

IP-3000 Series Service Manual

VER 1.00 010212

Infunix Technology Co., Ltd.

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1. HOW TO USE THIS MANUAL

1.1 Contents of Manual

- This Manual contains all the information needed to operate our patient monitor , **IP-3000 series**, which has been designed by giving most consideration on users' convenience. Please keep the operational manual after careful reading. You may refer it for proper handling.
- The chapters in the Manual are constructed so that each chapter can be used independently, and some contents may appear in more than one chapter.
- This manual is written to help users effectively operate **IP-3000 series**. The personnel authorized by Infunix should have clearer understanding of electrical engineering.
- In case some problems occur during the operation of our products, contact our company or the Customer Service Dept.

1.2 Meaning of Symbols Used in this Manual

- Symbols are used to specially emphasize the agreed details as follows. Users need to surely follow all the cautions and notes listed in this manual.
- In the event that the product is damaged due to misuse or negligence by a user, the manufacturer or the authorized agents shall not be responsible for any damage or loss to the product.

WARNING

The title “Warning” is used to inform the user of possible causes that could inflict the injury, death or property damage to the patients.

CAUTION

The title of “Caution” is used to inform the users of possible causes that could inflict the injury to the patients although it might not be severe enough to cause deaths.

NOTE

The title of “Note” is used to inform the users of items that are of importance in terms of installation, operation or maintenance of the equipment although the failure does not for the physical harm to the patients.



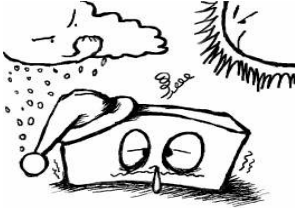







NOTE

The title of “Note” is used to inform the users of items that are of importance in terms of installation, operation or maintenance of the equipment although the failure does not for the physical harm to the patients.

2. OPERATIONAL DO'S AND DON'TS

2.1 Don'ts in Operational Environment

- Do not operate or store the equipment under the following environments.

	<p>Avoid the damp locations, and do not operate the equipment with wet hands...</p>		<p>Location where exposed to direct sunlight</p>
	<p>Location where the temperature fluctuation is rather than big (Operational temperature range: 10~40°C, Moisture level: 30~89%)</p>		<p>Location close to electrical heating apparatus</p>
	<p>Locations where moisture level could go up considerably or where air is not ventilated</p>		<p>Location where sudden impact of vibration could occur</p>
	<p>Location exposed to chemical or explosive gas.</p>		<p>Make sure to prevent dust and especially metal debris</p>
	<p>Disassembling of equipment should be done only by the authorized personnel. Otherwise, we will not be liable for any system failure or malfunction.</p>		<p>Do not plug in the power until the installation is completed. Otherwise, it can cause damage to the equipment.</p>

Standard operational conditions are as follows.

- Temperature : 10°C ~ 40°C (50°F ~ 104°F)
- Humidity : 80% RH max @40°C (104°F)
- Pressure : 500hPa ~ 1060hPa

Standard storage and transportation conditions are as follows.

- Temperature : -20°C ~ 80°C (-4°F ~ 176°F)
- Humidity : 90% RH max @50°C (122°F)
- Pressure : 500hPa ~ 1060hPa

2.2 Cautions for Electrical Safety

Prior to operation of the equipment, make sure to check following items.:

- Whether power supply is appropriate. (100 – 240VAC)
- Whether connections (power line or selected equipment) are properly made to the equipment. (Otherwise, noise can be occurred.)
- Whether the correct measuring accessory for required parameter is connected to the equipment prior to turning on the equipment.

Classifications

- The patient monitor belongs classified to “Class IIb ”
- ECG, Resp.IBP is “CF class” for electrical shock and EtCO₂ , SpO₂, NIBP,Temp is “BF class”.
- According to IEC/EN 60601-1 (Safety of Electric Medical Equipment) standard, the label of the noise is “B” according to B class IEC/EN 60601-1-2 (Electromagnetic Compatibility Requirements).
- Water resistance of the device is “IPX 0”

NOTE

- The equipment should be placed far from generator, X-ray equipment, broadcasting equipment, or transmitting wires to prevent the electrical noises from being generated during the operation. When these devices are placed close to the equipment, it can produce inaccurate measurements. For IP-1010, both independent circuit and stable grounding are essentially required. In the event that same power source is shared with other electronic equipment, it can also produce inaccurate output.

CAUTION

- Do not use the monitor around Inflammable anesthetic or solvent.

CAUTION

- Although IP-3000 SERIES have been value of measurement in compliance with existing EMI/EMC requirements, use of this system in the presence of an electromagnetic field can cause momentary degradation of the SpO2 waveform. If this occurs often, Infunix suggests a review of the environment in which the system is being used, to identify possible sources of electromagnetic waves. These waves could be from other electrical devices used within the same room or an adjacent room. Communication devices such as cellular phones and pagers can cause these waves. The existence of radio, TV or microwave transmission equipment located nearby can cause electromagnetic waves. If EMI causes disturbances, it may be necessary to relocate your system.
- Electrostatic discharge (ESD), commonly referred to as a static shock, is a naturally occurring phenomenon. ESD is the most prevalent during conditions of low humidity, which can be caused by heating or air conditioning. During low humidity conditions, electrical charges naturally build up on individuals and can create static shocks. An ESD condition occurs when an individual with an electrical energy build-up comes in contact with objects such as metal door knobs, file cabinets, computer equipment, and even other individuals. The static shock or ESD is a discharge of the electrical energy build-up from a charged individual to a lesser or non-charged individual or object. The level of electrical energy discharged from a system user or patient to the IP-3000 SERIES can be significant enough to cause damage to the system or probes. The following precautions can help to reduce ESD: anti-static spray on carpets; anti-static spray on linoleum; anti-static mats.

2.3 Maintenance and Cleaning

IP-3000 Series and its accessories can be cleaned by using various methods. Please follow the methods below to avoid unnecessary damage or contamination to the equipment.

At least once a month, clean and wipe off the monitor by using the soft cloth after wetting it in lukewarm water or alcohol. Do not use lacquer, thinner, ethylene or oxides which could be harmful to the equipment.

