SonoScape

S6

Portable Digital Color Doppler Ultrasound System

Service Manual

May 5, 2010

Contents

Chapter 1

Introduction

This manual describes the information for servicing and maintaining of the S6 Portable Digital Color Doppler Ultrasound System. Please read the Service Manual carefully before servicing/maintaining the equipment. Pay special attention to chapter 2 which is on safety issues.

1.1 Intended Users

The intended users of this manual are the Service Engineers trained and authorized by SonoScape Co., Ltd.

> **⚠ Warning!**
> *Only Service Engineers trained and authorized by SonoScape can perform service and repairs for the equipment.*

1.2 Contact Information

SonoScape values the customer's feedback, please feel free to contact us.

☎ Contact Information:
Address: 4/F., Yizhe Building, Yuquan Road, Shenzhen, P.R. China
Zip Code: 518051
Tel: 400–678–8019
Fax: 86–755–26722850
Website: http://www.sonoscape.com
E-mail: service@sonoscape.net

1.3 Software Updates

SonoScape may provide software updates to enhance the performance of the system. The Service Manual will be updated accordingly, please contact our service department to get the latest edition.

Chapter 2

Safety Considerations

2.1 Introduction

This chapter describes the safety precautions that must be observed during all phases of operation, service and repair of the equipment. For human safety, please read this chapter carefully before using or servicing the equipment.

⚠ Warning!

Please pay due attention to the items with this warning icon. Dismissing these warnings may cause serious personal injury or even endanger human life.

△ Attention!

The items with this caution icon describe the precautions necessary to protect the system. Failure to observe these precautions may cause system damage.

2.2 Symbol Used

Symbol	Description
	Insulated patient application part (Type BF)
	Dangerous electric voltage
	Warning! Follow these instructions to avoid personal injury or system damage.
	Attention! Follow these instructions to avoid system damage.
	Off (Mains power switch OFF)
	On (Mains power switch ON)
	Protective earth/ground connection.
	Potential equilibrium connection
	AC

Table 2.1: Table of Symbols

These symbols (icons) listed in table 2.1 are used with the equipment and/or within this manual. They serve as warnings, or for marking connections and etc.

2.3 Electrical Safety

- The equipment conforms with the following regulations for electrical safety,
  - IEC 60601-1: 1988+A1:1991+A2:1995, Medical Electrical Equipment Part 1: General Requirements For Safety, Class I, BF, continuous operation
  - IEC 60601-2-37: 2001 + A1:2004 + A2:2005, Medical Electrical Equipment Part 2-37: Particular Requirements For The Safety Of Ultrasonic Medical Diagnostic And Monitoring Equipment
- The equipment conforms with the following EMC/EMI standards: IEC60601-1-2: 2001+A1: 2004, Class A (CE)
- Degrees of protection against harmful liquid: IPX0 for the S6 system and IPX7 for the accompanying probes.

Please comply with the following rules for safety considerations:

- Properly grounding the system can prevent potential electric shock, ensure that the three-conductor AC power cord equipped with the system is plugged into an electrical outlet/receptacle marked with hospital grade. The equipment has an extra grounding point (located

at the lower rear panel). To avoid loss of image quality, it is compulsory to connect this point to ground (earth).

- Potentially hazardous electrical voltage exists inside the equipment. Unauthorized personnel DONOT attempt to open the cover of the equipment.
- The equipment must not be used in the presence of inflammable gases (e.g. anesthetic gases and nitrous oxide) to avoid explosion hazard.
- Devices must be powered from a receptacle marked "hospital grade" before being connected to the system directly. In case "hospital grade" receptacles are not available, use isolation transformers instead.

⚠ Warning!

Electrostatic discharge (ESD) may cause electric shock or damage the equipment. Observe the following precautions:

1. Prior to repairing or cleaning the equipment, ensure that the system has been turned off and the power cable unplugged.
2. The equipment must be grounded correctly during operation. Use anti-ESD spray on the ground if possible.

- The leakage current of the entire system including all auxiliary equipments must not exceed the limit as stated in IEC 60601-1.
- The equipment may interfere with or be interfered by other high frequency devices (e.g. medical lasers). Extra safety measures must be taken if other HF devices have to be used nearby.
- Use the couplant shipped with the equipment or any other couplant recommended by SonoScape. Use any unrecommended couplant may damage the probe and void the warranty.

2.4 Mechanical Safety

1. Prior to using the equipment, place it horizontally and lock the wheels.
2. Take care when moving the equipment. Failure to follow the precautions listed below could result in injury, uncontrolled motion and costly damage.

* **Take the following precautions before transporting the system:**

1) Ensure that the system is powered off and with power cable unplugged.

2) Disconnect all the probes from the system and place them in their carrying case.
3) Ensure that all the peripherals and auxiliary devices have been disconnected from the system.
4) If you are moving the docking cart together with the S6 system, unlock the wheels.
5) Now you can hold the handle and push the system to the destined place.

* **If the system is to be transported for long distance, take the following precautions as well:**

6) It's highly recommended to backup the critical data (e.g. patient data and images) to a DVD/CD or hardcopy.
7) Ensure that the system is well prepared and packed in its original packaging before transporting.
8) Place the system upwards, and ensure that it is firmly secured while inside the vehicle during transport.

⚠ Warning!

Avoid collisions and excessive vibrations to prevent data loss or system malfunction.
Never move the equipment which is still operating.

Environmental Conditions for Transportation:

Relative Humidity: 20% to 90%, no condensation
Temperature: -20°C to 55°C
Barometric Pressure: 700 to 1060hPa

2.5 Human Safety

Modern diagnostic ultrasound system has been proved to be safe for daily diagnostic usage, however, only the well trained/educated medical personnel should operate the equipment. The ALARA (As Low As Reasonably Achievable) principle must be observed. The following are some more detailed guidelines on safety use of the equipment.

- Keep the power levels and the exposure time as low as possible, as long as a satisfactory diagnosis has been achieved.
- Use the freeze function or move the probe away from the patient while not scanning.
- Do not rest the transducer on the skin surface when not scanning.

- The imaging system of S6 is based on Doppler and Color Doppler Imaging. The output power of the ultrasound is lower than the limits as required by the standard IEC 60601-1.

Chapter 3

Description of the System

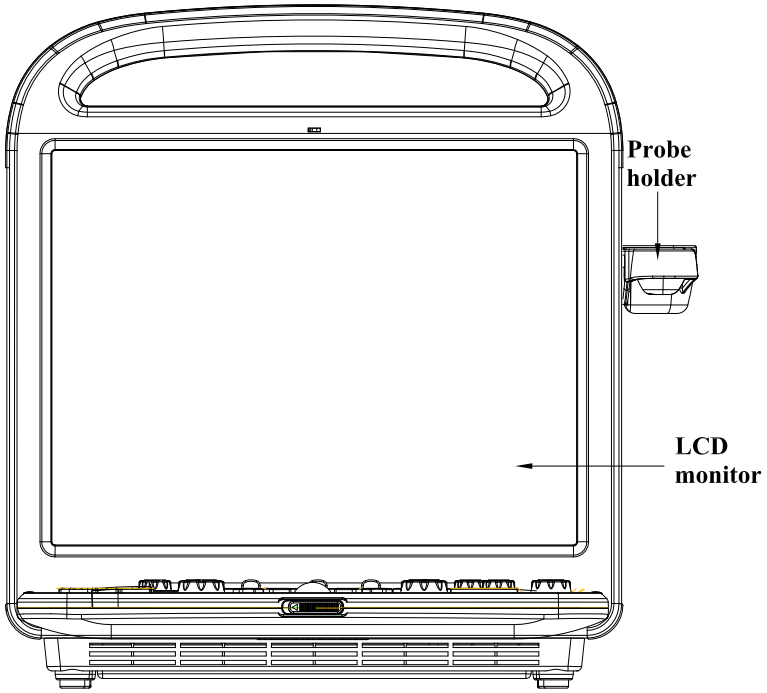
3.1 Product Description

The S6 is a professional, general purpose portable color Doppler diagnostic ultrasound system. It employs digital technology and fully exploits the potential of integrated circuits. The software is based on Linux system, which enhances the stability and efficiency while maintains the portability. The user interface has been optimized for ease of use. The imaging system can be adjusted during the scanning process; while for advanced users, the system configurations can be changed quite intuitively.
A wide range of probes make the system suitable for many applications.
To keep the system up to date, the software updates are provided regularly. To enhance the system performance even more, users may also take the hardware upgrade service provided by SonoScape. There are a variety of upgradeable options available.

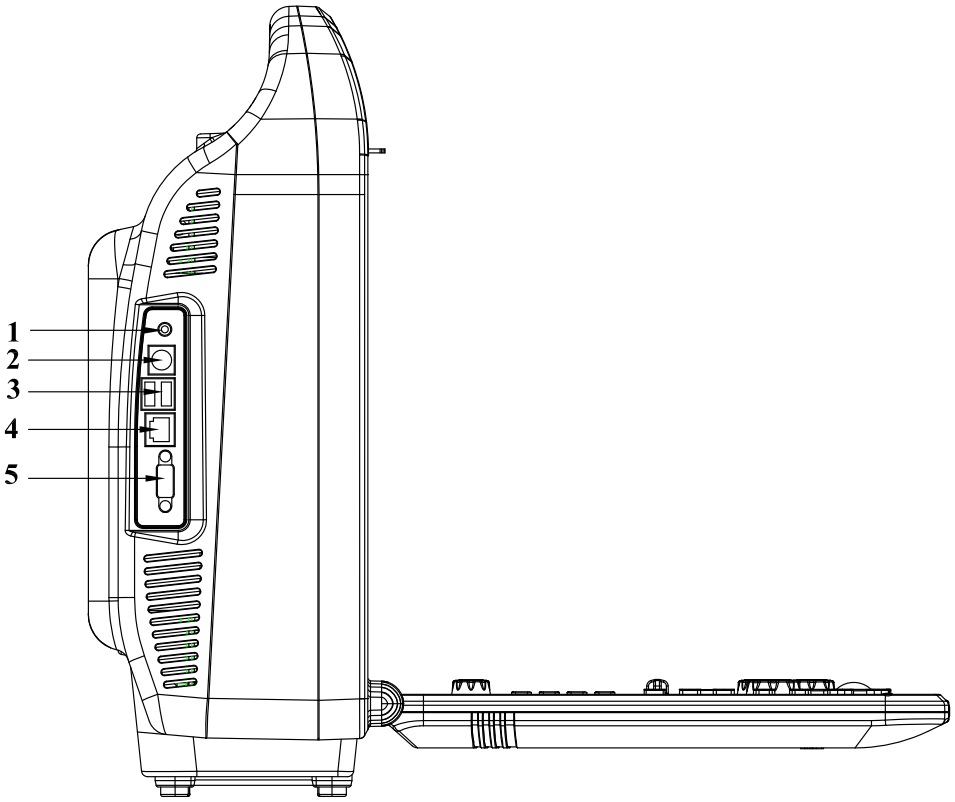
3.2 System Configuration

Overview of the S6 System

Front View

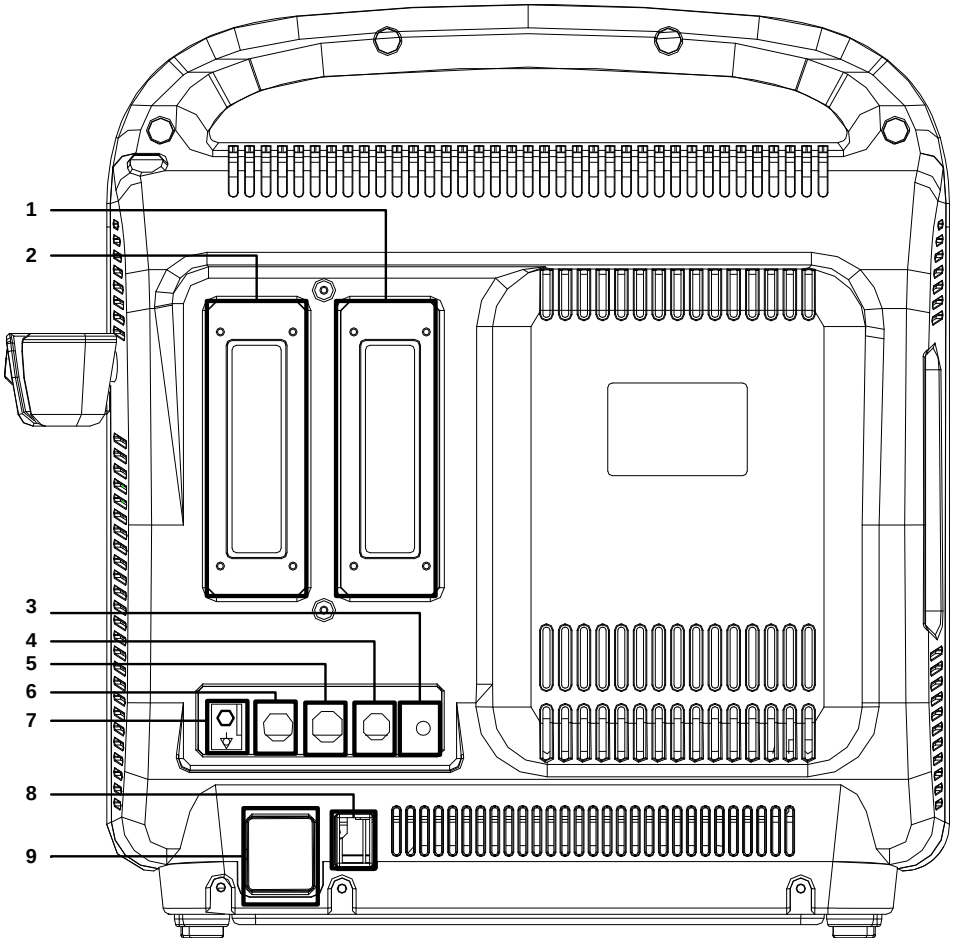


Side View



1 Audio Out
2 S-Video Socket
3 Two USB Ports
4 Ethernet Port
5 VGA Port

Rear View



1	Probe Connection Port 1	6	ECG Port
2	Probe Connection Port 2	7	Equipotential point (earth)
3	Video Printer Controller Port	8	Power Switch
4	Foot Switch Socket	9	Power Input Socket
5	Video Out		

3.3 Applications

The S6 system, with a wide range of probes available, is extremely versatile. This section introduces the applications that the S6 system is suitable for.

- ✧ Small organs (breast, thyroid, testicle and etc.)
- ✧ Vascular
- ✧ Abdomen (liver, spleen, cholecyst, kidney and etc.)
- ✧ Obstetric

- Gynecology and fertility
- Cardiology
- Urology
- Musculoskeletal

Note: The application fields are dependent on the probe in use.

⚠ Warning!

The S6 system is not intended for ophthalmic use or any use causing the acoustic beam to pass through the eye.

3.4 Operating Modes

- B Mode
- B FLOW
- Tissue Harmonic Imaging (THI)
- M Mode
- Color Doppler Imaging (CDI or CFM)
- Power Doppler Imaging (DPI)
- Directional Power Doppler Imaging (DDPI)
- Pulsed Wave Doppler Imaging (PW)
- Continuous Wave Doppler Imaging (CW)
- Tissue Doppler Imaging (TDI)

3.5 Combined Modes

The system provides the following Duplex modes with some in dual display format.

Notations: Left means left screen, Up means upper screen. Similar for Right and Down, e.g., Left B+COLOR, Right B implies that the left screen is of duplex mode, B and CFM, and the right screen is of B mode.

- Left B, Right B
- Left B+COLOR, Right B;
- Left B+COLOR, Right B+COLOR

- Up B, Down M
- Up B, Down PW/CW (real time)
- Up B+COLOR,Down PW/CW
- Up B+COLOR, Down PW/CW (real time)
- Up B+COLOR, Down PW/CW (real-time refreshing)
- Color+M

3.6 Scanning Modes

- Electronic linear array scanning
- Sector curved array (convex) scanning
- Sector phased array scanning
- Trapezoid linear scanning

3.7 Adjustable Parameters

Users can change these parameters during the scanning process to get the best image quality.

3.7.1 B Mode

Image Parameters:

- Bandwidth: 1 to 15MHz
- Maximum Depth: 32.9cm
- Sector Width/Angle: 10 to 193 degrees
- Sector Position: adjustable in imaging area
- Zoom: magnification factor>10
- Power: 1% to 100%
- 2D Gain Range: 1 to 255
- TGC: adjustable for 8 different depth
- Sound Volume Adjustable
- Focal Zones: 1 to 9 focal zones may be chosen, with focal distance adjustable.

- Persistence range: from 0 to 95, may vary with the probes
- Line Density: 3 level adjustable (high/medium/low)
- Chroma: 13 different colors available
- Adaptive Image Fusion: 6 level adjustable
- Tissue Characteristic Index: adjustable from 1400 to 1700
- Image Orientation: flip vertically and/or horizontally

3.7.2 Spectral Doppler (PW/CW)

Image/Video Parameters

- Video inversion
- Flow Inversion
- Sweep Speed: 4 level adjustable

Signal Processing

- Dynamic Range: 5 level adjustable
- Chroma: 5 different colors available
- D Gain: adjustable from 1 to 255
- Doppler Angle Correction: adjustable from -80 to 80 degrees
- Sound Volume Adjustable

3.7.3 Color Doppler and Power Doppler

Signal Processing

- D Gain: adjustable from 1 to 255
- Persistence Range: 0 to 80 (also depends on the probe in use.)
- Color Mapping: 4 options available
- B-Reject Range: from 0 to 255
- Baseline: 31 level adjustable.

3.7.4 Archive and Backup

- ✧ 160G HDD (Hard Disk Drive)
- ✧ Image/Video Format: The system supports local format (PPM and CIN) and PC format (JPEG, BMP, TIF, AVI and WMV) and offers the function of conversion from local format to PC format.
- ✧ Cine Playback: More than 1 minute video supported.
- ✧ Accessing local cine files remotely through Ethernet is supported.
- ✧ Data storage using external disks (USB and DVD/CD) is supported.
- ✧ Video output: S-VIDEO/ VGA

3.8 Measurements and Calculations

Measurements Functionality

- ✧ Measurements can be performed either during real-time scanning or in freeze mode.

Measurements and Calculations for 2D Image

- ✧ Length measurements: straight line, ellipse and perimeter of any other arbitrary shapes
- ✧ Area measurements: ellipse, rectangular and area of any other arbitrary shapes
- ✧ Volume measurements
- ✧ Doppler area
- ✧ Calculation and measurement in gynecology and fertility applications.
- ✧ LV (Left-Ventricular) measurements and calculations

  Available LV Calculation Methods:

  - Single Plane Ellipse
  - Biplane Ellipse
  - Bullet
  - Simpson
  - Cube
  - Teichholz
  - Gibson

M Mode

- Distance
- Time
- Slop
- HR (Heart Rate)
- LV (Left-Ventricular) measurements and calculations

  Available LV Calculation Methods:

  - CUBE
  - TEICHHOLZ
  - GIBSON
  - Mitral Valve
  - Aortic Valve

4D Analysis Software

Doppler Image

- Length measurements: straight line, perimeter of ellipse and any other arbitrary shapes.
- Area measurements: area of rectangular, ellipse and any other arbitrary shapes.
- Blood flow velocity and acceleration
- Time
- Cardiac measurements: Mitral Valve, Aortic Valve, Tricuspid Valve, Pulmonary Valve, TEI index

Report Functionality

- Cardiac
- OB/GYN
- Fetal
- Vascular
- Urology

Chapter 4

Principle of the S6 System

4.1 Introduction

This chapter provides the functional explanations of the electronics of the S6 system.

4.2 System Block Diagram

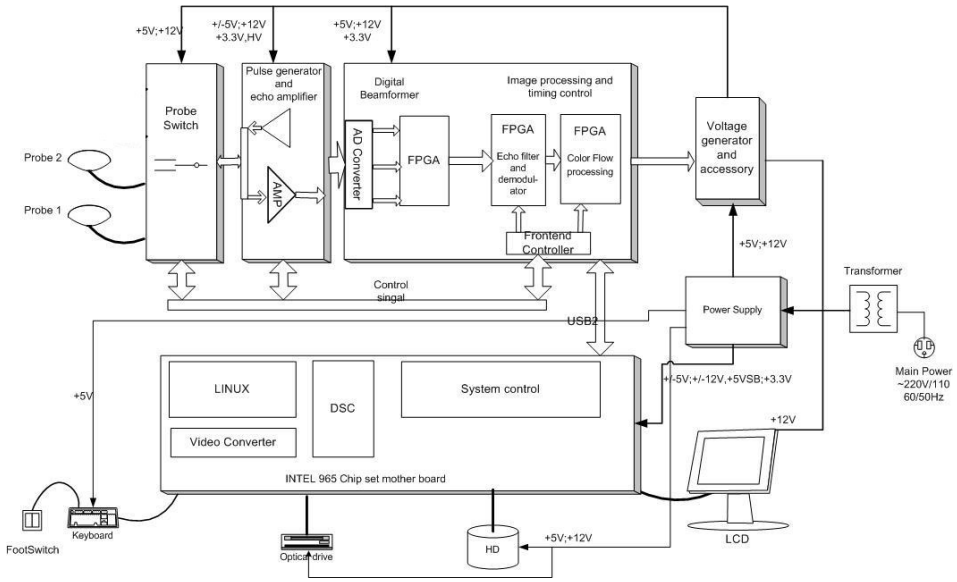


Figure 4.1: Block Diagram of the S6 System

The DBTR board has the following functionalities: Control the timing and band width of the emitted ultrasound; Amplify the variable gain of the echoes; Adjust the electronic focus position, TGC, dynamic filtering, logarithmic compression, demodulation and other signal processing functions.

