SERVICE MANUAL

DIANA

MP400N

MULTI PARAMETER PATIENT MONITOR

CE 0434

M:EK

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6. PART LIST

1. STRUCTURE OF MP-400N

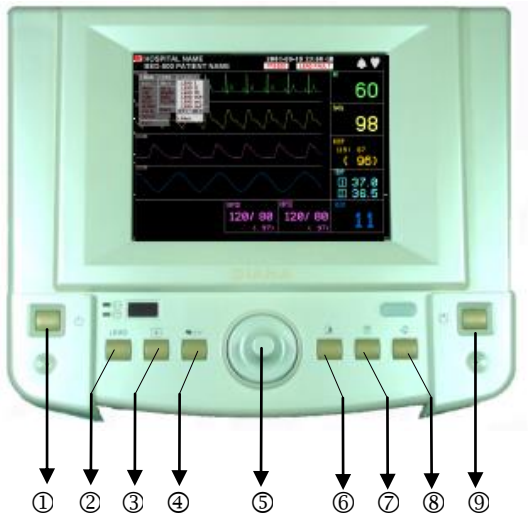
(1) Standard Functions and Accessories

- **Multi Parameter Patient Monitor(ECG1, ECG2, SpO2, NIBP, IBP1, IBP2, Resp, TEMP1, TEMP2) 1EA**
- **Adult SPO2 Sensor 1EA**
- **NIBP HOSE 1EA**
- **NIBP CUFF 1EA**
- **3 CABLE CLAMPS 1EA**
- **5 CABLE CLAMPS 1EA**
- **POWER CABLE 1EA**
- **10 DISPOSABLE ELECTRODES**
- **USER'S MANUAL 1 Booklet**

(2) Additional Options and Accessories

- **58mm THERMAL PRINTER MODULE 1EA**
- **58mm THERMAL PRINTER ROLL PAPER 1EA**
- **IBP MODULE (Invasive Blood Pressure)**
- **IBP SENSOR SET 1EA**
- **TEMP MODULE (Temperature)**
- **TEMPERATURE SENSOR 1EA**
- **RS232 CABLE 1EA**

(3) Exterior Structure



① **POWER :** Screen displays when pressed.

② **LEAD :** Used to select ECG LEAD.

③ **FREEZE :** Button to turn ON/OFF FREEZE function. Initial press to freeze the wave, second press to resume display.

④ **NIBP :** Activates NIBP measurement.

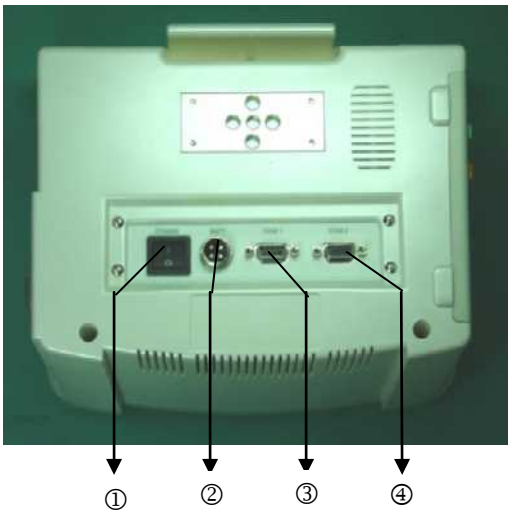
⑤ **ENCODER :** Views the Pop-UP menu when Encoder is pressed. Rotate to left and right direction to select desired menu.

⑥ **EXIT :** Removes the menu tree when pressed.

⑦ **PRINT :** Prints the data being measured when pressed.

⑧ **ALARM :** Press for temporary standstill for 30 seconds during the course of alarm activation.

⑨ **NURSE CALL :** Calls for the attendance of personnel in charge(Doctor/Nurse) when linked to central program (MP600).



① **POWER :** Main Power Switch.

② **BATTERY SUPPLY :** Power Connection to Car Battery (DC12V) when the device is implemented on motor vehicle(vehicle-mounted).

③ **SERIAL PORT :** Links to PC when MEK Genuine Central Program(MP600) is applied.(In conformity with RS-232C Standard)

④ **VGA OUT :** Visual output to ordinary PC Monitor.

(4) MONITOR SPECIFICATION

Display 5.7" Mono LCD
6.4" Color TFT LCD
Trace line Mono LCD : 3 Wave form max.
Color LCD : 4 Wave form max.
(ECG Ⅰ, ECGⅡ, SpO2, IBP or RESP)
Trace speed ECG/SpO2/IBP
6.3, 12.5, 25mm/sec
Resp.
6.3, 12.5, 25mm/sec
Resolution Mono LCD 320 * 240
Color LCD 640 * 480

Display parameter
Heart rate and alarm limit
SpO2 rate and alarm limit
Blood pressure (NIBP, IBP)
Respiration
Temperature
Name,Bed ID, Date & time, Menu and menu information,
Event message

Performance
ECG
Channel : Mono LCD -2 channel / Color LCD-2 channel
Electrode ; 3 or 5electrode
Lead, ; 6Lead(I, II, III, aVR, aVL, aVF) selective
Dynamic range 10mV
Frequency response: menu selective
Diagnostic mode
Lower side 0.05 or 0.5Hz
Upper side 40Hz or 80Hz
Digital band-stop filter (notch filter) - on/off
Monitoring mode (Default Mode): 0.5 ~ 40Hz
and digital band stop filter on (50 / 60Hz)
Heart rate 20 ~300 bpm
Accuracy +/- 2%
Input signal range +/- 0.5mV ~ +/-5mV

Respiration
Method ; Impedance for ECG Lead
Respiration rate 2 ~ 150 bpm
Accuracy +/- 1 bpm
Frequency response 0.1 ~ 4Hz (-3dB)
Impedance range 100 ~ 2K ohm
Detect sensitivity 0.5 ohm min

SpO2 Percentage Oxygen Saturation
Probe MSS0A Finger type reusable sensor
Measurement range 40% ~ 100%
Accuracy Adult
+/- 2%, for readings between 70 % ~ 100%
+/- 3%, for readings between 50% ~ 69%
Neonate
+/- 3 % 70%~ 95%
Unspecified 0 ~ 49%
Setting time Wave out time : 2 sec
SpO2 percentage Display : 10 sec
Averaging (after setting time) 8beat

NIBP (Oscillometric method upon inflation and deflation)
Pressure
Measurement range 0 ~300mmHg
Accuracy +/- 2mmHg or +/- 2%
Cuff
Reusable cuff Adult/Child cuff (STD. accessory)
Disposable cuff Neonatal cuff. (optional)
Auto deflation pressure
Adult 300mmHg
* Neonate 150mmHg
Measurement time max 40sec at standard adult cuff & normal

IBP (2-IBP : Optional)
Measurement range -50 ~ 300 mmHg
Sensor 5uV /mmHg (optional)
Accuracy +/- 2%
Zero balance + / - 150mmHg
Automatic Biasing and scaling for IBP Signal Display

Temperature
Sensor YSI 400 series(optional)
Resolution 0.2 ℃
Measurement range 0 ~ 50 ℃
Accuracy +/- 0.4 ℃ (15~34 ℃,41~45 ℃)
+/-0.2 ℃ (34~41 ℃)

Alarms
ECG Heart rate
High limit 30 ~ 300 bpm , Low limit 20 ~ 290 bpm

Respiration rate
High limit 10 ~ 150 bpm , Low limit 2 ~ 145 bpm

* Do not use for the detection of Apnea.

SpO2
High Saturation 52 ~ 100%, 2% Interval (default = off)
Low Saturation 51 ~ 99%, 2% Interval (default = 81%)

NIBP
Systolic high and low limit setting, 40~300/30~290 ,5mmHg Interval
Diastolic high and low limit setting, 30~290 /20~280, 5mmHg Interval
Mean high and low limit setting, 35~295/25~285, 5mmHg Interval

IBP
Systolic high and low limit setting, 40~300/30~290 ,5mmHg Interval
Diastolic high and low limit setting , 30~290 /20~280, 5mmHg Interval
Mean high and low limit setting, 35~295/25~285, 5mmHg Interval

Temp high limit 20 ~ 50℃
Low limit 10 ~ 40℃
Alarm silence ; 30 second
Alarm on/off ; all parameters on/off selective independently

Power input DC15V +/- 10%

Battery 12 V 2Ah - Continuous operating time: 1 Hr min

Power consumption 50 W max

Dimensions W 267 x H 196 x D 141

Weight 4.5 Kg (with printer, battery)

Environmental
Operating temperature 10 ~ 40℃ (50℉ ~ 104℉)
Storage temperature -20 ~ 70℃ (-4℉ ~ 158℉)
Relative humidity 10 ~90% (storage)
0~95% non-condensing (operating)

Input and Output communication
COM1 RS-232 Baud rate 19200 bps STD I/O communication port
(MEK'S standard protocol)
COM2 VGA Signal Output(MP400NC Only)

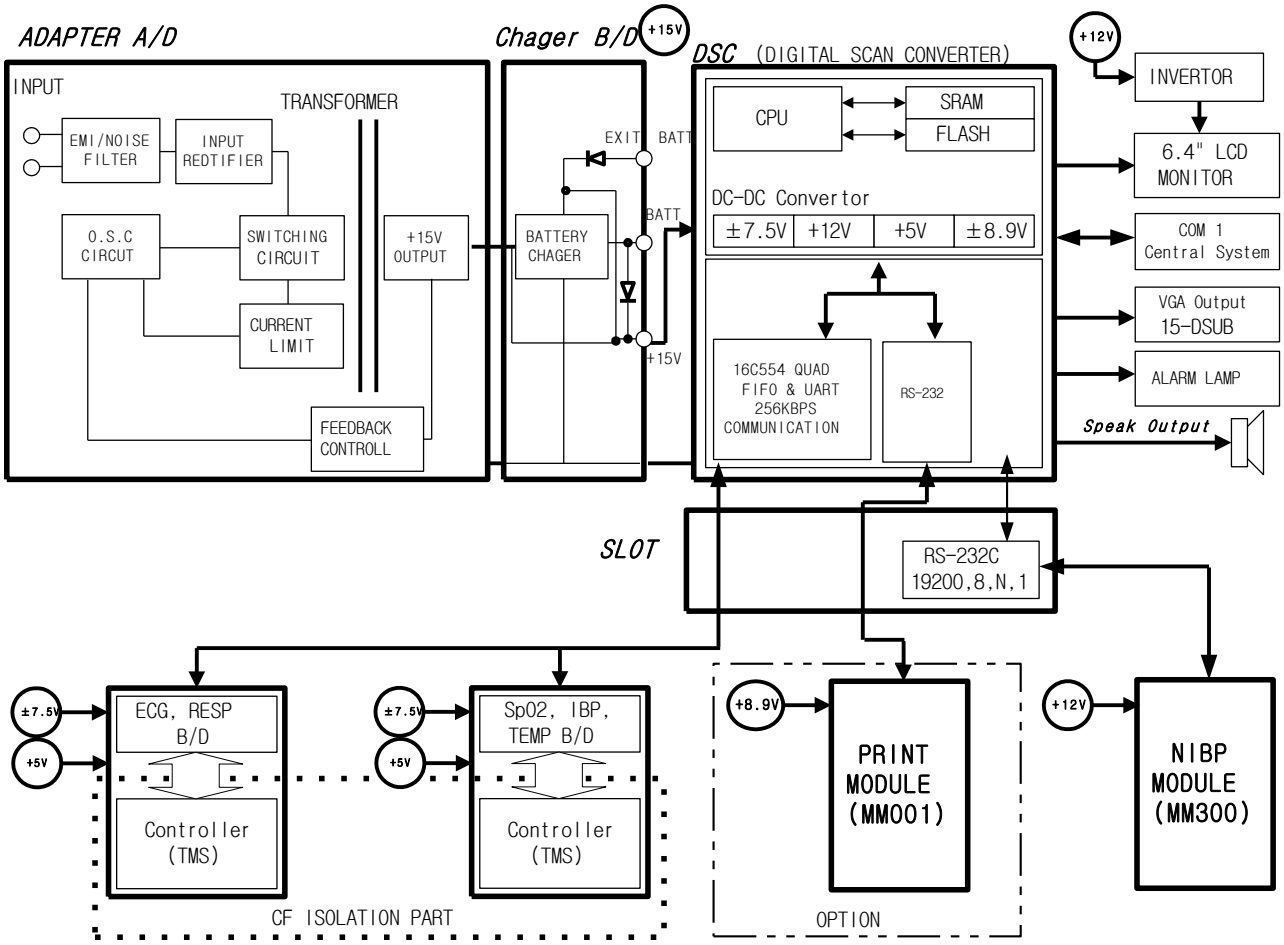
Option

Printer Thermal printer (58mm paper width)
Temperature Sensor, YSI 401 type
IBP Sensor Kit (Disposable), Deltran II Series
IBP Cable for MP400N
** Central station MP600: 8ch Central station

