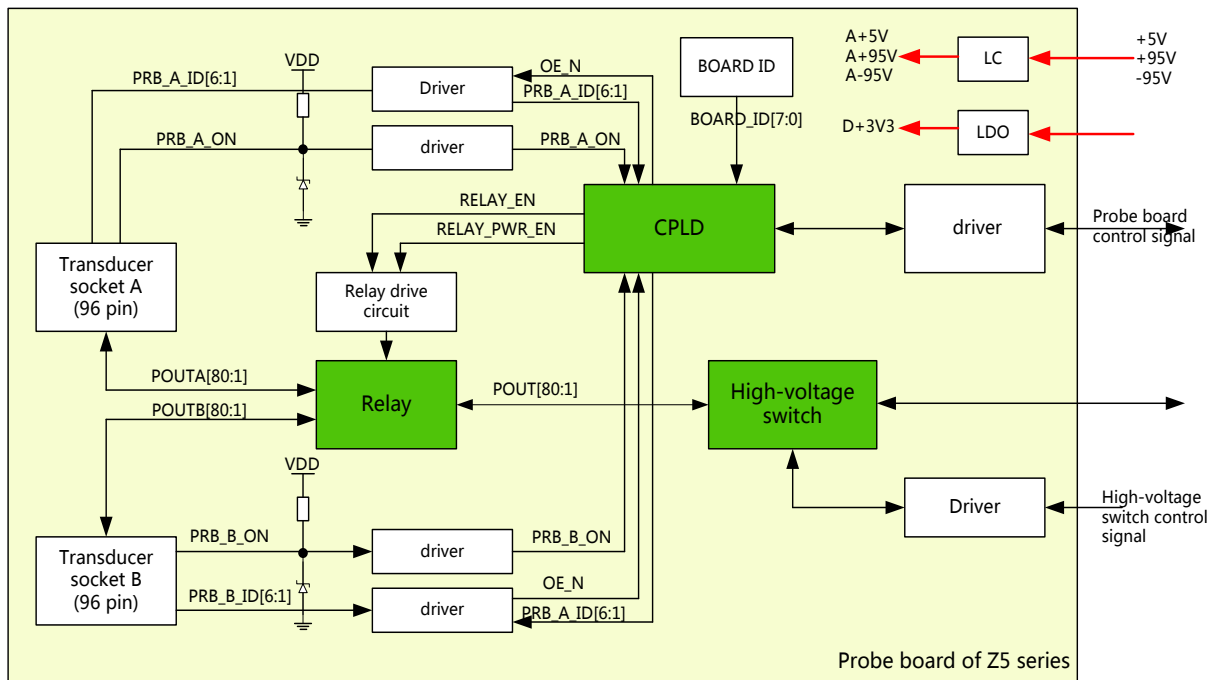
2.B socket control signal:  
 PROBE\_B\_SPI\_CLK/CLK  
 PROBE\_B\_SPI\_CS/nLE  
 PROBE\_B\_SPI\_DIN/DATA0  
 PROBE\_B\_SPI\_DOUT/DP\_SWITCH  
 PROBE\_B\_SPI\_nWP/DATA1  
 PROBE\_B\_SPI\_SEL

**Figure 6-3 Principle Diagram of Z5 Series' Probe Board**

The function of Z6 series probe board describes as following:

- The ultrasound signal is transferred from 64-channel to 128-array by the high-voltage switch on the probe board.
- Probe information could be obtained by probe board via reading probe online signal and probe ID.
- The probe board supplies power to corresponding Flash of saving probe ID when reading probe ID, and Flash power shuts off after getting probe ID.
- Support two 156-array probes (A and B), and only one probe could be chosen by relay switching on the probe board.
- Support 192-array probe and bi-planar probe.
- Support 192-array probe and bi-planar probe to work normally by 5v output of the probe board.
- The main board supplies  $\pm 95\text{v}$  output to 192-array probe and bi-planar probe to work normally.

### 4.2.1.2 Probe Board of Z5 Series



**Figure 6-3 Principle Diagram of Z5 Series' Probe Board**

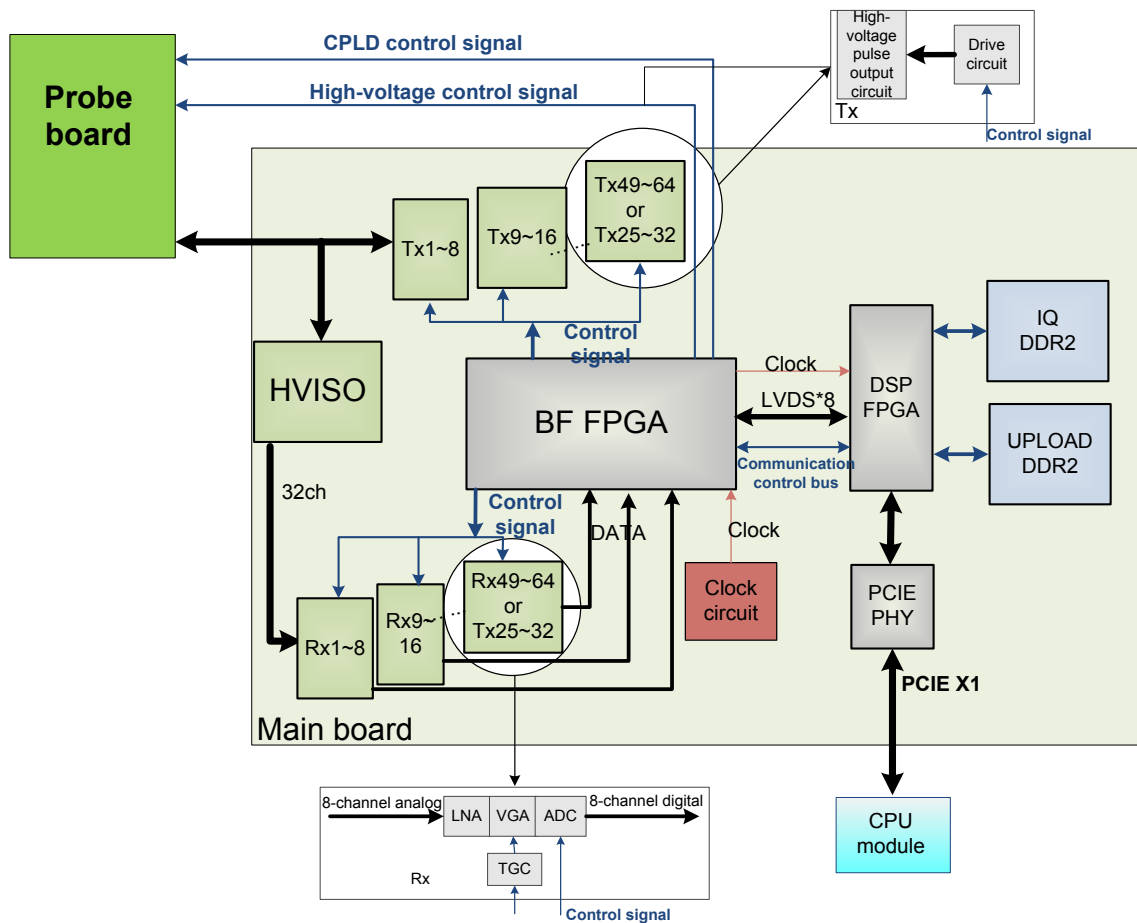
The function of Z5 series probe board describes as following:

- The ultrasound signal are transferred from 32-physical channel to 80-array by the high-voltage switch on probe board.
- Probe information could be obtained by probe board via reading probe online signal and probe ID.
- Support two 80-pin probes, and only one probe could be chosen to work by relay switching on probe board.

### 4.2.2 Main board

The main board could be divided into two parts: front-end of the main board and back-end of the main board.

#### 4.2.2.1 Front-end of main board



**Figure 4-4 Principle Diagram of Front-end of the Main Board**

As shown in the figure above, ultrasound front-end internal structure consists of ultrasound receiving module (Rx1~Rx64), ultrasound transmission module (Tx1~Tx64), high-voltage isolation module (HVISO), BF FPGA module, DSP FPGA module, PCIE\_PHY module and so on.

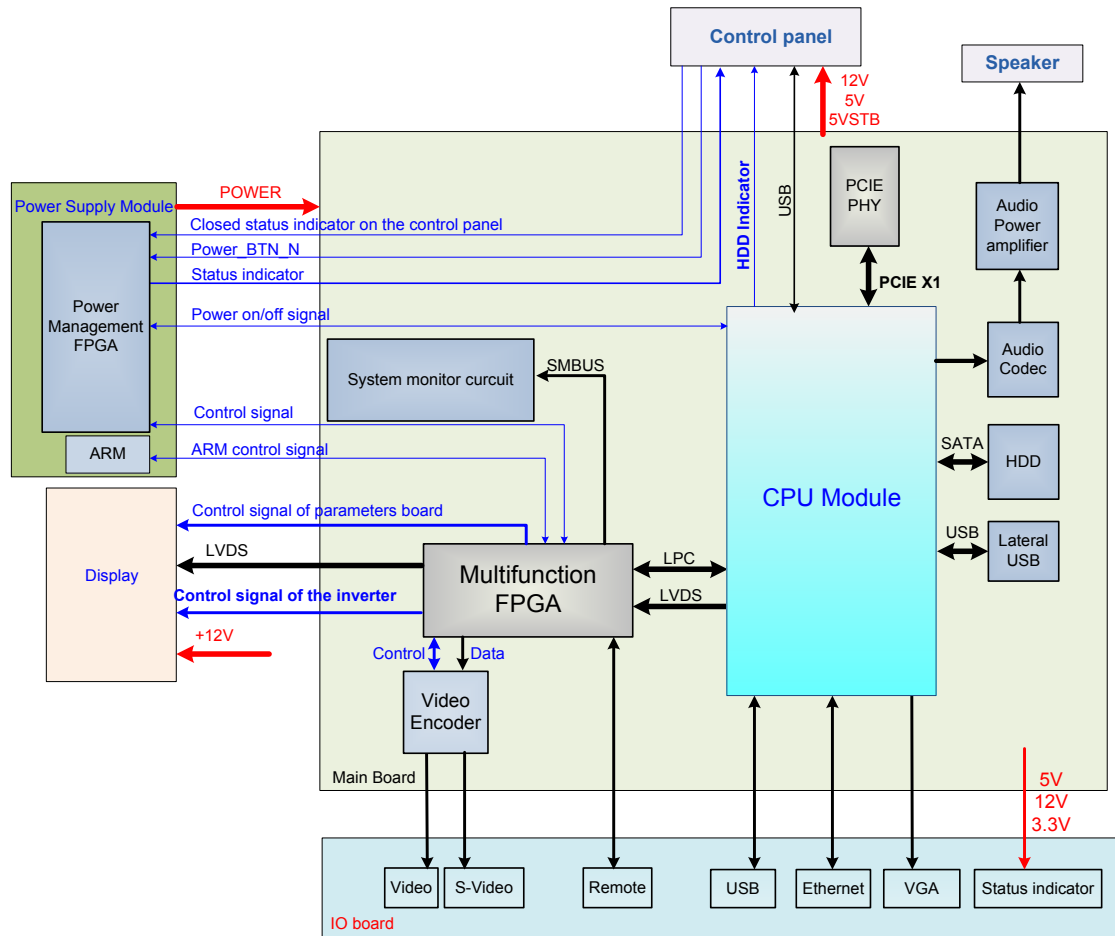
Ultrasound receiving module (Rx1~Rx32), ultrasound transmission module (Tx1~Tx32), high-voltage isolation module (HVISO) of Z5 series are half of Z6 series.

Function describes as following:

- Support 32/64-channel high-voltage isolation (HVISO) to protect ultrasound receiving module (Rx) to avoid ultrasound transmission high-voltage contamination.
- 32/64-channel transmission wave forms according to scanning time sequence and control parameters.
- 32/64-channel transmission wave forms to 32/64-channel high-voltage transmission wave by driver.
- Echo receiving LNA is to enlarge fixed gain.
- By the control of TGC, echo receiving carries out variable gain amplification by depth.
- 32/64-channel analog echo could be switched to 32/64-channel digital signal by ADC.
- BF FPGA combines 64-channel echo signal to output to DSP FPGA, and DSP FPGA is sent to signal processing to a single image which is uploaded to CPU module by PCIE\_PHY, then CPU module performs post processing.
- PCI\_PHY implements PCIE interface switching.
- BF FPGA can communicate with the CPU module through transferring DSP FPGA.

- The CPU module communicates with the probe board via BF FPGA.

#### 4.2.2.2 Back-end of Main Board



**Figure 4-5 The Schematic Diagram of Back-end of Main Board**

Back-end of main board is the core of back-end ultrasound system, which mainly includes back-end of main board, CPU module, IO interface board, monitor assembly and control panel. Mainly implements display interface, user's operation interface, power module controlling interface and all kinds of Peripherals Supported interface.

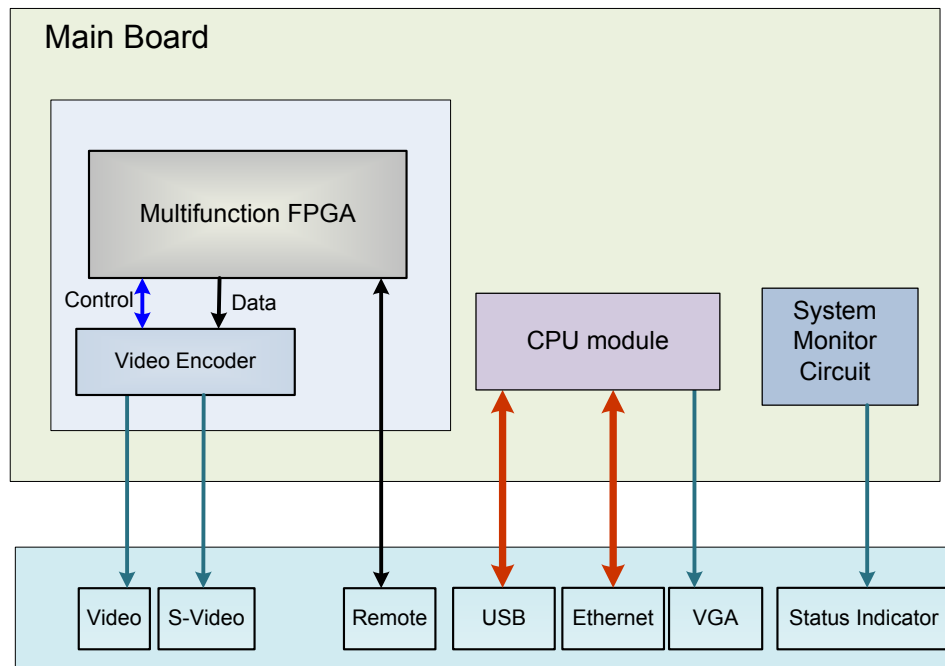
Also provides system monitoring, running status of the monitor system, indicator of system status and running status of the indicating system via LED.

Function describes as following:

- Back-end of main board connects to front-end of main board via PCIE PHY.
- The USB on the lateral of Main board is the output of the CPU module.
- The relevant signal in HDD of the main board is output of the CPU module.
- Back-end of the main board MUL FPGA implements display ports, it also supports display assembly, video and s-video interface of IO board.
- Multifunction FPGA on the back-end of the main board is to implement the REMOTE port on the IO panel.
- The CPU module implements interfaces including USB, Ethernet and VGA on the IO board.
- System monitor circuit connects Multifunction FPGA though smbus.
- Multifunction FPGA communicates with ARM by serial port to control transmission high-voltage, and also implements ARM update by serial port.

- FPGA on the power supply module implements the machine power on/off by the switch signal.
- Standby indicator, AC present indicator and working status indicator on the control panel are output by FPGA.
- The control panel implements communication with CPU module by USB.
- CPU output the audio signal to the speaker on the front cover of main unit, via audio coder and audio amplifier.

### 4.2.3 IO Broad

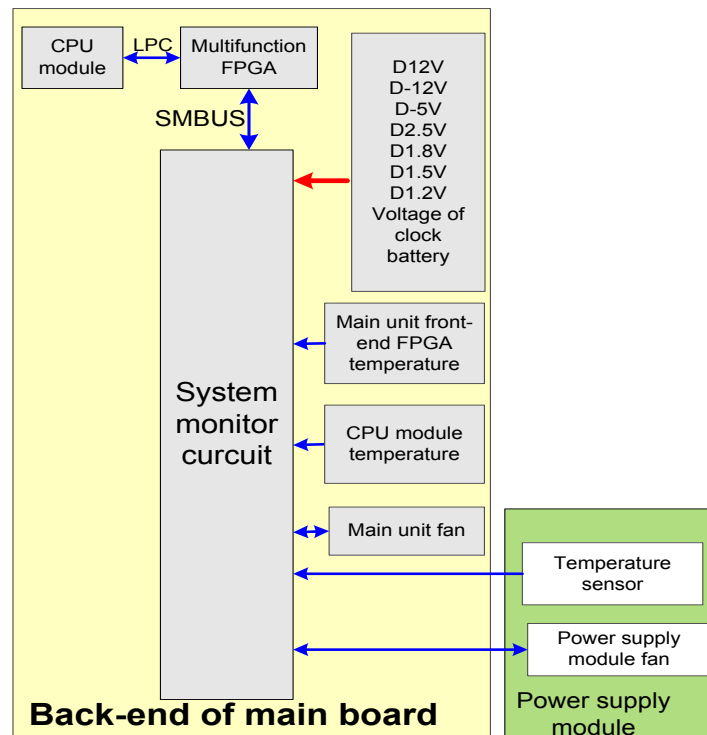


**Figure 4-6 Principle Diagram of IO Board**

IO board is connected to the main board via connectors in order to implement the user interface function and indicate if the power is normal.

- IO board supports Video and S-Video, and the two channels of signal get by Video Encoder driven by Multifunction FPGA.
- IO board supports REMOTE signal, which is obtained by Multifunction FPGA on the main board.
- USB signal, Ethernet signal and VGA signal on the IO board are obtained by CPU module output.
- Status indicators of IO board respectively refers to 12V, 5V and 3.3V powers are normally working.

## 4.2.4 Ultrasound System Monitor



**Figure 4-7 Principle Diagram of Ultrasound System Monitor**

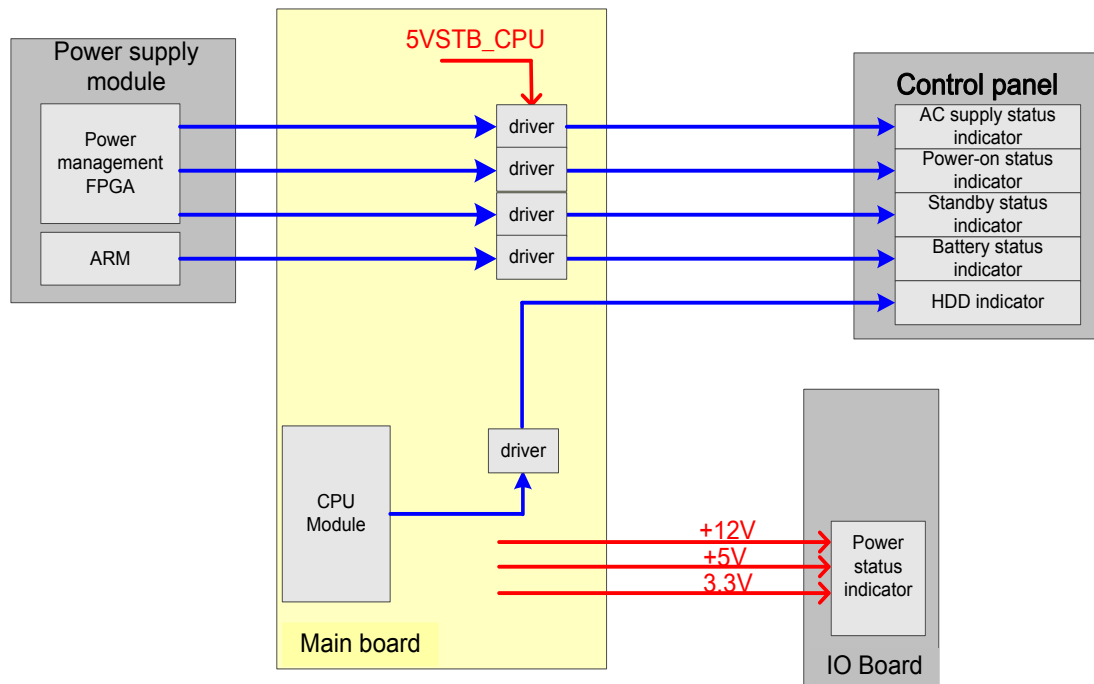
Ultrasound system monitor is mainly to monitor every voltage of interior machine and temperature.

Function:

- On the back-end of the main board, a special monitor IC is used to monitor signal voltages and clock battery power that are provided to the main board by the main unit box power supply module.
- The system temperature is detected in three positions: BF FPGA, CPU module and power supply module.
- Monitoring chips control the main unit fan and power supply module fan, and then read the fan rotating, which send to Multifunction FPGA by smbus, and to PC module by LPC bus.



## 4.2.5 Ultrasound System Indicator

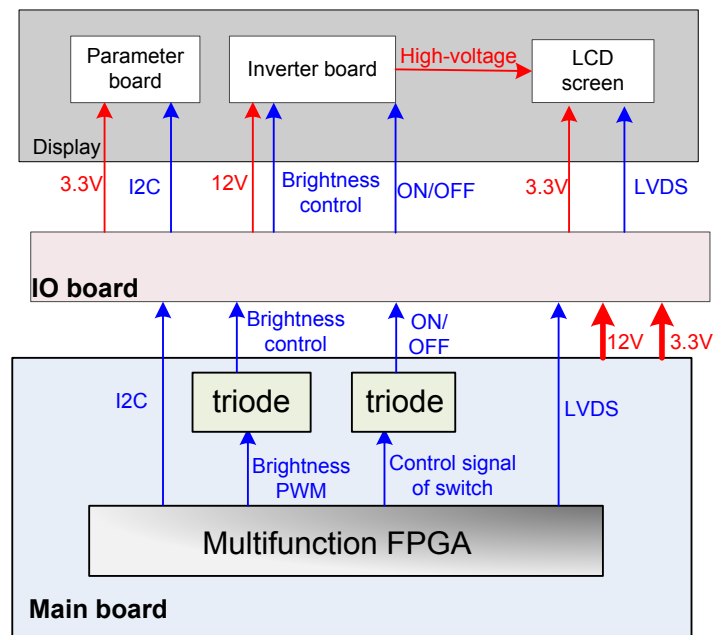


**Figure 4-8 Principle Diagram of Ultrasound System Indicator**

Function describes as following:

- There are four power status indicators on the IO panel: three are used for indicators of +12V, +5V and 3.3V output on the DC-DC power board, the other one is used for reserved indicator.
- There are five indicators on the control panel, in which power-on status indicator is below the power button.
- AC power-on status indicator control is output by the power management FPGA on the power module.
- The hardware indicator control is output by CPU.
- The status indicator of battery are controlled by the battery management ARM on the power module which driven by 5VSTB on the main board.
- The status indicators of power-on and standby are both generated by the battery management FPGA in the power module and driven by 5VSTB on the main board.

## 4.2.6 Display



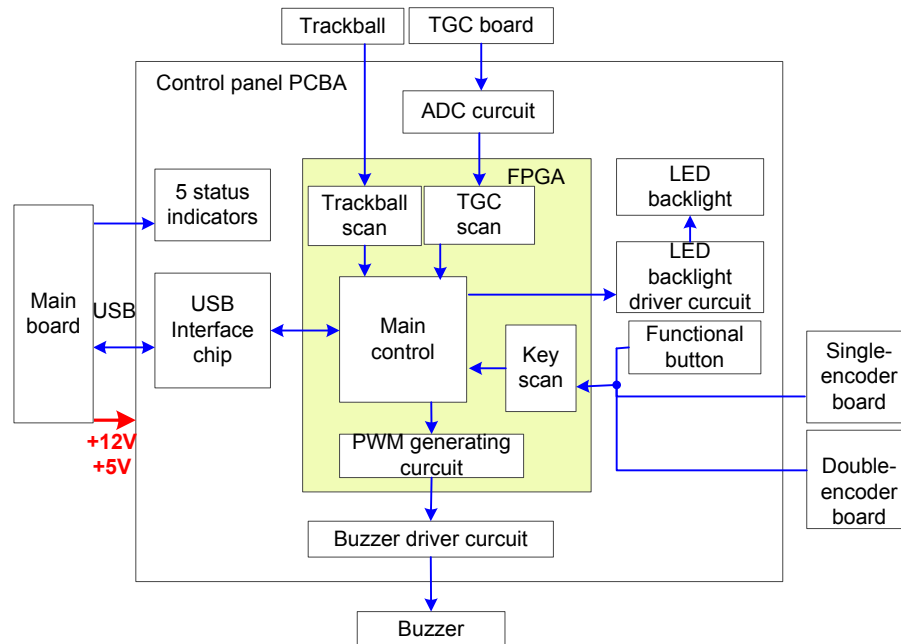
**Figure 4-9 Principle Diagram of Display**

Monitor mainly consists of the inverter board, LCD and the parameter board.

Function describes as following:

- The inverter board produces high voltage to illuminate backlight of LCD which is adjusted by signal control switch and brightness of the IO board output.
- Color temperature and Gamma correction data memory in parameter board used matches LCD so that the corresponding display effect shall be consistent.
- Multifunction FPGA generates switch control signal which drives triode to control inverter to open or shut off high-voltage output.
- Multifunctional FPGA generates PWM signal, which drives triode to control output high-voltage of the inverter to adjust the brightness of the display.
- Multifunctional FPGA outputs LVDS digital signal of display, which is sent to screen directly.
- Multifunctional FPGA communicates with parameter via I2C signal and supports to adjust parameters of display.

