

**EDAN**

**F9**

Fetal & Maternal Monitor  
Release 1.3

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CE 0123

## **About this Manual**

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## **Statement**

This manual will help you understand the operation and maintenance of the product better. It is reminded that the product shall be used strictly complying with this manual. User's operation failing to comply with this manual may result in malfunction or accident for which Edan Instruments, Inc. (hereinafter called EDAN) can not be held liable.

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EDAN holds the rights to modify, update, and ultimately explain this manual.

## **Responsibility of the Manufacturer**

EDAN only considers itself responsible for any effect on safety, reliability and performance of the equipment if:

Assembly operations, extensions, re-adjustments, modifications or repairs are carried out by persons authorized by EDAN, and

The electrical installation of the relevant room complies with national standards, and

The instrument is used in accordance with the instructions for use.

Upon request, EDAN may provide, with compensation, necessary circuit diagrams, and other information to help qualified technician to maintain and repair some parts, which EDAN may define as user serviceable.

# **Using This Label Guide**

This guide is designed to give key concepts on safety precautions.

## **WARNING**

A **WARNING** label advises against certain actions or situations that could result in personal injury or death.

## **CAUTION**

A **CAUTION** label advises against actions or situations that could damage equipment, produce inaccurate data, or invalidate a procedure.

## **NOTE**

A **NOTE** provides useful information regarding a function or a procedure.

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# Chapter 1 Warranty and Service

## Standard Service

EDAN provides a one-year-warranty for the warranted products (accessories are included). The warranty period begins on the date the products are shipped to customers. If a customer promptly notifies EDAN of customer's warranty claim hereunder, EDAN will either repair, adjust or replace (with new or exchange replacement parts) EDAN's products. EDAN warrants that any service it provides to customers will be performed by trained individuals in a workmanlike manner.

## Limitation of Warranty

Direct, indirect or final damage and delay caused by the following situations for which EDAN is not responsible may void the warranty:

- ✧ Groupware is dismounted, stretched or redebugged.
- ✧ Unauthorized modification or misuse.
- ✧ Damage caused by operating beyond the environmental specifications for the medical product.
- ✧ Change or remove original serial number label or Manufacturer symbol.
- ✧ Improper use.

## Service Procedure

### (1) Fill in the **Service Claim Form (SCF)**.

Fill in the SCF with detailed information including: **Model Name, Serial Number (SN)** and **Problem Phenomena**.

EDAN should not have any obligation to take over the case without this information. The form can be downloaded at: <http://www.edan.com.cn> or obtained from EDAN's Service Department.

### (2) Send EDAN the SCF and Select a Solution.

Once the service department receives the fully filled SCF, EDAN's engineer will offer a solution in three working days. EDAN will follow out the case based on the two conditions below:

***Within Warranty:***

There are two options:

- i) After receiving the **Return Material Authorization (RMA)** form from EDAN service department, the customer sends EDAN the defective parts and informs about the shipment tracking number. Then we will dispatch new part(s) to your confirmed address with confirmed shipping invoice.
- ii) The customer signs the **Declaration Form** and sends it back by email or fax. This form is legally certificated to make sure the customer or end-user will return the defective parts to EDAN on time. We will, at this option, dispatch the replacement one(s) with confirmed shipping invoice.

***NOTES:***

- 1 Both Return Material Authorization Form and Declaration Form are offered by EDAN service department once the SCF is confirmed by service engineer.
- 2 The customer is responsible for freight & insurance charges when the equipment is shipped to EDAN for service, including custom charges. EDAN is responsible for the freight, insurance & custom charges from EDAN to the customer.

***Out of Warranty:***

After receiving the RMA form from the service department, the customer sends defective parts to EDAN in advance. We will analyze the problems and discuss with the customer about either repairing or replacing the part(s). Once the maintenance fee is invoiced and paid, we will make sure to dispatch good part(s) to the confirmed address.

**NOTE:** The customer is responsible for any freight & insurance charge for the returned product.

**(3) Obtain the RMA Form.**

Before the shipment of the materials, the customer must obtain an RMA form from our service department, in which the RMA number, description of returning parts and shipping instructions are included. The RMA number should be indicated on the outside of the shipping container.

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**NOTE:**

EDAN should not have any obligation to the end-user or customer who returns the goods without the notification by EDAN's service department. The sender takes full responsibility for the accounted fee.

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(4) Send the Parts to EDAN.

Follow these recommended instructions:

- ✧ Please disassemble the parts with anti-static facility, do not touch the parts with naked hand.
- ✧ Please pack the parts safely before return.
- ✧ Please put the RMA number on the parcel.
- ✧ Please describe the returned parts as 'sample of \*\*\*\*\*' and put the total value on the invoice, and note on the invoice as 'sample, no commercial value'.
- ✧ Please confirm the invoice with EDAN before shipment.
- ✧ Please send back the parts after EDAN's confirmation.

#### Contact Information

If you have any question about maintenance, technical specifications or malfunctions of devices, do not hesitate to contact us.

EDAN Instruments, Inc.

TEL: +86-755-26898321, 26899221

FAX: +86-755-26882223, 26898330

E-mail: [support@edan.com.cn](mailto:support@edan.com.cn)

## Chapter 2 Overview

### NOTE:

This service manual is written to cover the maximum configuration. Therefore, your model may not have some of the parameters / modules described, depending on what you have ordered.

### 2.1 Introduction

This service manual is a reference for periodic preventive maintenance and corrective service procedures for the F9 fetal & maternal monitor.

It provides troubleshooting information, assembly procedures, instructions for functional testing and performance verification. It is intended for use only by technically qualified service personnel.

#### **WARNING**

When performing a service procedure, follow the instructions exactly as presented in this manual. Failure to do so might damage the monitor, invalidate the product warranty or lead to serious personal injury.

### 2.2 General Information

- ◆ F9 Fetal & maternal Monitor (hereinafter called F9) is designed to comply with the international safety requirements IEC/EN 60601-1 for medical electrical equipment. It is class I equipment.
- ◆ The protective categories against electric shock of the patient connections are:



- 1) Ultrasound (FHR1, FHR2)
- 2) External TOCO
- 3) Remote Event Marker (FM)
- 4) Fetal Stimulator (FS)

This symbol indicates that the electric shock defending grade of this instrument is Type B.



- 1) IUP
- 2) NIBP
- 3) SpO<sub>2</sub>

This symbol indicates that the electric shock defending grade of this instrument is Type BF.



- 1) DECG 2) ECG 3) TEMP

This symbol indicates that the electric shock defending grade of this instrument is Type CF.

The monitor described in this user manual is not protected against:

- ◆ The effects of defibrillator shocks
- ◆ The effects of defibrillator discharge
- ◆ The effects of high frequency currents
- ◆ The interference of electrosurgery equipment

## 2.3 Safety Precautions

**WARNING** and **CAUTION** messages must be observed. To avoid the possibility of injury, observe the following precautions during the operation of the instrument.

### **WARNING**

- 1 The F9 monitor must be serviced by authorized and qualified personnel only. EDAN does not accept responsibility for safety compliance, reliability and performance if modifications or repairs are carried out by unauthorized personnel. Identical replacement parts must be used.
- 2 The service personnel should be familiar with the operation of this monitor. Refer to *F9 Fetal & maternal Monitor User Manual* for details.
- 3 Perform periodic safety testing to insure proper patient safety. This should include leakage current measurement and insulation testing. The recommended testing interval is once per year.
- 4 Disconnect the power cord before changing fuses. Replace them with the fuses of the same specifications.
- 5 **SHOCK HAZARD** - Do not attempt to connect or disconnect a power cord with wet hands. Make sure that your hands are clean and dry before touching a power cord.
- 6 **SHOCK HAZARD** - Do not remove the top panel cover during operation or while power is connected. Only authorized service personnel could remove the unit cover.

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**WARNING**

- 7 Accessory equipment connected to the analog and digital interfaces must be certified according to the respective IEC/EN standards (e.g. IEC/EN 60950 for data processing equipment and IEC/EN 60601-1 for medical equipment). Furthermore all configurations shall comply with the valid version of the system standard IEC/EN 60601-1-1. Everybody who connects additional equipment to the signal input connector or signal output connector configures a medical system, and is therefore responsible that the system complies with the requirements of the valid version of the system standard IEC/EN 60601-1-1. If in doubt, consult our technical service department or your local distributor.
  - 8 Do not unplug the battery in the course monitoring.
  - 9 Do not connect battery directly to an electric outlet or cigarette lighter charger.
  - 10 Do not solder the leading wire and the battery terminal directly.
- 

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**CAUTION**

- 1 Refer servicing to qualified personnel.
  - 2 The device is designed for continuous operation and is “ordinary” (i.e. not drip or splash-proof).
  - 3 Do not operate the unit if it is damp or wet because of condensation or spills. Avoid using the equipment immediately after moving it from a cold environment to a warm, humid location
  - 4 While the battery is charged, used or stored, keep it away from objects or materials with static electric charges.
-

## Chapter 3 Installation

### **WARNING**

Only qualified service engineers should install this equipment.

### 3.1 Environment Requirements

<b>Working Environment</b>	
Temperature:	+5 °C ~ +40 °C ( +41°F ~ +104°F)
Relative Humidity:	25% ~ 80% (non-condensing)
Atmospheric Pressure:	860hPa ~ 1060hPa
<b>Classification</b>	
Anti-electric Shock Type:	Class I equipment with internal power supply
Anti-electric Shock Degree:	Type B applied parts
Degree of Protection against Harmful Ingress of Water:	Main Unit: Not-protected Transducer: IPX8
Degree of Safety in Presence of Flammable Gases:	Equipment not suitable for use in presence of flammable gases
Disinfection/Sterilizing Method:	Refer to <i>User Manual</i> for details
EMC:	Group I Class A

- ◆ If the monitor is installed in a cabinet, allow at least 2 inches (5 cm) clearance around the monitor for proper air circulation; allow adequate accessibility for servicing, and adequate room for visualization and operation.
- ◆ Ensure the monitor is not subjected to any source of strong electromagnetic interference, such as CT, radio transmitters, mobile phones base stations, etc.
- ◆ Do not install the monitor in a flammable atmosphere where concentrations of flammable anesthetics or other materials may occur.
- ◆ Keep the environment clean. Avoid vibration. Keep it far from corrosive medicine, dust area, high-temperature and humid environment.

## 3.2 Electrical Requirements

Operating Voltage: 100V-240V ~  
Operating Frequency: 50Hz/60Hz  
Input Power: 110VA

## 3.3 Safety Requirements

- ◆ **SHOCK HAZARD-** the power receptacle must be a three-wire grounded outlet. A hospital grade outlet is required. Never adapt the three-prong plug from the monitor to fit a two-slot outlet. If the outlet has only two slots, make sure that it is replaced with a three-slot grounded outlet before attempting to operate the monitor.
- ◆ Do not touch signal input or output connector and the patient simultaneously.
- ◆ Equipment and devices that connect to the monitor should form an equipotential body to ensure effective grounding.
- ◆ Do not switch on the monitor until all cables have been properly connected and verified.

## 3.4 Installing the Monitor

### 3.4.1 Installing the Monitor on a Flat Surface.

Place the monitor on a flat surface. Make sure the surface does not vibrate, and is free of corrosive medicine and dust.



Figure 3-1 The monitor on a flat surface

### 3.4.2 Mounting the Monitor on a Wall

To mount the monitor on a wall,

- 1 Order a wall mounting board (MS1R-107983) and a connecting board (MS1R-107984) from the manufacturer.
- 2 Turn the monitor over and fix the connecting board to the bottom panel using two pan head screws.

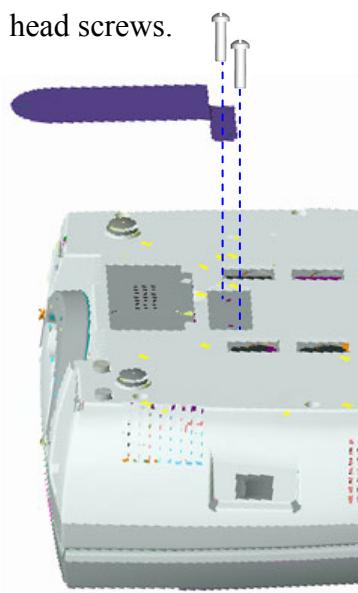


Figure 3-2 Fixing Connecting Board

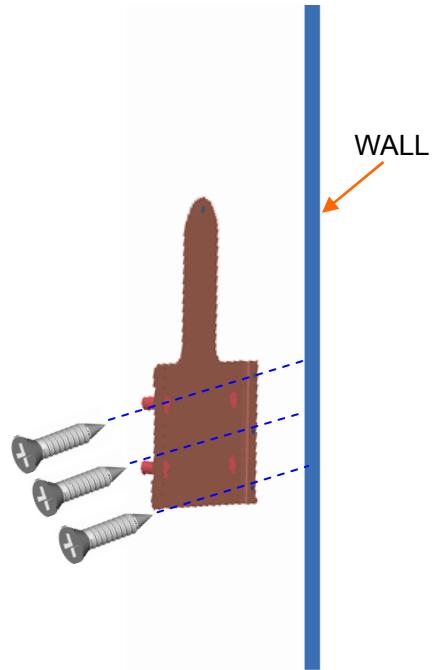


Figure 3-3 Fixing Wall Mounting Board

- 3 Fix the wall mounting board to the wall with six self-tapping screws.
- 4 Lift the monitor with the bottom panel facing the wall. Let the four posts on the board stretch into wall-mounting holes and then release your hands from the monitor slowly.
- 5 Secure the connecting board to the wall mounting board with a pan head screw.



Figure 3-4 Securing Two Boards

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**CAUTION**

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- 1 Shut the display completely flat before mounting the monitor to the wall.
  - 2 Make sure the wall mounting board is firmly fixed to the wall. If there is any doubt, do not hang the monitor to this board.
  - 3 Make sure the monitor is safely hung on the posts of the board before releasing your hands from the monitor.
- 

### 3.4.3 Installing the Monitor on a Roll Stand/Trolley

An Assembling Instruction will be delivered with the roll stand/trolley. Refer to that instruction for details of installing the monitor on a roll stand/trolley.

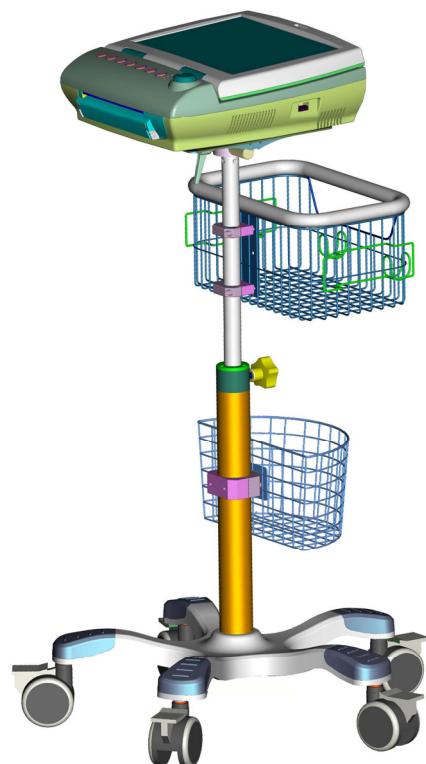


Figure 3-5 The Monitor on a Trolley (Sketch Map)

### 3.5 Connecting to AC Power

Apply the power cable provided with the monitor. Plug one end of the power cable to the power socket of the monitor. Connect the other end to a grounded 3-slot power output special for hospital usage.

## Chapter 4 Functional Checks

This section describes the procedure for a complete functional test to support recommended preventive-maintenance schedules.

Functional checks do not require opening the device case.

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### **WARNING**

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Only qualified service personnel should perform a full functional check procedure.

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Whenever the monitor is serviced or problems are suspected, the manufacturer recommends a full functional check procedure.

### **4.1 Switching on Check**

Press the **POWER** switch on right panel to switch on the monitor.

Check if the power indicator lights up; if a start-up tone is heard. if the screen lights up in a few seconds.

If any failure is detected, refer to section *8.1 Monitor Booting Failures* for details.

### **4.2 LCD Screen Check**

Observe if some characters are missing, or there are bright spots and dark shadows on the LCD screen. Observe if the waveforms, fonts and symbols displayed on the LCD screen are normal.

If any failure is detected, refer to section *8.1 Monitor Booting Failures* for details.

### **4.3 Keys Check**

Press the keys on the front panel to check if they work properly. When pressing a key, a normal key tone should be heard, unless its related function is disabled.

If any failure is detected, refer to section *8.2 Display Failures* for details.

### **4.4 Touch Screen Check**

When the monitor is configured with touch screen, touch any available keys on the screen to check if it is working properly.

If you touch the center of a key but the monitor does not execute the right operation, calibrate the touch screen. Refer to section *5.5 Calibrating Touch Screen* for details.

If any operation failure is detected, refer to section *8.3 Touch Screen Failures* for details.

## 4.5 Printing Check

Press the **PRINT** key to start printing. Check if the recorder starts printing.

Enable the **Print Self-Test** function in the recorder's configuration. Restart the monitor and verify if the recorder prints a baseline.

Enter **DEMO** mode and print some traces and check if all the traces are clear on the paper.

If any failure is detected, refer to section *8.5 Recorder Failures* for details.

**NOTE:**

Please make sure the paper loading and setting are correct before the printing starts.

## 4.6 Alarms Check

Stimulate a signal that is higher than the upper limit or lower than the lower limit to activate a physical alarm. Disconnect one of the plugs to of the monitor to activate a technical alarm. Check if the audible alarms and visible alarms are working properly.

If any failure is detected, refer to section *8.7 Alarm Failures* for defective details.

## Chapter 5 System Configuration

The end users can not change the system configurations of the monitor. As a service engineer, you need to change these configurations for them after the monitor is installed and checked properly.

### NOTE:

Restart the monitor after changing the settings.

### 5.1 Opening System Setup Menu

The system configurations of the monitor are to be changed in the system setup menu. To open this menu,

- 1 Select the setup key  on the main interface.
- 2 Select **System**.
- 3 Input the password **9999** on the soft keyboard.
- 4 Select **Ok** on the soft keyboard.

### 5.2 Entering Demo Mode

The monitor works in real-time monitoring mode when monitoring a patient. If you want to show the traces and parameters for a demonstration, you need to enter the **Demo** mode.