Accessories ECG 3 electrode cable, SpO2 sensor, Cuff(Adult/Child) & Hose, DC15 AC adapter

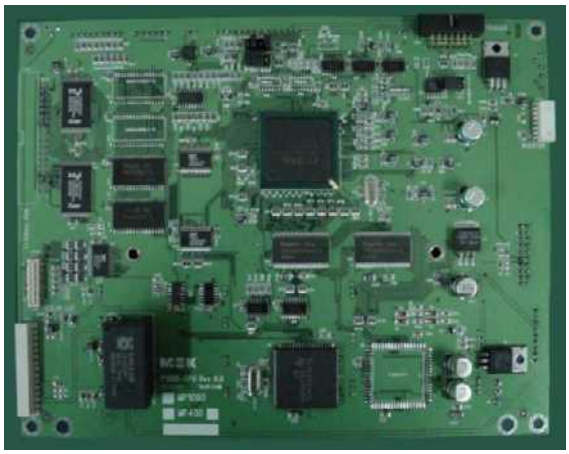
2. SYSTEM DIAGRAM

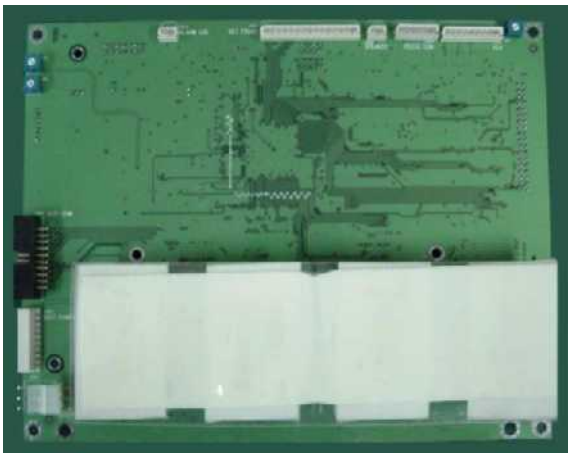
(1) OVERALL BLOCK DIAGRAM



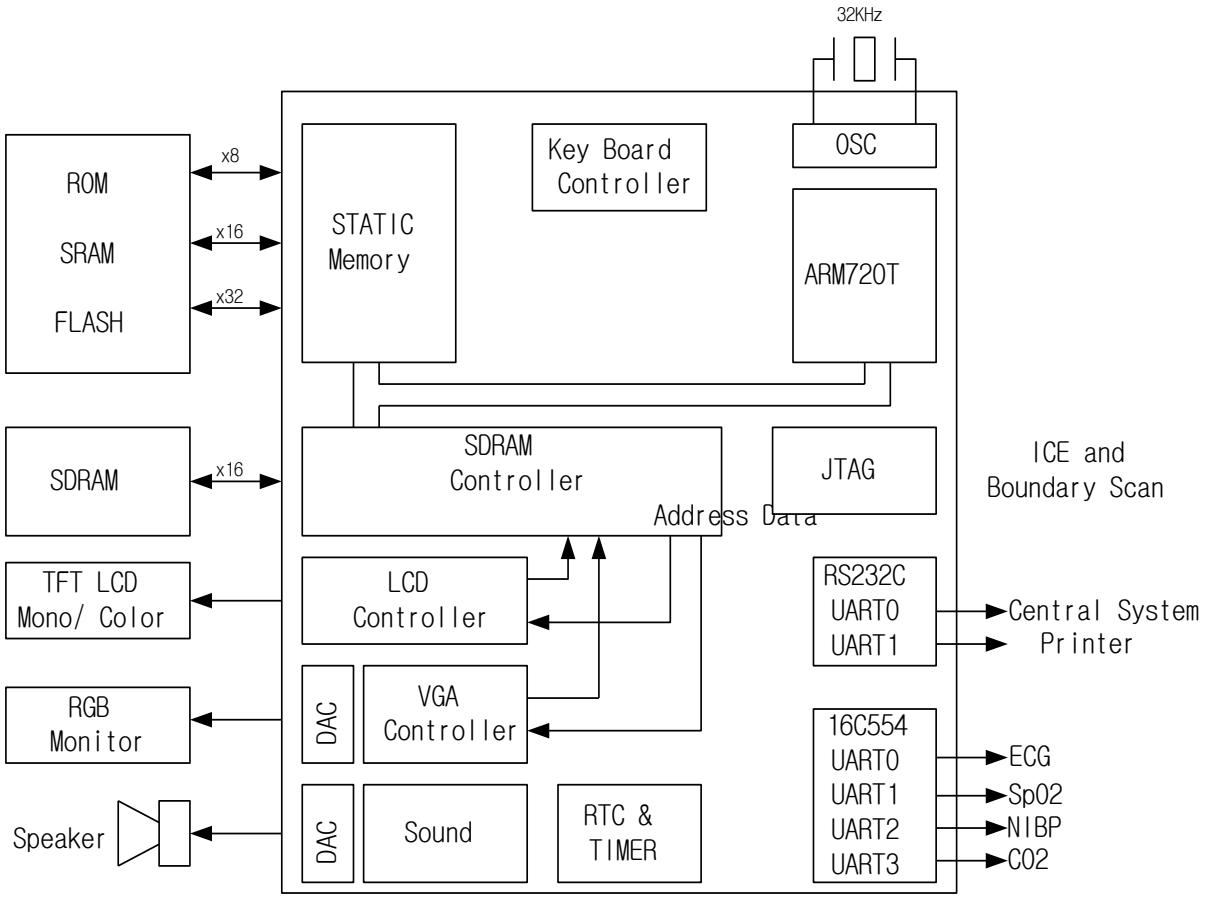
(2) DSC B/D

A. BOARD SNAPSHOT



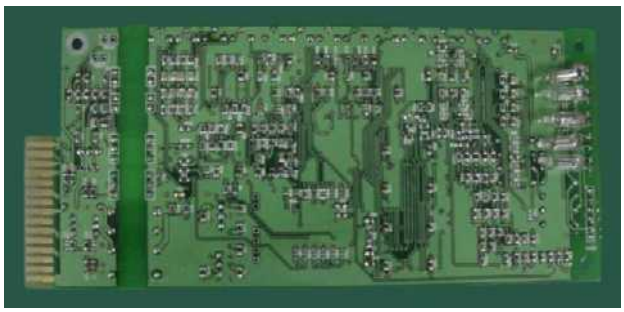


B. BLOCK DIAGRAM

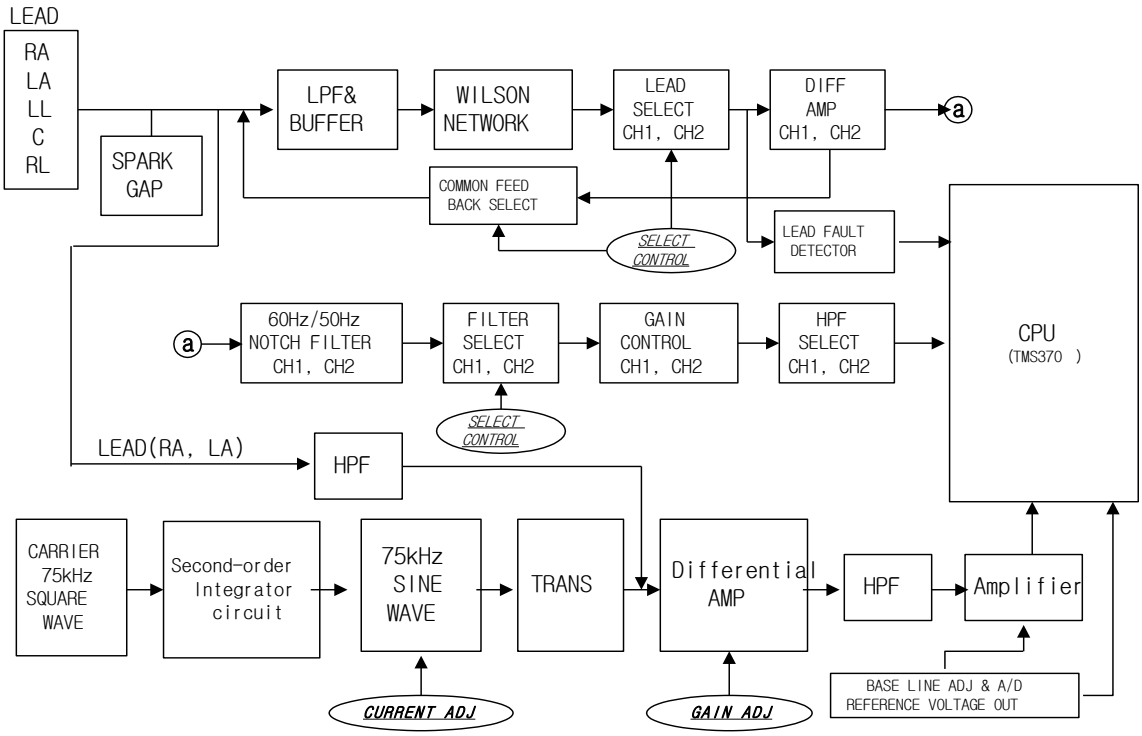


(3) ECG B/D

A. BOARD SNAPSHOT



B. BLOCK DIAGRAM



a. SPARK GAP

Electric Discharge to prevent Electronic Shock when High Voltage(Defibrillator) is applied.

b. LPF(Low Pass Filter)

Filters and passes low frequency signals only. (1/2πRC)

c. Buffer

5 Electrodes on Patient's body consist of RA(right arm), LA(left arm), LL(left Leg), RL(right leg), C(chest) and signals from these electrodes are to be input to Buffer which is made up of OP amp. Circuit Clamping diode and Neon lamp circuit on the amplifier is to prevent instant high voltage of power supply.

d. Wilson network & Lead selector

Respective signal from the Buffer links Lead Selector which consists of Analogue Multiplexer and LEAD Vector is selected by control signal from the CPU depending on the key input.

