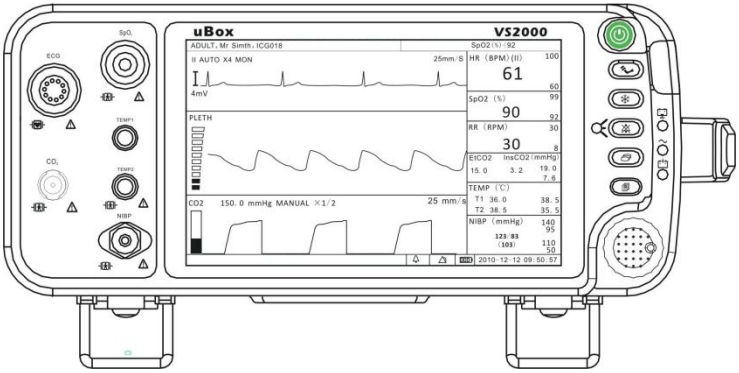
Vital Signs Monitor
Service Manual



Catalogue

Warranty and Service Information

Proprietary Notice

Information contained in this document is copyrighted by manufacturer and may not be duplicated in full or part by any person without prior written approval of manufacturer. Its purpose is to provide the user with adequately detailed documentation to efficiently install, operate, maintain and order spare parts for the device supplied. All information contained in this document is believed to be current and accurate as of the date of publication or revision, but does not constitute a warranty.

manufacturer's Responsibility

manufacturer is responsible for the safety, reliability and performance of the device under the following conditions:

(1) Operating this device following this Manual.

(2) Assembling, upgrading, resetting, and repairing are performed by manufacturer's authorized personnel.

(3) Product storing environment, operating environment, and electrical environment are as described in this manual.

(4) Product serial number and labels are intact to verify the product identity as manufactured by manufacturer

(5) Damages not by miss-use, or accidental dropping.

Limited Warranty

("Seller") warrants to the original purchaser that the Product, not including applicable accessories, shall be free from defects in material and workmanship under normal use, if used in accordance with its labeling, for **one year** from the date of shipment to the original purchaser.

Seller warrants to the original purchaser that the reusable oximeter sensors supplied as accessories, shall be free from defects in materials and workmanship under normal use, if used in accordance with its labeling, for one year from the date of shipment to the original purchaser.

Seller warrants to the original purchaser that the reusable ECG leads and reusable NIBP purple hose supplied as accessories, shall be free from defects in materials and workmanship under normal use, if used in accordance with its labeling, for 90 days from the date of shipment to the original purchaser.

Blood pressure cuffs carry a (6) six month warranty, pending evaluation by manufacturer Technical Services. Cuffs that are contaminated, have liquid in them, have been misused/ abused or are older than (6) months will not be covered under warranty. The sole obligation of manufacturer under this warranty will be to repair or replace, at its option, products that prove to be defective during the warranty period.

The foregoing shall be the sole warranty remedy. Except as set forth herein, seller makes no warranties, either expressed or implied, including the implied warranties of merchantability and fitness for a particular purpose. No warranty is provided if the products are modified without the express written consent of manufacturer and seller shall not be liable in any event for incidental or consequential damage. This warranty is not assignable.

Warranties are subject to change. Please contact manufacturer for current warranty information.

Disclaimer of Warranties

THE FOREGOING EXPRESS WARRANTY, AS CONDITIONED AND LIMITED, IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES WHETHER EXPRESS OR IMPLIED, BY OPERATION OF LAW OR OTHERWISE, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Seller disclaims responsibility for the suitability of the Product for any particular medical treatment or for any medical complications resulting from the use of the Product. This disclaimer is dictated by the many elements which are beyond Seller's control, such as diagnosis or patient, conditions under which the Product may be used, handling of the Product after it leaves Seller's possession, execution

Conditions of Warranty

of recommended instructions for use and others.

This warranty is void of the Product has been altered, misused, damaged by neglect or accident, not properly maintained or recharged, or repaired by persons not authorized by Seller. Misuse includes, but is not limited to, use not in compliance with the labeling or use with accessories not manufacturer by Seller. This warranty does not cover normal wear and tear and Service items.

Limitation of Remedies

The original purchaser's exclusive remedy shall be, at Seller's sole option, the repair or replacement of the Product. **THIS IS THE EXCLUSIVE REMEDY. In no event will Seller's liability arising out of any cause whatsoever (whether such cause is based in contract, negligence, strict liability, tort or otherwise) exceed the price of the Product and in no event shall Seller be responsible for consequential, incidental, or special damages of any kind or nature whatsoever, including by not limited to, lost business, revenues and profits.**

Service Support

Repairs for devices manufactured by manufacturer company under warranty must be made at authorized repair centers. If the device needs repair, contact your local distributor or the manufacturer company after-service department. When calling, have the device's model and serial number ready.

If you need to ship the device, pack the device and accessories carefully to prevent shipping damage. All accessories should accompany the device.

NOTE! Shipments received without a return number will be returned to sender.

Keep all original packing material, including any inserts. If you need to ship the device, use only the original packaging material, including inserts. Box and inserts should be in original condition. If original shipping material in good condition is not available, it should be purchased from manufacturer

Damages occurring in transit in other than original shipping containers are the responsibility of the shipper. All costs incurred returning devices for repair are the responsibility of the shipper.

Chapter 1: Introduction

1.1 Definition of Symbols

The following symbols appear in the monitor documentation and on monitor labels. These internationally recognized symbols are defined by the International Electrotechnical Commission, IEC 878 and IEC 417A.

SYMBOLS	DEFINITION
	Attention, see in instructions for use
	Type BF Defibrillation
	Defibrillator-proof type CF equipment
	NIBP Start/ Stop Key
	Freeze Key
	Alarm Silence
	Battery Supply LED
	AC Power LED
	Battery Charge LED
	Date of Manufacturing
IPX1	Drip Proof (monitor only)
	Indicates separate collection for electrical and electronic equipment.

1.2 Warning Information

KEYWORD	DEFINITION
WARNING	Tells you something that could hurt the patient or hurt the operator.
CAUTION	Tells you something that could damage the device.
NOTE	Tells you other important information.

General Warning, Cautions, and Notes

WARNING! Do not use this device in the presence of flammable anesthetics or other flammable substance in combination with air, oxygen-enriched environments, or nitrous oxide.

WARNING! To avoid risk of electric shock, this equipment must only be connected to supply mains with protective earth.

WARNING! The ME EQUIPMENT must be connected to an appropriate power source.

WARNING! Don't put any restrictions on other equipment or NETWORK/DATA COUPLINGS, other than those forming part of an ME SYSTEM, to which a SIGNAL INPUT/OUTPUT PART may be connected.

WARNING! The ME EQUIPMENT is difficult to operate the disconnection device when an APPLIANCE COUPLER or separable plug is used as isolation means.

WARNING! No modification of this equipment is allowed.

WARNING! ELECTRICAL SHOCK HAZARD when cover is removed. Do not remove covers. Refer servicing to qualified personnel.

WARNING! Do not use this device in the presence of magnetic resonance imaging (MR or MRI) equipment.

WARNING! Do not plug the monitor into an outlet controlled by a wall switch.

WARNING! This device is intended for use by persons trained in professional health care. The operator must be thoroughly familiar with the information in this manual before using the device.

WARNING! Do not autoclave, ethylene oxide sterilize, or immerse the monitor and other accessories in liquid. Evidence that liquid has been allowed to enter the monitor voids the warranty.

WARNING! This device must be used in conjunction with clinical signs and symptoms. This device is only intended to be an adjunct in patient assessment.

WARNING! Equipment is protected against defibrillator discharge. Rate meters and displays may be temporarily affected during defibrillation, but will rapidly recover.

WARNING! The vital signs monitor is suitable for use within the patient environment EN 60601-1 approved equipment must be placed outside of the patient environment. The patient environment is defined as any volume in which intentional or unintentional contact can occur between the patient and parte of systems or between the patient and other persons touching parts of the system.

WARNING! When connecting this monitor to any instrument, verify proper operation before clinical use. Use only equipment meeting specifications given in this manual. Refer to the instrument's user manual for full instructions. Accessory equipment connected to the monitor's data interface must be certified according to the respective standards, i.e. EN 60601-1 for electro medical equipment. All combinations of equipment must be in compliance with IEC 60601-1-1 systems requirements. Anyone connecting additional equipment to the signal input port or signal output port configures a medical system, and therefore, is responsible that the system complies with the requirements of the system standard IEC 60601-1-1.

WARNING! Any monitor that has been dropped or damaged should be checked by qualified service personnel to ensure proper operation prior to use.