- 1 Open the System Setup menu.
- 2 Select **Demo**.
- 3 Select **OK**.

### 5.3 Reloading Default Settings

The default settings are predefined in the factory. Users can change the monitor setup, but this default configuration stays the same. To reload this default,

- 1 Open the System Setup menu.
- 2 Select **Default**.
- 3 Select **OK**.

## 5.4 Clearing Data

The monitor saves the most recent 24-hour data in its long-term memory automatically. In order to delete this data,

- 1 Open the System Setup menu.
- 2 Select **Clear Data**.
- 3 Select **OK**.

### **NOTE:**

The archives will not be cleared with the data. You may use the archive opening key to delete the archives.

## 5.5 Checking Product Information

The product information menu lists the hardware and software information of this monitor. This information can be very helpful when contacting the manufacturer for service.

To check the product information,

- 1 Open the System Setup menu.
- 2 Select **Product Information**.

## 5.6 Calibrating Touch Screen

### **NOTE:**

Make sure the touch screen is enabled before trying to open the touch screen calibration menu.

When the monitor does not react to each touch on the touch screen properly, calibrate the touch screen by performing the following steps:

- 1 Open the System Setup menu.
- 2 Select **Touch Screen Calibration**.
- 3 Touch the cross mark “X” of button 1.
- 4 Touch the cross mark “X” of button 2.
- 5 Touch the **EXIT** button.



## 5.7 Changing the Device No.

This device No. determines the bedside monitor ID on the data receiving software, such as MFM-CNS central monitoring system of EDAN.

- 1 Open the System Setup menu.
- 2 Select **Network Setup**.
- 3 Select the pane next to **Device No.**.
- 4 Select a device number from 1 ~ 99.
- 5 Select **OK** in the Network Setup menu.
- 6 Select **OK** in the System Setup menu.

### **CAUTION**

Make sure the device numbers of the monitors in the same system do not overlap.

## 5.8 Changing Net Version

This Net version determines the network protocol of monitor when it is connecting to a PC.

Connecting Mode	Other Requirements	Net Version
F9 connects to MFM-CNS via DB9 interface.	MFM-CNS version is V3.0 or higher	<b>RS485 V1.1</b>
	MFM-CNS version is V3.3 or higher	<b>RS485 V1.2</b>

	MFM-CNS version is V3.7 or higher	<b>RS485 V1.3</b>
F9 connects to Insight software via DB9 interface.	---	<b>INSIGHT V1.2</b>
F9 connects to MFM-CNS or Insight software via RJ45 interface.	MFM-CNS version is V3.4 or higher	<b>ETHERNET V1.2</b>
F9 connects to OB TraceVue system of PHILIPS.	---	<b>PHILIPS</b>
F9 connects to MILOU	---	<b>PHILIPS2</b>

- 1 Open the System Setup menu.
- 2 Select **Network Setup**.
- 3 Select the pane next to **Net Version**.
- 4 Select a net version.
- 5 Select **OK** in the Network Setup menu.
- 6 Select **OK** in the System Setup menu.

## 5.9 Configuring Wireless Network

When connecting the monitor to MFM-CNS via wireless network, you need to set wireless channel number and wireless module number:

- 1 Open the System Setup menu.
- 2 Select **Network Setup**.
- 3 Select **Wireless CH**.
- 4 Select a number (6 ~ 31).
- 5 Select **Wireless MOD**.
- 6 Select a number (0 ~ 31).
- 7 Select **OK** in the Network Setup menu.
- 8 Select **OK** in the System Setup menu.

### NOTE:

Refer to *MFM-CNS Wireless Network Installation Guide* for details of setting wireless network.

## 5.10 Configuring for Ethernet Connecting

When connecting the monitor to a PC via Ethernet, you need to set the server IP and Ethernet port:

- 1 Open the System Setup menu.
- 2 Select **Network Setup**.
- 3 Select **Server IP**.
- 4 Set the IP address to be the same as that of the PC.
- 5 Select **Ethernet Port**.
- 6 Set the port number to be the same as that of the software.
- 7 Select **OK** in the Network Setup menu.
- 8 Select **OK** in the System Setup menu.

## 5.11 Changing Trace Width

In order to differentiate the traces clearly, you may assign different widths for different traces.

- 1 Open the System Setup menu.
- 2 Select **Recorder Setup**.
- 3 Select **FHR1**.
- 4 Select a number from **1, 2, 3** and **4**. The width of the trace increases by degrees from **1** to **4**.
- 5 Set width of FHR2, AFM and TOCO traces in the same way.
- 6 Select **OK** in the Recorder Setup menu.
- 7 Select **OK** in the System Setup menu.

## 5.12 Changing Paper Style

The paper style determines the range of FHR trace background pane bar. Observe the recorder paper that the user has ordered, 30 ~ 240 is USA style; 50 ~ 210 is International style.

- 1 Open the System Setup menu.
- 2 Select **Recorder Setup**.
- 3 Select the pane next to **Paper Style**.
- 4 Select the required style from **USA** and **International**.
- 5 Select **OK** in the Recorder Setup menu.
- 6 Select **OK** in the System Setup menu.

---

**CAUTION**

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To avoid inconsistency between FHR traces on the recorder paper and those on the screen, the paper style must comply with the style of the recorder paper being used.

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## 5.13 Changing the Language

The software supports several languages.

- 1 Open the System Setup menu.
- 2 Select **Language**.
- 3 Select the required language.
- 4 Select **OK**.

## 5.14 Changing FHR Algorithm

The **Beat-to-beat** FHR algorithm provides vivid short-term variation information of the fetal heart rate. The **Average** FHR algorithm provides a smoothed FHR trace.

- 1 Open the System Setup menu.
- 2 Select **FHR Algorithm**.
- 3 Select **Beat-to-beat** or **Average**.
- 4 Select **OK**.

## Chapter 6 Maintenance

### 6.1 Maintenance Inspections

#### (1) Visual Inspection

Prior to using the monitor every time, do the following inspections:

- ◆ Check the monitor and accessories to see if there is any visible evidence of damage that may affect patient safety. Pay special attention to the cracks on the transducers and cables before immersing them into conductive fluid.
- ◆ Check all the outer cables, power socket and power cables.
- ◆ Check if the monitor functions properly to make sure it is in good condition.

If any damage is detected, stop using the monitor on the patient. Replace the damage part(s) or contact EDAN for service before reusing it.

#### (2) Routine Inspection

The overall check of the monitor, including safety check and functional check, should be performed by qualified personnel every 6 to 12 months, and each time after service.

The equipment should undergo periodic safety testing to insure proper patient isolation from leakage currents. This should include leakage current measurement and insulation testing. The recommended testing interval is once a year or as specified in the institution's test and inspection protocol.

#### (3) Mechanical Inspection

Make sure all exposed screws are tight.

Check the external cables for splits, cracks or signs of twisting.

Replace any cable that shows serious damage.

Pay particular attention to the supply socket.

### 6.2 Maintenance of the Monitor

Keep the exterior surface of the monitor clean, free of dust and dirt.

The gathering of dew in the screen may occur with abrupt temperature or humidity changes. A

stable environment is recommended.

Do not scratch and damage the screen.

Avoid high voltage and static charge.

### **6.3 Maintenance of the Transducers**

Keep the transducers in a dry environment with the temperature lower than +45°C (+113°F).

Wipe off coupling gel from the ultrasound transducer after use to prolong the life of the transducer.

Handle the transducers with care. Rough handling could damage the cover, piezoelectric crystals and mechanical movement. Contacting the transducers with hard or sharp objects should be avoided.

Do not excessively flex the cables.

### **6.4 Maintenance of the Recorder**

The recorder platen, thermal print head and paper sensing mechanism must be cleaned at least once a year or when needed (when traces become faint).

To clean the recorder:

- 1) Clean the recorder platen with a lint-free cloth and soap/ water solution.
- 2) Wipe the thermal array using a cotton swab moistened with 70% Isopropyl alcohol-based solution.
- 3) Remove dust on the paper sensing mechanism and paper sensor with a dry clean cloth.

---

#### **CAUTION**

---

Only use the recorder paper provided by EDAN, or it may damage the recorder. This kind of damage is not covered by warranty.

---

## Chapter 7 Principle Introduction

### 7.1 Modules Principle

#### 7.1.1 Ultrasound Doppler

The fetal heart Doppler signal detecting is based on Ultrasound Doppler frequency shifting principle. A sound source sends out constant frequency sound wave, the wave transmits in organs and reflects when coming across interfaces. If the interface moves toward the sound source, the frequency of the reflected wave will be different from that of the incident wave: the incident wave's approaching will be translated into an increase in frequency; its receding will cause the frequency to decrease. This is the Doppler Effect. When the Doppler Effect happens, there is a difference between the frequencies of the sent out sound wave and the received sound wave, which is called Doppler frequency Offset ( $f_D$ ).

$$f_D = \pm 2V * \frac{f_0}{C}$$

In this equation  $f_0$  is for the frequency of the ultrasound, C denotes the speed of wave transmitting in the organ, V denotes the moving speed of the interface.

For the fetal heart, the frequency offset of 1 MHz ultrasound source is about  $60 \sim 400\text{Hz}$  (the standard adapted by EDAN). After being demodulating, amplified and filtered, the received ultrasound signals (the filter has a passband of  $60 \sim 400\text{Hz}$ ) are translated into fetal Doppler frequency offset signals. For the convenience of calculating, we envelope these signals after that. Then DSP does autocorrelation calculation to the A/D sampled results and figure out the fetal heart rate.

#### 7.1.2 Fetal movement Doppler Signal Detecting Principle

When the sound source is 1MHz ultrasonic, the frequency offset ( $f_D$ ) of fetal movement is about  $10 \sim 40\text{Hz}$ , the flow of signal processing is the same as that of the fetal heart detecting. The algorithm applied currently is squaring the A/D sampling results and taking the average value as the fetal movement signal intensity.

#### 7.1.3 Pressure Detecting Principle

The pressure detecting applies the Wheatstone bridge circuit. Refer to figure 8-1, the pressure signal has been transformed into voltage signal for measuring. Two pressure stain gauges R1 and R8 are installed on both sides of the spring, the spring's being forced causes the resistance of R1

and R8 to change, one increases the other decreases, and the increment equals to the decrement. Apply voltage at E1 and E4, change of resistance becomes change of voltage. The formula is:

$$E2 = \frac{\Delta R}{R1 + \Delta R + R8 - \Delta R} (E1 - E4) = \frac{\Delta R}{2R} (E1 - E4)$$

In the formula, R denotes the resistance of R1 and R8 when there is no distortion ( $R1=R8$ ). Amplify the difference between E2 and E3 with an apparatus amplifier, now the change of pressure has become change of voltage, which is simple for the system to measure.

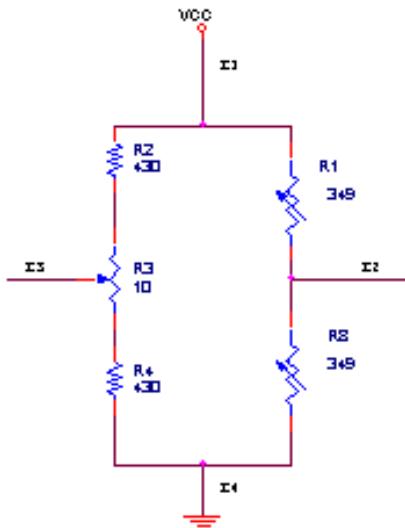


Figure 7-1 Internal circuit in TOCO transducer

#### 7.1.4 DECG Module Principle

DECG measuring principle: collect DECG signals through spiral electrode; amplify and filter them with Front-End circuit; the microprocessor calculates the fetal heart rate; transfer the fetal heart rate and original wave data to the main control board through serial port.

IUP measuring principle: sense the pressure of inner uterine with the IUP transducer; transform the pressure signals into electricity signals; amplify and filter them with Front-End circuit; the microprocessor calculates the pressure; transfer the result to the main control board through serial port.

## 7.2 The System Principle Block Diagram

F9 monitor consists of the main control board, fetal monitor (FM) module, DECG module, print board, power module, key board, LCD and corresponding interface boards. Here is the system principle block diagram:

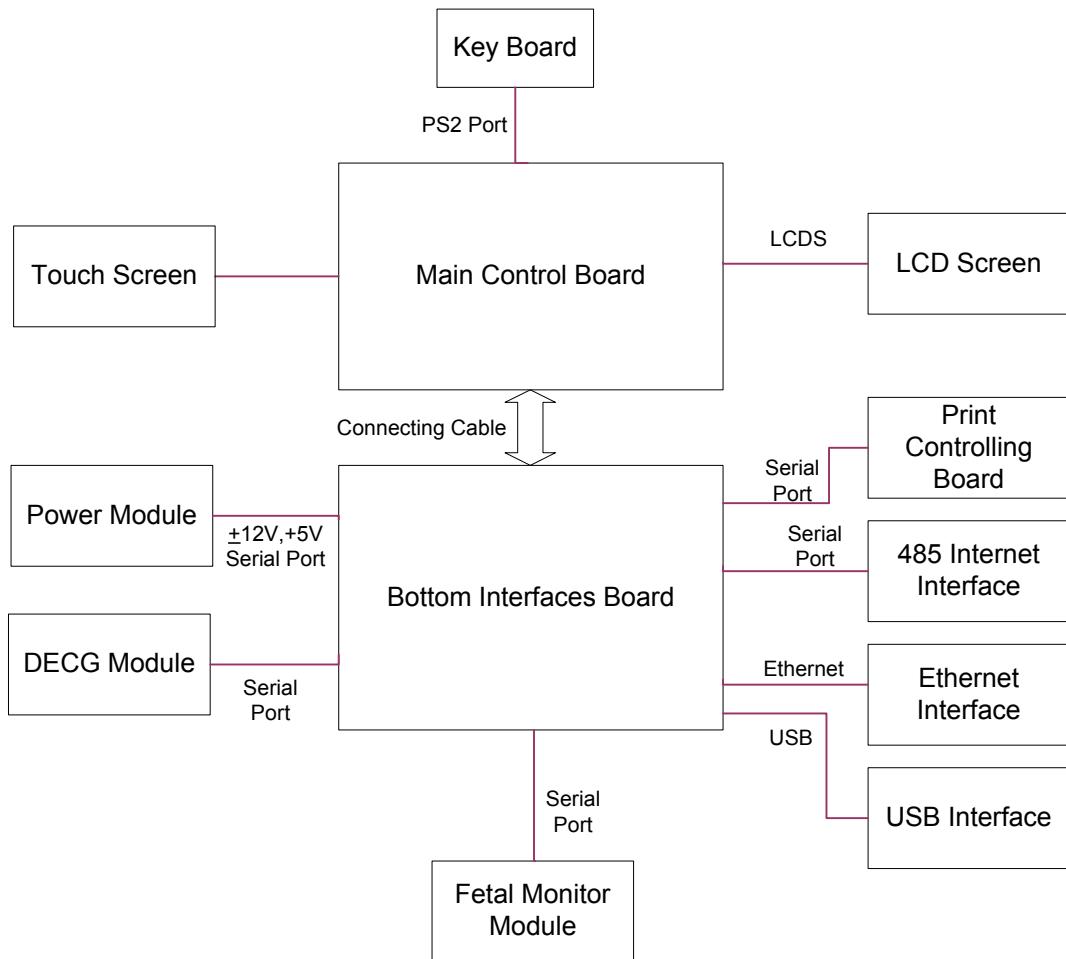


Figure 7-2 The system principle block diagram

### 7.2.1 Main Control Board

The main control board applied in F9 is the 2410 main control board. It fulfills the following function: key input control, LCD display, process print, audio alarm and led indicate light alarm, data memorize and recall, time and date management, communication with the internal modules, etc.

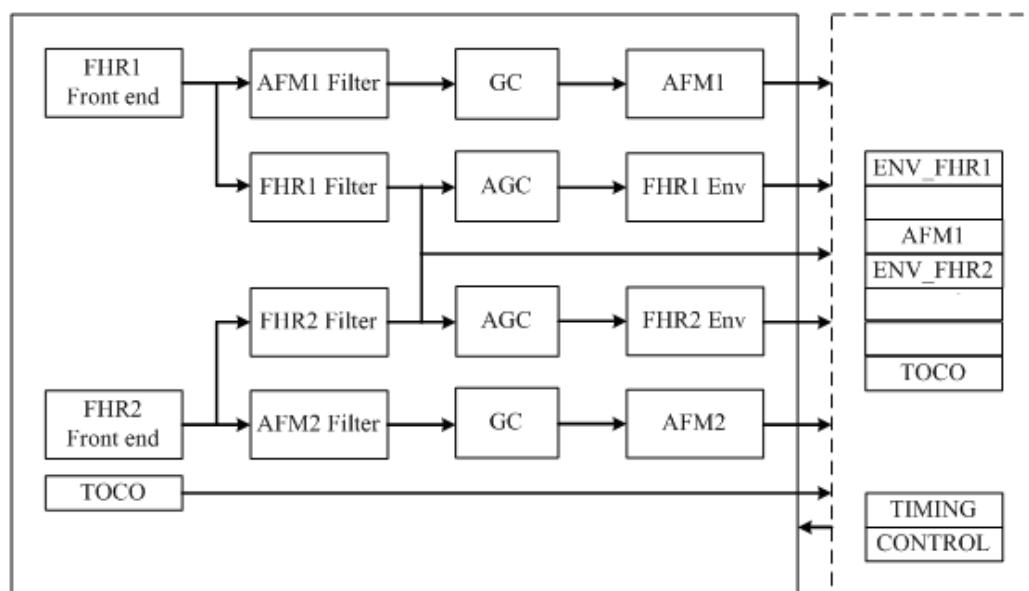
The parameters of this main control board are listed below:

Power	5V, 12V
Processor	S3C2410A Work frequency: 266MHz / 200MHz External bus frequency: 1/2 or 1/4 of main frequency Dictate Cache: 16K bytes Data Cache: 16K bytes
Net Port	10M Standard Ethernet port
Parallel Port	1 parallel port, with CENTRONIX subclass interface definition

EMS Memory	SDRAM: 64M byte Flash: program 8M bytes + data 64M bytes
Serial Port	Configure in 5 serial ports and 9 serial ports way
Headphone Interface	Loudspeaker output
Touch Screen Interface	1 interface.
USB	1 standard USB HOST interface, 1 standard DEVICE interface (1.1 specification)
VGA	1 VGA output port, standard VGA outputting
LCD	1 TFT LCD interface, 1024*768 (highest resolution)
Keyboard	1 PS/2 keyboard interface
GPIO	At least 10
Watchdog Timer	1.6s
Power Consumption	700mA @ +5V (max)
Size	142 mm×105 mm
Operating System	Linux

## 7.2.2 Fetal Monitor Module

The main function of the fetal monitor module is to detect FHR, AFM and TOCO, a new function of collecting and playing back audio signals is added. Refer figure 7-3 for its system structure block diagram, power, simulating front circuit, ADC, audio processing circuit and digital circuit are included. Signal detecting is divided into three branches: two fetal hearts and fetal movements detecting and a TOCO (pressure on the pregnant woman's abdomen) detecting.



