Patient Monitor Series

BM3/BM5/BM7

Operation Manual

BM3 BM5 BM7

Ver. 5.07

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www.ebionet.com

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-			
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Caution	**Please read this operation manual before operating the patient monitor. Keep it well for future reference.**

BM3/BM5/BM7 User Manual

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The entire manual should be carefully read.

This manual contains information on limitations, cautions, and warnings associated with the use of the Brio patient monitors.

Regardless of the complexity of the equipment, patient monitoring device should never be used to replace human care, attention, and judgement by trained health professionals.

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Contact

If you have any questions or comments relating to our products or purchasing, please contact the telephone numbers or E-mail below. You can talk to our sales people. Bionet always welcomes your enquiries. Please contact us.

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U.S.A Sales & Service Representative	**Bionet America, Inc.** 2691 Dow Ave. Suite B, Tustin, CA 92780 Toll Free : 1-877-924-6638 / Fax : 1-714-734-1761 E-mail : support@bionetus.com Website: www.bionetus.com

※ In the event of a malfunction or failure, contact Service Dept. Of Bionet Co., Ltd. along with the model name, serial number, date of purchase and explanation of failure.

Introduction

1) Indications for use

The patient monitors are intended for monitoring, displaying, reviewing, storing, notifying, and transferring of multiple physiological signs of a patient, such as (ECG / 3-Lead, 5-Lead selectable), arrhythmia detection, ST-segment analysis, Heart Rate (HR), Respiration rate (Resp), Temperature (Temp), Pulse Oxygen Saturation (SpO2), Pulse Rate (PR), Non-invasive Blood Pressure (NIBP), Carbon Dioxide(CO2), and Invasive Blood Pressure (IBP, BM5/BM7 only).

All the parameters could be monitored on single adult, pediatric, and neonatal patients except for the following:

- The arrhythmia detection monitoring is intended for adult and pediatric patients only.
- These patient monitors are to be used in healthcare facilities by clinical professionals or under their guidance. They should only be used by persons who have received adequate training in their use.

2) Contraindications

The following bullet lists describe when and where the patient monitors are not Intended for Use:

- As therapeutic device
- Domestic use
- In transport situations within hospital environments
- During MRI
- As apnea monitors
- ECG measurements are not intended to be used for diagnosis of rhythm and morphology of cardiac complexes.

Caution	**Federal law restricts this device to sale by or on the order of physician.**

3) Overview

BM3/BM5/BM7 patient monitor is a multi-parameter instrument designed for monitoring the vital physiological signs of patients.

BM3/BM5/BM7 patient monitor offers visual and audible monitoring alarms when it indicates outside of the value ranges from high alarm limit to low alarm limit of various physiological measurement.

It allows comprehensive analysis of patient's physiological conditions.

Patient monitor can be connected to BM Central which is Windows based central monitoring software.

Note	**All Bionet hardware drawings and screenshots on this user manual use for an example only. The actual product can be slightly different from drawings and screenshots.**

The patient monitors can monitor the following items.

- Heart Rate
- Respiration Rate
- Non-Invasive blood pressure
- Arrhythmia
- Temperature (BM3: x1 / BM5, BM7: x2)
- SpO2
- Pulse Rate
- Apnea
- ST segment analysis
- EtCO2(option)
- FiO2(option)
- Invasive blood pressure x2 (BM5, BM7 only)

Caution	**BM series patient monitor is applicable for use in hospitals and clinical institutions. The operation should be performed by qualified professionals only.**

4) Applications and scope

BM3/BM5/BM7 patient monitor is a multi-functional instrument designed for monitoring the vital physiological signs of adult, pediatric and neonate patients.

ST segment analysis and arrhythmia should be used for adult and pediatric patients only.

5) Functional Safety

The essential function of the patient monitors is to provide the healthcare practitioner with meaningful parameter values.

An alarm occurs if the parameter values are out of the specified range or when they are not provided properly.

Bionet has assessed the risks associated with the use of the patient monitors in consideration of the main functions and has mitigated the risks threatening their product life, provided that they are used in compliance with service recommendations and regular maintenance.

6) Warnings, Cautions and Notes

Read the "Warnings, Cautions and Notes" thoroughly to ensure safety and to prevent product damage before using the patient monitors. Be sure to follow the "Warnings, Cautions and Note" indicated below, as these are important messages related to safety.

Specifications or functions described in this manual are subject to change without notice for product improvement.

Warning	**[Warning] Failure to follow this message may cause severe injuries, casualty or physical damage to patients.**

Caution	**[Caution] Failure to follow this message may cause in non-life-threatening injury or damage to the equipment**.

Note	**[Note] indicates some important information and tips, which are not dangerous, about installation, operations and maintenance.**

7) Definition of Groups

Bionet defines user groups of the patient monitors as Users, Service representative, and Experts.

All defined groups should read this operation manual very carefully before starting to use the patient monitors and should be trained in their use, installation, reprocessing, maintenance, and repair.

The patient monitors can be used, installed, reprocessed, maintained, and repaired by the defined groups only.

User

Users shall use the patient monitors for their intended use.

Service representative

Service representative are responsible for the maintenance of the patient monitors.

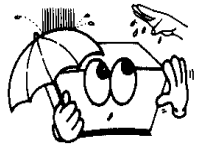
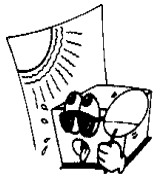
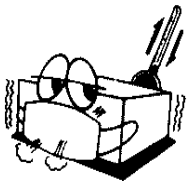
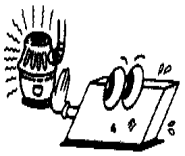
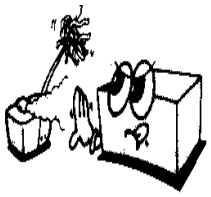
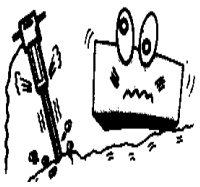
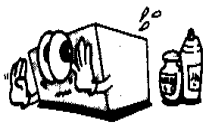
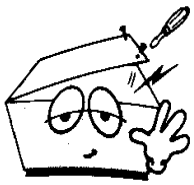
They shall be trained in the installation, reprocessing, and maintenance of them.

Expert

The experts shall have enough knowledge and experience to repair or conduct the complicated maintenance tasks on the patient monitors.

8) General Precautions on Environment

DO NOT store or operate the equipment in the places listed below.

	A place exposed to moisture (DO NOT touch the equipment with wet hands.)		A place under direct sunlight
	A place in areas with highly fluctuating temperatures.		A place in the vicinity of Electric heater
	A place with excessive humidity rise or poor ventilation		A place with sources that cause excessive shock or vibration
	A place exposed to chemicals or at risk of gas leakage		Avoid the invasion of small objects/ particles such as dust, and especially avoid metallic material.
	Do not disjoint or disassemble the equipment. (Bionet is not liable for broken products caused by attempted disassembly).		DO NOT connect power until the product is completely installed. It may cause damage to the product.

9) Electromagnetic Compatibility

The patient monitors have been designed and tested for compliance with current regulatory standards as to their capacity to limit electromagnetic emission (EMI), and as to their ability to block the effects of EMI from external sources.

They comply with the following standards pertaining to EMI emissions and susceptibility: EN60601-1-2.

To reduce possible hazardous situations caused by electromagnetic interference, we recommend the following:

- Use only accessories provided by Bionet.
- Ensure that other products used in areas where patient monitors and life support are used comply to accepted emissions standards (CISPR 11, Class A).
- Try to maximize the distance between electro-medical devices. High-power equipment related to electrical simulators, electrosurgical instruments, and radiators (X-ray machines), as well as evoked potential devices may cause monitor interference.
- Strictly limit exposure and access to portable radio frequency sources (e.g., cellular phones and radio transmitters). Be aware that portable phones may periodically transmit even when in standby mode.
- Maintain good cable management. Do not route cables over electrical equipment. Do not intertwine cables.
- Ensure all electrical maintenance is performed by qualified personnel.

Caution	**Infectious devices and parts must be sanitized and cleaned before disposal.**

PART 1. Basic

1) Overview

This patient monitor is for adult, pediatric, and neonatal monitoring. It can be used as an independent device or connected to the BM Central network. Use of the monitor is limited to one patient at a time.

The following optional software features are available:

- Arrhythmia analysis.
- 3-lead ST segment analysis.
- It is common to connect B2B VIEWs, and the two connections are optional.
- Wireless network connection.

2) Electric Safety Precautions

Caution	**Please check the following before using the product.** **1. Be sure that AC power supply line is appropriate to use. (AC100 - 240V)** **2. Be sure that the power source is the one supplied from Bionet.** **3. Be sure that the entire connection cable of the system is properly and firmly fixed.** **4. Be sure that the equipment is completely grounded. (If not, there might be the problem occur in the product.)** **5. The equipment should not be placed in the vicinity of electric generator, X-ray, Broadcasting apparatus to eliminate the electric noise during operation. Otherwise, it may cause incorrect result.** **Each monitor requires an independent circuit and a reliable ground. Inaccurate measurements may occur when using the same power supply as other electrical equipment.**

Note	**BM3, BM5, BM7 are classified as follows:** **- It is classified as Class I, BF & CF concerning electric shock. It is not proper to operate this Equipment around combustible anesthetic or dissolvent.** **- Noise level is A class regarding IEC/EN 60601-1 and the subject of Noise is A level concerning IEC/EN60601-1-2.**

Warning	**Do not touch the patient while using the defibrillator. The user may be at risk. When using the defibrillator, be careful about safety and use only the supplied cable.**

Warning	**In case the Equipment does not operate as usual or damaged, do not use on patient, and contact to the medical equipment technician of the hospital or the equipment supply division.**

3) Equipment Connection

Caution	**Doctors and patients in hospitals are exposed to the risk of uncontrollable currents. These currents are caused by a potential difference between the patient monitor and conductive objects, which may come into the monitor. To solve this problem, make sure that the auxiliary equipment connected to the patient monitor satisfies EN60601-1.**

4) Biocompatibility

When used as intended, the parts of the patient monitor described in this operator manual, including accessories that come in contact with the patient during the intended use, fulfill the biocompatibility requirements of the applicable standards. If you have questions about this matter, please contact Bionet or its representatives.

5) Product Configuration

Basic components

1.	Main body of BM3/5/7 monitor	1 EA
2.	3-Lead ECG patient cable (**BM3**)	1 EA
	5-Lead ECG patient cable (**BM5, BM7**)	1 EA
3.	Disposable electrodes	10 EA
4.	NIBP extension tube	1 EA
5.	Reusable adult NIBP cuff	1 EA
6.	SpO2 extension cable	1 EA
7.	Reusable adult SpO2 probe	1 EA
8.	DC power adaptor	1 EA
9.	Operation manual	1 EA
10.	Thermal roll paper	2 ROLL
11.	Rechargeable battery	1 EA
12.	Power Cord	1 EA

Option components

1. Reusable temperature probe (Skin type)
2. Sidestream EtCO2 module (Respironics)
3. Mainstream EtCO2 module (Respironics)
4. Sidestream EtCO2 sample lines
5. Mainstream EtCO2 airway adapters
6. 5-Lead ECG patient cable (**BM3** only)
7. 3-Lead ECG patient Cable (**BM5, BM7** only)
8. IBP transducer set (Disposable/Reusable) (**BM5, BM7** only)
9. Ethernet cable

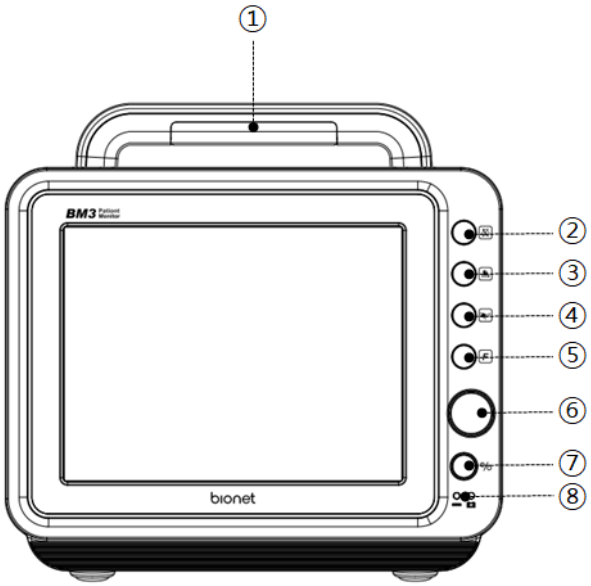
Warning	**To avoid electrical shock, do not open the cover. Disassembling the patient monitor should be done only by service representative authorized by Bionet.**

Warning	**Users must pay attention on connection any auxiliary device via LAN port or nurse calling. Always consider about summation of leakage current, please check if the auxiliary device is qualified by IEC 60601-1, or consult your hospital biomedical engineer.**

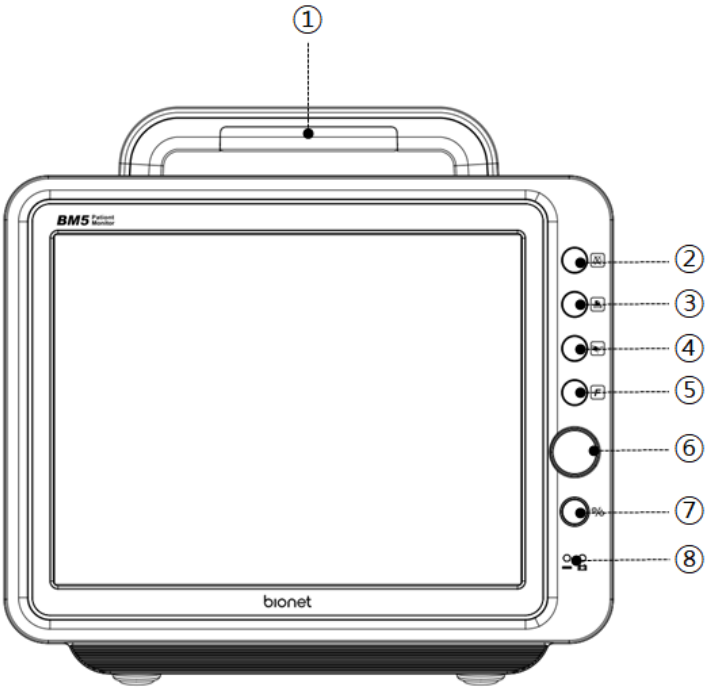
6) Basic Unit

Front view

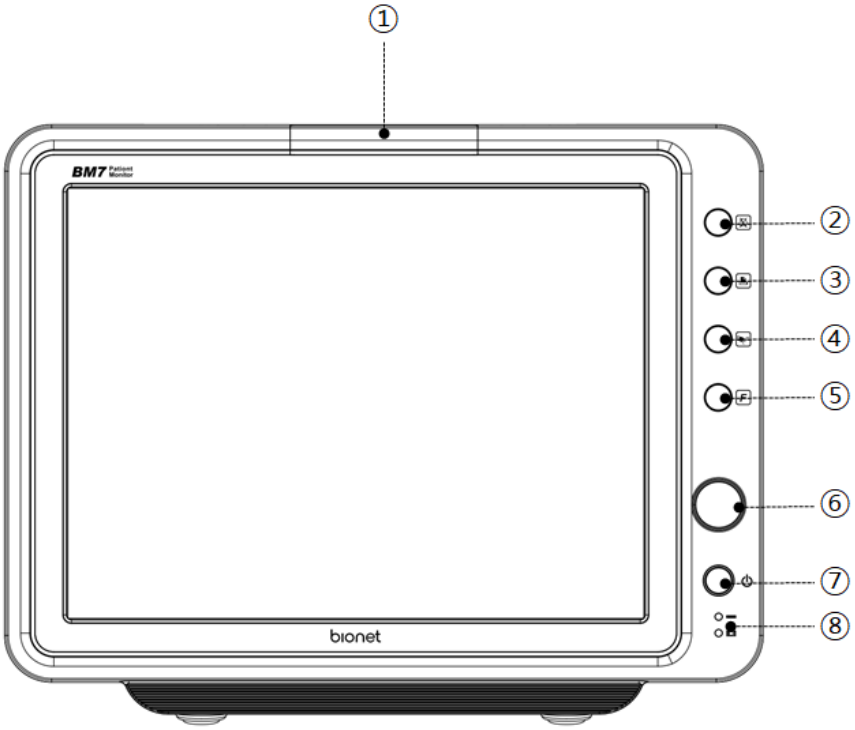
BM3



BM5



BM7



① Alarm lamp

② Alarm control key

③ Printer key

④ Blood pressure measurement key

⑤ Home key

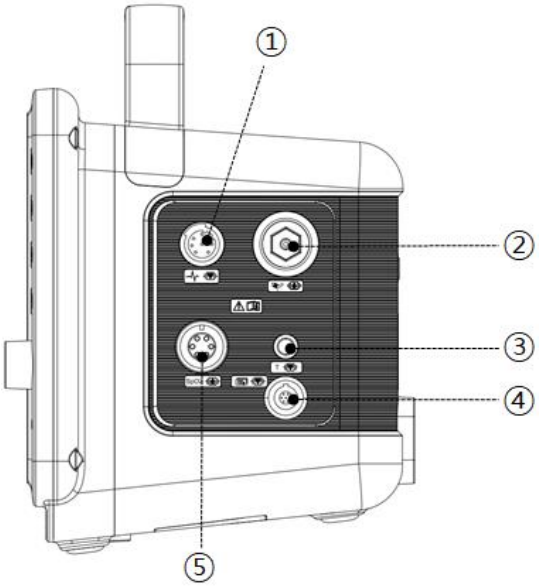
⑥ Rotary knob

⑦ Power ON/OFF Key

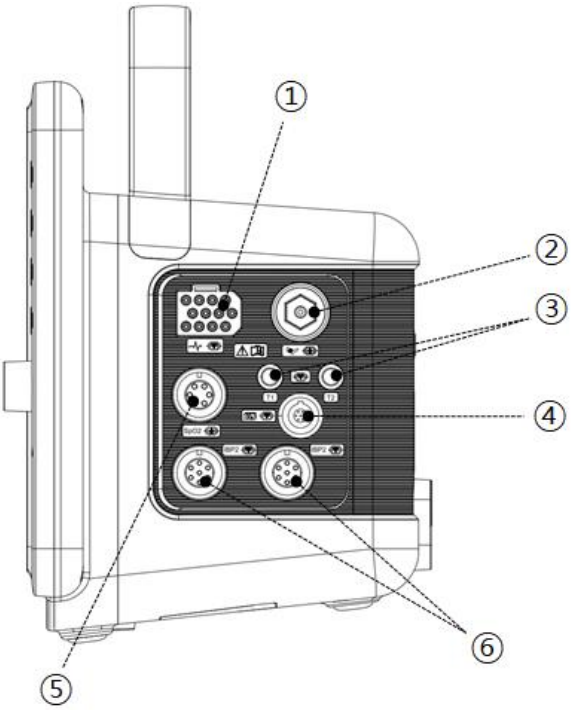
⑧ Battery status indicator

Right side view

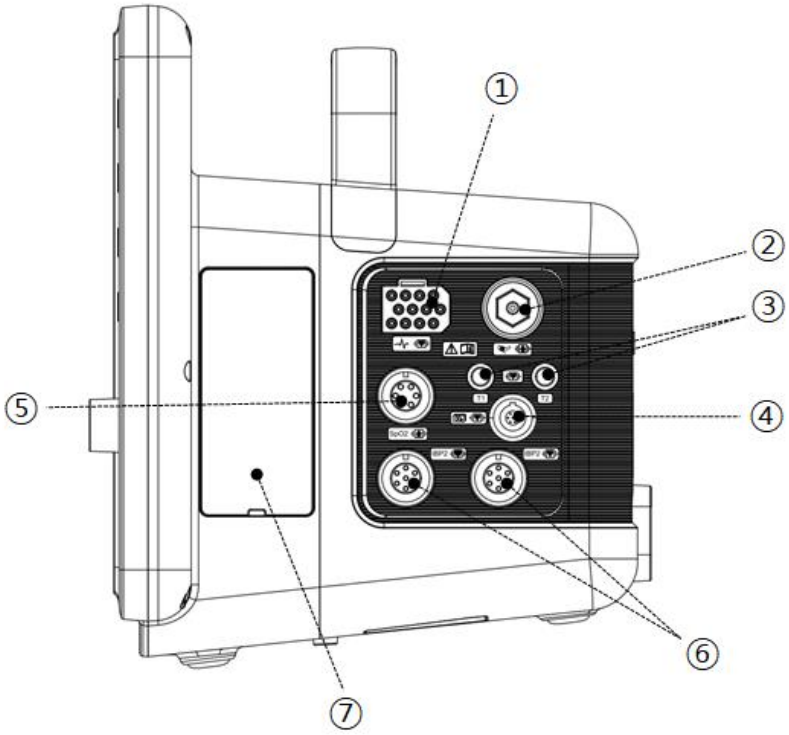
BM3



BM5



BM7



① ECG connector

② Blood pressure tube connector

③ Temperature connector

④ EtCO2 connector

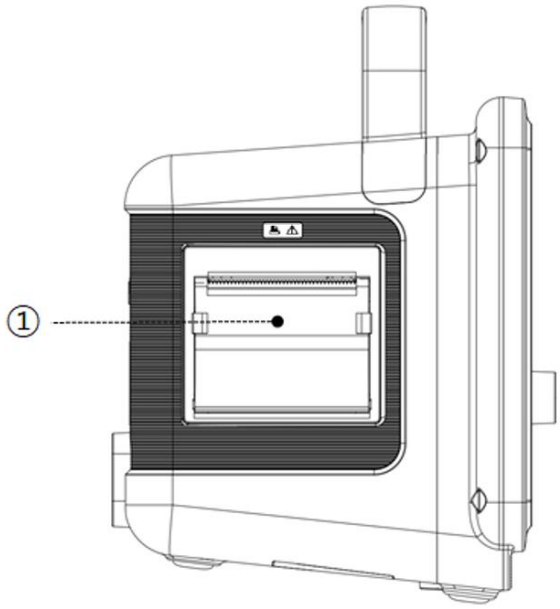
⑤ SpO2 connector

⑥ IBP connector (BM5, BM7 Only)