Make sure both cables and accessories are free of dust or contaminants and wipe them off with soft cloth wet by lukewarm water (40°C/104°F) and at least once a week clean them with clinic alcohol. Do not soak the accessories in any liquid or detergent. Also, don't let the liquid penetrate into the equipment or probe.

● How to clean accessories

1. Sterilization and cleansing of SpO₂ finger probe and cuff
For cleaning the SpO₂ finger probes, be directed below.

Chemicals		How to clean
Alcohol	Isopropyl Alcohol	Wash with wet gauze
Liquid soap	Benzalconium chloride	0.05 W/V%(200x diluted)/Wash with wet gauze
		0.01 W/V%(50x diluted)/Wash with wet gauze
Iodine	Povidone Iodine	0.02 W/V%(50x diluted)/Wash with wet gauze
Glutaral	C ₅ H ₈ O ₂	2 W/V%(experiment solution)/Wash with wet gauze

CAUTION

When harmful (unaccepted) materials are used for cleaning, we shall not offer the service without charge in regardless of warranty period.

CAUTION

Check carefully both monitor and sensor after cleaning the equipment.
Do not use the equipment that is worn out or damaged.

3. DESCRIPTION OF IP-1010

3.1 The features of IP-1010

IP-3000 SERIES are a patient monitor which display state of patient's data with waveform

※ Basic functions of Patient measuring

- ECG 3 lead (I, II, III,) select and Respiration measurement
- Arrhythmia measurement, ST Level analysis and Pacemaker Detect function
- SpO₂ and Pulse Rate measurement
- NIBP, 2 IBP measurements
- Body Temperature (2 Temp)

※ Optional functions of Patient measuring

- ECG 5 lead (I, II, III, aVR, aVL, aVF, V) select
- End-tidal partial pressure respiration (EtCO₂)

※ Etc

- Trend Data Saving for 72 hours
- VGA (Display Output) Function
- Clone Function (This function support patient checking thru Internet)
- Built-in 3 channel Printer. (Option)

3.2 Composition

Standard Accessories

① IP-3000 SERIES Monitor	(1 EA)
② SpO ₂ Finger Probe(Adult) 1M	(1 EA)
③ SpO ₂ Extension CABLE 2M	(1 EA)
④ NIBP Cuff(Adult)	(1 EA)
⑤ NIBP HOSE	(1 EA)
⑥ IBP KIT	(1 EA)
⑦ IBP Extension cable 2M	(1 EA)
⑧ ECG Cable 3 lead type	(1 EA)
⑨ ECG electrode (3M)	(5 EA)
⑩ Temperature sensor (Rectal type)	(1 EA)
⑪ 220V Power cord	(1 EA)
⑫ Operation Manual	(1 EA)

Optional Accessories

SpO₂ Finger Probe(Child, Neonate)

Disposable SpO₂ Finger Probe(Neonate)

NIBP Cuff (BIG Adult, Child, Pediatric, Infant)

Printer Module

Roll Paper

Ground Cable

DISPOSABLE SPO2 SENSOR

Press Measuring Kit

ECG Cable 5 lead Type

EtCO₂ Kit set

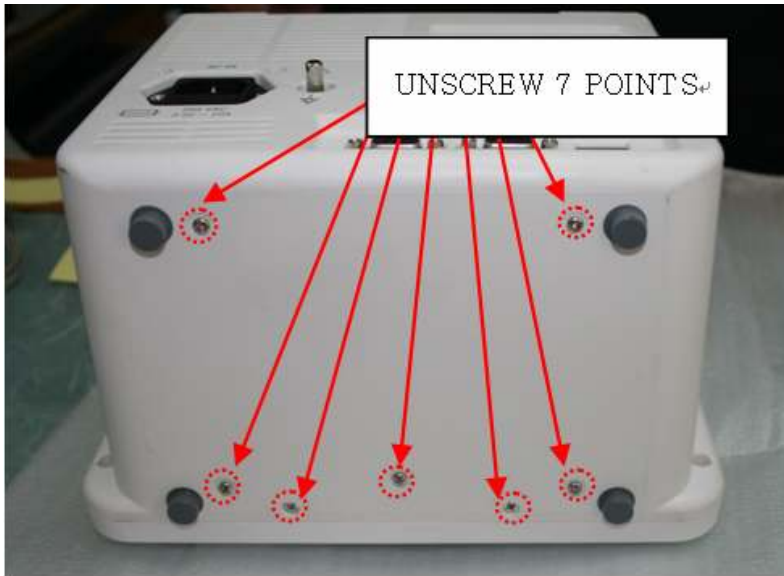
Temperature Sensor

4. DISASSEMBLY & ASSEMBLY OF IP-3000

4.1 Prior to disassembly of IP-3000 series

Person in charge of repair should have full knowledge referring pictures about IP-3000 series before disassembly .

4.2 Disassembly



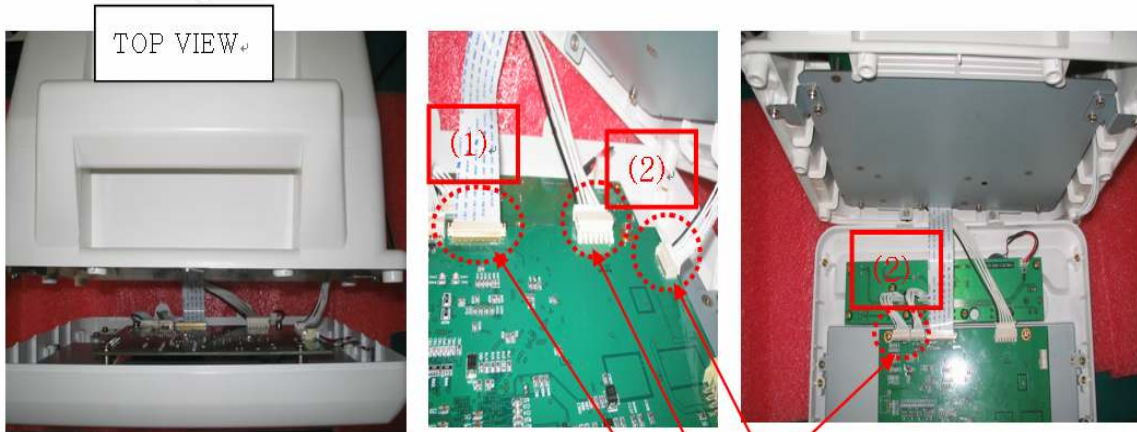
Step1

Disassembly of Front part and Rear part.