The echo signals are transmitted to the computer and the DBF board. The DBF board serves for extracting the Doppler signals from the echo signals, and sends the output signals to the computer system. After processed

through the computer system, the signals are sent to the graphics card and then to the display (e.g. LCD monitor).

The computer system is the core control unit of S6. Following user instructions from the keyboard, it controls the operating modes and adjusts the status of the system. The computer system is also responsible for the display of diagnostic data, calendar, time and etc.

4.3 Principle of Probes

The transducer provides conversions between ultrasonic and electronic signals. At the start of a scanning process, the probe first converts the electronic excitation signals to ultrasonic vibrations. The ultrasonic vibrations (or ultrasound) propagate into the body of the patient; and the echoes are picked up by the probe. Electronic signals converted from these echoes are sent back to the computer system or the DBF board for further processing. The acousto-electric conversion efficiency and the ultrasound focusing ability are the key features that are vital to the system's performance, such as resolution, maximum scanning depth.

4.4 Operating Modes

This section gives brief explanations of the principles of the scanning modes of the S6 system.

M Mode

Primarily applied in cardiology, M mode provides Time and Motion echo information derived from a stationary ultrasound beam. It records moving anatomical structures and produces subtle patterns of motion.

2D/B Mode

B mode image, also called 2D image, provides a cross sectional view of tissues. The ultrasound image is derived from the tissue echoes that received by the probe. Each echo's intensity is mapped to a shade of gray; and the location that the echo occurs is mapped to a unique point on the screen. Except for linear array probes which produce rectangular images, most probes produce fan shaped images.

Spectral Doppler(PW/CW)

The spectral Doppler mode detects the movements of red blood cells based on the Doppler principle. The moving cells reflect the ultrasound sent by the probe. The echoes are frequency shifted (phase shift are detected for PW mode) as a result of Doppler Effect. The spectral distribution of the echoes reveals details of the blood flow: red (blue) shift implies flow away from (towards) the probe head. The pulsed wave mode (PW) is normally applied at detecting low flow velocity, while the continuous wave mode (CW) is normally for measuring high speed blood flow.

Color Flow Mode (CFM)

CFM (Color Flow Mode) is also called CDI (Color Doppler Mode) sometimes. CFM combines 2D grayscale imaging with color imaging. The 2D imaging gives information on tissues; the color imaging, which uses the Doppler principle, gives information on blood flow. The output is the color image overlaid with the 2D grayscale image.

Power Doppler (DPI)

The color image in Power Doppler Imaging (DPI) is in principle different from that in CFM. DPI analyzes amplitude shift, while CFM analyzes frequency shift. The color image is overlaid onto the 2D grayscale image which gives information on tissues. DPI is capable of detecting low speed blood flow.

A high pass filter (wall filter) is used to remove the signals from stationary or slowly moving structures. Tissue motion is discriminated from blood flow by assuming that blood is moving faster than the surrounding tissue, although additional parameters may also be used to enhance the discrimination. The power in the remaining signal after wall filtering is then averaged over time (persistence) to present a steady state image of blood flow distribution.

4.5 Functional Boards/Units of the S6 System

Besides the probes, the S6 system consists of the following critical functional boards/units.

- MPC board: Also called probe board. Two probes can be connected at the same time and one of them active (scanning).
- DBTR board: It has an emitting pulse synthesizer and a receiving signal preamplifier/TGC. The DBTR sends electronic signals to drive the probes and pre-amplifies the echoes.
- DBF board: It converts analog signals to digital signals and sends the signals for digital beam forming (DBF). DBF board also has scan controller, front end controller, demodulation unit and USB ports.
- DBHV board: It provides the high voltages for the pulse generator and the low voltages for other system units. The ECG and 4D motor units are also on this board.
- PC Motherboard: It is the core data processing unit of the S6 system.
- Power supply: ATX SMPS power supply. It provides stable power supply to the whole system (probes, host and LCD monitor).
- User Keyboard: hard keys, trackball, flip switches and knobs.

- Monitor: 15 inch LCD
- Loudspeakers: Serve as Doppler audio device.

4.5.1 Functional Block Diagram

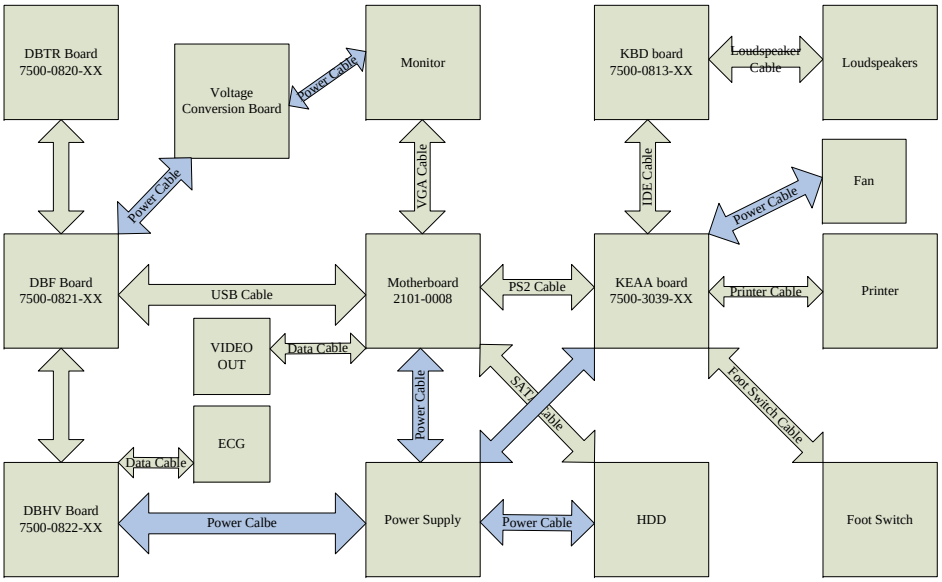


Figure 4.2: Functional Block Diagram

4.5.2 Explanations of the System Functions

The electronic pulse signals are sent to the DBTR board from the RAM of the DBF board. After processing, DBTR sends the HV signals to drive the piezo oscillator in the probe. The probe emits the ultrasonic sounds towards patient, and also picks up the echoes. The signals are then processed by the front end amplifier and the TGC, both on the DBTR board. At the same time, the DBF board converts the analog signals to the digital signals, utilizes the digital dynamic receive focusing and dynamic tracing technologies, and then demodulates. With some further processing, the signals carrying image information are transmitted to the computer through high speed USB2.0 connection. The computer processes the image data, and the tissue and/or blood flow information is displayed on the screen. The computer also takes user inputs from the keyboard, and sends the control signals to the DBF board through USB2.0 port. Peripherals and Ethernet ports are available on the Motherboard. The switching power supply for medical use provides 12V and 5V DC outputs to other system units/boards. The DBHV board supplies 90V DC and the low voltages for other digital and analog circuits.

4.6 Part List

Part No.	Name	Quantity	Description
7500-0826	MPC	1	Probe connection PCB board
7500-0820	DBTR	1	Emission/Reception PCB board
7500-0821	DBF	1	PCB board for receiving digital beam forming and signal processing
7500-0822	DBHV	1	PCB board providing high voltages
7500-0815	KBD	1	Keyboard PCB board
7500-3039	KEAA	1	KEAA board serves as a hub for interconnecting other PCB boards.
2101-0008	PC Motherboard	1	It is the central control unit for data processing and video/audio output.
2101-0152	HDD	1	160G hard disk drive
3900-0012	LCD Monitor	1	Designed exclusively for medical use
NA	Voltage Inversion Board	1	Provides high voltage source for LCD.

Chapter 5

S6 Disassembly Instructions

This chapter contains step-by-step instructions on how to disassemble the S6 system for servicing. The flowchart (Figure 5.1, page 5-2) gives a graphic representation on the disassembly sequence and instructs the units that need to be removed during servicing. Additionally you can find information on connecting different parts inside the system in chapter 6.

Refer to table on page 4-5 to find the part numbers of the PCB boards.
Refer to the contents table on page 6-1 to find the part numbers of the wires/cables .
Connector identification numbers, normally in the form of 'J#', are marked on the corresponding PCB boards. Connectors on the motherboard are indicated in figure 6.1 on page 6-3.
It is recommended to follow procedures in the flowchart to replace the faulty component.

Contents

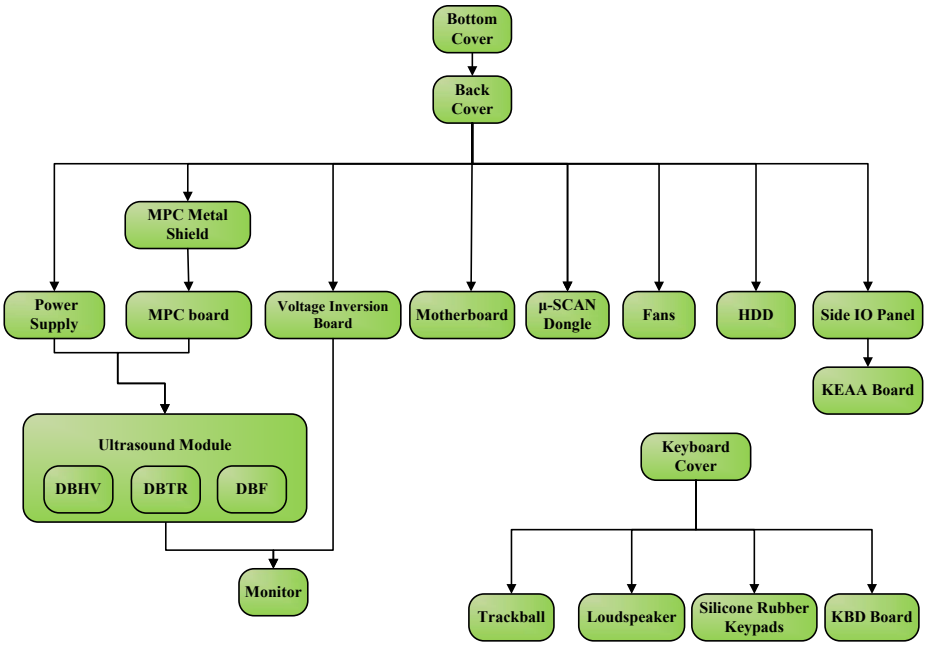
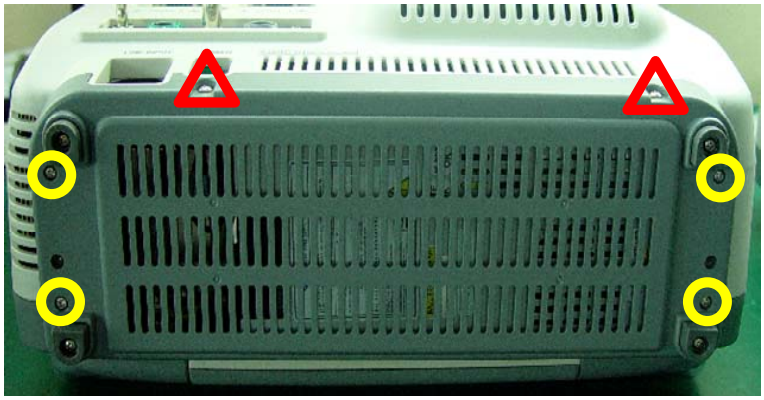


Figure 5.1: S6 Disassembly Procedure Flowchart

⚠ Warning!

- *Servicing should be performed by personnels authorized by SonoScape only.*
- *Any other personals without written permission from SonoScape DONOT attempt to disassemble the system.*
- *Before removing any parts, ensure that the system has been turned off and the mains power cord is unplugged.*

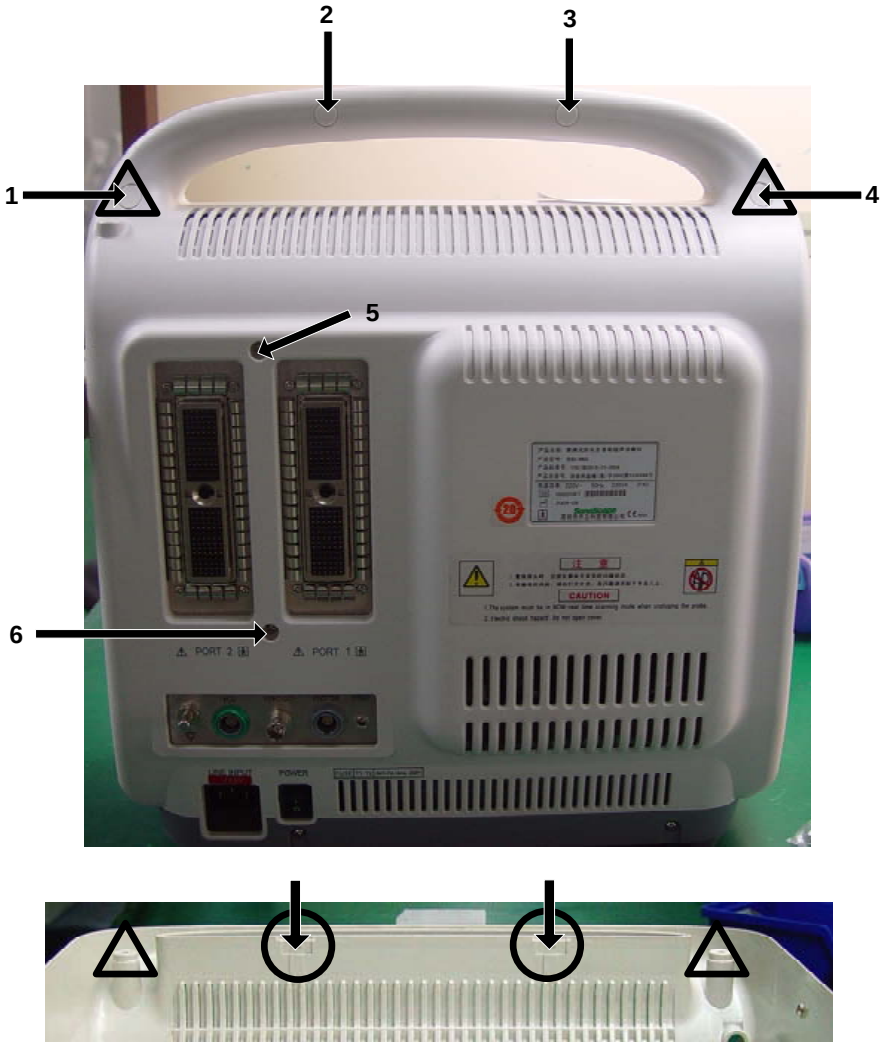
5.1 Bottom Cover



Instructions

Remove all the two pan head screws (M3×6) and four round head screws (M3×6) from the system, and pull the bottom cover away from the system to remove it.

5.2 Back Cover



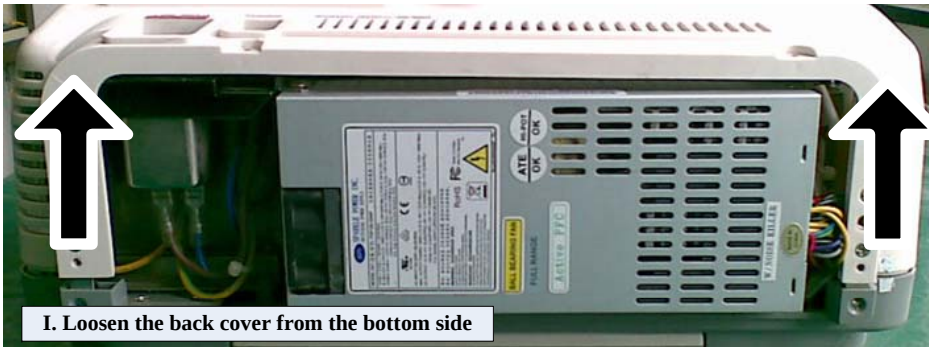
Item	Description	Quantity
1~6	M3×6 screws	6

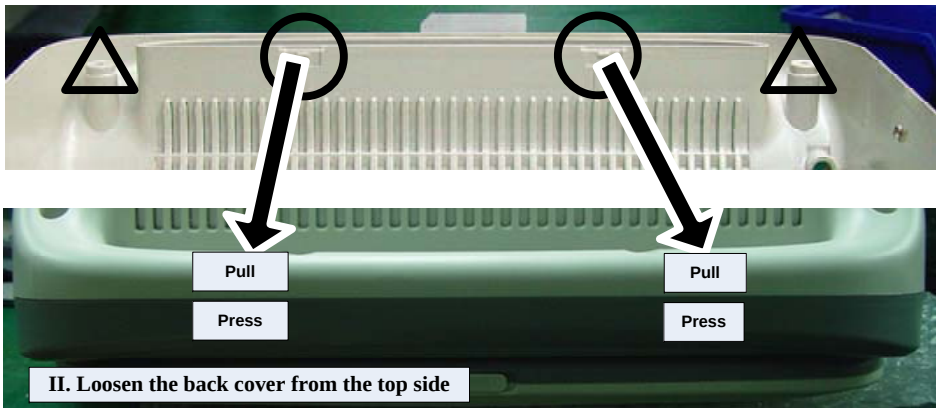
Instructions

Note: *Screws 1~4 are covered by rubbers. You need tweezers to remove them before removing the screws.*

Remove all the 6 screws shown in the picture above.

Continued on next page . . .





Note: Two hooks locks the back cover and the front frame together.
I. Loosen the back cover from the bottom side, **II.** then apply force as indicated in the picture below to loosen the back cover from the top side. Remove the back cover by pulling it at the bottom side.

5.3 Motherboard

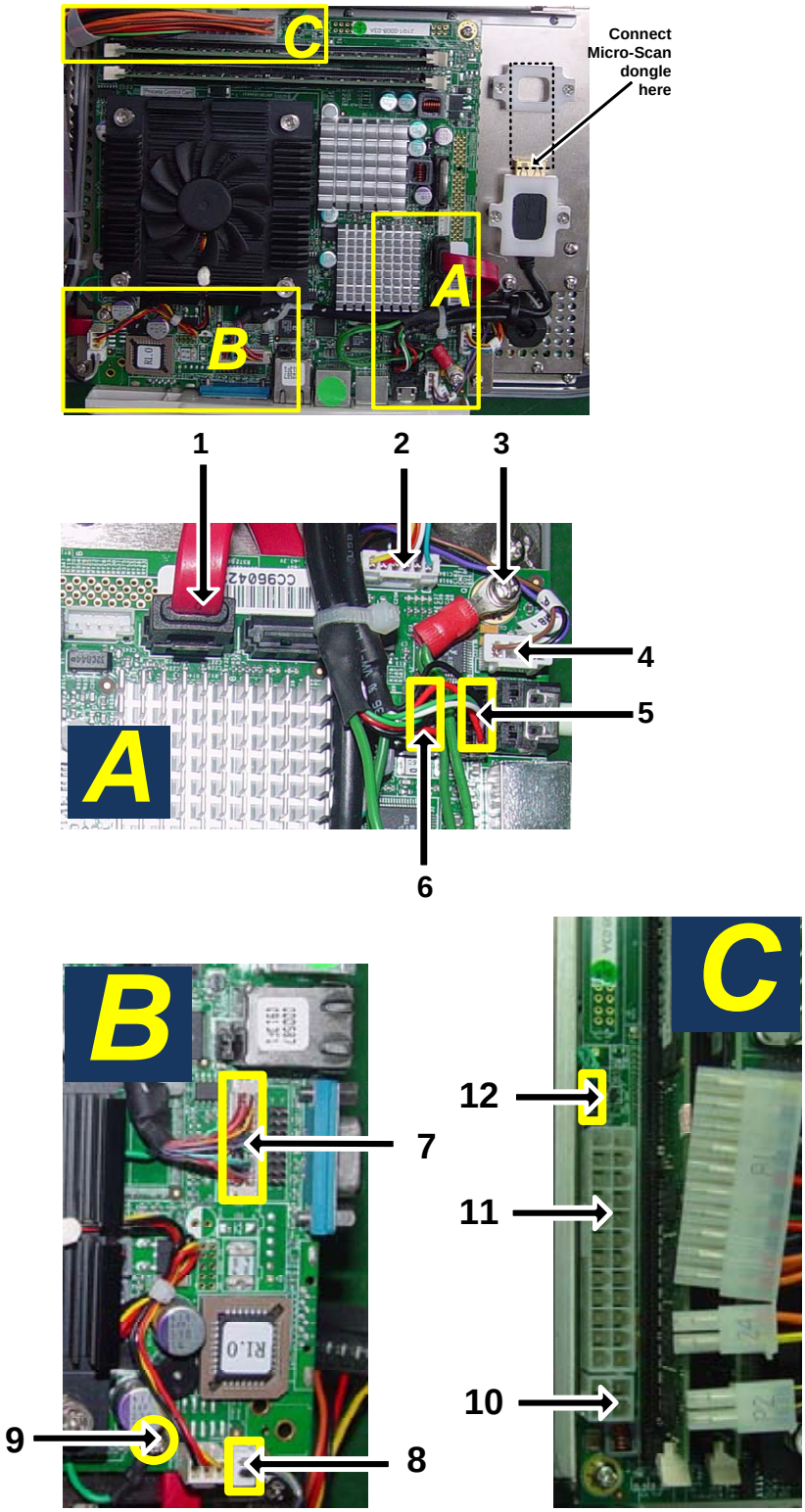


Figure 5.2: Motherboard

Item	Description	Item	Description
1	HDD SATA cable (3520-0506) → SATA1	2	Keyboard cable (3520-0508, CN2) →EKBM1
3	USB cable shield	4	Audio cable (3520-0508, CN4) → SOUT1
5	USB cable for DBF board (3520-0510) → USB2	6	USB cable for μ-SCAN dongle (3520-0511) → USB3
7	LVDS cable (3520-0507) → JC2	8	Composite video BNC cable (3520-0515) → JC3
9	LVDS shield	10	Power cable for CPU (for connection refer to Sec. 6.3.16)
11	Power cables for motherboard (for connection refer to Sec. 6.3.16	12	Power switch wires (3520-0508, CN3) → J3

Instructions

Disconnect all the cables shown in the picture.