LD(2-0)	SELECT	DIFF AMP(+)	DIFF AMP (-)
000	I	LA	RA
001	II	LL	RA
010	III	LL	LA
011	AVR	RA	LA+LL
100	AVL	LA	RA+LL
101	AVF	LL	RA+LA
110	C	V	RA+LA+LL
111	CAL		

e. Differential Amp

Electrocardiograms signal from the Analogue Multiplexer is first amplified through differential amplifier with CMRR. Reason for applying differential amplifying is to eliminate the noise not only from the electrocardiogram signal from the electrode attached to the patient but also to get rid of the noise such as noise from the circuit simultaneously.

f. Lead fault detector

Circuit to detect high-resistance substance and display on the screen in order to report the status where the attached electrode is detached or improperly attached. Signals from the differential amplifier are used to detect the facts of saturation through window parallel drawing device and display on the screen and eventually authorize the signals on the transformer.

g. 60/50Hz Notch filter

Used to filter unnecessary frequency range. Generally used to eliminate the frequency of 60/50Hz from the power supply

h. GAIN CONTROL

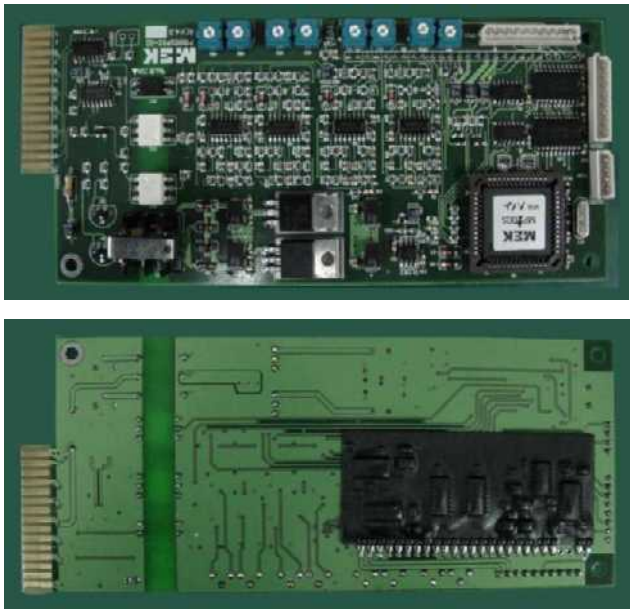
Used to control the gains from wave on analogue basis. CH1 GAIN and CH2 GAIN are controlled by VR1 and VR2 respectively..

I. HPF SELECT

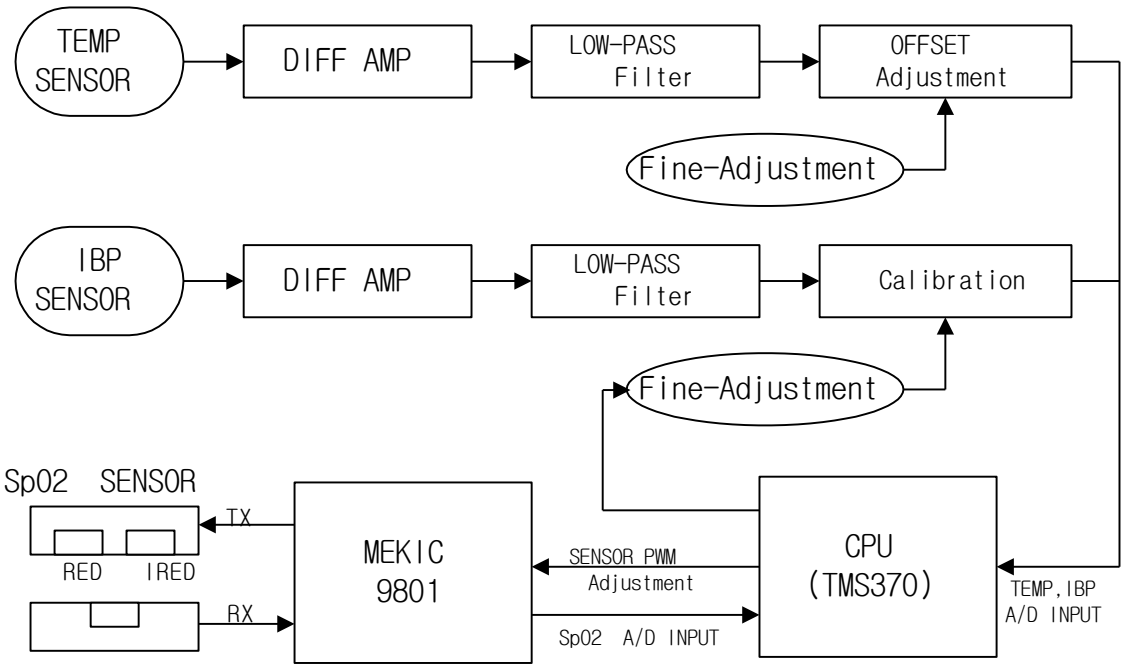
Only filters the high frequency range.

(4) SpO2 B/D

A. Board Snapshot



B. Block Diagram



Above diagram displays brief flow of the system.

Sensor Section : RED ray(880nm)and IRED(980nm) ray are used. Bottom concept is red color for HbO2 and black color for Hb. Light source including RED and IRED reflects from one side and evaluates the reduced figure and measures accordingly.

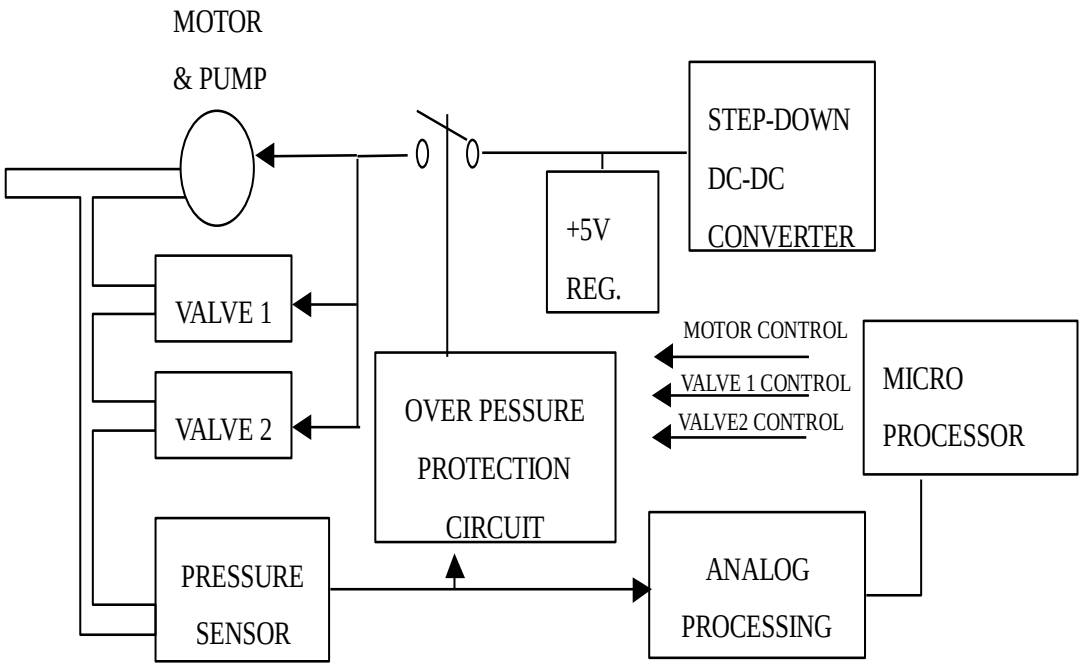
980nm wave length is used as a standard for measuring environment standard and revised value standard. 880nm wave length will appear as a resulting figure of measured object.

- Analog Processing : To control the electricity in order to adjust the intensity of light or to receive the measured data.
- CPU(Signal Processing & Control) : Receive data(TEMP, SpO2, IBP) are being AD and the result are used to calculate the heart rate and SPO2. If the resulted figure is not within the range of revised value, then adjustment will be made to determine the need for another intensity control. Additional function is to transmit and receive the data to and from external entity.

(5) NIBP B/D

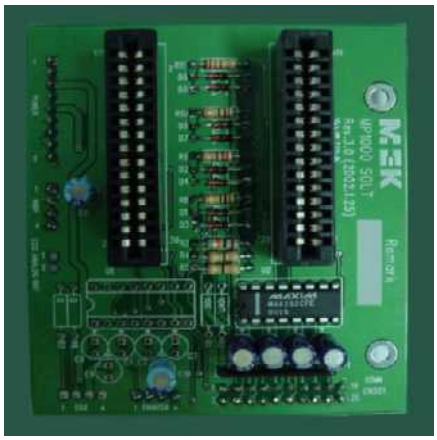
A. Board Snapshot

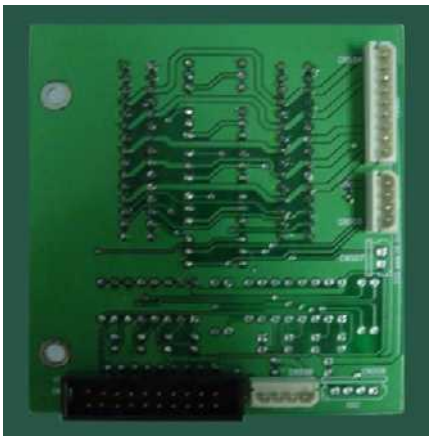
B. Block Diagram



(6) SLOT B/D

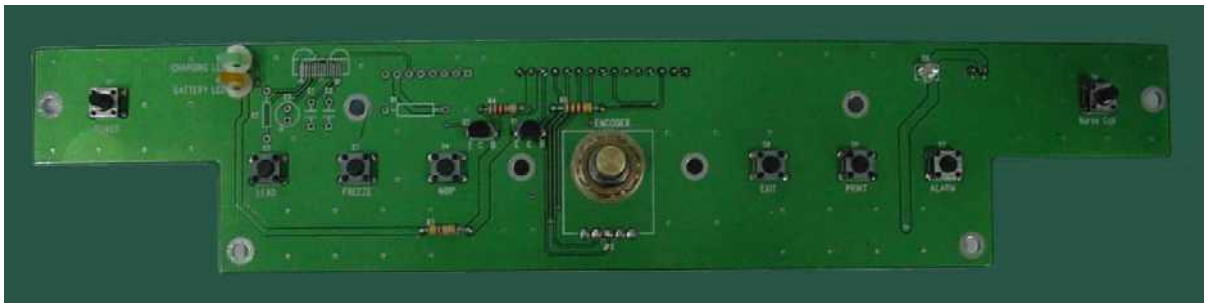
A. Board Snapshot





(7) KEY B/D

A. Board Snapshot

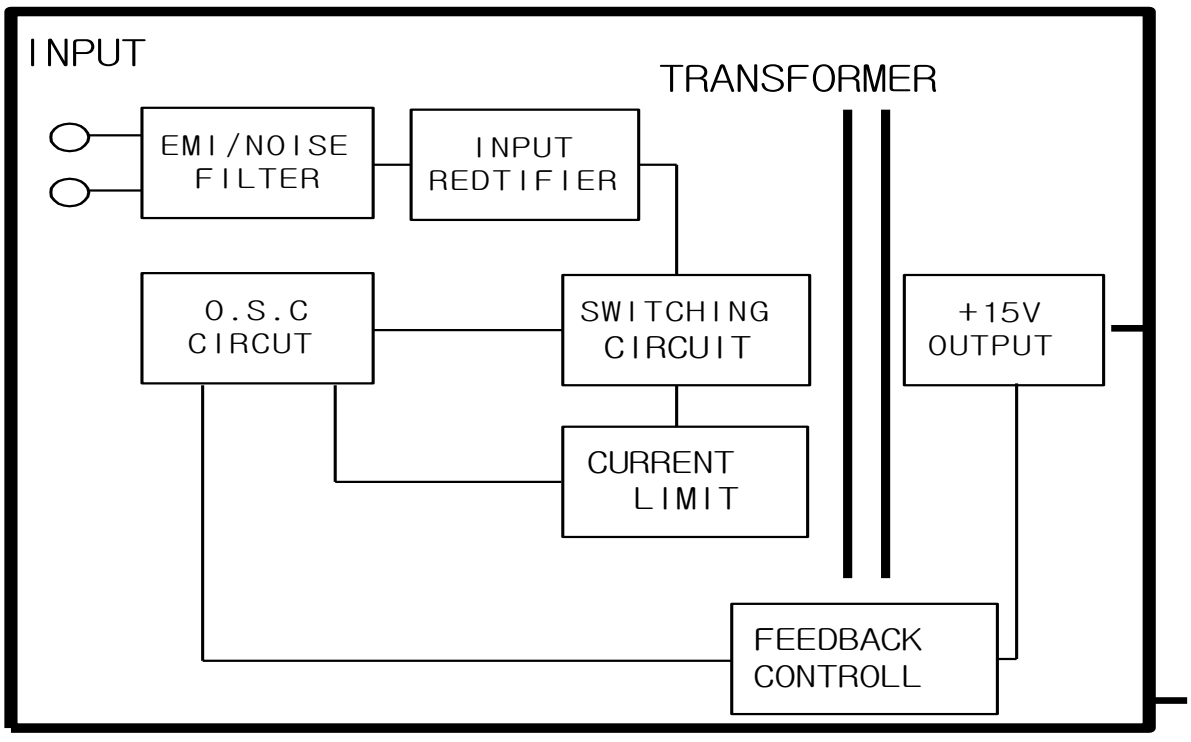


(8) ADAPTER B/D(AC-DC)