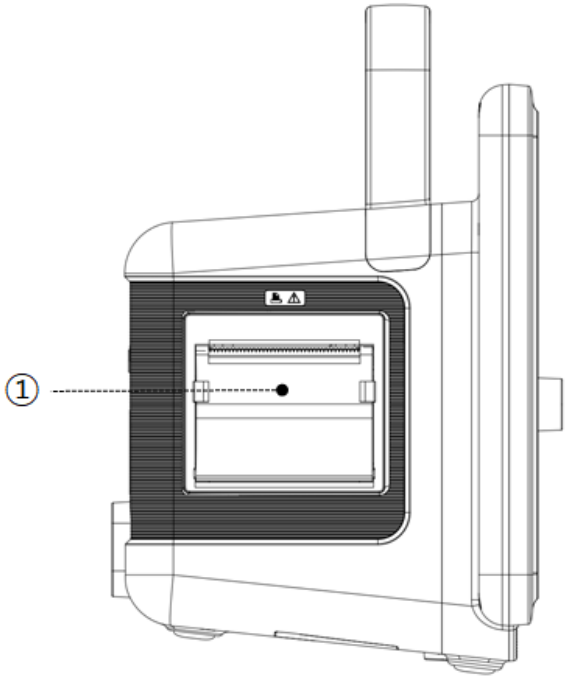
⑦ Option battery cover (BM7 Only)

Left side view

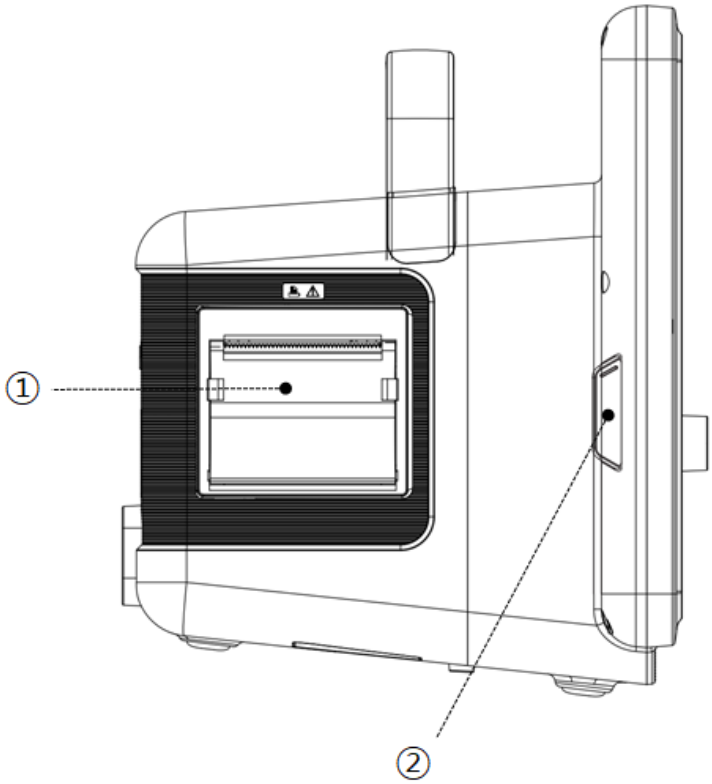
BM3



BM5



BM7

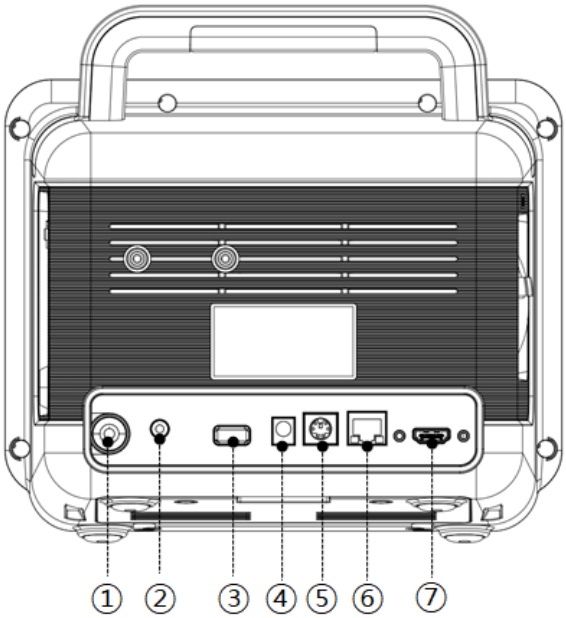


① Printer bracket

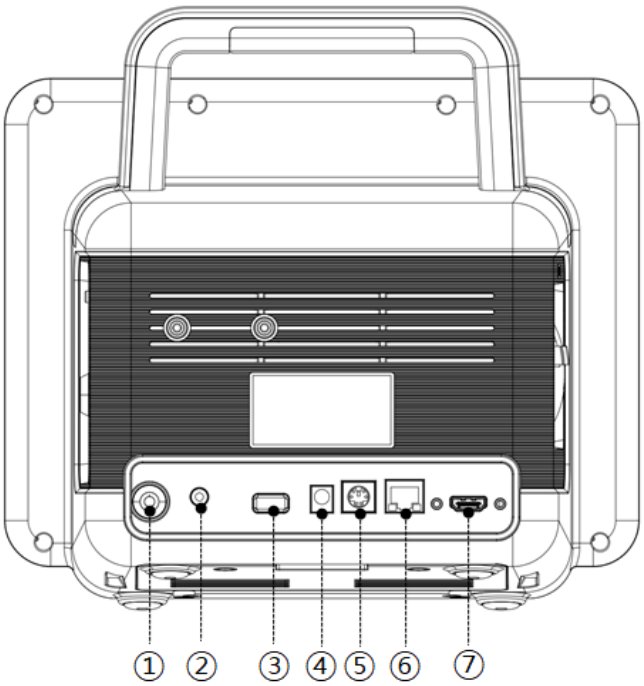
② USB port (BM7 Only)

Back side view

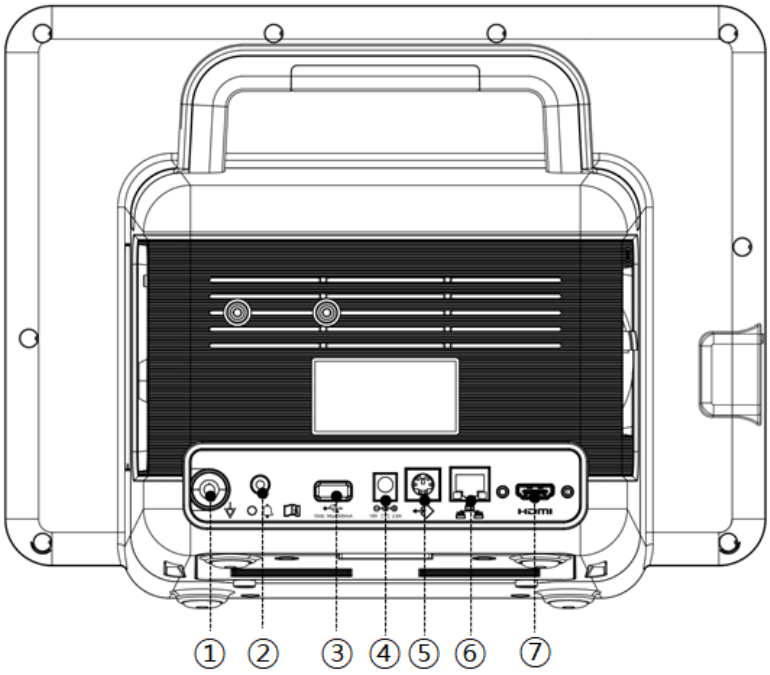
BM3



BM5



BM7



① Potential equivalent

② Nurse call connector

③ USB port (USB 2.0 5Vdc / Max. 500mA)

④ DC input connector

⑤ Auxiliary port

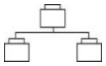
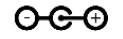
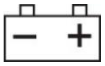
⑥ LAN port

⑦ HDMI output port

Warning	**USB compatible** **The BM series monitor is compatible with external USB memory drives up to 64GB.** **We recommend the products of the brands listed in the manual (Sandisk, PNY, Transcend, Samsung).** **When using a product with high power consumption, such as an external hard drive, be sure to use the adapter dedicated to it for suitable power supply. (You can't use it with the patient monitor's power supply alone.)** **You should save the data of connected device before connecting the additional device.** **It may not be supported some devices that required high power.**

Note	**The HDMI output of (BM3, BM5) is 800x600 @59Hz and (BM7) is 1024x768 @60Hz.** **Depending on the specifications of the patient monitor, the screen may not display the output, so please check beforehand.** **Appliance inlet of separate power supply unit is used as mains disconnecting device.**

7) Device Markings

	Caution: Consult accompanying documents		Type BF applied part
	Type CF applied part		ECG
	IP (Ingress Protection)		NIBP
T	Temperature	SpO2	SpO2
	EtCO2		Ground terminal
IBP	IBP		LAN port
	DC input connector		Auxiliary Port
	Nurse call		USB port
HDMI	HDMI external port		Printer Key
	Alarm Key		Function Key
	NIBP Key		Battery charge indicator
	Power ON /OFF Key		WEEE (Waste Electrical and Electronic Equipment)
	DC Input Indicator		Safety Sign: It indicates that you should read the user manual. Read the user manual before starting work or operating the equipment.

	Date of manufacture		Manufacturer
	Consult instructions for use. This symbol advises the reader to consult the operating instructions for information needed for the proper use of the device.		

8) Power

The BM series patient monitor uses DC power (100-240 VAC / 18VDC 2.8A). In the event of a power outage or cable shortage, the monitor automatically switches to battery power to continue patient monitoring without data loss. The built-in battery is intended for back-up use only during a power-outage.

DC Adaptor information

Manufacture: BRIDGE POWER CORP.

Model name: BPM050S18F02

Input Power: 100~240V 1.5A

Output Power: 18 V, 2.8 A

DC Power LED is lighted on when the DC Power is plugged into the inlet at the back of the product. A press of power key makes the machine ready for use.

Caution	**This equipment must be connected to a protective earth grounded power supply.** **Using non-standard products other than the adapters supplied by us may cause signal distortion or noise. Be sure to use a genuine adapter that is supplied by our company and is insulated.** **Do not position the patient monitor in a space that creates difficulty in unplugging its power supply cord.**

Battery Power

It uses battery power when power failure and portable use.

The battery is attached to the bottom of the equipment.

Operation

1. Battery Power LED is lighted on when the machine is in use.
2. Battery is automatically charged when the machine is connected to DC Power Supply. The charging status is displayed at the top right of the screen
3. The charging status of the batteries is displayed with 5 step diagrams

Battery Status Display		
Display	**Charging Status**	**Remarks**
	The battery is charging	
	The battery is fully charged	
	The battery is 80% remained	
	The battery is 60% remained	If possible, connect the monitor to the AC adapter.
	The battery is 40% remained	Immediately connect the monitor to the AC adapter.
	The battery is very low. (The power will turn off in about 2min.)	Immediately connect the monitor to the AC adapter.
	There is no battery.	Connect the battery.

Caution	**The battery status display is accurate only when the battery is functioning normally.**

Note	**When external power is not supplied, it takes about 15 minutes for the battery status display to reflect the actual remaining battery capacity.**

Battery information

- Battery specification : Li-ion , 10.8V
  3BL335-BIO-S (3250mAh) or 031PpTC3(3ICR19/65) (2150mAh) (BM3, BM5: default)
  6BL335-BIO-S (6500mAh) (BM7 default / BM3, BM5 optional)
- Battery charging time:
  3BL335-BIO-S: More than 3 hours
  6BL335-BIO-S: More than 5 hours
- Continuous battery usage time when fully charged:

  BM3

  - 3BL335-BIO-S: about 2 hours
  - 6BL335-BIO-S: about 4 hours

  BM5

  - 3BL335-BIO-S: about 2 hours
  - 6BL335-BIO-S: about 4 hours

  BM7

  - 6BL335-BIO-S: about 2 hours

  * (measured every 15 minutes NiBP with SpO2 and ECG)

Warning	**Older or defective batteries will have significantly reduced capacity or operating time.**

Warning	**Be careful of the polarity when replacing the battery.** **We strongly recommend that you use the battery supplied by Bionet.** **Using unauthorized batteries may damage the equipment.** **Remove the battery if the me equipment is not likely to be used for some time.**

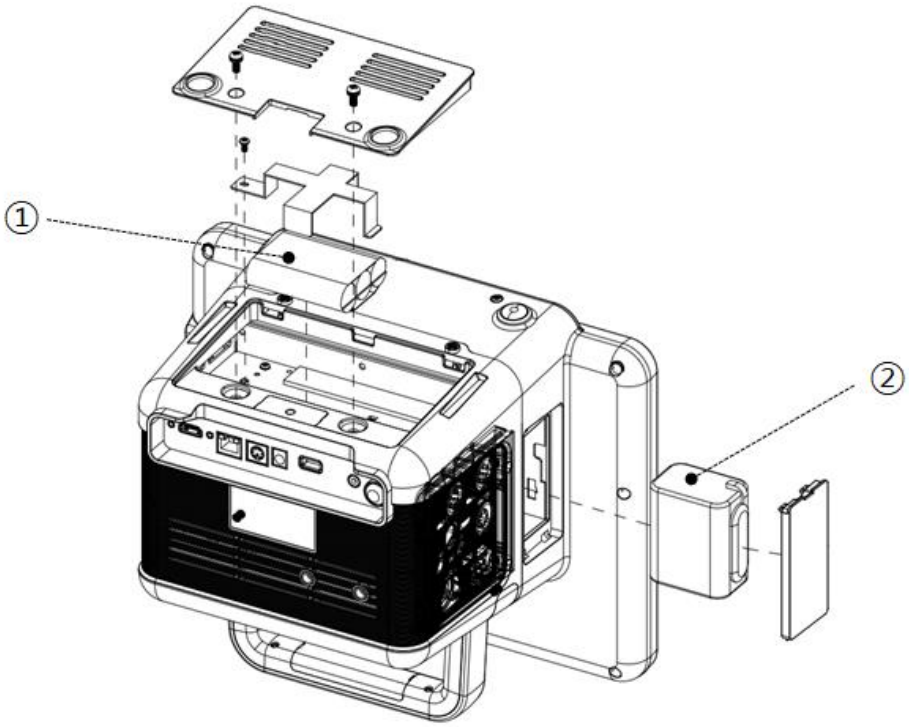
Note	**The Lithium-Ion battery is a rechargeable battery containing Lithium-Ion cells. Each battery contains an integrated electronic fuel gauge and a safety protection circuit.**

Note	**To maximize the charge for transport, keep the monitor connected until you are ready to transport the patient. Reconnect the monitor immediately after transport.** **Bionet recommends replacing the lithium-Ion battery after 24 months of use.** **Battery life depends on usage. If battery life continues, battery life will decrease and frequency of replacement will increase.** **To prevent pre-discharge, recharge after the battery is discharged.**

Note	**Charging is not possible at low power (below 16V).** **Cannot be used in vehicles with 24V power supply.** **When replacing the battery, be sure to remove the DC adapter and replace it.**

How to replace the battery

Please assemble and replace as shown below.



① Standard battery

② Additional option battery (BM7 Elite Only)

The Impact of Lithium-Ion Battery Technology on the Battery

The following are the key points you should know about Lithium-Ion battery technology:

The battery will discharge on its own, even when it is not installed in a monitor. This discharge is the result of the Lithium-Ion cells and the bias current required for the integrated electronics.

By the nature of Lithium-Ion cells, the battery will self-discharge.

The self-discharge rate doubles for every 10°C (18°F) rise in temperature.

The capacity loss of the battery degrades significantly at higher temperatures.

As the battery ages, the full-charge capacity of the battery will degrade and be permanently lost. As a result, the amount of charge that is stored and available for use is reduced.

Warning	**We strongly recommend the use of battery officially supplied by Bionet.** **Ensure that the battery is properly secured to the bracket.** **Do not inflict extreme levels of impact on the battery.** **Ignoring the above warnings may cause battery explosion or other critical damages to the patient monitor.**

Conditioning Guideline

The battery in the monitor full charged and discharged every six months and condition it using the battery charger.

How to Recycle the Battery

When the battery no longer holds a charge, it should be replaced. The battery is recyclables. Remove the old battery from the monitor and follow your local recycling guidelines.

Warning	**EXPLOSION HAZARD** **DO NOT incinerate the battery or store at high temperatures as it may explode, which may cause you serious injury.**

Warning	**Do not use the battery that has been impacted, disfigured, or submerged; dispose of it.**

9) Getting Started

Starting the monitor:

Press the power key at the bottom right of the monitor's front panel. The power light on the monitor and the alarm bar lights up, signifying that the power has turned on. Then, the screen lights up, displaying the main screen after a self-diagnosis test.

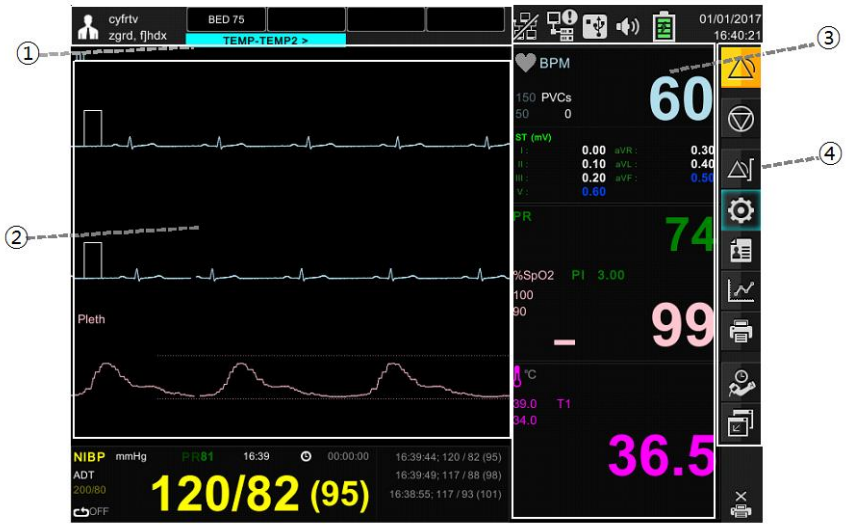
Stopping the monitor:

Press and hold the power key for 3 seconds, and the screen goes off.

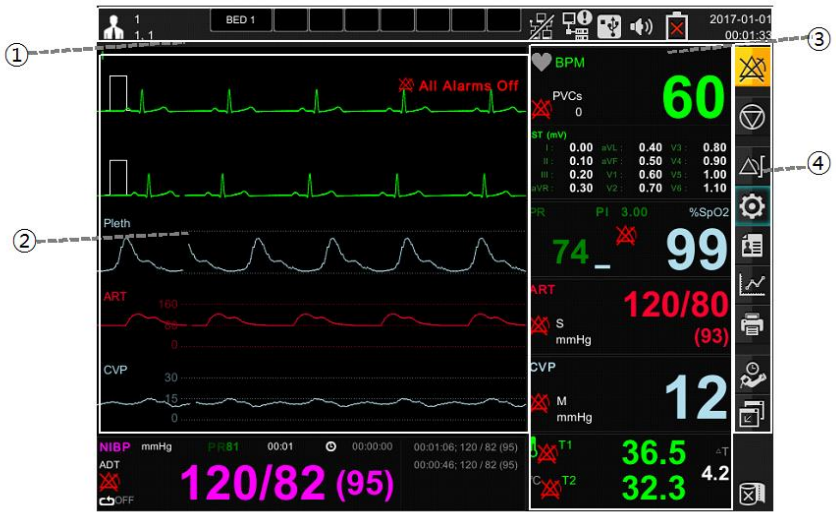
Main screen setup

After the monitor is turned on, the main screen is displayed.

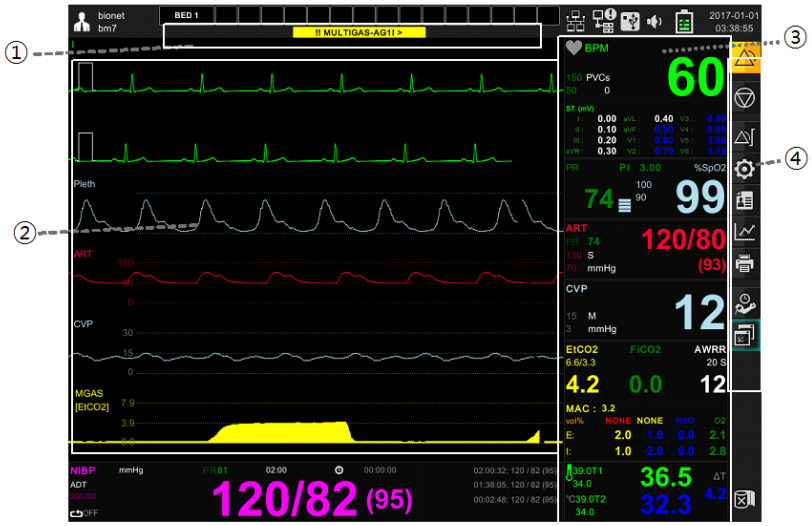
BM3



BM5



BM7



① Status Message

② Waveform Window

③ Numeric Window

④ Menu Window

Main screen

The parameter box displays values, alarm limits and icons for the selected parameter. You can set the parameters and their associated waveforms so that they are easy to distinguish.

The message appears at the top of the screen. The patient name bed label is displayed in the upper left corner of the screen. The top right of the screen displays the time, network and device management status.