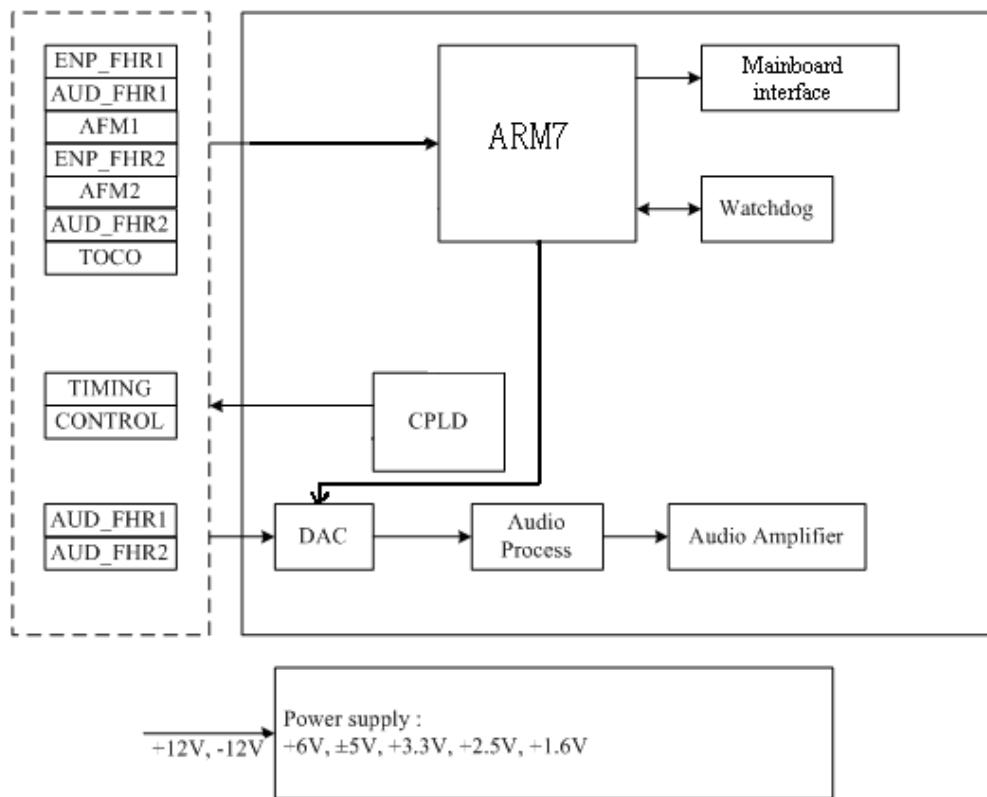


Figure 7-3 Fetal monitor module circuit block diagram

### 7.2.3 DECG Module

The DECG module fulfills the function of DECG detecting, TOCO and intrauterine pressure measuring, then send the results to the main control board through serial port.

### 7.2.4 Print Controlling Board

The print controlling board is in charge of receiving data from main control board and driving the thermosensitive print head to print. Its structure block diagram is as follows:

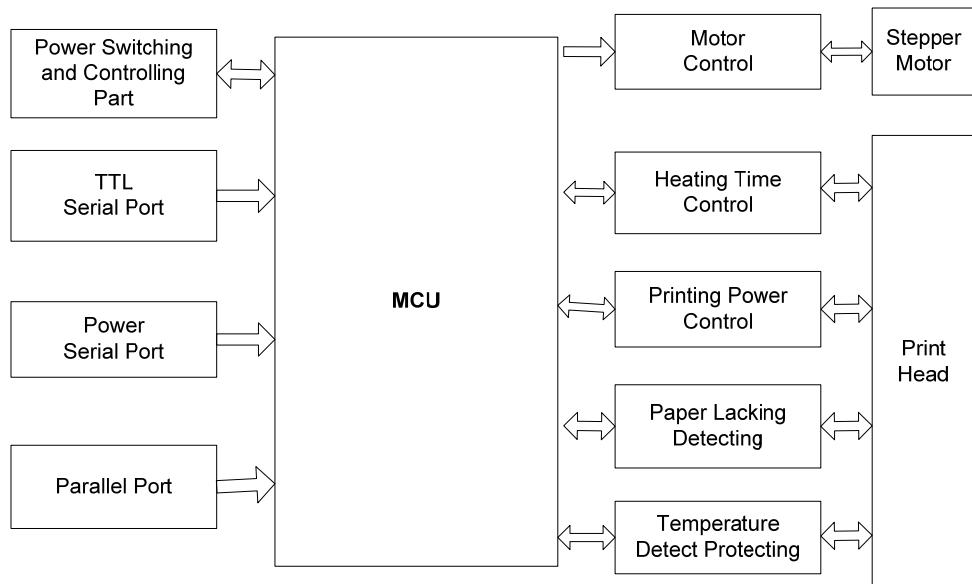


Figure 7-4 Print controlling board principle block diagram

The F9 recorder module includes: microprocessor MC9S12A64 circuit, power switch and control, communicate interface, motor control part, recorder paper detecting circuit, time control for printing power and heating, paper lacking temperature control and thermosensitive head protecting circuit.

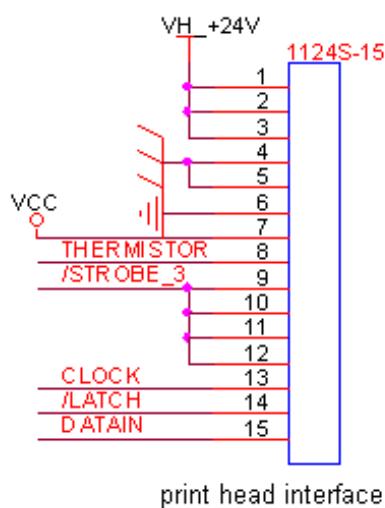
### Definitions of print controlling board interfaces

#### (1) Interface connects to bottom interface board

CON6		Pin No.	Symbol
9	PE	1	VDD
8	BUSY	2	VDD
7	RXD	3	GND
6	TXD	4	VCC
5		5	GND
4		6	TXD
3		7	RXD
2		8	BUSY
1		9	PE

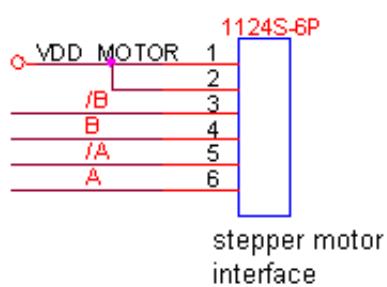
**Serial Port**

## (2) Interface connects to print head



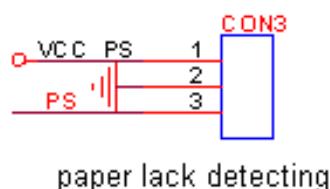
Pin No.	Symbol
1	VH_+24V
2	VH_+24V
3	VH_+24V
4	GND
5	GND
6	GND
7	VCC
8	THERMISTOR
9	/STROBE_3
10	/STROBE_3
11	/STROBE_3
12	/STROBE_3
13	CLOCK
14	/LATCH
15	DATAIN

## (3) Interface connects to stepper motor (gear assembly)



Pin No.	Symbol
1	VDD_MOTOR
2	VDD_MOTOR
3	/B
4	B
5	/A
6	A

## (4) Interface connects to paper sensor (paper lack detecting)

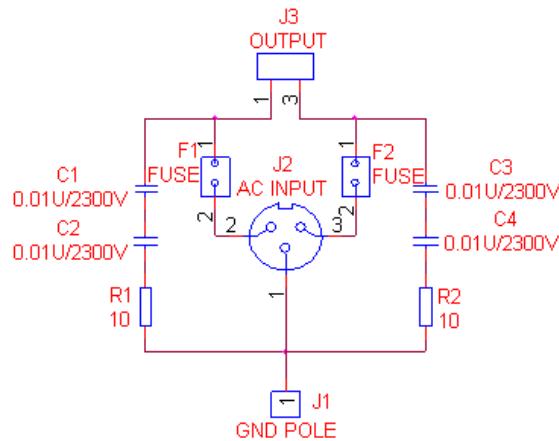


Pin No.	Symbol
1	VDD_PS
2	GND
3	PS

## 7.2.5 Power Module

The power module outputs +12V, -12V, +5V voltage and manages charging.

The power interface board is used to transfer the power, its circuit is:



F1 and F2 are two containers for fuses containing, the specification of the fuse is: 1.6A 250V.

J1 is the equipotential grounding point that connects to the ground.

J2 is a 3-pin socket for outer power input.

J3 is input connects to the PS800B module in the machine.

C1, C2, C3 and C4 are Y capacitors, every capacitor resists 2300V voltage. Connecting a  $10\ \Omega$  resistor and two Y capacitors in series between L-PE and N-PE will improve the fetal heart and data jumping problem when measuring FH with EFT.

When laying out the PCB of this board, the creepage distance between L, N and PE must not less than 8mm, the distance between L and N must not less than 3mm.

## 7.2.6 Key Board

The key board codes the operation of keys and control knob with AT89C2051 singlechip processor, sends keycode to main control board with PS2 protocol, answers for corresponded keys and controls display of power indicator, AC indicator and Charge indicator. Its structure block diagram is as follows:

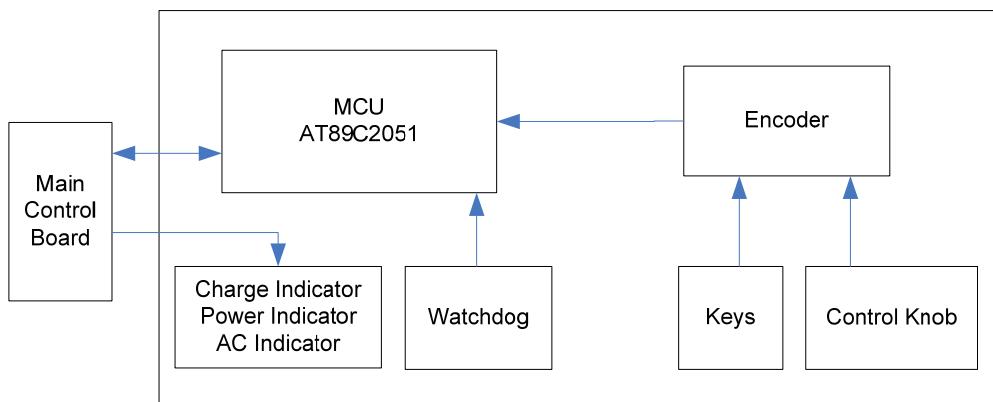


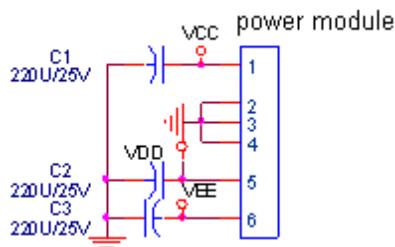
Figure 7-5 Key board principle block diagram

## 7.2.7 Bottom Interfaces Board

F9 bottom interfaces board consists of connect CNS interconnection circuit, voltage switching circuit, built-in wireless module power circuit and interfaces.

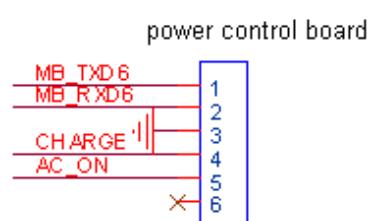
### Interface definition

#### (1) Interface connects to PS800B power module



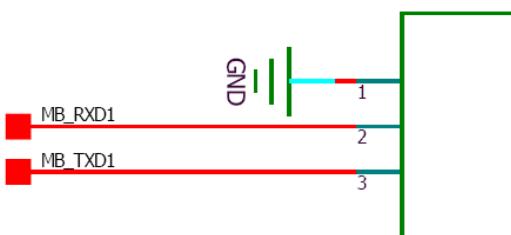
Pin No.	Symbol
1	VCC
2	GND
3	GND
4	GND
5	VDD
6	VEE

#### (2) Interface connects to power control board



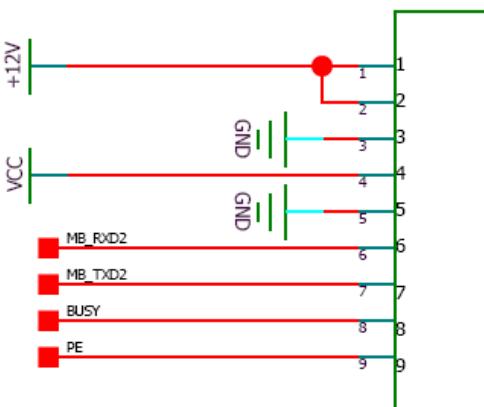
Pin No.	Symbol
1	MB_RXD6
2	MB_TXD6
3	GND
4	CHARGE
5	AC_ON
6	Reserved

#### (3) Interface connects to FM board



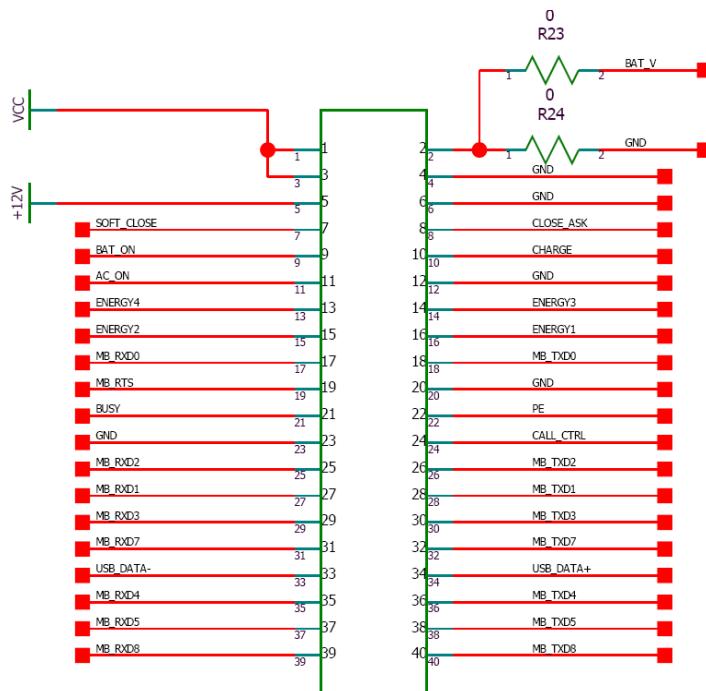
Pin No.	Symbol
1	GND
2	MB_RXD1
3	MB_TXD1

#### (4) Interface connects to print controlling board



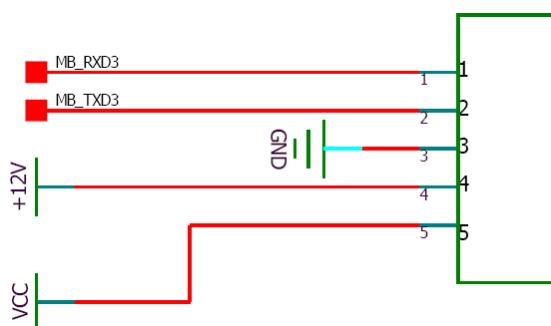
Pin No.	Symbol
1	+12V
2	+12V
3	GND
4	VCC
5	GND
6	MB_RXD2
7	MB_TXD2
8	BUSY
9	PE

### (5) Interface connects to main control board

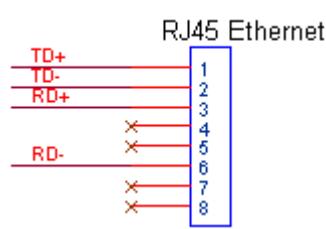


Pin No.	Symbol	Pin No.	Symbol	Pin No.	Symbol
1	VCC	15	ENERGY2	29	MB_RXD3
2	GND/BAT_V	16	ENERGY1	30	MB_TXD3
3	VCC	17	MB_RXD0	31	MB_RXD7
4	GND	18	MB_TXD0	32	MB_TXD7
5	+12V	19	MB_RTS	33	USB_DATA-
6	GND	20	GND	34	USB_DATA+
7	SOFT_CLOSE	21	BUSY	35	MB_RXD4
8	CLOSE_ASK	22	PE	36	MB_TXD4
9	BAT_ON	23	GND	37	MB_RXD5
10	CHARGE	24	CALL_CTRL	38	MB_TXD5
11	AC_ON	25	MB_RXD2	39	MB_RXD8
12	GND	26	MB_TXD2	40	MB_TXD8
13	ENERGY4	27	MB_RXD1		
14	ENERGY3	28	MB_TXD1		

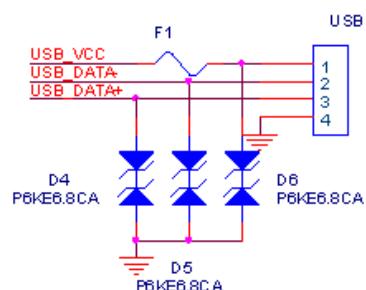
### (6) Interface connects to DECG module



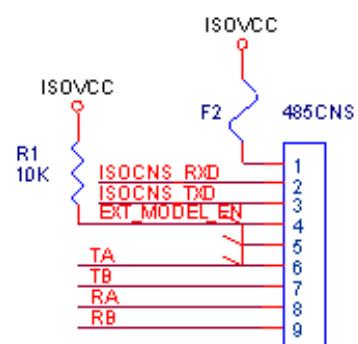
Pin No.	Symbol
1	MB_RXD3
2	MB_TXD3
3	GND
4	+12V
5	VCC

**(7) RJ45 Ethernet interface**

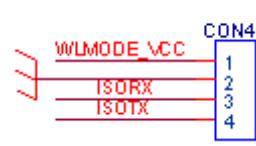
Pin No.	Symbol
1	TD+
2	TD-
3	RD+
4	Reserved
5	Reserved
6	RD-
7	Reserved
8	Reserved

**(8) USB interface**

Pin No.	Symbol
1	USB_VCC
2	USB_DATA-
3	USB_DATA+
4	GND

**(9) 485 network interface**

Pin No.	Symbol
1	ISOVCC
2	ISOCNS_RXD
3	ISOCNS_TXD
4	EXT_MODEL_EN
5	GND
6	TA
7	TB
8	RA
9	RB

**(10) Interface connects to built-in wireless module**

Pin No.	Symbol
1	WLMODE_VCC
2	GND
3	ISORX
4	ISOTX

**(11) Ethernet interface**

Pin No.	Symbol
1	TD+
2	TD-
3	RD+
4	RD-

## 7.2.8 LVDS LCD

LCD applies a 12.1" screen with LCDS interface from Taiwan AU Company. Its main technical specifications are as follows:

<b>Items</b>	<b>Unit</b>	<b>Specifications</b>
Screen Diagonal	[mm]	310 (12.1")
Active Area	[mm]	246.0(H) x 184.5(V)
Pixel H x V		800(x3) x 600
Pixel Pitch	[mm]	0.3075(H) x 0.3075(V)
Pixel Arrangement		R.G.B. Vertical Stripe
Display Mode		Normally White
Typical White Luminance (ICFL= 6mA)	[cd/m <sup>2</sup> ]	200 Typ. (center)
Contrast Ratio		500:1 Typ.
Optical Rise Time / Fall Time	[msec]	10/25 Typ.
Nominal Input Voltage VDD	[Volt]	+3.3 Typ.
Typical Power Consumption (VDD line + VCFL line)	[Watt]	7.8 Typ.
Weight	[Grams]	640 ± 10
Physical Size	[mm]	279.0(W) x 209.0(H) x 11(D)
Electrical Interface		LVDS
Support Color		Native 262K colors (RGB 6-bit driver)
Temperature Range:		
Operating	[°C]	-10 to +65
Storage(Shipping)	[°C]	-30 to +70

## 7.3 Interfaces



On the rear panel of the monitor, there are two interfaces and an antenna:

- DB 9 interface (RS232)
- RJ45 interface (NETWORK)
- Antenna

### 7.3.1 DB9 Interface

All the monitors are configured with a DB9 interface.