A. BOARD SNAPSHOT

B. Block Diagram

ADAPTER A/D



a. INPUT

Voltage	100 to 240 VAC- 10%, +10%
Line Frequency	47-63Hz
Current	1.2A Max
Protection	Internal primary current fuse Inrush limiting
Configuration	In Case IEC320 with Ground

b. OUTPUT

Combined line and load regulation	+, - 1% (Excluding cord)
Ripple	150mVp-p Max
Transient response	0.5 msec for 50% load change typically
Holdup time	18 msec min @120VAC 80 msec min @240VAC
Protection	Over Current Protection Short Circuit Protection

c. SAFETY APPROVALS : TUV/IEC601, cULus, MITI, Australia

d. ELECTRICAL

Topology	Switching – Fixed Frequency Flyback
Dielectric Withstand	4000VAC(5656VDC) Primary-Secondary, 1500VAC(2121VDC) Primary-Ground, 500VDC Secondary-Ground
Spacing	8.0 mm Primary-Secondary
Leakage current	Less than 100uA at 264 VAC 50Hz
Efficiency	80% minimum(excluding output cord) Normal Input
EMI	Complies with EMC Directives
CE	CE Compliant

e. ENVIRONMENTAL

Operating Temperature	0℃ to 40℃ with no derating
Storage temperature	-30℃ to +85℃
Relative humidity	5% to 95% non-condensing
Altitude	0-10,000feet
Cooling	Conventional-non vented case

f. MECHANICAL

Case and Dimensions	LP6-desktop 4.20L * 2.6W * 1.46H(inch) 107L * 66W * 37H(mm)
Storage temperature	Black 94VO polycarbonate
Relative humidity	10 Ounces, 285grams(excluding cord)

g. LINE VOLTAGE RANGE

Low Line	90VAC
High Line	264VAC
Frequency Range	47-63Hz

h. OUTPUT CURRENT CAPABILITY

This unit is capable of supplying +15.0V@3.0A

Total output power is limited up to 45W

i. TYPICAL RATINGS ARE AS FOLLOWS

Light Load	0.0A
Full Load	3.0A
(Burn Load)	3.0A

j. HI-POT TEST PROCEDURE : 2sec

Primary(Live Neutral Tied Together)-Secondary(Tied All Together) : 4000VAC or 5656VDC

Primary(Live Netural Tied Together)-Ground : 15000VAC or 2121VDC

Secondary(Tied All Together)-Ground : 500VDC

k. SHORT CIRCUIT / OVERLOAD RECOVERY:

Short circuit and overload protections are foldback

Foldback range : 4.0A ~ 7.9V

And the unit operates normally again after removing short or overload.

l. REGULATION & RIPPLE REQUIREMEMENTS

AC VOLTS	+15.0VDC LOAD	OUTPUT VOLTAGE	MAXIMUM RIPPLE
110VAC	0.0A	+14.4VDC~+15.6VDC	150m Vp-p
110VAC	3.0A		
220VAC	0.0A		
220VAC	3.0A		

m. BURN-IN SPECIFICATION

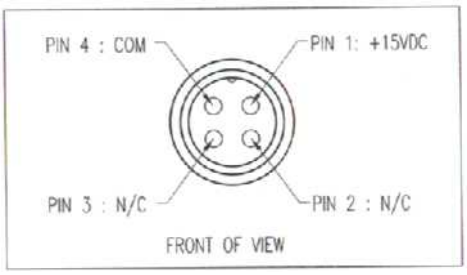
Load Resistor : 5.0 Ohm. 400W Minimum

Time/Voltage : 4 Hours Minimum With 100-240VAC Input

Output voltage should be measured within load connected before removing the units from the burn-in-rack:

OUTPUT	MINIMUM	MAXIMUM
+15.0VDC	+14.4VDC	+15VDC

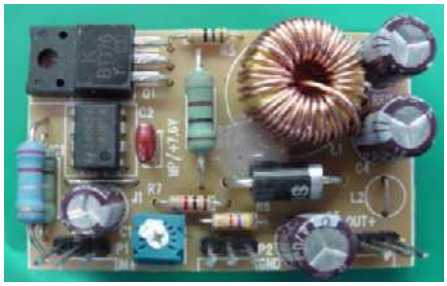
n. Pin Out



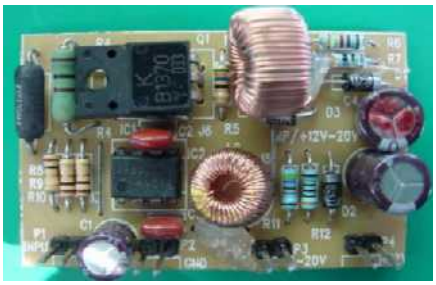
(9) POWER B/D(DC-DC)

A. BOARD SNAPSHOT

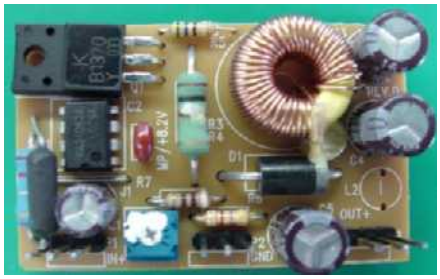
<< +12V/-20V DC-DC B/D>>



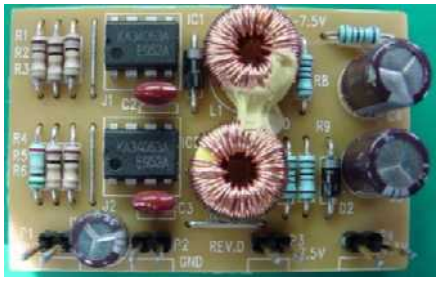
<<+5V DC-DC B/D>>



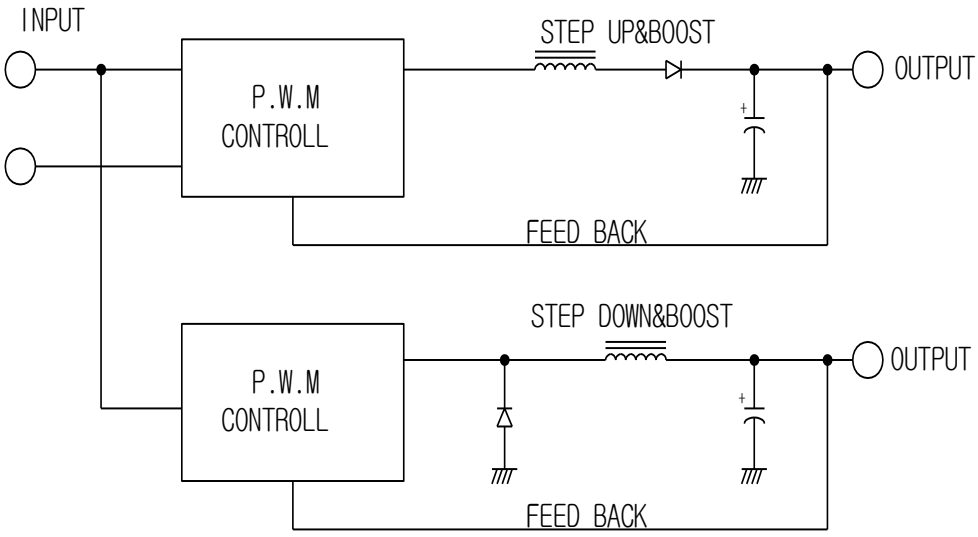
<<+7.5V/-7.5V DC-DC B/D>>



<<+8.9V DC-DC B/D>>



B. BLOCK DIAGRAM



a. MP400N DC-DC CONVERTOR

NO.	Description	+8.9V	+5V	±7.5V	+12V -20V	Remarks
1	Rated Output Voltage	+8.9V	+5V	±7.5V	+12V -20V	
2	No-load Voltage Range(%)	±1%	±1%	±5%	±5%	
3	Load Rated Current	2.5A	1.5A	0.3A	+12V 0.6A -20V 0.1A	
4	Load Voltage Range	±1%	±1%	±5%	±5%	
5	RIPPLE & NOISE (Rated Input & Rated Current)	100mV P-P	100mV P-P	250mV P-P	+12V 250mV P-P -20V 250mV P-P	
6	Over Current Protection (In case of Short Output)	Normal	Normal	Normal	Normal	
7	Output Power	20.5W	7.5W	4.5W	9.6W	

*Input Voltage based on DC+15V

b. Input Voltage Variation Rate

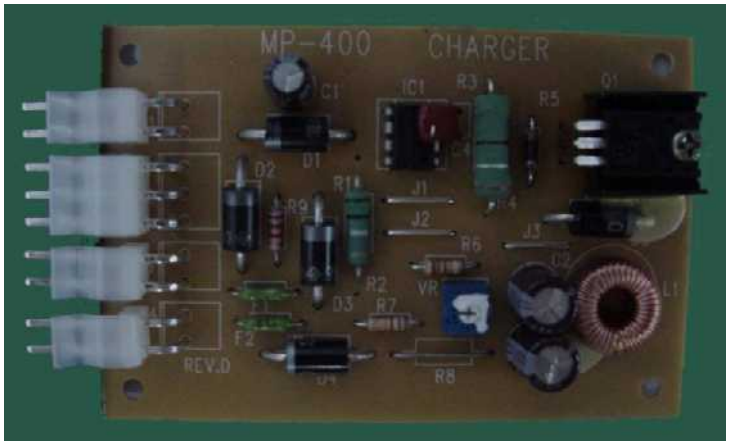
In case the rated current is loaded, even if the input voltage fluctuates as b, #4 on C is satisfied the range of voltage.

c. Load Variation Rate

AC110V or 220V, DC-DC +9V~ +15V under rated input condition to satisfy the range of output voltage in case of #3,4 on c under loaded current.

