DC-3 Series

Diagnostic Ultrasound System

Service Manual

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For this Operator's Manual, the issue date is 2013-06.

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⚠ **Note** ⚠

This equipment is not intended for family usage.

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Return Procedure

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2. Freight policy: The customer is responsible for freight charges when this product is shipped to Mindray for service (this includes customs charges).
3. Return address: Please send the part(s) or equipment to the address offered by Customer Service department

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Safety Precautions

1. Meaning of Signal Words

In this operator's manual, ⚠**DANGER**, ⚠**WARNING**, ⚠**CAUTION** and **CAUTION** are signal words used to indicate 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.**
CAUTION	Indicates property damage may occur potentially in this hazardous situation if not avoided.

2. Meaning of Safety Symbols

Symbol	Description
	Type-BF applied part. The ultrasound transducers connected to this system are Type-BF applied parts. The ECG module connected to this system is also a Type-BF applied part.
	"Attention" indicates the points requiring attention. Be sure to read the operation manual concerning these points before using the equipment.

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 because an explosion may occur.**

⚠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 an adapter or multifunctional receptacle may affect the system's grounding performance, and cause the leakage current to exceed safety requirements. Besides, do connect the video printer to the auxiliary power supply socket of this system, and use the printing cable provided with this system to connect the printer. Otherwise, it may cause electric shock.**
	2	**Connect the grounding conductor only before turning ON the system. Connect the grounding cable after turning OFF the system. Otherwise, electric shock may result.**
	3	**For the connection of power and grounding, follow the appropriate procedures described in this operator's manual. Otherwise, there is risk of electric shock. Do not connect the grounding cable to a gas pipe or water pipe; otherwise improper grounding may result or a gas explosion may occur.**
	4	**Before cleaning the system, disconnect the power cord from the socket. System failure may result in electric shock.**
	5	**This system is not water-proof. Do not use this system in any place where water leakage may occur. If any water is sprayed on or into the system, electric shock may result. If water is accidentally sprayed on or into the system, please turn off the system power immediately and contact Mindray Customer Service Department or sales representative.**
	6	**Store and use the transducers carefully. In case that a scratched transducer surface is found, immediately stop using the transducer and contact Mindray Customer Service Department or sales representative. There is risk of electric shock if using a damaged or scratched transducer.**
	7	**Do not allow the patient to contact the live parts of the ultrasound system or other devices, e.g. signal I /O ports. If the system or other devices is defective, there is risk of electric shock.**

	8	**Do not use an aftermarket transducer other than those specified by Mindray. The transducers may damage the system, causing a profound failure, e.g. a fire in the worst case.**
	9	**Do not subject the transducers to knocks or drops. Use of a defective transducer may cause an electric shock.**
	10	**Do not open the covers and front panel of the system. Otherwise, short circuit or electric shock may result.**
	11	**Do not use this system simultaneously with equipments such as an electrical knife, high-frequency therapy equipment, or a defibrillator, etc., otherwise, electric shock may result.**
	12	**Only use the ECG leads accompany with the ECG module; otherwise electric shock may result.**
	13	**Attentions in the transportation: when this system is moved, please hold the handle. If other parts of the system are held, it may cause damage due to the abnormal force. Do not push the system from the left/right side, otherwise, it may be toppled over.**
	14	**Accessory equipments connected to the analog and digital ports must comply with the relevant IEC standards (e.g., IEC 60950 information technology equipment safety standard and IEC 60601-1 medical equipment standard). Furthermore, all conFigureurations must comply with the standard IEC60601-1-1. It is the responsibility of the person, who connects additional equipments to the signal input or output ports and configures a medical system, to verify if the system complies with the requirements of IEC60601-1-1. If you have any questions regarding these requirements, consult your sales representative.**
	15	**Prolonged and repeated use of keyboards may result nerve disorders in hand or arm for some individuals. Observe the local safety or health regulations concerning the use of keyboards.**

⚠CAUTION:	1	**Precautions concerning clinical examination techniques:** **(1) This system must be used only by qualified medical professionals.** **(2) This operator's manual does not describe clinical examination techniques. The clinician should select the proper examination techniques based on specialized training and clinical experience.**

2 Malfunctions due to radio wave:

(1) Using devices transmitting RF signals in the vicinity of the system may affect the system's performance. Do not use or take any devices transmitting RF signals (such as cellular phones, transceivers and radio controlled products) in the room placing the system.

(2) If a person brings a device that generates radio waves near the system, ask him / her to immediately turn OFF the device.

3 Precautions concerning moving the system:

(1) Make sure the system is installed on a plane with the caster been locked, otherwise, movement of the system may result in damage.

(2) Do not move the system laterally, which may result in damage in case of toppling.

(3) Move the system slowly on the slope by two people, otherwise, damage may result in case of unexpected sliding.

(4) Do not sit on the system, which may result individual falling in case of system moving.

(5) Object placed on the monitor may fall and injure an individual.

(6) Fasten and fully secure any peripheral device before moving the system. A loose peripheral device may fall and injure an individual.

(7) When move the system on the steps, please take care to prevent the system from toppling.

4 Do not expose the system to excessive vibration during the transportation. Mechanical damage may result (such as damage to the caster). If the system has to be moved on uneven floor frequently, please contact Mindray Customer Service Department or sales representative.

5 Do not connect this system to outlets with the same breakers and fuses that control the current of devices such as life-support systems. If malfunctions or over-current appear on this system, or when there is an instantaneous current at power ON, the breakers and fuses of the building's supply circuit may be tripped.

6 **Always keep the system dry. Avoid transporting this system suddenly from a cold place to a warm place; otherwise condensation or water droplets may form, which may result short circuit.**

7 **If the circuit protector is tripped on, it indicates that malfunction appears on the system or a peripheral device. You should not repair the system under this circumstance but call the Mindray Customer Service Department or sales representative for help.**

8 **There is no risk of high-temperature burns during normal ultrasound examinations. It is possible for the surface temperature of the transducer to exceed the body temperature of a patient due to environmental temperature and exam type combinations. If a patient complains of abnormal heat from the transducer, immediately stop scanning. To prevent patient burns, ensure there is no surface damage to the transducer. Do not apply the transducer to the same region on the patient for a long time. Apply the transducer only for a period of time required for the purpose of diagnosis.**

9 **The system and its accessories have not been disinfected or sterilized prior to delivery. The operator is responsible for the cleaning and disinfection of transducers and sterilization of biopsy brackets according to the manuals before application. All items must be thoroughly processed to completely remove harmful residual chemicals, which will not only harmful to the human body, but also damage the accessory.**

10 **It is necessary to press [End Exam] to end the current scan and clear the current Patient Information field. Otherwise new patient data may be mixed with the previous patient data.**

11 **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.**

12 **Do not turn OFF the power supply of the system during printing, file storage or data invoking. An interrupted work may not be completed afterwards, and the file may be lost or corrupted.**

13 **If the system is powered off improperly during operation, it may result in data damage to the system's hard disk or system failure.**

14 **Do not use the system to examine a fetus in the Doppler mode for a long period of time.**

15 **Do not use a USB memory device (e.g., a USB flash drive, or removable hard disk) which may include unsafe data. Otherwise, system damage may result.**

16 **It is recommended to use the video devices specified in this manual.**

17 **Read the Acoustic Output Principle in the operation manual carefully before operate this system on clinical examination.**

18 **The auxiliary power output outlet in the system is used to supply power for the recommended peripheral devices. Do not connect other devices to the outlet, otherwise the rated output power may be exceeded and failure may result. Maximum output outlet for peripheral devices is 330V.**

NOTE:

1 Do not use the system in the vicinity of strong electromagnetic field (such as a transformer), which may affect the performance of the system.

2 Do not use the system in the vicinity of high-frequency radiation source, which may affect the performance of the system or even lead to system failure.

3 To avoid damage to the system, do not use it in the following environment conditions:

(1) Locations exposed to direct sunlight;

(2) Locations subject to sudden changes of environmental temperature;

(3) Dusty locations;

(4) Locations subject to vibration;

(5) Locations near heat generators;

(6) Locations of high humidity.

4 Turn ON the system only after the power is turned OFF for more than 20 seconds. If the system is turned ON immediately after being turned OFF, the system may not reboot properly and may lead to malfunction.

5 Do not disconnect a transducer that remains in a live imaging state. This can damage the system and / or transducer. Press [Freeze] or turn off the power of the system before connecting or disconnecting a transducer.

6 Remove the ultrasound gel from the face of the transducer when the examination is completed. Water in the gel may enter the acoustic lens and adversely affect the performance and safety of the transducer.

7 To ensure safety of the data, please back up all the data to a secure external storage media, as data stored to the system's internal memory may be lost due to system failure, or improper operation.

8 Do not apply external force to the control panel. The system may be damaged.

9 If the system is used in a small room, the room temperature may rise. Please ensure good ventilation.

10 To dispose the system or any part, please contact Mindray Customer Service Department or sales representative. Mindray would bear no responsibility for the damages resulting from disposal of this system without consulting Mindray.

11 Electrical and mechanical performance may be degraded due to long usage (such as current leakage or distortion and abrasion). To ensure optimal system operations, it is recommended that you maintain the system under a Mindray service agreement. Various aspects of system performance and operation can be maintained under the professional supervision of a service representative.

12 The iScape feature constructs a single extended image from a series of continuous individual image frames scanned on the interesting field. The quality of the final image is user-dependent and thus requires skills to efficiently apply the feature and technique. Exercise caution when measurements are performed under an iScape mode.

13 Ensure that the current exam date and time are the same as the system date and time.

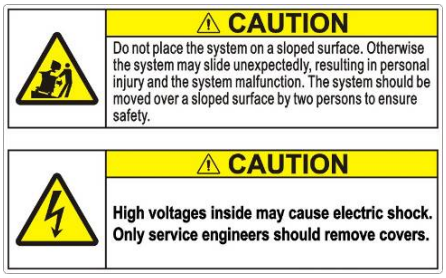
4. Warning Labels

The warning labels are attached to this system in order to call your attention to potential hazards.

The symbol ⚠ on the warning labels indicates safety precautions. The warning labels use the same signal words as those used in the operator's manual.

Please refer to the operator's manual for detailed information about the warning labels.
Read operator's manual carefully before using the system.

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

No.	Label	Meaning
<1>		(a) Do not sit on the system. (b) There is explosion risk if the system is applied around flammable gas. (c) Before using the system, be sure to carefully read the relevant contents of this operator's manual.
<2>		(a) Place the system on a plane. (b) (b) Do not open the cover, because the high voltage inside may result in electric shock.

1 SYSTEM INTRODUCTION

1.1 Intended Use

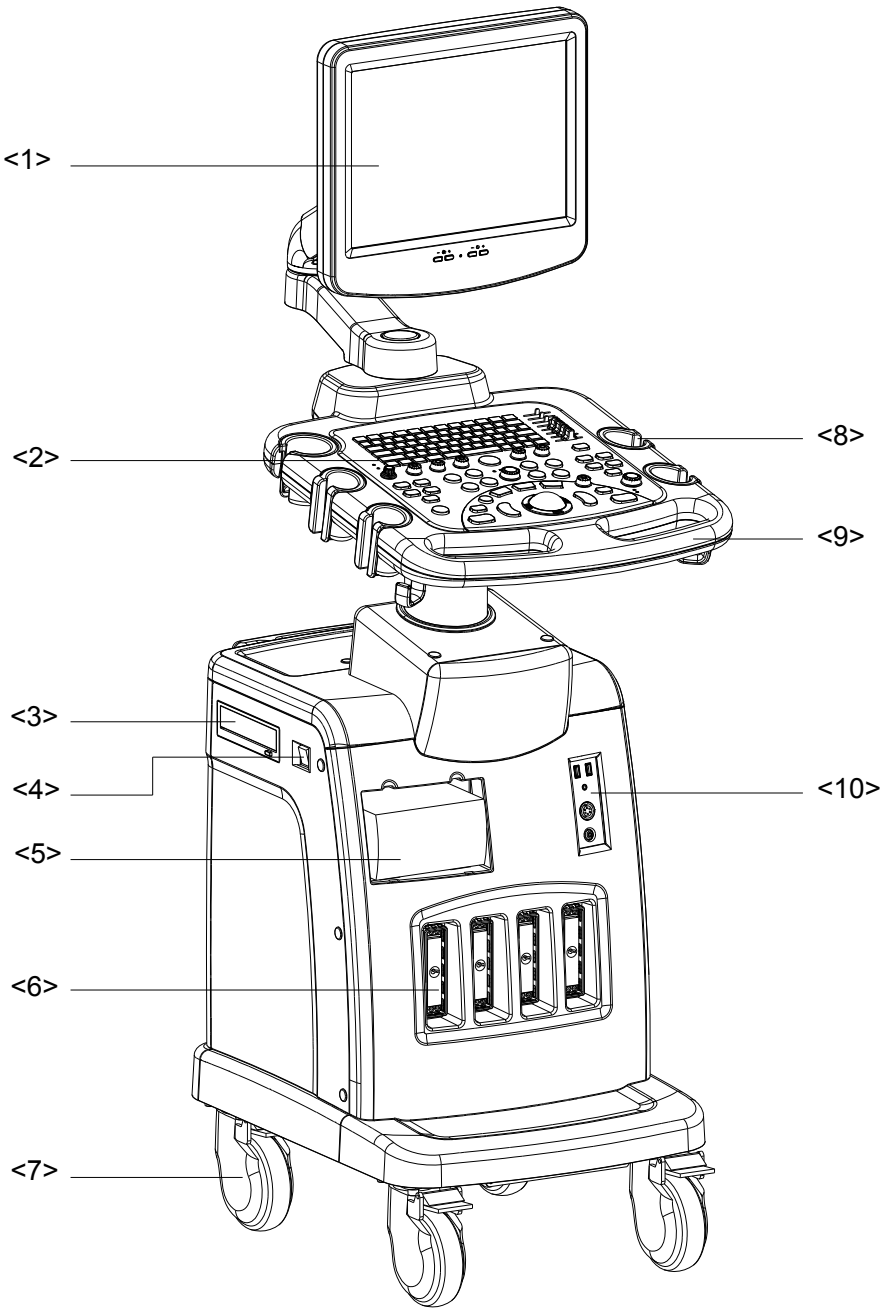
DC-3/DC-3T diagnostic ultrasound system is applicable for clinical ultrasound diagnostic examination.

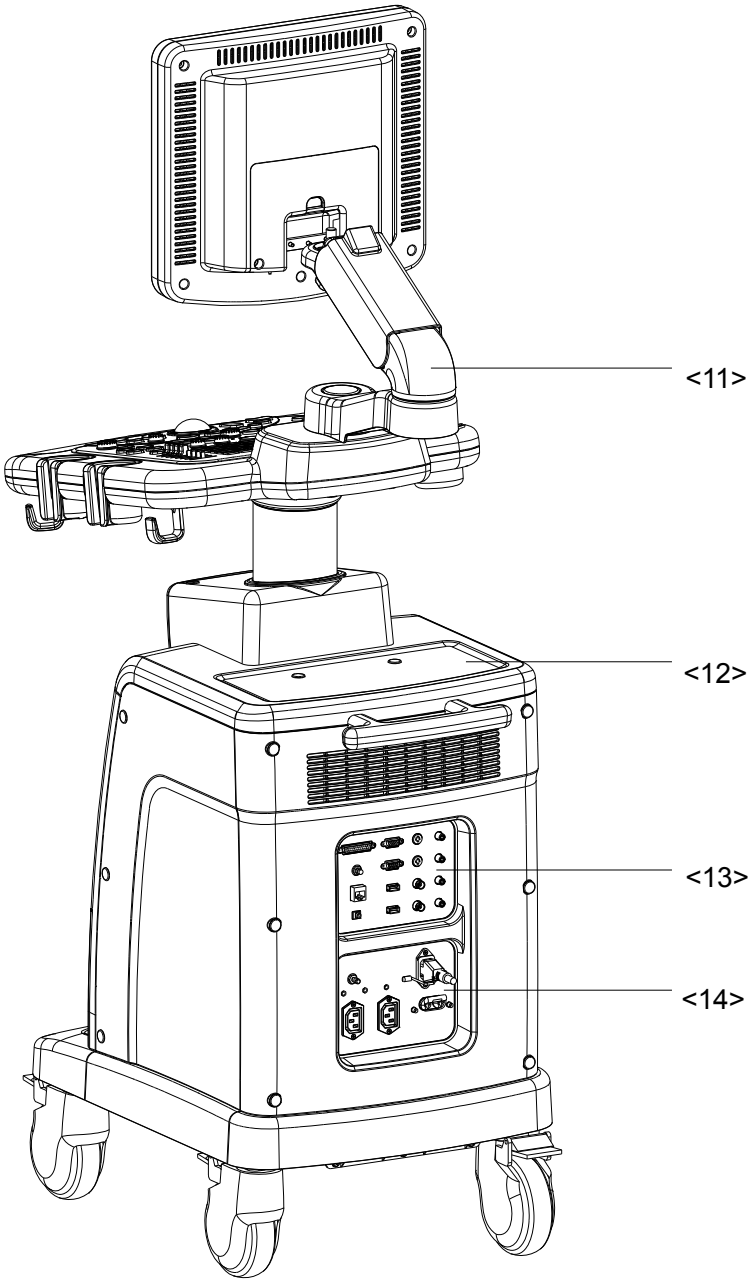
There is one difference between DC-3 and DC-3T, that is, DC-3 has an orthopedics measurement package, but DC-3T does not.

DC-3Vet is intended for diagnosis of animals.

2 SYSTEM STRUCTURE

2.1 Appearance of the System

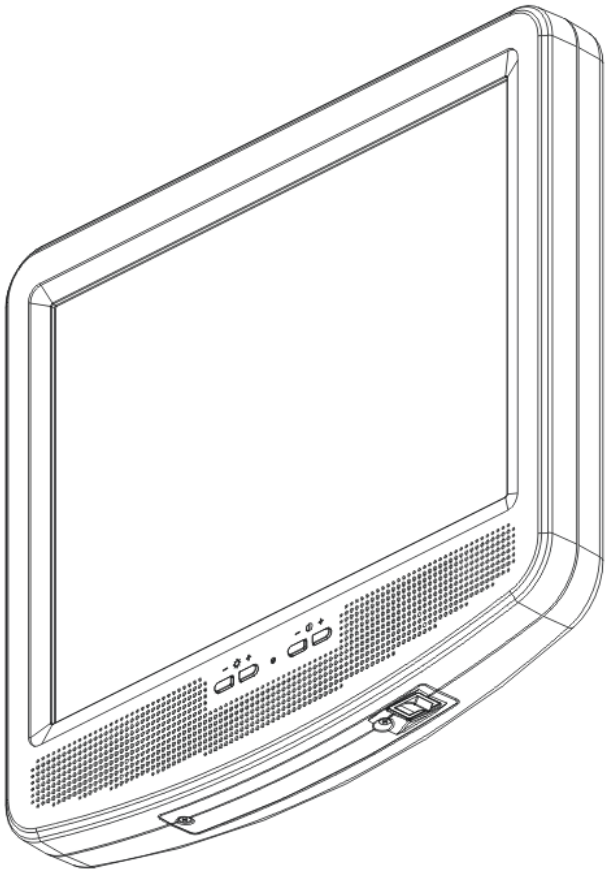




No.	Part	Function
<1>	Monitor	Displays the images and parameters during scanning.
<2>	Control panel	Operator-system interface, operation control.
<3>	DVD-RW	DVD-RW drive.
<4>	Power switch	Used for turning on/ off the power supply.
<5>	Compartment for placing video printer	Used for placing B/W video printer.
<6>	Transducer socket	Sockets connecting transducers and the main unit. There are 3 active sockets and 1 parking socket.

<7>	Caster	Used for fixing or moving the system.
<8>	Transducer& gel holder	Used for placing transducers and gel temporarily.
<9>	Handle	Used for pushing and moving the system.
<10>	ECG panel	Used for connecting the ECG cable, USB devices and footswitch.
<11>	Monitor support arm	Used for supporting and adjusting the height and position of monitor.
<12>	Table for placing objects	Used for placing articles and instruments and so on.
<13>	I/O panel	Port panel for input and output signals.
<14>	Power panel	Electrical port panel.

2.2 LCD Monitor

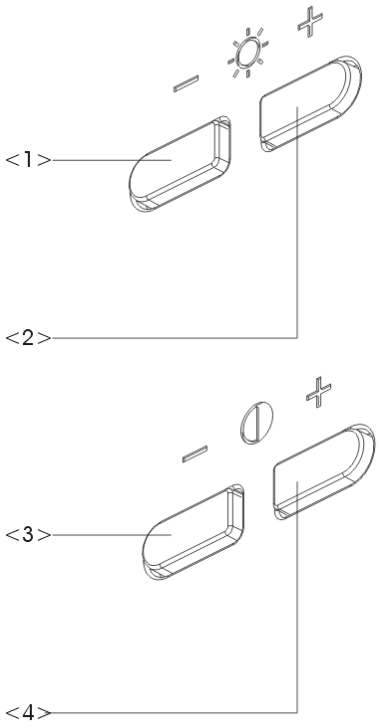


2.2.1 Contrast& Brightness Control Key of the Monitor

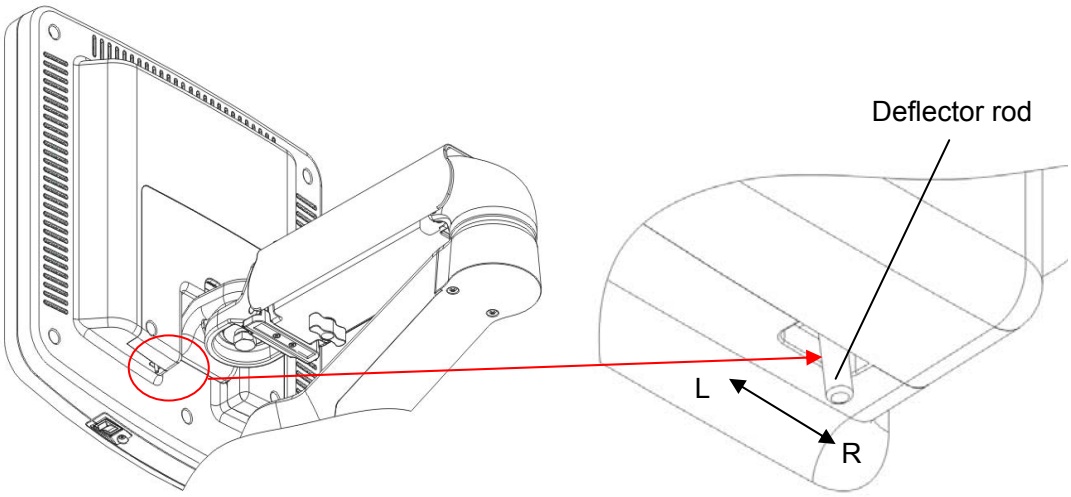
Shown as figure at the right side:

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

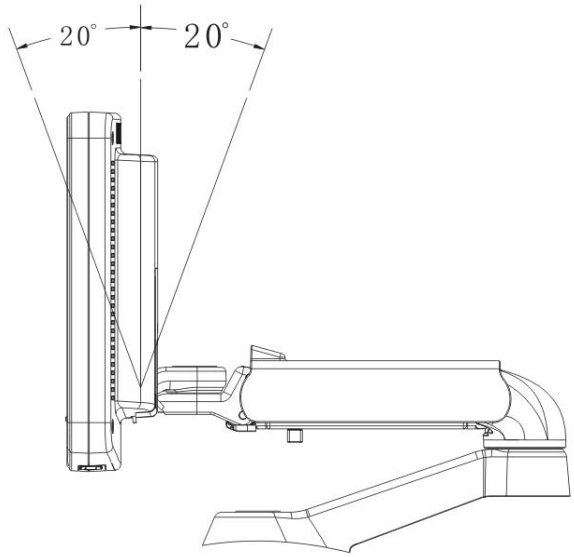
<3>, <4> refer to the contrast control keys with a lune marked at the top side; key <3>, which marked a “-” on the top side, can be used to decrease the contrast, while key <4>, which marked a “+” on the top side, can be used to increase the contrast.



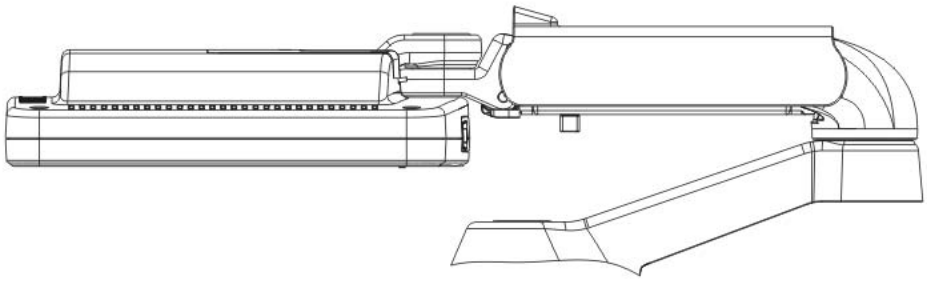
2.2.2 Up/down Deflector Rod of Monitor



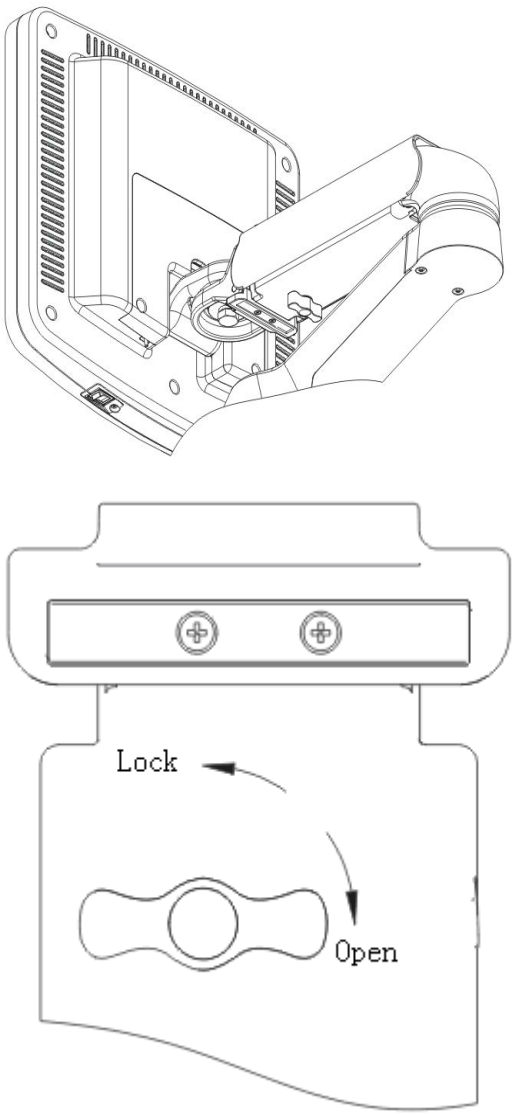
Shown as above, the deflector rod is located at the left lower corner at the back of the monitor. When the deflector is at the rightmost, the monitor is at working status and the angle between monitor and support arm can be changed at the range controlled by the deflector rod. The monitor can be turned for 20° both forward and backward, shown as follows:



In the process of transportation or moving the system, the deflector rod can be toggled left to level the monitor, shown as follows:



2.2.3 Up/down Lock of Upper Support Arm

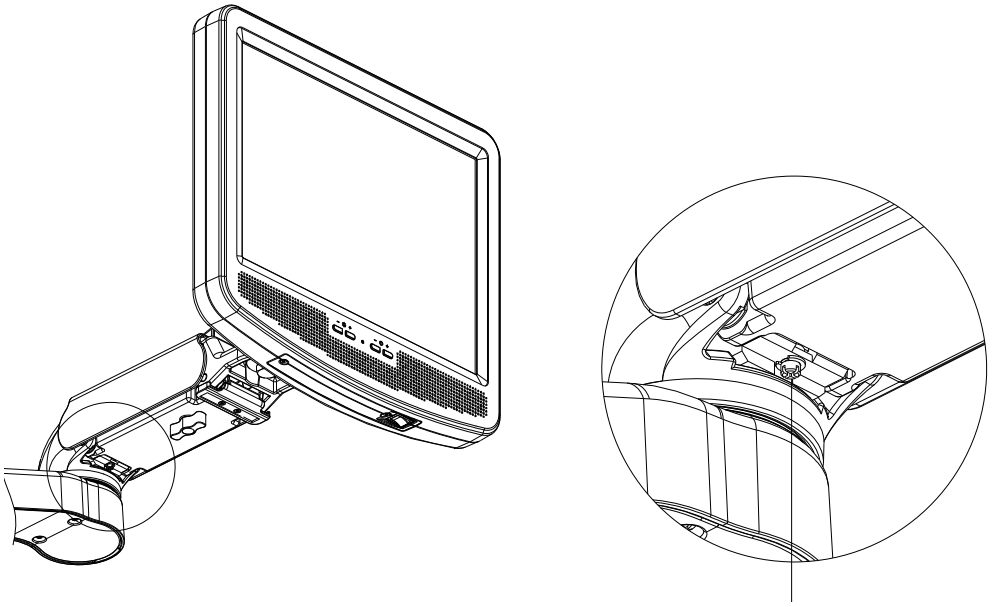


Put the support arm to horizontal position, the arm will be locked if the lock is at the locked position; when the lock is located at the unlocked position, the arm can be adjusted from upside to downside.

2.2.4 Tuning Screw of Air Spring on Support Arm

Turn the monitor and the support arm to the same position, adjust the tuning screw by screwdriver.

Try to adjust the screw when the monitor rises and falls automatically, and the air spring needs to be replaced if it can not meet the requirement even when the screw is at the tightest or loosest status. (For the replacement of the air spring, please refer to 4.3.8).

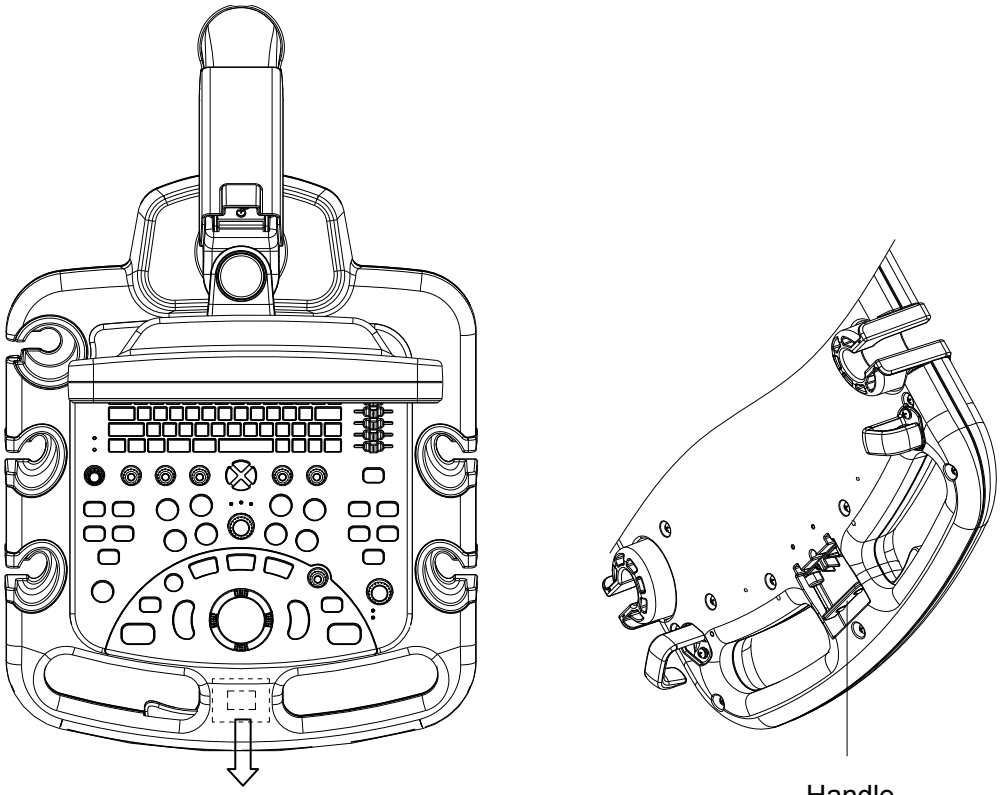


Tuning screw

2.3 Turning and Lifting the Keyboard

2.3.1 Turning

Hold and push the handle in the direction of front part of machine (located at the frontal part of back keyboard), turn the keyboard left and right within 45°, the keyboard will be locked at where the handle be loosened.

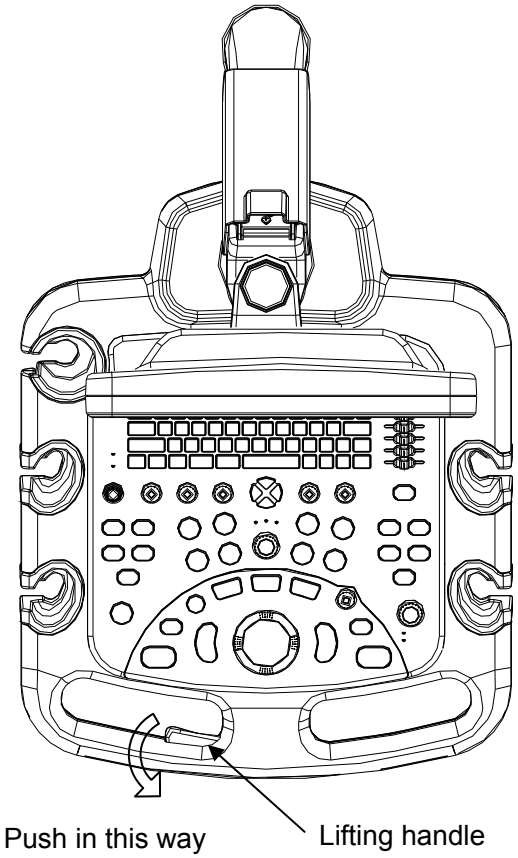


Hold and push the handle in the direction of front part of machine to turn the

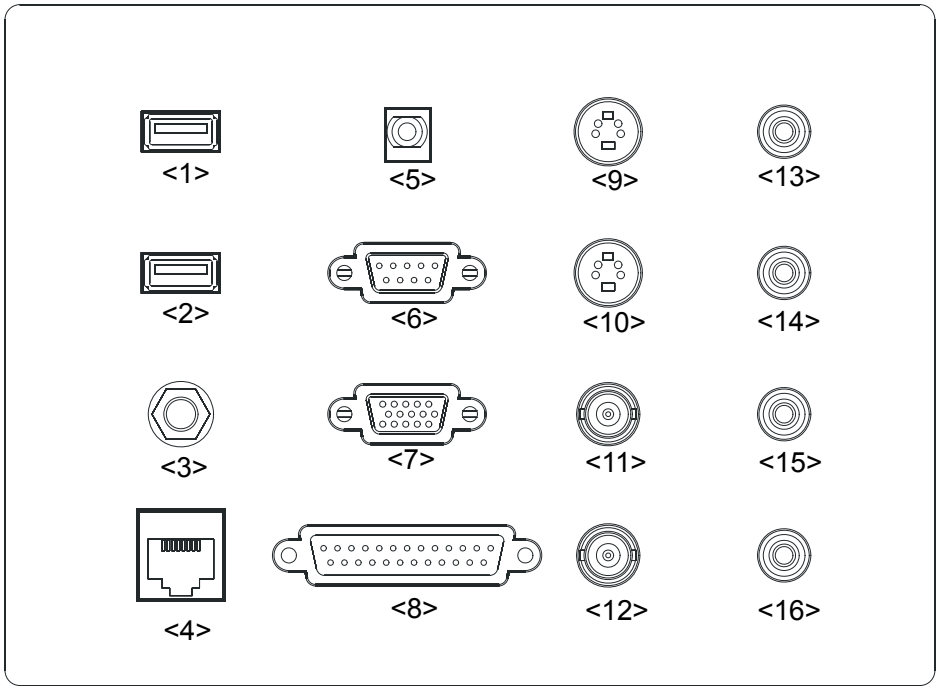
Handle

2.3.2 Lifting

Handhold the handle of the keyboard with both hands, with the left hand hold the lifting handle, press the lifting handle to a certain position, uplift or push down the keyboard with both hands, then the keyboard can be elevated or lowered. The height can be adjusted is 150mm at most.



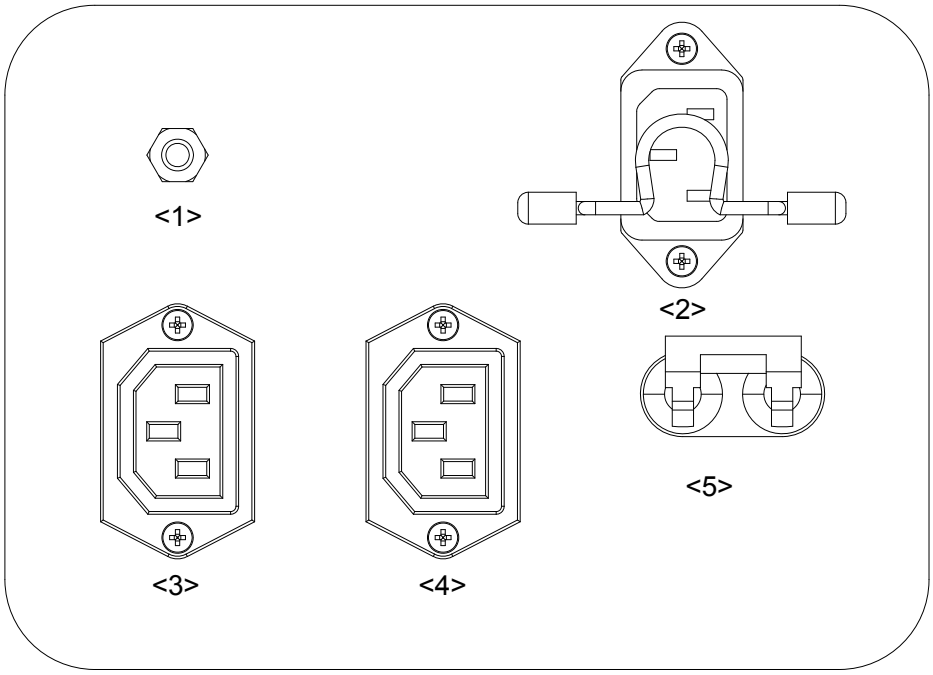
2.4 I/O Panel



No.	Port	Function
<1>, <2>	USB port	Used to connect USB devices.
<3>	Reset	System reset.
<4>	Ethernet port	Used to connect to the network.
<5>	Remote control port	Connects to the video printer control port.
<6>	Serial port	Connects to the serial port device.
<7>	VGA output port	Connects to the external display devices such as monitor and projector.
<8>	Parallel port	Connects the parallel port device.
<9>	Separate video input port	Separates the input video signal.
<10>	Separate video output port	Used for composite video output, connect to VCR output or video printer.
<11>	Video input port	Used for composite video input.
<12>	Video output port	Used for composite video signal output, connect to VCR output or video printer.
<13>	Audio input port	Used for audio signal input.
<14>	Audio input port	Used for audio signal input.

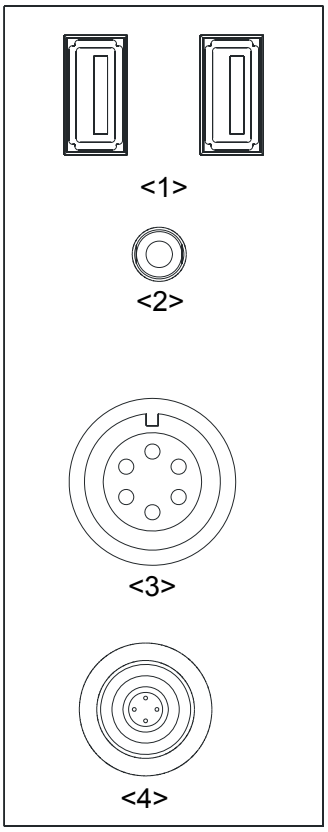
<15>	Audio output port	Used for audio signal output.
<16>	Audio output port	Used for audio signal output.

2.5 Power Supply Panel



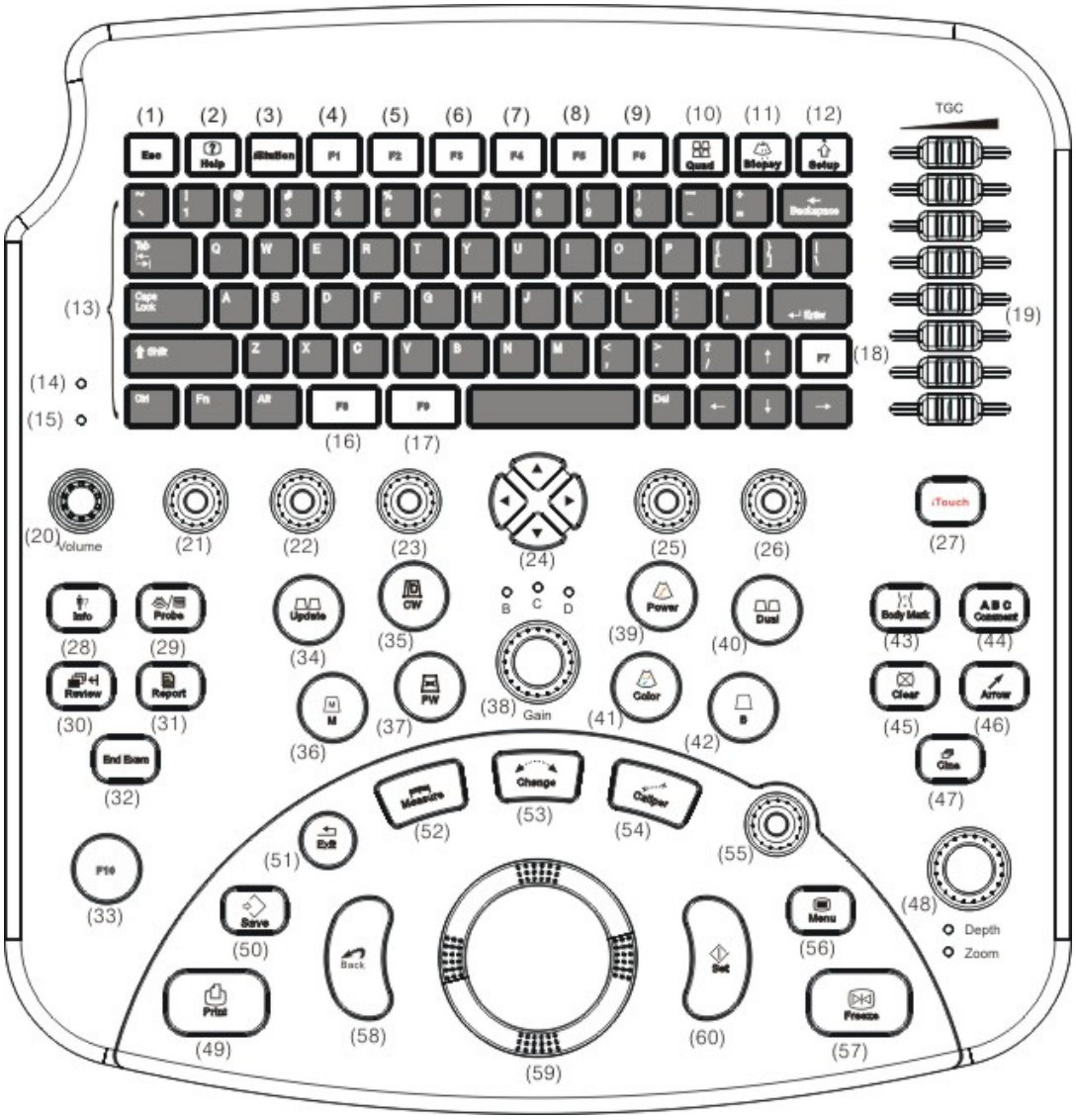
No.	Name	Function
<1>	Equipotential terminal	Connects the equipotential points
<2>	Power inlet	AC power inlet
<3>, <4>	Power output	Supply power for optional peripheral devices (e.g. VCR)
<5>	Circuit breaker	Switches off the power supply

2.6 ECG Panel



No.	Name	Function
<1>	USB ports (2)	Connects the USB devices.
<2>	Mic In port	Reserved for future use. (used for connecting microphone to record vocal comments).
<3>	ECG lead signal input port	Connects to ECG leads, to directly obtain the electrocardiosignal of the patient.
<4>	Pencil probe port	Reserved for future use. (used for connecting a pencil probe)

2.7 Control Panel



No.	Symbol	Name	Function
<1>	Esc	Escape	Press to exit the current status to the previous status.
<2>	Help	Help	Press to open or close the accompanying help documents.
<3>	iStation	/	Press to enter or exit patient information management system.
<4>	F1	User-defined key	The function is definable.
<5>	F2	User-defined key	The function is definable.

<6>	F3	User-defined key	The function is definable.
<7>	F4	User-defined key	The function is definable.
<8>	F5	User-defined key	The function is definable.
<9>	F6	User-defined key	The function is definable.
<10>	Quad	Quad-split screen	Press to enter/ exit quad-split screen mode.
<11>	Biopsy	Biopsy	Press to show or hide the biopsy guide line.
<12>	Setup	Preset	Press to open/ close the preset dialog box.
<13>	/	Character key	Same as the keys of PC.
<14>	/	Indicating light 1	The indicator light is on after the power is switched on; it is off after the system is turned on.
<15>	/	Indicating light 2	The indicator light flashes when the hard disk is reading or writing; and in other situations, it is off.
<16>	F8	User-defined key	The function is definable.
<17>	F9	User-defined key	The function is definable.
<18>	F7	User-defined key	The function is definable.
<19>	TGC	Slide bar	To adjust the depth and gain.
<20>	Volume	Volume	Rotate to increase or decrease spectrum volume.
<21>	/	Multi-function knob 1	To adjust the parameters, the functions are shown by the sketch map displayed at the downside of the screen.
<22>	/	Multi-function knob 2	To adjust the parameters, the functions are shown by the sketch map displayed at the downside of the screen.
<23>	/	Multi-function knob 3	To adjust the parameters, the functions are shown by the sketch map displayed at the downside of the screen.
<24>	/	Four-direction key	The functions are shown by the sketch map displayed at the downside of the screen.
<25>	/	Multi-function knob 4	To adjust the parameters, the functions are shown by the sketch map displayed at the downside of the screen.
<26>	/	Multi-function knob 5	To adjust the parameters, the functions are shown by the sketch map displayed at the downside of the screen.
<27>	iTouch	/	Press to optimize the images.

<28>	Info	Patient information	To enter into patient information input interface.
<29>	Probe	Transducer switch	To switch the transducer and exam mode.
<30>	Review	Review	To review the stored images.
<31>	Report	Diagnostic report	Press to open/ close the report.
<32>	End Exam	End exam	To end an exam.
<33>	F10	Self-defining key	The function is definable.
<34>	Update	/	To switch the live image window in the multi-window mode.
<35>	CW	/	Reserved key (press to enter the CW mode).
<36>	M	/	Press to enter the M mode.
<37>	PW	/	Press to enter the PW mode.
<38>	Gain	Gain	To adjust the gain of the live image, the light is on; press to adjust the gain of the corresponding mode in 2D mode or 3D mode.
<39>	Power	/	Press to enter the Power mode.
<40>	Dual	/	To enter Dual mode in Non-Dual mode; or to switch the live window in Dual mode.
<41>	Color	/	Press to enter Color mode.
<42>	B	/	Press to enter B mode.
<43>	Body Mark	Body mark	To enter/ exit Body mark mode.
<44>	Comment	Comment	To enter/ exit the character comment mode.
<45>	Clear	Clear	To clear the comments and measurement caliper and so on.
<46>	Arrow	Arrow	To enter/ exit arrow comment.
<47>	Cine	Cine review	To enter/ exit Cine review.
<48>	Depth/Zoom	Depth/ Zoom	Press to switch to the depth/zoom function, the corresponding light will be on; turn the knob to adjust the depth or zoom factor.
<49>	Print	Print	Press to print the contents which have been set.
<50>	Save	Save	Save the single frame image.
<51>	Exit	Exit	To exit the current status.
<52>	Measure	Measure	To enter/ exit the general measure mode.
<53>	Change	Change	To change the active point of the caliper during measurement.
<54>	Caliper	Caliper	To enter/ exit the general measure mode.

<55>	/	Multi-function knob	Status dependent.
<56>	Menu	Main menu	To invoke or close the menu corresponding to the current status.
<57>	Freeze	Freeze	Press to freeze or unfreeze an image.
<58>	Back	Back	Press to return to the previous operation or to delete the last project.
<59>	/	Trackball	Rotate to change the position of the cursor on the screen.
<60>	Set	Set	To confirm an operation, equivalent to the left-button of the mouse.

3 SYSTEM PRINCIPLE

3.1 System Principle

The block diagram of DC-3 system is shown as follows:

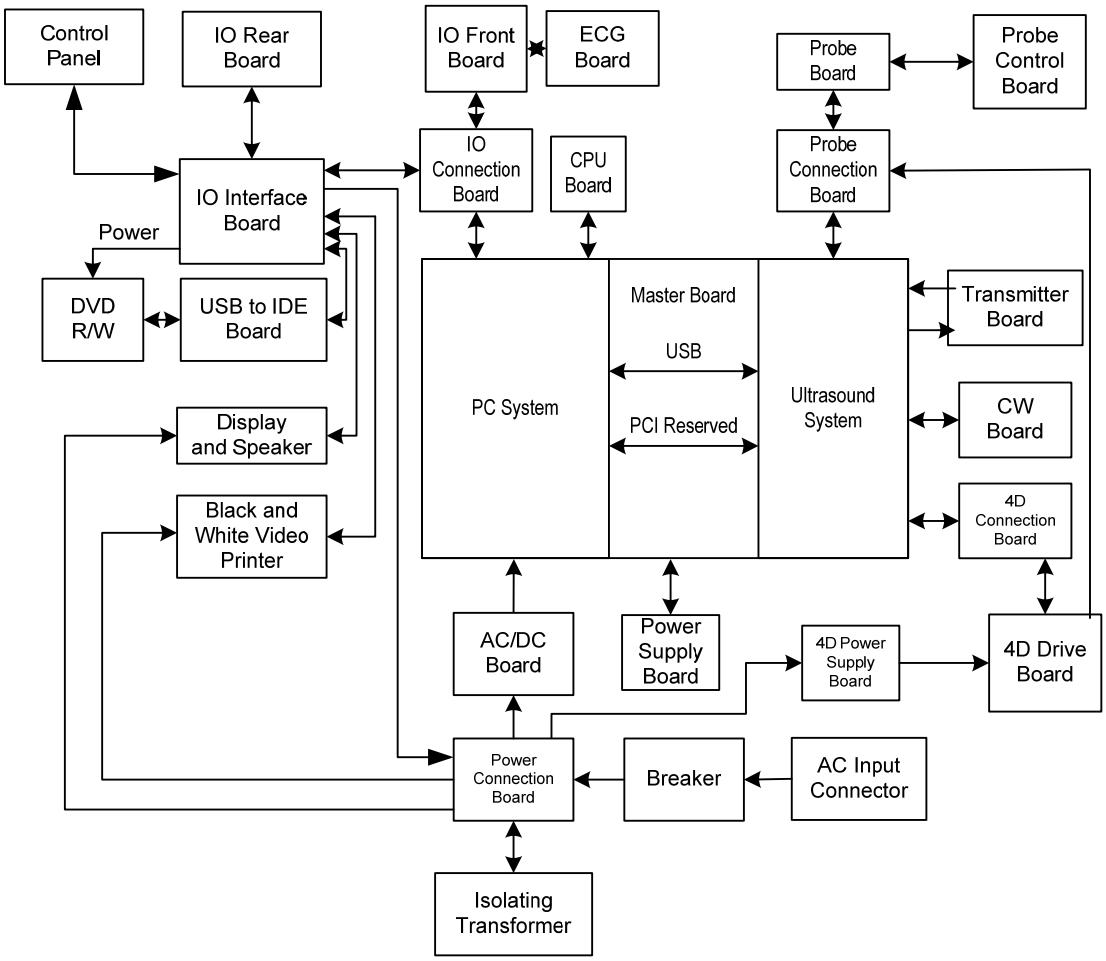


Figure 3-1 Block Diagram of DC-3

The system consists of main unit and power system, and the main unit consists of:

Master board: including ultrasound system, PC system, and power supply management and filtering system;

Ultrasound system: to carry out functions including echo receiving, zoom in, sampling, Beam

forming, signal processing, ultrasound scanning receiving control as well as data exchange between PCs;

PC system: post processing the echo data, communicate with users, to support many kinds of peripherals;

Power management and filtering system: to ensure the normal working of power system, support system shutdown, stand-by mode and dormancy mode;

Meanwhile, master board provides connecting sockets with each module;

Transmitting board: to realize delay focusing transmitting for N channels;

Control panel can communicate with the master board through USB;

CPU board；

Probe board module: including probe control board, probe board, probe connection board, used to connect the transducers, supports 4 transducer sockets, of which 3 sockets are general, the other one is 4D transducer socket.

CW Board: processing CW signal and pencil transducer signal;

4D driver board: implements the transfer function of 4D controlling signals;

The peripheral extension modules including:

I/O connecting board: connects the master board and IO front board, IO interface board, provides power supply to the hard disk;

IO front board，USB HUB(one input, three outputs), provides external MIC port, USB port as well as pencil probe port;

IO port board: USB HUB (one input, six outputs), video acquisition, and provides sockets to some inner wires;

IO rear board: provides IO port for the rear part;

USB-to-IDE board: USB to IDE converting board, connects to DVD R/W;

ECG board；

Display module: including display and speaker;

4D driver board: implements the drive function of 4D probe.

The power system consists of (In fact, it also includes the power management system on the master board and the filtering system):

Power supply board: provides power for the system;

Power supply connecting board: provides connection sockets between auxiliary output, breaker and isolating transformer, to realize voltage input selection;

4D power supply board: implements the power supply for 4D driver board;

AC/DC board: to change the AC input into 12V DC.

3.2 Working Principles of Each Module in the Hardware System

3.2.1 Master Board

The block diagram of the master board is shown as follows:

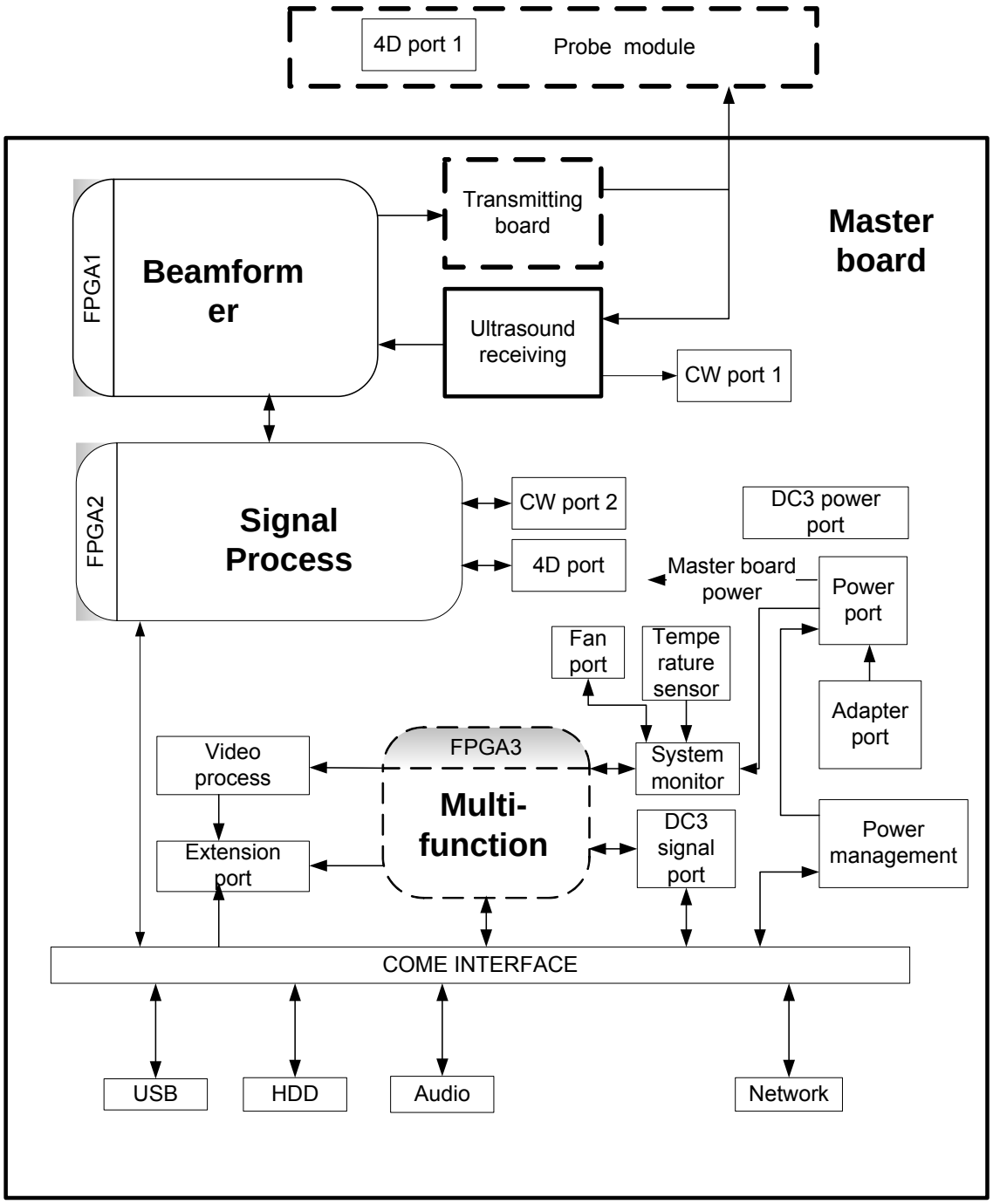


Figure 3-2 Block Diagram of the Master Board

Shown as above, the function modules of the master board are:

Ultrasound receiving;

Signal process;

Power management;

System monitoring;

Video process.

And the master board provides connecting sockets for the following devices:

Probe board module;

Transmitting board;

CW board;

4D board (reserved);

CPU module;

IO connection board;

Power supply module;

Hard disk;

DC-3 power socket;

DC-3 signal socket;

Fan;

Speaker;

Network.

The layout of the above modules' sockets on the master board is shown as Figure A-1.

3.2.2 Ultrasound Receiving

Ultrasound receiving consists of high voltage isolating & receiving channel selection, voltage-control gain amplifier and ADC. The receiving channel selection is controlled by two CPLDs, the analog control voltage of the amplifier comes from a DAC, and SPI signals of DAC, the amplifier as well as the ADC all come from beamformer FPGA1.

3.2.3 Signal Processing

Signal processing is completed by two FPGAs, they are FPGA1 and FPGA2.

FPGA1 mainly controls the front-end chip (channel selection CPLD, VGA gain control DAC, ADC and the transducers), produces transmitting sequence pulse, carries out wave combination, quadrature demodulation and so on.

FPGA2 is used to process signal, upload data, call real-time parameter scanning and so on, data is uploaded through PCI socket, and the USB port is a reserved port.

3.2.4 Power Management

Power management is basically completed by CPLD.

According to the power on sequence, the system power can be classified into: STANDBY power supply, CPU STANDBY power supply and normal working power supply.

STANDBY power supply is the power supply under POWERDOWN status. It includes +5VSTB, +3V3STB and +1.8VSTB. They power the comparator that generated POWER OK, crystal of 6M, power supply management CPLD, power supply drive and 244 status drive. Just to connect to AC power and switch on the breaker.

CPU STANDBY is the power supply when PC is in standby mode, it stops working when the system is turned off, and it works first when the system begins to work.

The normal working power supply refers to the power required during normal work of the system. Except STANDBY and CPU STANDBY mode, others all belong to normal working power supply, of which the indicator lights are shown as follows:

Table 3-1 Indicator Lights of the Master Board Power Supply

No.	LED number	Meaning
1	D7	12V
2	D25	3.3V indicator light
3	D26	5V indicator light

One indicator light on the DC-3 control panel indicates the working status of the breaker. The related lights descriptions are described as Table 3-2:

Table 3-2 Description of Power Supply Indicator Lights

1	Indicator light of breaker status （refer to the 14th item marked on the control panel Figureure)	Single color(green), indicates the working status of the breaker after mains power connected; the light is off when the breaker is switched off; The light is green when the breaker is switched on, it flashes during start-up process, and it is off when the back light of the keyboard is on.

3.2.5 System Monitoring

System monitoring including monitor on the voltage, temperature, fan malfunction detection and control on the fan speed;

Monitor on the voltage: direct measurement, including measurement of 12V, VCC(+5V), VDD(+3.3V), 2.5V, 1.5V, PHV, A+3, -5V, -12V;

Monitor on the power supply module and temperature of ultrasound front-end;

Monitor and control on fans and ventilation unit.

3.2.6 Video Processing

Video signal that outputs from the PC module is converted into standard S_Video and video signal post processed by FPGA3 and video code chip.

3.2.7 Sockets on Master Board

The standard sockets, which have no definition in the master board sockets, are required to be designed by the related standards, the sockets include: dual-USB port, SATA socket, Ethernet socket, SATA hard disk socket of notebook, COM EXPRESS socket, button-shaped battery socket and S-Video socket.

3.2.7.1 Socket between Master Board and Probe Module

Signals between the probe board module and master board socket are defined as Table A-1.

Descriptions of signals are described as follows:

Table 3-3 Definition of Signals between the Master Board and Probe Module Socket

Signal name	Description
SPI_CLK	Commands and data port to the probe module.
SPI_DIN	
SPI_DOUT	
SPI_CS	
FLASH_POWER	Reserved
FLASH_WP	Reserved
PROBE_ID[7:6]	Reserved signal
PROBEID_CS[1:0]	
RELAY_EN[1:0]	
PROBE_PRESENT	Presents probe signal
EXP_PRESENT	Connected to earth (in the probe unit)
PE[1:N]	N channel transmitting and receiving signal

3.2.7.2 Socket between Master Board and Transmitting Board

Signals between the master board and transmitting board are defined in Table A-1 and Table A-2.

3.2.7.3 Socket between CW Board and Master Board

Signals between the CW board and master board sockets are defined as Table A-3 and Table A-4. Of which, the signals of CW CON1 are defined as follows:

Table 3-4 Signals Definition at CW CON1 Socket

Name	Description
CW[9:0]	CW echo signal
12V	+12 power supply
-12V	-12V power supply
5V	+5V power supply

-5V	-5V power supply

3.2.7.4 JTAG Socket Definition of Clock Chip

The JTAG socket is defined as follows:

Table 3-5 Definition of JTAG Socket

PIN	SIG
1	CLK_TMS
2	CLK_TDI
3	CLK_TDO
4	CLK_TCK
5	GND
6	VDD_CLK

3.2.7.5 Socket between 4D Board and Master Board

Socket design between 4D board and master board is reserved currently, and the signals are defined as Table A-6.

3.2.7.6 Socket between Speaker and Master Board

Socket between speaker and master board is defined as follows:

Table 3-6 Definition of Sockets between Speaker and master Board

PIN	SIG
1	ROUTP
2	ROUTN
3	NC
4	LOUTP
5	LOUTN

3.2.7.7 Socket between Fan and Master Board

Socket between fan and master board is defined as follows;

Table 3-7 Definition of Socket between Fan and Master Board

PIN	SIG	PIN	SIG
1	FANSPEED4	2	12V
3	PWM45	4	12V
5	FANSPEED5	6	CPU_FAN_PN
7	FANSPEED2	8	CPU_FAN_SPEED
9	PWM23	10	12V
11	FANSPEED3	12	12V

3.2.7.8 Socket of Master Board CPLD JTAG Socket

Master board CPLD JTAG socket is defined as follows:

Table 3-8 Definition of Master Board CPLD JTAG Socket

PIN	SIG
1	TCK
2	TDO
3	TMS
4	TDI
5	3V3
6	GND
7	3V3
8	PLUGED

3.2.7.9 Signal Socket

Signal socket is defined as follows:

Table 3-9 Definition of Signal Socket

No.	Name	No.	Name
1	I^C_DA	2	GND
3	I^C_CK	4	GND
5	GND	6	Gnd
7	Power_ON	8	HDD_Status
9	SYS_RESET	10	Gnd
11	C_Print	12	Breaker_Status
13	C_Busy	14	Gnd
15	Gnd	16	Y_Svideo
17	Power_SSW	18	C_Svideo
19	Gnd	20	Gnd

3.2.7.10 Power Supply Socket

Power supply socket is defined as follows:

Table 3-10 Definition of Power Supply Socket

No.	Name	No.	Name
1	+12V	2	+12V
3	+12V	4	+12V
5	Gnd	6	Gnd

No.	Name	No.	Name
7	Gnd	8	Gnd
9	Gnd	10	Gnd
11	+5V	12	+5V
13	+5V	14	+5V
15	+5V	16	+5V
17	+5V	18	+5V
19	Gnd	20	Gnd
21	Gnd	22	Gnd
23	+3.3V	24	+3.3V

3.2.7.11 Socket between Adapter and Master Board

Socket between adapter and master board is defined as follows:

Table 3-11 Definition of Socket between Adapter and Master Board

No.	Name	Direction
1	Gnd	\
6	Gnd	\
2	Gnd	\
4	Gnd	\
3	+12V	In
7	+12V	In
5	+12V	In
8	+12V	In

3.2.7.12 Socket between Power Supply Module and Master Board

Definition of socket between power supply module and master board is shown as Table A-8, and the signals description is shown in Table A-9. The signal direction is defined relative to the power supply module.

3.2.7.13 Signal Definition between Master Board and Extended Socket

Signal definition between master board and extended socket is shown as Table A-10.