Remove the four screws fastening the motherboard.

Note for installation:

The two USB wires (5~6) should be connected in the correct order.

Refer to chapter 6 and the schematic diagram in appendix B to connect power cables/wires.

5.4 KEAA board

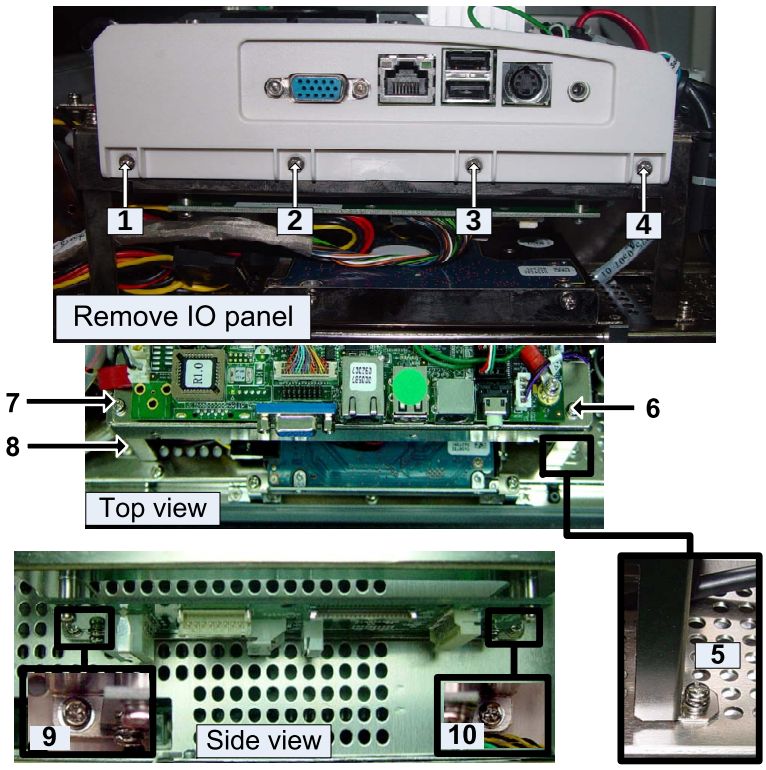


Figure 5.3: KEAA Board

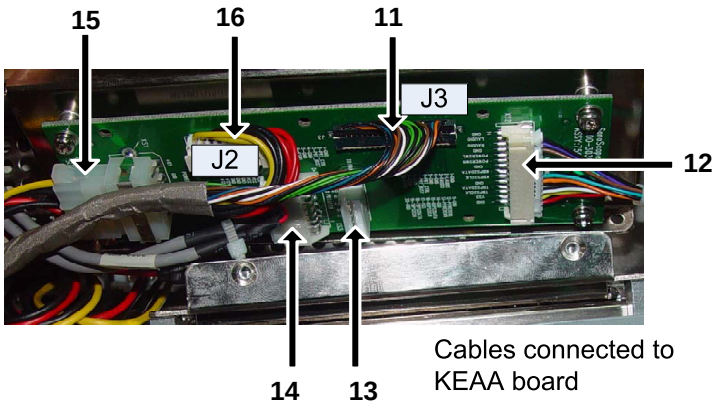


Figure 5.4: Cables Connected to KEAA Board

Item	Description	Item	Description
1~4	Countersunk head screws M3×6	5~10	Combination screws M3×6
11, 16	Keyboard data cables (3520-0505) → J2 & J3	12	KEAA main cables (3520-0508) → XS2
13	Power wires for fans (3520-0509) → J1	14	Foot switch and video printer control cables (5320-0514) → XS3
15	Power wires for KEAA board (refer to Sec. 6.3.16) → XS1		

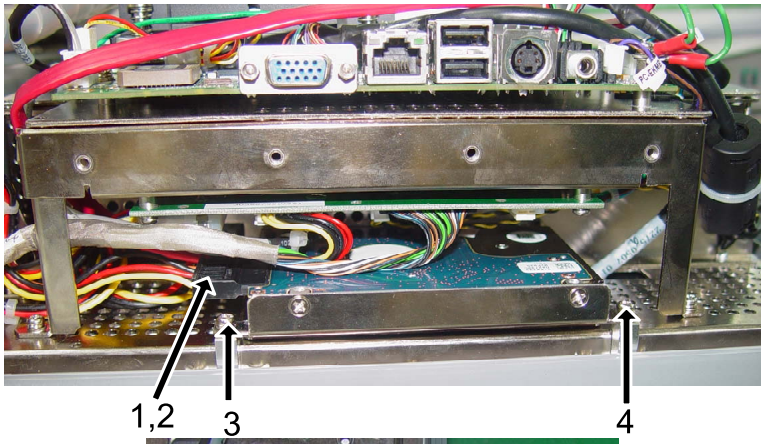
Instructions

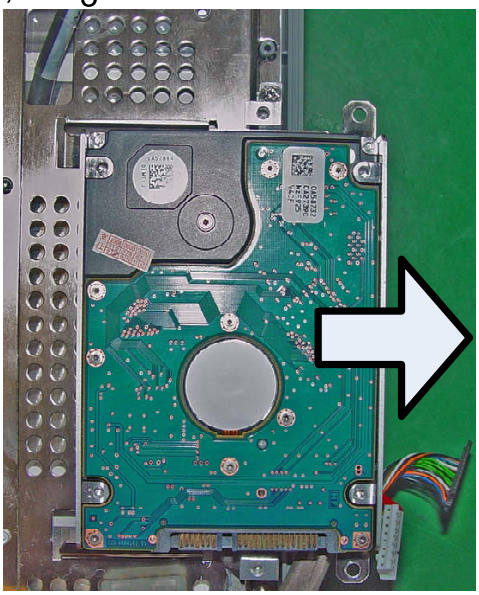
Remove the four screws (1~4), and remove the plastic IO panel.

Remove the four screws (5~8). Note that screws 5 and 8 are at symmetrical positions.

Disconnect the wires 9~14, and remove the KEAA board together with the metal frame.

5.5 HDD





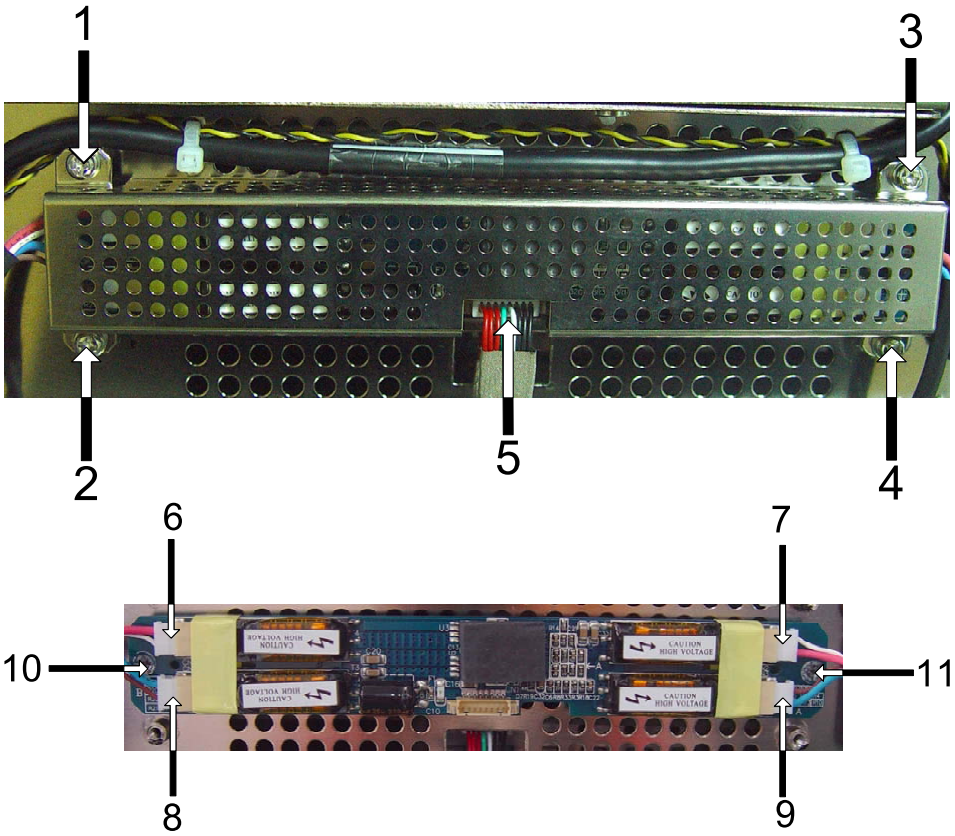
Item	Description
1 &2	HDD SATA and power cables
3~4	Combination screws M3×6

Instructions

Remove the SATA and power cables (1~2).

Remove screws (3~4), and pull the HDD horizontally along the arrow direction to remove it.

5.6 Voltage Conversion Board

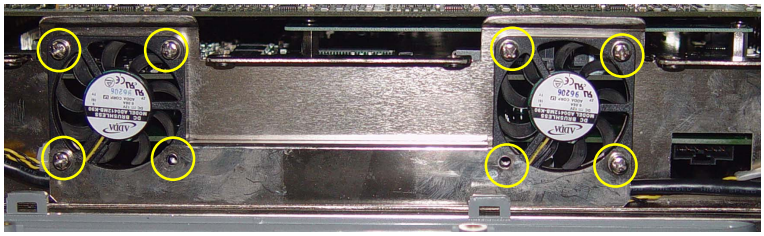


Item	Description
1~4	Combination screws M3×6
5	Power connector for voltage conversion board
6~9	LCD power wires
10~11	Plastic screws

Instructions

Remove the four screws (1~4).
Remove the power connector (5) and remove the metal cover.
Remove the power wires (6~9).
Unfasten the plastic screws (10~11) and remove the voltage conversion board.

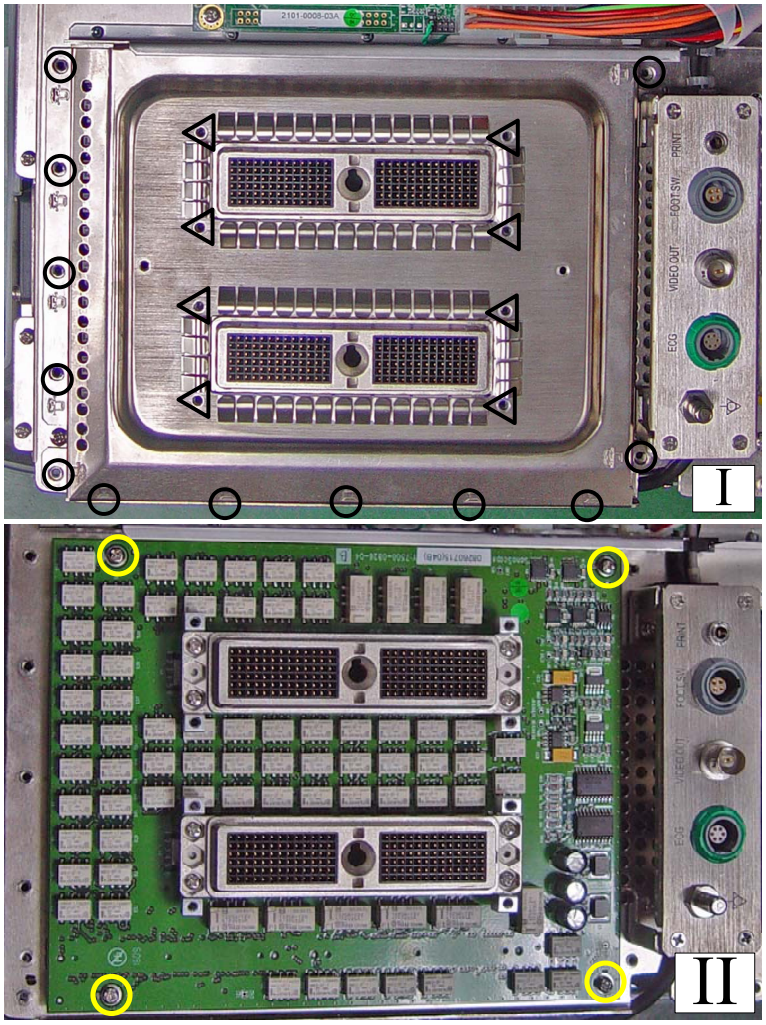
5.7 Fans



Instructions

There are three interconnected fans (only two are shown in the picture) inside the system. In order to remove them, you first need to remove these combination screws (M3×6) as indicated in the pictures, and remove the metal cover.

5.8 MPC board



Instructions

I. Unfasten and remove the twelve combination screws (M3×6) from the metal shield.

Remove eight pan head screws from the metal shield (indicated by triangles).

II. Remove the four combination screws (M3×6) and take care to remove the MPC board.

5.9 Ultrasound Module Assembly

In order to remove the ultrasound module, the metal shied must be removed first.

5.9.1 Ultrasound Metal Shield

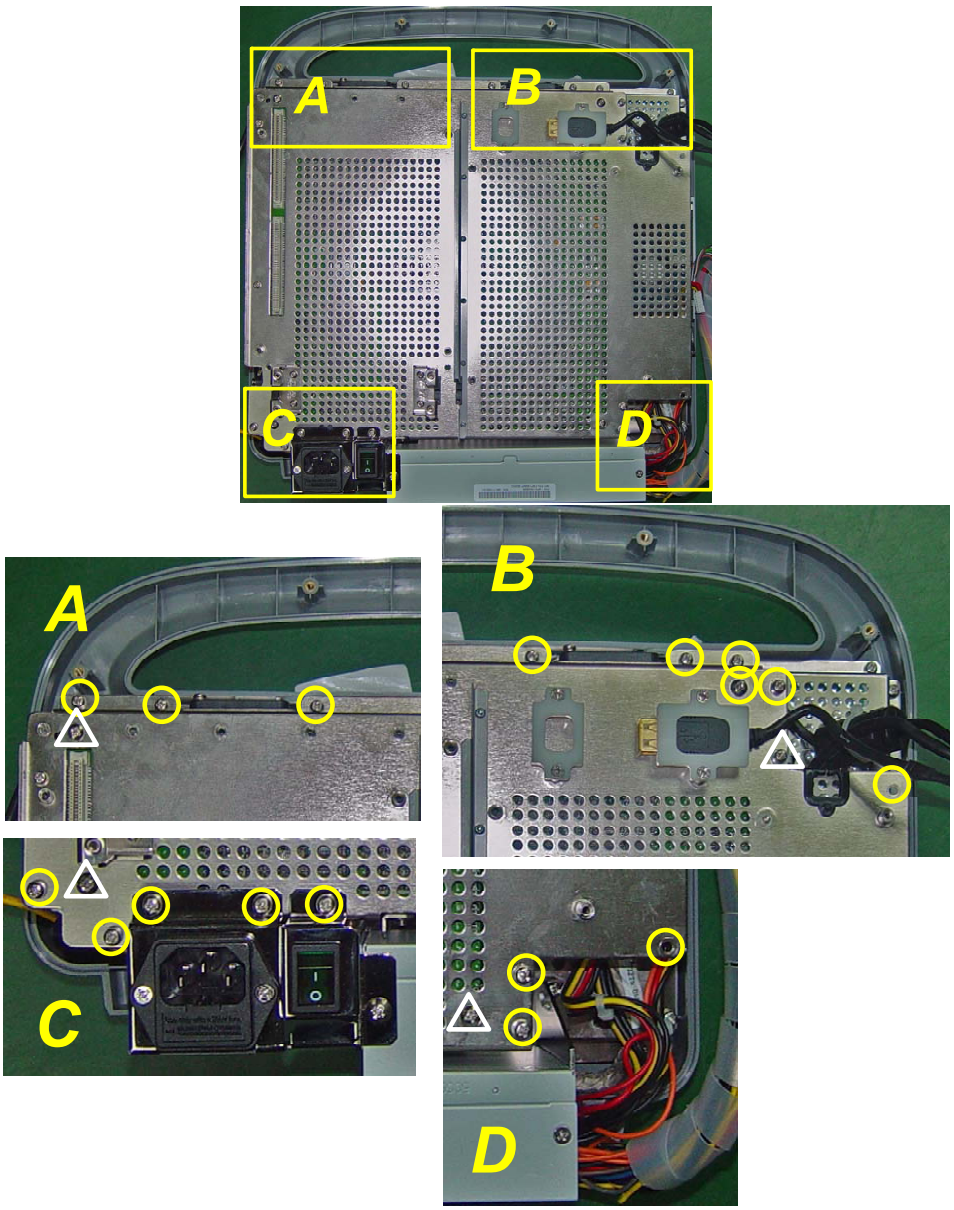


Figure 5.5: Remove the screws fastening the ultrasound metal shield

Instructions

Unfasten and remove all the seventeen combination screws (M3×6) and four pan head screws (M3×6) indicated above.

Remove the metal shield.

5.9.2 Ultrasound Module

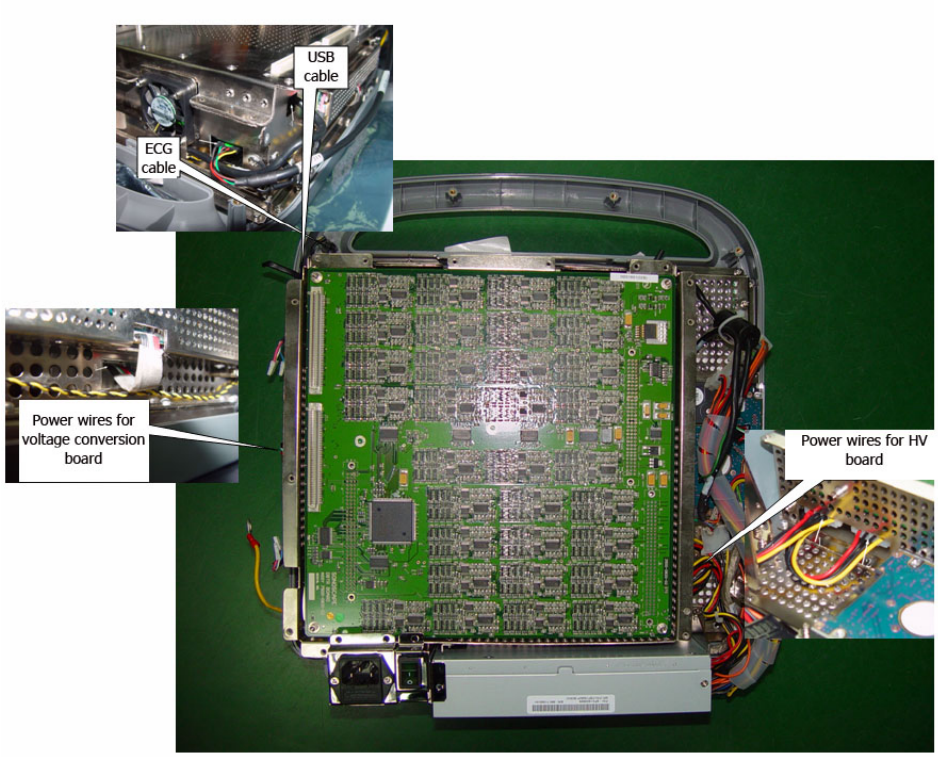


Figure 5.6: Remove the cables attached to the ultrasound module

Instructions

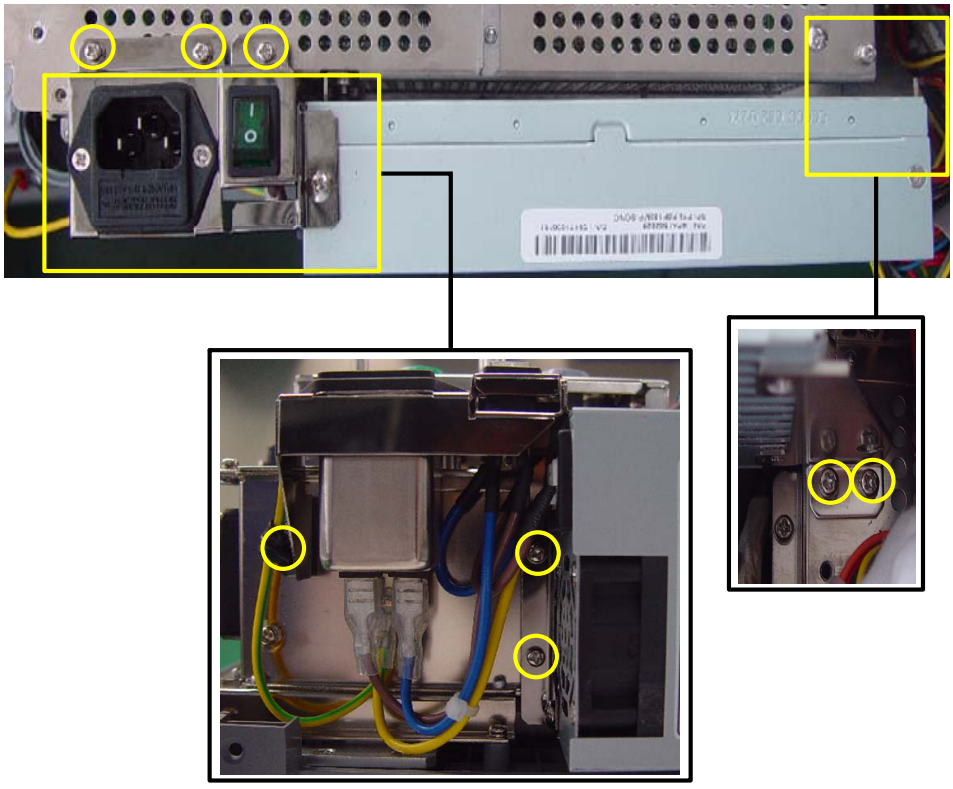
Refer to Figure 5.6 to remove the wires/cables attached to the ultrasound module.