## 4.2.7 Control Panel



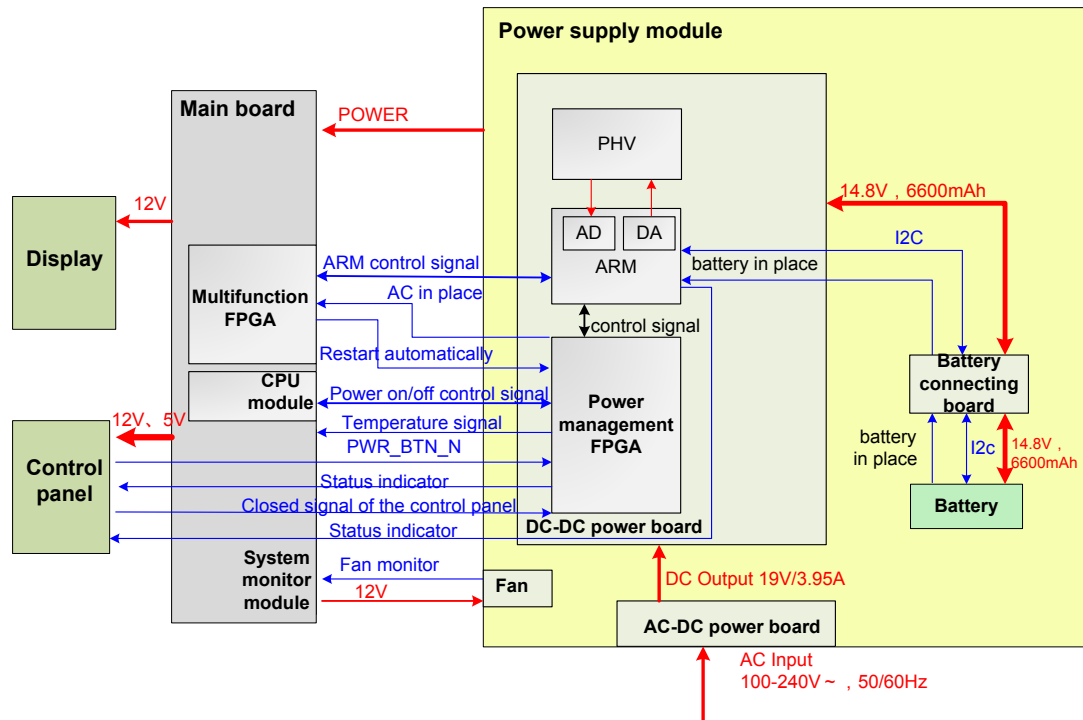
**Figure 4-10 Principle Diagram of Control Panel**

The control panel PCBA is the core of the control panel which comprises control panel PCBA, trackball, TGC board, encoder board and buzzer.

Function describes as following:

- FPGA is regarded the control panel as a main controller , key, single/dual-encoder, trackball and TGC.ect are basically scanned by FPGA; Key LED backlight and buzzers are both controlled by FPGA, and only when FPGA is normal can key LED backlight be on.
- Five indicators on the control panel are directly driven by interior of main unit.
- The control panel communicates with the CPU module by USB ports.

## 4.3 Power System



**Figure 4-11 Block Diagram of Power System**

The power supply configuration of the system describes as following:

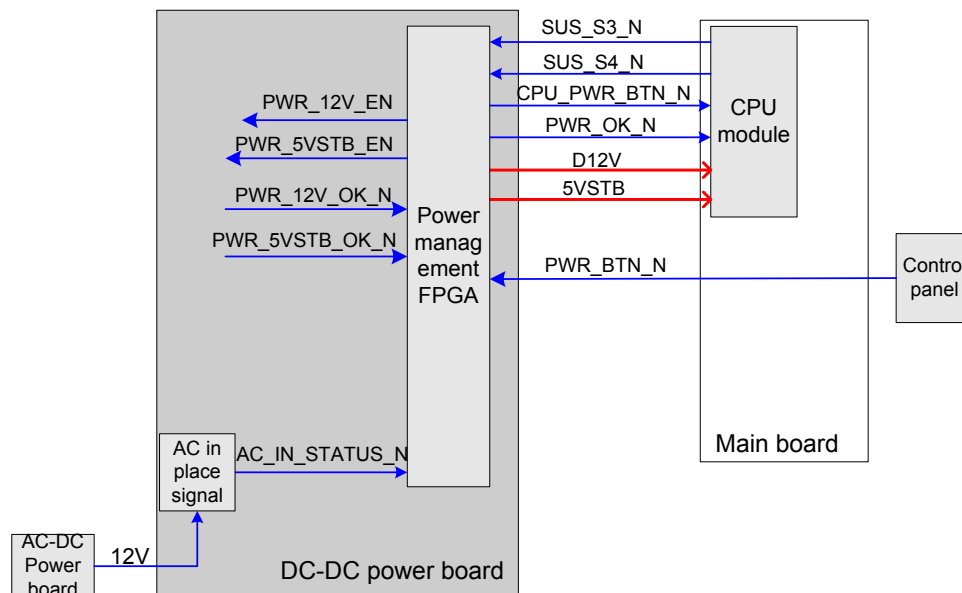
- The power supply module can be divided into AC-DC power board, DC-DC power board, battery and battery connecting board.
- High-voltage programmable ARM and power management FPGA are on the DC-DC power board.
- Power output by the power supply module is transmitted to main board, and then it is output to control panel and display by the main board.
- Battery is connected to the DC-DC board via the battery connecting board and connecting cable of BTB sequentially.

### 4.3.1 Power Output of the Power Supply module and Supporting Function Distribution

No.	Power description	Support circuit module or function	Remarks
1	+12V	CPU module, Display, Fan, Control panel	
2	-12V	No use	
3	+5V	HDD, Control panel, Front-end of main board, Probe board	
4	-5V	Front-end of main board	
5	5Vst	CPU module	
6	VDD	Front-end of main board, Back-end of main board, Display	

7	1V2	Back-end of main board (FPGA core voltage)	
8	1V8A	Front-end of main board (receiving chip)	
9	1V8	Back-end of main board ( video encoder, FPGA IO voltage , DDR2)	
10	2V5	Back-end of main board ( video encoder, FPGA IO voltage)	
11	+95V	Probe board (high-voltage switch)	
12	-95V	Probe board (high-voltage switch)	
13	+PHV	Transmitting high-voltage	
14	-PHV	Transmitting high-voltage	

### 4.3.2 System Power-on Control



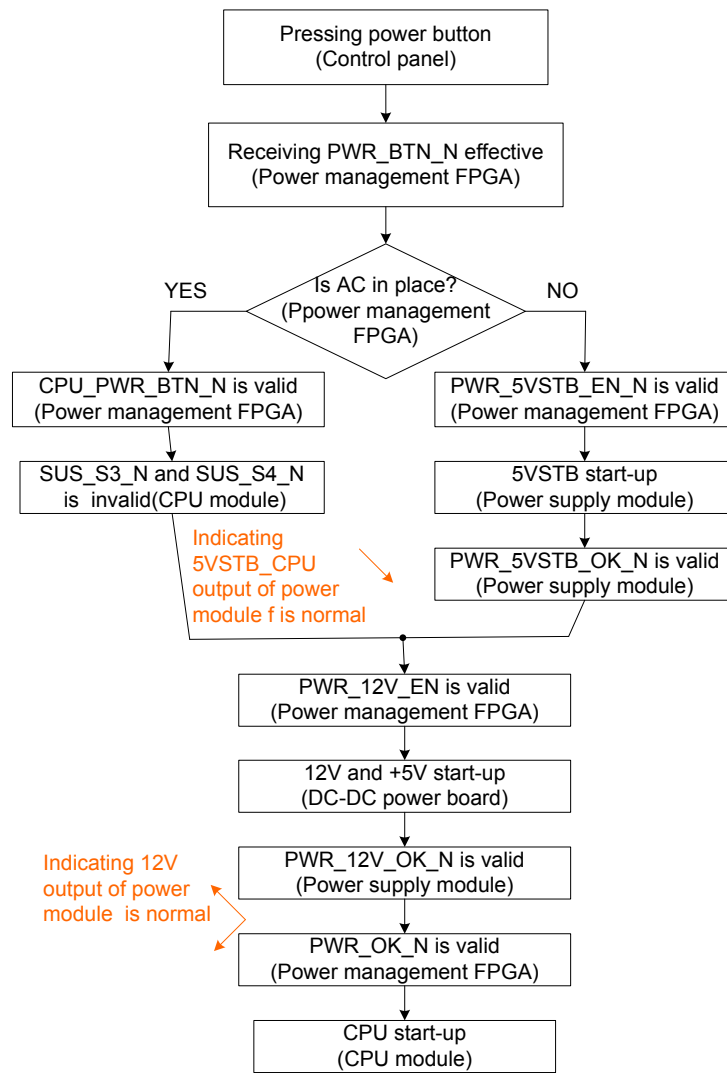
**Figure 6-12 Diagram of System Power-on Supported Circuit**

➤ Related controlling signal comment:

No	Controlling signal	Description	Remarks
1	PWR_BTN_N	The pulse generated by the power button on the control panel is sent to CPU module through power management FPGA, to power on the system.	
2	SUS_S3_N	CPU module output effectively represents that CPU system has been in the standby status, when 5VSTB which is controlled by power management FPGA is in the charging status.	
3	SUS_S4_N	CPU module output effectively represents that CPU system has been in the dormancy status.	
4	PWR_OK_N	The output of power supply module is transmitted to the CPU module by power management FPGA, which represents the +12V output of power supply module has been powered on.	

5	CPU_PWR_BTN_N	Power management FPGA is transmitted to CPU, which notifies CPU power on or power off.	
6	PWR_12V_EN	The output of power management FPGA is transmitted to the power supply module, which is used to control other power of the DC-DC power board except 5VSTB and 3V3STB to be power-on..	
7	PWR_5VSTB_EN	The output of power management FPGA notifies power to provide 5V standby power.	
8	PWR_12V_OK_N	Power status signal; indicate 12V power has been provided steadily.	
9	PWR_5VSTB_OK_N	Power status signal; indicate 5VSTB power has been provided steadily.	

- When battery and AC supply, the power supply module always maintains the 3V3STB output, and supports power management FPGA of the power module to be standby status.
- No matter the system is on when AC supply, Power management FPGA will always control DC-DC power board to output 5VSTB via PWR\_5VSTB\_EN\_N. However, when powered by battery, power management FPGA could control DC-DC power board to output 5VSTB through PWR\_5VSTB\_EN\_N if only users turn on the system via power button of the control panel.
- The detailed flow of power-on is shown as follows:



**Figure 4-2 System Power-on**





# 5 Function and Performance Checking Method

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## 5.1 Instruction

The chapter supplies the method to verify main function and performance of product. This is only used for reference, not preventive execution.

Function checking and testing of this part shall be carried out by Mindray service engineers and the user together.

## 5.2 Checking System Status

### 5.2.1 System Running Status

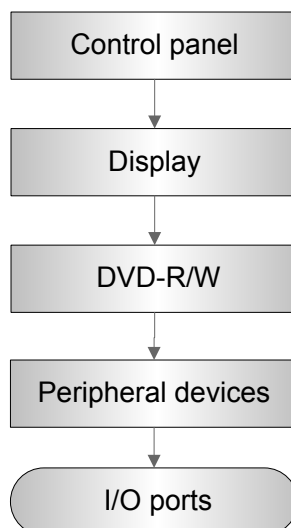
1. The ultrasound system can be turned on or off normally, working normally, no any abnormal noise and phenomenon appear when the system is running.
2. The fan starts to work as soon as the system is turned on, no any abnormal noise appear in process
3. Check basic system information such as product configuration, options, software version, etc. Confirm all the information is normal.
4. Check the preset of the monitor, such as contrast and brightness.
5. Check if the time and date are correct, if not, please preset them again.
6. Check the log together with the user to confirm any abnormality or occasional abnormalities when the system is running.

### 5.2.2 System Running Status

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.

## 5.3 General exam

### 5.3.1 Check Flow



### 5.3.2 Checking Content

#### 5.3.2.1 Check Control Panel

Procedure	Standard
Check the functions of all keys and knobs Follow the direction: left to right, and up to down.	All keys and knobs are effective.
Function checking of the trackball <ul style="list-style-type: none"><li>● Press the &lt;Freeze&gt; key to enter the Freeze status.</li><li>● Press &lt;Measure&gt; to enter into measure status, do vertical and horizontal measurement, or do other trackball operations.</li></ul>	The trackball can be rotated easily and smoothly, the cursor responds sensitively, the rotation direction is the same as the direction of the cursor.

#### 5.3.2.2 Check the Display

Procedure	Standard
<ul style="list-style-type: none"><li>● Adjust LCD brightness</li><li>● Adjust LCD contrast</li><li>● Display color temperature adjustment</li></ul> Click “Cold” or “Warm” in the [General] page in System Preset screen.	<ul style="list-style-type: none"><li>● Press “&lt;Fn&gt;+&lt; →&gt;”, the brightness increases; and press “&lt;Fn&gt;+&lt; ←&gt;”, the brightness decreases.</li><li>● Press “&lt;Fn&gt;+&lt; ↑&gt;”, the contrast increases; and press “&lt;Fn&gt;+&lt; ↓&gt;”, the contrast decreases.</li><li>● The LCD color temperature changes correspondingly.</li><li>● Click each functional button, the LCD responds correctly, the standard is as follows</li></ul>

<ul style="list-style-type: none"> <li>● LCD maintenance</li> </ul> <p>Log in as “Service”, click [Maintenance] in the Setup menu, then click [Monitor Test] to go for the monitor test.</p>	<p>1 .Light-spot: 0; flash point: 0.</p> <p>2. The adjoining dark dots are no more than 3 pairs, and there is no adjoining dark dot in image area.</p> <p>3. There is no adjoining dark dots of 3 or more than 3</p> <p>4. The dark dots are no more than 7 and those in the image area are no more than 2</p> <p>5. The distance between bad dots is no less than 5mm.</p> <p>Note: image area refers to the red the background is black/right.</p>
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### 5.3.2.3 Check DVD-R/W

Procedure	Standard
<b>DVD-R/W Drive</b> <ul style="list-style-type: none"> <li>● Check if connection is normal</li> <li>● Press &lt;Eject&gt; button on the drive</li> <li>● Perform DVD reading and writing.</li> </ul>	<ul style="list-style-type: none"> <li>● The DVD-R/W driver can be ejected smoothly.</li> <li>● Data reading and writing performs normally without abnormal noise.</li> </ul>

### 5.3.2.4 Check Peripheral Device

Procedure	Standard
<b>Footswitch:</b> Connect the footswitch connection, and check the functions of footswitch according to the functions listed in Key Config.	<ul style="list-style-type: none"> <li>● Press the freeze key (the right key), image is frozen, the freeze menu is displayed; press the key again, image is unfrozen.</li> <li>● Press the key (middle key), color printing starts</li> <li>● Press the print key (left key), B/W printing starts</li> </ul>
<b>Video Printer:</b> Check if the video printer and ultrasound system are correctly connected. Then check the function of each key.	<ul style="list-style-type: none"> <li>● Press &lt;Print&gt; key, the printer begins to work, no image print deficiency or degradation. Switch video output port</li> <li>● Press &lt;Print&gt; key, the printer begins to work, no image print deficiency or degradation.</li> </ul>
<b>Graph/ text Printer:</b> Check if the graph/text printer and ultrasound system are correctly connected. Then check the function of each key.	Press <Print> key, the printer begins to print, no print deficiency or degradation.
<b>bar Code scanner:</b> Perform code bar scanning when the ultrasound system is running normally.	The bar code is correctly displayed on the screen.

### 5.3.2.5 Check IO Ports

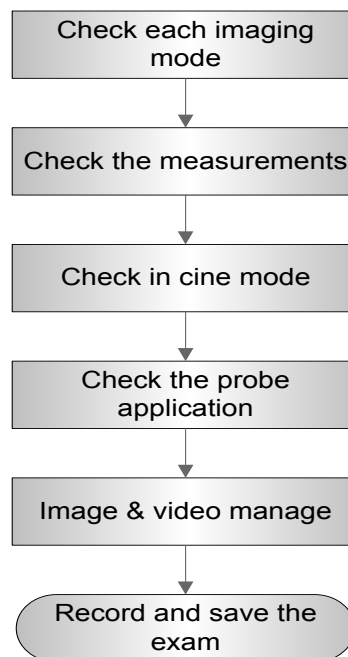
Procedure	Standard
Checking IO ports: Video/audio interface, USB	<ul style="list-style-type: none"> <li>● The contents displayed on the VGA/LCD are the same as</li> </ul>

port have been verified, remains are: <ul style="list-style-type: none"> <li>● VGA port</li> </ul> Connect VGA display <ul style="list-style-type: none"> <li>● Network port</li> <li>● USB port</li> </ul>	those displayed on the ultrasound system display, no character and image loss, no color difference, no fluttering and flicking. <ul style="list-style-type: none"> <li>● Smooth communication in both network and connection.</li> <li>● USB port data storage/accessing are normal.</li> </ul>
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## 5.4 Function Checks

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

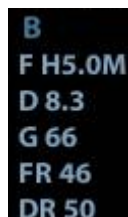
### 5.4.1 Check Flow



## 5.4.2 Checking Content

### 5.4.2.1 B Mode

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



B  
F H5.0M  
D 8.3  
G 66  
FR 46  
DR 50



Display	F	D	G	FR	DR
Image Parameters	Frequency	Depth	Gain	Frame Rate	B Dynamic Range

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

Adjustment	Items
Control Panel	Gain, Depth, TGC, iTouch, Focus, Frequency
Menu	Frequency, Acoustic power , Line Density, , ExFOV ,iClear, H Scale, Focus Position, Focus Number, Persistence, iBeam, Dynamic Range, TSI, Gray Map,Tint Map,L/R Flip, U/D Flip, Gray Invert , , , Lithotrity,FOV, iTouch, Biopsy Kit.

#### 1. Control Panel

Procedure	Standard
Press <B>	Enter B mode, and B image displays
Gain adjustment. Rotate <Gain/iTouch>	Rotate clockwise to increase Rotate anticlockwise to decrease The adjusting range is 0-100.The real-time value will be displayed in the image parameter area in the upper right corner of the screen.
Depth Adjustment Press <Depth/zoom> to light on the Depth indicator, rotate the knob	Rotate clockwise to increase Rotate anticlockwise to decrease The adjustable depth values vary depending upon the probe types.
TGC adjustment Adjust through the 8-segment toggles	Push the toggle to the right to increase the corresponding area brightness Push the toggle to the left to decrease the corresponding area brightness About 1.5s after the adjustment is finished, the TGC curve disappears.

Focus Position Adjustment Press <Focus/Freq./THI.> to light on the Focus indicator, rotate the knob	The focus position will change in correspondence with the knob rotates.
Frequency adjustment Press <Focus/Freq./THI.> to light on the Freq./THI indicator, rotate the knob	Rotate clockwise to increase Rotate anticlockwise to decrease “FR” will be changed relevantly.
iTouch Press <Gain/iTouch>	iTouch sign will be displayed in the image area to activate image effect auto optimization. Click [iTouch] on the image menu to adjust gain value in iTouch mode. Click [iTouch Brightness] on the image menu to adjust brightness in iTouch mode.
Image Magnification Press <Depth/zoom> to light on the Zoom indicator, rotate the knob	Rotate clockwise to zoom in the image (max. magnification factor is 10); rotate anticlockwise to zoom out the image. Roll the trackball to change position of the magnified image. Press <Zoom> in zoom status to exit the mode, the current window returns to the display before zoom.
Press <B>, and then press 	<ul style="list-style-type: none"> <li>● Enter dual mode, and the right image is activated</li> <li>● Press again to switch between the windows</li> </ul>
Press <B>, and then press 	<ul style="list-style-type: none"> <li>● Press 4 times, and 4 images will be displayed on the screen with only one image activated at one time</li> <li>● Press again to switch among the windows</li> </ul>
Press <B>	To enter single mode in multiple window mode, or to exit from other modes.

## 2. Menu

Procedure	Standard
Acoustic power B mode menu→ [A.power]	Click [A.power] and rotate the multifunctional knob to adjust. AP value is displayed in real time in the upper part of the screen. You should perform exams according to actual situation and follow the ALARA Principle.
Focus B mode menu→ [Focus Number]	Click [Focus Number] and rotate the multifunctional knob to adjust (B mode image has max. 4 focus ) The focus position symbol is displayed on the right side of the image.
FOV (Field of View) B mode menu-> [FOV]	Click [FOV] and rotate the multifunctional knob to adjust
Dynamic Range B mode menu-> [Dynamic Range]	Click [Dynamic Range]; rotate the multifunctional knob to adjust, the real time value will be displayed on the image parameter area in the upper right of the screen. As the dynamic range increases, the darker the image and the contrast, as well as the noise may increase.
Line Density	Click [Line Density], and rotate the multifunction knob to adjust the

B mode menu-> [Line Density]	parameter. The higher the line density, the higher the resolution, and the lower the frame rate.
iClear B mode menu-> [iClear]	Click [iClear] to adjust, off represents no iClear is turned on, and the bigger the value the stronger the effect. The bigger the value the more clearly the profile of the image.
B mode menu-> [U/D Flip]/[L/R Flip]	B mode menu-> [U/D Flip]/[L/R Flip] Click [Rotate] to adjust.

### 5.4.2.2 M Mode

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

M  
F H5.0M  
D 8.3  
G 94  
V 2  
DR 50

Display	V	IP 6	DR	G	F	D
Image Parameters	M Speed	M IP	M Dynamic Range	M Gain	M Frequency	Depth

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

Adjustment	Items
Control Panel	Frequency, Gain, TGC, Depth
Menu	Frequency, Acoustic Power Focus Position, Edge Enhance, M Soften, Speed, Dynamic Range, Gray Map, Tint Map, Display Format.

#### 1. Control Panel

Procedure	Standard
Press <M>	Press <M> on the control panel, and roll the trackball to adjust the sampling line.
Then press [M] again.	Press [M] on the control panel again to enter M Mode, then you can observe the tissue motion along with anatomical images of B Mode.
Press <Update>	To switch between the active B image and frozen B image.
Tips:	
a) Adjustment of the depth, focus position or TGC to the B Mode image will lead to corresponding changes in M Mode image.	
b) For details of other control panel adjusting parameters, please refer to descriptions in B mode	

#### 2. Menu

Procedure	Standard
Speed B mode menu-> [Speed]	Click [Speed], and rotate the multifunction knob to adjust the parameter. The lower the value the faster the refreshing.
Display Format M mode menu-> [Display Format]	There are 4 formats available for image display: L/R, V1:1, V1:2, Full.
Tips: a) During M Mode scanning, frequency and acoustic power of the probe are synchronous with that of B Mode. b) Refer to B mode for more details.	

### 5.4.2.3 Color Mode

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

F 2.5M  
 G 0  
 WF 59  
 PRF 0.4k

Display	F	G	WF	PRF
Image Parameters	Frequency	Color Gain	Color Wall Filter	Pulse Repetition Frequency

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

Adjustment	Items
Control Panel	Color Gain、Frequency、Depth、Steer, Scale
Menu	Frequency、Acoustic Power, Persistence, Line Density, Packet Size, Priority , B/C Align, Smooth, Wall Filter, Scale, Baseline, Invert, Color Map、Dual Live



### 5.4.2.4 PW Mode

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

PW  
F 2.5M  
WF 0  
G 0  
SVD 21.0  
SV 0.5  
PRF 18.0k  
Angle 0°

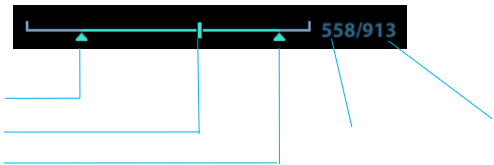
Display	F	G	WF	PRF	SVD	SV	Angle
Image Parameters	Frequency	PW/CW Gain	Wall Filter	Pulse Repetition Frequency	Sample Volume Depth	Sample Volume Size	Angle

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

Adjustment	Items
Control Panel	Gain、Frequency
Menu	Frequency, Acoustic Power ,Scale, Wall Filter, Speed, Duplex/Triplex, SV, Quick Angle, Angle, Invert, Baseline, Trace Area, T/F Res, Audio, Auto Calc, Auto Calc Cycle, Auto Calc Para, HPRF, Dynamic Range, Gray Map, Tint Map, Display Format

### 5.4.2.5 Cine Review

Procedure	Standard
<ul style="list-style-type: none"> <li>● Press [Freeze] key to freeze an image, and the [Cine] key indicator lights on. The system automatically enters the manual cine status.(Precondition: set "Status after Freeze" to be "Cine")</li> <li>● Press iStation, click [Review] or press &lt;Review&gt; to open the cine file</li> </ul>	<ul style="list-style-type: none"> <li>● Cine Review status</li> <li>● To enter cine auto cine review status.</li> </ul>
Roll the trackball	Manual cine review
Click image menu->[Auto Play]	Activate auto cine play status
Manually review the images until the frame which you want to set it as start point, and then click [Set First Frame] to set a start mark.	Set first frame:
Manually review the images until the frame which you want to set it as end point, and then click [Set End Frame] to set an end mark.	Set end frame
Click [Auto Play]	The cine is played within the setting region.
Then press the [Cine] key again.	Cine review stops
<ul style="list-style-type: none"> <li>● Press the &lt;Freeze&gt; key to defreeze the image.</li> </ul>	<ul style="list-style-type: none"> <li>● &lt;Freeze&gt; backlight is off, the image returns to the scanning process and exits</li> </ul>

<ul style="list-style-type: none"> <li>● Press &lt;ESC&gt; or &lt;Cine&gt;</li> </ul>	<p>cine review.</p> <ul style="list-style-type: none"> <li>● The images are still frozen but the system exits cine review.</li> </ul>
	

#### 5.4.2.6 Measurement

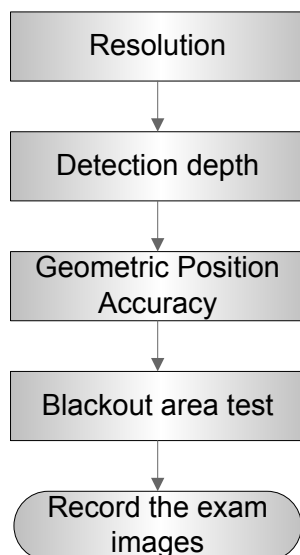
Procedure	Standard
<p>In B mode</p> <ul style="list-style-type: none"> <li>● Press &lt;Measure&gt;:</li> <li>● Press &lt;Caliper&gt; key</li> </ul>	<ul style="list-style-type: none"> <li>● Enter the application measurement mode.</li> <li>● Enter the general measurement mode.</li> </ul> <p>Click any 1-2 measurement items, the measurement results will be displayed below the image</p>
Press <ESC> or the same key again.	Exits measurement.
Perform similar operations in other modes	Application measurement functions are related to certain application software packages.