3.2.8 Testing Points on the Master Board

The testing points on the master board are shown as follows:

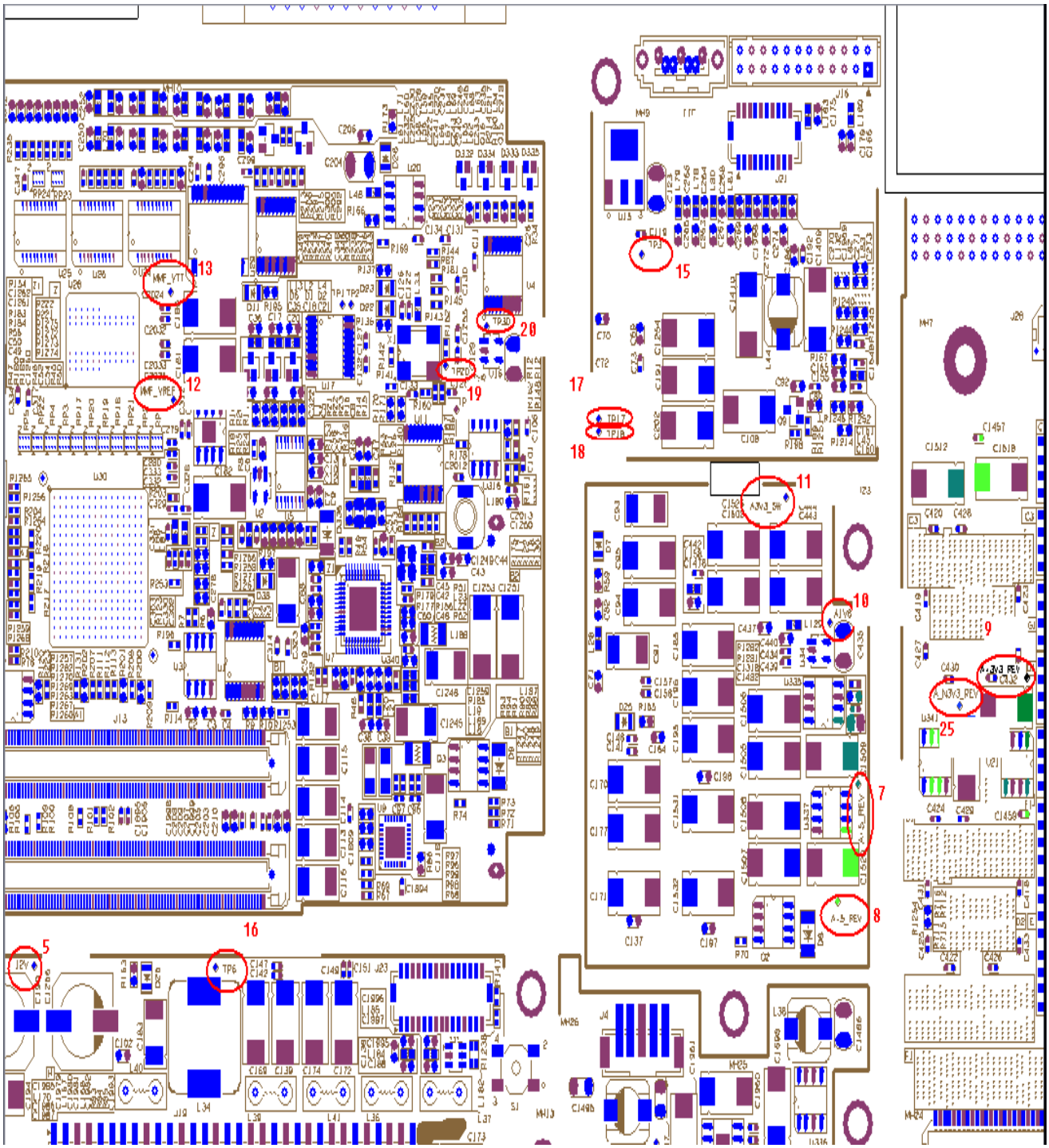


Figure 1 Testing Points

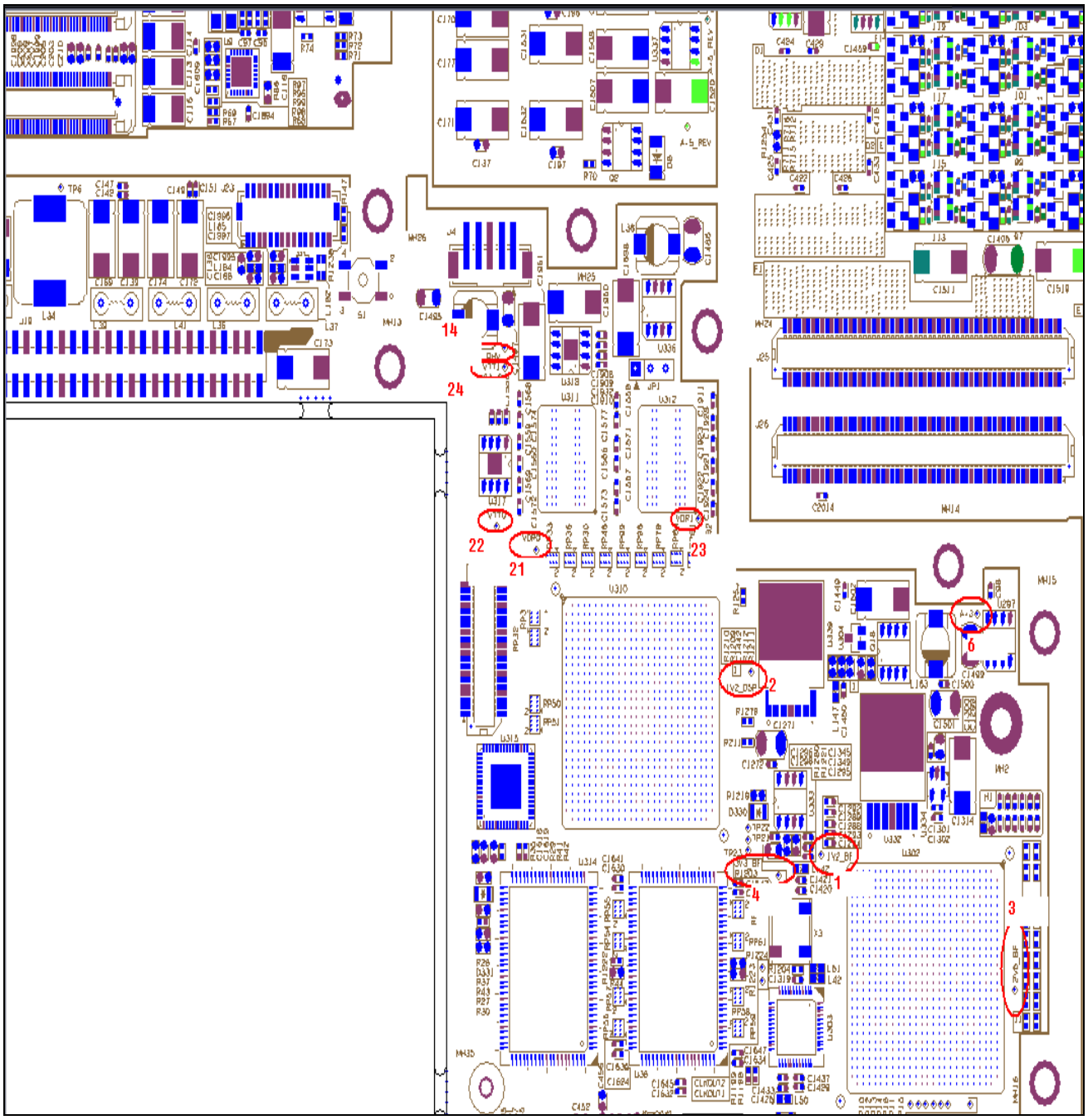


Figure 2 Testing Points

Table 3-12 Testing Points on the Master Board

No.	Symbol	Location
1	1V2_BF	FPGA1 kernel voltage (1.2V)
2	1V2_DSP	FPGA2, FPGA3 kernel voltage (1.2V)
3	2V5_BF	FPGA1 IO voltage (2.5V)
4	3V3_BF	FPGA1 IO voltage (3.3V)
5	12V	12V voltage
6	A+3	Changeable gain amplifier voltage (3V)
7	A+5V_REV	Voltage of receiving module (4.65V)
8	A-5V_REV	Voltage of receiving module (-4.65V)
9	A+3V3_REV	Voltage of receiving module (3.3V)
10	A1V8	Voltage of receiving module (1.8V)
11	A3V3_SW	Voltage of receiving module (3.3V)
12	MMF_VREF	FPGA3 DDR voltage (1.25V)
13	MMF_VTT	FPGA3 DDR voltage (1.25V)
14	PHV	Remote control high voltage 5-10V(CW), 20-140V(B\C\D)
15	TP3	STB voltage (3.3V)
16	TP6	Working voltage (5V)
17	TP17	Left audio input
18	TP18	Right audio input
19	TP20	Power supply management CPLD clock (6M)
20	TP30	Power for CPLD power supply management (1.8V)
21	VDR0	FPGA2 DDR0 voltage (1.25V)
22	VTT0	FPGA2 DDR0 voltage (1.25V)
23	VDR1	FPGA2 DDR1 voltage (1.25V)
24	VTT1	FPGA2 DDR1 voltage (1.25V)
25	A_N3V3_REV	Voltage of receiving module (-3.3V）

3.3 Transmitting Board

The function of transmitting board is to convert the low voltage pulse from the master board into high voltage pulse that required by transmitting. The block diagram is shown as follows:

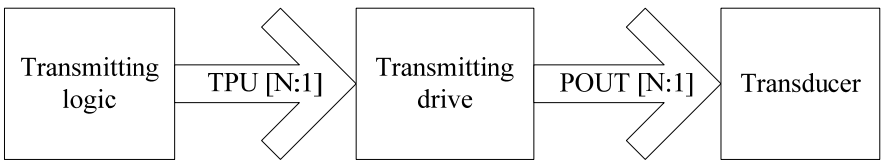


Figure 3-3 Ultrasound Transmitting Diagram

Sockets definition of transmitting board and master board is shown in Table A-1 and Table A-2. The testing points related to the power supply of transmitting board is defined as follows:

Table 3-13.Testing Points Related to Power Supply of Transmitting Board

No.	Symbol	Location
1	PHV	Remote control high voltage 5-10V(CW),20-140V(B\C\D)
2	A+12	11.4V voltage
3	VOE	3.3V voltage

The N testing points are corresponding to the N transmitting channels. Of the 4 rows of testing points, the upper two rows are even number points, while the lower two rows are odd number points. The numbers are marked between the spaces, e.g. P65 refers to the 65th channel.

The tested wave of transmitting signal under B Mode is shown as follows:

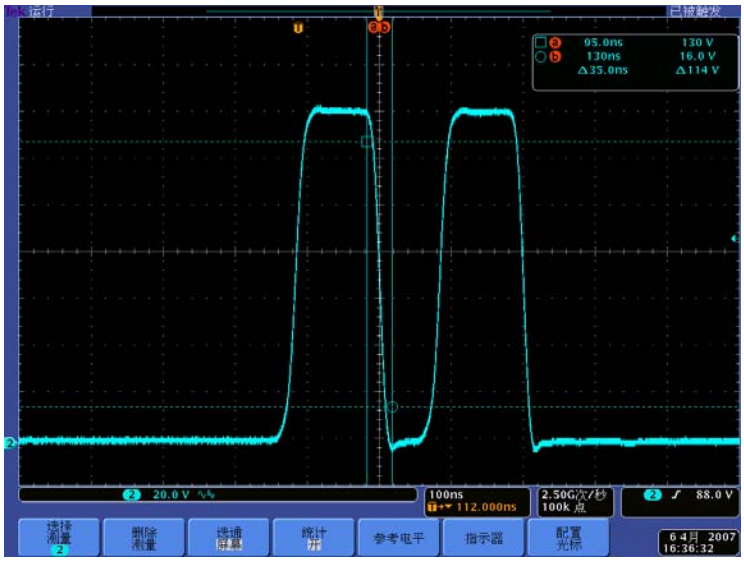


Figure 3-4 Tested Wave of Transmitting Signal in B Mode

Note: the amplitude, pulse width and pulse number vary with the transmitting parameters.

3.4 Probe Board/4D Probe Board Module

3.4.1 Principle of Probe Board/4D Probe Board Module

Functions of the probe are carried out by the probe connection board, probe control board as well as probe board. Probe control board are buckled with probe board, probe board and

master board are combined by probe connection board. Signals between the three panels and the control structure are shown as follows:

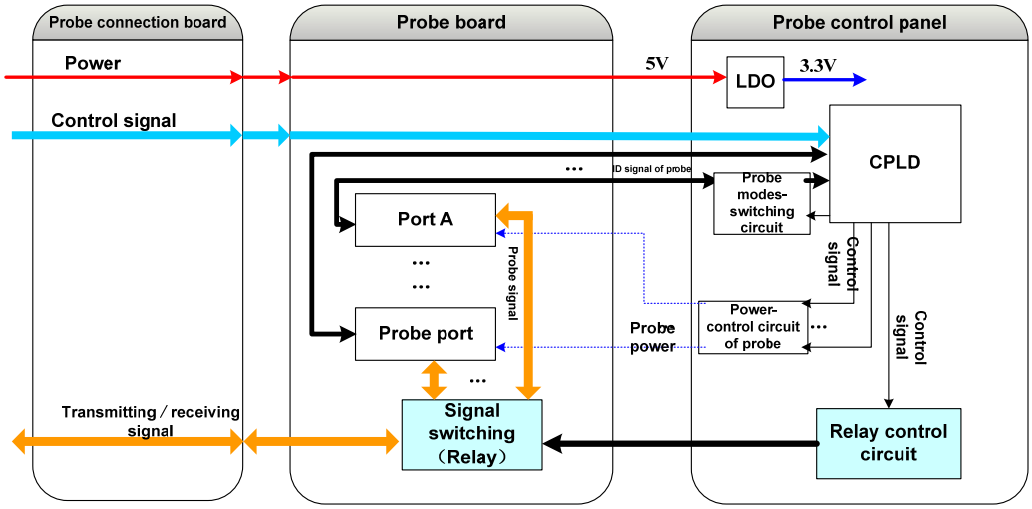


Figure 3-5 Electrical Block Diagram of Probe Board Module

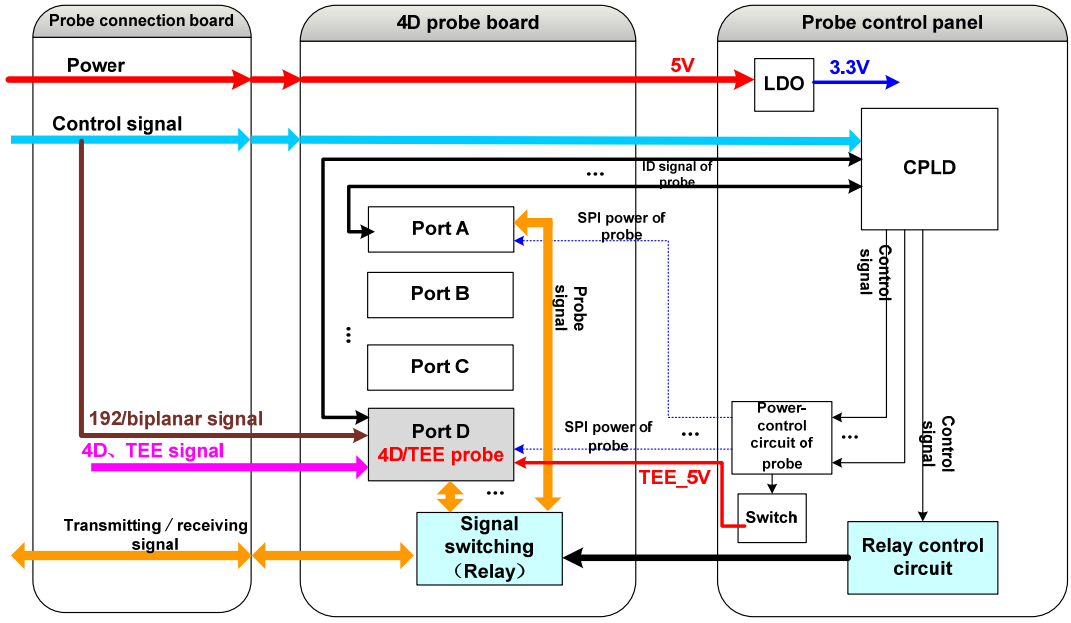


Figure 3-6 Electrical Block Diagram of 4D Probe Board Module

The probe connection board is applied to connect the master board and the probe board: the probe control board, which is buckled with probe board, takes control on the switching relays on the probe board, switches the working probes and A probe mode (probes including general probes, 4D probe and TEE probe), and reads the probe ID and so on.

Port D of 260 PIN 4D probe is newly added to 4D probe board. The new circuitous philosophy diagram of 4D probe board module is shown as below:

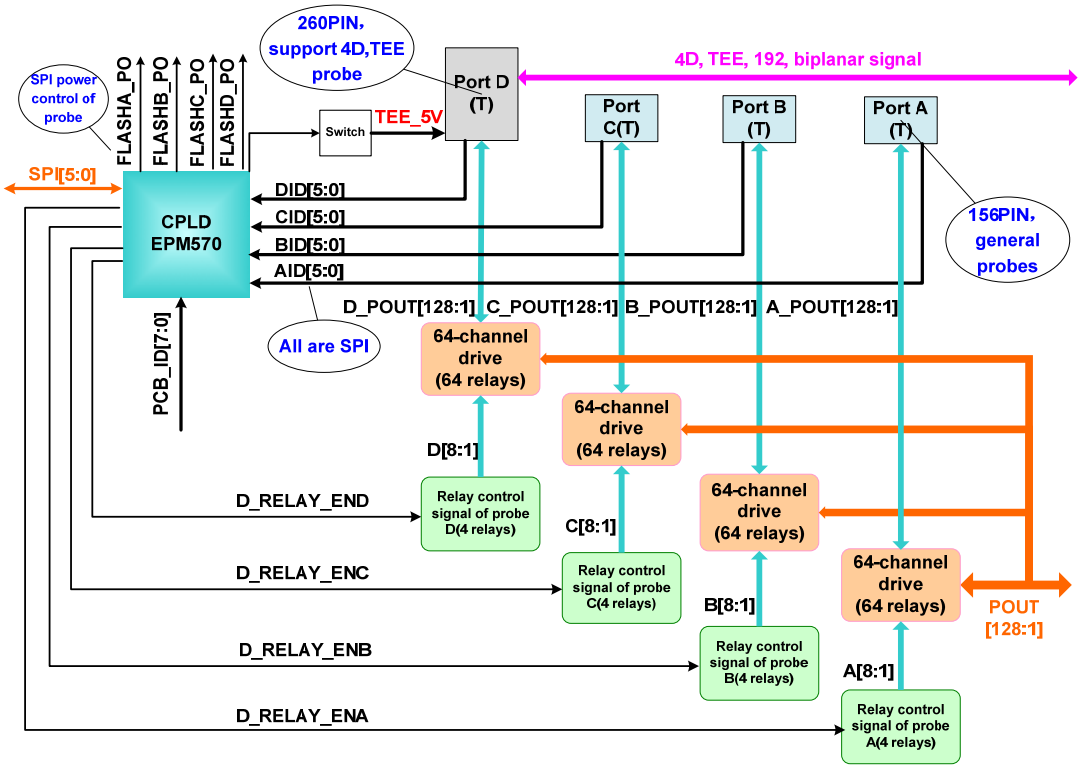


Figure 3-7 Circuitous Philosophy Diagram of 4D Probe Board Module

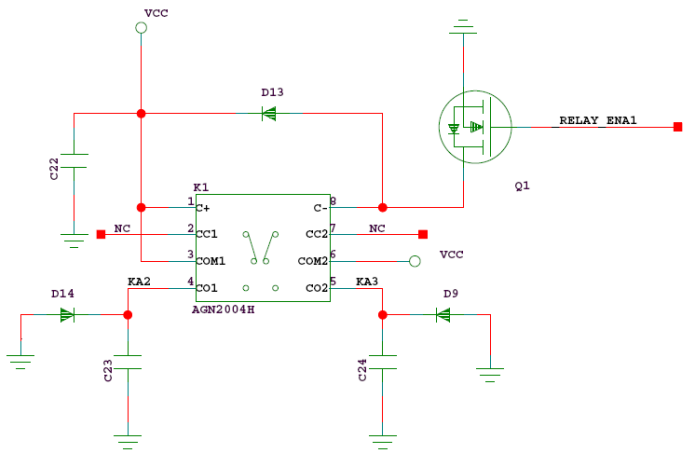


Figure 3-8 Principle Diagram of Relay Control Circuit

The above diagram shows the control circuit principle of a group of relays. Control signal produced by CPLD turns into RELAY_EN1 after driven by 245, and the RELAY_EN1 signal will then take control on the conduction and cut-off of N-MOSFET Q1. Q1 controls the contactor position of relay K1 (whether toggle to normal open or to normal close). When the contactor is normal close, signal KA2 and KA3 are of VCC level, both signals can act as the power supply of the related relay, let the relay to be working status.

3.4.2 Definition of Sockets

Table 3-14 Sockets between Probe connection board and Probe Board

Socket P1									
No.	Name	No.	Name	No.	Name	No.	Name	No.	Name
A1	Gnd	B1	PE127	C1	Gnd	D1	PE128	E1	Gnd
A2	PE124	B2	Gnd	C2	PE125	D2	Gnd	E2	PE126
A3	PE121	B3	Gnd	C3	PE122	D3	Gnd	E3	PE123
A4	Gnd	B4	PE119	C4	Gnd	D4	PE120	E4	Gnd
A5	PE116	B5	Gnd	C5	PE117	D5	Gnd	E5	PE118
A6	PE113	B6	Gnd	C6	PE114	D6	Gnd	E6	PE115
A7	Gnd	B7	PE95	C7	Gnd	D7	PE96	E7	Gnd
A8	PE92	B8	Gnd	C8	PE93	D8	Gnd	E8	PE94
A9	PE89	B9	Gnd	C9	PE90	D9	Gnd	E9	PE91
A10	Gnd	B10	PE87	C10	Gnd	D10	PE88	E10	Gnd
A11	PE84	B11	Gnd	C11	PE85	D11	Gnd	E11	PE86
A12	PE81	B12	Gnd	C12	PE82	D12	Gnd	E12	PE83
A13	Gnd	B13	PE79	C13	Gnd	D13	PE80	E13	Gnd
A14	PE76	B14	Gnd	C14	PE77	D14	Gnd	E14	PE78
A15	PE73	B15	Gnd	C15	PE74	D15	Gnd	E15	PE75
A16	Gnd	B16	PE71	C16	Gnd	D16	PE72	E16	Gnd
A17	PE68	B17	Gnd	C17	PE69	D17	Gnd	E17	PE70
A18	PE65	B18	Gnd	C18	PE66	D18	Gnd	E18	PE67
A19	Gnd	B19	PE63	C19	Gnd	D19	PE64	E19	Gnd
A20	PE60	B20	Gnd	C20	PE61	D20	Gnd	E20	PE62
A21	PE57	B21	Gnd	C21	PE58	D21	Gnd	E21	PE59
A22	Gnd	B22	PE55	C22	Gnd	D22	PE56	E22	Gnd
Socket P2									
No.	Name	No.	Name	No.	Name	No.	Name	No.	Name
A1	PE52	B1	Gnd	C1	PE53	D1	Gnd	E1	PE54
A2	PE49	B2	Gnd	C2	PE50	D2	Gnd	E2	PE51
A3	Gnd	B3	PE47	C3	Gnd	D3	PE48	E3	Gnd
A4	PE44	B4	Gnd	C4	PE45	D4	Gnd	E4	PE46
A5	PE41	B5	Gnd	C5	PE42	D5	Gnd	E5	PE43
A6	Gnd	B6	PE111	C6	Gnd	D6	PE112	E6	Gnd

A7	PE108	B7	Gnd	C7	PE109	D7	Gnd	E7	PE110
A8	PE105	B8	Gnd	C8	PE106	D8	Gnd	E8	PE107
A9	Gnd	B9	PE103	C9	Gnd	D9	PE104	E9	Gnd
A10	PE100	B10	Gnd	C10	PE101	D10	Gnd	E10	PE102
A11	PE97	B11	Gnd	C11	PE98	D11	Gnd	E11	PE99
A12	Gnd	B12	PE39	C12	Gnd	D12	PE40	E12	Gnd
A13	PE36	B13	Gnd	C13	PE37	D13	Gnd	E13	PE38
A14	PE33	B14	Gnd	C14	PE34	D14	Gnd	E14	PE35
A15	Gnd	B15	PE31	C15	Gnd	D15	PE32	E15	Gnd
A16	PE28	B16	Gnd	C16	PE29	D16	Gnd	E16	PE30
A17	PE25	B17	Gnd	C17	PE26	D17	Gnd	E17	PE27
A18	Gnd	B18	PE23	C18	Gnd	D18	PE24	E18	Gnd
A19	PE20	B19	Gnd	C19	PE21	D19	Gnd	E19	PE22
A20	PE17	B20	Gnd	C20	PE18	D20	Gnd	E20	PE19
A21	Gnd	B21	PE15	C21	Gnd	D21	PE16	E21	Gnd
A22	PE12	B22	Gnd	C22	PE13	D22	Gnd	E28	PE14

Socket P3

No.	Name	No.	Name	No.	Name	No.	Name	No.	Name
A1	PE9	B1	Gnd	C1	PE10	D1	Gnd	E1	PE11
A2	Gnd	B2	PE7	C2	Gnd	D2	PE8	E2	Gnd
A3	PE4	B3	Gnd	C3	PE5	D3	Gnd	E3	PE6
A4	PE1	B4	Gnd	C4	PE2	D4	Gnd	E4	PE3
A5	Gnd	B5	Gnd	C5	Gnd	D5	Gnd	E5	Gnd
A6	PROBEID_CS1	B6	Gnd	C6	RELAY_EN1	D6	Gnd	E6	EXP_PRESENT
A7	PROBEID_CS0	B7	Gnd	C7	RELAY_EN0	D7	Gnd	E7	PROBE_PRESENT
A8	Gnd	B8	Gnd	C8	Gnd	D8	Gnd	E8	Gnd
A9	SPI_DIN/PROBE_ID1	B9	SPI_DOUT/PROBE_ID2	C9	FLASH_POWER/PROBE_ID4	D9	FLASH_WP/PROBE_ID5	E9	PROBE_ID7
A10	SPI_CLK/PROBE_ID0	B10	Gnd	C10	SPI_CS/PROBE_ID3	D10	Gnd	E10	PROBE_ID6
A11	Gnd	B11	Gnd	C11	Gnd	D11	Gnd	E11	Gnd
A12	Gnd	B12	Gnd	C12	Gnd	D1	Gnd	E12	Gnd

						2			
A13	+5V	B13	+5V	C13	+5V	D13	+5V	E13	+5V
A14	+5V	B14	+5V	C14	+5V	D14	+5V	E14	+5V
A15	+5V	B15	+5V	C15	+5V	D15	+5V	E15	+5V
A16	Gnd	B16	Gnd	C16	Gnd	D16	Gnd	E16	Gnd
A17	Gnd	B17	Gnd	C17	Gnd	D17	Gnd	E17	Gnd
A18	4D-Gnd	B18	4D-Gnd	C18	4D-Gnd	D18	4D-Gnd	E18	4D-Gnd
A19	4D-RES1 Thermison＋	B19	4D-RES2 Thermison－	C19	4D-RES3 TEE-Agnd	D19	4D-RES4 Hall_signal	E19	4D-RES5 4D-ID
A20	4D-Gnd	B20	4D-Gnd	C20	4D-RES6 TEE-Angle	D20	4D-Gnd	E20	4D-Gnd
A21	4D-MOTOROUT1A Sin+	B21	4D-MOTOROUT1B Sin-	C21	4D-Gnd	D21	4D-MOTOROUT2B Cos-	E21	4D-MOTOROUT2A Cos+
A22	4D-MOTOROUT1A Sin+	B22	4D-MOTOROUT1B Sin-	C22	4D-Gnd	D22	4D-MOTOROUT2B Cos-	E22	4D-MOTOROUT3A Cos+

Table 3-15 Definition of 4D Reserved Socket on Probe connection board

PIN No.	Name	PIN No.	Name
1	4D_MOTOROUT1A	2	4D_MOTOROUT1A
3	4D_MOTOROUT1B	4	4D_MOTOROUT1B
5	4D_MOTOROUT2A	6	4D_MOTOROUT2A
7	4D_MOTOROUT2B	8	4D_MOTOROUT2B
9	4D_GND	10	4D_GND
11	4D_GN D	12	4D_GND
13	4D_RES1/Thermison+	14	4D_RES2/Thermison-
15	4D_RES3/TEE_AGND	16	4D_RES4/4D_Hall_angle
17	4D_RES5/4D_ID	18	4D_RES6/TEE_angle_out
19	4D_GND	20	4D_GND

Table 3-16 Definition of Sockets on Probe Board Module

Probe control board socket J1

PIN No.	Name	PIN No.	Name

1	KA3	2	KA2
3	KA7	4	KA1
5	SPI4/FLASH_POWER	6	GND
7	PROBEID_CS1	8	SPI5/FLASH_WP
9	RELAY_EN0	10	SPI7/PROBE_ID7
11	GND	12	PROBE_PRESENT
13	PROBEID_CS0	14	RELAY_EN1
15	SPI2/SPI_DOUT	16	EXP_PRESENT
17	SPI1/SPI_DIN	18	GND
19	SPI6/PROBE_ID6	20	A+5V
21	SPI3/SPI_CS	22	A+5V
23	SPI0/SPI_CLK	24	A+5V
25	GND	26	A+5V
27	4D_GND	28	GND
29	4D_RES4/4D_Hall_angle	30	4D_RES5/4D_ID
31	4D_RES1/Thermison+	32	4D_RES3/TEE_AGND
33	4D_RES2/Thermison-	34	4D_RES6/TEE_angle_out
35	4D_GND	36	4D_GND
37	4D_MOTOROUT1A	38	4D_MOTOROUT2B
39	4D_MOTOROUT1B	40	4D_MOTOROUT2A

Probe control board socket J2

PIN No.	Name	PIN No.	Name
1	KD2	2	DID4
3	KD3	4	DID7
5	KD7	6	KD4
7	KD1	8	KD8
9	GND	10	GND
11	DID1	12	KD6
13	DID2	14	KD5
15	D_ON	16	GND
17	DID8	18	KA8
19	DID6	20	KA6
21	DID3	22	KA5
23	DID5	24	KA4

PIN No.	Name	PIN No.	Name
25	GND	26	GND
27	4D_RES3/TEE_AGND	28	PA_6S
29	4D_RES6/TEE_angle_out	30	PA_5S
31	A_ON	32	4D_GND
33	4D_ON	34	PA_6P
35	4D_GND	36	PA6R
37	PA_5M	38	PA5R
39	PA_5N	40	PA5P

Probe control board socket J3

PIN No.	Name	PIN No.	Name
1	C_ON	2	CID3
3	CID1	4	CID5
5	CID2	6	CID4
7	CID7	8	CID6
9	GND	10	GND
11	CID8	12	KC4
13	KC3	14	KB4
15	KC1	16	KC5
17	KB7	18	KC6
19	GND	20	GND
21	KC7	22	KC8
23	KC2	24	KB5
25	KB2	26	KB6
27	KB3	28	KB8
29	GND	30	GND
31	DID7	32	BID8
33	KB1	34	BID6
35	B_ON	36	BID5
37	BID1	38	BID4
39	BID2	40	BID3

3.5 I/O Connecting Board

Function of I/O connection board includes sending signals from the master board to port board and front board, providing power supply to SATA hard disk and so on.

3.5.1 Definition of Sockets on I/O Connection Board

- ✧ 1 connecting socket to the master board 50Pin I/O extended ports, signals definition is shown as Table A-10.
- ✧ 1 connecting socket to the master board 20Pin reserved socket, signals definition is shown as Table 3-9.
- ✧ 1 connecting socket to the master board 24Pin power reserved socket, signals definition is shown as Table 3-10.
- ✧ 1 connecting socket to the CW board pencil probe port, the signals definition is shown as follows:

Table 3-17 Signal Definition between I/O Connecting Board and CW Board Pencil Probe Port

PIN NUM	SIGNAL
1	PENCIL_R
2	AGND
3	AGND
4	PENCIL_T

- ✧ 1 connecting socket to the DC-3 master board speaker socket, socket definition is shown as Table 3-6.
- ✧ 1 connecting socket to the DC-3 I/O front board socket, the socket definition is shown as Table 3-21.
- ✧ 1 connecting socket to the DC-3 I/O port board socket, the socket definition is shown as follows:

Table 3-18 Socket Definition between the I/O Connecting Board and I/O Port Board

No.	Name	No.	Name	No.	Name	No.	Name	No.	Name
A1	3V3	B1	3V3	C1	3V3	D1	3V3	E1	3V3
A2	GND	B2	GND	C2	GND	D2	GND	E2	GND
A3	5V	B3	5V	C3	5V	D3	5V	E3	5V
A4	5V	B4	5V	C4	5V	D4	5V	E4	5V
A5	GND	B5	GND	C5	GND	D5	GND	E5	GND
A6	12V	B6	12V	C6	12V	D6	12V	E6	12V
A7	GND	B7	GND	C7	GND	D7	GND	E7	GND
A8	C_SVIDEO	B8	Y_SVIDEO	C8	VIDEO	D8	VGA_GREEN	E8	GND
A9	GND	B9	GND	C9	GND	D9	GND	E9	VGA_RED
A10	RIGHT-	B10	LEFT-	C10	AUDIO_L	D10	GND	E10	GND
A11	RIGHT+	B11	LEFT+	C11	AUDIO_R	D11	GND	E11	VGA_BLUE
A12	GND	B12	GND	C12	GND	D12	GND	E12	GND
A13	USB-5	B13	UART_RX0	C13	POWER_SSW	D13	VGA_VS	E13	VGA_HS

A14	USB+5	B14	UART_TX0	C14	BREAKER_STATUS	D14	C_BUSY	E14	C_PRINT
A15	GND	B15	GND	C15	GND	D15	GND	E15	GND
A16	D2	B16	HD_STATUS	C16	SYS_RESET	D16	POWER_ON	E16	D0
A17	RM_PRINT	B17	GND	C17	I^2C_CK	D17	I^2C_DA	E17	D1
A18	GND	B18	GND	C18	GND	D18	GND	E18	GND
A19	ACK_N	B19	BUSY	C19	RM_BUSY	D19	D3	E19	D4
A20	D5	B20	D6	C20	D7	D20	PE	E20	AUTOFD_N
A21	SEL	B21	ERROR_N	C21	INIT_N	D21	STROBE_N	E21	SELIN_N
A22	GND	B22	GND	C22	GND	D22	GND	E22	GND

Power socket definition of SATA hard disk is shown as follows:

Table 3-19 Power Supply Socket Definition of SATA Hard Disk

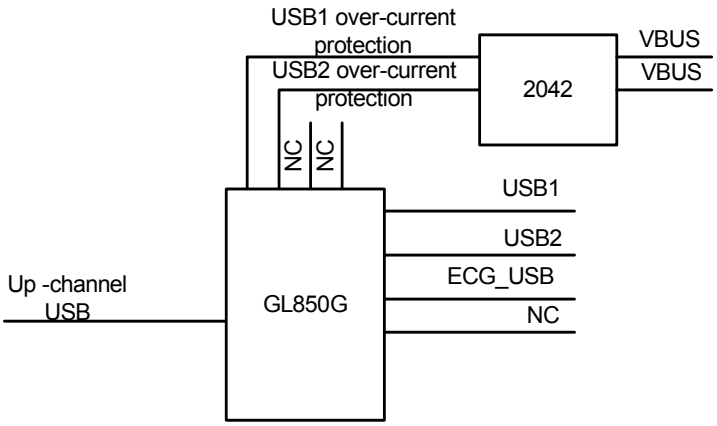
No.	Name
1	12V
2	GND
3	+5V
4	GND
5	+3.3V
6	GND

3.6 IO Front Board

The main function of I/O front board is to extend 1 channel USB signal into 3 channels, and transmit some signals from the master board at the same time.

3.6.1 USB

The one-channel USB signal from the master board turns into 3 channels after processed by HUB, of which, 1 channel is connected to ECG module and the other two channels are connected to external standard USB ports. Meanwhile, the external USB port is turned into VBUS that connects to U port by a 2042.



The chip is externally powered, the chip and peripheral circuits are powered by 3.3V, which is adapted from 5V VCC by the adapter that built-in the chip; the drive level of HUB U port is powered by on-board power supply. After powered on, the requested bus ID will be recorded in the built-in memory by GL850G, so no external EEPROM or FLASH is required for memory. In the PGANG position, interface to a pull-up resistor to enable the chip's GANG mode, and we reserve a 0ohm resistor position to make the chip work in independent mode. The corresponding indicator light is used to indicate if the USB channel is OK. The relationship between the indicator light and USB channel is as follows:

Table 3-20 Function of LED Indicator Lights on I/O Front Board

Item	Function
D1	USB3 abnormal work indicator light
D2	USB3 normal work indicator light
D3	GANG mode indicator light
D4	USB1 normal work indicator light
D5	USB1 abnormal work indicator light
D6	USB2 normal work indicator light
D7	USB2 abnormal work indicator light

3.6.2 Sockets Definition of IO Front Board

✧ 1 socket connected to I/O connecting board, defined as Table 3-21:

Table 3-21 Socket Definition between I/O Front Board and I/O Connecting Board

No.	Name	No.	Name
1	GND	2	AGND
3	MIC_L	4	PENCIL_T
5	MIC_R	6	AGND
7	GND	8	PENCIL_R
9	USB-4	10	GND
11	USB+4	12	3.3V
13	GND	14	GND

No.	Name	No.	Name
15	+5V	16	+5V
17	+5V	18	+5V
19	GND	20	GND

✧ 1 pencil probe port (reserved), defined as follows:

Table 3-22 Socket Definition between I/O Front Board and Pencil Probe

PIN NUM	SIGNAL
1	PENCIL_R
2	AGND
3	AGND
4	PENCIL_T

✧ 2 USB ports that provide external output, defined as follows:

Table 3-23 Standard USB Ports for External Output

No.	Name
1	＋5
2	USB-
3	USB+
4	GND
5	GND
6	GND

Table 3-24 USB Port for ECG Module

No.	Name
1	+5V
2	+5V
3	USB-
4	USB+
5	Gnd
6	Gnd

✧ 1 MIC port (function reserved), defined as follows:

Table 3-25 MIC Port Definition

No.	Name
1	GND
2	MIC_R
3	MIC_L

3.7 IO Port Board

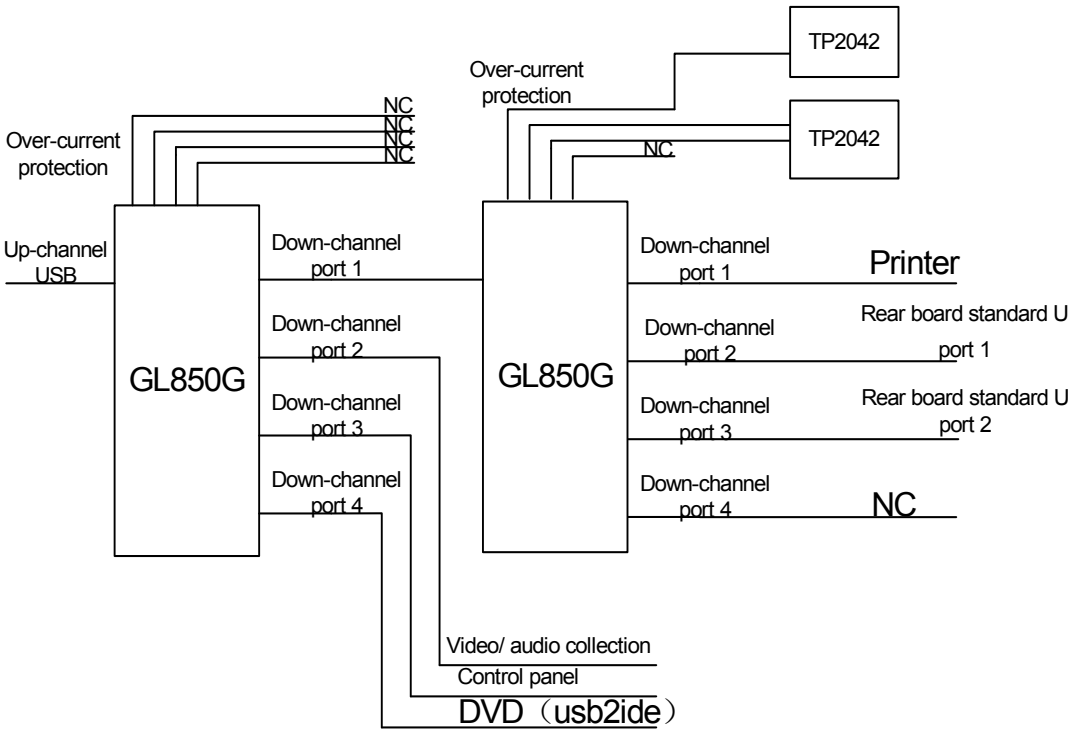
I/O port board mainly provides connections for master board, I/O rear board, the console, the printer, LCD, DVD-RW and so on; other functions including extending 1 channel VIDEO signal into 2 channels S-VIDEO signal, 1 channel VGA signal into 2 channels, 1 channel USB signal into 6 channels, and video/audio signal collection and so on.

Signals through I/O port board can be classified into two kinds: some signals are processed on the board, including USB, VGA output, VIDEO input/output, S-VIDEO input, and left/right audio input; other signals are not processed on the board, just transmitted, including parallel port, serial port, left/right audio output, speaker output, HD of keyboard, BREAKER signal, soft switch control signal and 2 channels remote signals.

3.7.1 Functional Modules

3.7.1.1 USB

The one-channel USB signal from the master board is connected to the board through a 110PIN socket, two one-to-four USB HUB CONTROLLER ICs are used to work in cascade mode to realize USB 1-to-6, the diagram is shown as follows:



The chip is externally powered, the chip and peripheral circuits are powered by 3.3V level, which is adapted from 5V VCC by the adapter that built-in the chip; the drive level of HUB U port is powered by on-board power supply. After powered on, the requested bus ID will be recorded in the built-in memory by GL850G, so no external EEPROM or FLASH is required for memory. In the PGANG position, interface to a pull-up resistor to enable the chip's GANG mode, and we reserve a 0Ohm resistor position to make the chip work in independent mode. There is no great difference between the two modes. In the assignment of pins of the HUB, considering the bandwidth, we assign the port which has more data

onto the first level HUB. The corresponding indicator lights are used to indicate if the USB channel is OK. The relationship between the indicator lights and USB channels is as follows:

No.	Name
D1	EM2860 working indicator light.
D3	HUB1working indicator light.
D4/D5	HUB1 1 channel (HUB2 up-channel) indicator light.
D6/D7	Working status indicator light of video/ audio collection module.
D8/D9	Working status indicator light of control panel U port.
D10/D11	Working status indicator light of DVD U port.
D12	Working status indicator light of HUB2.
D13/D14	Working status indicator light of standard USB port 2 on rear board.
D15/D16	Working status indicator light of printer U port.
D36/D37	Working status indicator light of standard USB port 2 on rear board.

Of which, the yellow light means abnormal work, and the green light means normal work. Indicator light EM2860 can only be lightened when the collection software is running.

3.7.1.2 Video/ Audio Collection

Solution of EMPIA is applied for video/ audio collection.

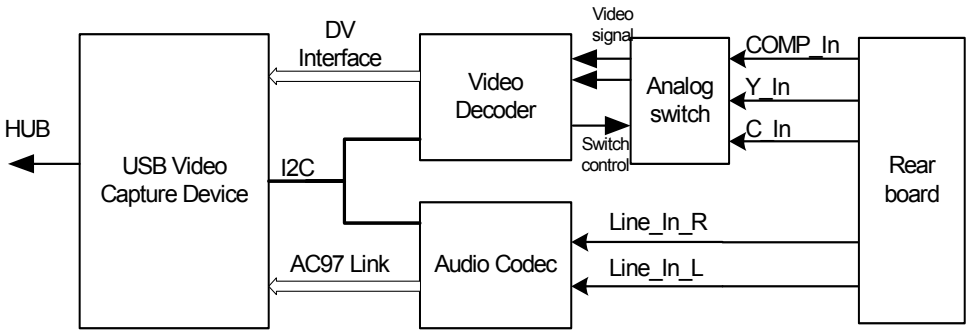
For audio collection, one EMP202, which change the audio data into serial data (the data will be sent to EM2860 through SDI signal and then to the master board by USB bus via the connecting board), is involved for signal encoding and decoding.

For video data collection, TVP5150AM1 of TI is applied for video decoding. The S-VIDEO or VIDEO signal, which is sampled by TVP5150AM1 after being sent to the port board via the rear board, will be transferred to 8 bits digital signal and be output in parallel to EM2860, and then to be sent to the master board through USB bus. An analog switch is required in the process of S-VIDEO and VIDEO signal to be input into the port board, this is because TVP5150AM1 can encode only one signal at a time. ADG774 is applied here, and one channel is selected for collection. The analog switch is controlled under GPCL signal of TVP5150AM1.

After powered on, the control signal will be sent to TVP5150AM1 by USB port from EM2860 via I2C bus. Then BIT5 and BIT6 of Miscellaneous Control Register, (When BIT5 is high, enable GPCL signal output, the value of GPCL is reflected on BIT6), as well as BIT0, BIT1 of Input Source Selection Register will be set. (When BIT0 is high, AIPIA/AIPIB signal receives SVIDEO signal, and when BIT0 is low, COMPOSITE VIDEO signal will be received; BIT1 controls the input of AIPIA/AIPIB, when it is low, input AIPIA, when it is high, input AIPIB). At the same time, a high level pass through a PMOS to control the reset time of EM2860 costs less time than EMP202.

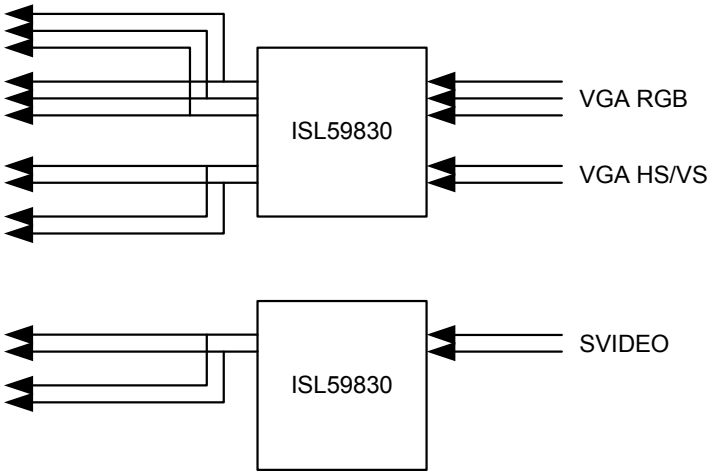
The signals from EMP202 and TVP5150AM1 will be gathered by EM2860, and then be sent to the master board by USB bus, at the same time, it is a way for the master board to control video collection via USB bus.

Block diagram of video collection is shown as follows:



3.7.1.3 Signal Extension

Signal extension is driven by ISL59830, which will extend one signal into two signals, the block diagram is shown as follows:



3.7.2 Sockets Definition of I/O Port Board

- ✧ 1 socket connected to I/O connecting board, which is defined as Table 3-18.
- ✧ 1 socket connected to I/O rear board, which is defined as follows:

Table 3-26 Socket between I/O Port Board and I/O Rear board

No.	Name	No.	Name
A1	GND	B1	GND
A2	D0	B2	D1
A3	GND	B3	D2
A4	D3	B4	D4
A5	D5	B5	D6
A6	GND	B6	D7
A7	AUTOFD_N	B7	PE
A8	BUSY	B8	ACK_N

No.	Name	No.	Name
A9	GND	B9	SELIN_N
A10	STROBE_N	B10	INIT_N
A11	SEL	B11	ERROR_N
A12	GND	B12	GND
A13	UART_RX0	B13	UART_TX0
A14	USB_1-	B14	USB_1+
A15	USB_1BUS	B15	USB_1BUS
A16	GND	B16	GND
A17	USB_2-	B17	USB_2+
A18	USB_2BUS	B18	USB_2BUS
A19	GND	B19	GND
A20	C_PRINT	B20	C_BUSY
A21	SYS_RESET	B21	GND
A22	VGA_HS	B22	VGA_VS
A23	GND	B23	GND
A24	Y_SVIDEO_IN	B24	C_SVIDEO_IN
A25	GND	B25	VIDEO_IN
A26	GND	B26	GND
A27	VGA_RED2_FI	B27	GND
A28	VGA_GREEN2_FI	B28	GND
A29	VGA_BLUE2_FI	B29	GND
A30	GND	B30	GND
A31	AUDIO_L_IN	B31	AUDIO_R_IN
A32	GND	B32	GND
A33	Y_SVIDEO	B33	C_SVIDEO
A34	GND	B34	VIDEO_OUT2_FI
A35	GND	B35	GND
A36	AUDIO_R	B36	AUDIO_L
73	GND	74	GND
75	GND	76	GND
77	+12V	78	+12V
79	+12V	80	+12V

✧ 1 socket connected to the USB port on DVD-RW module, which is defined as follows:

Table 3-27 Socket between I/O Port Board and USB Port on DVD-RW Module

No.	Name
1	+5V
2	+5V
3	DM6
4	DP6
5	GND
6	GND

✧ 1 power supply socket of DVD-RW module, which is defined as follows:

Table 3-28 Socket between I/O Port Board and Power Supply of DVD-RW Module

No.	Name	No.	Name
1	+5V	2	GND
3	+12V	4	GND

✧ 1 socket connected to VGA port of LCD, which is defined as follows:

Table 3-29 Socket Connected to VGA Port of LCD

No.	Name
1	VGA_V
2	GND
3	VGA_H
4	GND
5	VGA_R
6	VGA_B
7	VGA_G
8	GND
9	GND
10	GND

✧ 1 socket of speaker output, which is defined as follows:

Table 3-30 Speaker Output Port

No.	Name
1	LEFT+
2	LEFT-
3	RIGHT+
4	RIGHT-

✧ 1 socket of W/B video printer, which is defined as follows:

Table 3-31 Socket of W/B Video Printer Output

No.	Name
1	VIDEO_OUT
2	VIDEO_OUT
3	GND
4	GND
5	RM_PRINT
6	RM_BUSY

✧ 1 socket between I/O port board and control panel, which is defined as follows:

Table 3-32 Socket between I/O Port Board and Control Panel

No.	Name	No.	Name
1	DM5	2	HD_STATUS
3	DP5	4	BREAKER_STATUS
5	GND	6	GND
7	+12V	8	+12V
9	GND	10	GND
11	+5V	12	+5V

✧ 1 socket between I/O port board and power supply soft switch, which is defined as follows:

Table 3-33 Socket between I/O Port Board and Power Soft Switch

No.	Name
1	POWER_SSW
2	GND

✧ 1 socket of power supply auxiliary output control, which is defined as follows:

Table 3-34 Socket of Power Supply Auxiliary Output Control

No.	Name
1	+12V
2	+12V
3	GND
4	GND

✧ Socket connected to built-in USB port of digital W/B video printer, which is defined as follows:

Table 3-35 Socket Connected the USB Port of Digital W/B Video Printer

No.	Name
1	USB_DM1BUS
2	USB_DM1BUS

3	DM1
4	DP1
5	GND
6	GND

3.7.3 Introduction of Testing Points on IO Port Board

3.7.3.1 USB

The working status of USB channel can be seen from the indicator light on the IO port board. If the light is still off after booting strap, it means no power on the board or the first USB received no signal from the up-channel USB, or the chip didn't be initialized. Check if there are clock waves on C58, C59, if not, it means the chip or crystal is damaged.

3.7.3.2 Video Collection

The video collection part tests the 9th pin of TVP5150 to check if it is working at 27MHz, if not, check the input frequency of crystal; If the input frequency of crystal is 14MHz, and the voltage of 4th pin is 1.8V and the 3rd pin is of 0V, then the chip should be replaced. Check if the signal frequency of R28 is about 12.36MHz, if not, check if the frequency of 6th pin on EMP202 is normal, if it is still abnormal, please replace the IC. If USB device can be recognized by PC, then EM2860 is normal.

3.8 IO Rear Panel

IO rear panel is installed on the back of the machine, it provides all kinds of ports to the external devices (most of them are standard ports), the main signals are from IO port board as well as network ports of the master board.

3.8.1 Sockets Definition of IO Rear Panel

The definition is only concerned on the un-standard sockets:

- ✧ 1 socket connected to I/O port board, which is defined as Table 3-26.
- ✧ 1 socket connected to RESET button, which is defined as follows:

Table 3-36 Definition of Socket Connected to RESET Button

No.	Name
1	SYS_RESET_FI
2	GND

- ✧ 1 reserved socket to the power supply of fan, which is defined as follows:

Table 3-37 Socket Definition of Fan Power Supply

No.	Name
1	+12V

2	GND
3	+12V
4	GND

3.9 CW Board

Principle of CW board is shown as follows. It mainly consists of a CW receiving channel and pencil probe receiving & transmitting channel. It can be classified into several modules, which include socket unit (power supply filtering and transforming), delay-line unit, pencil probe unit, low pass filter unit, demodulation unit, wall filter wave unit, gain adjusting unit and A/D conversion unit; power supply on the board can be classified into analog and digital one, the former one includes A+5V, VCC(5V), A-5V, A+12V, A-12V, PHV, A+1v5, and the latter one includes VDD(3.3V).

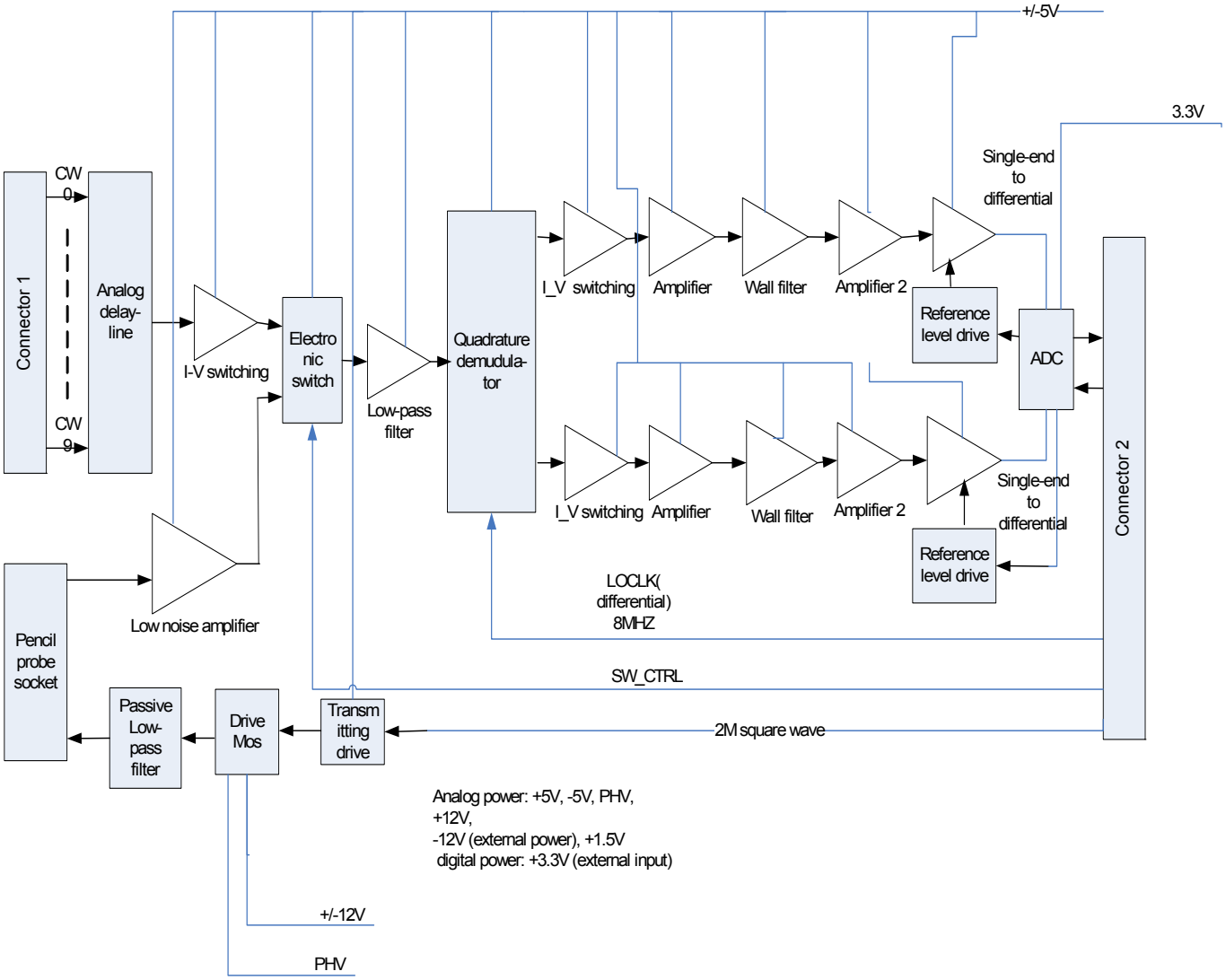


Figure 3-9 Principle Diagram of CW Panel

3.9.1 Functional Modules Introduction

3.9.1.1 Interface Circuit

The interface circuit module consists of analog signal socket (connect 1), digital signal socket (connect 2), power supply filtering circuit and 1.5V transforming circuit, for the detailed definition of pins, please refer to definition of analog and digital signal sockets.

Filtering module is used to filter the power supply that provided by the main control board, and there are indicator lights for +5V and 3.3V power supply, the return circuit of indicator lights is connected in series with current-limiting resistance of 510 Ohm, the diagram is shown as follows:

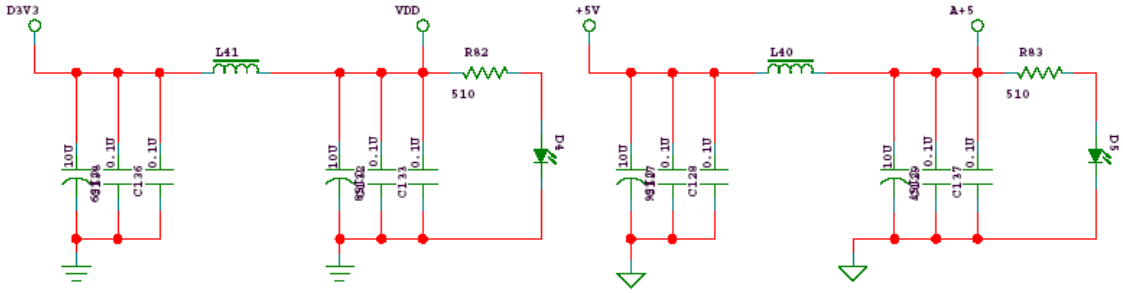
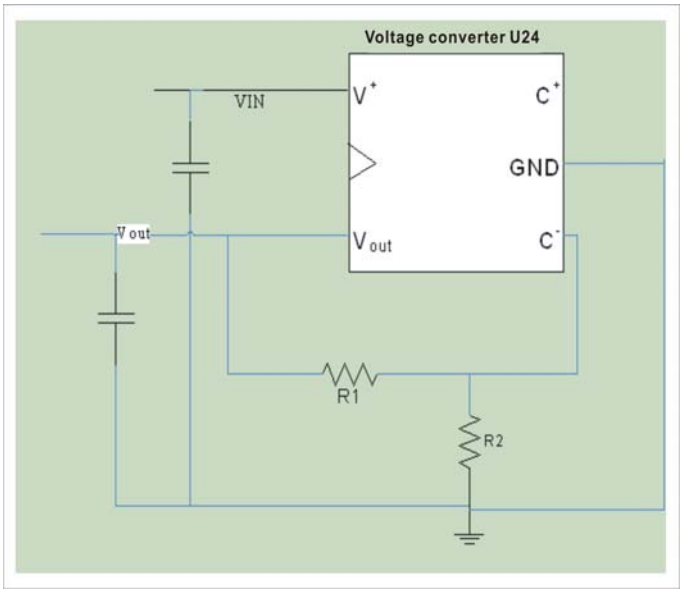


Table 3-10 Diagram of Power Indicator Light

In 1.5V converting circuit, +5V is converted into 1.5V through voltage drop IC, and voltage control is determined by the peripheral sampling resistors according to R1=R2*[（VOUT/0.9）-1].



3.9.1.2 Delay-line Circuit

The main function of delay-line module is to combine CW signal into a current signal after processed by the delay-line. But in order to adapt to the later quadrature demodulation, filtering, amplification and A/D conversion, the current signal should to be transformed into voltage signal. So the delay-line unit consists of two parts: the one is delay-line circuit and the other is I-V conversion circuit.

3.9.1.3 Pencil Probe Unit

Pencil probe unit consists of two parts: transmitting circuit and receiving circuit. Of which, the transmitting circuit is shown as follows:

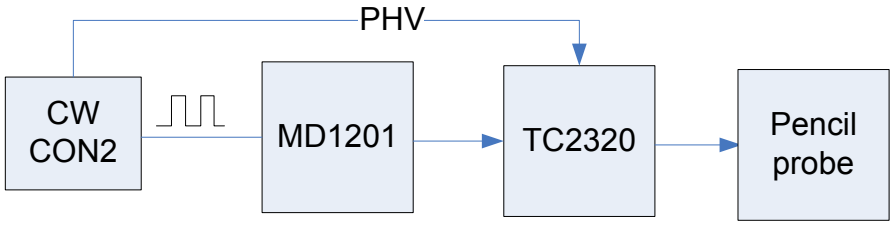


Figure 3-11 Transmitting and Receiving Circuits of Pencil Probe

The function of receiving circuit is to amplify the signal received by the pencil probe, and then send the signal to the front-end filter to share the after filtering demodulation and A/D sampling circuit with the voltage wave output from CW, and before sharing, both signals will be switched by analog switch.

3.9.1.4 Low-pass Filter

Two functions are involved in this unit, the one is to make channel selection for CW voltage wave and signals received by the pencil probe; the other is to filter the signal input from analog switch. In application, channel selection is controlled by signals from the main control board, S1, S2 are connected to CW voltage signal and the signal received by the pencil probe respectively. Controlling signal SW_CTRL is produced by FPGA, at the same time, a pull-down resistance is connected to the pin of analog switch to ensure the default input channel is CW input. For the filter, two active filtering units are involved to make a four–scale low-pass filter. The low-pass filter is applied to filter out the high frequency signals (above 2.5M). The principle diagram is shown as follows:

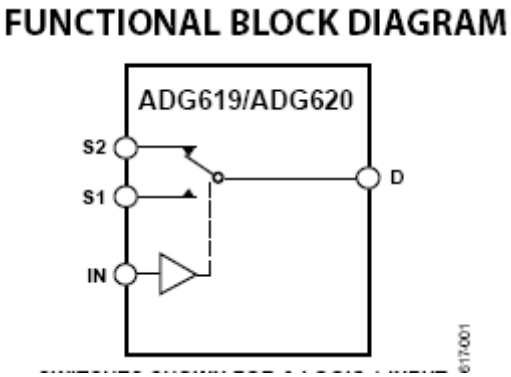


Figure 3-12 Principle Diagram of Analog Switch

The block diagram of low-pass filter unit is shown as follows:

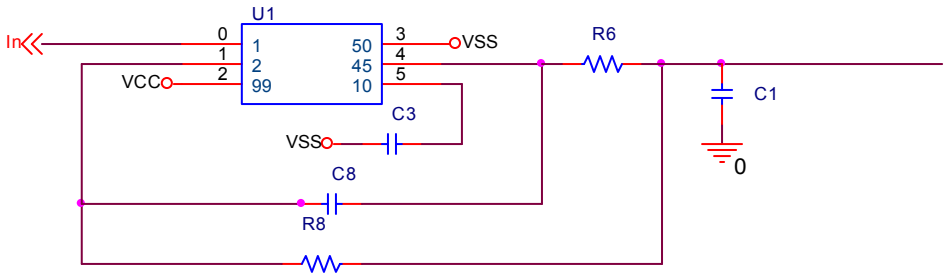


Figure 3-13 Principle Diagram of Low-pass Filter

3.9.1.5 Demodulation Circuit

Quadrature demodulation unit is to convert the analog signal sent from the front filter into I/Q baseband signal by quadrature demodulating, the I/Q baseband signal is to be applied by the sampling unit.

3.9.1.6 Wall Filter Wave Circuit

The I and Q voltage signals have to be processed by low and high pass filter after quadrature demodulation. The main object of high-pass filter in CW Doppler system receiving circuit is to eliminate DC level caused by interference and the low frequency signal resulted from slow movement tissue, then dynamic range of ADC can be fully used. The structure is shown as follows. Low-pass filter of CW receiving circuit acts to filter the wide-range high frequency harmonic wave caused by frequency mixing and to filter the wide-band noise.

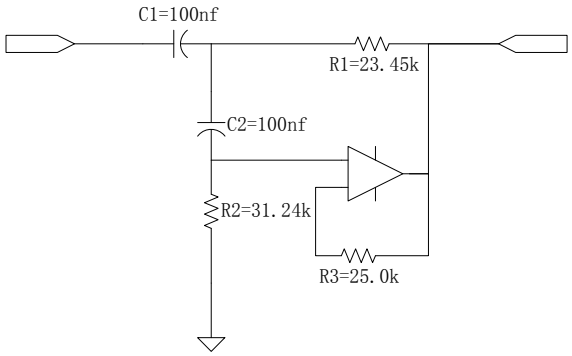


Figure 3-14 Structure of High-pass Filter (Two-scale Bessel)

3.9.1.7 Gain Adjustment Circuit

This unit can be divided into two parts: before the high-pass filter and after the low-pass filter respectively. The current design is to amplify 13dB before the filter, the gain is controlled by a feedback resistance that the gain varies with the resistance. The position of first-order gain circuit is reserved for adjustment of circuit gain mode according to the system requirements in the final period. The current way is to short-circuit 0 Ohm resistance. The purpose to amplify the gain is to adjust I, and Q signal to the full range of A/D converter.