Rotary knob switch

The rotary knob switch allows the user to navigate menus, select settings, and perform menu functions. Rotate the rotary knob to move the menu item. To confirm the selection, press the rotary knob switch.

Fixed key

The fixed keys on the front panel of the monitor allow you to perform the frequently used functions.

Fixed key	Description	Fixed key	Description
	The alarm control key switches between Normal / Audio Paused and Alarm Paused mode. Press more than 3 seconds to switch to Audio Off or Alarm Off mode		It is the start or stop NIBP measurement.
	Start or stop recording on time.		Return to the main screen or switch the extended parameter screen mode.
 + 	Pressing the alarm control key and the home key simultaneously switches to the user input lock mode. In lockdown mode, all touch screens and key inputs except the power key are ignored. Press the alarm button and the home button simultaneously to unlock.		

Function key

On the right side of the monitor's front panel, you can find the touch screen icons that allows you to select frequently used functions.

Function key	Description	Function key	Description
	Set the maximum and minimum alarm limits.		Alarm mode key. Switch to Normal/ Audio Paused/ Alarm Paused mode.
	Admit/Discharge menu. register patient information.		Displays the setup menu.
	Waveform stop function.		Automatic blood pressure measurement interval setting menu.
	Printer setup menu.		Displays trend menu.
	Displays the mini Trend window.		Set parameters in text screen.

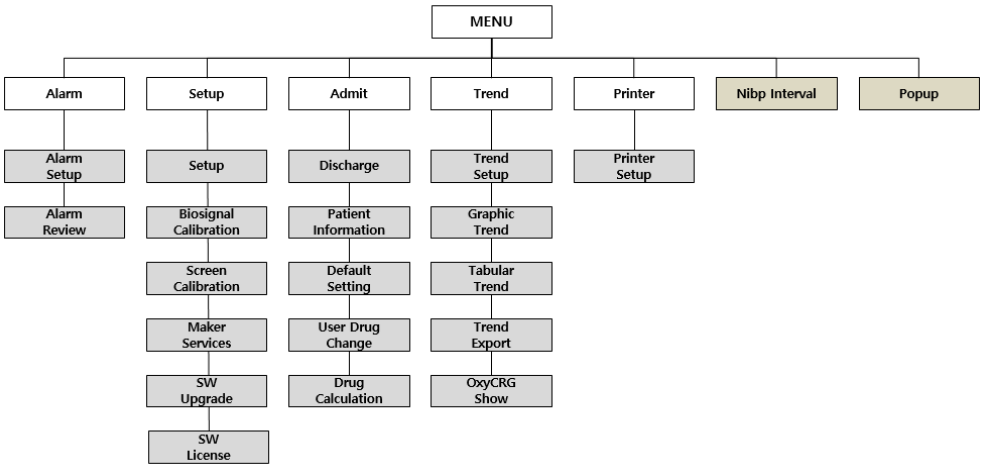
PART 2. Setup

1) Overview

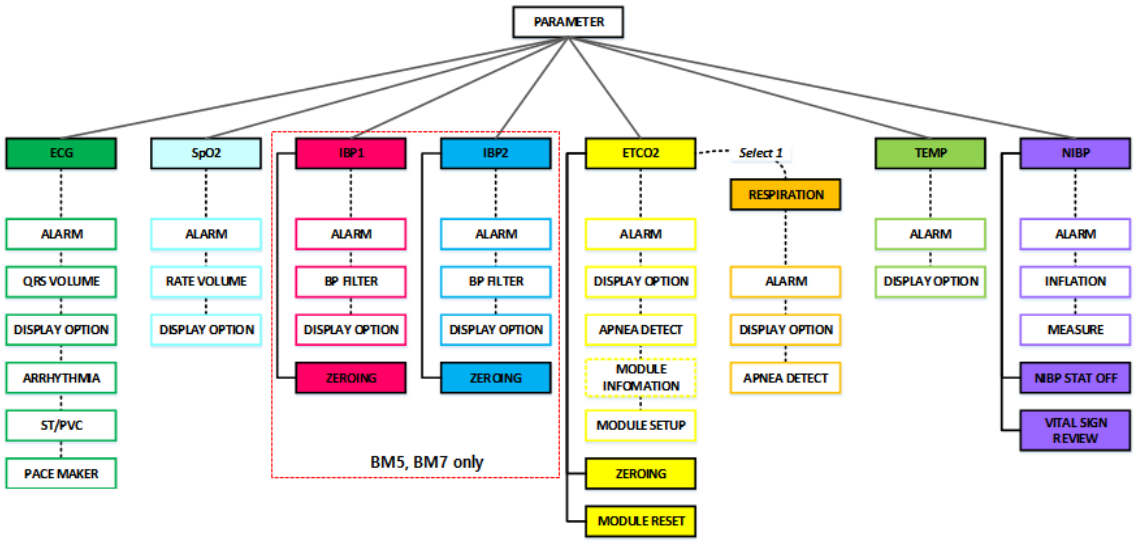
This part describes how to configure the monitor.

2) Monitor configuration

Main Menu tree



Parameter menu tree



3) Main menu setup

The Setup menu allows the user to access submenus, display screens, and perform specific monitor setup functions.

1. To display the Settings menu, click the Settings icon to open the submenu.
2. Click the desired setting to access the submenu that performs the desired function or goes one step further down.
3. Click Close at the bottom of the submenu list to return to the previous menu or screen.

	Main menu	Sub menu
	A. Setup	**A-1.** Parameter setup
		A-2. Parameter units
		A-3. User services
		A-4. System information
		A-5. Network information
		A-6. Central
		A-7. HL7
		A-8. Alarm setup
		A-9. Display option
		A-10. Hospital information
	B. Biosignal calibration	**B-1.** ECG & RESP
		B-2. NIBP
		B-3. NIBP
	C. Screen calibration	
	D. Maker service	**D-1.** MAC address
		D-2. Factory reset
		D-3. System information (Emmc)
	E. SW upgrade	
	F. SW license	

Menu	Description	Available settings
A. Setup menu		
A-1. Parameter setup	Measurement on the monitor parameter selection and color setting menu:	Parameter enable On/Off Parameter color

	ECG, SPO2, RESP, NIBP, TEMP, ETCO2, IBP1[1)], IBP2[1)]	setup
A-2. Parameter units	Unit setting menu used for monitor measurement	
A-2-1. Weight unit	Weight measurement unit	Kg Lbs
A-2-2. Height unit	Height measurement unit	Cm Inch
A-2-3. Blood pressure unit	Blood pressure measurement unit	mmHg kPa
A-2-4. ST unit	ST measurement unit	mm mV
A-2-5. Temperature unit	Temperature measurement unit	°C °F
A-2-6. Gas pressure unit	Gas measurement unit	mmHg kPa vol%
A-3. User service	User configuration menu	
A-3-1. Hospital unit	Set Monitor Environment Group	GENERAL ICU NICU OR CCU USER DEFINE
A-3-2. Bed #	Set device number	1~300
A-3-3. Key sound	Set key activation	On / Off
A-3-4. Key volume	Set key sound	Off ~ 100%
A-3-5. AC filter	Power filter settings	Off, 50Hz, 60Hz
A-3-6. Screen brightness	Set screen brightness	10~100%
A-3-7. Date display	Set type of date display	On / Off
A-3-8. Demo	Set demo	On / Off
A-4. System information		
A-4-1. S/W version	Display main S/W version	
A-4-2. EIA version[1)]	Display ECG S/W algorithm version	
A-4-3. NIBP version	Display NIBP module F/W version	
A-4-4. License	Display device license	
A-4-5. Language	Set language	English, Korean French, Bulgarian

		Polish, German Chinese, Portuguese Hungarian, Czech Romanian, Italian Turkish, Spanish Russian, Greek Japanese, Kazakh, Ukrainian
A-5. Network information	Network information and setup	
A-5-1. Wireless	Wifi setup	On / Off
A-5-2. DHCP	Auto IP allocation setting menu	On / Off
A-5-3. Device IP	IP setting menu	XXX.XXX.XXX.XXX
A-5-4. Subnet mask	Subnet mask setting menu	XXX.XXX.XXX.XXX
A-5-5. Gateway IP	Gateway setting menu	XXX.XXX.XXX.XXX
A-5-6. Network interface	Network interface information	
A-6. Central	Central network menu	
A-6-1. Protocol version	Network protocol menu	X.XX
A-6-2. Central comm	Remote communication menu	On / Off
A-6-3. Central IP	Remote PC IP address setting	XXX.XXX.XXX.XXX
A-7. HL7	HL7 network message settings	
A-7-1. HL7 COM	Communication version	
A-7-2. HL7 IP	Remote PC IP address setup	XXX.XXX.XXX.XXX
A-7-3. Port	Remote PC port address	XXXX
A-7-4. HL7 Period	Transmission cycle settings menu	10sec, 30sec, 1,3,5,10,15,30min, 1 hour, 6 hours
A-7-5. HL7 NAK	NAK transmission menu setup	On / Off
A-7-6. Editr HL7 label	Parameter label edit menu	
A-8. Alarm setup	Alarm settings menu	
A-8-1. Alarm password	Alarm setup password activation menu	On / Off
A-8-2. Setup password	Password setup menu	
A-8-3. Alarm sound	Alarm sound type selection menu	IEC60601 BIONET
A-9. Display option		
A-9-1. Sweep speed (ECG/SPO2/RESP)		6.25 mm/sec, 12.5 mm/sec 25 mm/sec (basics), 50 mm/sec

A-9-2. Sweep speed (RESP/ETCO2)		6.25 mm/sec, 12.5 mm/sec (basics), 25 mm/sec
A-10. Hospital information	Set Hospital information	
A-10-1. Hospital name	Hospital name	
A-10-2. Address 1	Address information 1	
A-10-3. Address 2	Address information 2	
A-10-4. Postal code	Set postal Code	
A-10-5. Doctor name	Doctor name	
B. Biosignal calibration		
B-1. ECG & RESP		
B-1-1. ECG calibration	ECG calibration menu	10mm/mV input calibration display
B-1-2. RESP calibration	RESP calibration menu	1ohm /1mm display
B-2. NIBP		
B-2-1. Zero calibration	NIBP zero calibration menu	Zero calibration menu at atmospheric pressure
B-2-2. Gain calibration	NIBP gain control menu	Perform 250mmHg pressure calibration and select menu
B-2-3. Pneumatic pump	NIBP pump control menu	On / Off
B-2-4. Pneumatic valve	NIBP valve control menu	Close /Open
B-3. IBP[1)]		
B-3-1. IBP1 calibration[1)]		Perform 100mmHg pressure calibration and select menu
B-3-2. IBP2 calibration[1)]		Perform 100mmHg pressure calibration and select menu
C. Screen calibration	Perform touch screen calibration point input	
D. Maker services		
D-1. MAC address editing		Enter a unique address for the device
D-2. Factory reset	Reset menu for setting the device to factory default state	Perform factory reset
D-3. System information (Emmc)	View emmc information	

E. SW upgrade	Software Upgrade menu
F. SW license	Software License menu

1) : BM5, BM7 only

Parameter color

Selectable colors			
green, light blue, magenta, yellow, blue, sky blue, white, coral, scarlet, purple, orange, pale green, pink, pale yellow			
Parameter	**Basic color**	**Parameter**	**Basic color**
ECG (ST)	Green	SpO2	Light Blue
RESP	Yellow	NIBP	Magenta
TEMP	Green	ETCO2	Yellow
IBP1[1)]	Scarlet	IBP2[1)]	Light Blue

1) : BM5, BM7 only

PART 3. Network

1) Overview

When the patient monitor is connected to the network, it can be accessed remotely through other patient monitors or the central station.
BM Central connects multiple patient monitors to the central station and allows the remote control of the connected patient monitors for various settings as well as patient data management.
The monitor's B2B View (Bed to Bed View) feature allows you to view other monitor screens connected to the network and to silence remote control and alarms [Audio Paused].
The functions that can be remotely controlled from BM Central are as follows.

- Start recording
- Modify alarm limit
- Alarm Mute
- Print the current monitor screen to a network laser printer (Using the optional remote keypad)
- Enter, edit and view patient data

2) Network Connection

In a network, data can be transferred over wired or wireless connection.
All data interfaces (e.g. RS-232, LAN, USB interface) follow the standard network procedure. BM series can exchange patient data with other BM monitors through the network during operation and supports the following functions.

- Display waveform and parameter data.
- Alarm signals (physiological alarms and technical alarms).
- Alarm limits and conditions.
- Remote control (e.g. alarm management).
- Device setup and transmission of patient data.

When BM series are connected to the network with other devices, if there are any changes in the network, it could impose risks to patients, users, and third parties. These risks must be identified, analyzed, and evaluated before the monitor is connected to the network or before the network is changed, and appropriate measurement must be carried out.

Subsequent changes to the network example:

- Network configuration change.
- Removing a device from the network.

- Adding new devices to the network.
- Upgrading or updating devices connected to the network.

Warning	**Recommendations for wireless connections** ● **The patient monitor connected to the network could vary depending on wireless AP (Access Point) performance.** ● **When using a general AP, it is recommended to connect no more than 8 units to the same network.** ● **Due to the characteristics of wireless connection, the connectivity might not be stable depending on the environmental interferences.**

Note

Supported USB Wi-Fi Dongle

This patient monitor supports the following dongles of USB VID and PID.

USB VID:PID
2357:0120
2357:011e, 2357:0122
2357:011f
0bda:0811, 0bda:0821, 0bda:8822, 0bda:a811
2357:010d
148f:761a
0e8d:7650
148f:7601
0bda:8176

This patient monitor has tested the following USB Wi-Fi dongles.

TP-Link

Model	USB VID:PID	chipset
TP-LINK T2U plus	2357:0120	Realtek 8821a
TP-LINK T2U nano	2357:011e, 2357:0122	Realtek 8821a
TP-LINK T2U v3	2357:011f	Realtek 8821a
Other 8821A models	0bda:0811, 0bda:0821, 0bda:8822, 0bda:a811	Realtek 8821a
TP-LINK T2UHP	2357:010b	MediaTek 7650u
TP-LINK T2U	148f:761a	Ralink 7610u
TP-LINK T2UH	148f:761a	Ralink 7610u
TP-LINK T2U v2	0e8d:7650	MediaTek 7650u

ipTime

Model	USB VID:PID	chipset
Other 7650u / 7610u models such as ipTime A1000	148f:7610, 0e8d:7610	MediaTek 7650u / 7610u
ipTime N150UA TP-Link TL-WN727N v4	148f:7601	Ralink 7601U
ipTime N150UA / N150U	148f:3070	Realtek 3070
ipTime N150UA	148f:5370	Realtek 5370
ipTime N100mini (N300U / Ncubic)	0bda:8176	Realtek 8188CU/8192CU
TP-Link TL725N v2	0bda:8179	Realtek 8188EUS

Even if the USB VID and PID dongles are listed above, dongles that have not been tested by the company may not be supported.

Caution	**It may take up to 5 seconds for the Wi-Fi dongle to connect to the patient monitor and be recognized.** **At this time, be careful as the USB may not work when the Wi-Fi dongle is removed.**

Note	**The BM series monitor is compatible with BM Central v2.4.01 or later.**

3) IT Network Connection

As only the authorized personnel can connect the patient monitor to the network, consult with the IT staff in the hospital at the time of installation.

Please refer to the following documents to proceed with the installation.

- Documents attached to this unit
- Network Interface Manual
- BM Central user documentation

We recommend following IEC 80001-1 (Hazard Management of IT Networks Connected with Medical Devices).

4) LAN Network

LAN networks are usually configured through a star topology. Individual devices can be combined into groups via a layer-n-switch. Other data traffic is separated by individual VLAN networks. Configure the device's network settings according to this manual and your network specifications. LAN connection specifications are described in the following standard standards.
LAN connection specifications are described in the following standard specifications.

- Wired Network: IEEE 802.3
- Wireless network: IEEE 802.11 (a, b, g, n)

If the monitor is to be used as a layer-2-switch or layer-3-switch, the port setting must be configured on the network switch. Configure the network of Bionet devices to be compatible with

the specifications of your operating organization.
The BM series monitor exchanges data with other medical devices over a LAN network. The network must support the following transports and protocols:

- TCP / IP
- Broadcast

5) VLAN network

If data is exchanged within a single network, you must establish an independent VLAN network for clinical information systems. At least one of the following independent VLAN networks must be established.

- Network for medical devices in hospital
- Network for portable patient monitors

Also, you should build a network system that detects and defends against denial-of-service attacks by establishing a system dedicated to DDos protection.

6) Inappropriate Network

If your network does not meet the requirements, the following risk factors can occur.

If the distributed alarm system is not safe: ㄱ

- The alarm will not be delivered.
- The alarm or data is delayed.
- An error alarm appears

If the network connection is interrupted:

- The alarm will not be delivered.
- Reactivates with the alarm off or the alarm sound off

If you do not have firewall and antivirus software:

- Your data is not protected.
- The device settings are changed
- The device raises an error alarm or does not generate an alarm.
- Data is sent incomplete, to the wrong device, or not at all.
- Patient data is blocked, falsified, or corrupted.
- The time stamp of the data is inaccurate

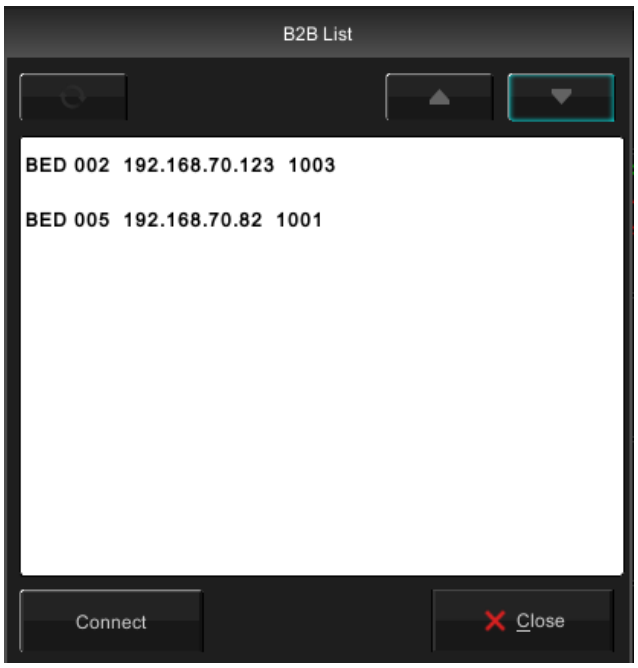
Excessive over-loading due to very high network loading (e.g., denial of service attacks) can cause interface deactivation. The interface can only be used again after the device is restarted. Rarely, booting may be slow and repeated rebooting may occur.

7) B2B view

If a monitor is connected to the network, you can access other monitors in the same network by using the B2B menu at the bottom to see the real time data and silence alarms when needed.

Note	**The Print Screen Sticky key on the front panel of the monitor allows you to print the remote view screen as it appears on your local monitor.**

The menu below is a setup menu for retrieving data from other patient monitoring devices connected to the same network. To view the menu settings, touch the My BED number box in the top menu bar.

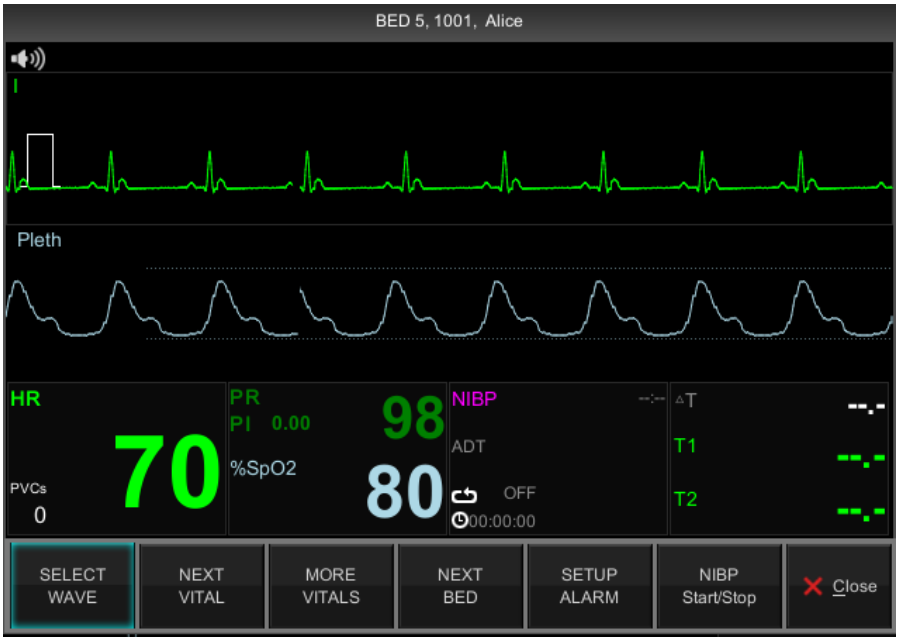


B2B view monitor list submenu

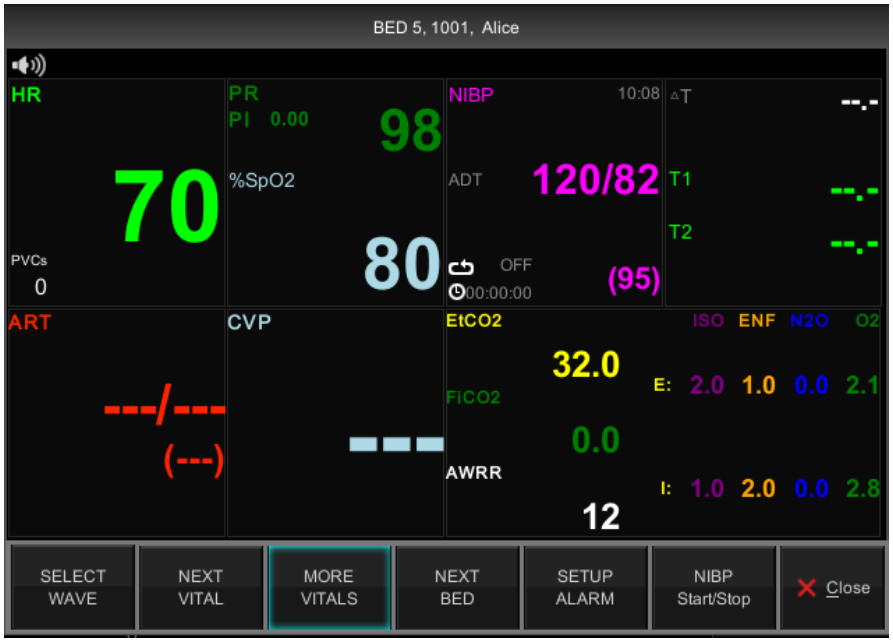
Menu	Description	Available settings
B2B view monitor list sub menu		
Refresh	Menu to update monitor list connected to network	
Up	Move to upper list	
Down	Move to lower list	
Monitor list	List of monitor information connected to the network	
Connect	Monitor connection menu for remote connection	

Display Mode

Wave and numeric mode



Numeric Mode



Menu	Description	Available settings
A-1. Select wave	Waveform selection menu to view	
A-1-1. Trace I	The waveform selection menu for Trace I in the B2B view window	ECG, SpO2, RESP, EtCO2, IBP1[1)], IBP2[1)]
A-1-2. Trace II	The waveform selection menu for Trace II in the B2B view window	ECG, SpO2, RESP, EtCO2, IBP1[1)], IBP2[1)]
A-2. Next vital	Additional parameter selection menu	
A-3. More vitals	Wave screen and text screen selection menu	
A-4. Next bed	Connect to the following connected monitor devices	
A-5. Setup alarm	Alarm setting menu of remotely connected monitor	Normal Audio paused Alarm paused Audio off Alarm off
A-6. NIBP Start/Stop	NIBP measurement start and stop menu	Start Stop
A-7. Close	Remote viewer close menu	

[1)] : BM5, BM7 only

PART 4. Admission and Discharge

1) Overview

When a patient is connected to the monitor, it displays the patient's physiological data so that the patient can be monitored without hospitalization. However, since the monitor's alarm generation and trend data storage require the patient to be hospitalized, managing the patient's admission and discharge is important. The patient management menu enables you to manage the patient's admission, discharge, and patient information. The monitor displays the set unit and Bed information along with the information of a hospitalized patient and ID information.