WARNING! Use only original manufacturer or recommended patient cables. Use of accessories other than those specified may result in increased electro-magnetic (EM) emissions or decreased EM immunity of the device. To avoid potential electro-static discharge interference, do not use cables that incorporate metal or metal-coated connectors.

WARNING! Medical electrical equipment, including this device, needs special precautions regarding electro-magnetic compatibility (EMC) and needs to be installed and put into service according to the EMC information provided in this manual.

WARNING! There is no defibrillator synchronization output on the monitor.

Make no connections between the monitor and a defibrillator.

WARNING! This monitor will not operate effectively on patients who are experiencing convulsions or tremors.

WARNING! This monitor is not for home use.

WARNING! The monitor should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, the monitor should be observed to verify normal operation in the configuration in which it will be used.

WARNING! This monitor is not for apnea detection. The monitor has not been tested or validated for use in apnea detection.

WARNING! Verify proper operating mode before attaching patient. See Select the Patient Type in Chapter of Setting Up the Monitor.

WARNING! Default alarm limits are provided for convenience. Verify that alarm limits are appropriate for given patient and condition, and adjust according to institutional policy.

WARNING! Ensure the monitor's AC rating is correct for the AC voltage at your installation site before using the monitor. The monitor's AC rating is shown on the rear panel rating plate. If the rating is not correct, do not use the monitor.

WARNING! Disconnect the AC power supply from the outlet before disconnecting it from the monitor. Leaving the AC power supply connected to an AC power outlet without being connected to the monitor may result in a safety hazard.

WARNING! Do not allow any moisture to touch the AC power supply connectors or a safety hazard may result. Ensure that hands are thoroughly dry before handling the AC power supply.

WARNING! Do not place the monitor in the patient's bed. Do not place the monitor on the floor.

WARNING! Failure to place the monitor away from the patient may allow the patient to turn off, reset, or damage the monitor, possibly resulting in the patient not being monitored. Make sure the

patient cannot reach the monitor from their bed.

WARNING! If there is a risk of the AC power supply becoming disconnected from the monitor during use, secure the cord to the monitor several inches from the connection.

WARNING! This device is intended for use by trained healthcare professionals. The operator must be thoroughly familiar with the information in this manual before using the device.

WARNING! Do not disassemble the unit. The unit is not use serviceable. Refer to qualified service personnel.

WARNING! It is the operator's responsibility to set alarm limits appropriately for each individual patient.

WARNING! If the accuracy of any measurement is in question, check the patient's vital sign(s) by an alternative method and then check the monitor for proper functioning.

WARNING! Operation of this device may be affected in the presence of strong portable and mobile communications equipment.

WARNING! Operation of this device may be adversely affected in the presence of computed tomography (CT) equipment.

WARNING! This Device can connect a POTENTIAL EQUALIZATION CONDUCTOR.

WARNING! Only PATIENT-related ACCESSORIES including , ELECTRODES, LEAD WIRES and PATIENT CABLES as specified by the manufacturer shall be used to guarantee defibrillator protection and specification or type number of such ACCESSORIES are disclosed

WARNING! Do not use the device with the HF surgical equipment.

CAUTION! This device contains rechargeable lithium batteries .The user can replaceable it follows the manual.

CAUTION! Pressing front panel keys with sharp or pointed instruments may permanently damage the keypad. Press the front panel keys only with your finger.

CAUTION! Blocking the ventilation holes on the monitor's rear panel can prevent air circulation inside the monitor, possibly resulting in damage to the monitor. Leave an air gap behind the monitor to allow air to circulate through the ventilation holes.

CAUTION! Chemicals used in some cleaning agents may cause brittleness of plastic parts. Follow cleaning instructions in this manual.

CAUTION! If the device becomes wet, wipe off all moisture and allow sufficient time for drying before operating.

CAUTION! Follow local governing ordinances and recycling instructions regarding disposal and recycling of device components and packaging.

NOTE! All user and patient accessible materials are non-toxic.

NOTE! Each input and output connection of the monitor is electrically isolated. Connection of this monitor to other equipment will not increase leakage current.

Chapter 2: Overview

2.1 Purpose and Scope

TheVS2000 Service Manual is intended as a reference for monitor Service and repair. This manual provides the technically qualified service person with troubleshooting information, repair procedures, and calibration and performance verification instructions. A technical overview of the monitor subsystems is provided as an introduction to the device's circuitry and pneumatic.

NOTE! Configurations vary for different customers. You may just need to repair part of parameters.

This manual is intended for the technically qualified service person. Service training classes on manufacturer' products are available. Contact manufacturer Technical Service for information.

2.2 Unpacking Procedure

Use the following guidelines when unpacking the monitor from its shipping carton.

1. Before opening the monitor shipping carton, check it for damage.
2. If damage is apparent, stop unpacking the carton and contact the shipping company for further instructions. If the carton is intact, unpack the monitor.
3. With the monitor out of its carton, check to see that all the items listed on the packing slip (provided with shipment) are in the shipping carton.
4. If an item is missing, first recheck the carton, then check with your receiving department. If necessary, contact manufacturer at the address and phone number shown below.

NOTE! Save the shipping carton and packing material for repacking the monitor in case it needs to be sent to a repair center or back to manufacturer for service.

2.3 Warranty Service

DO NOT ATTEMPT TO REPAIR the monitor yourself during the warranty period. For service and repair, contact manufacturer as described below.

2.4 Technical Support Services

manufacturer offers a wide range of technical support services including:

- 24-hour telephone support
- loaner equipment
- service contracts
- factory repair

For any of these services, contact manufacturer Technical Support at the following.

2.5 Recommended Service Intervals

At the intervals listed below, check the Encore monitor for normal operation.

Interval/Condition	Perform	Located in this manual
Every 6 months to 2 years (according to hospital rotocols).	Complete risk (leakage) current Safety Check followed by a Functional Verification.	"Functional Verification"
If battery does not retain a charge.	Check battery pack capacity.	"Troubleshooting"
Monitor is dropped or suspected of damage or rough handling.	Complete Safety Check followed by Functional Verification.	"Functional Verification"

Suspected malfunction with all or part of monitoring parameters.	Functional Verification of suspected parameter(s).	"Functional Verification"
Monitor does not pass Functional Verification.	repair, followed by Safety Check and Functional Verification.	"Functional Verification"

WARNING! If the monitor is opened for repair or calibration, a dielectric strength test must be completed to ensure the integrity of the patient isolation barrier.

2.6 Identifying Equipment Configurations

The following table identifiesVS2000 monitor configurations and how they are indicated. The model-option number and serial number are located on the back of the housing. The monitor indicators are located under the handle on the back.

Table 1. Monitor Configurations

#	Product Model	Parameters
1	VS2000	ECG+RESP+TEMP+NIBP+SpO2
2	VS2000C	ECG+RESP+TEMP+NIBP+SpO2+CO2
3	VS2000B	ECG+RESP+NIBP
4	VS2000D	NIBP+SpO2
5	VS2000E	SpO2
6	VS2000EC	SpO2+CO2
7	VS2000F	ECG+RESP+SpO2
8	VS2000G	ECG+RESP+NIBP+SpO2
9	VS2000N	NIBP
10	VS2000H	ECG+RESP+TEMP+SunTech_NIBP+SpO2
11	VS2000I	TEMP+NIBP+SpO2
12	VS2000J	ECG+RESP
13	VS2000Y	ECG+RESP+NIBP+SpO2+YSI_TEMP

14	**VS2000K**	**ECG+RESP+TEMP+SpO2**
15	**VS2000CE**	**ECG+RESP+TEMP+NIBP+SpO2+CO2**

2.7 Indicators and Displays with Embedded Submenus

The monitor has a high-resolution, high-contrast, color LCD display. It provides a continuous, real-time display of up to seven waveforms. It also shows measured values, chronological data, measurement trends, alarm limits and patient information.

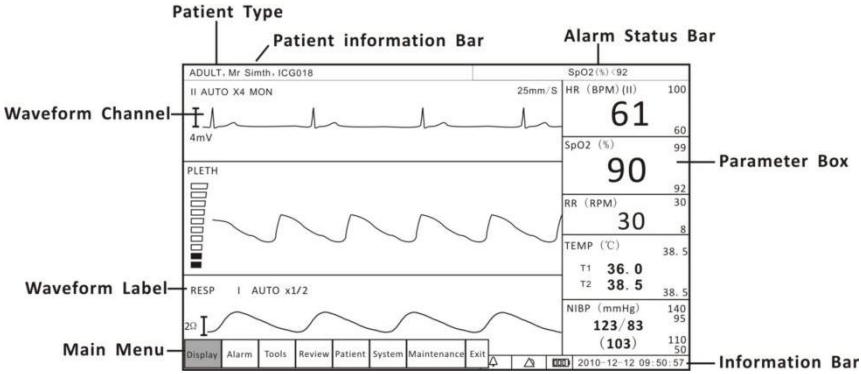


Figure 2.1: Display

DISPLAYS	DESCRIPTION
Patient Type	You must select the patient type (ADULT or PEDIATRIC) before monitoring a patient. When you change the patient type: •The alarm limits will be reset to their default settings.(if not in STATIC LIMITS mode) •NIBP inflation pressure settings will be reset for an adult, or pediatric patient. •The NIBP mode will be reset to MANUAL.
Patient Information	Patient name and bed number will be shown here.
Alarm Status Bar	Shows active alarm events.