3.9.1.8 A/D Converting Circuit

The I and Q signals, after the gain is adjusted by AD8671, will finally be sampled by A/D converter of high resolution. In ADC, the analog input is differential monopole signal, while

signal output at stage of amplification is single-end signal. So, a single-end to differential circuit is required, and a DC biasing voltage of 2.5V is input into ADC. So a drive circuit of reference level is added to this unit.

3.9.2 Sockets Definition

Sockets between the board and system can be divided into three parts: analog signal socket, digital signal socket and pencil probe port.

3.9.2.1 Analog Signal Socket

Signals at analog signal socket J1 include the input of CW current signal and power input of analog circuit. The definition is shown in Table A-3. For the definition of signal, please refer to Table 3-4.

3.9.2.2 Digital Signal Socket

Signals at digital signal socket J2 include all the digital signals between each board and the main control board, as well as power input digital signal, for the definition, please refer to Table A-4.

3.9.2.3 Pencil Probe Port

The pencil probe port J3 includes the receiving and transmitting sockets of the probe.

Table 3-38 Pencil Probe Port

PIN NUM	SIGNAL
1	PIN
2	PENPRESENT
3	AGND
4	POUT

Table 3-39 Definition of Pencil Probe Port

Name	Description
PIN	Receive
POUT	Transmit
PENPRESENT	Presenting signal

3.9.3 Layout of CW Board

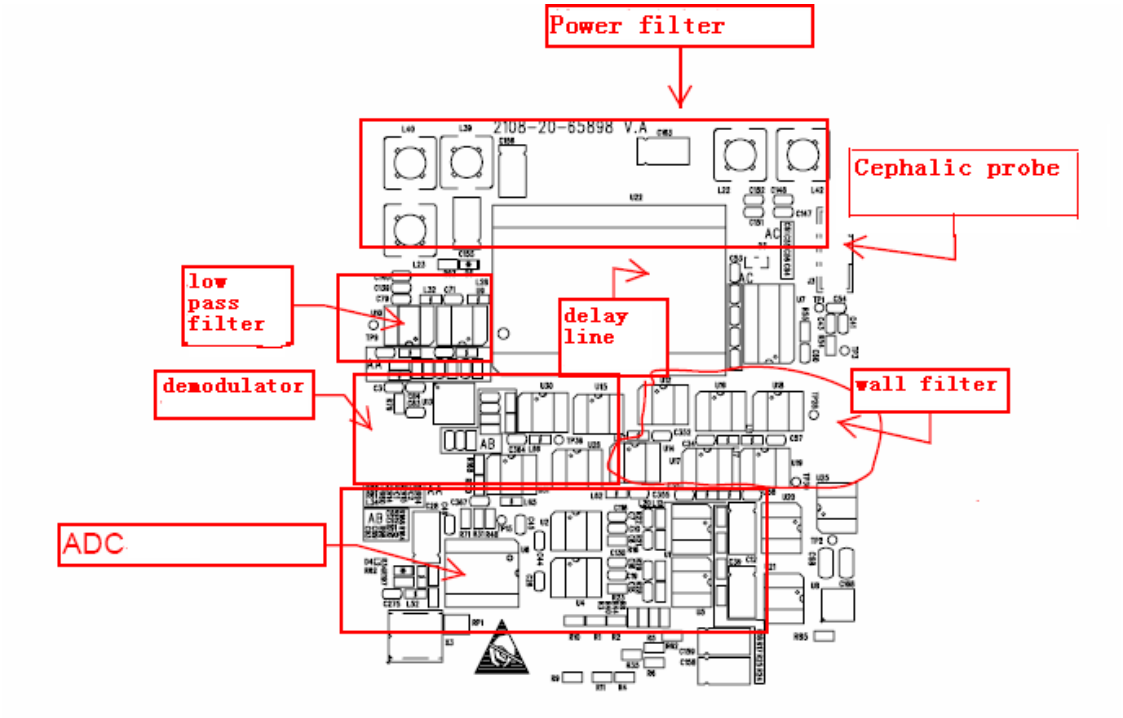


Figure 3-15 Components Layout of CW Front Board

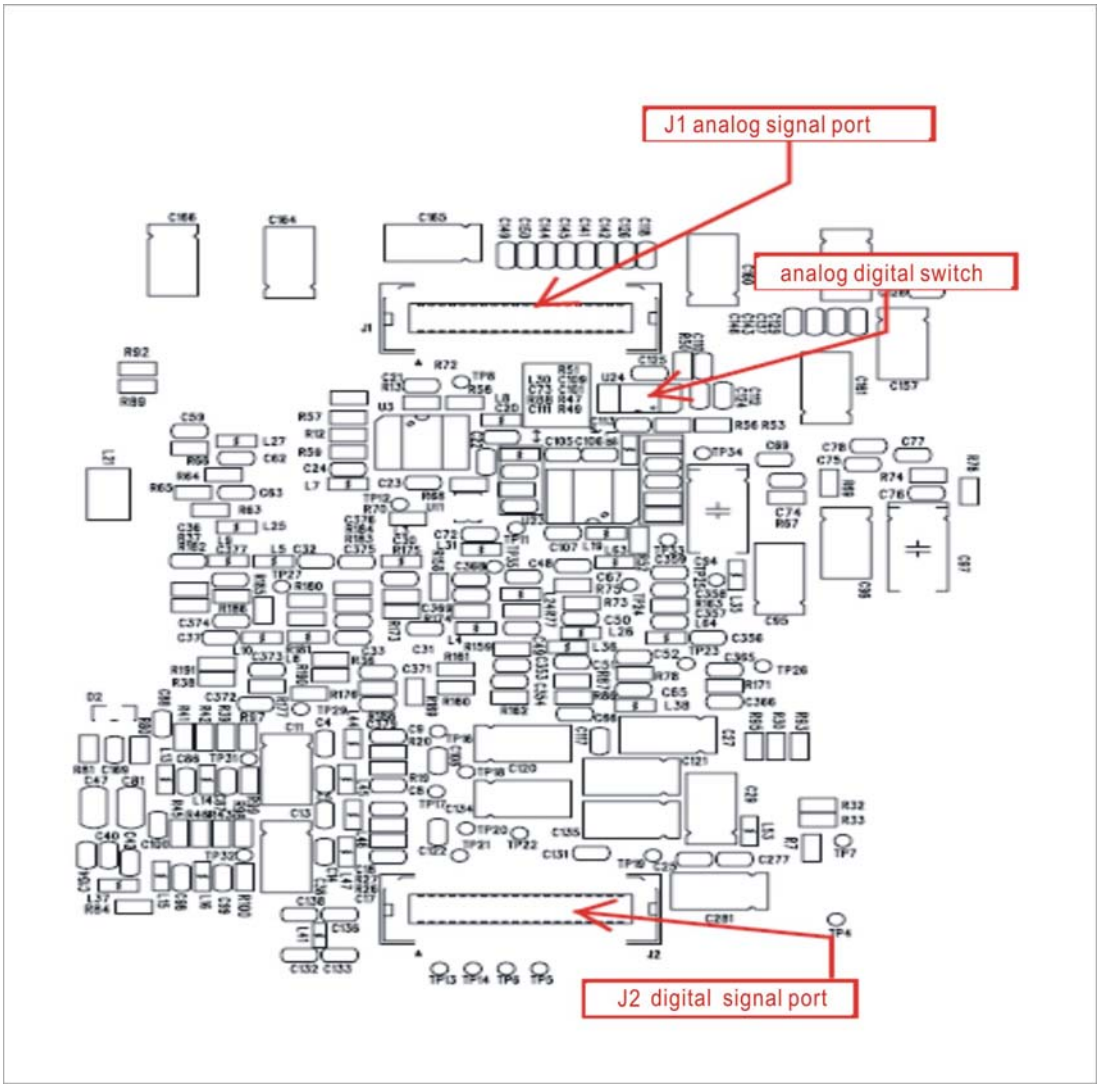


Figure 3-16 Components Layout of the Rear Control Board

3.10 Control Panel

3.10.1 The Buckled Board on the Control Panel

This buckled board is the control center of the whole control panel, it consists of FPGA, SDRAM, SPI Flash, reset circuit and USB control chip; FPGA consists of soft kernel NiosII and other necessary logic circuits, the block diagram of the buckled board is shown as follows:

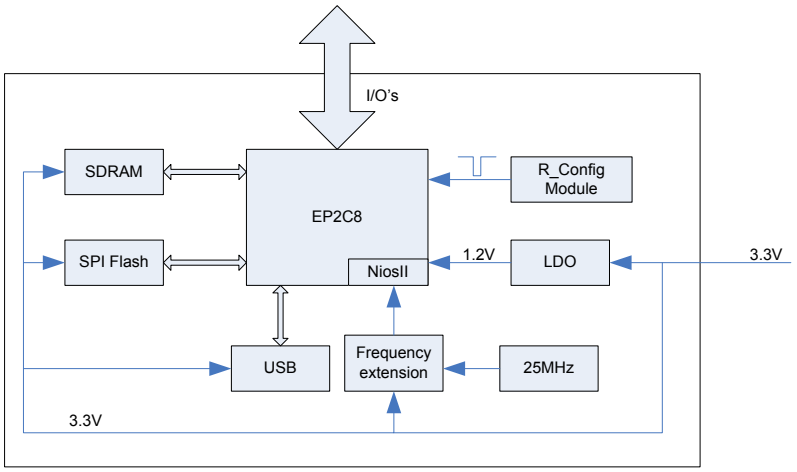


Figure 3-17 Block Diagram of the Buckled Board

After powered by 3.3V and the reset signal output from R_ConFigure Module became effectless, the buckled board will read out data from SPI Flash and allocate FPGA, after the allocation is completed, program Boot Loader saved in FPGA will copy the application program Boot Loader to SDRAM, and the whole board starts to work.

3.10.2 Control Panel

The peripheral components of control panel include encoders, keys, trackball, LED, buzzer, TGCs and so on. The control panel is powered by 5V and 12V external power supply. The encoders and trackball are 5V powered, LEDs and drive circuit are 12V powered, and other circuits are 3.3V powered.

The block diagram of control panel is shown as follows:

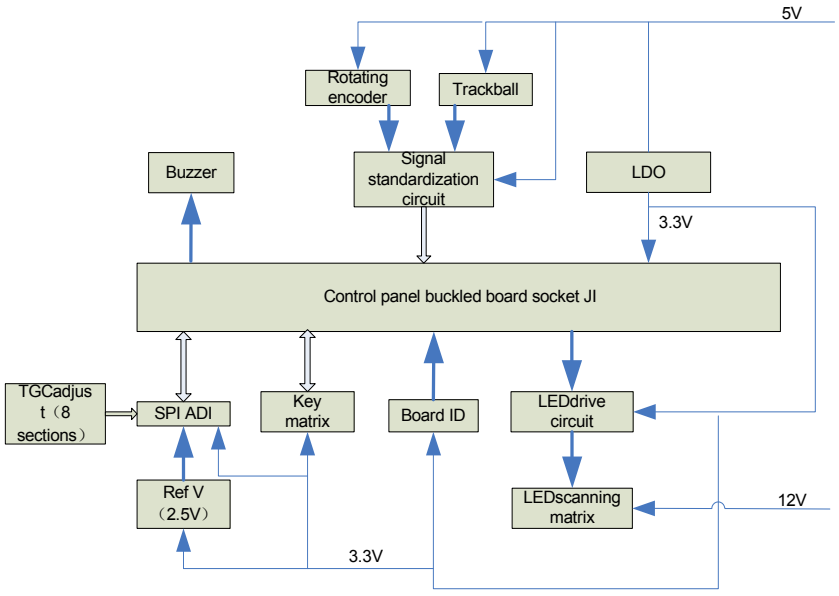


Figure 3-18 Block Diagram of the Control Panel

3.10.2.1 LED Drive Circuit

The LED matrix consists of 4 arrays, the signal in row and signal in array are controlled differently. The principle is show as Table 3-16.

Signals in array are connected to the LED anode, driven by EL7212, when the control signal is of high level (input pin of EL7212), LED anode is connected to 5V power, LED is array enable.

Signals in row are connected to the LED cathode, when 74LS07 outputs low level under the control of FPGA, LED is row enable.

When both the row and array control signals of a LED are enable, this LED will be lightened.

3.10.2.2 Key Scanning Circuit

The key matrix consists of 11 rows and 12 arrays, the signal in row and signal in array are controlled differently. Testing signal will be output from FPGA row by row, when press a certain key, the signal in row will corresponding to a signal in array. The location of the pressed key can be known from the number of row and array.

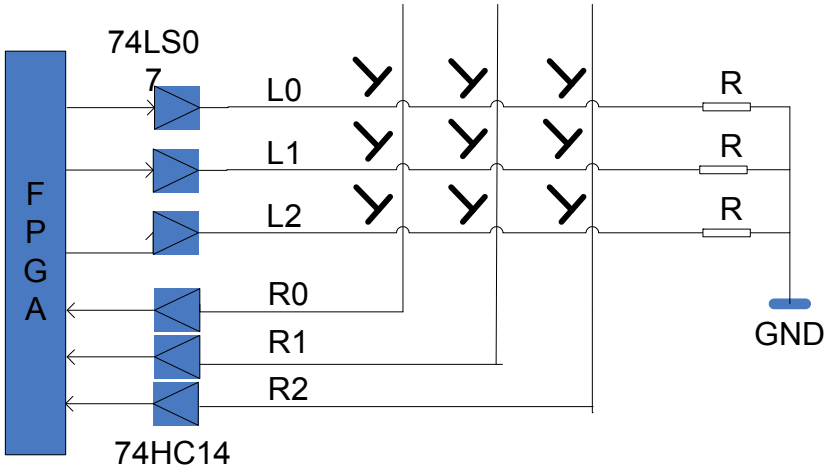


Figure 3-19 Principle Diagram of Key Scanning

3.10.2.3 Socket Definition

Table 3-40 Socket Definition of the Control Panel

Socket number on PCB	Name	Pin definition			Remarks
		No.	Pin name	Specification	
J2, J6, J9	Single-encoder socket	1	GND	Signal grounding	
		2	EDA	Encoder signal A	
		3	KLx	Key scanning signal in row	
		4	LRy	Key scanning signal in array	
		5	VCC	5V power supply	

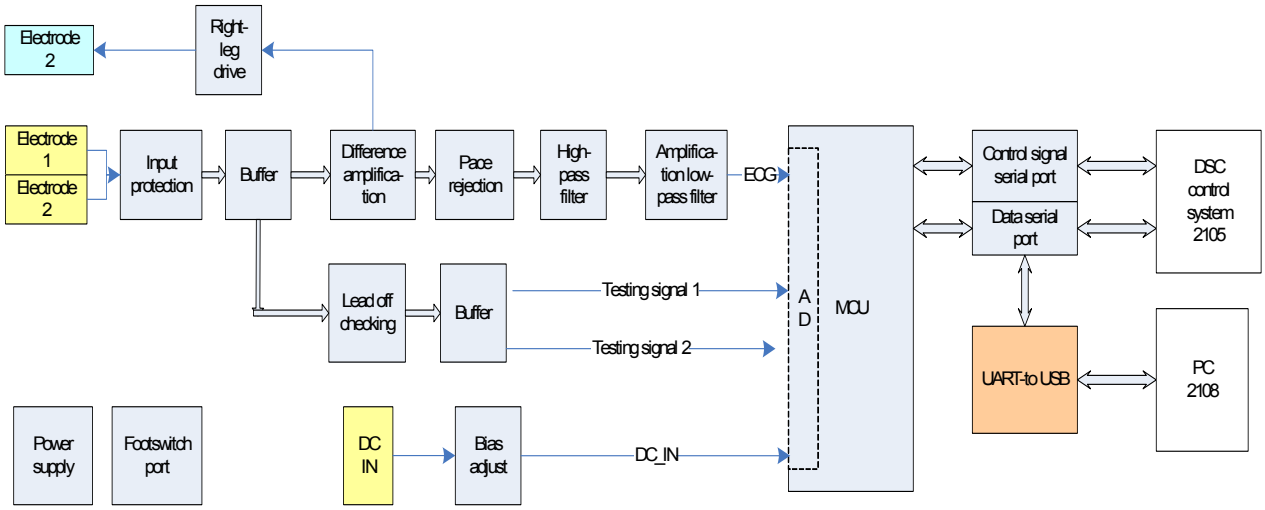
		6	EDB	Encoder signal B	
J3	Power supply socket	1	VCC	5V power supply	
		2	GND	System grounding	
		3	GND	System grounding	
		4	GND	System grounding	
		5	VPP	12V power supply	
		6	VPP	12V power supply	
J7	Power supply socket	1	DP	USB-DP signal	
		2	DN	USB-DN signal	
		3	GND	System grounding	
		4	HD_Status	Signal of HDD status indicator light	
		5	Break_Status	Break	
J5	Multi-encoder socket	1	ED1A	Encoder 1 signal A	
		2	ED1B	Encoder 1 signal B	
		3	ED2A	Encoder 2 signal A	
		4	ED2B	Encoder 2 signal B	
		5	ED3A	Encoder 3 signal A	
		6	ED3B	Encoder 3 signal B	
		7	ED4A	Encoder 4 signal A	
		8	ED4B	Encoder 4 signal B	
		9	ED5A	Encoder 5 signal A	
		10	ED5B	Encoder 5 signal B	
		11	ED6A	Encoder 6 signal A	
		12	ED6B	Encoder 6 signal B	
		13	KR9	Key scanning signal in array 9	
		14	KL8	Key scanning signal in row 8	
		15	KR10	Key scanning signal in array 10	
		16	KL9	Key scanning signal in row 9	
		17	KR11	Key scanning signal in array 11	
		18	NC	Not connected	
		19	VCC	5V power supply	
		20	GND	System grounding	

3.11 ECG Module (optional)

3.11.1 Principle and Functions

The function of the ECG board contains: ECG signal detection; ECG waveform display; ultrasound image reference signal; real-time 2-D image and color flow image synchronous signal.

The electrocardiosignal, after been amplified, filtered, and sampled, will be uploaded to the PC for R-wave testing, the tested cardioelectrical trigger signal will be uploaded to PC through USB port. Block diagram is shown as follows:



3.11.2 Outlet Definition

Table 3-41 Socket Definition of ECG Module

Socket number on PCB	Name	Pin definition			Remarks
		No.	Pin name	Specification	
J1	DC_IN socket	1	FGND	ECG module floating ground	
		2	FGND	ECG module floating ground	
		3	DC_IN	DC IN input	
		4	DC_IN	DC IN input	
		5	FGND	ECG module floating ground	
		6	FGND	ECG module floating ground	
J2	Lead cable socket	1	Lead_F_IN	Lead cable, Green	
		2	Lead_R_IN	Lead cable Red	

		3	Lead_N_DR	Lead cable, Black (Fixed to the right leg)	
		4	NC	Not connected	
		5	C_SHIELD	Cable shielding level drive	
		6	NC	Not connected	
J3	Main system socket	1	GND	Earth terminal of main system	
		2	+12V	Power supply of the main system	
		3	GND	Earth terminal of main system	
		4	+12V	Power supply of the main system	
		5	ECG_CTRLT	Serial control transmitting	
		6	+12V	Power supply of the main system	
		7	ECG_CTRLR	Serial control receiving	
		8	GND	Earth terminal of main system	
		9	GND	Earth terminal of main system	
		10	GND	Earth terminal of main system	
		11	ECG_DATAT	Serial data transmitting	
		12	GND	Earth terminal of main system	
		13	ECG_DATAR	Serial data receiving	
		14	GND	Earth terminal of main system	
		15	GND	Earth terminal of main system	
		16	GND	Earth terminal of main system	
		17	ROW	Common input terminal of footswitch	
		18	GND	Earth terminal of main system	
		19	LINE1	Input of switch cable 1	
		20	LINE2	Input of switch cable 2	
J4	USB port	1	VBUS	5V input	
		2	DM	Differential signal DM	
		3	DP	Differential signal DP	
		4，5，6	GND	Earth terminal of main system	
J5	Footswitch socket	1	ROW	Common input terminal of footswitch	
		2	LINE1	Input of footswitch cable 1	
		3	LINE2	Input of footswitch cable 2	
		4	NC	Not connected	

J6	JTAG debugging socket	1	VCC	3.3V	Applied in Debugging
		2	GND	ECG module floating ground	
		3	TRST	JTAG——TRST signal	
		4	TCK	JTAG——TCK signal	
		5	TDI	JTAG——TDI signal	
		6	TDO	JTAG——TDO signal	
		7	TMS	JTAG——TMS singal	
		8	RTCK	JTAG——RTCK signal	
		9	NRST	JTAG——NRST signal	
		10	NC	Not connected	
J7	ARM BOOT socket	1	/	To pin LPC213X P0.14	Applied in repairing
		2	GND	ECG module floating ground	
J8	USB port	1	VBUS	5V VBUS signal	
		2	USB-		
		3	USB+	JTAG——TRST signal	
		4	TCK	JTAG——TCK signal	

3.11.3 Plug-in Diagram and Components

The blue broken line means electrical insulation, the right part is power supply input and communication ports, and the left part is electro cardia signal processing circuit.

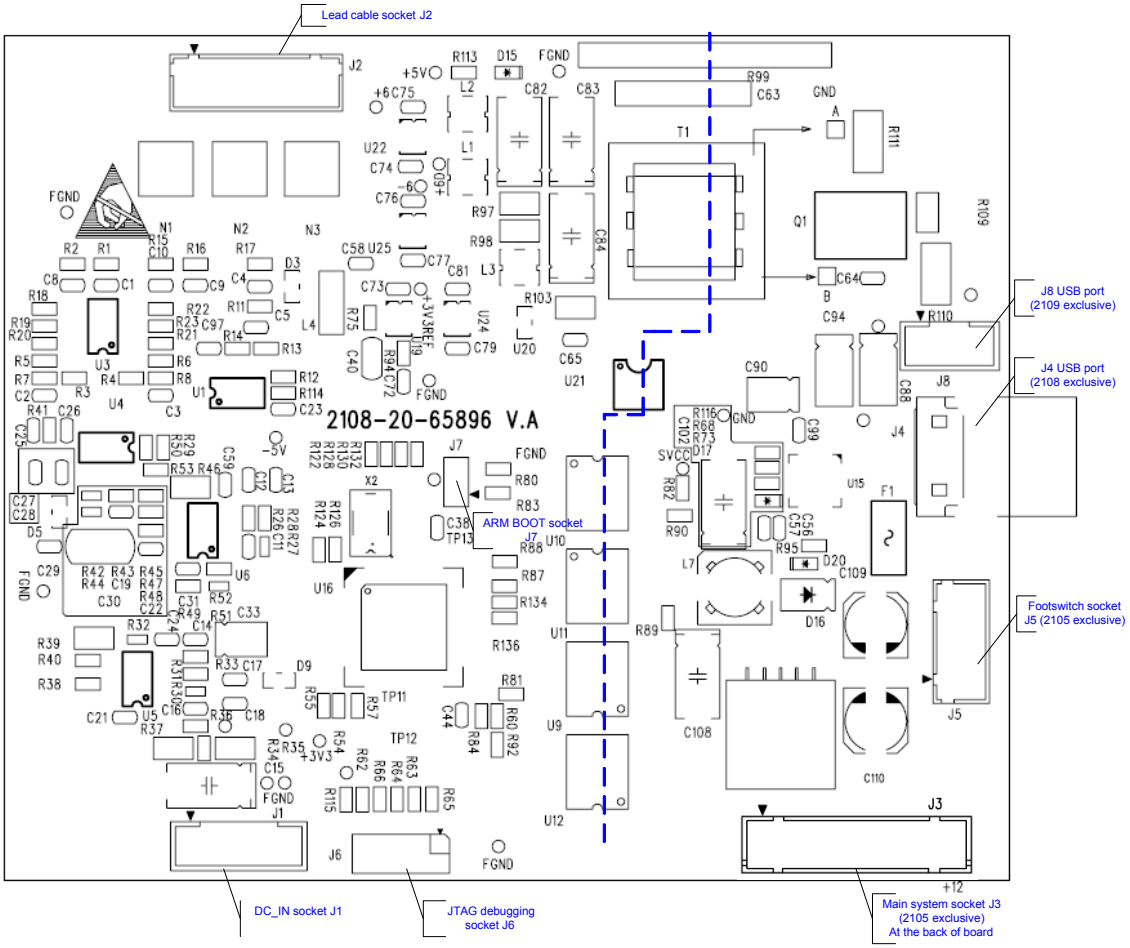


Figure 3-20 ECG Plug-in Diagram and Components Layout

3.12 4D Power Supply Board

3.12.1 Principle of 4D Power Supply Board

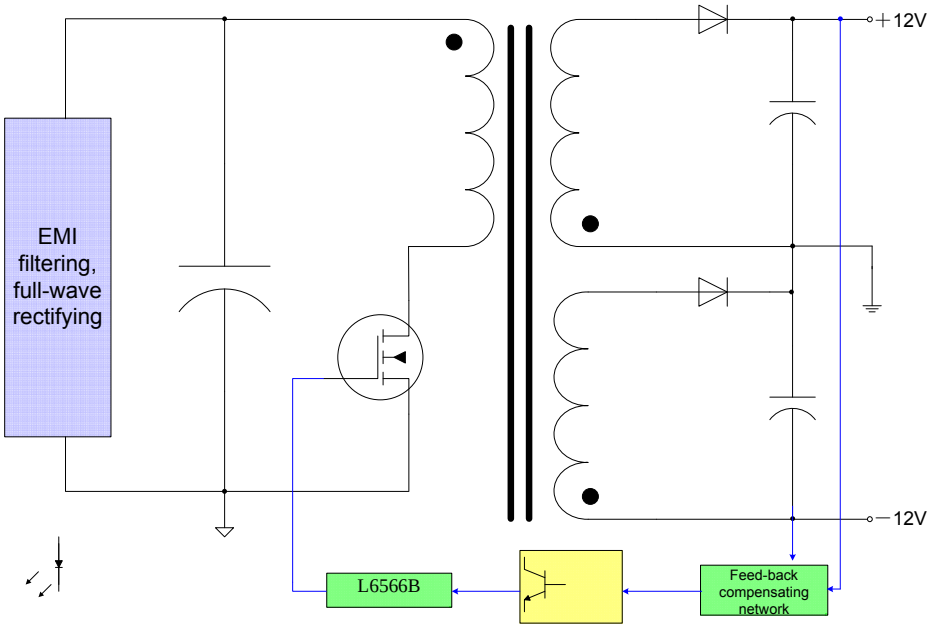


Figure 3-21 Block Diagram of 4D&TEE Power Supply Board

±12V AC/DC circuit with the character of overcurrent protection adopts quasi resonant flyback converter controlled by L6566B and it is controlled by current mode. The circuit estimates the situation of core reset by checking the voltage of assistant winding to implement quasi resonant cut-over and decrease cut-over loss, at the same time, sending the voltage information of auxiliary winding to internal comparator and implementing overvoltage protection function.

Two secondary windings respectively generate +12V and -12V and both of two outputs participate in feedback adjustment.

3.12.2 Interface Definition of 4D Power Board

Table 3-42 Interface Definition of 4D Power Board

No.	Name	Description	Function &Model of Connector
J1-1	L line	NC means J1-2 are blank	As the AC input interface of 4D&TEE power board, the model is M32-032005-00, HEADER WTB 3.96mm DIP1*3 SIDE VHseries
J1-2	NC		
J1-3	N line		
J2-1	GND	Secondary ground of power board	As the output interface of 4D&TEE power board and drive board, the model is M32-049003-00, HEADER
J2-2	+12V	+12V output	

J2-3	GND	Secondary ground of power board	WTB 4.2mm DIP2*2SIDE
J2-4	-12V	-12V output	

3.13 4D &TEE Drive Board

3.13.1 Basic Principle of 4D &TEE Drive Board

4D &TEE drive board mainly implements two relative independent functions:

Power amplification for drive signal of 4D probe;

Amplification for temperature signal and angle signal of TEE probe and supply of AD acquisition channel.

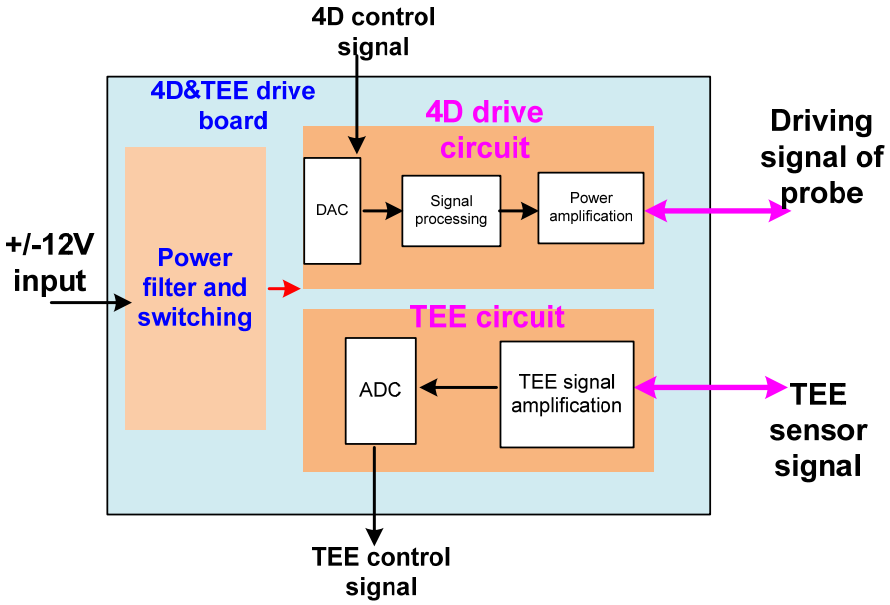


Figure 3-22 Principle Block Diagram of 4D &TEE Drive Board

4D driving signal is divided to A and B two channels via DAC. When the signal drives 4D probe works normally, the phase difference of two signals is 90°. The relation of phrase advance decides the swing direction of probe.

TEE circuit includes amplifications for two signals: temperature signal and angle signal, finally inputting them to ADC.

3.13.2 Interface Definition of 4D &TEE Drive Board

The interface socket between 4D &TEE drive board and power is J1. The interface definition is shown as below.

Table 3-43 Interface Definition between 4D &TEE Drive Board and Power

No.	Signal	No.	Signal

1	+12V	2	GND
3	-12V	4	GND

The interface socket between 4D &TEE drive board and 4D/TEE is J2. The interface definition is shown as below.

Table 3-44 Interface Definition between 4D &TEE Drive Board and 4D/TEE

No.	Signal	No.	Signal
1	GND	2	GND
3	+5V	4	+3.3V
5	GND	6	GND
7	RES	8	HALL
9	SPI_CLK	10	SPI_DAT
11	SPI_SYNC	12	FD_ID
13	GND	14	GND
15	AD_SCLK	16	AD_DIN
17	AD_DOUT	18	AD_NCS
19	GND	20	GND

The interface socket between 4D &TEE drive board and probe connection board is J3. The interface definition is shown as below.

Table 3-45 Interface Definition between 4D &TEE Drive Board and Probe Connection Board

PIN No.	Name	PIN No.	Name
1	PHASE_A_POS	2	PHASE_A_POS
3	PHASE_A_NEG	4	PHASE_A_NEG
5	PHASE_B_POS	6	PHASE_B_POS
7	PHASE_B_NEG	8	PHASE_B_NEG
9	NC	10	NC
11	AGND	12	NC
13	T+_TEE	14	T-_TEE
15	AGND	16	HALL_4D
17	+5V_4D	18	ANGLE_TEE
19	NC	20	NC

NOTE: Twin twist the positive and negative driving wires of electric machine with the current design of 2A virtual value.

Table 3-46 Signal Definition of Interface

No.	Name	Signal transmission form	Description
1	+5V	Power input	5V power supply
2	+3.3V	Power input	3.3V power supply
3	GND	Ground	Ground
4	HALL	Output	Reset signal of probe origin
5	P_E	Input	Reserved power enable end
6	SPI_CLK	Input	DAC serial clock input of 4D drive circuit
7	SPI_DAT	Input	DAC serial data input of 4D drive circuit
8	SPI_SYNC	Input	DAC serial sync signal input of 4D drive circuit
9	FD_ID	Inout	4D&TEE drive board ID，1-wire device
10	AD_SCLK	Input	ADC serial clock input of TEE circuit
11	AD_DIN	Input	ADC serial data input of TEE circuit
12	AD_DOUT	Output	ADC serial data output of TEE circuit
13	AD_NCS	Input	ADC chip select signal of TEE circuit
14	PHASE_A_POS	Current signal	Phase A positive end of probe drive signal
15	PHASE_A_NEG	Current signal	Phase A negative end of probe drive signal
16	PHASE_B_POS	Current signal	Phase B positive end of probe drive signal
17	PHASE_B_NEG	Current signal	Phase B negative end of probe driving signal
18	AGND	TEE angle ground	TEE probe angle ground
19	T+_TEE	Analog signal	Positive end of TEE probe temperature signal
20	T-_TEE	Analog signal	Negative end of TEE probe temperature signal
21	+5V_4D	Reserved 5V output	Reserved 5V output to probe board
22	HALL_4D	Input	Reset signal of probe origin
23	ANGLE_TEE	Analog signal	TEE probe angle signal

NOTE: Signal transmission is based on 4D &TEE drive board, and input means input for drive board.

3.14 4D Converting Board

3.14.1 Principle Block Diagram & Principle Description

4D/TEE converting board is only used for 4D control signal converting, the principle block diagram is shown as below:

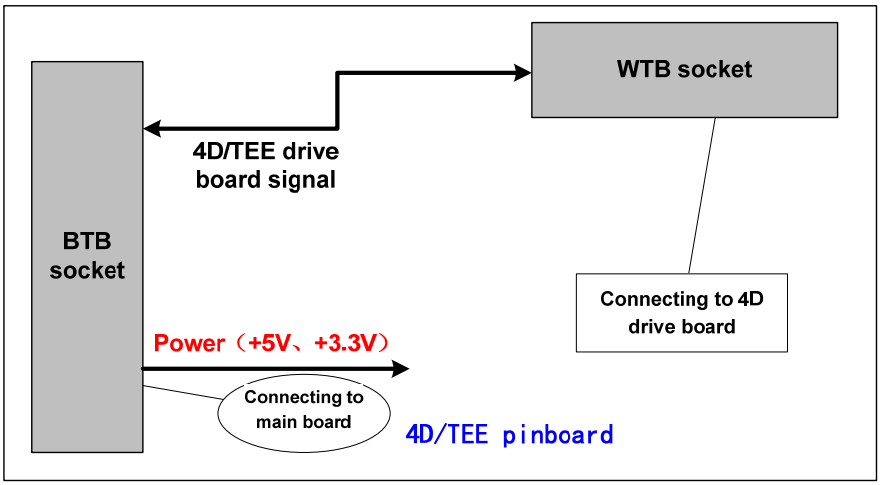


Figure 3-23 Principle Block Diagram of 4D/TEE Converting Board

3.14.2 Socket Definition

Table 3-47 Interface Definition between 4D/TEE Converting Board and Master Board

No.	Name	No.	Name
1	NC	2	NC
3	NC	4	NC
5	NC	6	NC
7	GND	8	GND
9	GND	10	NC
11	NC	12	NC
13	GND	14	GND
15	+5V	16	+5V
17	+5V	18	+5V
19	GND	20	GND
21	GND	22	GND
23	+3.3V	24	+3.3V
25	GND	26	GND
27	FD_ON	28	HALL
29	SPI_CLK	30	SPI_DAT
31	SPI_SYNC	32	FD_ID
33	GND	34	GND
35	AD_SCLK	36	AD_DIN
37	AD_DOUT	38	AD_NCS
39	GND	40	GND

Table 3-48 Interface Signal Description between 4D/TEE Converting Board and Master Board

Name	Description
FD_ON	4D drive board on-site signal
HALL	HALL feedback signal
SPI_CLK	SPI clock signal
SPI_DAT	SPI data signal
SPI_SYNC	Sync signal
FD_ID	4D board ID
AD_DIN	AD SPI data input end
AD_DOUT	AD SPI data output end
AD_SCLK	AD SPI clock
AD_NCS	AD SPI chip select

Table 3-49 Interface Definition between 4D/TEE Converting Board and 4D Drive Module

No.	Name	No.	Name
1	FD_ON	2	GND
3	FD_ID	4	GND
5	SPI_SYNC	6	GND
7	SPI_CLK	8	GND
9	SPI_DAT	10	GND
11	AD_NCS	12	GND
13	AD_DIN	14	GND
15	AD_SCLK	16	GND
17	AD_DOUT	18	GND
19	HALL	20	GND

3.15 USB-to-IDE Port Board

The structure of USB-to-IDE port board is shown as Table 3-19. The kernel is GL811S, which supports protocols USB2.0 and ATA/ATAPI-6 1.0; it will convert IDE port to USB port.

The chip is connected to 12MHz crystal X1, the power supply voltage of the chip is 3.3V, and it is powered by the VBUS of USB. LDO (U2) on the board will convert 5V voltage into 3.3V.

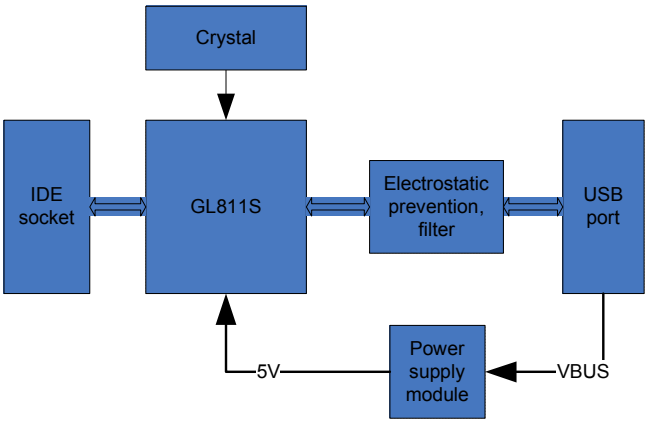


Figure 3-24 Block Diagram of USB-to-IDE Module

3.15.1 Socket Definition

Table 3-50 Socket Definition of USB-to-IDE

Socket number on PCB	Name	Pin definition			Remarks
		Pin No.	Pin name	Specification	
J1	IDE port	1	RESET	IDE device reset signal	
		3～18	DD0~DD15	IDE device data cable（16 bit）	
		2,19,22,24,26,28,30,40	GND	Earth grounding	
		20	NC	Free	
		21	DMARQ	DMARQ signal	
		23	DIOW	DIOW signal	
		25	DIOR	DIOR signal	
		27	IORDY	IORDY signal	
		29	DMACK	DMACK signal	
		31	INTRQ	INTRQ signal	
		32	OBSOLETE	Pull-down 5V	
		33	DA1	DA1 signal	
		34	CBLID/PDIAG	NC	
		35	DA0	DA0 signal	
		36	DA2	DA2 signal	
		37	CS0	CS0 signal	
		38	CS1	CS1 signal	
		39	DASP	Communication indicator light	
J2	USB	1，2	VBUS	5V	

	port	3	DM	USB signal DM	
		4	DP	USB signal DP	
		5，6	GND	System grounding	

3.16 Power Supply System

3.16.1 Basic Functions of Power Supply System

The power supply system, which powers the whole system, consists of power supply connecting board, isolating transformer, adapter, the power supply master board and auxiliary board and 4D&TEE power board. The layout of each part is shown in Figure 3-25. In Figure 8-7, the input power supply is mains supply, the different connections of primary and secondary windings are changed by the voltage-controlled switch, so the AC input voltage can be changed in different countries. There are four AC power outputs on the power supply connecting board, of which, three are for the external devices and one for adapter and 4D&TEE power board. The adapter output is connected to the power supply master board and auxiliary board via system master board, the DC outputs provided to the main machine by the two power supply boards are listed as follows:

Table 3-51 DC Output of Power Supply System

No.	Output	Board	Remarks
1	+12V	Master	Controlled by power_on signal
2	5Vstb	Master	Keep output
3	5Vstb_CPU	Master	Controlled by 5Vstb_CPU_EN signal
4	+5V	Master	Controlled by power_on signal
5	+3.3V	Master	Controlled by power_on signal
6	THV	Master	Controlled by power_on signal
7	+2.5V	Auxiliary	Controlled by power_on signal
8	+1.2V	Auxiliary	Controlled by power_on signal
9	-5V	Auxiliary	Controlled by power_on signal
10	-12V	Auxiliary	Controlled by power_on signal

4D&TEE power supply board mainly provides ±12V power for 4D&TEE drive board. The positive and negative rated load is 2A. As long as switching on the system, the power board is at work.

3.16.2 Basic Principle of Power Supply System

There are four AC power outputs on the power supply connection board, of which, three are for the external devices and one for adapter and 4D&TEE power board, the +12V output is input to the DC bus of the power supply master board and the auxiliary board. 4D&TEE power board mainly provides 4D&TEE drive board with ±12V power supply.

The system master board and power supply master board are connected through a 64-pin socket, signal is defined as Table A-9. In Table 3-20, the inputs of related signals on the system master board and power supply to the power supply master board is finished through the 64-pin socket. The power supply master board and auxiliary board output +12V, +5V, 5Vstb, 5Vstb-cpu, +3.3V, THV; the two boards are connected through 26-pin socket (signal definition is shown as Table 3-52). The Vbus+, +5v, EDC_Power signals that input to the power supply master board are transformed into -12V, -5V, +2.5V, and +1.2V outputs by the auxiliary board, the four outputs are returned to the power supply master board through 26-pin socket, and then be output to each electro-terminal on the system master board through 64-pin socket.

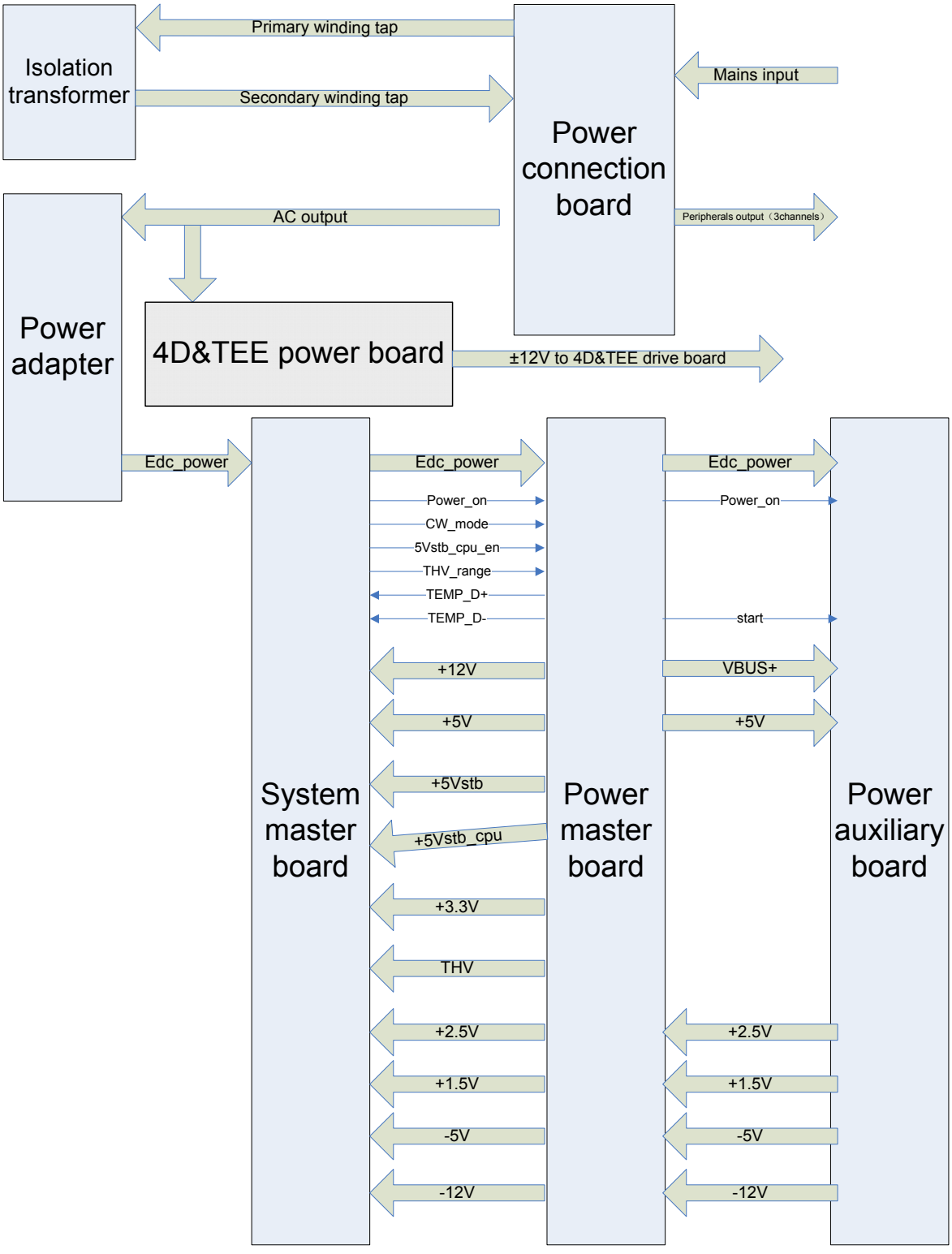


Figure 3-26 Block Diagram of Power Supply System

Table 3-52 Definition of Signals between the Power Supply Master Board and Auxiliary Board

No.	Name	No.	Name

1	GND	2	-5.3V
3	Scan_status	4	-12V
5	Power_on	6	+2.5V
7	B_Battery_NTC	8	+2.5V
9	A_Battery_NTC	10	GND
11	GND	12	GND
13	B_Battery+	14	1.5V_feedback
15	A_Battery+	16	+1.5V
17	Edc_power	18	+1.5V
19	GND	20	GND
21	GND	22	GND
23	Vbus+	24	+5VL
25	GND	26	Start

3.16.2.1 5vstb Circuit

The Edc_power output from the adapter is the input of 5vstb circuit, 5vstb is gained after linear regular voltage chip MIC5202-5.0YMS.

MIC5202-5.0YMS integrated over-current and over-temperature protection functions internally.

3.16.2.2 +12V Circuit

Voltage rise-and-fall IC LTC3780EG#PBF of Linear Company is applied in +12V circuit, whether the input voltage is higher or lower than 12V, the output voltage will keep at 12V.

Both +12V over-current and over-voltage protection will not be locked, the over-current point is 6.5A～9.5A, and the output voltage is resumed to normal after over-current disappeared.

3.16.2.3 +5V and +3.3V Circuit

Both +5V and +3.3V are provided by LTM4600 of Linear Company, the chip is of voltage drop synchronous, integrates two MOSs and power inductor.

LTM4600 integrated over-current protection function internally.

3.16.2.4 THV Circuit

THV consists of a step-down circuit and step-up circuit, with the output voltage of the step-down circuit is 5～10V (the voltage is controlled by THV_range, 0V is corresponding to 5V of THV, and 4V to 10V of THV), and output voltage of the step-up circuit is 20～140V (the voltage is controlled by THV_range, 0V is corresponding to 20V of THV, and 4V to 140V of THV), the step-down circuit keeps working all the time; the step-up circuit is controlled by cw_mode, it works only when the cw_mode is of low level.

The model of step-down circuit control chip u10 is TPS54350, it integrates a MOS.

The model of step-up circuit IC U2 is the commonly used TL594CDR2G, there is PMOS U6 between the input of step-up circuit and +12V.

There is no over-voltage protection in step-down circuit, while such function exists in the step-up circuit (20V～140V), the over-voltage is about 170V, the voltage keeps at about 170V without been locked.

There is over-current protection in both step-up and step-down circuits, over-current appears in any circuit will stop the work of both circuits and lock the circuit.

3.16.2.5 +2.5V and +1.5V Circuit

Both +2.5V and +1.5V are provided by the commonly used synchronous rectifying voltage drop IC EL7566, it is a chip of high reliability with few malfunction appeared in the products.

EL7566 integrated over-current protection function internally, it will not be locked in case of over-current, and it will resume to normal status after over-current disappeared.

3.16.2.6 -5V and -12V Circuit

Both -5V and -12V are provided by the commonly used IC Max1847 that applied to generate negative voltage. Both circuits have over-current and over-voltage protection that both outputs will be stopped in case of over-voltage and over-current in any circuit, and the circuits will be locked.

3.17 System Power Supply Distribution

The power supply distribution is shown as follows:

Table 3-53 Power Supply Distribution

No.	Power supply	Loads
1	+5VSTB	Power supply management CPLD, crystal, 244 chip and so on.
2	+12V	CPU module, audio operational amplifier, transmitting board, CW board, keyboard board, CD-ROM driver, fan
3	+5VSTB_CPU	CPU module
4	-5V	High voltage insulation, CW panel
5	-12V	CW panel
6	+5V	CW panel, high voltage isolating, beamformer FPGA, hard disk, key board, CD-ROM-driver, audio encode and decode chip, electrostatic prevention chip, parallel port drive, gain and remote control high voltage control DA, probe module, video collection
7	+2.5V	DDR, FPGA
8	+1.5V	FPGA
9	+3.3V	FPGA, channel selection control CPLD, ADC, transmitting board, VCA, audio encode and decode chip, 2245 chip, clock drive chip, crystal, system reset chip, FPGA configure FLASH, video encoder, video amplifier, SSRAM, USB HUB
10	PHV	Transmitting board, CW board

3.18 LCD

3.18.1 Inverter

3.18.1.1 Block Diagram and Principle Diagram

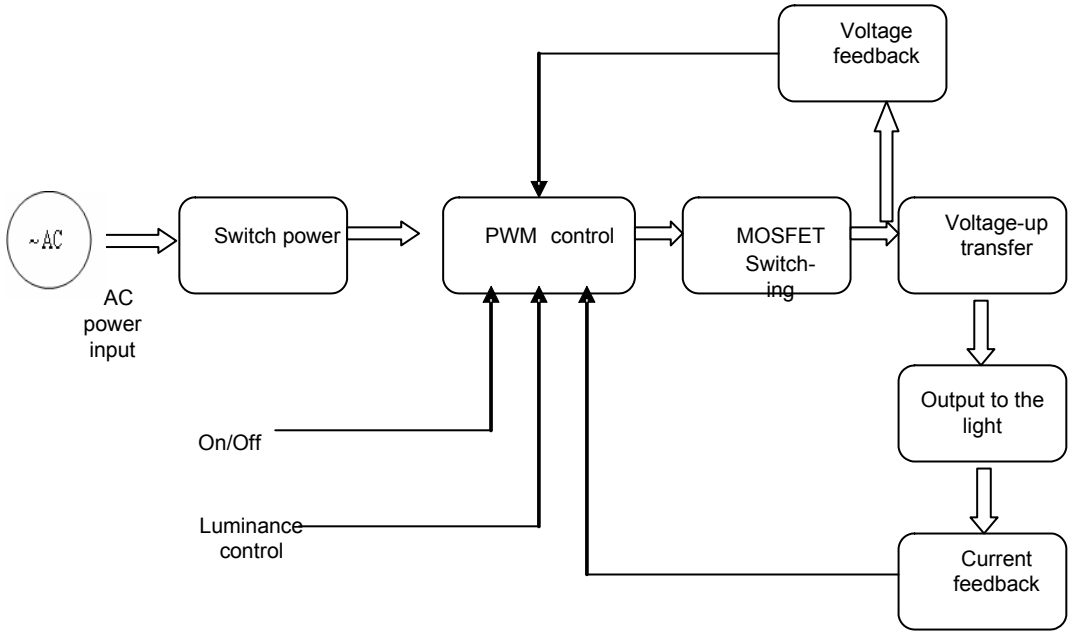


Figure 3-27 Block Diagram of LCD Inverter

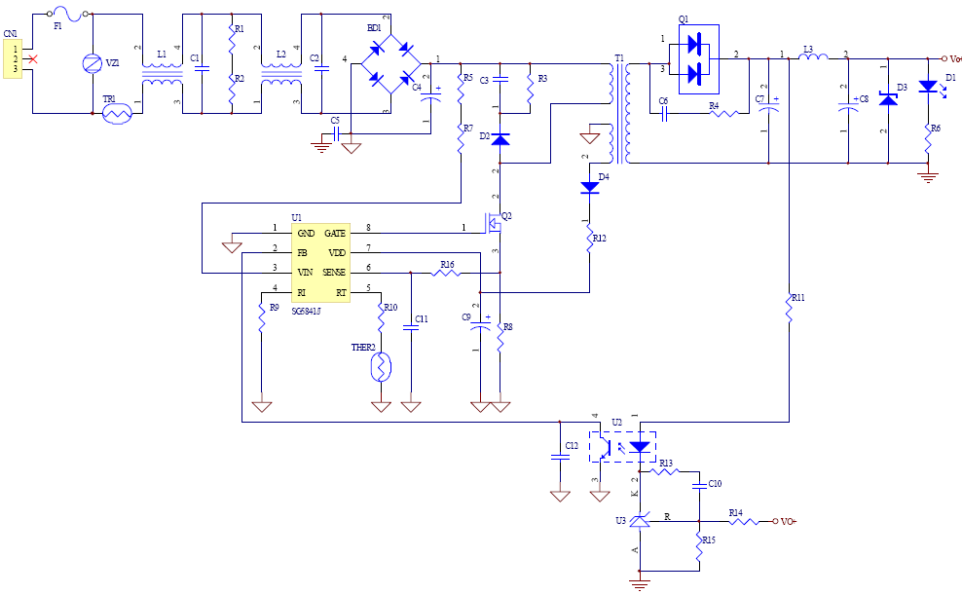


Figure 3-28 Principle Diagram of LCD Inverter Power Supply

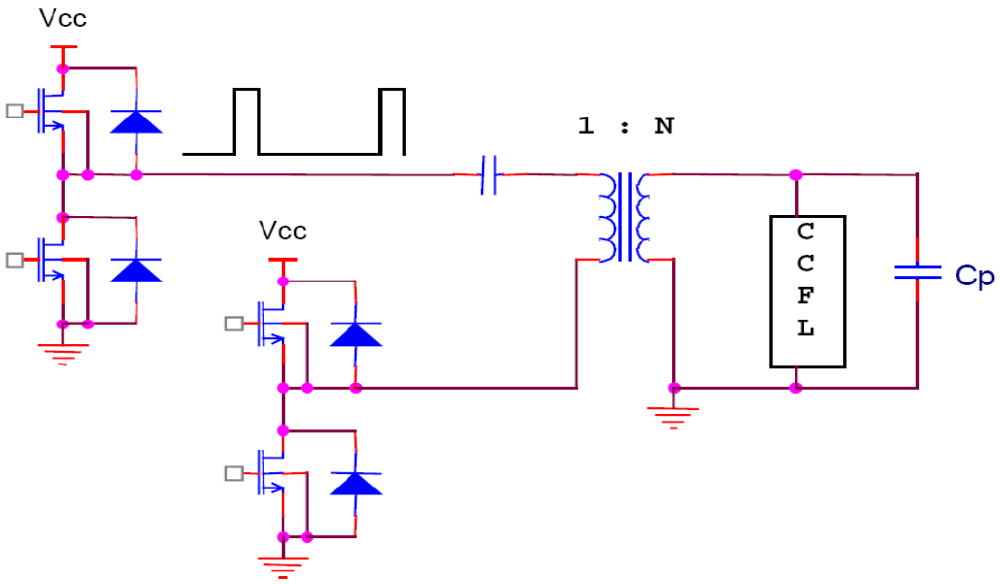


Figure 3-29 Principle Diagram of LCD Inverter

3.18.1.2 Working Principle

Both power supply and inverter are integrated on the power supply board, the power supply, which provides 12V and 5V power to the inverter and AD board, adopts power switch circuit with wide voltage range. The inverter works in full bridge mode that 4 MOSFETs are connected into a bridge, the work status (close/ open) is driven by the main IC, and AC voltage is imposed on the primary winding of the transformer. The secondary square wave of the transformer, after LC resonance, is changed into sine wave to drive the CCFL gives out light. The light is controlled by the switch signal (the signal will control the enable pin of the main IC), the brightness of the light is controlled by the brightness signal, which will control the duty cycle of square wave of main IC.

The power supply board consists of open circuit, over-voltage and over-current protection circuit. For example, when open circuit happened to any of the light, the open circuit protection circuit will act; when the current is too high, the feedback signal from the light to main IC will limit the duty ratio of the square wave to decrease the current for circuit protection; when the output voltage is too high, the feedback signal from the light to main IC will turn off PWM drive.

3.18.1.3 Sockets Definition

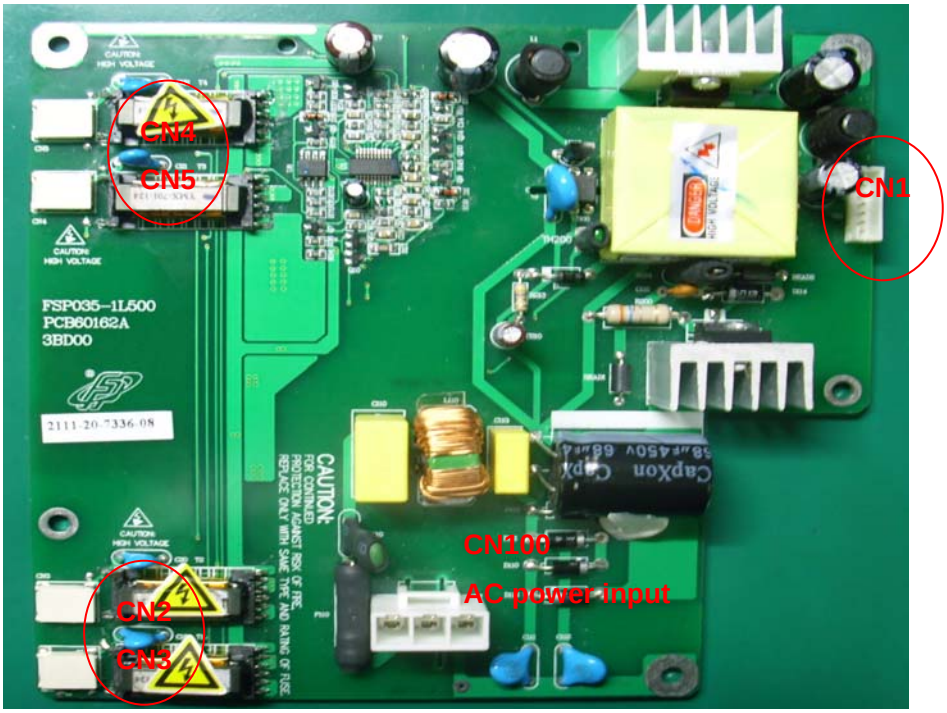


Figure 3-30 Sockets Location

Table 3-54 Socket of between Power Supply and Inverter

CN1	Pin definition
Pin1	ADJ（Backlight Adjust）
Pin2	EN（Backlight ON/Off）
Pin3	GND
Pin4	GND
Pin5	12V
Pin6	12V
Pin7	PS（Power Saving）

Lights drive output sockets CN2, CN3, CN4, and CN5 are defined as follows:

Table 3-55 Output Socket Definition of Lights Drive

Pin	Symbol	Description
1	Vout -H	High-voltage terminal
2	Vout -L	Low voltage terminal

AC power input socket CN100 (socket model: JST, B03P-VL600V20A) are defined as follows:

Table 3-56 AC Power Input Socket

Pin	Symbol
1	L
2	N
3	GND

3.18.2 AD Controller Board

3.18.2.1 Working Principle and Block Diagram

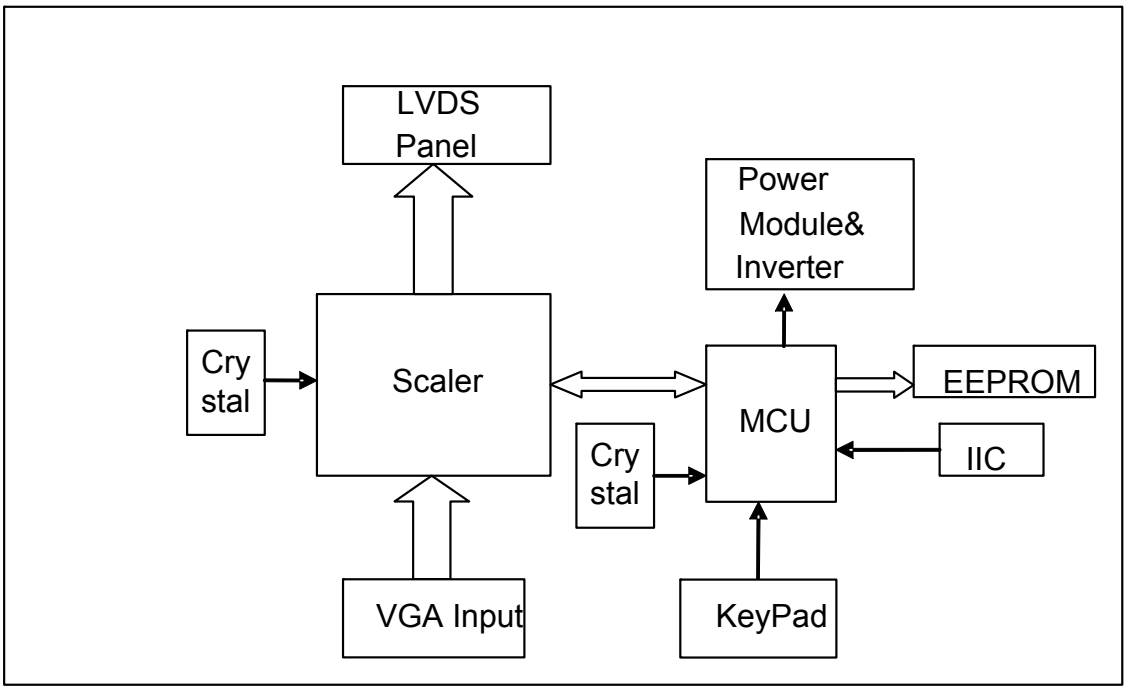


Figure 3-31 Principle Diagram of AD Controller Board

After VGA signal is input to RTD2620, MCU will carry out functions including signal recognition, zoom, color process and transform signal into LVDS signal and then display it to LCD. U6 (MTV412) is MCU, functions of MCU include: controlling on RTD2620 and external related operation, such as operation on the keys and IIC. U1, U3, U4 carry out DC-DC voltage converting, thus providing normal voltages to each circuit.