(10) CHARGER B/D

A. BOARD SNAPSHOT



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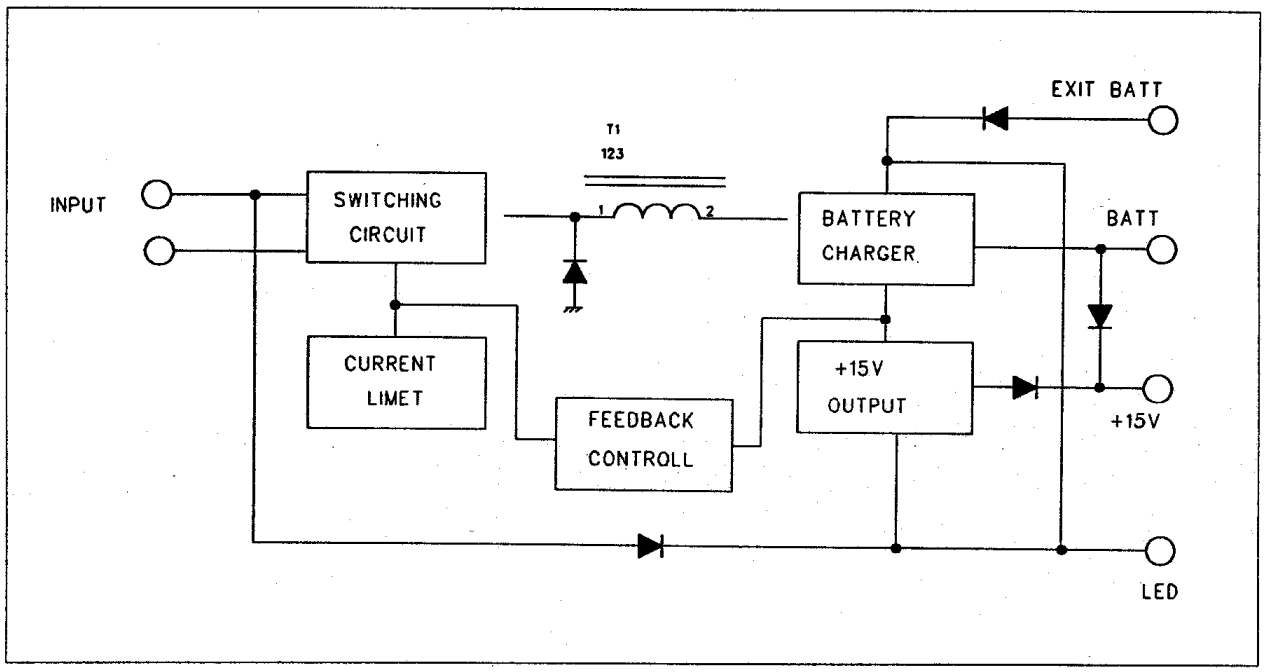


a. General Characteristic

This BATTERY charger receives power source from AC/DC CONVERTOR or DC 13V~DC 17V of the vehicle battery and supplies the main voltage for MP400N. This power is used to charge the battery for backup supply of power in case of electricity failure to maintain patient monitoring.

b. Electrical Characteristic

Rated Input	Input Variation Rate	Frequency Range	Remarks
DC +15V	DC+13V~DC+17V	-	BATTERY CHARGER

c. Out Put Characteristic

No.	Description	+13V CHARGER	Remarks
1	Rated Output Voltage	±13.8V	
2	No-LoadVoltageRange(%)	±1%	
3	Load Rated Current	0.5A±0.1A	
4	Load Voltage Range	Above +11V	
5	RIPPLE & NOISE (Rated Input & Rated Current)	=	
6	Over Current Protection	If above 0.5A, below 11V	Time consumed for BATTERY recharge 4H±30m BATTERY Voltage above **+13.65V**
7	Output power	6W	

*Input Voltage: DC15V Standard

d. Environment Condition

- Normal Operation at temperature 0~40℃, Correlative Moisture 10~90%.
- Normal Operation after a long period of storage at Storage Temperature -20℃~85℃, Correlative Moisture 10~90%.

3. INSTRUCTION FOR OPERATION

(1) ECG(Electrocardiogram) Measurement

1). NOTCH FILTER(60Hz) CH1, CH2Control

① Set the frequency to 60 Hz on the simulator and select FILTER as DIAGNOSTIC MODE with 0.05-40Hz frequency setting.

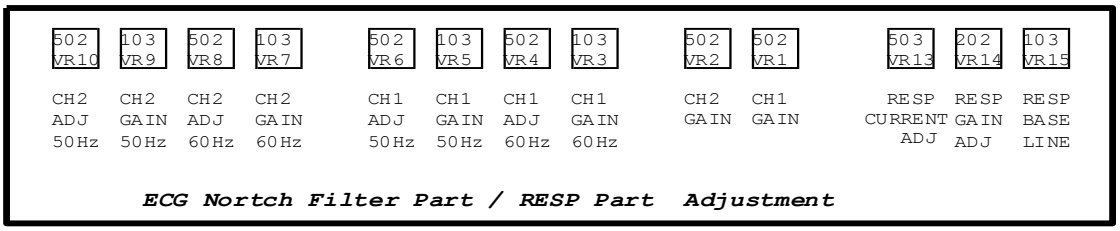
② Do not select Digital Band-Stop Filter

③ Set 60Hz for Line Frequency.

④ D32 Cathode on Oscilloscope ECG B/D (NORTCH_PART sheet 3 of 4) is measured and by using VR4(ADJ), VR3(GAIN) CH1 is controlled in order to reserve the smallest possible wave.

⑤ D33 Cathode on Oscilloscope ECG B/D (NORTCHLPART sheet 3 of 4)is measured and by using VR8(ADJ), VR7(GAIN) CH2 is controlled in order to reserve the smallest possible wave.

※ In case of not having Oscilloscope, operate article ④ and ④ while monitoring waves on the LCD display.



2). NOTCH FILTER(50Hz) CH1, CH2 Control

① Set the frequency to 50 Hz on the simulator and select FILTER as DIAGNOSTIC MODE with 0.05-40Hz frequency setting.

② Do not select Digital Band-Stop Filter

③ Set 50Hz for Line Frequency.

④ D32 Cathode on Oscilloscope ECG B/D (NORTCH_PART sheet 3 of 4) is measured and by using VR6(ADJ), VR5(GAIN) CH1 is controlled in order to reserve the smallest possible wave.

⑤ D33 Cathode on Oscilloscope ECG B/D (NORTCHLPART sheet 3 of 4)is measured and by using VR10 (ADJ), VR9(GAIN) CH2 is controlled in order to reserve the smallest possible wave.

※ In case of not having Oscilloscope, operate article ④ and ⑤ while monitoring waves on the LCD display.

3). LEAD FAULT CHECK

Check LEAD FAULT on LCD Display when attached LEAD on the simulator.

(Check all LEADS)

※ When checking Oscilloscope board, High condition is observed on output electrode D20 in case of LEAD FAULT.

4). ECG GAIN CONTROL(CH1, CH2)

① Adjust to 10mm by changing VRI(Gain) on ECG Board while monitoring the QRS wave. (Set SIMULATOR and device as GAIN : 1mV, Select LEAD : I)

② Adjust to 10mm by changing VR2(Gain) on ECG Board while monitoring the QRS wave. (Set SIMULATOR and device as GAIN : 1mV, Select LEAD : I)

5). LEAD Check

Set each lead in sequence to inspect normal operation. (Unaided eye observation)

6). SPEED GAIN Check

Set each SPEED and GAIN to inspect normal operation. (Unaided eye observation)

7). FILTER Check

Inspect each filter for normal operation.

8). RESPRATION Control

① Connect ECG cable to ECG simulator and link to Device. ② Set RESP SPEED to 12.5mm/SEC and GAIN to ×1 on the menu respectively.

③ Set BASE : 1K, LEAD : I, H/R : 85, DELTA : 94 on the RESP simulator and control.

④ By using oscilloscope, measure TP8(T3) and gradually adjust R13 and to control CURRENT ADJ to have 300mV.

⑤ Set RESP SIMULATOR as BASE : 500, LEAD : I, H/R : 85, DELTA : 94 then control.

⑥ By using oscilloscope, measure TP9(Output pin #9 on U34) and gradually adjust R14 and to control GAIN to have 1V.

⑦ Finally control BASE LINE on ECG B/D By using VR15.

※ Respiration data can be obtained from lead RA and LA from the ECG cable.

(2) SpO2 Measurement Operation

1). GAIN Check

Check to confirm if SPO2 gain has been changed on the GAIN MENU.

2). SPEED Check

Check to confirm if SPO2 speed has been changed on the GAIN MENU

3). Check Value

By using SpO2 SIMULATOR, check to confirm if the changed value on the simulator is in conformity with the displayed value. (Error Allowed ±2%)

4). Check Accuracy

By using the SPO2 simulator, check and confirm if the tested value is within the range of error allowance of ±2%.

(3) IBP(Invasive Blood Pressure) Operation

1). IBP1Operation

① Connect BP Simulator to IBP1.
② Select simulator atm 0mmHg(01) and operate.
③ Select IBP Calibration IBP1 on the Menu.
④ In case IBP Calibration is not operative, change VR7 and repeat ②.
⑤ Select and operate atm 0mmHg(01) on the simulator.
⑥ Select IBP Calibration IBP1 on the MENU
⑦ Check to see if B/P is 120/0 when lv 120mmHg(10) is selected on the simulator.
⑧ Failure to have 120/OmmHG on the screen, repeat step ⑤ after adjusting (IBP1) VR5 on order to have outcome of 120 as the difference of Blood Pressure
⑨ Select 200mmHg(15) on the simulator and check to see if the Blood Pressure is 200/0mmHG.

2). IBP2Operation

① Connect BP Simulator to IBP2.
② Select simulator atm 0mmHg(01) and operate.
③ Select IBP Calibration IBP2 on the Menu.
④ In case IBP Calibration is not operative, change VR8 and repeat ②.
⑤ Select and operate atm 0mmHg(01) on the simulator.
⑥ Select IBP Calibration IBP2 on the MENU.
⑦ Check to see if B/P is 120/0 when lv 120mmHg(10) is selected on the simulator.
⑧ Failure to have 120/OmmHG on the screen, repeat step ⑤ after adjusting (IBP1) VR6 on order to have outcome of 120 as the difference of Blood Pressure.
⑨ Select 200mmHg(15) on the simulator and check to see if the Blood Pressure is 200/0mmHG.

(4) TEMP(Temperature) Measurement Operation

1). TEMP1 Operation

① Link temperature JIG to connector1 and set 37℃.
② Minimize VR1(Gain control).Rotate the encoder to the maximum left.
③ Minimize VR2(Offset control)(Rotate to the far left end)

④ Control VR2 and set the temperature at 36.5c.
⑤ Control VR1 and set the temperature at 37.0℃.
⑥ Select temperature JIG at 40℃ and check if the temperature is corresponded with.
⑦ If the temperature is over 40℃, repeat ②③ and control VR2 to lower the temperature difference to set at 36.5C. Continuously repeat ⑤⑥to check if the temperature is corresponded with.
⑧ In reverse, if the temperature is below 40℃, repeat ②③ and control VR2 to raise the temperature difference to set at 36.5℃. Continuously repeat ⑤⑥ to check if the temperature is corresponded with..
⑨ Control temperature JIG to check respective temperature.

2). TEMP2 Operation

① Link temperature JIG to connector2 and set 37℃.
② Minimize VR3(Gain control). Rotate the encoder to the maximum left.
③ Minimize VR4(Offset control)(Rotate to the far left end)
④ Control VR4 and set the temperature at 36.5c.
⑤ Control VR3 and set the temperature at 37.0c.
⑥ Select temperature JIG at 40℃ and check if the temperature is corresponded with.
⑦ If the temperature is over 40℃, repeat ②③ and control VR2 to lower the temperature difference to set at 36.5C. Continuously repeat ⑤⑥to check if the temperature is corresponded with.
⑧ In reverse, if the temperature is below 40℃, repeat ②③ and control VR2 to raise the temperature difference to set at 36.5℃. Continuously repeat ⑤⑥ to check if the temperature is corresponded with.
⑨ Control temperature JIG to check respective temperature.

▣ Correlation between Temperature and Resistance(YSI 400 Series)

The following table is a data sheet to display the correlation between temperature of YSI Series temperature sensor and the resistance.