#### 5.4.2.7 Patient Information Management

Procedure	Standard
Press <Save1/2> in image scanning process (preset already).	The image will be saved to corresponding patient database and the saving icon will be displayed in the right of the screen.
<ul style="list-style-type: none"> <li>● Press &lt;Review&gt;</li> <li>● Click [Exit] on the Review screen; or press &lt;Review&gt; or &lt;ESC&gt;.</li> </ul>	<ul style="list-style-type: none"> <li>● To enter Review:</li> <li>● To exit Review:</li> </ul>
Press <iStation> to enter Patient information management (iStation page)	<p>Saved images and information for the patient can be checked here, and you can:</p> <ul style="list-style-type: none"> <li>● Backup/ Restore</li> <li>● Send to (DICOM or network storage)</li> </ul>

## 5.5 Performance Test

### 5.5.1 Test Process



### 5.5.2 Test Content

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

#### Requirements:

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

#### Tips:

For the testing phantoms, please refer to Appendix B.

#### 5.5.2.1 Resolution

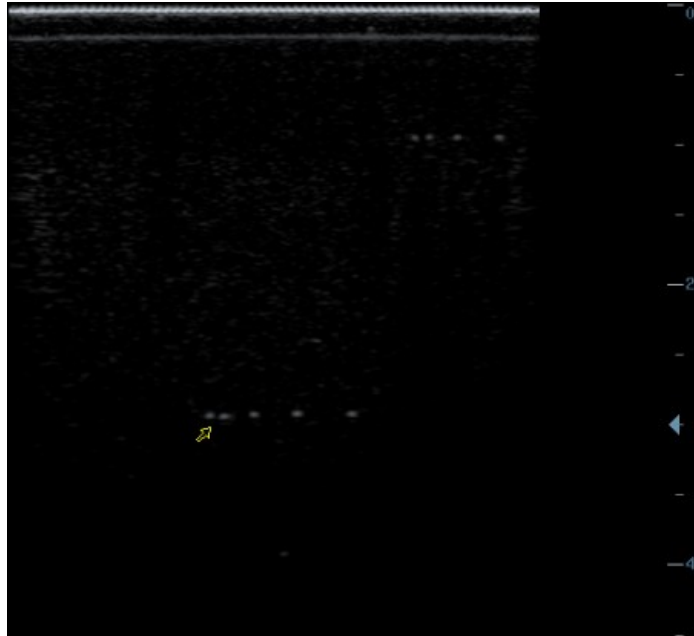
##### ■ transverse resolution

##### Test Step:

1. Cover the scan surface of the phantom with water or couple gel, gently contact the probe with the scan surface, making the transverse resolution testing targets to be displayed around the midline of the image.
2. Adjust the focus point focuses at the position where the transverse resolution testing targets are displayed.
3. Adjust parameters like gain, dynamic range, TGC, making the background tissue unseen, just displaying the target image clearly.

4. In condition that the transverse resolution testing targets are horizontally displayed, record the minimal distance of two targets that can be clearly recognized.
5. Repeat the operation above for the transverse resolution testing targets at other depths.

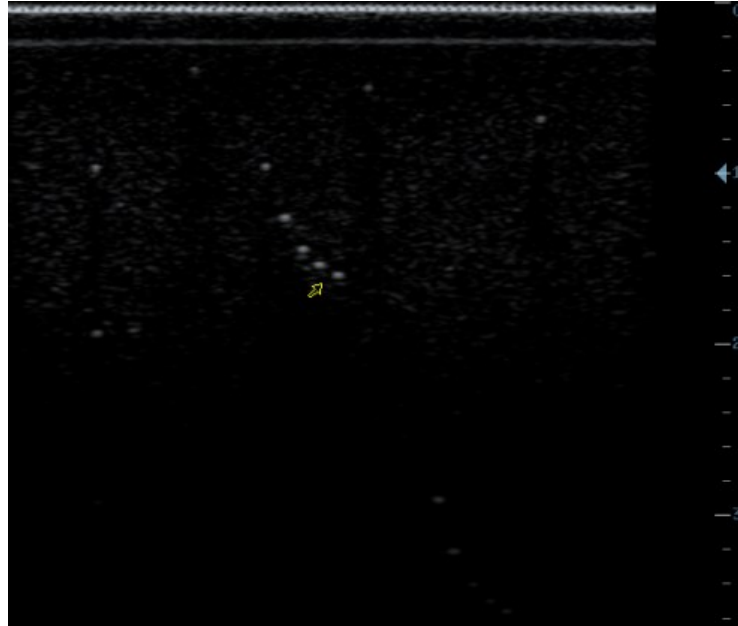
As shown in figure below.



#### ■ Axial resolution

Test Step:

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



**NOTE:**

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

### 5.5.2.2 Maximum Depth

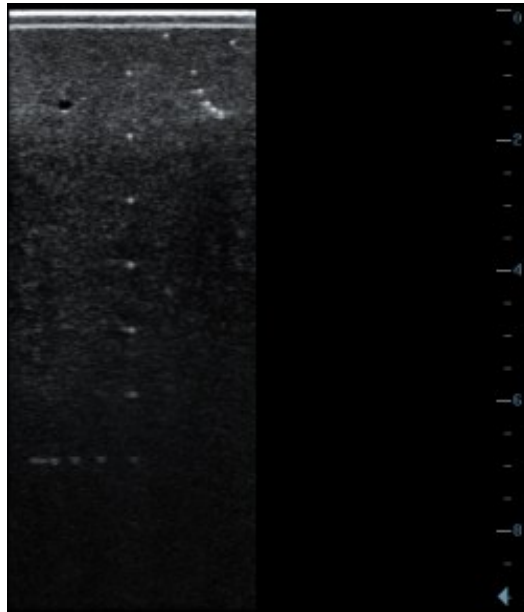
Test Step:

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

**NOTE:**

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

As shown in figure below.



### 5.5.2.3 Geometric positioning accuracy

#### ■ Longitudinal geometric positioning accuracy

Test Step:

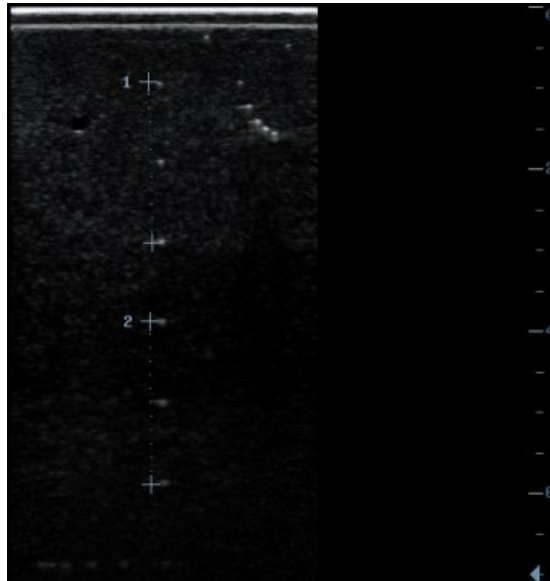
1. Do adjustments as the way in testing the maximum depth.
2. Record the distance by 20mm each segment on the longitudinal targets line using the measurement caliper;
3. Select the value with the greatest error (to 20mm), calculate the accuracy using the formula below

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

#### **NOTE:**

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

As shown in figure below.



■ Transverse geometric positioning accuracy

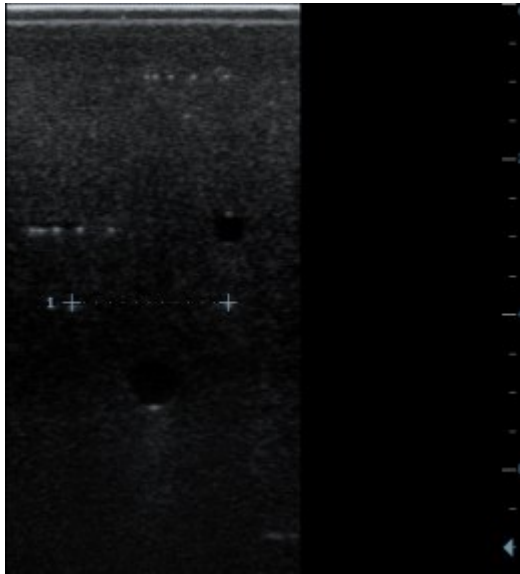
Test Step:

1. Cover the scan surface of the phantom with water or couple gel, gently contact the probe with the scan surface
2. Adjust the depth, making the transverse targets to be displayed in the image.
3. Adjust the focus point to be posited beside the transverse targets (the standard is not clear)
4. Adjust parameters like gain, TGC, making each transverse targets to be clearly displayed.
5. Record the distance by 20mm each segment on the transverse targets line by using the measurement caliper
6. Select the value with the greatest error (to 20mm), calculate the accuracy by using the formula below

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

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

As shown in figure below.



#### 5.5.2.4 Blackout Area

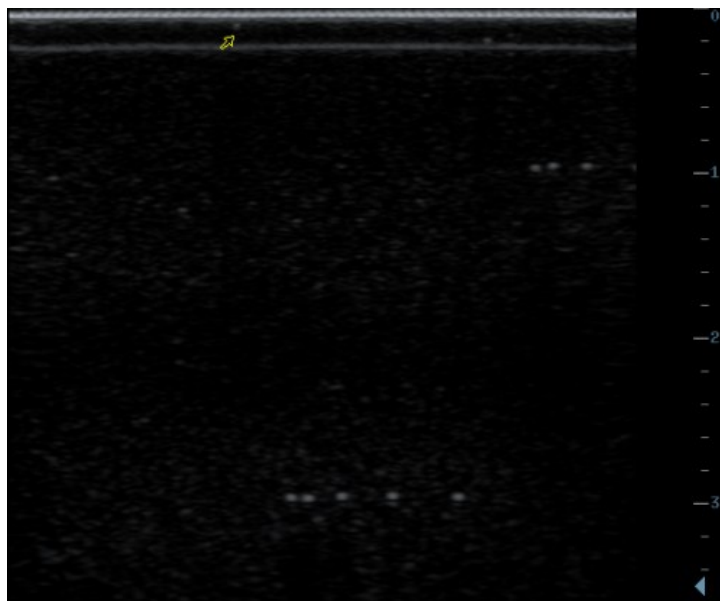
Test Step:

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

**NOTE:**

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

As shown in figure below.





# 6 Software Upgrade and Maintenance

---

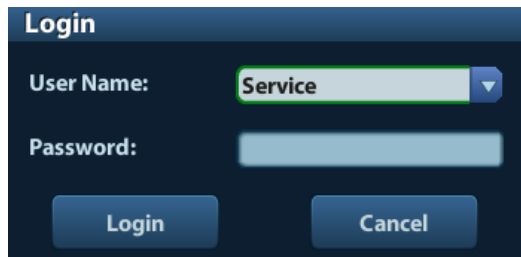
**⚠ WARNING:** DO NOT directly remove a USB memory device; otherwise, the USB memory device and / or the system may be damaged.

## 6.1 Enter the Maintenance Window

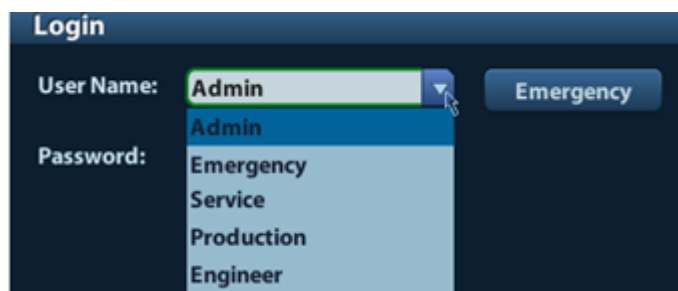
**NOTE:** Log on the system with the identity of Service before perform system maintenance.

To log on the system:

1. When access control function has not been activated: press “Ctrl+” to show the Login dialogue box, and then select the Service as the user name.

A screenshot of a 'Login' dialog box. It has a dark blue header with the title 'Login'. Below the header, there are two fields: 'User Name:' and 'Password:'. The 'User Name:' field is a dropdown menu with 'Service' selected and highlighted. The 'Password:' field is a text input box. At the bottom, there are two buttons: 'Login' and 'Cancel'.

2. When access control function has been activated already: press “Ctrl+” when the Login dialogue box is displayed, and then select the Service as the user name.

A screenshot of a 'Login' dialog box. It has a dark blue header with the title 'Login'. Below the header, there are two fields: 'User Name:' and 'Password:'. The 'User Name:' field is a dropdown menu with 'Admin' selected. A list of options is displayed below the dropdown: 'Admin', 'Emergency', 'Service', 'Production', and 'Engineer'. The 'Password:' field is a text input box. To the right of the dropdown menu, there is a button labeled 'Emergency'.

3. Press <Setup> key to open the Setup menu, click [Maintenance] and then select the target items to perform the maintenance respectively.



## 6.2 System Software Installation/ Restoration



### **WARNING:**

1. Back up the patient data and preset data before restoring the system.
2. Do not cut off, shut down or restart the system during system restoring.

### 6.2.1 Restore the Operating System and Doppler

#### 6.2.1.1 Preparation before Restoring

1. Back up preset data and patient data.
2. USB disk requirement:
  - a) Volume of USB disk should be more than 2G.
  - b) The system supports only FAT or FAT32 format USB disk.
  - c) If there are many drives in USB disk, installation may fail.
  - d) Disconnect the extra USB devices to the machine.

#### 6.2.1.2 Method

The operation system ("OS" for short) adopts Linux kernel and uses USB disk to install. You can install the ultrasound software to the hardware when installing the operation system.

1. Copy files of the system restoration package (including operation system and Doppler) to USB disk root, and make sure that all the files of Doppler restoration package are within the Doppler file.

- NOTE:**
1. The restoration package must be copied to USB disk root, or else it may cause to failure of restoration;
  2. Please check all the files in the restoration package when copying, or else copy the package again.

2. Insert the USB disk to the ultrasound machine.
3. Power on the machine, press the button to start, and press <F1> immediately, and when the "Mindray eRescue" displays on the screen, stop pressing F1 to enter system installation program.

```
Ready to install system, please wait .....
1. Install system with keeping user's data.
2. Install system without keeping user's data (format all disk)
3. Human version converts to vet version, or ver versino converts to human vers
ion.
please enter your choice[1, 2, 3, or q=quit(defalut)]:
```

4. Select the installation operation to enter. Enter the corresponding method (1, 2,3 or q) and press <Enter>.

Option	Display	Note
1	1.Install system with keeping user's data	Start the OS restoring directly, user data will be kept when finished.
2	2. Install system without keeping user's data (format all disk)	The HDD will be formatted and all data will be erased at first, then start the OS restoring.
3	3.Human version converts to vet version, or vet version converts to human version	It is only used for implementing the conversion between human and vet version and all data will be erased (only applied for service restoration package)
q	quit	Exit, The system does nothing and restarts.

5. Screen prompts:
  - If you enter q, the screen displays as below:

```
Ready to install system, please wait .....
1. Install system with keeping user's data.
2. Install system without keeping user's data (format all disk)
3. Human version converts to vet version, or ver versino converts to human vers
ion.
please enter your choice[1, 2, 3, or q=quit(defalut)]:
q
System will reboot, press ENTER to continue.
```

- If you enter 1, the screen displays as below:

```

Ready to install system, please wait .....

  1. Install system with keeping user's data.
  2. Install system without keeping user's data (format all disk)
  3. Human version converts to vet version, or ver versino converts to human vers
ion.
please enter your choice[1,2,3, or q=quit(defalut)]:
1
formatting disk....

Installing system, please wait .....
...
..Probing devices to guess BIOS drives. This may take a long time.
...

System has been installed successfully!
System will reboot, press ENTER to continue.

```

- If you enter 2 and press <Enter>, the system will ask the user to confirm if to delete all data, enter “Y” and the system performs formatting and then goes to installation.

```

Ready to install system, please wait .....

  1. Install system with keeping user's data.
  2. Install system without keeping user's data (format all disk)
  3. Human version converts to vet version, or ver versino converts to human vers
ion.
please enter your choice[1,2,3, or q=quit(defalut)]:
2
ALL DATA on disk will be DELETED, are you sure? [Y/N]

```

If you enter N here, the installation is stopped, and the system remains unchanged.

```

Ready to install system, please wait .....

  1. Install system with keeping user's data.
  2. Install system without keeping user's data (format all disk)
  3. Human version converts to vet version, or ver versino converts to human vers
ion.
please enter your choice[1,2,3, or q=quit(defalut)]:
2
ALL DATA on disk will be DELETED, are you sure? [Y/N]
n
It seems that you are not so sure, you can try again later.
System will reboot, press ENTER to continue.

```

- If you enter 3 and press <Enter>, the system will implement the conversion between human and vet version.

<b>Note:</b>	Please select the method “3” to install the operation system only when human version converts to vet version or vet version converts to human version.
--------------	--

The system will check if the conversion is passed before installing. Only when the service restoration package type named “Doppler” in the U disk which is different from the model (for example, human model with vet restoration package or vet model with human restoration package), the conversion can be passed and installation will continue.

If conversion is passed, the system will ask user to confirm again.

```

Ready to install system, please wait .....

1. Install system with keeping user's data.
2. Install system without keeping user's data (format all disk)
3. Human version converts to vet version, or ver versino converts to human vers
ion.
please enter your choice[1, 2, 3, or q=quit(defalut)]:
3
ALL DATA on disk will be DELETED, are you sure? [Y/N]

```

Other steps are the same as method “2”.

When enter 3 and press <Enter>, if the model type is the same as service restoration package (for example, human model with human restoration package or vet model with vet restoration package), the conversion will be failed .System installation will stop without any change.

```

Ready to install system, please wait .....

1. Install system with keeping user's data.
2. Install system without keeping user's data (format all disk)
3. Human version converts to vet version, or ver versino converts to human vers
ion.
please enter your choice[1, 2, 3, or q=quit(defalut)]:
3
Failed to conversion.
System will reboot, press ENTER to continue.

```

6. After the system has been installed successfully, the following information will display on the screen, press <Enter> to restart the system.

```

System has been installed successfully!
System will reboot, press ENTER to continue.

```

7. After the OS is restored, Doppler restoration starts automatically. The process of restoring refer to 6.2.2 Doppler restoration (from the 5<sup>th</sup> to the 8<sup>th</sup> step)

### 6.2.1.3 File Processing during Restoration

During the OS installation procedure, the machine will back up the key file in the HDD automatically, see below:

◆ Select the choice 1:

1. Back up the option key file of the C drive to D: /mnt/bkcfg (temporary catalogue)
2. Format the C drive and restore the OS.
3. Copy the option Key file to the previous catalogue in C drive, and the temp file will be deleted.

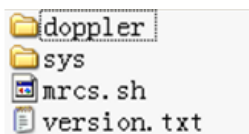
◆ Select the choice 2:

1. Back up the option key file of the C drive to U: /bkcfg (temporary catalogue)
2. Format the whole HDD and restore the OS.
3. Copy the option Key file to the previous catalogue in C drive, and the temporary file in U disk will be deleted.

In the OS with previous configuration data, if the ultrasound system is restored by package without configuration data, the product configuration and the option state will take effect as the configuration data in OS.

### 6.2.1.4 Software Introduction

Operating System restoration package includes the files as follow:



Doppler: Doppler software restoration data will be placed here. If the data exists, ultrasound software will be restored after the operation system is restored; otherwise, only the OS will be installed.

Sys: operation system data is placed here.

Mrcs.sh: installation program.

Version.txt: version file.


**NOTE:** Please check all the files in the restoration package before starting restoring, or else copy the package again.

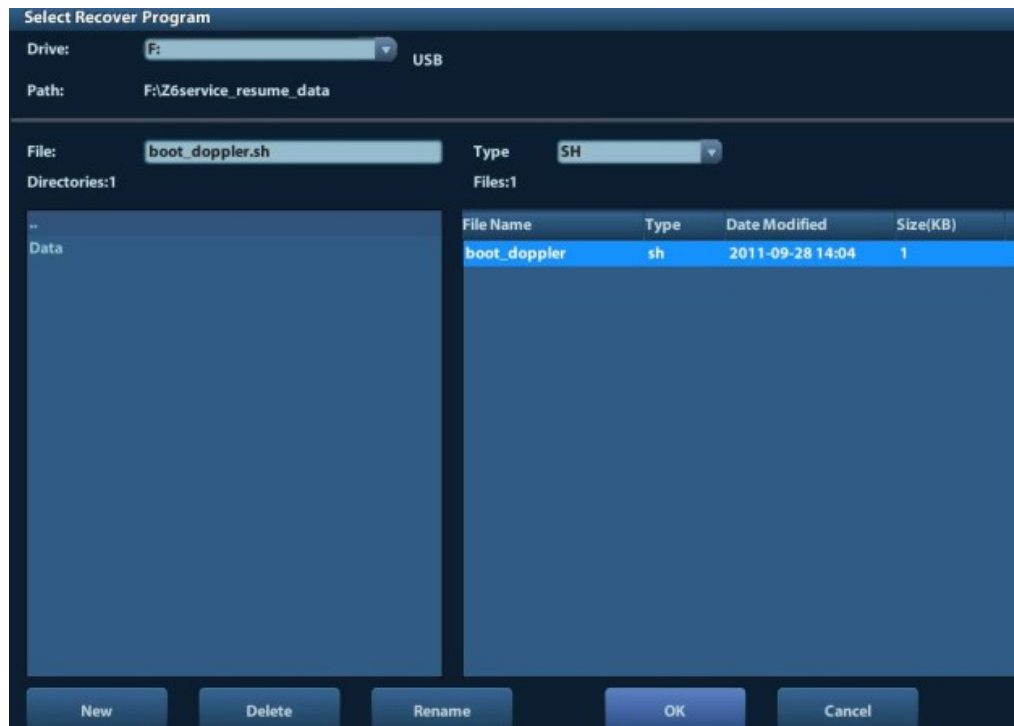
## 6.2.2 Doppler Restoration

### 6.2.2.1 Using Package in Doppler

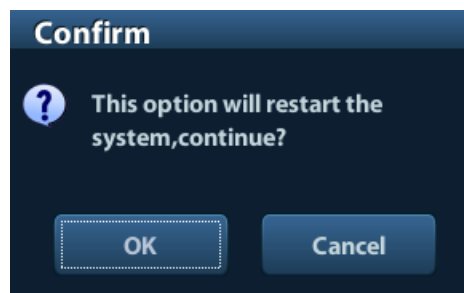
**NOTE:**

1. Before executing the restoration package, please back up the patient data as well as the user-defined preset data.
2. When using the restoration package, key catalog in the HDD will remain the same, and after restoration, the option key can take effect directly.

1. Copy the Doppler restoration package to USB disk root (USB disk requirement is the same as in 6.2.1.1)
2. Insert the USB disk to USB interface in the ultrasound system, the USB icon  displays on the right corner of the screen.
3. Press <Setup> to enter [Setup] menu, Click [Maintenance] to enter the [Other] page, Select [Recover] in the Maintenance menu and press <Set>.
4. Switch to the USB catalog in the popped up dialogue box, and select boot\_doppler.sh file in the package and click [OK].



5. The system then will ask to restart the system. Click [OK] to enter restore procedure, click [Cancel] will cancel the operation and returns to Doppler.



6. During the course, when the restoration is almost done, the following prompts will display:

```
Do you want to delete user preset data?(Y/N)
```

Enter "Y" or "y" to delete the data in D:\z5\Preset\Enter "N" and the system will not delete data.

**NOTE:** The old user preset data may be not compatible with the restored system, if this happen, the operator must select "Y" when the system asks whether to delete user preset data or not, otherwise, the system can't be restarted normally.

