DP-10/DP-20 /DP-30series

Digital Ultrasonic Diagnostic Imaging System

Service Manual

Revision 5.0

Table of Content

Revision History

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

Revision	Date	Reason for Change
1.0	2013.1.10	Initial release
2.0	2013.4.22	Change picture of the main board assembly
3.0	2013.6.24	Add “The attentions to the assembly/disassembly, otherwise the hard disk will be damaged” to Chapter 7.4.9.4
4.0	2015.3.10	Add “Chapter 6.2 Set Installment”
5.0	2016.8	Update the labels in 1.2.2.

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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.

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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.**

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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
⚠**DANGER**	**Indicates death or serious injury may occur imminently in this hazardous situation if not avoided.**
⚠ **WARNING**	**Indicates death or serious injury may occur potentially in this hazardous situation if not avoided.**
⚠ **CAUTION**	**Indicates minor or moderate injury may occur potentially in this hazardous situation if not avoided.**
NOTE	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 transducers connected to this system are Type-BF applied parts.	Rear panel
	Caution.	Rear panel

	Patient/user infection due to contaminated equipment. Be careful when performing the cleaning, disinfection and sterilization.	Rear panel
	Patient injury or tissue damage from ultrasound radiation. It is required to practice ALARA when operating ultrasound system.	Rear panel

1.2.2 Warning Labels

No.	Warning Labels	Meaning
1.		Caution! Please carefully read this manual before use device.
2.	The following labels are available when the system works with the mobile trolley. a  b c	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. b. Do not sit on the device. c. DO NOT push the device. When the casters are locked.

1.2.3 General Symbols

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

No.	Symbol	Description	Location
1.		Caution	Power panel
2.		Equipotentiality	
3.		Power button	Upper middle in the control panel
4.	SN	Serial number	Product Label
5.	~	AC (Alternating current)	Lower left corner in the control panel
6.		Battery Status Indicator	

No.	Symbol	Description	Location
7.		Standby indicator	Lower right corner in the control panel
8.		Hard disk indicator	
9.		Brightness of the monitor	control panel
10.		Contrast of the monitor	
11.		Video out	I/O panel
12.		Remote control port	
13.	VGA 	VGA out	
14.		USB port	
15.		Network port	
16.	 A	Transducer socket A	Rear panel
17.	 B	Transducer socket B	
18.		Date of manufacture	Product Label
19.		Authorized representative in the European Community.	
		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.	Product Label

1.3 Safety Precautions

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

⚠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 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 transducers 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 referring to the operator's manual.

2 Product Specifications

2.1 Introduction

2.1.1 Intended Use

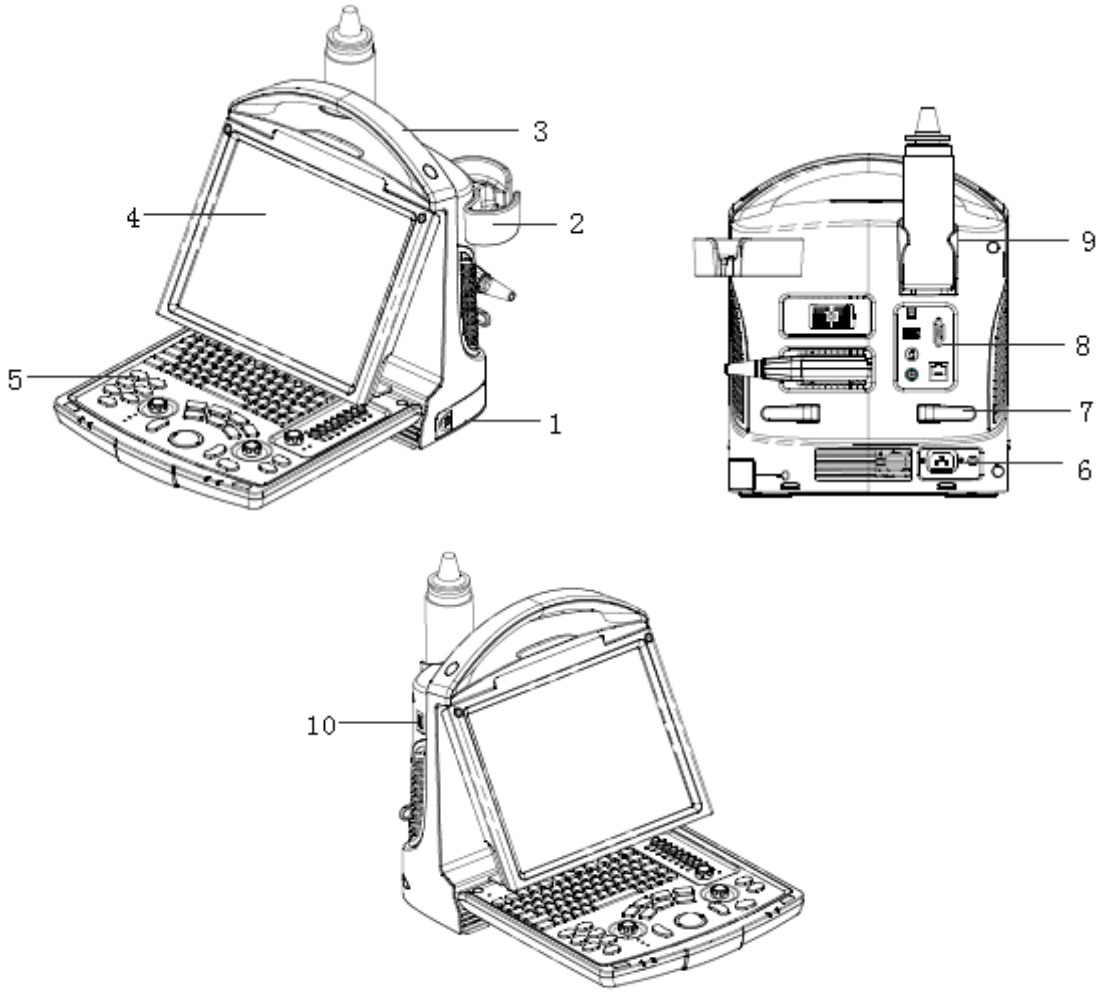
DP10/DP-20/DP-30 series is Digital Ultrasonic Diagnostic and applicable for ultrasonic exams of human body.

DP-10 series：DP-10、DP-10T/DP-11/DP-15/DP-18、DP-10Vet

DP-20 series:DP-20、DP-20T/DP-21/DP-25/DP-28、DP-20Vet

DP-30 series：DP-30、DP-30T、DP-30Vet

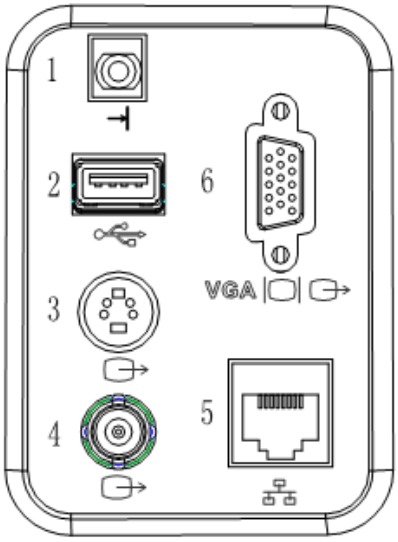
2.1.2 Introduction of Each Unit



No.	Name	Function
1	Battery cover	Used to hold the battery
2	Probe holder	Used to place probes temporarily
3	Handle	Used to lift the machine
4	LCD display	Used to displays the image and parameters
5	Control Panel	Man-machine interface, referring to 2.1.2.3 control panel
6	Power Supply Panel	Electric interface panel, referring to 2.1.2.2 Power supply panel”
7	Winding rack	Used to wind the power cord.
8	I/O Panel	Input and output interface panel, referring to 2.1.2.1 I/O panel
9	Gel holder	Used to place the ultrasound gel temporarily.
10	USB ports	Used to connect USB devices.

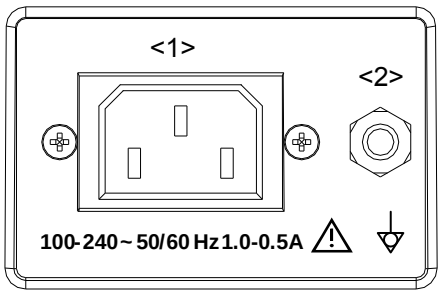
2.1.2.1 I/O Panel

The I/O panel locates at the back of the system.



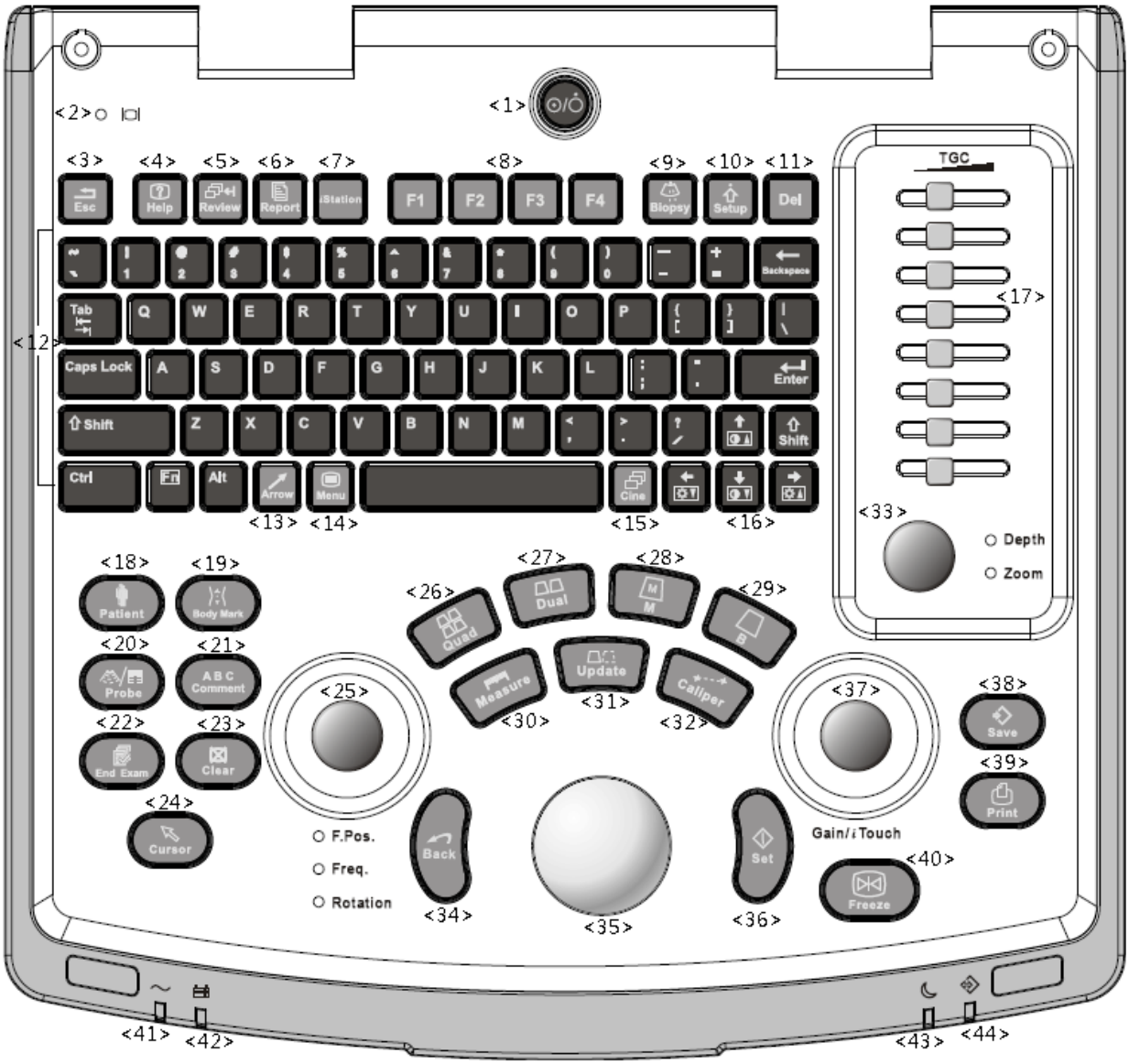
No.	Name	Function
1	Video printing control	Connects the remote cable of the video printer.
2	USB ports	Used to connect USB devices.
3	S-Video output	Separate video output, connecting video printer or monitor
4	Video output (coaxial-cable)	Video output, connecting video printer or monitor
5	Network port	To connect the network cable
6	VGA output	VGA signal output

2.1.2.2 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.

2.1.2.3 Control Panel



No.	Name	Description	Function
1	/	Power button	Power button Press to turn on/off the system. The indicator is not on when the system is turned off; After power on, the indicator is green.
2	/	Monitor status indicator	Monitor status indicator Green: working in normal status; Orange: no signal.
3	Esc	Exit	Press to exit the current status to the previous status.
4	Help	/	Press to open or close the accompanying help documents.

No.	Name	Description	Function
5	Review	/	Press to review the stored images.
6	Report	/	Press to open or close the diagnosis reports.
7	iStation	/	Press to enter or exit the patient information management system.
8	F1~F4	User-defined key	You can assign a function to the key.
9	Biopsy	/	Press to show or hide the biopsy guide line.
10	Setup	Setting	To open/close the Setup menu.
11	Del	/	Press to delete the comment, etc.
12	/	Alphanumeric keys	Same as on PC
13	Arrow	Arrow	Press to enter or exit the arrow comment status.
14	Menu	Main menu	Press to display or hide a mode-specific parameter menu.
15	Cine	Cine Review	Press to enter/ exit the Cine Review status.
16	/	Direction key	To adjust monitor brightness or contrast when pressing with <Fn> key.
17	TGC	/	TGC slider, to adjust the depth gain.
18	Patient	End Exam	To end the current exam.
19	Body Mark	Body Mark	To enter/ exit the Body Mark status.
20	Probe	Transducer switch	Press to switch Probe and Exam Type
21	Comment	Comments	Press to enter/ exit the character comment status.
22	End Exam	/	Press to end an exam.
23	Clear	/	Press to clear the comments or measurement calipers on the screen.
24	Cursor	/	Press to show the cursor.
25	F.pos/ Freq./Rotation	Focus Position Frequency Rotation	Press: switch between F.Pos and Freq; Rotate: adjust rotation angle.
26	Quad	Quad-split screen	Press to enter Quad mode from non-Quad mode; Press to switch between windows in Quad mode.
27	Dual	Dual-split screen	Press to enter Dual mode from non-Dual mode; Press to switch between windows in Dual mode.
28	M	/	Press to enter the M mode.
29	B	/	Press to enter the B mode.
30	Measure	/	Press to enter/Exit Measurement.

No.	Name	Description	Function
31	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.
32	Caliper	/	Press to enter/exit Measurement.
33	Depth Zoom	/	Press: to switch between Depth and Zoom; Rotate: to adjust corresponding parameter.
34	Back	/	Press to decrease parameter value or undo last step during measurement
35	/	Trackball	Roll the trackball to change the cursor position.
36	Set	/	Used in selection.
37	Gain/iTouch	/	Rotate: to adjust B or M gain. Press: to enter/exit iTouch.
38	Save	/	Press to save, user-defined key.
39	Print	/	Press to print: user-defined key.
40	Freeze	/	Press to freeze or unfreeze the image.
41	/	Indicator 1	AC indicator AC supply: light green; Battery supply: light off.
42	/	Indicator 2	Battery status indicator Non-charge/ discharge: light off, else referring to 8.1.1
43	/	Indicator 3	Standby indicator
44	/	Indicator 4	HDD status indicator

2.1.3 Peripherals

The system supports the following models of peripherals.

Name	Model
Footswitch	971-SWNOM（USB port、two pedals）, 971-SWNOM（USB port、three pedals）, FS-81-SP(USB port、one pedal)
Black / white video printer	MITSUBISHI P93W-Z,P93W,SONY UP-897MD SONY UP-D897 SONY UP-D898MD SONY UP-X898MD
Color video printer	Analog：SONY UP-20、MITSUBISHI CP910E

Graph/ text Printer	HP series Tested: HP deskjet 1280, HP Laserjet CM1015, HP officejet 6000, HP LaserJet 1020 puls, HP LaserJet P1007, HP OfficeJet J3600 HP Deskjet Ink Advantage 1018
USB removable storage device	U disk, removable hard disk

2.2 Specification

2.2.1 Dimensions and Weight

External dimensions: 336mm×343mm×151mm (Width×Height×Depth)
Net weight: <6kg (without the battery and accessories)

2.2.2 Electric Specification

2.2.2.1 AC input

Voltage:	100-240 V～
Frequency:	50/60Hz
Input current:	1.0~0.5A

2.2.2.2 Battery

Voltage:	DC11.1V
Capacity:	4800mAh

2.2.3 Environment Specification

	Operating Conditions	**Storage & Transportation Environment**
Temperature:	0℃-40℃	-20℃-55℃
Humidity:	35%-85% (no condensation)	30%-95% (no condensation)
Atmospheric pressure:	700hPa-1060hPa	700hPa-1060hPa

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

2.2.4 Monitor Specification

Work Voltage:	12V
LCD Dimension:	12.1 inch LCD
Resolution:	1024*768

3 Installation

3.1 Preparations for Installation

NOTE:	Do not install the machine in the following locations: 1. Locations near heat generators 2. Locations with high humidity 3. Locations with flammable gases

3.1.1 Electrical Requirements

3.1.1.1 Requirement of Regulated Power Supply

Power specification is showing in 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) by radio frequencies, magnetic fields, and transient in the air wiring. They also generate a weak electromagnetic radiation. Possible EMI sources should be identified before the unit is installed. Electrical and electronic equipment may produce EMI unintentionally as the result of defect.

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

3.1.2 Device Requirements

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 conditioner.
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 2m of each other, with peripheral within 1 m of the unit to connect cables.

3.1.3 Network Environment

Wired LAN function is supported by this ultrasound system.
Data transmission is allowed between different departments or areas with network cable. 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.

3.1.4 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.

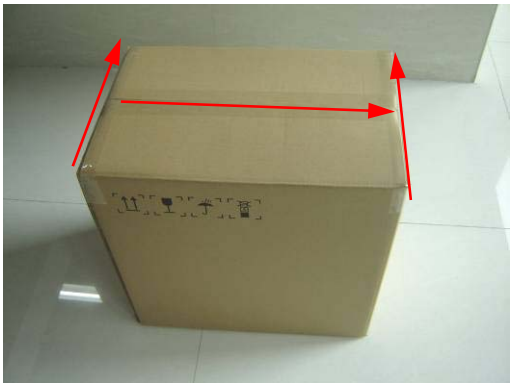
Please confirm the items above prior to the installation training, and do the system settings according to the universal setting of installed region or country.

3.2 Unpacking

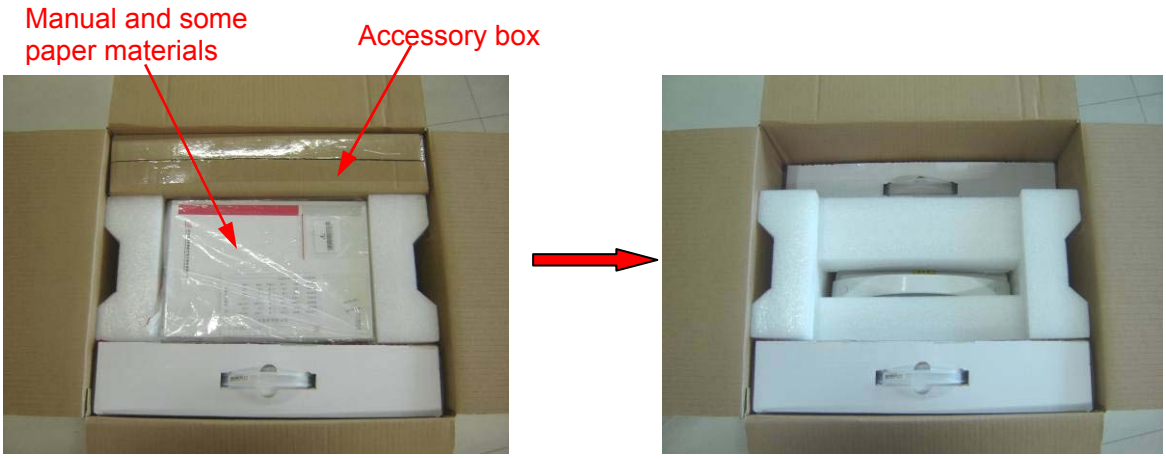
Tools Required: a scissor or a knife.

3.2.1 Process of Unpacking

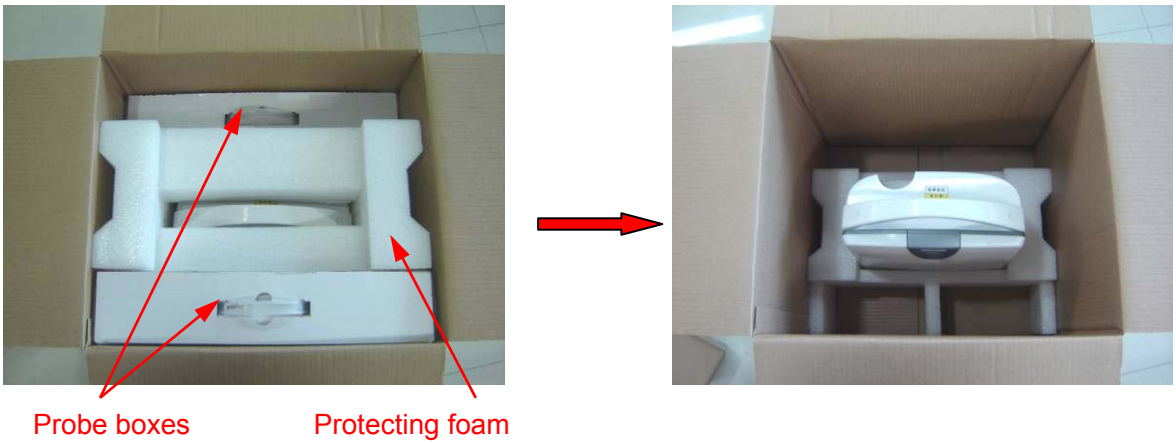
1. Use a knife to cut 3 tapes on the top of package in the direction of the arrow.



2. Open the crate, take out the manual and some paper materials first, and then take out the accessory box.;



3. Take out two probe boxes, then remove the top protecting foam of the main unit.



4. Take out the main unit from the package at last.

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 Control Panel and Monitor Adjusting

1. Hold both sides of the control panel and open the control panel to the horizontal position (with the largest degree).
2. Put the finger into the bottom of the monitor, you can pull and tilt the monitor (30 degree max).
3. Tear off the screen protective film.

- Brightness Adjustment:

 Refer to the brightness control keys; press “Fn” and  key to decrease the brightness; and press “Fn” and  key to increase the brightness.

- Contrast adjustment:

   Refer to the contrast control keys; press “Fn” and  key to decrease the contrast; and press “Fn” and  key to increase the contrast.

- Restore the default settings

  ■ Press both of “  ” and“  ” key about 3S, when “Default……”appears on the monitor, restore the brightness/contrast to default settings. When stopped pressing the keys, “Default……” would disappear in 3S.

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

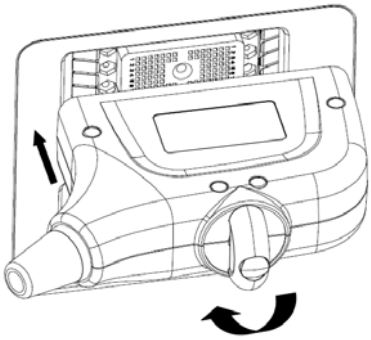
3.3.2 Installing Probe and Gel Holder

1. Fix the ultrasound gel holder hanger into four square holes at the back of the main unit, and push downwards to confirm the installation.

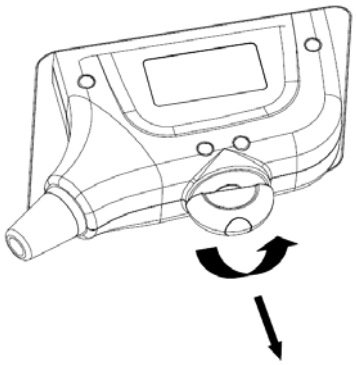
2. Fix the probe holder hanger into two square holes at the back of the main unit on the left side, and push downwards to confirm the installation.

3.3.3 Connecting a Probe

1. Check the probe connector, if 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 cable 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

The system supports the models of peripherals referring to “2.1.3 peripherals”.

3.4.1 Footswitch Installation

Insert the USB connector to the USB ports in the rear or left of the machine (each USB port support).

For settings of footswitch, please refer to 3.5.2.

3.4.2 Video Printer Installation

- Analog video printer:

1. Connect one end of the signal line to the video input interface of the printer, and the other to the S-Video output port in the ultrasound system I/O panel (s terminal).

2. Connect the Remote control line to the Remote interface in the ultrasound system I/O panel.
3. Insert the power cord to a power supply receptacle that is well grounded.

◆ Digital Video Printer

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, then connect the printer with the power supply receptacle that is well grounded.

NOTE: It is possible to print the image if SONY UP-D898MD and SONY UP-X898MD printers should be set to UP-D897 drives. Please refer to the guide from manufacturer for the detailed configuration methods.

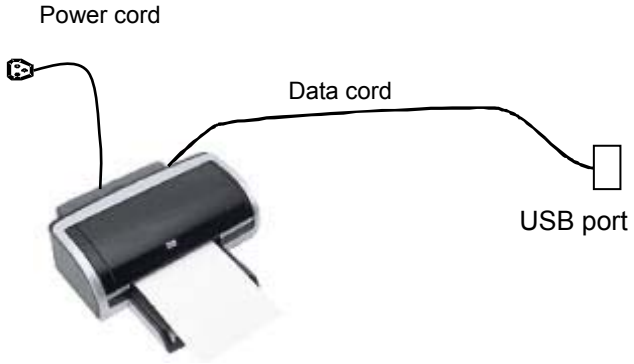
Or you can set the printer driver following the procedures below:

1. Start the printer up, the screen displays READY, and toggle the PUSH ENTER to the right to display PUSH, and press PUSH ENTER to display HISTORY.
2. Toggle PUSH ENTER several times downward until DIGITAL displays on the screen, and toggle PUSH ENTER to the right to display DRIVER.
3. Toggle PUSH ENTER to the right to display DRV:897 or DRV:898 (if it displays DRV:898, toggle PUSH ENTER up and down to switch to driver DRV:897), and press PUSH ENTER to finish setting.

You do not need to set the driver again after powering down and restart the printer.

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.