Refer to Figure 5.7 to remove the two combination screws (M3×6, indicated by triangles) and the four pan head screws (M3×6, indicated by circles).

Take the ultrasound module (three PCBs: DBTR, DBF,DBHV are stacked in order) out from the ultrasound module bracket.

Figure 5.7: Remove the six screws

5.10 Power Unit



Instructions

Remove the eight combination screws (M3×6) indicated in the above pictures. Note that the two pictures at the lower half are the view from the bottom; the power supply (the gray box) and the mains power switch are to be removed as one unit.

5.11 Keyboard Assembly

Instructions

Lift off and remove the keycaps indicated in the picture.

Remove the four screws (indicated with triangles) from the keyboard cover.

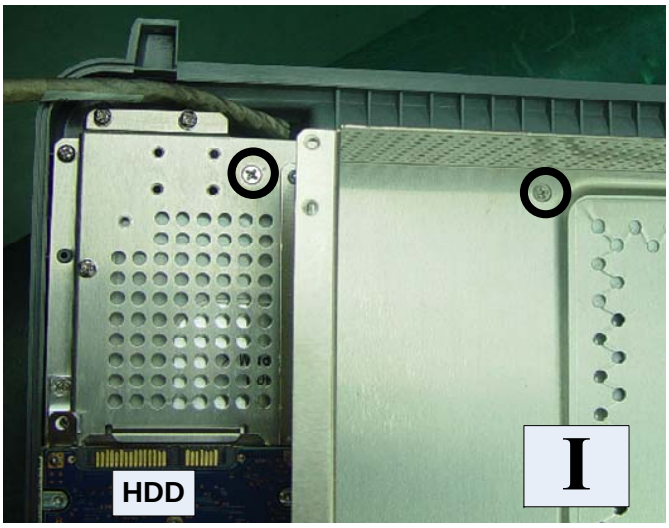
Note: *These screws are covered by rubbers. You need tweezers to remove them before removing the screws.*

Tilt the monitor to keep a 120° angle between the monitor and the keyboard. Carefully lift the keyboard up (apply force at the black arrow positions), and disconnect the keyboard data and power wires.

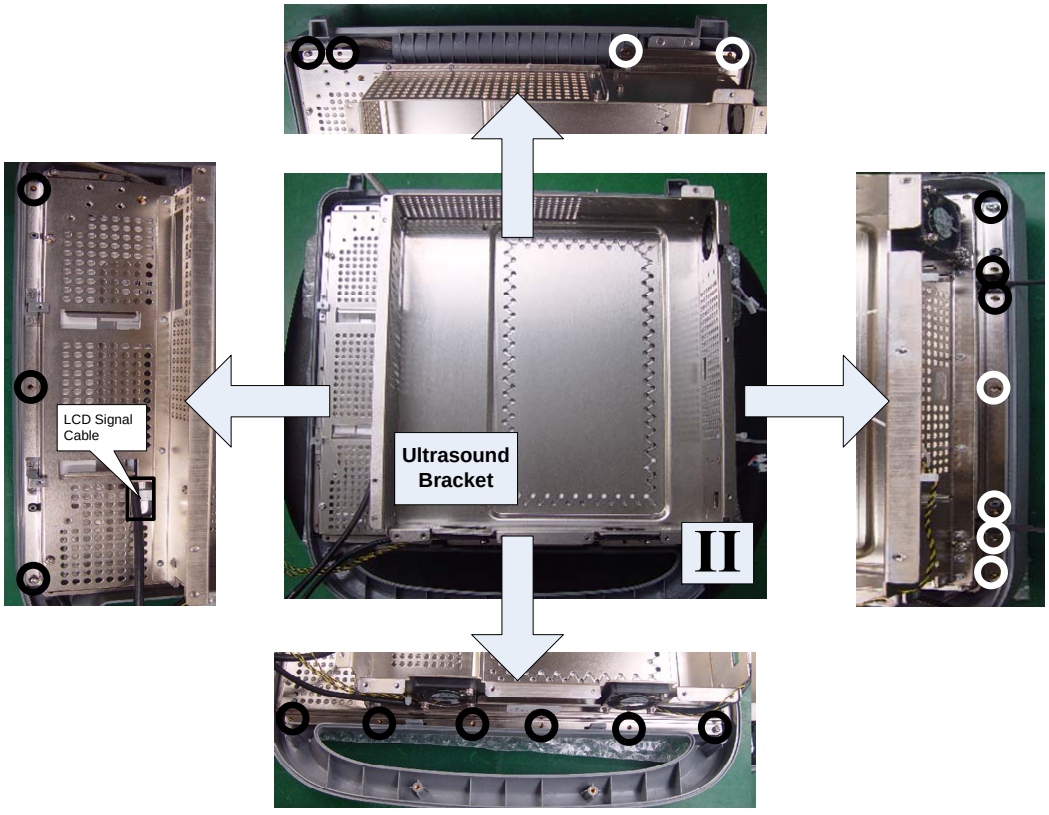
5.12 LCD assembly

Instructions

I. Remove the 2 Countersunk head screws (M3×8) from the ultrasound module bracket.

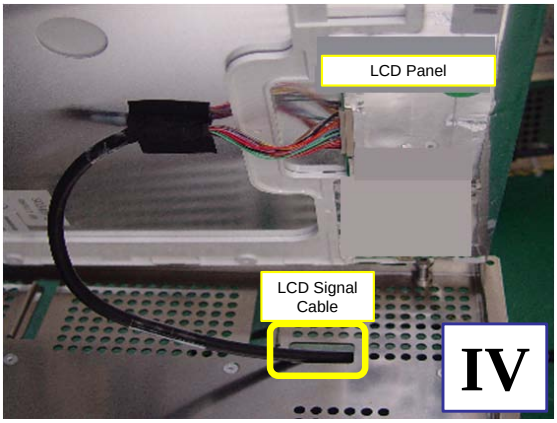


II. Remove the 20 combination screws (M×6) fastening the ultrasound module bracket. Carefully detach the front frame from the ultrasound module bracket.



III. To detach the ultrasound module bracket from the LCD, remove the 4 pan head screws (M3×4).

IV. Gently lift up the LCD, and pull the LCD signal cable out through the ultrasound module bracket.



Chapter 6

Wiring Instructions

6.1 Introduction

This chapter contains information for wiring inside the system. Section 6.2 gives the general information and precautions for connecting miscellaneous parts/units. Section 6.3 includes details on how to make each connection in the correct way.

Contents

6.2 Wiring in the System Level

Please also refer to the schematic diagram attached in appendix B of this service manual for connection.

Refer to table on page 4-5 to find the part numbers of the main PCB boards .
Refer to the contents table on page 6-1 to find the part numbers of the wires/cables .
Connector identification numbers, normally in the form of 'J#', are marked on the corresponding PCB boards. Connectors on the motherboard are indicated in figure 6.1 on page 6-3.

Warning!

- Connect the DBF board and the USB port on the Motherboard:
  - Incorrect connection may lead to burning the DBF board!
  - Ensure that the connectors are attached firmly.
- The two connectors of the power switch must be plugged into the correct sockets on the motherboard. It's highly recommended to take note of the positions before removing the two connectors. Incorrect connection will lead to system startup failure.
- The connectors on the KEAA board are complex. Some ports or connectors look alike and can be easily mixed up. It's highly recommended to take note of the positions before removing these connectors. Bad connections will lead to system malfunction.

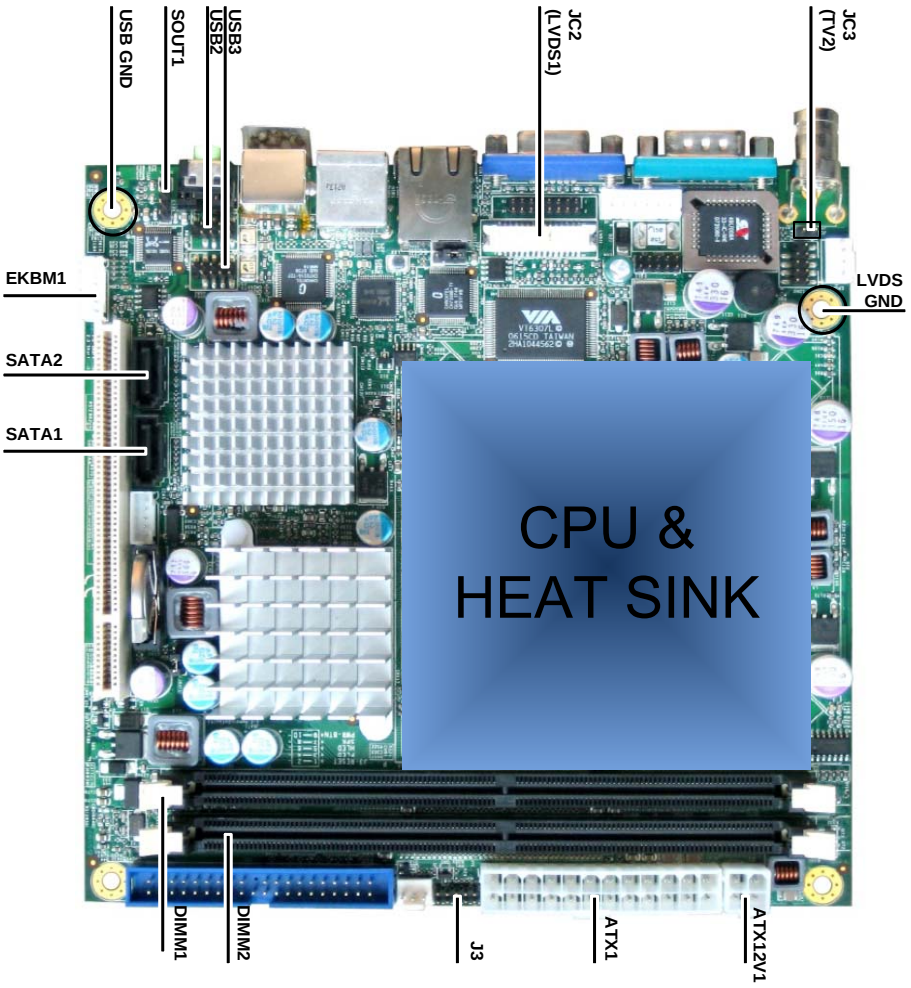


Figure 6.1: Connectors on the PC motherboard (2101-0008)

6.3 Detailed Connection Instructions

6.3.1 Control Cable for Keyboard Unit (3520-0501)

To KBD board 7500-0815
XS1 and XS2

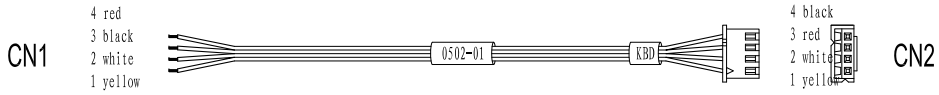
To keyboard small board 2100-0006

CN1	1	2	3	4	5	6	7	8	9	10	11	12	13	14
CN2	28	26	24	22	20	18	16	14	12	10	8	6	4	2

Connection Instructions:

There are two identical control cables, both of them are connected in the same way. Connect CN1 to XS1 or XS2 on the KBD board. Connect CN2 to keyboard small board which is attached to the KBD board with screws. Make sure to plug in connectors firmly to avoid keyboard malfunction.

6.3.2 Connection wires for keyboard small board (3520-0502)



To keyboard small board 2100-0006

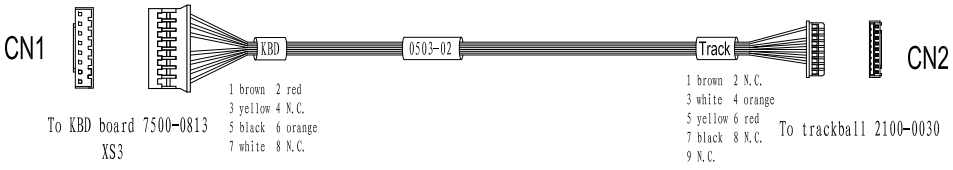
To KBD board 7500-0815
J12

Color	Yellow	White	Black	Red
Signal	CLK	DAT	GND	VCC
CN1	1	2	3	4
CN2	1	2	4	3

Connection Instructions:

Connect CN1 to the keyboard small board through soldering. Plug CN2 to J12 on the KBD board.

6.3.3 Connection wires for trackball (3520-0503)



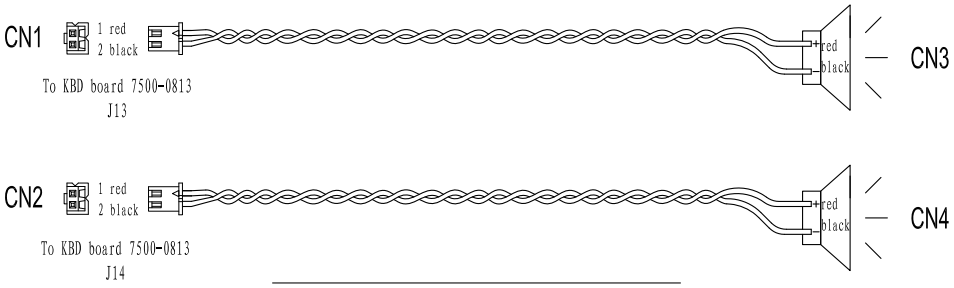
To KBD board 7500-0813
XS3

To trackball 2100-0030

Signal	VCC	GND	TBPS2DATA	TBPS2CLK	SET	ESC	GND	NC	NC
Color	Brown	Green	White	Orange	Yellow	Red	Black		
CN1	8	1	7	6	3	2	5		
CN2	1	2	3	4	5	6	7	8	9

Connection Instructions: Connect CN1 to XS3 on the keyboard. Connect CN2 to the trackball (keep the white wire upwards.) Avoid inserting the connectors by force.

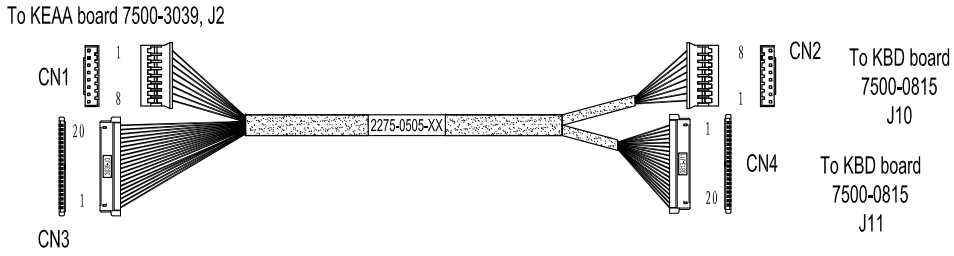
6.3.4 Connection cable for loud speakers (3520-0504)



Color	Red	Black	Red	Black
CN1	1	2		
CN2			1	2
CN3	+	-		
CN4			+	-

Connection Instructions:
Connect CN1 and CN2 to J13 and J14 respectively. Connect CN3 and CN4 to the loudspeaker sockets on the keyboard assembly.

6.3.5 Signal Transmission cable for keyboard (3520-0505)

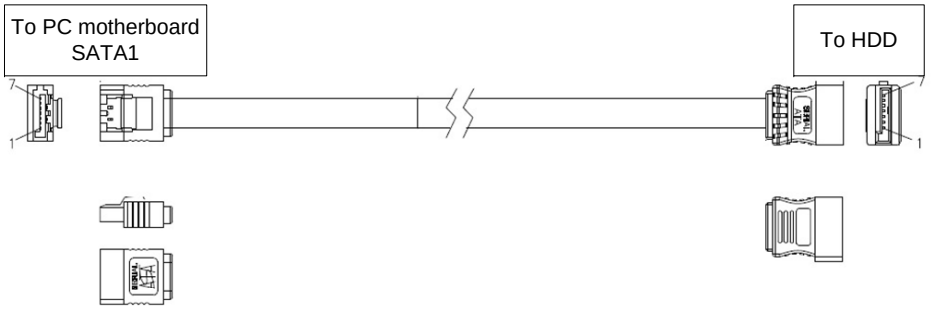


To KEAA board 7500-3039, J3

Signal	VCC	VCC	VCC	GND	GND	GND	+12V	+12V		
Color	Red	Red	Red	Shield	Shield	Shield	Yellow	Yellow		
CN1	1	2	3	4	5	6	7	8		
CN1	1	2	3	4	5	6	7	8		
Signal	GND	Laudio	Raudio	GND	GND	PRT CTRL	PRT BUSY	GND	FSW1	FSW2
Color	Black	Blue	Orange	Black	Black	Brown	White	Black	Green	Green
CN3	1	2	3	4	5	6	7	8	9	10
CN4	1	2	3	4	5	6	7	8	9	10
Signal	GND	PowerSWL	PowerSWR	GND	KBPS2DATA	KBPS2CLK	GND	TBPS2DATA	TBPS2CLK	GND
Color	Black	Green	Green	Black	Brown	White	Black	Blue	Orange	Black
CN3	11	12	13	14	15	16	17	18	19	20
CN4	11	12	13	14	15	16	17	18	19	20

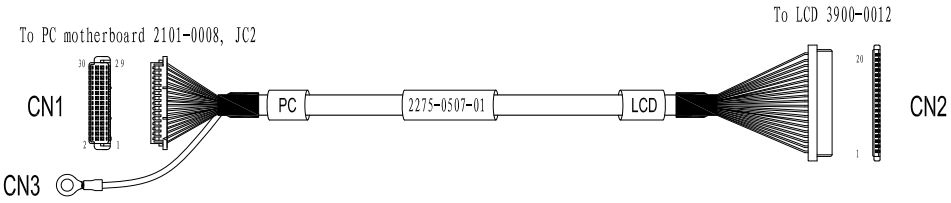
Connection Instructions:
Connect CN1 and CN3 to J2 and J3 respectively on the KEAA board. Connect CN2 and CN4 to J10 and J11 respectively on the KBD board. Make sure to attach these connectors tight.

6.3.6 SATA cable for HDD (3520-0506)



Connection Instructions:
Connect CN1 to the SATA socket on the motherboard. Connect CN2 to the SATA socket on the HDD. To disconnect CN1, press the metal tab and release the connector gently. Be careful when handling the SATA connectors, they can be easily damaged.

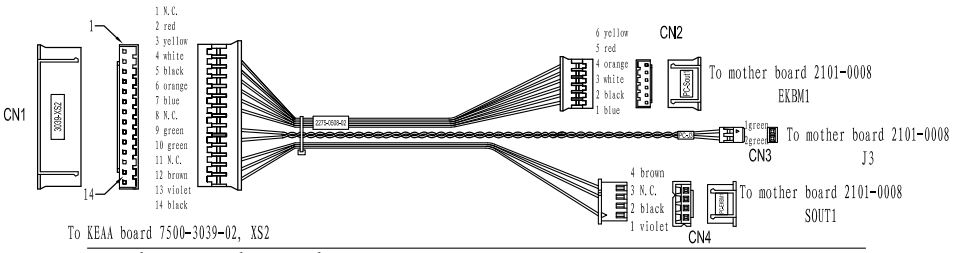
6.3.7 LVDS Signal Cable (3520-0507)



Signal	Color	CN1	CN2
VCC	red/black	1	1
VCC	red/blue	2	2
GND	pink/black	7	3
GND	pink/black	8	4
Rx0-	orange/white	11	5
Rx0+	orange	9	6
GND	green/black	13	7
Rx1-	violet	17	8
Rx1+	violet/white	15	9
GND	green	19	10
Rx2-	blue/black	23	11
Rx2+	blue	21	12
GND	red	25	13
CK-	yellow/red	5	14
CK+	yellow/blue	3	15
GND	red	26	16
Rx3-	brown	29	17
Rx3+	brown/white	27	18
GND	black/white	14	19
GND	black	20	20

Connection Instructions:
Connect CN1 to LVDS1 on the motherboard. Connect CN3 to ground pin on the motherboard. Connect CN2 to the monitor.

6.3.8 Cables Connecting Keyboard and motherboard (3520-0508)

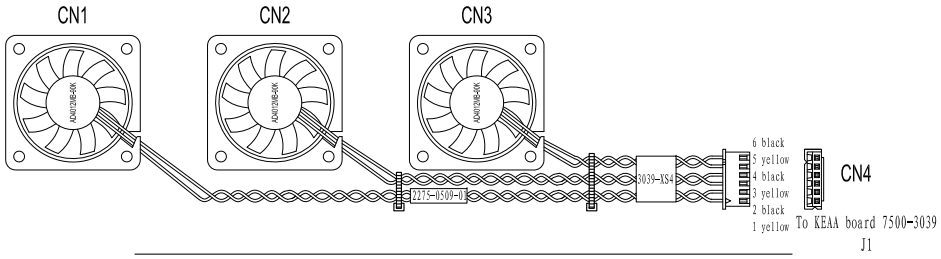


Signal	GND	Audio L	Audio R	GND	POWSWL	POWSWR	GND	KBDATA	KBCLK	GND
Color	Black	Violet	Brown	NC	Green	Green	NC	Blue	Orange	Black
CN1	14	13	12	11	10	9	8	7	6	5
CN2								1	4	2
CN3					1	2				
CN4	2	1	4							

Connection Instructions:

Connect CN1 to XS2 on the KEAA board. Connect CN2 to EKBM1 on the motherboard. Connect CN3 to the 9th and the 10th pins of J3 on the motherboard. Connect CN4 to SOUT1 on the motherboard.