Patient admission and discharge can be managed also from the central monitoring unit (BM Central)

2) Admitting a Patient

How to admit a patient:

1. Press the **Patient icon** button.
2. Click on **Admit**.
3. Click on **Patient information**.
4. Please select a field. The data entry screen appears.
5. Click the letter of the word you want to input.
6. If you made a mistake, click **Backspace** and try again.
7. Click **Enter** to confirm your entry.
8. Click on the next field and repeat steps5 and 6.

Note	**To change the patient's type (adult, pediatric or neonate), access the patient settings menu.** **Additional settings such as Gestational Age and Birth Weight are available for neonate mode.**

3) Discharging a Patient

To terminate the monitoring of hospitalized patients, or admit new patients, discharge the current. Once a patient is discharged, trend data is not be saved any more.

How to discharge a patient:

1. Press the **Patient icon** button.
2. Press the **Discharge menu.**
3. You can show Discharge confirm message
4. Press the **Accept button**. The discharge procedure is in progress. The monitor displays a Discharge message. When the patient is successfully discharged, a banner with the following message is displayed.

Patient type: When you set the patient type, type image is displayed on the upper left corner

Type	Male admit	Female admit	Discharge
Adult			
Pediatric			
Neonate			

	Main menu	Sub menu
	A. Admit / Discharge	
	B. Patient information	**B-1**. Patient information
	C. Default setting	
	D. User drug change	
	E. Drug calculation	**E-1**. Setting
		E-2. Titration table

Menu	Description	Available settings

A. Admit / Discharge	Admission and discharge setting	
B. Patient information		
B-1. Patient Information		
B-1-1. Patient type	Select patient type	Adult, Pediatric, Neonate
B-1-2. ID	Enter patient ID	
B-1-3. First Name	Enter first name	
B-1-4. Last Name	Enter last name	
B-1-5. Gender	Select gender	Male, Female
B-1-6. Birthday	Enter birthday	YYYY/MM/DD
B-1-7. Weight	Enter weight	XXX.XX Kg (Lbs)
B-1-8. Height	Enter height	XXX.XX Cm (inch)
B-1-9. Blood type	Default setting	A Rh+/ Rh-/ -D-/ Rh Null B Rh+/ Rh-/ -D-/ Rh Null O Rh+/ Rh-/ -D-/ Rh Null AB Rh+/ Rh-/ -D-/ Rh Null Unknown
C. Default setting	Set patient info to default value.	
D. User drug change		
D-1. Drug type	Set drug type of patient.	Drug-1~5
D-2. Drug name	Set name of drug	
D-3. Drug unit	Choose the unit of drug	mg/hr, mg/min, mg/kg/hr mg/kg/min, mcg/hr, IU/hr, mcg/min, mcg/kg/hr, mcg/kg/min, units/hr
E. Drug Calculation		
E-1. Setting		
E-1-1. Drug type	Choose drug type in the list(21)	Aminophylline Tpa Bretylium Lidocaine Procainamide

		Epinephrine Levophed Isoproterenol Dopamine Dobutamine Nitroglycerine Nitroprusside Inocor Heparin Insulin Streptokinase Drug-1~5
E-1-2. Drug quantity	Set drug quantity	
E-1-3. Solution volume		
E-1-4. Dose quantity	Set dose quantity	
E-1-5. Inflation rate		
E-1-6. Weight		Some drugs may not be supported
E-1-7. Dose step		
E-2. Titration table		
E-2-1. Drug name	Set drug name	
E-2-2. Drug quantity		Refer to drug list bellow.
E-2-3. Solution volume		
E-2-4. Dose quantity		Refer to drug list bellow.
E-2-5. Inflation rate		Refer to drug list bellow.
E-2-6. Weight		Refer to drug list bellow.
E-2-7. Dose step		Refer to drug list bellow.

The table shows the formula for calculating the dosage of drugs below.

Unit	Name	Equation
mg/hr	Aminophylline Tpa	$\text{Flow rate(ml/hr)} = \frac{\text{Dose(mg/hr)} \times \text{SolutionVolume(ml)}}{\text{Drug QTY(mg)}}$

mg/min	Bretylium Lidocaine Procainamide	$\text{Flow rate(ml/hr)} = \frac{\text{Dose(mg/min)} \times \text{SolutionVolume(ml)} \times 60}{\text{Drug QTY (mg)}}$
mcg/min	Epinephrine Levophed Isoproterenol	$\text{Flow rate(ml/hr)} = \frac{\text{Dose(mcg/min)} \times \text{SolutionVolume(ml)} \times 60}{\text{Drug QTY (mg)} \times 1000}$
Mcg/kg/min	Dopamine Dobutamine Nitroglycerine Nitroprusside Inocor	$\text{Flow rate(ml/hr)} = \frac{\text{Dose(mcg/kg/min)} \times \text{Weight(kg)} \times \text{SolutionVolume(ml)} \times 60}{\text{Drug QTY (mg)} \times 1000}$
units/hr	Heparin Insulin	$\text{Flow rate(ml/hr)} = \frac{\text{Dose(units/hr)} \times \text{SolutionVolume(ml)}}{\text{Drug QTY(units)}}$
IU/hr	Streptokinase	$\text{Flow rate(ml/hr)} = \frac{\text{Dose(IU/hr)} \times \text{SolutionVolume(ml)}}{\text{Drug QTY (IU)}}$

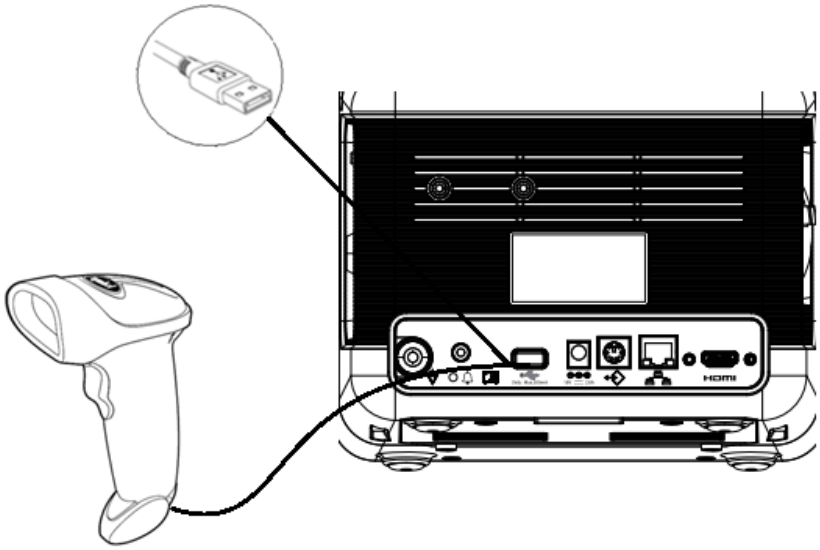
Shows setting range for each stage.

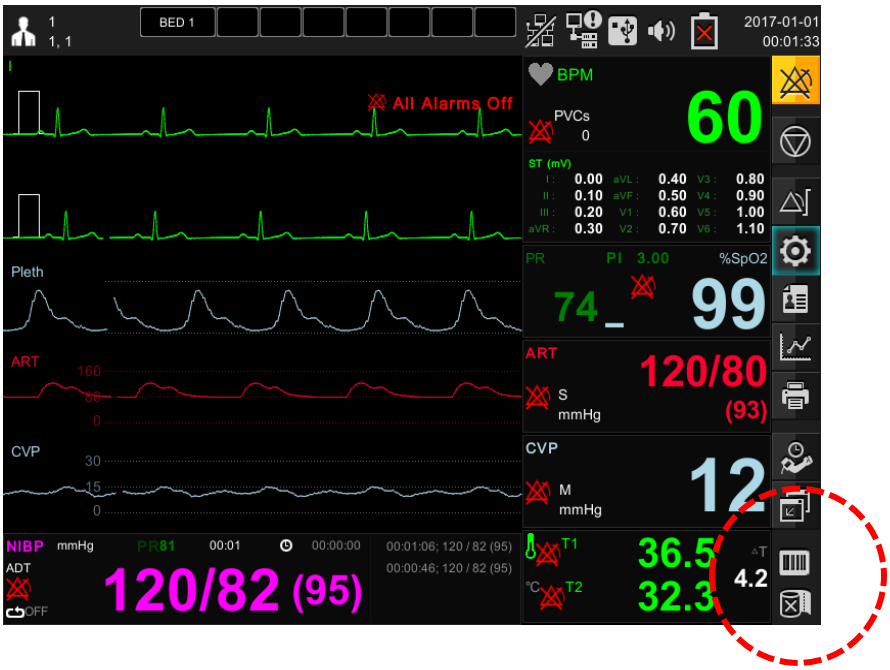
Dose		**Drug QTY**	
Unit	**Setting range**	**Unit**	**Setting range**
mg/hr	0.01 to 500	mg	0.01 to 2000
mg/min			
mg/kg/hr			
mg/kg/min			
mcg/hr			
mcg/min			
mcg/kg/hr			
mcg/kg/min			
units/hr	10 to 15000	Units	100 to 150000
IU/hr	1000 to 1500000	IU	1000 to 1500000

Items	**Unit**	**Drug QTY unit**
Volume of Liguid	mL	1 to 1000
WEIGHT	Kg	0 to 300
Velocity of Flow	ml/hr	0.1 to 600

4) Registration of Patient ID Using Barcode

The monitor can register the PATIENT ID in barcode format using a USB barcode scanner. First, connect the barcode scanner to the USB port on the back of the monitor as shown below. When you hear a beep, the barcode can be used.





The barcode that you want to input is matched to the index LED generated by the scanner, and if you press the input button, the corresponding ID is read and sent to the equipment. The sender ID is displayed at the top center of the screen.

PART 5. Alarm

1) Overview

The monitor displays the alarm limit (parameter threshold) and can be configured to occur an alarm if exceeded limits are detected both in the alarm limits table and in the parameter box. If this limit is exceeded, a visual or audible alarm occurs.

Once the monitor's alarm and other parameter setting values are set, unless a separate operation is performed, they remain same even if the monitor power is turned off. After connecting the power to the monitor and turning it back on, it starts to operate normally, and the alarm and other parameter values keep the set values.

- Hearing sound reflecting alarm severity
- Change the color in the parameter box of the alarm parameter
- Alarm messages in the local message area
- Alarm banner indicating alarm status
- External alarm device such as nurse call system
- Activate alarm recording

The monitor generates an alarm when the parameter in the Alarm Limits table is **ON**. It is not a prerequisite that the parameter is displayed on the display or connected in the event of an alarm.

2) Alarm Priority

The alarm type is divided into a patient status alarm and a product status alarm.

The patient status alarm sounds when the diagnostic function (ECG 13 auto diagnosis) and alarm upper and lower limits are exceeded, and there are levels of High, Medium, Low and Message, and there is a difference in the order and volume of the alarm. You can set the alarm level for each parameter and function. The patient status alarm provides the highest priority alarm.

The features of each alarm are described as follows.

According to the severity of the alarm, it is divided into high priority, medium priority, and low priority.
If multiple alarms occur at the same time, the monitor displays the highest priority alarm sound with a light.

Alarm priority	Alarm sound	Numeric window	Alarm printer	Alarm lamp
High		**RED** 1time every 2sec blinking		 2times every 1sec blinking
Medium		**YELLOW** 1time every 2sec blinking		 1time every 2sec blinking
Low		**YELLOW** 1time every 2sec blinking		 Non blinking
Message		**BLUE** Non blinking		

Product status alarm -It is labeled as 'Technical Alarm' in the instrument.

Alarm priority	Alarm sound	Numeric window	Alarm printer	Alarm lamp
Low		**BLUE** 1time every 2sec blinking		 No blinking
Message		**BLUE** 1time every 2sec blinking		

: Alarm sounds

: Waves are printed out

RED : Red color alarm indicator on the screen

YELLOW : Yellow color alarm indicator on the screen

BLUE : Blue color alarm indicator on the screen

: Red color alarm lamp

: Yellow color alarm lamp

: Cyan color alarm lamp

Audible alarm		
Alarm priority	**BIONET**	**IEC**
High	1 high tone every 5 seconds	10 consecutive beeps every 5 seconds
Medium	1 high tone every 15 seconds	3 consecutive beeps every 15 seconds
Low	1 low tone every 30 seconds	2 consecutive beeps every 30 seconds

Note	**The maximum aduible alarm latency is less than 10 seconds after the Alarm Delay time.** **The alarm delay time of the distributed alarm system is less than 2 seconds.**

3) Alarm management

You can use the lock key on the front of the monitor to hold the alarm.

To change Alarm Mode: A short press of the alarm control key circulates through the Audio Paused -> the Alarm Paused -> the Alarm On modes.
Press and hold the key for more than 3 seconds to switch to Alarm Off / Audio Off mode using the mode selection dialog regardless of which alarm mode the monitor is currently in.
Audio_Paused: The audible alarm stops for 1 minute while the visual alarm is still activated. A window notifying that the audio has paused appears on the screen, along with the remaining time of the Audio Paused. When you press the alarm button or after the timeout period has elapsed,

visual and audible alarms are activated again.

Alarm_Paused: The visual and audible alarms stop during user defined time. Alarm Paused message and countdown timer are shown in the alarm status area on the top of the screen. When you press the alarm button for another alarm mode or after the timeout period has elapsed, visual and audible alarms are activated again.

Alarm_Off: The visual and audible alarms stop. Alarm Off. Alarm window with audible sound is Off and shown on the screen. The monitor maintains Alarm Off mode until user switches to another alarm mode.

Audio_Off: The audible alarm stops. Audio Off. Alarm window with audible sound is Off and shown on the screen. The monitor maintains Audio Off mode until you switches to another alarm mode.

Alarm control

Various alarm functions, such as alarm hold, validity and alarm limit indicators, can only be configured in the alarm control menu, accessible only through the password protected unit manager menu.

Nurse call

If the monitor is sounding an alarm, the nurse call system is signaling.

When an audible alarm is silenced (Audio Pause or Audio Off) at the bedside unit, the nurse call system will not alarm.

Your system administrator can change the alarm priority level for the nurse call signal.

if the priority level is set to **High,** only high-priority alarms will sound on the nurse call system.

Note	**Alarm Paused and Off modes only stop the audible alarm sound. Touch and key sounds are still heard. To adjust the Touch or Key Sounds, use the Key Sound menu in Setup.**

Warning	**Check the saved alarm setting of the patient monitor in advance to ensure that the current setting is appropriate for the patient.**

4) Alarm settings

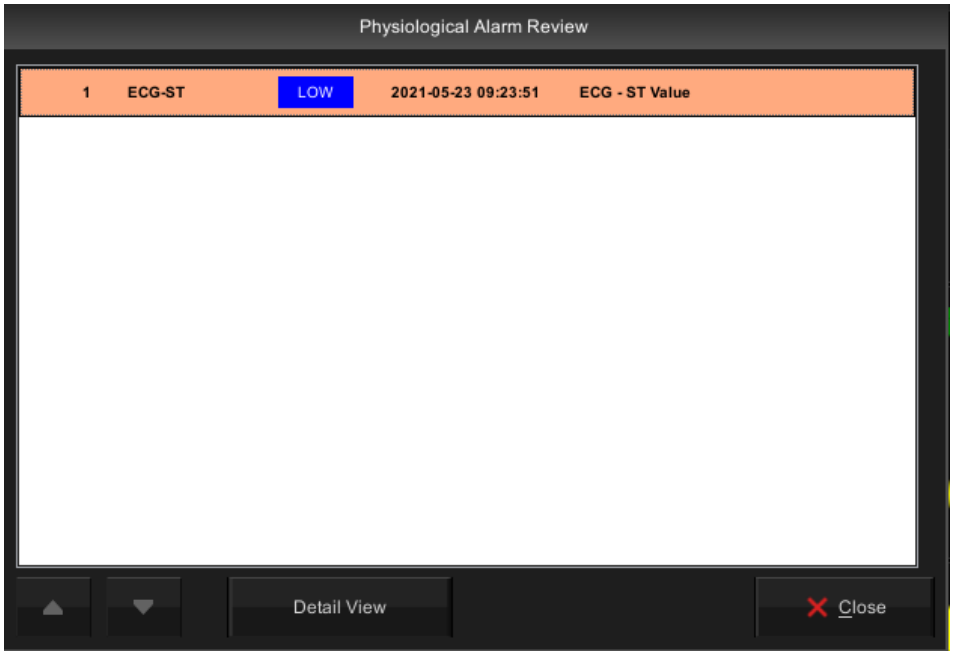
	Main menu	Sub menu
	A. Alarm setup	**A-1.** Parameter alarm limit
		A-2. Arrhythmia alarm condition
		A-3. System alarm condition
		A-4. Alarm parameter
		A-5. Nurse call
	B. Alarm review	

Menu	Description	Available settings
A. Alarm setup menu		
A-1. Parameter alarm limit	All parameter alarm, level, activate Setup	
A-2. Arrhythmia alarm condition	Arrhythmia alarm level setting ASYSTOL, VTAC, VTAC /VFIB, BIGEMINY[1)], TRIGEMINY[1)], ACCVENT[1)], COUPLET[1)], IRREGULAR[1)], PAUSE[1)], RONT[1)], VBRADY[1)], SHORTRUN[1)], PVC[1)]	
A-3. System alarm condition	System alarm level setting Low battery	
A-4. Alarm parameter	Alarm settings menu	
A-4-1. Alarm volume	The volume can be changed from off to 10% to 100%.	Off, 10~ 100%
A-4-2. Alarm pause time	No sound for 5minutes, Release on alarm again	1,2,3,5,10,15min
A-5. Nurse call	Nurse call setup menu	
A-5-1. Nurse call on alarm	Nurse call setup	On / Off
A-5-2. Call type	Nurse call type setup	Normal open Normal close
A-5-3. Duration	Nurse call duration setup	One time Continue Cycling
A-5-4. Level	Alarm level setup	Low Medium High

B. Alarm review

[1] : BM5, BM7 only

5) Alarm Event



Testing Alarms

On the demo mode, you can test the alarm tone and the alarm lamp by changing the alarm range and the alarm level. We recommend you to test the alarms every day.

Note	**When using the patient monitor, we recommend you to operate it from the front.**

PART 6. Trend

1) Overview

The monitor stores trend data for all connected signals. Users can request trend recording and can also print the screen of trends displayed.