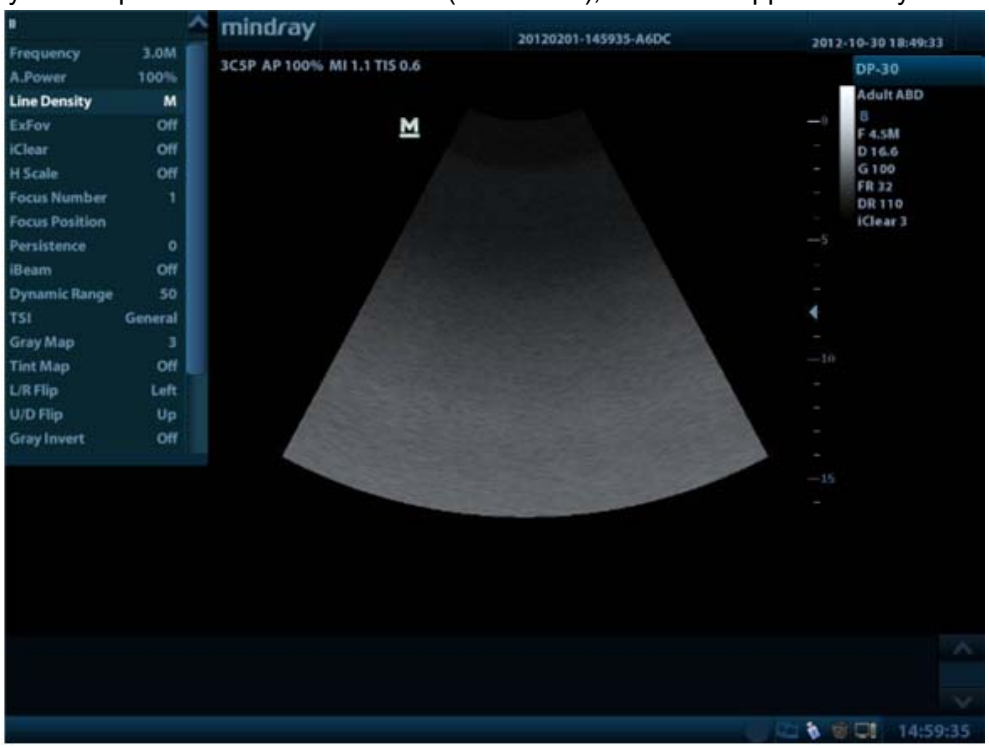
3.5 System Configuration

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 middle of the control panel) 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 60S), it enters Doppler directly:

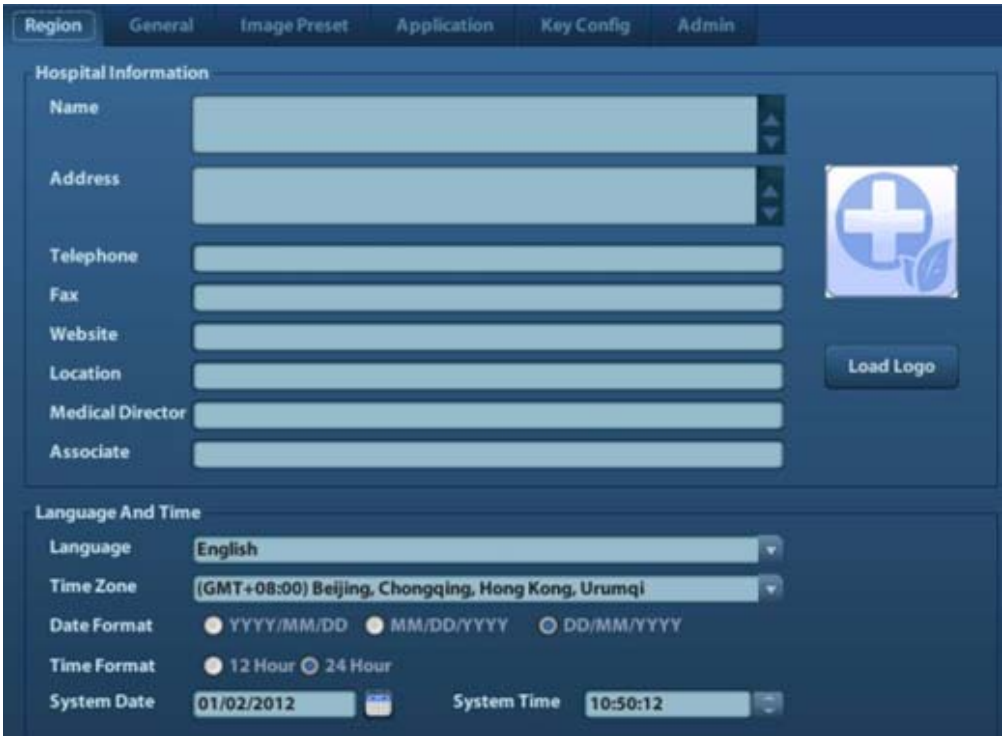


3.5.3 System Preset

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

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

◆ **Region**

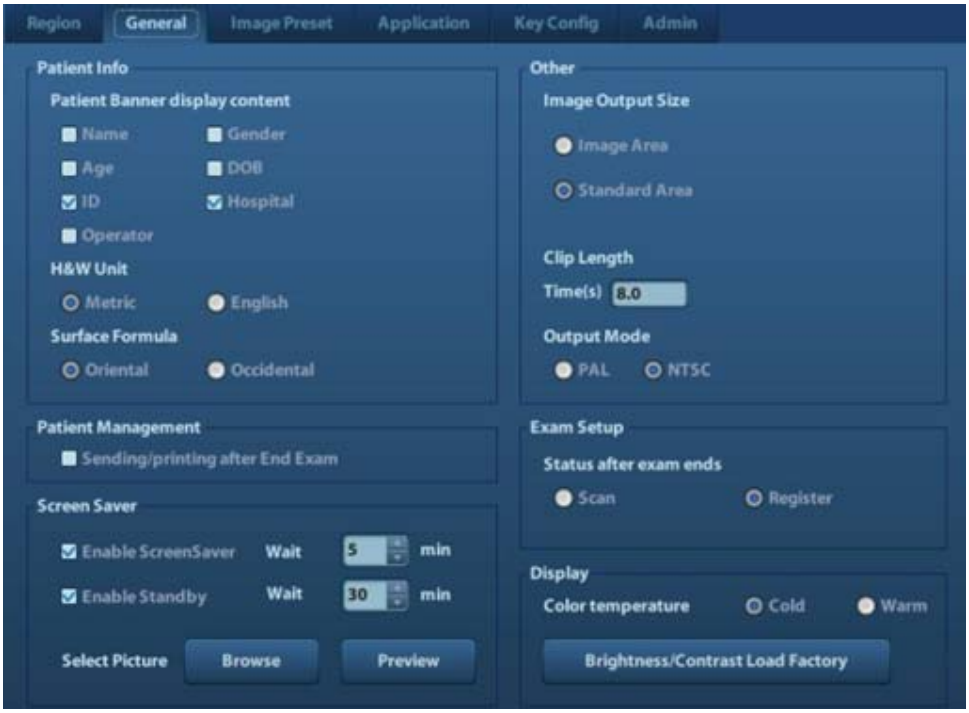


In the Region page, set the system language, date format, date, time and hospital related information, etc.

NOTE:	The format of hospital LOGO must be ".bmp", the recommended size is 400*400.

◆ **General**

Click <General> to enter:



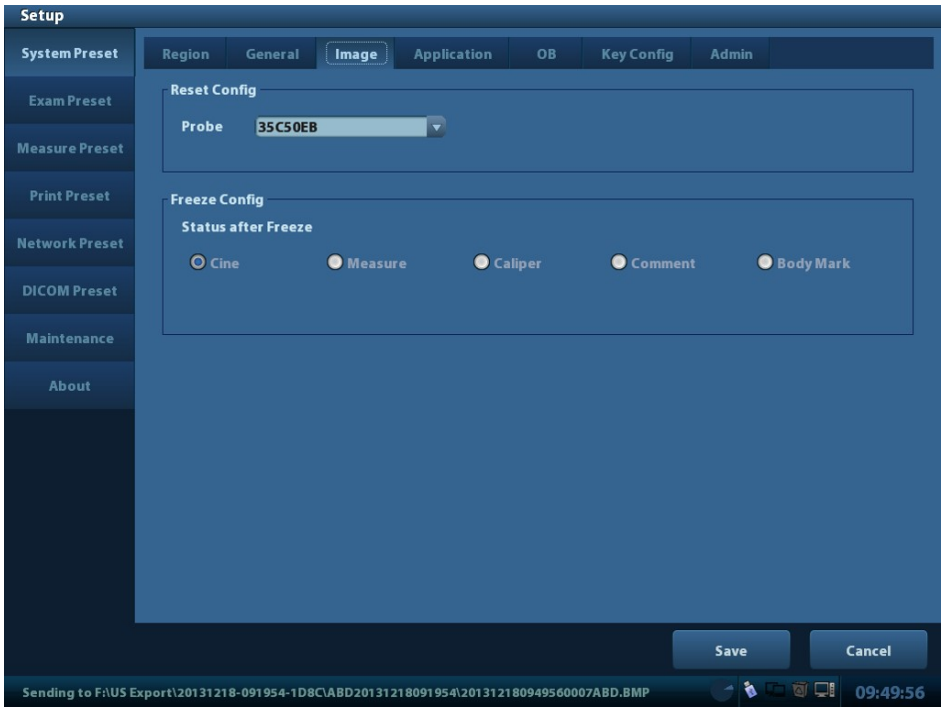
In this page, set the time of standby, brightness/contrast load factory and color temperature of monitor, etc.

◆ **Key Config**

1) Function of keyboard keys F1~F4 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**

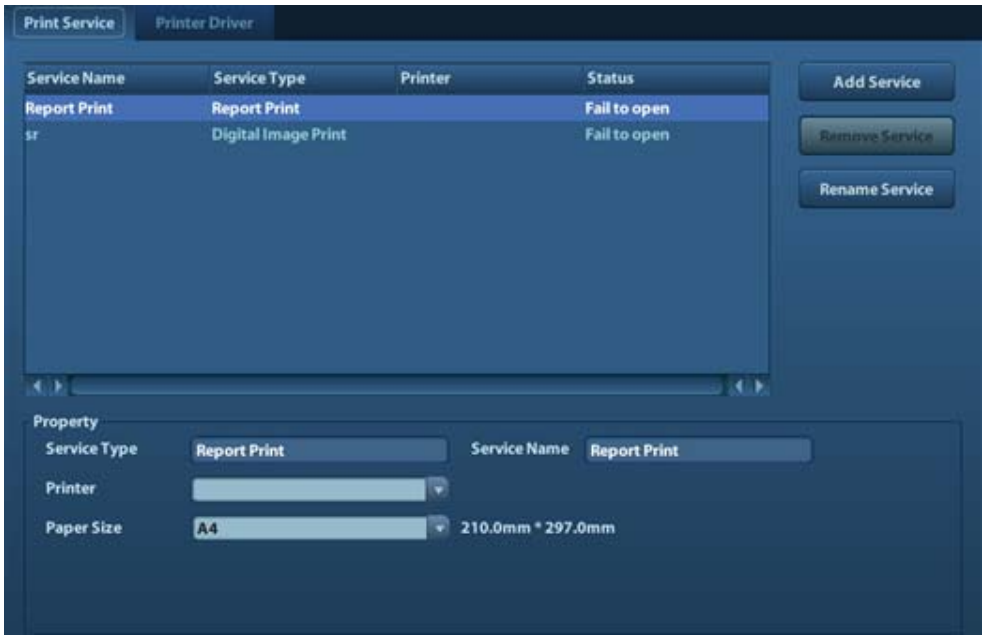
Click [Image Preset] to enter:



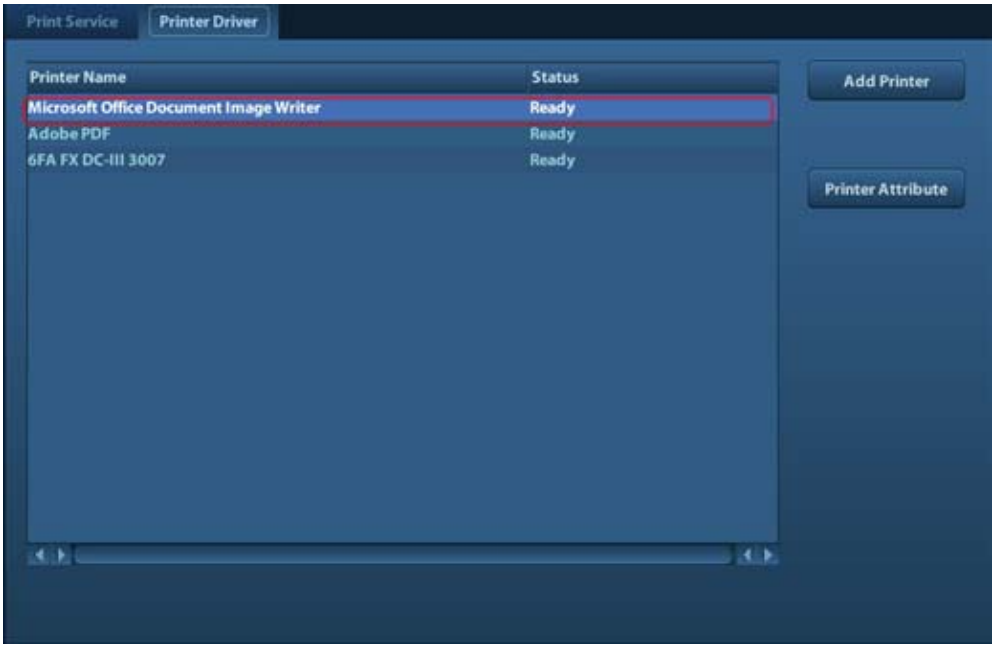
General image parameters can be set in this page.

3.5.4 Print Preset

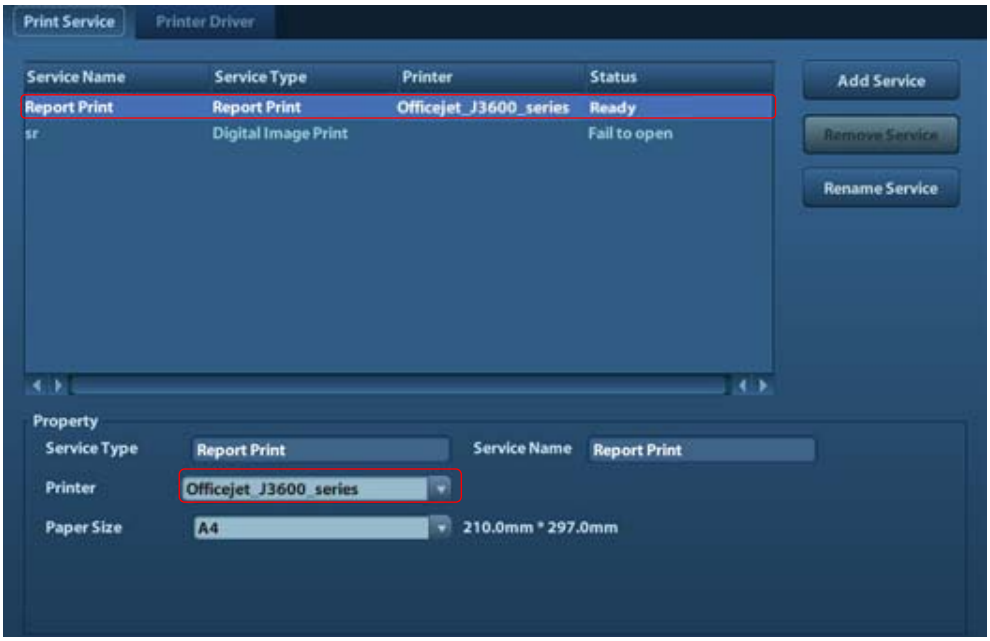
1. Press <Setup> and click [Print Preset] to set video printer, graph/text printer parameters:



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. (Supporting printers refer to 2.1.3).



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



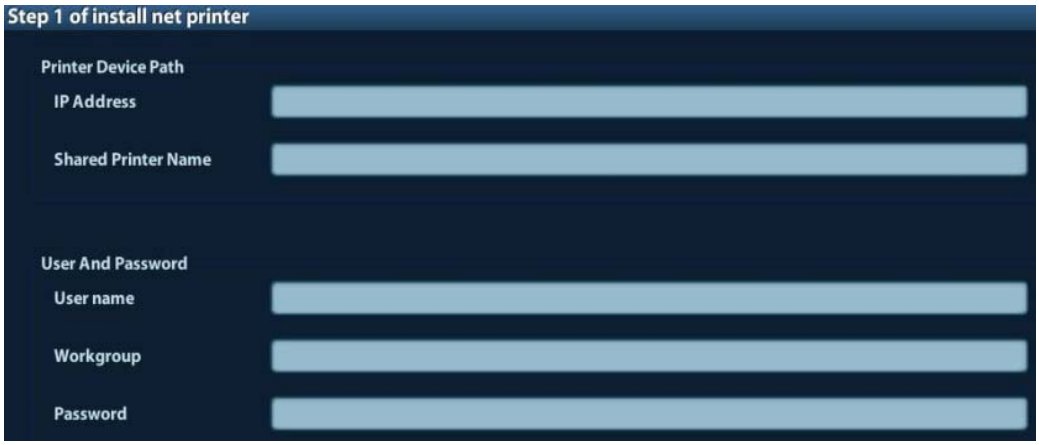
The system integrates drivers of HP printers, after HP printers are connected, drivers will be installed automatically (about 10s).If auto installation fails, icon will display on the right lower corner of the screen to warn you that manual installation is necessary. The driver installation method is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



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 Local TCP/IP Preset

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

1) Please select the network type according the actually status, Select "DHCP", click [Apply].

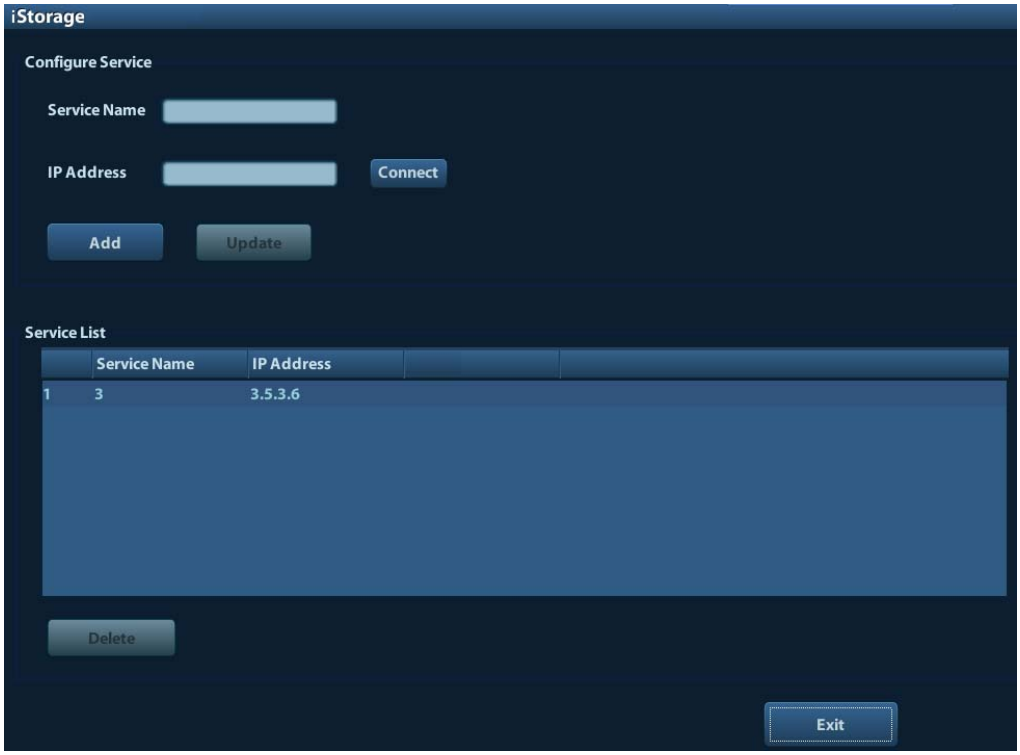
2) Or, select "Static", and input the IP address, subnet mask and gateway, then click [Apply].

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 iStorage Preset

- The iStorage screen is as follows:



Name	Description
Service Name	Name of the device, cannot be empty.
IP Address	IP address of the PC installed with iStorage software cannot be empty.
Connect	Press to verify connection with the PC server. On PC server, if the storage path has not been confirmed, a dialog box will pop up and guide the user to set it. If the storage path on PC has already been set, here it displays connection successful after clicking this button.
Add	Click it to add the new service to the service list.
Update	To save the changed parameters.
Delete	Click to delete the selected service in the service list.

3.5.6 DICOM Preset

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

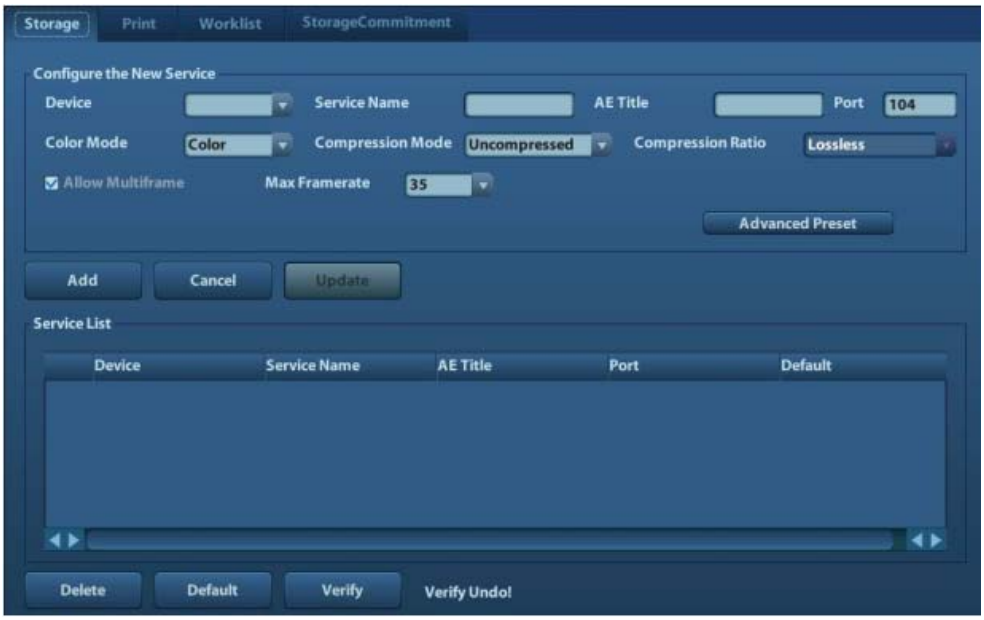
1. Click [DICOM Preset] to open the DICOM preset screen.

DICOM 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.



Only when the system is configured with DICOM basic function module, and installed DICOM Work list, can the corresponding preset settings be found in DICOM Service screen.

The DICOM Service Setting is used to delete and increase the DICOM services, set properties of DICOM services.

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.

3.5.7 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 [About].

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

NOTE:	1.	Be sure to confirm the system information before and after the software maintenance.
	2.	If you want to export the system information, you should enter maintenance screen and click [Export log] to export it to U disk.

4 Hardware System

4.1 General Structure of Hardware System

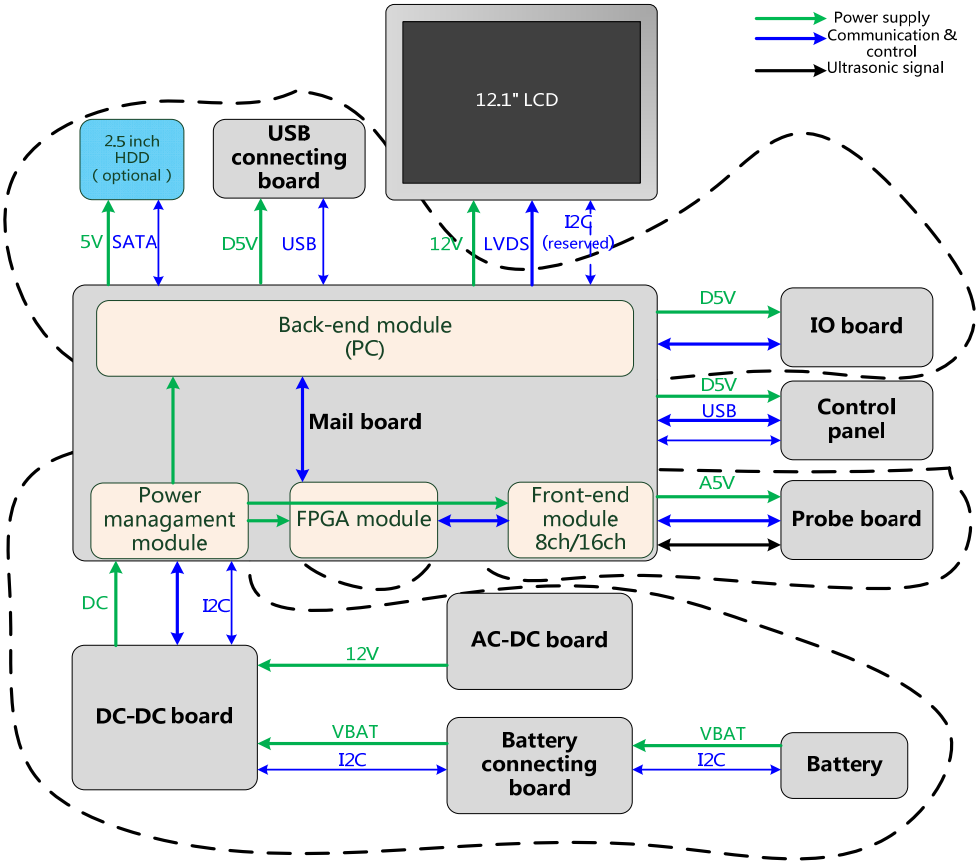


Figure 4-1 Schematic Diagram of System Hardware

As described in the figure above, the system hardware of DP10/20/30 consists of the following units:

- Front-end unit (probe board, front-end module of main board).
- Back-end unit (FPGA module of main board, PC module of main board, IO board, USB connecting board, optional HDD).
- Control panel unit (consists of control panel and some assemblies, the communication interface with main board is USB 1.1).
- Monitor unit.
- Power supply unit (AC-DC board, DC-DC board, battery connecting board, power management module, battery).