- 1) Take off bolts in 7 spots.
- 2) Take off 2 bolts in 2 spots of AC power.
- 3) Take off 8 bolts of Front cover and Rear cover.
- 4) Take off Front over and Rear cover.

CAUTION

- Do not disassemble front and rear covers by force



- (1) Separate Main BD(Board) FPCB CONNECTOR : 1 POINT
- (2) Separate Main BD HARNESS CONNECTOR : 4 POINTS

Step2

Disassemble Front cover from the body

- 1) Disassemble each cable.

CAUTION

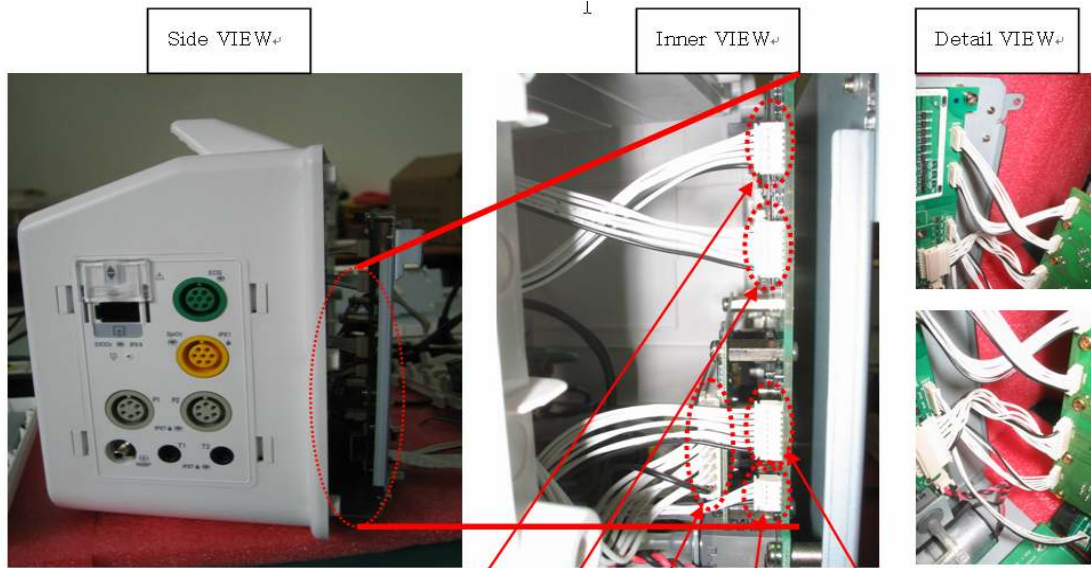
- Disassemble FFC Cable using tweezers.



Step 3

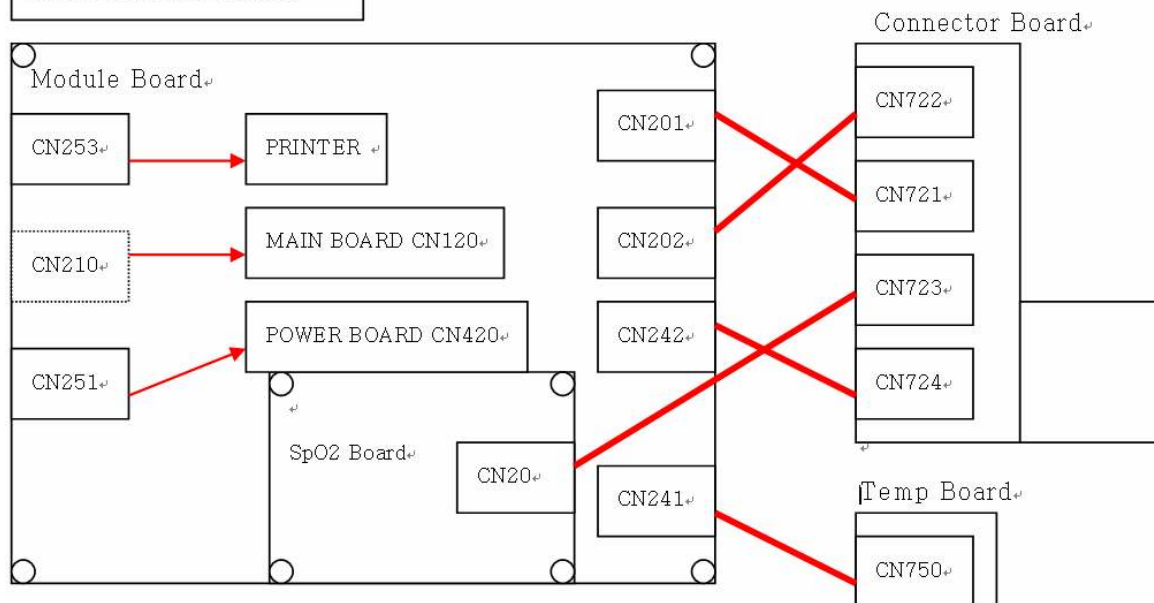
Disassembly of Main Frame and Rear cover

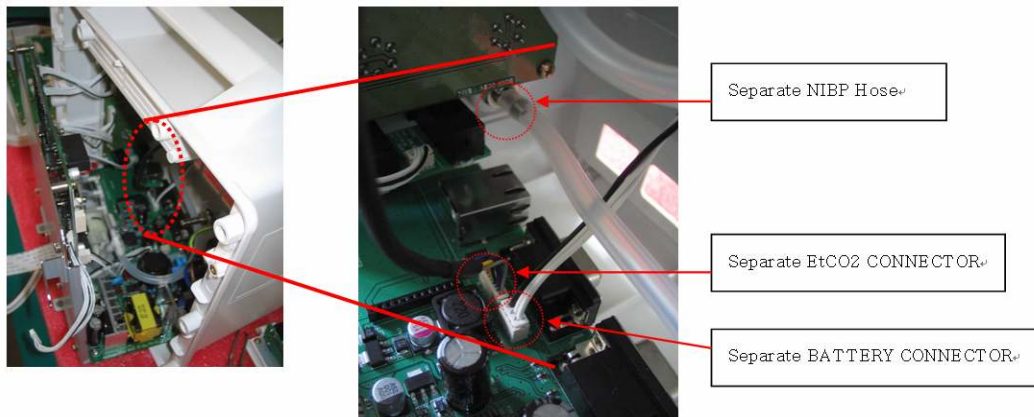
1) Take off 2 bolts in 2 spots.