Triggered alarm events are displayed in red inverted triangles on the Event List and Timeline

2) Trend Setting

	Main menu	Sub menu
	A. Trend Setup	**A-1.** Popup Trend
	B. Graphic Trend	**B-1**. Graphic Trend
		B-2. Tabular Trend
	C. Tabular Trend	**C-1**. Graphic Trend
		C-2. Tabular Trend
	D. Trend Export	
	E. Full Disclosure[2)]	**E-1**. Setting
	F. OxyCRG Show/Hide	

[2)] : BM7 only

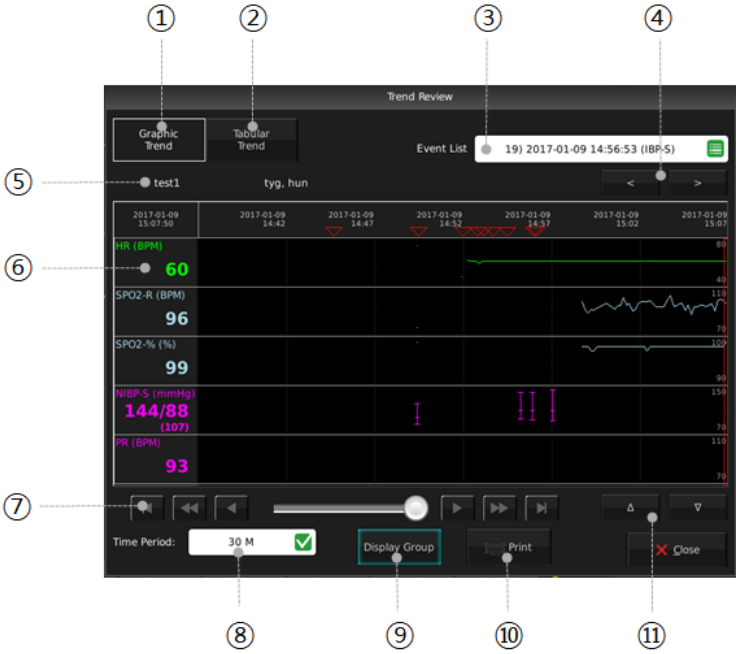
menu	Description	Available settings
A. Trend setup menu		
A-1. Popup trend		
A-1-1. Time period	Show time interval setting menu	30min, 60min, 90min, 3hour, 6hour
A-1-2. Configure parameters	Configure the biosignal to be shown in the popup trend window	
B. Graphic trend menu		
B-1. Graphic trend		
B-1-1. Event list	Selectable alarm list is displayed	
B-1-2. Time period	Set the time and see the stored values at each set time.	30min, 60min, 90min, 2hour, 3hour, 4hour, 6hour, 8hour, 12hour
B-1-3. Display group	Configure the bio signal to be shown	

	in the graphic trend window	
B-1-4. Print	Graphic trend print output	
C. Tabular trend menu		
C-1. Tabular trend		
C-1-1. Event list	Selectable alarm list is displayed	
C-1-2. Time period	Time period setting	1min, 5min, 10min, 15min, 30min, 1hour, 2hour
C-1-3. Display group	Configure the bio signal to be shown in the Tabular trend window	
C-1-4. Print	Tabular trend print output	
D. Trend export menu		
D-1. Start time	Parameter save start time setting menu	hh:mm
D-2. End time	Parameter save last time setting menu	hh:mm
D-3. Export time period	Time period setting	1min, 5min, 10min, 15min, 30min, 1hour
D-4. Export order	Sequence of parameters	Descending Ascending
D-5. Export	Save data to USB memory	
E. Full disclosure[2)]		
E-1. Lead[2)]	Select lead to display on screen	I, II, III, AVR, AVL, AVF, V
E-2. Duration[2)]	The time interval you want to see during the entire time	1/2/3/4/5 min.
E-3. Detail View[2)]	Show the detail view corresponding to the detail time interval	
F. OxyCRG Show/Hide	When selected, the screen shows heart rate, breathing, and oxygen saturation trends. It is not displayed in single parameter mode or 7ch ECG screen.	Show Hide

[2)] : BM7 only

3) Graphic Trend

Graphic trend shows the saved trend data with individual graph type for each parameter. These graphs show that the displayed parameters are active over a significant period, five channels at a time. Confirmed color and scale meter labels and numbers are shown on the left side of the trend channel. Vertical lines show each graph, which displays the time of distribution. Trends keeps the most up-to-date data. It is automatically updated on the right side of the graph.



① Graphic trend select menu

② Tabular trend select menu

③ Event list menu

④ Event previous/next menu

⑤ Patient ID

⑥ Parameter numeric window

⑦ Interval search window

⑧ Trend interval setup menu

⑨ Parameter selection menu to show

⑩ Printer menu

⑪ Parameter window selection menu

4) Tabular Trend

The Trends table displays the trend data in an easy-to-read table format. Up to six are displayed, updated every minute. The time stamp above each column indicates the interval at which the data in that column was trended. The value displayed is the last one acquired during the interval, and the most recent data is displayed in the rightmost column.

① Graphic trend select menu

② Tabular trend select menu

③ Event list menu

④ Event previous/next menu

⑤ Patient ID

⑥ Numeric parameter window

⑦ Selection navigation window

⑧ Trend interval setting menu

⑨ Parameter selection menu

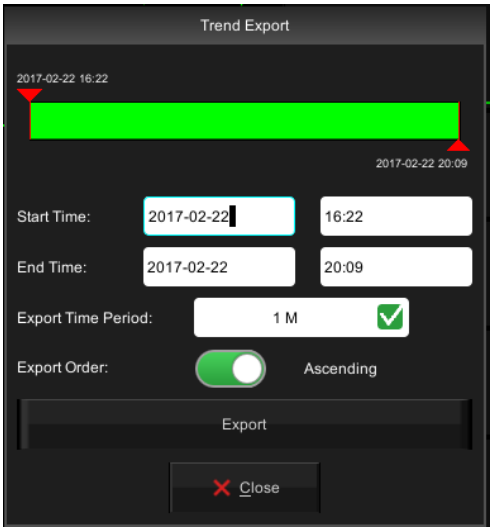
⑩ Printer menu

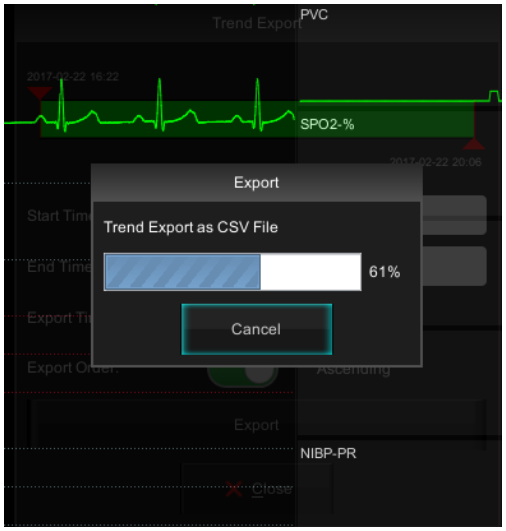
⑪ Parameter select window menu

5) File Export

The file extract function can transfer trend to a file using USB memory.

1. Confirm USB memory connection.
2. Press TREND > Trend Export button.
3. Set a start time, end time, export time period, and export order.
4. Press Export button
5. The data is transferred to USB memory. A completion message is displayed when the transmission is completed.





Note	**Saving Patient Data to a USB** **Exported patient data on a USB memory drive is not encrypted and therefore raises privacy concerns. So, only authorized personnel should be allowed to view, handle, store or transmit patient data.** **The file format of the USB memory drive used for the BM Series patient monitoring device is FAT32.**

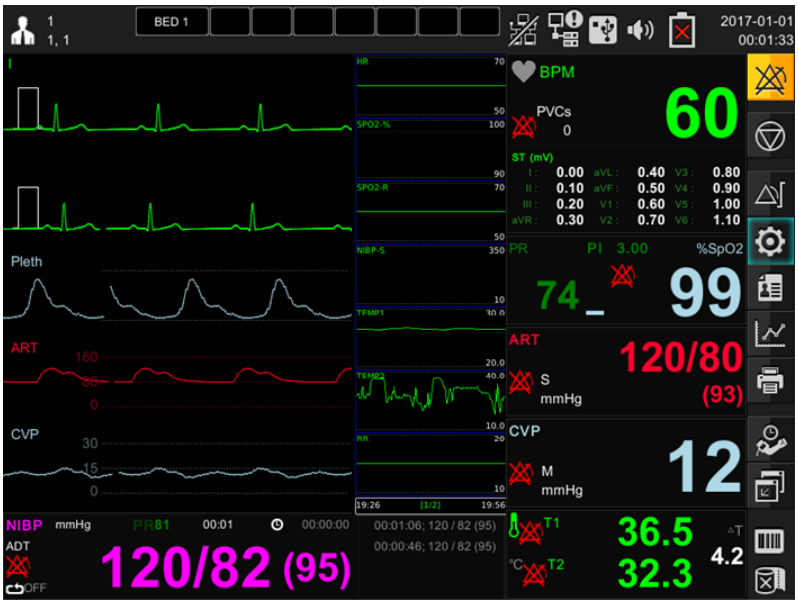
6) Popup trend

The user can continue to monitor the main screen waveform and parameter box while displaying trend data for up to 7 parameters for up to 6 hours. The pop-up trend graph follows the display order indicated by each parameter in the trend setup and is updated with new trend data every 60seconds. When selecting pop-up trend, you can switch to ST analysis window and double-zoom mode.

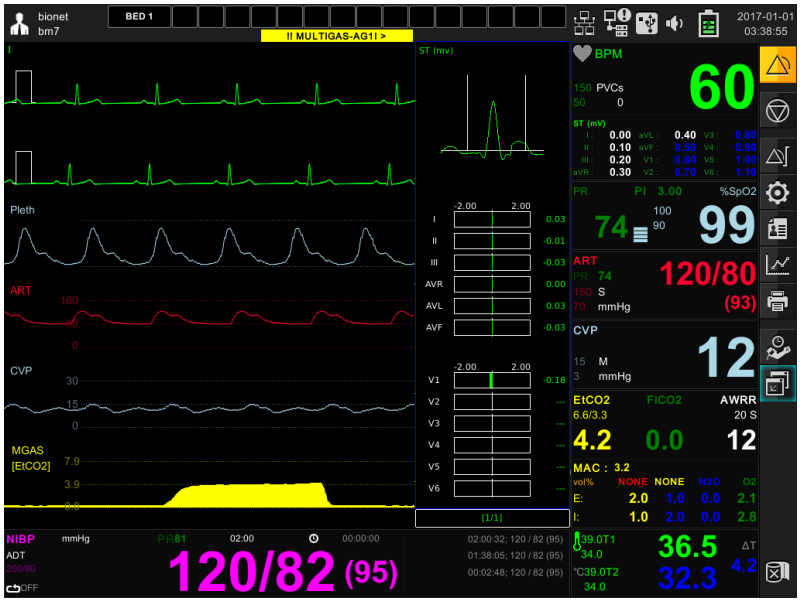
If there is no parameter set in Trend setup> Configure parameters, only ST analysis window is displayed.

To change the popup menu window, touch the top and bottom of the popup menu with the touch key, or select it with the rotary switch.

Popup trend window

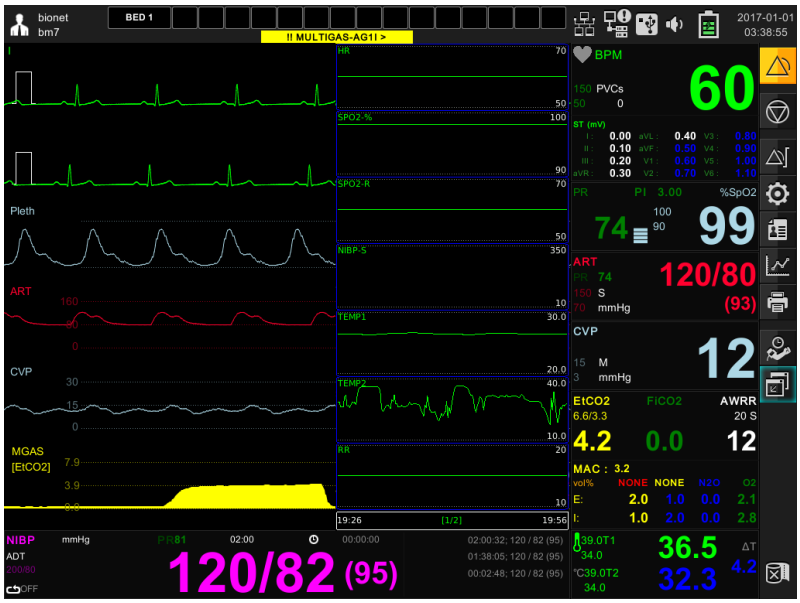


Popup ST window



Popup enlarge trend window

You can change the size of the popup menu by pressing and releasing the center of the popup menu for at least 1second.



7) OxyCRG Monitoring

The monitor can display Oxycardiorespirogram (OxyCRG or OCRG) in neonatal mode. OCRG displays updated HR trend, SpO2 or trend, respiratory / etCO2 waveforms, as well as apnea events in 3 or 6 consecutive minutes. The monitor will continue to update the main screen parameters, alarm announcement, and alarm recording start.

OxyCRG display method:

1. Set patient type to Neonatal
2. Connect SpO2 sensor, HR lead and breath or etCO2 lead.
3. Set the apnea time in the RESP menu.
4. Press the TREND icon key.
5. Click OxyCRG to display the OxyCRG screen.

Scale

To change the HR scale:

1. Select the parameter window using the rotary knob and click.
2. Turn the dial to the desired scale setting and click.
3. The values are shown in the following table (you can only modify HR scales).

Cursor

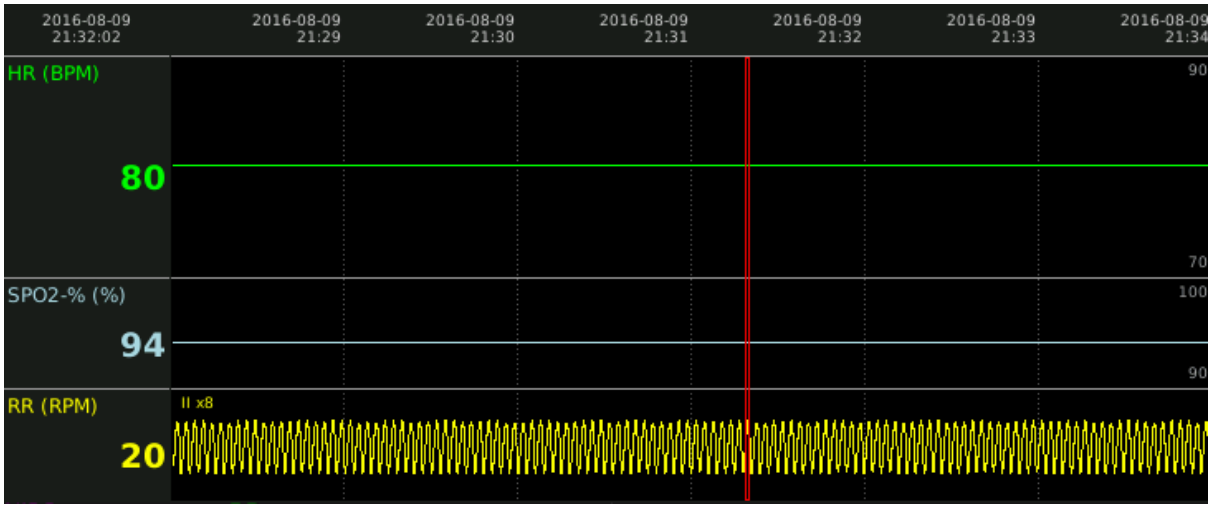
When you select the cursor box, a vertical bar is displayed in the trend area of the screen. The number on the left of the screen no longer indicates the scale value, but the parameter value of the time marked with the cursor is displayed. The monitor continuously displays the current value (real time) on the right side of the screen. When the cursor is moved to the right or left with the rotary knob, it is corrected and displayed accordingly.

Parameter definition

The highest (maximum) and lowest (lowest) HR values over the last 6 minutes

SpO2 50 -100% The lowest saturation value over the last 6 minutes

Respiration waveform



8) OxyCRG setup menu

Menu	Description	Available settings
ECG auto scale	ECG range auto scale setup	On / Off
ECG manual scale	ECG range manual scale setup	
Parameter type	RESP, EtCO2 parameter setup menu	RESP EtCO2

PART 7. ECG

1) Overview

The monitor can calculate heart rate, detect arrhythmias (adult and pediatric patients), and display ECG data. The electrocardiogram screen provides 1 channel, 2 channel, 7 channel (BM5, BM7 Only), and displays.
It calculates the heart rate by detecting the electrocardiogram signal of the patient and alarms according to the set upper and lower limit of alarm.

2) ECG Precaution

Warning	**CABLES — Route all cables away from patient's throat to avoid possible strangulation.** **CONDUCTIVE CONNECTIONS — Extreme care must be exercised when applying medical electrical equipment. Many parts of the human/machine circuit are conductive, such as the patient, connectors, electrodes, transducers. It is very important that these conductive parts do not come into contact with other grounded, conductive parts when connected to the isolated patient input of the device. Such contact would bridge the patient's isolation and cancel the protection provided by the isolated input. In particular, there must be no contact of the neutral electrode and ground.** **DEFIBRILLATION — Do not contact with animals during defibrillation. Otherwise, serious injury or death could result.** **To avoid the risk of serious electrical burn, shock, or other injury during defibrillation, all persons must keep clear of the bed and must not touch the patient, or any equipment connected to the patient.** **After defibrillation, the screen display recovers within 10seconds if the correct electrodes are used and applied in accordance with the manufacturer's instructions.** **Patient cables can be damaged when connected to an animal during defibrillation. Check cables for functionality before using them again.**

The peak of the synchronized defibrillator discharge should be delivered within 60ms of the peak of the R wave. The signal at the ECG output on the veterinary patient monitor s is delayed by a maximum of 30ms.

If the ECG waveform on the screen is too unstable to synchronize with the animal's heartbeat because of the following reason, remove the cause of an alarm, message, or unstable ECG, and then use a stable ECG lead for synchronization.

- ✓ **ECG electrode is detached or broken. Lead wire is detached or broken.**
- ✓ **Lead wire moves. AC interference, EMG noise or noise from ESU is superimposed.**
- ✓ **Connection cable is broken or has a short circuit. Connector has poor contact.**

INTERFACING OTHER EQUIPMENT — Devices may only be interconnected with each other or to parts of the system when it has been determined by qualified biomedical engineering personnel that there is no danger to the patient, the operator, or the environment as a result. In those instances where there is any element of doubt concerning the safety of connected devices, the user must contact the manufacturers concerned (or other informed experts) for proper use. In all cases, safe and proper operation should be verified with the applicable

Manufacturer's instructions for use and system standards IEC 60601-1-1/EN 60601-1-1 must be complied with.

Electro surgery Unit

- ✓ **Electrosurgical unit (ESU) emits a lot of RF interference. If the monitor is used with an ESU, RF interference may affect the monitor operation.**
- ✓ **Locate the monitor as far as possible from the ESU. Locate them on opposite sides of the operating table, if possible.**
- ✓ **Connect the monitor and ESU to different AC outlets located as far as possible from each other.**
- ✓ **When using this monitor with an electrosurgical unit, its return plate and the electrodes for monitoring must be firmly attached to the patient. If the return plate is not attached correctly, it may burn the patient's skin where the electrodes are attached.**

	During surgery: **Use the appropriate orange electrode ECG safety cable, or lead cable with an red connector, for measuring ECG in the operating room. These cables have extra circuitry to protect the patient from burns during cautery, and they decrease electrical interference. This also reduces the hazard of burns in case of a defective neutral electrode at the HF device. These cables cannot be used for measuring respiration.**

3) Patient Preparation

Careful skin preparation and proper electrode placement allow you to receive a strong signal that minimizes handwriting. If a technical alarm (e.g. lead disconnect) has occurred, prepare the patient again according to the following recommendations.

Follow hospital approved clinical procedures to prepare the patient's skin. Change the electrode every 24 to 48 hours to improve signal quality. You may need to replace the electrode more often in the following situations:

- ECG signal degradation
- Excessive sweating of the patient
- Patient's skin irritation

There are a variety of reusable and disposable electrodes available. Choose the electrode that best fits your monitoring situation. Bionet recommends Ag / AgCl disposable electrodes.

If you are using an electrode with a gel beforehand, make sure that the electrode is sufficiently gelled. Never use this product if the disposable electrode has expired or the gel is dry.

Determine the electrode location that will provide the best ECG in the configuration (P-wave and T-wave amplitudes should not exceed 1/3 of the QRS amplitude). Choose a flat, muscleless location to maximize contact with the electrodes and minimize muscle fatigue.

Avoid joints or bony protrusions. When choosing a location for electrode placement, consider the following special conditions:

- Surgery - Place electrodes as far away from the surgical site as possible.

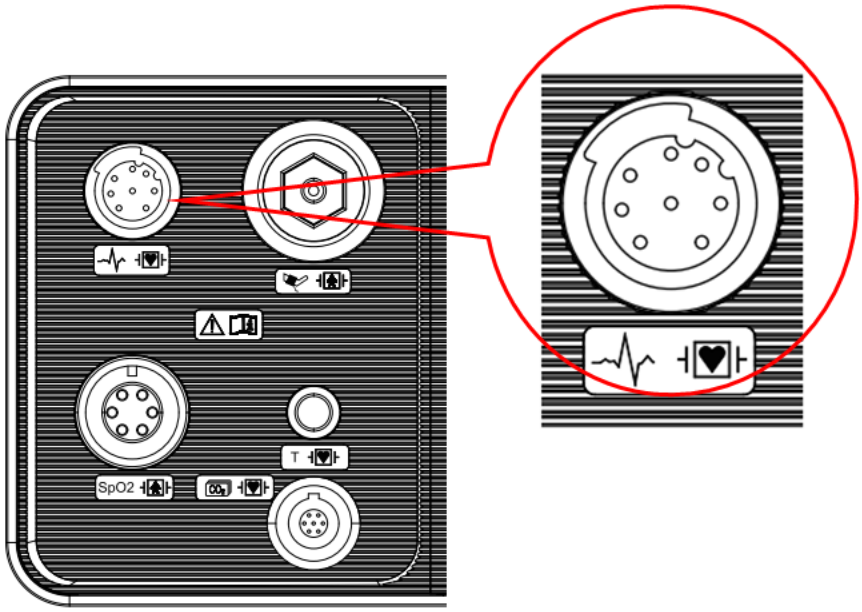
- Burn patient - use sterile electrodes. Thoroughly clean the equipment. Follow hospital infection control procedures.

Use a waterproof tape (about 2 inches wide) or Steri-Drape to secure the electrode Protect from liquids. Make a small loop from the lead wire just below the connection and secure with tape.