Note: the hardware configuration of DP10 is completely the same as DP20, only difference existed in software. The hardware configuration of DP30 is the same as DP10/20 except main board as below:

Name	DP10/DP20 series	DP30 series
Main board	8 physical receiving channels	16 physical receiving channels

4.2 Main Unit

4.2.1 Main Board

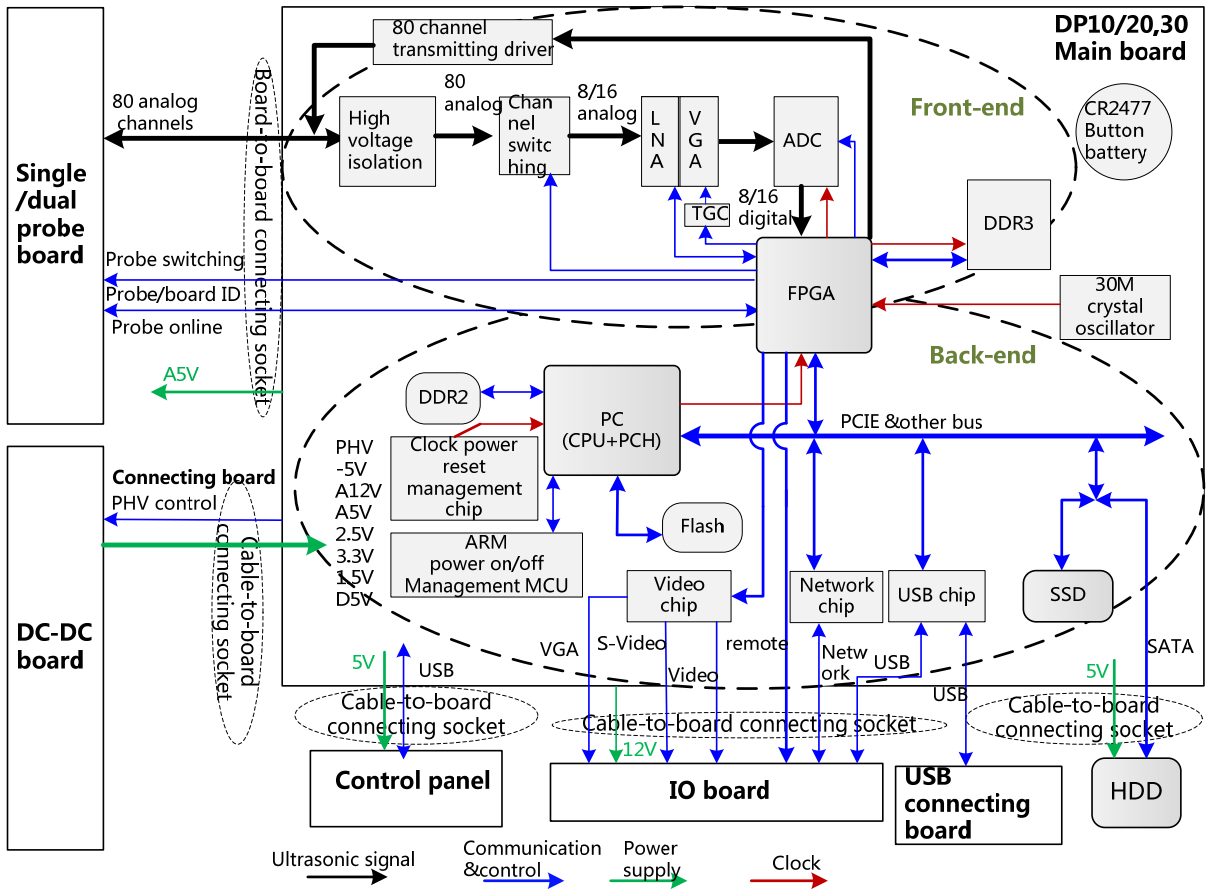


Figure 4-2 Schematic Diagram of DP10/20/30 Main Board

From the ultrasound function, main board can be divided into two parts: ultrasound front-end and ultrasound back-end.

The functions of ultrasound front-end:

- Generate 80-channel transmission waveform according to the scanning sequence and control parameter, which are driven into 80-channel high-voltage transmission pulses by the drive circuit.
- Echo receiving support 80-channel high voltage isolation so as to prevent the receiving circuit from damage by transmitting high voltage.
- 80-array analog channel can be switched to 8/16 receiving channel by channel switching circuit.
- Receiving signal comes into LNA first to implements fixed gain amplification.
- Echo receiving carry out variable gain amplification with depth via the control of TGC.
- 8/16-channel analog echo could be switched to 8/16-channel digital signal by ADC.
- Beam forming and digital signal processing are implemented in FPGA.

The functions of ultrasound front-end:

- After digital signal processing and video scanning, the data used for displaying are formed in the FPGA, then output to video chip to perform the function of VGA, Video and S-Video.
- PC module is consisted of CPU, PCH and other circuits, which implements the control function of main unit.
- The power, clock and reset sequence of the whole back-end are supplied by clock power reset management chip in PC module.
- Power management and power on-off management are supplied by ARM in main board, which implements the fan monitoring, power detecting and indicators control.
- There are SDRAM chip and Flash chip around CPU chip. SDRAM implements the function of memory and Flash is as the solidify carrier of system software.
- All kinds of user interfaces of back-end module are extended by PCH, such as USB, Serial port, SATA, port of solid state disk (SDD for short).etc.
- CPU chip combining with USB chip implement the function of USB. There are two USB interfaces in machine: one is in the left side, the other is on IO board of backside.
- CPU chip implements communication with network chip via PCIE*1 to realize the network function.
- Main board implements communication with control panel via USB 1.1 to realize related functions of control panel.
- Main board implements communication with DC-DC board via I2C to realize battery information management.

4.2.2 Probe Board

There are two kinds of probe boards: single probe board and dual probe board .Main Functions:

- Support 80-array probe.
- Contain one or two 96-pin probe socket.
- Support one or two probe ID acquisition.
- Dual probe board supports switching between two probe sockets.
- Probe socket switching function is not necessary for the single probe board.

The hardware structure of the probe board is shown in the figure below:

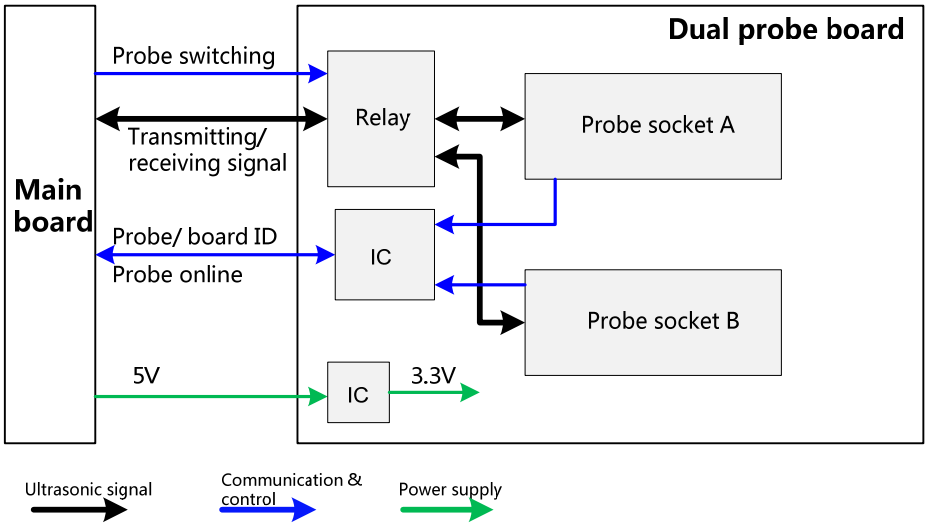


Fig 4-3 Schematic Diagram of Dual Probe Board

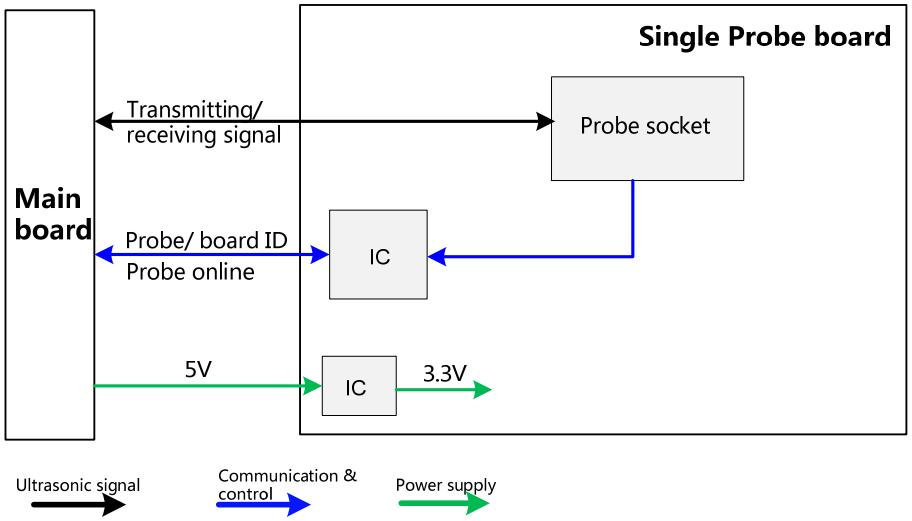


Fig 4-4 Schematic Diagram of Single Probe Board

4.2.3 IO Board

IO board realizes the IO ports conversion function, which connects the main board and IO.

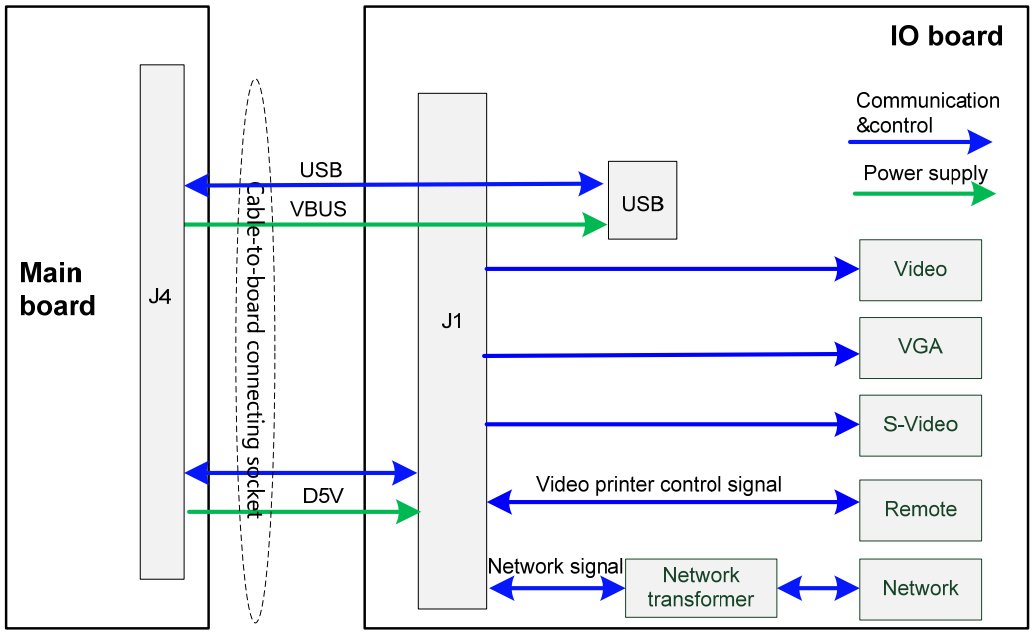


Fig 4-5 Schematic Diagram of IO Board

IO board mainly supplies following ports:

a) G-bit Ethernet port, 1.

b) Video output port,1.

c) Video print control port,1, for both B/W and color.

d) USB port, 1 for external.

4.3 Monitor

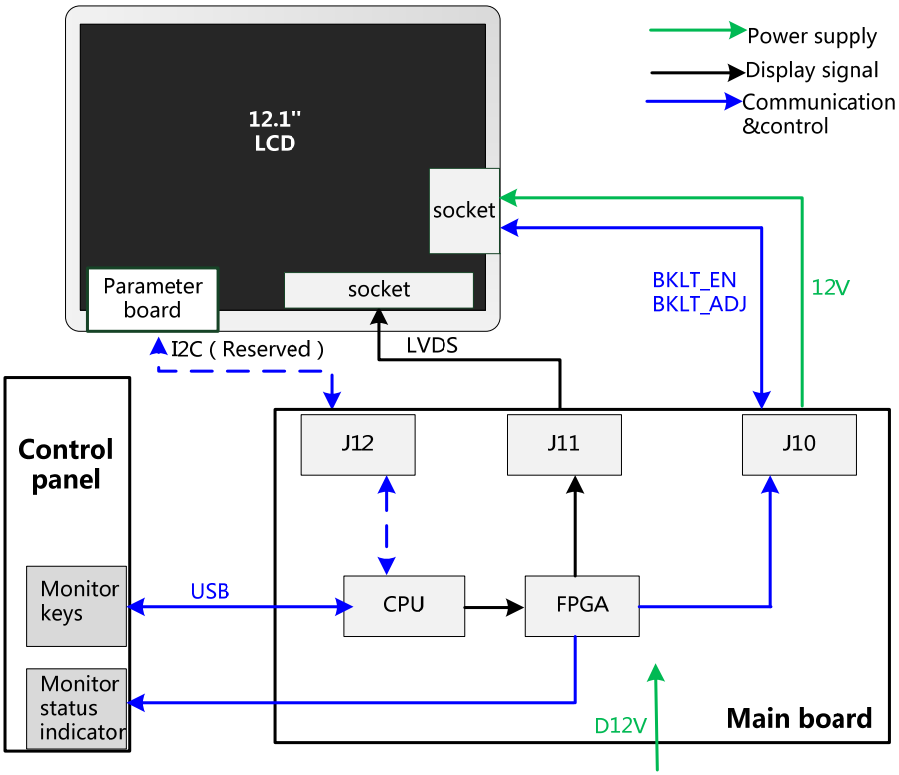


Figure 4-5 Schematic Diagram of Monitor

Display system mainly consists of LCD screen, CPU and video control function module of main board and related indicators in control panel.

Function

- As the carrier of display function, main board mainly implements the following function:

1. Video flow (LVDS signal) output by CPU is carried on by FPGA, then output to LCD after signal processing.
2. The on-off and brightness of LED backlight are controlled by FPGA.
3. The reserved I2C port is convenient to update the adjustable color temperature curve of monitor.
4. The signal of monitor status indicator is output by FPGA, then supplied to control panel to indicate.

- There are 5 keys for adjustment of monitor in keyboard: brightness+/-, contrast +/-, F4 (colorize); user operation is received via keyboard, so that users can adjust brightness, contrast and colorize.

4.4 Control panel

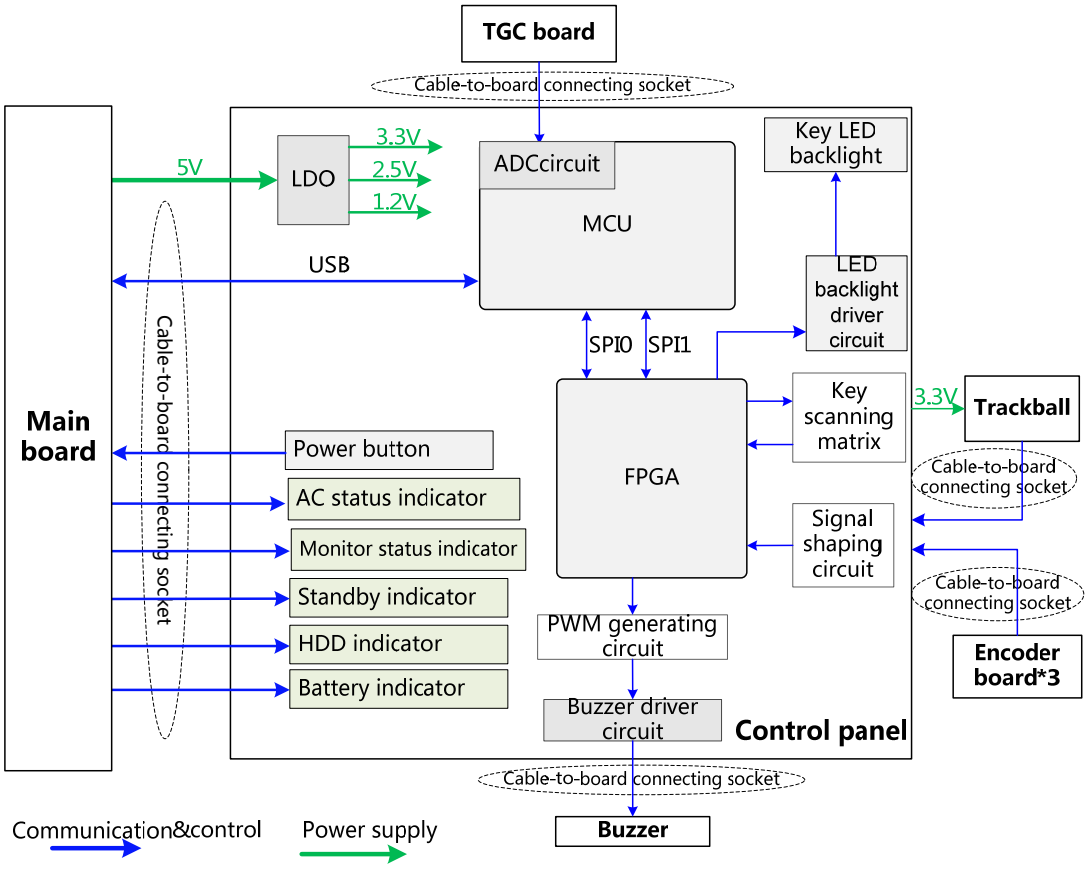


Figure 4-6 Schematic Diagram of Control panel

Control panel PCBA is the core of the control panel, which consists of PCBA, trackball, TGC board, encoder boards and the buzzer.

Functions:

- FPGA of main board is regarded as a main controller of control panel. Actions of keys, encoders, trackball and TGC are basically scanned by FPGA, key LED backlight and buzzer are controlled by FPGA, too. Only when FPGA is normal, can it drive the key LED backlight on.
- Status indicators on the control panel are directly driven from interior of main board.
- The control panel communicates with the CPU of main board via USB port.

4.5 Video Flow

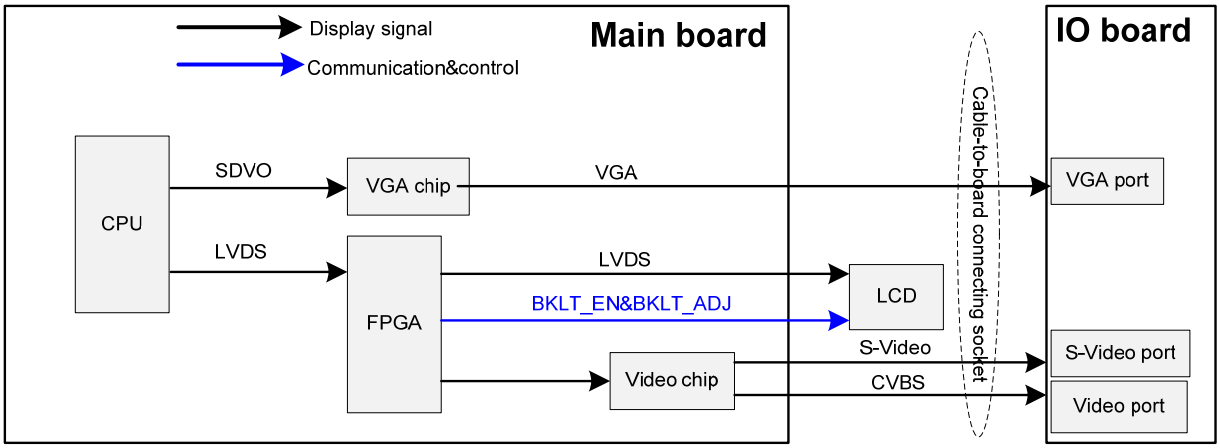


Figure 4-7 Schematic Diagram of Video Flow

Function description：

- CPU is the source of video, which output two channels of video signal with the same source: SDVO and LVDS.
- SDVO is converted to VGA signal via the video converting chip on main board, then output to IO board to supply a VGA port for user.
- LVDS is used for display and video extending of built-in LCD.
- After receiving the LVDS from CPU, FPGA starts to do the transfer processing, then output one channel LVDS to LCD directly. The other is supplied for video chip as the video input, then implements the video extending function of video and S-Video output at last.
- Meantime, backlight control signal (BKLT_ADJ) and backlight control enable signal (BKLT_EN) are also supplied by FPGA, being used for the on-off and brightness of LCD.

4.6 Power Supply Unit

Power supply unit mainly consists of AC-DC board, DC-DC board and battery connecting board, etc. The connection is as below:

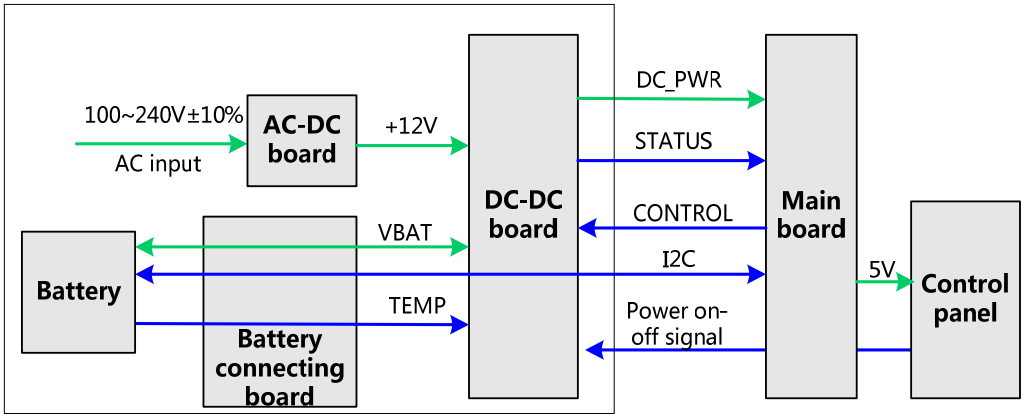


Figure 4-8 Schematic Diagram of Power Supply Unit

- AC-DC board: converts 220V AC power to 12V stable direct current, then output to DC-DC board.
- DC-DC board: converts the 12V input by AC-DC board and 9~12.6V input by battery to all kinds of voltages of hardware system. Meantime, it supplies the battery for charging when AC-DC power is on-line.
- Battery connecting board: implements the power and control signal transmission between battery and DC-DC board.

4.7 AC-DC Board

As shown in figure, there is only connection between AC-DC board and DC-DC board. The work of AC-DC board is not controlled by interior signal, only related to external AC power. It supplies some power protecting functions: over current, over voltage and short-circuited protection.

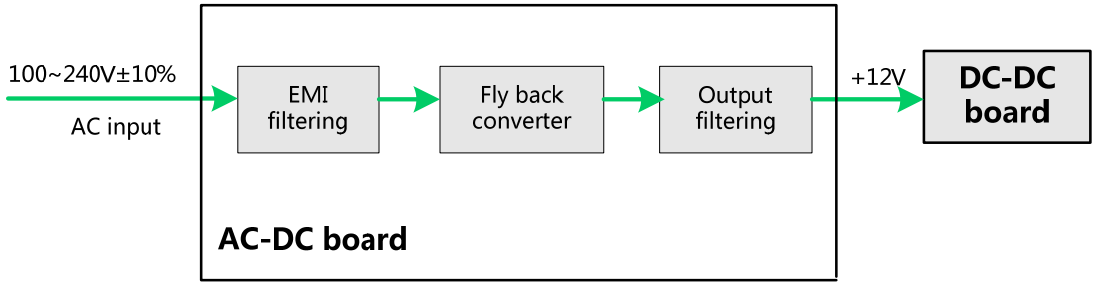


Figure 4-9 Schematic Diagram of AC-DC Board

- EMI filtering: filter the common mode and differential mode noise signal in input line.
- Fly back converter: implements the conversion from high voltage to 12V output.
- Output filtering: filter the high frequency ripple and noise signals in output line.

4.8 DC-DC Board

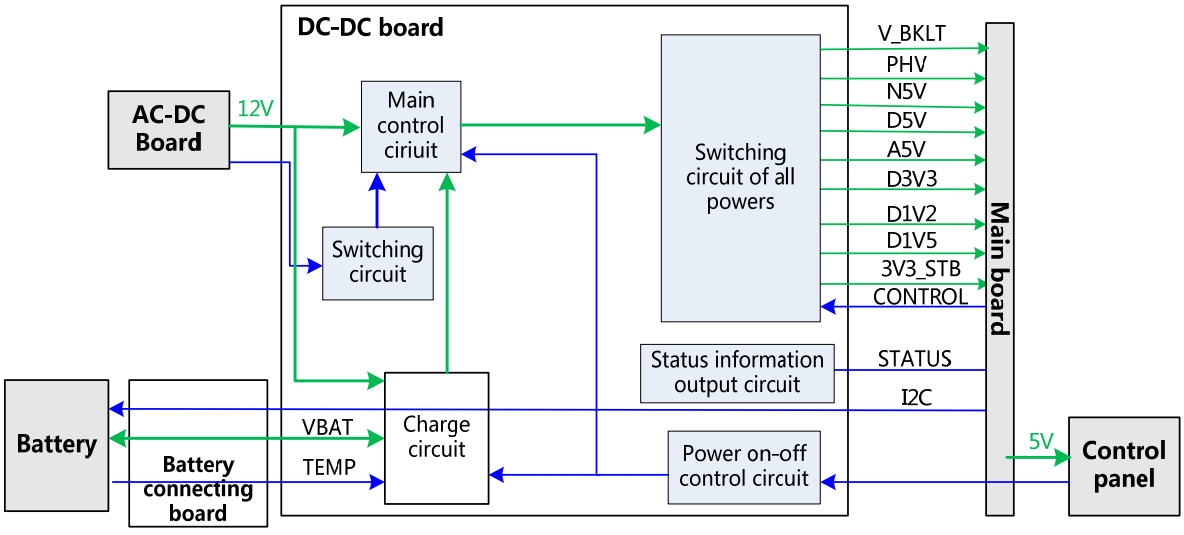


Figure 4-10 Schematic Diagram of DC-DC Board

Functions：

- Power on-off control circuit: remove dithering and transfer the power on-off signal from the control panel to control the on-off of main circuit.

- Main control circuit: output the signal to turn on or cut off the main circuit according to power on-off circuit.
- Status information output circuit: output the status information, e.g. PWR_OK、AC_OR_BAT.etc. Via which the main board can judge the work status of DC-DC board.
- Battery charge circuit: charging for battery with over temperature, over voltage and over current protection functions.
- Switching circuit：implements the selection and switch between battery and AC power(AC power in priority)

4.9 System Power and Supporting Function Distribution

12V is output via AC-DC board and input to DC-DC board via J1 socket of it. After conversion, all powers are output via J3 socket. The detailed powers are as below:

Power	Voltage（V）	Note
PHV	20～140	Programmable high-voltage
V_BKLT	9～12.6	Used by LED backlight and fans
D5V	+5	Used for back-end
A5V	+5	Used for front-end
3V3_STB	+3.3	Used for power on-off circuit
D3V3	+3.3	Used for front-end and back-end
D1V5	+1.5	Used for back-end
D1V2	+1.2	Power supply for FPGA.
N5V	-5	Used for front-end

The battery related signal is transferred to DC-DC board via J4 socket of DC-DC board.
Power on-off signal output by control panel and status information which is output by DC-DC board to main board are transferred via J2 socket of DC-DC board.

4.10 System Power on Control

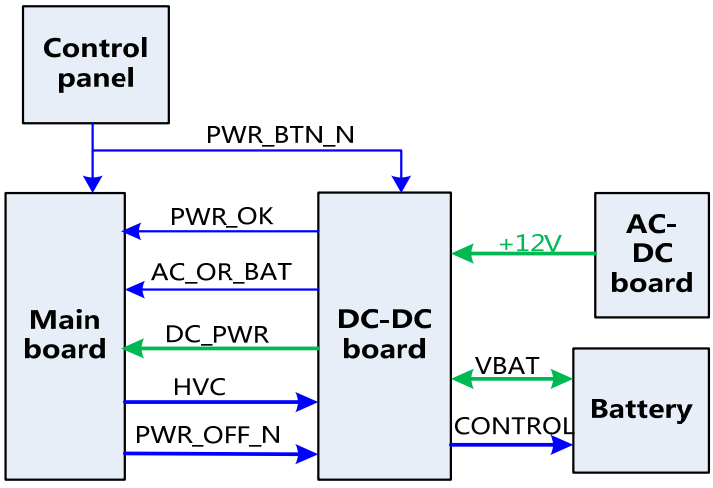


Fig 4-11 Schematic diagram of system power on control

The related control signals：

No.	Control signal	Explanation
1	PWR_BTN_N	Turn-on signal
2	PWR_OK	Outputting this signal means that D5V of DC-DC board has been powered on.
3	AC_OR_BAT	High level means that it's supplied by AC power. Low level means that it's supplied by battery.
4	DC_PWR	All powers which are output by DC-DC board
5	HVC	The signal that the main board output PHV and adjust the output voltage value of PHV.
6	PWR_OFF_N	Turn-off signal
7	CONTROL	The signal which is used for controlling the charge current via DC-DC board.