Separate Module BD HARNESS CONNECTOR : 5 POINTS

Attach Block diagram



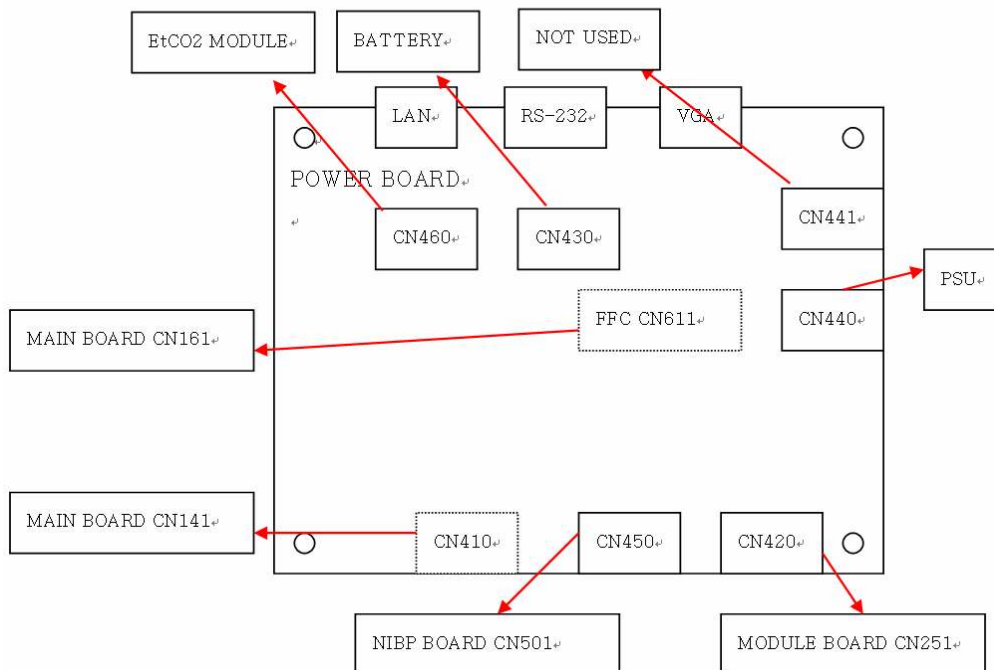


Step4.

Disassemble main frame, rear cover and power bBoard.

- 1) Disassemble Main Frame and Rear Cover carefully.
- 2) Disassemble each cable in each.
- 3) Take off NIBP hose , battery power cable, EtCO2 power cable Cable and hose.

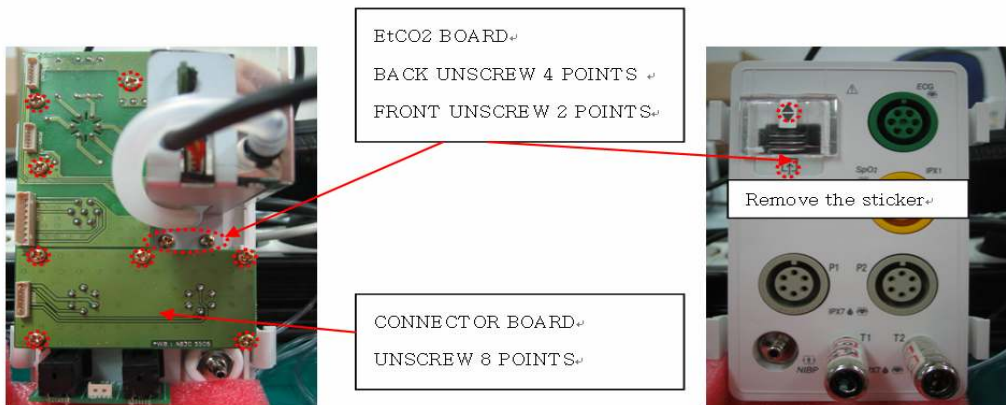
Attach Block diagram (POWER).



Step5

Disassemble main frame and PCB

- 1) Take off SpO2 board and module board .
- 2) Take off SpO2 board from module board.
- 3) Take off all connectors of NIBP board.
- 4) Take off all connectors of Module board.
- 5) Take off main board from main frame.



EtCO2 BOARD
 BACK UNSCREW 4 POINTS
 FRONT UNSCREW 2 POINTS

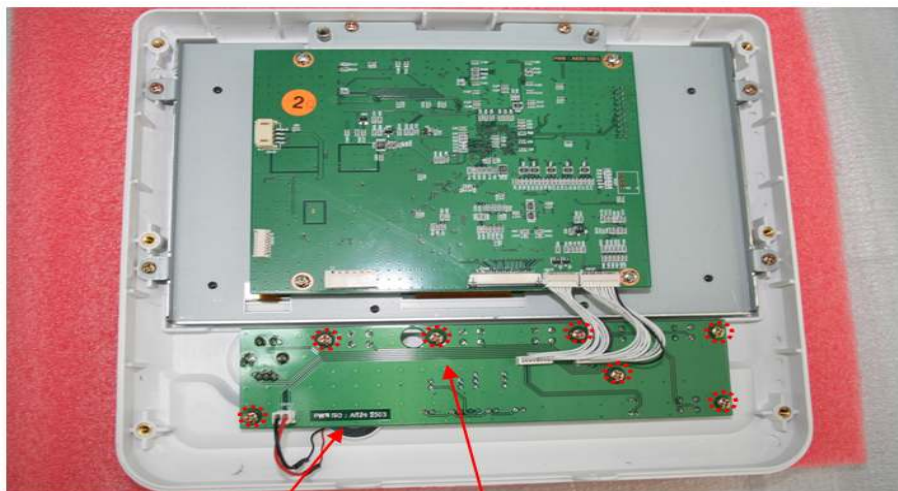
CONNECTOR BOARD
 UNSCREW 8 POINTS

Remove the sticker

TEMP Board
 To change TEMP BD, First detach CONNECTOR BD.