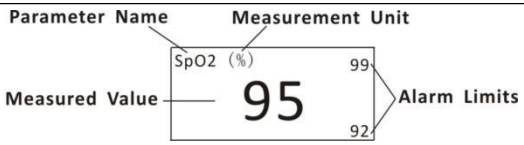
<table>
<tr><td>Main Menu</td><td>The main menu provides a means of changing monitor settings, such as alarm limits and patient information, and performing monitoring functions. There are several points of entry into the monitor's menu system including the main menu, parameter menus, and waveform menus.</td></tr>
<tr><td>Waveform Channel</td><td>Up to three waveform channels can be displayed simultaneously. Every channel can be assigned to a waveform from any enabled parameter, graph, table or blank. The waveform label provides access to a menu for each waveform where you can adjust various settings related to the waveform. For some parameters, such as ECG, the waveform label displays information about the primary lead and the size of the ECG tracing.</td></tr>
<tr><td>Waveform Label</td><td>The waveform label shows the name of the waveform.</td></tr>
<tr><td>Information Bar</td><td>Shows date and time, battery symbol and volume icon etc.</td></tr>
<tr><td rowspan="3">Parameter Box</td><td> 

Figure 2.2 Parameter Box</td></tr>
<tr><td>The parameter box provides access to a menu for the parameter where you can adjust various settings related to the parameter.

The parameter box contains the parameter or measurement name, the numeric values for the selected measurement, the high and low alarm limits, and the measurement unit. In figure 3.2, the parameter is SpO_2, the numeric measured value is the pulse oxygen saturation (SpO_2), the alarm limits shown are for the pulse oxygen saturation (SpO_2), and the measurement unit is percent (%).</td></tr>
<tr><td><table><tr><td>Parameter Name</td><td>The name of the monitored parameter is displayed.</td></tr></table></td></tr>
</table>

	Numeric Measured Values	The number value for the selected measurement (such as HR or SpO_2) is displayed. The value may be derived or calculated. Dashes (- - -) in place of a numeric measured value indicate that the measurement is invalid or unavailable.
	High and Low alarm limits	The high and low alarm limits for the numeric measured values are displayed. If you do not set alarm limits for a new patient, the default high and low limits will be used.
	Measurement Unit	Units of measurement can be changed for pressure. Pressure measurement units may be displayed as millimeters of mercury (mmHg) or kilopascals (kPa).

2.8 Keys

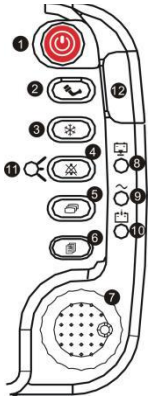


Figure 2.3: Keys

No.	DESRIPTION	INSTRUCTION
1	ON/OFF	Hold on this key for 3 seconds to turn on or turn off the monitor.
2	NIBP	Press this key to activate an immediate non-invasive blood pressure (NIBP) measurement. To cancel an NIBP measurement in progress, press the key again.

3	Freeze	Press this key to freeze the displayed waveform.
4	Alarm Silence	Press it in turn to silence the alarm volume for 30 sec, 60sec, 90sec, 120 sec or indefinitely.
5	Mode Key	Use this key to switch between the four main display modes: 1 ECG mode, 3 ECG mode, oxyCRG mode and the huge digit mode.
6	Menu Key	Press it to enter or exit the main menu.
7	Rotary Knob	The rotary knob is a dial control with a push selection switch. It is located on the front of the monitor, in the lower right corner. Turn the rotary knob to navigate the cursor around the display. Push the knob to select highlighted options.
8	Battery Supply LED	The green Battery Supply LED will light to indicate that the monitor is supplied by battery.
9	AC Power LED	The green AC Power LED will light to indicate that the monitor is connected to an AC power source.
10	Battery Charge LED	The green Battery Charge LED will light to indicate that the monitor is been charging.
11	Alarm Silence LED	The red Alarm Silence LED will flash to indicate that the alarm volume has been silence for 30 sec, 60sec, 90sec, 120 sec or indefinitely.
12	Work Status LED	Green when the monitor is working normal. Red when there is an alarm.

2.9 Left Panel

The left side panel of your monitor contains all of the patient connector receptacles.

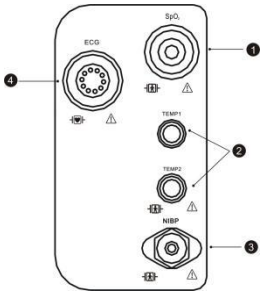


Figure 2.4: Left Panel

NO.	DESRIPTION	INSTRUCTION
1	Oximetry Connector (SpO_2)	Attach the SpO2 sensor to the monitor. Measured values for oxygen saturation (%SpO_2) in the blood and pulse rate (PR) will be displayed when the sensor is attached to the patient.
2	Dual Temperature Connector (T1 up and T2 low)	If the temperature is installed on your monitor, the TEMP parameter box will appear on the display when the patient connector is attached to the monitor. A measured value for temperature (TEMP) will be displayed when the sensor is attached to the patient.

3	Non-Invasive Blood Pressure Connector (NIBP)	Attach the NIBP cuff to the monitor. Measured values for non-invasive blood pressure (systolic, diastolic, and mean) will be displayed when the most recent NIBP measurement is complete.
4	ECG Connector	Attach the ECG leads to the monitor. A measured value for the ECG heart rate (HR) will be displayed when the ECG leads are attached to the patient.
5	CO2 Connector	Attach the CO2 nose tube to the monitor. A measured value for the ETCO2 will be displayed when the CO2 nose tube attached to the patient.

2.10 Back Panel

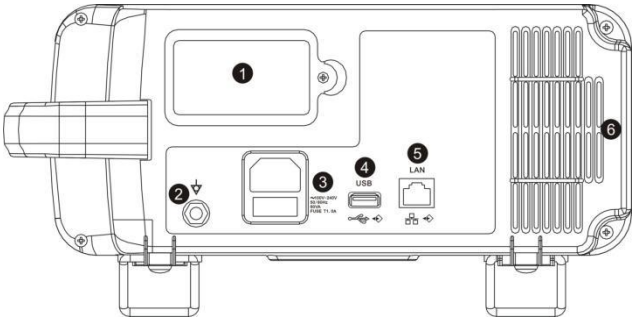


Figure 2.5: Back Panel

NO.	DESRIPTION	INSTRUCTION
1	Battery	The monitor is equipped with a lithium battery.
2	Equipotential Grounding	
3	AC Power Connector	Plug the AC power cord into the AC power receptacle at the back of the monitor. When the other end is plugged into a ground, three wire hospital-grade outlet, the AC Power LED will light. The monitor automatically switches between 100V and 240V AC line voltage sources. **WARNING! Do not plug the monitor into an outlet controlled by a wall switch.**
4	USB Connector	
5	Network	Connect to the central monitor.

	Interface	
6	Air Vents	The monitor has air vents at the top of the back panel and on the bottom of the monitor.

2.11 Internal Battery

The installed internal rechargeable battery is intended primarily for backup and switch-over use. With correct use, the battery normal life is Charge and discharge about 500 times. When use the monitor, check the battery whether can use normally.

Charge the battery after the device has operated using battery power or after the monitor has been shipped or stored. When charge the battery, connect the AC power cord to the monitor.

CAUTION! The internal rechargeable battery is user-replaceable. Disposal of such batteries should be conducted in accordance to local and federal guidelines. The battery must be complies with the standard IEC62133. Rechargeable battery: 11.1V, 4.4Ah.

NOTE! Typical battery life is 2 to 5 years depending on usage.

NOTE! Storing the monitor for a long period of time may degrade the battery capacity. Batteries should be removed from the monitor before storing.

Chapter 3: Functional Verification

3.1 Introduction

The functional verification procedures ensure proper operation of the monitor and its options. These procedures should be performed following module-level repairs, calibration, or whenever there is a question about the accuracy or safety of the patient functions.