- Both battery and AC power can support turn-on function .
- When AC is online, the battery can be charged with large current(2.41A±10%）in shutdown status and small current （0.48A±50%）in turn-on status.
- The system can be switched to battery supply automatically when AC is offline.

The power on process is shown as below:

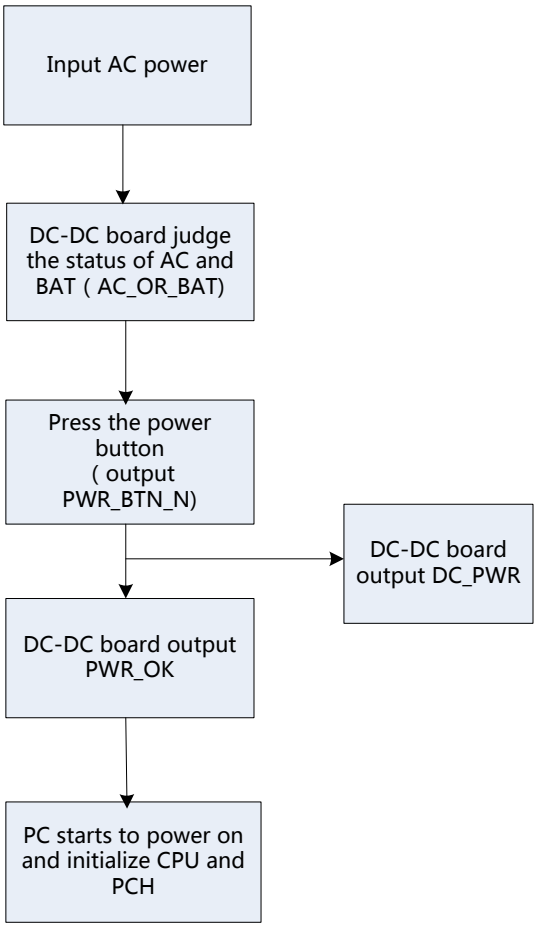


Fig 4-12 Schematic diagram of system power on Process

5 Function and Performance Checking Method

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

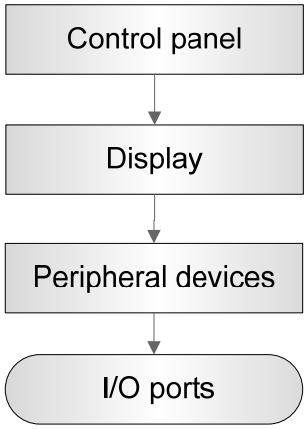
1. The ultrasound system can be turned on or off normally, working normally, no any abnormal noise and phenomenon appear when the system is running.
2. The fan starts work as soon as the system is turned on, no any abnormal noise appear in process.
3. Check basic system information such as product configuration, 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 if all status indicators are normal.
7. Check the log together with the user to confirm any abnormality or occasional abnormalities when the system is running.

5.2.2 System Running Environment

Check if the ambient temperature and humidity are in the specified range (described in chapter 2.2.3).

5.3 General exam

5.3.1 Check Flow



5.3.2 Checking Content

5.3.2.1 Check Control Panel

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

5.3.2.2 Check Monitor

Procedure	Standard
● Adjust LCD brightness ● Adjust LCD contrast Press<Setup> to enter [System Preset]→[General], In “Display” column:	● Press “Fn” and  key, the brightness increases; and press “Fn” and  key, the brightness decreases. ● Press “Fn” and  key, the contrast increases; and press “Fn” and  key, the contrast decreases.

● Click color temperature [Cold/Warm]. ● Click [Load factory]. ● Monitor maintenance Log in as "Service", click [Maintenance] in the Preset menu, then click [Test Main Monitor] to enter the monitor test.	● The LCD color temperature changes correspondingly. ● Brightness/contrast return to the default setting. ● Click each functional button, the LCD responds correctly, the standard is as follows： 1. Light-spot: 0; flash point: 0. 2. The adjoining dark dots are no more than 3 pairs, and there is no adjoining dark dot in image area. 3. There is no adjoining dark dot of 3 or more than 3. 4. The dark dots are no more than 7 and those in the image area are no more than 2 5. The distance between bad dots is no less than 5mm. ● Note: image area refers to the rectangle when the background is each type of color.

5.3.2.3 Check the Peripheral Devices

Procedure	Standard
Footswitch： Confirm the footswitch connection normal, check the functions of footswitch according to the functions listed in Key Config(ex. right pedal=freeze, left pedal=print)	● Press the freeze key (the right key), image is frozen, the freeze menu is displayed; press the key again, image is unfrozen. ● Press the print key (left key),B/W printing starts
Video Printer： Check if the video printer and ultrasound system are correctly connected. Then check the function of each key.	● Press <Print> key, the printer begins to work, no image print deficiency or degradation. Switch video output port ● Press <Print> key, the printer begins to work, no image print deficiency or degradation.
Graph/ text Printer： 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.

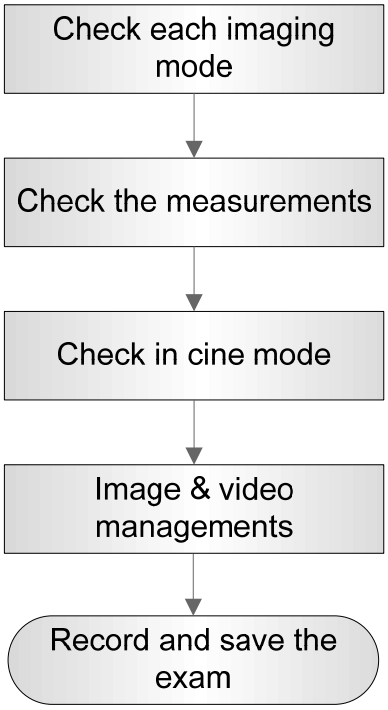
5.3.2.4 Check I/O Interface

Procedure	Standard
Checking the main I/O Interfaces Video interface and USB port have been verified, remains are: ● VGA interface Connect VGA monitor ● Network port ● USB port	● The contents displayed on the VGA/LCD are the same as those displayed on the ultrasound system monitor, no character and image loss, no color difference, no fluttering and flicking. ● Smooth communication in both network and connection. ● USB port data storage/accessing are normal.

5.4 Function Checks

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

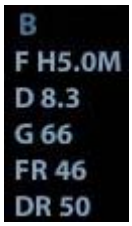
5.4.1 Check Flow



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:



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

Adjustment	Items
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 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.
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.
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 <F.Pos/Freq./Rotation.> to light on the F.Pos indicator, rotate the knob	The focus position will change in correspondence with the knob rotates.
Frequency adjustment Press <F.Pos/Freq./Rotation.> to light on the Freq indicator, rotate the knob	Press the button to light the “Freq.” Rotate clockwise to increase Rotate anticlockwise to decrease
Press <B>, and then press 	● Enter dual mode, and the right image is activated ● Press again to switch between the windows
Press <B>	To enter single mode in double B mode, or to exit from other modes.

2. Menu

Procedure	Standard
Acoustic power	Click [A.power] and rotate the multifunctional knob to adjust. You should perform exams according to actual situation and

B mode menu→ [A.power]	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.
Dynamic Range B mode menu-> [Dynamic Range]	Click [Dynamic Range], adjust Dynamic Range, As the dynamic range increases, the darker the image is, The contrast as well as the noise may increase.
IP (Image Processing) B mode menu-> [IP]	Click [IP] to switch among the IP groups, and the specific value of each parameter can be preset.
B mode menu-> [Flip Vertical] B mode menu-> [Flip Horizontal]	Click [Rotate] [Flip Vertical],the image can do flip vertical When click [Flip Horizontal], the image can do flip horizontal.

5.4.2.2 M 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:

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

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

Adjustment	Items
Control Panel	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 enter the “B+M” mode, 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.
Gain adjustment Rotate <Gain/iTouch>	Rotate clockwise to increase Rotate anticlockwise to decrease The real-time value (B and M gain) will be displayed in the image parameter area in the upper right corner of the screen.
■ 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 referring to descriptions in B mode

2. Menu

Procedure	Standard
Speed M mode menu-> [M Speed]	Click [M Speed], can adjust the parameter of M image The lower the value the lower the refreshing.

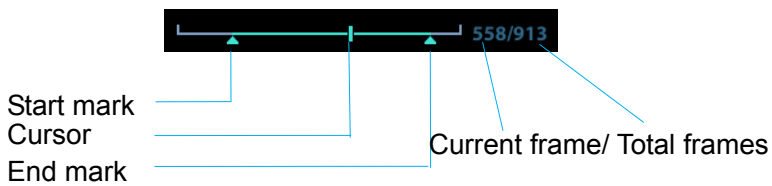
■ Tips:

a) During M Mode scanning, frequency and acoustic power of the transducer are synchronous with that of B Mode.

b) Referring to B mode for more details.

5.4.2.3 Cine Review

Procedure	Standard
● Press [Freeze] key to freeze an image, and the [Cine] key indicator lights on. The system automatically enters the manual cine status.(Precondition: set “Status after Freeze” to be “Cine”) ● Press iStation, click [Review] or press <Review> to open the cine file	● Cine Review status ● To enter cine auto cine review status.
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
● Press the <Freeze> key to defreeze the image. ● Press <ESC> or <Cine>	● <Freeze> backlight is off, the image returns to the scanning process and exits cine review. ● The images are still frozen but the system exits cine review.



5.4.2.4 Measurement

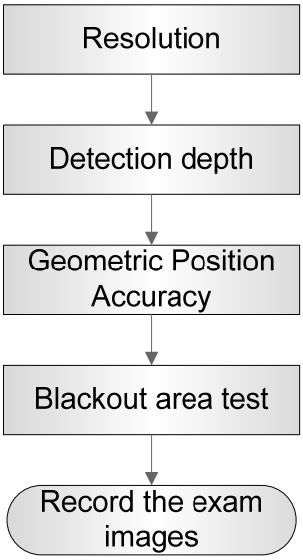
Procedure	Standard
In B mode ● Press <Measure>: ● Press <Caliper> key	● Enter the application measurement mode. ● Enter the general measurement mode. Click any 1~2 measurement items, the measurement results will be displayed below the image
Press <ESC> or the same key again.	Exits measurement.
Perform similar operations in other modes	Application measurement functions are related to certain application software packages.

5.4.2.5 Imaging Information Management

Procedure	Standard
Press <Save> in image scanning process.	The image will be saved to corresponding patient database and the saving icon will be displayed in the right of the screen.
● Press <Review> ● Click [Exit] on the Review screen; or press <Review> or <ESC>.	● To enter Review: ● To exit Review:
Press <iStation> to enter Patient information management (iStation page)	Saved images and information for the patient can be checked here, and you can: ● Backup/ Restore ● Send to (DICOM , network or removable storage device)

5.5 Performance Test

5.5.1 Test Flow



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:**

1. For the testing phantoms, please refer to Appendix B.
2. For the testing standards, please refer to Appendix C.

5.5.2.1 Resolution

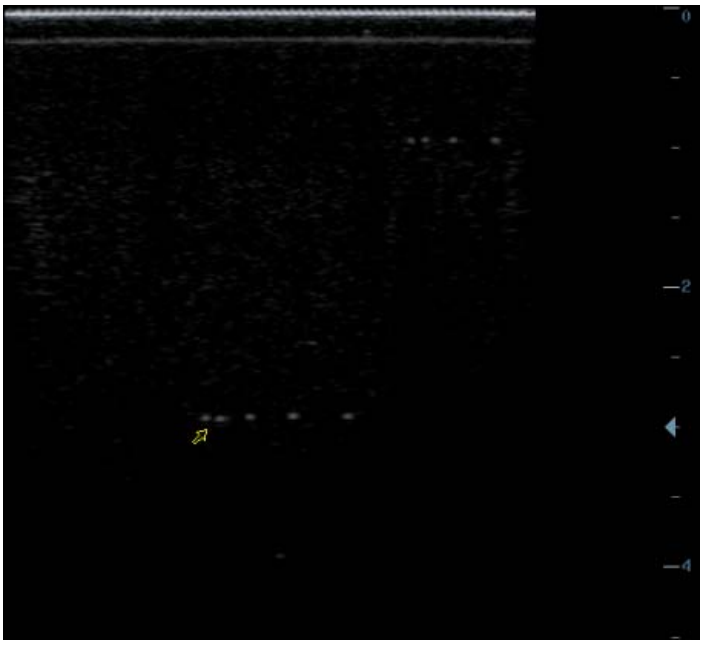
◆ transverse resolution

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.

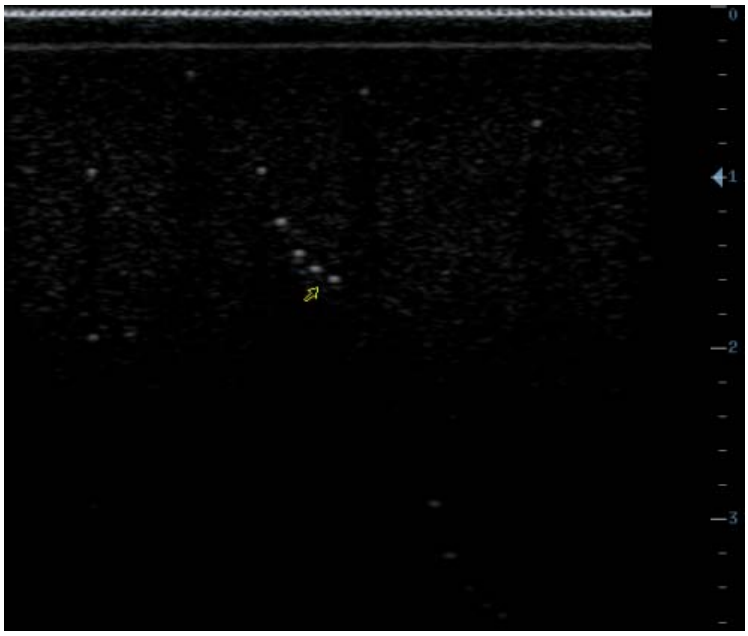
As shown in figure below.



◆ 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 use the convex probe, keep the transverse resolution testing targets to be displayed near the midline.
	2. When use 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 use a linear probe, please completely contact the probe with the scan surface, no side clearance is allowed.
	3. When use 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

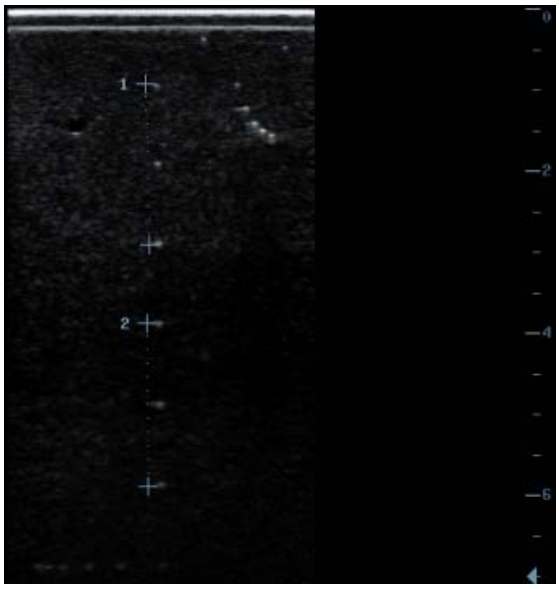
Test Step:

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

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

NOTE:	1. The measurement caliper should be posited 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, which 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. 5. Record the distance by 20mm each segment on the transverse targets line using the measurement caliper
6. Select the value with the greatest error (to 20mm), calculate the accuracy using the formula below

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

NOTE:	1. When use a linear probe, record the transverse distance by segment.
	2. When use 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.

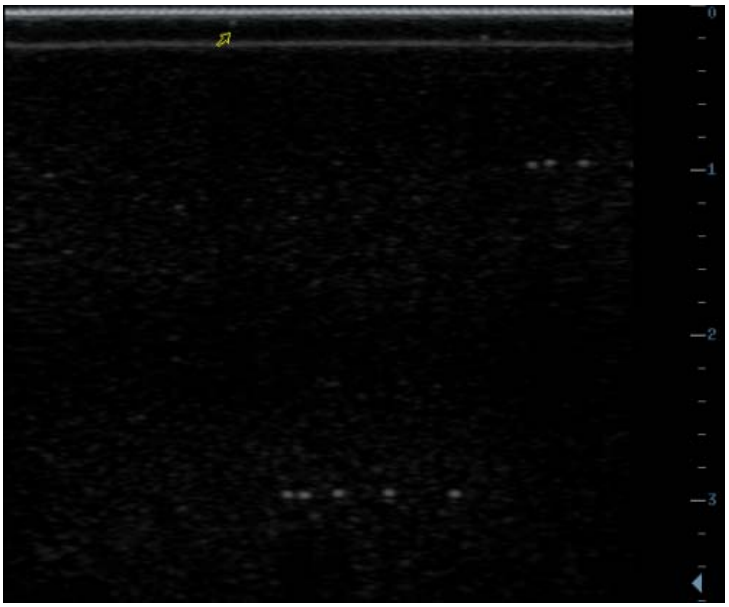
5.5.2.4 Blackout Area

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

As shown in figure below.



6 Software Installation 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.

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.

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

6.2 Set Installment

If the customer purchases the product with the installment, the service can set installment and the installment password will be generated by the system automatically.

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

1. Press [Setup]. Select [Maintenance] -> [Other] -> [Installment]. Click [Set Installment], and set the times of the installment in “Periods” list. Set the time interval of each installment in “Days” list, as shown below.

2. Click [Generate], and tick off “Display Password”. The password generated by the system will be displayed in “Password List”, as shown below.

Take the Figure above as an example.

Note: the first time installment is the down payment.

a) The system creates each 4 installment password for 4 times installment.

b) First installment password:

After the user paying off the down payment, the installment dialog box appears after turning on the device. Enter this password in “Period Password”, and click “Start” to log in the system.

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

c) Second installment password:

- The user prepays the amount of this period installment.

  Press [Setup]. Select [Maintenance] -> [Other] -> [Prepay Installment], Choose [2] in “Periods” list, and then enter the password. Then, click [OK] to log in the system. The system reminds the user of the current available days.

- Installment due. The user pays off the amount of this period installment.

  The installment dialog box appears after turning on the device when installment is due. Enter this password in “Period Password” list, and click [Start] to log in the system.

The using of the third and the fourth installment password is identical with that of the second one. After the user paying off the fourth payment, the system is no longer limited to the installment.

d) Payoff password: it is the password with which the user pays off the rest amount of the installment.

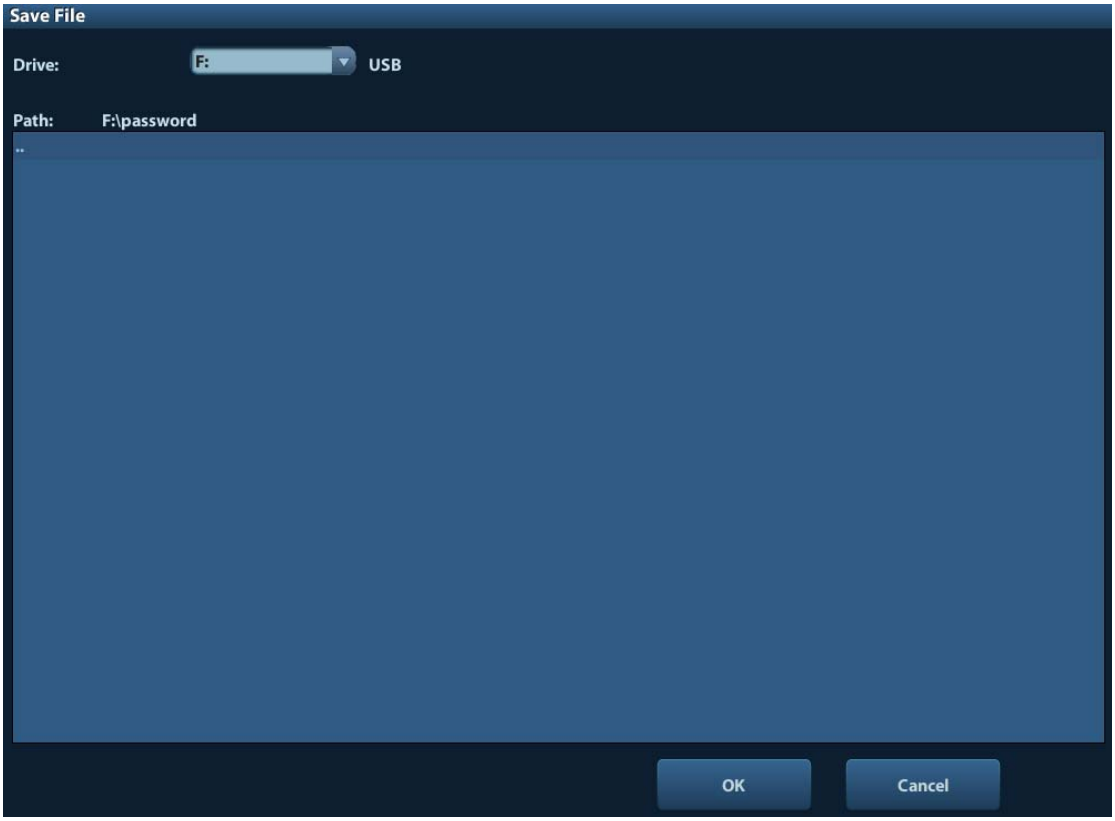
- The user prepays the rest amount of the installment.

  Press [Setup]. Select [Maintenance] -> [Other] -> [Prepay Installment]. Choose [Pay Off] in “Periods” list, and then enter the password. Click [OK] to log in the system. The system is no longer limited to the installment.

- Installment due. The user pays off the rest amount of the installment.

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

3. Click [Reset] to reset the installment. Set the times of the installment in “Periods” list and the time interval of each installment in “Days” list. Then, click [Generate], and tick off [Display Password]. The new installment password generated by the system is displayed.
4. Insert USB device. Click [Save As] to select the directory, and then click [OK] to save the installment password, as shown below.



5. Restart the system, the installment will be worked.

- View the installment password
- Press [Setup]. Select [Maintenance] -> [Other] -> [Installment], and tick off [Display Password] to view the installment password. Or
- Open txt. file which contains the password, and view the installment password.

6.3 System Software Restoration

Please refer to《H-046-004644-00 System Recovery Guide》for detail.

6.4 Data Backup and Manage

6.4.1 Manage Settings

Press <Setup> to open the Setup menu, click [maintenance] →[Other] to open the Preset manager 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.

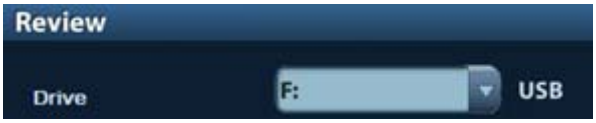
6.5 Software Maintenance

6.5.1 Log Maintenance

6.5.1.1 Export the Log

1. Connect the USB disk to the left USB port of ultrasound machine.
2. Click [Export Log] on the Maintenance menu.

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

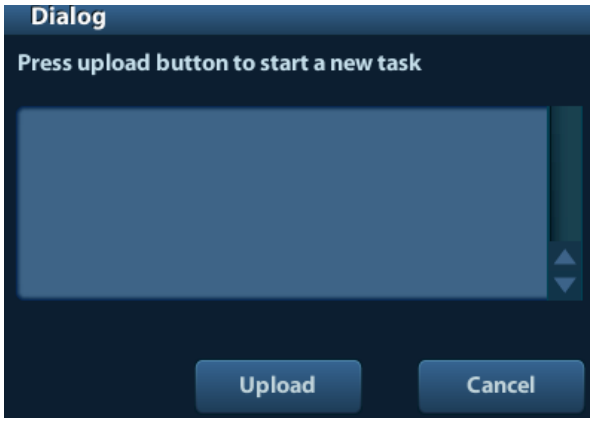


4. When the log is exported, the system prompts “Export succeed!” click [OK] to return to the Maintenance menu.

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

6.5.1.2 Log Uploading

1. Click [Upload Log] on the Maintenance 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”.



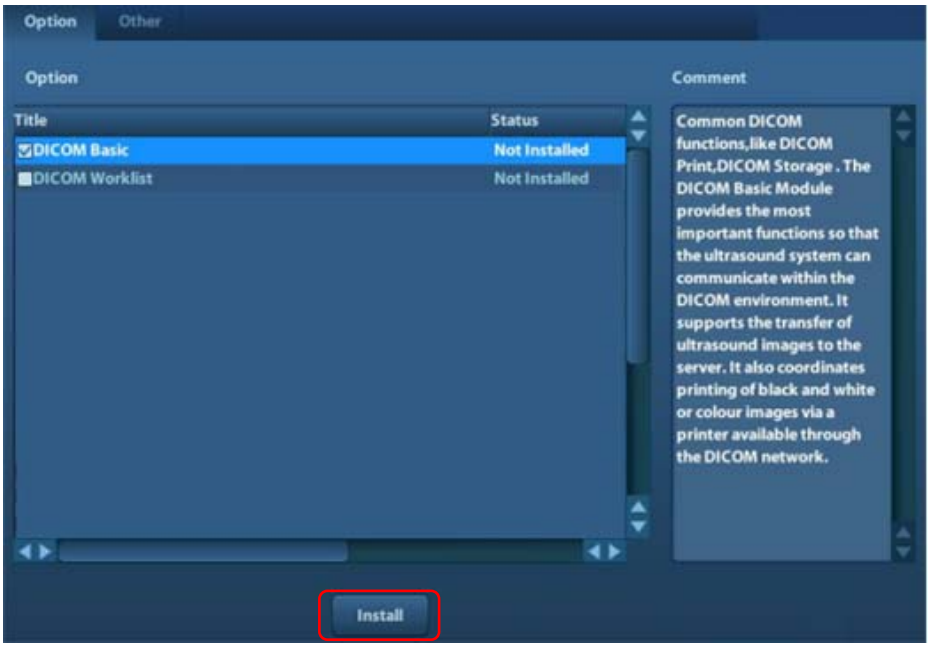
If uploading is failure or can't find the server, the system will prompt information as below.

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) is already specified by the system, the user doesn't have to select it.

6.5.2 Install and Uninstall Optional Software

◆ Installing

1. Enter the web "http://ukmo.mindray.com/" ,click the icon "Make new key" ,you can make the "DICOM KEY" by related tool after logging on (Note: you must get the MAC address of ultrasound machine at first,) then copy it to the U disk (the requirement of U disk referring to 6.2.1).
2. Insert the USB disk into the USB port of the ultrasound machine.
3. Enter [Preset], click [Maintenance] to enter [Option] menu to select the option module to be installed.