Step6 Disassembly of connector board module

- 1) Disassemble rear cover and connector module.
- 2) Disassemble EtCO2 module and connector module .
- 3) Take off 8 bolts in 8 spots of connector board.



SPEAKER

UNSCREW 7 POINTS

Step7 Disassemble key board and front cover

- 1) Take off 7 bolts between front cover and key board .
- 2) Disassemble front cover and key board.
- 3) Disassemble front cover and speaker.

CAUTION

- Below Instructions, IP3010(TFT LCD : 7 inch) is different from IP3050(TFT LCD : 8.5 inch)

IP3010(TFT LCD : 7 inch)

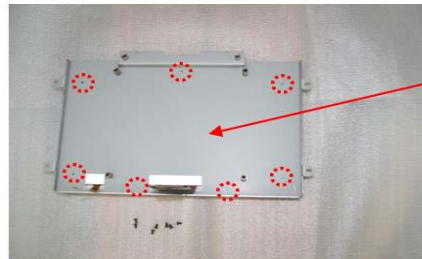
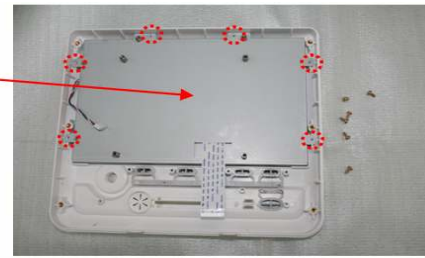


Separate MAIN Board ∴
IP3010 FPCB : 2 POINTS∴
IP3050 FPCB : 1 POINT∴

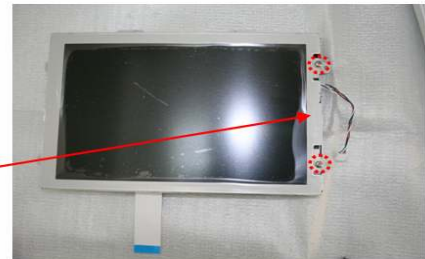
IP3050(TFT LCD : 8.5 inch)



UNSCREW Front frame ∴
IP3010 FPCB : 6 POINTS∴
IP3050 FPCB : 6 POINTS∴



UNSCREW LCD Frame ∴
IP3010 FPCB : 7 POINTS∴



UNSCREW LCD Frame ∴
IP3050 FPCB : 2 POINTS∴



4.3 Assembly

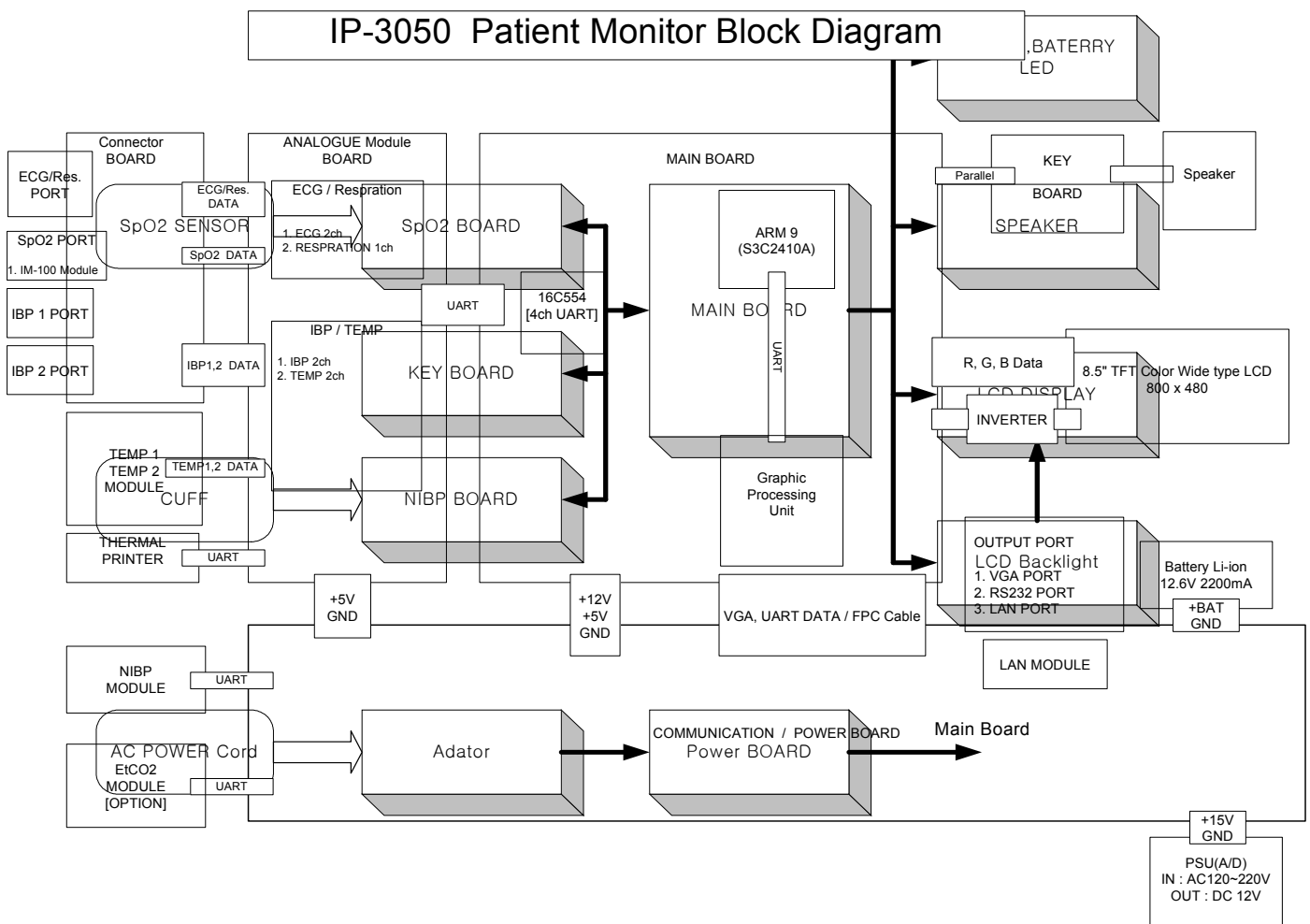
Assemble the parts in reverse order of disassembly.