6.3.9 Connection wires for system fan(3520-0509)

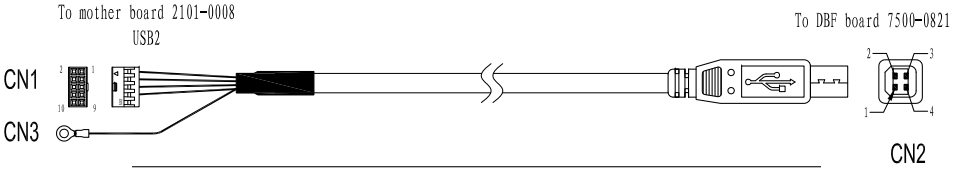


Signal	+12V	GND	+12V	GND	+12V	GND
Color	yellow	black	yellow	black	yellow	black
CN1	1	2	3	4	5	6

Connection Instructions:

Attach CN1, CN2 and CN3 to their corresponding designated brackets holding the fans. Connect CN4 to J1 on the KEAA board.

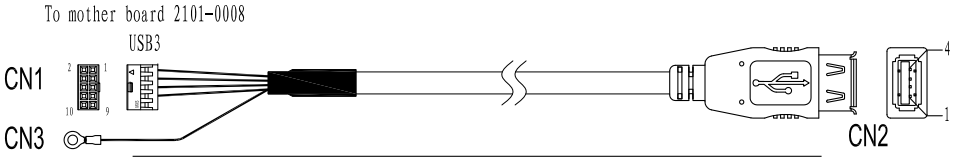
6.3.10 DBF USB Signal Cable (3520-0510)



Signal	+5V	D-	D+	GND	NC	GND
Color	red	white	green	black	no pin	shield
CN1	1	3	5	7	10	
CN2	1	2	3	4		Metal shell
CN3						GND pin

Connection Instructions:
Connect CN1 to USB2 on the motherboard. Make sure to connect in the correct direction: the vacant hole on CN1 corresponds to the single-pin side of USB2. Connect CN3 to the GND pin on the motherboard. Connect CN2 to the DBF board.

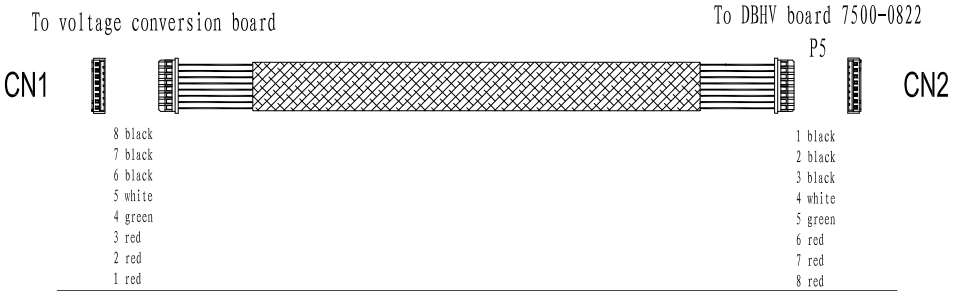
6.3.11 USB Cable for μ-Scan Dongle(3520-0511)



Signal	+5V	D-	D+	GND	N/C	GND
Color	red	white	green	black	no pin	shield
CN1	1	3	5	7	10	
CN2	1	2	3	4		Metal shell
CN3						GND pin

Connection Instructions:
Connect CN1 to USB3 on the motherboard. Make sure you get the correct direction: the vacant hole on CN1 should correspond to the single-pin side on USB3. Connect CN3 to ground on the motherboard. Fasten CN2 to the motherboard bracket, and connected it to the μ-Scan Dongle.

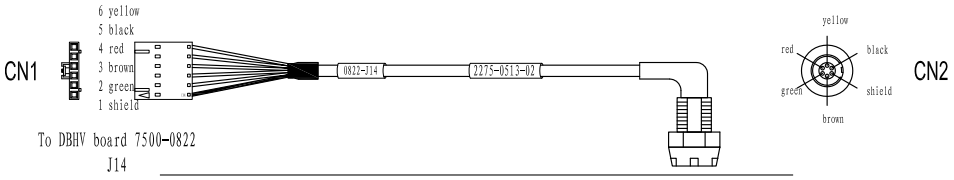
6.3.12 Power Supply Cable for Voltage Inversion Board (3520-0512)



Signal	Vcc	Vcc	Vcc			GND	GND	GND
Color	red	red	red	green	white	black	black	black
CN1	1	2	3	4	5	6	7	8
CN2	8	7	6	5	4	3	2	1

Connection Instructions:
Connect CN1 to the voltage inversion board. Connect CN2 to P5 on the DBHV board.

6.3.13 ECG internal connection cable (3520-0513)

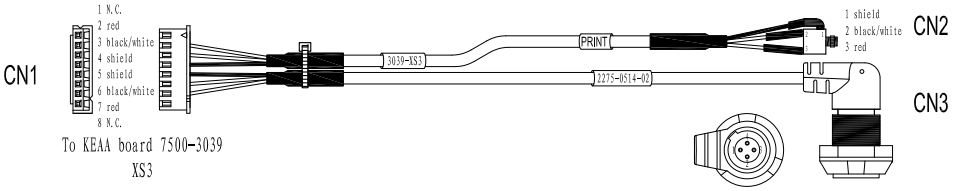


Signal	RA	LA	LL			GND
Color	shield	green	brown	red	black	yellow
CN1	1	2	3	4	5	6
CN2	6	4	5	3	1	2

Connection Instructions:

Connect CN1 to J14 on the DBF board and CN2 to the ECG connector on the back panel.

6.3.14 Foot Switch Cable (3520-0514)

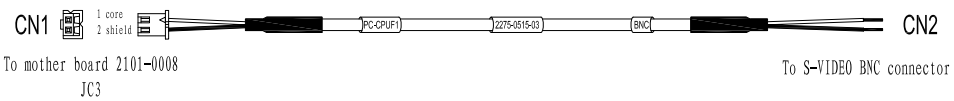


Signal	GND	FSW2	FSW1	GND	GND	PRT-BVSY	PRT-CTRL	GND
Color	NA	red	black/white	shield	shield	black/white	red	NA
CN1	8	7	6	5	4	3	2	1
CN2								
CN3		2	3	1,4				

Connection Instructions:

Connect CN1 to XS3 on the KEAA board. Connect CN2 and CN3 to the printer socket and the foot switch socket respectively on the rear IO panel.

6.3.15 Composite Video BNC Cable (3520-0515)

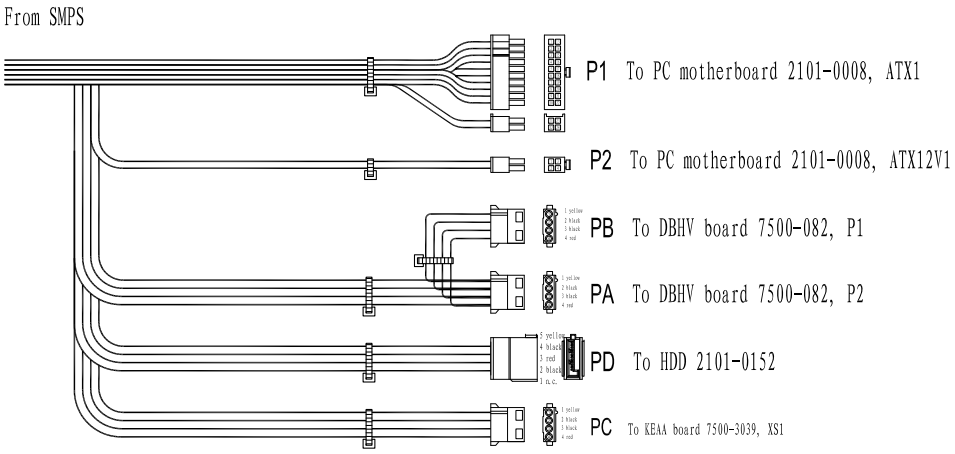


Color	Core	Shield
CN1	Core	BNC shell
CN2	1	2

Connection Instructions:

Connect CN1 to JC3 on the motherboard. Attach CN2 to the back panel as VIDEO-OUT port.

6.3.16 Main power cables from SMPS (3520-0520)



Chapter 7

Install and Update the System Software

7.1 Introduction

The software design takes a significant part in the development of the whole system. The S6 system utilizes Linux platform, and the programs are written in C. Thanks to innovative algorithms employed in the system, most of the complicated tasks, such as data acquisition and data management, are performed through software. The performance of the system can be improved even more by upgrading the software.

For normal software upgrade, SonoScape will send the upgrade files, through either email or CD, to the authorized personals of regional Service Center or Representative. The authorized personal should copy these files to a USB 2.0 removable disk (USB flash drive or removable hard drive), and follow the instructions in the following sections to upgrade the S6 system.

△ Attention!

- *The upgrade files are model-dependent. Ensure that these files match with the system model number before upgrading.*
- *The hard disk drives for different models are not interchangeable.*
- *Backing up patient and image data is recommended before kernel-level upgrading (section 7.5).*

7.2 Applicable Models

Instructions in this chapter are applicable to the models of S6 series and S6 series.

7.3 Update Files

Two update files, a main file (adata file) and a control file (asecure file), are sent by the R&D department of SonoScape. Copy them to the root path of a USB disk or a removable hard dirk drive.

> **⚠ Attention!**
> The main file and the control file are named as `adata_*.*.*.*.tgz` and `asecure******_*.*.*.*.tgz` respectively. The four digits (`*.*.*.*`) in the file names should be identical for the two files and consistent with the current software version. The six consecutive digits (`******`) in the asecure file represent a control number. This control number must be consistent with that on the system to be upgraded.
> Example: For the two files: `adata_2.0.0.12.tgz` and `asecure200008_2.0.0.12.tgz`, `2.0.0.12` stands for the current software version, `200008` stands for the control number.

You can find the control number for the system with either of the following two methods:

Method 1:

1. Turn on and start up the system.
2. Press MENU key at the EXAM screen, this will lead you to the system menu.
3. Select System Information by moving the trackball.
4. Press Set key to enter the system information submenu. The control number and the current software version number are shown (refer to Figure 7.1).

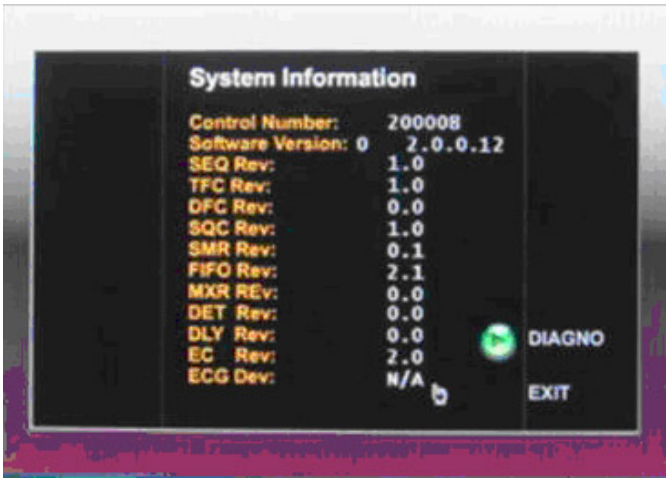


Figure 7.1: System Information Window

Method 2:
The control number is also the serial number of the DBF board. You will need to disassmeble the system to find it, so use this method only if you are unable to start up the system.

7.4 Non-kernel Level Update Instructions

7.4.1 Precautions

1. Ensure that the USB disk you are using is accessible on the ultrasound system. Here is a simple way to check for this: try to copy some files from the ultrasound system to the USB disk.

2. Ensure that the files are consistent with the system by checking the software version and the control number.

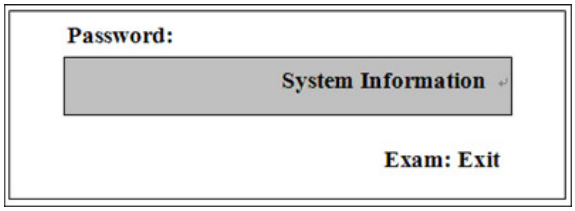
3. Do not change the file formats or the file names after transferring them to the USB disk.

4. Change date/time to the correct values if they are displayed incorrectly on the ultrasound system.

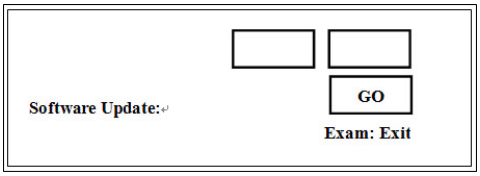
△ Attention!
If the files are sent through email, their names might change unexpectedly. If this is the case, correct their names before upgrading using these files.
E.g.: Change the file name from
`asecurexxxxxx.tar.gz(1)` to
`asecurexxxxxx.tar.gz`.

7.4.2 Non-kernel Level Software Update Procedures

1. Plug the USB disk drive with update files into the USB port of the system.
2. Boot up the system, wait until the EXAM screen appears.
3. Press these keys successively: Shift, E and Menu. The system will require a password to continue:



4. Enter the correct password (the default password is HH77 for year 2009), the update confirmation dialogue is shown as below.



5. Select [GO] and press SET key to continue (Press Exam key will cancel the update process).
6. The system will show this message: “Please wait...”.
7. Wait until the message “Shut Down System” is displayed on the screen. Press Exam key, remove the USB disk and restart the system to complete the update.

Note:

1. The password used in the update process is provided to authorized service/maintenance personals by SonoScape. The password is NOT case sensitive.
2. If the message, “Check the USB”, pops up, reinsert the USB disk or use the other USB port.
3. Do not plug in any removable disks into it while the system is starting up to avoid any interruption.
4. The above update process will not change the local cine files or the patients data.

7.5 Upgrade Kernel and Software

7.5.1 Upgrade Using USB Boot-up Disk

Use the USB boot-up disk to upgrade the system if either of the following two cases is true:

1. The system is to be upgraded from versions older than `2.0.0.16` to `2.0.0.16` or later. In this case, the kernel and the software are to be updated at the same time.
2. The data on the hard disk drive has been corrupted and the whole system needs to be reinstalled.

7.5.2 Notes

1. The user data (cine files and patients data) on the hard disk drive may be erased during kernel upgrade process. Ensure that you have backed up these files before upgrading.
2. Ensure that the USB disk has the latest kernel inside. Refer to Appendix A for details.
3. Unzip/Extract the update files (adata and asecure files) into the `update` directory in the USB disk. Create it if the file folder "`update`" does not exist.
4. Use the "safely remove" function in MS Windows to disconnect the USB disk safely.
5. Unless otherwise stated, the following conventions are assumed for configuring BIOS: Use the arrow keys to highlight and select item; Press Enter key to confirm the selection and enter a submenu or a dialogue box. Press Freeze key to exit current submenu and return to previous menu.

7.5.3 Upgrade Procedures

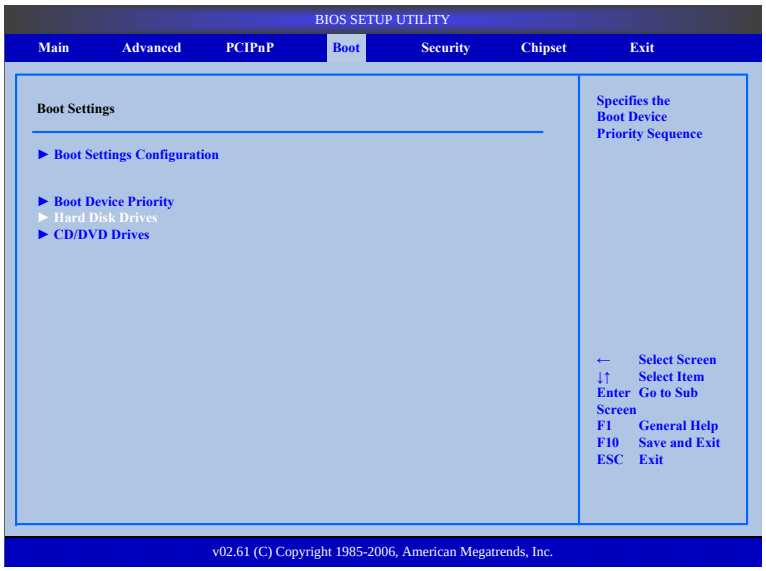
7.5.3.1 Entering Bios

Plug the USB boot up disk containing the update files into the USB port on the system.

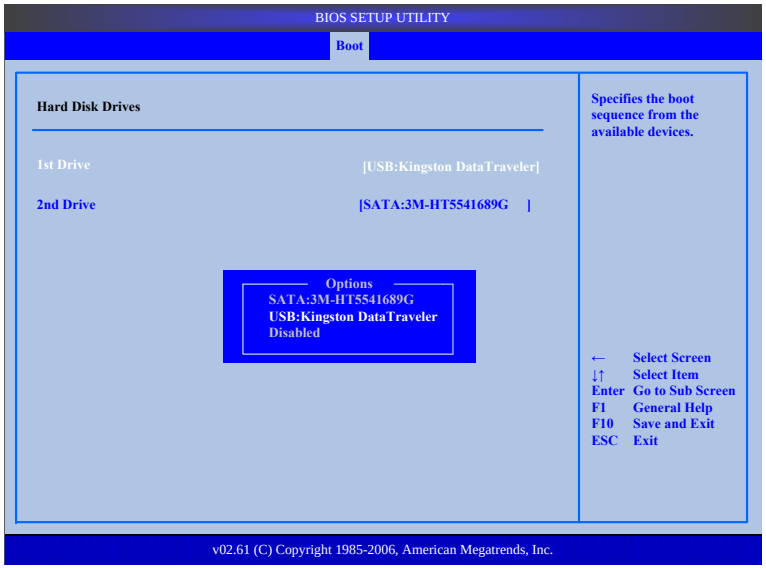
Boot up the system, and press the DEPTH key downwards and hold it in position until a password dialogue box pops up. Type "service" and press Enter key. This leads to the BIOS setup window.

7.5.3.2 BIOS Setup

1) Select Hard Disk Drives under Boot tab.

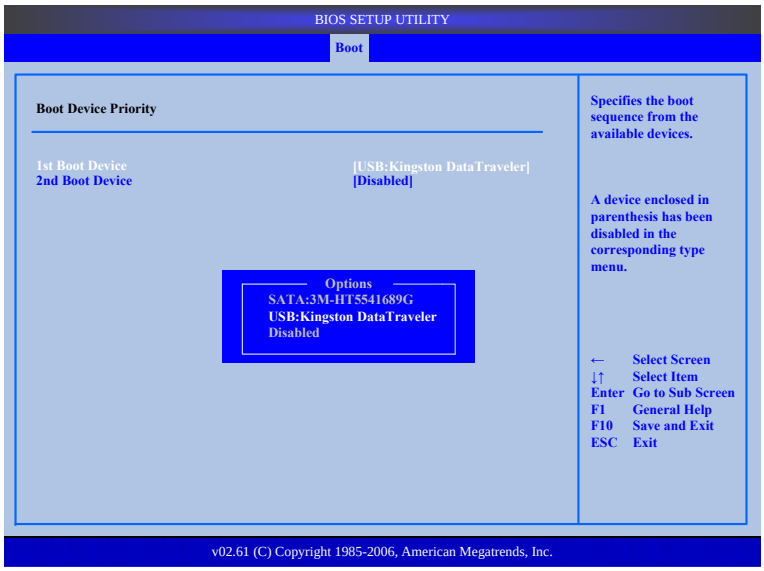


2) Change the first drive to the target USB drive.



3) Press the Freeze key to return to the Boot tab window, and select Boot Device Priority.

4) Set the first boot device to the USB drive.



4) Go to Exit tab → Save & Exit.

7.5.3.3 Install the updates

1. After saving and exiting BIOS setup, the system automatically reboots. Linux will perform power on self test (POST). Do not press any keys during this process. Wait until the following information in figure 7.2. Type "y" followed by Enter key to continue. Or alternatively, type "forcekill" followed by Enter key to continue.

⚠ Warning!

Issueing the "forcekill" command will reformat the HDD. So be sure to back up your essential data first.

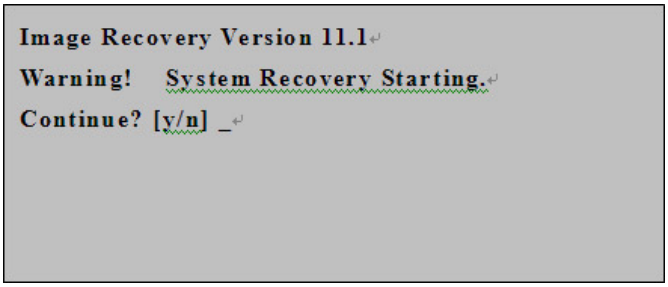


Figure 7.2: Upgrade dialog

2. The installation starts immediately. It will take 7 to 10 minutes to complete.

   ⚠ Attention!