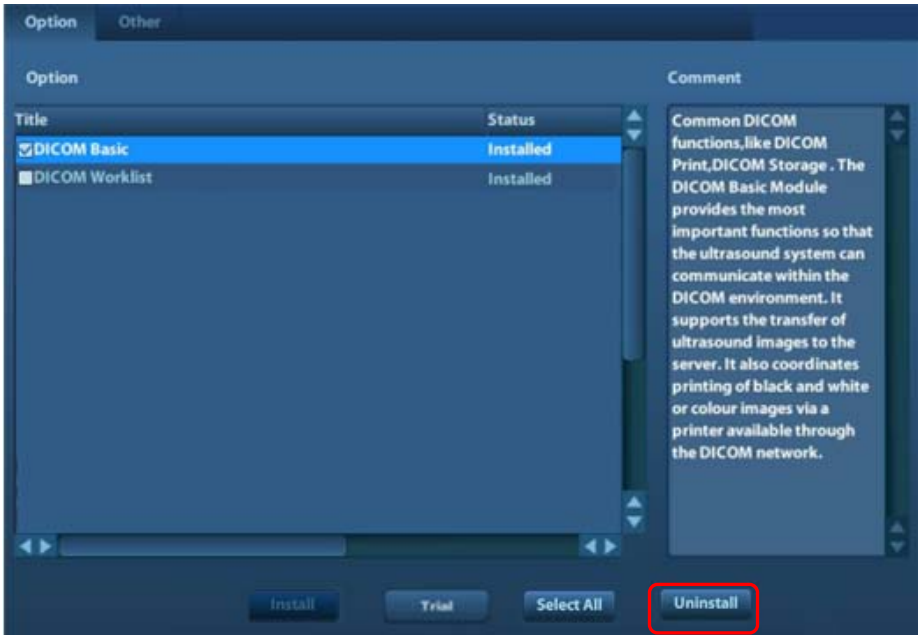


4. Select the corresponding key file in the prompted “Load File” dialogue box and click [OK].
5. After the Key file is successfully installed, you can see the option module in the “Installed” status. Corresponding functions are available after return from preset.
6. Trial: select the option module, then click [Trial] to pop up the dialogue box, after inputting the password, the trial function can be used.

NOTE:
1. You can only install one key at one time.
2. If select “Trial”, you need to input the password. Please contact service engineers.

◆ Uninstalling

1. Enter into [Option] menu, and in the list select the software package to be uninstalled.
2. Click [Uninstall] to pop up the [Confirm] dialogue box, and click [OK];



3. Return to the system preset interface, the optional devices status changes into "uninstalled".

NOTE:	Optional uninstalling is only available to internal users. Service engineers must log on as service and then conduct uninstall function. You can uninstall one key or more at one time.

6.6 Introduction of HDD partitions

◆ Solid State Disk:

Blocks(G)	system	Notes
3	Linux	C:
4	Linux	D:

◆ HDD(optional):

Blocks(G)	system	Notes
320	Linux	E：

Note: The optional HDD is only used for patient data storage.

◆ Data distribution of each disk:

1. C drive

Catalog		Data	Illustration
C:\ CS04	\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.bm	Inactive icon
		Dorm_logo.bmp	Standby graphics
		Product.PCF	Product configuration file
	\Key	Factory.key	Factory key file
	\ProductConfig	product_info.ini	Configuration file
		version.txt	Version file

2. D drive

Catalog		Data	Illustration
D:\CS04	\gui	\word	User-defined word library
	\log	\DcmLog	DICOM log
		\Operation	Operation log
		\Monitor	Monitor log
		message.txt	Warning message
		\SystemStat	Power on/off log
		PeriLog.txt	Peripheral log
		commentlog.txt	Comment log
		error.txt	System error log
	\PATIENTDATA	\	Main patient database path
	\Preset	\Current	User preset data
	\temporary	\	Temporary file
	Userconfig.txt	\	User configuration file
	\Demo		Ivision default DEMO path
	demofile.txt		Ivision default DEMO file
	\PatientBack	\	Patient back up data

3. E drive

Catalog		Data	Illustration
E:\CS04	\PATIENTDATA	\	Main patient data path (HDD has been configured)

7 Structure and Assembly/Disassembly

7.1 Structure of the Complete System

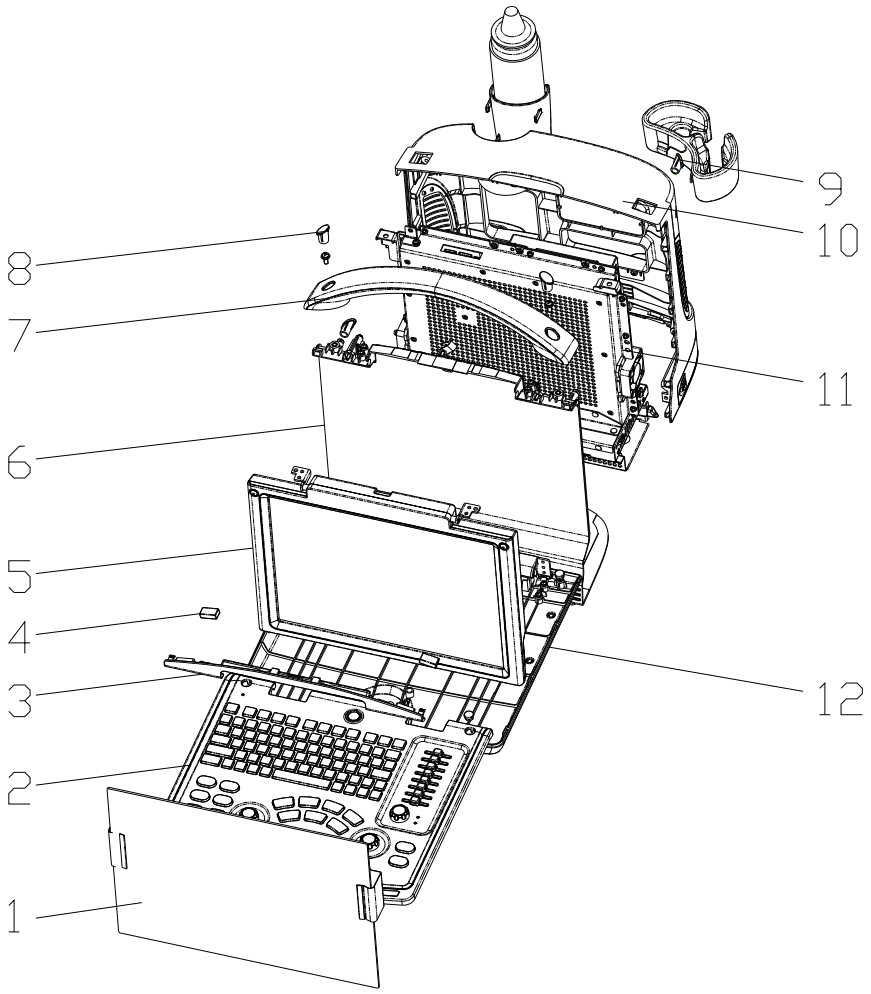


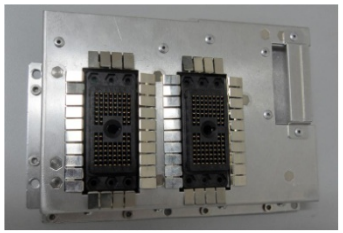
Figure 7-1 Overall Explosion View

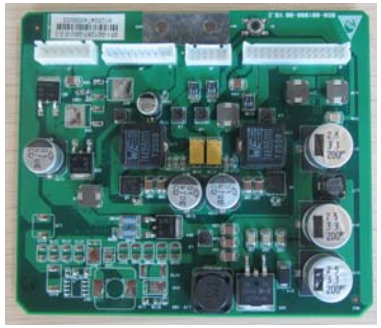
No.	Name	No.	Name	No.	Name
1	Glare screen	5	Monitor assembly	9	Upper screw cap of main unit
2	Top Cover Assembly of the Keyboard	6	Front cover assembly	10	Rear cover assembly
3	Monitor turning axis cover	7	Handle	11	Machine assembly
4	Magnet	8	Left screw cap of handle	12	Bottom cover of control panel

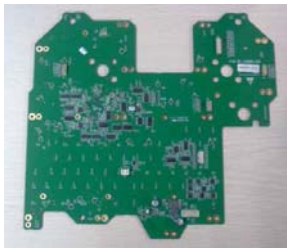
7.2 Field Replaceable Unit

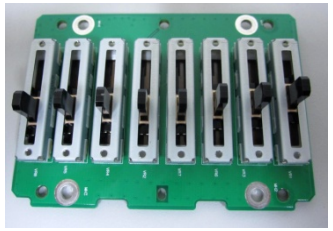
No	Classification	Description	Order Number	Photo	Model	Remark(including regulation type, compatibility)	Assembly/ Disassembly
1.	Main Unit Related	Main Board Assembly	115-016679-00		DP-10 series /DP-20series	Include the button battery. Mark the software version, machine type (e.g.DP-20 or DP-20Vet), configuration type (e.g. CE or FDA) when apply.	Refer to7.4.7
2.			115-016680-00		DP-30series		
3.			115-032851-00		DP-10 new main board (CE)		
4.			115-032848-00		DP-10 new main board (Include the button battery)		
5.			115-032852-00		DP-10Vet new main board (CE)		
6.			115-032864-00		DP-10Vet new main board (FDA)		
7.			115-032853-00		DP-20 new main board (CE)		

8.			115-032867-00		DP-20 new main board (FDA)		
9.			115-032854-00		DP-20Vet new main board (CE)		
10.			115-032862-00		DP-20Vet new main board (FDA)		
11.			115-032858-00		DP-30 new main board (FDA)		
12.			115-032847-00		DP-30 new main board (Include the button battery)		
13.			115-032849-00		DP-30 new main board (CE)		
14.			115-032859-00		DP-30vet new main board (FDA)		
15.			115-032850-00		DP-30vet new main board (CE)		

16.		Speaker assembly	115-014848-00		DP-10series /DP-20series /DP-30series	Speaker assembly	Refer to7.4.4
17.		Single Probe Board	801-2305-00003-00		DP-10series /DP-20series		Refer to7.4.6
18.		Dual Probe Board	115-010274-00		DP-10series /DP-20series /DP-30series	Include the shielding cover	Refer to7.4.6
19.		IO Assembly	115-014841-00		DP-10series /DP-20series /DP-30series		Refer to7.4.5

20.		HDD	023-000415-00		DP-10series /DP-20series /DP-30series	No bracket	Refer to7.4.10.4
21.	Power Related	AC-DC Assembly	115-014842-00		DP-10series /DP-20series /DP-30series	Include fan and the DC power output cable	Refer to7.4.2
22.		DC-DC Board	051-001287-00		DP-10series	Not support battery for DP10series	Refer to7.4.3
23.		DC-DC Board	051-001254-00		DP-10series /DP-20series /DP-30series	Support battery for DP10/DP20/DP30 series	Refer to7.4.3

24.		Battery	0146-00-0091-01		DP-10series /DP-20series /DP-30series		Refer to7.4.1
25.	Control Panel Related	Control Panel	051-001229-00		DP-10series /DP-20series /DP-30series		Refer to7.4.9.5
26.		Silicon Rubber Keypad （1113）	049-000490-00		DP-10series		Refer to7.4.9.5
27.		Silicon Rubber Keypad （2307）	049-000488-00		DP-20series		Refer to7.4.9.5

28.		Silicon Rubber Keypad（2308）	049-000489-00		DP-30series		Refer to7.4.9.5
29.		Trackball Assembly	801-1150-00015-00		DP-10series /DP-20series /DP-30series	Include the cable	Refer to7.4.9.2
30.		TGC board	801-1111-00007-00		DP-10series /DP-20series /DP-30series	Not include the cable and knob	Refer to7.4.9.3
31.		Encoder Board	801-1111-00006-00		DP-10series /DP-20series /DP-30series	Not include the cable and knob	Refer to7.4.9.1

32.	Monitor Related	LCD Assembly	115-016681-00		DP-10series /DP-20series /DP-30series	Include cable and copper paper	Refer to7.4.8
33.	Others	USB Connecting Board	051-000837-00		DP-10series /DP-20series /DP-30series		Refer to7.4.10.3
34.		Fan 40*40*10	024-000388-00		DP-10series /DP-20series /DP-30series		Refer to7.4.9.1 and 7.4.10.2

7.3 Preparations

7.3.1 Tools Required

Cross-headed screwdriver: 1, 105X100

Electrostatic protecting gloves: 1

7.3.2 Requirement for Engineers

Only technical professionals from Mindray or engineers authorized by Mindray after training can perform assembly and disassembly

7.3.3 Requirements

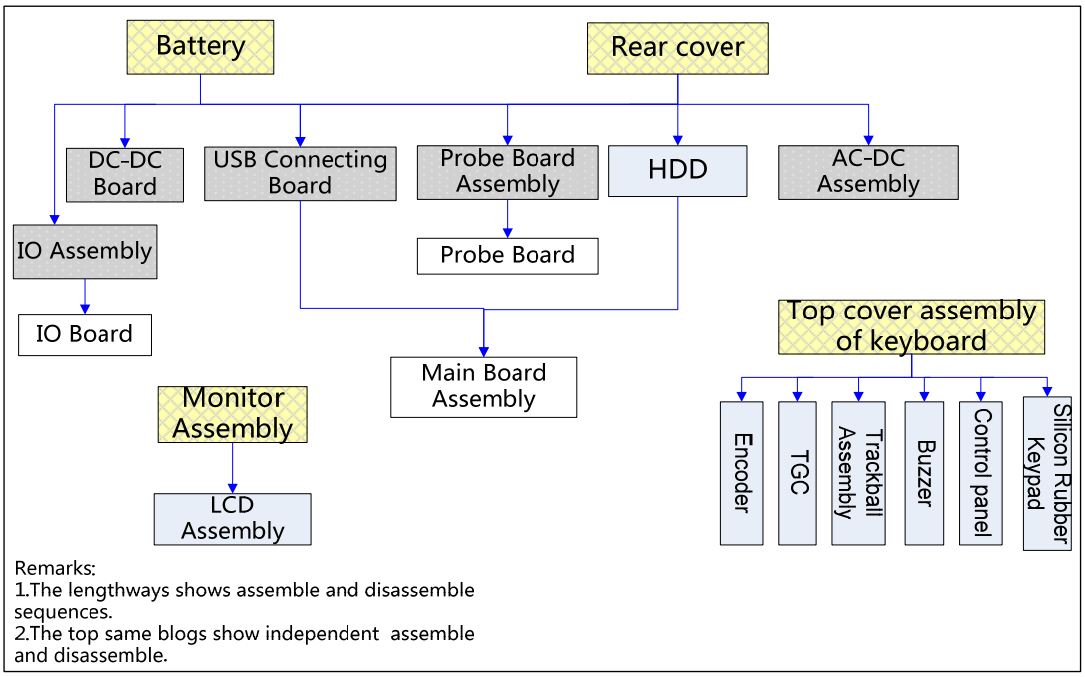
You should perform the following preparations before the disassembling of ultrasound equipment.

1. When you stop scanning and capturing image, you should power off the system and disconnect the system from the AC power supply, then pull out AC power cable.
2. Prepare the necessary tools.

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**



⚠Warning：	**Battery must be removed first before disassembly if the machine is configured with battery.**

NOTE:	Figures below are for reference. Please take actual equipment as a standard.

7.4.1 Battery

1. Press the guide hole of the battery cover, push backwards to open the battery cover.

Figure 7-2 Disassembly of Battery (1)

2. As shown in the figure, press the green button and the battery will eject from the battery bay, then remove the battery.

Figure 7-3 Disassembly of Battery(2)

NOTE：	When installing the battery, makes sure it is tightly locked then the green battery ejecting button will turn down automatically.

7.4.2 AC-DC Assembly

1. Press the guide hole of the battery cover, push backwards to open the battery cover.

Figure 7-4 Disassembly of Battery Cover

2. Remove the left and right handle screw caps, and use the cross-headed screwdriver to remove 2 M4X12 combination screws fixing the handle, then take off the handle.

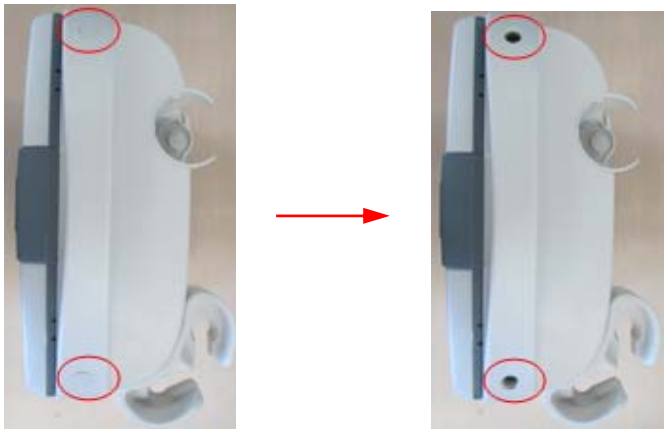


Fig 7-5 Disassembly of Rear Cover Assembly of Main Unit (1)

3. From the rear side of the main unit, remove 2 screw caps at the top and 1 screw cap at the bottom, and then remove 4 M3X8 panhead screws with washers fixing the rear cover assembly of main unit, then you can remove rear cover assembly.

Fig 7-6 Disassembly of Rear Cover Assembly of Main Unit (2)

4. Remove 4 M3X6 screws fixing the cable cover board, then take off the cover board from the machine.

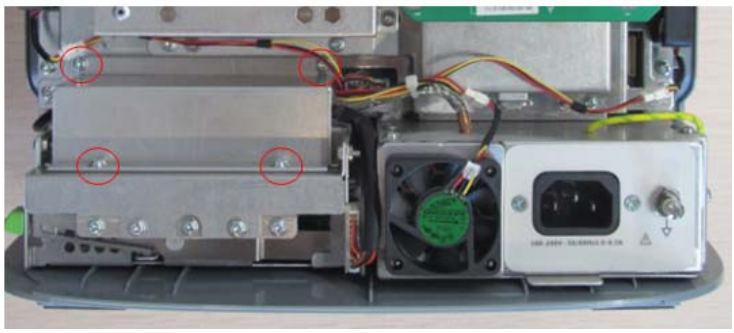


Fig 7-7 Disassembly of AC-DC assembly (1)

5. Pull out the plug of connecting cable between DC-DC board and AC-DC assembly, pull out the plug of fan connecting cable, too.

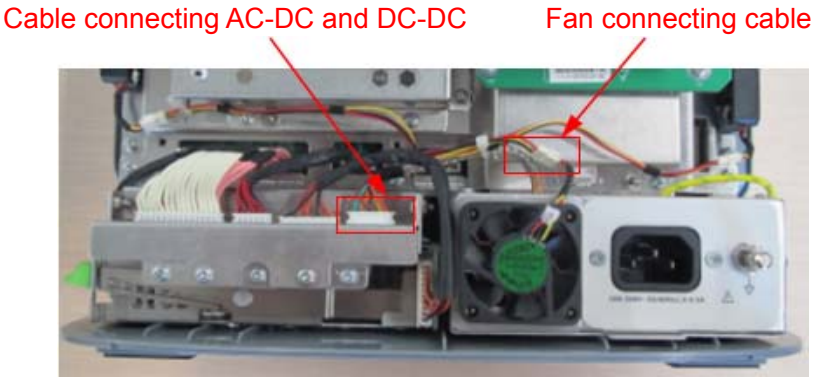


Fig 7-8 Disassembly of AC-DC assembly (2)

6. Remove 3 M3X6 panhead screws with washers fixing the AC-DC assembly, and remove 1 M4X8 small panhead combination screw fixing the ground line of AC-DC assembly.

Fig 7-9 Disassembly of AC-DC assembly (3)

7. Separate the clasp in the AC-DC assembly from the groove on the main unit; pull out the AC-DC assembly horizontally.

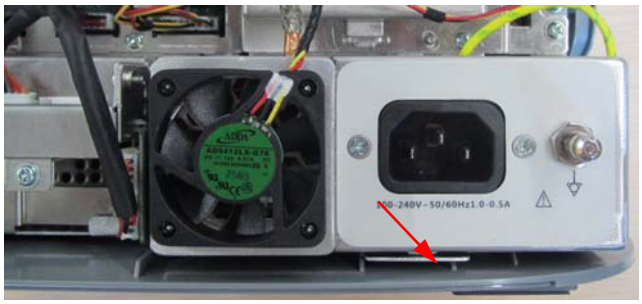


Fig 7-10 Disassembly of AC-DC assembly (4)

7.4.3 DC-DC Board

1. Remove rear cover assembly of main unit and cable cover board (referring to 7.4.2, the 1st~4th step).
2. Pull out all cable connectors from the DC-DC board.
3. (a). Remove 4 M3X6 panhead screws with washers fixing DC-DC board on the main unit bracket; uncover the DC-DC board shielding cover to pull the DC-DC board out from the main unit horizontally.

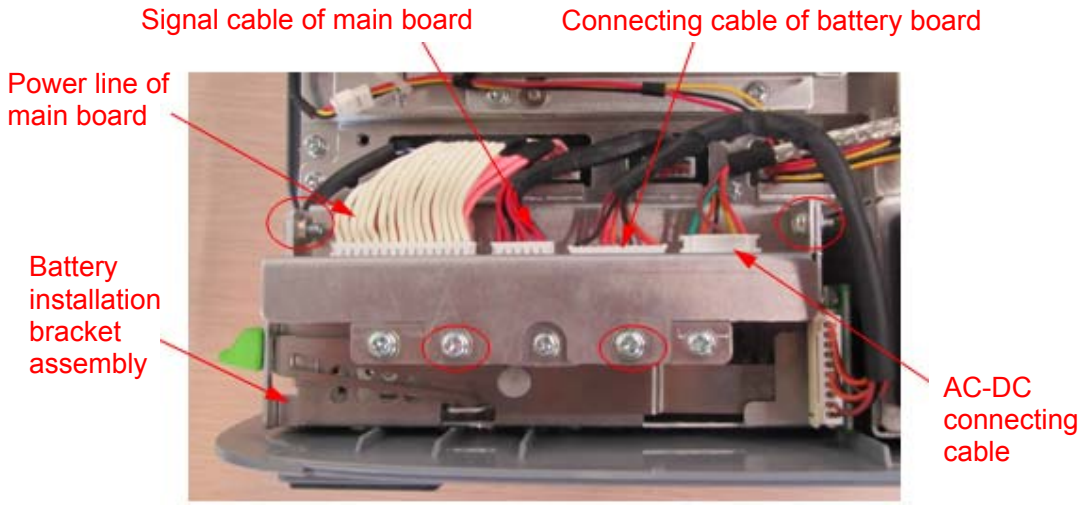


Fig 7-11 Disassembly of DC-DC board (1)

(B) There is a little difference between DC-DC board supporting battery and that not supporting battery: 1.no battery connecting cable; 2.change the battery installation bracket assembly into battery bracket.

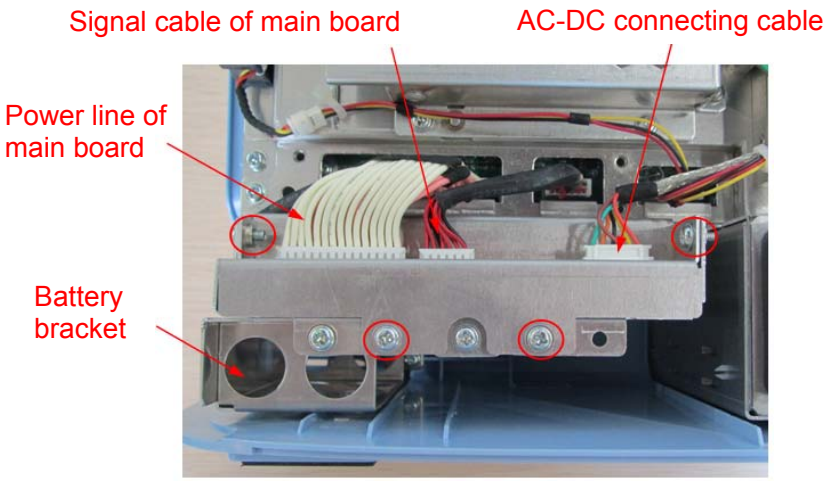


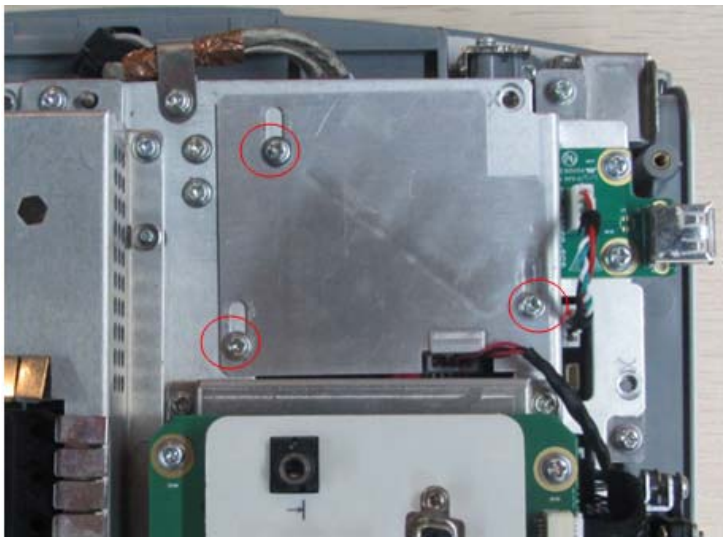
Fig 7-12 Disassembly of DC-DC board (not support the battery) (2)

4. After removing 2 M3X6 panhead screws with washers fixing the DC-DC board, and then you can take off the DC-DC board.

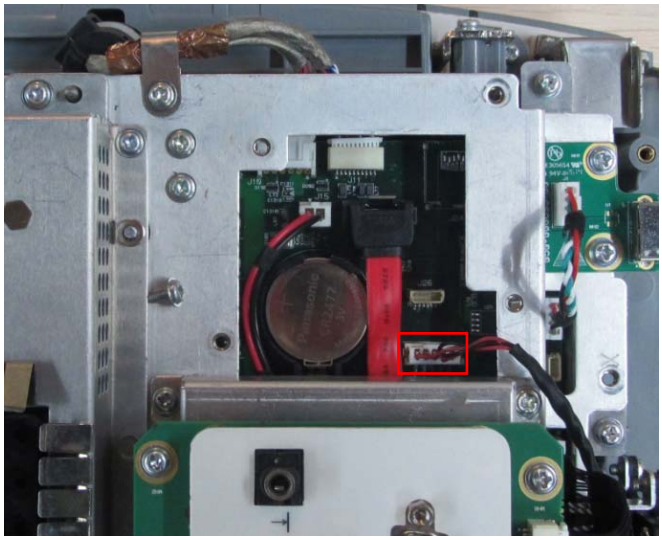
Fig 7-13 Disassembly of DC-DC board (3)

7.4.4 Speaker assembly

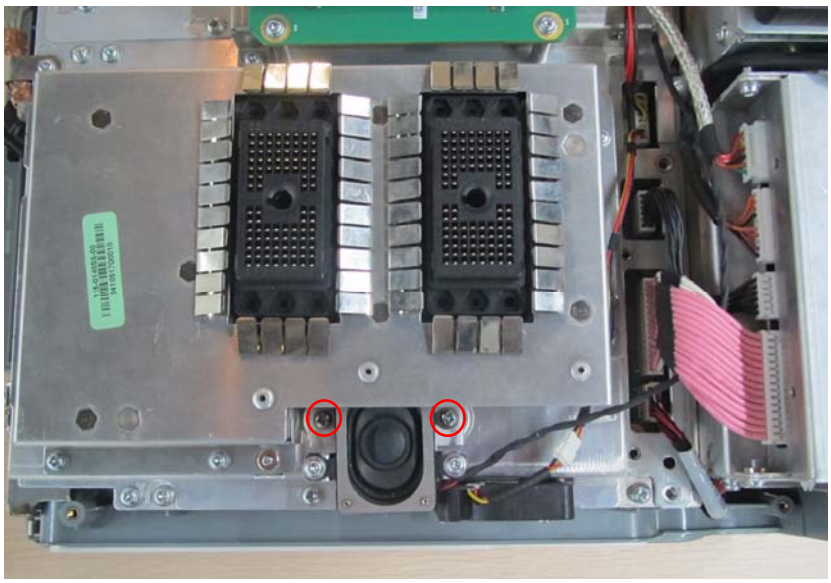
1. Remove rear cover assembly of main unit (referring to 7.4.2, the 1st~3rd step).
2. Remove 3 M3X6 panhead screws with washers on the metal cover, take off the metal cover.