It is used to connect the monitor to a computer for monitoring information collection (with a software such as Insight.), or to an obstetrical monitoring system such as MFM-CNS.

### 7.3.2 RJ45 Interface

All the monitors are configured with a RJ45 interface.

It is used to connect the monitor to a computer for updating or monitoring information collection (with a software such as Insight.), or to an obstetrical monitoring system such as MFM-CNS.

### 7.3.3 Antenna

If the monitor has a wireless module built in it, an antenna will be configured.

It is used to send signals of the F9 bedside monitor to the obstetrical monitoring system.

# Chapter 8 Troubleshooting

This troubleshooting guide introduces the suitable actions for correcting the problems or replacing the accessory or calling the service person. It can also help you to have more exact descriptions of the fault symptoms when calling for service.

EDAN supports replacement of PCBs and major subassemblies for this product. Verify the malfunction of the PCBA / Modules prior to disassembling with the method described in chapter 9 *Modules' Malfunction Verification*. When replacement is needed, follow the procedures described in chapter 10 *Dissembling the Monitor*.

## 8.1 Monitor Booting Failures

Phenomenon	Possible Cause	Solution
After switching on, LCD has no display; the power indicator is off; the fan doesn't run.	No AC mains connected.	Check if the power cord is damaged. Check if the power cord is well connected to the power socket of the monitor and hospital AC outlet.
	The fuses are blown.	Replace the fuses.
	Main control board defective.	Replace the main control board.
The fuses blow when switching on the monitor.	Power board defective.	Replace the power board.
	Short circuit of other parts	Look for the short circuit source and fix it.
Abrupt switching off.	The monitor is stricken by strong high voltage, such as lighting strike.	Check the power supply and earth system.
	Bad power supply performance.	Replace power supply.
	Main control board defective.	Replace the main control board.
	Bad connection.	Check all the connectors.

## 8.2 Display Failures

Phenomenon	Possible Cause	Solution
The LCD has no display.	The LCD related cable(s) is (are) disconnected.	Check that the LCD related cables between the main control board, power inverter board and the LCD are well connected. Check that the LCD backlight cable is well connected.
	LCD defective.	Replace the LCD.
	Power inverter board defective.	Replace the power inverter board.
	LCD backlight board defective.	Replace the LCD backlight board.
	Main control board defective.	Replace the main control board.
LCD displays improper characters.	LCD defective.	Replace the LCD.

## 8.3 Touch Screen Failures

Phenomenon	Possible Cause	Solution
The touch screen is not functioning.	The touch screen is disabled.	Check if the touch screen is disabled in the system setup. If yes, enable it.
	The touch screen related cable(s) is (are) disconnected.	Check that the touch screen related cables between the main control board, touch screen controlling board and the touch screen are well connected.
	The touch screen is damaged.	Replace the touch screen.
The touch position invalid.	The touch screen is not calibrated.	Calibrate the touch screen using procedures described in section 5.6 <i>To Calibrate Touch Screen</i> .

## 8.4 Operation Failures

Phenomenon	Possible Cause	Solution
Keys not functioning	Bad key board connection.	Check key board wire.
	Key board is damaged.	Replace the key board.
When a key is pressed, no tone is heard.	Loudspeaker or wire has a failure.	Replace the loudspeaker or the wire.
Hoarse or odd sound from loudspeaker.	Loudspeaker defective.	Replace the loudspeaker.
	Main control board defective.	Replace the main control board.

## 8.5 Recorder Failures

Phenomenon	Possible Cause	Solution
No paper advances.	No paper in the drawer.	Load paper and close the drawer.
	Paper drawer is open.	Close the drawer.
	Paper jam.	Open the drawer and remove the paper jam. Re-load paper then close the drawer.
	Print controlling board defective.	Replace the print controlling board.
	Recorder connection failure.	Check all the connectors.
	Gear assembly defective.	Replace the gear assembly.
	Main control board defective.	Replace the main control board.
The "Check paper" alarm message appeared on the screen, but the drawer is not empty.	Paper sensor dirty.	Clean the paper sensor with a dry clean cloth.
	Paper sensor defective.	Replace the paper sensor.
	The paper drawer is not closed properly.	Push the drawer back in position.
Blank, blurry or incorrect traces.	Paper is not correctly loaded.	Reload paper correctly.
	The print head adjusting nuts are lopsided.	Adjust the print head adjusting nuts.
	Print head defective.	Replace the print head.
	Improper paper settings of the monitor.	Set paper style according to section 5.12 <i>Changing Paper Style</i> .

## 8.6 Network Failures

Phenomenon	Possible Cause	Solution
The monitor can not connect to a network.	The RS232 or Ethernet socket defective.	Replace the RS232 or Ethernet socket.
	Bad connection between the bottom interfaces board and main control board.	Check the connection.
	Main control board defective.	Replace main control board.
	Overlapped device no. in the network.	Change device no. of the monitor.
	Incorrect sever IP setting.	Set server IP correctly.

## 8.7 Alarms Failures

Phenomenon	Possible Cause	Solution
No audible alarm is activated.	The audible alarm is temporarily disabled.	Switch on the audible alarm.
	Loudspeaker or wire defective.	Replace the loudspeaker or the wire.
The alarm indicator stays off.	Alarm indicator defective.	Replace alarm indicator.
	Alarm indicator board defective.	Replace alarm indicator board.
No audible alarm or visual alarm is activated.	Program defective.	Update the software.

## 8.8 Technique Alarms

Phenomenon	Possible Cause	Solution
Fetus EQUIP MALF	Bad connection between FM module, bottom interfaces board and main control board.	Check the connection.
	FM module defective.	Replace FM module.
	Main control board defective.	Replace main control board.

DECG EQUIP MALF	Bad connection between DECG module, bottom interfaces board and main control board.	Check the connection.
	DECG board defective.	Replace DECG board.
	Main control board defective.	Replace main control board.

## 8.9 FHR/TOCO Monitoring Failures

Phenomenon	Possible Cause	Solution
No FHR/TOCO trace or numeric value.	Bad connection of the transducers.	Check the connection.
	US Transducer defective.	Replace the transducer.
	FM module defective.	Replace the FM module.
	Main control board defective.	Replace the main control board.
Lower heart beat or no sound.	Loudspeaker defective.	Replace the loudspeaker.
	US transducer defective.	Replace the US transducer.
	Main control board defective.	Replace the main control board.
Inaccurate measurement values.	FM module defective.	Replace the FM module.
	Main control board defective.	Replace the main control board.

## 8.10 DECG/IUP Monitoring Failures

Phenomenon	Possible Cause	Solution
No DECG/IUP trace or numeric value.	Bad connection of cables.	Check the connection.
	Cables defective.	Replace the cables.
	DECG module defective.	Replace the DECG module.
	Main control board defective.	Replace the main control board.

## Chapter 9 Modules' Malfunction Verification

When a module is suspected of malfunction, verify it using the method described in this chapter.

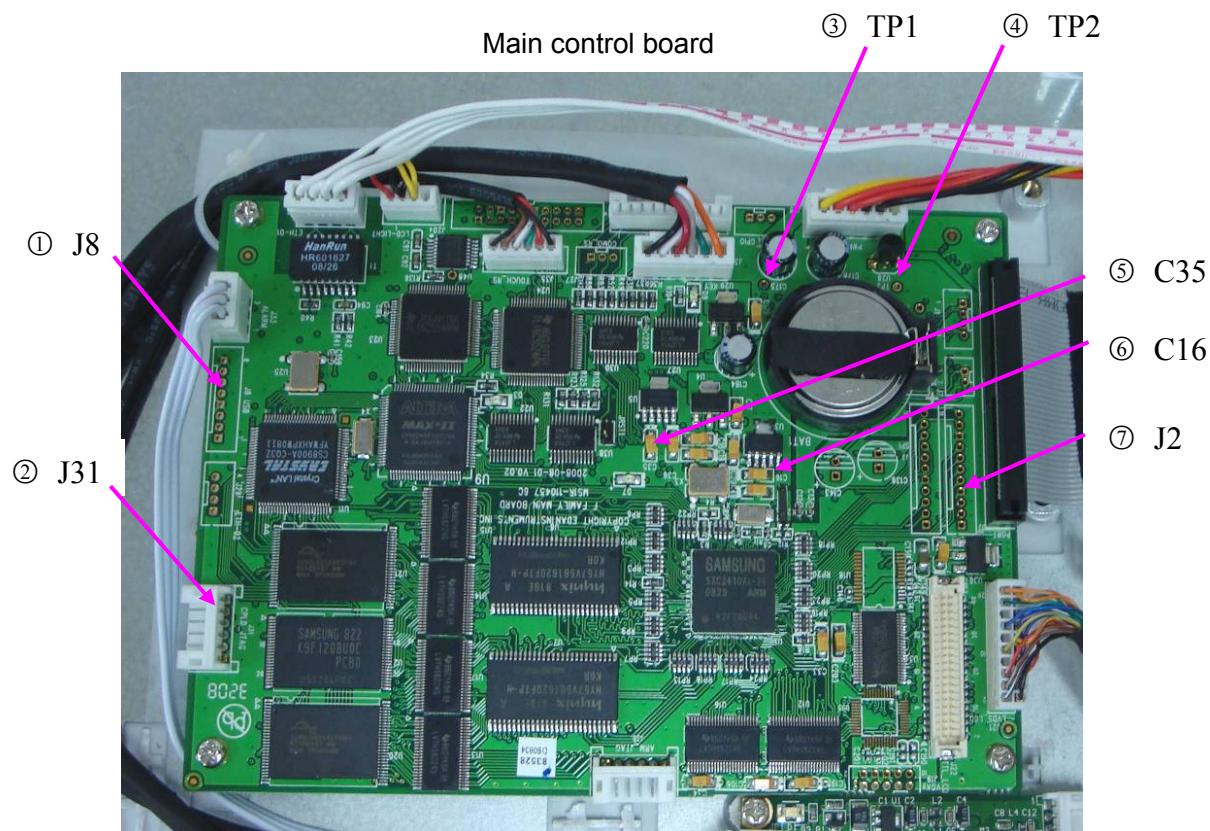
**NOTE:** For all the interfaces, the first pin is the one with a square solder pad.

### 9.1 Verifying Malfunction of the Main Control Board

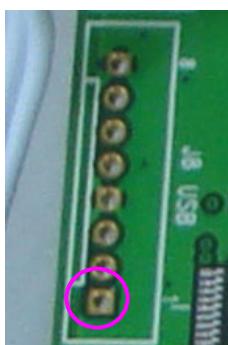
To verify the main control board,

- 1) Open the main unit using the procedures described in section 10.3.
- 2) Switch on the monitor. (Powered by AC or battery.)
- 3) Measure the voltage to earth of the pins listed below, using a multimeter:

Item	Pin	Reference result
①	J8's first pin	VCC+5V ( $5.0\pm5\%$ ) V
②	J31's first pin	VCC33 ( $3.3\pm5\%$ ) V
③	TP1	+12V ( $12.0\pm5\%$ ) V
④	TP2	PVCC ( $3.3\pm5\%$ ) V
⑤	C35's positive pole	VDDARM ( $1.9\pm5\%$ ) V
⑥	C16's positive pole	VDDALIVE ( $1.9\pm5\%$ ) V
⑦	J2's first pin	VBB33 ( $3.3\pm5\%$ ) V
⑧	C59	VDD_RTC ( $1.8\pm5\%$ ) V
⑨	C61	Li_BAT ( $\geq 2.75V$ )



J8



J31



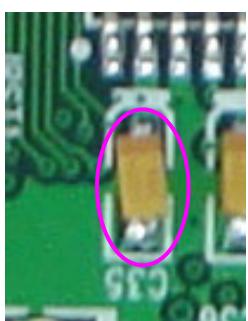
TP1



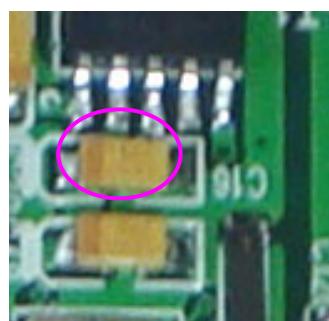
TP2



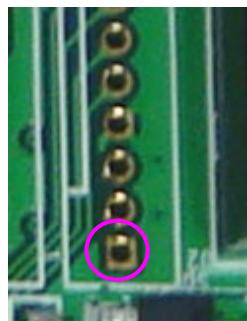
C35



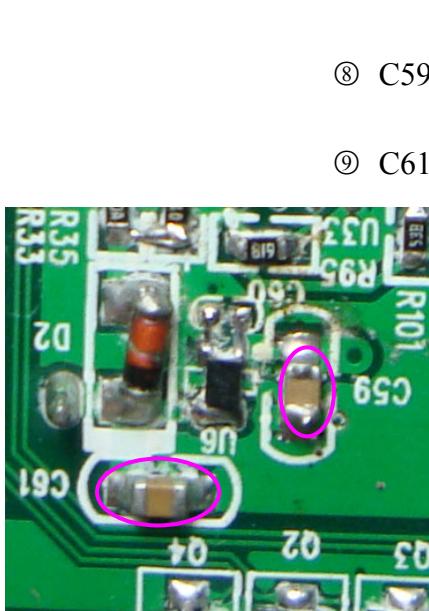
C16



J2



Rear of the Main control board



- 4) Compare the measurement results with the reference results in the list. If any one of the results exceeds the reference range, the main control board defect is confirmed. Replacement of the main control board is recommended.