7. After the whole system is restored, if there is only green shutdown prompts displayed, the restore process is normal, and press <Enter> to quit.



```

Start recovering, please do not shutdown the machine!!
./Target/27.DSD -> /n7/driverdata recover succeed!!
Driver Install Success: /n7/driver/UsEngine.ko
Driver Install Success: /n7/driver/UsFunctionKeys.ko
Driver Install Success: /n7/driver/UsMultiFunc.ko
Driver Install Success: /n7/driver/UsSpiBus.ko
./Target/27.FTD -> /n7/flasherdata recover succeed!!
Start burning Bf-Tx Fpga...
Comparing data from file with data from Fpga...
Data are identical
Burn Bf-Tx Fpga Successfully!
Start burning Dap Fpga...
Comparing data from file with data from Fpga...
Data are identical
Burn Dap Fpga Successfully!
Start burning MultiFunc Fpga...
Comparing data from file with data from Fpga...
Data are identical
Burn MultiFunc Fpga Successfully!
All FPGA Burn Succeed, Take effect after cut the power!
./Target/27.ARM file recover succeed!!
UpdateArmFlashData::handshake Succeed!
UpdateArmFlashData::Erase Flash Succeed!
Write :1077 Line Data Succeed!
ARM Update OK!
Keyboard program recover start .....
UKeyProgramUpdate::UpdateKey success
UKeyProgramUpdate::write data, please waiting ...
UKeyProgramUpdate::Write Data success
UKeyProgramUpdate::check sum, please waiting ...
UKeyProgramUpdate::update keyboard success!
N10S and FPGA update succeed!
./Target/27.ECD -> /n7/excddata recover succeed!!
./Target/27.VSD -> /n7/videdata recover succeed!!
./Target/27.APD -> /n7/apdata recover succeed!!
./Target/27.GUD -> /n7/guidata recover succeed!!
./Target/25.IRD -> /n7/iradata recover succeed!!
./Target/25.PCD -> /n7/configdata recover succeed!!
Do you want to delete user preset data? (Y/N)
y
User preset data have been deleted.
Start copying demo files...
cp: cannot stat './demo': No such file or directory
Finish copying demo files...
./doppler.out -> /n7/ren/main/doppler.out
./calib11b -> /n7/ren/11b
the system need to shut down after recover process finish.
press Enter key to exit...

```

the system need to shut down after recover process finish.  
press Enter key to exit...

Check if every item is restored successfully, press <Enter> according to the prompts, and the machine shut down automatically.

**NOTE:** If red prompts displays, please check the failed items.

- After restoration and restart, please check software version information in the path:  
<Setup>-[About]

### 6.2.2.2 product\_info.ini Description

product\_info.ini is used for configuring the regulation type (SFDA, FDA, CE).

No.	Regulation Type	Applicable for
1.	CE	European region
2.	FDA	North America
3.	SFDA	China

If OS and Doppler are restored together, the regulation taken effect will be the default type in the package after the restoration finished. If the regulation type is not the same as the area the system to be used, please change the regulation type as the procedures below:

- Open product\_info.ini in notepad or WordPad in the package.
- If the default regulation type is not the same as the area that the system to be used. Change the regulation type, e.g., change "SFDA" into "FDA", save it and then exit.

```

[REGULATION TYPE]
TYPE=SFD
[PRODUCT_TYPE]
TYPE=DC8

```



**NOTE:** Just change the contents in the red box, otherwise may cause an error.

### 6.2.2.3 Data Processing during Restoration

Data structure and location is as the following after Doppler package restoring.

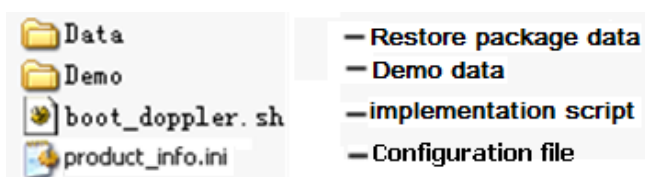
**Table 6-1 data processing list**

Type	File Suffix	Process	Destination
HDD data	APD	Analyze the update file; replace the old data with the new data according to the update item.	C:\z5\app
	EXD		C:\z5\exe
	VDD		C:\z5\video
	GUD		C:\z5\gui
	IMD		C:\z5\image
	PST		C:\z5\Preset
	PCD		C:\z5\config, C:\usr\share\plashy\themes\default\poweron.png and poweroff.png
Demo Data		Replace the old demo with the new demo in the resume package.	E:\z5\Demo
Driver	DRD	Decompress the update file to the temporary directory in the hard disk, then install the driver,	Install the drivers C:\z5\driver
FPGA	FPD	Decompress the update files to the temporary directory of the hard disk, and write data in their configured flash through the corresponding drive program. Delete the temporary directory when finished.	Configuration flash chip in the main board in corresponding to logic.
Control Panel	KUG	Decompress the update files and cache the keyboard data to the buffer, inspect keyboard communication and erase the flash.	Control Panel
Power supply monitor	ARM	Decompress the update file, save ARM data to the temporary directory in the hard disk, inspect the ARM communication and erase the flash, and then delete the temporary directory in the hard disk after the installation finished.	Power supply panel

**NOTE:** After the Doppler is restored, product configuration data will be overwritten by general configuration data in Doppler restore package, if necessary, please configure the product manually.

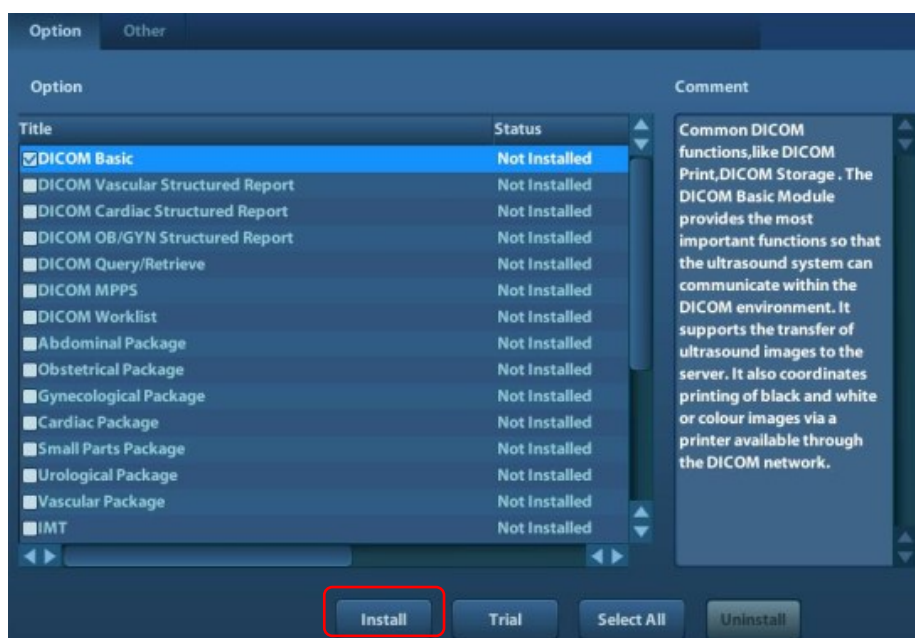
### 6.2.2.4 Doppler Software Introduction

Doppler restoration includes files as follow:



## 6.3 Installation of Optional Devices

1. Copy the optional devices to the U disk, then insert it to the USB port of the ultrasound system;
2. Enter [Preset], click [Maintenance] to enter [Option] menu to select the option module to be installed.



3. Select the corresponding key file in the prompted "Load File" dialogue box and click [OK].
4. After the Key file is successfully installed, you can see the option module in the "Installed" status. Corresponding functions are available after return from preset.

**NOTE:**

1. You can only install one key at one time.
2. The option uninstall function is only accessible to internal user, for service engineer, you can log on the system as "Service" first, and then conduct uninstall function. You can uninstall one key or more at one time.
3. If select "Trial", you need to input the password. Please contact service engineers.

## 6.4 Data Backup and Storage

### 6.4.1 Manage Settings

Press <Setup> to open the Setup menu, click [Other] to open the Manage Setting interface. System preset can be performed here. Image parameters can be exported, imported or restored to factory.



#### 6.4.1.1 Back up the Preset Data

1. On Manage Settings page, Click [Export] to open the [Export Data] dialogue box.
2. Select the path to save data.
3. Click [OK], a progress bar will appear and the preset data of the selected items will be exported to the specified path.

#### 6.4.1.2 Restore the Preset Data

1. On Manage Settings page, Click [Import] to open the [Import Data] dialogue box.
2. Select the path of the preset data.
3. Click [OK], a progress bar will appear and the preset data will be imported to the specified path.

Note: If selecting [Load factory], it will restore the system to the factory setting, but the [Region],[Admin] , [Network Preset] and [DICOM Preset] cannot be restored.

### 6.4.2 Patient Data Backup and Restore

#### 6.4.2.1 Patient Data Backup

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

#### 6.4.2.2 Restore Patient Data

1. Press [iStation] on the control panel to open the iStation dialogue box;

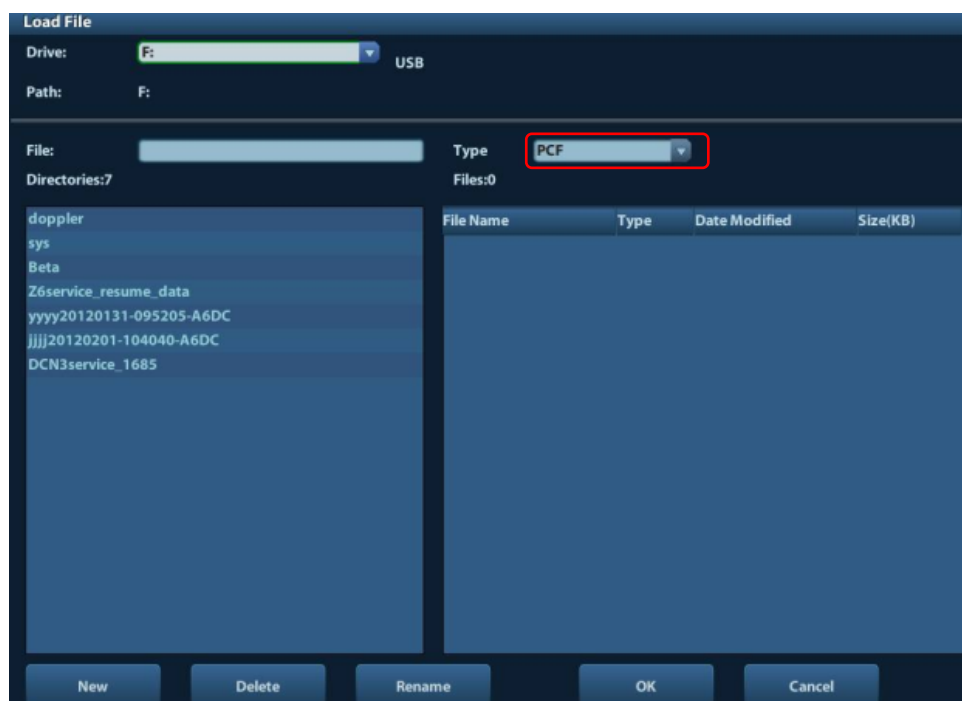
2. Select the drive which contains the patient data, click [Select All] to select all the data or select the target data one by one, and click [Restore] to restore the patient data from the current drive to the patient database.

## 6.5 Software Maintenance

### 6.5.1 Product Configuration

**NOTE:** [Config] is available on the Maintenance menu only if the operator logged on the system as Service.

1. Make the product configuration file—PCF file (generated by the production line or already archived PCF file) according to specific requirements and copy to the USB disk.
2. Connect the USB disk to the machine, click [Config] and load the file in the popped up dialogue box.



3. Select correct file (PCF format), and click [OK]. After the operation is completed, the successful prompt appears. Restart the machine according to the prompt.

Specific configuration:

- a) Model configuration
- b) Customized product logo, hospital logo, screen saver/hibernation icon, active/inactive icon of dual B mode, system information, boot up/shut down graphics.

**NOTE:** After Doppler restoration, please do product configuration manually according to the practical situation.

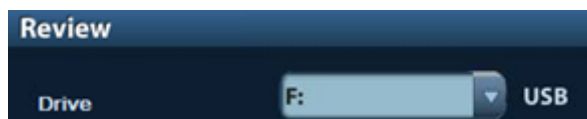
## 6.5.2 Log Maintenance

### 6.5.2.1 Export the Log

1. Connect the USB disk.
2. Click [Export Log] on the Maintenance menu.



3. Select the path in the Browse page to save the log, and click [OK].

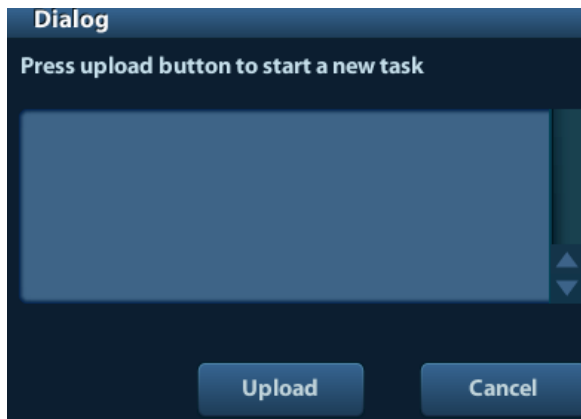


4. When the log is exported, the system prompts "Export succeed!" click [OK] to return to the Maintenance menu.

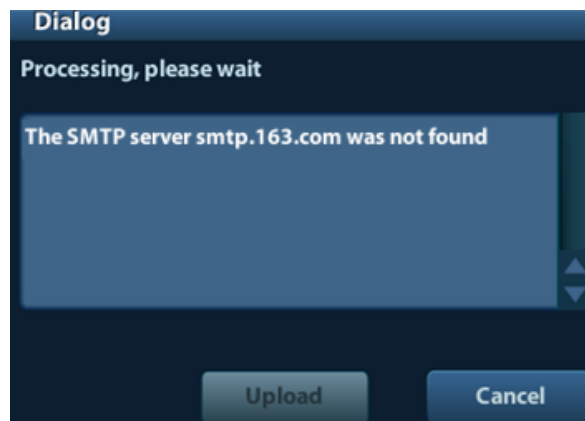
**NOTE:** The log can be exported to the external USB storage device only, make sure the connection between U disk and ultrasound is normal before the exporting.

### 6.5.2.2 Log Uploading

1. Click [Upload Log] on the Maintenance menu, and select the log type in the sub-menu
2. Click [Upload] in the popping up dialogue, the system performs log uploading automatically. After the uploading is finished, the system will prompt "Upload succeed"



If uploading is failure or can't find the server, the system will prompt information as below.



- NOTE:**
1. Before uploading the log, make sure the ultrasound system has been connected to network, otherwise, the system may warn “could not connect to server”
  2. The server ([smtp.163.com](mailto:smtp.163.com)) is already specified by the system, the user doesn't have to select it.

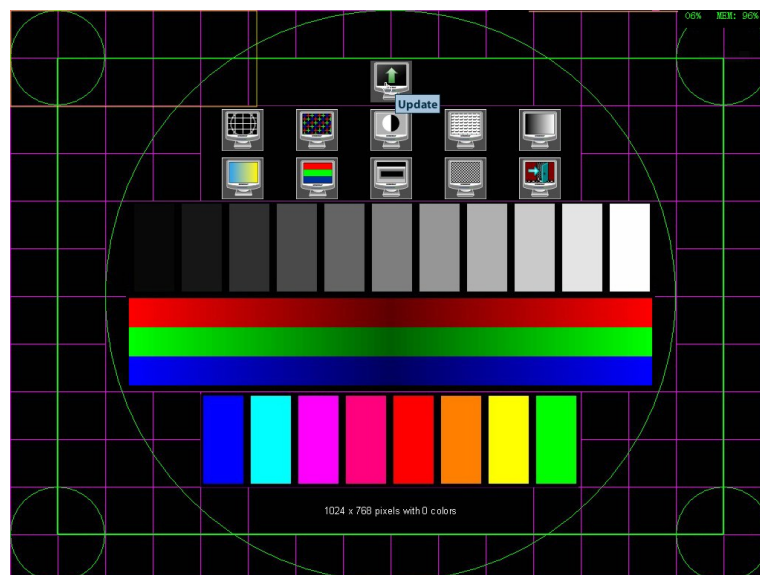
## 6.6 Display Parameter Setting

- NOTE:** In normal condition, when changing display assembly or main board assembly, the hardware will update the display data automatically. If synchronization fails, please load display parameters manually to assure image effect.

1. Log in as Service user.
2. Enter [Maintenance] menu in Setup menu. Then select [Test Main Monitor] to enter.



- Click the upper icon in the screen (prompts “Update” if you put the cursor on it), the update step is carried out, if fails, please send to R&D center.



**Figure 6-1 Main Monitor Maintenance Screen**

- After update is successful, restart the machine after power off to make the data effective.

## 6.7 HDD Partition

- The storage capacity of the system HDD is 320G or more, and the partition information is as follows:

Blocks(G)	system	Notes
10	Linux	C:
263	Linux	D:
38	Linux	E:

## 1. C drive

Catalog		Data	Illustration
C:\z5	\Image	POD	Probe data (supported probes in the system)
		ColorSpectrum	map data, color scale and colorize
	\gui	Font	font file
		Skin	Skin file
		pinyinmap	pinyin data
		Word	input setting data
		LayoutInfo	Layout configuration file
		version.txt	Version file
	\app	bodymark	pictogram
		DCM	structured report related data file and DICOM viewing software
		Report	report template
		obd.bin	OBD data file
		version.txt	Version file
		Comment	Comment file
		AnatomyImage	Anatomical images
		Measurement	Measurement library
	\exe	main	Doppler program and related boot configuration file and plug-ins, remote desktop server
		nls	Multilanguage string file
		videoplay	Video play exe file
		Sound	Cine saving and hint sound file
		version.txt	Version file
	\video	Picture	Display testing picture
		version.txt	Version file
	\preset	factory	Factory data
		version.txt	Version file
	\config	Boot_logo.png	Doppler boot-up graphics
		Hospital logo.bmp	Hospital logo
		manu_logo.png	Manufacturer logo
		Real_Image.bmp	Active icon
		Non_Real_Image.bmp	Inactive icon
		Dorm_logo.bmp	Standby graphics
		Product.PCF	Product configuration file
	\Key	Factory.key	Factory key file



## 2. D drive

Catalog		Data	Illustration
D:\z5	\gui	\word	User-defined word library
	\log	\DcmLog	DICOM log
		\Monitor	Monitor log
		\Operation	Operation log
		\SystemStat	Power on/off log
		\selftest	Self test log
		appmon_window_monitor.txt	Appmon monitor log
		message.txt	Warning message
		PeriLog.txt	Peripheral log
		commentlog.txt	Comment log
		burn_cd_msg.txt	Burn log
		error.txt	System error log
	\PATIENTDATA	\	Main patient database path
	\Preset	\Current	User preset data
	\temporary	\	Temporary file
	\PatientBack	\	Patient back up data

## 3. E drive

Catalog		Data	Illustration
E:\z5	Demo		Ivision default DEMO path
	Patient Backup		Patient data back up
	demofile.txt		Ivision default DEMO path



# 7 Structure and Assembly/Disassembly

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## 7.1 Structure of the Complete System

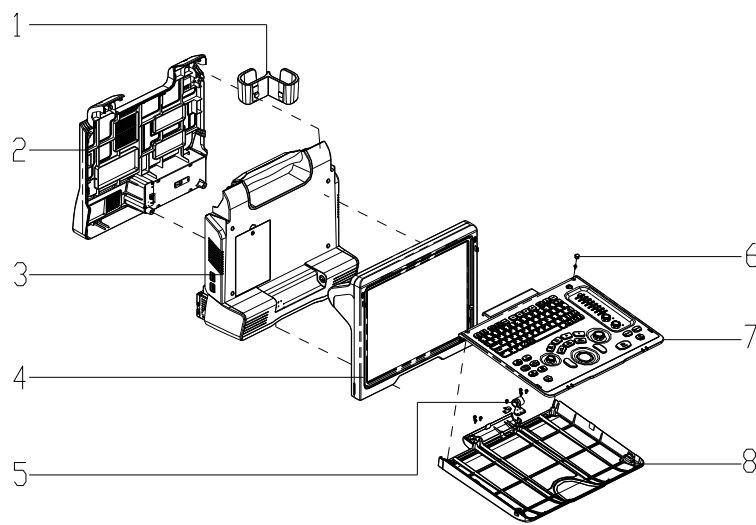







Figure 7-1 Overall Exploded View


No.	Name	No.	Name
1	Holder	5	Null turning axis of keyboard
2	Rear cover assembly of main unit	6	Silicon cap of keyboard
3	Assembly of main unit rack	7	Top cover assembly of keyboard
4	Display assembly	8	Bottom cover assembly of keyboard


## 7.2 Field Replaceable Unit

No	Classification	Description	Photo	Order Number	Model	Compatibility	Assembly/ Disassembly
1.	Main unit related	1112 Main board(FRU)		801-1112-00001-00	Z6 Series		Refer to7.4.5
2.		1112 Main Board Assembly(FRU EAF328-F)		115-031629-01		This board should be used with software of version 02.01.00 (Rev7960) and later.	
3.		1112 Main Board Assembly(FRU Matched with BayTrail PC module)		115-031629-02		This board should be used with software of version 03.00.00 (Rev8742) and later.	

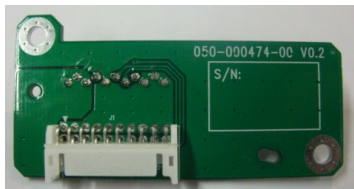

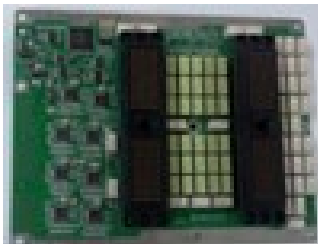
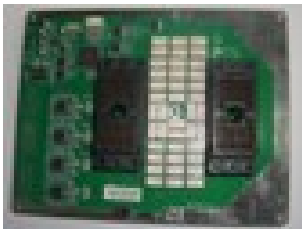
4.		1114 Main Board(FRU)		115-015654-00	Z5 Series		Refer to 7.4.5
5.		1114 Main Board Assembly(FRU EAF328-F)		115-015654-02		This board should be used with software of version 02.01.00 (Rev7959) and later.	
6.		1114 Main Board Assembly(FRU Matched with BayTrail PC module)		115-015654-03		This board should be used with software of 03.00.00 (Rev8856) version and later	
7.		CPU Module		801-1150-00002-00	Z5&Z6 Series		Refer to 7.4.5
8.		BayTrail PC Module (1112/1114 FRU)		115-043600-00	Z5&Z6 Series	Z5: be used with software of 03.00.00 (Rev8856) version and later Z6: be used with software of version 03.00.00 (Rev8742) and later. CPU Module with 115-043600-00 has been	


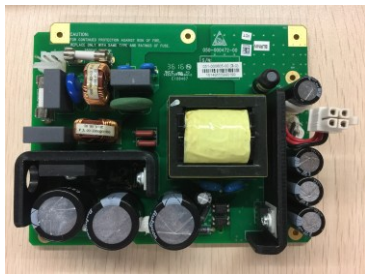
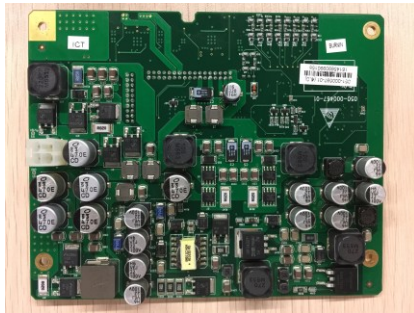
						discontinued. If it is out of stock, please use 115-043600-01 to order and restore the latest Doppler software and compatible OS as well after replacement.	
		BayTrail PC Module (1112/1114 FRU)		115-043600-01	Z5&Z6 Series	<p>Z5: be used with software of 03.00.00 (Rev8856) version and later</p> <p>Z6: be used with software of version 03.00.00 (Rev8742) and later.</p> <p>CPU Module with 115-043600-00 has been discontinued. If it is out of stock, please use 115-043600-01 to order and restore the latest Doppler software and compatible OS as well after replacement.</p>	




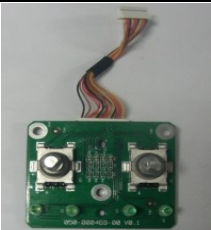
9.		HDD		115-018452-01	Z6 (FDA)	/	Refer to7.4.8
				115-018452-02		Matched with software version of 03.00.00 (Rev8742) and later.	
				115-018453-01	Z6Vet (FDA)	/	
				115-018453-02		Matched with software version of 03.00.00 (Rev8742) and later.	
				115-018454-01	Z6 (CE)	/	
				115-018454-02		Matched with software version of 03.00.00 (Rev8742) and later.	
				115-018455-01	Z6Vet (CE)	/	
				115-018455-02		Matched with software version of 03.00.00 (Rev8742) and later.	




10.		HDD		115-018456-01	Z5 (CE)	/	Refer to 7.4.8
				115-018456-02		Matched with software version of 03.00.00 (Rev8856) and later.	
				115-033819-01	Z5 (FDA)	/	
				115-033819-02		Matched with software version of 03.00.00 (Rev8856) and later.	
				115-018457-01	Z5BW (CE)	/	
				115-018457-02		Matched with software version of 03.00.00 (Rev8856) and later.	
				115-018459-01	Z5Vet (CE)	/	
				115-018459-02		Matched with software version of 03.00.00 (Rev8856) and later.	
				115-033820-01	Z5Vet (FDA)	/	
				115-033820-02		Matched with software version of 03.00.00 (Rev8856) and later.	
				115-039358-00	DP-50 (color) [CE]	/	
				115-039358-01		Matched with software version of 03.00.00 (Rev8856) and later.	
				115-018458-01	Z5T (CE)	/	
				115-018458-02		Matched with software version of 03.00.00 (Rev8856) and later.	