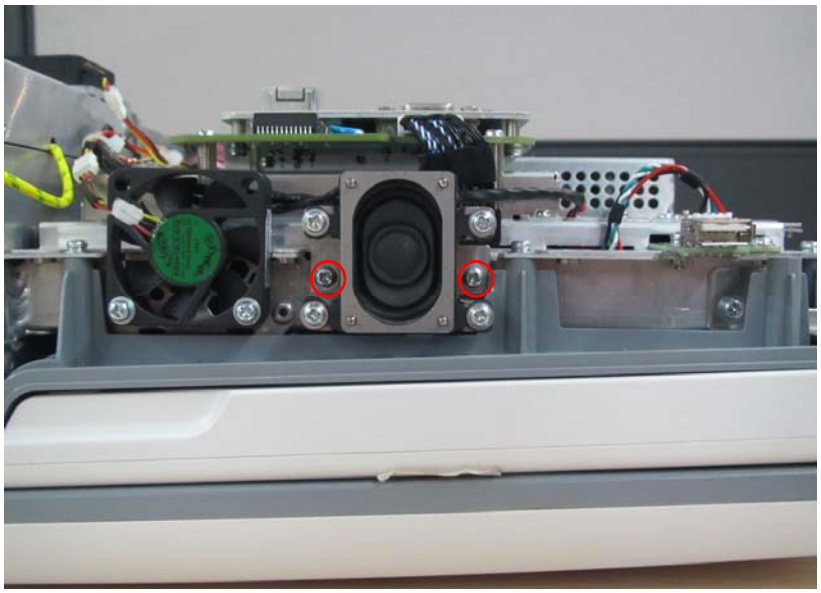


3. Pull out the plug of speaker assembly.



4. Keep the main unit horizontal and cut off the cable ties, then remove 4 M3X8 cross panhead screw assembly with washers on speaker assembly, take off speaker assembly.





7.4.5 IO Assembly

1. Remove rear cover assembly of main unit (referring to 7.4.2, the 1st~3rd step).
2. Pull out the plug of connecting cable on the IO board assembly.
3. Remove 4 M3X6 panhead screws with washers fixing the IO assembly, and then you can pull out the IO assembly.

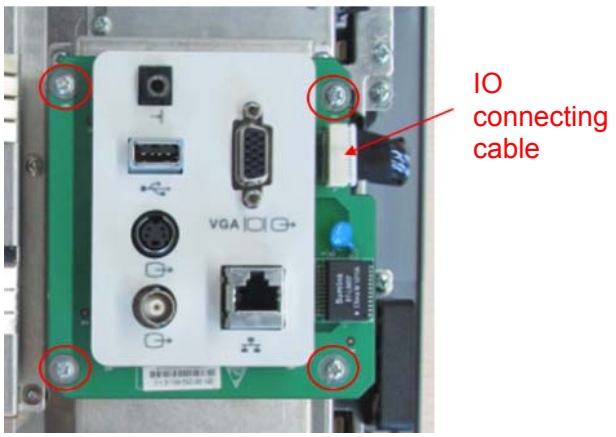


Fig 7-14 Disassembly of IO Assembly

4. When inverting the IO assembly, remove four M3X6 panhead screws with washers fixing the IO board, then you can take the IO board.

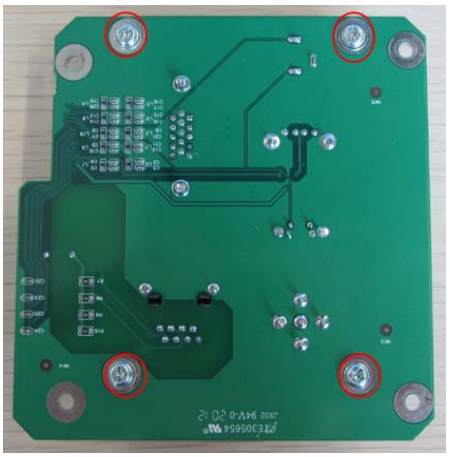


Fig 7-15 Disassembly of IO Board

7.4.6 Probe Board

1. Remove rear cover assembly of main unit (referring to 7.4.2, the 1st~3rd step).
2. Keep the main unit horizontal and remove 8 M3X6 panhead screws with washers fixing the probe board assembly, then pull out the probe board assembly upward on the position of action point.

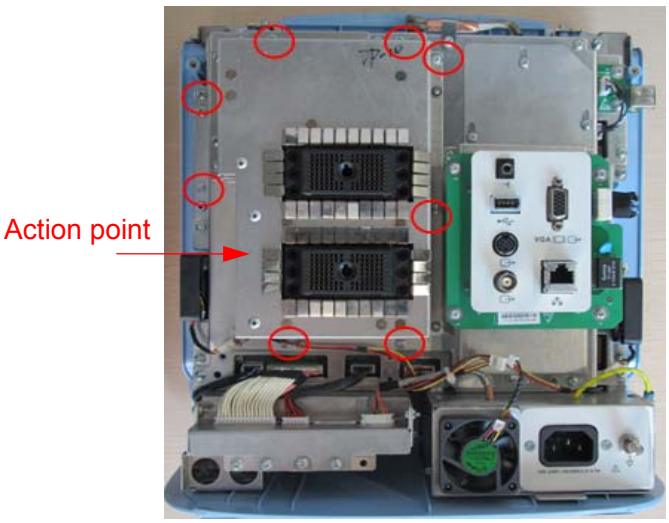


Fig 7-16 Disassembly of Probe Board assembly

3. When inverting the probe board assembly, remove 4 M3X6 panhead screws with washers fixing the probe board cover board, and then you can remove the cover board.

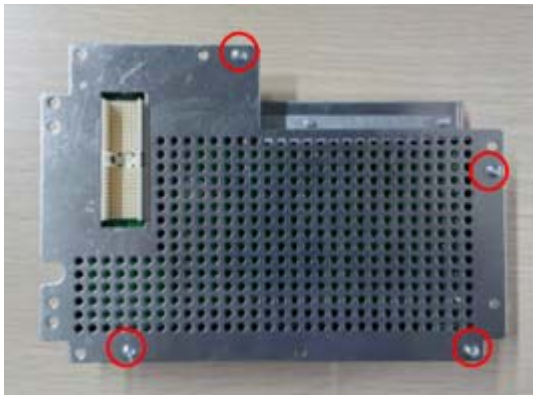


Fig 7-17 Disassembly of Probe Board (1)

4. Remove 7M3X6 panhead screws with washers fixing the probe board and take the probe board.

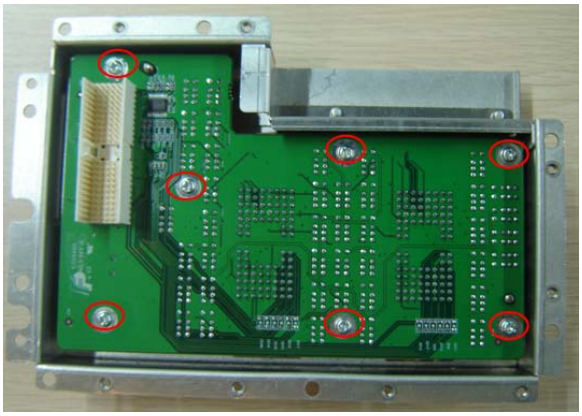


Fig 7-18 Disassembly of Probe Board (2)

7.4.7 Main Board Assembly

1. Remove the probe assembly (referring to 7.4.6, the 1st~2nd step).
2. Remove 4 M3X6 panhead screws with washers fixing the cable cover board, then remove the cover board from the machine.

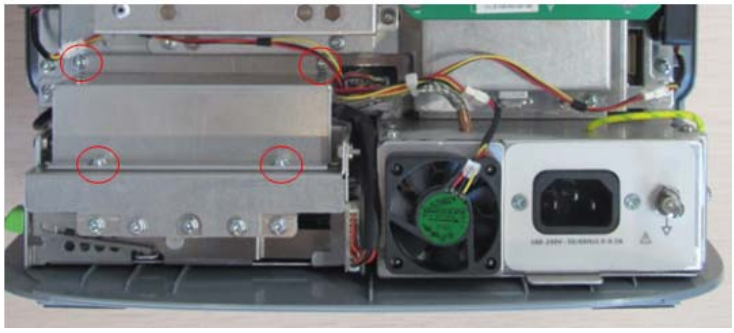


Fig 7-19 Disassembly of Cover board

3. Pull out 7 connecting cable plugs and cut off 2 cable ties.

Fig 7-20 Disassembly of Main Board(1)

4. Remove 3 M3X6 panhead screws with washers fixing the top sheet metal, remove the top sheet metal and pull out the plugs of HDD cables.

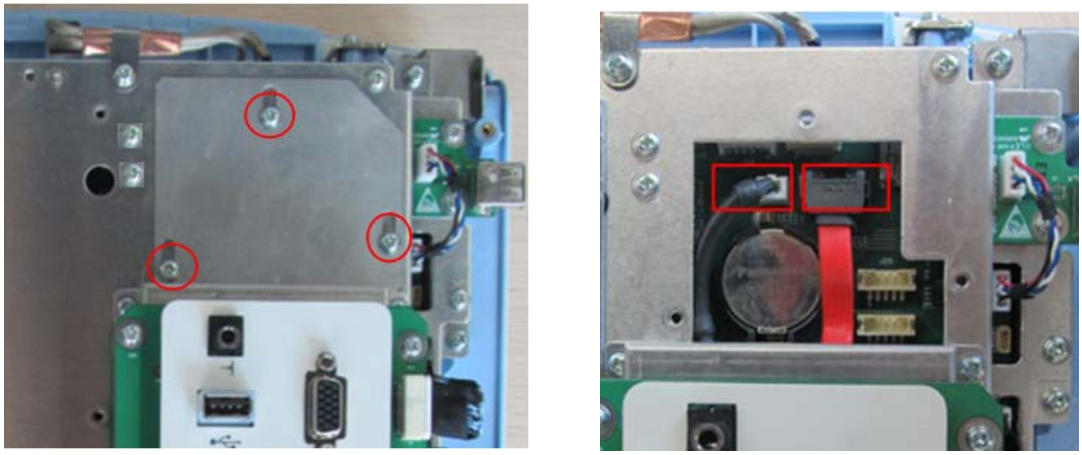


Fig 7-21 Disassembly of Main Board (2)

5. Remove 2 M3X6 panhead screws with washers fixing the USB connecting board and pull out the plug, remove the connecting board. Remove 1 M3X8 small panhead screws with washers fixing the cable clip, too.

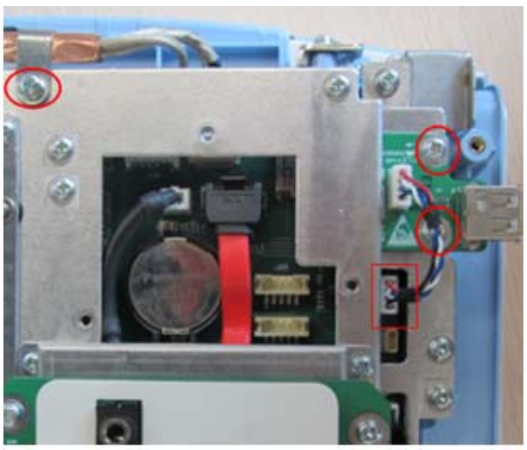


Fig 7-22 Disassembly of Main Board (3)

6. Remove 11 M3X6 panhead screws with washers fixing the shielding cover of main board, and then remove the shielding cover.

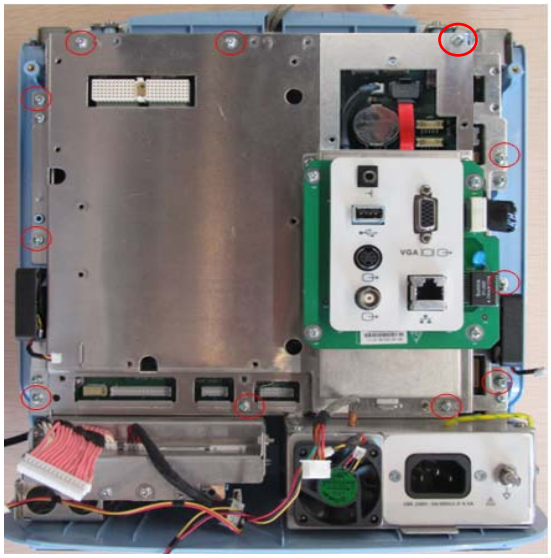


Fig 7-23 Disassembly of Main Board (4)

7. Remove 12 M3X6 panhead screws with washers fixing the main board, and then remove the main board.

Fig 7-24 Disassembly of Main Board (5)

7.4.8 LCD assembly

1. Remove rear cover assembly of main unit (referring to 7.4.2, the 1st~3rd step).
2. Remove 1 M3X8 panhead screw with washers fixing the LCD connecting cable clip. Open and remove the cable clip after pulling out two plugs.

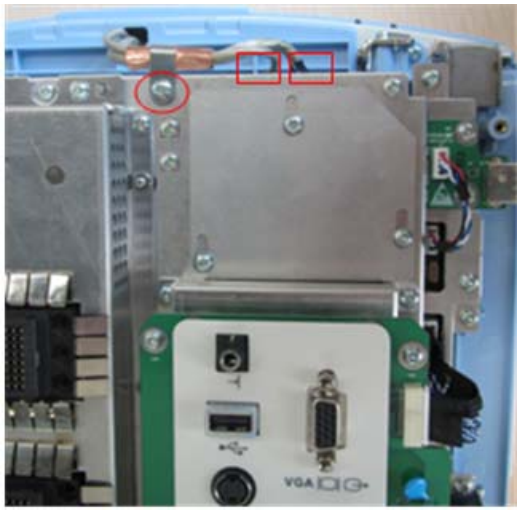


Fig 7-25 Disassembly of LCD Assembly (1)

3. Remove 2 monitor caps (1 at each side), take out 2 M3X8 screws below the caps, and then remove the front cover of the monitor upwards via holding the upper of cover.

Fig 7-26 Disassembly of LCD Assembly (2)

4. Remove 4 M3X8 panhead screw with washers fixing the LCD assembly and 1 PT3X8 self-tapping screw fixing the sheet metal pressing the cable, then remove the sheet metal.

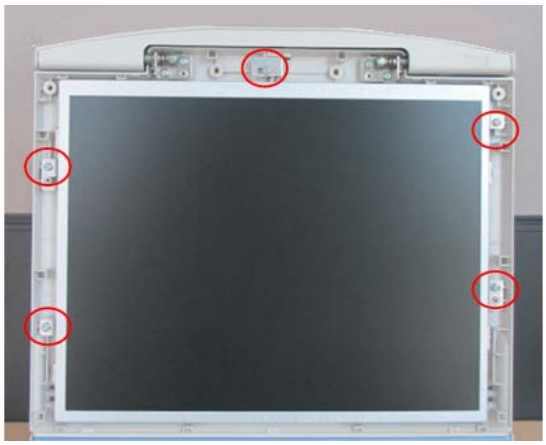


Fig 7-27 Disassembly of LCD Assembly (3)

5. Lift LCD assembly at certain degree via holding two sides of it, you can separate the LCD assembly from the rear cover .Exist the LCD connecting cables carefully from upper hole, then take off the LCD assembly.

7.4.9 Top Cover Assembly of Keyboard

1. Remove 2 screw caps on the top cover of keyboard and pull out corresponding 2 M3X8 small panhead screws, then hold the upper of top cover of keyboard to remove it upwards.

Fig 7-1 Disassembly of Top Cover Assembly of Keyboard (1)

2. Hold the bottom of top cover of keyboard to lift it at certain degree, remove 1 M3X8 small panhead screw fixing the connecting cable clip of keyboard and 1 M3X8 screw fixing the ground line, pull out the plug of keyboard connecting cable, and then get the top cover assembly of keyboard.

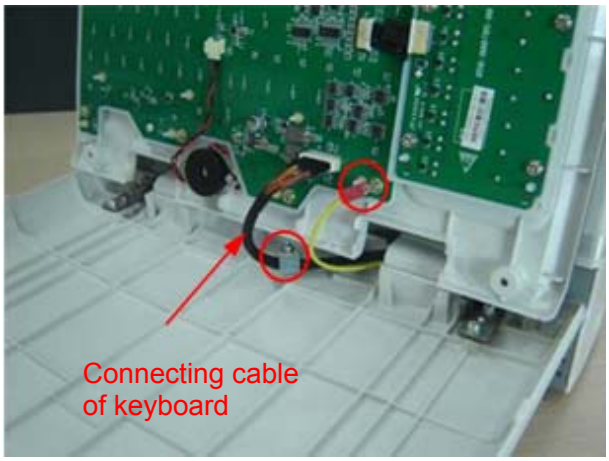


Fig 7-2 Disassembly of Top Cover Assembly of Keyboard (2)

You can remove the following units on the top cover assembly of keyboard:

7.4.9.1 Encoder Board

1. Pull out the 3 knobs on the encoder board upwards from the face of top cover assembly of keyboard.

Fig 7-28 Disassembly of the encoder board (1)

2. Pull out 3 plugs of encoder connecting cable and remove 6 PT3X8 countersunk head self-tapping screw used to secure the encoder board, you can remove the 3 encoder boards.

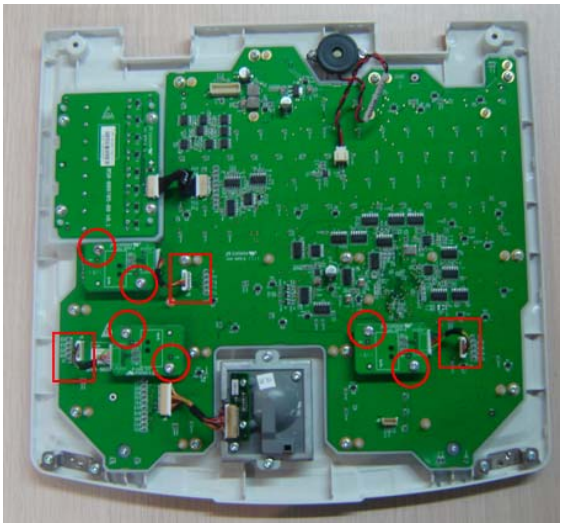


Fig 7-3 Disassembly of the encoder board (2)

7.4.9.2 Trackball Assembly

Pull out the plug of trackball cable from the top cover assembly of keyboard and remove 4 PT3X8 countersunk head self-tapping screws. After taking off the metal part fixing trackball, you can get the trackball assembly.

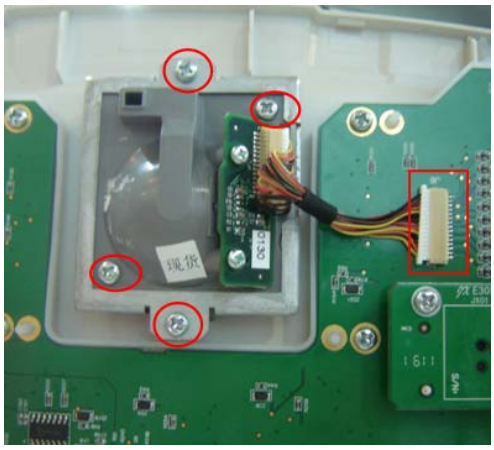


Fig 7-4 Disassembly of Trackball assembly

7.4.9.3 TGC Board

1. Pull out the 8 knobs on the TGC board upwards from the face of top cover assembly of keyboard.

Fig 7-5 Disassembly of TGC Board (1)

2. Pull out the plug of TGC cable and remove 4 PT3X10 countersunk head self-tapping screws fixing the TGC board, you can remove the TGC board.

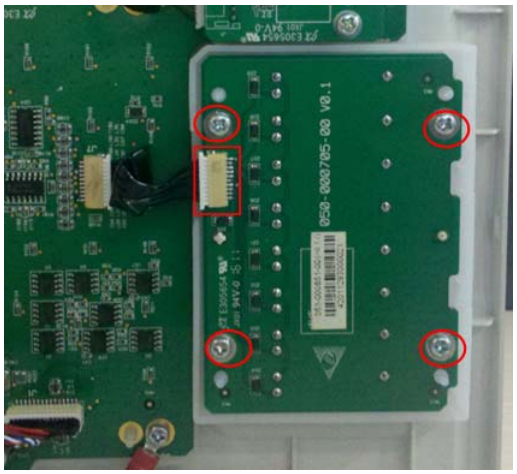


Fig 7-6 Disassembly of TGC Board (2)

7.4.9.4 Buzzer

Pull out the plug of buzzer cable from the top cover assembly of keyboard and remove 2 PT2X8 countersunk head self-tapping screws fixing the buzzer, you can remove the buzzer.

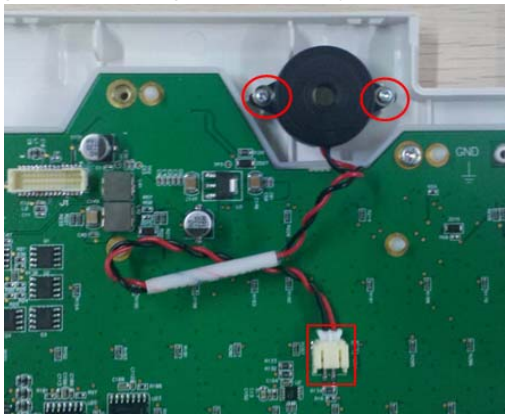


Fig 7-7 Disassembly of Buzzer

7.4.9.5 Control Panel and Silicon Rubber Keypad

1. Pull out the 8 TGC knobs and 3 encoder knobs upwards from the top cover assembly of keyboard.

Fig 7-8 Disassembly of Control Panel and Silicon Rubber Keypad (1)

2. Remove 6 connecting cable plugs of encoder boards, TGC board, trackball and buzzer on control panel.

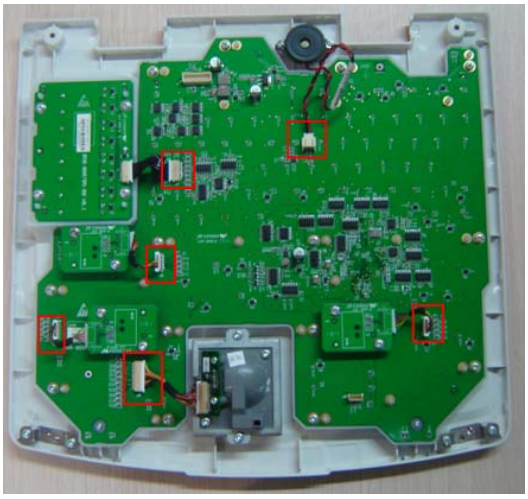


Fig 7-9 Disassembly of Control Panel and Silicon Rubber Keypad (2)

3. Remove 23 PT3X8 countersunk head self-tapping screws fixing the control panel, encoder boards and TGC board, pull out encoder boards, TGC board and control panel.

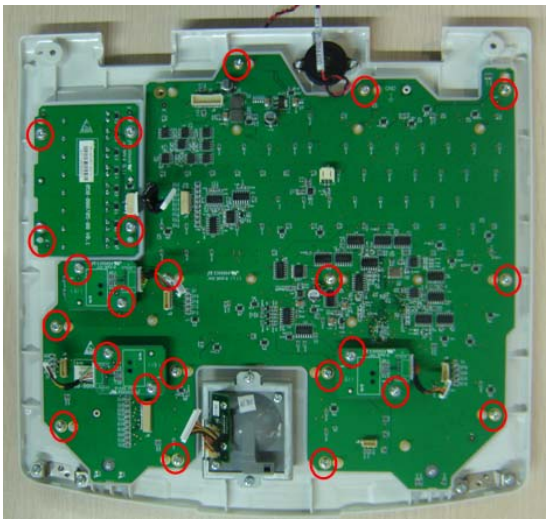


Fig 7-10 Disassembly of Control Panel and Silicon Rubber Keypad (3)

4. Pull out the locating poles of silicon rubber keypad from the control panel; you can separate silicon rubber keypad from control panel.

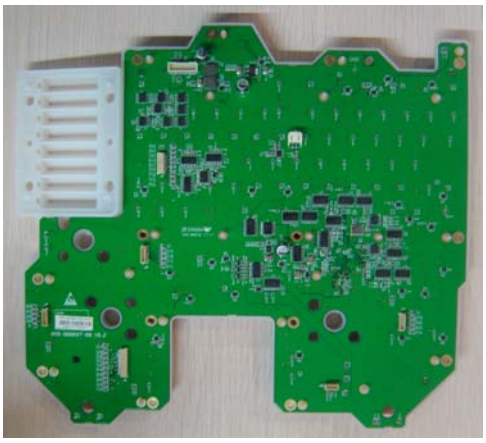


Fig 7-11 Disassembly of Control Panel and Silicon Rubber Keypad (4)

7.4.10 Other Parts

7.4.10.1 Fan of Main Board

1. Remove rear cover assembly of main unit (referring to 7.4.2, the 1st~3rd step).
2. Pull out the cable plug of fan cable connecting fan connection wire.
3. Remove 2 M3X16 panhead screws with washers fixing the fan of main board; you can get the single fan.

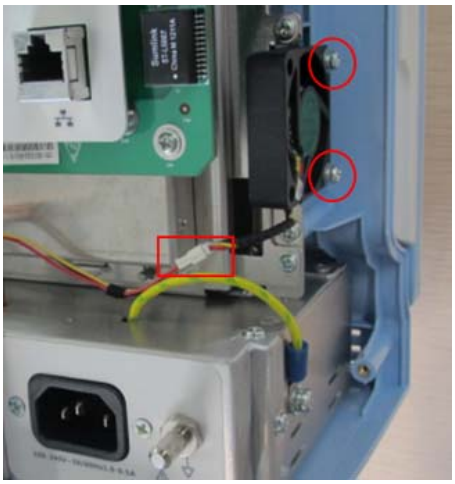
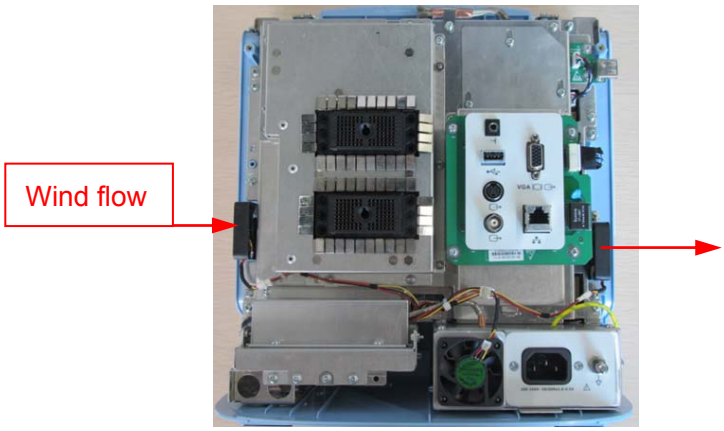


Fig 7-12 Disassembly of Fan of Main Board

Note： Pay attention to the direction of wind flow when install the fan.



7.4.10.2 Fan of AC-DC board

1. Remove the AC-DC assembly (referring to 7.4.2).
2. Remove 2 M3X10 sunk head screws fixing the rear cover of AC-DC assembly, you can get the rear cover.