5. Entire diagram of IP-3000 series

Patient monitor IP-3000 series is composed of hardware parts and software parts. Hardware parts of IP-3000 are consisted of main board, Bio-signal Board, power board and Board for alternating current power supply. On the other hand, software parts have firmware for each board and software for main Board.

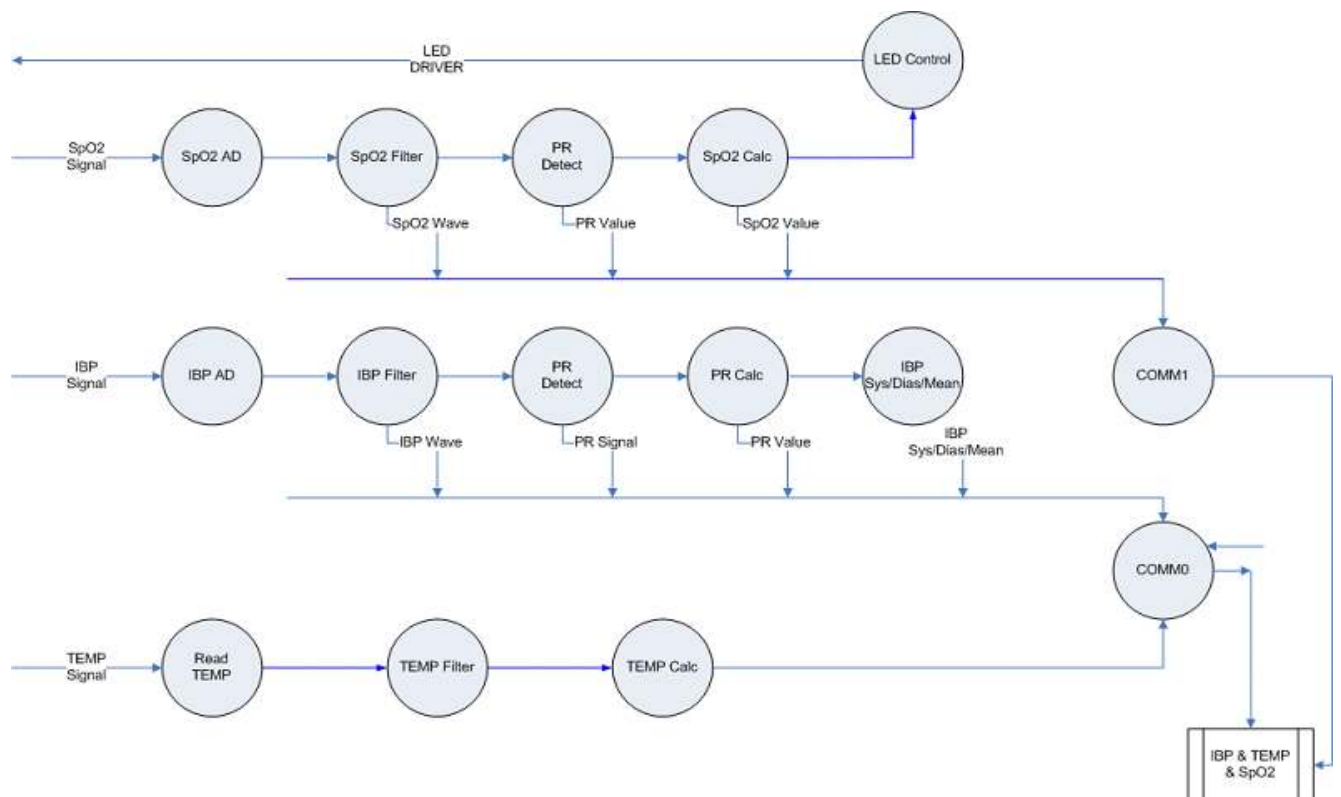
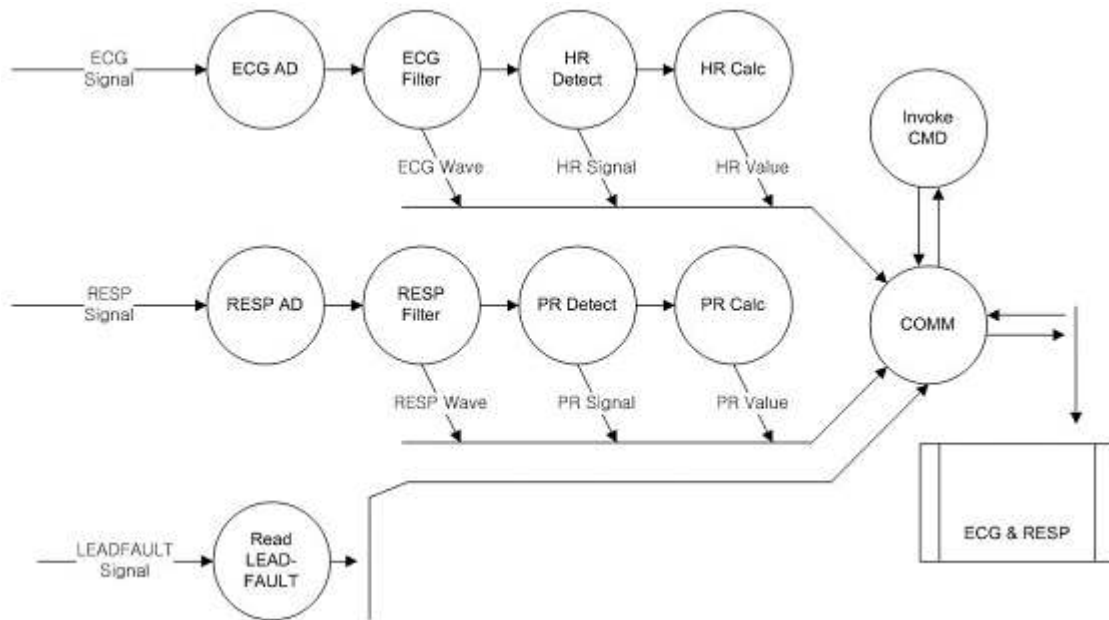
5.1 Hardware composition