WARNING! Whenever the monitor is opened for calibration or repair, a risk (leakage) current safety check as well as a dielectric strength integrity (hi-pot) test must be performed as described in this section.

3.2 Self Tests

Many functions, such as alarms, waveform and scale sizing, are software operations. During the monitor's power-up self-test, the integrity of all programming is checked first. If software testing is successful, hardware tests are initiated. If all testing is successful, the monitor is ready for use.

3.3 Safety Tests

The following two safety tests, a risk (leakage) current safety check and a dielectric strength integrity (hi-pot) test, must be performed whenever the monitor has been opened for calibration or repair.

NOTE! A hi-pot test is only required if the monitor has been opened.

3.3.1 Risk (Leakage) Current Test

A risk (leakage) current test must be performed to verify that the patient remains electrically isolated from the power circuits of the monitor.

Check leakage currents using a Dynatech/Nevada 431F-1D safety analyzer or its equivalent. The source current should not exceed 10µA rms. The sink current, measured between the isolated patient connections (ECG) and the dc power input

connector of the monitor, should not exceed 20µA rms. See the analyzer's operator's manual for the proper safety check procedure.

Safety Test	Power Adapter	Monitor dc Input	Monitor Cable	Safety Analyzer
Source current	Plugged into analyzer outlet	Connected to power adapter	RA LA LL C RL	RA LA LL C RL
Sink current	Not used	Connected to ground connector on analyzer	RA LA LL C RL	RA LA LL C RL

3.4 Functional Verification

The functional verification must be done only when the monitor is fully assembled. If the monitor has been stored for longer than one month without the monitor connected to the ac adapter (for recharging), the battery voltage must be checked. The battery must be replaced if it cannot hold a charge.

NOTE! Before starting the verification procedures, charge the battery for at least 8 hours with the monitor turned off.

3.4.1 Power System

The following steps check the integrity of the monitor's power system.

1, Turn the ac power adapter's power switch off.

2, Plug the ac power adapter into an ac mains receptacle and connect it to the monitor's back panel dc power connector.

3, Check that the green LED charging indicator on the monitor's lower left side panel is off.

4, Turn on the power adapter's power switch.

5, Check that the green LED on the power adapter turns on and that the green LED charging indicator on the monitor's lower left side panel turns on.

6, Disconnect the power adapter from the monitor. Check that the monitor's green LED charging indicator on the lower left side panel turns off.

3.4.2 System Tests

The following procedures check that the buttons operate properly, that the display works correctly, and that the date is correctly displayed.

1, Turn on the monitor.

2, Verify that no error messages appear and the monitor correctly powers up.

3, Press **"Rotary Knob" ; "MEMU" ; "MODE" ; "FREEZE" ; "Alarm Silence"** key to test the display and verify that no pixels are missing.

4, Using the appropriate table below as a guide, press the indicated buttons in sequence and verify that the monitor responds as indicated and that the buttons do not stick.

FREEZE/UNFREEZE button	Freezes the waveforms
FREEZE/UNFREEZE button	Unfreezes the waveforms
ALARM SILENCE/RESUME button	Changes alarm silence status
MAIN MENU button	Returns to the main menu
NIBP START/STOP button	Starts the NIBP pump
NIBP START/STOP button	Stops the NIBP pump

1. **Press menu key -> "System"-> "Volume"**. Press rotary knob and turn it to change the volume level. Verify that the tone volume changes and goes off when turned OFF.

2. **Press menu key -> "System"-> "date"** and check that the displayed time and date are correct. If is incorrect, please use the rotary knob to set it.

3. Turn off the monitor.

Chapter 4: Repair Procedures

4.1 Introduction

Instructions on how to remove the battery pack are followed by instructions on how to disassemble the monitor, the expansion module etc.

NOTE! In general, reassembly procedures are the reverse of the disassembly procedures. If there are items to note during reassembly, they are described after the disassembly section.

WARNING! Whenever the monitor is opened for calibration or repair, a risk (leakage) current safety check and a hi-pot test must be performed, followed by a complete functional verification.

4.2 Replacing the Power Input Fuse

The fuse protects the Recharger board circuitry against excessive current at the dc input connector. You do not need to disassemble the monitor to replace this fuse.

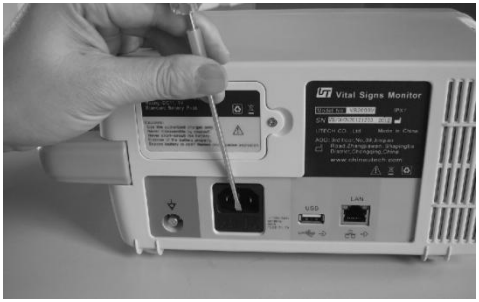
Check the fuse if the ac power adapter is functioning properly and the following two conditions exist:

- the green LED charging indicator on the monitor's right side panel does not Illuminate.
- the monitor battery does not charge.

To remove the fuse, please follow the steps below:

CAUTION! Replace only fuses of the same rating and size. Size 5mm*20mm, rated voltage 250V, rated current 1.5A

1. Use a flat blade screwdriver to turn the fuse cover and release the fuse.



2. Take out the damaged fuse and replace it with a new one.

4.3 Replacing the Battery Pack

Insert a new battery pack into the monitor when the current battery no longer holds an adequate charge.

Dispose of used battery promptly. Keep away from children. Do not disassemble and do not incinerate or burn.

WARNING! Do not pinch the battery wires when inserting the battery pack into the monitor. Monitor failure or fire could occur if wires get pinched.

You must remove the battery pack before opening the monitor case and replacing components. The following steps describe how to remove the battery pack from the monitor:

1. Using a flat blade screwdriver, unscrew the screw securing the battery pack cover as shown below.

2. Disconnect the battery pack cable from the battery pack.

3. Remove the battery pack from the monitor.
4. Store the battery in a safe place while disassembling the monitor.

4.4 Opening the Monitor

Follow these steps to open the monitor casing and gain access to the three removable monitor boards.

1. Remove the battery pack ("Replacing the Battery Pack").
2. Using a screwdriver, remove the four screws securing the monitor casing.

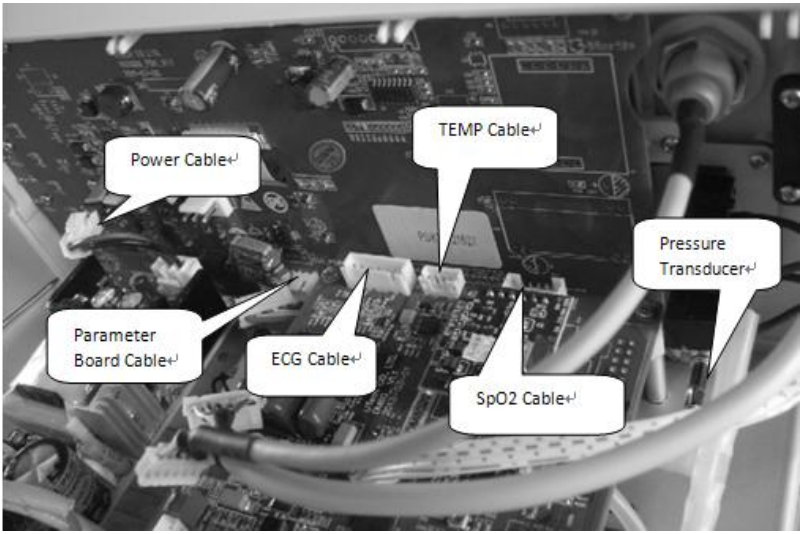
3. Take off the two front Silica gel pad and two supporting feet.

CAUTION! Before opening the casing more than one inch in the next step, disconnect the tube from the pressure transducer at the joint. Failure to disconnect the tubing may cause damage to the transducer or tubing.

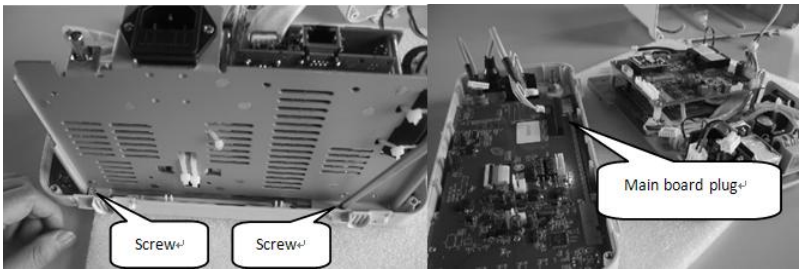
4. Press the up and down edges of rear chassis to separate the front and rear chassis.