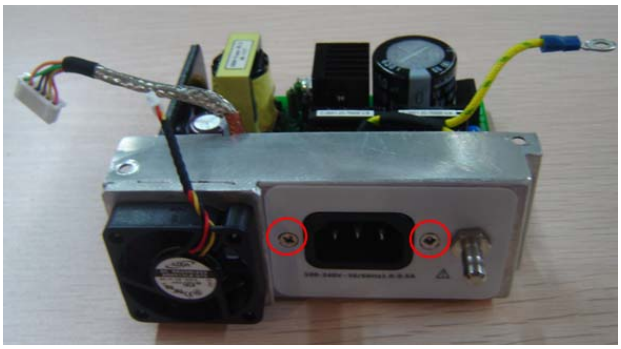


Fig 7-13 Disassembly of Fan of AC-DC Board (1)

3. After removing 4 crews fixing the fan of AC-DC board, you can remove the fan.

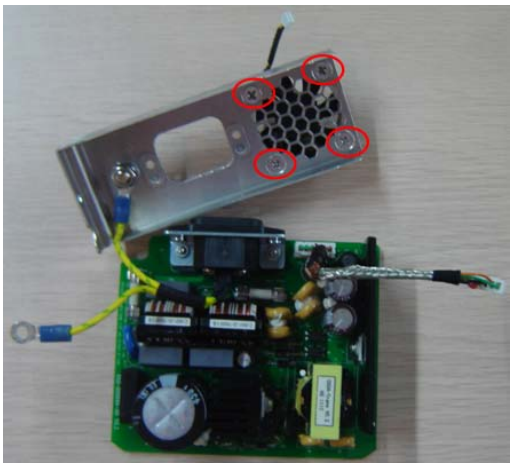


Fig 7-14 Disassembly of Fan of AC-DC Board (2)

NOTE:	The fan label must be toward outside when assembling.

7.4.10.3 USB Connecting Board

1. Remove rear cover assembly of main unit (referring to 7.4.2, the 1st~3rd step).
2. Pull out the cable plug of USB connecting board**.**
3. After removing 2 M3X6 panhead screws with washers fixing the USB connecting board, you can remove the USB connecting board.

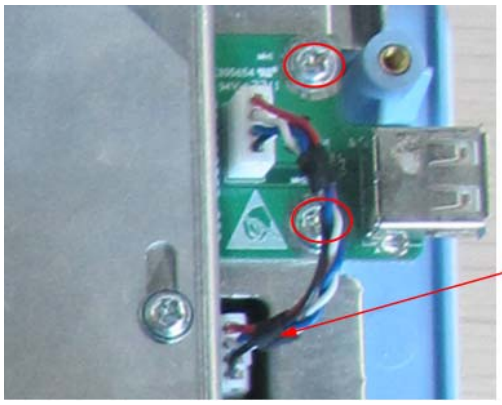


Fig 7-15 Disassembly of USB Connecting Board

7.4.10.4 Hard Disk(optional)

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. Remove rear cover assembly of main unit (referring to 7.4.2, the 1st~3rd step).
2. Remove 3 M3X6 panhead screws with washers fixing the top sheet metal, remove the top sheet metal.

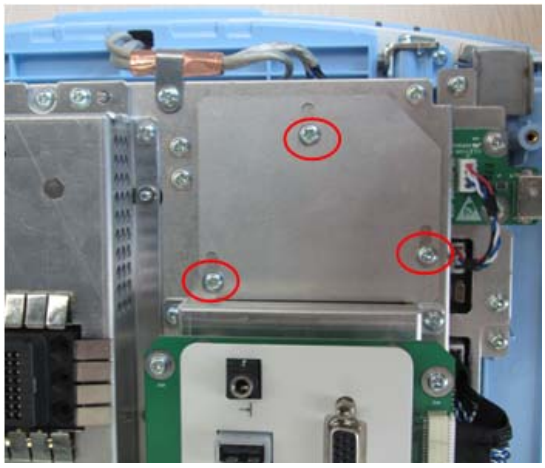


Fig 7-16 Disassembly of HDD Assembly (1)

3. Pull out two plugs of HDD assembly cables and remove 2 M3X6 panhead screws with washers fixing HDD assembly; you can remove the HDD assembly.

Fig 7-17 Disassembly of HDD Assembly (2)

4. Remove 4 M3X4 cross sunk head screws fixing the HDD bracket (2 at each side), pull out the cables, you can get the HDD.

Fig 7-18 Disassembly of HDD Assembly (2)

5. The assembly of HDD is the inverse process of disassembling; remove 2 spare M3x6 screws to fix the HDD assembly when assembling. Note: the front-end of HDD assembly must be inserted into the “bridge” character of shielding cover.

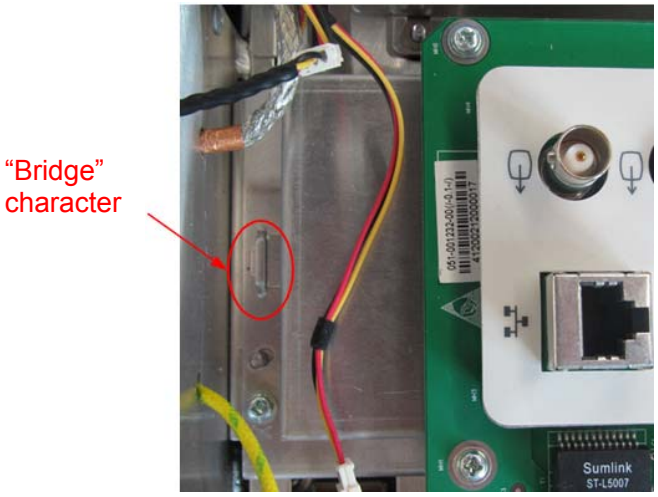


Fig 7-19 Assembly of HDD

8 System Diagnosis and Support

8.1 General Status Indicator

8.1.1 Status Indicators of the Control Panel

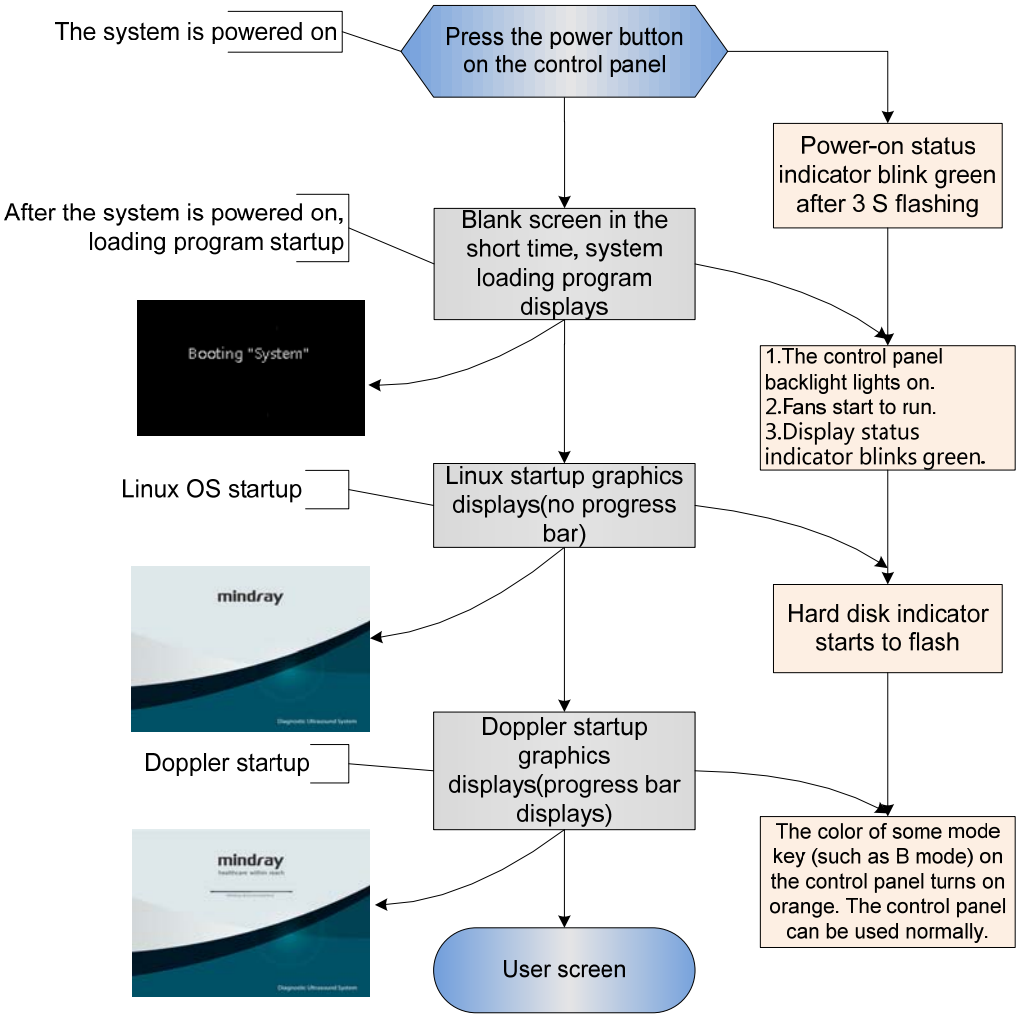
Status indicators	Icon	Status definition and indicators	Position
Power-on status indicator		The indicator is not on when the system is turned off; Press the power button, the indicator blinks in green when the system is powered on. After power on, the indicator is green.	In the upper middle part of control panel
Battery status indicator		Indicate the status of battery: it's off when the machine has no battery ,the other status: 1. It illuminates in orange when battery is being charged; 2. It illuminates in green when battery is charged to full capacity; 3. The battery discharges with more than 20% capacity, the indicator is green. 4. The battery discharges with less than or equal 20% capacity, the indicator blinks in orange. 5. The battery discharges with less than or equal 5% capacity, the indicator blinks in orange quickly. 6. When the battery is in non-charge/discharge status, the indicator is off (not including the situation with 100% capacity).	In the lower left corner of control panel
AC indicator		The indicator is on green when the ultrasound system is connected to the AC power supply. The indicator is off only when batteries supplied.	In the lower left corner of control panel
Standby status indicator		The indicator blinks orange in standby status. The indicator is off on the other status.	In the lower right corner of control panel
Hard disk indicator		The indicator light blinks in green when the hard disk is reading or writing. The indicator is off automatically in other situations.	In the lower right corner of control panel

Monitor status indicator		The indicator is green when monitor is working in normal status; It's orange when there is no signal.	In the upper left corner of control panel.

8.1.2 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; The [Freeze] key is white or light off.	Entering or exiting the scanning status by the [Freeze] key	
Freezing status	The Power-on status indicator turns on green, and the [Freeze] key is orange.	Entering or exiting the freezing status by the [Freeze] key	
Standby status	The standby indicator blinks orange.	1. Press the power button 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 (default).	The system restores to the freezing status after restarting by pressing the power button for a short time.
Screen-saver status	There is a Screen-saver picture moving on the monitor (the default is "mindray"). The brightness of the monitor is 0% The backlight of the control panel is still on. The system is frozen. Operating system is in the Screen-saver status	There is no operation for the time set firstly, and then the system would enter into the screen-saver status automatically(The time can be set from 5 to 60 seconds)	When you press any keys on the control panel, the system would return to the previous status. The brightness of monitor restore to the previous status.
Power-off status	The system is on the power-off status: when connected the AC power supply, only the AC indicator is on, battery indicator referring to the instruction of "Battery status indicator"	Press the power button for a short time, the system is turned off.	Starting the system by pressing the power button for a short time.

8.2 Starting Process of the Whole System



8.2.1 Start-up Process of Complete System

8.2.1.1 Powered on by AC

Basic Procedures	Phenomenon
The original status: Finishing loading 3.3VSTB	The AC status indicator on the control panel lights on, but the indicators of HDD, standby and battery are off.
Press the power button, the power management sends the power-on request to CPU on main board.	The Power-on status indicator flashes continuously on the control panel.
CPU responds to requests, the power management opens the power supply.	The Power-on status indicator on the control panel.
The power supply has been powered on	1: The control panel backlight lights on.

	2: Fans start to run.
After finishing HDD initialization and logic configuration, enters into BIOS stage	There are data output and images displaying on the monitor. The monitor status indicator lights green for a long time.

8.2.1.2 Powered on by Battery

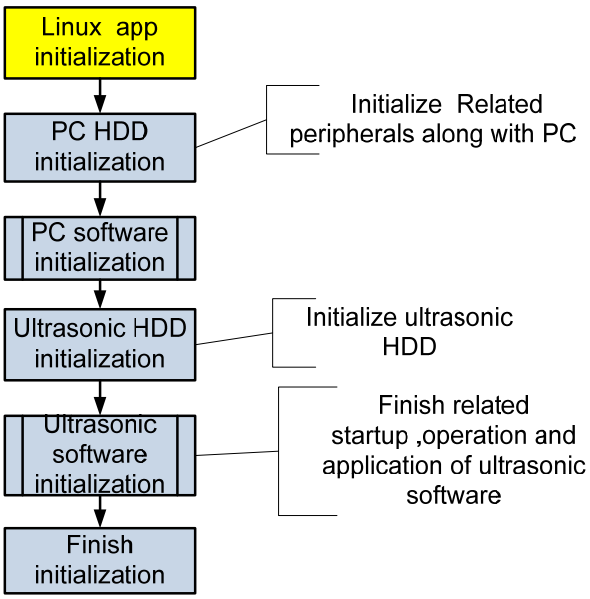
Basic Procedures	Phenomenon
Loading 3.3VSTB is finished after pressing the power button.	The battery indicator on the control panel lights on, but the indicators of HDD, standby and AC status are off.
The power management send the power-on request to CPU on main board	The Power-on status indicator flashes continuously on the control panel.
CPU responds to requests, the power management opens the power supply.	The Power-on status indicator on the control panel lights for a long time.
The power supply has been powered on.	1: The control panel backlight lights on. 2: Fans start to run.
After finishing HDD initialization and logic configuration, enters into BIOS stage	There are data output and images displaying on the monitor. The monitor status indicator lights green for a long time.

8.2.2 Start-up Process 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.

8.2.3 Start-up of Doppler

8.2.3.1 Procedure of Startup



8.2.3.2 Details of Procedures

Now, DOPPLER starting is in increments of 20, 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	Attach the path to configuration files Initialize monitor, the main window, sound and the USB representative Turn on the bus device BackboneDev and LPC Initialize the time and the processing function of Multilanguage Initialize peripheral file system, network and the driver Enumerate peripheral ports Configure timer, Initialize soft interruption, construct maintenance servicer and configure static data of the system Configure system font Load layout information Initialize UI management, and Initialize UI mark standard library	In increments of 7.
Initializing hardware…	When loading boot-trap graphic, 7 refreshing progress bars will display Release factory package of configuration data Maintain the data servicer	
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	Set related information of the zoom, languages, font library	In increments of

locale…	and input Construct widget factory Configure the GUI layer Set menu items Initialize function library Construct UICenter	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 machine has alarm function. When the malfunction exists in the machine, an alarm dialog box will be popped up, and the LOG file generated will be saved in the system log, which will be in the directory of D: \CS04\Log\. The detailed description of alarm information is as follows:

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

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! (id9256)	none	Reinstall the system software.

8.3.2 The voltages of system power is abnormal

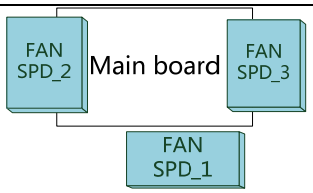
Alarming tips	LOG record	Suggestion
none	×××: System Monitor: Power supply alert! [XXX], Current voltage: [VVV] V, Limit voltage:[LLL]-[HHH]V. ×××represents time, e.g. 2010-12-25 14:15:25 [XXX] represents voltage name, [VVV] represents the current value, and [LLL]-[HHH] represents the lower and upper limits. The voltage names respectively are: AD5V，N5V，D3V3，D1V5，D1V2 和 PHV	Short-circuited, protection or overvoltage. Check the related circuit.

8.3.3 Temperature Alarming

Alarming tips	LOG record	Suggestion
none	×××: System Monitor: Temperature Alert! [CPU thermal sensor], Current voltage: [VVV] degree, Limit temperature: [LLL] degree ×××represents time, e.g. 2010-12-25 14:15:25 [VVV] represents the current value, and [LLL] represents the first limit of CPU temperature.	CPU over-temperature (level 1) Check the fan log D：\CS04\Log \Perilog (if the fan stops working)/check if the heating condition is normal.
Temperature alarming(id1218), Shut down XX (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.	CPU over-temperature (level 2) Suggestion as above

8.3.4 Fan Alarming

Alarming tips	LOG record	Suggestion
Fans need maintenance, please contact service engineers!（id:7340）	×××: System Monitor: Fan alert！[XXX], Current speed: [VVV] degree, Limit speed: [LLL] rpm. ×××represents 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: FAN_SPD1, FAN_SPD2, FAN_SPD3 “FAN_SPD1” indicates the fan of power supply in the back;”FAN_SPD2” and “FAN_SPD3” separately indicate left fan and right fan of main board.	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!(id10642)	Battery Hot Plug	Stop the illegal operation.
Battery communication error! Battery may not be used or capacity of battery may not be displayed correctly !(id7330)	Battery I2C error	Check the battery connection or replace the battery
Battery temperature is too high; please connect to AC power supply or shut down! Otherwise the system shuts down automatically after 60s!(id7333)	Battery temperature is out of range temp，Battery temperature is: xx centigrade	Check if the heat radiating condition is normal.
Battery temperature is too low; please connect to AC power supply or shut down! Otherwise the system shuts down automatically after 60s!!(id7336)	battery voltage is low, battery volt is xx V	Check the battery connection or replace the battery
Battery error! Battery cannot be used!!(id7476)	battery break	Replace the battery
Battery voltage is too low, please connect to AC power supply or shut down! Otherwise the system shuts down automatically after 60s!(id4298)	Low battery power，battery power is XX	Input AC, check if the battery charging is normal, and it can be used when full of power. Or replace the battery
Battery life is approaching, please replace with new battery!(id7420)	battery cycle is XX, please change the battery	Replace the battery
/	Battery I2C error，Shutdown State	Check the battery connection to confirm the malfunction module with I2C. Or replace the battery.
/	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	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 is 1.1 times more than the limit of

images display normally!(id7379)		voltage (100%AP）.
none	PHV protect, PHV_P is XX	PHV protection and the voltage of PHV is less than the lower limit.

9 Care and Maintenance

9.1 Overview

The following procedures 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	Used to be file the physiological saline, which can accommodate two probes
Soft brush	1 pcs	About a toothbrush size, with soft head.
Small plastic basin	1 pcs	Used to fill the soapy water
Safety test analyzer	1 pcs	Refer to appendix A
Cross-headed screwdriver	1 pcs	105 X100

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 Card and Maintenance Items List

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

9.2 Cleaning the System

9.2.1 Flow of Cleaning

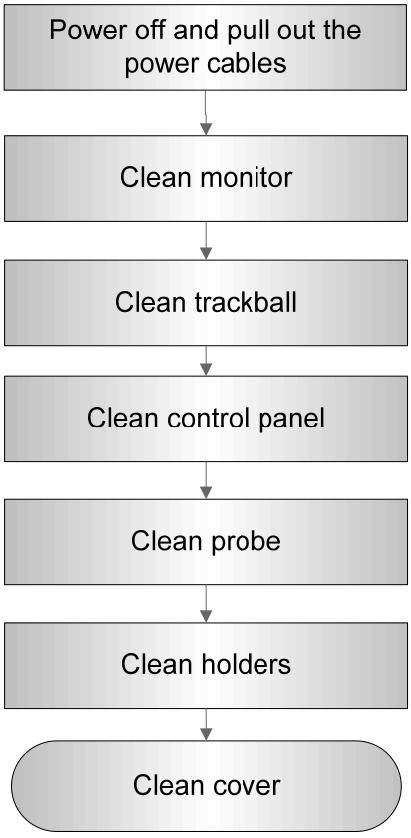


Fig 9-1 Cleaning Maintenance Flow

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

9.2.2 Content

1. Clean Monitor

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

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

2. Clean Trackball

- Tool: dry soft cloth, 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 drive 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:

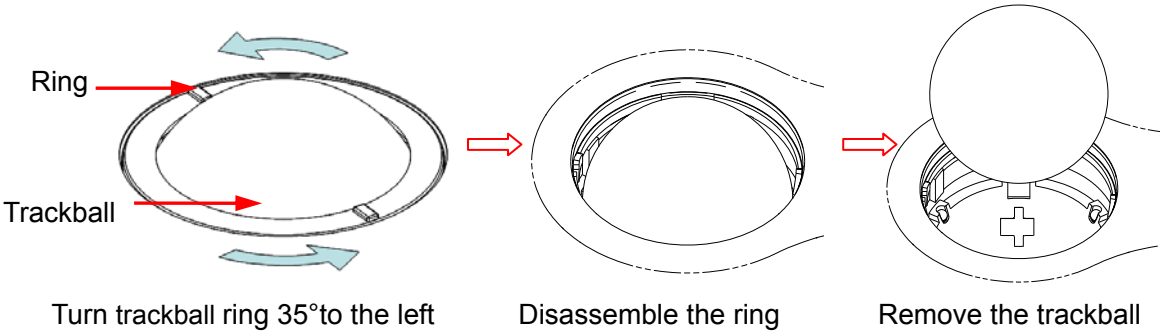


Fig 9-2 Disassembly of the Trackball

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.

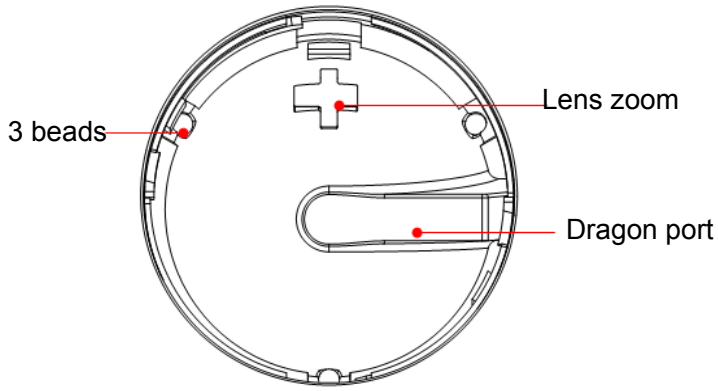
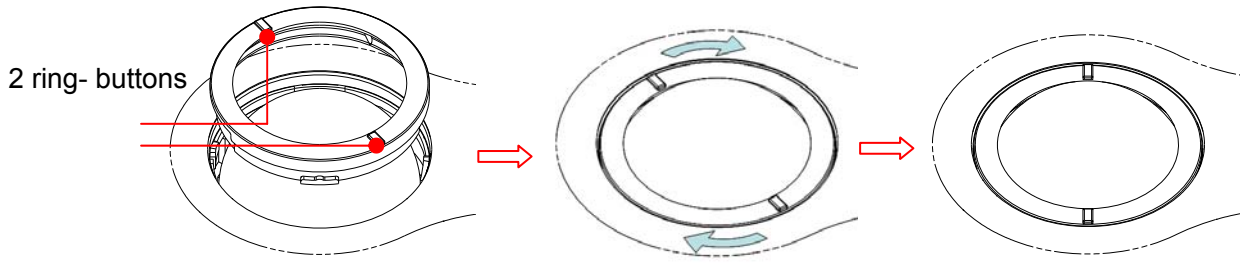


Fig 9-3 The Sketch Map of Len, Bead, Dragon groove

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° clockwise 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, soapy water
- Method:

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

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

4. Clean Probe

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

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

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

  c) Remained stain or dust attached to surface of cable or surface of connector should be washed out by cloth with a little soapy water, and then air-dry.

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

5. Clean Holders

- Tool: dry soft cloth , soapy water, soft brush
- Method:

  a) Use dry soft cloth to wipe off the dust attached to inside, outside or gap of probe holder or gel holder. As to small intra-cavity probe holder or its gap, use the soft brush to brush the dust or stain.

  b) Remained stain attached to inside, outside of holder should be washed out by cloth with a little soapy water after it was taken out, and then install the holder after air-dry.

6. Clean Cover

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

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

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

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 9-3 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 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 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.

9.3 Checking

9.3.1 General check

Table 9-4 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 to cable. The connection of plug is reliable and the retaining clamp of power supply cable is effective.

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

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 9-5 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.	M mode	Verify basic operation of M mode. Check basic software and hardware controls affecting M mode operations.
3.	Measurement（2D, M, optional applied measurement ）	Scanning gray scale imaging on phantom, verify distance and area accuracy with measurement control. Verify measurement accuracy by performance test.
4.	Keyboard test	Operate keyboard test to verify if all control keys can work normally.
5.	LCD	Verify LCD display function and parameters adjustment. Refer to that of LCD checking.
6.	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 9-6 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.

No.	Content	Method
3.	Foot switch	Check if the foot switch can implement the set functions according to the program.
4.	DICOM	Check if DICOM can work normally and send pictures and other data to DICOM server.
Remark：Please refer to 5.3 for details.		

9.4 System Maintenance

9.4.1 Mechanical Safety Maintenance

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:

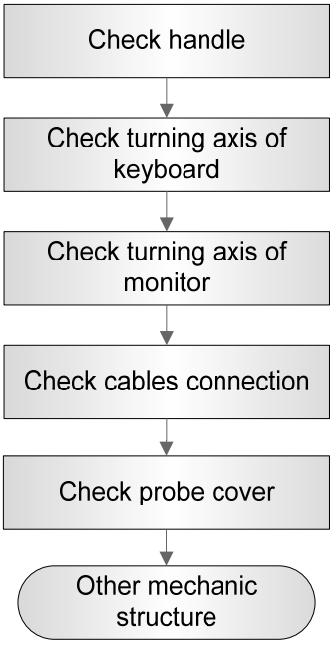


Figure 9-4 Mechanical Safety Inspection Flow

Table 9-9 Checking Mechanic Safety List

Checking Item	Checking standard	Tool
Handle	1. Check by sight if there is no crack. 2. Check by hand to confirm that the handle is free of looseness.	none
Keyboard	Unfold and rotate the keyboard to confirm that the whole keyboard is normal and the rotation axis is free of looseness	none
Fixing and rotating mechanism of the monitor	1. Visually check to confirm if any inclination happened to the monitor.	
	2. Manually operate the monitor to check if the monitor is about 30° from the vertical direction and abnormal sound exists	
	3. Manually turn the monitor left/ right, make sure there is no obvious looseness.	
	4. Remove bottom cover assembly of keyboard to confirm the fixing screws are free of looseness, check by eyes to confirm that the cables are not scratched or clipped out that the core can be seen.	Cross-headed screwdriver
Cable connection	1. Visually check to confirm if the cables, inside or outside the system, are free of damage and scratch. 2. Check by hands to confirm that the cables inside the system are free of looseness or falling off.	Cross-headed screwdriver
Transducer appearance	Visually check to confirm transducers are free of crack, peeling, looseness or damage.	none
Other mechanical structures	Check to confirm that there is no other crack and their conductive parts in mechanical parts.	none

9.4.2 Electric Safety Maintenance

Only technical professionals or engineers after training can perform electric safety inspection.

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

10 Troubleshooting of Regular Malfunctions

10.1 Troubleshooting When System Can't Be Powered on

10.1.1 Module or Board Related

No.	Descriptions	Remarks
1.	AC-DC Board	
2.	DC-DC Board	DP10/20/30 series
3.	Battery	Optional，used for DP10/20/30 series

10.1.2 Key Points Supporting Troubleshooting

No.	Key Points Supporting Troubleshooting	Remarks
1.	AC power indicator	Located below the control panel.
2.	Power-on status indicator	Backlight of the power button
3.	Battery indicator	Located below the control panel.