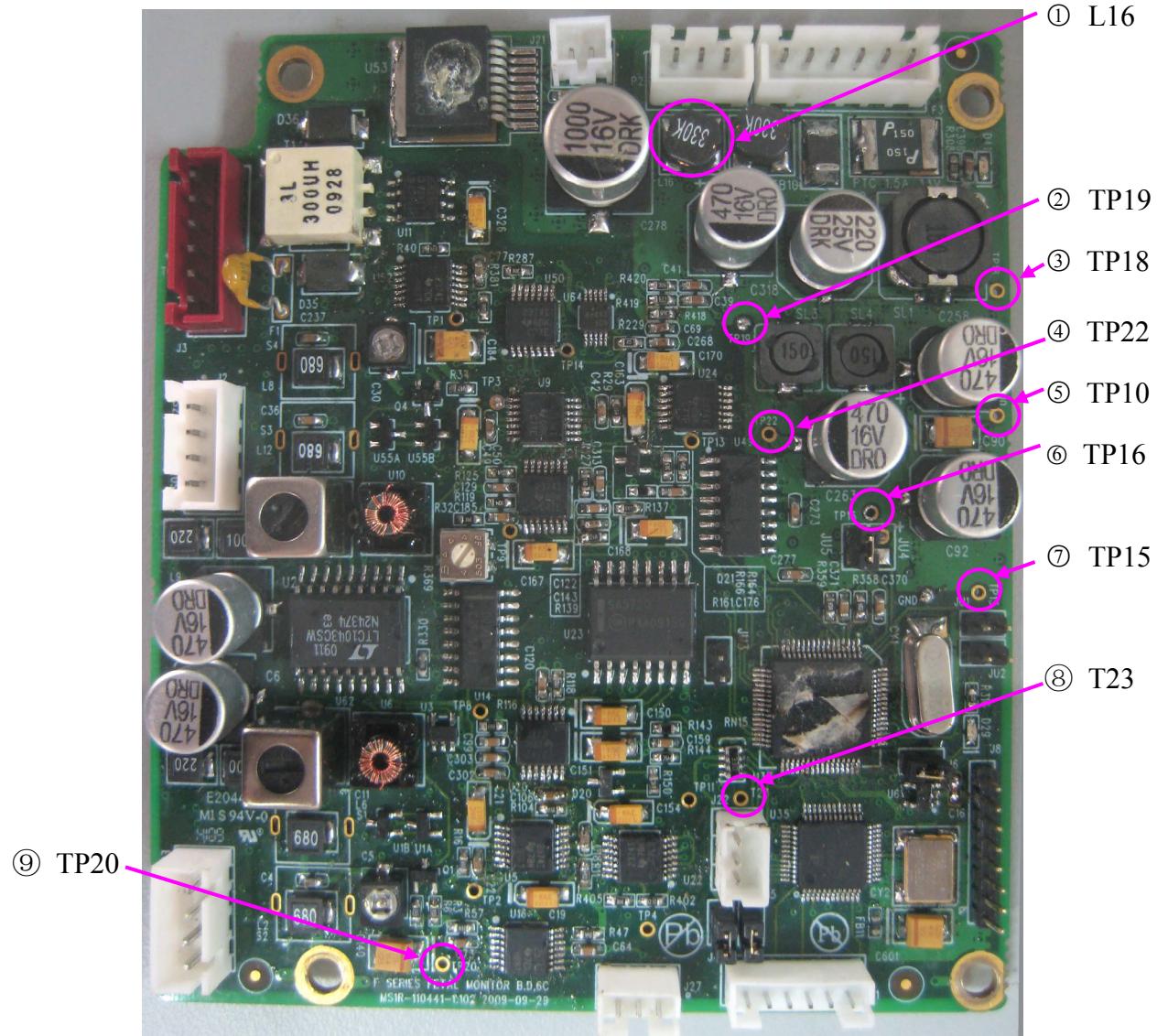
## 9.2 Verifying Malfunction of the FM Module

To verify the FM module,

- 1) Open the main unit using the procedures described in section 10.3.
- 2) Measure the voltage to earth of the pins listed below, using a multimeter:

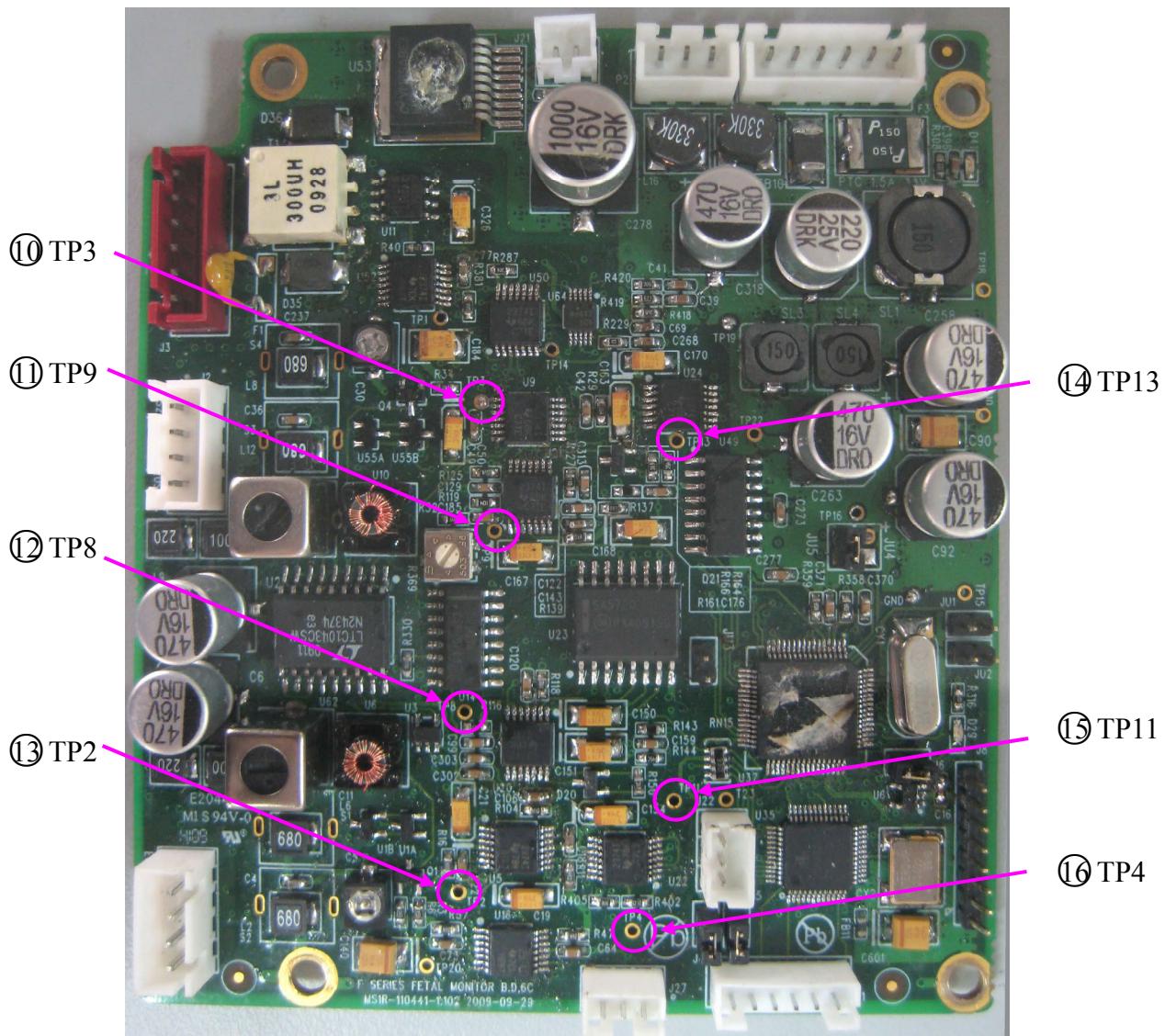
Item	Pin	Reference result
①	L16	(+5±10%) V
②	TP19	(+6±10%) V
③	TP18	(+6.8±10%) V
④	TP22	(-5±10%) V
⑤	TP10	(+2.5±10%) V
⑥	TP16	(-6.5±10%) V
⑦	TP15	(+3.3±10%) V
⑧	T23	(+3.3±10%) V
⑨	TP20	(+5±10%) V

FM Module PCBA



- 3) Compare the measurement results with the reference results in the list. If all the results are in the allowance range. Switch on the monitor and measure the voltage to earth of the pins listed below.

Item	Pin	Reference result
⑩	TP3	(0.45±20% )V
⑪	TP9	(0.9±20% )V
⑫	TP8	(0.9±20% )V
⑬	TP2	(0.45±20% )V
⑭	TP13	(3.30±20% )V
⑮	TP11	(3.30±20% )V
⑯	TP4	(0.40±20% )V



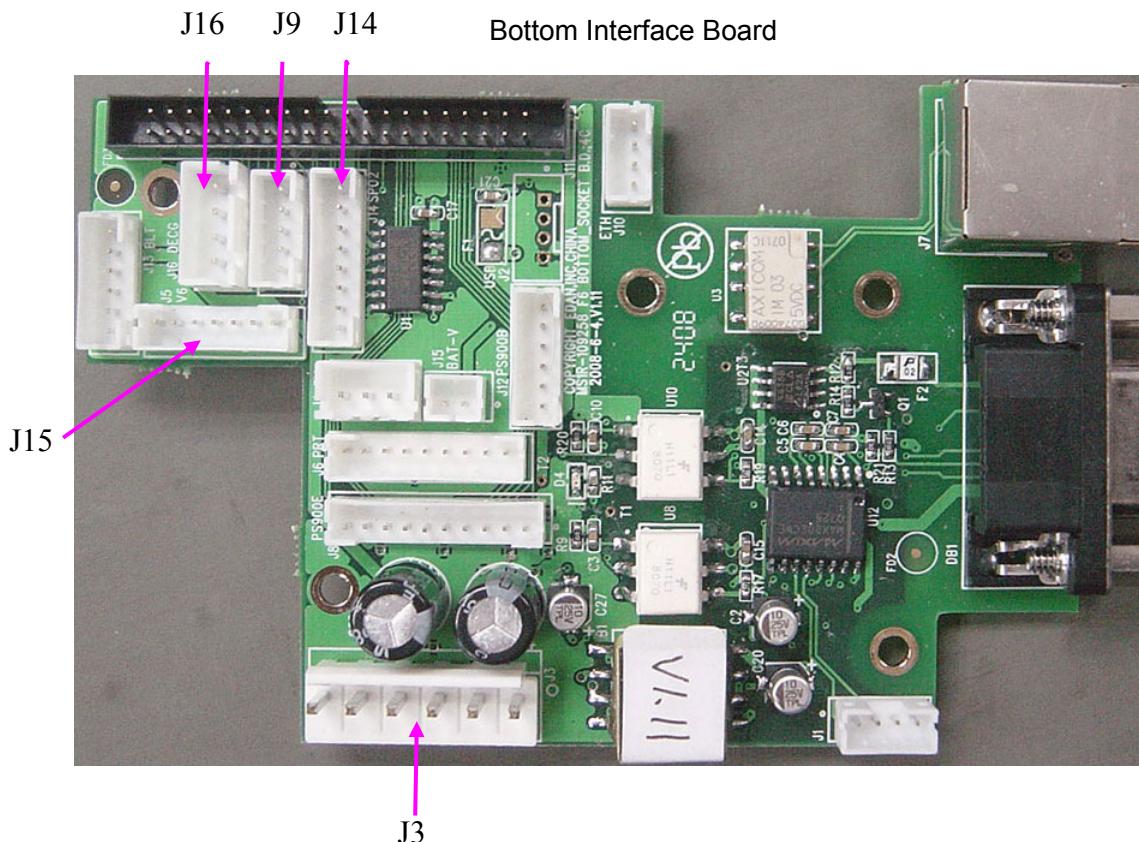
- 4) If any one of the results exceeds the reference range, the FM module deflection is confirmed. Replacement of the module is recommended.

### 9.3 Verifying Malfunction of the DECG Module

To verify the DECG module,

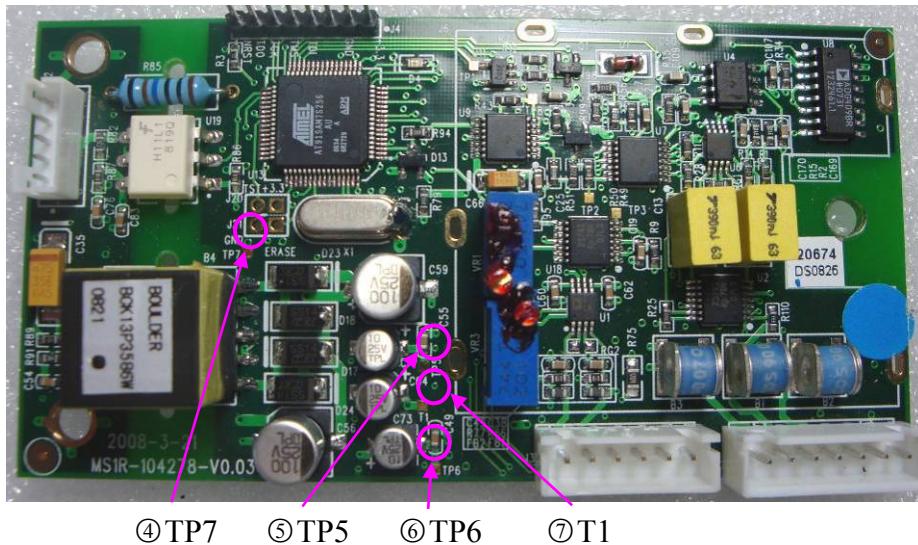
- 1) Open the main unit using the procedures described in section 10.3.
- 2) Disconnect the DECG cable connector from the bottom interface board.
- 3) Switch on the monitor.
- 4) Measure the voltage to earth of the following pins on the bottom interface board, using a multimeter:

Item	Pin	Reference result
①	1 <sup>st</sup> pin of J9	MB_RXD3
②	2 <sup>nd</sup> pin of J9	MB_TXD3
③	5 <sup>th</sup> pin of J9	(+5 ±5%) V



Item	Pin	Reference result
④	TP7	(+3.3±5%) V
⑤	TP5	(+8±5%) V
⑥	TP6	(-8±5%) V
⑦	T1	(+5±5%) V

DECG Board



- 7) Compare the measurement results with the reference results in the list. If any one of the results exceeds the reference range, the DECG module deflection is confirmed. Replacement of the module is recommended.

## 9.4 Verifying Malfunction of the Power Module

To verify the power module,

- 1) Open the main unit using the procedures described in section 10.3.
- 2) Disconnect the power board connector from the bottom interfaces board.
- 3) Switch on the monitor.
- 4) Measure the voltage to earth of the following pins on the bottom interface board, using a multimeter: (Refer to section 9.3 for J3's location.)

Item	Pin	Reference result
①	1 <sup>st</sup> pin of J3	(+5±5%) V
②	5 <sup>th</sup> pin of J3	(+12±5%) V

- 5) If any one of the results exceeds the reference range, the power module deflection is confirmed. Replacement of the module is recommended.

# Chapter 10 Disassembling the Monitor

## **WARNING**

- 1 Only qualified service personnel should open the monitor case.
  - 2 Switch off the monitor and remove the AC power cable before disassembling the monitor.
  - 3 After any repair of the monitor, perform safety tests before using the monitor again.

## 10.1 Tools Required

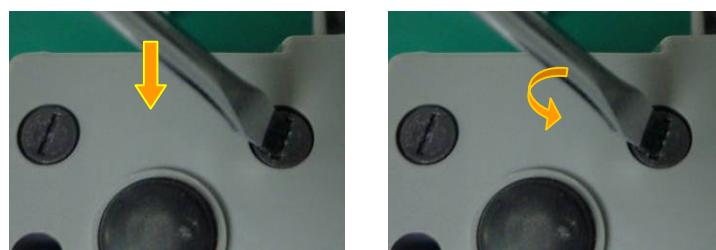
- 1 – A cross-head screwdriver
  - 2 – A flat-head screwdriver
  - 3 – A M3 nut driver
  - 4 – A pair of pliers



## 10.2 Replacing Fuses

To replace the blown fuse,

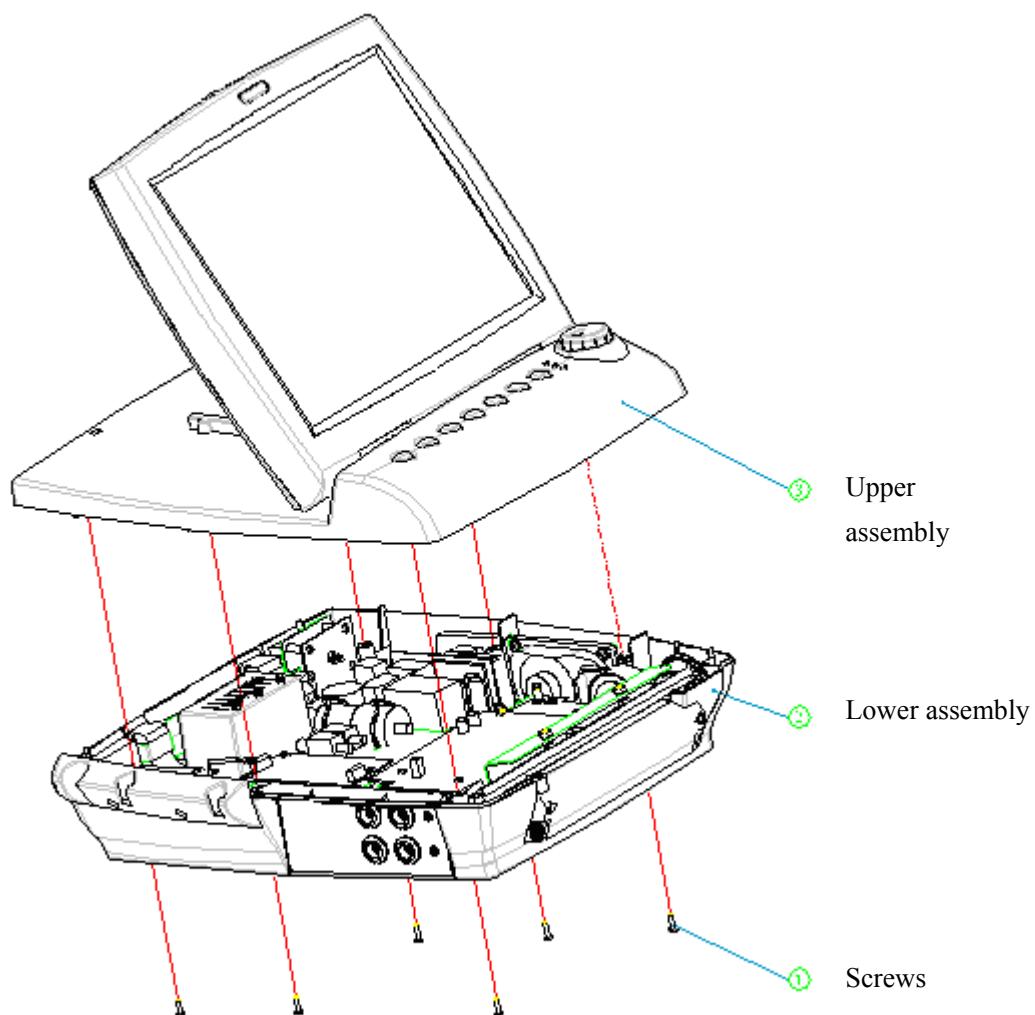
- 1) Switch off the monitor and unplug it.
  - 2) Fold the LCD display completely flat.
  - 3) Carefully place the monitor upside down on a flat surface covered with cloth or other protecting pad.
  - 4) Place a flat-head screw driver in the gap of the fuse. Apply a certain amount of pressure on the screw driver to sink the fuse for about 1 mm. Unscrew the fuse anticlockwise.



- 5) Remove the old fuse. Take out a new fuse supplied by EDAN or of the same specification:  
Size: Φ5mm\*20mm; Model: T1.6AL 250V.
- 6) Place the new fuse in the fuse socket. Press it in and screw it clockwise back in position.

### 10.3 Disassembling the Main Unit

The main unit consists of two major parts: upper assembly and lower assembly.