3.18.2.2 Main ICs and the Functions

Table 3-57 Functions of IC

Item	Model	Function description
U1	LM2596-33	DC-DC converting, 12V to 3.3V
U3	AMS1117 2.5	3.3V-to-2.5V converting

U4	AIC1804-18PM	3.3V-to-1.8V converting
U5	24C16	EEPROM
U6	MTV412	MCU
U7	RTD2620	Signal processing
U8	K4D263238I	GDDR
U9	4435	Panel Power On/Off
Y1/Y2	K24.000	Crystal

3.18.2.3 Socket Definition

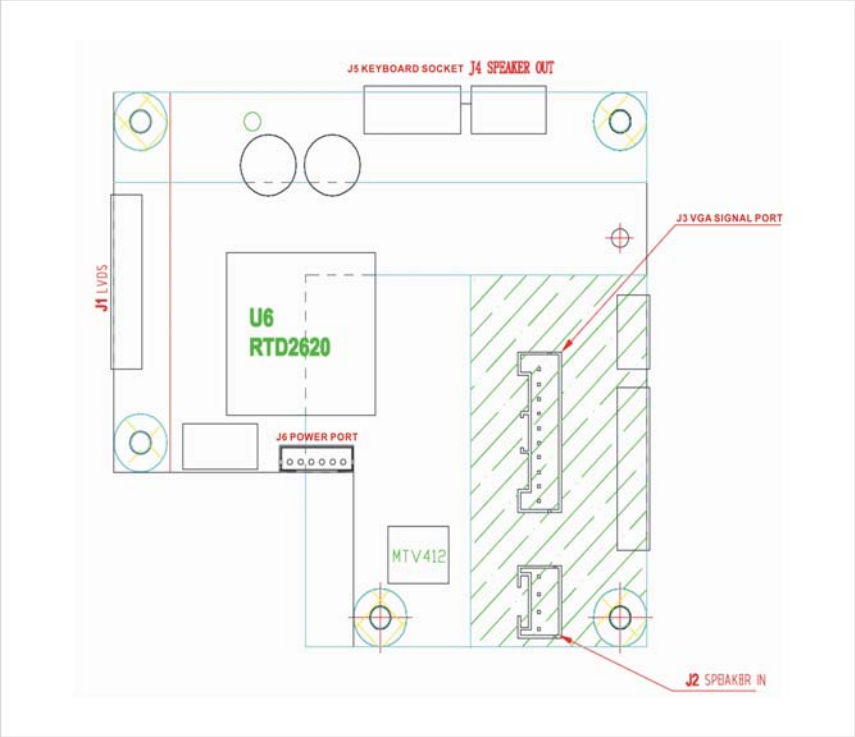


Figure 3-32.Sockets Location

Table 3-58 LVDS Sockets

J1	Pin definition	J1	Pin definition
Pin1	GND	Pin2	GND
Pin3	RXOIN3+	Pin4	RXOIN3-
Pin5	GND	Pin6	RXOCKIN+
Pin7	RXOCKIN-	Pin8	GND
Pin9	RXOIN2+	Pin10	RXOIN2-

Pin11	GND	Pin12	RXOIN1+
Pin13	RXOIN1-	Pin14	GND
Pin15	RXOIN0+	Pin16	RXOIN0-
Pin17	GND	Pin18	GND
Pin19	PANEL_VCC	Pin20	PANEL_VCC

Table 3-59 Input Socket of Speaker

J2	Pin definition
Pin1	L-SDBX+
Pin2	L-SDBX-
Pin3	R-SDBX+
Pin4	R-SDBX-

Table 3-60 Signal Input Socket

J3	Pin definition		
Pin1	VSYNC	Pin2	GND
Pin3	HSYNC	Pin4	GND
Pin5	RED	Pin6	BLUE
Pin7	GREEN	Pin8	GND
Pin9	GND	Pin10	GND

Table 3-61 Output Socket of Speaker

J4	Pin definition
Pin1	L-SDBX+
Pin2	L-SDBX-
Pin3	R-SDBX+
Pin4	R-SDBX-

Table 3-62 Socket of Key Board

J5	Pin definition
Pin1	R_LED
Pin2	G_LED
Pin3	AD0
Pin4	AD1

Pin5	GND
Pin6	GND
Pin7	12V
Pin8	5V

Table 3-63 Control Socket of Power Supply and Converter

J6	Pin definition
Pin1	ADJ（Backlight Adjust）
Pin2	EN（Backlight ON/OFF）
Pin3	GND
Pin4	GND
Pin5	12V
Pin6	12V
Pin7	PS（Power Saving）

4 SYSTEM STRUCTURE AND ASSEMBLY / DISASSEMBLY

4.1 Overall Exploded View

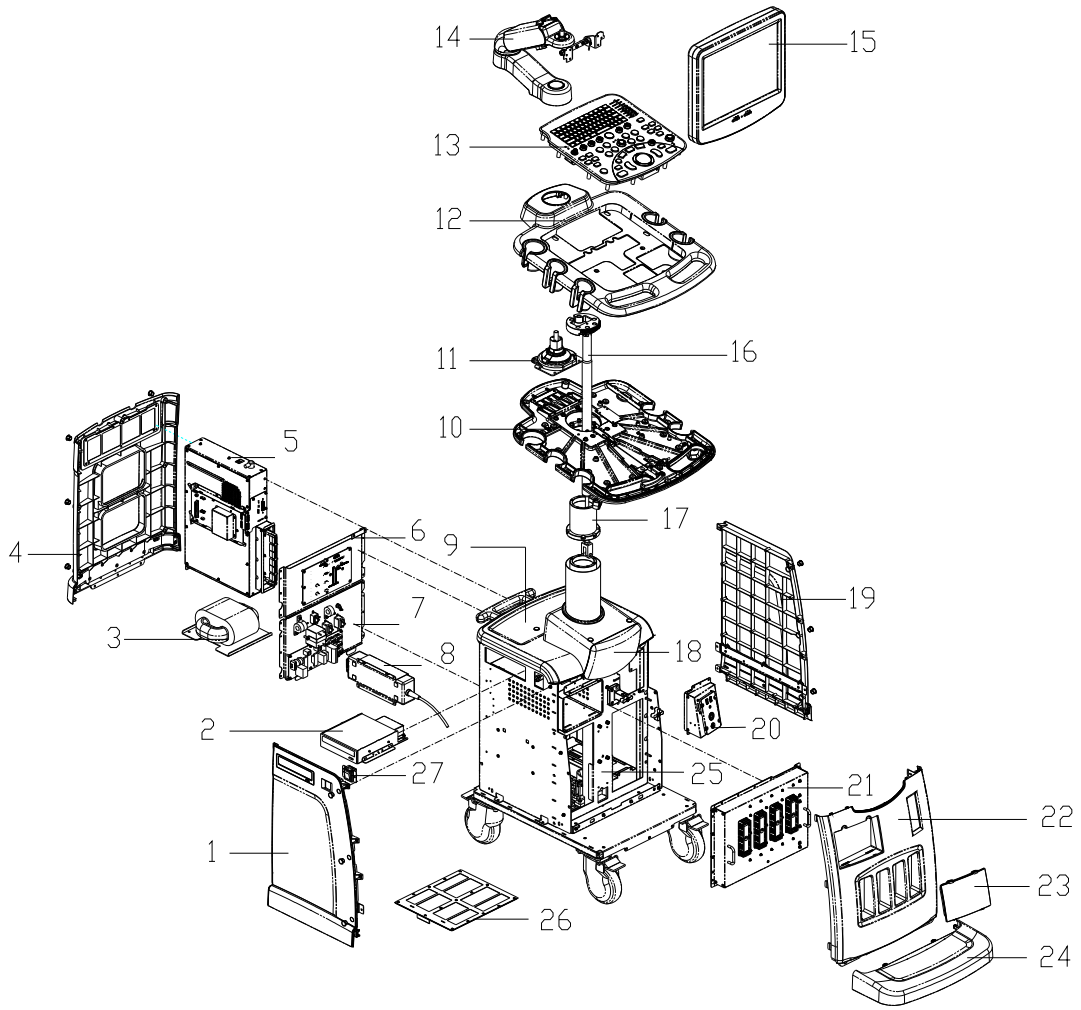


Figure 4-1 Overall Exploded View

No.	Material number	Name	No.	Material number	Name
1	2109-30-76182	Main unit left cover	15	2109-30-76336	Monitor module
2	115-002826-00	DVD-R/W module	16	2109-30-76189	Up/down air spring module
3	2109-20-76214	Isolating transformer	17	2109-20-76078	Rotating axis barrel
4	2109-30-76181	Main unit rear cover	18	2109-30-76178	Front cover of main unit module
5	2109-30-76199	Main unit box module	19	2109-30-76183	Main unit right cover
6	2109-30-76188	IO module	20	2109-30-76193	ECG module
7	2109-30-76187	Power input module	21	2109-30-76258	Probe board
8	051-000384-00	2109 built-in adapter’s power PCBA	22	2109-30-76179	Main unit frontal cover
9	2109-30-76177	Main unit top cover	23	2109-20-76091	Cover of printer compartment
10	2109-20-76059-51	Cast aluminium keyboard base	24	2109-30-76180	Footswitch
11	2109-30-76169	Support arm base	25	2109-30-76185	Main unit housing module
12	2109-20-76071	Cover of cast aluminium base	26	2109-20-76145	Dustproof net bracket
13	2109-30-76261	Control panel	27	2109-30-76184	System soft switch module
14	115-003062-00	Support arm			

4.2 Exploded View of Each Module

4.2.1 Exploded View of LCD Display and Support Arm

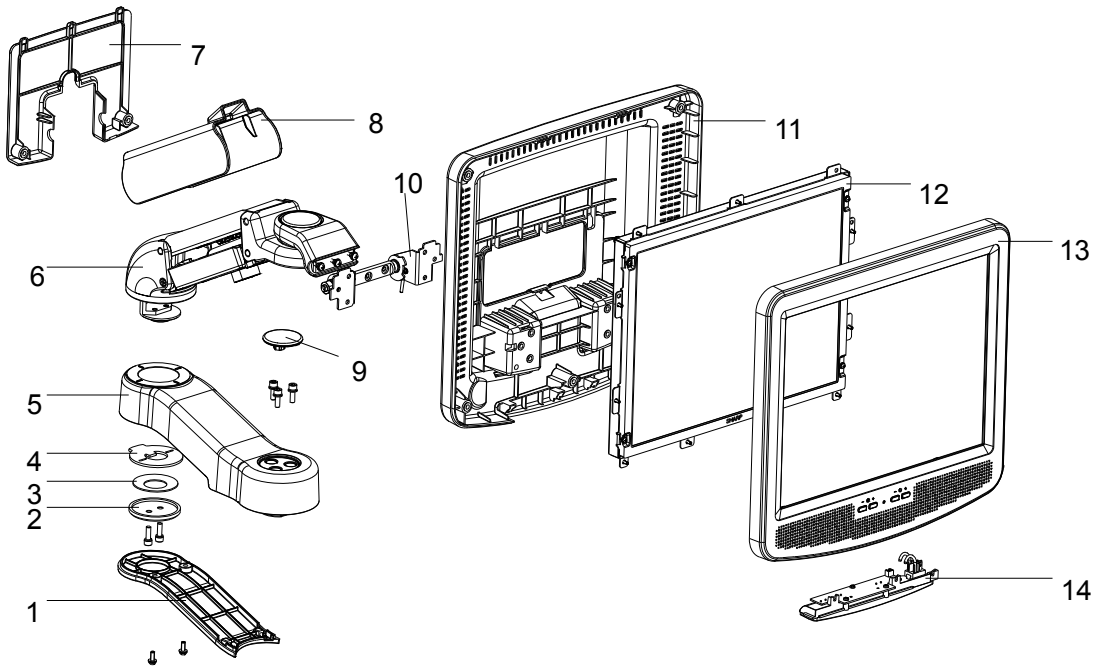


Figure 4-2 Exploded View of LCD Display and Support Arm

No.	Material number	Name	No.	Material number	Name
1	2109-20-76057	Cover of lower support arm	8	043-000396-00	Cover of upper support arm
2	2111-20-73313	Upper arm turning auxiliary pressing block	9	2111-20-73285-51	Decorative cover
3	M6T-020002---	Dish-shaped spring, the 3rd series D=50	10	2111-20-73325	Damp axis
4	2111-20-73296	Upper arm turning auxiliary washer	11	2111-20-73288	Monitor rear cover
5	2109-30-76170	Lower support arm	12	2109-20-76334	Monitor components-install board module
6	115-003061-00	Upper support arm	13	2111-30-73334	Frontal cover

7	2111-20-73289	Monitor cable cover	14	2111-30-73335	Bottom lights(included in the frontal cover module)

4.2.2 Exploded View of Monitor Components-install Board

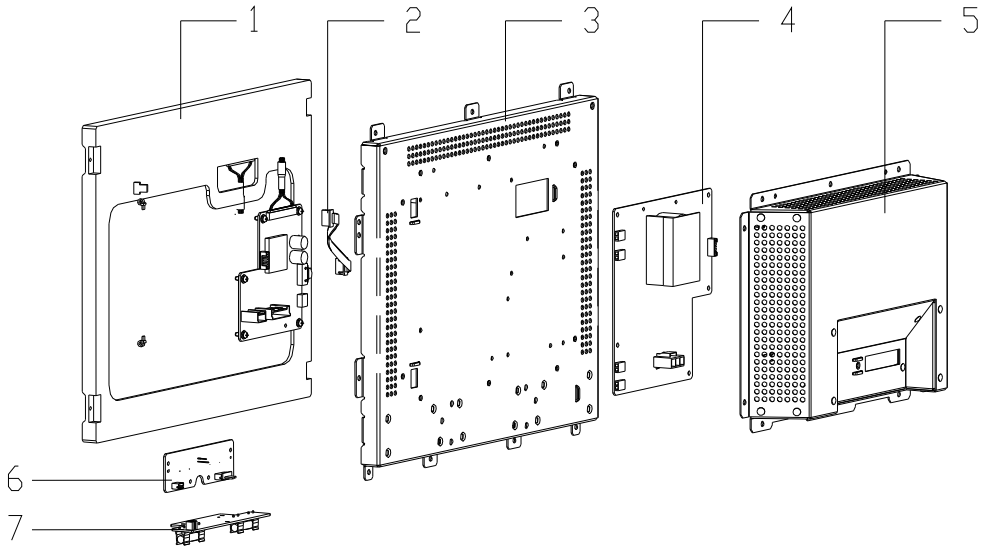


Figure 4-3 Exploded View of Monitor Components-install Board

4.2.3 Exploded View of Main Unit Box Module

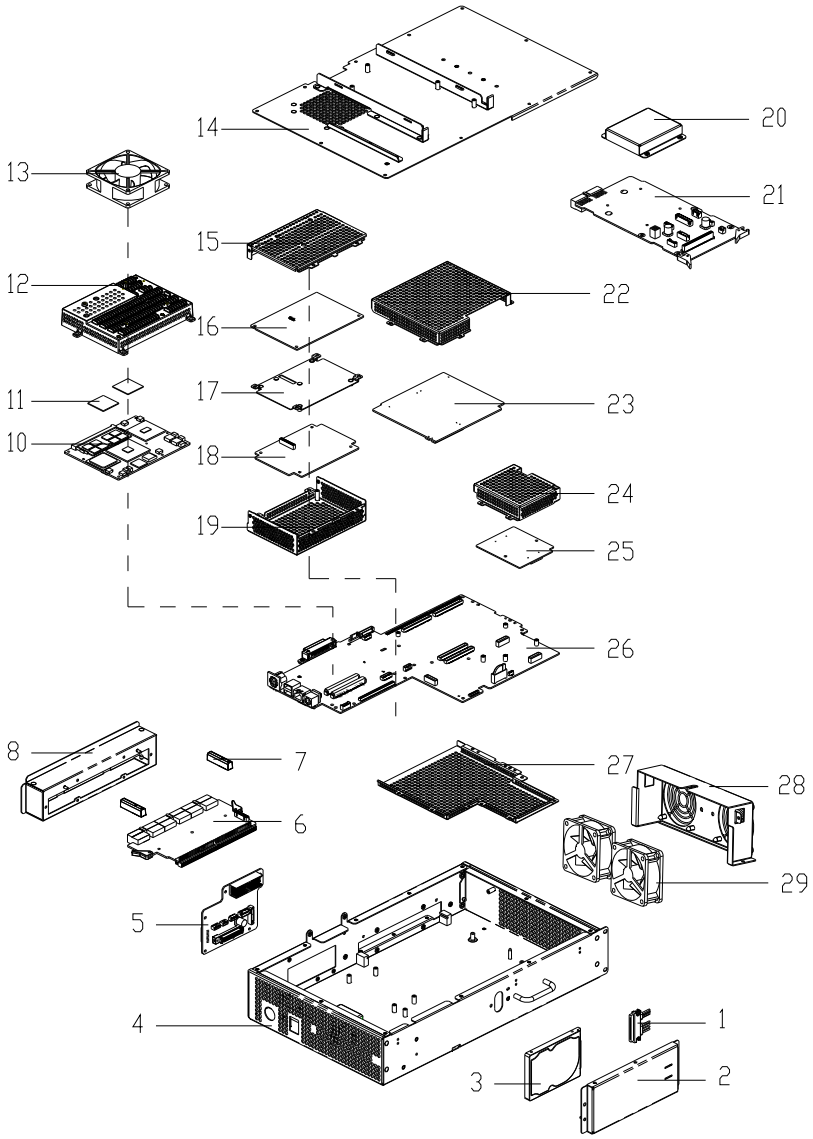


Figure 4-4 Exploded View of Main Unit Box Module

No.	Material number	Name	No.	Material number	Name
1	2109-20-76326	Power and signal cable of SATA	16	2109-30-76310	Power supply main board
2	2109-20-76305	HDD bracket	17	2108-20-65745	Power supply separating board
3	023-000045-00	HDD 160GB 5400rpm SATA notebook	18	2109-30-76312	Power supply auxiliary board
4	042-000509-00	Main box	19	2108-20-65744	Bottom cover of power supply box

5	2109-30-76201	IO connecting board	20	2109-20-76158	Shielding cover of port board
6	2109-30-76211	Probe connection board	21	2109-30-76224	IO port board
7	2109-20-76155	Board guide-pin socket	22	2109-20-76149	Transmitting board shielding cover
8	2109-20-76154	Shielding frame of probe connection board	23	2109-30-76456	Transmitting board
9	/	/	24	2108-20-65750	CW board shielding cover
10	023-000040-00	Industrial control board CE760A	25	2108-30-65899	CW Doppler board
11	047-001186-00	Heat conducting washer (conductivity factor=3)	26	2109-30-76294	Master board
12	045-000092-00	Radiator (CE760A)	27	2109-20-76061	Lower shielding cover of master board
13	2109-20-76238	CPU fan and connecting cable	28	2109-20-76153	Air inlet fan frame
14	042-000511	Cover of main unit box	29	2109-20-76231	Air inlet fan and the connecting cable
15	2108-20-65743	Top cover of power supply box			

4.2.4 Exploded View of Probe Board Module

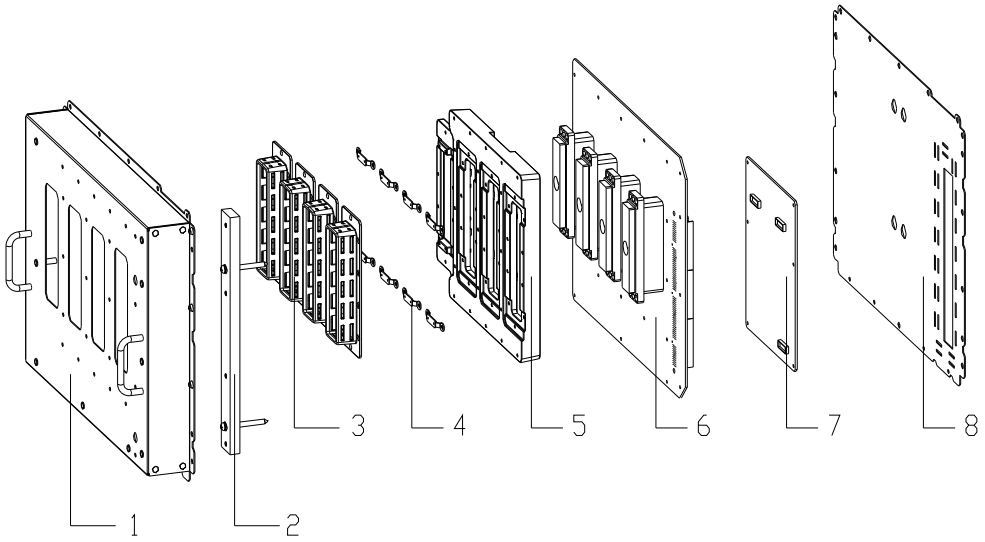


Figure 4-5 Exploded View of Probe Board Module

No.	Material number	Name	No.	Material number	Name
1	2109-20-76161	Probe board shielding cover	5	2105-20-40131	Probe aluminium shielding cover
2	2109-20-76160	Guide-pin installation bar	6	2109-30-76311	Probe board
3	2105-20-40132	Aluminium shielding frame of probe port	7	2109-30-76309	Probe control board
4	2105-20-40133	Probe installation bracket	8	2109-20-76162	Probe board shielding cover

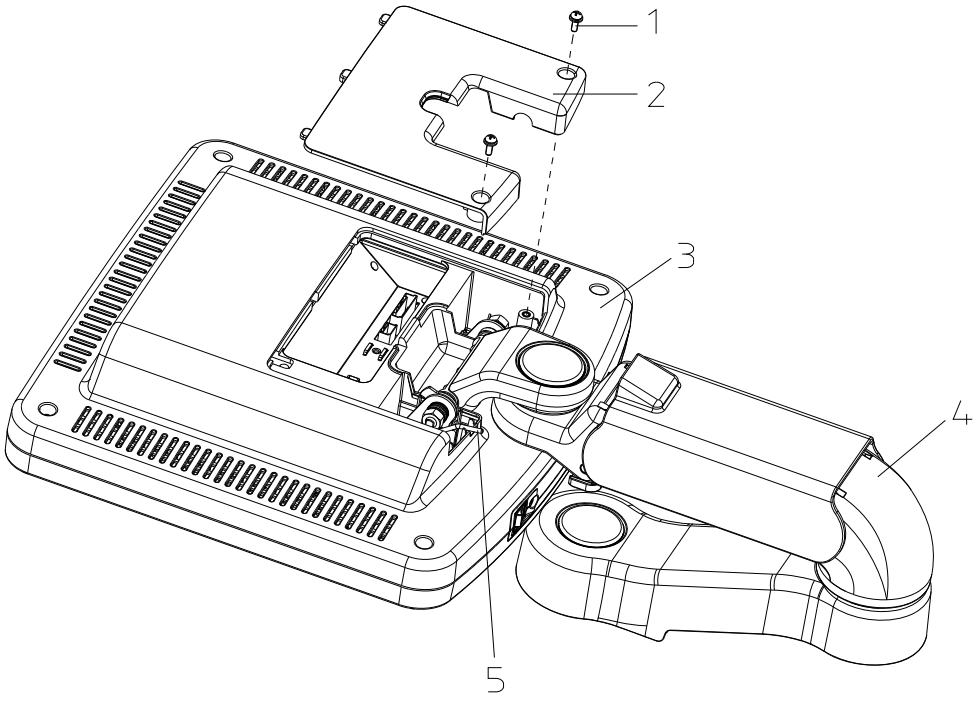
4.3 Overall Disassemble and Parts Replace

4.3.1 Disassemble the Monitor Module

1） Lock the upper support arm by the up/ down spanner. (Refer to 2.2.3)

2） Turn the monitor to the level position when toggle the deflector rod left side. (Refer to 2.2.2)

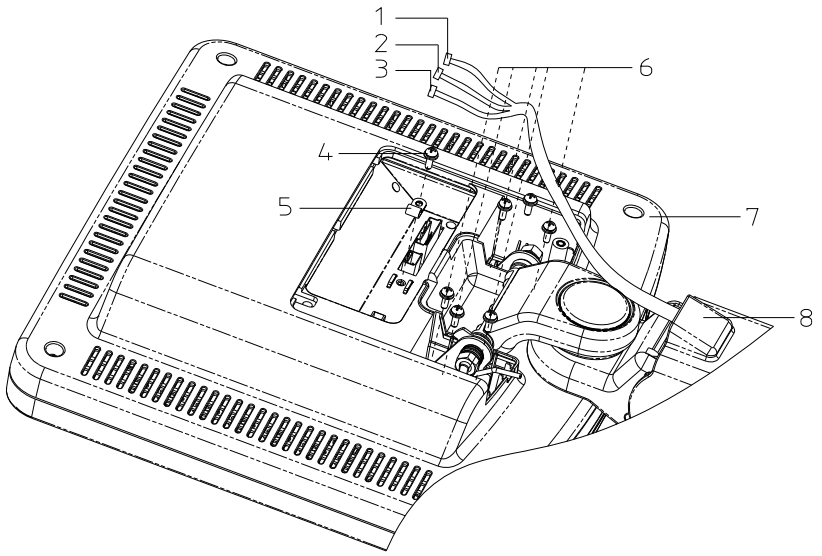
3） Remove the two M4X12 screws which are used to secure the monitor cable, and then remove the monitor cable cover aslant.



1. Screw M4X12 2. Monitor Cable Cover 3. Monitor Module
4. Support Arm Module 5.Deflector Rod

Figure 4-6 Disassemble the Monitor Module (1)

4） Remove the 1 M4X12 screw securing the ground wire holder, take out the cable plug and remove the 6 M4X12 screws that are used to secure the monitor.



1. Signal Cable 2. Audio Cable 3. Power Supply 4.M4X12
5. Ground Wire Holder 6. Screw M4X12 7. Monitor Module 8. Support

Figure 4-7 Disassemble the Monitor Module (2)

5）Hold the lateral sides of the monitor, raise up the monitor to separate it with the support arm hooker when the monitor is 20° from the vertical direction, and then remove the monitor.

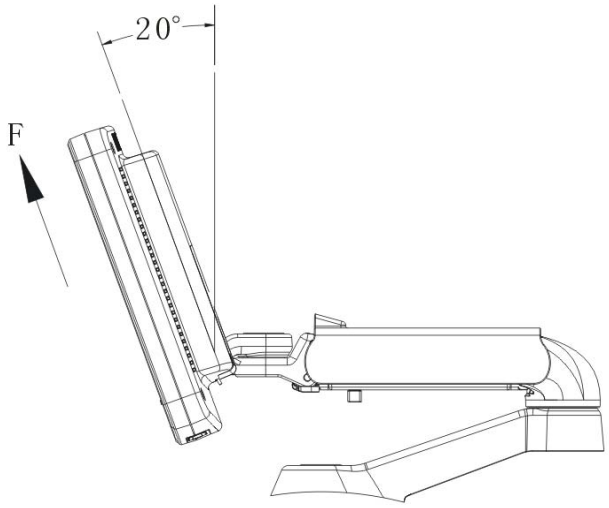
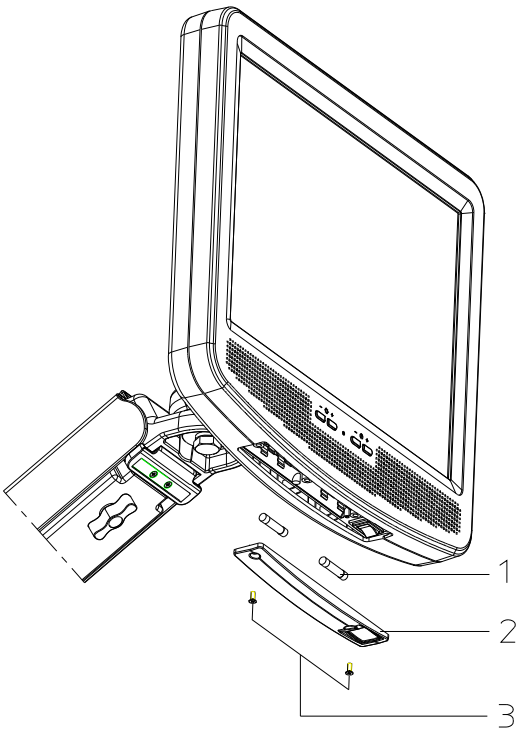


Figure 4-8 Disassemble the Monitor Module (3)

4.3.2 Disassemble the Bottom Lights of the Monitor

1) Turn the monitor to one side of the main unit.
2) Remove the 2 M3X8 screws securing the light cover, and then remove the cover.
3) Take the lights from the light hanger gently.

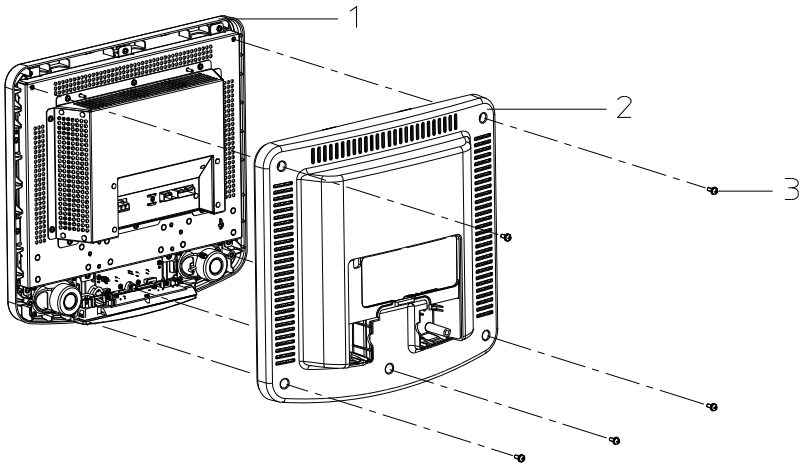


1. Bottom Light 2. Transparent Cover 3. M3X8 Screw

Figure 4-9 Disassemble the Bottom Light of Monitor

4.3.3 Replace the Speaker on the Monitor

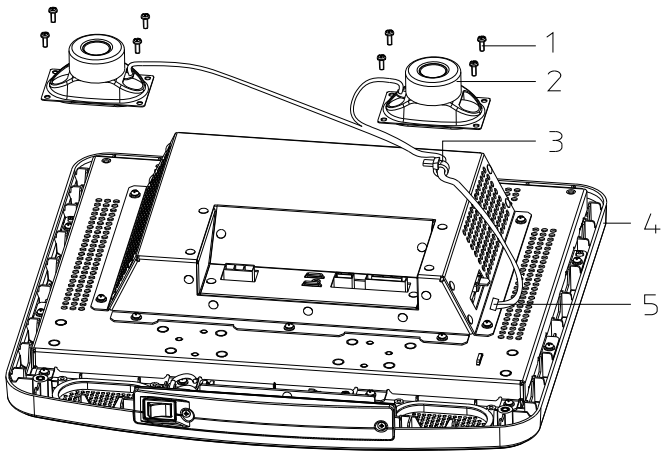
1) Disassemble the monitor module. (Please refer to 4.3.1)
2) Remove the 5 M4X12 screws on the rear cover of the monitor, and then remove the cover.



1.Frontal Cover of the Monitor 2. Rear Cover of the Monitor 3.M4X12 Screw

Figure 4-10 Replace the Speaker (1)

3) Pull out the speaker connecting cable plug and cut off the tie which is used to secure the cable, remove the self-driving screws which are used to secure the speaker (4 screws at each side), and then remove the speaker.



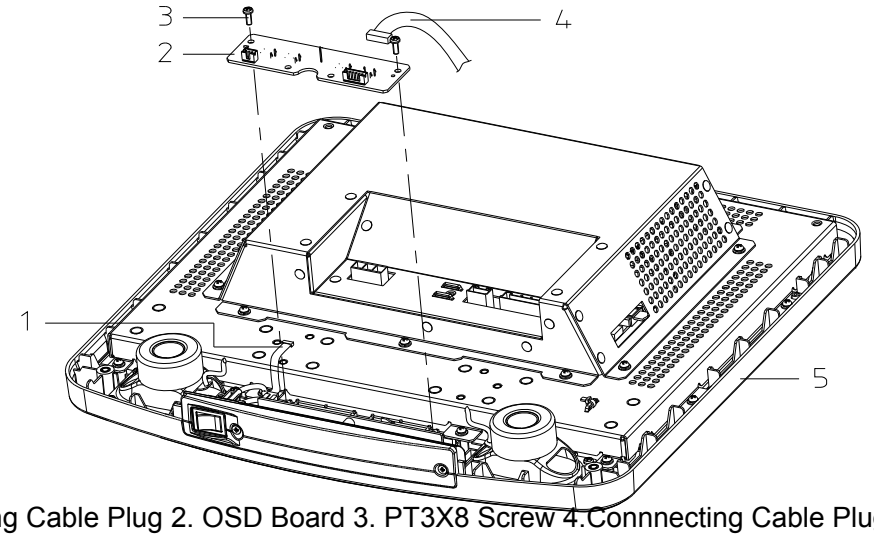
1. Self-driving Screw PT3X8 2 Speaker 3. Cable Tie

4. Monitor Front Cover Module 5.Speaker Connecting Cable Plug

Figure 4-11 Replace the Speaker (2)

4.3.4 Replace the OSD Board of Monitor

1) Disassemble the rear cover of the monitor. (Please refer to procedure 1, and 2 as described in 4.3.3).
2) Pull out the connecting cable plug on the OSD board.
3) Remove the 2 PT3X8 self-driving screws which are used to secure the OSD board, and then remove the OSD board.

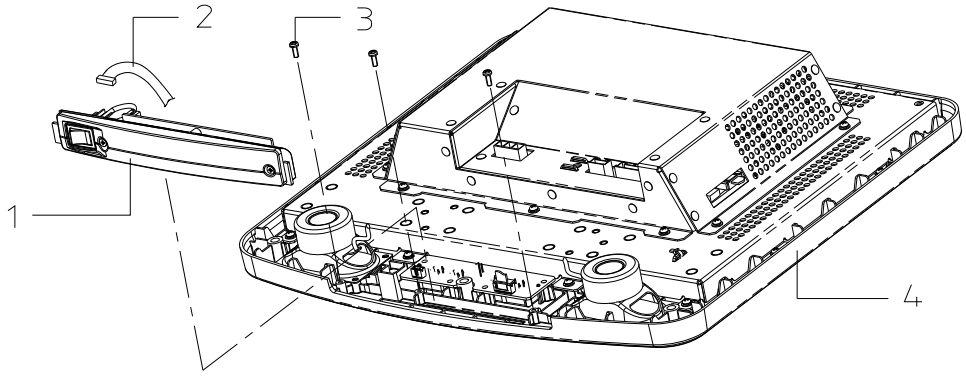


1. Connecting Cable Plug 2. OSD Board 3. PT3X8 Screw 4.Connnecting Cable Plug 5. Monitor

Figure 4-12 Replace the OSD Board

4.3.5 Replace the Bottom Light Board of the Monitor

1) Disassemble the rear cover of the monitor. (Please refer to procedure 1, and 2 as described in4.3.3).
2) Pull out the connecting cable plug on the bottom light module.
3) Remove the 3 self-driving screws PT3X8 which are used to secure the light module, and then take away the module.



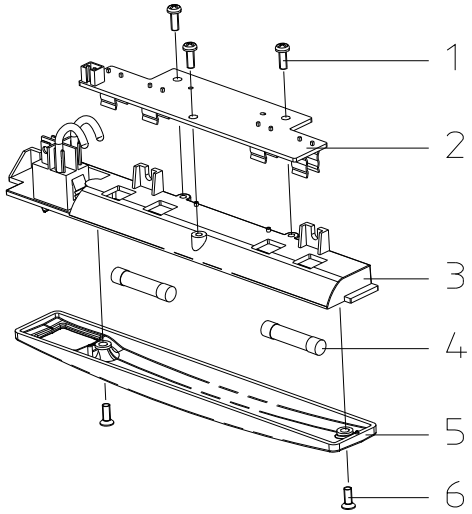
1. Bottom Light Module 2. Connecting Cable Plug 3. Screw PT3X8 4. Monitor Front

Figure 4-13 Replace the Bottom Light Board of Monitor (1)

4) Remove the 2 M3X8 sunk screws securing the transparent cover, and remove the cover.

5) Take off the two light tubes.

6) Remove the 3 self-driving screws PT3X8 which are used to secure the monitor light board, and then remove the board.



1. ScrewPT3X8 2. Light Board 3. Light Secure Base
4. Light Tube 5. Cover 6. Screw M3X8

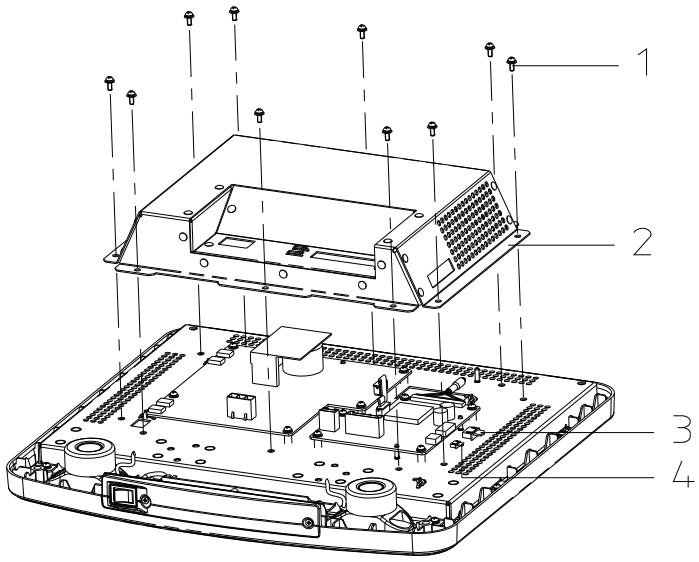
Figure 4-14 Replace the Bottom Light Board of Monitor (2)

4.3.6 Replace the Power Supply Inverter Board of the LCD

1）Remove the rear cover of the LCD.(Please refer to procedure 1, and 2 as described in 4.3.3).

2）Pull out the connecting cable plug of OSD board and connecting cable plug of speaker output from the left side of LCD components-install board module.

3）Remove the 10 M3X8 screws which are used to secure the PCB shielding cover, and remove the cover.

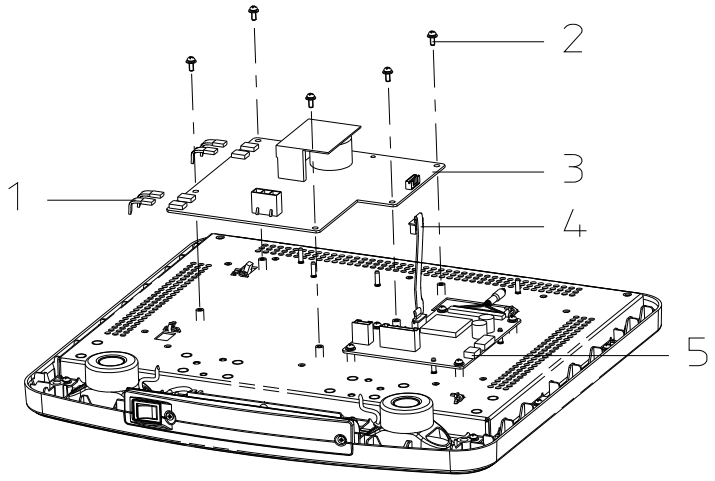


1. M3X8 Screw 2. PCB Shielding Cover 3. Connecting Cable Plug of OSD Board 4. Connecting Cable Plug of Speaker Output

Figure 4-15 Replace the Power Supply Inverter Board of the Monitor (1)

4）Pull out the 4 LCD connecting cable plugs at the left side of LCD power supply converter, and pull out the connecting cable plug at the right side between the LCD power supply board and the driving board.

5）Remove the 5 M3X8 screws which are used to secure the LCD power supply inverter, and then remove the power supply inverter.



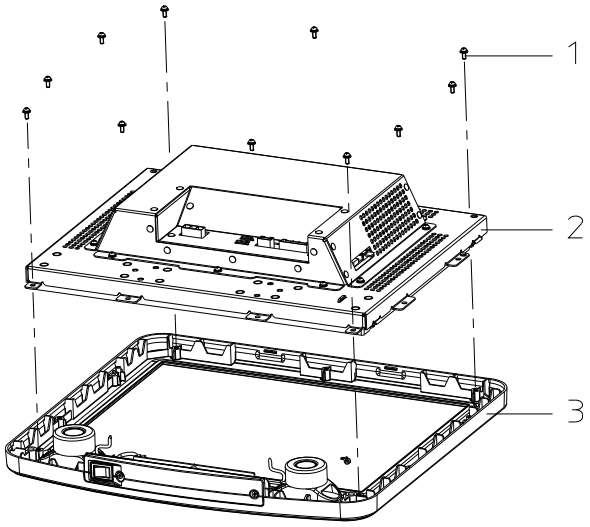
1. LCD Power Supply Cable Plug 2. M3X8 Screw 3. LCD Power Supply inverter Board

4. Cable connecting LCD Power Supply Board with Drive Board 5. LCD Control

Figure 4-16 Replace the Power Supply Inverter Board of LCD (2)

4.3.7 Replace the LCD Screen and LCD Control Board

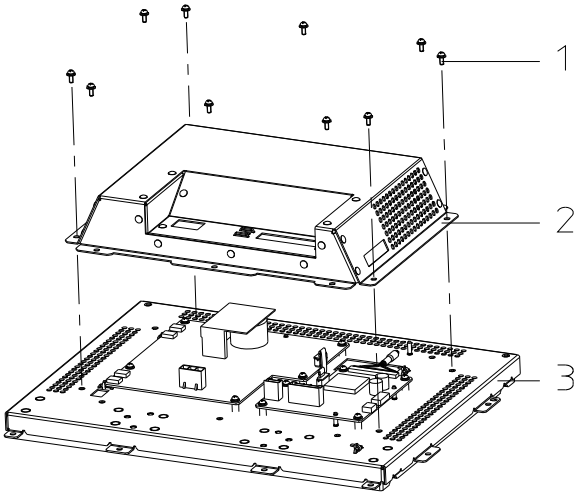
1) Disassemble the rear cover of the monitor, pull out the LCD OSD board connecting cable plug and the speaker output connecting cable plug. (Please refer to procedure 1, and 2 as described in 4.3.3).
2) Remove the 11 M3X8 screws securing the monitor components-install board, and remove the board.



1. M3X8 Screw 2. Monitor Components-install Board 3. Front Cover

Figure 4-17 Replace the LCD Screen and LCD Control Board (1)

3）Remove the 10 M3X8 screws which are used to secure the PCB shielding cover, and then remove the cover.

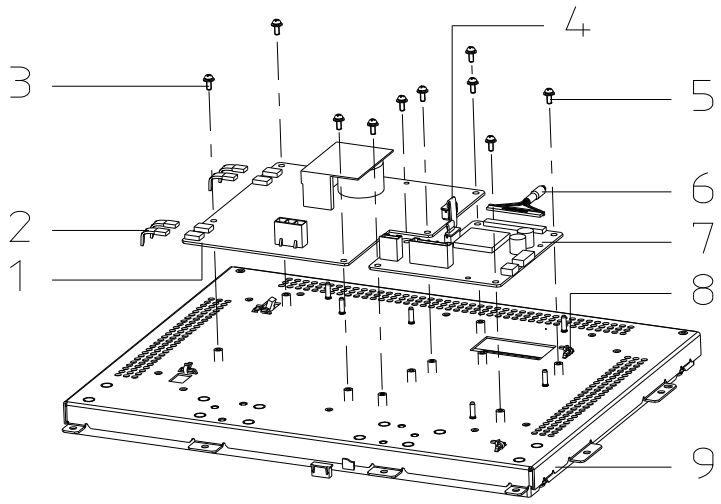


1. M3X8 Screw 2. PCB Shielding Cover 3. LCD Secure Frame

Figure 4-18 Replace the LCD Screen and LCD Control Board (2)

4）Pull out the 4 LCD connecting cable plugs at the left side of LCD power supply inverter, and pull out the connecting cable plug on the LCD control board between the LCD power supply board and drive board, pull out the LCD LVDS connecting cable plug.

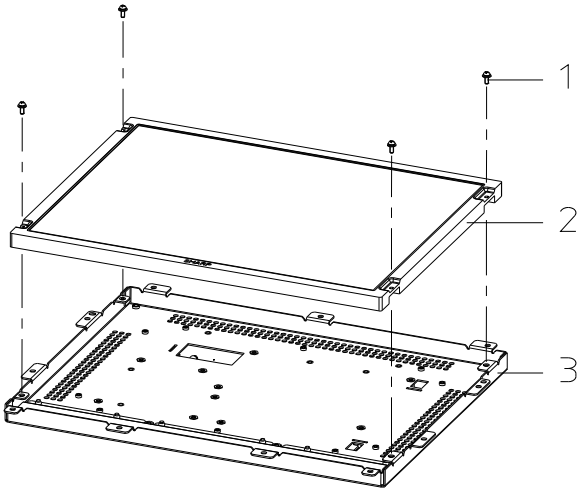
5）Cut off the 2 ties which are used to secure the connecting cable, remove the 5 M3X8 screws which are used to secure LCD power supply inverter and the 5 M3X8 screws which are used to secure LCD control board, and then take away the inverter board and LCD control board.



1. Power Supply Converter Board　2. LCD Connecting Cable Board　3. M3X8 Screw
4. Connecting Cable between LCD Power Supply Board and Drive Board
5. M3X8 Screw　6.LCD LVDS Connecting Cable

Figure 4-19 Replace the LCD Screen and LCD Control Board (3)

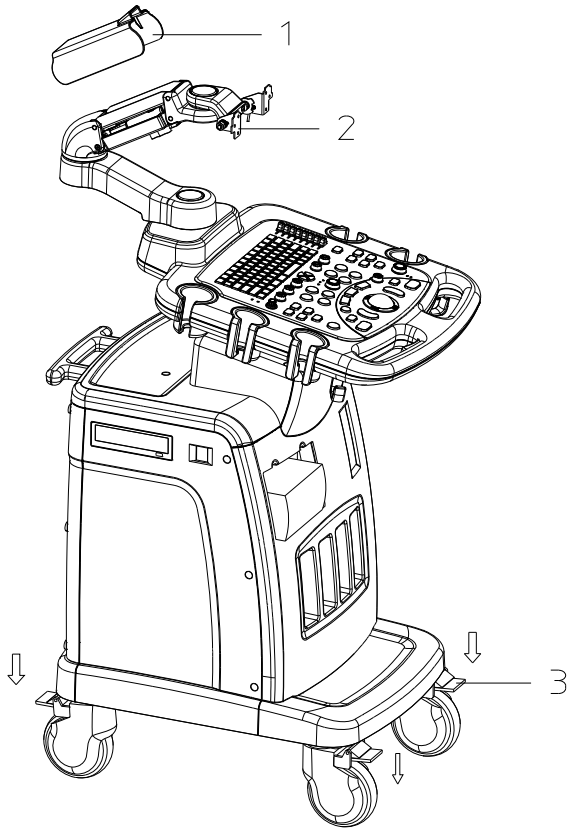
6）Remove the 4 M3X8 screws which are used to secure LCD screen, take away the LCD screen, and then finish the replacement of LCD screen and LCD control board.



1. M3X8 Screw　2. LCD Shielding Cover　3. LCD Secure Frame
Figure 4-20 Replace the LCD Screen and LCD Control Board (4)

4.3.8 Replace the Spring Damping Parts of Support Arm

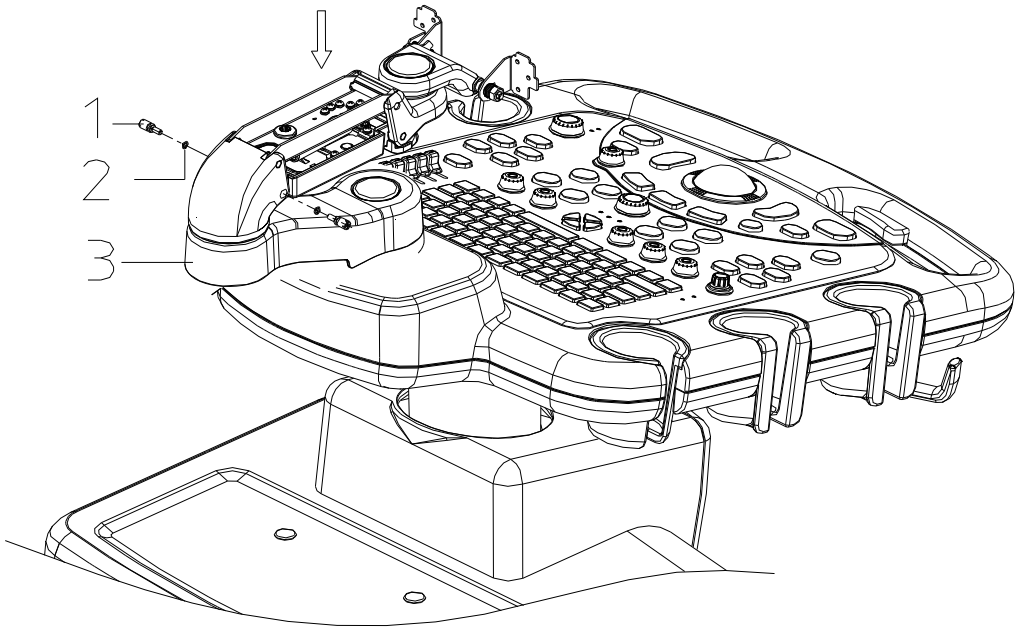
1) Stamp down the 4 caster brakes to lock the machine.
2) Take away the monitor module. (Refer to 4.3.1)
3) Take the cover of upper support arm from the support arm module.



1. Upper Support Arm Cover 2. Upper Support Arm Module 3. Caster

Figure 4-21 Replace the Air Spring of Support Arm (1)

4) Lock the upper support arm by the up/down spanner of upper support arm. (Refer to 2.2.3).
5) Push down the upper support arm by left hand, screw out the securing pins and remove them. And then leave the arm carefully.

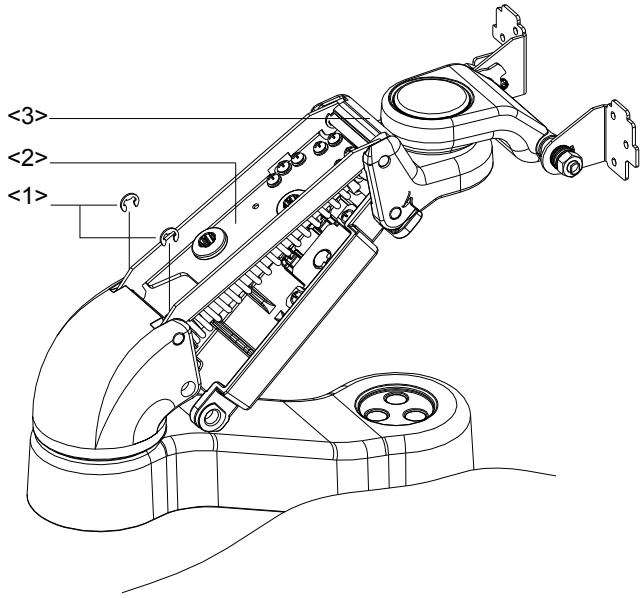


1. M5 Pin 2. Elastic Washer M5 3. Support Arm Module

Figure 4-22 Replace the Spring Damping Parts of Support Arm (2)

NOTE:	Please drop some fixing glue onto the tail of the pin when installing the pin.

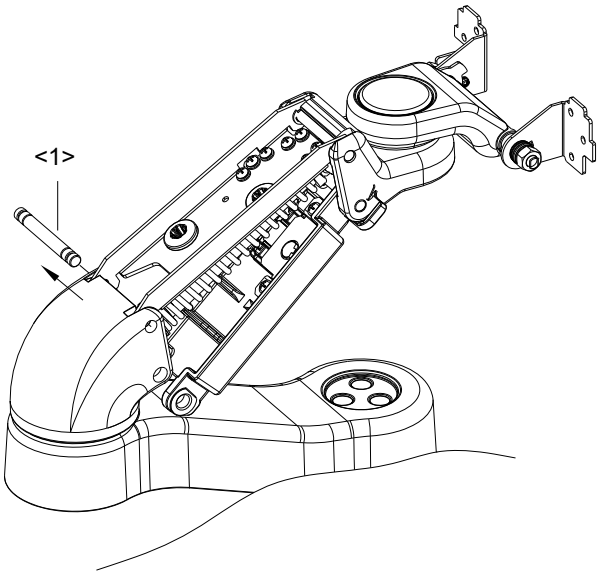
6) Lift the support arm upward to the extreme position, and then remove the two retainer rings at the end of the parallel bracket of the upper support arm.



1. Retainer rings 2. Parallel bracket of the upper support arm 3. Upper support arm

Figure 4-23 Replace the Spring Damping Parts of Support Arm (3)

7) Hold the support arm to lift it steadily and push the cross-pin out from one side.

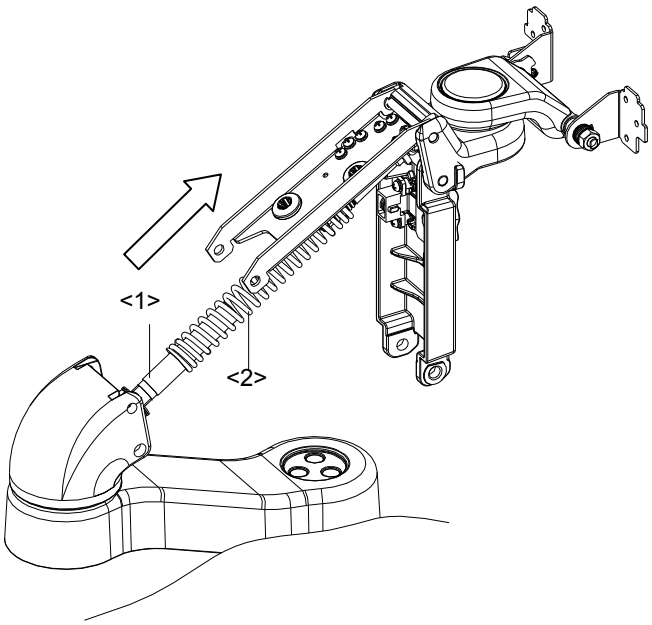


1. Cross-pin of the upper support arm

Figure 4-24 Replace the Spring Damping Parts of Support Arm (4)

NOTE:	**1.**	**Make sure the upper support arm is turned upward to the extreme position before pushing the cross-pin out.**
	2.	**Hold the upper support arm when removing the cross-pin in case the upper support arm falls off. Hold the upper support arm tightly because it will be ejected out by the spring.**

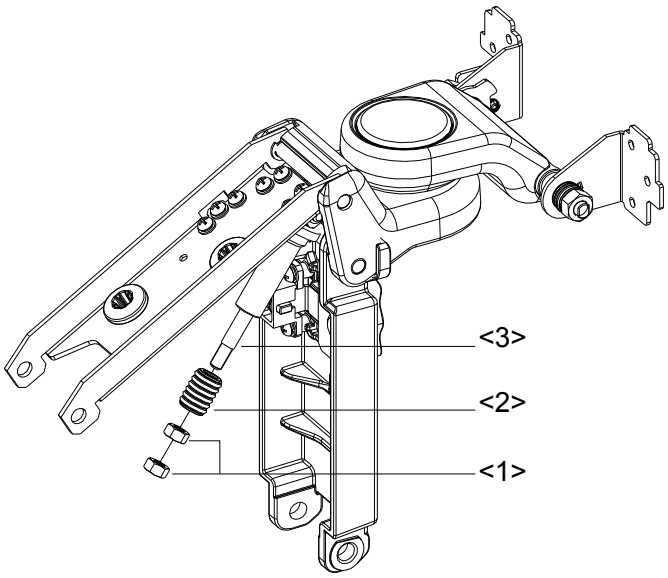
8) Extract the upper support arm along the pilot sleeve and extract the spring from the pilot sleeve.



1. Pilot sleeve of the spring 2. Spring

Figure 4-25 Replace the Spring Damping Parts of Support Arm (5)

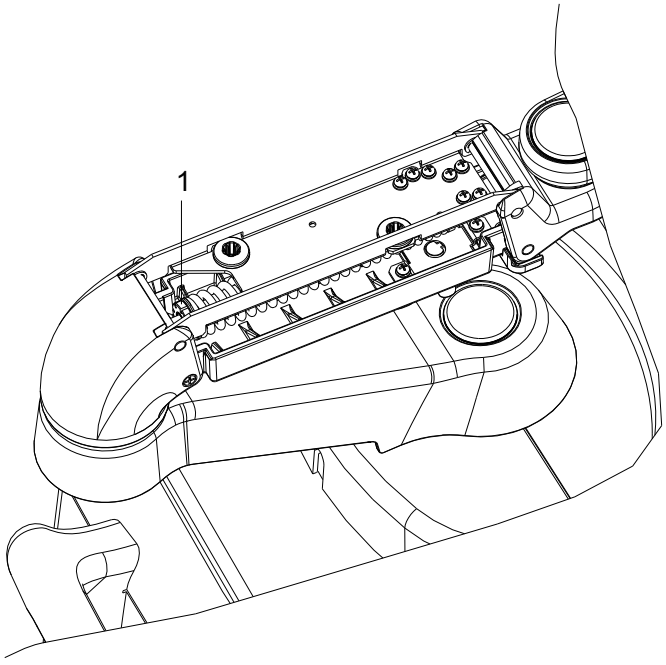
9) Remove the retaining nuts of the rubber damping pole and then remove the rubber damping pole from the end of the pilot sleeve.



1. Retaining nuts of the rubber damping pole 2. Rubber damping pole
3. Pilot sleeve of the spring

Figure 4-26 Replace the Air Spring of Support Arm (6)

NOTE:	**After assembling the support arm (including the monitor), check whether the monitor stays still at a random height. If not, adjust the tightness of the spring by screwing the adjusting nut with a screwdriver until the monitor stays still at a random height and then fix the upper support cover.**

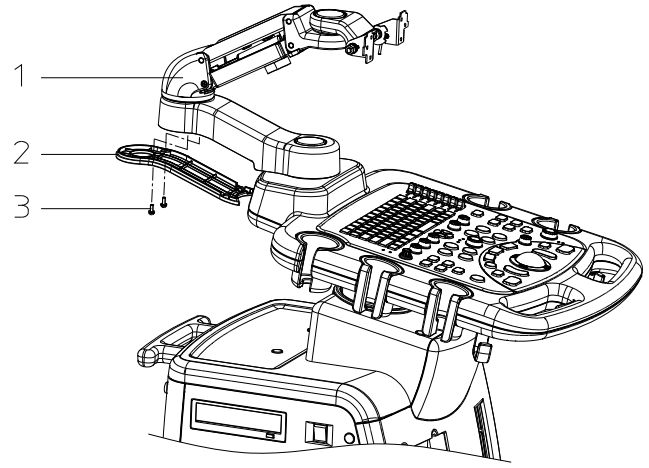


1. Adjusting nut of the spring

Figure 4-27 Replace the Air Spring of Support Arm (7)

4.3.9 Disassemble the Support Arm

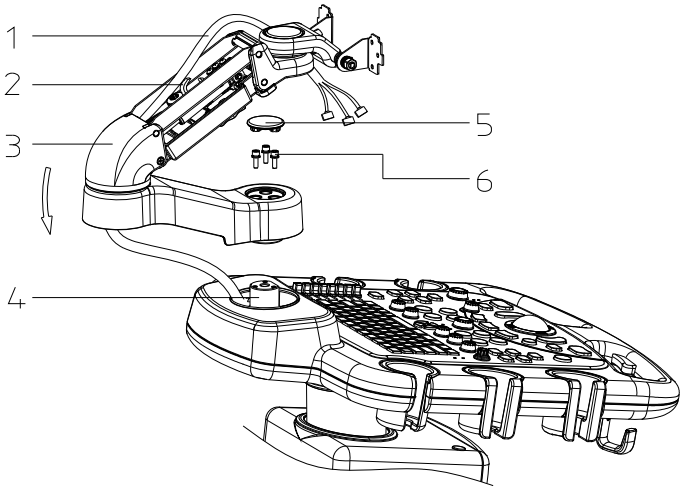
1) Disassemble the monitor and the upper support arm cover. (Please refer to 4.3.1and step 3 of 4.3.8).
2) Remove the 2 M4X12 screws which are used to secure the lower support arm cover, slightly move the cover laterally and take it off.



1. Support Arm Module 2. Lower Support Arm Cover 3. M4X12 Screw

Figure 4-28 Disassemble the Support Arm Module (1)

3) Cut off the tie on the monitor signal cable, and pull out the cable from the joint of the support arm.
4) Take off the plastic cover from the support arm using the straight screwdriver, and then take off the 3 internal hexagonal screws M5X16 as well as the washer, at last separate the support arm module from the base module.

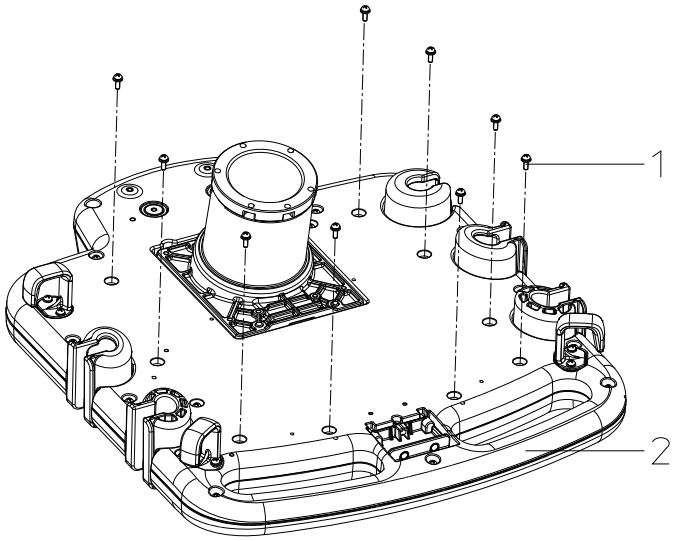


1. Signal Cable 2. Cable Tie 3. Joint of the Support Arm
4. Support Module 5. Decorative Cover 6. M5X16 Screw and Washer

Figure 4-29 Disassemble the Support Arm Module (2)

4.3.10 Disassemble the Control Panel

1) Turn the keyboard module to the right/left side of the main machine, remove the 9 M4X12 screws which are used to secure the keyboard module at both sides of the casting aluminium base.

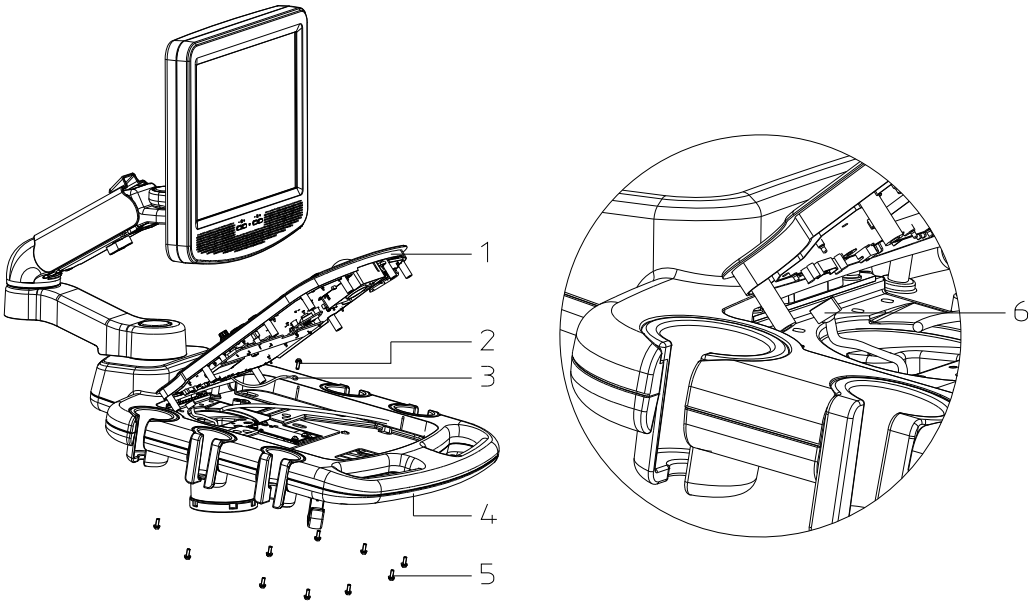


1. M4X12 Screw 2. Casting Aluminium Base

Figure 4-30 Disassemble the Control Panel Module (1) (Bottom View)

2) Slightly pull out the control panel module forward in the frontal handle direction, lift the frontal part of the panel and draw out the external cable plug connected to the control panel module.

3) Remove the 1 M3X8 screw that jointed with the base module, and separate the control panel module from the base.



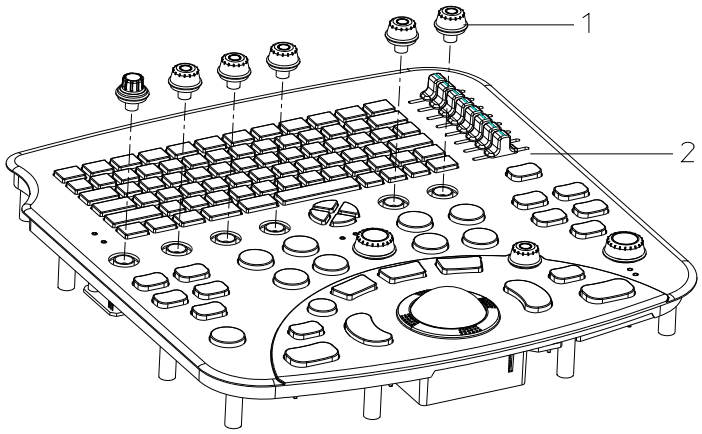
1. Control Panel Module 2. M3X8 Screw 3. Grounding Wire
4. Casting Aluminium Base 5 M4X12 Screws 6. Cable Plug

Figure 4-31 Disassemble the Control Panel Module (2)

4.3.11 Replace the Encoder Connecting Board

4.3.11.1 Replace the Encoder 6-to-1 Connecting Board

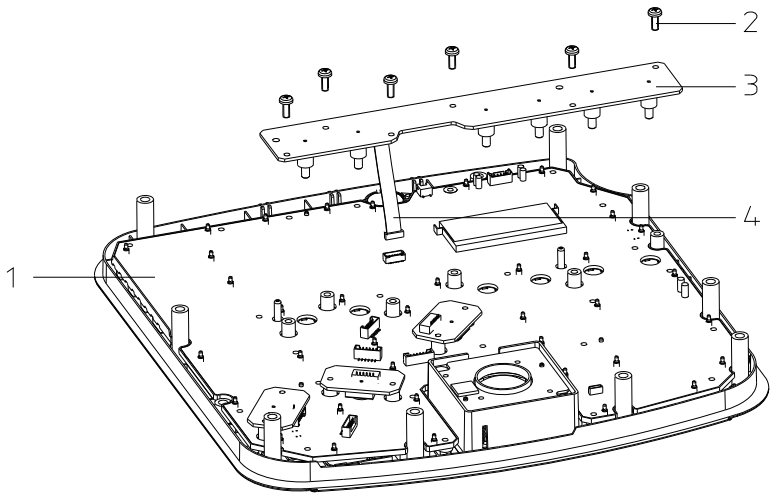
1) Disassemble the control panel module. (Refer to 4.3.7).
2) Draw out the 6 knobs on the connecting board.



1. Encoder Knob 2. Control Panel Module

Figure 4-32 Replace the Encoder 6-to-1 Connecting Board (1)

3) Pull out the connecting cable plug on the control panel, remove the 6 M3X8 screws which are used to secure the encoder 6-to-1 connecting board, then replace the board.

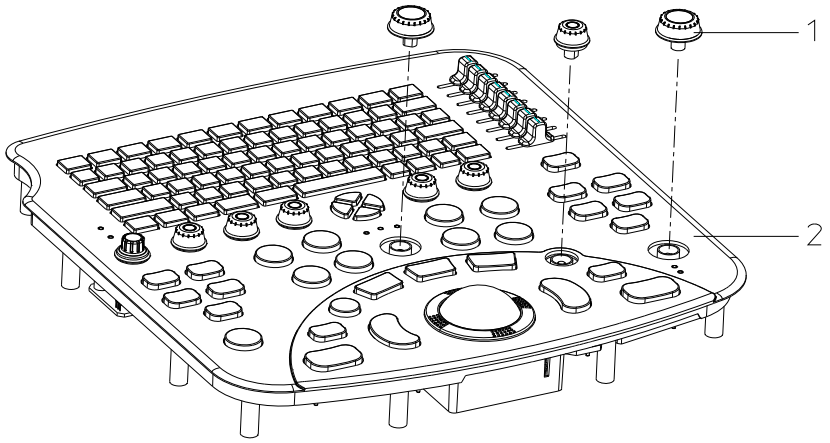


1. Control Panel 2. M3X8 Screw 3. Encoder 6-to-1 Connecting Board 4.

Figure 4-33 Replace the Encoder 6-to-1 Connecting Board (2)

4.3.11.2 Replace the Single-encoder Connecting Board

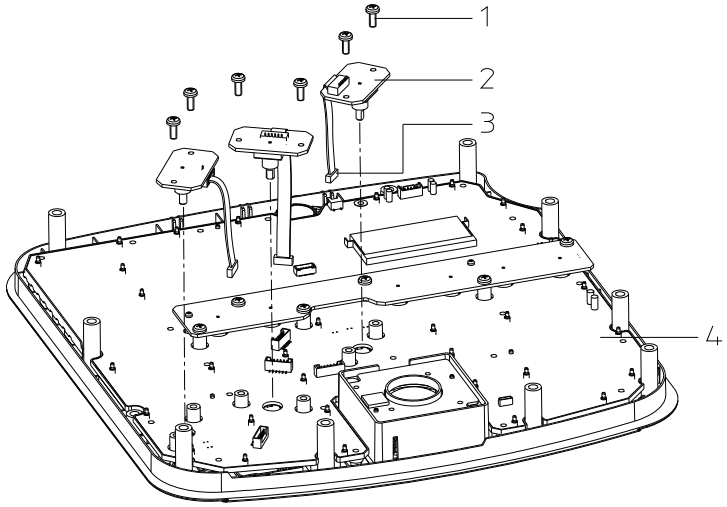
1) Disassemble the control panel module.(Refer to 4.3.7)
2) Pull out the knobs on the encoder connecting boards. (1 knob on 1 board).