NO.	Temp (℃)	RES (Ω)	NO.	Temp (℃)	RES (Ω)	NO.	Temp (℃)	RES (Ω)	NO.	Temp (℃)	RES (Ω)	NO.	Temp (℃)	RES (Ω)
1	-40	75.79K	13	4	6011	25	16	3379	37	28	1977	49	40	1200
2	-35	54.66K	14	5	5720	26	17	3226	38	29	1894	50	41	1153
3	-30	39.86K	15	6	5444	27	18	3082	39	30	1815	51	42	1108
4	-25	21.87K	16	7	5184	28	19	2944	40	31	1740	52	43	1065
5	-20	16.43K	17	8	4937	29	20	2814	41	32	1668	53	44	1024
6	-15	16.43K	18	9	4704	30	21	2690	42	33	1599	54	45	984.2
7	-10	12.46K	19	10	4483	31	22	2572	43	34	1534	55	46	946.6
8	-5	9534	20	11	4273	32	23	2460	44	35	1471	56	47	910.6
9	0	7355	21	12	4075	33	24	2354	45	36	1412	57	48	876.2
10	1	6990	22	13	3887	34	25	2253	46	37	1355	58	49	843.2
11	2	6645	23	14	3708	35	26	2156	47	38	1301	59	50	811.7
12	3	6319	24	15	3539	36	27	2065	48	39	1249	60	55	672.9

(5) NIBP(Non-Invasive Blood Pressure) Measurement Operation

1). Preparation Task for Measurement

① Run after Installing MM300 PROGRAM on TESTING

- MM300.EXE (EXE file)
- MM300.LOG

② Connect Communication JIG and COM1 PORT on PC.

③ Connect HOSE and CUFF to BP-PUMP SIMULATOR.

④ Connect Power after connecting MM300 and Communication JIG.

2). MM300 Inspection and Operational Procedure

① Inspection for Communication

a. Inspect the communication between the PC and MM300(NIBP MODULE)

b. Press F1 on the keyboard of the computer- Initiate communication-Straight line will appear on the graph when normal

- Straight line on the graph must appear without noise
- Inspect TMS or ANALOG PART if NOISE appears

c. Press F2 on PC – communication interrupt – stops the straight on the graph

d. Press F3 on PC – RESET – back to initial setting

e. Press F4 on PC – Measures BP

f. Press F5 on PC – Switch ADULT and NEONATE

② SOLENOIDE Inspection.

a. Press V(Valve) on PC

b. Numerical key 0 on PC – SOLENOIDE 1(JR2) **OFF** / SOLENOIDE 2(JR3) **OFF**

c. Numerical key 1 on PC – SOLENOIDE 1(JR2) **ON** / SOLENOIDE 2(JR3) **OFF**

d. Numerical key 2 on PC – SOLENOIDE 1(JR2) **OFF** / SOLENOIDE 2(JR3) **ON**

e. Numerical key 3 on PC – SOLENOIDE 1(JR2) **ON** / SOLENOIDE 2(JR3) **ON**

For SOLENOIDE, inspect if the contact point on the valve is operative.

③ Inspection for PUMP (MOTOR) Operation.

a. Press M(Motor Pump) on PC .

b. Numerical Key 1-9 on PC for setting of pressure on the Motor Pump (10%～90%)

c. Numerical Key 0 on PC- to stop the Motor Pump

d. Press (–) key on PC – to start the Motor Pump

Inspect the operation of Motor Pump.

④ Pressure Adjustment

a. Control **VR4(200) to set** 0mmHg.

b. Close all SOLENOIDE valves – Press V and 3.

c. Set the BP-PUMP SIMULATOR at TESTS MODE with pressure of 200, and External Cuff.

d. Press BP-PUMP START TEST .

e. When pressure value reaches 200 on the BP-PUMP, set the pressure at 198mmHg in case of BP-PUMP, at 196mmHg if you are using mercurial BP measuring device on the screen by VR3.

f. Range of error allowance ±1mmHg

⑤ Blood Pressure Measurement TEST

a. Set BP-PUMP at PRESET MODE and test respectively selected SIMULATION condition is resulting appropriate outcome.

b. Press F3(RESET) then measure by pressing F4(READ-measure).

c. Set ADULT MODE of the TEST program on the PC.

d. 1st condition on BP-PUMP – Sys 120 / M 93 / Dia 80 / HR 80

e. 2nd condition on BP-PUMP – Sys 80 / M 60 / Dia 50 / HR 80

f. 3rd condition on BP-PUMP– Sys 200 / M 166 / Dia 150 / HR 80

g. 4th condition on BP-PUMP- Set SIMULATION MODE and select SYS 120 / DIA 80 / HR 60

h. After setting each condition, Press F3 (RESET) and inspect the appropriate measurement by pressing F4(READ measure).

i. PASSes Inspection if allowed difference is within the range of ±5

j. Set NEONATE MODE in the TEST PROGRAM of the computer.

k. Set– Sys 60 / M 40 / Dia 30 / HR 80(120) on the PRESET MODE of the BP-PUMP and inspect the appropriate measurement of the Blood Pressure.

⑥ The living body TEST

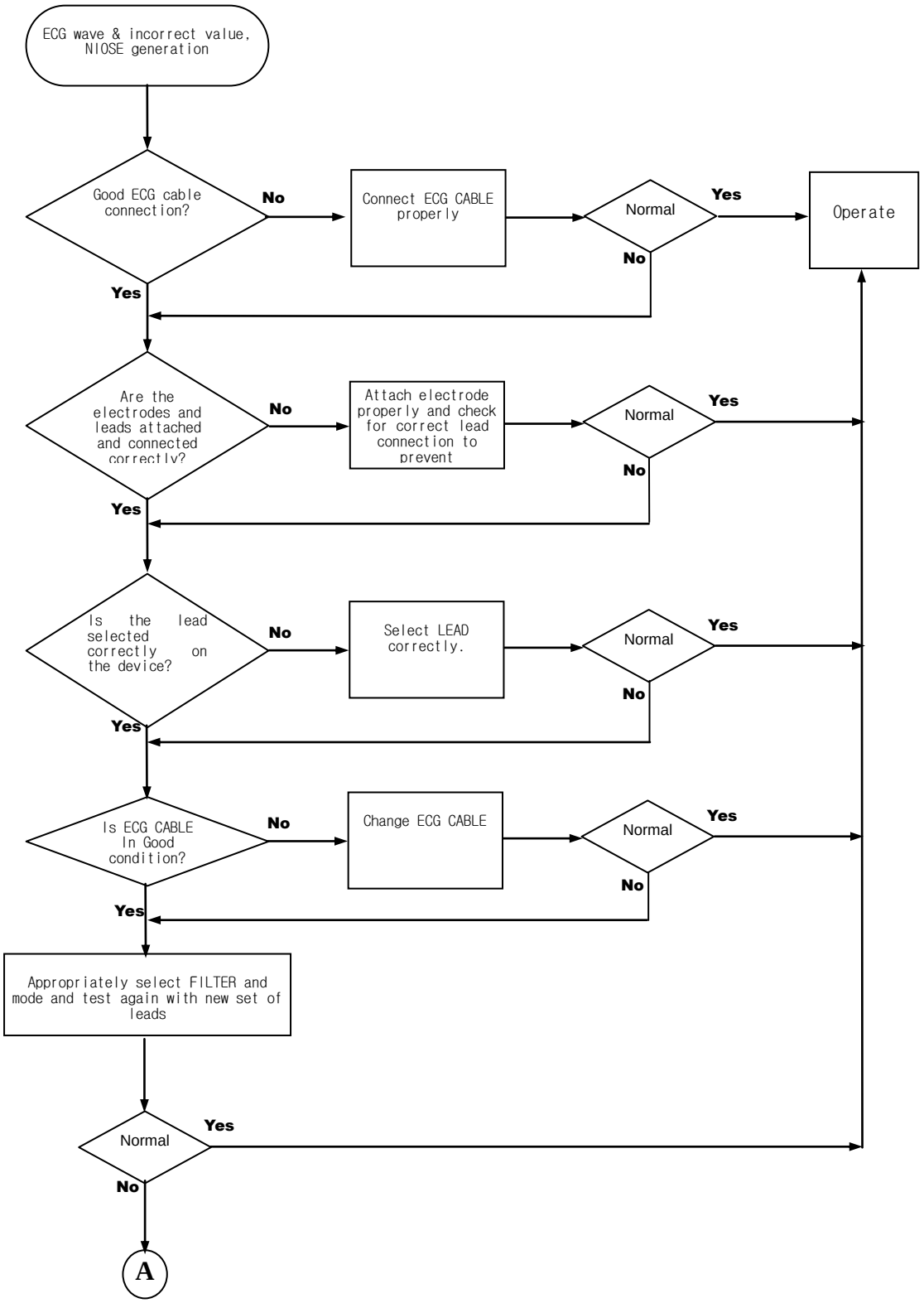
a. Wind the CUFF around arms and set ADULT MODE on PC TESTING

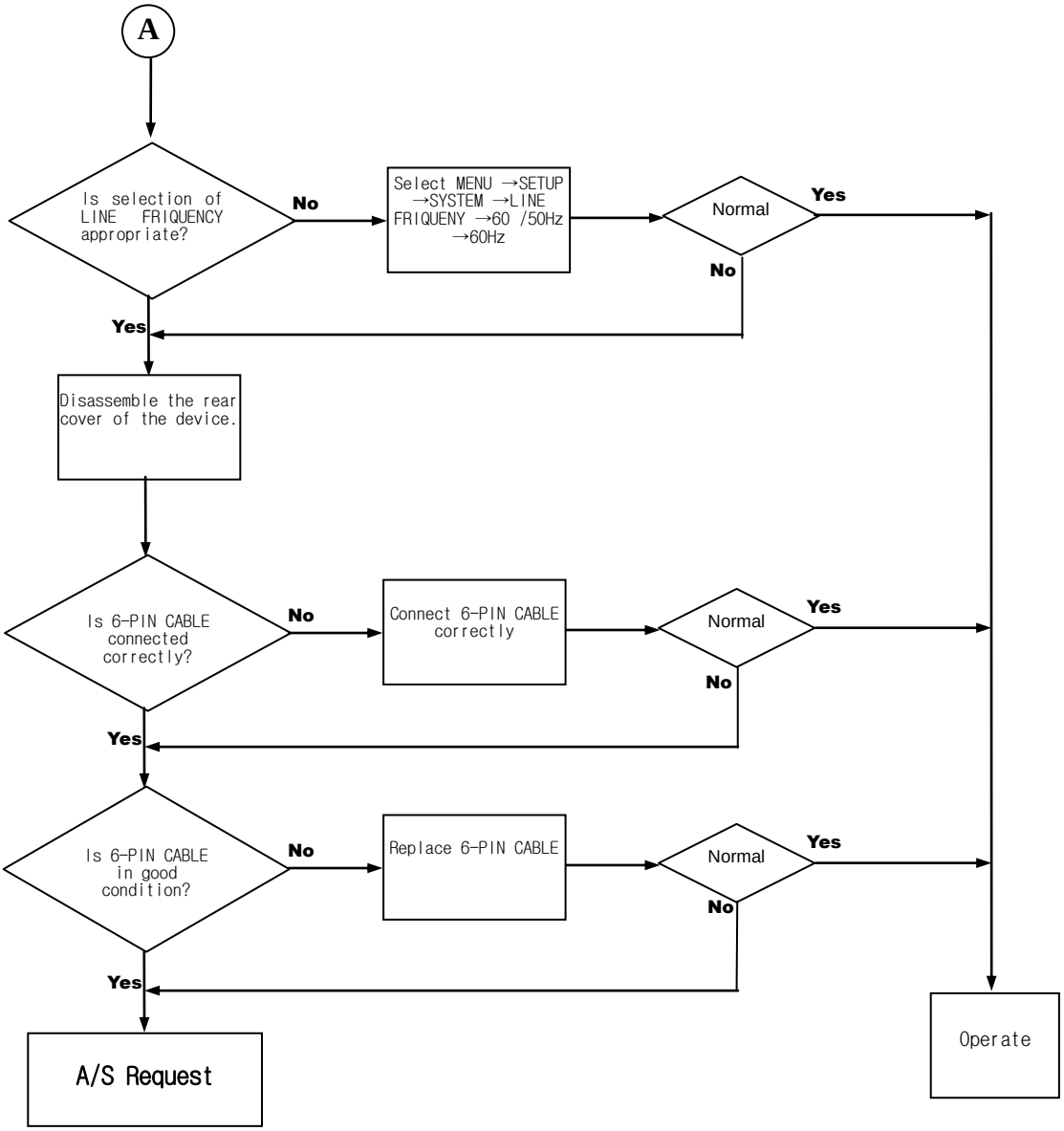
b. Press F3(RESET) followed by pressing F4(READ to measure) for measurement .