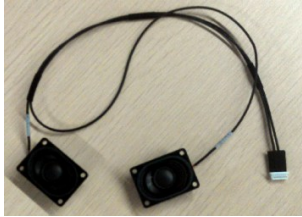


11.		Battery connecting board		801-1150-00004-00	Z5&Z6 Series		Refer to 7.4.1
12.		IO board		801-1150-00005-00	Z5&Z6 Series		Refer to 7.4.3
13.		1150 probe board		801-1151-00006-00	Z5&Z6 Series		Refer to 7.4.4
14.		1151 probe board		801-1151-00002-00	Z5&Z6 Series		Refer to 7.4.4

15.	Power related	power supply module		801-1150-00009-00	Z5&Z6 Series		Refer to 7.4.2
16.		AC-DC board( FRU)		115-051844-00	Z5&Z6 Series	/	Refer to 7.4.2
17.		DC-DC board( FRU)		115-051845-00	Z5&Z6 Series	/	Refer to 7.4.2

18.		Battery		M05-010005-09	Z5&Z6 Series		Refer to 7.4.1
19.	Control panel related	1112 Top cover assembly of keyboard (basic)		801-1112-00002-00	Z5&Z6 Series		Refer to 7.4.6.5
20.		1112 Silica gel keypad		049-000393-00	Z5&Z6 Series		Refer to 7.4.6.5
21.		Double encoder		801-1150-00013-00	Z5&Z6 Series	Refer to “Focus/Freq and Depth/Zoom”	Refer to 7.4.6.1

22.		Single encoder		801-1150-00014-00	Z5&Z6 Series	Refer to "Gain" or "Nav.Rot"	Refer to 7.4.6.1
23.		Trackball		801-1150-00015-00	Z5&Z6 Series		Refer to 7.4.6.2
24.		TGC board		801-1150-00016-00	Z5&Z6 Series		Refer to 7.4.6.3
25.	Monitor related	1150 Display assembly		115-037591-00	Z5&Z6 Series		Refer to 7.4.7

26.	Others	Backboard fan		024-000147-00	Z5&Z6 Series		Refer to 7.4.5
27.		Power fan		024-000146-00	Z5&Z6 Series		Refer to 7.4.2.1
28.		Speaker		020-000016-00	Z5&Z6 Series		Refer to 7.4.9

## 7.3 Preparations

### 7.3.1 Tools Required

Cross-headed screwdriver: 1pcs, Spec: 105 X100

Anti-static gloves: 1 pair

### 7.3.2 Engineers Required

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

### 7.3.3 Assembly/Disassembly Required

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

1. When you stop the scanning and the image capture, you should power off the system and disconnect the system from the AC power supply, then pull out AC power cables.
2. Open the battery cover and removing battery.
3. Prepare Tools disassembled and anti-static gloves.



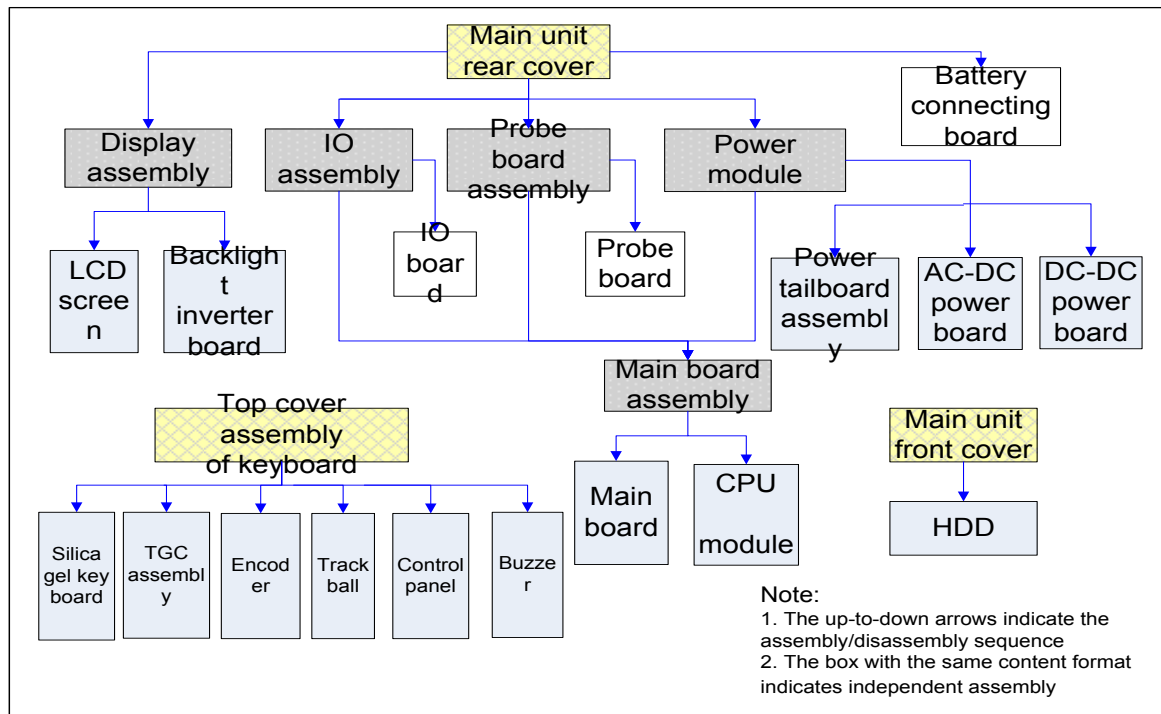
**WARNING:**

Please start to disassemble when you are sure that you have pull battery out.

## 7.4 Assembly/Disassembly

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

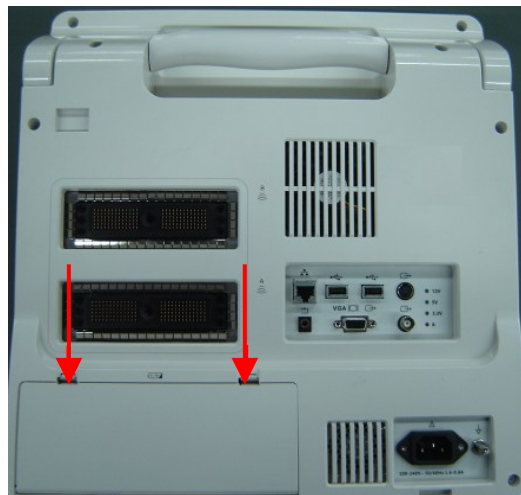
### ■ Sketch map



**NOTE:** The illustration of disassemble is provided for reference only, and the concrete picture depends on the actual model.

## 7.4.1 Battery Connecting Board

1. Press the clasp of the battery cover, and then rotate the battery cover down to open it.



**Figure 7-2 Disassembly of Battery (1)**

2. Slide battery to the left side pressing it all the time, and then remove the battery when the battery pops on the recommended distance.



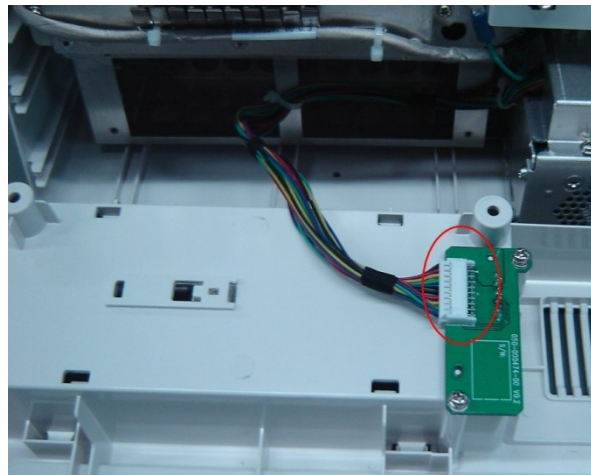
**Figure 7-3 Disassembly of Battery (2)**

3. Remove panhead screws with washers (5 M3X8 and 2 M3X12) which are installed on the rack of the main unit rear cover.



**Figure 7-4 Disassembly of Rear Cover Assembly of Main Unit (1)**

4. Hold the battery bay and then remove the rear cover of the main unit simultaneously, pull out the plugs from the battery connecting board.





### Figure 7-5 Disassembly of Rear Cover Assembly of Main Unit (2)

5. Remove panhead screws with washers (2 M3X6) fixed on the main unit box, and then take off the battery connecting board.

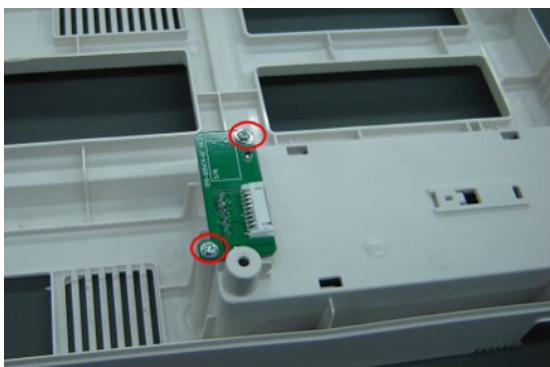


Figure 7-6 Removing the Battery Connecting Board

## 7.4.2 Power Supply Module

1. Remove rear cover assembly of the main unit (referring to 7.4.1 the 1~4 step)
2. Remove panhead screws with washers (4 M3X6) fixed on the main unit box.

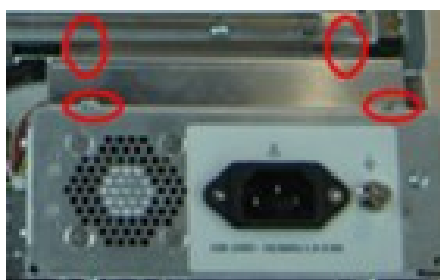


Figure 7-7 Removing the power shielding box

3. Then take off the power shielding box. Pull out the plug of the battery connecting board cables on the power module assembly.
4. After removing panhead screws with washers (6 M3X6) fixed on the main unit box and one panhead combination screw (M4X8), and pulling out the plug of the cables connecting the power module and main board, you can take out the power board assembly backward.



Figure 7-8 Disassemble the Power Module Assembly (1)



**Figure 7-9 Disassemble the Power Module Assembly (2)**

#### 7.4.2.1 Power module Fan

1. Removing panhead screws with washers (5 M3X6) fixed on the power module assembly and pulling out the plug of the fan connecting cables and power input outlet connecting cables, you can take off the rear panel of power supply assembly.

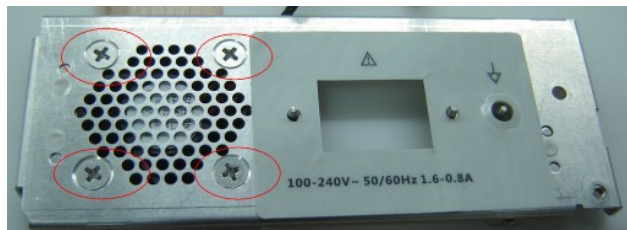


**Figure 7-10 Disassemble the rear panel of power supply assembly (1)**



**Figure 7-11 Disassemble the rear panel of power supply assembly (2)**

2. Remove the 4 screws fixed on the fan and then take out the fan on the rear board.



**Figure 7-12 Disassemble the Power Module Fan**

#### **NOTE:**

During the assembly, fan label must be pasted towards the surface of the machine, and don't confuse with fans of other products.

#### 7.4.2.2 DC-DC Power Board

1. Remove panhead screws with washers M3X6 (4) used to fix the DC\_DC power board.



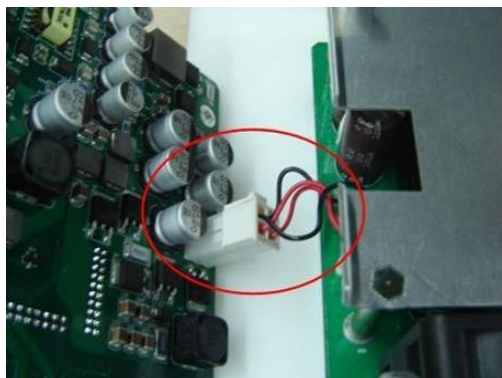
**Figure 7-13 Disassemble the DC-DC Power Board (1)**

2. Remove the plug of fan cable.



**Figure 7-14 Disassemble the DC-DC Power Board (2)**

3. After removing the connecting plug between DC-DC power board and AC-DC power board, you could take out the DC-DC power board.



**Figure 7-15 Disassemble the DC-DC Power Board (3)**

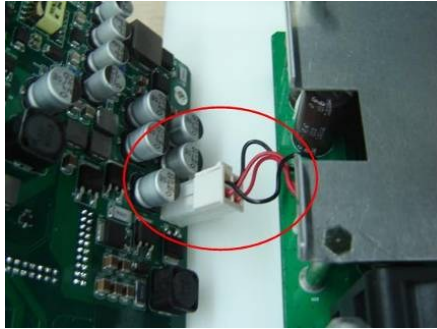
### 7.4.2.3 AC-DC Power Board

1. Remove panhead screws with washers M3X6 (5) used to fix the AC\_DC power board.



**Figure 7-16 Disassemble the AC-DC Power Board (1)**

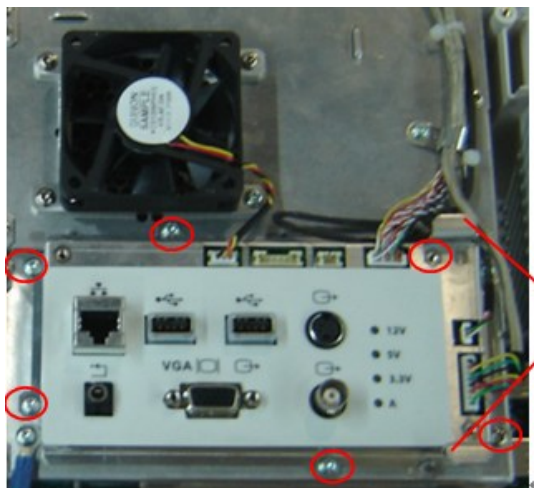
2. After removing the connecting plug between DC-DC power board and AC-DC power board, you could take out the AC-DC power board.



**Figure 7-17 Disassemble the AC-DC Power Board (2)**

### 7.4.3 IO Broad

1. Remove rear cover assembly of the main unit (referring to 7.4.1 the 1~4 step)
2. Pull out the connecting cable plug on the IO board assembly.
3. Remove panhead screws with washers (6 M3X6 ) which are fixed on the rack of the main unit at the back of the main unit, and take out the IO board assembly backward.

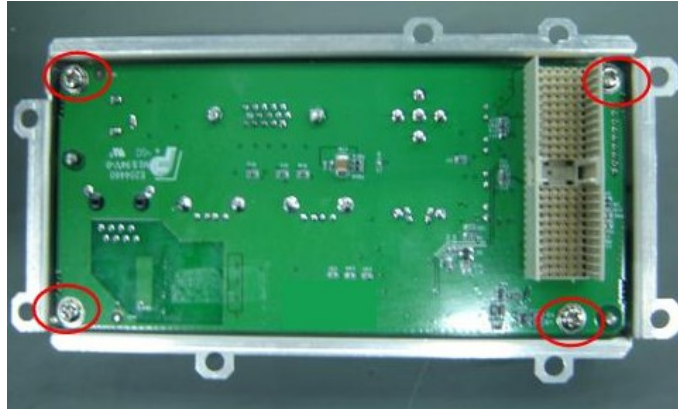


**Figure 7-18 Disassemble the IO Board Assembly**

**NOTE:** Make sure that you could pull out and push into the IO board sockets vertically when pulling out and assembling the IO board assembly on the position of the handle.

4. Remove panhead screws with washers M3X6 (4) used to secure the IO board, and then you could take out the IO board.

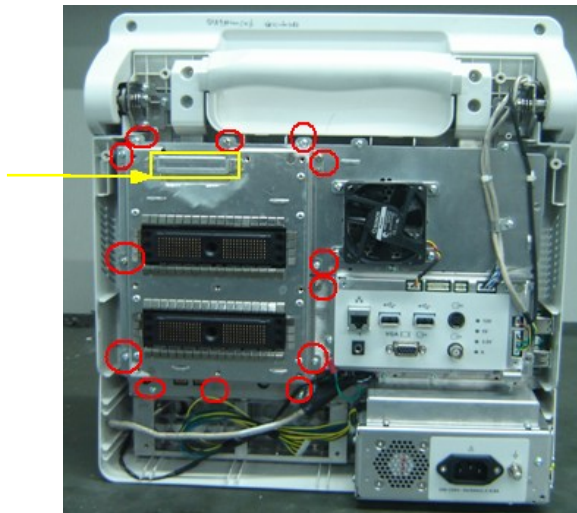




**Figure 7-19 Disassembly of the IO Board**

#### 7.4.4 Probe Board

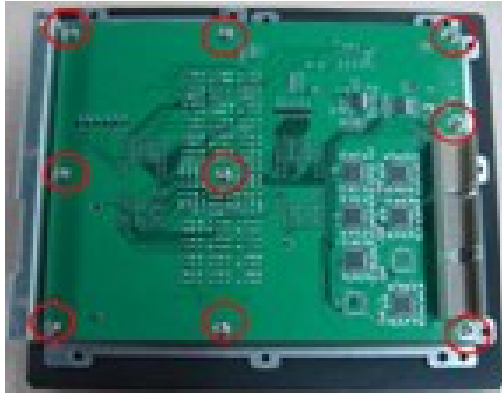
1. Remove rear cover assembly of the main unit (referring to 7.4.1 the 1~4 step)
2. After removing panhead screws with washers (13 M3X6) which are installed on the rack of the main unit rear cover and cutting off cable ties fixed on the probe board, you could remove the probe board assembly backward.



**Figure 7-20 Disassemble the Probe Board Assembly**

**NOTE:** Make sure that you could pull out and push into the probe board sockets vertically when pulling out and assembling the probe board assembly on the position of the handle.

3. After removing panhead screws with washers (9 M3X6) used to fix the probe board, you could take out the probe board.



**Figure 7-21 Disassemble the Probe Board**

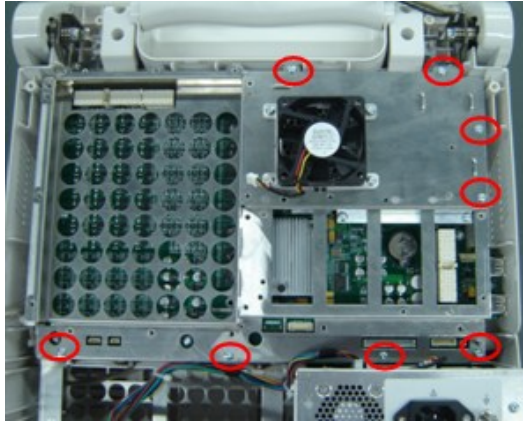
## 7.4.5 Main Board and CPU Module

1. Remove rear cover assembly of the main unit (referring to 7.4.1 the 1~4 step)
2. Remove panhead screws with washers (4 M3X6) which are fixed on the main unit, take out the power shielding board and then pull out two cables connecting the main board to the power module assembly.



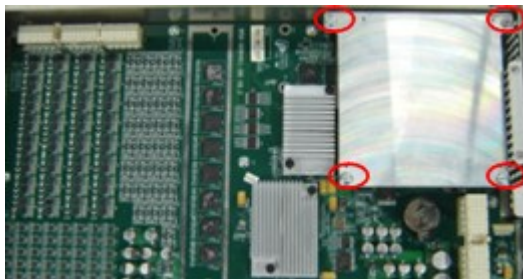
**Figure 7-22 Disassemble the Main Board Assembly (1)**

3. Remove the probe board assembly (referring to 7.4.4 the 2<sup>nd</sup> step) and the IO assembly (referring to 7.4.3 the 1~4 step)
4. Remove panhead screws with washers (8 M3X6) fixed on the main unit box, and take out separating board assembly of the main unit (including separating board of the main unit, heightening washer of fan and fan on the rear board).



**Figure 7-23 Disassemble the Main Board Assembly (2)**

5. When removing panhead screws with washers (4 M3X6) used to fix the CPU module, you can take out the CPU module.



**Figure 7-24 Disassemble the CPU module**

- |       |   |
|-------|---|
| NOTE: | <ol style="list-style-type: none"> <li>1. You can't draw out the CPU module abruptly, but you would pull it out after loosening the board from the left/right side to avoid damaging the main board FPGA.</li> <li>2. After replacing the CPU module, key file must be generated once again according to the new MAC address and written into HDD of the machine. Or else, the configuration function of the product will be lost.</li> </ol> |
|-------|---|

6. After removing the CPU module, Remove panhead screws with washers (12 M3X6) fixed on the main unit box, you can take off the board. Remove the HDD in back of the board, the left is main board.

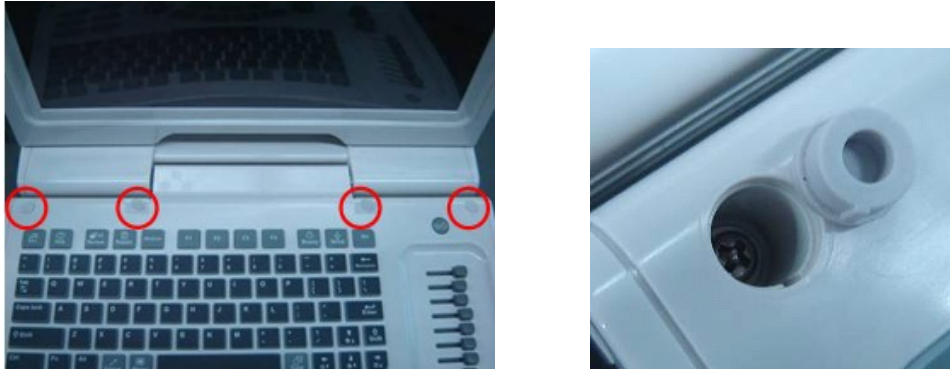


**Figure 7-25 Disassemble the Main Board**

NOTE:	1. The button cell model of the main board PCBA is Lithium 3V220mAh D20*3.2. 2. During assembly, please assemble the main board and fasten with the screws, and then install the CPU module.
-------	---

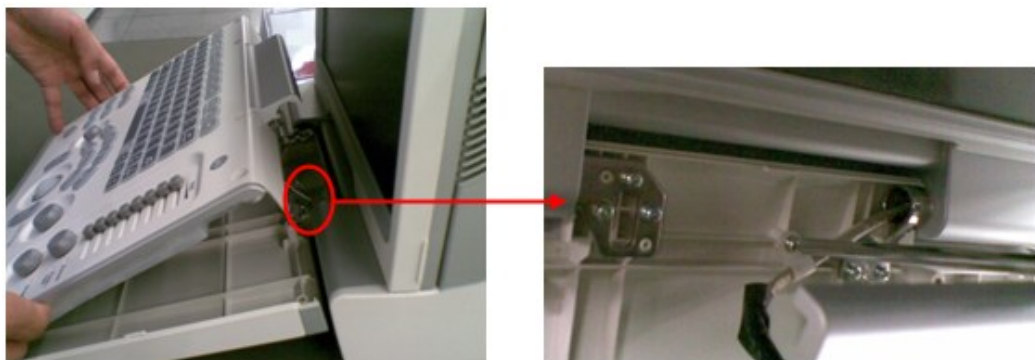
## 7.4.6 Top Cover Assembly of Keyboard

1. Remove plugs fixed on the on the top cover of keyboard (4 for each), and take off the corresponding panhead screws with washers M3X8 (4 for each).



**Figure 7-26 Disassemble the Top Cover of Keyboard (1)**

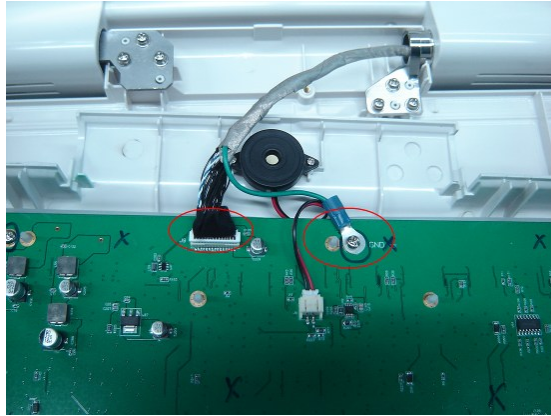
2. Hold the upper edge of the keyboard upper cover assembly, and open up the keyboard upper cover to the extent till you can remove the screw for fixing the cable connecting the keyboard and the main unit, as described in the figure, and then pull out the whole keyboard upper cover assembly.



**Figure 7-27 Disassemble the Top Cover of Keyboard (2)**

3. After removing one countersunk head self-tapping screw PT3X10 fixed on the top cover of keyboard and take out the plug of the keyboard and the main unit connecting cables, you could remove the top cover of keyboard assembly.





**Figure 7-28 Disassembly of the Top Cover Assembly of Keyboard (3)**

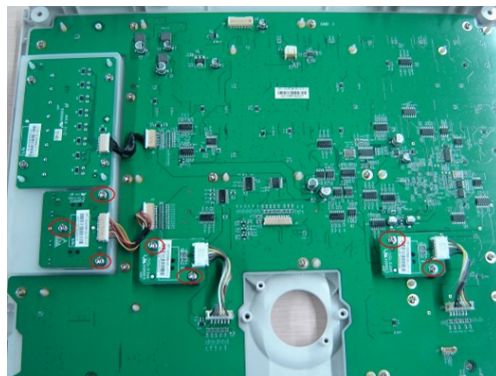
#### **7.4.6.1 Encoder Board**

1. Draw out the 4 knobs upwards fixed on the encoder board on the control panel assembly.



**Figure 7-29 Disassemble the Encoder Board (1)**

2. After removing the connecting cable plug on the control panel and taking out countersunk head self-tapping screw PT3X10(7) used to secure the encoder board, you could remove the encoder board.