1. Encoder Knob 2. Control Panel Module

Figure 4-34 Replace the Single-encoder Connecting Board (1)

3) Pull out the connecting cable plug of the single encoder connecting board from the control panel, remove the 2 M3X8 screws and replace the connecting board.



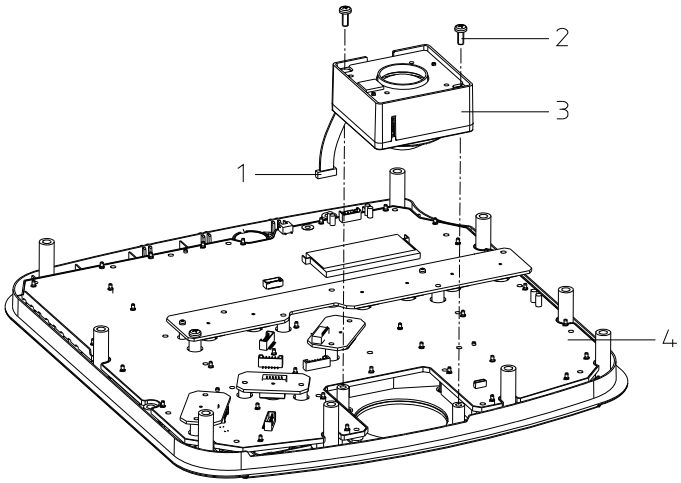
1. M3X8 Screw 2. Connecting Board of Single Encoder

3. Connecting Cable Plug 4. Control Panel

Figure 4-35 Replace the Single-encoder Connecting Board (2)

4.3.12 Replace the Trackball

1) Disassemble the control panel module. (Refer to 4.3.7)
2) Pull out the connecting cable plug connected to the trackball, remove the 2 M3X8 screws which are used to secure the trackball, and take away the trackball.

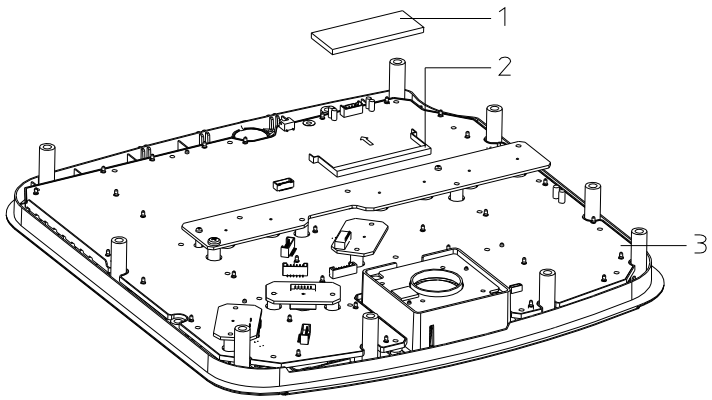


1. Connecting Cable Plug 2. M3X8 Screw 3. Trackball 4. Control Panel

Figure 4-36 Replace the Trackball

4.3.13 Disassemble the Control Panel Buckled Board

1) Disassemble the control panel module. (Refer to 4.3.7)
2) Loosen the board clip on the left and right sides of the buckled board, and the board will automatically spring up, and then take the board out from the socket.

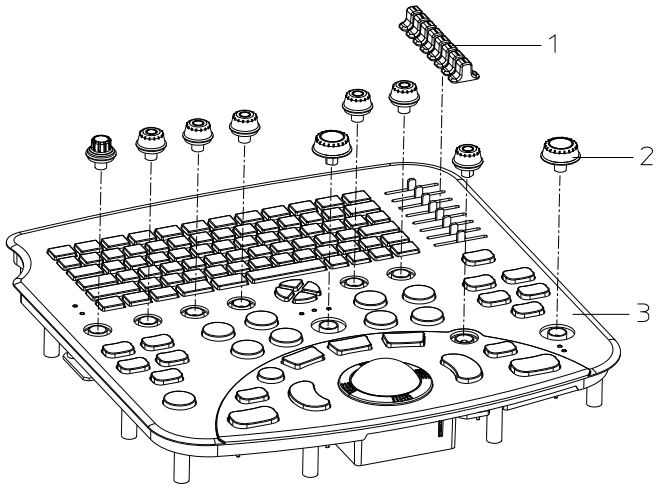


1. Buckled Board 2. Board Clamp 3. Control Panel

Figure 4-37 Replace the Control Panel Buckled Board

4.3.14 Replace the Control Panel

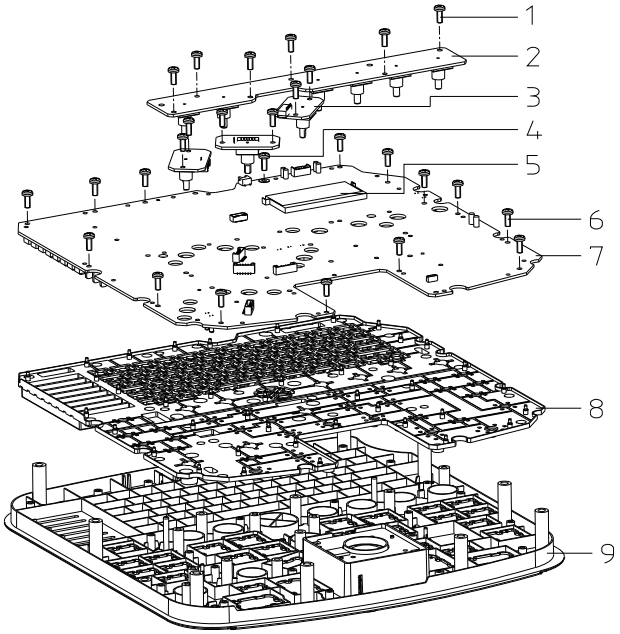
1) Disassemble the control panel module.(Refer to 4.3.7)
2) Pull out the 8 TGC knobs and 9 encoder knobs upward from the control panel. (Refer to 4.3.8)



1. TGC Knob 2. Encoder Knob 3. Control Panel Module

Figure 4-38 Replace the Control Panel (1)

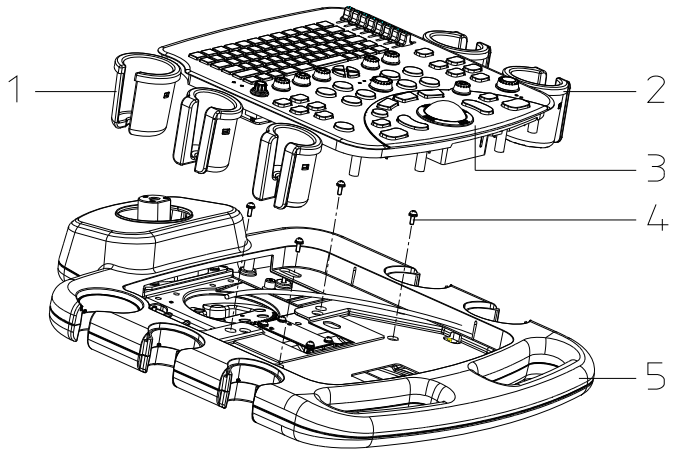
3) Take off the encoder 6-to-1 connecting board, each single encoder connecting board and the control panel buckled board.(Refer to 4.3.8 and 4.3.10)
4) Pull out the connecting cable plug of the buzzer from the control panel.
5) Remove the 26 PT3X10 screws on the control panel and the 1 M3X8 screw which is used to secure the grounding wire.
6) Take out the control panel and the keys from the keyboard cover, and then separate them to finish the replacement.



M3X8 Screw 2. Encoder 6-to-1 Connecting Board 3. Single Encoder Connecting Board
4. M3X8 Screw 5. Control Panel Buckled Board 6. PT3X10 Self-driving Screw
7. Control Panel 8. Silica Gel Key 9. Keyboard Cover

4.3.15 Disassemble the Casting Aluminium Base Cover

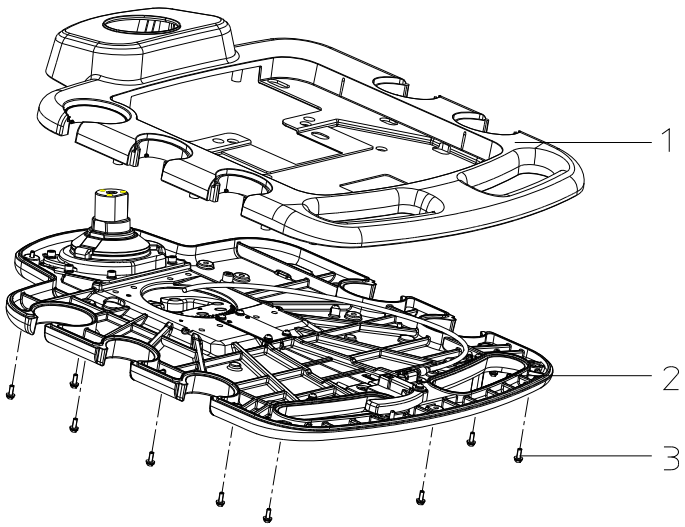
1) Disassemble the monitor module, support arm module and control panel module. (Refer to 4.3.1, 4.3.6 and 4.3.7)
2) Take off the 1 transducer gel holder and the 4 probe holders, and then remove the 4 M4X8 screws which are used to secure the casting aluminium base cover from the frontal surface.



1. Transducer Gel Holder 2. Probe Holder 3. Control Panel Module
4. M4X12 Screw 5. Casting Aluminium Base Cover

Figure 4-40 Disassemble the Casting Aluminium Base Cover

3) Remove the 15 M4X12 screws which are used to secure the casting alumilinium cover at the back of the cover, and then remove the cover.

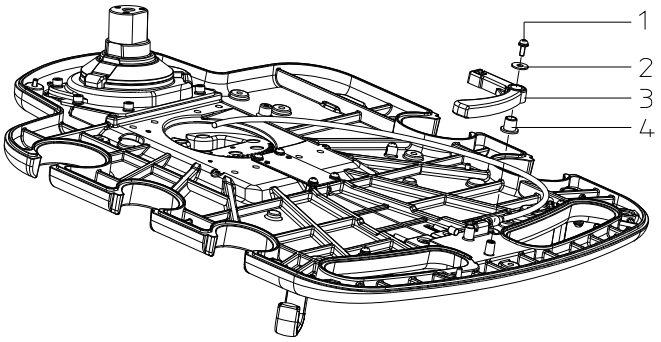


1. Casting Aluminium Base Cover 2. Casting Aluminium Base 3. M4X12 Screw

Figure 4-41 Disassemble the Casting Aluminium Cover (2)

4.3.16 Disassemble the Up/ Down Handle

1) Disassemble the casting aluminium base cover. (Refer to 4.3.12)
2) Remove the 1 M4X12 screw which is used to secure the handle, take off the large flat washer, and then take off the handle.

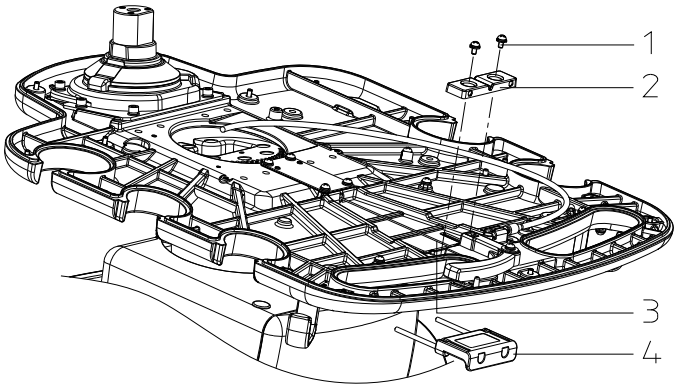


1. M4X12 Screw 2. Large Flat Washer 3. Up/Down Handle 4. Turning Axis Socket

Figure 4-42 Disassemble the Up/ Handle

4.3.17 Disassemble the Turning Handle Module

1) Disassemble the casting aluminium base cover. (Refer to 4.3.12 Replace the Trackball)
2) Remove the 2 M4X8 screws securing the fixing block of balancing pole, pull the dragline to the direction of frontal machine to separate the head of dragline from the locating hole, then remove the fixing block and pull out the turning handle.



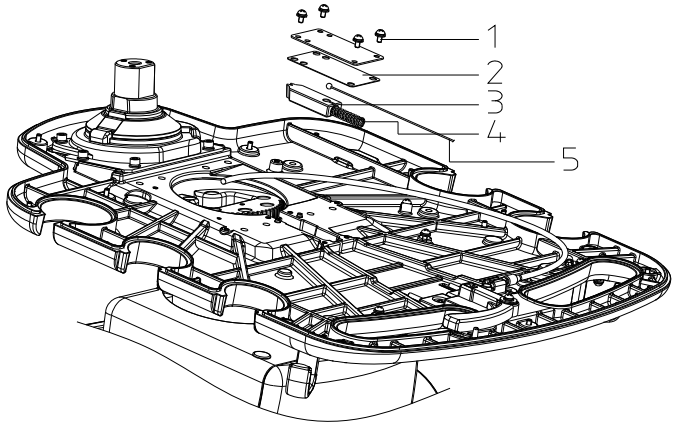
1. Screw M4X8 2. Fixing Block of Balancing Pole 3. Dragline 4. Turning Handle

Figure 4-43 Disassemble the Rotating Handle

4.3.18 Disassemble the Turning Block Cover

1) Disassemble the cast aluminium base cover.(Refer to 4.3.12)

2) Remove the 4 M4X8 screws which are used to secure the cover, after taking off the turning block cover, the turning block as well as the spring can be dissembled.



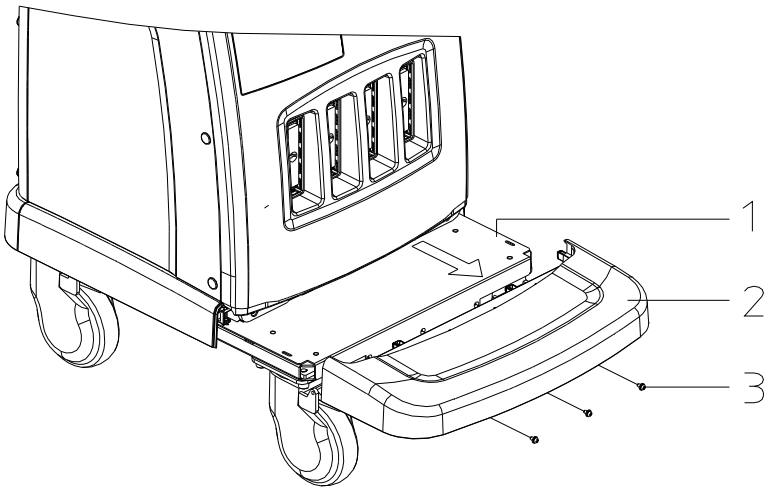
1. M4X8 Screw 2. Turning Block Wearing Piece 3. Turning Block 4. Spring 5.

Figure 4-44 Disassemble the Turning Block Cover

4.3.19 Disassemble the Frontal Cover of the Main Unit

1） Remove the 3 M4×8 screws which are used to secure the base of the main unit rack below the footswitch board.

2） Pull out the footswitch board module horizontally from the machine.

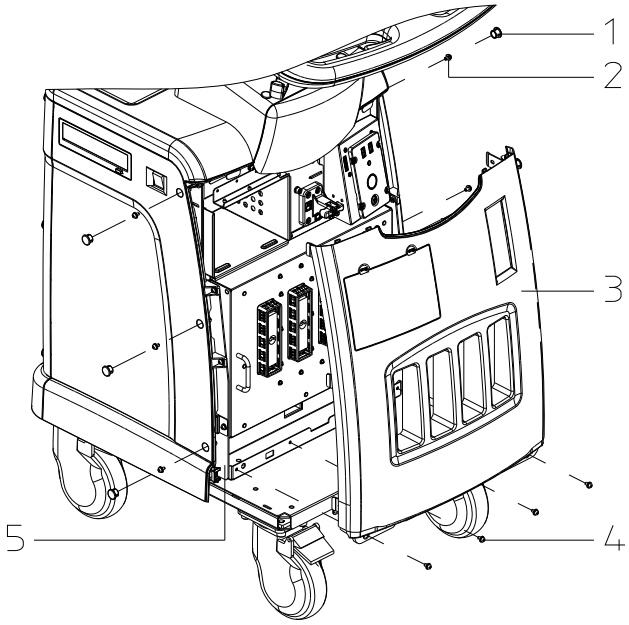


1. Main Unit Rack Base 2. Footswitch Board Module 3. M4X8 Screw

Figure 4-45 Disassemble the Frontal Cover of the Main Unit (1)

3） Pull out the plugs (three at each side) that are filled in the left and right lateral sides, and then remove the screws (three at each side) which are installed on the two sides of the rack.

4） Remove the 4 M4X8 screws which are used to secure the rack below the main unit cover, remove the cover downward slightly and take off the frontal cover when the cover is separated from the slot at the top side.

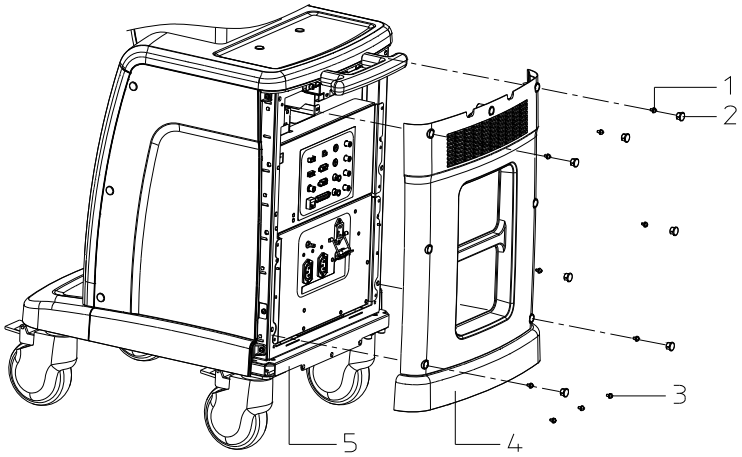


1. Plug 2. M4X8 Screw 3. Frontal Shell of Main Unit
4. M4X8 Screw 5. Main Unit Rack

Figure 4-46 Disassemble the Frontal Cover of the Main Unit (2)

4.3.20 Disassemble the Rear Cover of the Main Unit

1) Remove the 3 M4X8 screws which are used to secure the rack at the back of the rear cover.
2) Pull out the 7 plugs filled in the bolt hole at the rear cover of the main unit from the back side of the machine, and remove the 7 M4X8 screws which are used to secure the rack.

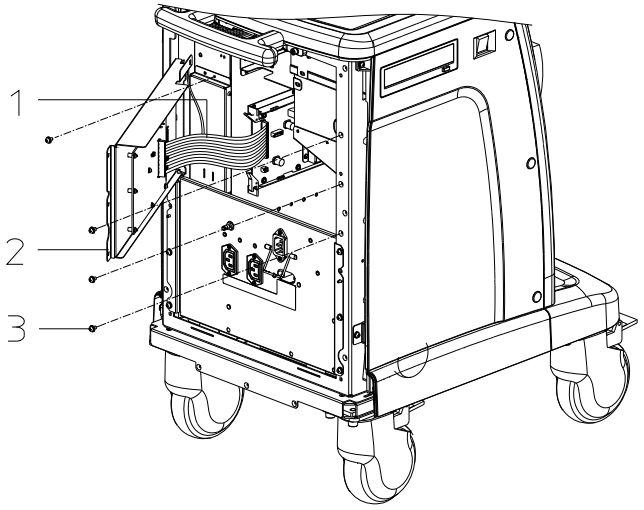


1. M4X8 Screw 2. Plug 3. M4X8 Screw
4. Back Cover of the Main Unit 5. Main Unit Rack

Figure 4-47 Disassemble the Back Cover of the Main Unit

4.3.21 Disassemble the IO Module

1) Disassemble the rear cover of the main unit. (Please refer to 4.3.17)
2) Remove the 4 M4X8 screws which are used to secure the IO module, then the IO module can be turned around within 90°outward.
3) To disassemble the IO module, first pull out the connecting cable, then slightly lift the module and separate it from the rack shaft.



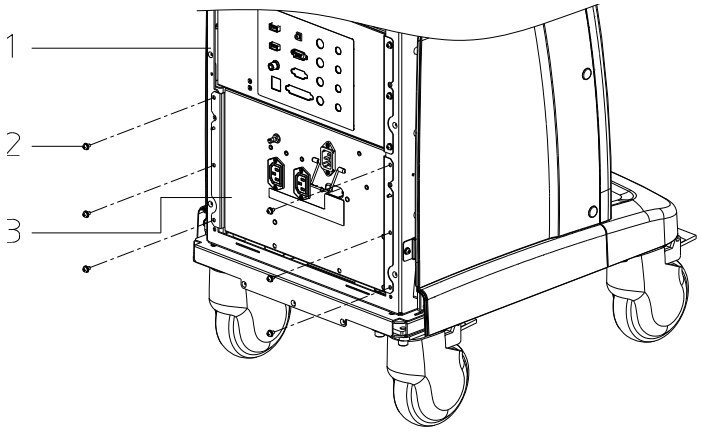
1. Connecting Cable 2. I/O Module 3. M4X8 Screw

Figure 4-48 Disassemble the IO Module

4.3.22 Disassemble the Power Supply Input Module

1）Disassemble the rear cover of the main unit. (Please refer to 4.3.17)

2）Remove the 6 M4X8 screws which are used to secure the module.

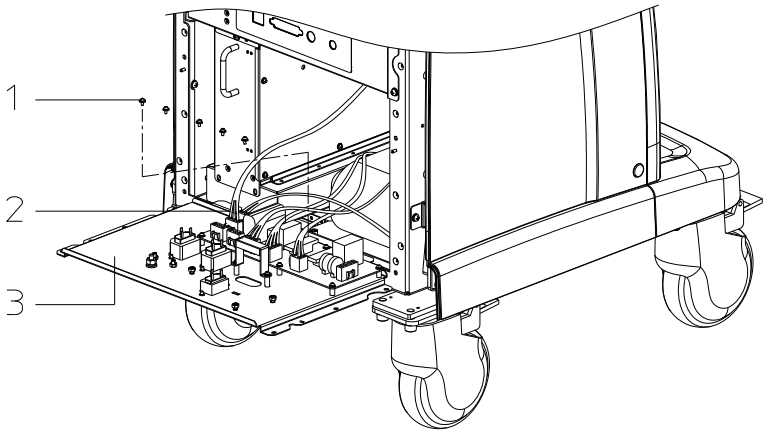


1. Main Unit Rack 2. M4X8 Screw 3. Power Supply Input Module

Figure 4-49 Disassemble the Power Supply Input Module (1)

3） Turn the module 90°to insert its two lugs into the rectangular hole at the lower part of the rack.

4） If the module has to be disassembled, first remove the 5 M4X8 screws securing the rack base, and then pull out the cables.

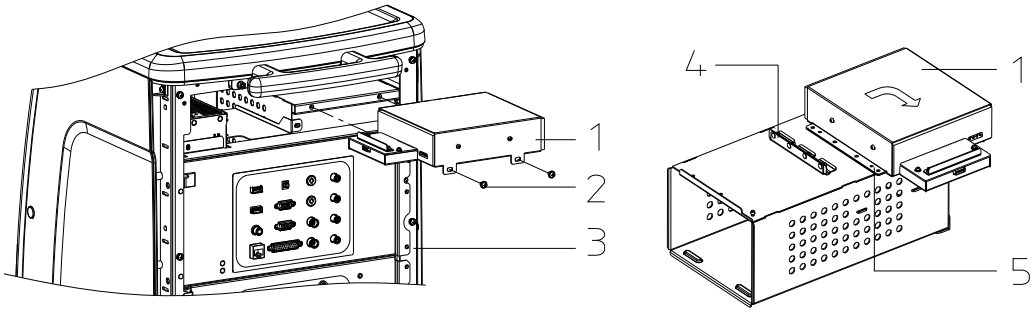


1. M4X8 Screw 2. Connecting Cable 3. Power Supply Input Module

Figure 4-50 Disassemble the Power Supply Input Module (2)

4.3.23 Disassemble the DVD-R/W Module

1) Disassemble the rear cover of the main unit. (Please refer to 4.3.17)
2) Remove IO module and pull out DVD power cable and DVD signal cable.
3) Remove 2 M4X8 screws fixing DVD-R/W module.
4) Pull out the module from the back of the machine, separate the frontal edge fold from the main unit rack.

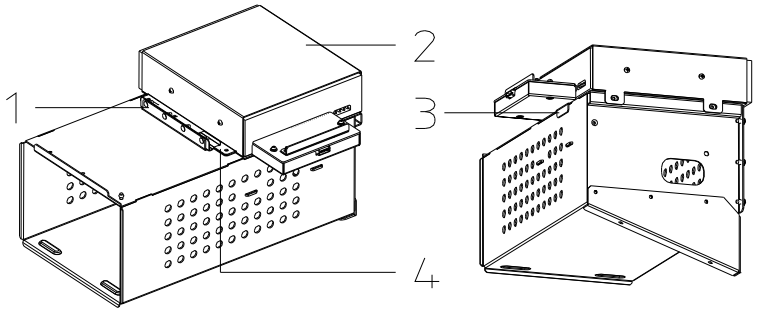


1. DVD-R/W Module 2.M4X8 Screw 3. Main Unit Rack

4. Elastic Sheet of the Main Unit Rack 5. Edge fold of DVD-R/W

Figure 4-51 Disassemble the DVD-R/W Module

5) When assemble the module, put the edge fold of the module totally on the elastic sheet of main unit, and close the bottom guarding edge to the main unit rack, meanwhile, try to press down the DVD button and make some changes if necessary.

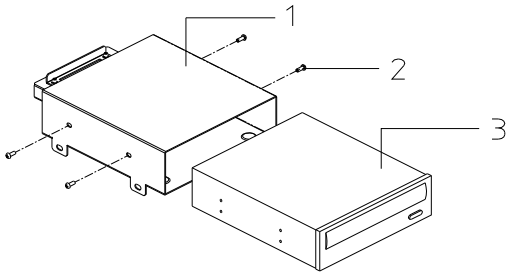


1. Elastic Sheet of Main Unit Rack 2. DVD-R/W Module
3. DVD-R/W Guarding Edge 4. DVD-R/W Front Edge Fold

Figure 4-52 Assemble the DVD-R/W Module

4.3.24 Disassemble the DVD and USB-to-SATA Port Board

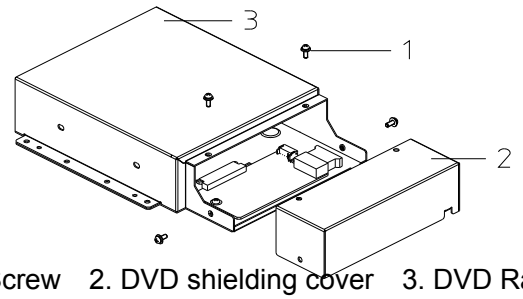
1) Disassemble the DVD-R/W module. (Please refer to 4.3.20)
2) Remove the DVD-R/W M3X8 screws at the two sides (two screws at each side), and take out the DVD-R/W module outwardly. (Note: Properly connect the connector of the DVD-R/W with the connector on the port board when assemble the module, take care when insert the module.)



1. DVD Rack 2. M3X8 Screw 3. DVD-R/W

Figure 4-53 Disassemble the DVD-R/W

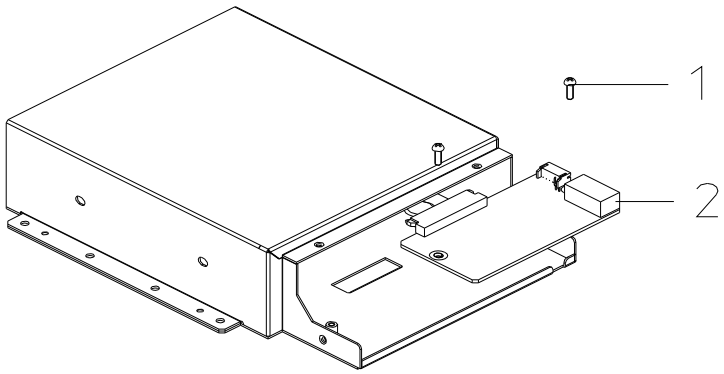
3) Remove 4 M3X8 screws connecting DVD shielding cover and the racket，then take out the shielding cover；



1. M3X8 Screw 2. DVD shielding cover 3. DVD Rack

Figure 4-54 Disassemble the USB-to-SATA Port Board (1)

4) Remove 2 combination M3X8 screws fixing USB to SATA board to remove the board and DVD power cable and signal cable (the cable is not drawn in the figure).



1. M3X8 Screw 2. USB-to-SATA Port Board

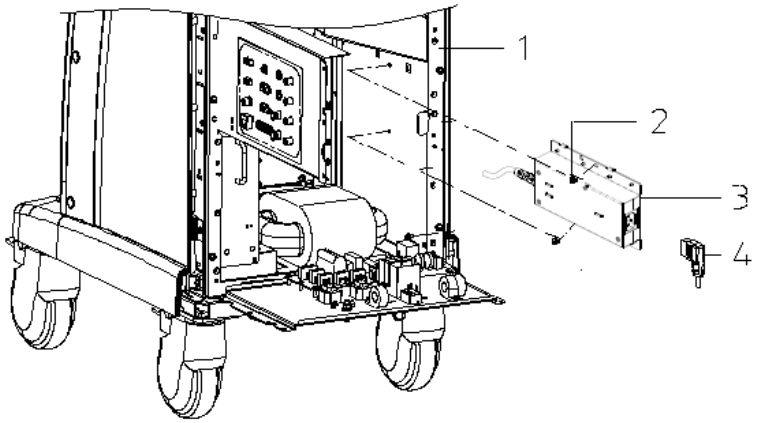
Figure 4-55 Disassemble the USB-to-SATA Port Board (2)

4.3.25 Disassemble the Power Supply Adapter

1） Remove the 4 M4X8 screws on the IO module, and turn it within a certain angle (can be turned within 90°). (Please refer to 4.3.21)

2） Remove the 6 M4X8 screws on the power supply input module, and turn it 90°to insert its two lugs into the rectangular hole at the lower part of the rack.(Please refer to procedure 1, 2, 3 as described in 4.3.22)

3） Remove the 2 M4X12 screws which are used to secure the power supply adapter rack, slightly lift the rack and then take off the rack and power supply adapter, at last, pull out the connecting cable to complete the disassembly.(Note: Pull out the connecting cable plug between the adapter and the main unit box.)

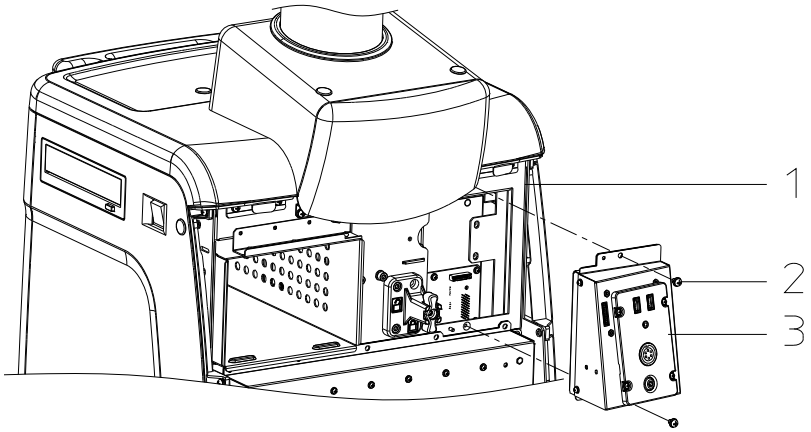


1. Main Unit Rack 2. M4X12 Screw(2 pieces) 3. Power Supply Adapter 4. Connecting Cable

Figure 4-56 Disassemble the Power Supply Adapter

4.3.26 Disassemble the IO Frontal Board and ECG Board

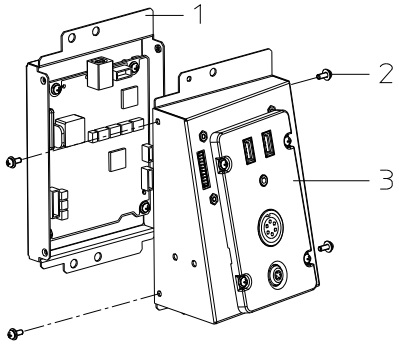
1) Disassemble the frontal cover of the main unit. (Please refer to 4.3.16)
2) Pull out the cable connecting to the ECG module, remove the 2 M4 X8 screws securing the ECG module, and then take out the ECG module.



1. Main Unit Rack 2. M4X8 Screw 3. ECG Module

Figure 4-57 Disassemble the ECG Module

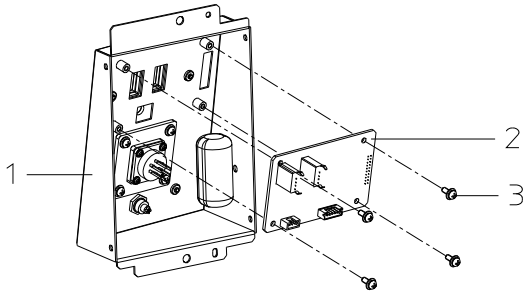
3) Remove the 4 M3 X8 screws on the enclosure of ECG module, take off the internal cables and disassemble the ECG base module and ECG installation cover module.



1. ECG Base Module 2. M3X8 Screw 3. ECG Installation Cover Module

Figure 4-58 Disassemble the IO Frontal Board and ECG Board (1)

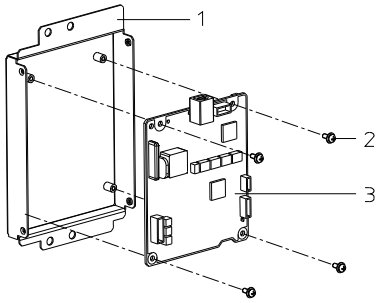
4) Pull out the internal cables, remove the 4 M3X8 screws securing the IO frontal board, and then take off the I/O frontal Board.



1. ECG Frontal cover 2. I/O Frontal Board 3. M3X8 Screw

Figure 4-59 Disassemble the I/O Frontal Board and ECG Board (2)

5) Remove the 4 M3X8 screws securing the ECG board, and then take off the ECG. (When configured with ECG module.)

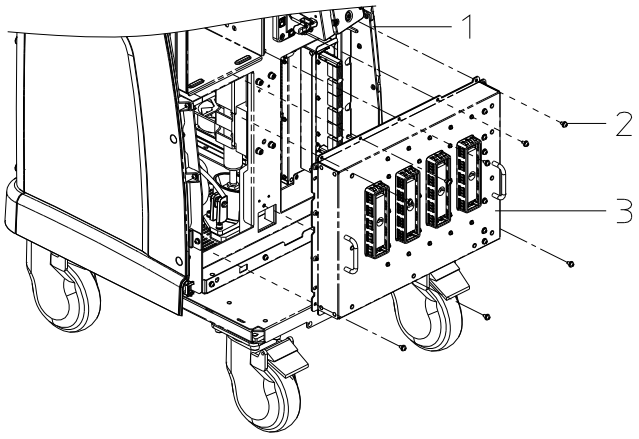


1. ECG Base 2. M3X8 Screw 3. ECG Board

Figure 4-60 Disassemble the I/O Frontal Board and ECG Board (3)

4.3.27 Disassemble the Probe Board

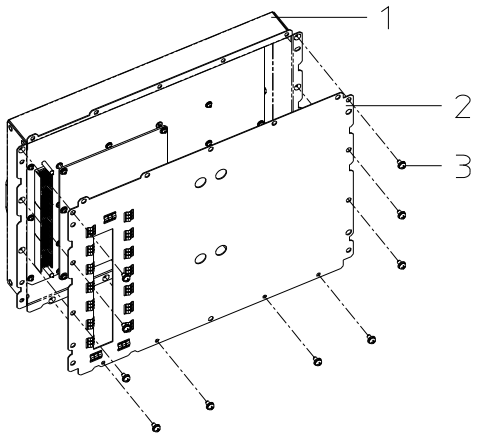
1) Disassemble the frontal cover of the main unit. (Please refer to 4.3.16)
2) Remove the 8 M4x8 screws which are used to secure the probe board module, hold the 2 handles and stably pull out the probe board module.



1. Main Unit Rack 2. M4X8 Screw 3. Probe board Module

Figure 4-61 Disassemble the Probe Board Module (1)

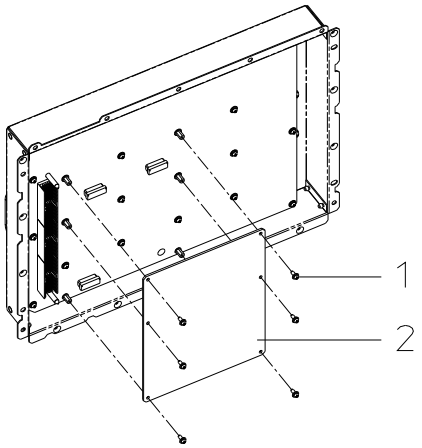
3) Remove the 10 M4X8 screws which are used to secure the probe board shielding cover and then take off the cover.



1. Probe Board Shielding Cover 2. Shielding Plate of Probe Board 3. M4X8 Screw

Figure 4-62 Disassemble the Probe Board (2)

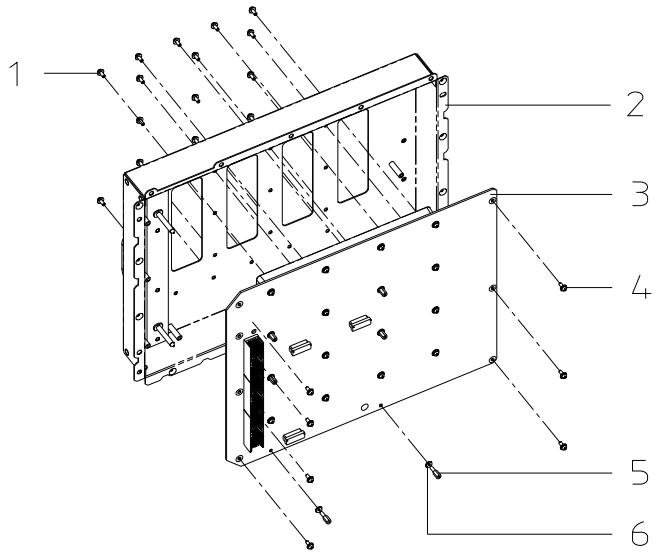
4) Remove the 6 M3X8 screws which are used to secure the probe control board, vertically pull out the board, and then slightly separate the 3 connectors from the board.



1.M3X8 Screw 2. Probe Control Board

Figure 4-63 Disassemble the Probe Board (3)

5) Remove the 19 M3X8 screws which are used to secure the shielding cover of the probe board and aluminium shielding frame, then remove the 7 M3X8 screws and 2 M3X7 bolts securing the probe board and the probe board shielding cover, and at last take away the 4 gaskets, then the probe board shielding cover can be taken off.

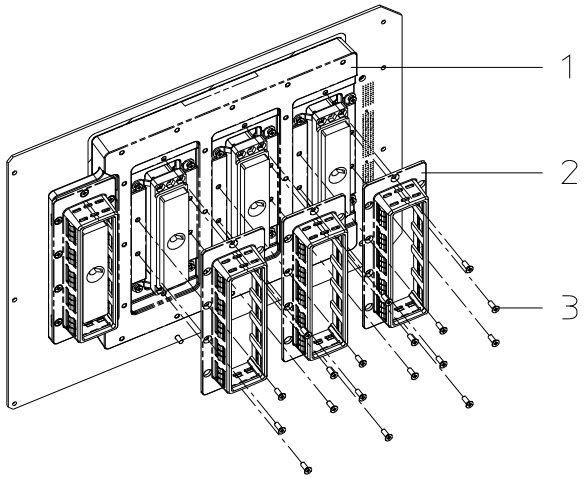


1. M3X8 Screw 2. Shielding Cover of the Probe Board 3. Probe Board

4. M3X8 Screw 5. M3X7 Stud Screw 6. D3 Gasket

Figure 4-64 Disassemble the Probe Board (4)

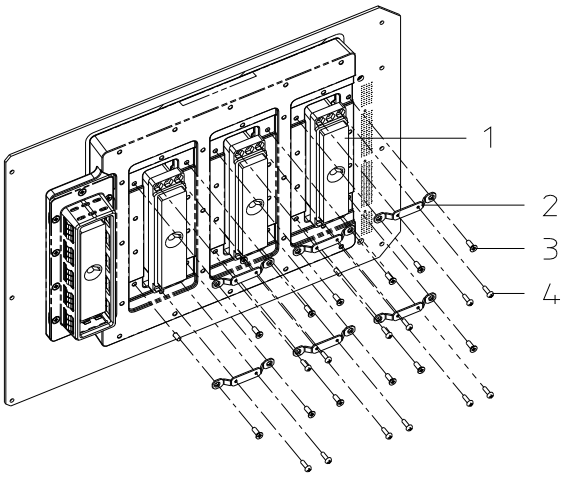
6) Remove the M3X8 sunk screws on the aluminium shielding frames and shielding plates of the transducer socket (6 for each), then remove the 3 shielding frames of the transducer. (Do not move the pseudo transducer at the leftmost).



1. Aluminium Shielding Plate 2. Aluminium Shielding Frame 3. M3X8 Sunk Screw

Figure 4-65 Disassemble the Probe Board (5)

7) Remove the M3×8 sunk screws securing the probe installing bracket and the aluminium probe shielding cover (there are 2 sunk screws on each part), then remove the 2 M2.5X8 panhead screws securing the probe port and probe installing bracket, and then take off the 6 installing brackets.

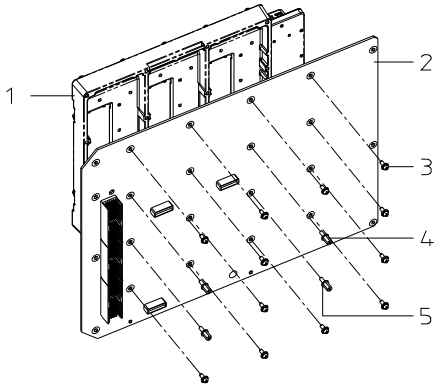


1. Probe Port 2. Probe Installing Bracket

3. M3X8 Sunk Screw 4. M2.5X8 Panhead Screw

Figure 4-66 Disassemble the Probe Board (6)

8) Remove the 12 M3X8 screws securing the transducer board and aluminium shielding plate, then remove the 4 M3X7+8-6 stud screws and 8 gaskets, and then separate the shielding plate from the transducer board.



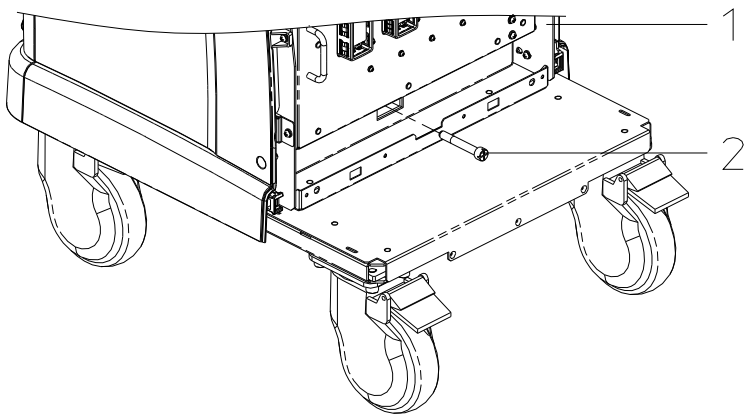
1. Aluminium Shielding Plate 2. Transducer Board 3. M3X8 Screw

4. M3X7 Stud Screw 5. D3 Gasket

Figure 4-67 Disassemble the Probe Board (7)

4.3.28 Replace the Air Spring

1) Trample down the brake of the caster to lock the caster, raise the keyboard and the monitor to the top.
2) Disassembly the control panel module and frontal cover of the main unit. (Please refer to 4.3.7and 4.3.16)
3) Pull out the lower cross-pin of the air spring from the guide holder.

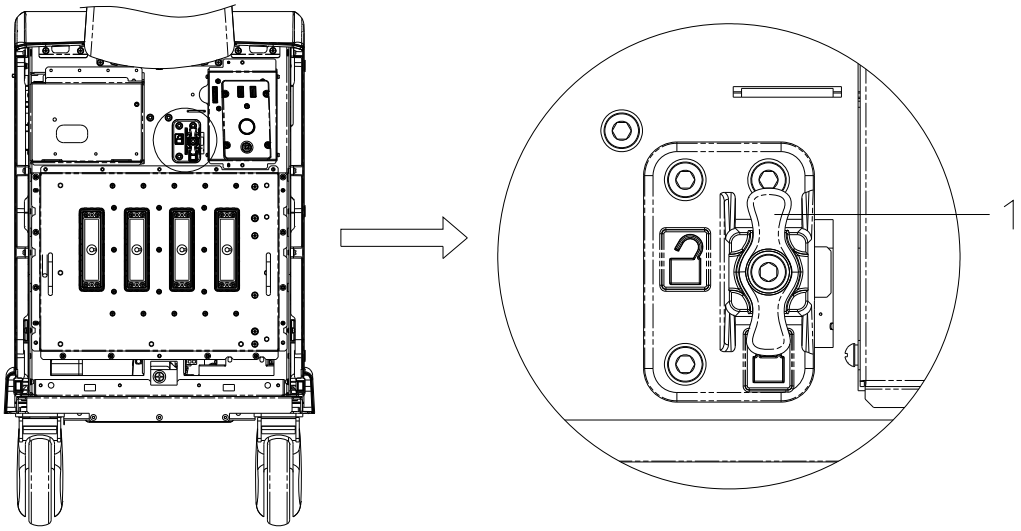


1. Main Unit Rack 2. Lower Cross-pin of the Air Spring

Figure 4-68 Replace the Air Spring (1)

4) Draw the spanner of the retainer cross-pin outwardly, turn it 90°clockwise, and the spanner will be locked after releasing. (There are lock and unlock symbols marked on the retainer).

   (Note: Remove the ECG module first if it is an obstacle for the operation of the spanner).

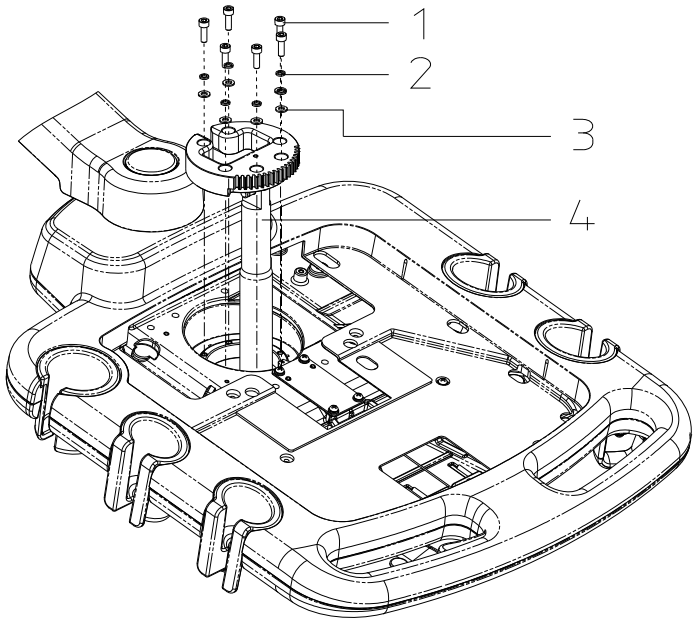


1. Spanner of the Retainer Cross-pin

Figure 4-69 Replace the Air Spring (2)

5) Hold the keyboard handle by both hands, press down the up/down handle on the keyboard handle and raise the keyboard. When you hearing “Cluck”, it means the cross-pin is inserted into the hole of the back-up block, the keyboard is vertically locked with the main unit.

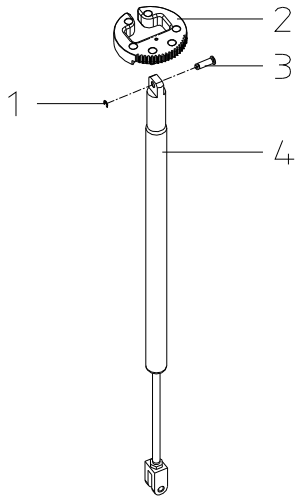
6) Remove the 6 M5X16 inner hexagon screws, the flat washer, and elastic washer by the inner hexagon spanner, and then take out the air spring module from the machine.



1. M5X16 Inner Hexagon Screw 2. Elastic Washer 3. Flat Washer 4. Air Spring

Figure 4-70 Replace the Air Spring (3)

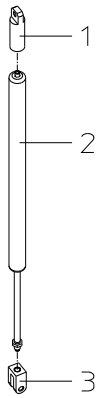
7) Disassemble the retaining ring from the upper cross-pin of air spring by the cross screwdriver, and then take off the rotary gear.



1. Retaining ring 2. Rotary Gear 3. Upper Cross-pin 4. Air Spring

Figure 4-71 Replace the Air Spring (4)

8) Screw out the upper connecting link and lower connecting link of the air spring, and then finish the disassembly of the air spring.

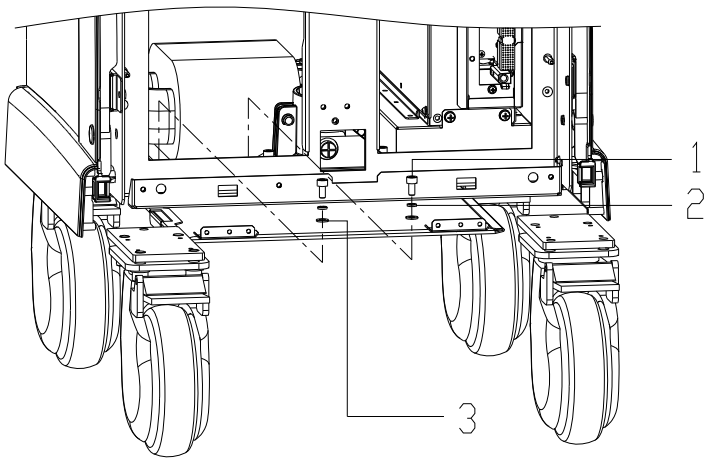


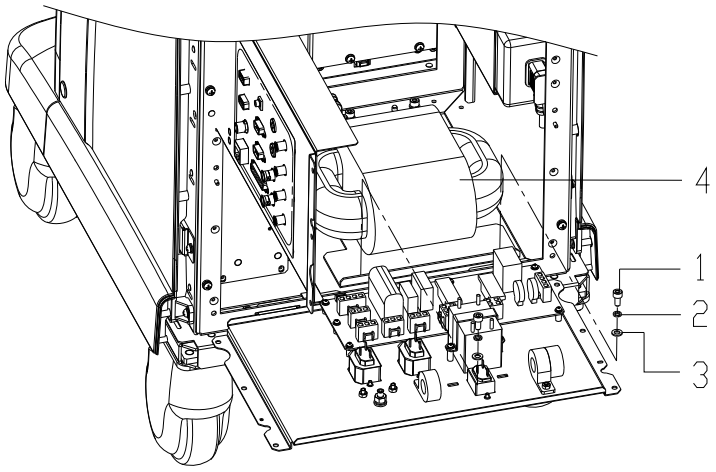
1. Upper Connecting Link 2. Air Spring 3. Lower Connecting Link

Figure 4-72 Replace the Air Spring (5)

4.3.29 Disassemble the Isolating Transformer

1) Disassemble the probe board module. (Please refer to procedure 1 and 2 as described in section 4.3.24).
2) Remove the 4 M4X8 screws securing the IO module, turn the module a certain angle. (within 90°) (Please refer to procedure 1 and 2 as described in section 4.3.18).
3) Remove the 6 M4X8 screws securing the power supply input module, turn the module 90°, insert the two supporting lugs into the rectangular hole. (Please refer to procedure 1, 2, 3 as described in section 4.3.19).
4) Remove the M4X8 screws securing the grounding wire of the transformer, disassemble the flat washer, elastic washer and the 4 M5X10 inner hexagon screws securing the isolating transformer, then take off the transformer.





1. M5X10 Inner Hexagon Screw 2. Elastic Washer 3. Flat Washer 4. Isolating

Figure 4-73 Disassemble the Isolating Transformer

4.3.30 Replace the HDD

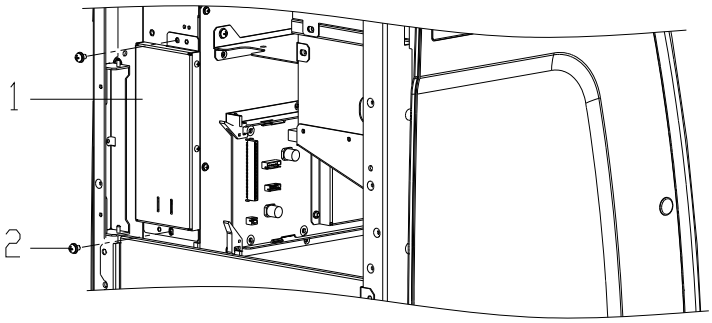
NOTE Please pay attention to the following matters during disassembling/assembling, otherwise the hard disk will be damaged:

- 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

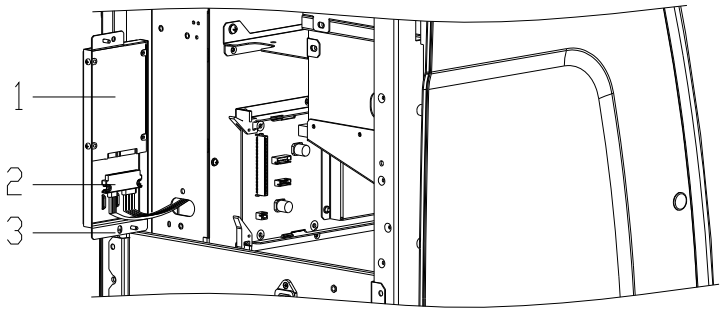
1) Disassemble the IO module. (Please refer to section 4.3.18).
2) Remove the 2 M4X8 screws securing the HDD bracket.



1. HD Module 2. M4X8 Screw

Figure 4-74 Replace the HDD (1)

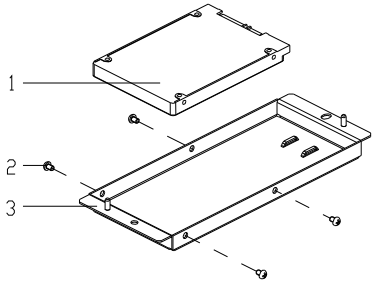
3） Take out the HDD bracket and pull out the HDD plug.



1. HDD 2. HDD Plug 3. HDD Bracket

Figure 4-75 Replace the HDD (2)

4） Take off the HDD and its bracket, remove the 4 M3X4 panhead screws securing the HDD, and then finish the replacement.

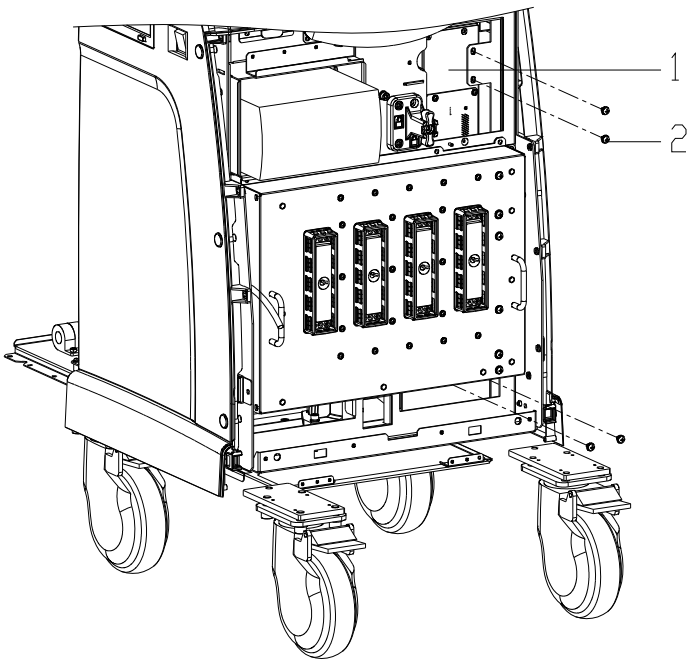


1. HDD 2. M3X4 Screw 3. HDD Bracket

Figure 4-76 Replace the HDD (3)

4.3.31 Disassemble the Main Unit Box Module

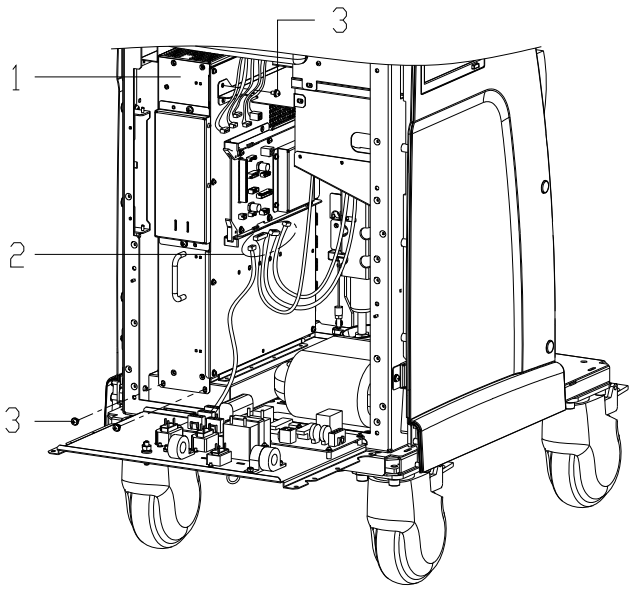
1) Disassemble the ECG and IO modules. (Please refer to section 4.3.18 and procedure 1, 2 as described in section 4.3.23).
2) Remove the 6 M4X8 screws securing the power supply input module, turn the module 90°, insert the two supporting lugs into the rectangular hole. (Please refer to procedure 1, 2, 3 as described in section 4.3.19).
3) Remove the 4 M4X8 screws securing the main unit box module from the front part of the machine.



1. Main Unit Box Module 2. M4X8 Screw

Figure 4-77 Disassemble the Main Unit Box (1)

4) Pull out the cable plugs on the IO port board, take off the IO module, and remove the 4 M4X8 screws securing the main unit box module from the back part of the machine.

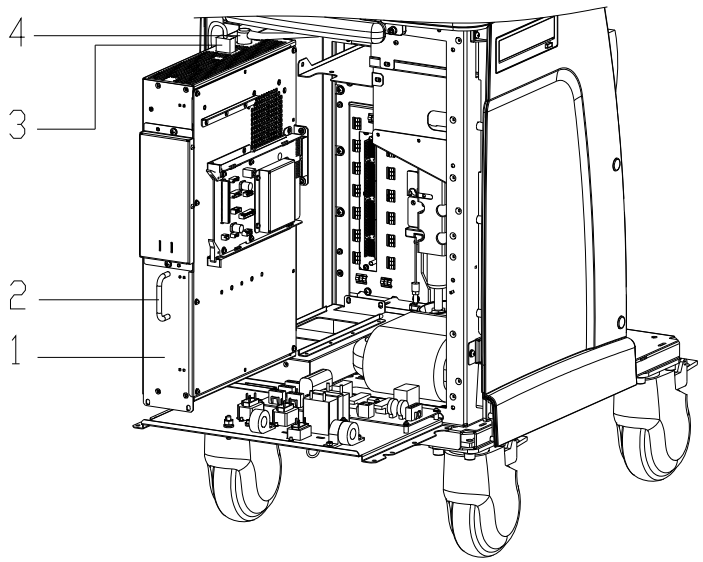


1. Main Unit Box Module 2. M4X8 Screw (used to fix the cable)

3. M4X8 Screw (To fix the main unit box)

Figure 4-78 Disassemble the Main Unit Box (2)

5) Hold the handle of the main unit box, slowly pull out the main unit box module, pull out the plugs of network cable and power supply adapter (when the plugs can be seen on the top part of the main unit box), and then finish the disassembly.

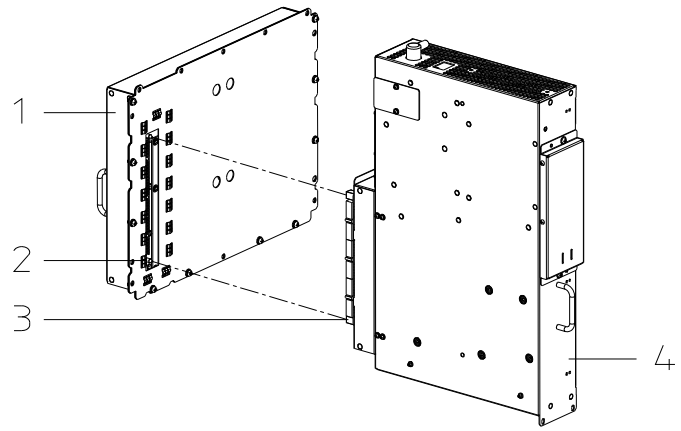


1. Main Unit Box Module 2. Handle of the Main Unit Box

3. Plug of the Network Cable 4. Plug of the Power Supply Adapter

Figure 4-79 Disassemble the Main Unit Box (3)

6) When assemble the main unit box module, make sure to align the guide-pin socket with the guide-pin, and align the plug of probe connection board with the socket on the probe board.



1. Transducer Board Module 2. Guide Pin 3. Guide-pin Socket 4. Main Unit Box module

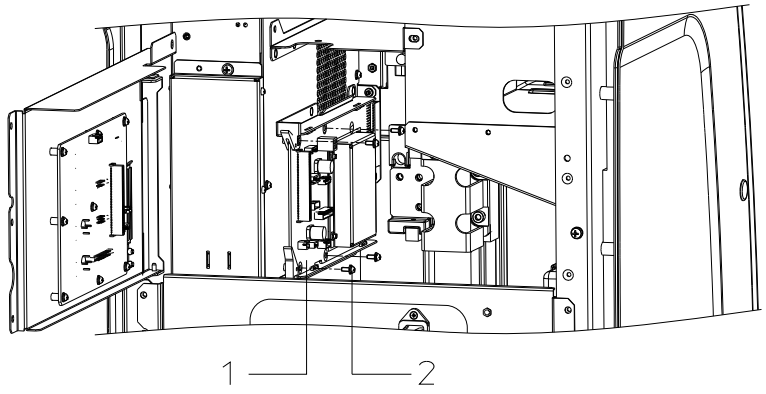
Figure 4-80 Disassemble the Main Unit Box Module

4.3.32 Replace the IO Port Board

1) Remove the 4 M4X8 screws securing the IO module, and turn the module a certain angle (within 90°).(Please refer to procedure 1 and 2 as described in section 4.3.18).

2) Pull out all the connecting cables on the IO port board, and remove the 4 M3X8 screws securing the IO port board.

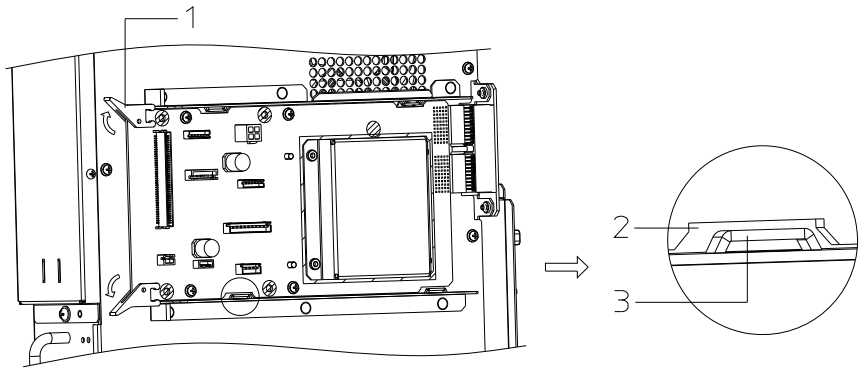
If it is not convenient to remove the screws above, you can first remove the 6 M4X8 screws securing the power supply input module, turn the module 90°, insert the two supporting lugs into the rectangular hole. (Please refer to procedure 1, 2, 3 as described in section 4.3.19).



1. IO Port Board 2. M3X8 Screw

Figure 4-81 Replace the IO Port Board (1)

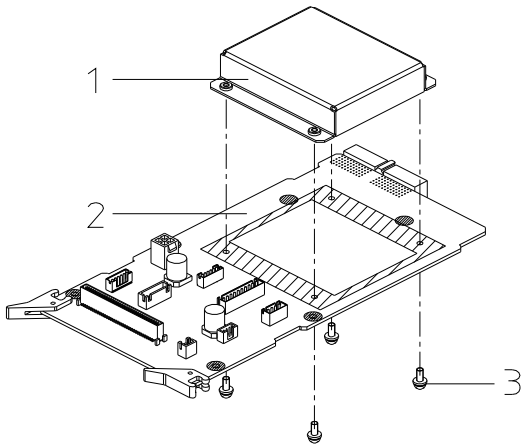
3) Pull the two spanners to separate the socket of IO port board from the socket of IO connecting board, and then take out the IO port board upward.



1. Spanner 2. IO Port Board Gap 3. Limit Bridge

Figure 4-82 Replace the IO Port Board (2)

4) Remove the 4 M3X8 screws securing the IO port board shielding cover and then finish the replacement.