5. Unplug the connectors of battery and the speaker to unfold the front and rear chassis totally.

6. Spread the casing open to an angle of about 80 degrees.
7. Detach the following cables from the front chassis (indicated in figure below):
    - power cable
    - temperature cable
    - Spo2 cable
    - ECG cable
    - parameter board cable
    - pressure transducer

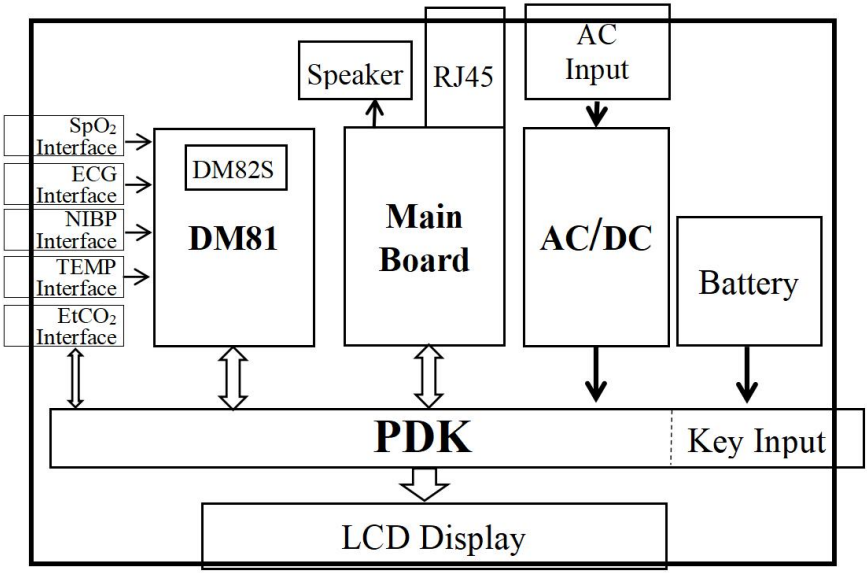


8.Unscrew the two screws and disconnect the main board plug to separate the bezel assembly and the core assembly totally.



Chapter 5: Circuit Introduction

5.1 System Module

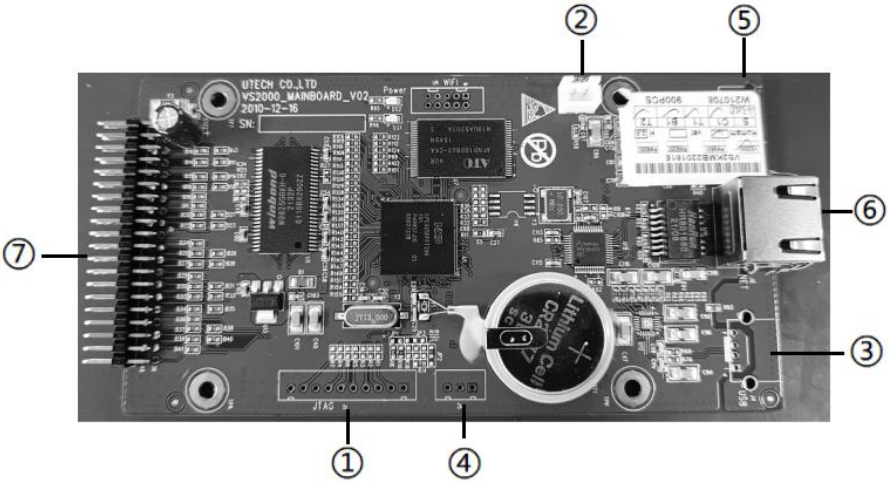


5.2 PCBA Interface Introduce

5.2.1 Main Board

The main board of VS2000 monitor should be equipped with the following items: more than 200MHz CPU, LINUX system,64MByte memory, 64MByte flash.

It supports LCD display, internet, USB HOST, Audio decoding, RTC,SPI, UART function etc.



No.	Connector	Function	Definition	Remark
①	J1	JTAG Interface	10 PIN, Interval: 2.54mm	NC.
②	J3	Speaker Interface, Connect Speaker	2 PIN, Interval: 2.54mm	
③	J4	Host USB Interface	UAB A Type	NC.
④	J5	UART Interface	3 PIN, Interval: 2.54mm	NC.
⑤	J7	Nurse Call Interface	RJ11 Connector	NC.
⑥	J8	Network Interface	RJ45 Connector	
⑦	J9	Connect PDK Board module J4	40 PIN, Interval: 2.54mm	

Connector J1 function definition:

PIN	Function	Description	Remark
1	VDD	+3.3V Power supply	
2	NTRST	Test system reset signal	
3	TDI	Test data serial input	
4	TMS	Test Mode Select	
5	TCK	Testing Clock	
6	RTCK	Test clocks return signal	
7	TDO	Test data serial output	

8	nRESET	The target system reset signal	
9		Not Connect	
10	GND	Power ground	

Connector J3 function definition:

PIN	Function	Description	Remark
1	SPK+	Speaker output	
2	SPK-	Speaker output	

Connector J4 function definition:

PIN	Function	Description	Remark
1	V BUS	+5V Power supply	
2	D-	Data -	
3	D+	Data +	
4	GND	Ground	

Connector J5 function definition:

PIN	Function	Description	Remark
1	TXD	UART 6 Transmit Data	
2	GND	Ground	
3	RXD	UART 6 Receive Data	

Connector J7 function definition:

PIN	Function	Description	Remark
1	VCC	+3.3V Power supply	
2	MICPHONE	MicPhone input	
3	Nurse Call	Nurse Call signal	
4	GND	Power ground	

Connector J8 function definition:

PIN	Function	Description	Remark

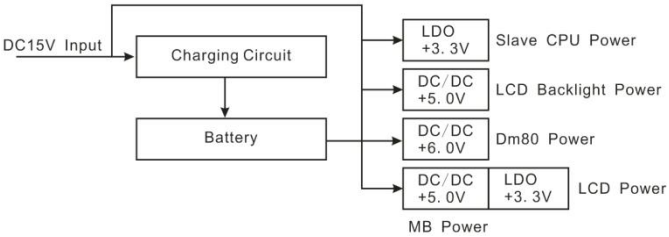
1	TX+	Tranceive Data+	
2	TX-	Tranceive Data-	
3	RX+	Receive Data+	
6	RX-	Receive Data-	
4,5,7,8	N/C	Not connected	

Connector J9 function definition:

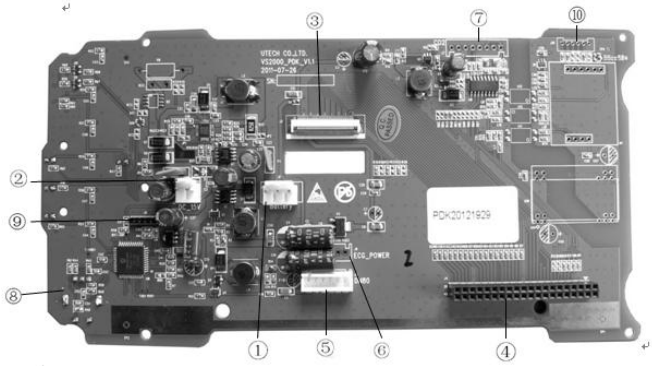
PIN	Function	Description	Remark
1,2	VDD	+5V Power supply	
3,4, 19,26,33,40	GND	Power ground	
5	TXD1	UART1 Transmit Data	
6	RXD1	UART1 Receive Data	
7	TXD2	UART2 Transmit Data	
8	RXD2	UART2 Receive Data	
9	TXD3	UART3 Transmit Data	
10	RXD3	UART3 Receive Data	
11	TXD5	UART5 Transmit Data	
12	RXD5	UART5 Receive Data	
13	SPK	Audio signal	
14	Nurse_Call	Nurse Call signal	
15	LCD_EN	LCD Data enable	
16	LCD_VSYNC	LCD Vsync signal output	
17	LCD_HSYNC	LCD Hsync signal output	
18	LCD_DOTCK	LCD Sample clock	
20,21,22,23,24,25	LCD_DATA_B0 ~5	LCD Blue data output	
27,28,29,30,31,32	LCD_DATA_G 0~5	LCD Green data output	
34,35,36,37,38,39	LCD_DATA_R0 ~5	LCD Red data output	

5.2.2 VS2000 PDK Board

The main function of the PDK board is: manage DC-DC power supply, manage battery charging, check key board



etc.