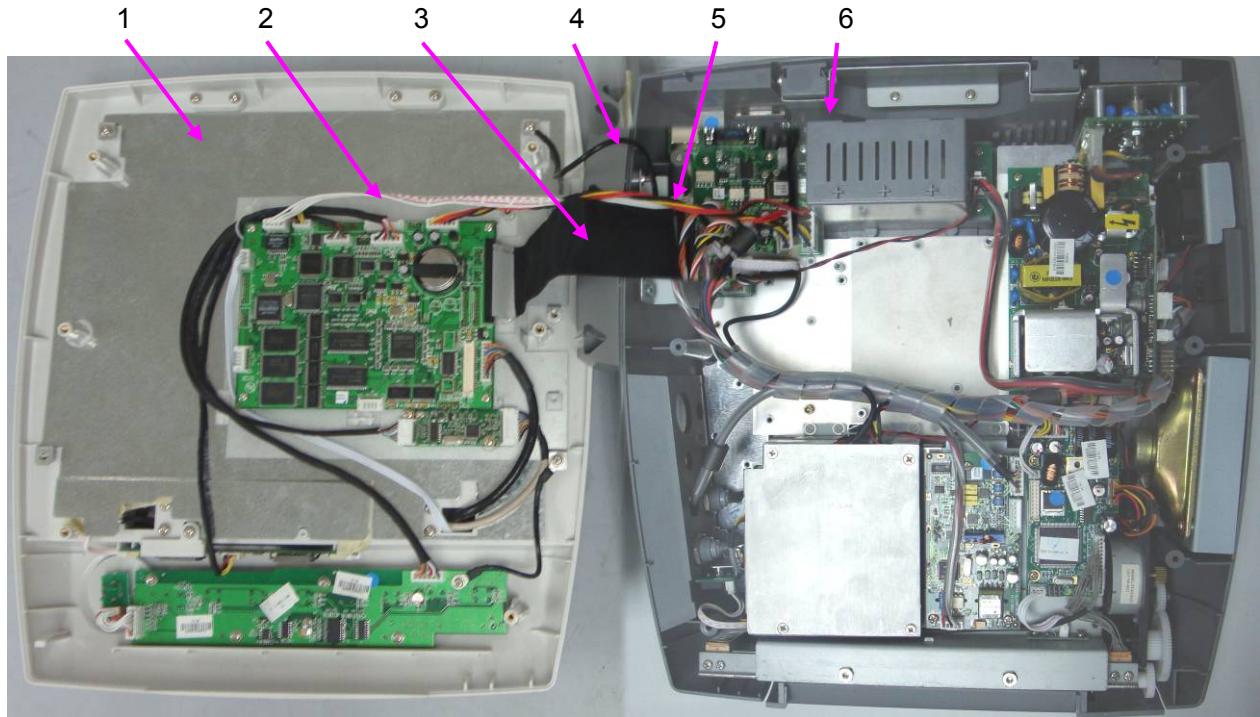


To disassemble the main unit,

- 1) Fold the LCD display completely flat.
- 2) Carefully place the monitor upside down on a flat surface covered with cloth or other protecting pad.
- 3) With a cross-head screw driver, remove the six screws securing the upper assembly to the

lower assembly.

- 4) Hold both upper assembly and lower assembly together, place the monitor upright again.
- 5) Carefully lift up the upper assembly and place it upside down on the left side of the lower assembly.



- 1 – Upper assembly
- 2 – Network Cable
- 3 – Main Control Board & Bottom Interfaces Board Connecting Cable
- 4 – Ground Wire (connecting the upper assembly and the lower assembly)
- 5 – Main control board Power Cable
- 6 – Lower assembly

- 6) Disconnect the cables/wires to separate the two parts.

## 10.4 Disassembling the Lower assembly

### 10.4.1 Replacing the FM Module

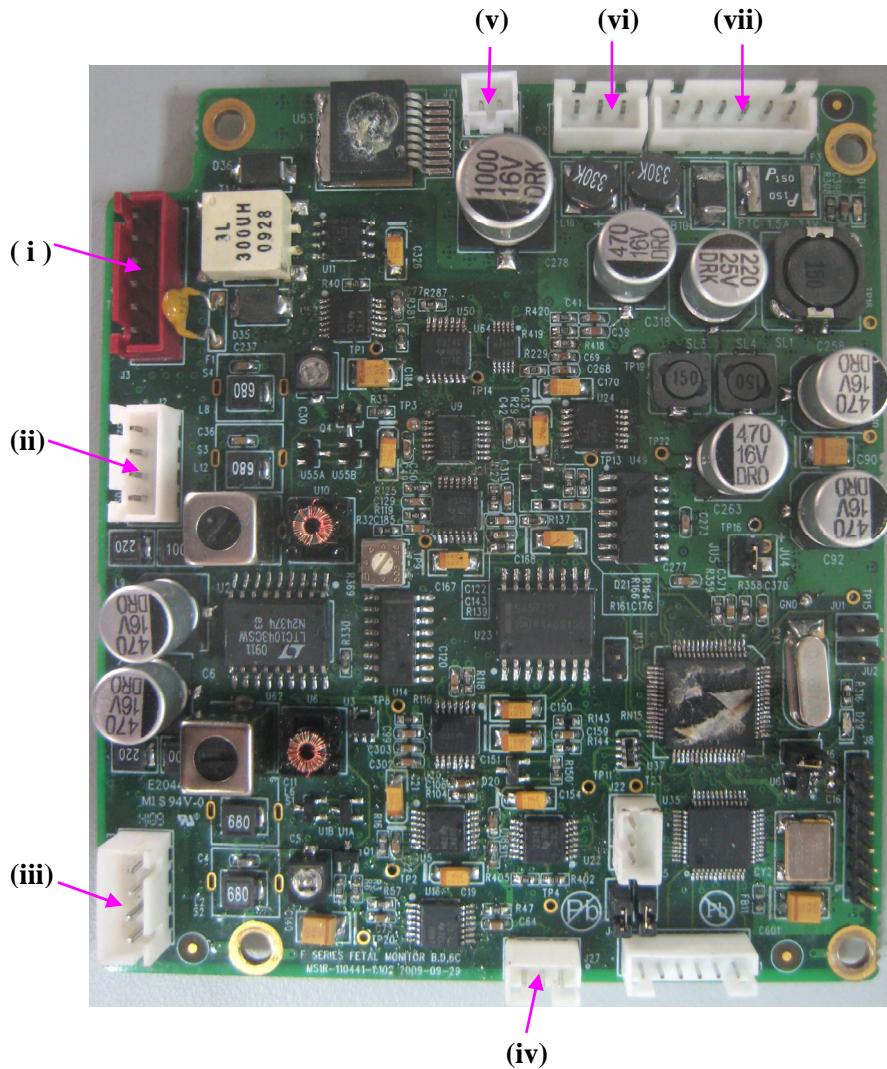
To remove the FM module,

- 1) Separate the upper assembly and the lower assembly.
- 2) Remove the four screws on the FM module shield cover.

- 3) Disconnect all the wires.
  - 4) Remove the studs/screw securing the FM module.

To replace the FM module,

Replace the FM module in a reverse procedure. Refer to the following illustration when connecting wires. Ensure they are all correctly connected.



No. Connect to

- i Toco Socket
- ii US2 Socket
- iii US1 Socket
- iv Mark Socket
- v Speaker
- vi Bottom Interfaces Board
- vii Power Module

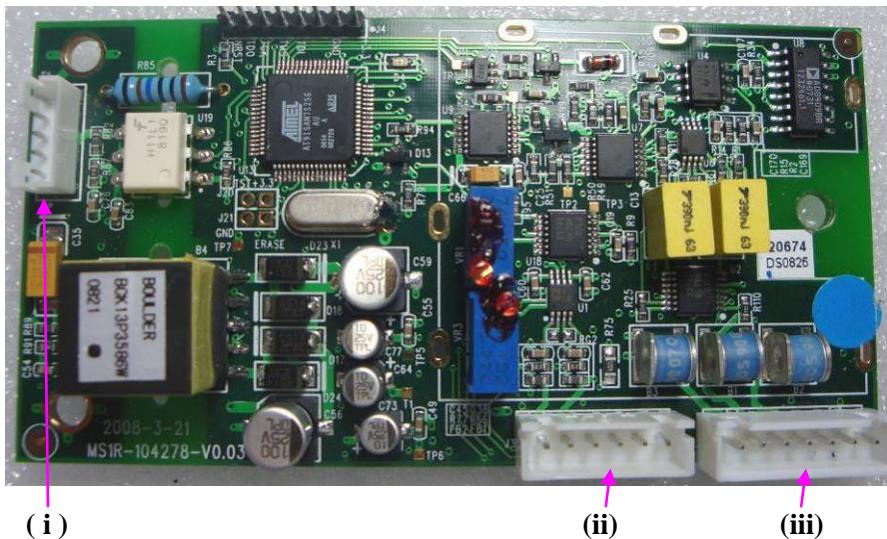
#### 10.4.2 Replacing the DECG Module

To remove the DECG module,

- 1) Separate the upper assembly and the lower assembly.
  - 2) Disconnect all the wires.
  - 3) Remove the four screws securing the DECG module.

To replace the DECG module,

Replace the DECG module in a reverse procedure. Refer to the following illustration when connecting wires. Ensure they are all correctly connected.



#### No. Connect to

- i Bottom Interfaces Board
- ii IUP Socket
- iii DECG Socket

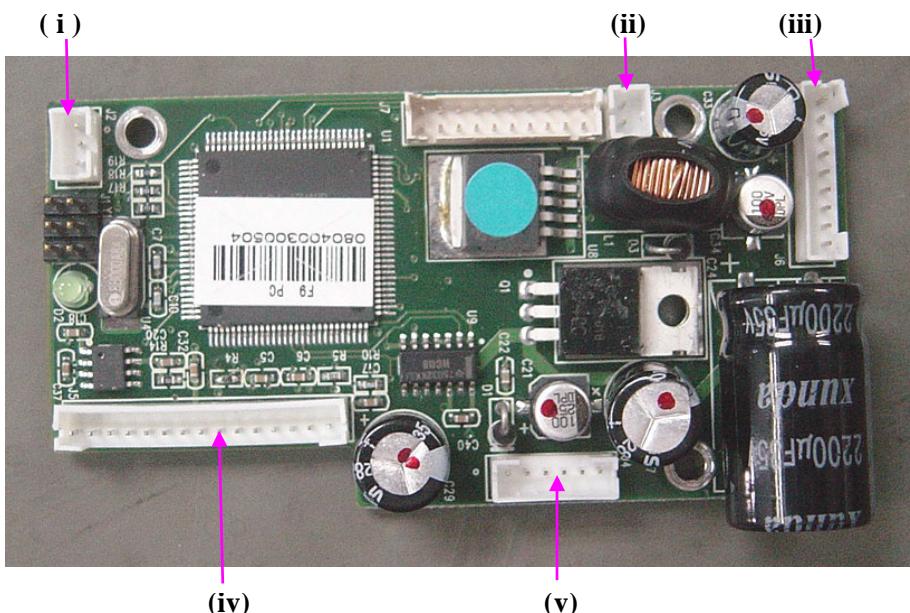
### 10.4.3 Replacing the Print Controlling Board

To remove the print controlling board,

- 1) Separate the upper assembly and the lower assembly.
- 2) Disconnect all the wires on the PCBA.
- 3) Remove the three screws securing the PCBA.

To replace the print controlling board,

Replace the print controlling board in a reverse procedure. Refer to the following illustration when connecting wires. Ensure they are all correctly connected.



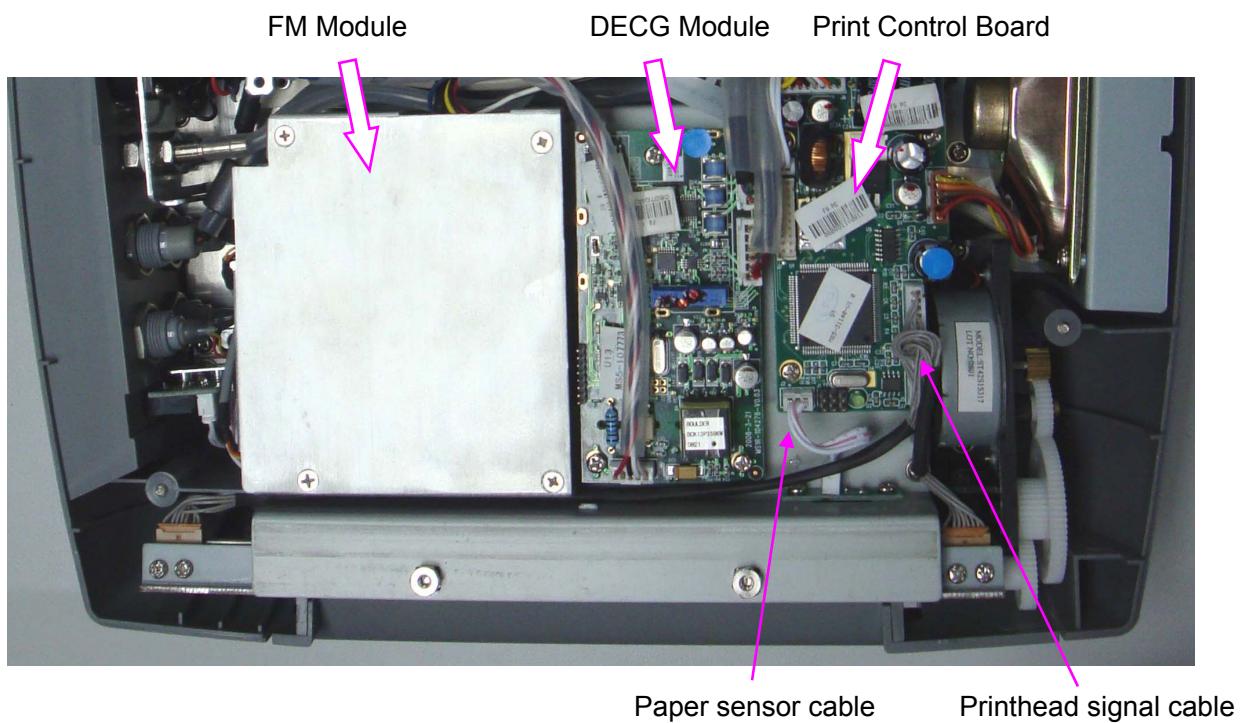
#### No. Connect to

- i Paper Sensor
- ii Paper Drawer Detector
- iii Bottom Interfaces Board
- iv Print head (2 Sockets)
- v Gear Assembly

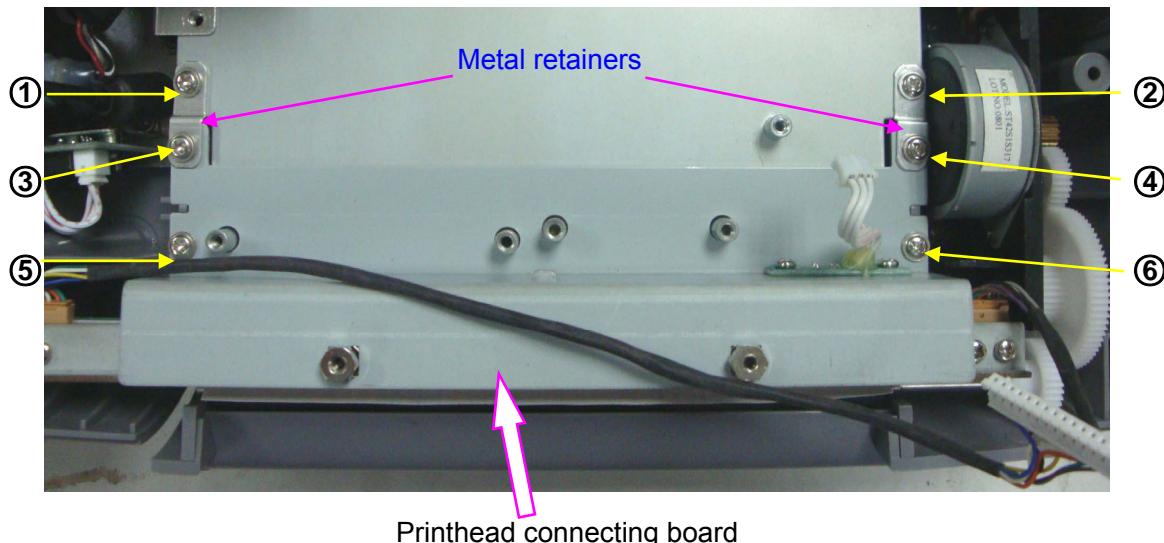
#### 10.4.4 Replacing the Printhead

To remove the printhead,

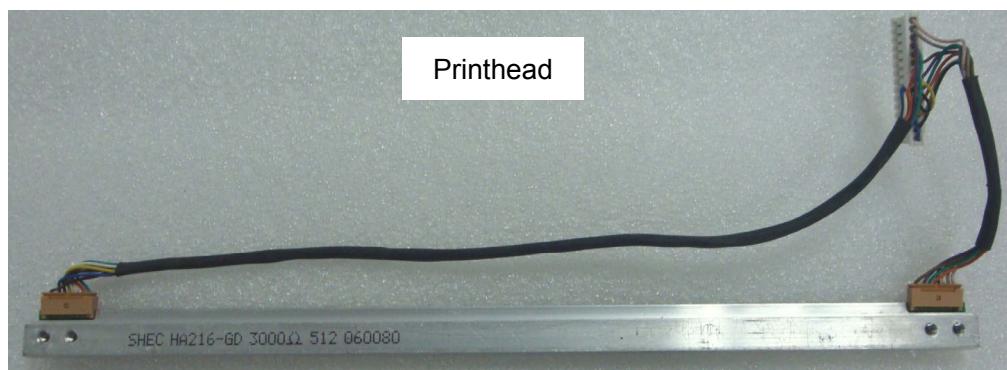
- 1) Separate the upper assembly and the lower assembly.
- 2) Loosen the FM module by removing its fixing screws.
- 3) Remove the DECG module.
- 4) Unplug the connectors of the printhead signal cable and paper sensor cable from the print control board, and then loosen the print control board by removing its fixing screws.



- 5) Remove the film that separates the boards and the metal piece (paper drawer cover).
- 6) Remove the screws ③-⑥, loose the screws ①-② and then rotate the metal retainers sideward to release the printhead connecting board.



- 7) Take the printhead connecting board out from the monitor and then remove the four screws that fix the printhead.