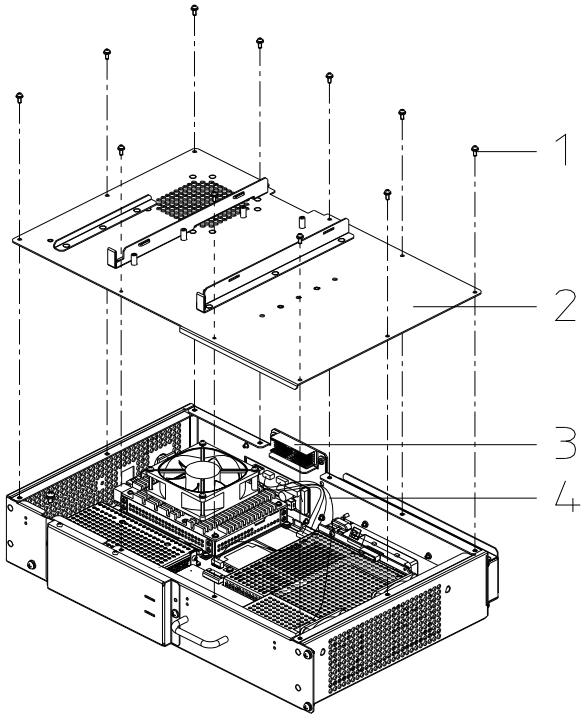


1. Shielding Cover 2. I/O Port Board 3. M3X8. Screw

Figure 4-83 Replace the IO Port Board (3)

4.3.33 Replace the IO Connecting Board

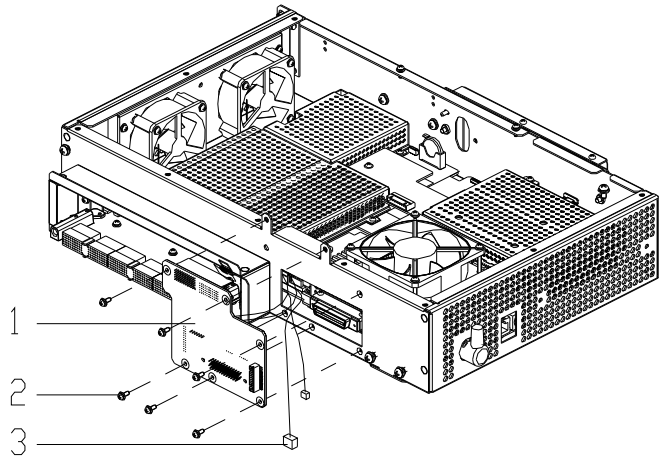
1) Disassemble the main unit box module. (Please refer to section 4.3.28).
2) Disassemble the IO port board. (Please refer to procedure 2, 3 as described in section 4.3.29).
3) Remove the 11 M3X8 screws securing the main unit box cover, and then take off the cover.



1. M3X8 Screw 2. Main Unit Box Cover 3. IO Connecting Board
4. Cables between the Master Board and IO Connecting Board

Figure 4-84 Replace the IO Connecting Board (1)

4) Remove the 6 M3X8 screws securing the IO connecting board, pull out the IO connecting board outward, and draw out the cable plugs on the IO connecting board, then finish the replacement.

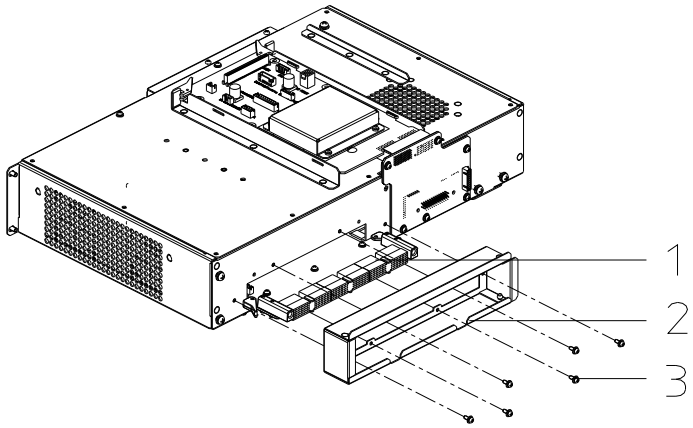


1. IO Connecting Board 2. M3X8 Screw 3. Cable Plug

Figure 4-85 Replace the IO Connecting Board (1)

4.3.34 Disassemble the Transducer Connecting Board

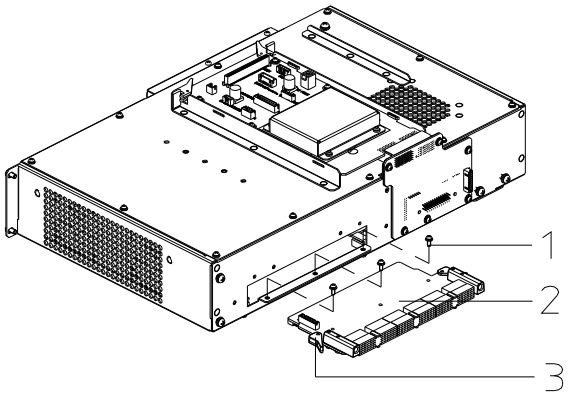
1) Disassemble the main unit box. (Please refer to section 4.3.28).
2) Remove the 6 M3X8 screws securing the probe connection board shielding cover, and then take off the cover.



1. Probe connection board 2. Shielding Cover 3. M3X8 Screw

Figure 4-86 Disassemble the Probe connection board (1)

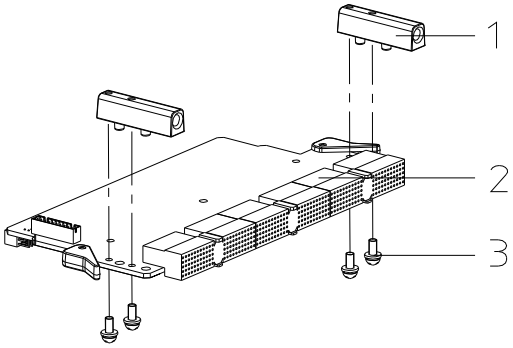
3）Remove the 3 M3X8 screws, pull the 2 spanners to separate the board from the sockets and then pull out the probe connection board.



1. M3X8 Screw 2. Probe connection board 3. Spanner

Figure 4-87 Disassemble the Probe connection board (2)

4） Remove the 4 M3X8 screws securing the guide-pin socket, and then replace the connecting board.

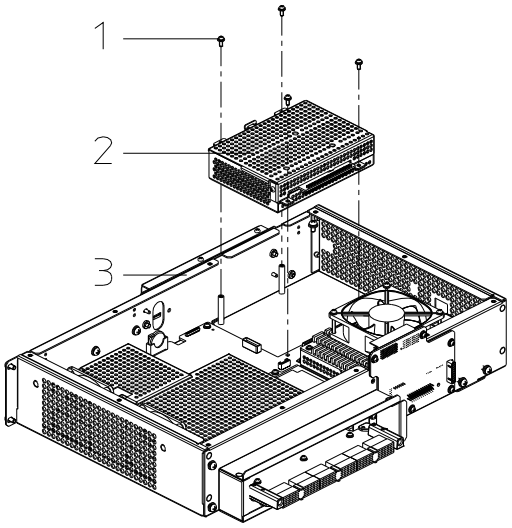


1. Guide-pin Socket 2. Probe connection board 3. M3X8 Screw

Figure 4-88 Disassemble the Probe connection board (3)

4.3.35 Replace the Power Supply Main Board and Auxiliary Board

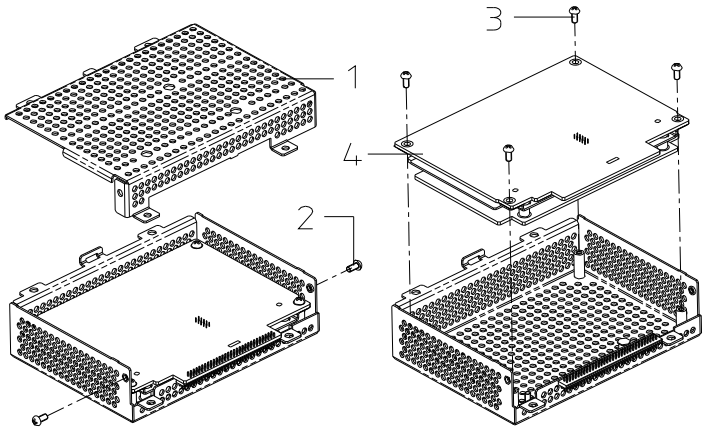
1) Remove the main unit box cover. (Please refer to the procedure 1, 2, 3 as described in section 4.3.30).
2) Remove the 4 M3X6 panhead screws securing the power supply module, draw out the cables on the power supply module and take out the module.



1. M3X8 Screw 2. Power Supply Module 3. Main Unit Box

Figure 4-89 Replace the Main Board and Auxiliary Board of Power Supply (1)

3) Remove the 2 M3X6 panhead screws securing the power supply box, take off the cover; remove the 4 M3X6 screws securing the power supply main board; take out the main board, the power supply box clapboard and power supply auxiliary board assembly.

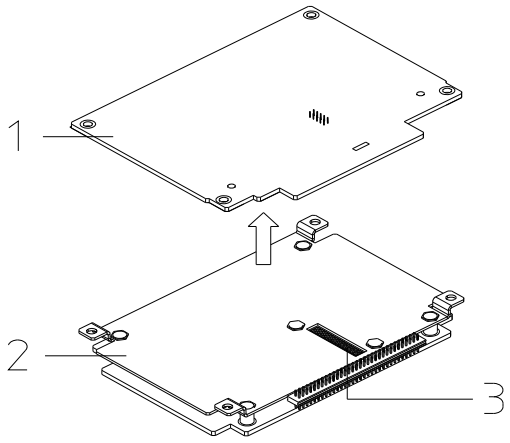


1. Upper Cover of Power Supply Box 2. M3X6 Screw

3. M3X6 Screw 4 Power Supply Main Board

Figure 4-90 Replace the Power Supply of Main Board and Auxiliary Board (2)

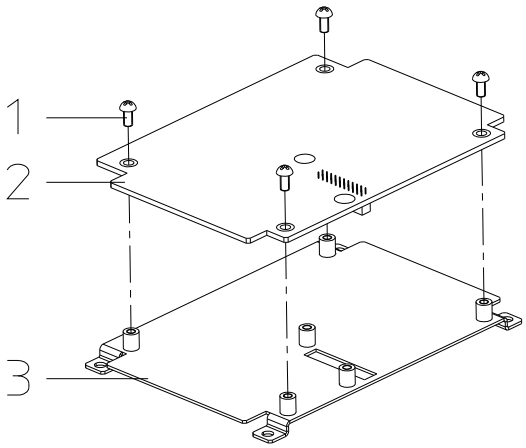
4) Raise the power supply main board to separate it from the connecting socket of the auxiliary board, and then take off the power supply main board.



1. Power Supply Main Board 3. Clapboard 3. Connecting Socket

Figure 4-91 Replace the Main Board and Auxiliary Board of Power Supply (3)

5) Remove the 4 M3X6 panhead screws securing the power supply auxiliary board, and then take off the auxiliary board.

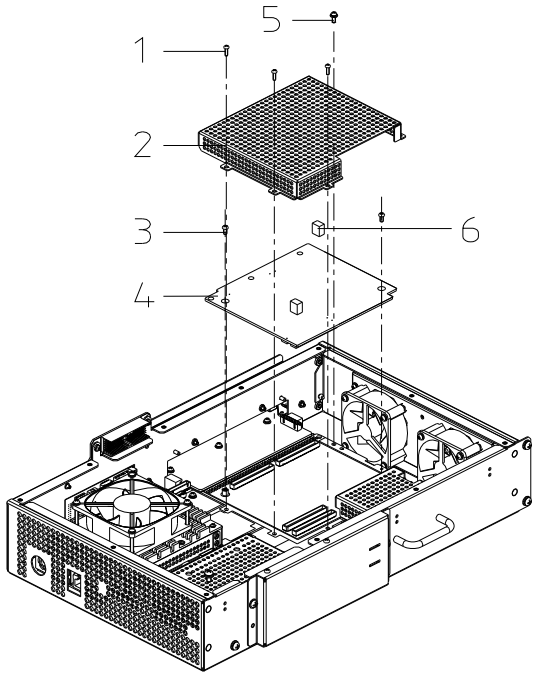


1. M3X6 Screw 2. Power Supply Main Board 3. Clapboard

Figure 4-92 Replace the Main Board and Auxiliary Board of Power Supply (4)

4.3.36 Replace the Transmitting Board

1) Disassemble the cover of main unit box. (Please refer to procedure 1, 2, 3 as described in section 4.3.30).
2) Remove the 3 M2.5X8 panhead screws securing the transmitting shielding cover and lower shielding cover of master board, then remove the 1 M3X8 screw securing the transmitting shielding cover and main unit box, take off the 2 board pressing blocks, remove the 2 M3X6 screws securing the transmitting board. Pull out the board upward, and then remove the board. (If the double glue on the block became effectless, please replace the block or the glue.)



1. M2.5X8 Screw 2. Shielding Cover of the Transmitting Board

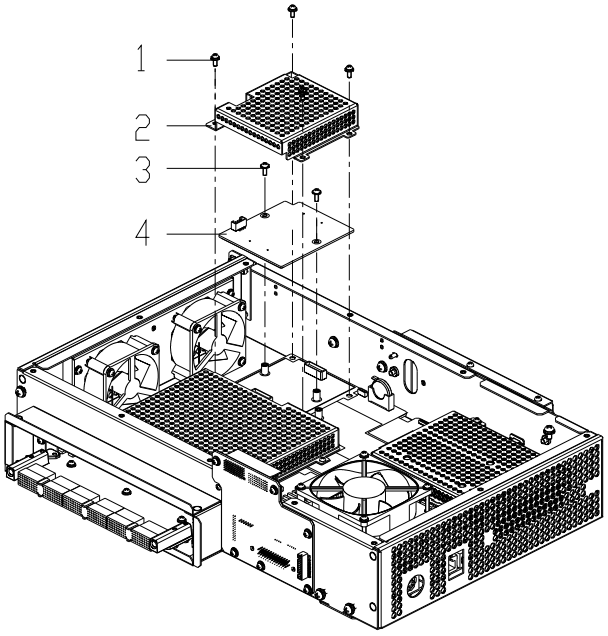
3. M3X6 Screw 4. Transmitting Board

Figure 4-93 Replace the Transmitting Board

4.3.37 Replace the CW Board

1） Disassemble the cover of main unit box. (Please refer to procedure 1, 2, 3 as described in section 4.3.30).

2） Remove the 4 M3X8 screws securing the shielding cover of CW board and the 2 screws securing the CW board, then replace the board.

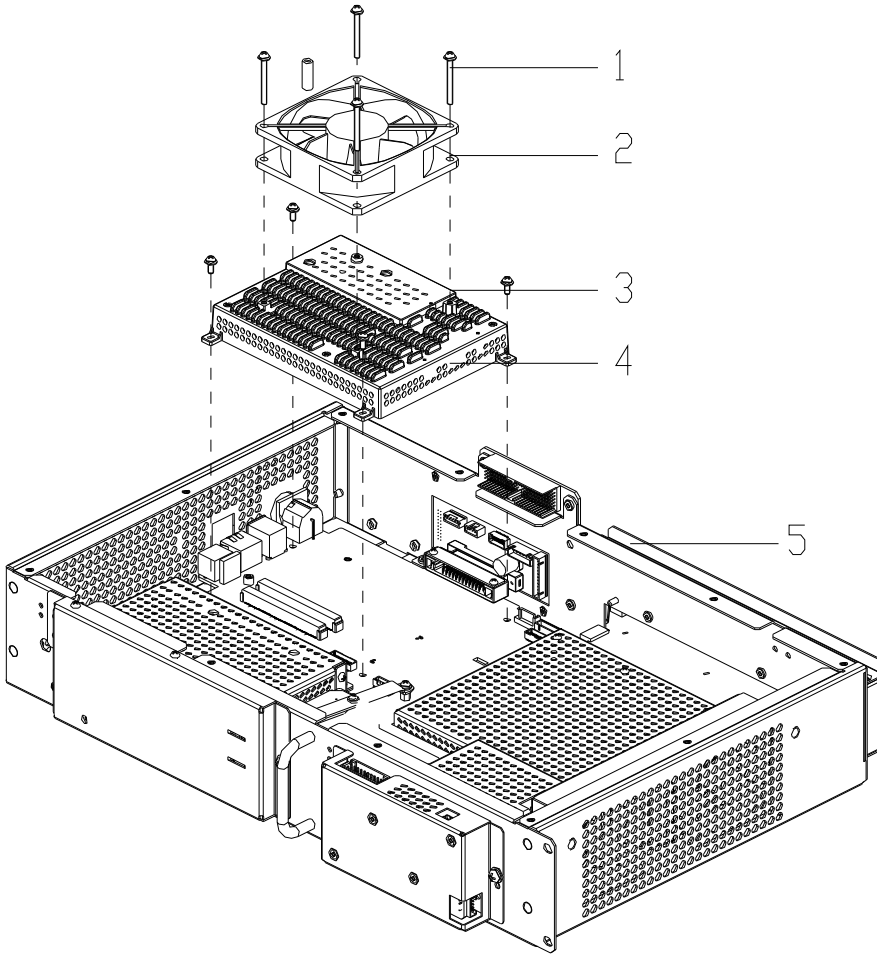


1. M3X8 Screw 2. Shielding Cover of CW Board 3. M3X6 Screw 4. CW Board

Figure 4-94 Replace the CW Board

4.3.38 Replace the CPU Board

1) Remove the cover of main unit box (Please refer to procedure 1 and 2 as described in 4.3.33 Replace the IO Connecting Board).
2) Pull out the plug of CPU fan, remove the four M3X30 panhead screws securing the fan, take off the fan as well as the connecting cable; then remove the four M3X8 screws securing the industrial control board, and then remove the board.



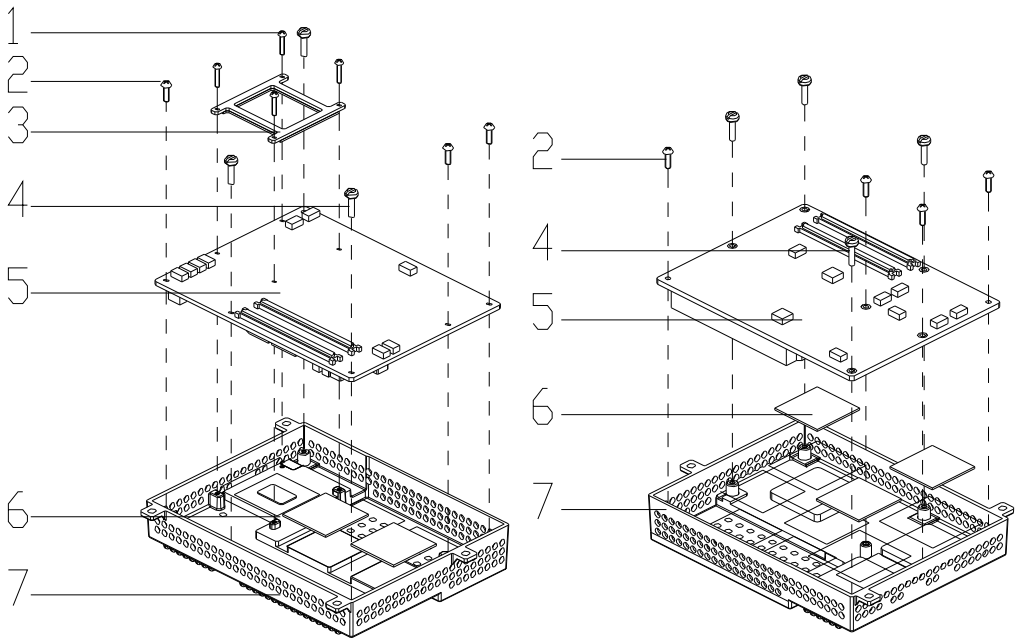
1. M3X35 Screw (4 pcs) 2. Fan and the Connecting Cable 3. M3X8 Screw (4 pcs)
4. Main Unit Box 5. Industry Control Board Module

Figure 4-95 Replace the CPU Board (1)

3) Remove the 3 (4 screws for L7400) plastic screws M2.6X10 that securing the industry control board and the CPU radiator; remove the 4 (no screw for L7400) M2X10 screws securing the CPU bracket on the radiator, remove the 3 (4 screws for L7400) M2.5X8 screws securing the CPU radiator and industry control board. Slightly poke (in the direction as shown in the figure below) the industry control board with an isolating stick to remove the industry control board. To replace the

CPU heat-conducting washer, heat-conducting cream is needed to be covered onto the washer.

Pay attention to the direction of the fan during the assembly. When poke the industry control board, perpendicular the stick to the top of the radiator through the hole, using gradually increasing force.

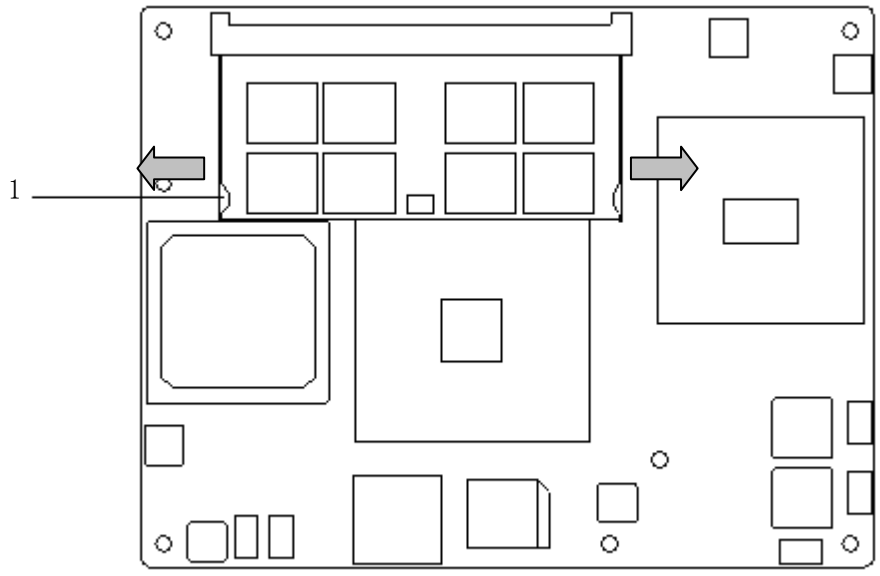


1. Screw M2X10 (4 pcs) 2. Screw M2.5X8 3. CPU bracket 4. Plastic screw M2.6X10
5. Industry control board 6. CPU heat-conducting washer 7. CPU radiator

Figure 4-96 Replace the CPU Board 760A and L7100 (2)

4.3.38.1 Disassemble the Memory Bank

Loosen the two clips outward, the memory will automatically spring up, then replace the memory.

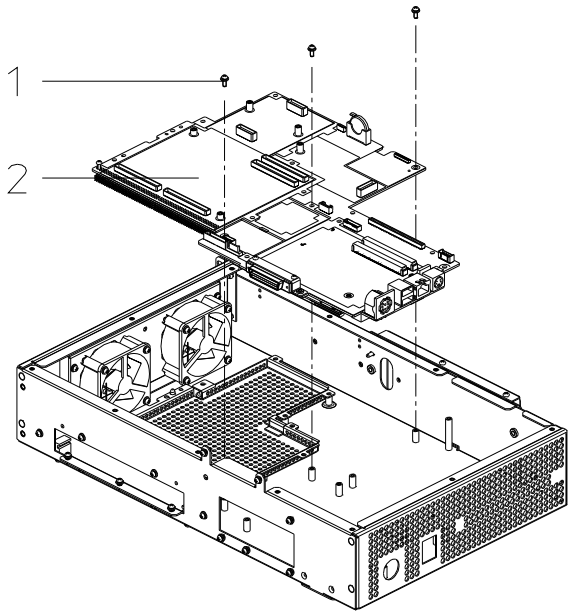


1. Memory Bank

Figure 4-97 Disassemble the Memory Bank

4.3.39 Replace the Master Board

1) Disassemble the main unit box cover, the IO connecting board, probe connection board, power supply board, transmitting board, CW board and CPU module. (Please refer to the procedure 1, 2, 3 as described in section 4.3.30, procedure 2, 3 in section 4.3.31, procedure 2 in section 4.3.32, procedure 2 in section 4.3.33, procedure 2 in section 4.3.34 and procedure 2 in section 4.3.35).
2) Remove the 3 M3X8 screws securing the master board, pull out the cable plug of the fan and HDD, then finish the replacement of the master board.

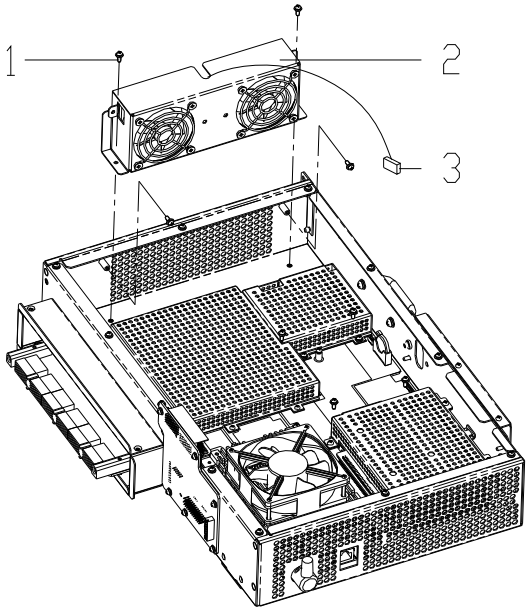


1. M3X8 Screw 2. Master Board

Figure 4-98 Replace the Master Board

4.3.40 Replace the Air Inlet Fan

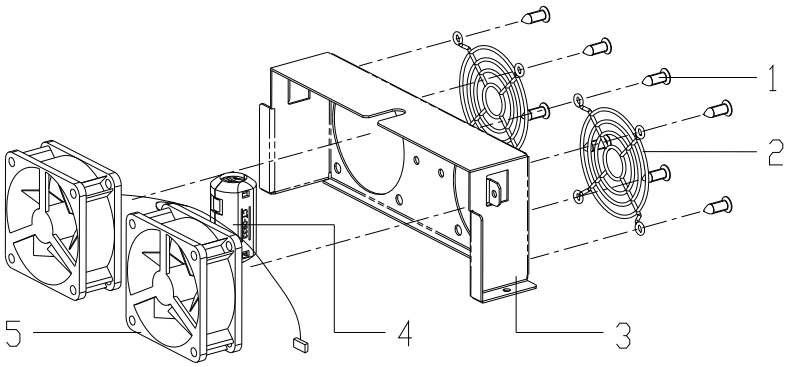
1) Remove the main unit box cover. (Please refer to procedure 1, 2, 3 as described in section 4.3.30).
2) Pull out the cable plug of the fan, remove the 4 M3X8 screws securing the fan module, turn the fan slightly inward and then take out the fan module.



1. M3X8 Screw 2. Fan Module 3. Plug

Figure 4-99 Replace the Air inlet Fan (1)

3) Cut off the tie securing the magnetic ring, remove the 8 screws securing the fan covers, take off the fan after removing the cover.



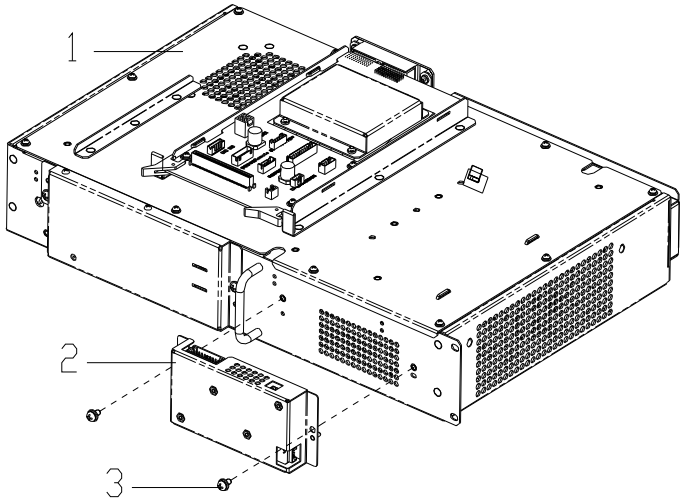
1. Screw 2. Fan Cover 3. Fan Bracket 4. Magnetic Ring 5. Fan and the Cables

Figure 4-100 Replace the Air inlet Fan (2)

4.3.41 Disassemble 4D&TEE Drive Board

1） Disassemble the main unit box module (refer to 4.3.31Disassemble the Main Unit Box Module).

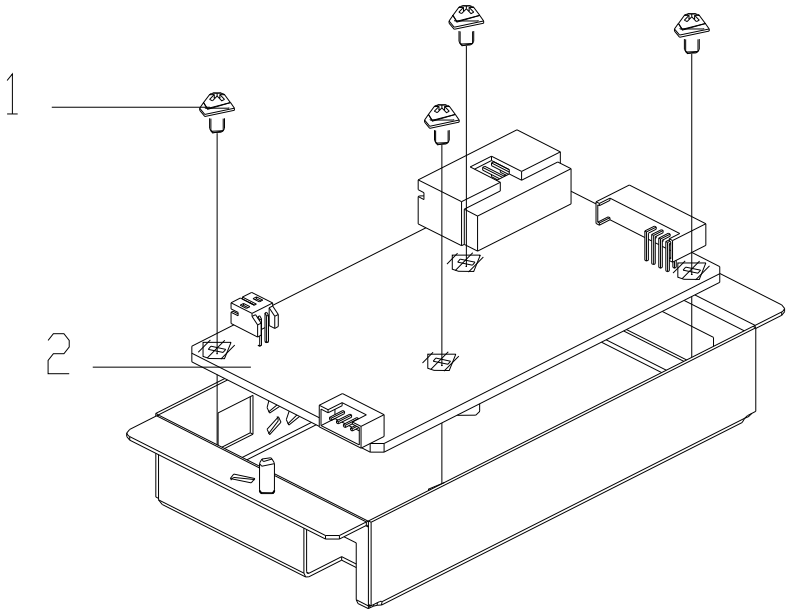
2） Remove the 2 M4X8 combination screws which set 4D drive board, and then pull out the cables of internal board of main unit box, at last disassemble 4D drive board module.



1. Main unit box module 2. 4D drive board module 3. M3X8 combination screw (totally 2)

Figure 4-101 Replace 4D Drive Board (1)

3） Remove the 4 M3X6 combination screws which set 4D drive board, and then remove 4D drive board.



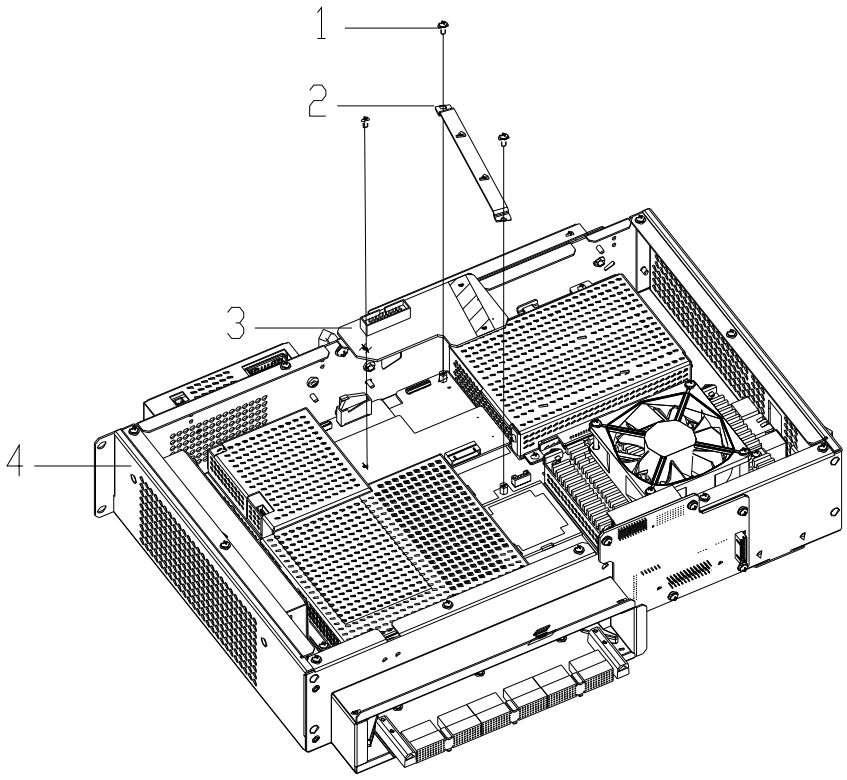
1. M3X6 combination screw (totally 4) 2. 4D drive board

Figure 4-102 Replace 4D Drive Board (2)

4.3.42 Disassemble 4D&TEE Connecting Board

1) Pull out the cables connecting 4D drive board with internal boards of main unit box and remove the cover of main unit box (Refer to procedure 1, 2, and 3 described in 4.3.33Replace the IO Connecting Board).

2) Remove the 2 M3X8 setting screws which set the board, and then remove the press layer, at last carefully pull out the connection socket of 4D connecting board and main board (don't pull it rudely to avoid the impact between board and sheet-metal of power module).



1. M3X8 screw (totally 3) 2. Press layer of board 3. 4D connecting board 4. Main unit box

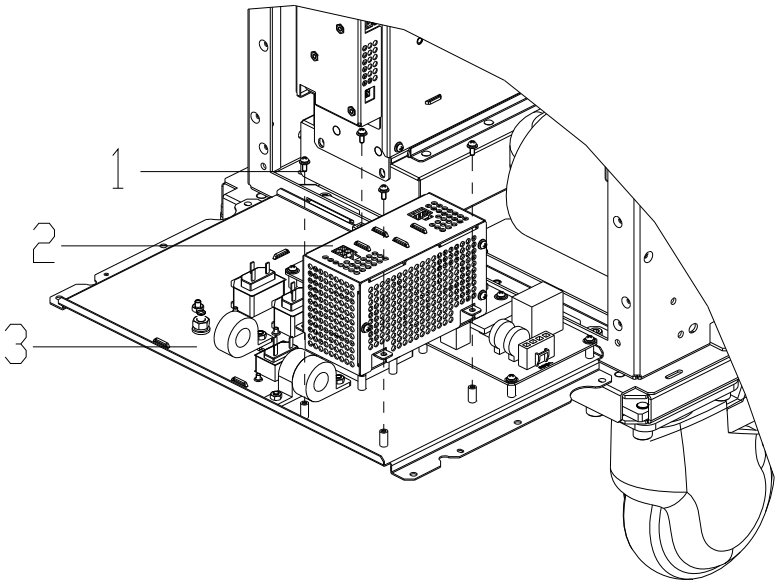
Figure 4-103 Replace 4D Connecting Board

4.3.43 Disassemble 4D&TEE Power Board

1） Remove the 4 M4X8 screws on IO module, and then turn the module a certain angle (within 90°). (Refer to procedure 1 and 2 described in 4.3.21Disassemble the IO Module).

2） Remove the 6 M4X8 combination screws set on power input module, and then turn the module a certain angle (within 90°) to insert 2 lugs into rectangular slots below framework. (Refer to procedure 1, 2 and 3 described in 4.3.22Disassemble the Power Supply Input Module).

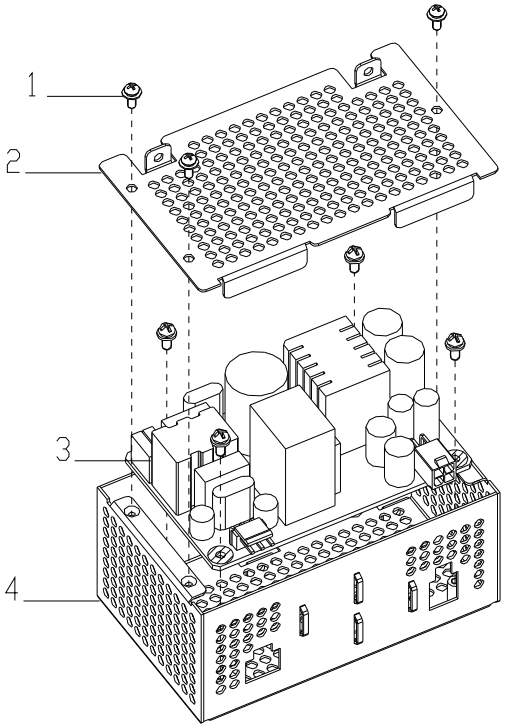
3） Remove the 4 M3X8 combination screws set on 4D power module, and then remove 4D power module.



1. M3X8 combination screw（totally 4） 2. 4D power module 3. Power input module

Figure 4-104 Replace 4D&TEE Power Board (1)

4） Remove the 3 M3X8 combination screws set on the cover of 4D power board, and then remove the cover of 4D power module, at last remove 4 M3X8 combination screws set on 4D power board and remove it.



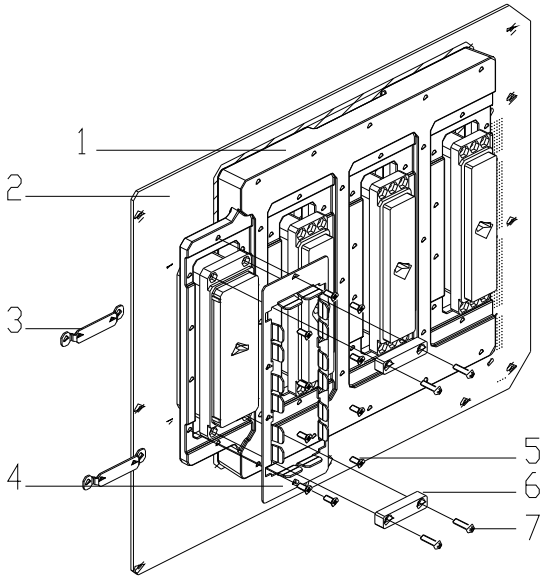
1. M3X8 combination screw (totally 7) 2. Cover of 4D power board 3. 4D power board 4. 4Dpower board box

Figure 4-105 Replace 4D&TEE Power Board (2)

4.3.44 Disassemble 4D Probe Board

1） Remove the front cover. (Refer to procedure 1 to 7 described in 4.3.27Disassemble the Probe Board).

2） Remove the screws set on the shielding cover of 4D probe and 4D probe bracket, and then remove them.



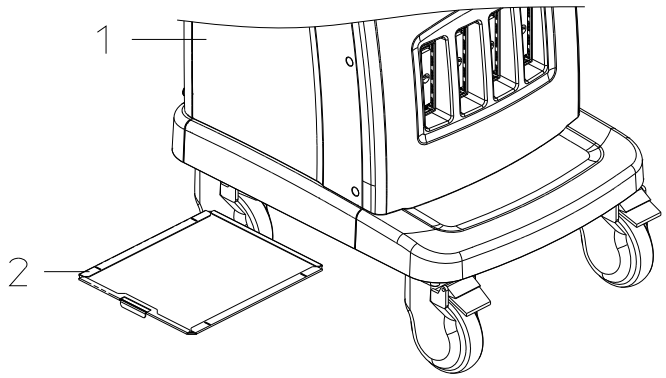
1. Aluminium shielding frame of probe 2. 4D probe board 3. Bracket of probe port 4. Shielding cover of 4D probe port 5. M3X6 sunk screw（totally 10）6. Pad 7. M3X14 pan head screw（totally 4）

Figure 4-106 Disassemble Probe Bracket and Shielding Cover of 4D Probe Port

3） Remove the screws set on 4D probe board and aluminium shielding frame, and then remove 4D probe board (the method is the same as that of probe board disassembly. Refer to procedure 8 described in 4.3.27Disassemble the Probe Board).

4.3.45 Disassemble the Dust Net

1) Grab the lower side of the dust net frame, and then pull out the net.



1. Main Unit 2. Dust Net

Figure 4-107 Disassemble the Dust Net

4.3.46 Replace the Caster

1) Lock the casters that needn't to be replaced. (Front or rear)
2) Place a jack (with maximal load: over 100kg) in the mounting area of casters, and lift the casters at the same time, thus the system will not topple to one side.
3) Place a piece of wood at the middle of front/ rear bottom. (150 mm × 150 mm × 220 mm, W×L×H).

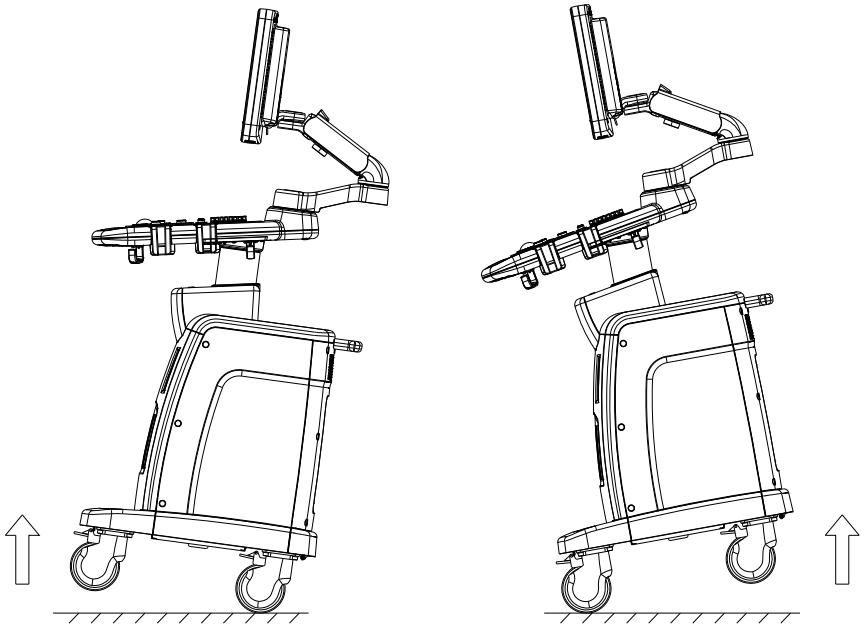
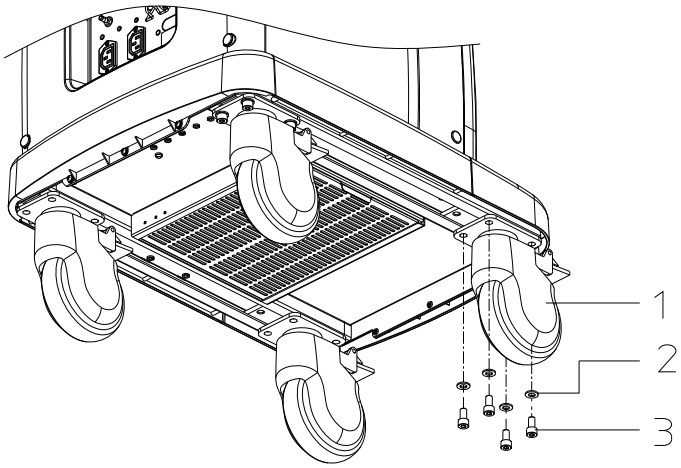


Figure 4-108 Replace the Caster (1)

4) Remove the 4 M8X16 screws securing the caster by the inner hexagon spanner, take out the flat washers, and then disassemble the caster for replacement.



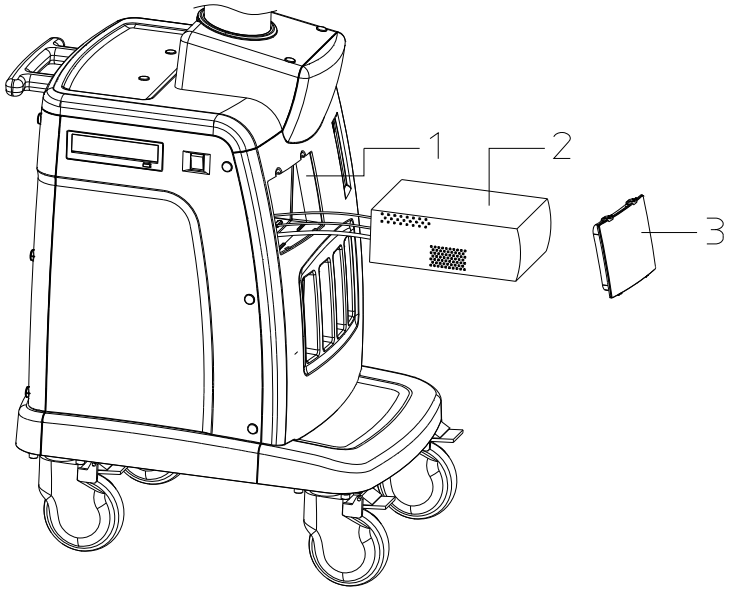
1. Caster 2. Flat Washer 3. M8X16 Inner Hexagon Screw

Figure 4-109 Replace the Caster (2)

4.4 Installation of Peripherals

4.4.1 Installation of W/B Video Printer

1) Remove the cover of the printer placing compartment, connect the power cable, control cable and signal cable that reserved in the compartment to the printer.



1. Printer Placing Compartment 2. W/B Printer 3. Cover

Figure 4-110 Installation of W/B Printer (1)

2) Place the printer into the compartment and grab it with the frontal cover of the main unit. (To avoid slippage)

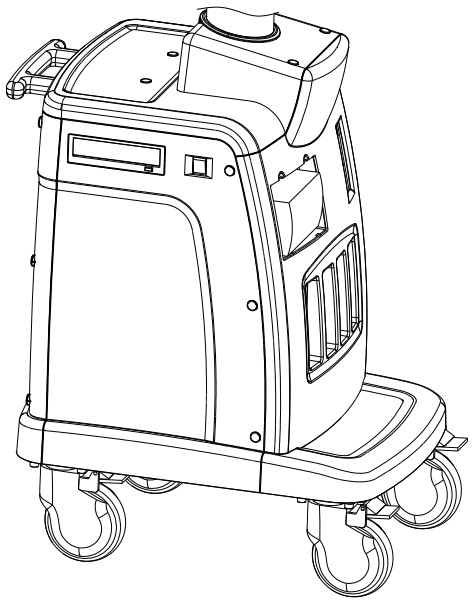


Figure 4-111 Installation of W/B Printer (2)

3) Take away the cover of the compartment.

5 MAINTENANCE REQUIREMENTS

5.1 Tools Used in Maintenance

5.1.1 Tools, Measurement Devices, Consumables

Tools and Measurement Devices

Tool/Device	Qty.	Description
Resin or stainless steel container	1	Can hold two transducers
Plastic bag	1	About 2m×2m (0.3mm thickness)
Vacuum dust-collector	1	
Air blower (600W ~16000 mm/min)	1	Makita 4014NV or like devices
Cleaner		
Brush	1	About a toothbrush size
Air blowout device and blower brush	1	For fan cleaning

Consumables

Consumable	Qty.	Description
Aluminum foil	1	
Physiological saline (0.85 - 0.95%)		To fill the whole container.
Glass cleaner	1	To clean the display
Neutral cleanser		
Soft cloth		

NOTE: **1 Do not use soluble solvent (such as paint thinner or gasoline) or abrasive cleanser to clean the system. Otherwise, the system may be**

damaged.

2 Do not use hydrocarbon detergent or detergent used on OA equipments to clean the screen. Otherwise, the display performance may degrade.

5.1.2 Standard Configuration of Tools and Consumables

Tools

Tool	Model	Manufacturer	Specification/Standard
Screwdrivers (all models and sizes)			Not specified
Blunt cross screwdriver (big)			Not specified
Wire cutting pliers			Not specified
Sharp nose pliers			Not specified
Diagonal cutting pliers			Not specified
Electric iron and its holder			Not specified
De-soldering gun			Not specified
Wrench suite			Not specified
Adjustable wrench			Not specified
Tweezers			Not specified
Hammer			Not specified
Metric general wrench suite			Not specified
Cable (all models)			Not specified
Knife			Not specified

Consumables

Consumable	Model	Manufacturer	Specification/Standard
Insulating tape			Not specified
Hishilite tube (heat shrink tube), insulating tube (all models)			Not specified
Cable (all models)			Not specified
Screws, nuts, gaskets (all models)			Not specified
Solder stick			
File folders (all models)			
Alcohol for cleaning and			

disinfection			

5.2 Maintenance Personnel

To ensure the system performance and safety, only Mindray engineers or engineers authorized by Mindray can perform maintenance.

6 CHECKING

6.1 System Status Checking

6.1.1 Checking Plan

Check plan within one year after installation:

Model	Check times		Remarks
	6 months after installation	12 months after installation	
DC-3 series	—	1	

6.1.2 Confirmation before Checking

6.1.2.1 Checking System Status

Check the following items or the log together with the customer to confirm the system status.

1) Any abnormality when the system is running;
2) Occasional abnormality;
3) Other items the customer requires to check.

6.1.2.2 Checking Operation Environment

Check the ambient temperature and humidity. The measurements related to safety features are sensitive to humidity, and measurement position and circuit as well.

If the insulation feature of the system degrades as the service time increases or due to the system malfunctions, the deflection range of measurement result may increase as the humidity increases.

6.1.2.3 Checking System Setup

Check the system's preset, contrast and brightness of display, optional parts, transducers, etc.

6.1.2.4 Checking the System Version

Press [Setup] key on the control panel to enter the menu of Setup, select [About] to enter the system information page for system version checking.

6.1.2.5 Checking System Running Status

Check if all menus and dialog boxes can pop up normally.

Check if measurements can be performed in each exam mode.

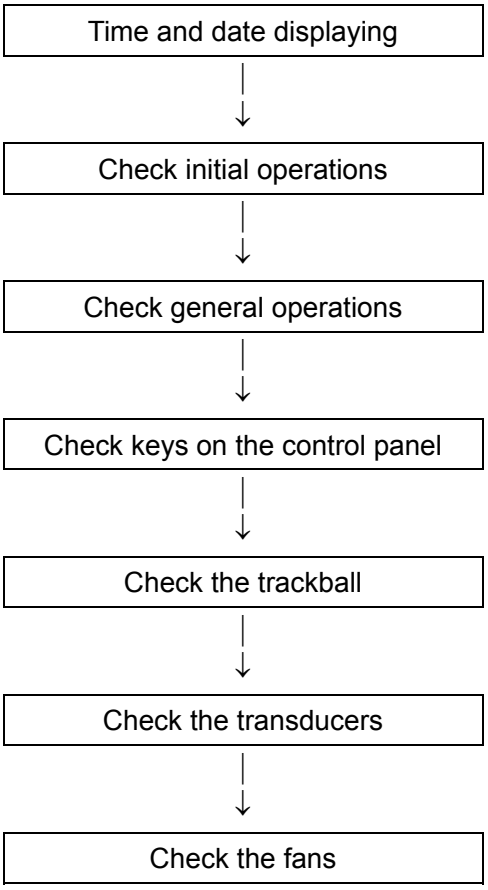
Check if exam modes can be switched normally.

Check if images modes can be switched normally.

Check if transducers can be switched normally.

6.2 Checking Functionality

6.2.1 Flow of Functionality Checking



6.2.2 Details of Functionality Check

1) Time and date displaying
   - Confirm the time and date displayed are correct.
   - If they are incorrect, correct them.
2) Checking the initial operations
   - Check the functions of keys under each mode.
   - Check the images produced by each transducer and print them.
   - Check the functions of peripherals.
3) Checking general operations
   - Check if the [Freeze] key can work normally.
   - Check if the total gain can be adjusted properly.
   - Check if the CW, Color, PW, M and B modes can be switched.
4) Checking keys on the control panel
   - Check all keys on the control panel from left to right and from up to down to see if they can work properly.
   - If a video printer is connected to the system, check if the [Print] key can work normally.
5) Checking the trackball
   - Press the [Freeze] key to enter the image freeze status. Press the [Measure] key to enter the measurement status.
   - Measure the vertical distance and horizontal distance to see if the trackball can work normally.
6) Checking the peripherals
   - Check if the CD-ROM-drive can jet normally.
   - Check if the breaker can work normally.
   - Check if the transducers can be pulled out properly. Check if the transducers can work normally after been connected to the main unit.
7) Checking the fans
   - Check if the system fan (fan in the main unit) can work normally after the main unit is powered on.
   - Check if the fans make any abnormal noise when they are working.

6.3 Safety Checking

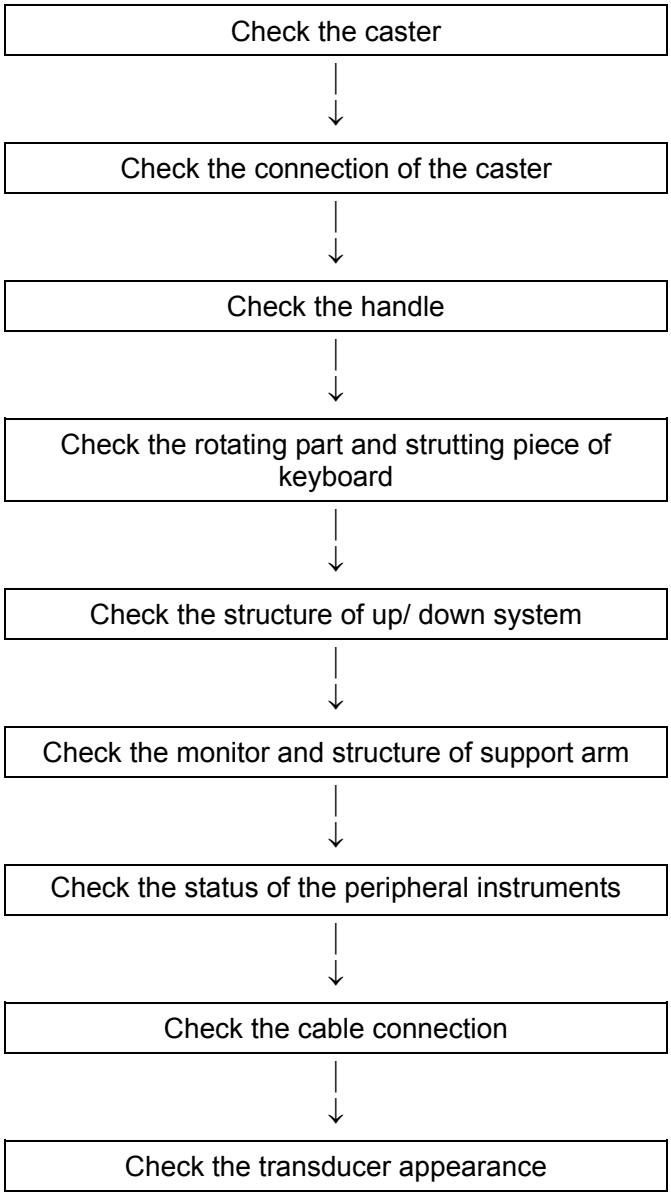
6.3.1 Electrical Safety Checking

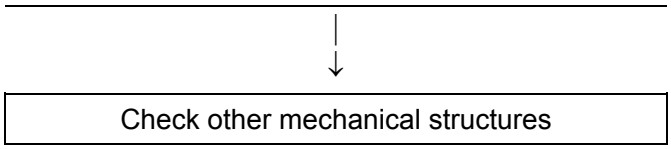
Refer to Appendix B Electrical Safety Inspection.

6.3.2 Mechanical Safety Checking

Evaluation
Perform the evaluation by eye-measuring and checks.

- Checking flow





If the check result is “fail”, the system is in abnormal status. Stop the system and adopt proper measures.

Type	Check	Procedure	Tool
Mechanical safety	Caster	1) Check by sight if the caster has any crack.	
		2) Operate the caster, make sure the caster can be locked and loosened normally.	
	Connection of the caster	1) Check by sight if the caster is skew, and make sure no damage to the screw and no screw is missing.	
		2) Check with the spanner to make sure that there is no looseness between the caster and the base connection screw.	Inner hexagon spanner
	Handle	1) Check by sight if the handle has any crack.	
		2) Pull the handle to make sure it is not loose.	
	Rotating part and strutting piece of keyboard	1) Pull the keyboard to make sure it is not loose.	
		2) Turn the keyboard within 45°both left and right to see if it can move smoothly and flexibly, without any abnormity such as giving out friction noise.	
		3) Rotate the main body by moving the handle, leave the handle at the left end, right end and at the middle position, and check if the upper part of the main body can stay still without any turning.	
	Structure of the up/down system	1) Posit the main body to the lowest position and then loosen the up/ down handle, then raise the cast aluminium base to check if the upper main body can keep still.	
		2) Posit the main body to the highest position and then loosen the handle, then press down the cast aluminium base cover to check if the upper main body can keep still.	

		3) When the main body is at the highest position, hold still the up/down handle, the body shown not fall down	
		4) The machine can be smoothly moved without any abnormity such as giving out friction noise.	
	Structure of the monitor and support arm	1) Check by sight if any inclination happened to the monitor	
		2) Manually operate the monitor to make sure the monitor can act normally when turned left/ right, lifted/ lowered, and no abnormal noise exists.	
		3) Manually turn the monitor left/ right, make sure there is no obvious looseness.	
		4) Lower the monitor to posit the support arm at level and slope-down, check if the monitor can keep still at the two positions when no outside force is imposed on it.	
		5) Take apart the upper cover of the support arm, check by sight if any cable is scratched or clipped out that the core can be seen.	
	Status of the peripheral instruments	Check manually if any instrument is loose.	
	Cable connection	1) Check by sight to make sure that there is no damage happened to the cable both inside and outside the instrument.	Phillips screwdriver
		2) Check manually to make sure that there is no looseness and falling off happened to the cable inside the instrument	
	Probe appearance	Check by sight to make sure that there is no crack, peel, loose and damage happened to the transducer	
	Other mechanical structures	Check to make sure that there is no part is crack, and no conducting part is exposing to the outside	

6.4 Image Checking

6.4.1 Checking the B/W Image Phantom Data and Image Recording

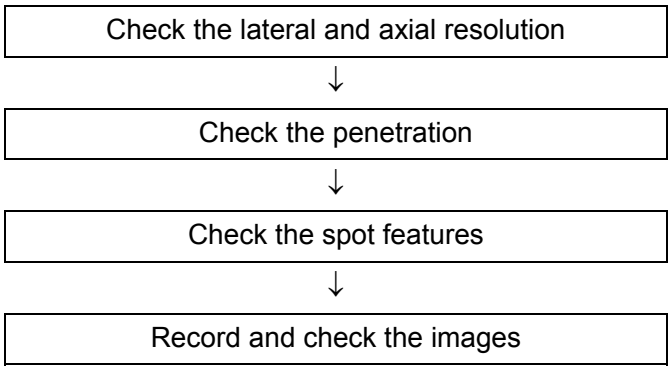
6.4.1.1 System Setups

The user-defined setups are adopted for all the setups which aren't mentioned in this manual. For any setups changed due to special reason, they shall be recorded as the additional information.

6.4.1.2 Image Recording and Archiving

Print the images and archive them with data recorded.

6.4.1.3 Checking Flow



Perform the checks above on all transducers used by customers.

6.4.2 Checking Phantom Data

6.4.2.1 Lateral / Axial Resolution

1) Put some gel on the phantom and then scan the phantom with a transducer.
2) After obtaining an optimal image, freeze the image and record it.

Condition: system preset parameters.

6.4.2.2 Penetration

1) Put some gel on the phantom and then scan the phantom with a transducer.
2) Adjust the gain to make the soft tissue spot displayed at the deepest position.
3) Measure the depths of noise and of the soft tissue boundary, and record the images for the measurement.

6.4.2.3 Spot Features

Evaluate the change of image quality after the system is used for a long time. The evaluation items include the gain, and the periodic record of the images described above.

6.4.2.4 Recording images

Archive the images printed out according to the descriptions above.

6.4.3 Final Operation Checking and Image Archiving

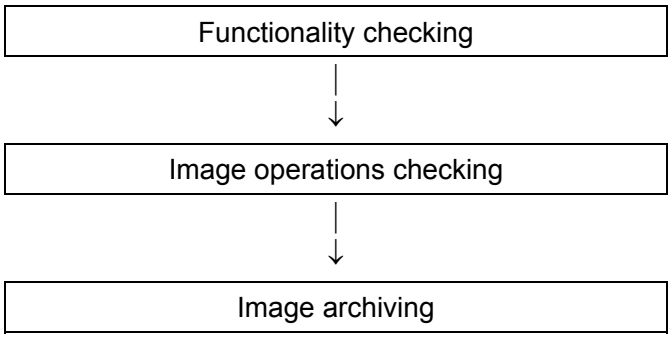
6.4.3.1 Operation Checking

Check image operations with each transducer in each mode.

6.4.3.2 Image Printing and Archiving

Print images and archive them with data recorded.

6.4.3.3 Checking Flow



Perform all the checks above on each transducer.

6.4.3.4 Checking Details

1) Functionality check

Check changes of the exam mode, measurements and related information.

2) Image operation check

Perform image operations with each transducer in each mode.

3) Image archiving

Print images obtained through the steps above and archive them.

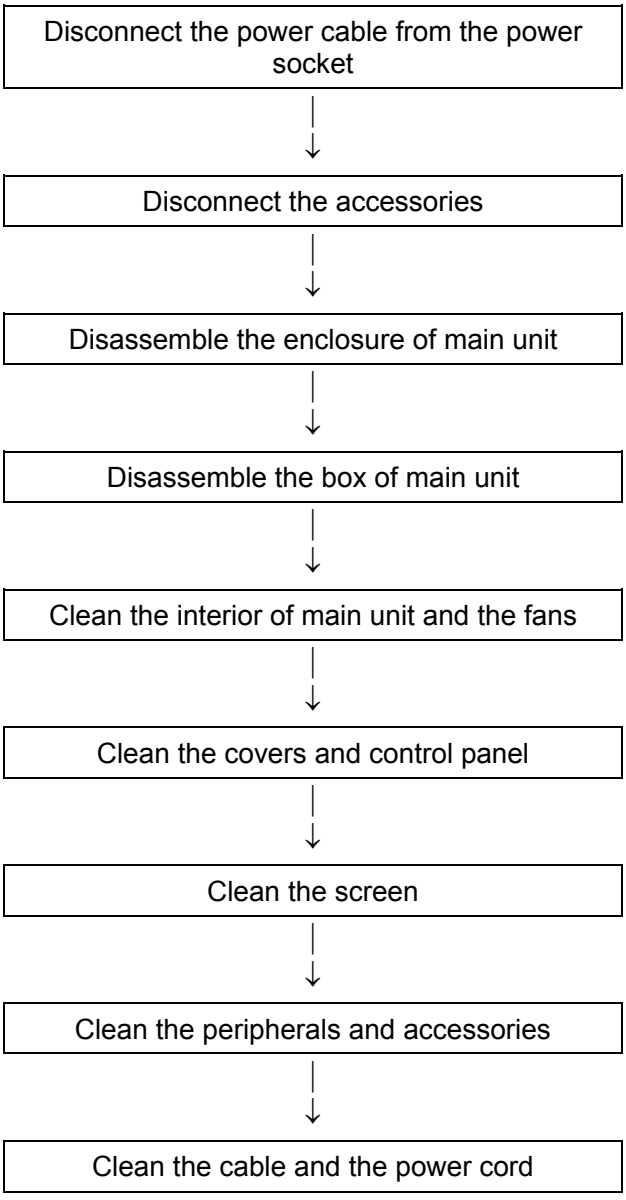
6.4.4 Color flow image check

The service engineers should be trained by Mindray's professionals, and the method is to use a transducer to examine and capture a color carotid flow image. The color image should be evaluated depending on whether the flow is full, whether there is an artifact and overflow, and whether the flow is flat.

7 SYSTEM MAINTENANCE

7.1 System Cleaning

7.1.1 Cleaning Flow



7.1.2 Details for Cleaning

1) Clean the interior of main unit and fans

   Disconnect the power cord from the power socket.

   Disassemble accessories such as transducers and printers.

   Disassemble the enclosure of main unit, and the relative shielding covers to check the PCBA and power supply part. If the PCBA have no abnormality, do not disassemble them.

   Cover the main unit with a big plastic bag.

   Put the mouth of the vacuum dust-collector into the plastic bag and turn on the dust-collector to collect the dust.

   Open a small hole on the top of the plastic bag to insert the mouth of the air blower. Then turn on the blower to remove the dust.

   Take away the plastic bag carefully, avoiding dust rising.

   Use the dust collector to remove all remaining dust.

2) Clean the enclosure and control panel

   Use neutral cleanser to remove the dust on the enclosure of main unit and on the control panel. If it is difficult to clean the control panel, disassemble the keys first and then use neutral cleanser to clean it.

3) Clean the display

   Make sure the display is not skew and the fixing mechanism is secured.

4) Transducers

   Remove the dust on the transducer. Check if it has any abnormality such as crack. Then connect it to the main unit. Use a soft brush to clean the transducer holder.

5) Video printer

   Clean the thermal head according to the user manual of the printer.

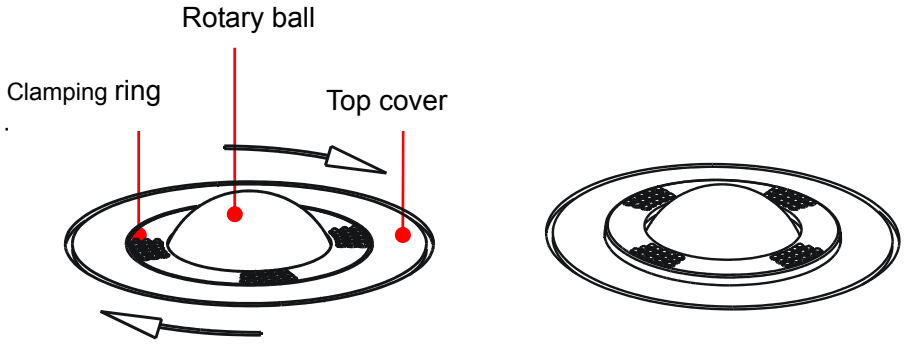
6) Cable / cord

   Use neutral cleanser to clean the cable and power cord.