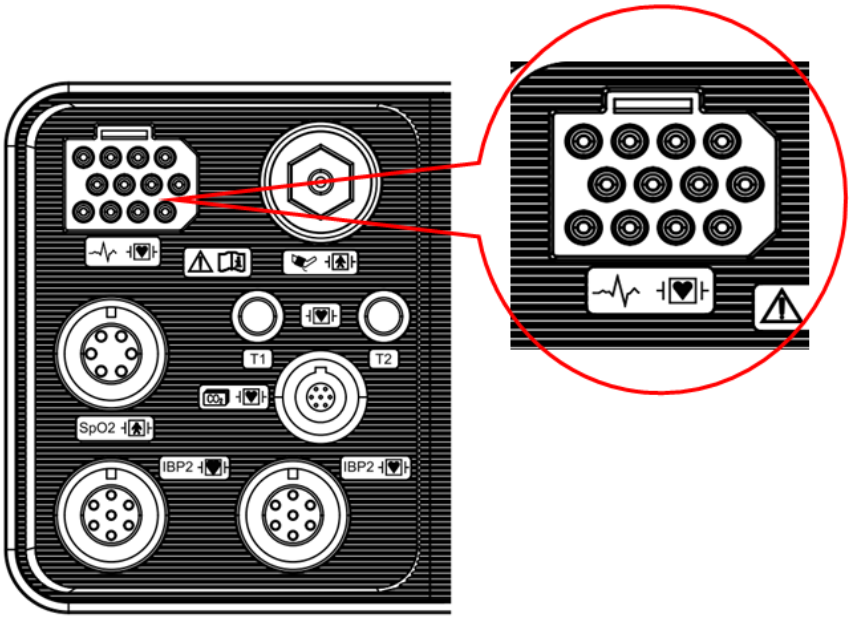
4) Connector and Measurement Cable

ECG connector

BM3



BM5, BM7



5) Electrode Placement

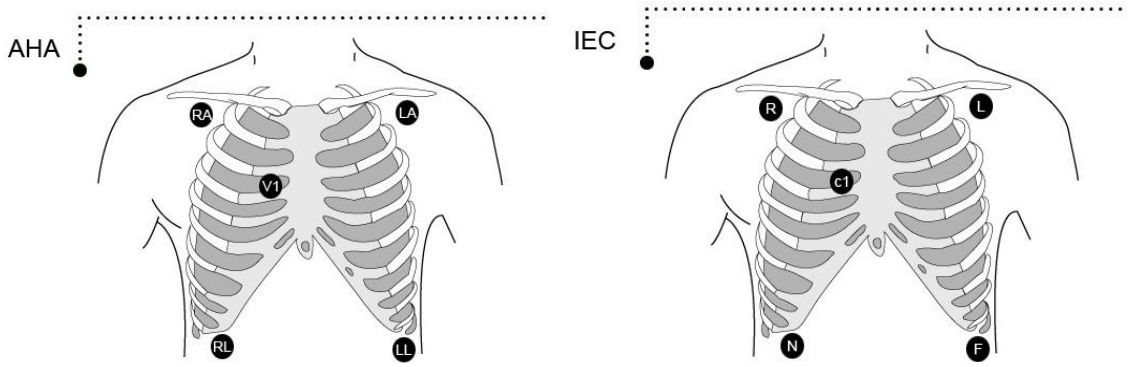
1. If you have a lot of hair, shave. With alcohol-soaked cotton, wipe the patient's skin to attach the electrode. Avoid wrinkled or uneven skin and wipe off alcohol with a dry cotton towel.
2. Remove the protecting film on surface of the electrode. Be careful not to touch the adhesive side.
3. Attach the disposable electrodes to the sterilized skin, which has been prepared as mentioned earlier.
4. Attach disposable electrodes to the previously sterilized skin.
5. Connect the lead of the electrodes to the monitor cable.
6. Fix the electrodes to the skin and secure the cable with the remaining length between the monitor and the electrode by using surgical tape. This fixation prevents the electrode from moving.

Note	**Make sure that the contact area of the disposable electrode are not dry to maintain good connection between the electrode and the skin.** **If you suspect that the disposable electrode is in poor contact, replace it immediately with a new one. Otherwise, the contacting impedance of the skin and electrode is increased, and the ECG signal is not obtained correctly.** **If the packing condition is not proper even if the expiration date on the packaging is not reached yet, it should be replaced with a new one.** **To get a stable ECG waveform, rub the skin with gel or benzoin tincture.**

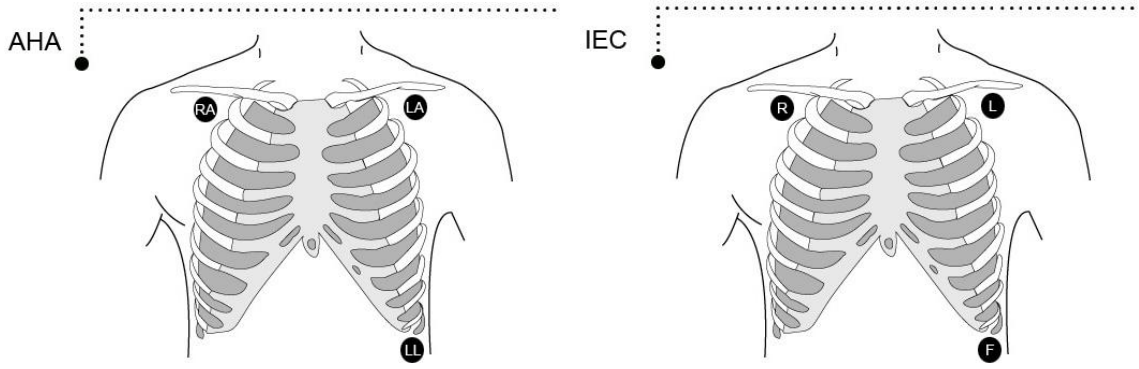
Caution	**When using a generating electric potential equipment, it may interfere with ECG monitoring.** **Do not rely solely on ECG for patients with epileptic tendencies. Electrical disturbances of non-cardiac circles such as seizures may interfere with the detection of specific arrhythmias.**

6) ECG Lead

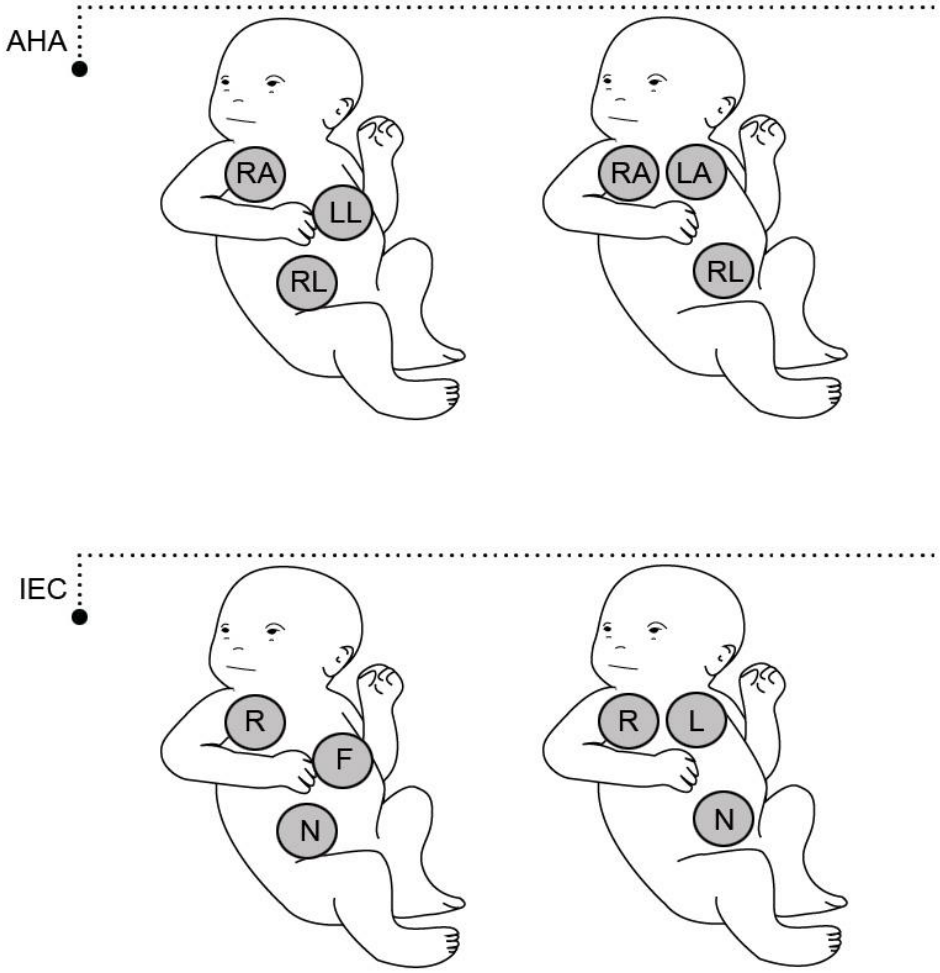
5-Lead Electrode Placement



3-Lead Electrode Placement



How to Attach Electrodes for Neonate



Cable Color and Size

AHA : American Heart Association (U.S.A. standard)

IEC : International Electro technical Commission (Europe standard)

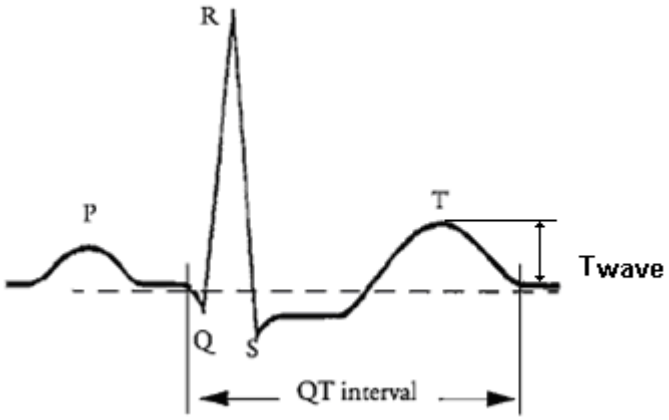
3-Lead / 5-Lead

Lead wire	AHA Color code	AHA Label	IEC Color code	IEC Label
Right arm	White	RA	Red	R
Left arm	Black	LA	Yellow	L
Right leg	Green	RL	Black	N
Left leg	Red	LL	Green	F
V1(precordial)	Brown	V1	White	C1

7) ECG Signal Processing and Display

The monitor distinguishes the QRS amplitude of 0.4 to 5.0 mV (0.2-5.0 mV with a scale setting of 0.5 mV / cm or less) and an adult with a QRS width of 70-120ms (or neonates with a QRS / ARR Select chapter). The heart rate is calculated from 15 to 300 times per minute using the last 10 seconds of the R-R interval and the two longest intervals and the two shortest intervals at the R-R interval. The remaining interval is averaged, and the current heart rate is displayed in the HR parameter box of the main screen as a result.

f arrhythmia monitoring is possible (except for neonatal patients), the HR parameter box is changed accordingly. If you select Basic, you can display three basic arrhythmias called ASYS, VFIB, and VTAC. If Full is selected, a separate ARR parameter box is displayed next to the HR parameter box (for details on selecting the arrhythmia mode, refer to the Arrhythmia setting part.)



When the ECG signal is 80 BPM, the interval of the T wave is 180 ms, and the QT period is 350 ms.

8) ST Signal Processing and Display

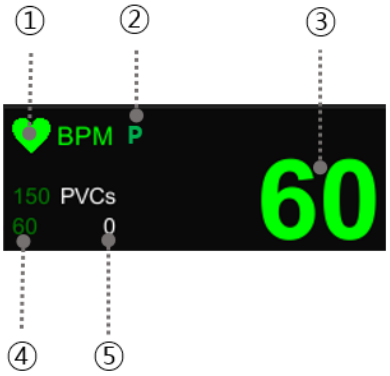
ST segment deviation is defined as the movement above or below the equipotential level (mm). The different measurement compares the isoelectric point with the ST measurement point. The isoelectric point defines a zero-volt point (no electrical activity, 0 mm) on the horizontal axis. In the ST segment, the ST point occurs between the QRS offset (J point) and the T-wave. The default position is 80ms after the QRS offset.

The ST analysis feature examines the QRS complex that are classified as "normal" beats, from the selected ECG leads. The monitor learns each ST-lead and combines measurements and characteristics of a normal beat into a composite (or average) QRS Complex. Take the ST segment deviation from this mean. If ST monitoring is enabled, the current ST value is stored in the trend and can be reviewed in the trend display. The significance of the ST segment changes needs to be determined by a clinician.

9) Alarm and Its Status

High P-wave and T-wave - Long P-wave or T-wave with high amplitude duration can be detected by QRS Complex. Place the leads on the ECG1 channel with the highest R-wave (compare to T-wave and / or P-wave) to allow the monitor to detect properly low heart rate conditions in this situation. If the monitor continues to misinterpret the P-wave or T-wave, use a pulse oximeter to reposition the electrodes or monitor the patient's pulse rate.

10) Display



① Heart rate detector: It detects heart rate and flickers simultaneously.

② Pacemaker: Pacemaker signal is detected and flashes simultaneously.

③ Heart rate: Displays the heart rate per minute.

④ HR Alarm limits: Displays heart rate threshold.

⑤ PVC count number per 1 minute

11) Setting ECG

	Main menu	Sub menu
ECG	**A.** ECG Parameters	**A-1.** Alarm
		A-2. QRS Volume
		A-3. Display Option
		A-4. Arrhythmia
		A-5. ST/PVC
		A-6. Pacemaker

Menu	Description	Available settings
A. ECG		
A-1. Alarm	ECG alarm setting menu	
A-1-1. Parameter alarm limit	HR, ST, PVC parameter alarm limits, level, activation setup menu.	
A-1-2. Technical alarm condition	ECG-cableoff[1)] ECG-leadfault	

	ECG-checkelectrode ECG-HR-search	
A-2. QRS volume	QRS detection volume setting menu. When you set the SpO2 volume, it is automatically set to Off.	Off, 0%~100%
A-3. Display option		
A-3-1. Sweep speed	The speed of the ECG displayed on the screen can be set. Default setting: 25mm/s	6.25mm/s, 12.5mm/s, 25mm/s, 50mm/s
A-3-2. Filter	The filter setting is monitor by default. ECG filter : Selects among four frequency bands to filter the signal. Monitor 0.5Hz ~ 40Hz Maximum 5Hz ~ 25Hz Moderate 0.5Hz ~25Hz Diagonosis 0.05Hz ~150Hz	Monitor Maximum Moderate Diagonosis
A-3-3. Size (sensitivity)	Changes the display amplitude of the ECG waveform.	0.25, 0.5, 1, 2, 4mm/mV
A-3-4. HR source	The cardiac source can be selected as ECG or SpO2, Auto.	ECG, SpO2, Auto
A-3-5. View channel	Number of channels in the ECG waveform to be shown on the screen. Display two lines of 1CH ECG waveform. 3LEAD : Display only 1CH 5LEAD : Display 1CH, 2CH[1)], 7CH[1)]	1CH, 2CH[1)], 7CH[1)]
A-3-6. Trace 1, Trace 2[1)]	The ECG channel selection. 3 lead cable: only Trace I can select I, II, III. 5 lead cable: I, II, III, aVR, aVL, aVF, V can be selected.	I, II, III, aVR, aVL, aVF, V
A-4. Arrhythmia	Arrhythmia alarm setting menu	
A-5. ST/PVC	PVC diagnostic setting, ST template channel selection, ST analysis and ISO (R-) / ST (R +) value setting	
A-5-1. PVC analysis	PVC diagnostic results display setup	ON/OFF
A-5-2. ST template ch	ST diagnostic ECG channel setup (Menu display according to the	Lead I, II, III, aVR, aVL, aVF, V

	currently connected cable)	
A-5-3. ST analysis	ST diagnostic ECG channel setup	
A-5-4. ISO(R-)	ISO point position setting	120 ~ 4ms
A-5-5. ST(R+)	ST point position setting	4~160 ms
A-5-6. Initial setup	ISO, ST point position initial value setting	ISO : 80 ST : 108
A-6. Pacemaker	Pacemaker detection display setting	ON/OFF

[1] : BM5, BM7 only

12) Troubleshooting

Problem	Solution
Inaccurate heart rate and/or false asystole.	Check ECG signal from patient: 1. Check/adjust lead placement. 2. Check/perform skin preparation. 3. Check/replace electrodes. Check amplitude of ECG waveform: 1. Select ECG parameter label. 2. Select DISPLAY LEAD. 3. Scroll through all ECG leads and check for 0.5mV amplitude at normal (1X) size. (at least 0.5mV amplitude is required for QRS detection.) for borderline signals, validate on a graph. 4. If amplitudes are low, electrodes may need to be repositioned or replaced.
False ventricular calls.	Check ECG signal from patient: (the chest lead may exhibit polarity changes which may occasionally cause an inaccurate call.) 1. Check/adjust lead placement. 2. Check/perform skin preparation. 3. Check/replace electrodes. (if chest lead is a problem, move the chest lead to another chest position or leg position.)
Inaccurate pacemaker detection	Use pacemaker processing: 1. Select ECG parameter label. 2. Display the lead of ECG with the greatest amplitude in the top waveform position. 3. Select Pacemaker. 4. Select Pacemaker On

PART 8. Monitoring Arrhythmia

1) Overview

Arrhythmia monitoring is available for adult and pediatric patients only; it is not available for neonates. The monitor compares the received beats to the reference beats that have been recorded and stored in the reference template. Through this process, it can identify the occurrence of an arrhythmia event, classify it, and draw clinical conclusions based on the frequency and type of the signal. It observes all doubtful beats if the baseline moves beyond a defined limit. It uses QRS processing results for arrhythmia analysis. During multiple lead arrhythmia treatment, it measures the QRS Complex of each lead and compare it to the main learned beats. It classifies the beats based on information obtained from all available leads.

2) Arrhythmia Templette

Template	Description	
Aststole	Ventricular asystole occurs whenever the displayed heart rate drops to zero.	
V-Fib / V-Tach	Ventricular fibrillation occurs when the ECG waveform indicates a chaotic ventricular arrhythmia.	
ACC Vent[1)]	Adult	Accelerated ventricular occurs when six or more ventricular beats are detected with an average heart rate for the ventricular beat between 50 and 100 beats per minute.
	0-2 years	Occurs when six or more ventricular beats are detected with an average heart rate for the ventricular beat between 60 and 160 beats per minute.
	3-10 years	Occurs when six or more ventricular beats are detected with an average heart rate for the ventricular beat between 60 and 140 beats per minute.
	11-13 years	Occurs when six or more ventricular beats are detected with an average heart rate for the ventricular beat between 60 and 130 beats per minute.
Bigeminy[1)]	Occurs when two or more bigeminal cycles (a ventricular beat followed by a non-ventricular beat) are detected.	
Brady[1)]	Bradycardia is the average of the most recent eight R-to-R intervals at a heart rate less than the set low heart rate limit.	

Couplet[1)]	Occurs when two ventricular beats are detected and have non-ventricular beats before and after the couplet The coupling interval must be less than 600 milliseconds.	
Irregular[1)]	Occurs when six consecutive normal R-to-R intervals vary by 100 milliseconds or more.	
Pause[1)]	Occurs when the interval between two consecutive beats exceeds three seconds.	
PVC[1)]	Isolated premature ventricular complexes occur when a premature ventricular beat is Detected and has non-ventricular beats before and after.	
R on T[1)]	Occurs when ventricular COMPLEX is detected within the repolarization period of the normal beat (when the RR interval is less than or equal to 360 msec).	
Trigeminy[1)]	Occurs when two or more trigeminal cycles (a ventricular beat followed by two non-Ventricular beats) are detected.	
Tachy[1)]	Tachycardia is four R-to-R intervals at a heart rate greater than the set high heart rate limit.	
V-Brady[1)]	Adult	Occurs when three or more ventricular beats less than 50 beats per minute are detected.
	3-10 years	Occurs when three or more ventricular beats less than 60 beats per minute are detected.

[1)] : BM5, BM7 only

Note	**The Brady limit matches the low heart rate limit. If the low heart rate limit is changed, the Brady limit changes.**

Note	**The Tachy limit matches the high heart rate limit. If the high heart rate limit is changed, the Tachy limit changes.**

3) Settings Arrhythmia

Menu	Description	Available settings
A. ECG menu		
A-1. Arrhythmia	Arrhythmia parameter alarm, level,	

	Activation setup menu.	
A-1-1. Arrhythmia type	Sets up On / Off to indicate detection of diagnosis (Asys, VTAC/VFIB and VTAC). Off: Do not perform arrhythmia diagnosis. Lethal: Performs the detection of Asys, VTAC/VFIB, and VTAC at the selected lead Full[1)]: Performs the detection of all 13 arrhythmia. The analysis algorithm simultaneously uses leads I, II, III, and the V lead for ECG and arrhythmia analysis.	Off, Lethal, Full[1)]
A-1-2. Arrhythmia alarm condition	Alarm setting menu by arrhythmia type	

[1)] : BM5, BM7 only

Warning	**Display Heartbeat Equipment Signal** **Pacemaker signal is shown when the PACE mode is ON; it is shown in a consistent form. The signal size or form are clinically meaningless.** **Number Of Heartbeat** **Patient with pacemaker needs close attention. The pacemaker can continue to show heartbeat even during arrhythmia. Therefore, do not depend on heartbeat alarm excessively.**

Warning	**VENTRICULAR ARRHYTHMISAS** **The arrhythmia analysis program is intended to detect ventricular arrhythmia. This program is not designed to detect trial or supra ventricular arrhythmias. In some cases, it may not be possible to distinguish the presence or absence of arrhythmias. Therefore, doctors should analyze the arrhythmia information like other medical information.**

	SUSPENDED ANALYSIS **Certain conditions can delay the arrhythmia analysis. Detection and alarms associated with arrhythmias do not occur when arrhythmia conditions are delayed. This message is generated when the arrhythmia analysis is delayed:** **Lead Fault, Alarm Paused, Alarm Off, Patient Discharge**

PART 9. Respiration

1) Overview

Respiration via ECG Lead I or Lead II electrode is measured by using the changes in the resistance of skin, caused by the chest skin enlargement. In this process, the respiration value per minutes is calculated and the alarm is triggered according to limit value.