No.	Connector	Function	Definition	Remark
①	J1	Lithium Ion Battery Interface	3 PIN, Interval:3.96mm	
②	J2	DC15V input Interface	2 PIN, Interval: 3.96mm	
③	J3	TFT LCD Interface	40PIN, Interval: 0.5mm	
④	J4	Connect Main Board module J9	46 PIN, Interval: 2.54mm	
⑤	J5	Connect DM80 Board module J900	6 PIN, Interval: 2.54mm	
⑥	J6	Connect DM10 Board module J100	6 PIN, Interval: 2.54mm	NC.
⑦	J7	Connect CO2 link module	8PIN, Interval: 2.54mm	
⑧	J8	Encoder	ALPS EC11E15244B2	

⑨	J9	PIC-ICSP In-Circuit Serial Programming	5 PIN, Interval: 2.0mm	
⑩	J10	SPO2 link Interface	6 PIN, Interval: 2.0mm	

Connector J1 function definition:

PIN	Function	Description	Remark
1	BAT+	Battery+	
2	NC.	Not connected	
3	BAT-	Battery- GND	

Connector J2 function definition:

PIN	Function	Description	Remark
1	DC15V	DC15V Input	
2	GND	Power ground	

Connector J3 function definition:

PIN	Function	Description	Remark
1,2	VLED	+5V Power voltage for LED Driver	
3	ADJ	Adjust the led brightness with PWM Pulse	
4,5,	GLED	Ground for LED circuit	
6,7	VDD	+3.3V Power voltage for digital circuit	
12, 16,20,24,28,32,36, 38	GND	Power ground	
8	MODE	DE or HV mode control	
9	DE	Data enable	
10	VS	Vsync signal input	
11	HS	Hsync signal input	
13	B5	Blue data input (MSB)	
14	B4	Blue data input	
15	B3	Blue data input	
17	B2	Blue data input	

18	B1	Blue data input	
19	B0	Blue data input(LSB)	
21	G5	Green data input(MSB)	
22	G4	Green data input	
23	G3	Green data input	
25	G2	Green data input	
26	G1	Green data input	
27	G0	Green data input(LSB)	
29	R5	Red data input(MSB)	
30	R4	Red data input	
31	R3	Red data input	
33	R2	Red data input	
34	R1	Red data input	
35	R0	Red data input(LSB)	
37	DCLK	Sample clock	
39	L/R	Select left or right scanning direction	
40	U/D	Select up or down scanning direction	

Connector J4 function definition:

PIN	Function	Description	Remark
1,2	VCC	+5V Power	
3，4,19，26,33,40	GND	Power ground	
5	TXD1	UART1 Transmit Data	
6	RXD1	UART1 Receive Data	
7	TXD2	UART2Transmit Data	
8	RXD2	UART2Receive Data	
9	TXD3	UART3Transmit Data	
10	RXD3	UART3Receive Data	
11	TXD5	UART5Transmit Data	
12	RXD5	UART5Receive Data	
13	SPK	SPK contorl	
14	NC	NC	

15	LCD_EN	LCD enable	
16	LCD_VSYNC	LCD_VSYNC	
17	LCD_HSYNC	LCD_HSYNC	
18	LCD_DOTCK	LCD_DOTCK	
20	LCD_D23	LCD Data	
21	LCD_D22	LCD Data	
22	LCD_D21	LCD Data	
23	LCD_D20	LCD Data	
24	LCD_D19	LCD Data	
25	LCD_D18	LCD Data	
27	LCD_D15	LCD Data	
28	LCD_D14	LCD Data	
29	LCD_D13	LCD Data	
30	LCD_D12	LCD Data	
31	LCD_D11	LCD Data	
32	LCD_D10	LCD Data	
34	LCD_D7	LCD Data	
35	LCD_D6	LCD Data	
36	LCD_D5	LCD Data	
37	LCD_D4	LCD Data	
38	LCD_D3	LCD Data	
39	LCD_D2	LCD Data	
40	U/D	U/D	
41	RXA	Receive Data	
42	TXA	Transmit Data	
43	RXB	Receive Data	
44	TXB	Transmit Data	
45	I2C3_SDA	I2C SDA	
46	I2C3_SCL	I2C SCL	

Connector J5 function definition:

PIN	Function	Description	Remark
1	VCC	+5V Power supply	

2	VCC	+6V Power supply	
3,5	GND	Power ground	
4	TXD1	UART1 Transmit Data	
6	RXD1	UART1 Receive Data	

Connector J6 function definition:

PIN	Function	Description	Remark
1,2	VCC	+5V Power supply	
3,5	GND	Power ground	
4	TXD3	UART3 Transmit Data	
6	RXD3	UART3 Receive Data	

Connector J7 function definition:

PIN	Function	Description	Remark
1,3	VCC	+5V Power supply	
2,6,8	GND	Power ground	
4	CO2 TXD	RS232 Transmit Data	
5	CO2 RXD3	RS232 Receive Data	
7	NC.	Not connected	

Connector J9 function definition:

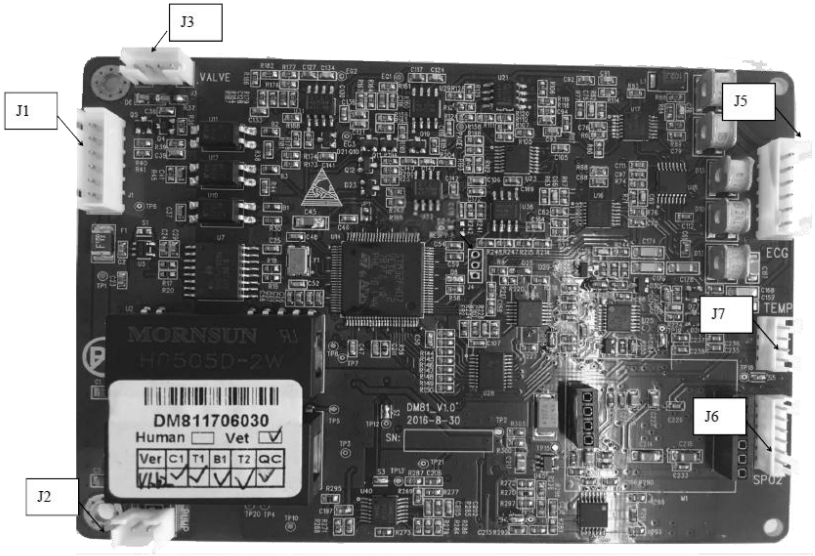
PIN	Function	Description	Remark
1	VDD	+3.3V Power supply	
2	GND	Power ground	
3	MCLR/VPP	Programming/check	
4	ICSPCLK	Clock input	
5	ICSPDAT	Transmission serial data	

Connector J10 function definition (only used to VS2000 SpO2 oximeter):

PIN	Function	Description	Remark

1	DOUT	Data input	
2	VDD	+3.3V Power supply	
3	RD+	Red light	
4	IR+	Infrared light	
5	DGND	Power ground	
6	Pro_Det	Probe Detection	

5.2.3 Parameter Board(DM81 Board)



Connector	Function	Definition	Remark
J1	Connect PDK Board module J5	6 PIN, Interval:2.54mm	
J2	DM80 JTAG Interface	6 PIN, Interval: 2.0mm	
J3	ECG link Interface	6 PIN, Interval: 2.54mm	
J5	SPO2 link Interface	6 PIN, Interval: 2.0mm	
J6	TEMP link Interface	4 PIN, Interval: 2.0mm	
J7	Pump Interface	2PIN, Interval: 2.54mm	

Connector J1 function definition:

PIN	Function	Description	Remark

1	VCC	+5V Power supply	
2	VCC	+6V Power supply	
3	GND	Power ground	
4	TXD1	UART1 Serial Data Input	
5	RXD1	UART1 Serial Data output	

Connector J2 function definition:

PIN	Function	Description	Remark
1	PUMP+	Air Pump +	
2	PUMP-	Air Pump -	

Connector J3 function definition:

PIN	Function	Description	Remark
1	Air-release Valve 1+	Fast Air-release Valve +	
2	Air-release Valve 1 -	Fast Air-release Valve -	
3	Air-release Valve 2+	Slow Air-release Valve +	
4	Air-release Valve 2 -	Slow Air-release Valve -	

Connector J5 function definition:

PIN	Function	Description	Remark
1	V	V Channel	
2	LL	LL Channel	
3	RL	RL Channel	
4	LA	LA Channel	
5	ECG GND	Shield	
6	RA	RA Channel	
7	NA	NA Channel	

Connector J6 function definition:

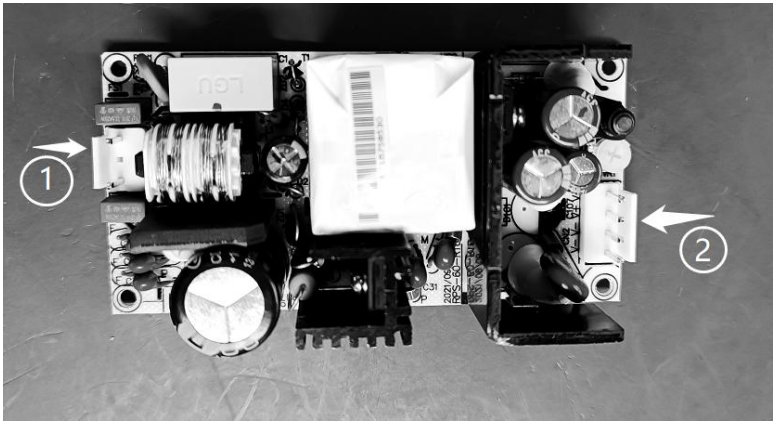
PIN	Function	Description	Remark
1	PD+	Photodiode +	
2	PD-	Photodiode -	
3	RED+	Light-emitting diodes+	

4	RED-	Light-emitting diodes-	
5	DGND	Power ground	
6	Pro_Det	Probe Detection	

Connector J7 function definition:

PIN	Function	Description	Remark
1	T1+	Temperature 1 Channel +	
2	T1-	Temperature 1 Channel -	
3	T2+	Temperature 2 Channel +	
4	T2-	Temperature 2 Channel -	

5.2.4 AC/DC Power Supply Module



No.	Connector	Function	Definition	Remark
①	CN1	AC Input Interface	3PIN, Interval: 3.96mm	
②	CN2	DC Output Interface , Connect PDK Board module J2	4 PIN, Interval: 3.96mm	

Connector CN1 function definition:

PIN	Function	Description	Remark
1	N	AC N	
2	NC.	Not connected	
3	L	AC L	

Connector CN2 function definition:

PIN	Function	Description	Remark
2	DC Output	DC+15V Output	
3	GND	Power Ground	
1,4	NC	NC	

Chapter 6: Troubleshooting

6.1 Introduction

This section provides information that can be helpful in troubleshooting the monitor.

6.2 Screen Messages

Messages may appear on the display to inform the operator of some condition requiring operator or service attention. Messages that indicate that the monitor may need servicing are listed below.

Screen Messages	MEASURE
History data is full	Back to the factory default setting or change the system date
Alarm record is full	
Event is full	
Parameter board is no communication	Check the connection and integrality of module
SpO2 module is no communication	
CO2 module is no communication	
Sensor Over Temp	Make sure sensor is not exposed to extreme heat
Sensor Faulty	Reinsert or reset the sensor of necessary.
In Sleep Mode	The bit is set when sensor has been placed in sleep mode.
Zero In Progress	A capnostat zero is currently in progress
Sensor Warm Up	This error condition is normal at startup. This error should clear when the warn up is complete
Check Sampling Line	Check that the sampling line is not occluded or kinked.
Zero Required	To clear, check airway adapter and clean of necessary
CO2 Out of Range	Perform a zero
Check Airway Adapter	To clear, clean airway adapter if mucus or moisture is see.

6.3 Battery Capacity Check

Several variables affect monitor operating time on battery:

- active options
- frequency of NIBP measurements
- frequency and length of printouts
- ambient temperature
- battery age and condition
- displayed information.

CAUTION! A new battery should pass the following test. The run time of older batteries will decrease proportionally with age. Replacement is recommended when the run time becomes insufficient for the monitor's intended application.

1. Use the ac power adapter and charge the monitor for at least 8 hours with the monitor turned off.
2. Disconnect the cuff and all cables from the monitor.
3. Disconnect the power adapter.
4. Turn on the monitor.
5. Run the monitor for 4 hours.
6. Check that the monitor did not automatically turn off.
7. Use the ac power adapter and charge the monitor for at least 8 hours with the monitor turned off.

6.4 Cleaning the Monitor's Surfaces

WARNING! Do not autoclave, ethylene oxide sterilize, or immerse the monitor in liquid.

CAUTION! Do not allow water or any other liquid to be spilled onto the monitor. Unplug the AC power cord from the monitor before cleaning or disinfecting.

CAUTION! Where the equipment has accidentally gotten wet, it should be wiped dry externally and allowed to dry thoroughly before use.

NOTE! Use only a soft cotton cloth, or a cloth specifically designed for cleaning LCD displays, to clean the monitor's screen. Do not clean the screen with tissues, paper towels, or any other paper-based wipe. Paper-based wipes can scratch the screen.

NOTE! Do not clean the screen with isopropyl alcohol or glutaraldehyde. These liquids can scratch the screen. Use only water or a mild soap solution to clean the screen.

Clean the surfaces of the monitor with a soft cloth moistened in water or a mild soap solution. If disinfecting is necessary, wipe the surfaces of the monitor (but not the screen) with isopropyl alcohol or glutaraldehyde. Then wipe the surfaces with a soft, water-moistened cloth.

6.5 Long-term Storage

If the monitor will be stored for a long period of time, pack the monitor and its accessories in the original packing materials and shipping carton. The long-term storage facility should meet these requirements:

- Indoor
- From -40°C to 75 °C (-40° F to 167 °F)
- Relative humidity from 10-95% (non-condensing)
- No periodic inspection required

6.6 Operator's Troubleshooting Chart

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
The AC power LED on the front of the monitor is not lit.	The AC power cord is not connected to the monitor, the AC line, or both.	Connect the AC power cord to the monitor and to the AC line.
	The AC power cord is connected to a wall outlet that is controlled by a wall switch.	Only connect the AC power cord to an outlet that is not controlled by a wall switch.
	The AC line fuse has blown.	Contact your authorized repair center.
Battery run time is excessively short on a fully charged battery	The battery is spent.	Contact your authorized repair center.
The display on the monitor does light.	The display backlight is defective.	Contact the service department.

SENSOR OFF is displayed in the Pleth waveform channel	The SpO2 sensor is improperly positioned on the patient.	Reposition the sensor on the patient.
	You are using the improper SpO2 sensor for the application.	Change the sensor or contact the manufacturer service department.
	Either the SpO2 sensor is defective.	Change the sensor or contact the manufacturer service department.
Pulse rate is erratic, intermittent, or incorrect.	The SpO_2 sensor is improperly positioned on the patient.	Reposition the sensor on the patient.
	The patient is experiencing poor perfusion.	Reposition the sensor on the patient.
	The patient is moving too much.	Make sure that the patient remains still.
	There is too much ambient light around the SpO_2 sensor.	Shield the SpO_2sensor with a towel.
There is no peripheral pulse registering on the bargraph in the SpO_2 parameter box.	The SpO2 sensor is not connected to the monitor or to the patient.	Connect the sensor to the extension cable and connect the extension cable to the monitor.
	The SpO_2 sensor is improperly positioned on the patient.	Reposition the sensor on the patient.
	The patient is experiencing poor perfusion.	Reposition the sensor on the patient.
	Either the SpO_2 sensor or the extension cable is defective.	Change the sensor or contact the manufacturer service department.

LEADS FAIL is displayed in the ECG waveform channel.	One or more of the ECG leads is not connected to the electrode.	Connect the ECG lead to the electrode.
	One of the ECG leads is broken, creating high impedance.	Replace the ECG leads.
	The electrode's impedance is too high.	Reapply the electrodes.

6.7 Service Menu

6.7.1 Access the Service Menu

Press the menu key to pop up the main menu and turn the rotary knob on the monitor to move the cursor to the "Service" option. Then press the rotary knob to enter its submenu.

OPTIONS	INSTRUCTION
Machine	Back to factory default settings and use the DEMO mode.
Login	These three menus are password protected and contains "System configure" and the calibration of ECG, NIBP and TEMP which only open to dealer and producer.
Config	
Calibrate	

6.7.2 Back to Factory Default Values

You can set up your monitor to operate using the default values you choose for alarm limits, volume, LCD brightness, parameter settings.

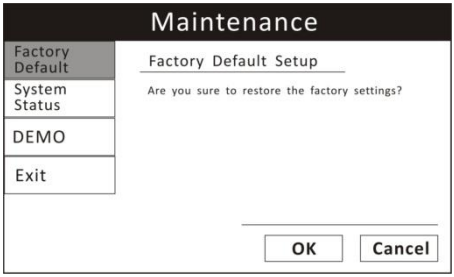


Figure6.7-1: Factory Default Values

1. Press the menu key to pop up the main menu and turn the rotary knob to move the cursor to the "Service" option.

2. Push the rotary knob to access the "Service" submenu and choose "Machine" option. Turn the knob to highlight the "Factory Default" option.

3. Push the rotary knob to access the factory default submenu and turn the knob to "OK" and push it if you want to restore the factory settings.

6.7.3 Using the Demo Mode

This demo mode is intended for service personnel. Contact your authorized repair center for help.