7) Cleaning of the trackball

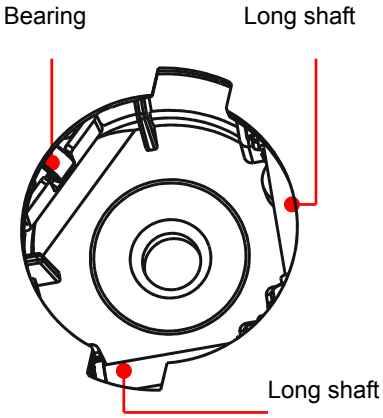
   a）Disassemble

   Press the bulges on the clamping ring by both the hands and turn the ring about 45°clockwise until it lifts. Take out the ring and the rotary ball. Be careful not to drop the ball. Shown as follows:



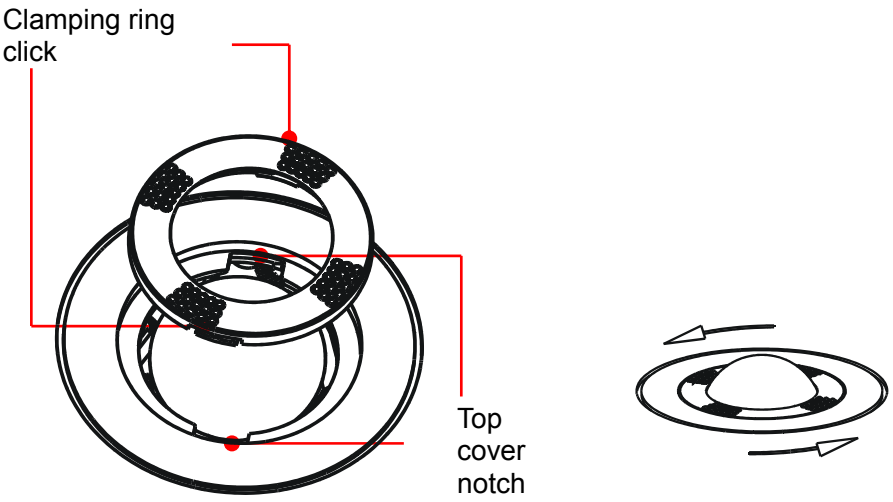
b）Cleaning

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



c）Installing

Put the rotary ball back in the trackball and then align the clamping ring click with the top cover notch. Press the bulges on the ring with both hands and turn the ring about 45°counterclockwise until the ring clicks. As the bulges are flush with the top cover, the ring is secured.



7.2 Software Maintenance

NOTE: **Do not turn off the power supply in the process of upgrading, otherwise, it will lead to upgrading failure and can't be restarted.**

7.2.1 Confirming the System Starting

There are three courses from starting the system to enter the ultrasound interface, they are BIOS guiding, WINDOWS guiding and ultrasound software guiding.

BIOS guiding: from the appearing of boot-strap interface 1 to the disappearing of the blue progress bar on interface 1.

WINDOWS guiding: from the company logo to appear the boot-strap interface 2, till the blue progress bar on interface 2 disappears.

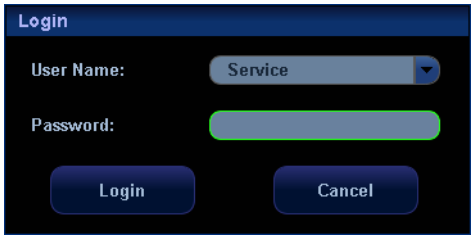
Ultrasound software guiding: from the appearing of boot-strap interface 3 to the disappearing of the blue progress bar on interface 3. And again, this part can be divided into the following parts:

Step	Phenomenon	Task
1	Appear boot-strap interface 3, but no progress bar	To initialize the system clock and soft interruption module.
2	Appear the progress bar, but not any progress	To initialize the preset server, need to preset the data.
3	1/7 progress bar	To set the region, language and font.
4	2/7 progress bar	Can't be seen.
5	3/7 progress bar	To create the operation interface (can't be seen), to initialize the icons and the function bank.

6	4/7 progress bar	To initialize the keyboard.
7	5/7 progress bar	To initialize the ultrasound system, USB manager, video printer, VCR, CD-RW, file manager, iVision player and so on.
8	6/7 progress bar	To initialize the application software, including the measurement, patient management, report printing, system monitor, running log, fore/ end image parameters, POD data is needed.
9	7/7 progress bar	End, switch to the ultrasound system operation interface.

Before performing the software maintenance, ensure the data used matches the model; and enter the maintenance status:

Press the combination key Ctrl+/, and select “service” from the [User Name], input the password and click [Login] to enter the maintenance status.



7.2.2 Preset

Press [Setup] key, pops up the preset menu.

7.2.3 Viewing System Information

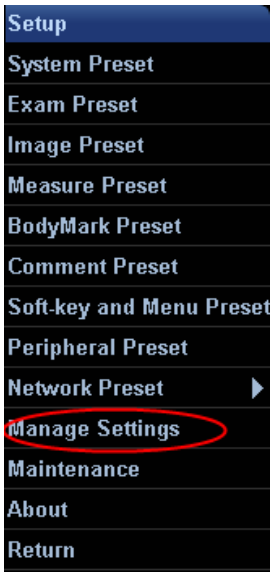
In the Setup menu, select “System”, and the system information dialog box appears. Move the cursor onto “Save” and press [Set], you can export the system information in “txt” format.

NOTE	**Be sure to confirm the system information before and after the software maintenance.**

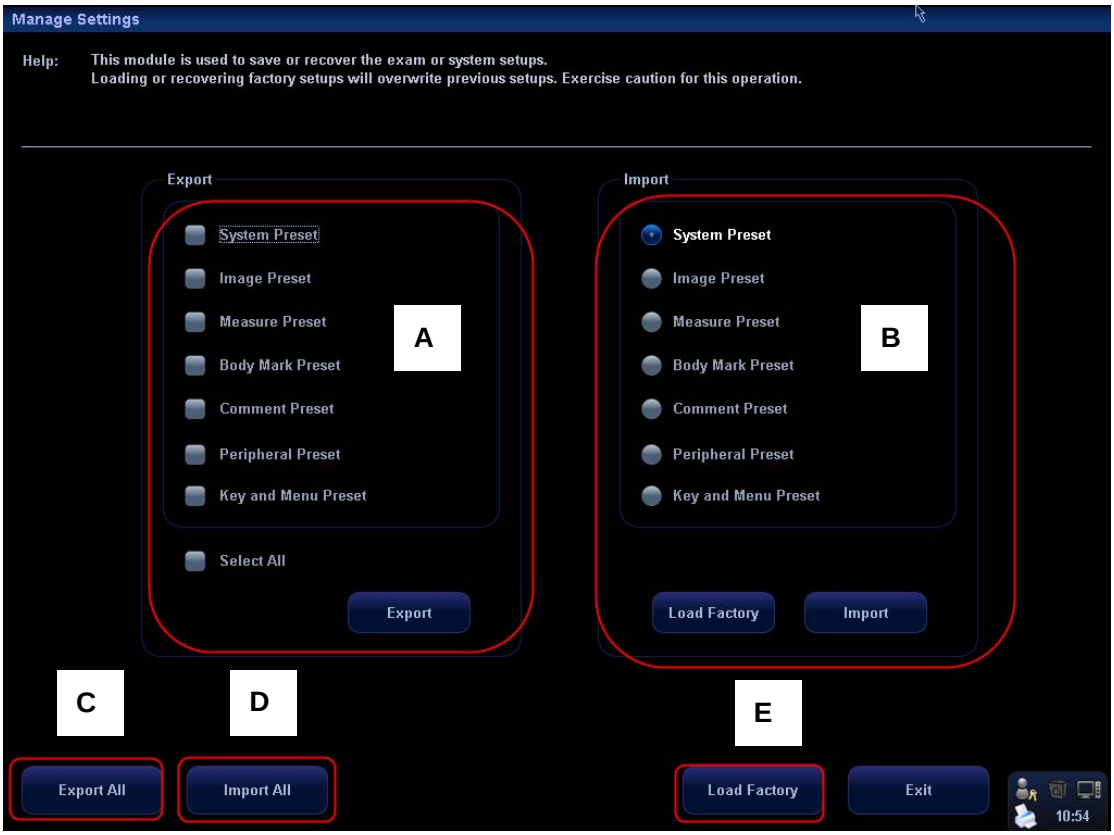
7.2.4 Preset Data Management

1）Press [Setup] key to enter into the preset status.

2）Move the cursor onto “Manage Settings” and press [Set].



3）Select Export (Import or Restore factory) as required.



Mark	Function
A	To export the selected presets, and save them in different files.
B	To import the preset parameters according to the selection, or to restore it to the original factory default.
C	To export all the preset parameters, and save them in a file.
D	To import all the preset parameters at one time.

E	To restore all preset parameters to the default value.

7.2.5 Maintenance Status

Copy the files to be used into a USB flash drive. Then insert the USB flash drive into the USB port on the main unit.

1. Enter into the setup status; (Please refer to 7.2.2)

2. Select “Maintenance”.

3. Press [Set], to enter the “Maintenance” menu.

7.2.6 Software Upgrading

NOTE

1 The process is slow when upgrade FP2, please wait.

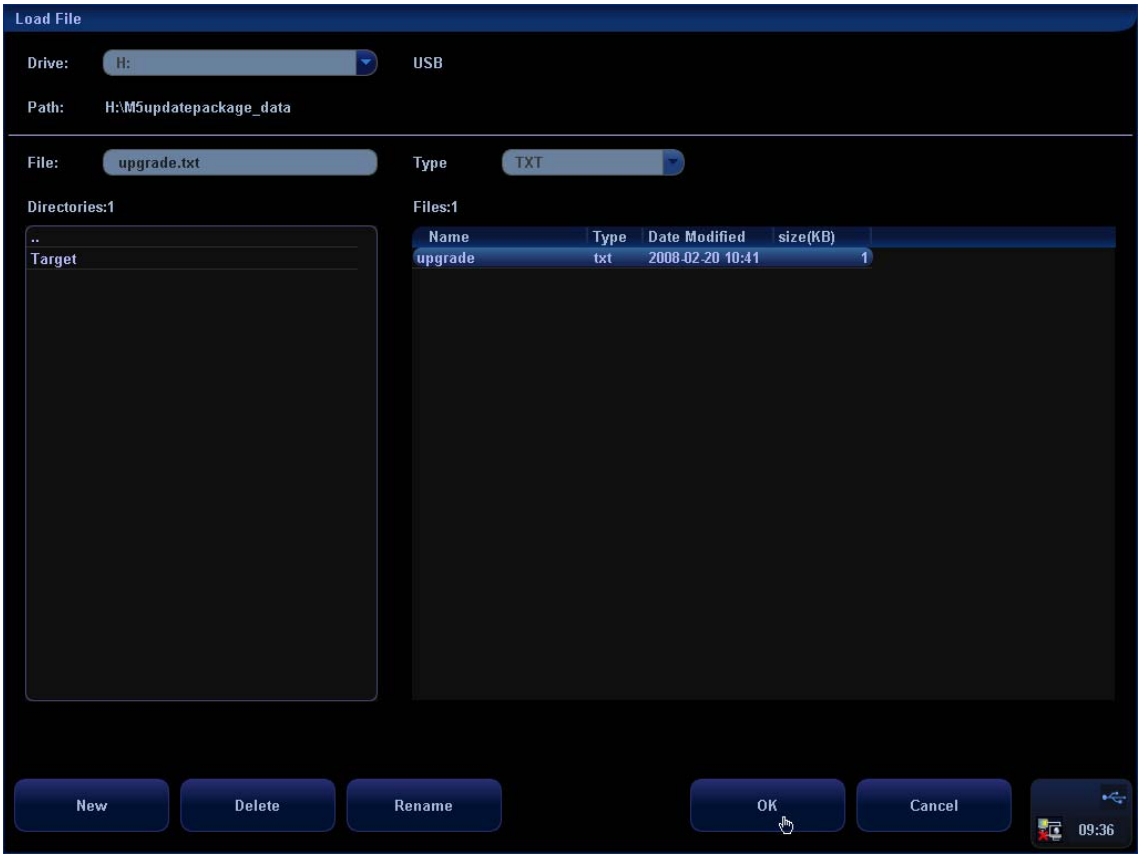
2 Do not turn off the power supply in the process of upgrading.

7.2.6.1 Upgrading

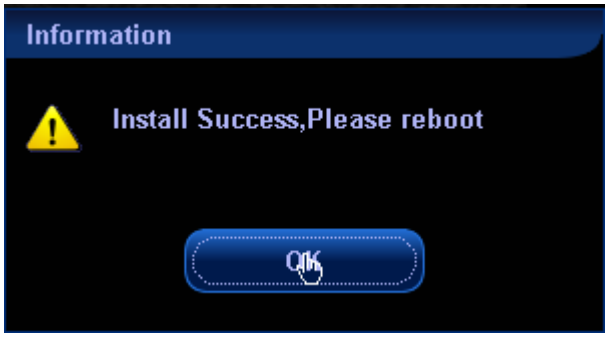
This upgrading is done through an upgrading package, the content to be upgraded is the content changed in the last version prior to the upgrading package.

1. Enter into maintenance status (Please refer to 7.2.5);
2. Select “System Update”, press [Set] key;

3. Select the correct file in the Load File dialog box, and click “OK”, the system will start the upgrading, and the progress will be displayed on the bottom of the screen.



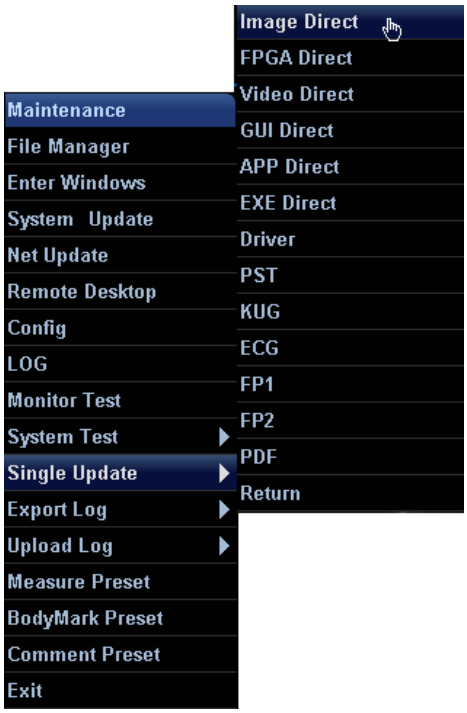
4. After the upgrading is complete, the successful prompt appears. Restart the system according to prompts.



NOTE: **Select the proper upgrading program (package) whether or not ECG module is configured.**

7.2.6.2 Upgrading a Single Item

1. Enter into maintenance status (Please refer to 7.2.5)
2. Select [Single update].



3. Select the item to be upgraded, and press [Set], select the right file in the Load File dialog box, and click “OK” then the system begins to upgrade the file and the progress will be displayed at the bottom of the screen.

4. After the upgrading is completed, the system will give out related information and prompt the user to restart the system.

⚠ WARNING: After upgrading preset data, you shall recover the preset data according to steps described in section 7.2.4, so that the upgraded preset data can take effect.

Select the preset data according to machine models and Regions where the machine is sold.

After all the upgrading is finished, please turn off the machine, switch of the power and then restart the system.

Preset & Machine model

Model	**DC-3(CE)**	**DC-3(FDA)**	**DC-3Vet(CE)**	**DC-3Vet(FDA)**
Preset NO.	**G-110-000927-00**	**G-110-000927-00**	**G-110-000935-00**	**G-110-000935-00**
Model	**DC-3T（CE）**	**DC-3T（FDA）**	**/**	**/**
Preset NO.	**G-2109-30-76426**	**G-2109-30-76426**	**/**	**/**

7.2.7 Enter Windows

After doing this, the system enters the Windows interface quickly, and you can install software or drives through the interface.

1. Enter into maintenance status. (Please refer to 7.2.5)
2. Choose the “Enter Windows” menu, and press [Set].
3. It’ll pop up “My computer” window about 2 seconds later.
4. Close the window, then it will retune to ultrasound system interface.

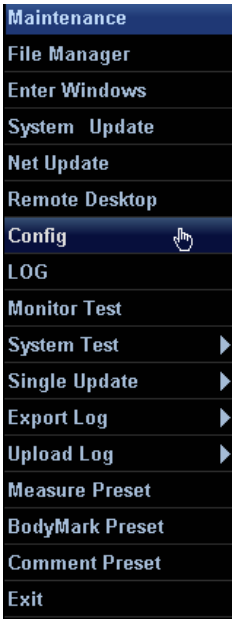
7.2.8 Enter 4D Mode

The operations are only used for the system with 4D:

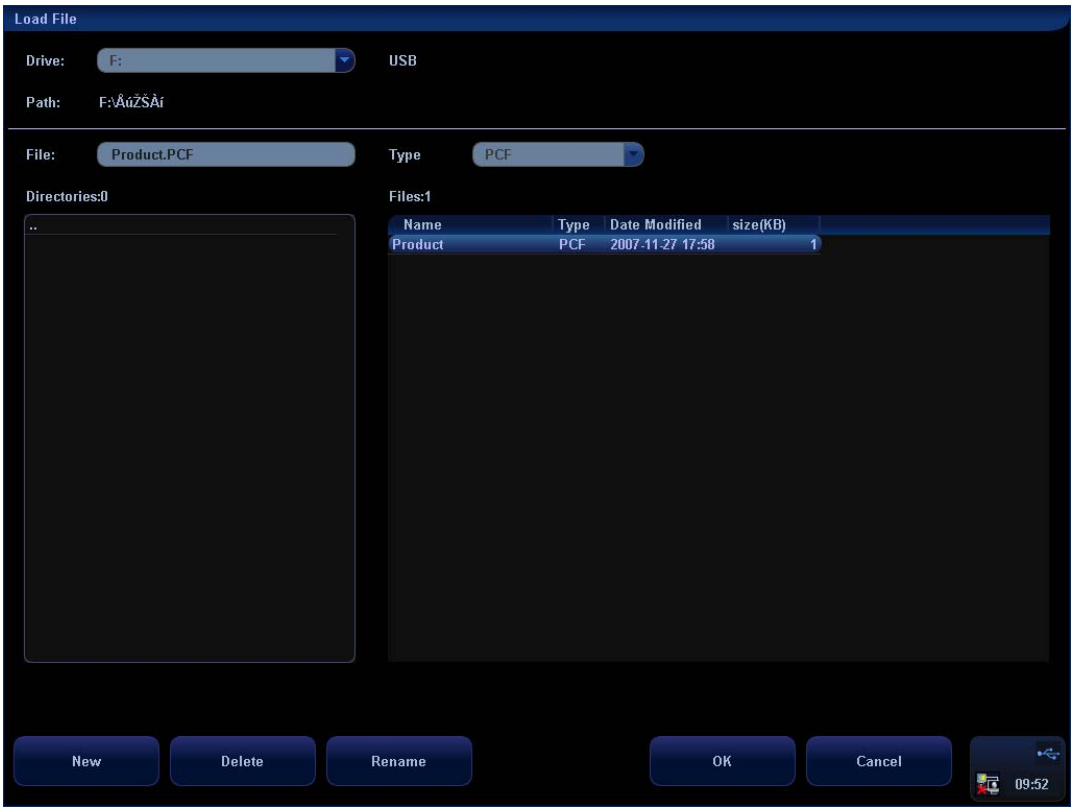
1. Press [Menu] on the control panel to pop up the B mode menu, roll the trackball onto "B" and select [Other] item.
2. Select 3D/4D in [other] menu.

7.2.9 Model ConFigureuration

1. Enter into maintenance status. (Please refer to 7.2.5)
2. Choose the “Config”, and press [Set].



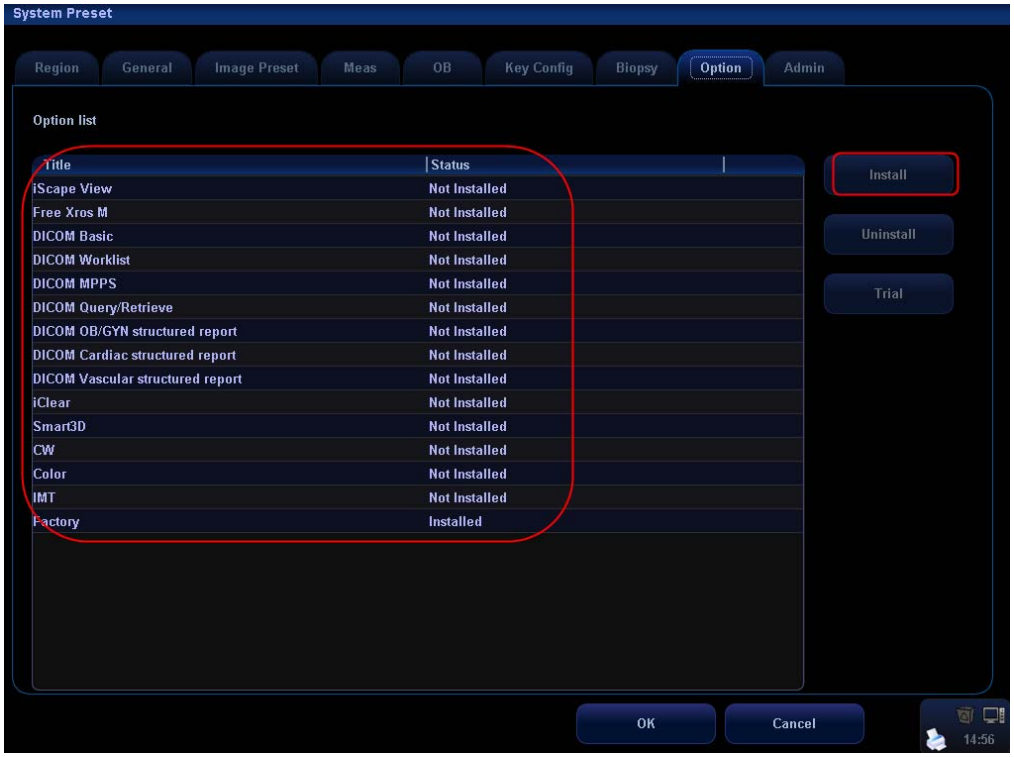
3. The following dialogue box pops up.



4. Select correct files, and click “OK”. After the operation is complete, the successful prompt appears. Restart the system according to prompts.

7.2.10 Install the Software of Optional Devices

1. Enter the preset status. (Please refer to 7.2.2)
2. Choose the “System” menu;
3. In the system setup dialog box, select “Option”, as shown in the Figure below:



4. In the optional list, select the desire software function, and click “Install”;
5. Select the corresponding file with suffix “key” in the dialogue box, and then click “OK”.

The files and the devices are of one-to-one correspondence, install the software.

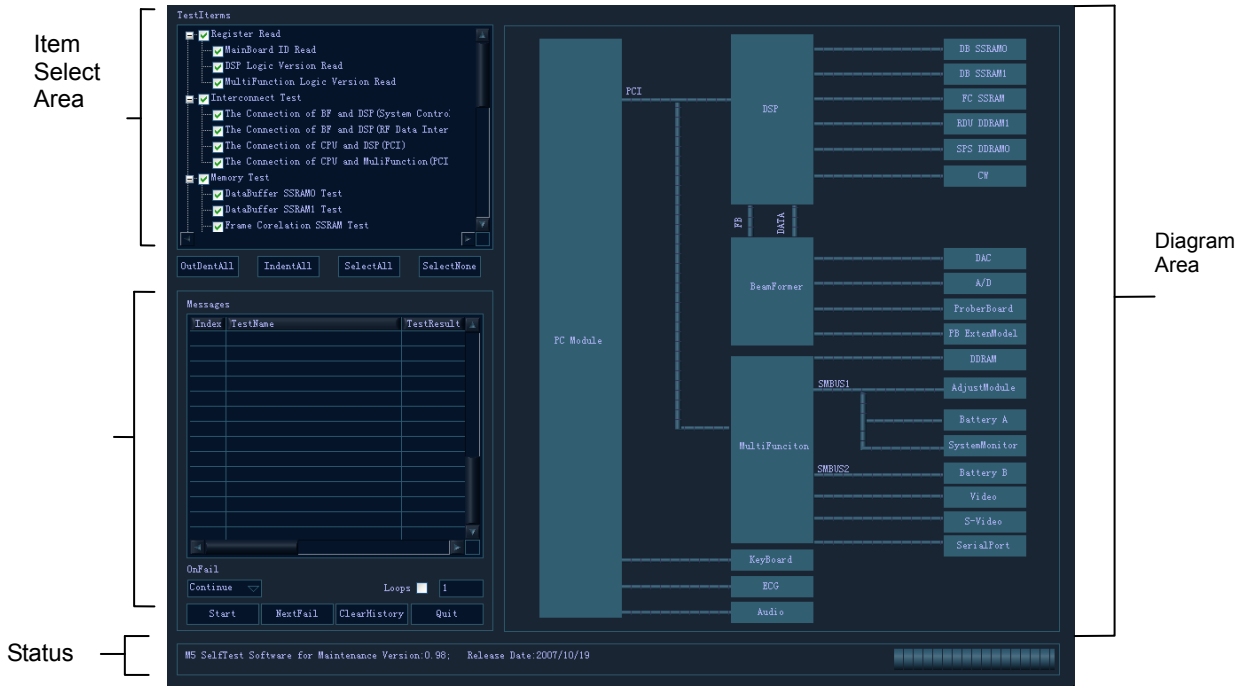
6. After successful installation, return to the system preset interface, the corresponding optional modules should be shown as installed. Click “OK” to close the system preset dialog box.

Note: you can find the optional function Key file in the CD provided with the machine.

If you restore the ultrasound software, you must install the Color function and iClear function.

7.3 System Self-diagnosis

7.3.1 Self-diagnosis Interface



7.3.1.1 Option Area of Self-diagnosis Items

The testing items can be set in this area, each item is classified into the corresponding upper item, if the check box is selected (that is ☑), it means this testing item is put into the testing sequence, otherwise, it will not. When the upper item is selected, all the corresponding default lower items are also selected, if the upper item is cancelled, all the corresponding default lower items will be cancelled.

Function of [OutDentAll]: click this button, the closed testing items will be opened;

Function of [InDentAll]: click this button, the opened testing items will be closed;

Function of [SelectAll]: click this button to select all the testing items;

Function of [SelectNone]: click this button to cancel all the selected testing items.

7.3.1.2 Display and Control Area of the Testing Information

This area displays the testing results of all items.

Messages: to display the information of all testing items, of which,

Index means the testing sequence number;

TestName means the testing name;

TestResult means the testing result;

Remark displays remark information, e.g. if the test failed, the detailed error information can be checked by right-drawing the level scroll bar.

OnFail drop-down list box: two options, they are Continue and Stop, when select Continue, the test will be continued even though a test item fails during testing, while Stop means the test will stop once a test item fails during testing.

Loops check-box: this item determines whether to recycle the test, if it is selected, the test will be repeated according to the number entered in the right box.

Start button: click this button to perform the tests one by one, and at the same time, the button will change into Stop button; click Stop, the test will be stopped, and the button changes to Start, waiting for the next test.

NextFail button: there will have many fails after the tests are finished, click this button to browse the details one by one. Click this button for once, the current failed test will be displayed in the first row of the table, when click the button again, the next failed test will be displayed in the first row of the table.

ClearHistory button: click this button to clear all the tested results listed in the Messages, and the flow diagram will be returned to the original status.

Quit button: click this button to exit the self-diagnosis and return to the operation interface.

7.3.1.3 Status Bar

Some information as well as the testing progress are displayed in the status bar.

The version and issued date of the system self-diagnosis software will be displayed at the left side of the status bar when the program is running.

The information of versions is displayed in the following forms:

Table 7-1 Version Information of System Self-checking Software

Model	Application	Information
DC-3	Production test	DC-3 SelfTest Software for Manufacuture Version:xx; Release Date:YYYYMMDDXX
DC-3	User and user service	DC-3 SelfTest Software for Maintainese Version:xx; Release Date:YYYYMMDDXX

During the test, the progress bar is displayed at the right side of the status bar to indicate the testing progress.

7.3.1.4 Structure Diagram Area

This area shows the structure of the whole hardware system, each module will be colorized according to the test result during the testing. Red means communication failure of the module or between the related module and the system; while green means the module is working normally.

7.3.2 Description of Testing Items

Differences exist in the testing items of different user groups.

Table 7-2 Differences in the Test Items of Each Version

Testing Item	DC-3	
	Manufacturer	Maintenance

Register Read	MainBoard ID Read	☒	☒
	DSP Logic Version Read	☒	☒
	MultiFunction Logic Version Read	☒	☒
Interconnect Test	The Connection of BF and DSP(System Control Bus)	☒	☒
	The Connection of BF and DSP(RF Data Port)	☒	☒
	The Connection of CPU and DSP(PCI)	☒	☒
	The Connection of CPU and MultiFunction (PCI)	☒	☒
Memory Test	DataBuffer SSRAM0 Test	☒	☒
	DataBuffer SSRAM1 Test	☒	☒
	Frame Correlation SSRAM Test	☒	☒
	RealTime Data Upload DDR1 Test	☒	☒
	Scan Parameter Setting DDR Test	☒	☒
	MuliFunction DDR Test	☒	☒
Power Circuit Test	Battery A Test	☐	☐
	Battery B Test	☐	☐
	Scan Mode and PHV Control Test	☒	☒
System Monitor Test	Voltage Monitor Test	☒	☒
	CPU Temperature Monitor Test	☒	☒
FrontEnd Circuit Test	ADC Digital Port SelfTest	☒	☒
Port Test	CW Circuit Port Test	☒	☒
	Adjust Module Connunication Test	☐	☐
	Prober Port Test	☒	☒
	Prober Expension Module Port Test	☐	☐
	KeyBoard Communication Test	☒	☒
	Serial Port Test	☒	☐
	Video Test	☐	☐
	S-Video Test	☐	☐
	Audio Test	☒	☒
	ECG Module Port Test	☒	☒

Note: ☒: means this testing item exists in the system self-diagnosis software of this version.

□: means this testing item doesn't exist in the system self-diagnosis software of this version.

7.3.3 Details of the Testing Items

7.3.3.1 Register Read

1）MainBoard ID Read

Testing function:

Read boards and cards IDs of the main board.

Details description:

The boards and cards IDs of the main board will be displayed in the Remark column of Messages list box in the format of:

MainBoard Version：x.x.

2）DSP Logic Version Read

Testing function:

Read the DSP logic version.

Details description:

DSP logic version will be displayed in the Remark column of Messages list box in the format of:

The Release Date is YY/MM/DD.

The Compile Version of BF Logic is :xx；

3）MultiFunction Logic Version Read

Testing function:

Read the multifunction FPGA logic version.

Details description:

Multifunction FPGA logic version will be displayed in the Remark column of Messages list box in the format of:

The Version of:

MultiFunction FPGA is: xx.

The date of MultiFunction Modified is: YY/MM/DD.

7.3.3.2 InterConnect Test

1）The connection of BF and DSP (System Control Bus)

Testing function:

Test the connection of system control bus between BF and DSP.

Details description:

Test if the system control bus between BF and DSP is working normally.

2）The connection of BF and DSP (RF Data Port)

Testing function:

Test the connection of RF data port between BF and DSP.

Details description:

Test if the RF data port between BF and DSP is working normally.

3）The Connection of CPU and DSP (PCI)

Testing function:

Test the connection of CPU module and DSP (PCI).

Details description:

Test if the PCI channel between the CPU module and DSP is working normally.

4）The Connection of CPU and MultiFunction (PCI)

Testing function:

Test the (PCI) connection of CPU and MultiFunction FPGA.

Details description:

Test if the PCI channel between the CPU module and MultiFunction FPGA is working normally.

7.3.3.3 Memory Test

1）DataBuffer SSRAM0 Test

Testing function:

Test the databuffer SSRAM0.

Details description:

Overall test on SSRAM U36, which including two parts:

Test if the connections between FPGA U310 and SSRAM U36 (including the data bus, address bus and control signal cable) are normal.

Test if the SSRAM U36 itself is normal.

2）DataBuffer SSRAM1 Test

Testing function:

Test the data-buffer SSRAM1.

Details description:

Overall test on SSRAM U313, which including two parts:

Test if the connections between FPGA U310 and SSRAM U313 (including the data bus, address bus and control signal cable) are normal.

Test if the SSRAM U313 itself is normal.

3）Frame Correlation SSRAM Test

Testing function:

Test frame correlation SSRAM.

Details description:

Overall test on SSRAM U314, which including two parts:

Test if the connections between FPGA U310 and SSRAM U314 (including the data bus, address bus and control signal cable) are normal.

Test if the SSRAM U314 itself is normal.

4）RealTime Data Upload DDR1 Test

Testing function:

Real-time data upload DDR1 test.

Details description:

Overall test on DDRAM U312, which including two parts:

Test if the connections between FPGA U310 and DDRAM U312 (including the data bus, address bus and control signal cable) are normal.

Test if the DDRAM U312 itself is normal.

5）Scan Parameter Setting DDR Test

Testing function:

Scan parameter setting DDR test.

Details description:

Overall test on DDRAM U311, which including two parts:

Test if the connections between FPGA U310 and DDRAM U311 (including the data bus, address bus and control signal cable) are normal.

Test if the DDRAM U311 itself is normal.

6）MultiFunction DDR Test

Testing function:

Multi-function DDR test.

Details description:

Overall test on DDRAM U28, which including two parts:

Test if the connections between FPGA U30 and DDRAM U28 (including the data bus, address bus and control signal cable) are normal.

Test if the DDRAM U28 itself is normal.

7.3.3.4 Power Circuit Test

1）Battery A Test, Battery B Test

This testing item does not included in Model DC-3, only in M5.

2）Scan Mode and PHV Control Test

Testing function:

Mainly test if the PHV control is normal under all kinds of scanning modes.

Details description:

The circuits concerned including the connecting circuit between Beamformer (U302) and DA chip (U297), U279, connecting circuit between DA output of U297 to the power supply module, as well as PHV power circuit.

NOTE: **It may take about 3 minutes to finish this test, please wait.**

7.3.3.5 System Monitor Test

1) Voltage Monitor Test

Testing function:

The voltage detection test is to test if power detection circuit of the system main board and power circuit of each group can work normally.

Details description:

To test if the connecting circuit between PC module and power monitor IC U9, U9, and the 12V, +5V, 2.5V, 1.5V, -5V and 3.3V voltages on the boards are normally working.

2) CPU Temperature Monitor Test

Test function:

CPU temperature test, to check if the radiating temperature of the CPU is in the normal range.

Test Description:

The software monitors the CPU temperature for about 10 min by checking value of "Current Temperature" on the testing interface. The system warns for CPU overheat if the temperature exceeds 80 °C. Click "Test Fail" to exit; Otherwise, if the temperature is not more than 80 °C, click "Test Pass" to exit the CPU temperature monitor test. (In product that configured with 4D module, it's normal when the CPU temperature occasionally exceed 80°C but with no increment during 10 min monitoring.)FrontEnd Circuit Test

2）ADC Digital Port SelfTest

Testing function:

To test if the frontend circuit ADC digital port is normally working.

Details description:

The concerned circuits include the connecting circuit between BeamFomer (U302) and frontend AD (U298～U301) and AD converter itself.

3）ADC DC Bias SelfTest

Testing function:

Frontend ADC DC biasing test, to judge if the noise level is normal by gathering the system noise through the frontend circuit ADC.

Details description:

The concerned circuits include the connecting circuit between BeamFomer (U302) and AD(U298～U301) as well as frontend AD itself.

7.3.3.6 Port Test

1）CW Circuit Interface Test

Testing function:

It is CW circuit interface test.

Details description:

The main function is to test if connection between CW module and the system, as well as CW module itself are normally working.

2）AD Controller Board Communication Test

Testing function:

It is AD controller board communication test.

Details description:

It is to test if SM bus between PC module and AD controller board is normal, and if AD controller board is normal.

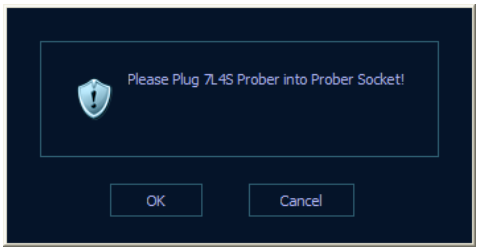
3）Probe Port Test

Testing function:

To test the ID communication channel between the probe board and the probe is normally working.

Details description:

Plug the probe 7L4A into the A socket of the probe board before testing the DC-3 series instruments.



DC-3 probe is equal to probe 7L4A

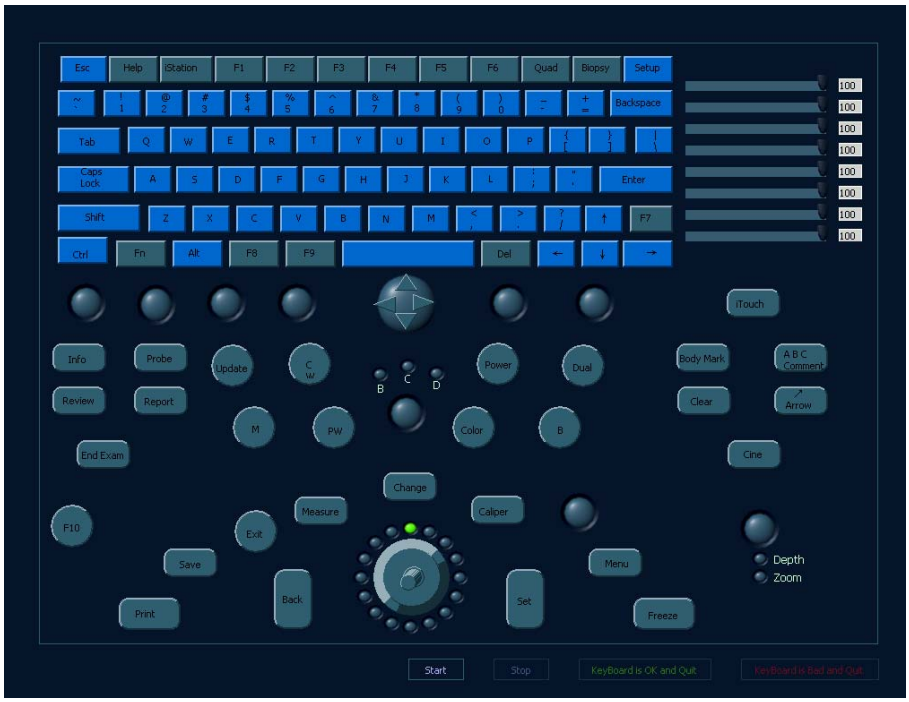
4）KeyBoard Communication Test

Testing function:

It is to test the keyboard board assembly (key, encoder, trackball, TGC and key backlight), boards and cards ID read, keyboard FPGA version read and keyboard operating program version read.

Details description:

The keyboard testing interface is shown as follows:



Click [Start] to start the testing, each control on the simulating keyboard is corresponding to the one control on the actual keyboard.

Press down the key on the actual keyboard, the corresponding key on the simulating keyboard will flash and change into green, flashing means the key is being tested, while green means the key past the test.

Scroll the trackball, the cursor on the interface will be shifted accordingly.

Encoder rotating function test:  on the simulating keyboard represents the encoder on the actual keyboard, when the rotating function of the encoder is being tested, the ball corresponding to the encoder will flash and change into green. Flashing means the encoder is being tested, while green means the encoder past the tested. Meanwhile, with the rotating of the encoder, the green ball around  will rotate in the same direction with the encoder.

Encoder key test: press down the key of the encoder, the ball corresponding to the encoder will flash and change into green. Flashing means the encoder being tested, while green means the encoder past the test. Meanwhile, the central key of  will change with the changing of the encoder.

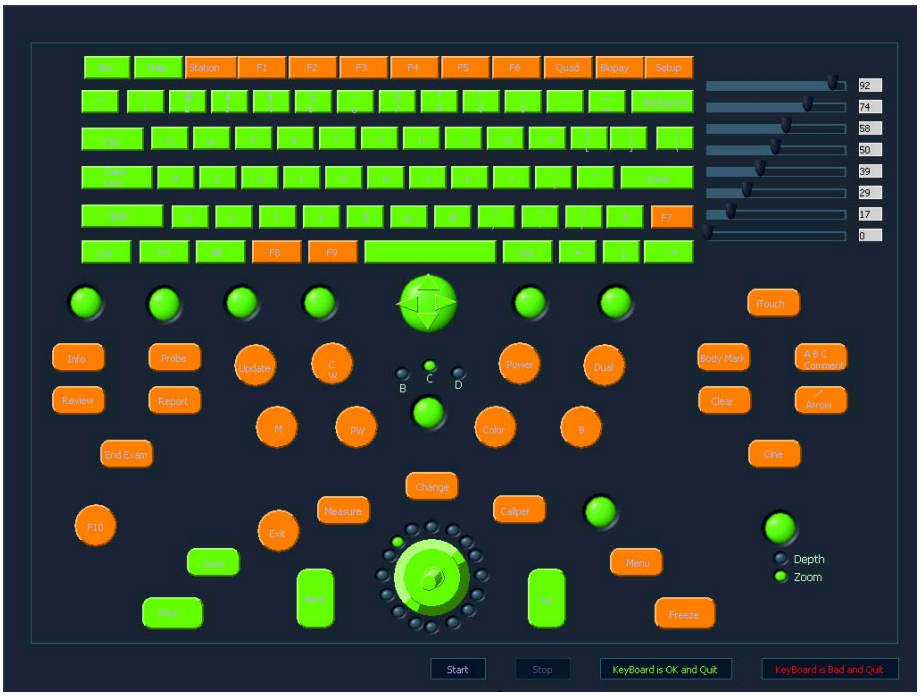
TGC test: the 8 TGCs on the keyboard are corresponding to  controls on the simulating keyboard respectively. Slide the TGC on the keyboard, the TGC on the simulating keyboard will slide accordingly.

Keyboard back lights test: when the keyboard is initialized, all the two-color lights will change into green; when being tested, the color will change into orange under the control of the running program.

Zoom, Depth LED lights test: press down Zoom/Depth encoder, the Zoom and Depth lights will be turned on alternately under the control of the running program.

B C D LED lights test: when rotate the gain encoder, the B, C, D LED lights will be turned on cyclically under the control of the related programs.

After all parts are tested, the keyboard will be shown as below. (Note: when test the Alt key, you have to press down Ctrl + Alt).



If all parts of keyboard are in normal conditions, press down [KeyBoard is OK and Quit] button, otherwise, press down [KeyBoard is Bad and Quit] button.

5）Serial Port Test

Testing function:

Serial port test, the main function is to test if the serial ports are normally working.

Details description:

Connect a tester with the serial port before the testing.

6）Audio Test

Testing function:

The main function is to test if the two buzzers and the related circuits are normally working.

Details description:

During the test, the left side of machine will play out “Ding~~”, and pops up the following dialog box to ask if you can hear “Ding~~” playing out of the left side machine. If you didn’t hear it, please click “Retry” to play it again, and click “No, I Can’t”, if you still can’t hear it after trying many times. And if you heard it, please click “Yes, I Can”.

After that, the program will control the right side of the machine to play out “Ding~~”, and pop up the same dialog box, please do the same operation as described above.

7）ECG Module Port Test

Test function:

The main function is to test if the ECG module is normally working.

Details description:

After the ECG module is connected to the machine, it will communicate the system self-checking module during the self-checking process, and the ECG module can be judged if it is normally working according to the feedback information.

NOTE:	**If no ECG module is configured, this item is a Fail item during the self-checking.**

8 Troubleshooting

8.1 Malfunction

8.1.1 Examine and Repair Flow of Blank Screen

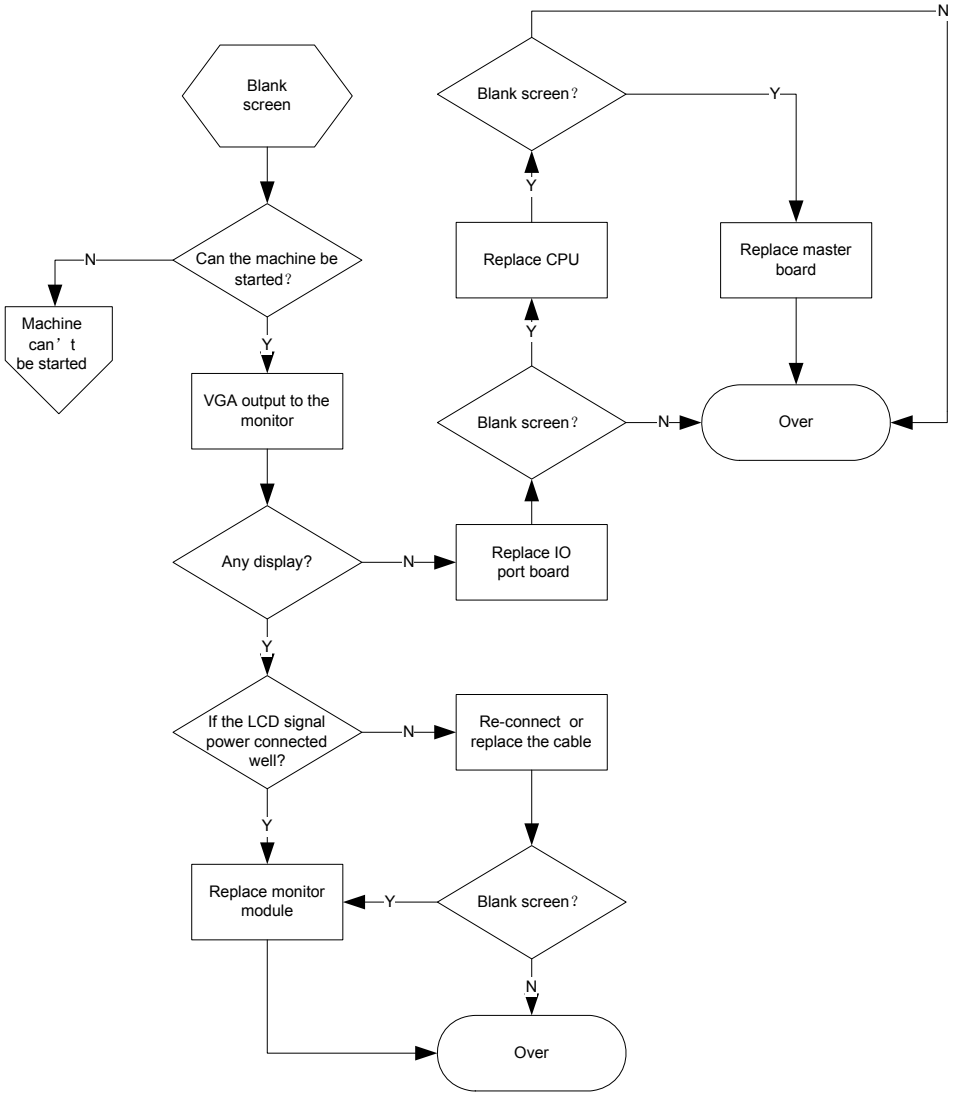


Figure 8-1 Examine and Repair Flow of Blank Screen

8.1.2 Examine and Repair Flow When No Image Displayed in the Image Area

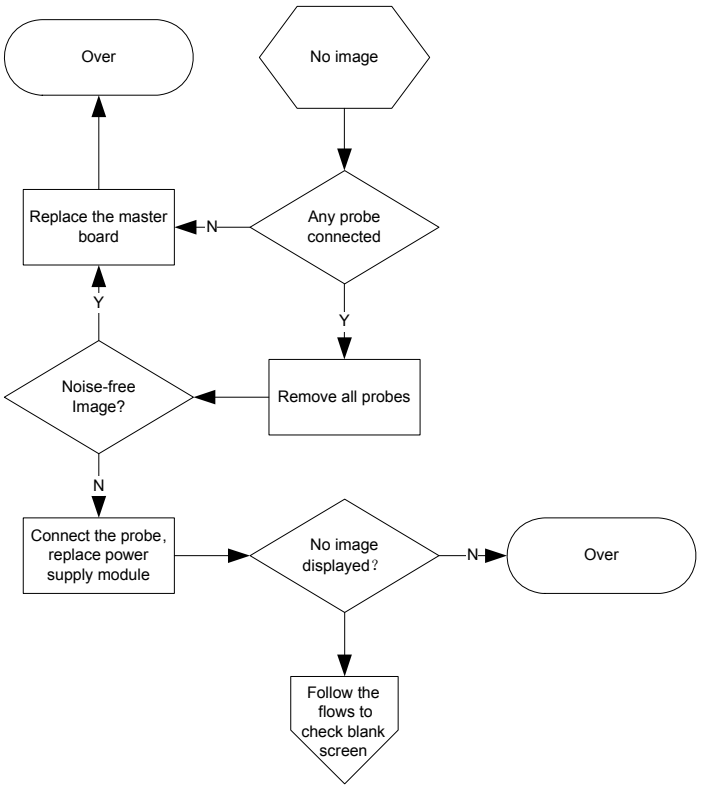


Figure 8-2 Examine and Repair Flow When No Image Displayed in the Image Area

8.1.3 Examine and Repair Flow When Black Area Exists in the Image

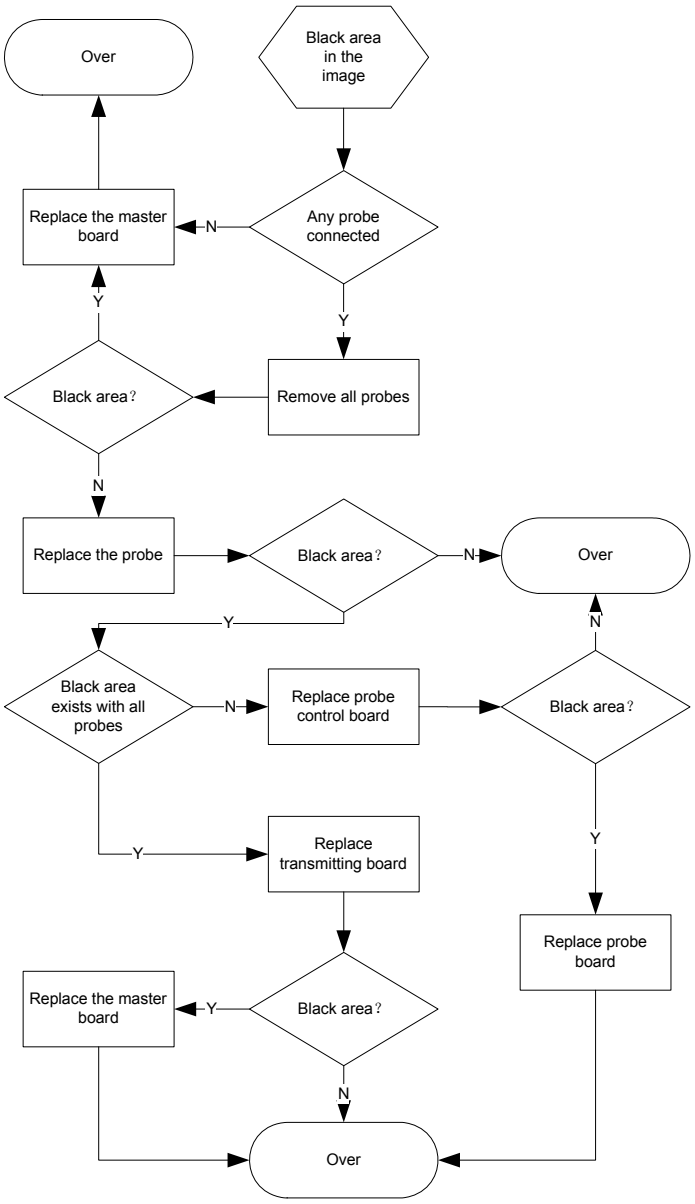


Figure 8-3 Examine and Repair Flow When Black Area Exists in the Image

8.1.4 Abnormal Image in the Image Area

Problems concerned in this section including B, C, PW images abnormity, to exclude these malfunctions, first you shoud make sure there is no power supply malfunction according to Figure 8-8, and then change the master board.

8.1.5 CW Image Abnormity

To exclude this problem, there are three steps to be carried out:

Replace the power supply module to judge if it is normal, for the examine and repair flow, please refer to Figure 8-8.

Replace the CW board to judge if it is normal, for the malfunction collection, please refer to General Malfunction of CW Board.

If CW board has no problem, you have to change the master board.

8.1.6 Examine and Repair Flow When the System Can’t Start-up

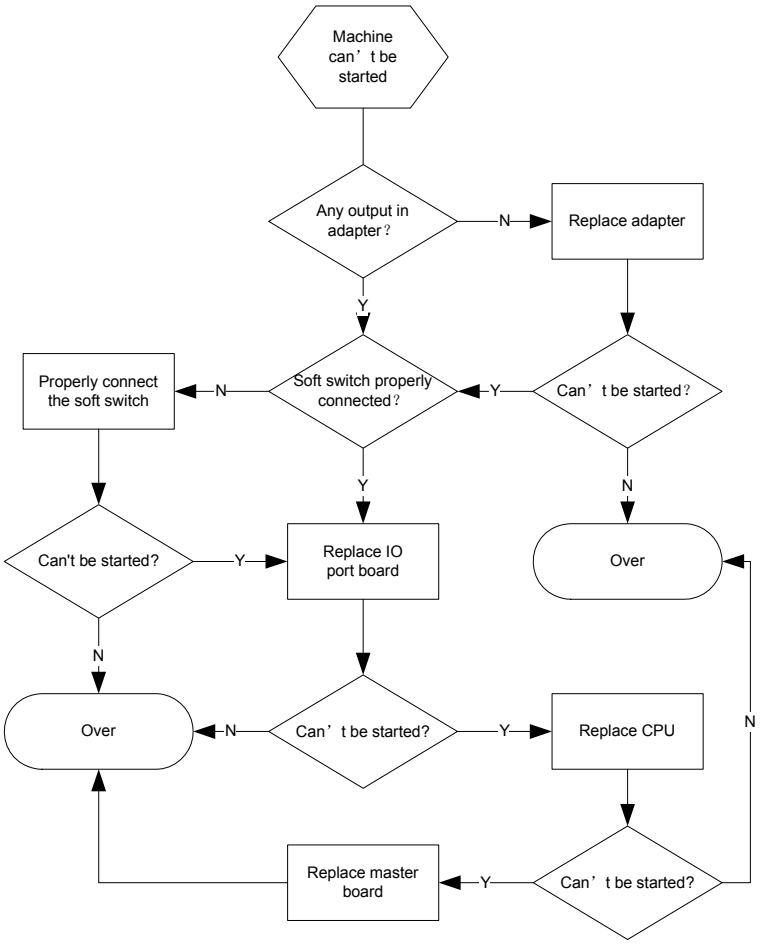
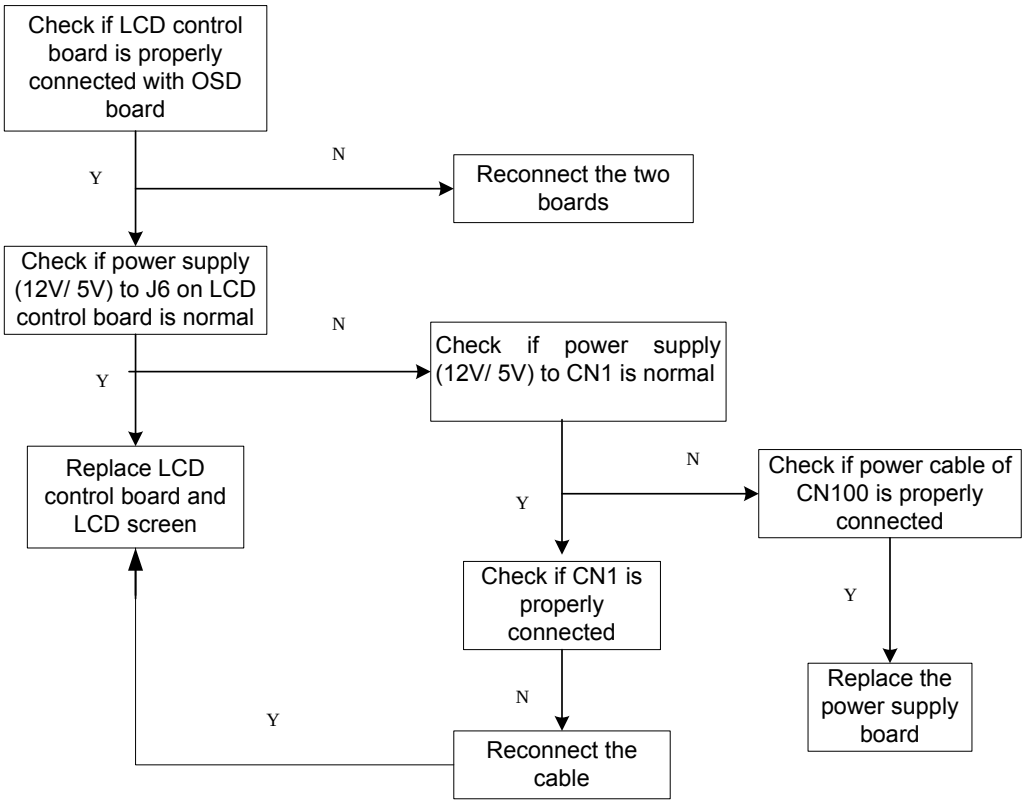


Figure 8-4 Examine and Repair Flow When the System Can’t Start-up

8.2 Modules and Boards Malfunction

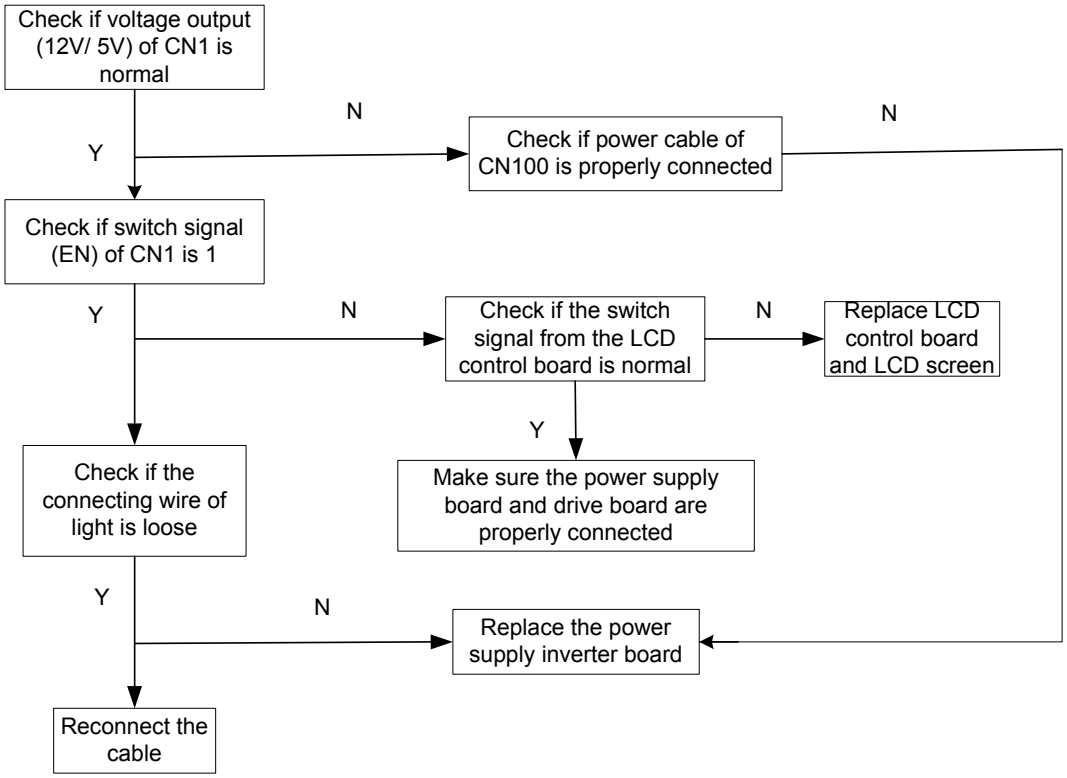
8.2.1 LCD Display

8.2.1.1 No Displaying in the LCD and the Indicator Lights are OFF



Note: LCD control board should match with the screen, and them should be replaced together if required.

8.2.1.2 LCD Malfunction, While the Indicator Lights Can be ON



Note: LCD control board should match with the screen, and they should be replaced together if required.

8.2.1.3 General Malfunctions of the AD Controller Board

No.	Failure	Possible Cause	Measure
1	The image is located in the wrong area, or lateral and vertical strips appear on the image.		Try Auto Adjust under the image without boundary.
2	The image color is abnormal.		Try Auto Color under the black/ white image.
3	There is signal input, but nothing displayed on the screen.		Check the socket of the back-light board, check if LVDS is connected well with PANEL, and if LVDS is properly connected with J1 socket of AD board.
4	The displaying image is abnormally fluttering.		Check if AD board is securely connected with the master board, and LVDS is properly connected.
5	Appears remnant image.		Check if the display protection program or timer is acting when the same image is displayed for a long time. The remnant image is caused by the LCD itself, please avoid displaying the same

			image for a long time.
6	The indicator light is OFF, no response to the switches		Check if socket of J5 key board is connected well; Check if J6 socket power cable is connected well; Check the 12V, 5V power supply of J6 socket is normal.
7	The color of the indicator lights are orange		If the output of main unit is normal, but the display indicator light is orange and no display on the screen, please check if J3 signal input port is connected well and if there are voltages input to HSYNC, VSYNC synchronization signals.

8.2.2 General Malfunctions of the Control Panel Unit

8.2.2.1 General Malfunctions of the Control Panel Buckled Board

No.	Failure	Possible Cause	Measure
1	Indicator light D4 is OFF	No 3.3V power supply to the control panel.	Check the 3.3V power supply output on the control panel.
2	Indicator light D1 is OFF	USB is not properly enumerated.	Check if USB cable is damaged or dropped down.
3	Indicator light D3 is OFF sometimes.	FPGA configure file hasn't been burned.	Burn the FPGA configure file.
		Check if the kernel voltage of FPGA is normal, test the voltage drop of C27, the standard voltage is 1.2V.	Replace U20.
		FLASH malfunction	Replace U3.

8.2.2.2 General Malfunctions of the Control Panel

No.	Failure	Possible Cause	Measure
1	Indicator light D6 is OFF.	No 12V power supply to the control panel.	Check the 12V power supply circuit of the control panel.
2	Indicator light D175 is OFF.	No 3.3V power supply to the control panel.	Check the 3.3V power supply circuit of the control panel.
3	Indicator light D176 is OFF.	No 5V power supply to the control panel.	Check the 5V power supply circuit of the control panel.
4	When operating the trackball, it has no	Trackball connecting cable malfunction.	Check if the trackball connecting cable is properly connected.
		Trackball damaged.	Check if the trackball is

	response.		dust-covered or damaged.

8.2.3 General Malfunctions of the Probe Board

No.	Failure	Possible Cause	Measure
1	The probe can‘t be recognized by the probe port of the main unit.	Check if the two boards of the probe board module have been properly buckled.	Properly buckle the probe board and probe control board.
		The probe expander can’t be powered (no sound of switching the relay can be heard when powered on)	Checks if fuse F1 of the probe control board is conducted, if it is damaged, please replace the fuse.
		Test if the VCC (5V), VDD (3.3V) voltages on the probe control board are normal.	Check if there is short circuit, if no such problem can be found, take the following methods: Replace U1 if 3.3V voltage is abnormal; If the 5V voltage is over-low, the main unit may be damaged (the possibility is little).
		Check the connection of each boards, pay more attention to check if the socket connecting the probe connection board and probe board is loose or been damaged.(make sure that the communication cable is connected well).	Connect the boards properly. If the socket is damaged, please replace the board.
		CPLD U3 of the probe control board or the driver’s U3, U4 are damaged.	Return the probe control board for testing and repairing.
2	Probe A, B, C sockets can’t be recognized by the main unit.	U9 (A socket), U12 (B socket) or U13(C socket) of the probe control board are damaged.	Replace the corresponding unit.
		The resistors corresponding to AID, BID or CID signal are shortened or opened.	Replace the corresponding resistor.
		Note: Carry out testing on the testing jig to determine the malfunction before returning the module for repairing.	
3	When the probes of A, B, C sockets are working, about 1/8 or	Check if the two boards of the probe board module are properly connected, and if socket is damaged or the leg deviated.	Properly connect the boards, or replace the corresponding socket.

	1/4 of fixed area has no image displayed.	The parts in the relay control circuit of the corresponding probe are damaged.	Replace the damaged parts.
4	When the probes of A, B, C socket are working, there are one or several vertical blank passes in the images.	Check if other probes have the same problem.	If all other probes have the same problem, may be the board of the main unit is damaged. If only one probe has this problem, may be the probe is damaged.
		Check if the probes of sockets A, B, C have the same problem.	If the three sockets have this problem, the possible causes are: 1. The probe board sockets P1~P3 have been damaged; 2. The probe module is not properly connected with the probe connection board (the possibility is little); 3. If the two passes are in series, it may caused by the damaged corresponding relays.
			If the problem only exists in one of the socket, the possible causes are: 1. The two boards are not buckled well; 2. The “board-to-board” socket is damaged; The probe port of the probe board module is damaged (the possibility is little).

8.2.4 General Malfunctions of CW Doppler Board

No.	Failure	Possible Cause	Measure
1	The 3.3V or 5V power supply indicator light is OFF after powered on.	Make sure the board is properly connected to the master board, and there is power supply to the CW board from the master board.	Fix the connections; make sure there are power supply existing in J1, J2 power pins, otherwise, please replace the master board.
		The L41，L40 are effectless.	Replace the effectless inductor.
2	CW output signal frequency error.	Test the frequency of the output signal of U30, and U31; if they are normal, then test the output of U12, and U14 to check if the output signal is normal and if there are distortion in the	Replace U30, U31 if error exists in output signals of U30, U31, if error still exists, replace U13; if U30, U31 and U13 are normal but error exists in output signals of U12, U14, first check if the

		signal.	peripheral resistors and power supply of U12, U14 are OK, if they are normal, then replace U12, U14.
		The pre-demodulation low-pass filter is damaged.	Check if there is damage to the filtering peripheral units, and replace the damaged units.
3	Amplitude inconsistency of the CW output signal I, Q.	2.5V voltage input/output error in U2, and U4.	Replace U6, U2 or U4.
		U1，U5 is damaged, which can be concluded from the same input but different output.	Replace U1 or U5.
		U13 is damaged, which can be concluded from the output inconsistency.	Replace U13.
		There are amplifier or peripheral devices be damaged in the amplification stage or filtering unit of I and Q.	Test and compare the testing points, and then replace the damaged units.
4	High harmonic wave appears in the CW output signal.	U13 is damaged.	Replace U13
		The pre-demodulation low-pass filter is damaged.	Check if there is damage to the filtering peripheral units, and replace the damage units.
		Output signal saturation distortion in the amplification stage of I, Q.	Check if any peripheral unit in the amplification stage is damaged, if any, please replace it.
		I, Q wall filter output distortion.	Check if there is damage to the filtering peripheral units, and replace the damage units.
5	No CW output signal	Electronic switch is damaged.	Replace U11.
		The low-pass filter is damaged.	Check if any amplifier in the amplification stage is damaged, if any, replace it.
		Demodulation IC U13 is damaged.	Replace U13.
		Amplifier damaged in the amplification stage and wall filter of I, Q.	Replace the damaged units.
		Damage to ADC IC U6 or signal end to difference circuit.	Replace U6, U2 or U4.