   If the installation fails double check the following prerequisites:

   - All boot up files and the kernel files should be intact.
   - The update files are correctly extracted, and have been put into the update folder in the root directory of the USB disk.
   - The data and power cables of the hard disk drive are attached firmly.

   Make sure the above prerequisites have been fulfilled. Restart the installation process, type "forcekill" instead of "y" at the prompt screen (refer to step 1). If the problem persists, it is very likely that the USB disk or the hard disk drive has been damaged. Replace it and restart the installation.

3. Press Enter to turn off the system as "Press Enter Key to shutdown:" appears on the screen.

4. Remove the USB disk and turn on the system. The blue screen will be shown for a while, during when some software will be installed automatically. The system will auto restart twice, and enter the EXAM screen. After writing in config (see instructions below), the system is ready to use.

7.5.3.4 Writing in aconfig file

Note: Writing in "`aconfig`" file is required only when upgrading/reinstalling kernel.

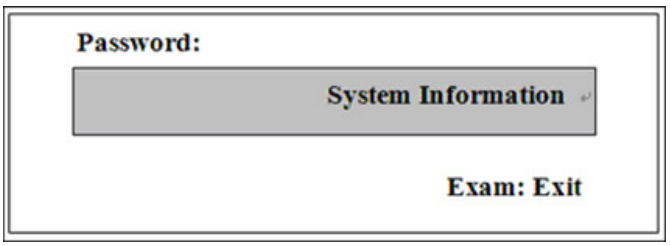
Procedures:

a. Copy the `aconfig` file consistent with the ultrasound system into the USB disk from PC.

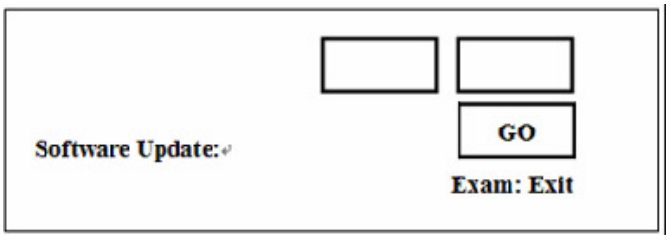
   Note: To be consistent means that the 6 digits in the name of the `aconfig` file must be exactly the same as the control number of the system. Refer to section instructions on page 7-2 if you do not know how to find the control number for your system.

b. Start up the S6 system, plug in the USB disk when the EXAM screen appears.

c. Press these keys successively: Shift, E and Menu. The system will prompt for a password.



d. Enter the correct password (the default password is "HH77" for year 2009), the update confirmation dialogue shows on the screen:



e. The system will show this message on the screen: "Please wait. . . ". Wait until the message "Shut Down System" is displayed on the screen. Press Exam key, remove the USB disk and restart the system to complete the update.

Note:

1. If the writing in process fails, press SET key to restart the process.

2. If the problem persists, ensure that, the `aconfig` file has the correct control number (refer to the note above), and the `aconfig` file is located at the root directory of the USB disk. Restart the writing in process.

7.5.4 Activate the μ-SCAN function

⚠ Attention!

In order to use the μ-SCAN function, any external USB disk drives should be removed before the system startup.

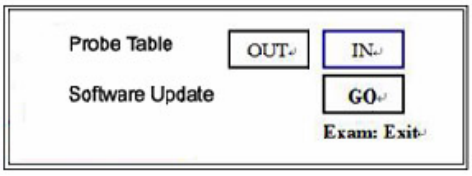
a. Insert the μ-SCAN dongle into the designated USB connector (refer to section 5.3 to connect).

b. Copy the Keypass file from PC to the root directory of a USB disk.

c. Remove any removable USB drives if any, start up the S6 system.

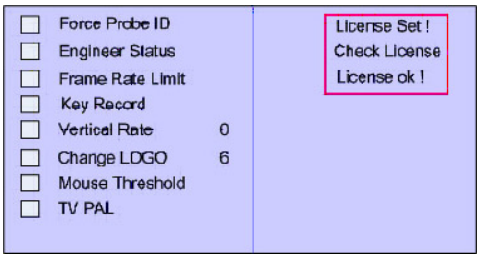
d. Plug in the USB disk drive with Keypass file when the EXAM screen appears.

e. Enter engineer mode by pressing these keys successively: Shift, E and Menu, and then type in the monthly engineer password.



f. Move the cursor above IN button, and press SET key to write in the Keypass file. After successfully writing in, press EXAM key to exit.

g. Re-entering engineer mode, select Engineer Config. Press 'I' button to activate Keypass. The successful activation will lead to the following screen. (If the activation fails, check whether the Keypass file is consistent with the μ-SCAN dongle and located at the root directory of the USB disk.)



h. Remove any removable USB drives, restart the system. Enter a diagnostic mode and press MENU key, the μ-SCAN functionality should be activated.

Note: If the μ-SCAN function has not been enabled up till now, ensure that the μ-SCAN dongle is correctly plugged in and repeat procedures from step d above. **In order to use the μ-SCAN function, no external USB drives should be connected during system startup.**

Chapter 8

System Functionality Tests

8.1 Introduction

After upgrading/updating or reinstalling the system, a series of system functionality tests should be performed to ensure that the system will work normally. In case of that any test fails, re-service the machine or reinstall the software and perform the system functionality test afterward.

⚠ Warning!

- *Only Service Engineers/Representatives trained to repair the S6 system and authorized by SonoScape should perform the system functionality tests.*
- *DONOT remove or replace any circuit boards while the system is powered on. ⇨ Danger of personal injury and system damage!*
- *DONOT remove the system's insulation unit. ⇨ Potential hazardous voltage inside!*

8.2 Testing Software

The system has built-in testing software which can be utilized to test the performance and functionality of the system hardware. The software supports both in-factory and field tests. After the system passed all the necessary functionality tests, service personal should reset and restart the system before handing it to the user for normal usage.

The test results will be shown in one of the following three cases:

1. A red mark means the system fails the corresponding test. The system needs service and be tested afterward.

2. A green mark means the corresponding test is a success. You may either quit or continue with the next test if necessary.
3. An illustration of data tables which reveal information on how the tested part is working.

Available tests are listed below.

8.2.1 Speaker Test

It checks the normal functionality of the loud speakers on the system.

8.2.2 System memory

Test all accessible registers and memories in the scanning unit.

8.2.3 TFC test

Test the connection between the DBF board and the DBTR board. A red mark implies there is connection error.

8.2.4 EC↔FIFO

Test the FIFO functionality of the DBF board. A red mark implies connection error.

8.2.5 Receive bus

Test the connection of receive bus on the DBF board. A red mark implies connection error.

8.2.6 Detector to FIFO

Test the functionality between demodulation circuit and FIFO circuit on the DBF board.

8.2.7 ADC Test (Rx on)

While Rx is on (the receive channel is on), it tests AD converter, and also signal channels on the DBF board by examining amplitude and phase. The normal functionality of AD conversion requires that both system memory and receive bus are functional, so either Receive bus test or System memory test fails implies that ADC Test (Rx on) fails.

8.2.8 Probe ID, HV and Temp

This test includes three elements:

1. Identify the probe ID; 255 is displayed if no probe is connected.
2. It tests the functionalities of HV generator and HV regulator.
3. It checks the temperature of HV generator.

Refer to DBHV test for the pass/fail standard of this test.

8.2.9 ADC Test (Rx off)

Run this test only if the DBTR board is not installed and receive channel is off (Rx off)! Refer to 8.2.7 for ADC test details.

8.2.10 Receive Channel Test

It displays illustration of the functionality of the 64 ADC channels on DBF board. This test requires the normal operation of the back ends (demodulation and scanning units). So the illustration is also an indication of whether the back ends work normally.

8.2.11 Single Element Test

Test the output signal channels from probe to demodulator. The probe for this test has an input either from echoes (by submerging the probe head into a cup of water) or from external ultrasound generator. An illustration will be displayed after running the single element test. The cause of the error, if any, can be identified from this illustration to be the probe board, the array elements or the DBTR board.

Note: In the Service Center, a simulation probe may be used instead. The simulation probe is a probe with a simulative load and is connected to an oscilloscope. By observing the test results from the oscilloscope, the problem of the output signal channels from probe to demodulator can be identified.

8.3 Test Procedures

At the EXAM screen, enter the System Configuration window by pressing MENU key. Select System Information and press SET key. The system information will be shown as below,

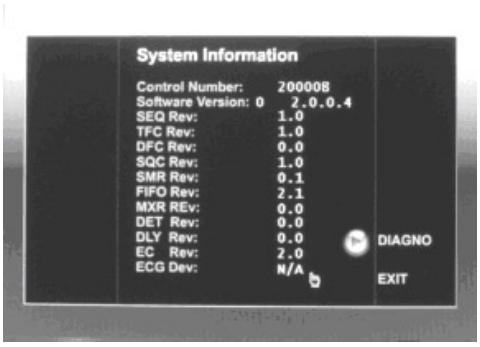


Figure 8.1: System Information Window

The Control Number shown hereis a unique number which varies from equipment to equipment; Software Version indicates the current version number which will be updated with system upgrade.

Select DIAGNO and press SET key. Type in the correct password followed by Enter key, and this brings to the test interface, or test mode (see below.)

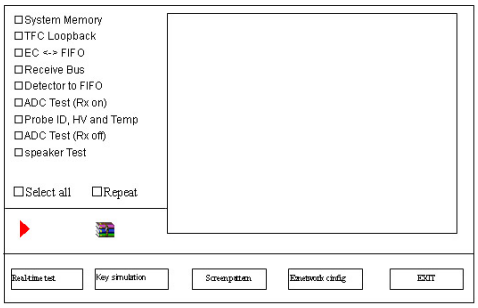


Figure 8.2: Test Interface

The test interface consists of five parts: system test, real-time test, key simulation, screen pattern and ezNetwork configuration.

Note: The correct password is required to enter the test mode. Authorized personals may request for this password from SonoScape.

8.3.1 Run Test 8.2.1 (Speaker Test)

a) Move the cursor to the check box next to “Speaker Test” and press SET key. (A cross symbol in the check box indicates that the corresponding item has been selected.)

b) Click ▷ PLAY button to execute Speaker Test. The screen will display “Left Channel (1000Hz) Press any key to continue...” The left channel should produce a sound at 1,000Hz if it’s working properly. Press any key (excluding trackball, left and right cursor keys) to continue the test in turn with Right Channel (1000Hz), Left Channel (500Hz), Right Channel (500Hz), Left Channel (125Hz) and Right Channel (125Hz).

8.3.2 Run Tests from 8.2.2 and 8.2.9

a) Move the cursor to the check box next to “System Memory", or any other test items mentioned from 8.2.2 to 8.2.9, and press SET key. You can also check the “Select all” check box to test all these items at the same time.

b) Click ▷ PLAY button to execute the tests selected. It automatically stops if the Repeat check box is not selected.

c) The testing status will be updated on the information panel on the screen during the test process. All the reports will be saved as log files on the hard disk drive at the end of the tests.

d) To browse the log file, click  (LOG) button and use ⇑ and ⇓ keys to select. (Click the LOG button again to return to test mode.)

e) Click Exit button to exit from the test mode to the system menu.

8.3.3 Run Tests from 8.2.10 to 8.2.11

a) Run Test 8.2.10 (Receive Channel Test)

b) In test mode, click Real-Time Test button, move the cursor to the check box next to “Power Measurement”, and press SET key. This brings to the EXAM screen.

c) Select a linear array probe, and enter the first diagnostic mode (carotid).

d) Press “PRINT” key, the Power Measurement menu pops up.

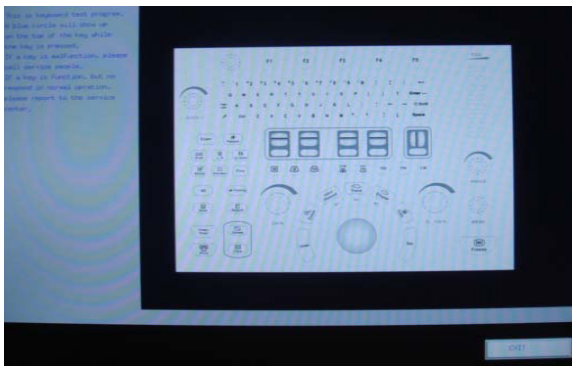
e) Check the box next to "ADCT" by pressing ENTER key. A signal is sent to the 64 channels on the RBF board, a white mask is overlaid onto the diagnostic window. You may control the signal frequency with the left and right arrow keys.

f) The system will display 128 white lines (192 lines for high density probe). The ADC channels are considered as working properly if either of the follow two is true:

- These white lines are evenly distributed.
- Some of these lines are distorted slightly, i.e. line density varies slightly at different parts. The system has passed the ADC test (Rx on) at 8.2.7.

8.4 Key Simulation Test

After clicking the Key Simulation button, the system enters the key simulation test. The interface simulates the user keyboard (refer to the figure below). All keys, flip switches and TGC sliders can be tested.



When a hard key/flip switch is pressed, the corresponding key on the screen will be highlighted with a blue dot. Move the cursor to the Exit button, press SET key to exit the key simulation.

Contact our service center if either

1. Any key fails the key simulation test.
2. Certain keys have passed the simulation test, but are not responsive during the ultrasound diagnosis.

8.5 Real-time Test

Force probe ID: Force the system to change the ID of the selected probe to another ID. The system will assume another probe with this new ID is connected. Use left and right arrow keys to switch among different IDs. You might want to use this function if no applicable probes exist during the test of 8.2.10 or 8.2.11.

Key record: If this function is enabled, all key/flip switch/trackball activities together with the dates can be recorded. During the real time diagnosis, press ELLIPSE key to start recording, press this key again to exit recording. Press TRACE key to replay the keyboard activities at the key simulation interface.

Power Measurement: This function must be enabled to run the tests of 8.2.10 and 8.2.11. Refer to 8.3.3 for details.

ezNetwork: If Ethernet is enabled but no static IP address has been set, the system will always try to search for an IP address during startup. This normally consumes extra startup time. If there is no available network,

it is recommended to turn off the Ethernet by setting ezNetwork to off to reduce startup time.

Notes: The network setting can also be configured at the DICOM setting interface (under the system menu).

△ Attention!

If network printer or computer is to be connected, Ethernet function must be enabled.

Chapter 9

Supported Peripherals

9.1 Introduction

The S6 system currently supports the following peripherals:

A. Network printer

B. PC with Windows XP (SP2/SP3) installed

C. USB 2.0 removable disk

D. Thermal printer

When connecting the device A or B to the S6 system, both the device and the ultrasound system must be properly configured before they are operational. Other devices listed above are ready to use after being connected to the S6 system, no configuration is required.

The S6 system currently only supports network printers and thermal printers . Some supported printer models are listed in the section 9.3. It's recommended to consult the service center of SonoScape if the user intends to use a printer model not in the support list. SonoScape will test the printer models based on market demand and extend the range of supported printer models for the S6 system.

The user can access the cine files (images or videos) on the S6 system remotely using a PC which has been connected through Ethernet.

9.2 Thermal Printer Installation

Thermal printer (or video printer), may be connected to the ultrasound system directly with the BNC or S-VIDEO cable provided. The printer controller should be connected to the printer controller port  on the ultrasound system. The printer is ready to use immediately after connection, with no configuration required. SONY UP-20 color-video and UP 895MD

black & white thermal printers have been tested to be fully functional when working with the S6 system.

9.3 Network Printer Installation

9.3.1 Supported Models (Not Exhaustive)

Printer Model	S6 system software version
HP 5850	2.0.0.12 or higher
HP 6840	2.0.0.12 or higher
HP 6848	2.0.0.12 or higher
HP K5400DN	2.0.0.12 or higher
HP CP1515N	2.0.2.0 or higher

9.3.2 Configurations

Before using the network printer, both the printer and the S6 system must be properly configured through the printer setting interface on a PC and/or printer control panel. This section gives instructions on how to install HP K5400DN and HP CP1515N printers, installations for other models should follow similarly.

9.3.2.1 HP K5400DN Installation Procedures

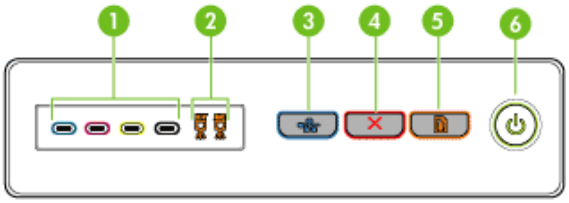


Figure 9.1: HP K5400DN Control Panel

1	Ink cartridge lights
2	Printhead lights
3	Configuration Page button
4	Cancel button
5	Resume button and light
6	Power button and light

1. Install printer driver on the computer.
2. Connect the printer to the computer with an Ethernet cable. Turn the printer on and wait for a while (about 3 minutes), press Configuration Page button on the printer, the printer information together with its current IP address (allocated randomly) will be printed out. (Refer to figure on page 9-4) In this example the IP address is 169.254.103.148.
3. Change this randomly allocated IP address to a fixed address, 192.168.254.183, by following these steps (also refer to figure 9.3),
   (a) Set the computer's IP address to 169.254.103.55.
   (b) Type the IP address printed out in step 2, i.e., 169.254.103.148 in our example, into the address bar of the IE explorer and press the Enter key. This leads to the printer setting page.
   (c) Click "Connection" on top left of the window, and then click "Wired",
   (d) Select "Manual IP Address". Set the IP address to 192.168.254.183, and the manual subnet mask to 255.255.255.0.

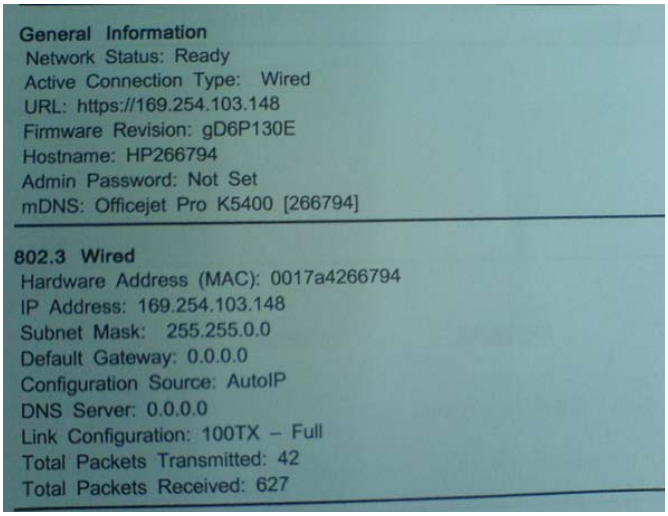


Figure 9.2: Printer configuration page

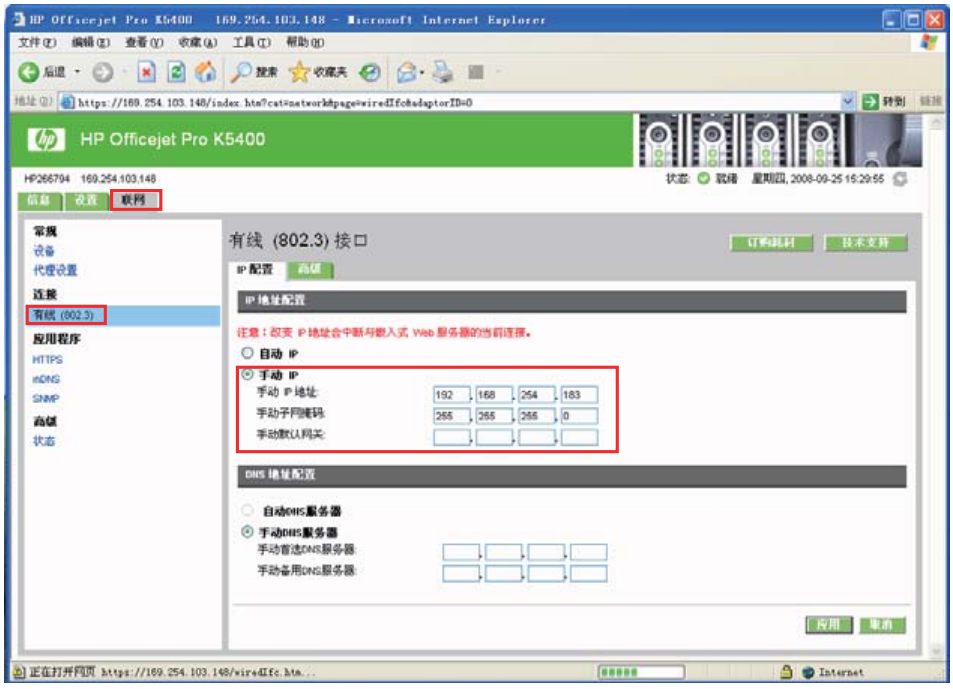


Figure 9.3: K5400 Printer setting window

9.3.2.2 HP CP1515N Installation Procedures

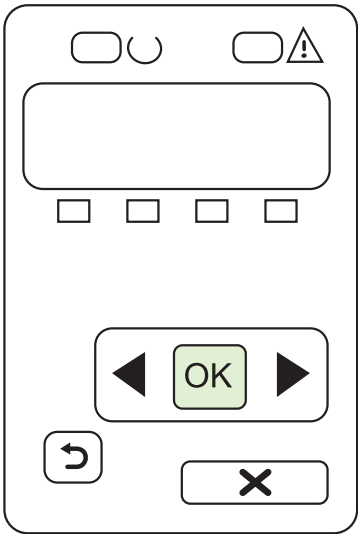


Figure 9.4: HP CP1515N Control Panel

Configuring the printer

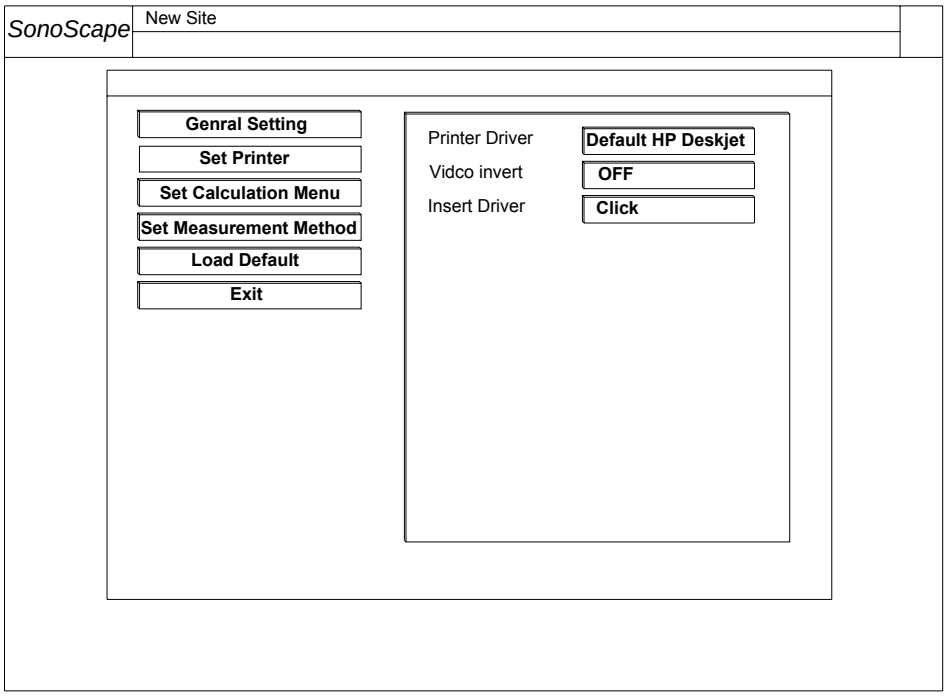
Note: Also refer to HP CP1515N's User Guide for more detailed operation instructions.