The monitor can use ECG leads I or II for breath detection, regardless of the leads selected for QRS processing. You can monitor the heart rate, SpO2 using the appropriate accessories, and display the relevant values in the Oxycardiorespirogram.

2) RESP Precaution

Safety and efficacy of respiration measurement methods for apnea detection, especially apnea of premature babies and apnea of infants, have not yet been established.

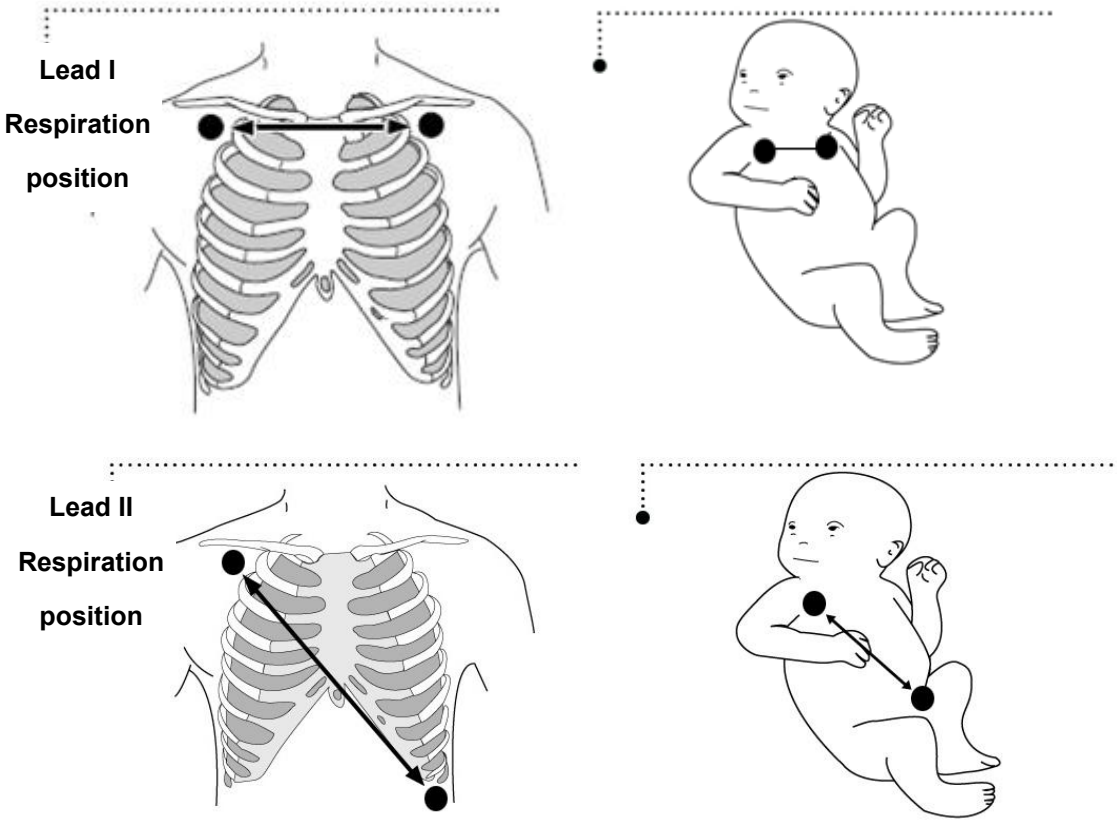
- The patient monitor does not monitor obstructive apnea**.** Patients in a breathing crisis should be closely monitored.
- Impedance breath monitoring should not be considered as the only way to detect breathing stops. Bionet recommends monitoring of additional parameters, such as EtCO2 and SpO2, that indicate the patient's oxygen supply status.
- If you use an ESU block or cable, the impedance breath monitor may not work, and the pacemaker detection performance may be degraded. If pacemaker detection is enabled, ESU interference may be detected as a pacemaker.
- Large amplitude pacemaker pulses (>100mV) may interfere with the monitor's breath measurement or detection function.

3) Preparing the Patient

Skin preparation and electrode placement must be properly and carefully monitored in impedance breath monitoring.
In general, the electrodes should be placed as clean as possible with the 60Hz noise minimized to make it possible to generate a signal. The best results can be obtained when the electrodes are firmly bonded, and the electrode area is wide.

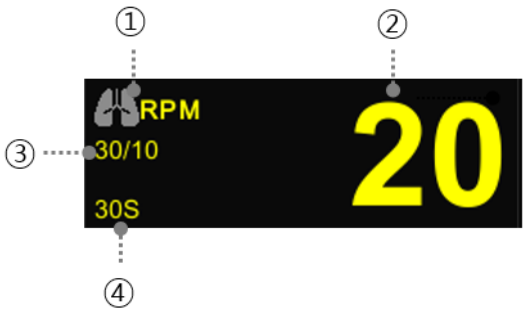
To improve the RESP signal, use a 5-lead cable set (RL as a neutral electrode). It is recommended that the electrodes be placed in the maximum expansion and contraction range of the lung, especially if deep breathing is involved.

For neonates, place the RA and LA electrodes on the mid-armpit line with the nipple. Place the LL electrodes under the diaphragm and navel. Avoid the liver and the ventricles of the heart to prevent 60Hz noise from pulsatile blood circulation. The following figure shows where we recommend placing ECG leads for impedance breathing in adults and neonates.



Note	**Cables and connectors to measure respiration rate (RR) are commonly used with ECG.**

4) Display



① Breathe indicator: indicates the detected breath

② The number of respirations per minute

③ Respiration alarm limit indicates respiration limits

④ Apnea limit Setting: Apnea limit sign

5) Respiration Setting Menu

Menu	Description	Available settings
A. Respiration menu		
A-1. Alarm	RESP alarm setting menu	
A-1-1. Parameter alarm limit	RR, APNEA Parameter alarm, level, activation setup	
A-1-2. Technical alarm condition	RESP - cable off RESP - lead fault RESP - check eletrode	
A-2. Display option	This is for changing the reference lead for respiration	
A-2-1. Sweep speed	A menu to setup wave display of speed Default setting is 25mm/s.	6.25mm/s, 12.5mm/s, 25mm/s,
A-2-2. Size	A menu to setup wave display	2, 4, 6, 8, 10
A-2-3. Lead select	This is for changing the reference lead for respiration	Lead I Lead II
A-3. Apnea detect	A menu to setup APNEA alarm display	Off / On

PART 10. SpO2

1) Overview

SpO2 monitoring is a non-invasive technique that measures the total amount of oxygen in hemoglobin. The pulse rate is measured by measuring the absorption of the wavelength of the selected light. The light emitted by the sensor in the probe passes through the tissue and is converted into an electrical signal by the light-detecting sensor in the probe. The monitor processes the electrical signal and displays the waveform, %SpO2, and pulse rate on the screen as quantified values. Red and infrared rays are passed through the capillaries of the fingertip to detect the pulsating component, calculate HR and oxygen saturation, and alarm according to the set alarm value.

2) Precautions

SpO2 measurements are particularly sensitive to arterial and arteriolar pulse rates. Patients experiencing shock, hypothermia, anemia, or patients taking medications that reduce arterial blood flow may have incorrect measurements.

Warning	• **The pulse oximeter cannot be used as an apnea monitor.** • **High oxygen levels can make premature babies vulnerable to retrolental fibroplasia. When this is the case, do not set the maximum alarm limit to 100%, such as the effect of turning off the alarm. Percutaneous SpO2 monitoring is recommended for premature infants receiving supplemental oxygen.** • **Ambient lighting, physical behavior, diagnostic tests, electromagnetic interference, and improper positioning of the probe may affect SpO2 accuracy.** • **Inspect the applied area every 2-3 hours to check the skin condition and check if the sensor is well attached with the naked eye. If skin conditions change, move the sensor to another location. Change the application every 4 hours at least.** • **Check compatibility before using the patient monitor, probe, and cable specified by the Bionet.**

	• **Use only Bionet-designated sensors. Other sensors may not provide adequate protection against defibrillation or may put the patient at risk.** • **Disposable accessories (disposable electrodes, transducers, etc.) should be used only once. Do not reuse disposable accessories.**

3) Preparing the Patient

The accuracy of SpO2 monitoring is largely dependent on the strength and quality of the SpO2 signal.

The age, sex and race of the clinical study report used to assess SpO2 accuracy are as follows:

- Age: 20-36 years
- Race: White, African, American, Hispanic
- Sex: Male, Famale

If you use your fingers as a monitoring site, remove the nail polish. Cut the patient's fingernail if needed to improve placement of the sensor. Only use sensors provided by Bionet and apply them according to manufacturer's recommendations on a per-sensor basis.

If the sensor is not attached correctly, the ambient light may interfere with the pulse oximetry, making the measurement irregular or causing the value to disappear. If you suspect interference from ambient light, make sure that the sensor is properly positioned and that the sensor cover with the opaque body is covered.

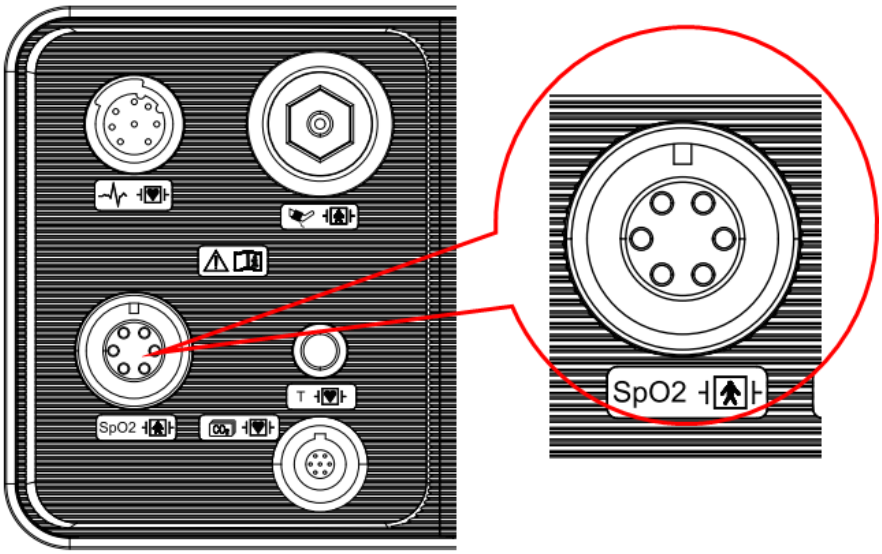
1. Select the sensor type and size that best suits your patient.
2. If the sensor can be reused, please wash it before use for each patient.
3. Position the sensor correctly and attach it to the patient.
4. Connect the sensor to the patient cable.
5. Check the application area of the sensor from time to time If the sensor is too tight, it may delay blood flow or overheat the skin and damage the tissue. Do not use a damaged sensor.

Note	**Read the documentation that came with your sensor for the best application technology and safety information. Never use a damaged sensor.** **If the sensor does not turn on after connecting the sensor, observe that a message appears on the patient monitor. If the sensor-LED does not turn on, replace the sensor.**

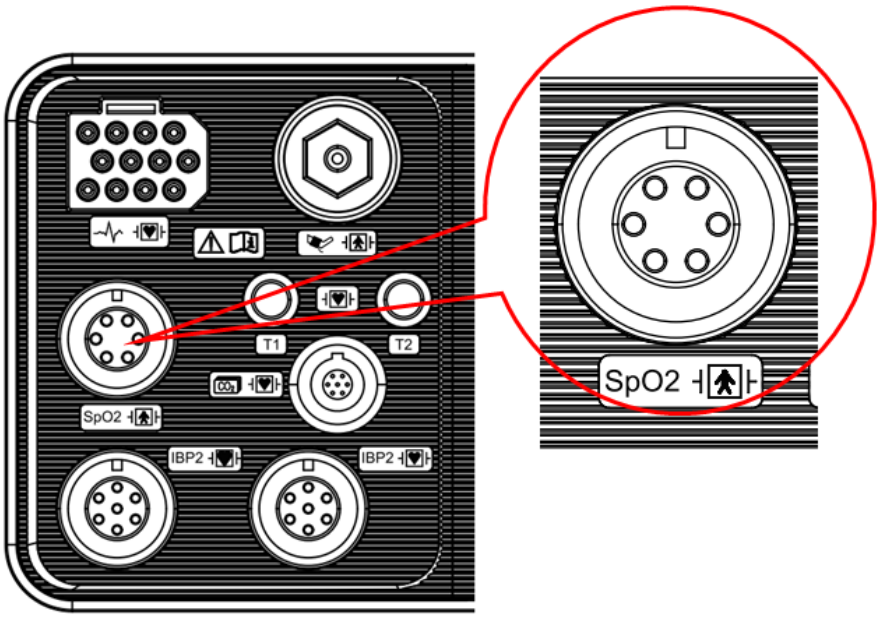
4) Connector and Measurement Cable

SpO2 connector

BM3



BM5, BM7



SpO2 measurement extension cable and adult SpO2 sensor

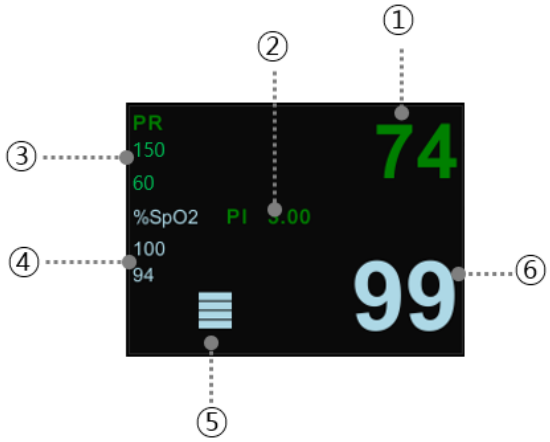
SpO2 sensors

	Adult SpO2 Sensor (Reusable type)
	Pediatric SpO2 Sensor (Reusable type)
	Neonatal SpO2 Sensor (Reusable type)
	Neonatal/ Adult/ disposable SpO2 Sensor

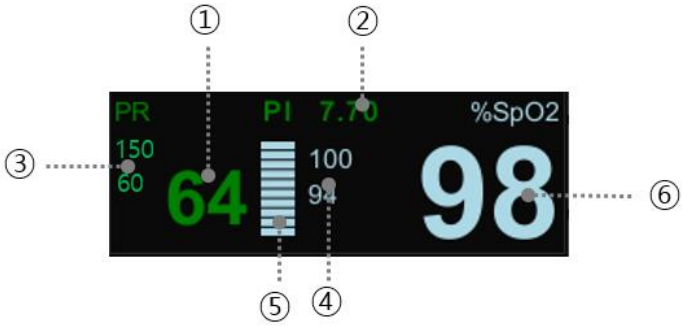
Note	**The signal input is a high-insulation port protected from defibrillator.** **(** **)** **The insulated input ensures patient safety and protects the patient monitor during defibrillation and electro surgery.**

5) Display

BM3



BM5, BM7



① SpO2 pulse rate display

② SpO_2 PI (Perfusion Index) measurement display

③ SpO2 pulse rate alarm limits display

④ %SpO2 alarm limits display

⑤ SpO2 strength indicator

⑥ %SpO2 Value display

The current SpO2 value and the derived pulse rate (RATE) are displayed. The block sets indicate the strength of the signal (twenty block bars indicate the strongest signal). The SpO2 measurements are averaged over a 6-second period of time and the monitor display is updated every second.
The SpO2 monitoring features are found in the SpO2 menu. These features include alarm limit adjustment, display of RATE, and RATE volume.

Note	**SpO2 wave size is changed automatically.** **A functional tester or SpO2 simulator (Fluke, Index 2 simulator) can be used to verify operation of pulse oximetery function.** **A functional tester or SpO2 simulator cannot be used to assess the SpO2 accuracy.**

6) Signal and Data Validity

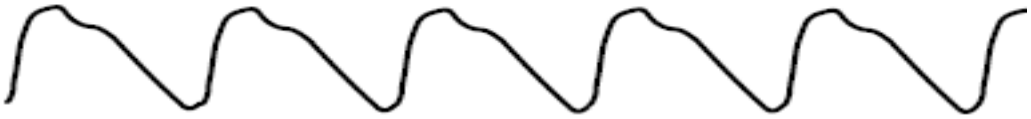
It is extremely important to determine that the probe is attached to the patient correctly and the data is verifiable. To make this determination, three indications from the monitor are assisted: the signal strength bar, the quality of the SpO2 waveform, and the stability of the SpO2 values. It is critical to observe all three indications simultaneously when ascertaining signal and data validity.

Signal Strength Bar

The signal strength bar is displayed within the SpO2 values window. This bar consists of 10 blocks set depending on the strength of the signal. Proper environmental conditions and probe attachment will help to ensure a strong signal.

Quality of SpO2 Waveform

Under normal conditions, the SpO2 waveform corresponds to (but is not proportional to) the arterial pressure waveform. The typical SpO2 waveform indicates not only a good waveform, but helps you find a probe placement with the least noise spikes present. The figure below represents an SpO2 waveform of good quality.



SpO2 Waveform in Good Quality

If noise (artifact) is seen on the waveform because of poor probe placement, the photo detector may not go through the tissue. Check that the probe is secured, and the tissue sample is not too thick. Pulse rate is determined from the SpO2 waveform which can be disrupted by a cough or other hemodynamic pressure disturbances. Motion at the probe site is indicated by noise spikes in the normal waveform (See the figure below). In order to reduce motion noise, you should carefully look at the SpO2 waveform and check the probe position on the patient.

SpO2 Waveform with Artifact

Stability of SpO2 Values

The stability of the displayed SpO2 values can also be used as an indication of signal validity. You can improve the stability of SpO2 values with a little practice. SpO2 Messages are provided in the SpO2 values window to aid you in successful SpO2 monitoring.

Warning	**In the monitoring of patients, the coincidence of adverse conditions may lead to a disturbed signal going unnoticed. In this situation, artifacts may simulate a plausible parameter reading, so that the patient monitor fails to sound an alarm. In order to ensure reliable patient monitoring, the proper application of the probe and the signal quality must be checked at regular intervals.**

7) SpO2 Setting Menu

Menu	Description	Available settings
A. SpO2 menu		
A-1. Alarm	SpO2 alarm setup menu	
A-1-1. Parameter alarm limit	Percent, PR parameter alarm , level , activate setup	
A-1-2. Technical alarm condition	SpO2 - probeoff SpO2 - checkprobe SpO2 - poorsignal SpO2 - lostpulse SpO2 - artifact SpO2 - pulse search	
A-2. Rate volume	Menu in which rate volume is set up when the ECG volume is set, it is automatically set to Off.	Off, 0%~100%
A-3. Display option	SpO2 waveform display setting	
A-3-1. Sweep speed	It can set the speed of SpO2 displayed on the screen. Default: 25 mm/s.	6.25mm/s, 12.5mm/s, 25mm/s, 50mm/s

8) SpO2 Status Messages

Below is a list of system status alarm messages which may be displayed in the SpO2 parameter window during monitoring.

Message	State
Check probe	Reusable finger probe is off the patient. Check the probe. The factory default for this alarm is MESSAGE ALARM.
Pulse search	Detection by the monitor of a repeatable pulse has ceased. Check the patient and the probe site.
Poor signal	The SpO2 signal is too low. No SpO2 data is displayed. This can be due to a low patient pulse, patient motion, or some other

	interference. Check the patient and the probe.
Lost signal	SpO2 data continues to be displayed, but the quality of the signal is questionable. Check the patient and the probe.
Artifact	It indicates that something happened to the pulses; determine if the artifact to be abnormal and irregular

9) Cleaning

- Do not autoclave, pressure sterilizes, or gas sterilizes.
- Do not soak or immerse the monitor in any liquid.
- Use the cleaning solution sparingly. Excessive solution can flow into the monitor and cause damage to internal components.
- Do not touch, press, or rub the display panels with abrasive cleaning compounds, instruments, brushes, rough surface materials, or bring them into contact with anything that could scratch the panel.
- Do not use petroleum-based or acetone solutions, or other harsh solvents, to clean the oximeter. These substances attack the device's materials and device failure can result.

If the accuracy of any measurement does not seem reasonable, first check the patient's vital signs by alternate means and the check the MS board pulse oximeter for proper functioning.

Inaccurate measurements may be caused by:

- Incorrect sensor application or use
- Significant levels of dysfunctional hemoglobins. (e.g. carboxyhemoglobin or methemoglgbin)
- Intravascular dyes such as indocyanine green or methylene blue.

PART 11. NIBP

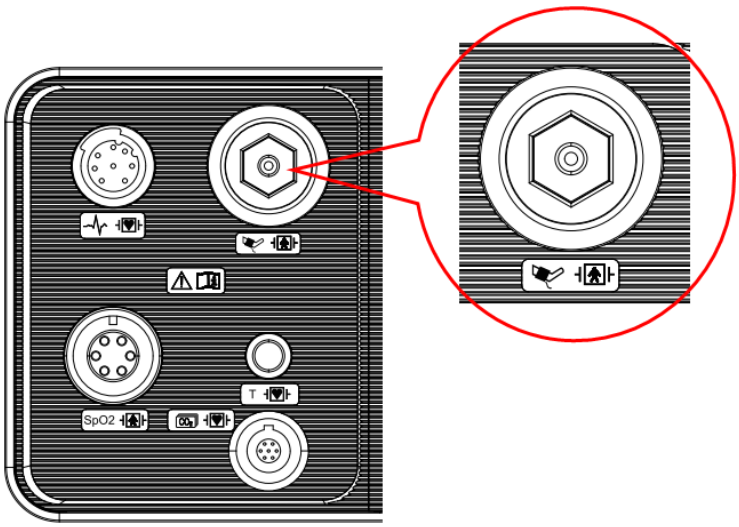
1) Overview

The monitor uses the oscillometric method for measuring Non-Invasive Blood Pressure (NIBP). and the blood pressure measurements taken with the patient monitor are identical to those obtained by the intra-arterial method within the limits prescribed by the Association for Advancement of Medical Instrumentation, Electronic Automated Sphygmomanometers (AAMI/ANSI SP-10).