4. TRUBLE SHOOTING

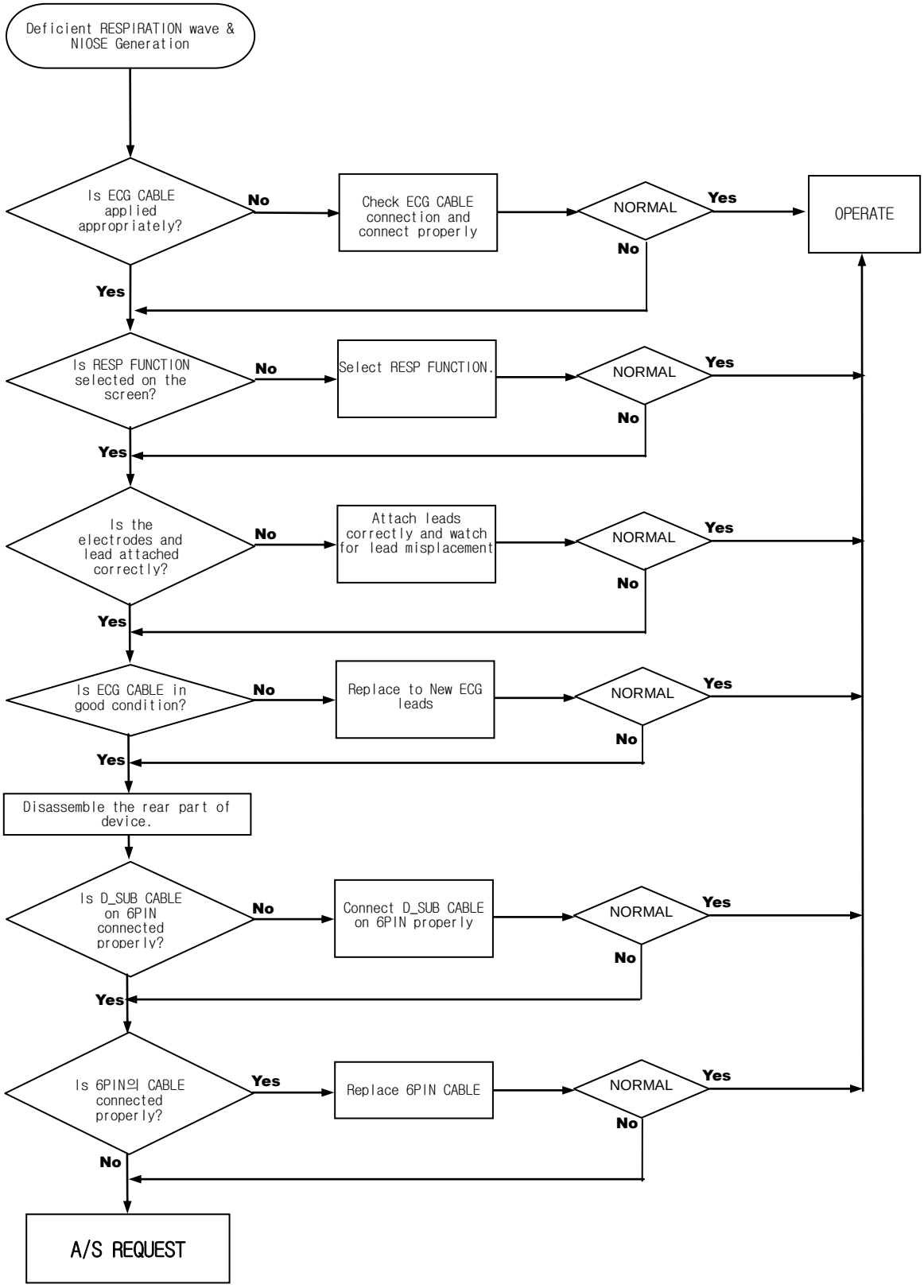
NO	B/D	Trouble Description	Referred PAGE
#1	ECG B/D	ECG Wave & Odd Figure and NOISE	23
#2	ECG B/D	RESPIRATION Deficient Wave & NOISE	25
#3	SpO2 B/D	SpO2 Inoperative.	26
#4	SpO2 B/D	SpO2 Wave & Odd Figure	27
#5	SpO2 B/D	IBP Inoperative & Odd Figure miscellaneous deficiency	28
#6	SpO2 B/D	Unable to measure TEMP	30
#7	NIBP B/D	Unable to measure NIBP.	31

#1 . ECG Wave & Incorrect value , NOISE

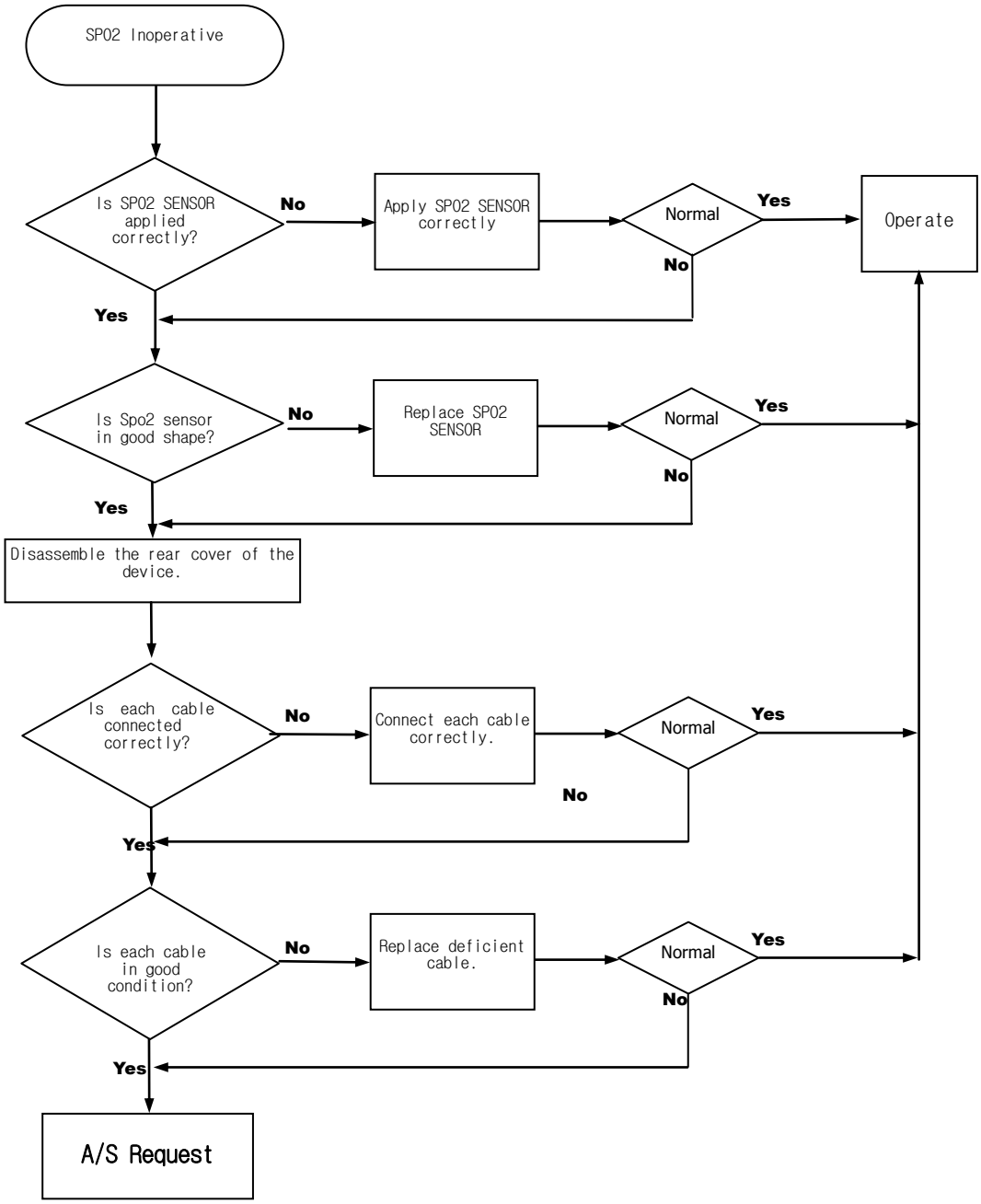



A
Is selection of LINE FRIQUENCY appropriate?
No
Select MENU →SETUP →SYSTEM →LINE FRIQUENY →60 /50Hz →60Hz
Normal
Yes
No
Yes
Disassemble the rear cover of the device.
Is 6-PIN CABLE connected correctly?
No
Connect 6-PIN CABLE correctly
Normal
Yes
No
Yes
Is 6-PIN CABLE in good condition?
No
Replace 6-PIN CABLE
Normal
Yes
No
Yes
A/S Request
Operate