1. Connect the printer to the S6 system, turn on the printer.
2. On the control panel menu, press OK.
3. Use the ◂ or ▸ buttons to select **Network config**, and then press OK.
4. Use the ◂ or ▸ buttons to select **TCP IP Config** and press OK.
5. Use the ◂ or ▸ buttons to select **Manual** and press OK.
6. An IP address is displayed. Change it to 192.168.254.183 if it is not so. Use the control panel buttons to change and press OK to confirm.
7. After setting the IP address, press OK to continue configuring the subnet mask. Set the subnet mask to 255.255.255.0 if it's not so.
8. Press OK to configure default gateway, set it to 192.168.254.183, and press OK.

Install the printer driver on the S6 system

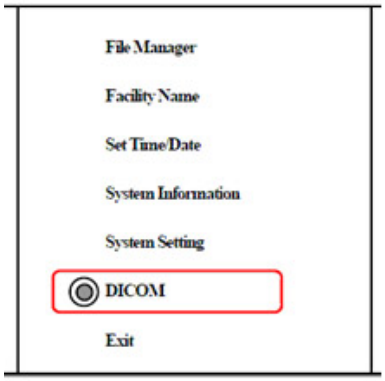
1. Copy the driver file, which is provided by SonoScape and should have the filename "deskjet.ppd", into the directory of a USB drive. Use this USB drive in the next step.

2. Insert the USB drive and start up the ultrasound system. Enter System Setting, select Set Printer (see below). Move the cursor to Insert Driver using the trackball and press the SET key on the "click" button. Follow the on screen instruction to press the SET key again. The system will start installing the printer driver.

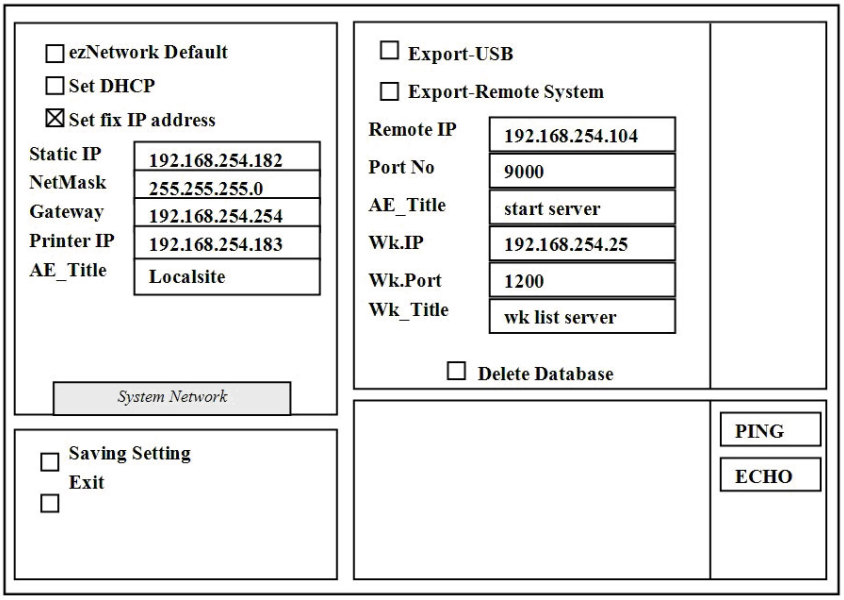


9.3.2.3 S6 Configuration Procedures

1. Press MENU key at the Exam screen.



2. Select DICOM and press SET key to confirm.



3. Check the box in front of "Set fix IP address".
4. Set "Static IP" to 192.168.254.182.

   Set "Net mask" to 255.255.255.0.

   Set "Gateway" to 192.168.254.254.

   Set "Printer IP" to 192.168.254.183.

   Keep other items unchanged.
5. Select "Save Setting" to save settings and exit.

9.3.2.4 Post Installation

1. Connect the printer to a SonoScape ultrasound system, whose IP address has been configured correctly, with an Ethernet cable.
2. Test the print function on the ultrasound system.
3. If the system passed the test, put a green label on it.
4. Otherwise review the IP setting of the ultrasound system, and/or reinstall the printer driver.

9.3.3 Network Connection with PC

Network connection between the S6 system and a PC can be achieved by either direct connection or indirect connection through router.

9.3.3.1 Connection through Router

You can set up the local network and DICOM functions in DICOM setting interface.

1. Follow instructions in 9.3.2.3 to enter the DICOM setting interface window.

   ⚠ Attention!

   - *Check/Uncheck the box next to the ezNetwork to enable/disable network connection.*
   - *Network connection must be enabled in order to connect the S6 system with PC or network printer.*

2. Connect the router to the PC with an Ethernet cable complying with T568B standard. Get instructions from the router manual to set the LAN port IP address to 192.168.254.1, subnet mask to 255.255.255.0, and turn the DHCP service on.
3. Open the computer's network setting window. Set the PC's IP address to 192.168.254.X. X can be any number from 1 to 255, but not 1 or 182 (The two addresses are already taken by the router and the S6 system.) Set subnet mask to 255.255.255.0. Set both default gate address and first DNS sever address to the router's IP address (192.168.254.1).
4. Change the computer's workgroup to "MSHOME" (Right click on My Computer icon, click Properties-Computer Name-Change.)
5. Connect the S6 system to the router with an Ethernet cable complying with T568B standard. Turn on the S6 system, wait until the EXAM screen appears (It takes about 5 minutes). Now open the Network Place window on the PC, the S6 system should have been shown as a computer named "SonoXXX". If it is not shown, type \\:192.168.254.182 in the address bar, and press Enter, available contents in the S6 system will be displayed in the window.

9.3.3.2 Direct Connection

Use crossover LAN cable instead of normal Ethernet cable. The crossover cable should have pinouts as shown in Figure 9.3.3.2.

1. Follow instructions in 9.3.2.3 to enter the DICOM setting interface window. Check the box next to "ezNetwork" to enable network connection.

Pin	Connection 1: T568A			Connection 2: T568B			Pins on plug face
	signal	pair	color	signal	pair	color	
1	BI_DA+	3	white/green stripe	BI_DB+	2	white/orange stripe	
2	BI_DA-	3	green solid	BI_DB-	2	orange solid	
3	BI_DB+	2	white/orange stripe	BI_DA+	3	white/green stripe	
4		1	blue solid		1	blue solid	
5		1	white/blue stripe		1	white/blue stripe	
6	BI_DB-	2	orange solid	BI_DA-	3	green solid	
7		4	white/brown stripe		4	white/brown stripe	
8		4	brown solid		4	brown solid	

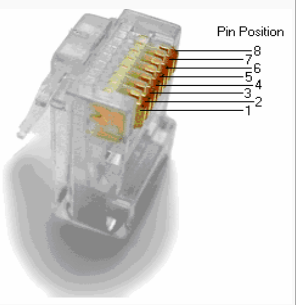


Figure 9.5: Crossover Ethernet Cable Pinouts

2. Open the network setting on the PC, and set its IP address to 192.168.254.X. X can be any number from 1 to 255, but not 182 (It is already taken by the S6 system.) Set subnet mask to 255.255.255.0.

3. Change the computer's workgroup to "MSHOME" (Right click on My Computer icon, click Properties-Computer Name-Change.)

4. Connect the S6 system to the PC with a cross over cable.

5. Turn on the S6 system, wait until the EXAM screen appears (It takes about 5 minutes). Now open the Network Place window on the PC, the S6 system should have been shown as a computer named "SonoXXX". If it is not shown, type \\192.168.254.182 in the address bar, and press Enter, available contents in the S6 system will be displayed in the window.

Chapter 10

System Troubleshooting

10.1 Introduction

This chapter contains information for troubleshooting the S6 system. With the information provided in this chapter, the service personnel should be able to pinpoint the causes of most of the common problems and repair the faulty equipment.

10.2 Preparation

1. The user and service manuals for the S6 system should be thoroughly read before troubleshooting the equipment. All the warnings and cautions should be thoroughly read and properly understood.
2. Determine the cause of the system malfunction: Is it originated from the user's misuse or from hardware/software failures?
3. Consider possible causes of the problems carefully: Has the system been operating continuously for too long? Any external factors (e.g. equipment drawing high power) that interfere with the normal operation of the system?
4. Check these devices/places first: external power supply socket, (extension) power cord, power supply outlet and fuse.
5. If an unusual problem is encountered, try to identify the cause by reproducing the problem.
6. With the testing software (chapter 8) provided and the information on the common problems introduced in the following sections, experienced service engineers may diagnose and eliminate a potential problem.
7. Consider the service cost. Do not replace a component if you are unsure if it is the cause. Avoid introducing extra factors that might

interrupt the test or cause another problem. If a certain component has been identified to be the cause of a problem, replace it but not the whole circuit board that holds it. For example, a faulty capacitor has been identified as causing a system malfunction. Replace this capacitor, but not the PCB board that holds it. However, double check this PCB board after replacing: sometimes the problem might be caused by more than one faulty IC.

8. After repairing the equipment, perform the necessary tests to ensure that the system will operate with optimal performance.

Warnings and Precautions
Before servicing, review all the warnings and cautions in the previous chapters.

⚠ Warning!

- *Potential hazardous voltage exists inside the system! Remove any personal jewelry that contain metallic substances.*
- *DONOT remove or replace any circuit boards while the system is powered on. => Danger of personal injury and system damage!*

10.3 Functional Check

10.3.1 Basic Functional Tests

The basic functional tests with the expected results are described below.

1. Connect a probe, take L743 for example, to the S6 system.
2. The supported diagnostic modes illustrated as large icons are displayed on the screen. Choose a diagnostic mode to start the real time scanning.
3. Enter color mode by pressing CFM key, an area of interest is shown on the screen. Adjust the D Gain from minimum to maximum, ensure that the color flow is always randomly distributed. The color flow should cover the whole area of interest as the D Gain is set to maximum.
4. Press the FREEZE key to enter the freeze mode. Ensure that all displayed data are correct by checking the cine replay.

5. Press M key to enter M mode, press UPDATE key to ensure that the system is working properly in M mode. Make sure that TGC, depth and power control are adjustable. Consult the user manual, if you do not know how to adjust these parameters.
6. Press PW key to enter Power Doppler mode, press UPDATE key and ensure that the Doppler trace is updating. No noise with fixed patterns should appear on the screen.
7. Press THI key, and then UPDATE key, ensure that the system is working properly in the harmonic imaging mode.
8. Press EXAM key to exit from diagnostic mode.
9. Remove the probe from the system.

Repeat the above steps using different probes.

10.3.2 Functional Test for Critical Parts

This system consists of several key units, i.e., keyboard, power supply, computer system and ultrasound module. If the equipment has been shifted more frequently than usual during usage, the electrical and mechanical connections/contacts are most likely to be the cause of problems. It is important for service engineers to check the connections/contacts both before and after servicing the equipment. The following instructions provide general information on how to check some of the critical connections/contacts.

10.3.2.1 Keyboard (7500-0815)

The keyboard can be worn quickly due to heavy daily usage. Ensure that all keys (there should be no stuck keys), knobs, switches and trackball are working properly after re-installing the keyboard.

10.3.2.2 Probe Board (7500-0826)

The probe board (MPC board) serves as the important transmission channel between the probe and the front end (DBF board). J1 and J2 are two 100-pin sockets on the probe board. J1 is connected to DBTR board to transmit ultrasound signals and probe codes. J2 is connected to the power supply to provide power for the switching relay and other ICs.

Connection problems between J1 and DBTR board will most likely lead to dark bars on the diagnostic image or even failure to detect the probe.

Connection problems with J2 will lead to failure to detect the probe, or difficulty with switching to another probe connected at the EXAM screen. Power indicators D10 and D11 will probably not be illuminated also.

10.3.2.3 Motherboard

The computer Motherboard is the central control unit of the S6 system, any faulty part or any faulty connection/contact will cause malfunction of the whole system. Ensure that all the connections/contacts with power supply, RAM, SATA connector, and etc. are good after servicing. Problems with these connections/contacts will lead to startup failure, auto shutdown, no video output, and/or other system malfunctions.

CPU ventilation fan is an easily worn out part, ensure that the paddels are rotating smoothly while the system is operating.

10.3.2.4 Ultrasound unit

Ultrasound unit (consists of DBTR board, DBF board and DBHV board) takes most duties concerning signal processing and sequence control. Good connections between these boards inside the ultrasound unit should be guaranteed. Among the connections from the Ultrasound unit to other units/parts, the following two are the most critical.

(1) USB2.0 Connection:
Ultrasound unit connects to Motherboard through USB2.0 port on the DBF board. This connection is critical for the normal operation of the system. A bad connection will cause the system to crash, auto shutdown and/or other serious system failures.

(2) Power Supply Connection
All the power consumed by the Ultrasound module is transferred through P3 and P4 (or P1 and P2 in some models) both on the DBHV board (7500-0822-XX). The current flowing through these connectors, therefore, are quite large. Bad connection increases the node resistance and reduces the voltage supplied to the Ultrasound unit, or even worse, it will cause the connector to burn. To avoid these problems, observe these precautions: 1) Hold the connector not the cable when disconnecting. 2) Ensure good contacts at P3 and P4 (or P1 and P2 in some models).

10.4 Common Problems and Service Instructions

Note: If the system is locked up and requires a password to continue at startup, type the password (press Shift key to change alphabet case) and press Enter key (not SET key!), then restart the system. The password, provided by SonoScape, consists of alphabets and numbers, and is case sensitive.

⚠ Attention!

After the system is powered on, if it shows abnormal startup screen or enters a diagnostic mode even without user's intervention, it is likely that the keyboard is not working properly. Test the keyboard (all hard keys, knobs and flip switches) before searching for the problem resolution elsewhere.

10.4.1 Repairing Procedures

A. Field Test

Get detailed information on the equipment from the user before testing: symptoms, working environment, frequency of the malfunction, whether the equipment has been moved frequently, and etc.

1. Understand the user's habit of operating the equipment. (Some users turn off the power supply before the system shuts down completely, this can cause software problems.) Make necessary recommendations for the user.
2. Check the power supply: Can the outlet provide the power required by the equipment? Any high power consuming devices connected to the same outlet? ...
3. Check the working environment: Humidity meets the operation requirement? ...
4. If there is burn smell from the equipment, identify the circuit board which has burned. Check power supply and fuse first, and then DBHV board, DBTR board, DBF board, Motherboard, and other parts.

B. Identify the Cause of the Problem

1. Record the symptoms of the problem, the time that the problem occurs, what the user has done after the problem occurs. Make initial guess on the cause of the problem based on your knowledge of the equipment and your experience (any same/similar problems happened before or described in this manual). The Problem Analysis Table in this chapter provides information on some common problems and their solutions.
2. It's recommended to check the connections first, especially the connectors and cables attached to hard disk drive, Motherboard, DBF board and power supply. Normally you should look for bad contacts and worn out cables.

C. Repair the Equipment

1. Replace only the part/element that causes the problem.

2. If you are uncertain about which component causes the problem, replace them one by one and re-test after each replacement until the problem is solved. Replacing all the components before re-test is NOT recommended. Fasten the wires/cables to the original place, if possible, to avoid introducing extra noise into the circuits.
3. Attach the connectors in the correct way: write down the arrangements for each connector before removing it.
4. After replacing all the necessary parts, put in all the screws, drive them tightly.
5. Never leave a free or loose screw inside the equipment.

D. Post-Service Instructions

1. After servicing the equipment, the service engineer should run the functional tests (described in section 10.3) to ensure the proper operation of the equipment.
2. Ensure that the system works normally in different diagnostic modes. Adjust various parameters (dynamic range, gray scale, gain, display brightness and etc) to meet the user's requirements for the image quality.
3. ON-OFF Test: Turn on and off the equipment several times, and test various diagnostic modes while it is on. Ensure that no problem occurs again. Increase the ON-OFF tests number if an occasional problem has just been resolved. Also check for any potential problems, if find any, resolve them also.
4. If the system has been used for a long time, it is necessary to do some clean work, e.g., clean the dust filter and keyboard (refer to chapter 11).
5. Ensure again that the external power supply meets the requirement.
6. If a workstation is connected, check whether cine images can be transferred to it from the S6 system.
7. Make a detailed record for the whole service process to assist in the future follow-up (maintenance or service). It should include description of the problem, replaced parts and corresponding part numbers and detailed repairing procedures. A signature from the hospital director on the service record is compulsory.

10.4.2 Problem Analysis

The common problems, divided into categories of startup problems (page 10-7), operating problems (page 10-9) and shutdown problems (page 10-13), and their solutions are provided in the following tables. You may take them for reference. However, you should analyze the problem on site with care, it may be caused by a different faulty part!

❄ Startup Problems

Problem	Symptoms	Suggested Solutions
Unable to turn the system on	There is no response after pressing the power button. The keyboard is not illuminated.	Check the following items: the power cord is correctly connected; the mains power switch on the back panel is switched on; the input voltage level meets the requirement. Check if the fuse is blown out. If nothing abnormal is found in the previous checks, replace the power supply.
Prompt for password	After POST, a prompt for password appears.	Check for any stuck keys, clean the dust on keyboard.
LILO–Keytable read/checksum error appears after startup	The message is displayed after POST.	Check keyboard and HDD for any defects. Update software if necessary.
System freezes at 40% booting up	The system freezes at the 40% loading screen.	Most likely to be caused by a faulty DBF board.
Unable to turn the system on	Power switch and monitor LED indicator are illuminated. The keyboard lights flash once after the power button is pressed, the system is not turned on.	Check for any burning smells from DBHV, DBTR, power supply and etc.
Auto shutdown	The system auto reboots at the 95% loading screen.	Check for the DBF board and the Motherboard malfunctions. Check for bad connections of USB and power supply.
Brown screen after system booting up - I	A brown screen, with the message: "Verification error", appears after startup. Restart the system always leads to this error: "SVF: open data file error."	It's most likely caused by the DBF board malfunction.
POST failure	System fails the power on self test. Unable to turn off the system normally.	Check if it's caused by a faulty DBF board by disconnecting the USB cable attached to the DBF board.
Black screen	The system freezes at a black screen after startup.	Long-press the power button to turn the system off. Restart the system. If the same problem occurs even after restarting several times. Reinsert the RAM or replace it if necessary.
Unable to enter Linux interface	The following message appears on the screen after showing the logo: Mandrake Linux release 9.1 (Bamboo) for i586 kernel 2.6.8.1-12 mdklcustom on an i686/tty4 localhost login:"	Update the software.

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Startup Problems: continued from previous page

Problem	Symptoms	Suggested Solutions

Brown screen after system booting up - II	The screen turns brown, displaying the following messages after startup:
	`ID=0.2`
	`Cmd Ack Timeout Exp=3,Res=1`
	`Command IN Ack Timeout`
	`EC Header Corrupted (255)!`
	`Swap IN pingpong 1...`
	`Flag=0`
	`Send our dummy packet...`
	`Flag=1`
	`wap IN pingpong 2...`
	`Flag=0`
		Restart the system several times to check if the same problem occurs.
		If the problem does occur again, update the software.
		If the problem persists, it might be caused by the DBF board malfunction.

Freezes at the booting up screen	The system freezes at the "System Booting" screen.	Update the software.
Slow start up	Blue screen appears after the system is turned on. The system is able to enter the EXAM screen after restarting three times, however, startup process may take more than 10 minutes.	Update the software. If the update fails, or the update does not solve the problem, replace the HDD with another one which has the updated software installed in.