To replace the printhead,

Replace the printhead in a reverse procedure. The connector of the paper sensor cable is supposed to be connected to J2 socket of the print control board. The connector of the printhead signal cable is supposed to be connected to J5 socket of the print control board.

### **CAUTION**

The thermal printhead is a fragile part. Handle it with care.

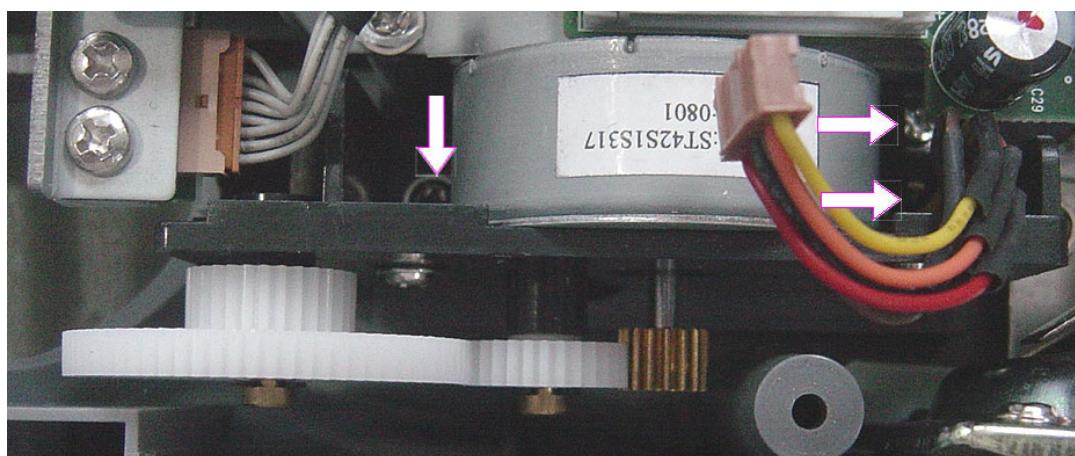
### 10.4.5 Replacing the Gear Assembly

To remove the gear assembly,

- 1) Separate the upper assembly and the lower assembly.
- 2) Disconnect the wires' connector from the print controlling board.
- 3) Remove the three screws securing the gear assembly.

To replace the gear assembly,

Replace the gear assembly in a reverse procedure. Ensure the wires' connector is correctly connected to the print controlling board.



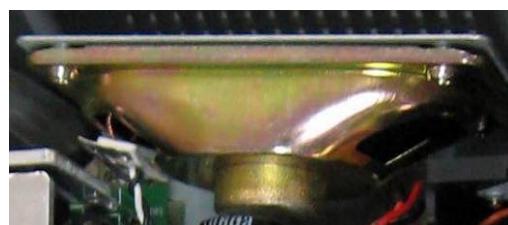
### 10.4.6 Replacing the Speaker

To remove the speaker,

- 1) Separate the upper assembly and the lower assembly.
- 2) Unplug the speaker wires' connector from the FM module.
- 3) Remove the four screws securing the speaker.

To replace the speaker,

Replace the speaker in a reverse procedure. Ensure the wires' connector is correctly connected to the FM module.



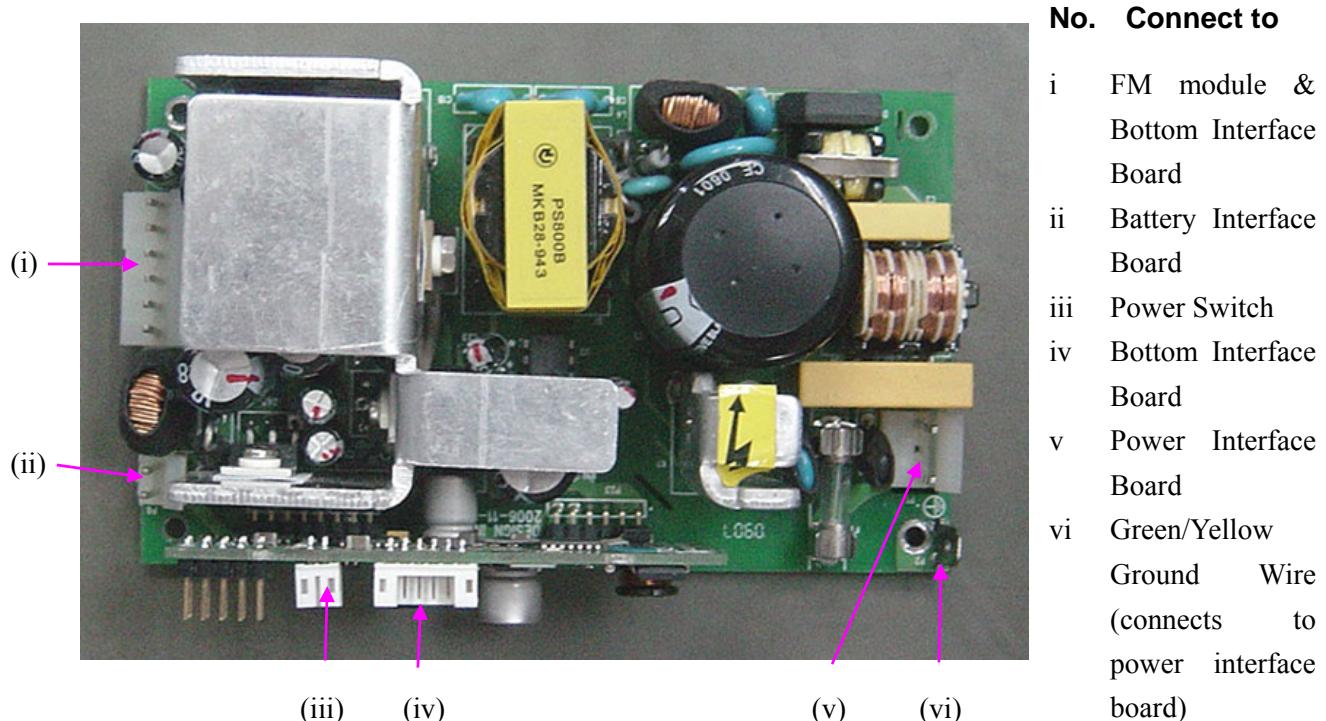
### 10.4.7 Replacing the Power Module

To remove the power module,

- 1) Separate the upper assembly and the lower assembly.
- 2) Disconnect all the wires on the module.
- 3) Remove the four screws securing the module.

To replace the power module,

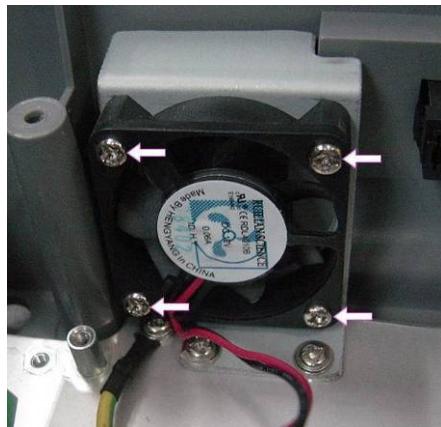
Replace the power module in a reverse procedure. Refer to the following illustration when connecting wires. Ensure they are all correctly connected.



### 10.4.8 Replacing the Fan

To remove the fan,

- 1) Separate the upper assembly and the lower assembly.
- 2) Unplug the fan wires connector from the power cable bundle.
- 3) Remove the four screws securing the fan.



To replace the fan,

Replace the fan in a reverse procedure. Ensure the wires' connector is correctly connected to connector on the power cable bundle.

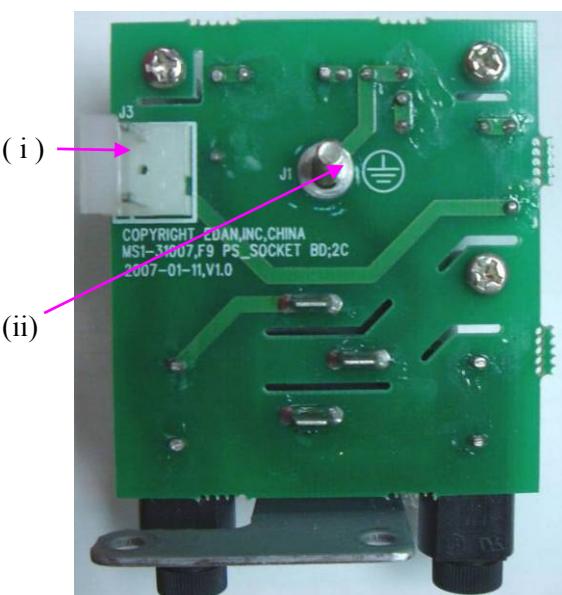
#### 10.4.9 Replacing the Power Interface Board

To remove the power interface board,

- 1) Separate the upper assembly and the lower assembly.
- 2) Unplug the power wires connector from the power interface board. Using pliers to release the ground wire.
- 3) Remove the three screws securing the power interface board.

To replace the power interface board,

Replace the power interface board in a reverse procedure. Ensure the wires are correctly connected.



**No. Connect to**

- |    |  |
|----|--|
| i  | Power Module                           |
| ii | Grounding Wires of<br>the Power Module |

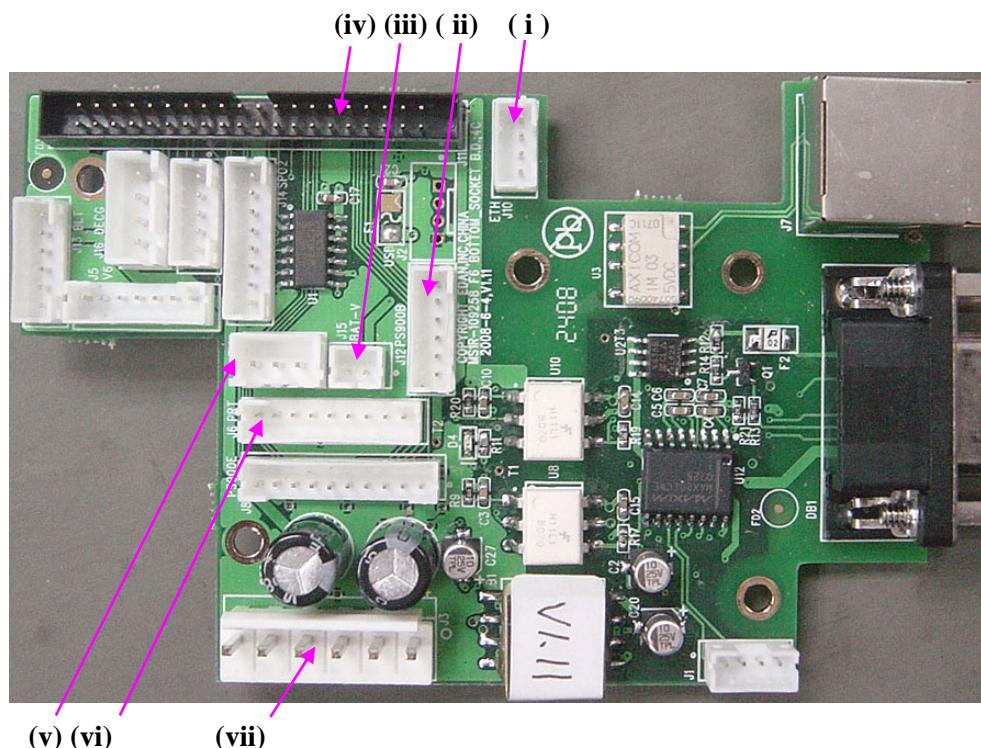
#### 10.4.10 Replacing the Bottom Interface Board

To remove the bottom interface board,

- 1) Separate the upper assembly and the lower assembly.
  - 2) Disconnect all the wires on the board.
  - 3) Remove the five screws securing the board.

To replace the bottom interfaces board,

Replace the bottom interfaces board in a reverse procedure. Refer to the following illustration when connecting wires. Ensure they are all correctly connected.



No.	Connect to
i	Network Wire
ii	Power Control Board
iii	Battery
iv	Signal Cable
v	FM Module
vi	Print Control Board
vii	Power Board + Fan

## 10.5 Disassembling the Upper assembly

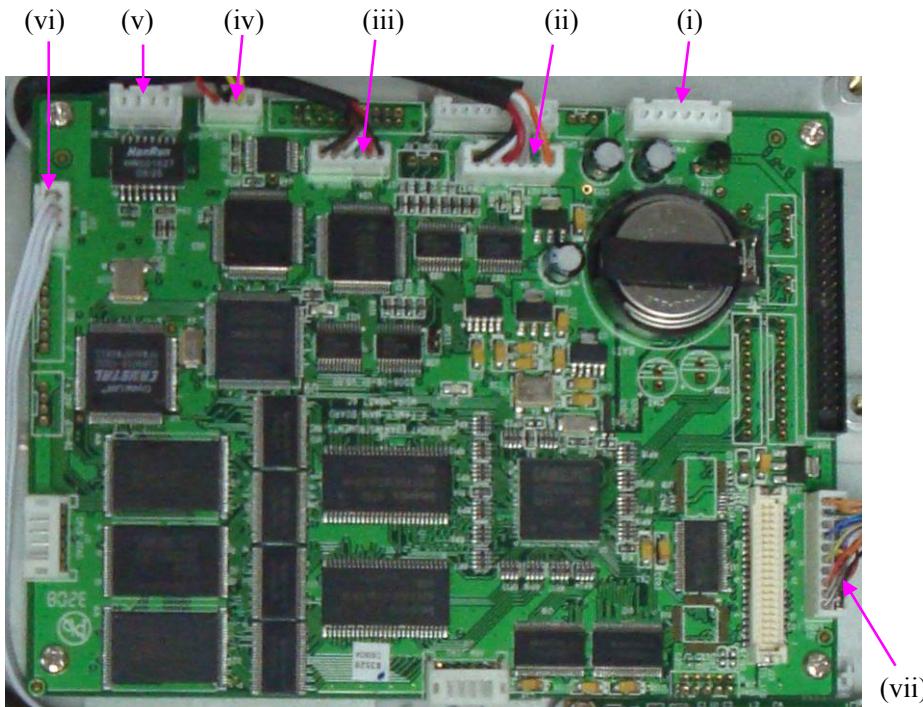
### 10.5.1 Replacing the Main control board

To remove the main control board.

- 1) Separate the upper assembly and the lower assembly.
  - 2) Disconnect all the wires on the main control board.
  - 3) Remove the four screws securing the board.

To replace the main control board,

Replace the main control board in a reverse procedure. Refer to the following illustration when connecting wires. Ensure they are all correctly connected.



#### No. Connect to

- i Power Module
- ii Key Board
- iii Touch Screen Control Board
- iv Power Inverter Board
- v Network Socket of Bottom Interface Board
- vi Alarm Indicator
- vii LCD Assembly

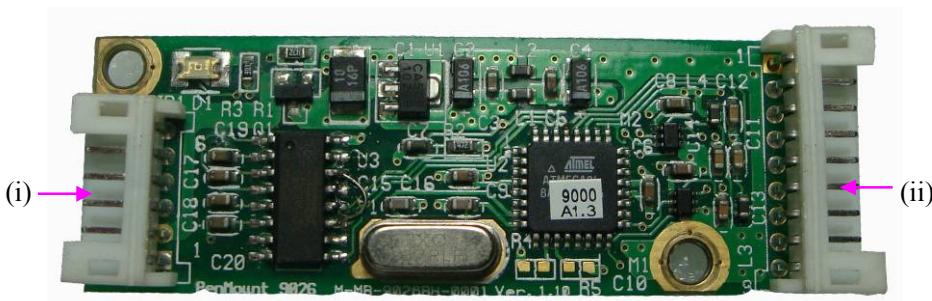
### 10.5.2 Replacing the Touch Screen Controlling Board

To remove the touch screen controlling board,

- 1) Separate the upper assembly and the lower assembly.
- 2) Disconnect all the wires on the touch screen controlling board.
- 3) Remove the four screws securing the board.

To replace the touch screen controlling board,

Replace the board in a reverse procedure. Refer to the following illustration when connecting wires. Ensure they are all correctly connected.



#### No. Connect to

- i Main Control Board
- ii Touch Screen Signal Cable

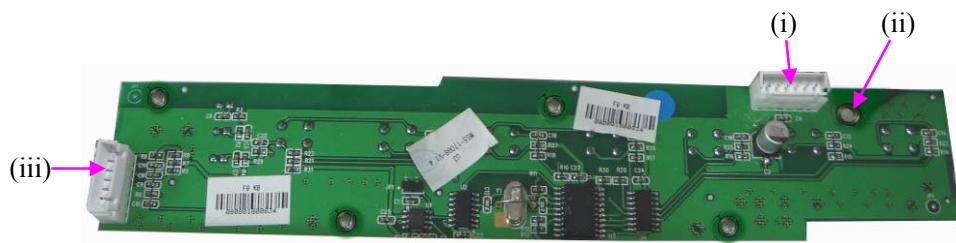
### 10.5.3 Replacing the Key Board

To remove the key board,

- 1) Separate the upper assembly and the lower assembly.
- 2) Disconnect all the wires on the key board.
- 3) Remove the four screws securing the board.

To replace the key board,

Replace the board in a reverse procedure. Refer to the following illustration when connecting wires. Ensure they are all correctly connected.



**No. Connect to**

- |     |  |
|-----|--|
| i   | Main Control Board                           |
| ii  | Ground Wire (connects to the upper assembly) |
| iii | Control Knob                                 |

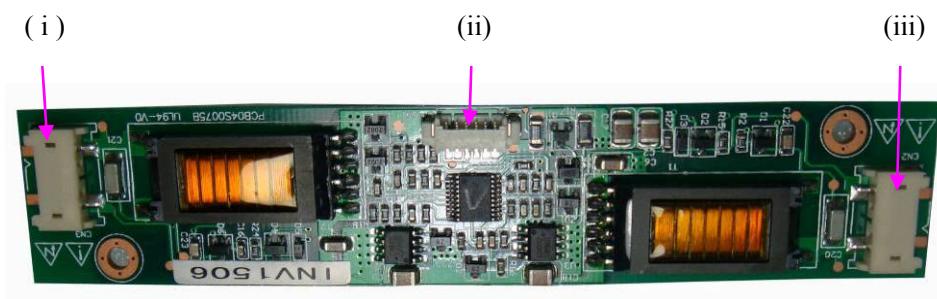
### 10.5.4 Replacing the Power Inverter Board

To remove the power inverter board,

- 1) Separate the upper assembly and the lower assembly.
- 2) Disconnect all the wires on the power inverter board.
- 3) Remove the four screws securing the board.