WARNING! While the demo mode is active, no patient data is collected or analyzed. Never attach a patient to the monitor while it is in demo mode.

The monitor includes a demonstration mode to be used for training and sales activities. Installed parameters are simulated when the demo mode is turned on. All of the functions of the monitor will be simulated in the demo mode, including alarms, trends, and NIBP history.

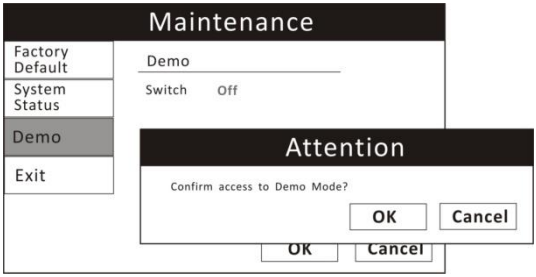


Figure 13.2: Demo Mode

To turn on the demo mode:

1. On the Service menu, highlight DEMO and push the knob to select.

2. Turn the rotary knob to highlight OFF and push the knob to select.

3. Turn the knob to ON and push to select.

4. Turn the rotary knob to highlight YES and push the knob to select. An attention will pop up to remind if you are ready to the demo mode. Turn the rotary knob to highlight OK and push to select.

DEMO will be displayed, gray, in the middle of the display.

To turn off the demo mode:

1. On the Service menu, highlight DEMO and push the knob to select.

2. Turn the rotary knob to highlight ON and push the knob to select.

3. Turn the rotary knob to OFF and push to select.

4. Press the OK button to turn the demo mode off.

The monitor will return to normal operating conditions and will collect patient data.

Chapter 7: Specification

7.1 Display

7-inch diagonal high-resolution TFT (Thin Film Transistor) Active Matrix LCD

Resolution: 800 X 480 pixels

7.2 Indicators

LEDs: Work Status LED
AC Power LED
Battery Charge LED
Battery Supply LED
Alarm Silence LED

7.3 Alarm Volume

45dBA to 85 dBA at 1 meter distance (adjustable)

7.4 Keys/User Controls

- On/Off Key
- NIBP Key
- Freeze Key
- Alarm Silence Key
- Mode Key
- Menu Key
- Rotary Knob

7.5 ECG

Heart Rate Range:	20bpm-350 bpm
Heart Rate Accuracy:	±2 bpm or ±2% (whichever is greater)
QRS Detection Range:	0.5mV to 5 mV
Pace Pulse Detection:	±2 mV to ±700 mV amplitude
Detection Duration:	0.1ms - 2.0 ms
Alarm Ranges Heart Rate:	High: (20-350) bpm and OFF Low: (20-350) bpm and OFF
Heart Rate Averaging:	Fixed 8 second averaging
Lead Selection:	I, II, III, V, aVR, aVL, or aVF (5-lead)
Display Gain Settings:	X 1/4, X1/2, X1, X2, X4
Input Range:	-5.0 mV to +5.0 mV
Frequency Response	0.05 Hz to 150 Hz
Input Impedance	>5 Mohms differential, as required and tested per ANSI/AAMI EC-13 .
I-Leakage:	< 10 uA
Patient Isolation:	> 4000 VAC
Display Waveform:	1 6.25, 12.5, 25, or 50 mm/sec
Update Rate Digits:	1 Hz
Tall T-wave rejection capability:	0.8mV
Ventricular bigeminy:	40bpm
Slow alternating ventricular bigeminy:	(27-33) bpm
Rapid alternating ventricular bigeminy:	No reading
Bidirectional systoles:	No reading
Response time of heart rate meter to change in heart rate	
80 bpm to 120bpm:	No more than 4S
120bpm to 80bpm:	No more than 5S
80 bpm to 40bpm:	No more than 8S
Time to ALARM for tachycardia and EQUIPMENT failure to ALARM and their amplitudes are one-half and twice the indicated amplitudes:	8s to 10s

Frequency response	
Operation mode:	1HZ to 15HZ
Monitor mode:	0.5HZ to 25HZ
Diagnoses mode:	0.05HZ to 100HZ
Maximum T-wave:	0.8mv

7.6 SpO2

SpO2 Range:	0-100% Functional Saturation
SpO2 Accuracy:	± 2% @ 70-100%, <70% unspecified
Resolution:	1 %
SpO2 test time:	10s max
Pulse Rate Range:	(30-250) bpm
Pulse Rate Accuracy:	± 2 bpm or ± 2% (whichever is greater)
SpO2 Alarm Ranges	
High:	0-100% and OFF
Low	0-100% and OFF

7.7 NIBP

Blood Pressure Measuring	
Method of Measurement:	Oscillometric with step-down deflation
Range: Systolic:	(10-280)mmHg
Mean Arterial:	(20-240)mmHg
Diastolic:	(10-220)mmHg
NIBP Accuracy:	Algorithm based on human algorithm that meets or exceeds accuracy requirements of ANSI / AAMI SP10:1992 and 2002 standards for non-invasive blood pressure using the oscillometric method.
Inflation Pressure Settings	
Measurement Time:	30 to 50 seconds typical, 120 seconds

	maximum
Default Inflation Pressure	165 mmHg- Adult 145 mmHg - Pediatric 135 mmHg - Neonate
Calibration:	Factory calibrated
AUTO Interval Times:	2, 3, 5, 10, or 30 minutes, or 1, 2 hours 20-260 (in 1 mmHg steps), and OFF
Alarm Range:	(25- 250) bpm, ± 2% or ± 3 bpm (whichever is greater)
Pulse Rate Accuracy:	(251-300) bpm, ± 5%

7.8 Respiration Rate (RESP)

Range:	0-120 breaths per minute (rpm)
Accuracy:	±1 rpm
Resolution:	1 rpm
RESP Alarm Range	
High:	(0-120) rpm (1 rpm steps), and OFF
Low:	(0-120) rpm (1 rpm steps), and OFF

7.9 Temperature (TEMP)

Channel:	Two
Range:	25℃to 45℃
Accuracy:	± 0.2℃ plus the temperature sensor tolerance
Resolution:	0.1 ℃
TEMP Alarm Range	
High:	(35.5-43.5) ℃ and OFF in 0.1 Increments
Low:	(35.5-43.5) ℃ and OFF in 0.1 Increments

7.10 ETCO2

Mode of Sampling :	Sidestream
Measuring parameters:	Respiration Rate, EtCO2 and InsCO2.

CO2 Warm-up Time:	10 seconds.

Measurement range	
CO2:	(0~150)mmHg
Respiration Rate:	2 to 150bpm
Accuracy:	0～40mmHg ±2 mmHg 41～150mmHg ±10% of reading
Resolution:	0.1mmHg
Flow rate:	50ml/min ±10 ml/min

7.11 Default Alarms Limits

Parameter (unit)		Default values of high alarm limit			Default values of low alarm limit		
		Adu.	Ped.	Neo.	Adu.	Ped.	Neo.
HR（bpm）		100	110	120	60	70	80
NIBP (mmHg)	SYS	140	110	90	95	80	60
	DIA	110	110	60	50	50	40
	MAP	125	125	75	70	70	50
SpO2 (%)		99	99	99	92	92	92
RR		30	40	50	8	8	8
TEMP ^{0}C		38.5	38.5	38.5	35.5	35.5	35.5
Ⅰ（mV）		23	22	20	-23	-22	-20
Ⅱ（mV）		20	20	20	-20	-20	-20
Ⅲ（mV）		20	20	20	-20	-20	-20
aVR（mV）		23	22	20	-23	-22	-20
aVL（mV）		20	20	20	-20	-20	-20
aVF（mV）		20	20	20	-20	-20	-20
V（mV）		20	20	20	-20	-20	-20

7.12 Power Requirement

AC Input:	100 to 240V, 50/60 Hz
Rechargeable battery:	11.1V, 4.4Ah

7.13 Dimensions

Width:	300mm (11.81 inches)
Length:	180mm (7.09 inches)
Height:	129mm (5.08 inches)
Weight:	2.05 kg (4.52lbs)

7.14 Environmental

Temperature:	0 °C to 50 °C(Operating,) -40 °C to 75 °C (Storage)
Humidity:	15% to 95% (Operation) 10% to 95% (Storage)

7.15 Equipment Classification

Type of Protection: (Against Electric shock)	Class 1 & Internally Powered
Mode of operation:	Continuous
Degree of Protection: (Against ingress of Liquids)	IPX1, drip proof
Degree of Mobility:	Portable
Degree of Protection: (Against Electric Shock)	Type CF
Safety Requirements:	EN60601-1:2002

7.16 Revision History

Revision	Date	Comment
Rev1.0	2022.5	First edition

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