❄ Operating Problems

Problem	Symptoms	Suggested Solutions
Diagnostic mode icons are flashing.	At the EXAM screen, the diagnostic mode icons of a probe are flashing.	Replace the probe or try another one. Check for bad contacts and cold soldered joints on the probe board and the DBTR board. Check for bad connections between the DBHV board and the Motherboard.
Unable to switch probes	Unable to switch the probes, or the switching is only "partial".	Check if the probe board works normally. Check if there are sounds when switching probes. Check the connections/contacts between the probe board and the DBTR board.
The probe icon does not match the actual probe connected.	Unable to detect the probe and/or the probe icon does not match the actual probe connected.	It's most likely caused by the DBF board malfunction.
Artifacts with triangular shapes appear in the near field.	White triangular wave liens and/or triangular dark shadows appear in the near field.	It's most likely caused by the DBF board malfunction.
Image stratification	The real time image is stratified in the vertical direction.	It's most likely caused by the DBF board malfunction.
Dark lines appear on the real time image.	The dark lines, 0th, 2nd, 4th, 64th, 66th and 68th appear on the screen when the depth is set to 241mm, the 0th and 64th dark lines are flashing. When setting the depth to the minimum value, only the 2nd and 66th dark lines appear.	It's most likely caused by the DBF board malfunction.
Actual scan depth is less than system specification.	In the B mode, the actual scan depth is limited to the near filed; the far field may not be resolved.	It's most likely caused by the DBF board malfunction. However, a faulty DBHV board is also known to cause the same problem.
Blood flow is not shown	Blood blow is not shown in the color mode.	Check for DBF board problem, if not problem found, check the DBHV board.
Artifacts with radiation lines' shape	Artifacts with radiation lines' shape appear in the real time image.	It's most likely caused by the DBF board malfunction.
Left and right parts appear to have different brightness.	Left and right parts of the real time image appear to have different brightness.	It's most likely caused by the DBF board malfunction.
Mirror artifacts	Mirror artifacts appear on the real time image.	It's most likely caused by the DBF board malfunction.
Dark near field	On the real time image, the near field is totally dark.	Check whether the various voltages, especially the HV output, on the DBHV board are normal. Check for DBTR board problem.

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Operating Problems: continued from previous page

Problem	Symptoms	Suggested Solutions
System crashes frequently and gain knobs are not working.	System crashes frequently. Sometimes gain potentiometers are not working in real time diagnostic mode.	It's most likely caused by the DBHV board malfunction.
System crashes frequently.	The system crashes frequently. The keyboard is not responsive. Small vibration can cause the system crash to a black screen.	Check for any bad connections between the DBF board and the Motherboard. Check the cables attached to the DBHV board.
Dark Image	The screen turns dark abruptly accompanied by abnormal noise. Darkened screen appears after restart.	Connect an external VGA monitor. If this monitor shows darkened screen, a faulty DBHV board probably caused this problem.
Dark Image. Blood flow is poorly resolved.	The diagnostic images, associated with the high frequency probes, are dark. The C344 and 2P1 images are dark while in the THI mode. The blood flow is poorly resolved even in the duplex modes with CFM or DPI.	It's most likely caused by the malfunction of the DBHV board and the DBTR board.
Real time image has poor resolution.	In a diagnostic mode the near field information is not shown, the far field is poorly resolved.	It's most likely caused by the malfunction of the DBHV board and the DBTR board.
No real time image	No ultrasound images sometimes.	It's most likely caused by the malfunction of the DBHV board and the DBTR board.
Dark image No color flow	Unable to increase the B mode gain. The ultrasound image, including the near field, is extremely dark. Putting the system in CFM or PW mode seems to bring no change.	It's most likely caused by the malfunction of the DBHV board and the DBTR board.
Color artifacts	Color artifacts appear for some probes: L741 and/or 2P1.	It's most likely caused by the malfunction of the DBTR board.
Dark bands artifacts	Dark bands in symmetrical pattern appear on real time images.	It's most likely caused by the malfunction of the DBTR board. However, a faulty probe board (MPC board) is also known to cause the same problem.
No echoes	No echoes detected.	If other probes are working properly on the system, replace this one.
Dark bands artifacts while moving probes	Dark bands appear while moving the probes.	If other probes are working properly on the system, replace this one.

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Operating Problems: continued from previous page

Problem	Symptoms	Suggested Solutions
Shadows on both sides of the real time image	Only central area of about 40 degrees is shown in the ultrasound image; the left and right sides of the image are covered by shadows.	If other probes are working properly on the system, replace this one. (Probably caused by array element failure.)
White block artifacts	A white block appears at the upper left near field.	Connect another probe to the same port. If this one works properly, the previous probe should be replaced.
Trackball malfunction	The SET key is not responsive. The UPDATA key is not responsive. The cursor is not responding while moving the trackball.	Turn off the system. Clean the trackball and restart the system. If problem persists, replace the trackball.
Keyboard not responsive	The keyboard is not responsive after the system enters a diagnostic mode.	Check if the keyboard is illuminated. Check the connections to keyboard circuit board. If nothing abnormal found, replace the keyboard circuit board. (The problem is probably caused by MCU data loss, reprogram the MCU will solve the problem.)
Some keys are not responsive.	The keyboard is not working properly, some keys, such as PW, CW, M, Depth, are not responsive.	Check if the keys are stuck or filled with dust. Clean the keyboard, update the software, remove and reconnect the chassis unit, if the problem persists, replace the keyboard (the chassis unitor the faulty crystal oscillator might be the cause of the problem.)
Enter the freeze mode unexpectedly	Freeze key malfunction: the system enters freeze mode automatically during the real time scanning, and sometime the Freeze key is not responsive.	Check if the Freeze key is stuck, or with too much dirt. If nothing abnormal found, replace the keyboard and the silicone rubber keypad.
Images are displayed on the workstation through S-VIDEO connection	Nothing displayed on the workstation's monitor after connecting the S-VIDEO.	Check whether other output, VGA and VIDEO, are working. Check for any defects on the IO panel.
Auto shut down	The system shuts down automatically during normal operations (e.g. in the middle of measuring, inserting USB disk, and freezing the real time scanning.)	Refer to 10.5.1 Item D to perform ON-OFF Test several times. Determine if the same operation leads to the problem. Also record the frequency that the problem occurs and how to reproduce the problem. Send the written report back to SonoScape. Update the software.

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Operating Problems: continued from previous page

Problem	Symptoms	Suggested Solutions
Distorted display	The displayed images gets shrunk, scaled or distorted.	Test with an external VGA monitor. If no problem is shown, this implies that the monitor on the system is not functioning properly.
Monitor problem	The colors displayed on the system monitor change abruptly, however, the external monitor connected at the same time works properly.	Replace the monitor on the system.
No display	Nothing displayed on the system monitor, however, the external monitor connected at the same time works properly.	Check the cables attached to the system monitor. If no connection problem is found, replace the system monitor.
The printer is not working.	The printer does not respond to the Print key on the system.	Check printer power cord and data cables. Check the printer ink level. Ensure that the ezNetwork function in DICOM setting interface has been enabled.
PC connection problem	The S6 system is not detected on the PC.	Check if ezNetwork in DICOM interface has been enabled. Check if the IP address settings are correct (refer to 9.2.3).
Unable to print in color with color video printer	Unable to print in color with color video printer.	Check for S-VIDEO connection problems and if S-VIDEO cable is too long. Replace S-VIDEO cable if necessary.
Auto shutdown	The system automatically shuts down while working, or is turned off without showing the shutting down window.	Check for any bad connections/contacts at the power supply ports. Replace the power supply if necessary.
Auto restart	Hit the hard keys will auto restart the system.	Check for any bad contacts/connections with the power supply. Replace the power supply if necessary.
System crash	The system crashes frequently. Especially while switching the probes, a blue screen appears; the system is not responding to the keyboard activities, and auto shuts down after about 5 minutes.	Update the software
Unable to shut down	The system won't shut down after the POWER button on the side panel is pressed. Need to use the mains power switch to turn off the system.	Update the software

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Operating Problems: continued from previous page

Problem	Symptoms	Suggested Solutions
System freezes	After being in Freeze mode for several hours, the system is not responding to the FREEZE key, or any other keyboard inputs. Need to use the mains POWER switch on the rear panel to turn off the system. The system seems to be working normally after restarting.	Update the software
Slow system response.	Startup takes too much time (a 30 minutes' startup has encountered by a customer). The system is responding slowly. While saving images is normal, reading may take as long as 30 minutes.	Update the software. If problem persists, replace the HDD.

❄ Shutdown Problems

Problem	Symptoms	Suggested Solutions
Unable to turn off the system normally	The system won't shut down after the POWER button on the side panel is pressed.	Press the power button for a few seconds until the system is powered off. Reinstall the system if the same problem occurs frequently.
Shutdown ends up with a Linux interface	After POWER button is pressed, a Linux interface appears instead of normal shutdown window.	Press the power button for a few seconds until the system is powered off. Reinstall the system if the same problem occurs frequently.
Freeze at shutdown window	After POWER button is pressed, the system freezes at the shutting down window.	Press the power button for a few seconds until the system is powered off. Reinstall the system if the same problem occurs frequently.
Unable to turn off the system even long-press the POWER button	The system won't shut down even long pressing the POWER button on the side panel.	Use the mains power switch on the rear panel to power off the equipment. Reinstall the system and update the software.
Keyboard remains illuminated	Unable to turn off the system completely: after POWER button is pressed, the monitor turns dark but the keyboard remains illuminated.	Replace the RAM. Update the software.

Chapter 11

System Maintenance

11.1 Backup

To avoid data loss due to unexpected system breakdown, it is highly recommended to make backups of critical files (cine files and patient data.) regularly and before updating. The backups can be saved to a CD/USB disk. Please follow these procedures to make backups:

1. Connect a writable CD/USB disk to the S6 system.
2. Enter the file manager window.
3. Click Patient Folder or General Folder icon to open it.
4. Select the files to be backed up and click COPY button.
5. Click "Go to Patient Directory" at the upper left corner of screen.

11.2 Host Maintenance

⚠ Warning!

- *Disconnect the system from the power supply outlet/socket before maintenance to avoid electrical shock or equipment damage.*
- *Ensure that the system is in freeze mode or has been turned off before removing/connecting a probe.*

- Clean the keyboard, system covers and monitor with either dry cloth or damp cloth soaked in mild soap water. Protect the electric parts from drip water.
- Remove and clean the dust filter at the rear of the system periodically (a least once every half a year). Reinstall the dust filter after it is dry.

⚠ Warning!

Stop using the system immediately if any liquid drops into the system! Turn off the system completely by disconnecting the power supply cord. Inform your service engineer authorized by SonoScape as soon as possible.

- Examine the ground cables periodically (at least once every half a year), to ensure that the grounding system meets the safety requirements.

△ Attention!

For disposal of the equipment, hand it over to SonoScape or a local representative of SonoScape!

Follow the procedures below to clean the system monitor, the keyboard and the outer surfaces of the equipment:

1. Remove all the cables (including the power supply cords) connected to the system.
2. Wipe the surfaces with damp cloth soaked with mild soap water.

△ Attention!

The keyboard, the interior part of the system, and the probe socket must be protected from drip water.

3. Clean dust and grime on the keyboard with a cotton mud or a toothpick.
4. When a contagious substance, e.g. blood, contacts part of the system or the system cables (EXCEPT the probe and the probe cable!), clean and disinfect that part with damp cloth soaked in isopropanol solution (70%).

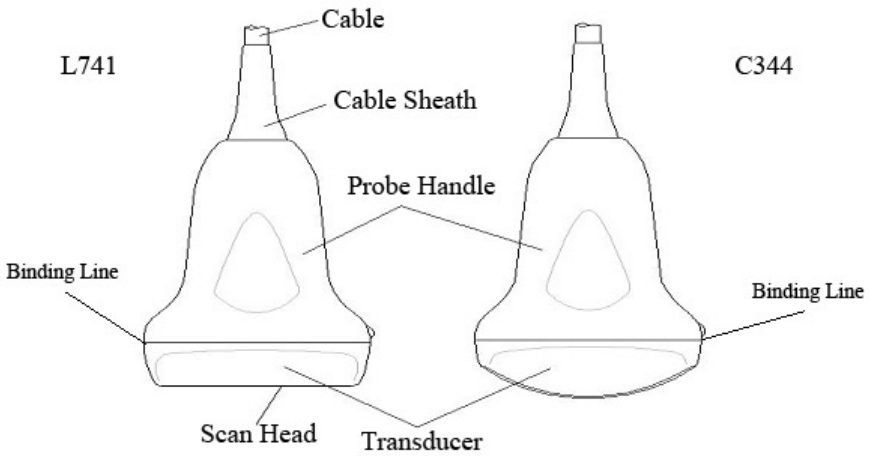
△ Attention!

When a contagious substance, e.g. blood, contacts the probe or the probe cable, use the germicides stated in the Probe User Manual for cleaning and disinfecting. But DO NOT use the isopropanol solution, as it will damage the probe and the probe cable.

5. Remove all residue with damp cloth soaked in sterile water.
6. To avoid corrosion damage, keep the system dry.

11.3 Probe Maintenance

The illustrations of a linear array probe and a convex array probe are shown below,



- The probe is very sensitive to vibrations, handle the probe with care to prevent any collision damage.
- The system must be in the freeze mode, at the EXAM screen or turned off when removing/connecting the probe.
- Avoid scratching the probe head.
- Clean the probe with soft cloth or wet sponge soaked in potable water. Do not use solutions containing alcohol or any other organic solvent (e.g. diluent).
- If any evidence of wear on a probe is discovered, you should stop using this probe immediately and contact service engineer as soon as possible.
- Turn the switch lock in the indicated direction as shown on the probe connector when connecting the probe.
- Avoid winding or stretching the probe cable excessively while using the probe.
- Use only the quality couplant to avoid damaging probe head.

11.4 Cleaning and Disinfecting Probes

⚠ Warning!

- *Disconnect the probe from the host before cleaning or disinfecting.*
- *When cleaning or disinfecting the probe, do not immerse it beyond the binding line.*

11.4.1 Cleaning Probes

1. Clean the probe with soft cloth and potable water after use.
2. If the probe surface carries too much residue, remove all visible residue with wet cloth soaked in mild soap water. Remove all soap water residue with damp cloth soaked in potable water.
3. Air dry or dry with a soft cloth.

⚠ Warning!

DO NOT use solutions containing alcohol for cleaning/disinfecting probes.

11.4.2 Disinfecting Probes

1. The probe must be disinfected with liquid chemical germicides that are FDA cleared, such as CIDEX. Prepare, store, use and dispose the germicide solution according to the manufacturer's instructions.
2. Immerse the probe head into the germicide for a time interval longer than 20 minutes but less than 1 hour. The immersion level should below the binding line.
3. After removing the probe from the germicide, rinse it thoroughly with clean, potable water to remove all visible germicide. Dry the probe with a soft cloth.

⚠ Attention!

DO NOT use high pressure steam to disinfect the probe.
DO NOT apply solutions contain ethyl oxides on the probe.
DO NOT use thermal disinfection! Exposing the probe at temperatures higher than 66°C /150°F will damage the probe.
DO NOT immerse the probe beyond the binding line.

Refer to the probe operation manual for more probe-specific instructions.

Appendix A

Make a Bootable USB Key

A.1 Make bootable key directly through PC

A. Turn on the PC, enter BIOS setup; set the first boot device to optical drive. Insert the SonoScape upgrade CD. Save BIOS setting and turn off the system.

B. It's strongly recommended to disconnect any removable disk drives (thumb drive and external hard drive) right now.

C. Insert a USB drive which is to be made bootable. Note that this USB drive will be **FORMATED**, any original data inside will be destroyed!

D. Start up the PC, boot up with the CD. Follow the on screen instruction to make a bootable USB key.

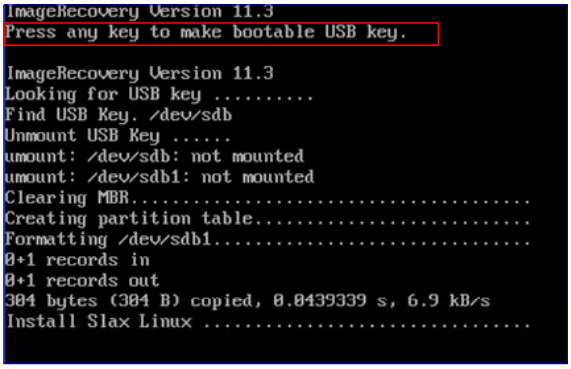


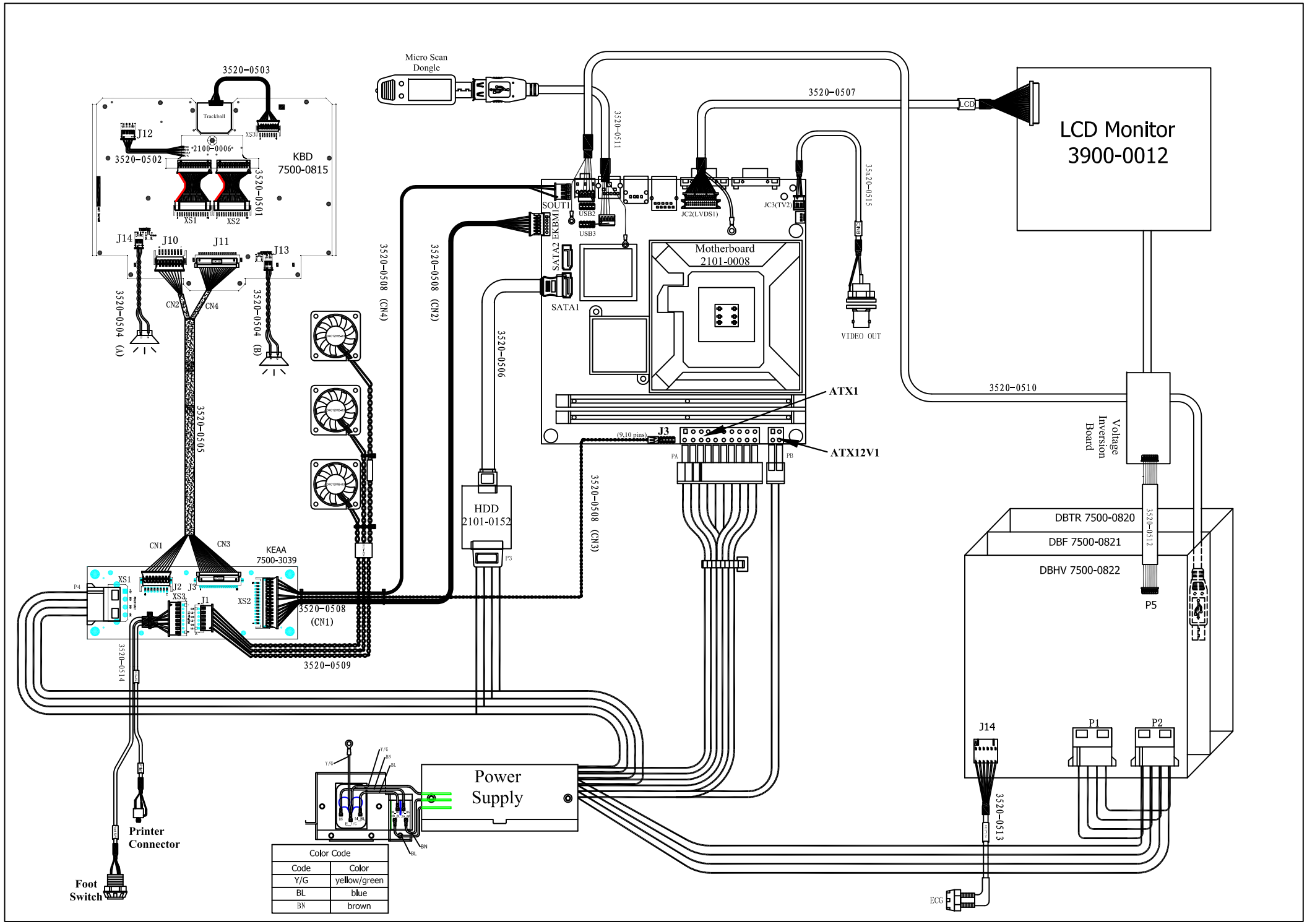
Figure A.1: Making bootable USB key

E. Turn off the system when the writing process completes. The USB drive is now bootable and with kernel written in.

Appendix B

Cables & Wires Inside the System

The figure shown on the next page can be taken as reference for wiring or assembling.


Micro Scan Dongle
3520-0503
Trackball
J12
XS3
2100-0006
3520-0502
KBD
7500-0815
3520-0501
XS1
XS2
J14
J10
J11
J13
3520-0504 (A)
3520-0504 (B)
CN2
CN4
3520-0505
3520-0508 (CN4)
3520-0508 (CN2)
3520-0511
3520-0507
LCD
LCD Monitor
3900-0012
SOUT1
EKBM
USB2
USB3
JC2(LVDS1)
JC3(TV2)
3520-0515
SATA2
SATA1
Motherboard
2101-0008
VIDEO OUT
3520-0506
ATX1
ATX12V1
(9,10 pins)
J3
PA
PB
3520-0510
Voltage Inversion Board
HDD
2101-0152
P3
3520-0508 (CN3)
DBTR 7500-0820
DBF 7500-0821
DBHV 7500-0822
3520-0512
P5
CN1
CN3
KEAA
7500-3039
P4
XS1
J2
J3
XS3
J1
XS2
3520-0508 (CN1)
3520-0509
3520-0514
Power Supply
J14
P1
P2
3520-0513
ECG
Printer Connector
Foot Switch
Y/G
BN
BL
Color Code
Code
Color
Y/G
yellow/green
BL
blue
BN
brown