10.1.3 Troubleshooting When System Can't Be Powered on

No.	Fault Description	Cause Analysis	Measure
1.	AC power indicator :off; Power-on status indicator :off.	AC power cable has not been plugged well.	Plug the power cable again.
		AC-DC board malfunction	Replace AC-DC board
2.	The system can start up by AC input, Fail to start up when powered by the	Battery is out of power (Press the button on the battery, check if the LED is on. Being	Charge up

No.	Fault Description	Cause Analysis	Measure
	battery and without the AC.	off states that battery is out of power. or else battery is full of power)	
		Battery has not been plugged well.	Plug the battery again (Note: there must not be an AC input when plugs the battery again. or else the battery may be destroyed.
		Battery malfunction	Replace the battery
		DC-DC board malfunction	Replace DC-DC board
		DC-DC board installation malfunction	Plug the cable between DC-DC board and battery connecting board.
3.	AC power indicator: ON; Power-on status indicator: off after power button pressed and the system can't start up.	AC-DC board is normal; DC-DC board malfunction	Replace DC-DC board
4.	AC power indicator: ON; Power-on status indicator: blinks after power button pressed Power indicators on IO board: off	Main board malfunction	Replace Main board

10.2 Troubleshooting When System cannot be started up Normally

10.2.1 Module or Board Related

No.	Descriptions	Remarks
1.	DP10/DP20 main board assembly	DP10/DP20 series
2.	DP30 main board assembly	DP30 series
3.	DC-DC Board	DP10/DP20/DP30 series
4.	HDD	Optional

10.2.2 Key Points Supporting Troubleshooting

No.	Key Points Supporting Troubleshooting	Remarks
1.	Character during the starting of the system	
2.	The monitor status indicator	

10.2.3 Troubleshooting When System cannot be Started

No.	Fault Description	Cause Analysis	Measure
1.	Control panel backlight normal; LCD blank; no output when connecting external monitor with VGA interface.	The system can be normally powered on; No power supply on the main board (happening on the inner of the main unit board after disassembly)	Install cable between DC-DC board and main board once more
		Main board malfunction	Replace the main board assembly
2.	Loading graphics is normally displayed, but it cannot be kept on.	Main board malfunction	Replace the main board assembly
3.	Enter into the system normally, but the control panel is invalid (The trackball cannot move and the keys have no response).	Control panel malfunction	Referring to 10.6 troubleshooting of the control panel in detail
		Main board malfunction	Replace the main board assembly
4.	Enter into the system normally, but the E disk is invalid (only optional HDD existed).	HDD malfunction	Replace HDD
		Main board malfunction	Replace main board assembly

10.3 Troubleshooting for Image Displaying

10.3.1 Module or Board Related

No.	Descriptions	Remarks
1.	DC-DC Board	
2.	DP10/DP20 main board assembly	Mainly ultrasound front-end: transmitting and receiving parts. DP10/DP20:80 physical transmitting channels and 8 physical receiving channels
3.	DP30 main board assembly	DP30 series:80 physical transmitting channels and 16 physical receiving channels
4.	DP20/DP30 single probe board	DP10/DP20 series
5.	DP20/DP30 dual probe board	DP10/DP20/DP30 series

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 and the same interface of probe socket.	

10.3.3 Troubleshooting for Image Displaying

No.	Fault Description	Cause Analysis	Measure
1.	NO echo signal in ultrasonic image region	PHV voltage output of DC-DC power board is 0V or abnormal ; Main board or DC-DC power board may be fail.	Confirm the failure cause by replacing main board assembly or DC-DC board.
2.	Dark strips display on B image	Probe malfunction, e.g. array damage etc.	Confirm by connecting another probe. Replace the probe.
		The probe board fails (at low rate)	Replace the dual-probe board
		If dark strips appear in the near field and distribute irregularly, Transmission channels may not generate transmission waveforms.	Replace the main board assembly
		If dark strips appear in the far field as well as in the near field, and distribute equidistantly regularly ; Some receiving channels may fail, certain channel cannot receive or generates echo signal.	Confirm the failure cause by replacing main board assembly or probe board.
		If dark district and normal image distribute as light and shade. The size of dark area is much smaller than that of image (only happening on DP30 series). Main board malfunction	Replace the main board assembly
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.

No.	Fault Description	Cause Analysis	Measure
		Other electrical equipments working in the same electrical network may cause interference to the system. E.g. Some ripple wave on the image. Displays ripple-shaped interference signal on the image.	Confirm the cause of failure by turning off all electrical equipments around working in the electrical network or connecting to the system. E.g. charger of electric bicycle, charger of MP3, timing switch of fan, elevator, ultrasound work station, TV set. Etc.

10.4 Probe Socket System Related Troubleshooting

10.4.1 Module or Board Related

No.	Descriptions	Remarks
1.	DP10/DP20 main board assembly	Mainly ultrasound front-end: transmitting and receiving parts. DP10/DP20:80 physical transmitting channels and 8 physical receiving channels
2.	DP30 main board assembly	DP30 series:80 physical transmitting channels and 16 physical receiving channels
3.	DP20/DP30 single probe board	DP10/DP20 series
4.	DP20/DP30 dual probe board	DP10/DP20/DP30 series

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	Imaging characteristics of all models of probes when connecting on the same or different ports	
3	Probe board ID of the system information	

10.4.3 Probe Socket System Related 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 (as to dual probe board). Probe board malfunction.	Replace the dual-probe board
		All probes cannot be recognized in all probe sockets; Probe board ID cannot be read correctly by the system information; Main board malfunction.	Replace the main board assembly
2	Dark strips appear on certain areas of the image	Dark strips appear with this probe connecting to all sockets; image displays normally with other probes; The probe malfunction	Replace the probe.
		As to dual probe board: Dark strips appear in a large area with all probes connecting to a certain socket; Probe board malfunction, a relay used for probe switching on the probe board may be damaged. Switch the probe socket，judge the Probe board malfunction if it change after that.	Replace the probe board
		As to dual probe board: Dark strips appear in a single line area with all probes connecting to a certain socket; Probe board malfunction, a relay used for array switching may be damaged. Switch the probe socket，judge the Probe board malfunction if it change after that.	Replace the probe board

10.5 IO System Related Troubleshooting

10.5.1 Module or Board Related

No.	Descriptions	Remarks
1.	DP10/DP20 main board assembly	

2.	DP30 main board assembly	
3.	IO board	DP10/DP20/DP30 series

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	
3	Working condition of Video, S-video and VGA video interfaces	
4	Printing condition of video printer	Check if output of connected video printer is normal

10.5.3 IO Interface System Related Troubleshooting

No.	Fault Description	Cause Analysis	Measure
1.	LCD displays normally; No video printer output when press <print> on control panel;	Firstly, eliminate the software setting problem, then confirm if remote printing control is failure	Installing IO board connecting cable once more.
		Confirm if it is the video output failure.	Replace the main board assembly. Replace IO board (at low rate).
2.	USB ports at the back and lateral sides cannot identify connecting USB devices	Main board malfunction	Replace the main board assembly.
3.	USB ports at the back and lateral sides cannot identify connecting USB devices	Cables connecting fails	Installing corresponding connecting cables once more (More happening after maintenance).
4.	Network disconnected or abnormal	First, check if it was caused by network or problem with setting , if no, malfunction on main board (at high rate) or IO board	Replace main board assembly or IO board.

10.6 Control Panel Troubleshooting

10.6.1 Module or Board Related

No.	Descriptions	Remarks
1.	Silicon keyboard	
2.	Control Panel	
3.	Encoder Board	
4.	Trackball assembly	
5.	TGC Board	

10.6.2 Key Points Supporting Troubleshooting

No.	Key Points Supporting Troubleshooting	Remarks
1	Backlight of control panel	To confirm if the control panel is powered 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 can’t be used normally	Key conflict due to key block of another key; or Silicon key damage; or Control panel malfunction.	Confirm there is no key block first. Try replacing silicon keyboard or control panel if no key blocks.
3	Trackball failed or abnormal	Dirt or obstacles jam in the trackball groove	Remove the trackball and clean the groove.
		Trackball speed and response time in the system preset are	Set the trackball speed and response time to a proper value.

No.	Fault Description	Cause Analysis	Measure
		not correct.	
		Trackball performance degraded.	Replace the trackball.
4	All keys of control panel are normal, Single encoder is failure.	Encoder malfunction	Replace encoder assembly
5	All keys of control panel are normal, Single slider of TGC is failure.	TGC board malfunction	Replace TGC board
	All sliders of TGC are failure.	Control panel malfunction	Replace top cover assembly of keyboard

10.7 LCD Troubleshooting

10.7.1 Module or Board Related

No.	Descriptions	Remarks
1.	LCD	
2.	DP10/DP20 main board assembly	
3.	DP30 main board assembly	

10.7.2 Key Points Supporting Troubleshooting

No.	Key Points Supporting Troubleshooting	Remarks
1	Backlight of the LCD	The effect is evident in a darker environment.
2	Video output port such as VGA, DVI on the IO board	Need to connect with another monitor.
3	Display status of the LCD	Blank screen, or the screen warns “No Signal”, or snowflakes are displayed on the screen.

10.7.3 Troubleshooting for LCD

No.	Fault Description	Cause Analysis	Measure
1.	Control panel can be powered on normally; No display (blank screen) ; Monitor status indicator is off Displays normally with external LCD connecting by VGA port on IO board.	LCD failure	Replace LCD
2.	Control panel can be powered on normally; “No Signal” displays on LCD; Monitor status indicator is orange. No display on external LCD connecting by VGA.	Main board malfunction	Replace main board assembly
3.	Control panel can be powered normally; The color of some mode key turns on orange. Warns “No Signal”; Monitor indicator is orange.	The signal cable of monitor is not connected well.	Check the connection.
4.	LCD is damaged, and images display abnormally.	LCD failure	Replace LCD

Appendix A ELECTRICAL SAFETY INSPECTION

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

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

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

ELECTRICAL SAFETY INSPECTION 1- Power Cord Plug	
TEST PROCEDURE	
◆ The Power Plug	
The Power Plug Pins	No broken or bent pin. No discolored pins.
The Plug Body	No physical damage to the plug body.
The Strain Relief	No physical damage to the strain relief. No plug warmth for device in use.
The Power Plug	No loose connections.
◆ The Power Cord	
The Power Cord	No physical damage to the cord. No deterioration to the cord. --For devices with detachable power cords, inspect the connection at the device. --For devices with non-detachable power cords, inspect the strain relief at the device.

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 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 facilities are 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.

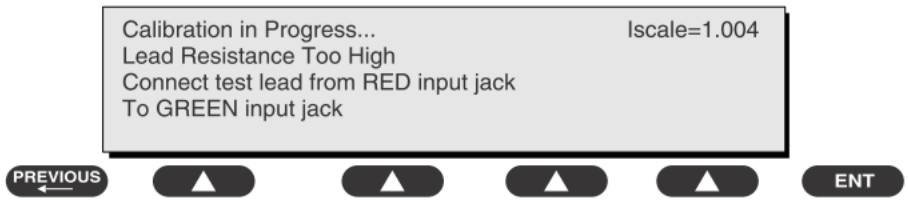
TEST PROCEDURE

◆ 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

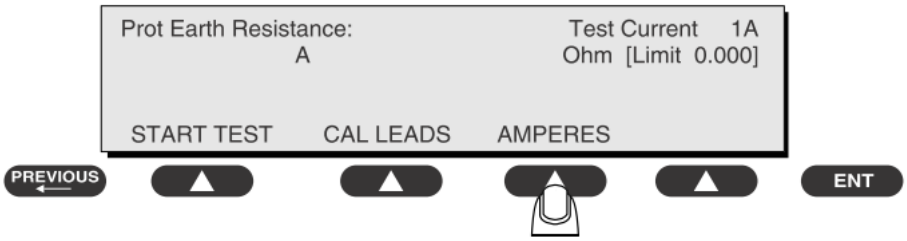
1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601PRO front panel outlet.

2) Attach the 601PRO RED input lead to the device's Protective Earth terminal or an exposed

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 and inform the Customer Service Engineer for analysis and disposal.

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:

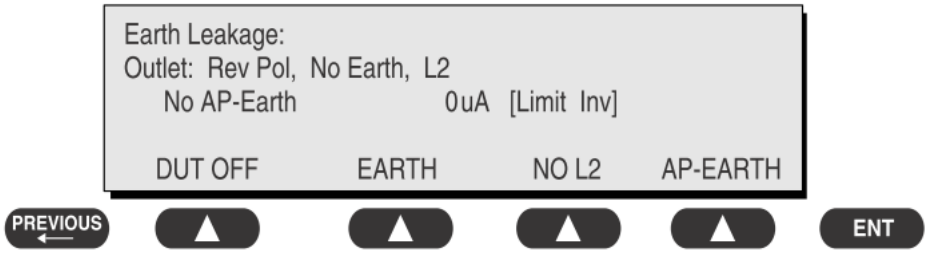
- Earth Leakage Current, leakage current measured through DUT outlet Earth
- Earth Leakage Current AP-EARTH (ALL Applied Parts connected to Earth), leakage current measured through DUT outlet Earth

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

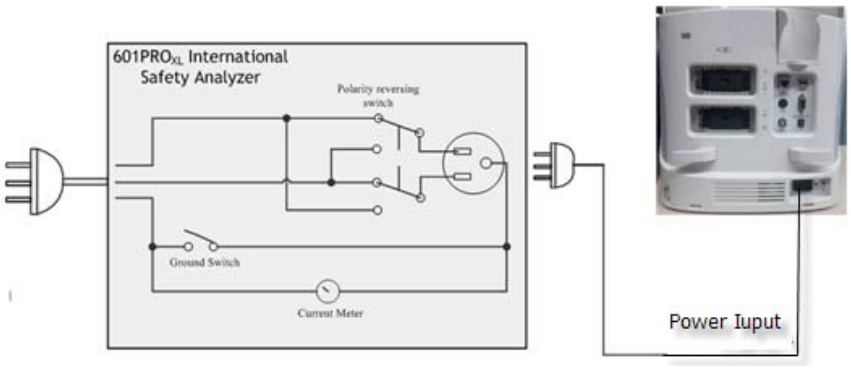


Figure 1 Earth leakage test

◆ Failure

Check any broken of the AC/DC adapter and its cable. Replace a new one if any portion defective.

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

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

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

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

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

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

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

LIMITS

UL60601-1：300 μA Normal Condition

1000 μA Single Fault Condition

IEC60601-1： 500 μA Normal Condition

1000 μA 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

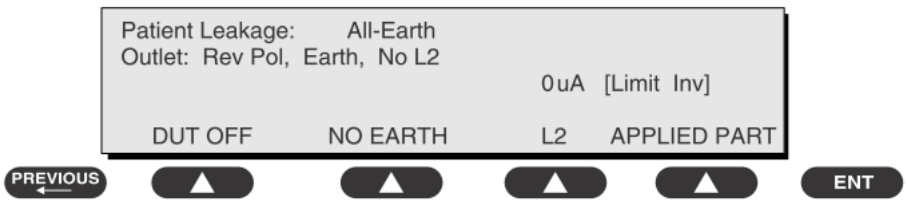
If all of the applied parts correspond to the instrument type, the applied parts will be tied together and one reading will be taken. If any of the applied parts differ from the instrument type, all applied parts will be tested individually, based on the type of applied part. This applies to Auto and 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 the 601PRO.

ELECTRICAL SAFETY INSPECTION

6- Patient Leakage Current

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

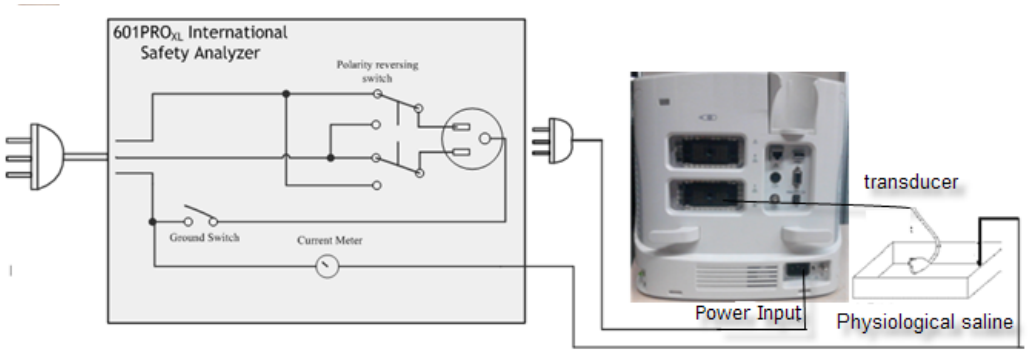


Figure 2 patient leakage Current

◆ Note

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 AC/DC adapter and its cable. Replace a new one if any portion defective.

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

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

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

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

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

If the leakage current measurement tests fail on a new unit and if situation 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

100 μ A Normal Condition

500 μ A Single Fault Condition

ELECTRICAL SAFETY INSPECTION

7- Mains on Applied Part Leakage

OVERVIEW

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

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

Normal Polarity;

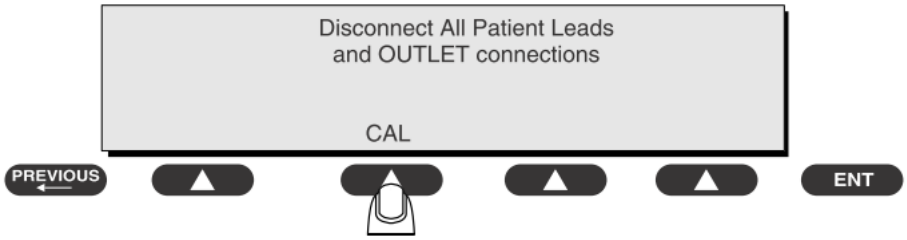
Reversed Polarity

TEST PROCEDURE

◆ Prepare

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

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



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

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

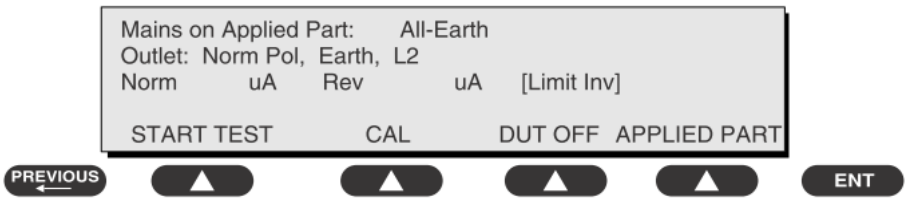
◆ Warning

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

◆ Performance

1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601
2) Attach the applied parts to the 601PRO applied part terminals.
3) Attach the red terminal lead to a conductive part on the DUT enclosure.

4) Press shortcut key 7. The Mains on Applied Part test is displayed.



5) Select the desired outlet configuration and applied part to test using the appropriate SOFT KEYS:

6) Press START TEST (SOFT KEY 1) to begin the test.

7) Press the print data key to generate a printout of the latest measurement.

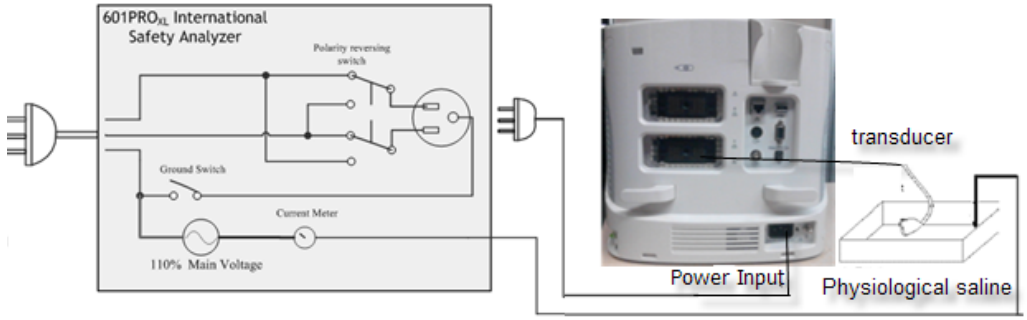


Figure 3 Mains on Applied part leakage

◆ Note

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 AC/DC adapter and its cable. Replace a new one if any portion defective.

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

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

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

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

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

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

ELECTRICAL SAFETY INSPECTION

7- Mains on Applied Part Leakage

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 μA

ELECTRICAL SAFETY INSPECTION FORM

（Class I equipment）

Overall assessment:

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

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

Note:

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

Name/ Signature: _____ Date: _____

Appendix B Phantom Usage Illustration

Targets Disposal of Phantom KS107BD

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

C： Longitudinal target group D： Horizontal target group

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

G Mimic sac (diam 6mm)

4. Line Target System

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

1．A1——A5：

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

2．B：

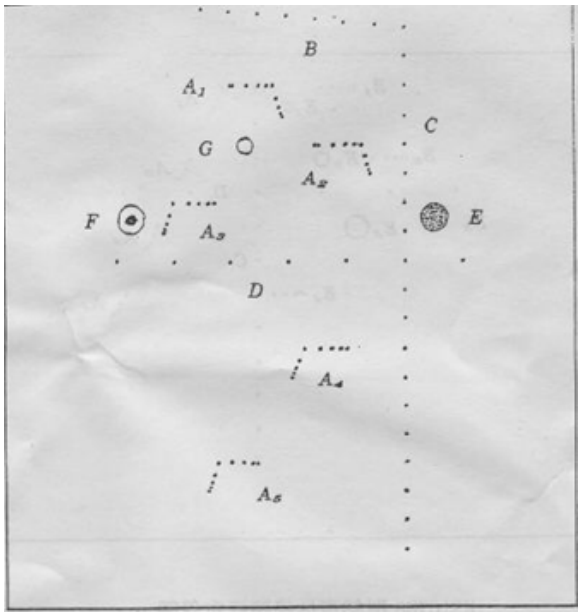
Blind-area target group. Center horizontal distance of adjacent lines is 10mm, distances to the acoustic window are 10, 9, 8, 7, 6, 5, 4, 3mm.

3．C：

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

4．D：

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



Targets disposal- KS107BD

A1——A4 Axial resolution target group

B1——B4 Lateral resolution target group

C Longitudinal target group

D Horizontal target group

E1——E3 Mimic sacs with diameters of 2, 4, 6mm

4. Line Target System

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

1．A1——A4：

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

2．B1——B4：

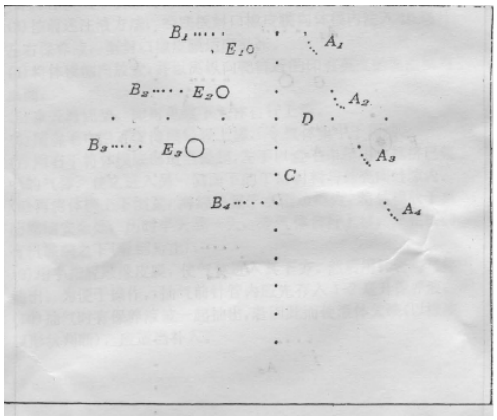
Lateral resolution target group. Locate at a depth of 10, 30, 50, 70mm, with a center horizontal distance of 4, 3, 2, 1mm in each group.

3．C：

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

4．D：

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



Appendix C Requirements of Performance Indices

◆ **DP-30 Series**

Probe model	35C20EA	35C50EA	35C50EB
Rated frequency (MHz)	3.5	3.5	3.5
Axial resolution (mm)	≤2（depth≤80）	≤2（depth≤80）	≤2（depth≤80）
	≤4（80<depth≤130）	≤4（80<depth≤130）	≤4（80<depth≤130）
Lateral resolution (mm)	≤1（depth≤130）	≤1（depth≤130）	≤1（depth≤130）
	≤2（130<depth≤170）	≤2（130<depth≤170）	≤2（130<depth≤170）
Blind area (mm)	≤3	≤3	≤3
Detection depth (mm)	≥160	≥170	≥170
Geometric positioning accuracy %	lateral≤5 Longitudinal≤3	lateral≤5 Longitudinal≤3	lateral≤5 Longitudinal≤3

Probe model	65EC10EA	75L38EA	75L53EA
Rated frequency(MHz)	6.5	7.5	7.5
Axial resolution (mm)	≤1（depth≤40）	≤1（depth≤60）	≤1（depth≤60）
Lateral resolution (mm)	≤1（depth≤70）	≤1（depth≤80）	≤1（depth≤80）
Blind area (mm)	≤3	≤2	≤2
Detection depth(mm)	≥60	≥80	≥80
Geometric positioning accuracy %	lateral≤4 Longitudinal≤3	lateral≤4 Longitudinal≤3	lateral≤4 Longitudinal≤3

Probe model	65EC10EB	65C15EAV	50L60EAV
Rated frequency(MHz)	6.5	6.5	5
Axial resolution (mm)	≤1（depth≤40）	≤2（depth≤40）	≤1（depth≤40）
Lateral resolution (mm)	≤1（depth≤70）	≤1（depth≤40）	≤1（depth≤40）
Blind area (mm)	≤3	≤4	≤3
Detection depth(mm)	≥60	≥60	≥80
Geometric positioning accuracy %	lateral≤5 Longitudinal≤3	lateral≤5 Longitudinal≤5	lateral≤5 Longitudinal≤5

Probe model	65C15EA	10L24EA	75L50EAV
Rated frequency(MHz)	6.5	10	7.5

Axial resolution (mm)	≤1（depth≤40）	≤1（depth≤40）	≤1（depth≤40）
Lateral resolution (mm)	≤1（depth≤40）	≤0.5（depth≤30）	≤1（depth≤40）
Blind area (mm)	≤3	≤2	≤3
Detection depth(mm)	≥60	≥60	≥70
Geometric positioning accuracy %	lateral≤5 Longitudinal≤5	lateral≤3 Longitudinal≤3	lateral≤5 Longitudinal≤5

◆ DP-10/DP-20Series

Probe model	35C20EA	35C50EB	65C15EA
Rated frequency(MHz)	3.5	3.5	6.5
Axial resolution (mm)	≤3（depth≤80）	≤3（depth≤80）	≤2（depth≤40）
	≤4（80＜depth≤130）	≤4（80＜depth≤130）	
Lateral resolution (mm)	≤2（depth≤80）	≤2（depth≤80）	≤1（depth≤40）
		≤3（80＜depth≤130）	
Blind area (mm)	≤3	≤7	≤4
Detection depth(mm)	≥140	≥140	≥60
Geometric positioning accuracy %	lateral≤10 Longitudinal≤10	lateral≤10 Longitudinal≤10	lateral≤5 Longitudinal≤5

Probe model	65EC10EB	65C15EAV	75L53EA
Rated frequency(MHz)	6.5	6.5	7.5
Axial resolution (mm)	≤2（depth≤40）	≤2（depth≤40）	≤1（depth≤40）
Lateral resolution (mm)	≤1（depth≤40）	≤1（depth≤40）	≤1（depth≤60）
Blind area (mm)	≤4	≤4	≤3
Detection depth(mm)	≥60	≥60	≥70
Geometric positioning accuracy %	lateral≤5 Longitudinal≤5	lateral≤5 Longitudinal≤5	lateral≤5 Longitudinal≤5

Probe model	75L50EAV	50L60EAV	75L38EB
Rated frequency(MHz)	7.5	5	7.5
Axial resolution (mm)	≤1（depth≤40）	≤1（depth≤40）	≤1（depth≤40）
Lateral resolution (mm)	≤1（depth≤40）	≤1（depth≤40）	≤1（depth≤60）
Blind area (mm)	≤3	≤3	≤3
Detection depth(mm)	≥70	≥80	≥70
Geometric positioning accuracy %	lateral≤5 Longitudinal≤5	lateral≤5 Longitudinal≤5	lateral≤5 Longitudinal≤5

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