8.2.5 General Malfunctions of USB-to-IDE Port Board

No.	Failure	Possible Cause	Measure
1	After DVD RW is connected, Windows doesn't ask to test the device.	Check if USB connecting cable can work normally.	Replace USB connecting cable.
		Malfunction of USB communication.	Refer to USB communication troubleshooting.
2	No power on the board (refer to testing method of board power supply).	Malfunction in the 5V voltage testing point.	Replace USB connecting cable or inductor L1.
		Malfunction in the 3.3V voltage testing point.	Replace U2.

USB communication malfunction on USB-to-IDE port board

USB signal input circuit is shown as Figure 8-5. DP and DM are USB signal differential input pair, they are connected to ESD protection IC IP4220 through J2 (PIN5 2mm). The electrostatic level of this IC is 8000V. L1 is the common-mode inductance specified for USB.

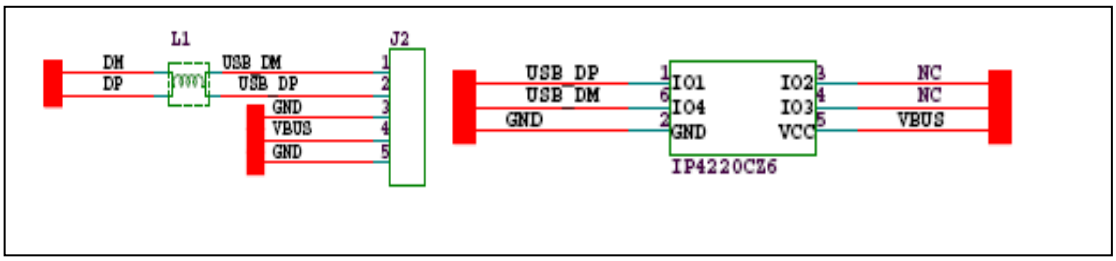


Figure 8-5 USB Port

To judge the USB communication malfunction, you can test if L1 is working normally, if not (the conducting resistor is less than 1Ohm), it means malfunction exists in L1. And if L1 is normal, please replace IP4220CZ6 to judge the malfunction. At last, test should be done to U3 and the peripheral circuit if the former method can't determine the malfunction.

Power supply test of USB-to-IDE port board

The board is powered by VBUS, which will be converted into 3.3V through LDOSPX1117, the circuit is shown as follows:

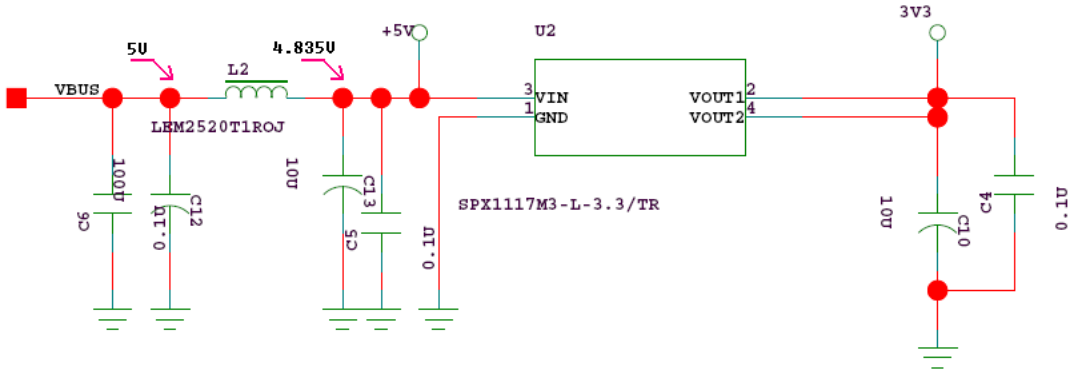


Figure 8-6 USB-to-IDE Power Supply Circuit

5V testing point: the voltage of L2, the standard value is 5V±5%;

3.3V testing point: the voltage-drop of C10, the standard value is 3.3V±5%.

8.2.6 PC System Related Malfunctions

No.	Failure	Possible Cause	Measure
1	PC can't be started.	5VSTB and 12V have no voltage output for PC board.	If 5VSTB has no output, the malfunction may exist in the power supply module.
			If just the 12V has no output, the malfunction may exist in the power supply management module.
2	The system gets reset repeatedly after powered on.	Management sequential malfunction in PC power supply.	Check if CPLD is damaged.
3	System startup is very low.	System access speed is slow because when flash memory is applied on the system, the system will be restarted from the flash memory.	Remove the flash memory and use it after accessing the operation system.
4	System clock is abnormal.	The battery has no power.	Replace for a new battery.
		RTC clock of CPU can't work normally.	Replace CPU.
5	Malfunction in PCI peripheral units (multi-function FPGA, DSP FPGA).	FPGA is damaged.	Replace the corresponding FPGA.
6	Malfunction in testing of	Multi-function FPGA can't work normally.	Check if multi-function FPGA is damaged.

	system voltage, temperature, as well as fan rotating speed.	Multi-function FPGA is normal, but ADT7462 can't work normally.	If the testing of voltage, temperature and fan rotating speed is abnormal while the multi-function FPGA is normal, then the malfunction must exist in ADT7462.
7	Malfunction in Video & S-Video output	Multi-function FPGA can't work normally.	Check if multi-function FPGA is damaged.
		Multi-function FPGA is normal, but the video converting IC 25874 can't work normally.	If Video/SVideo output is abnormal while multi-function FPGA is normal, then the malfunction must exist in 25874.
8	USB port can not be applied.	Check if the bus current to the USB is more than 1A.	If the USB port can't be used because of surge, just to turn off the system and then restart it.

8.2.7 Power Supply Malfunction

Most of the devices on the power supply connecting board are passive one, so they are not easy to be damaged, but it is possible that the fuse may be damaged due to peripheral device over-current or short circuit.

When malfunction exists in the voltage selection switch of the power supply connecting board, there are two possible causes:

1. Connection of 120Vac: when input 230Vac, the isolating transformer may be saturated, which will lead to the temperature fuse in the transformer be burnt out or cause the breaker tripped.

2. Connection of 230Vac: when input 120Vac, the transformer copper loss will get severe, which will lead to greater heat emitting. This will not be obvious when the overall load is insignificant.

The following Figureure shows the internal winding and the different connections of the isolating transformer.

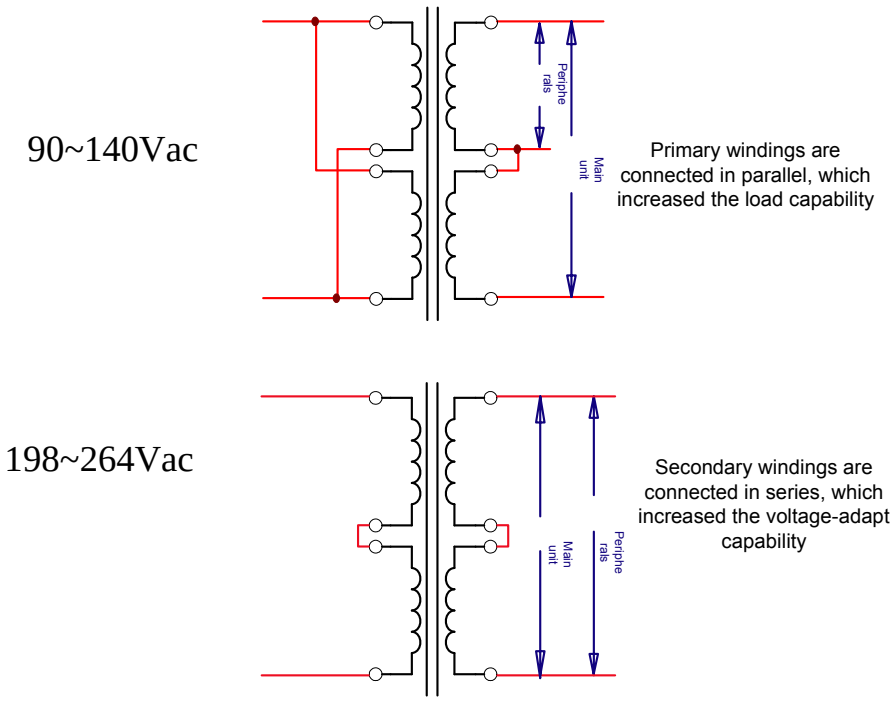


Figure 8-7 Connections of the Transformer Winding

When the malfunction exists in the adapter of the power supply system or the DC power, the malfunction can be determined according to the flows in Figure 8-8.

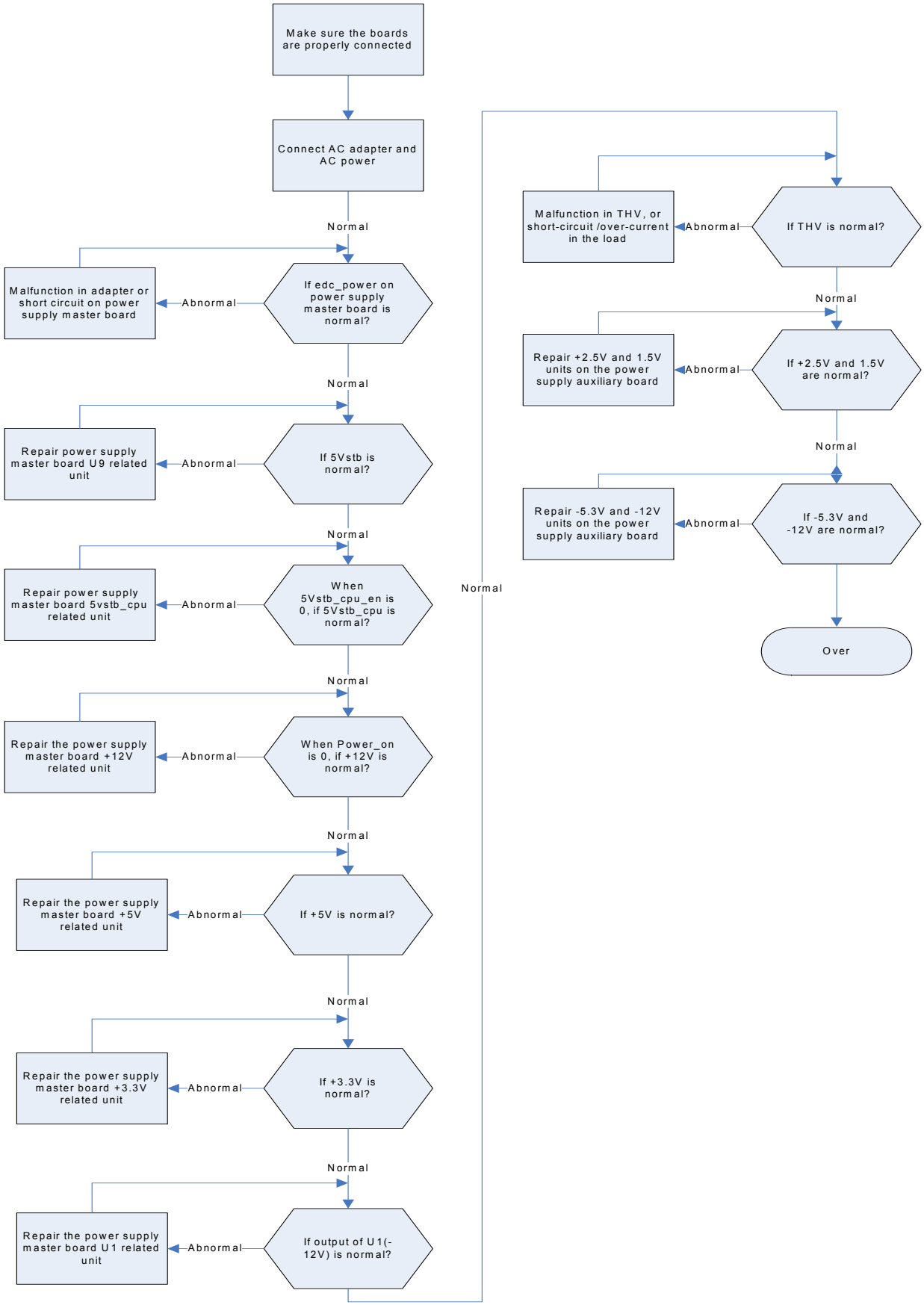

Make sure the boards are properly connected
Connect AC adapter and AC power
Normal
If edc_power on power supply master board is normal?
Abnormal
Malfunction in adapter or short circuit on power supply master board
Normal
If 5Vstb is normal?
Abnormal
Repair power supply master board U9 related unit
Normal
When 5Vstb_cpu_en is 0, if 5Vstb_cpu is normal?
Abnormal
Repair power supply master board 5vstb_cpu related unit
Normal
When Power_on is 0, if +12V is normal?
Abnormal
Repair the power supply master board +12V related unit
Normal
If +5V is normal?
Abnormal
Repair the power supply master board +5V related unit
Normal
If +3.3V is normal?
Abnormal
Repair the power supply master board +3.3V related unit
Normal
If output of U1(-12V) is normal?
Abnormal
Repair the power supply master board U1 related unit
Normal
If THV is normal?
Abnormal
Malfunction in THV, or short-circuit /over-current in the load
Normal
If +2.5V and 1.5V are normal?
Abnormal
Repair +2.5V and 1.5V units on the power supply auxiliary board
Normal
If -5.3V and -12V are normal?
Abnormal
Repair -5.3V and -12V units on the power supply auxiliary board
Over

Figure 8-8 Examine and Repair Flow of DC-DC Power Supply

8.2.7.1 Power Supply Connecting Board

When malfunction exists in the power supply connecting board, you should first check if the settings of the two voltage selection switches of the isolating transformer are correct and then observe if the fuses corresponding to the 3 peripheral devices' outputs are damaged.

8.2.7.2 Isolating Transformer

The malfunction in the isolating transformer may be caused by the burnt-out of the internal temperature fuse, disconnect the transformer external wiring and then test if the two primary windings are opened.

8.2.7.3 Malfunctions in the Power Supply Master Board and Auxiliary Board

8.2.7.4 Troubleshooting of 5vstb Circuit

If the malfunction exists in 5vstb, first test if the input voltage of PIN1 of U9 is normal; if it is normal, then it can be concluded that U9 is damaged or there are over-current or short circuit happened at the load end.

8.2.7.5 Troubleshooting of +12v Circuit

Before the test, please make sure that the power_on signal is of low level, and the input voltage VBUS+ is normal.

Examine and repair flow:

Test the voltage of PIN8 of U3, which should be higher than 4V;

Test the voltage of PIN19 of U3, which should be higher than 6V;

Check if there are drive pulse at the G polarity of MOS Q11, Q18, Q24 and Q25 by the oscilloscope. The normal status is that there should have 2 MOS have drive pulse at the G polarity.

Check if there are any damage to the 4 MOS Q11, Q18, Q24, Q25, and the 2 diodes D5, and D7.

8.2.7.6 Troubleshooting of +5v and +3.3v Circuit

Before the test, please make sure that the +12V input as well as the input voltage VBUS+ are normal.

Examine and repair flow:

Test the level of PIN23, which should be high;

Check by sight if R6 (+3.3v unit) and R12 (+5v unit) are properly jointed.

Check by sight if the joint of IC is deviated, which will lead to short circuit between the pins at the bottom of IC.

8.2.7.7 Troubleshooting of THV Circuit

Before the test, please make sure that the +12V output as well as the U1 negative voltage output are normal.

Low voltage section and high voltage section are independent from each other. First, check if the THV is at circuit protection status because of over-current and short circuit, and this can be done by the ocp signal (the ocp signal is of high level in the case of over-current).

When the malfunction exists in the low voltage section, please check if U10 (TPS54350), U7, D1, R142 and R143 are in good conditions.

When the malfunction exists in the high voltage section, please check if U6 (TL594), U2, Q5, D9, R110 and R111 are in good conditions.

Troubleshooting of U10 and the peripheral circuits:

Test the voltage of PIN7, which should be higher than 0.5V;

Test the voltage of PIN12, which should be higher than 8V;

Test the voltage of PIN12, which should be 8V higher than that of PIN15;

Test the voltage of PIN14 and PIN15, which should have pulse voltage wave.

Troubleshooting of U6 and the peripheral circuits:

Before the test, please make sure that the cw_mode is of low voltage, that means the instrument is working at high voltage section.

Test the voltage of PIN8 and PIN11, which should be higher than 12V;

Test the voltage of PIN14, which should be higher than +5V;

Test the voltage of PIN5, which should have oscillatory wave;

Test the voltage of PIN15, which should be higher than 1.6V;

Test PIN9 and PIN10, which should have drive pulse.

8.2.7.8 Troubleshooting of +2.5V and +1.5V circuit units

Before power on, please check by sight if EL7566 and the peripheral units are properly jointed, and if any pins of EL7566 are of short circuit and dry joint.

Examine and repair flow:

Test the voltage of PIN19～PIN21, which should be +5V;

Test the voltage of PIN22, which should be +5V；

Test PIN27, which should have oscillatory wave output;

Test PIN8～PIN13, which should have pulse voltage wave.

8.2.7.9 Troubleshooting of -5V and -12V Circuits

Make sure the power supply VBUS+ to the -5V and -12v circuits are at the normal range.

Examine and repair flow after powered on:

Test the voltage of PIN15 (power supply to the power supply chip), which should be the same with VBUS.

Test the voltage of PIN5 (the reference voltage pin), which should be 1.25V.

Test the voltage of PIN8 (over-voltage/ over-current protection control pin), which should be higher than 0.5V.

Test PIN14 (drive pin), which should output drive pulse.

8.2.7.10 Troubleshooting of 4D&TEE Power Supply Board

The control chip of this power board integrates relatively perfect protective function, which is reliable. When you find it can't work normally, firstly check if it's under protection, and then check if there is breakdown devices. The procedures are as follows:

1. When it's on load, measure any output of ±12V to check whether the voltage is zero or output voltage is floating in a range. At the same time, listen to the power board to check whether there is abnormal sound. If there are the situations described above, you can estimate power is under protection, and the reasons maybe overload or short of secondary circuit.
2. When it's no-load, if output voltage is floating in a range and it turns to zero after on load, you can change U1 or U2 to make the power normal.
3. If there is no output voltage, check the fuse and R17 after power down. It is recommended use the continuity test function of multimeter to directly test two connectors of the devices described above. In addition, there is black and yellow burning mark outside R17. If fuse and R17 are both normal, you can change Q1 to make the power normal.
4. Visually measure whether there is dig on the surface of U3. Under malfunction, the chip will be broke down under acute electric stress and its surface will be defected. Next you can measure PIN voltage of U3: when U3 is in normal working, the typical voltage value of PIN10 is 5V; the voltage of PIN15 is over 3V or that of PIN15 is less than 0.45V, which both make U3 can't work normally.

⚠WARNING: Because all boards of power system involve high voltage part, please be careful at test. Not only pay attention to the correct use of measurement device to avoid damage, but also notice tester's safety. Specially, under power on, don't touch the parts on the board, especially the high voltage part.

8.2.7.11 Troubleshooting of 4D Drive Board

1. Power lights D11 and D12 are off

Possible reason: protective tube is burned down. Firstly measure its connectivity using multimeter. If it is off or the resistance value is high, please change the protective tube and validate it.

2. Without drive output

1) Ondoscope measures DAC SPI interface, referencing from the specification of AD5324. If the signal is correct, measure DAC3.3V power and 2.5V for reference. If they are both normal, while there is no output wave of DAC, please change DAC or drive board.
2) Based on step 1, if there is output wave from DAC, check ±12V power supply of power amplifier and input pin. If there is no input, check the amplification node of M signal. Change the drive board, if there is no signal from M node.
3) Based on step 2, if there is output wave from DAC, and the power supply of power amplifier is normal; in addition, there is input for input pin, and there is no output from power amplifier, please change power amplifier or drive board.

3. Hall signal, TEE angle signal and temperature signal can be referenced from the procedures described above, checking each node according to the signal transmission and clarifying the problem.

8.3 Software Troubleshooting

8.3.1 Troubleshooting in the Case of HDD Damaged

If the hard disk is damaged due to some special causes, please make a new one follow to the following steps:

1. Use the Nero tool, select the menu [Rewriter| R/W CD-ROM image file…"], and then select the image file (2108-30-66180), rewrite a hard disk initialized CD-ROM.

2. Set the BIOS of ultrasound system.

2.1) Start the ultrasound system, press F2 on the control panel, enter the BIOS password to begin the BIOS setting.

2.2) Set 【CMOS Restore Condition】 as Never in the 【Exit】 page; then click Save Changes--Save CMOS To Flash; set 【Boot Order】as Boot from USB CDROM in the 【Boot】 page (Select USB CDROM by the up arrow or down arrow, press the 'Shift" key while pressing, at each pressing of "+", the USB CDROM will move up a step, we should put the item to the top).

3. Make a hard disk

3.1）Start the power, put the hard disk into the CD-ROM drive, it will prompt "Press any key to boot CD-ROM…" on the screen, press any key to automatically enter into the Windows XP pre-installation environment.

3.2）The control window will appear on the screen after successfully started, the version information will be displayed, and will prompt "Press any key to continue …", press any key to continue the hard disk initialization.

3.3）The initialization is automatically processed, and "Over" means the whole process is completed, and it will display "Press any key to continue …" again, press any key to restart the system, then a hard disk is made.

4. Change the BIOS setting after the hard disk is repaired. Enter into BIOS, cancel the function to start from USB-CDROM by setting the【Boot Order】on【Boot】page, (select the USB CDROM by up arrow or down arrow, press the 'Shift" key while pressing, at each pressing of "-", the USB CDROM will move down a step, we should put the item below the HDD), set【CMOS Restore Condition】as Always on【Exit】page, then click Save Changes--Save CMOS To Flash; at last, click 【Exit Saving Changes】 on 【Exit】 page to exit.

WARNING: All the data on the hard disk will be deleted after formatting!

Note: To make a new hard disk, you have to re-install the XPE system (refer to 8.3.2 XP Operation System Troubleshooting), and run the user service ultrasound software restore program (refer to 8.3.3 Ultrasound Software System Troubleshooting); then upgrade preset data (refer to 7.2.6.2 Upgrading a Single Item), and then configure the

machine according to the model, at last, configure the optional functions according to the function CD-ROM owned by the user. (see 7.2.9and 7.2.10).

8.3.2 XP Operation System Troubleshooting

1. Use Nero tool, select the menu [Rewriter| Rewrite CD-ROM image file"], add the XPE setup program to rewrite a CD-ROM with the XPE setup program (110-000336-00).

2. Set the BIOS of the ultrasound system

2.1) Start the ultrasound system, press F2 on the control panel, enter the BIOS password to begin the BIOS setting.

2.2) Set 【CMOS Restore Condition】 as Never on 【Exit】 page, click Save Changes--Save CMOS To Flash; set 【Boot Order】 as Boot from USB CDROM on 【Boot】 page (select USB CDROM by the up arrow or down arrow, press "Shift" key while pressing, at each pressing of "+", the USB CDROM will move up a step, we should move the item to the top), at last, select【Exit Saving Changes】on【Exit】page to exit.

3. Setup XP operation system

3.1) Put the XPE setup image CD-ROM into the CD-ROM driver, it will prompt "Press any key to boot CD-ROM…" on the screen, press any key to automatically enter into the Windows XP pre-installation environment.

3.2) The control window will appear on the screen after been successfully booted, the version information will be displayed, and will prompt "Press any key to continue …", press any key to continue the Windows© XPE installation.

3.3) "Over" means the whole process is completed, and it will display "Press any key to continue …" again, press any key to reboot the system.

NOTE:

1. The Windows setup is automatically processed, never do anything during the setup to avoid problem.

2. XPE will re-setup the drive program after XP is rebooted, it may ask to reboot again, and setup will be completed after rebooting.

3. Change the BIOS setting after the hard disk is repaired. Enter into BIOS, cancel the function to boot from USB-CDROM by setting the 【Boot Order】 on 【Boot】 page, (select the USB CDROM by up arrow or down arrow, press the 'Shift" key while pressing, at each pressing of "-", the USB CDROM will move down a step, we should put the item below the HDD), set 【CMOS Restore Condition】 as Always on 【Exit】 page, then click Save Changes--Save CMOS To Flash; at last, click 【Exit Saving Changes】 on 【Exit】 page to exit.

⚠WARNING: After the system is recovered, the ultrasound software will be deleted. However, the optional software、the model of product and the files in D disk and E disk still remain. After the ultrasound software

is reinstalled, you need to perform steps in section 7.2.6.2 to update preset data.

8.3.3 Ultrasound Software System Troubleshooting

8.3.3.1 System Malfunction Classification and Simple Troubleshooting

There are two situations if the ultrasound software is damaged:

Situation 1: System can not normally enter into the ultrasound system interface, if this happened, first, you have to restore the XPE system (see XP Operation System Troubleshooting), and then to restore the ultrasound system software;

Situation 2: System can enter into the ultrasound operation system, but some of the functions can not be normally operated. There are two methods to deal with this problem:

2.1) Upgrade the software according to the software maintenance methods that introduced in Chapter 7;

2.2) If no response to the first method, then restore the ultrasound system software according to the software maintenance methods that introduced in Chapter 7.

8.3.3.2 Ultrasound System Software Restore

Preparation: use Nero tool, select the menu [Rewriter| Rewrite CD-ROM image file"], select the ultrasound system restore software (2109-30-76419) to rewrite an ultrasound system restore software.

1） The ultrasound system software must be setup in XP interface, if the XPE system is setup just for a short time, the system can be restored by the ultrasound system restore software; if the machine is still running under the ultrasound system, some simple operations are required before restoring the system by the ultrasound system restore software.

1.1) To restore the ultrasound system software in the case that the XPE system is setup just for a short time: put the prepared ultrasound system restore software CD-ROM to the CD-ROM drive, the system software setup will be automatically started. When the interface prompts "System need reboot！ Please input Enter key to quit the Program!", press [Enter] on the control panel and the system will return to the Windows desk. Take out the CD-ROM and press the system soft switch to turn off the main machine and then switch off the breaker. After the system is booted, it will enter into the ultrasound system.

1.2）To restore the ultrasound system software in the case that the machine is still running under the ultrasound system:

Press "Ctrl + Shift + =" on the control panel, and enter the correct password in the popped out dialogue box, open the online debugger, and enter "shellapp off" in the debugging column, press [Enter], turn off the machine and then reboot it. After the machine is booted, it will directly enter into the Windows desk; delete the M5, and PatientBak file folders in C disk, and the PADIENTDATA_2108 folder in D disk; put the prepared ultrasound system restore CD-ROM into the CD-ROM drive, the setup will be automatically started, when it prompts "System need reboot! Please input Enter key to quit the Program!", press [Enter] and the system will return to Windows desk. Take out

the CD-ROM and press the system soft switch to turn off the main machine and then switch off the breaker. After the system is started, it will enter into the ultrasound system.;

3） If the ultrasound system is restored, the machine has to be configured, also, the optional functions should be configured according to the function CD-ROM owned by the user. (see 7.2.9and 7.2.10)

Note: if the ultrasound system is restored, you must upgrade preset data (refer to 7.2.6.2 Upgrading a Single Item) and install optional software, otherwise the system may not work normally.(You must install Color function and iClear function).

WARNING: After the ultrasound software system can be applied on the machine, the original ultrasound software, the related information (including the user preset files and backup information in patient data bank), as well as the patient information in the D disk will be deleted when restore the system of the machine, so remember to backup all the information before deletion.

8.3.4 Patient Databank Troubleshooting

All information will be backed up when the main databank is working, when any error appeared during the working, the backed up information can be used to restore the databank automatically without any manual operation.

1) Press “Ctrl + Shift + =” on the control panel, and enter the correct password in the popped out dialog box, open the online debugger, and enter “shellapp on” in the debugging column, press [Enter], turn off the machine and then reboot it.
2) After the machine is rebooted, it will enter into Windows desk, manually delete D:\PATIENT_2108 and C:\PATINET.BAK, and run the doppler.exe file under directory of C:\M5\TargetData\exe to start the ultrasound software.
3) Press “Ctrl + Shift + =” on the control panel, and enter the correct password in the popped out dialog box, open the online debugger, and enter “shellapp on” in the debugging column, press [Enter], turn off the machine and then restart it.

WARNING: Manual databank deletion is non-reverse, after deletion, all the saved patient information will be lost forever.

NOTE: If the patient databank loaded to the external mediums is damaged, there is no way to restore it.

Appendix A Definition of Commonly Used Sockets and Functions in System Maintenance

Figure A-1 Layout of Each Module and Socket on the Master Board

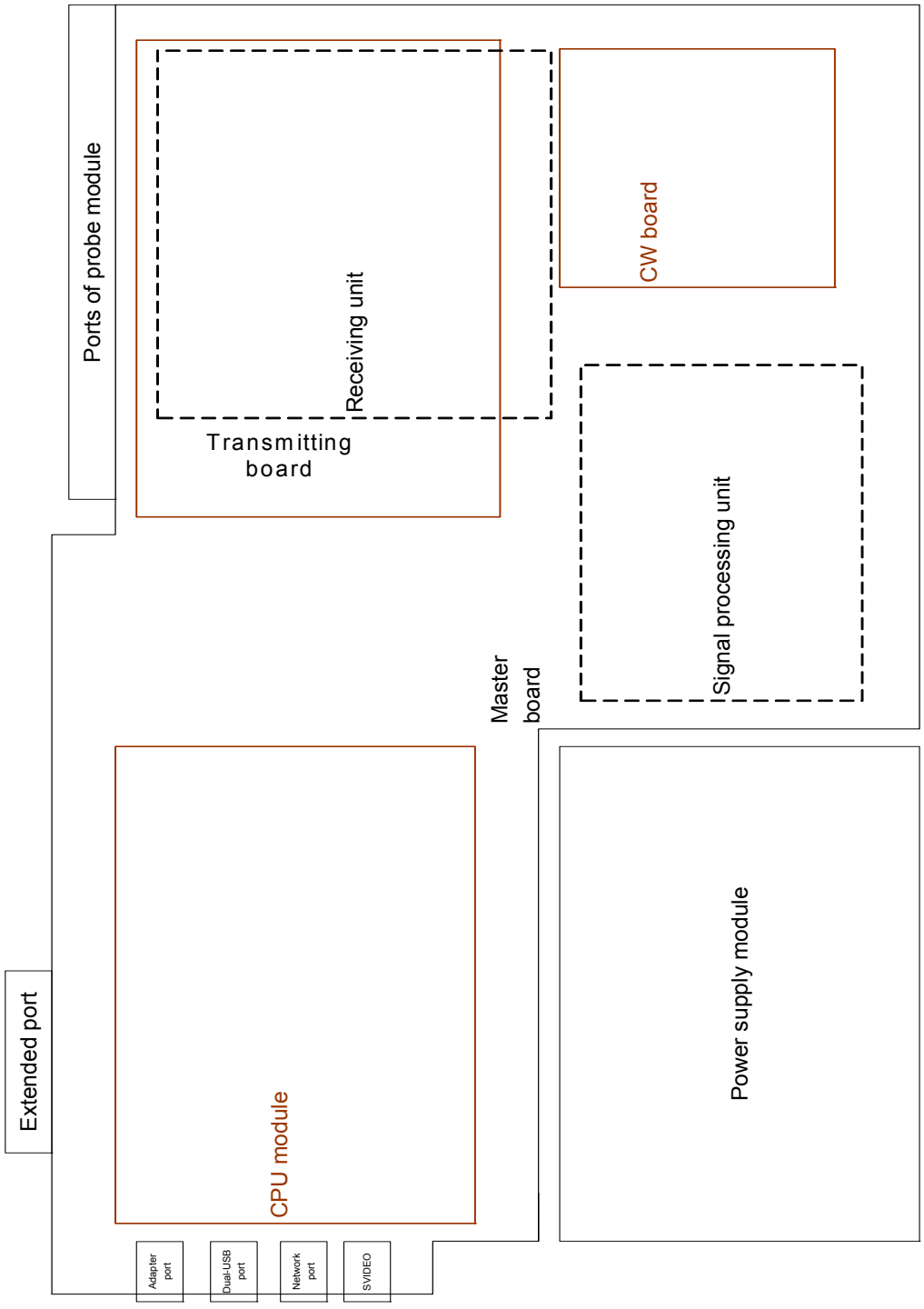


Table 8-1-1 Sockets between the Master Board and Probe Board

CON1							CON2					
PIN	PIN NAME	PIN	PIN NAME	PIN	PIN NAME		PIN	PIN NAME	PIN	PIN NAME	PIN	PIN NAME
1	GND	2	PE1	3	GND		1	PE69	2	PE70	3	PE71

4	PE2	5	GND	6	PE3		4	PE72	5	PE73	6	PE74
7	GND	8	PE4	9	PE5		7	PE75	8	GND	9	PE76
10	PE6	11	PE7	12	GND		10	GND	11	PE77	12	PE78
13	PE8	14	GND	15	PE9		13	PE79	14	PE80	15	GND
16	GND	17	PE10	18	PE11		16	PE81	17	GND	18	PE82
19	PE12	20	PE13	21	GND		19	GND	20	PE83	21	PE84
22	PE14	23	GND	24	PE15		22	PE85	23	PE86	24	GND
25	GND	26	PE16	27	PE17		25	PE87	26	GND	27	PE88
28	PE18	29	PE19	30	GND		28	GND	29	PE89	30	PE90
31	PE20	32	GND	33	PE21		31	PE91	32	PE92	33	GND
34	GND	35	PE22	36	PE23		34	PE93	35	GND	36	PE94
37	PE24	38	PE25	39	GND		37	GND	38	PE95	39	PE96
40	PE26	41	GND	42	PE27		40	PE97	41	PE98	42	GND
43	GND	44	PE28	45	PE29		43	PE99	44	GND	45	PE100
46	PE30	47	PE31	48	GND		46	PE101	47	PE102	48	PE103
49	PE32	50	GND	51	PE33		49	PE104	50	PE105	51	GND
52	GND	53	PE34	54	PE35		52	PE106	53	GND	54	PE107
55	PE36	56	PE37	57	GND		55	GND	56	PE108	57	PE109
58	PE38	59	GND	60	PE39		58	PE110	59	PE111	60	PE112
61	GND	62	PE40	63	PE41		61	PE113	62	GND	63	PE114
64	PE42	65	PE43	66	GND		64	PE115	65	PE116	66	PE117
67	PE44	68	GND	69	PE45		67	PE118	68	PE119	69	GND
70	GND	71	PE46	72	PE47		70	PE120	71	GND	72	PE121

73	PE48	74	PE49	75	GND		73	GND	74	PE122	75	PE123
76	PE50	77	GND	78	PE51		76	PE124	77	PE125	78	PE126
79	GND	80	PE52	81	PE53		79	PE127	80	GND	81	PE128
82	PE54	83	PE55	84	GND		82	SPI_CLK	83	SPI_CS	84	SPI_DIN
85	PE56	86	GND	87	PE57		85	SPI_DOUT	86	FLASH_WP	87	GND
88	GND	89	PE58	90	PE59		88	FLASH_POWER	89	GND	90	PROBE_ID6
91	PE60	92	PE61	93	GND		91	GND	92	PROBE_ID7	93	PROBEID_CS0
94	PE62	95	GND	96	PE63		94	PROBEID_CS1	95	RELAY_EN0	96	RELAY_EN1
97	GND	98	PE64	99	PE65		97	EXP_PRESENT	98	GND	99	PROBE_PRESENT
100	PE66	101	PE67	102	GND		100	GND	101	GND	102	GND
103	GND	104	GND	105	PE68		103	**VCC**	104	**VCC**	105	**VCC**

Table A-1 Definition of Input Sockets on Transmitting Board

CON1							
PIN	SIG	PIN	SIG	PIN	SIG	PIN	SIG
1	TPU58	2	TPU73	61	TPU82	62	TPU90
3	GND	4	GND	63	GND	64	GND
5	TPU50	6	TPU75	65	TPU127	66	TPU128
7	GND	8	GND	67	GND	68	GND
9	TPU79	10	TPU77	69	TPU89	70	TPU92
11	GND	12	GND	71	GND	72	GND
13	TPU71	14	TPU83	73	TPU91	74	TPU123
15	GND	16	GND	75	GND	76	GND
17	TPU49	18	TPU85	77	TPU121	78	TPU122
19	GND	20	GND	79	GND	80	GND

21	TPU57	22	TPU87	81	TPU124	82	TPU126
23	GND	24	GND	83	GND	84	GND
25	TPU41	26	TPU76	85	TPU119	86	TPU118
27	GND	28	GND	87	GND	88	GND
29	TPU56	30	TPU74	89	TPU116	90	TPU120
31	GND	32	GND	91	GND	92	GND
33	TPU72	34	TPU78	93	TPU112	94	TPU113
35	GND	36	GND	95	GND	96	GND
37	TPU54	38	TPU88	97	TPU105	98	TPU103
39	GND	40	GND	99	GND	100	GND
41	TPU68	42	TPU86	101	TPU114	102	TPU110
43	GND	44	GND	103	GND	104	GND
45	TPU80	46	TPU84	105	TPU104	106	TPU107
47	GND	48	GND	107	GND	108	GND
49	TPU66	50	TPU81	109	TPU108	110	TPU106
51	GND	52	GND	111	GND	112	GND
53	TPU93	54	TPU96	113	TPU101	114	TPU97
55	GND	56	GND	115	TPU100	116	TPU99
57	TPU95	58	TPU94	117	GND	118	GND
59	GND	60	GND	119	TPU98	120	TPU102
CON2							
PIN	SIG	PIN	SIG	PIN	SIG	PIN	SIG
1	TPU5	2	TPU34	61	TPU16	62	TPU61
3	GND	4	GND	63	GND	64	GND
5	TPU2	6	TPU42	65	TPU40	66	TPU45
7	TPU3	8	TPU46	67	TPU18	68	TPU37
9	GND	10	GND	69	GND	70	GND
11	TPU1	12	TPU25	71	TPU20	72	TPU29
13	TPU4	14	TPU48	73	TPU22	74	TPU70
15	GND	16	GND	75	GND	76	GND
17	TPU8	18	TPU23	77	TPU24	78	TPU69
19	TPU10	20	TPU62	79	TPU26	80	TPU52

21	GND	22	GND	81	GND	82	GND
23	TPU12	24	TPU21	83	TPU59	84	TPU60
25	TPU14	26	TPU64	85	TPU44	86	TPU51
27	GND	28	GND	87	GND	88	GND
29	TPU11	30	TPU19	89	TPU43	90	TPU125
31	TPU9	32	TPU27	91	TPU36	92	TPU115
33	GND	34	GND	93	GND	94	GND
35	TPU7	36	TPU33	95	TPU35	96	TPU109
37	TPU17	38	TPU65	97	TPU117	98	TPU111
39	GND	40	GND	99	GND	100	GND
41	TPU15	42	TPU55	101	VDD	102	VDD
43	TPU13	44	TPU63	103	GND	104	GND
45	GND	46	GND	105	GND	106	GND
47	TPU6	48	TPU47	107	GND	108	GND
49	TPU28	50	TPU39	109	12V	110	12V
51	GND	52	GND	111	GND	112	GND
53	TPU30	54	TPU31	113	GND	114	GND
55	TPU32	56	TPU67	115		116	
57	GND	58	GND	117	PHV	118	PHV
59	TPU38	60	TPU53	119	PHV	120	PHV

Table A-2 Definition of Output Sockets on Transmitting Board

CON1							
PIN	SIG	PIN	SIG	PIN	SIG	PIN	SIG
1	POUT1	2	POUT2	61	POUT33	62	POUT34
3	GND	4	GND	63	GND	64	GND
5	POUT3	6	POUT4	65	POUT35	66	POUT36
7	POUT5	8	POUT6	67	GND	68	GND
9	GND	10	GND	69	POUT37	70	POUT38
11	POUT7	12	POUT8	71	GND	72	GND
13	POUT9	14	POUT10	73	POUT39	74	POUT40
15	GND	16	GND	75	GND	76	GND
17	POUT11	18	POUT12	77	POUT41	78	POUT42

19	GND	20	GND	79	GND	80	GND
21	POUT13	22	POUT14	81	POUT43	82	POUT44
23	GND	24	GND	83	GND	84	GND
25	POUT15	26	POUT16	85	POUT45	86	POUT46
27	GND	28	GND	87	GND	88	GND
29	POUT17	30	POUT18	89	POUT47	90	POUT48
31	GND	32	GND	91	GND	92	GND
33	POUT19	34	POUT20	93	POUT49	94	POUT50
35	GND	36	GND	95	GND	96	GND
37	POUT21	38	POUT22	97	POUT51	98	POUT52
39	GND	40	GND	99	GND	100	GND
41	POUT23	42	POUT24	101	POUT53	102	POUT54
43	GND	44	GND	103	GND	104	GND
45	POUT25	46	POUT26	105	POUT55	106	POUT56
47	GND	48	GND	107	GND	108	GND
49	POUT27	50	POUT28	109	POUT57	110	POUT58
51	GND	52	GND	111	GND	112	GND
53	POUT29	54	POUT30	113	POUT59	114	POUT60
55	GND	56	GND	115	POUT61	116	POUT62
57	POUT31	58	POUT32	117	GND	118	GND
59	GND	60	GND	119	POUT63	120	POUT64
CON2							
PIN	SIG	PIN	SIG	PIN	SIG	PIN	SIG
1	POUT65	2	POUT66	61	POUT97	62	POUT98
3	GND	4	GND	63	GND	64	GND
5	POUT67	6	POUT68	65	POUT99	66	POUT100
7	POUT69	8	POUT70	67	GND	68	GND
9	GND	10	GND	69	POUT101	70	POUT102
11	POUT71	12	POUT72	71	GND	72	GND
13	POUT73	14	POUT74	73	POUT103	74	POUT104
15	GND	16	GND	75	GND	76	GND
17	POUT75	18	POUT76	77	POUT105	78	POUT106

19	GND	20	GND	79	GND	80	GND
21	POUT77	22	POUT78	81	POUT107	82	POUT108
23	GND	24	GND	83	GND	84	GND
25	POUT79	26	POUT80	85	POUT109	86	POUT110
27	GND	28	GND	87	GND	88	GND
29	POUT81	30	POUT82	89	POUT111	90	POUT112
31	GND	32	GND	91	GND	92	GND
33	POUT83	34	POUT84	93	POUT113	94	POUT114
35	GND	36	GND	95	GND	96	GND
37	POUT85	38	POUT86	97	POUT115	98	POUT116
39	GND	40	GND	99	GND	100	GND
41	POUT87	42	POUT88	101	POUT117	102	POUT118
43	GND	44	GND	103	GND	104	GND
45	POUT89	46	POUT90	105	POUT119	106	POUT120
47	GND	48	GND	107	GND	108	GND
49	POUT91	50	POUT92	109	POUT121	110	POUT122
51	GND	52	GND	111	GND	112	GND
53	POUT93	54	POUT94	113	POUT123	114	POUT124
55	GND	56	GND	115	POUT125	116	POUT126
57	POUT95	58	POUT96	117	GND	118	GND
59	GND	60	GND	119	POUT127	120	POUT128

Table A-3 Pins Definition of CW CON1

PIN	SIGNAL	PIN	SIGNAL
1	GND	2	GND
3	CW0	4	CW1
5	GND	6	GND
7	CW2	8	CW3
9	GND	10	GND
11	CW4	12	CW5
13	GND	14	GND
15	CW6	16	CW7
17	GND	18	GND
19	CW8	20	CW9

21	GND	22	GND
23	GND	24	GND
25	12V	26	12V
27	GND	28	GND
29	-12V	30	-12V
31	GND	32	GND
33	5V	34	5V
35	GND	36	GND
37	-5V	38	-5V
39	GND	40	GND

Table A-4 Pins Definition of CW CON2

PIN NUM	Signal name	Note
1	AD_NRST	AD reset signal(Alreadyposited to the right position, can be reserved)
2	RESERVED	Reserved, not be used temporarily
3	RESERVED	Reserved, not be used temporarily
4	RESERVED	Reserved, not be used temporarily
5	GND	
6	GND	
7	LOCLK_P	Quadrature demodulation local oscillation input (If it is difference, it is positive end)
8	RESERVED	Reserved, not be used temporarily
9	LOCLK_N	Quadrature demodulation local oscillation input (If it is difference, it is negative end）
10	RESERVED	Reserved, not be used temporarily
11	GND	
12	GND	
13	RESERVED	Reserved, not be used temporarily
14	RESERVED	Reserved, not be used temporarily
15	RESERVED	Reserved, not be used temporarily
16	AD_HPFD	AD internal high-pass filter enable control (Already posited to normal open, can be reserved)
17	GND	
18	GND	
19	AD_LRCK	AD audio serial port left/ right output clock （Audio serial port left/ right （or word） clock）

20	AD_DATA	AD audio serial port output data （Audio serial port left and right channel PCM data）
21	AD_BCK	AD audio serial port output bit clock （Audio serial port bit clock）
22	SW_CTRL	Analog switch channel selection control signal
23	GND	
24	GND	
25	TPU	Input of pencil probe drive signal
26	RESERVED	Reserved, not be used temporarily
27	GND	
28	GND	
29	RESERVED	Reserved, not be used temporarily
30	RESERVED	Reserved, not be used temporarily
31	RESERVED	Reserved, not be used temporarily
32	GND	
33	GND	
34	GND	
35	D3V3	
36	D3V3	
37	GND	
38	GND	
39	HV	Remote control, high voltage
40	HV	Remote control, high voltage

Table A-5 Interface Signal Definition between Master Board and 4D Board

Pin	Signal	Pin	Signal
1	NC	2	NC
3	NC	4	NC
5	NC	6	NC
7	GND	8	GND
9	GND	10	NC
11	NC	12	NC
13	GND	14	GND
15	+5V	16	+5V
17	+5V	18	+5V
19	GND	20	GND

21	GND	22	GND
23	+3.3V	24	+3.3V
25	GND	26	GND
27	FD_ON	28	HALL
29	SPI_CLK	30	SPI_DAT
31	SPI_SYNC	32	FD_ID
33	GND	34	GND
35	AD_SCLK	36	AD_DIN
37	AD_DOUT	38	AD_NCS
39	GND	40	GND

Table A-6 Signal Definition between the Master Board and 4D Board

Pin	Signal	Pin	Signal
1	+12V	2	+12V
3	+12V	4	+12V
5	+12V	6	+12V
7	GND	8	GND
9	GND	10	USB-2
11	USB_2_3_OC_N	12	USB+2
13	Gnd	14	Gnd
15	+5V	16	+5V
17	+5V	18	+5V
19	GND	20	GND
21	GND	22	GND
23	+3.3V	24	+3.3V
25	GND	26	GND
27	STEP	28	DIR
29	SLEEP	30	Reserved
31	Reserved	32	Reserved
33	GND	34	GND
35	SPI_CLK（Reserve SPI Ad port）/Txd	36	SPI_DIN/Rxd
37	SPI_DOUT	38	SPI_/CS
39	GND	40	GND

Table A-7 Pins Definition between the Master Board and AD Control Board

PIN NUM	NET NAME	PIN NUM	NET NAME
1	GND	2	GND
3	12V	4	12V
5	12V	6	12V
7	12V	8	12V
9	12V	10	12V
11	GND	12	GND
13	GND	14	GND
15	GND	16	GND
17	GND	18	GND
19	5V	20	5V
21	5V	22	5V
23	3.3V	24	3.3V
25	3.3V	26	3.3V
27	3.3V	28	3.3V
29	3.3V	30	3.3V
31	GND	32	GND
33	GND	34	VGA_SDA
35	GND	36	GND
37	GND	38	VGA_SCL
39	GND	40	GND
41	GND	42	VGA_VSYNC
43	GND	44	GND
45	GND	46	VGA_HSYNC
47	GND	48	GND
49	GND	50	VGA_BLUE
51	GND	52	GND
53	GND	54	VGA_GREEN
55	GND	56	GND
57	GND	58	VGA_RED
59	GND	60	GND

Table A-8 Pins Definition between the Master Board and Power Supply Module

PIN NUM	Name	PIN NUM	Name
1	EDC_Power	2	EDC_Power

3	EDC_Power	4	EDC_Power
5	GND	6	GND
7	GND	8	GND
9	A_Battery+	10	A_Battery+
11	A_Battery-	12	A_Battery-
13	B_Battery+	14	B_Battery+
15	B_Battery-	16	B_Battery-
17	Gnd	18	Gnd
19	A_Battery_NTC	20	B_Battery_NTC
21	EDC_Status	22	Power_ON
23	Gnd	24	Scan_Status
25	Temperature_D+	26	CW_Mode
27	Temperature_D-	28	+5VStb_CPU_En
29	Gnd	30	Gnd
31	+5VStb	32	+5VStb_CPU
33	+12V	34	+12V
35	Gnd	36	Gnd
37	GND	38	GND
39	-12V	40	-5V
41	Gnd	42	Gnd
43	+5V	44	+5V
45	Gnd	46	Gnd
47	+2.5V	48	+2.5V
49	Gnd	50	Gnd
51	Gnd	52	NC
53	+1.5V	54	+1.5V
55	Gnd	56	Gnd
57	3.3V	58	3.3V
59	Gnd	60	Gnd
61	Gnd	62	Gnd
63	THV	64	THV_Range

Table A-9 Signal Definition between the Master Board and Power Supply Module

No.	Name	Direction	Description	Notes
1	+12V	In	EDC in (external adapter input)	10A
2	+11.1V	In	Battery in (internal battery input)	9200mA

3	EDC_Status	Out	To indicate whether the main unit is connected with the mains power supply that high level means they are connected and normal power supply, while low level means battery power supply	5V TTL level
4	Scan_Status	In	Never charge the battery during scanning, and low level means scanning is being performed.	5V TTL level
5	CW_mode	In	Control the output range of remote control high voltage, when it is low level, the output voltage adjustable range of THV is 20~140V, when it is high level, the output voltage adjustable range of THV is 5~10V.	5V TTL level
6	Power_ON	IN	Control the power supply output, output in the power supply board should be normal in the case of low level.	5V TTL level
	+5Vstb_CPU_EN	IN	+5Vstb_CPU output control, normal output in +5Vstb_CPU in the case of low level.	5V TTL level
7	THV_Range	IN	Control the output range of remote control high voltage	
8	Temperature_D+	Out	Control the ambient temperature of power supply module.	
9	Temperature_D-	out	Control the ambient temperature of power supply module.	
10	A_Battery_NTC	IN	Control the temperature of battery A.	
11	B_Battery_NTC	IN	Control the temperature of battery B.	
12	+12V	Out		
13	THV	Out	Remote control high voltage.	
14	+5V	Out		
15	+5VStb	Out		
16	+5VStb_CPU	Out		
17	+3.3V	Out		
18	+2.5A	Out		
19	+1.5V	Out		
20	-5V	Out		
21	-12V	Out	Exclusive for CW board.	
22	NC	/	No connection.	

Table A-10 Signal Definition between Mater Board and Extended Socket

PIN	Signal Name	PIN	Signal Name	PIN	Signal Name	PIN	Signal Name

A1	USB+4	B1	USB-4	C1	USB+5	D1	USB-5
A2	VBUS_SYS45	B2	GND	C2	VBUS_SYS45	D2	GND
A3	GND	B3	VGA_HS	C3	VGA_RED	D3	VGA_GREEN
A4	UART_RX0	B4	VGA_VS	C4	GND	D4	GND
A5	UART_TX0	B5	GND	C5	VGA_BLUE	D5	D0
A6	GND	B6	AUDIO_L	C6	GND	D6	D1
A7	RM_PRINT	B7	AUDIO_R	C7	D2	D7	GND
A8	RM_BUSY	B8	GND	C8	D3	D8	AUTOFD_N
A9	GND	B9	D7	C9	D4	D9	BUSY
A10	MIC_L	B10	PE	C10	GND	D10	GND
A11	MIC_R	B11	STROBE_N	C11	D5	D11	ACK_N
A12	VIDEO	B12	INIT_N	C12	D6	D12	SELIN_N
\	\	B13	SEL	\	\	D13	ERROR_N

Table A-11 Signal Definition between Master Board and Keyboard Board

No.	Name	Direction	No.	Name	Direction
1	+3.3V		2	+3.3V	
3	+3.3V		4	+3.3V	
5	Gnd		6	Gnd	
7	Gnd		8	Gnd	
9	+5V		10	+5V	
11	+5V		12	+5V	
13	Gnd		14	Gnd	
15	Gnd		16	Gnd	
17	Gnd		18	Gnd	
19	Work_Status_O		20	Work_Status_G	
21	Battery_Status_O		22	Battery_Status_G	
23	Gnd		24	EDC_Status_G	
25	USB_DN		26	LCD_SW	
27	USB_DP		28	Power_BTN	
29	Gnd		30	Gnd	

Appendix B Electrical Safety Inspection

The following electrical safety tests are recommended as part of a comprehensive preventive maintenance program. They are a proven means of detecting abnormalities that, if undetected, could prove dangerous to either the 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.

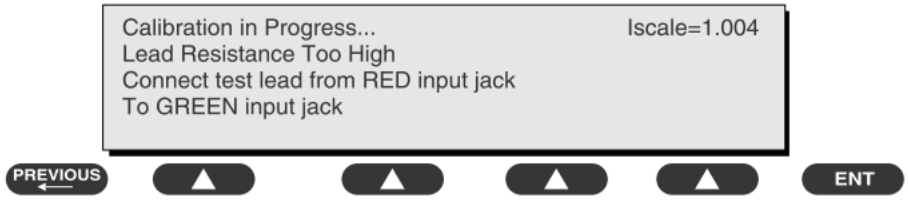
TEST PROCEDURE

◆ 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

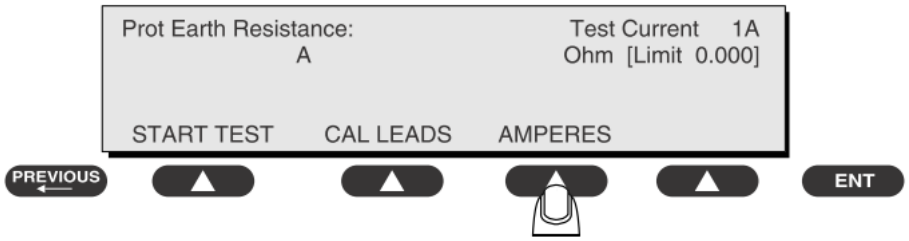
1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601PRO front panel outlet.

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:

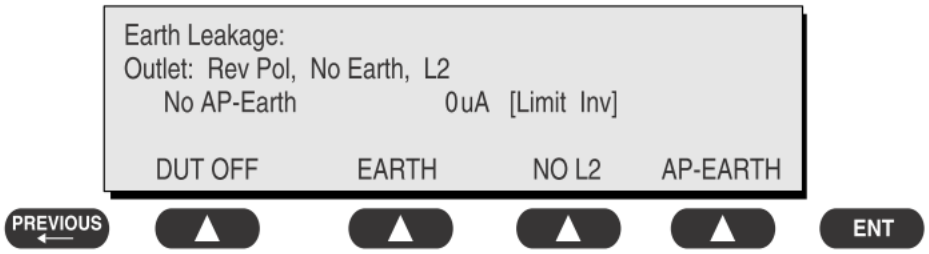
- Earth Leakage Current, leakage current measured through DUT outlet Earth
- Earth Leakage Current AP-EARTH (ALL Applied Parts connected to Earth), leakage current measured through DUT outlet Earth

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

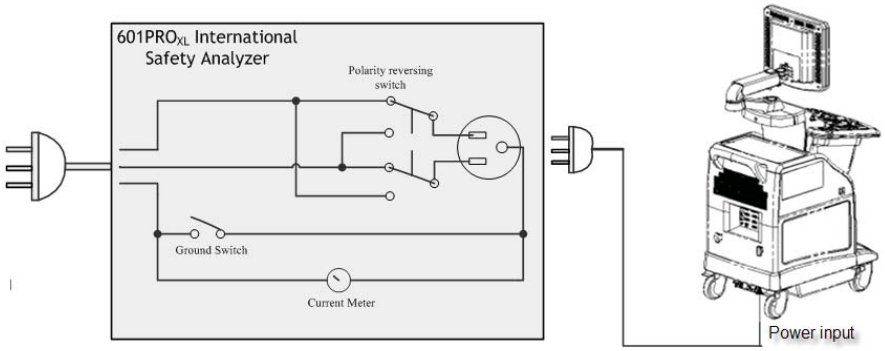


Figure 1 Earth leakage test

◆ 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

For UL60601-1：	300 μA Normal Condition
	1000 μA Single Fault Condition
For 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 RMS response.

TEST PROCEDURE

◆ Prepare

Perform a calibration from the Mains on Applied Part menu.

The following outlet conditions apply when performing this test:

Normal Polarity, Earth Open, Outlet ON

Normal Polarity, Outlet ON

Normal Polarity, L2 Open, Outlet ON

Reversed Polarity, Outlet ON

Reversed Polarity, Earth Open, Outlet ON

Reversed Polarity, L2 Open, Outlet ON

◆ Warning

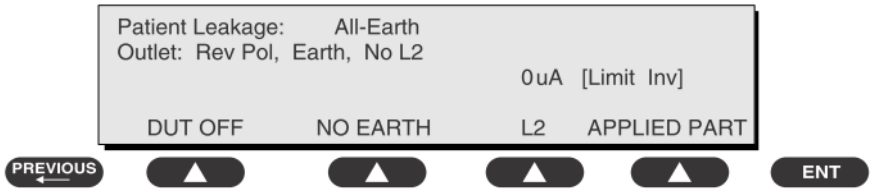
If all of the applied parts correspond to the instrument type, the applied parts will be tied together and one reading will be taken. If any of the applied parts differ from the instrument type, all applied parts will be tested individually, based on the type of applied part. This applies to Auto and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

◆ Perform the Test

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

2) Attach the applied parts to the 601PRO's applied part terminals.

3) Press shortcut key 6. The Patient Leakage test is displayed, and the test begins immediately.



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

ELECTRICAL SAFETY INSPECTION

6- Patient Leakage Current

5) Modify the configuration of the front panel outlet by pressing the appropriate SOFT KEY on the 601PRO.

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

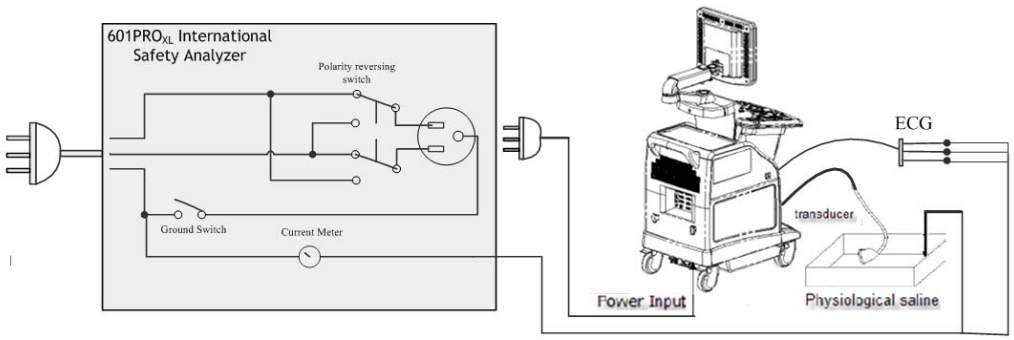


Figure 2 patient leakage Current

◆ Note

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 can not be corrected, submit a Safety Failure Report to document the system problem. Remove unit from operation.

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

LIMITS

ELECTRICAL SAFETY INSPECTION

6- Patient Leakage Current

For BF: ECG Input and transducer

100µA Normal Condition

500µA Single Fault Condition

ELECTRICAL SAFETY INSPECTION

7- Mains on Applied Part Leakage

OVERVIEW

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

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

Normal Polarity;

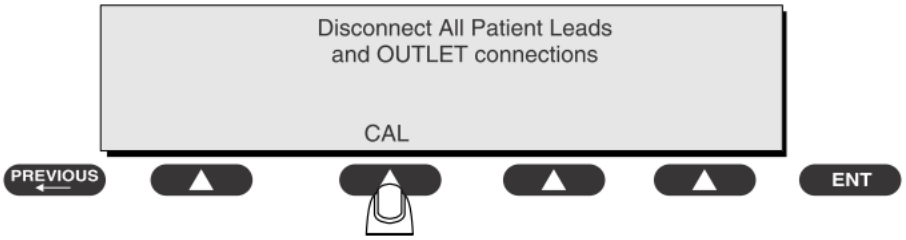
Reversed Polarity

TEST PROCEDURE

◆ Prepare

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

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



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

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

◆ Warning

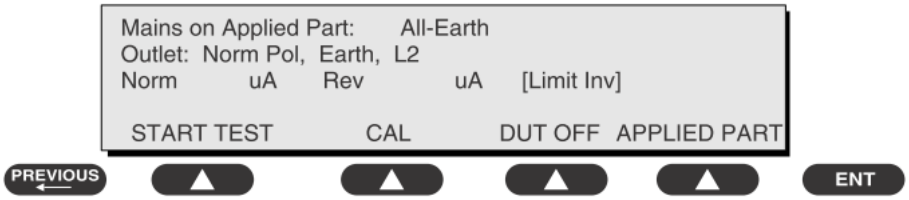
1) A 2-beep-per-second signal indicates high voltage present at the applied part terminals while a calibration is being performed.
2) High voltage is present at applied part terminals while measurements are being taken.

ELECTRICAL SAFETY INSPECTION

7- Mains on Applied Part Leakage

◆ Performance

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



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

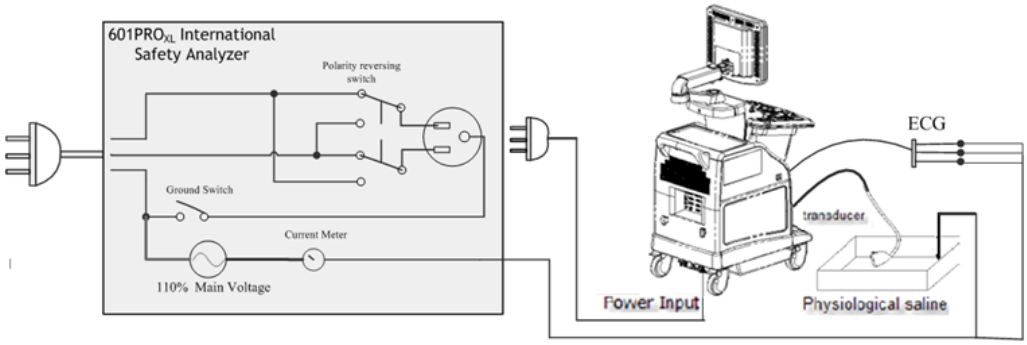


Figure 3 Mains on Applied part leakage

◆ Note

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.

ELECTRICAL SAFETY INSPECTION

7- Mains on Applied Part Leakage

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

For BF: ECG Input and transducer

5000μA

ELECTRICAL SAFETY INSPECTION

8- Patient Auxiliary Current

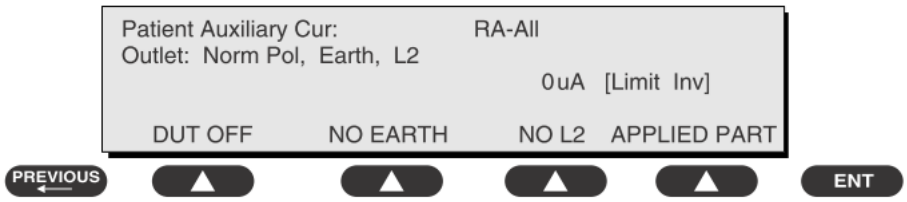
overview

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

TEST PROCEDURE

◆ Prepare

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



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

ELECTRICAL SAFETY INSPECTION

8- Patient Auxiliary Current

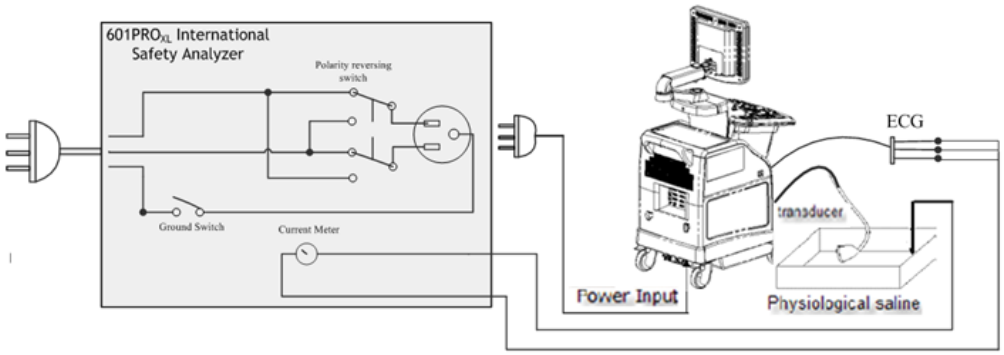


Figure 4 patient Auxiliary Current

◆ Note

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

◆ Failure

Check any broken of the AC/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

For BF: ECG Input

100μA Normal Condition

500μA Single Fault Condition

ELECTRICAL SAFETY INSPECTION FORM

(Class I equipment)

Overall assessment:

Scheduled inspection	Test item: 1, 2, 3, 4, 5, 6, 7, 8
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
Opened repair type, modify the power part including transformer	Test item: 1, 2, 3, 4, 5
Opened repair type, modify patient circuit board	Test item: 1, 2, 3, 4, 6, 7, 8

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

Note:

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

Name/ Signature: _____ Date: _____

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