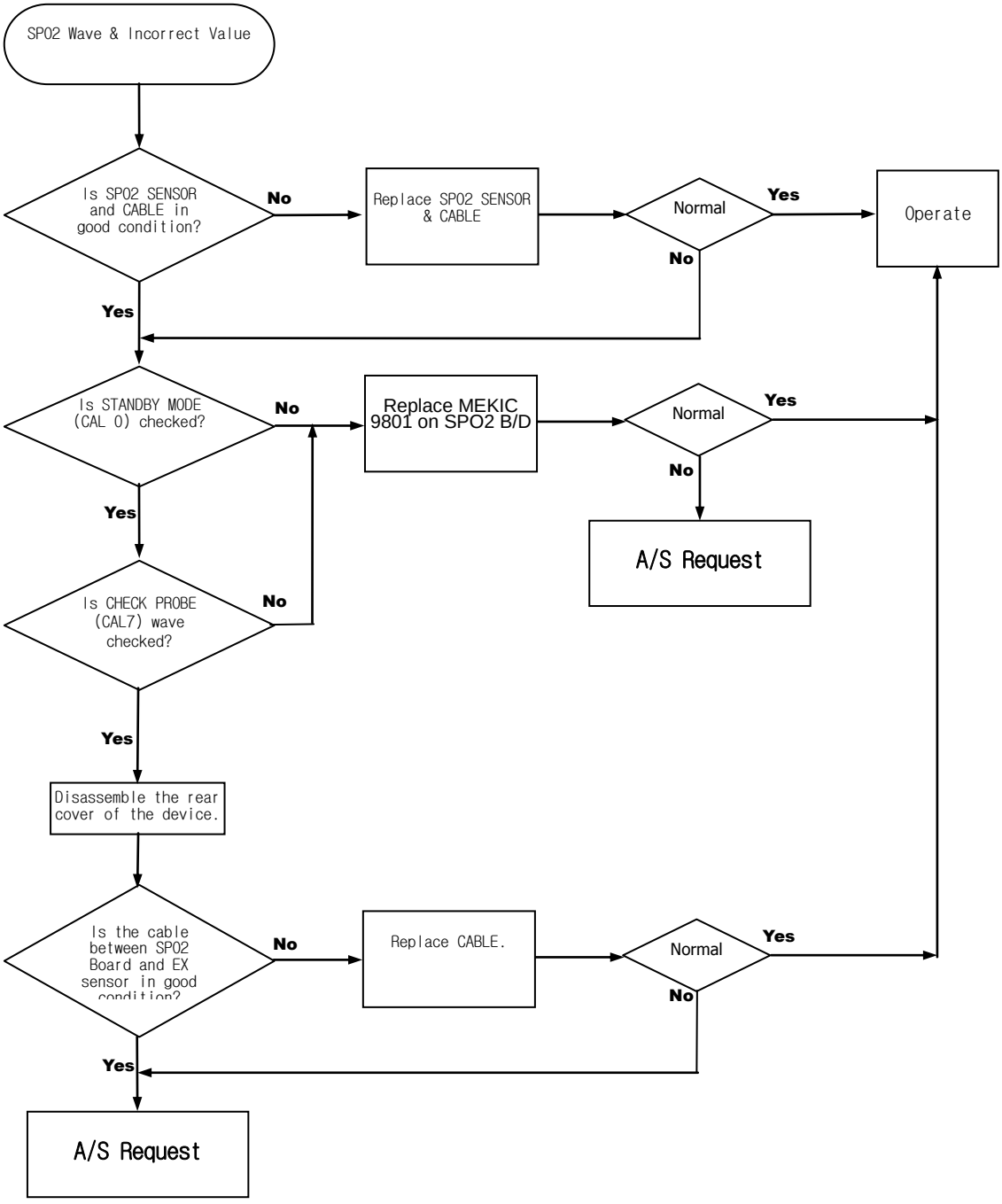
#2. RESPIRATION deficient wave & NIOSE



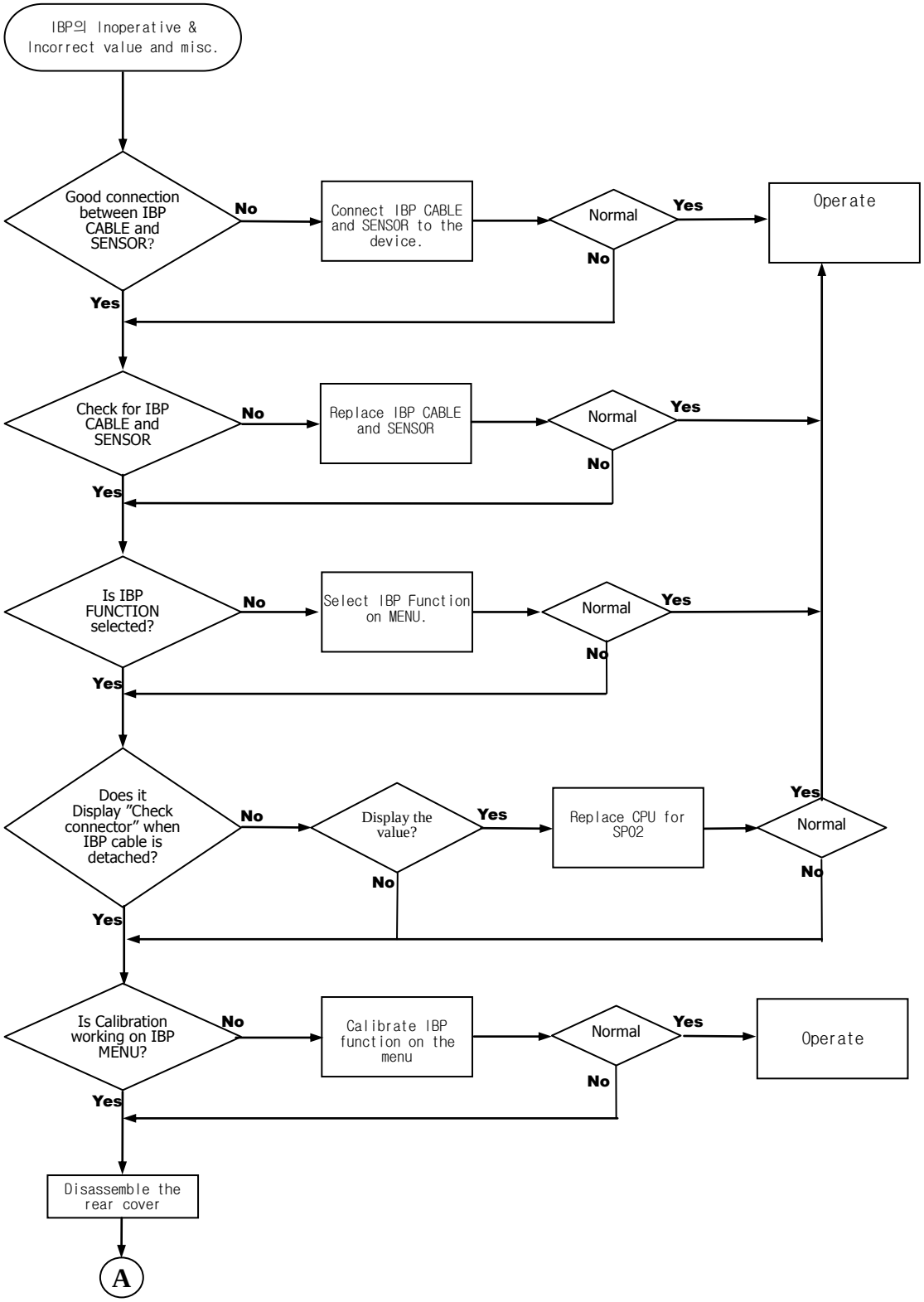
#3. SpO2 Inoperative.

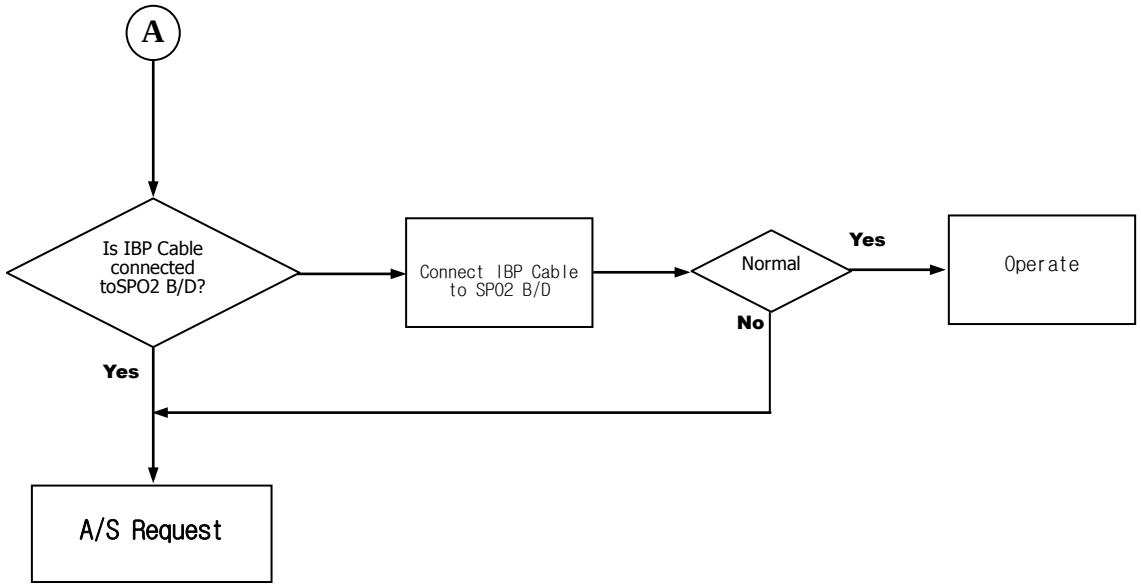


#4. SpO2 Wave & Incorrect value

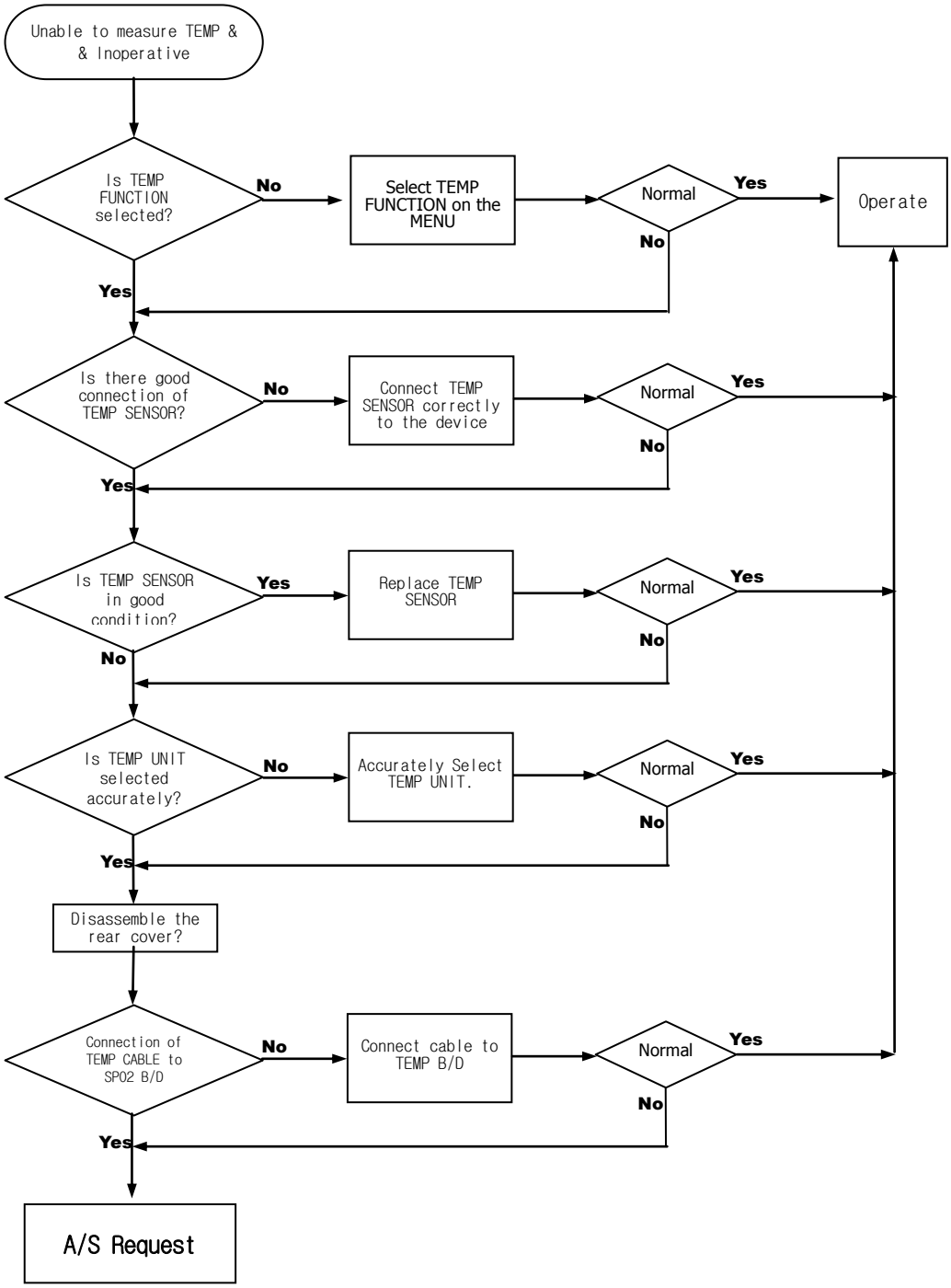


#5. IBP Inoperative & Incorrect value and miscellaneous deficiency




A
Is IBP Cable connected toSPO2 B/D?
Yes
Connect IBP Cable to SP02 B/D
Normal
Yes
No
Operate
A/S Request

#6. Unable to measure TEMP



#7. Unable to measure NIBP.