**Figure 7-30 Disassemble the Encoder Board (2)**

#### **7.4.6.2 Trackball**

Remove the connecting cable plug of trackball, and countersunk head self-tapping screw PT3X10 (4) fixed on the trackball. Take out the trackball;



**Figure 7-31 Disassembly of the Trackball**

### 7.4.6.3 TGC Board

1. Draw out the 8 knobs upwards fixed on the TGC board on the control panel assembly.



**Figure 7-32 Disassembly of the TGC Board (1)**

2. After removing the connecting cable plug of TGC board and removing screws PT3X10 (4) fixed on the TGC board, you could remove the TGC board.



**Figure 7-33 Disassembly of the TGC Board (2)**

### 7.4.6.4 Buzzer

After removing the connecting cable plug of buzzer on the control panel and taking out the buzzer fixing screw PT2X8 (2), you could remove the buzzer.



**Figure 7-34 Disassembly of the Buzzer**

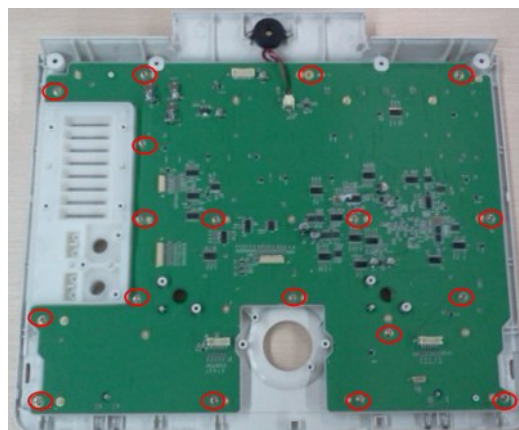
#### **7.4.6.5 Top cover assembly of keyboard (basic)**

1. Pull out the 8 TGC knobs and 4 encoder knobs upward from the control panel.



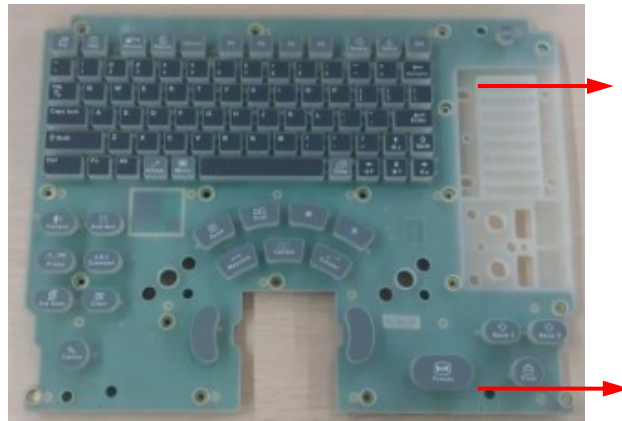
**Figure 7-35 Disassemble the Control Panel (1)**

2. Remove the encoder board, TGC board and trackball. The remained part is top cover assembly of keyboard (basic).
3. Remove the buzzer, and then remove 18 PT3X10 self-tapping screws fixed on the control panel.



**Figure 7-36 Disassemble the Control Panel (2)**

4. Pull out the control panel and silicon key from the keyboard cover and then dispatch them apart, you can take out the silicon key.



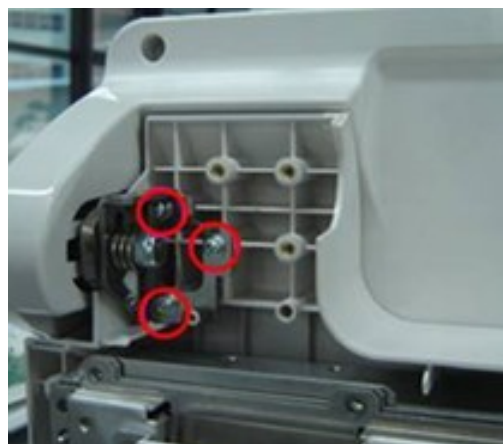
**Figure 7-37 Disassemble the Control Panel (3)**

## 7.4.7 Display Assembly

1. Remove rear cover assembly of the main unit (referring to 7.4.1 the 1~4 step)
2. Remove combination screws (6 M3X8) used to be secured the monitor on the front cover of the main unit by a screwdriver.



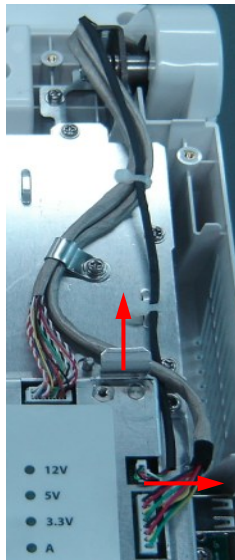
**Figure 7-38 Screws on the Right of the Display Assembly**



**Figure 7-39 Screws on the Left of the Display Assembly**

3. Cut off cable ties connecting the main unit on the display by diagonal cutting pliers, and then

pull out the corresponding cable plugs.



**Figure 7-40 Disassemble the Display assembly**

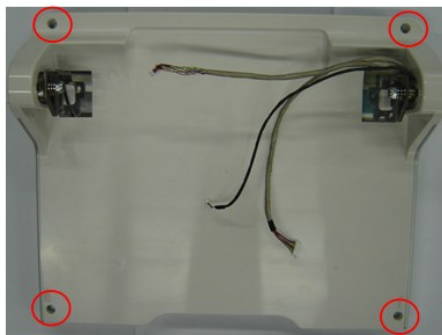
4. Pull the display assembly upwards to make it separated from the main unit.



**Figure 7-41 View of Display Assembly**

#### **7.4.7.1 Backlight Inverter Board**

1. Remove combination screws (4 M3X8) used to be secured the display on the front cover of the main unit by a screwdriver.



**Figure 7-42 Disassembly of Display Front Cover (1)**

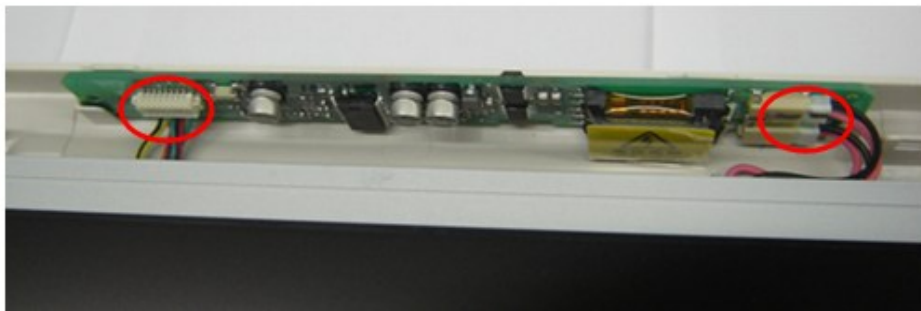
2. Tilt the frontal/rear cover of the monitor assembly by external force.





**Figure 7-43 View of the Front Cover of the Display (2)**

3. After pulling out inverter board a few from the bulges of the rear cover, and removing connecting cables of the inverter board and backlight extension cables from the inverter board, you could take out the inverter board.



**Figure 7-44 Disassemble the Backlight Inverter Board of Display**

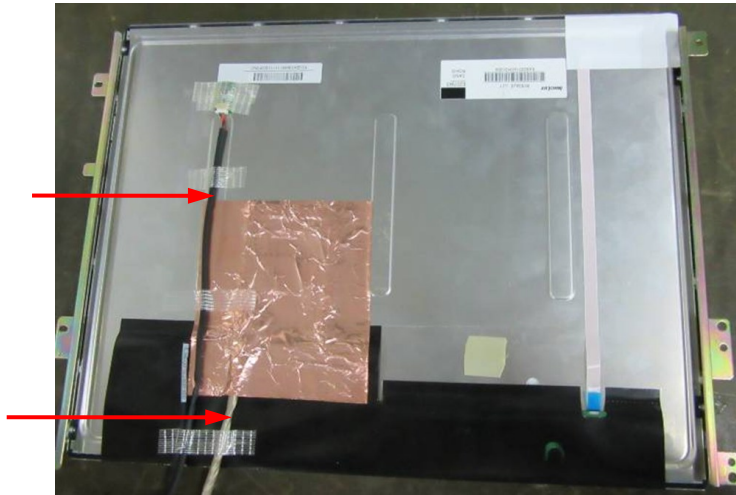
#### **7.4.7.2 LCD Screen**

1. Remove combination screws (4 M3X8) used to be fastened the LCD screen.



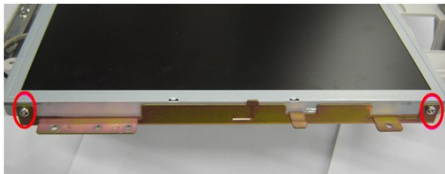
**Figure 7-45 Disassemble the LCD Screen (1)**

2. Remove EEPROM connecting cable;



**Figure 7-46 Disassemble the Monitor Assembly (2)**

3. Split slowly copper paper used to paste LCD signal cable at the back of the LCD screen, and pull out LCD signal cable.
4. After removing combination screws M3X4 (each for 2) used to fix the supporting assembly of display on the left and right, you can pull out the LCD screen.



**Figure 7-47 Disassemble the Monitor Assembly (3)**

5. When installing, please attach the plug of backlight extension cables to the inverter board socket.



**Figure 7-48 View of Connecting backlight Extension Cable and Inverter Board**

## 7.4.8 Hard Disk

**NOTE** Please pay attention to the following matters during disassembling/assembling, otherwise the hard disk will be damaged:

- Hold the side of the hard disk, and please do not touch the board of the hard disk.
- Fasten the screws with the handy screw driver, and do not with the electric screw driver.
- The torsion value of the screw lock is:

M3: 4 to 6 kgf.cm

M4: 6 to 8 kgf.cm

1. Fasten one M3x12 screw removed (7.2.4.2) into the damping axis adjusting hole of display about 2-3 rings to confirm that the screw is fixed, then pull out the monitor simultaneously rotate the display assembly to adjust the monitor to the horizon position.



Figure 7-49 Disassembly of HDD (1)

**NOTE:** When rotating the monitor to horizontal position, you are sure to push damping axes screw inward and rotate the display simultaneously.

2. Remove panhead screws with washers (5 M3X8 ) which are installed on the rack of the main unit front cover, then remove the HDD cover assembly (including HDD cover, HDD cover metal part and conductive foam ) to rotate display assembly to the vertical position.

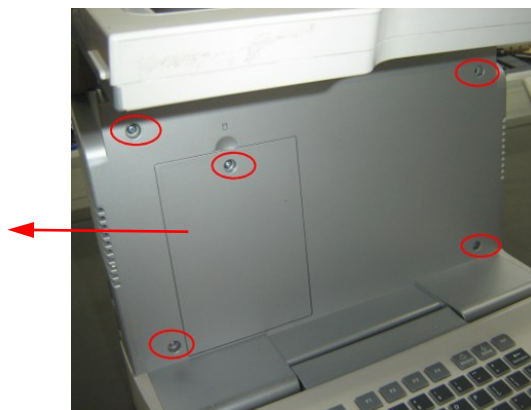


Figure 7-50 Disassembly of HDD (2)



3. Remove 3 panhead screws with washers M3X6 used to secure the rack of HDD, and take out the HDD assembly upwards.



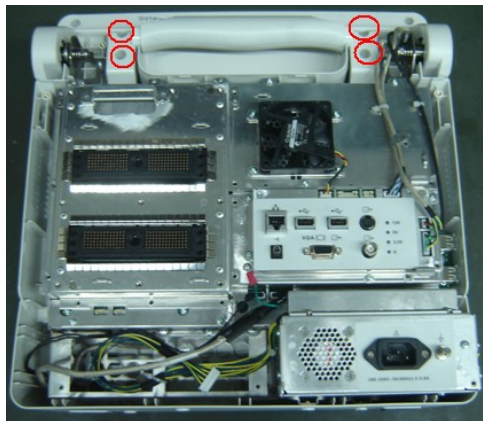
**Figure 7-51 Disassembly of HDD (3)**

**NOTE:** After replacing the HDD, you need to:

1. Restore the system;
2. Install the optional functions: Key file must be written according to MAC address of the machine, Or else, the optional function of the product will be lost.
3. Load configuration file, set the regulation type, system language and time zone.

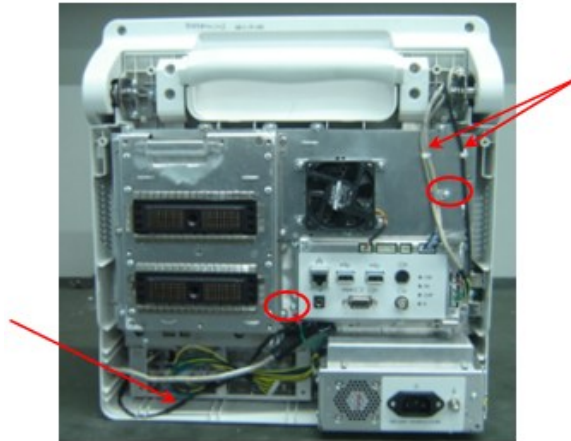
## 7.4.9 Speaker

1. Remove rear cover assembly of the main unit (referring to 7.4.1 the 1~4 step);
2. Remove 4 panhead screws with washers M3X6 used to fix the handle, then take out the handle.



**Figure 7-52 Disassembly of Speaker (1)**

3. Remove 1 combination screw used to fix the connecting cable of display assembly, Cut off two cable ties, and pull out the plug of connecting cable of display.
4. Remove 1 combination screw used to fix the connecting cable of keyboard assembly of display assembly, Cut off the tie used to fix the connecting cable of keyboard assembly and speaker cable, and then pull out two plugs.



**Figure 7-53 Disassembly of Speaker (2)**

4. Fasten one M3x12 screw removed (7.2.4.2) into the damping axis adjusting hole of display about 2-3 rings to confirm that the screw is fixed, then pull out the monitor simultaneously rotate the display assembly to adjust the monitor to the horizon position.



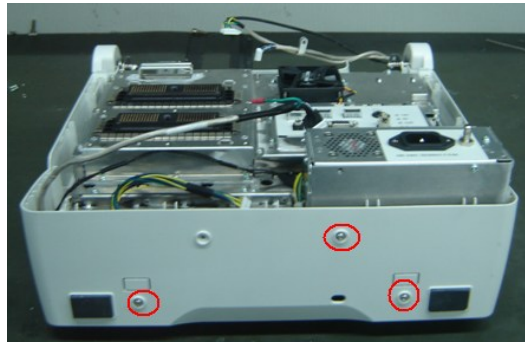
**Figure 7-54 Disassembly of Speaker (3)**

5. Remove 5 panhead screws with washers M3X8 used to fix the front cover and HDD cover, and then take the HDD cover assembly.



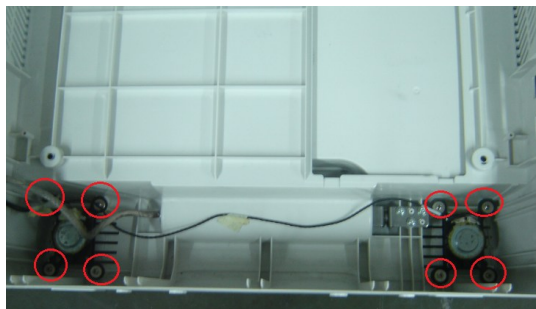
**Figure 7-55 Disassembly of Speaker (4)**

6. Put the machine on the horizontal position; remove 3 panhead screws with washers M3X8 which are fixed on the rack of the main unit at the bottom of the main unit, take out the main unit rack assembly.



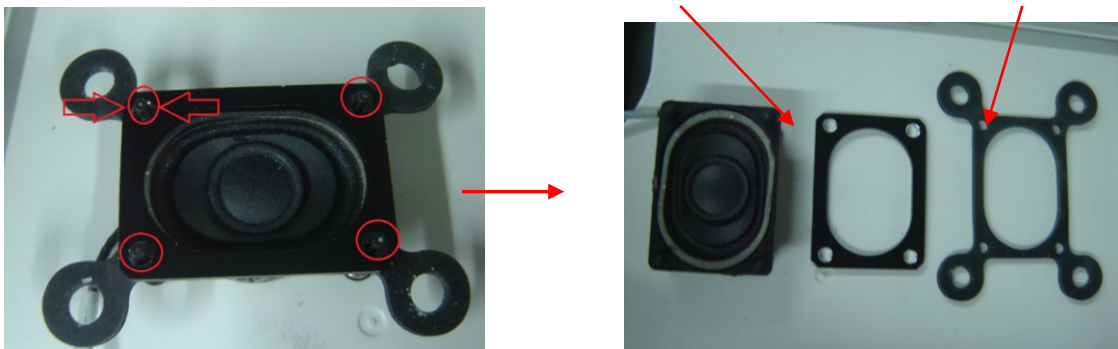
**Figure 7-56 Disassembly of Speaker (5)**

7. Remove 4 ST2.6X10 screws used to fix the speaker, and then take out the speaker.
8. As shown in the figure, remove 8 PT2.6X6 cross countersunk head self-tapping screws used to fix the speaker and then take out the speaker assembly.



**图 7-57 Disassembly of Speaker (6)**

9. As shown by arrow in the figure, extrude the buckle of spring screw (as shown in red circle) inward, take the pressing board of speaker first, then you can remove the reducing libration mat.



**图 7-58 Disassembly of Speaker (7)**

10. As shown by arrow in the figure, extrude the buckle of spring screw (as shown in red circle) inward, remove 4 spring screws, the left is speaker.

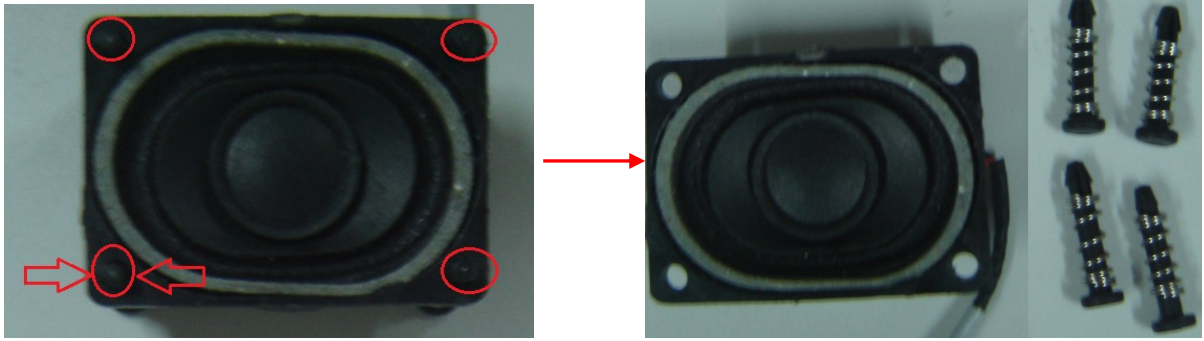







图 7-59 Disassembly of Speaker (8)

# 8 System Diagnosis and Support

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## 8.1 General Status Indicator

### 8.1.1 Status Indicators of the Control Panel

Status indicators	Icon	Status definition and indicators	Position
Power-on status indicator		The indicator is not on when the system is turned off; Press the key, the indicator blinks green at power on. After power on, the indicator is green.	The Control Panel on the upper right corner
Battery status indicator		1.It illuminates in orange when battery is charging; 2. It illuminates in green when battery is charging to 100% electricity; 3. When the battery capacity is more than 20% in discharging status, the green indicator blinks. 4. When the battery capacity is less than 20% in discharging status, the orange indicator blinks; When less than 10%, the orange indicator blinks quickly. 5. When the battery is in non-charging/discharging status or no battery is in, the indicator is not on.	The Control Panel on the lower left corner
AC indicator		The indicator blinks on green when the system is connected to the AC power supply. The indicator is not on when battery supplied.	The Control Panel on the lower left corner
Standby status indicator		The indicator blinks orange in standby status. The indicator is off on the other status.	The Control Panel on the lower right corner
Hard disk indicator		The indicator light flashes in green when the hard disk is reading or writing. The indicator is off automatically in other situations.	The Control Panel on the lower right corner

## 8.1.2 Status Indicator of the Power Supply on the IO Board

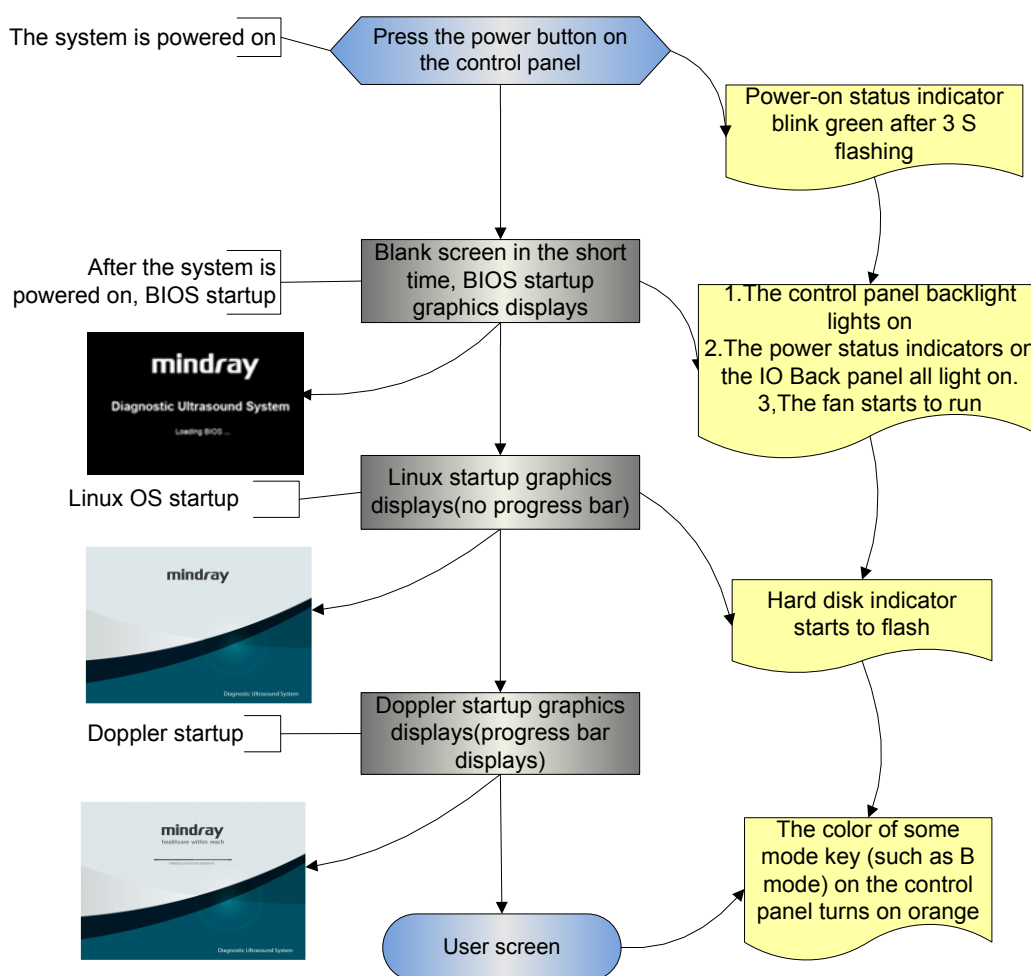
Status indicators	Icon	Status definition and indicators
12V power indicator	12V	Power on, and indicator is on (green), which indicates 12V output is normal
5V power indicator	5V	Power on, and indicator is on (green), which indicates 5V output is normal
3.3V power indicator	3.3V	Power on, and indicator is on (green), which indicates 3.3V output is normal
Reserved indicator	A	The indicator is on when the system is on the reserved status.

## 8.1.3 Status of whole machine

The status of whole machine	Status definition and indicators	To enter the Patient Info screen:	To exit the Patient Info screen:
Scanning status	The power-on status indicator turns on green, and the button indicator is white or off	Entering or exiting the scanning status by the [Freeze] key	
Freezing status	The power-on status indicator turns on green, and the [Freeze] key is orange	Entering or exiting the freezing status by the [Freeze] key	
Standby status	There are 3V3-STB and 5V_STB of power are normal, other power are off The standby indicator blinks orange.	1. Press the power switch for a short time, and then the system enters into the standby status by choosing from the status popped on the screen. 2. If there is no operation for the time set at first, the system would enter into the standby status automatically. 3. The system will enter into the standby status after 30s if the control panel is fold.	The system restores to the freezing status after restarting by pressing the power switch for a short time.
Screen-saver status	The brightness of the monitor is 0%, and the backlight of the control panel is off. Screen-saver default is "mindray" showing on the monitor.	There is no operation for the time set firstly, and then the system would enter into the screen-saver status from the freezing status automatically.	When you press any keys on the control panel, the system would return to the freezing status, the brightness and the backlight of the control panel both restore to the previous

	The system is frozen. Ultrasound imaging hardware system is in the dormancy mode		status.
Power-off status	The system is on the power-off status: when connected the AC power supply the AC indicator is on, else refer to the instruction of "Battery status indicator"	Press the power switch for a short time, and then the system is turned off by choosing from the status popped on the screen	Starting the system by pressing the power switch for a short time

## 8.2 Starting Process of the Whole System



### 8.2.1 Start Process of Complete System

#### 8.2.1.1 Powered on by AC

Basic Procedures	Phenomenon
The original status:	no indication

Finishing loading 3.3VSTB,Finishing loading 5VSTB	The AC status indicator on the control panel lights on, but the indicators of HDD and standby are off.
Press the power button, the power management send the power-on request to CPU	The Power-on status indicator flashes continuously on the control panel.
CPU responds to requests,	The Power-on status indicator on the control panel lights for a long time.
The power has been power on	1: The control panel backlight lights on. 2: The power status indicators on the IO panel all light on. 3: The fan starts to run.
After finishing HDD initialization and logic configuration, PC enters into BIOS stage	There are data output and images displaying on the monitor.