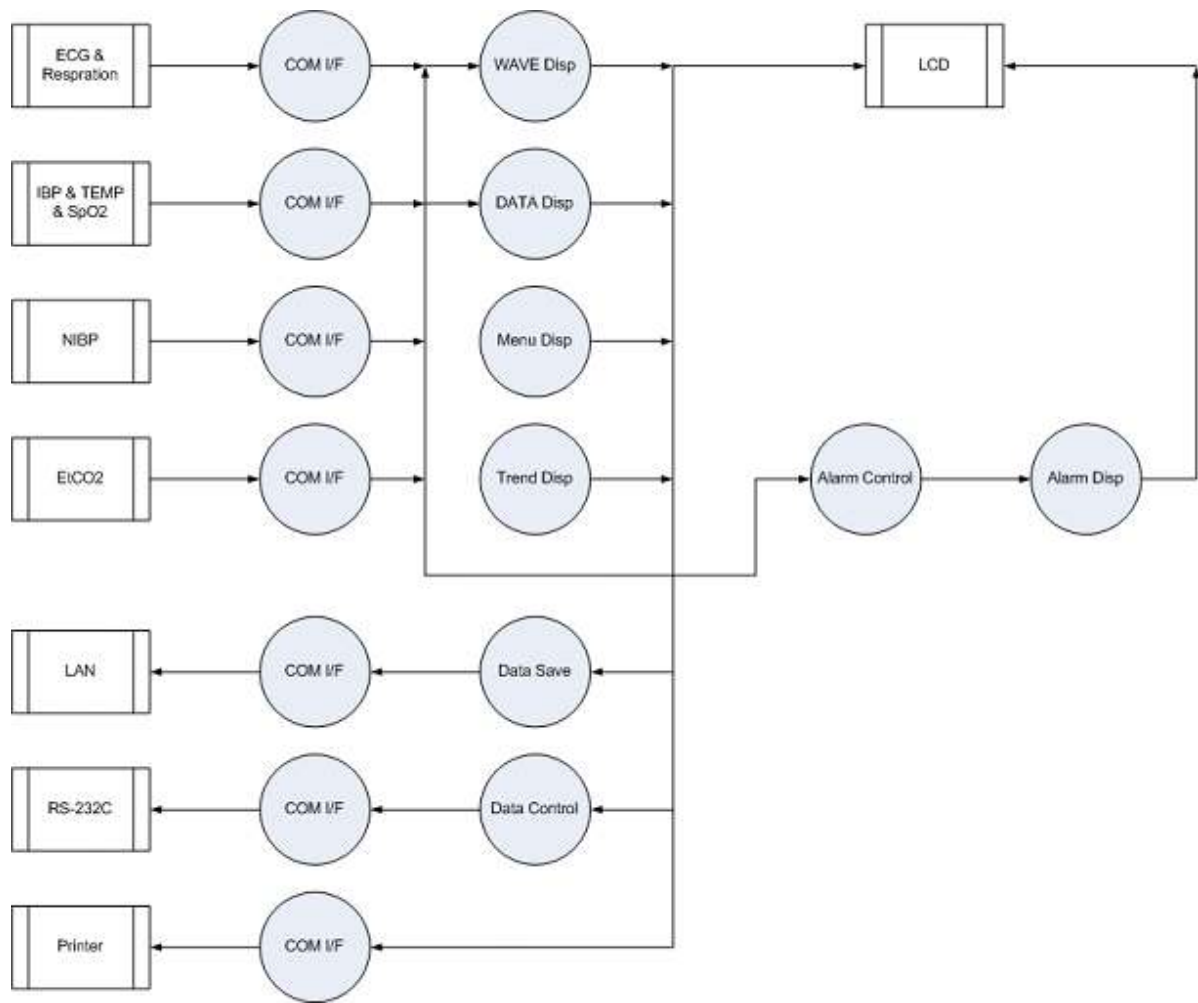
5.1.1 Entire diagram



5.2 Software composition

5.2.1 DFD (Data Flow Diagram)





6. Trouble Shooting Guide

This service manual provides you with trouble shooting guide for your to easily trace the cause of trouble . When serious troubles happens to occur, please refer to the trouble shooting guide for repairing. Trouble shooting levels are classified from 1 to 4 according to each difficulty.

Level	Person in charge	Person in charge
1	User	Repair in no disassembly
2	User	Repair in no disassembly
3	Repairman	Repair in disassembly
4	Repairman	Repair in disassembly

6.1 Troubles in System

Case1

Troubles in Main Board : Display, sound and other all system do not operate properly and it is impossible to detect the cause without measuring equipment. It is suspicious point that when power is on, LED of power switch works properly but the display in LCD doesn't work, however , as same troubles can be found in the other equipments, you need to check reset circuit , oscillator with measuring equipment before everything, after that, make sure if the sign comes from Address Bus and Data Bus to detect exact cause of the trouble. Troubleshooting level is 4.

Case2

Troubles in Display LCD : This can be occurred from troubles in main board or LCD Cable. First of all, please open the case , verify that LCD and inverter cable are connected properly, change main board and LCD in order , and repair it. In this time, as power might not turn on, please verify the power . Troubleshooting level is 3 or 4.

Case3

Darkness and lines in Display LCD : This may happen due to the defects of Main Board , LCD, or connecting cable. Open the case first and verify if LCD and inverter cable is connected in correct way ,then replace the cable and main board , and after that, replace LCD. In this time, as power might not turn on, please verify the power . Troubleshooting level is 3 or 4..