To replace the power inverter board,

Replace the board in a reverse procedure. Refer to the following illustration when connecting wires. Ensure they are all correctly connected.



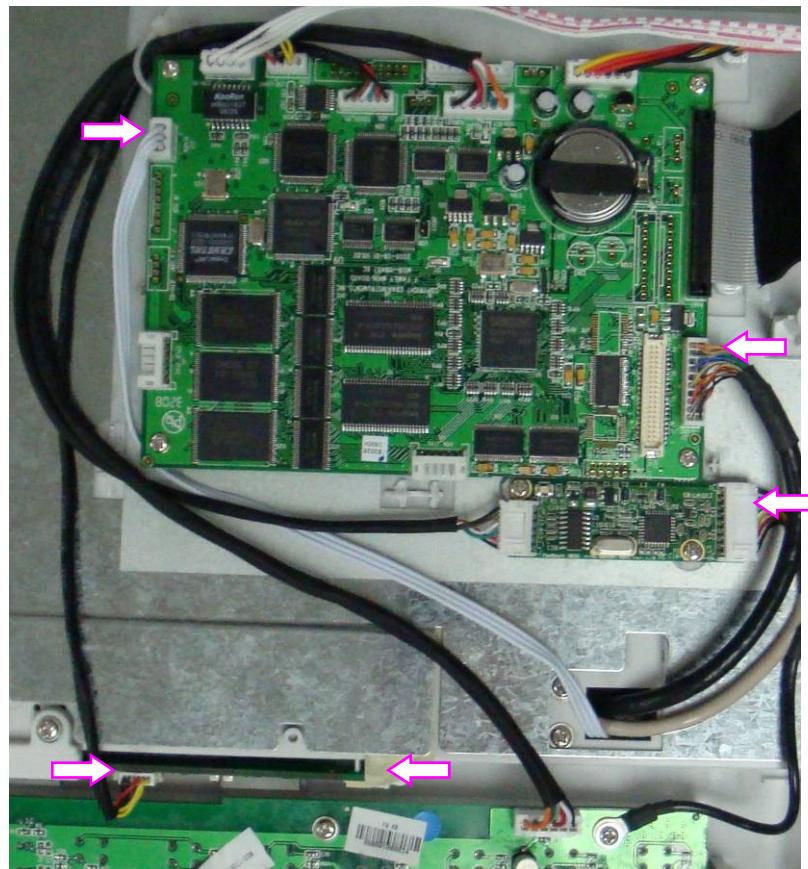
**No. Connect to**

- |     |                            |
|-----|----------------------------|
| i   | LCD Backlight Wire (Short) |
| ii  | Main Control Board         |
| iii | LCD Backlight Wire (Long)  |

### 10.5.5 Replacing the LCD

To remove the LCD,

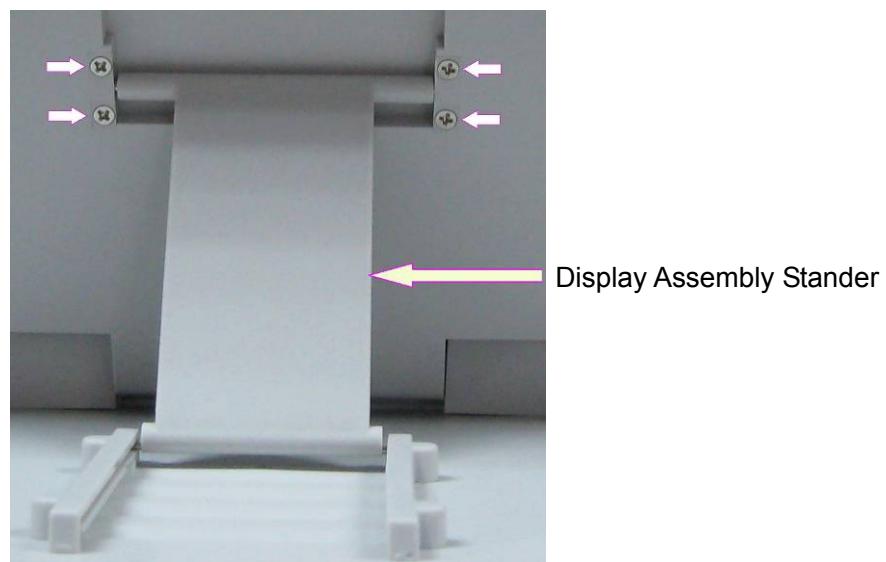
- 1) Separate the upper assembly and the lower assembly.
- 2) Disconnect the five wires from the power inverter board, main control board and touch screen controlling board (shown with arrows).



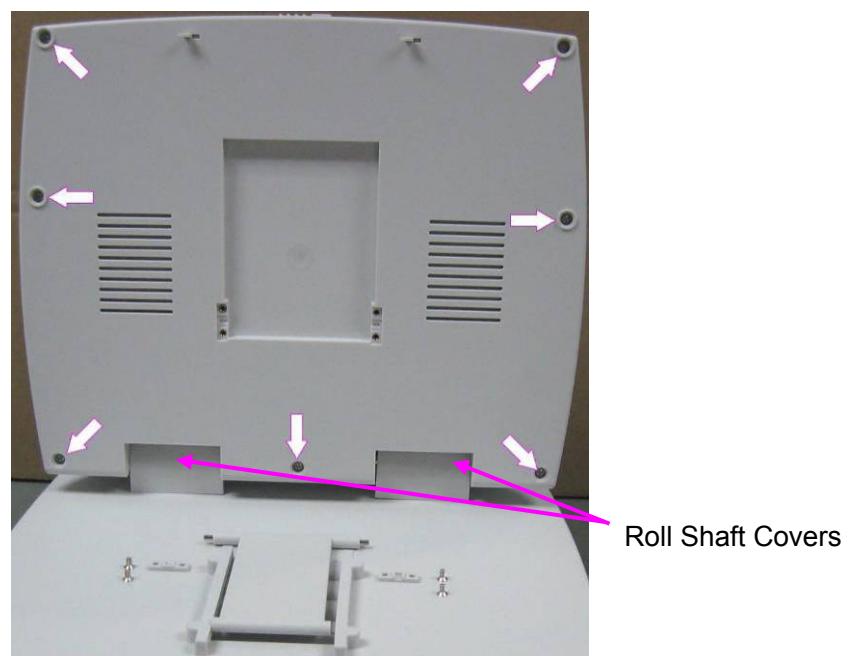
- 3) Remove the four screws shown with the arrows.



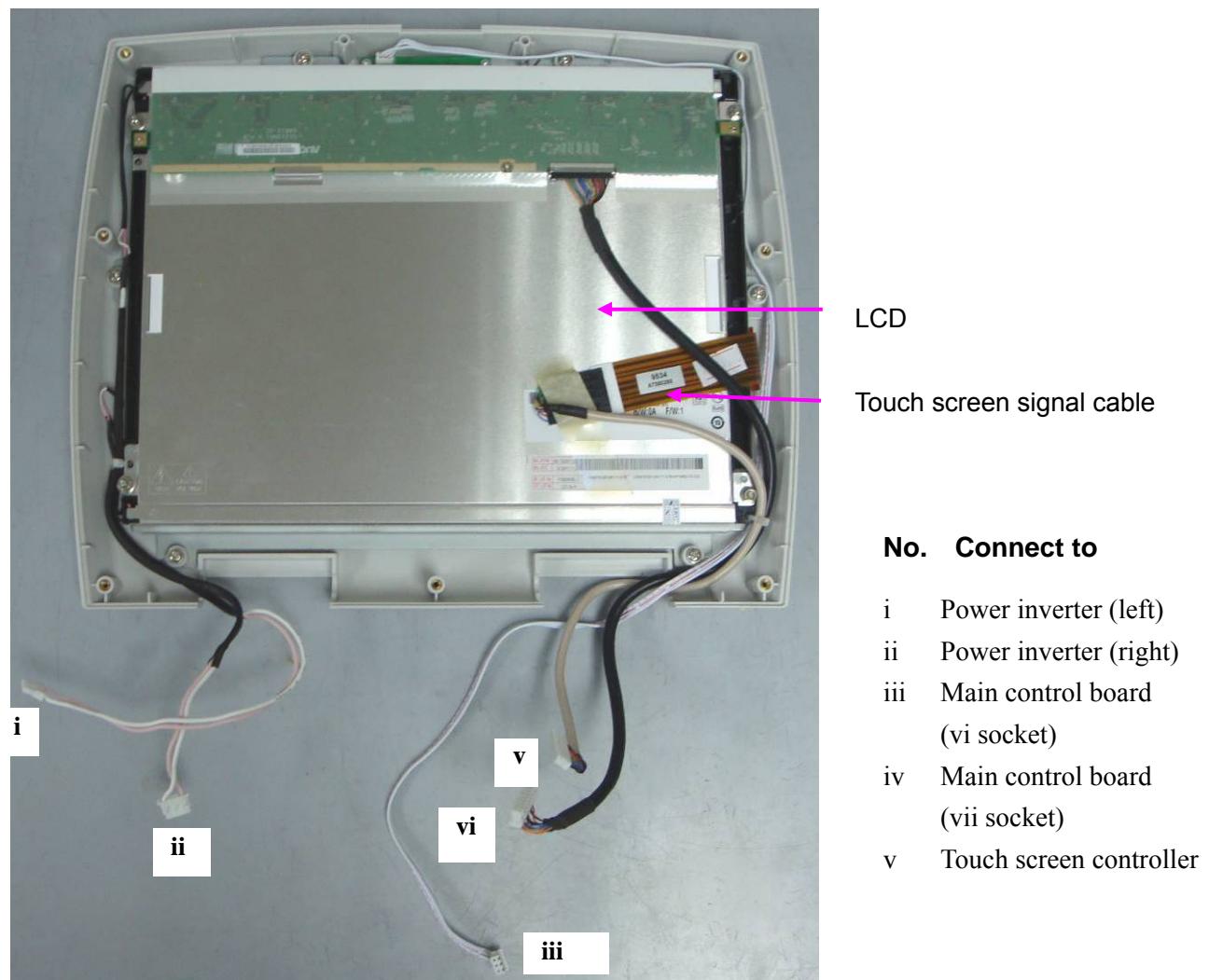
- 4) Place the upper assembly upright. Open the display assembly completely. Remove four screws securing the display assembly stander.



- 5) Remove seven screws on the back of display assembly and the two roll shaft covers.



- 6) Pull out the wires then open the display assembly with care.
- 7) Remove the touch screen signal cable from the LCD.
- 8) Remove the six screws securing the LCD to the case.



To replace the LCD,

Replace the LCD in a reverse procedure. Refer to the following illustration when connecting wires. Ensure they are all correctly connected.

## Chapter 11 Periodic Tests

### 11.1 Safety Tests

Safety tests should be performed by qualified personnel every 6 to 12 months, and each time after service.

Use a standard safety tester to perform safety tests. The tester must comply with IEC/EN 60601-1 or the local standards and statutes.

Refer to the accompanying operation instructions of the tester for test procedure details.

### 11.2 Performance Tests

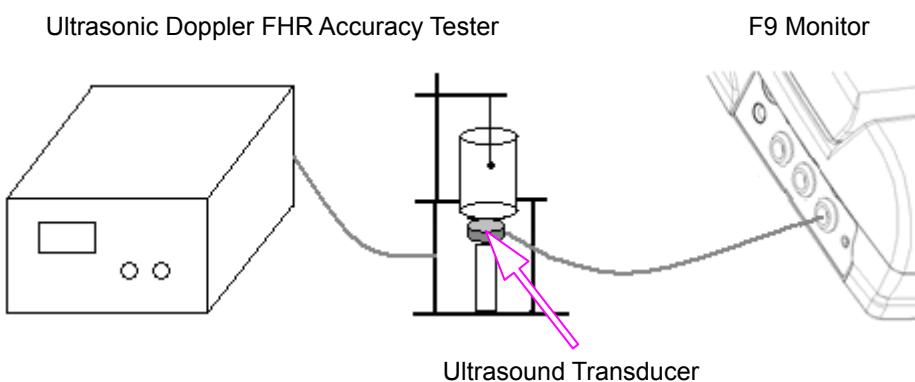
The performance test should be done once every 12 months or when you suspect the measurement is incorrect.

#### 11.2.1 FHR Performance Test

This test checks the performance of FHR measurement.

**Required Equipment:** Ultrasonic Doppler FHR Accuracy Tester System

- 1) Connect the equipment and the monitor as shown:



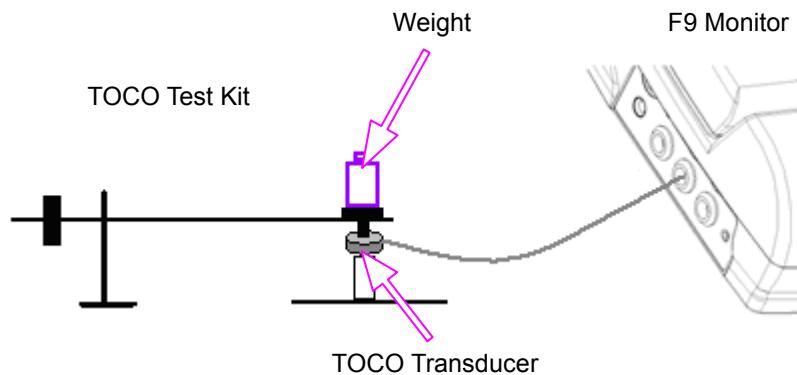
- 2) Switch on the monitor.
- 3) Generate the heart rate 50 bpm, 90 bpm, 120 bpm, 150 bpm, 180 bpm and 210 bpm in turn.
- 4) Check if the FHR value displayed on the screen is accurate. Error within 2 bpm is acceptable.
- 5) Connect the ultrasound transducer to the other US socket and perform the same test.

## 11.2.2 TOCO Performance Test

This test checks the performance of TOCO measurement.

**Required Equipment:** TOCO Test Kit, Weights

- 1) Connect the equipment and the monitor as shown:



- 2) Switch on the monitor.
- 3) Press **AUTO ZERO** key to zero the system when no weight is added to the tray.
- 4) Add weights to the tray. Document the weights ( $W_1$ ,  $W_2$ ,  $W_3$ ,  $W_4$ ) when the TOCO value reaches 25 (V1), 50 (V2), 75 (V3) and 100 (V4).
- 5) Calculate the non-linearity (NL) with this formula:  $NL_n = \left(1 - \frac{(W_n - W_{n-1})}{(V_n - V_{n-1})}\right) \times 100\%$ .  
( $n = 2, 3, 4$ ). Error within 10% is acceptable.

## Appendix 1 Renewal Parts

### **CAUTION**

Only connect the renewal parts supplied by EDAN to the monitor.

<b>Repair Part</b>	<b>Part Number</b>
Speaker	11.14.038018
Fan	01.58.47177
LCD	01.16.52161
Alarm Indicator Board PCBA	02.03.31022
Print Controlling Board	12.03.31002
Key Board	12.03.31020
Power Module	12.01.17716
Bottom Interfaces Board PCBA	02.03.109259
Main control board PCBA	02.03.110456
FM Module PCBA	02.03.110440
DECG Module PCBA	02.03.107740
Printhead	11.17.02385
Serial Port Cable	01.13.107702
Serial Port to RJ45 Cable #1	01.13.107974
Serial Port to RJ45 Cable #2	01.13.036124

## Appendix 2 Connecting to Philips OB TraceVue System

### Preparation

Prior to connecting F9 to the OB TraceVue obstetrical documentation and surveillance system of Philips, make sure that

- 1) Net Version of F9 on the Network Setup interface has this option: **PHILIPS**.
- 2) The OB TraceVue system of Philips has a network interface (DB9 or RJ45) available.
- 3) You have the proper connecting cable:

If a DB9 interface is available, you need a Serial Port Cable (MS1R-107702):



Figure A2-1 Serial Port Cable

If an RJ45 interface is available, you need a Serial Port to RJ45 Cable (MS1R-107974 or M13R-036124). The part numbers are shown on the labels attached to the cables.



Figure A2-2 Serial Port to RJ45 Cable

Check other bedside monitors in the OB TraceVue system to see if protocol converters (as shown in the following illustrations) are used.



Figure A2-3 Protocol Converter

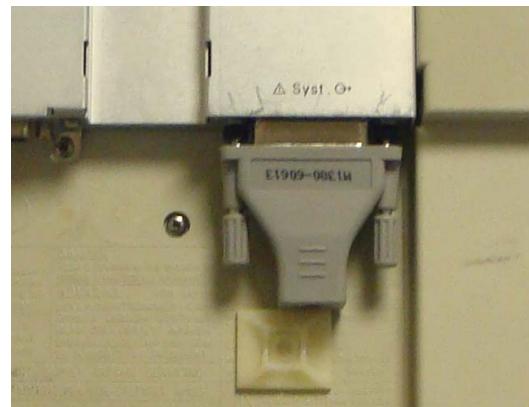


Figure A2-4 A Protocol Converter Used on a Monitor

If protocol converters are used on other bedside monitors, connect the monitor with the Serial Port to RJ45 Cable #2 (M13R-036124). Otherwise use the cable #1 (MS1R-107702).

## Connection

Put the convex plug of the Serial Port Cable into the DB9 interface of F9; put the concave plug of the Serial Port Cable into the free DB9 interface of the OB TraceVue system.

OR

Put the convex plug of the Serial Port to RJ45 Cable into the DB9 interface of F9; put the RJ45 plug of the Serial Port to RJ45 Cable into the free RJ45 interface of the OB TraceVue system.



Figure A2-5 Connecting DB9 and RJ45 interfaces of the OB TraceVue system

## Setting

Set the Net Version of F9 to PHILIPS. (Refer to 5.8 *Changing Net Version*)

Restart F9.

## Validation

- 1) Switch F9 to Demo mode.
- 2) Observe the surveillance window of the OB TraceVue system. If data from F9 is transferred to the system, the connection succeeds. Otherwise check the connection or try on another interface of the system.

### **NOTE:**

The identity number of this interface is preset. The device No. of F9 does not take effect in this system.

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