### 8.2.1.2 Powered on by Battery

Basic Procedures	Phenomenon
The original status: finishing loading 3.3VSTB	no indication
Finishing loading 5VSTB	The battery indicator on the control panel lights on, but the indicators of HDD, standby and AC status are off.
The power management send the power-on request to CPU	The Power-on status indicator flashes continuously on the control panel, and the machine can't start normally
CPU responds to requests,	The Power-on status indicator on the control panel lights for a long time.
The power has been power on	1: The control panel backlight lights on. 2: The power status indicators on the IO panel all light on. 3: The fan starts to run.
After finishing HDD initialization and logic configuration, PC enters into BIOS stage	There are data output and images displaying on the monitor.

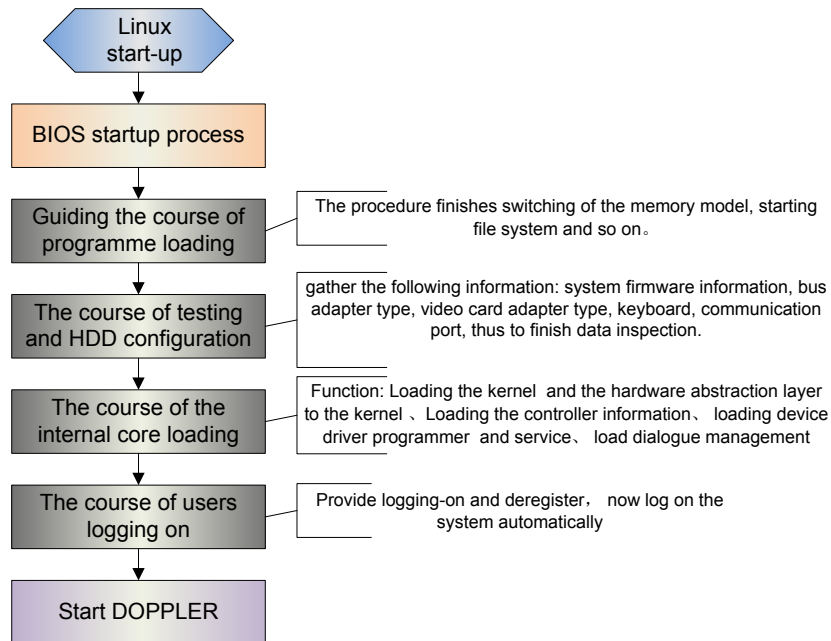
## 8.2.2 Start-up Process of BIOS

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

Basic Procedures	Basic phenomenon
Self-test after the system power-on	The LCD is blank screen in a short time.
Initialization& The settings of record system & Providing the resident programmer library & Loading the operation system	BIOS start-up display



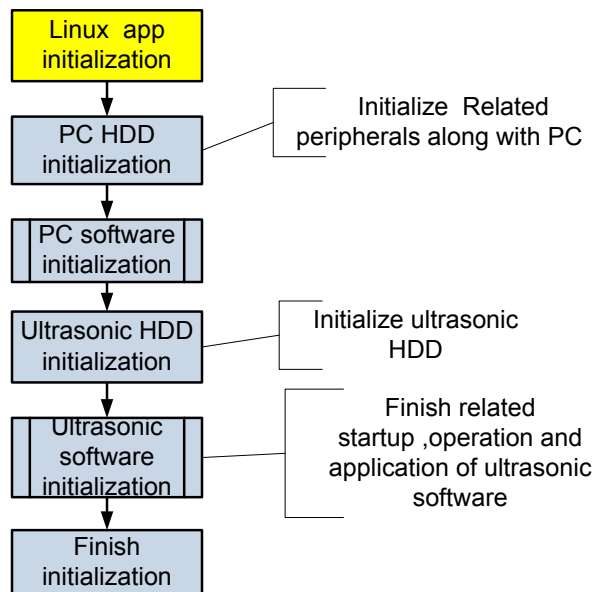
## 8.2.3 Start-up of Linux



Basic Procedures	Basic phenomenon
Guiding the course of programmer loading & the course of testing and HDD configuration	The LCD is black screen now, and the time of the course is short.
The course of the internal core loading & the course of logging on	LINUX startup graphics appears
Starting Doppler	Doppler startup graphics appears, and simultaneously progress bar displays the related information.

## 8.2.4 Start-up of Doppler

### 8.2.4.1 Procedure of Startup



### 8.2.4.2 Details of Procedures

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

Basic Procedures	Sub-procedures	Basic phenomenon	Description
Linux APP initialization		There is no progress bar on the screen	The progress bar does not appear unit in increments of 7.
PC hard disk initialization		There is no progress bar on the screen	
The PC software initialization	Peripheral initialization	There is no progress bar on the screen	
	Platform initialization	There is no progress bar on the screen	
	GUI initialization	There is progress bar appearing on the screen, and tips under the progress bar are: and tips under the progress bar are: Initializing hardware... Loading system preset... Loading common exam preset... Loading exam preset... Initializing locale...	The total increments are 7, and tips are displayed one by one.
PC HDD initialization		Initializing gui...	The total increment is 1
	GUI initialization	Initializing gui...	

Ultrasonic software initialization	Platform initialization	Initializing gui...	
	Peripheral initialization	Initializing ultrasound peripheral...	The total increment is 1
	Imaging initialization	Initializing ultrasound image...	The total increments are 2
	Application initialization	Initializing ultrasound application...	The total increment is 1
Finishing initialization		Initialization completed...	The total increment is 1

The configuration files of the course are as following:

Tips	Related operation	The corresponding increments
No tips	<p>Attach the path to configuration files</p> <p>Initialize display, the main window, sound and the USB representative</p> <p>Turn on the bus device BackboneDev and LPC</p> <p>Initialize the time and the processing function of Multilanguage</p> <p>Initialize peripheral file system, network and the driver</p> <p>Enumerate peripheral ports</p> <p>Configure timer, Initialize soft interruption, construct maintenance servicer and configure static data of the system</p> <p>Configure system font</p> <p>Load layout information</p> <p>Initialize UI management, and Initialize UI mark standard library</p>	In increments of 7.
Initializing hardware...	<p>When loading boot-trap graphic, 7 refreshing progress bars will display</p> <p>Release factory package of configuration data</p> <p>Maintain the data servicer</p>	
Loading system preset...	Generate the servicer of local setting and system setting	In increments of 1.
Loading common exam preset...	Generate general data management of the exam mode	In increments of 1.
Loading exam preset...	Generate measure preset, peripheral and network, KMP package of images and the preset servicer of the network strafing	In increments of 4.

Initializing locale...	Set related information of the zoom, languages, font library and input Construct widget factory Configure the GUI layer Set menu items Initialize function library Construct UICenter	In increments of 1.
Initializing gui...	Configure the application layer Initialize the keyboard. Construct the user account control management, and remote desktop management	In increments of 1.
Initializing ultrasound peripheral...	Configure the file dialogue box Initialize printing library Monitor battery and system handshake. Load printing mark Construct low power consumption Construct the USB management and writing management Initialize video replay device	In increment of 1.
Initializing ultrasound image...	Set the virtual machine device, and initialize the virtual machine Construct object trees of the front-end and the back-end (ultras and so on)	In increments of 2.
Initializing ultrasound application ...	Add function package of measure menu Register the application interface of measure patient	In increments of 1.
Initialization completed ...	The architecture of patient information management (UPatientApp)	In increments of 1.
Hide boot-trap graphic		

## 8.3 Alarming and Abnormal Information

The system has also alarming function, when the machine fails, it would pop up the alarming dialogue box, and simultaneously generate LOG file saved in the system log, whose place of saving in HDD is D: \z5\Log\Perilog. The detailed description of alarming information is as following:

### 8.3.1 Turning on the System Configuration File is Abnormal

Alarming tips	LOG record	Suggestion
Fail to open the file "SystemConfiguration.ini", and please check HDD data.	none	Reinstall the system software.

### 8.3.2 The voltage of system power is abnormal

Alarming tips	LOG record	Suggestion
The real-time battery will be out of power, please replace quickly!	xxx: System Monitor: Power supply alert! [VBAT], Current voltage: [VVV] V, Limit voltage: [LLL]-[HHH] V. xxxrepresents time, e.g. 2010-12-25 14:15:25 [VVV] represents the current value, and [LLL]-[HHH] represents the lower and upper limits.	Replace the button battery.
none	xxx: System Monitor: Power supply alert! [XXX], Current voltage: [VVV] V, Limit voltage:[LLL]-[HHH]V. xxxrepresents time, e.g. 2010-12-25 14:15:25 [XXX] represents voltage name, [VVV] represents the current value, and [LLL]-[HHH] represents the lower and upper limits. The voltage names respectively are: AD+12V, A-12V, A-5V, AD+2V5, AD+1V8, D+1V5, D+1V2	Short-circuited, protection and overvoltage. Check the related circuit.

### 8.3.3 Temperature Alarming

Alarming tips	LOG record	Suggestion
Temperature alarming, XX Shut down (XX means inversion timing, starting 60S)	xxx System Monitor: Temperature Alert! [XXX], Current voltage: [VVV] degree, Limit temperature: [LLL]-[HHH] degree xxxrepresents time, e.g. 2010-12-25 14:15:25 [XXX] represents voltage name, [VVV] represents the current value, and [LLL]-[HHH] represents the lower and upper limits. The detailed temperature name is as following: ADC thermal sensor, Multi FPGA thermal sensor,	Check the fan log D:\z5\log (if the fan stops working)/check if the heat radiating condition is normal.
	The log records are the same The temperature name is: power thermal sensor	as above
none	xxx: System Monitor: Temperature Alert! [CPU thermal sensor], Current voltage: [VVV] degree, Limit temperature: [LLL] degree xxxrepresents time, e.g. 2010-12-25 14:15:25	The first temperature of CPU Suggestion as above.

	[VVV] represents the current value, and [LLL] represents the first limit of CPU temperature.	
Temperature alarming, XX Shut down (XX means inversion timing, starting 60S)	The log records are the same [VVV] represents the current value, and [LLL] represents the second limit of CPU temperature.	The second temperature of CPU Suggestion as above

### 8.3.4 Fan Alarming

Alarming tips	LOG record	Suggestion
Fans need maintenance, please contact service engineers	xxx: System Monitor: Fan alert! [XXX], Current speed: [VVV] degree, Limit speed: [LLL] rpm. xxxrepresents time, e.g. 2010-12-25 14:15:25 [XXX] represents fan name, [VVV] represents the current value, and [LLL] represents the limit. The detailed fan names are as following: Main Board Fan、Power Fan	Replace the fan/connect the line again/remove the barrier which causes the fan malfunction

### 8.3.5 Battery Alarming

Alarming tips	LOG record	Suggestion
Alarming! Illegal operating battery! Lead to permanent damage.	Battery Hot Plug	Stop the illegal operation.
Battery communication is abnormal.	Battery I2C error	Check the battery connection or replace the battery
Battery communication is abnormal, please connect to AC power supply or shut down! Otherwise the system shuts down automatically after 60s!	Battery I2C error, the battery supply	Check the battery connection or replace the battery
Battery temperature is too high; please connect to AC power supply or shut down! Otherwise the system shuts down automatically after 60s!	Battery temperature is out of range temp, Battery temperature is: xx centigrade	Check if the heat radiating condition is normal.
Battery temperature is too low; please connect to AC power supply or shut down! Otherwise the system shuts down automatically after 60s!	battery voltage is low, battery volt is xx V	Check the battery connection or replace the battery
Battery error! Battery cannot be used!	battery break	Replace the battery
Battery voltage is too low, please connect to AC power supply or shut down! Otherwise the system shuts down automatically after 60s!	Low battery power, battery power is XX	Input AC, check if the battery charging is normal, and it can be used when full of power. Or replace the battery
Battery life is approaching, please	battery cycle is XX,	Replace the battery

replace with new battery	please change the battery	
/	Battery I2C error, Shutdown State	Replace the battery and confirm the malfunction module.
/	Battery Hot Plug, Shutdown State	Stop the illegal operation.

### 8.3.6 PHV Related Alarming

Alarming tips	LOG record	Potential reason
Alarm! High-voltage transmission is abnormal, and images display normally!	PHVX supply voltage error, PHVX is XX(upper limit is XX)	Something is wrong with the programmed voltage of power module, which make either of the both PHV circuits or multi-path voltage 1.1 more than the limit of voltage (100%AP) .
none	PHV protect, PHV1P is XX, PHV1N is XX	PHV protection and the voltage of PHV is less than the lower limit.
	95V Power supply voltage error, the voltage is XX ,normal region is 90V to 100V -95V Power supply voltage error, the voltage is XX ,normal region is -90V to -100V	Something is wrong with the programmed voltage of power module: positive/negative 95V of power transmitting exceeds the limited value





# 9 Care and Maintenance

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## 9.1 Overview

These procedures in this chapter are recommended.

### 9.1.1 Tools, Measurement Devices and Consumables

**Table 9-1 Tools and Measurement Devices**

Tool/Measurement Devices	Qty.	Remarks
Resin or plastic container	1 pcs	Can accommodate two probes
Soft brush	1 pcs	About a toothbrush size
Small plastic basin	1 pcs	Used to fill the soapy water
Safety test analyzer	1 pcs	Refer to appendix A
Inner hexagon wrench	2 pcs	Inner hexagon wrench 6

**Table 9-2 Consumable List**

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

## 9.1.2 Care and Maintenance Items

Table 9-3 Maintenance Items and Frequency

NO.	Maintain content	Frequency	Method
1.	Clean display	Monthly	Referring to 9.2.1
2.	Clean trackball	Monthly	Same as the above
3.	Clean control panel	Monthly	Same as the above
4.	Clean probes (the head)	Every time after using	Same as the above
5.	Clean probe cable and the surface of connector	Monthly	Same as the above
6.	Clean holders (including probe holder and gel holder)	Monthly	Same as the above
7.	Clean cover	Monthly	Same as the above
8.	Clean peripherals	Monthly	Referring to 9.2.2
9.	Check surface of probe	Daily	Referring to 9.3.1
10.	Check power cable and plug	Monthly	Same as the above
11.	Check battery	Annually	Same as the above
12.	Check function of peripherals and options	Annually	Referring to 9.3.3
13.	Mechanical safety inspection	Annually	Referring to 9.3.4
14.	Electrical safety inspection	Once per two years	Referring to appendix A

## 9.2 Cleaning

### 9.2.1 Clean the System

#### 9.2.1.1 Flow of Cleaning

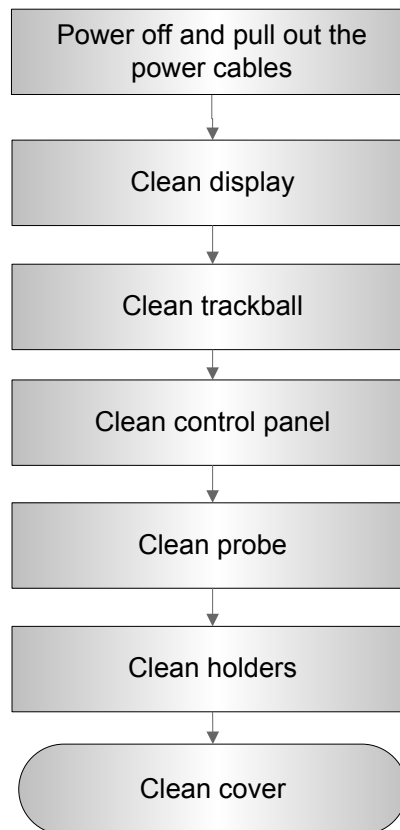


Figure 9-1 View of Cleaning Maintenance

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

### 9.2.2 Content

#### 1. Clean Display

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

Surface of display should be cleaned with soft dry cloth. Remained stain should be washed out by cloth with clear water or soapy water, and then air-dry the surface.

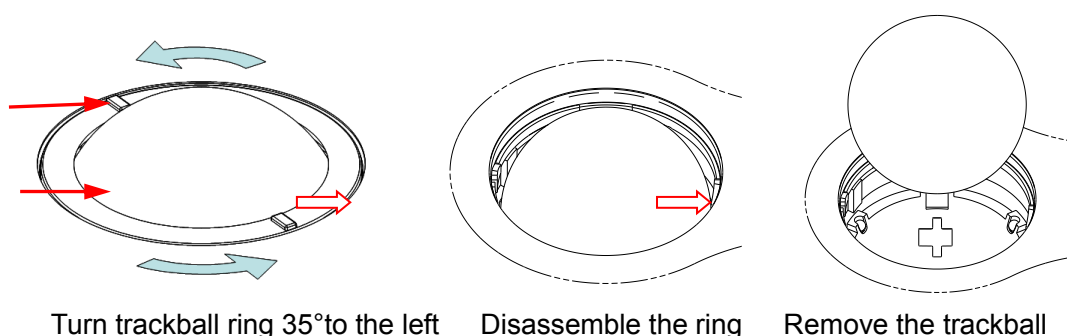
#### 2. Clean Trackball

- Tool: dry cloth, mild soapy water
- Method:

Trackball is one of important interface parts, which are embedded into the main unit keyboard, and part of which is exploded to be operated by users in order to implement variety of module's control functions. Trackball is one of the most using frequency of input assemblies on the whole operation panel, and the trackball similar to a multi-directory caster can rotate in every direction driven manually, due to the feature, gas or dust can enter into module internal easily, as a result, contamination of lens would lead to the failure of the trackball.

a) Disassembling the trackball:

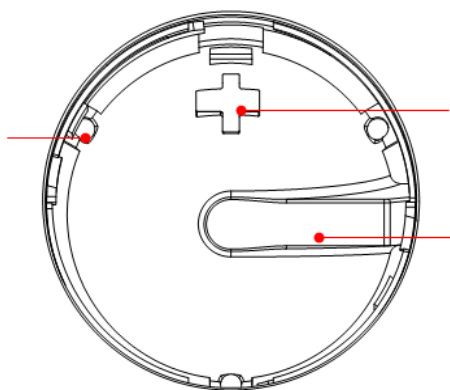
Turn the trackball ring about 35° counterclockwise until it lifts, now, you would remove the ring and pull out the trackball with plastic cloth if you can't hold it by your hands directly. Disassembling the trackball is as following:



**Figure 9-2 Disassembly of the Trackball**

b) Cleaning

After removing the ring and the trackball, wipe down the lens with a clean paper until you can see nothing in the groove zoom, and then clean the other contaminant material, please pay attention to your intensity adopted on wiping dust of bead down, as shown in the following figure. Power-off is not need during cleaning, and maintenance effect can be experienced directly. After cleaning completely, you can install the trackball and the ring.

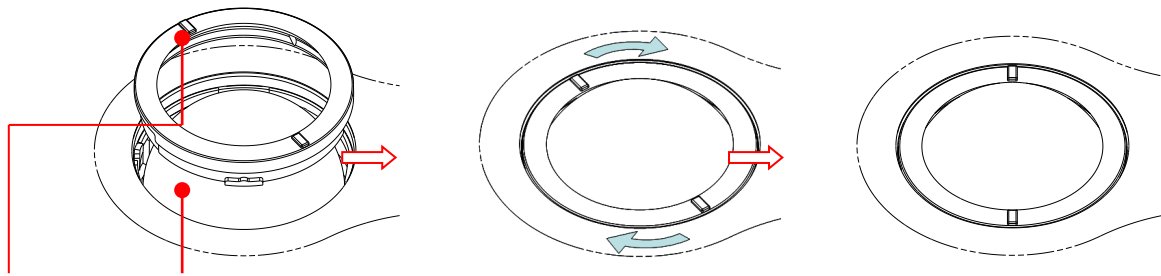


**Figure 9-3 The Sketch Map of Len, Bead, Dragon groove**

If liquid is accidentally sprayed on or into the system, most of which could discharge from the dragon port of trackball, but some of which would left in the trackball cover, now you may clean it with clean soft dry cloth or paper according to the above maintenance procedure.

c) Installing the trackball

After the trackball maintenance, you can restore the installing following procedure: Put the trackball back in the trackball mechanism and align the clamping ring with the top cover notches. Press the bulges on the ring with both hands and turn the ring about 35° counterclockwise until the ring clicks and locks. As the bulges are flush with the top cover, the ring is secured. See the figure below.



### 3. Clean control panel

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

Use dry soft cloth to clean the surface of the system. If the system is dirty, moisten the soft cloth with mild soapy water and wipe off any stains. Use dry soft cloth to remove any moisture and allow all hard surfaces to completely air-dry. If it is difficult to clean the control panel, disassemble the keys first and then use mild soapy water to clean it.

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

### 4. Clean Probe

- Tools: mild soapy water , dry soft cloth , soft brush
- Method:
  - a) Wipe out the dust attached to surface of probe, and check if it has any abnormality such as crack;
  - b) Remained stain or dust attached to surface of probe cable should be washed out by cloth with clear water or soapy water, and then air-dry the surface of probe cable;
  - c) Use a soft brush to clean the probe holder, removing dust simultaneously.

### 5. Clean Holders

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

  - a) Wipe out the dust attached to surface or inner of probe holder,
  - b) Remained stain or dust attached to probe holder should be washed out by cloth with clear water or soapy water, and then air-dry the surface of probe cable.

### 6. Clean the Cover

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

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

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

## 9.2.3 Clean the Peripherals

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

**Table 9-4 Peripherals Cleaning List**

No.	Content	Description
1.	Color and B/W video printer	First wipe off dust or stain attached to the cover of printer with soft dry cloth, then clean the inside of printer. Be sure to do the cleaning maintenance according to the operation manual if is necessary.
2.	Graph / text printer	First wipe off dust or stain attached to the cover of printer with soft dry cloth, then clean the inside of printer. Be sure to do the cleaning maintenance according to the operation manual if is necessary.
3.	Foot switch	Use soft dry cloth with a little mild soap water to wipe off the dust or stain attached to the pedals or cable of foot switch.
4.	Bar code scanner	First use soft dry cloth to wipe off dust attached to glass panel of scanner, then the dust or strain attached to cable and bracket. Be sure to do the especial cleaning maintenance according to the operation manual if is necessary.

## 9.3 Checking

### 9.3.1 General check

**Table 9-5 General check list**

No.	Content	Method
1.	Probe	a) Visually check to confirm that there is no crack and expansion to probe head. b) Visually check to confirm that there is no deterioration or desquamation to probe cable. c) Visually check to confirm that there is no bend, destroyed or falling off pins to the connector
2.	Power supply cable and plug	a) Visually check to confirm that there is no wrinkles, crack or deterioration b) Manually check to confirm that there is no looseness or rupture. The connection of plug is reliable and the retaining clamp of power supply cable is effective.

No.	Content	Method
3.	Battery	<p>Check the battery periodically :</p> <p>a) Check if battery can be charged normally when power-on: That the current capacity is 100% or capacity increases after a short time indicates that the battery can be charged normally. It takes less than 2 minutes to increase 1% capacity when the total capacity is less than 90% and it takes more time when the capacity is more than 90%.</p> <p>b) Disconnect the system from the AC power supply to confirm if the system can maintain normal work status in the battery power supply.</p>

### 9.3.2 System Function Check

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

**Table 9-6 System function list**

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

### 9.3.3 Peripherals and Options Check

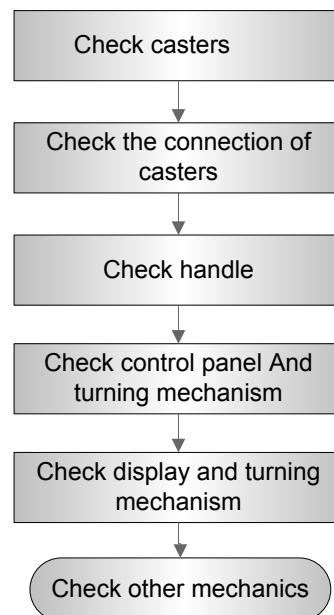
If the system is not configured with any module or peripheral, the corresponding items checking can be skipped.

**Table 9-7 Options, Peripherals and Accessories Check list**

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

### 9.3.4 Mechanical Safety Inspection

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



**Fig 9-4 Mechanical Safety Inspection Flow**



**Table 9-8 Mechanical Safety Check**

NO.	Item	Method	Tool
1.	Casters	a) Visually check to confirm there is no any crack. b) Operate the casters to confirm the locking and releasing functions are normal.	none
2.	Connection of the caster	a) Visually check to confirm that there is no skewness and the connecting screws are free of breakage or falling off. b) Check with the spanner to make sure that there is no looseness between the caster and the base connection screw.	Inner hexagon wrench 8
3.	Handle	1. Visually check to confirm there is no any crack. 2. Rock the handle gently and then lift the ultrasound machine to confirm that the handle is free of looseness and it can accept normal force.	none
4.	Control panel and turning mechanism	Open the control panel to confirm that turning mechanism is normal and the control panel is free of skewness and looseness.	none
5.	Display and turning mechanism	a) Visually check to confirm there is no any crack to the cover of display. b) Manually operate the monitor to make sure that the turning angle of display is normal and no looseness exists.	none
6.	Other mechanical structures	Check to confirm that there is no looseness to other mechanical parts, no crack to cover and no conductive parts show in sight.	none

### 9.3.5 Electrical Safety Inspection

Only technical professionals from Mindray or engineers authorized by Mindray after training can perform electric safety inspection.

Please refer to appendix A: Electrical Safety Inspection for details.