Case4

Troubles in Sound : This can be occurred from troubles from main board, speaker or defects of cable connection. First of all, please open the case , check if speaker cable is

connected properly ,and change main board and speaker in order. Troubleshooting level is 3 or 4.

Case5

Troubles in Key : Troubles in main board, key board, defects of cable connection. First of all, please open the case, check if key board cable is connected properly, and change key board and main board in order. Troubleshooting level is 3 or 4.

6.2 Defect of SpO2 Board

Case1

Troubles in SpO₂ Board : If you find troubles in SpO₂ Board, system operates properly but the data about SpO₂ might be incorrect on display. When simulator is linked, if SpO₂ sign is not appropriate or numeric values of heartbeat and SpO₂ are blurry or sign does not come out, we can assume that it has troubles in SpO₂ board. In this case, please verify that LED of SpO₂ sensor is on . If not, please try to take a test with normal sensor and figure out if the cause comes from the sensor. It is obviously troubles in SpO₂ board in the case of that the normal sensor is connected but sensor LED is not on. If the troubles were found clearly, please put your finger in the sensor and check if the intensity of the radiation is changed . If there is no any change, it is also obviously troubles in SpO₂ board. In this case, please change board and repair it. Troubleshooting level is 3 or 4.

Case2

Troubles in SpO₂ Sensor : Please make sure that LED of SpO₂ sensor is on . In this time, if LED of SpO₂ sensor is not on, please take a test with normal sensor to see if there is any trouble. If the trouble is so clear, please change and repair it. Troubleshooting level is 2.

Case3

Troubles in SpO₂ Sensor : If SpO₂ Sensor is defective , sign does not come out or value of heartbeat and SpO₂ might not be correct. In this case, please change to the sensor which we recommend. Troubleshooting level is 2.

6.3 Troubles in Power Board

Case1

Troubles in Power Board: If Power Board has troubles, system does not operate at all same as main board has. In this case, LED of power switch does not work to on the light . Therefore, if the trouble happens to be occurred , please check with digital multi-meter if voltage is in proper status. After that, change and repair it. Troubleshooting level

is 3 or 4.

Case2 Troubles in extension hose : If the extension hose is defective or in malfunction, the measurement value is incorrect. Verify if the pressure is leaked and replace it. Troubleshooting level is 2.

Case3 Trouble in cuff : If cuff is defective or in malfunction, the measurement value is incorrect. . Verify if the pressure is leaked and replace it. Troubleshooting level is 2.

6.4 Defect of Power Board

Case1 Troubles in Power Board: If Power Board has troubles, system does not operate at all same as main board has. In this case, LED of power switch does not work to on the light . Therefore, if the trouble happens to be occurred , please check with digital multi-meter if voltage is in proper status. After that, change and repair it. Troubleshooting level is 3 or 4.

6.5 Defect of Module Board

Case1 Troubles in Module Board : If ECG, RESP, IBP, TEMP do not work properly , each bio-signal value is not correct or the measurement is failed or the error message is displayed.

Verify each measurement and if the extension cable is disconnected or not . If there is not any problem, open the case and verify if the cable of each terminal disconnected or not and replace module boards in order , then verify if the signal comes out. **Troubleshooting level is 3 or 4.**

6.6 Defect of EtCO2 module

Case1 Defect of EtCO2 module : Verify 'warm up' message after 'Enable' message. Verify the sound volume of motor pump. Verify if the message is displayed correctly after ON/OFF, and if the malfunction is found, verify if the EtCO2 hose leaks out. If so, open the case and verify if the cable is disconnected and replace EtCO2 module in order, then verify if the signal comes out or not. If you find the error, replace and repair it .Troubleshooting level is 3 or 4.

6.7 Defect in Battery

Case1

Troubles in Battery : If battery has troubles, battery charging LED does not work to be on the light or blink on. Or on power supply by battery, system does not operate at all. In this case, LED of power switch does not work to on the light . Therefore, if the trouble happens to be occurred , please check with digital multi-meter if voltage is in proper status. After that, change and repair it. Troubleshooting level is 3 or 4

6.8 Other defects

Case1

Troubles in measurement value or display : Run (1010) RAM CLEAR on Service mode.
Troubleshooting level is 1 or 2.

7. Part List of IP-3000 series

No	Part Name	Part No.	Description
1	LCD Module 7inch	A8301009	
2	LCD Holder 7inch	A8302009	
3	LCD Module 8.2inch	A6107001	
4	AC Power Cord	A8307000	220V 3A
5	Battery	A6107500	Li-ion (3 cell): 11.1V, 2200mA
6	Module Board	A8305002	
7	Master Board	A8305001	
8	Front Cover	A6101001	ABS (with Overlay: Key/Function)
9	Rear Cover	A6101002	ABS
10	SpO2 Sensor	A6108000	Adult
11	SpO2 Sensor	A6108001	Child
12	SpO2 Sensor	A6108002	Neonate (Y sensor /Clip)
13	SpO2 extension Cable	A8308200	
14	ECG Cable (3ch)	A8308001	
15	ECG Cable (5ch)	A8308004	
16	Adult cuff (Regular)	A7104000	
17	Adult cuff (Big)	A7104001	
18	Disposable Sensor	A6108004	
19	Child cuff	A7104002	
20	Pediatric cuff	A7104003	

21	Infant cuff	A7104004	
22	Cuff extension hose	A7104100	
23	IBP Extension cable	A8308101	
24	IBP KIT	A8308100	
25	TEMP Sensor	A8308300	4000PSI
26	Speaker ass'y	A6107000	20Pie 0.5W
27	SPO2 Board ass'y	A6105002	
28	POWER BOARD	A6105004	
29	KEY Pannel Board	A8105003	
30	Frame ass'y	A8300010	
31	PSU	A8305000	
32	EtCO2 Module	A8308001	
33	EtCO2 Bracket	A8302008	
34	EtCO2 Kit	A8308103	
35	Printer Module	A8308002	
36	Operation Knob	A8301013	
37	Battery Cover	A8301007	
38	CONNECTOR Board	A8105006	
39	Printer Cover	A8301008	
40	Roll paper	A8309600	

* Above guidelines can be modified without any notice.