# 10 Troubleshooting of Regular Malfunctions



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## 10.1 System cannot be powered on

### 10.1.1 Module or Board Related

No.	Descriptions	Remarks
1	Battery Li-ion 14.8V 6600mAh LI34I002A	
2	Power supply module	
3	CPU module	

### 10.1.2 Key Points Supporting Troubleshooting

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

### 10.1.3 Troubleshooting

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

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

## 10.2 System Cannot Start up Normally

### 10.2.1 Module or Board Related

No.	Descriptions	Remarks
1	CPU module	
2	HDD	

### 10.2.2 Key Points Supporting Troubleshooting

No.	Key Points Supporting Troubleshooting	Remarks
1	Character and progress status during the starting of the system	
2	Alarm and prompts during the starting of the system	
3	Backlight status during power on the control panel	Support to check if the malfunction occurs in power supply assembly or CPU module

### 10.2.3 Troubleshooting

No.	Fault Description	Cause Analysis	Measure
1	Control panel backlight normal; LCD blank displaying "No signal"; no output when connecting external display with VGA	System powers on normally, enter BIOS self-checking but BIOS screen cannot display. CPU module failure.	Replace CPU module

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

## 10.3 Image Fault

### 10.3.1 Module or Board Related

No.	Descriptions	Remarks
1	Power supply module	
2	1112 main board/1114 main board	Ultrasound front end receiving and transmitting physical channels are 32.
3	1150 probe board/1151 probe board	High-voltage switch on the probe board

### 10.3.2 Key Points Supporting Troubleshooting

No.	Key Points Supporting Troubleshooting	Remarks
1	Image feature, including dark strips and noise	
2	Images appearance when contact occurs between different types of probe in different interface of probe socket.	

### 10.3.3 Troubleshooting

No.	Fault Description	Cause Analysis	Measure
1	NO echo signal in ultrasonic image region The probe can be indentify but no echo.	Main board , power supply module or probe board may be fail;	Confirm the fail cause by replacing main board, power supply module or probe board.
2	Dark strips display on B image	Probe malfunction, e.g. array damage etc. Confirm by connecting another probe.	Replace the probe.
		If several similar dark strips appear in the image.	Replace the main board or probe board.
		If dark strips appear, also after replacing the probe socket, dark strips disappear or change the place.	Replace the probe board.
3	Noise appears in B image	Probe malfunction, e.g. array, rear board, air bubbles and cable shielding etc. Confirm by connecting another probe.	Replace the probe.
		There are other electrical equipments working in the power grid, which introduces the common-mode interference to the probe. Displays ripple-shaped interference signal on the image	Confirm the cause of failure by turning off electrical equipment of all peripherals connected to the system.

## 10.4 Probe Socket System Malfunction

### 10.4.1 Module or Board Related

No.	Descriptions	Remarks
1	1112 main board/1114 main board	
2	1150 probe board/1151 probe board	

## 10.4.2 Key Points Supporting Troubleshooting

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

## 10.4.3 Troubleshooting

No.	Fault Description	Cause Analysis	Measure
1	Probe cannot be recognized	This probe cannot be recognized by connecting to all probe sockets, while reorganization of other probes is normal. Probe malfunction.	Replace the probe.
		This probe cannot be recognized when connecting to a certain socket. Probe board malfunction.	Replace the probe board
		All probes cannot be recognized in all probe sockets; Probe board ID cannot be read correctly by the system information; Main board or probe board malfunction.	Replace the main board or probe board.

## 10.5 IO Interface System

### 10.5.1 Module or Board Related

No.	Descriptions	Remarks
1	1112 main board/1114 main board	
2	CPU module	
3	IO board	
4	1112 Speaker	

## 10.5.2 Key Points Supporting Troubleshooting

No.	Key Points Supporting Troubleshooting	Remarks
1	Working condition of the control panel	Confirm if the USB main device is functional since the control panel is connected by internal USB cable
2	Working condition of each USB port	See 2.1.1.2
3	Working condition of Video, S-video and VGA video interfaces	See as above
4	Printing condition of video printer	Check if output of connected video printer is normal

## 10.5.3 Troubleshooting

No.	Fault Description	Cause Analysis	Measure
1	LCD displays normally; NO video printer output when press <print> on control panel	Remote printing control failure or video output failure if there is no user-defined key failure.	Replace the main board.
2	Two speakers have no sound	Main board malfunction	Replace the main board
3	Only one speaker has no sound	Speaker malfunction	Replace speaker
4	USB device cannot be recognized while connecting to the USB port Control panel works well	Main board malfunction	Replace the main board.
5	Network disconnected or abnormal	CPU module or IO board malfunction if there is no network or setting failure.	Confirm by replacing CPU module or IO board.

## 10.6 Control Panel

### 10.6.1 Module or Board Related

No.	Descriptions	Remarks
1	1112 silicon key	
2	Control panel	
3	Dual encoder module	
4	Single encoder module	



5	Trackball module	
6	TGC module	

## 10.6.2 Key Points Supporting Troubleshooting

No.	Key Points Supporting	Remarks
1	Backlight of control panel	To confirm if the control panel is powered on normally;
2	Key sound of the control panel.	To confirm if the buzzer works normally
3	Response to function keys on control panel	
4	Response to trackball operation	
5	Response to the sliding potentiometer	To confirm if a single sliding potentiometer or the control panel PCBA is damaged.
6	Response to each encoder	To confirm if a single encoder or the control panel PCBA is damaged.
7	Buzzer alarm	The buzzer alarms when a key is blocked for 100 seconds.

## 10.6.3 Troubleshooting

No.	Fault Description	Cause Analysis	Measure
1	Buzzer alarms	Key blocked	Check the control panel for key block
2	Some or a certain key failures	Silicon key damage; or Control panel malfunction.	Try replacing silicon key or control panel if no key blocks.
3	Trackball failed or abnormal	Dirt or obstacles jam in the trackball groove	Open and clean the groove
		Improper setting of trackball speed in system preset;	Make a proper preset
		Degenerated trackball performance	Replace the trackball module
4	All key of control panel are normal, Single encoder is failed.	Single encoder malfunction	Replace the encoder board
5	All key of control panel are normal, Single key of TGC is failed.	TGC board malfunction	Replace TGC board
	All keys of TGC are failed.	Control panel malfunction	Replace Control panel

## 10.7 LCD Display

### 10.7.1 Module or Board Related

No.	Descriptions	Remarks
1	1150 monitor assembly	Failure rate: low
2	IO board	Failure rate: low
3	1112 main board/1114 main board	
4	CPU module	

### 10.7.2 Key Points Supporting Troubleshooting

No.	Key Points Supporting Troubleshooting	Remarks
1	Backlight of the LCD	More evident in dark
2	VGA output port on IO board	Need external LCD
3	Display mode of the LCD	Blank screen, or “No Signal” displayed, or disordered screen, etc.

### 10.7.3 Troubleshooting

No.	Fault Description	Cause Analysis	Measure
1	Control panel powered on normally; No display (blank screen) on the LCD; Displays normally with external LCD connecting by VGA.	Monitor malfunction	Replace the monitor assembly
2	Control panel powered on normally; The color of some mode key turns on orange. No display (blank screen) on the LCD, with backlight only; or, disordered screen.	Main board malfunction	Replace the main board.
3	Control panel powered on normally and no key indicator turns on orange. “No Signal” displays on LCD; No display external LCD connecting by VGA.	CPU module malfunction	Replace CPU module

# Appendix A ELECTRICAL

## SAFETY INSPECTION

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

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

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

## ELECTRICAL SAFETY INSPECTION

### 1- Power Cord Plug

#### TEST PROCEDURE

##### ◆ The Power Plug

The Power Plug Pins	No broken or bent pin. No discolored pins.
The Plug Body	No physical damage to the plug body.
The Strain Relief	No physical damage to the strain relief. No plug warmth for device in use.
The Power Plug	No loose connections.

##### ◆ The Power Cord

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

## 2- Device Enclosure And Accessories

### TEST PROCEDURE

#### ◆ Visual Inspection

The Enclosure and Accessories	No physical damage to the enclosure and accessories.
	No physical damage to meters, switches, connectors, etc.
	No residue of fluid spillage (e.g., water, coffee, chemicals, etc.).
	No physical damage to probe surface (e.g. crack, etc.)
	No loose or missing parts (e.g., knobs, dials, terminals, etc.).

#### ◆ Contextual Inspection

The Enclosure and Accessories	No unusual noises (e.g., a rattle inside the case).
	No unusual smells (e.g., burning or smoky smells, particularly from ventilation holes).
	No taped notes that may suggest device deficiencies or operator concerns.

## ELECTRICAL SAFETY INSPECTION

### 3- Device Labeling

#### TEST PROCEDURE

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

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

# ELECTRICAL SAFETY INSPECTION

## 4- Protective Earth Resistance

### VOERVIEW

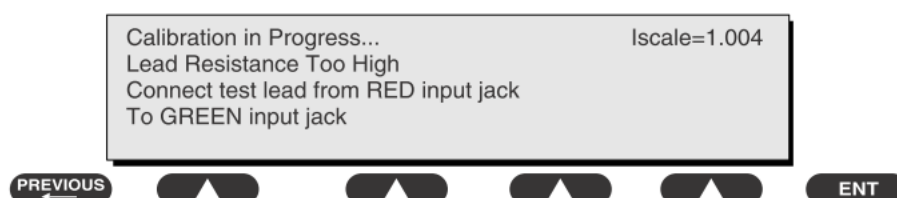
Protective Earth Resistance is measured using the RED test lead attached to the DUT Protective Earth terminal or Protective Earth Metal enclosure or equipotential terminal. Select the test current by pressing SOFT KEY 3 to toggle between 1AMP, 10AMP, and 25AMP. The front panel outlet power is turned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

The following conditions apply: L1 and L2 Open.

### TEST PROCEDURE

#### ◆ Prepare

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



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

#### ◆ Warning

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

#### ◆ Perform the Test

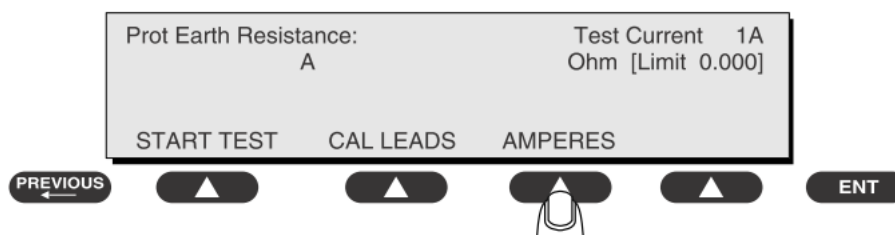
- 1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601PRO front panel outlet.
- 2) Attach the 601PRO RED input lead to the device's Protective Earth terminal or an exposed

## ELECTRICAL SAFETY INSPECTION

### 4- Protective Earth Resistance

metal area.

- 3) Press shortcut key 3. The Protective Earth Resistance test is displayed.
- 4) Press SOFT KEY 3 to select a test current (1AMP, 10AMP, or 25AMP). The selected test current is displayed in the upper right corner of the display.



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

#### ◆ Note

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

#### ◆ Failure

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

#### LIMITS

ALL COUNTRIES R = 0.2Ω Maximum



# ELECTRICAL SAFETY INSPECTION

## 5- Earth Leakage Test

### OVERVIEW

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

Leakage current is measured the following ways:

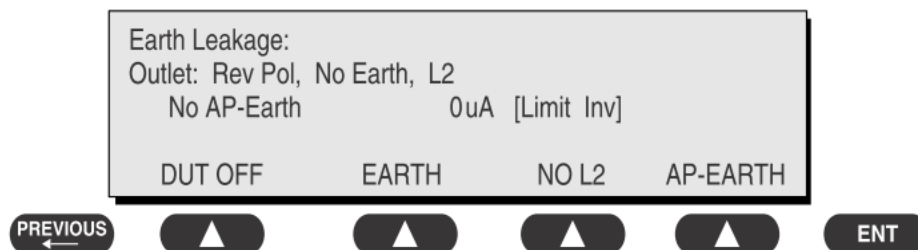
- ◆ Earth Leakage Current, leakage current measured through DUT outlet Earth
- ◆ Earth Leakage Current AP-EARTH (ALL Applied Parts connected to Earth), leakage current measured through DUT outlet Earth

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

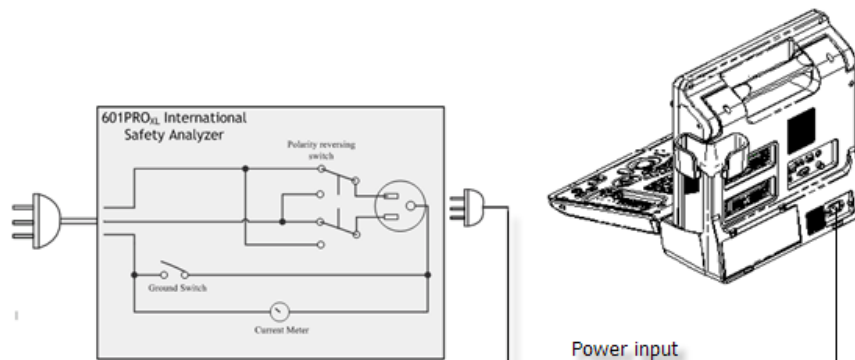
### TEST PROCEDURE

#### ◆ Perform the Test

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



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



## ELECTRICAL SAFETY INSPECTION

### 5- Earth Leakage Test

#### Figure 1 Earth leakage test

#### ◆ Failure

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

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

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

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

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

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

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

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

#### LIMITS

UL60601-1:	300 $\mu$ A Normal Condition
	1000 $\mu$ A Single Fault Condition
IEC60601-1::	500 $\mu$ A Normal Condition
	1000 $\mu$ A Single Fault Condition

# ELECTRICAL SAFETY INSPECTION

## 6- Patient Leakage Current

### OVERVIEW

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

### TEST PROCEDURE

#### ◆ Prepare

Perform a calibration from the Mains on Applied Part menu.

The following outlet conditions apply when performing this test:

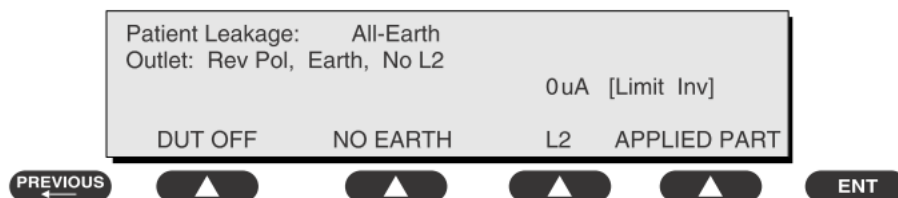
Normal Polarity, Earth Open, Outlet ON	Normal Polarity, Outlet ON
Normal Polarity, L2 Open, Outlet ON	Reversed Polarity, Outlet ON
Reversed Polarity, Earth Open, Outlet ON	Reversed Polarity, L2 Open, Outlet ON

#### ◆ Warning

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

#### ◆ Perform the Test

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



- 4) Press APPLIED PART (SOFT KEY 4) at any time to select the desired applied part leakage current.
- 5) Modify the configuration of the front panel outlet by pressing the appropriate SOFT KEY on

# ELECTRICAL SAFETY INSPECTION

## 6- Patient Leakage Current

the 601PRO.

- 6) Press the print data key at any time to generate a printout of the latest measurement.

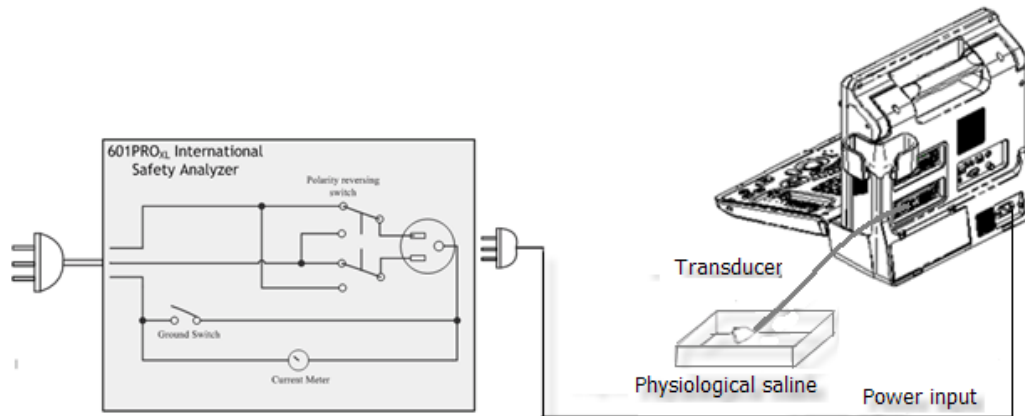


Figure 2 patient leakage Current

### ◆ Note

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

### ◆ Failure

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

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

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

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

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

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

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

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

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

## ELECTRICAL SAFETY INSPECTION

### 6- Patient Leakage Current

#### LIMITS

All countries

For BF ECG input and transducer

100  $\mu$  A Normal Condition

500  $\mu$  A Single Fault Condition

# ELECTRICAL SAFETY INSPECTION

## 7- Mains on Applied Part Leakage

### OVERVIEW

The Mains on Applied Part test applies a test voltage, which is 110% of the mains voltage, through a limiting resistance, to selected applied part terminals. Current measurements are then taken between the selected applied part and earth. Measurements are taken with the test voltage (110% of mains) to applied parts in the normal and reverse polarity conditions as indicated on the display.

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

Normal Polarity;

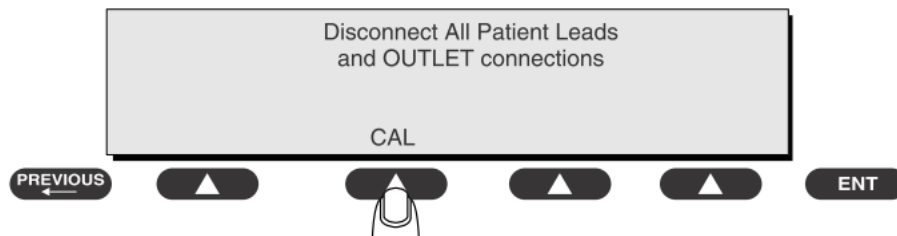
Reversed Polarity

### TEST PROCEDURE

#### ◆ Prepare

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

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



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

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

#### ◆ Warning

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

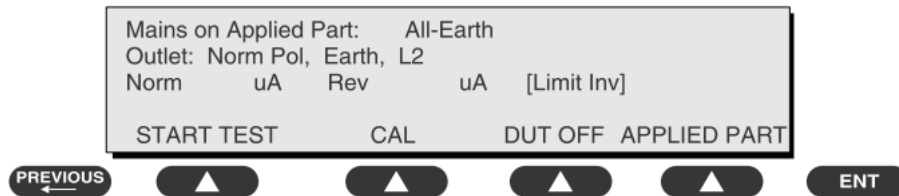
#### ◆ Performance

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

## ELECTRICAL SAFETY INSPECTION

### 7- Mains on Applied Part Leakage

- 2) Attach the applied parts to the 601PRO applied part terminals.
- 3) Attach the red terminal lead to a conductive part on the DUT enclosure.
- 4) Press shortcut key 7. The Mains on Applied Part test is displayed.



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

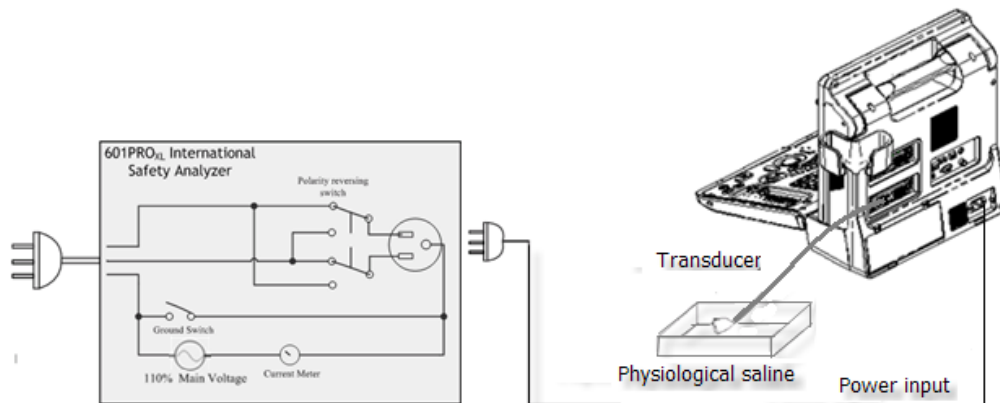


Figure 3 Mains on Applied part leakage

#### ◆ Note

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

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

#### ◆ Failure

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

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

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

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

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

## ELECTRICAL SAFETY INSPECTION

### 7- Mains on Applied Part Leakage

could be used instead.

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

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

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

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

### LIMITS

All countries:

For BF ECG input and transducer:

5000  $\mu$  A



## ELECTRICAL SAFETY INSPECTION FORM

## (Class I equipment)

## Overall assessment:

- ☐ Scheduled inspection Test item: 1, 2, 3, 9
- ☐ Unopened repair type Test item: 1, 2, 3, 9
- ☐ Opened repair type, not modify the power part Test item: 1, 2, 3, 4, 5, 9  
including transformer or patient circuit board
- ☐ Opened repair type, modify the power part Test item: 1, 2, 3, 4, 5, 6, 7, 8, 9  
including transformer or patient circuit board

<b>Location:</b>				<b>Technician:</b>	
<b>Equipment:</b>				<b>Control Number:</b>	
<b>Manufacturer:</b>		<b>Model:</b>		<b>SN:</b>	
<b>Measurement equipment /SN:</b>				<b>Date of Calibration:</b>	
<b>Inspection and Testing</b>				<b>Pass/Fail</b>	<b>Limit</b>
1	Power Cord Plug				
2	Device Enclosure and Accessories				
3	Device Labeling				
4	Protective Earth Resistance		$\Omega$		Max 0.2 $\Omega$
5	Earth Leakage	Normal condition(NC)	____ $\mu$ A		Max: NC: 300 $\mu$ A(refer to UL60601-1) * NC: 500 $\mu$ A(refer to IEC60601-1) * SFC: 1000 $\mu$ A
		Single Fault condition(SFC)	____ $\mu$ A		
6	Patient Leakage Current	Normal condition(NC)	<input type="checkbox"/> BF____ $\mu$ A		Max: BF applied part: NC:100 $\mu$ A, SFC: 500 $\mu$ A
		Single Fault condition(SFC)	<input type="checkbox"/> BF____ $\mu$ A		
7	Mains on Applied Part Leakage		<input type="checkbox"/> BF____ $\mu$ A		Max: BF applied part: 5000 $\mu$ A
8	Patient Auxiliary Leakage Current	Normal condition(NC)	<input type="checkbox"/> BF____ $\mu$ A		Max: BF applied part: NC:100 $\mu$ A, SFC: 500 $\mu$ A
		Single Fault condition(SFC)	<input type="checkbox"/> BF____ $\mu$ A		

## Note:

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

Name/ Signature: \_\_\_\_\_

Date: \_\_\_\_\_



# Appendix B Phantom Usage

## Illustration

Note: The use of Phantom is not required during Preventive Maintenance. Customer may use it as part of their Quality Assurance Program tests.

**Note:** Best storage and operating temperature of phantom is 10°C~35°C, do not use phantom beyond the specified temperature range, otherwise tested performance indicators may be affected.

**⚠WARNING:**

1. When in use, probe should be placed on acoustic window on the weight, and do not press it hard, otherwise acoustic window and TM material may be damaged.
2. Do not drop or violently shake phantom; in addition to make maintenance, phantom should be put uprightly, and do not make it upside down.

### ◆ Targets Disposal of Phantom KS107BD

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

C: Longitudinal target group D: Horizontal target group

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

G Mimic sac (diam 6mm)

#### 4. Line Target System

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

##### 1. A1—A5:

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

##### 2. B:

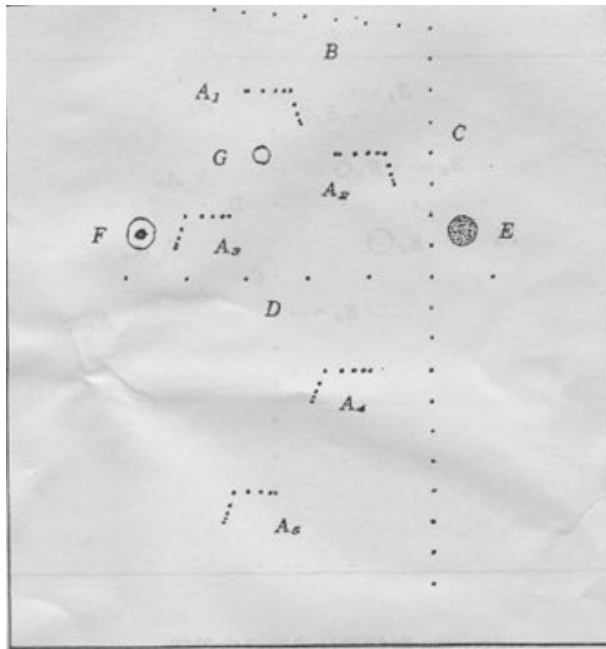
Blind-area target group. Center horizontal distance of adjacent lines is 10mm, distances to the acoustic window are 10, 9, 8, 7, 6, 5, 4, 3mm.

##### 3. C:

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

##### 4. D:

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



#### ◆ Targets disposal of Phantom KS107BD

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

#### 4. Line Target System

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

##### 1. A1——A4:

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

##### 2. B1——B4:

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

##### 3. C:

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

##### 4. D:

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