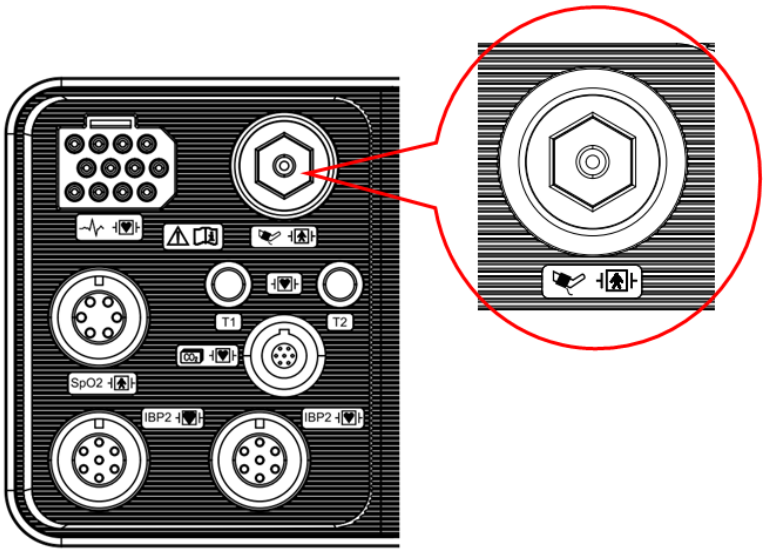
If the pulse signal is weak due to patient movement, improper cuff positioning, or noise in the signal, deflate the cuff and try a second measurement. Refer to the status alarm message table for causes and solutions for weak pulse signals. Connect the cuff and monitor with a hose to measure contraction, dilatation, and mean blood pressure in adult, pediatric, or neonatal patients.
The monitor's NIBP system expands and contracts the Pneumatic Cuff wrapped around the patient's arm or leg to initiate blood pressure measurement alone based on a set interval or persistence lasting more than 5 minutes.

2) Connector and Cuff

BM3

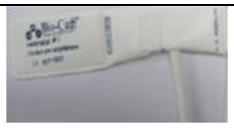


BM5, BM7



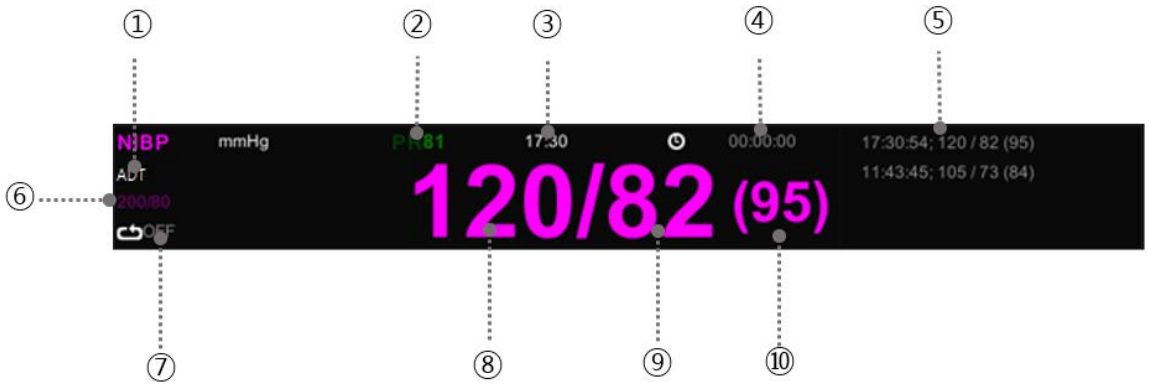
Adult Cuff

Optional accessory list

Thigh Adult		**Big Adult NIBP Cuff** Cuff Size : 458 * 143 Arm circumference : 45 to 56.5 Cm Option
Big Adult		**Big Adult NIBP Cuff** Cuff Size : 458 * 143 Arm circumference : 35.5 to 46 Cm Option
Child		**Child NIBP Cuff** Cuff Size : 430 * 108 Arm circumference : 20.5 to 28.5 Cm Option
Pediatric		**Pediatric NIBP Cuff** Cuff Size : 313 * 88 Arm circumference : 13.8 to 21.5 Cm Option
Infant		**Infant NIBP Cuff** Cuff Size : 210 * 60 Arm circumference 9 to 14.8 Cm Option
Neonate		NIBP Disposable Cuff Neonate 1 (3.3~5.6cm) Option
		NIBP Disposable Cuff Neonate 2 (4.2~7.1cm) Option
		NIBP Disposable Cuff Neonate 3 (5.0~10.5cm) Option
		NIBP Disposable Cuff Neonate 4 (6.9~11.7cm) Option

Note	**The NIBP should be set in the menu because the measured value differs depending on the patient's age and gender.**

3) Display



① Measurement cuff type.

② Pulse rates: Indicates pulse rate.

③ Measurement time: Indicates the completion time of measuring.

④ Measure time: Indicates the schedule counter time of measuring.

⑤ Indicates recent measurement data.

⑥ Systolic alarm limit: Indicates alarm limit of blood pressure.

⑦ Interval time: Indicates interval time when measures the blood pressure periodically.

⑧ Systolic blood pressure: Indicates the maximum blood pressure.

⑨ Diastolic blood pressure: Indicates the minimum blood pressure.

⑩ Mean blood pressure: Indicates the average blood pressure.

4) NIBP Setting Meun

Menu	Description	Available settings
A. NIBP menu		
A-1. Alarm	NIBP alarm setup menu	
A-1-1. Parameter alarm limit	SYS, MEAN, DIA parameter alarm limit, level, activation setup	
A-1-2. Technical alarm condition	NIBP - over pressure NIBP - overtime pressure NIBP - inflation failure NIBP - deflation failuer	

	NIBP - measurement error NIBP - pulse too weak NIBP - air leak NIBP - excessive motion NIBP - system fault	
A-2. Cuff size	Select cuff size	Adult Pediatric Neonate
A-3. Inflation	It is a function to set the range that is usually used by setting pressure at the beginning because it can give pain to the patient when the equipment is turned on and pressurized to the maximum pressure range at the initial pressurization. Default Settings value: ADT: 170 mmHg PED: 140mmHg NEO: 120mmHg *** After Inflation setting, initial pressurization pressurizes to Inflation setting value, but then pressurization differs depending on patient's blood pressure value.**	ADT: 120 - 250mmHg PED: 80 - 170mmHg NEO: 60 - 140mmHg
A-4. Setting time	How to apply pressure value setting. Once: When the blood pressure is measured for the first time, the pressure is set to the set pressure value, but automatically adjusted according to the patient's blood pressure value. Every time: Whenever blood pressure is measured, pressurize to the set pressure value every time	Once, Every time
A-5. Measurement Interval	A menu to set Interval time when measures the blood pressure periodically. After setting Interval, you must press NIBP Key to start NIBP Start	1min, 2, 3, 4, 5, 10, 15, 20, 30, 1hour, 2, 4, 8

	periodically.	
B-1. NIBP STAT	Patients with severe state changes in blood pressure are in continuous mode for 5minutes to check for changes in blood pressure continuously.	Off / On
C-1. Vital sign review	Record the 40 most recently measured blood pressure values.	

Warning	**Check periodically to see if the circulation from the cuff to the distal part of the patient's arm is good.** **Check the patient's condition frequently when using the automatic measurement of 1 minute and 2-minute interval. It is not recommended for measuring blood pressure for a long time after the measurement time is set to 10 minutes or less.**

Note	**Safety Considerations** **Software and Hardware for Cuff pressure Blocking** **The cuff is automatically reduced when the measurement time is longer than two minutes in Adult / Pediatric mode and more than 90seconds in Neonatal mode. Extension limits are set for all patient categories to prevent overpressure on the patient.** **The maintenance is performed every 2 years.** **Check the following list to ensure the patient monitor always operates properly and safely.** **1. Check for proper cuff size.** **2. Check for residual air left in the cuff from a previous measurement.** **3. Make sure cuff is not too tight or too loose.** **4. Make sure cuff and heart are at same level, otherwise hydrostatic pressure will offset the NIBP value.** **5. Minimize patient movement during measurement.**

	6. **Watch for pulses paradox us.** 7. **Check for leak in cuff or tubing.** 8. **Patient may have a weak pulse.**

It is recommended that patient position in normal measurement, as below.

1. Comfortably seated
2. Legs uncrossed
3. Feet flat on the floor
4. Back and arm supported
5. Place the cuff about in the middle level of the right atrium of the heart. We recommend waiting 5 min before taking the first reading.

5) Measurement Restrictions

The measurement may be inaccurate or impossible:

- Measurements are impossible with heart rate extremes of less than 40 bpm or greater than 300 bpm, or if the patient is on a heart-lung machine
- With excessive and continuous patient movement such as shivering or convulsions
- If a regular arterial pressure pulse is hard to detect
- With cardiac arrhythmias
- With rapid blood pressure changes
- With severe shock or hypothermia that reduces blood flow to the peripheries
- With obesity, where a thick layer of fat surrounding a limb dampens the oscillations coming from the artery
- On an edematous extremity

The effectiveness of this sphygmomanometer has not been established in pregnant, including preeclamptic patients.

6) Selectiong and Placing Cuff

The quality of NIBP monitoring depends largely on the quality of the signals received by the monitor. For this reason, it is important to select the correct cuff size for your patient. Cuff sizes are clearly marked on the cuff. Measure the circumference of your patient's limb. Use only Bionet cuffs with your monitor.

7) How to Change Patient Mode

When you admit the patient, you have to select the patient type from adult, pediatric, and neonate. The selected patient type is the patient mode which is applied to the NIBP measurement mode.

Warning	• **Noninvasive blood pressure monitoring is not recommended for patients with hypotension, hypertension, arrhythmias or extremely high or low heart rate. The software algorithm cannot accurately compute NIBP or patients with these conditions.** • **Do not apply the cuff over a wound, as this can cause further injury.** • **Since the value of NIBP may vary depending on the age of the patient, the correct patient type must be set in the Patient Management menu before measurement. Tubes between the cuff and the monitor are not kinked or blocked.** • **Pay attention not to block the connecting hose when you put cuff on patient.** • **Check for leaks on the cuff or hose connection. Measurements can be inaccurate if air leaks.** • **The air pad should be exactly over the branchial artery. Tubing is immediately to the right or left of the branchial artery to prevent kinking when elbow is bent.** • **Try to measure infants when they are calm. A kicking or crying baby may disturb or jiggle the cuff, causing noise within the system and resulting in unstable blood pressure readings. If necessary, hold the**

	cuffed limb steady, without impeding circulation. Do not hold onto the cuff and do not pat the cuffed limb to comfort the child. ● **NIBP cannot be taken under all conditions. Even manual methods, employing a sphygmomanometer and stethoscope, will not work on unstable or active patients.** ● **Pressurization of the cuff may result in loss of function of monitoring medical electrical devices used simultaneously on the same extremity.** ● **The need to check that operation of the NIBP does not result in prolonged impairment of the circulation of the blood of the PATIENT.** ● **Select the correct patient category setting for the neonatal patient. Do not apply the higher adult inflation, overpressure limits and measurement duration to neonatal patients.**

8) Status Messages

Messages	Description
Inflation failure check cuff	If the cuff hose is not connected properly
Over pressure	When the cuff pressure is excessive
Deflation failure	When the cuff breaks and cannot exhaust
Over time cuff pressure	When the cuff pressure exceeds the set time
Measurement error	When there is no measurement signal

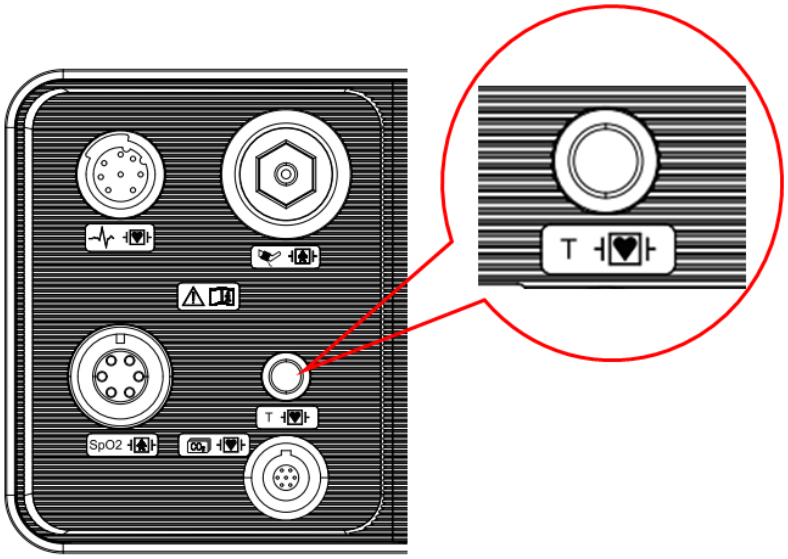
PART 12. Temperature

1) Overview

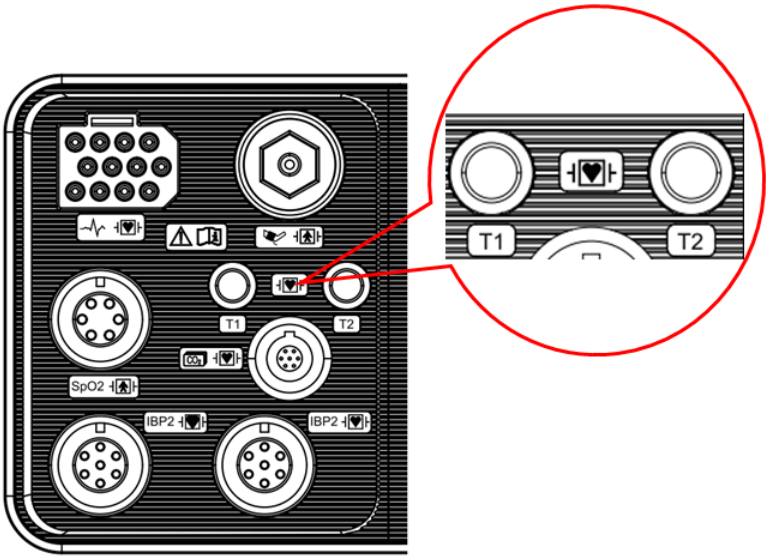
It uses a heat-sensitive resistor (thermistor) and is based on the principle that the electrical resistance of the thermistor changes with temperature change. The function involves the process of transferring the changes into electric signals.

2) Connector and Measurement Cable

BM3



BM5, BM7

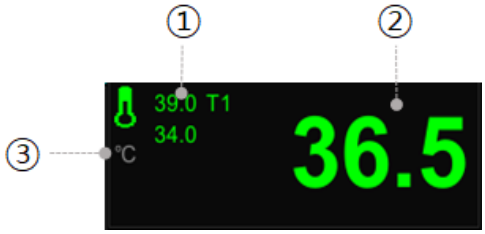


Temperature measurement sensor and cable

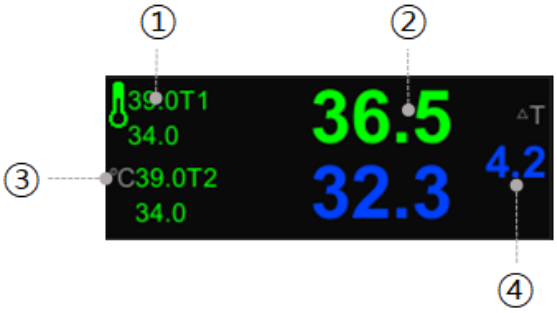
Note	**Correctly position the temperature probe and fix it not to be disconnected from the patient.**

3) Display

BM3



BM5, BM7



① T1 temperature unit and alarm limit

② T1 temperature value

③ T2 temperature unit and alarm limit

④ Temperature difference value display (BM5, BM7 only)

Note	• **The minimum measuring time required to obtain accurate readings at the specific body site is at least 3minutes.** • **If the measurement site like the patient's skin is directly exposed to air, the temperature may be lower than normal.** • **It takes about 20 ~ 30minutes to reach temperature equilibrium by attaching this sensor.**

4) Temp Setting Meun

Menu	Description	Available settings
A. Temp		
A-1. Alarm	Temp alarm settings menu	
A-1-1. Parameter alarm limit	TEMP1, TEMP2, DELTA TEMP Parameter alarm level, action setup	0℃ ~ 50.0℃ (32°F ~ 122°F)
A-1-2. Technical alarm condition	TEMP1-probe off TEMP2-probe off [1)]	
A-2. Display option [1)]	Temperature waveform display setting	
A-2-1. Delta display [1)]	It can set whether to display two temperature differences as a value.	On / Off
A-2-2. Temp. order [1)]	It can set the order of the temperature differences.	TEMP1 – TEMP2 TEMP2 – TEMP1
A-2-3. 2 channel view [1)]	2 channels display setup. If only 1 channel is used, set it to off. Which channel to use when using 1 channel is determined by Temp. order	On / Off

[1)] : BM5, BM7 only

PART 13. EtCO2

1) Overview

The BM Series monitor measures concentrations of end-tidal CO2 (EtCO2) when this option is enabled and the EtCO2 module is connected to your monitor.
The EtCO2 module can perform mainstream measurements in all monitoring modes and sidestream measurements in the adult and pediatric monitoring modes. For side stream measurements, the capnostat fits on the nasal sampling cannula tubing.

2) EtCO2 Caution

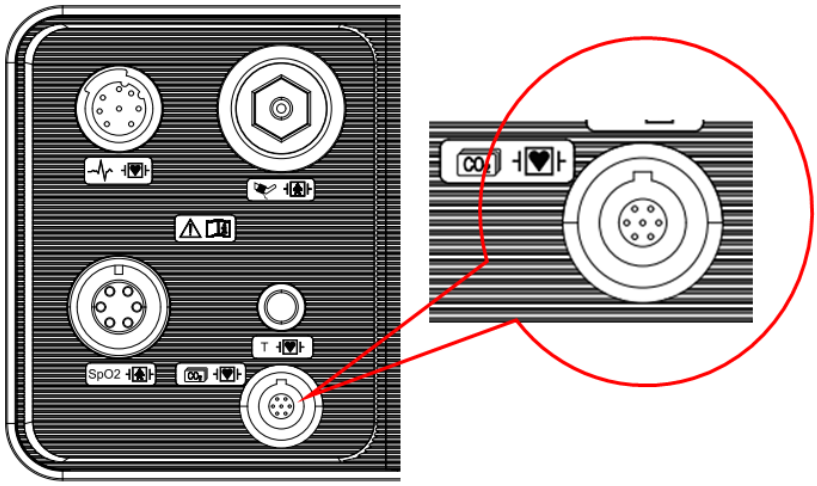
Warning	● **The safety and efficiency of breath measurement methods for apnea detection, especially apnea of premature babies and apnea of infants, have not yet been established.** ● **Patient monitors that measure CO2, anesthetics, and/or respiratory mechanics cannot be used as apnea monitoring and/or recording equipment. While these monitors provide an apnea alarm, the alarm condition begins with the elapsed time from when the last breath was detected. However, there are several physiological indications for the clinical diagnosis of real apnea events.** ● **The CO2 alarm is not activated until the first breath is detected after the patient monitor is turned on or the patient is discharged.** ● **Accuracy of the CO2 and breathing rate measurements may be impaired due to improper attachment of the sensor or due to certain patient conditions and certain environmental conditions.** ● **If the tube connection is faulty, lose or damaged, gas may leak and the accuracy of the measurement may be lowered, resulting in poor breathing. To prevent this, connect all component securely and check the connection according to standard clinical procedures to ensure that there are no leaks.**

Warning	● **Industrial safety: Carefully dispose used sampling tubes and T-connectors as they may cause infection. There is a risk of infection. Dispose of all**

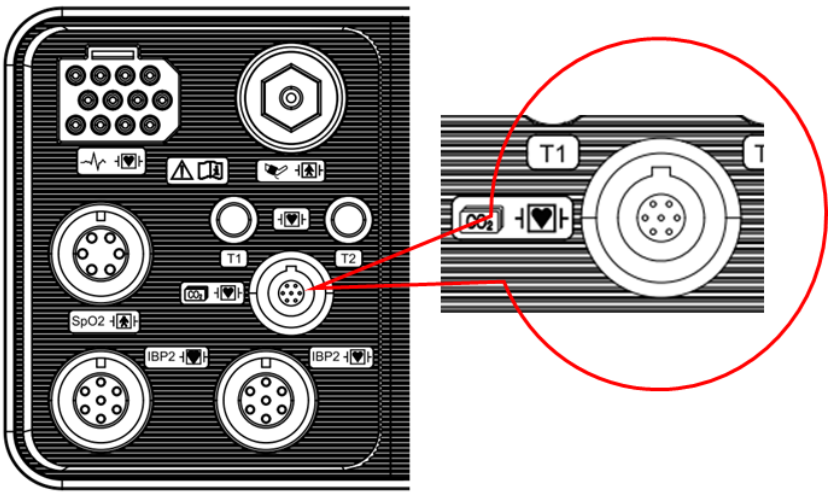
	equipment in accordance with local regulations. ● **Optimize reaction time by minimizing dead space and keeping sample collection tubes as short as possible. Long sampling tubes can lead to poor accuracy and slow response times for side stream measurement techniques.** ● **Do not place the airway adapter between the suction catheter and the endotracheal tube when using the sample collection line as a closed suction device for tuberous patients. This is to ensure that the airway adapter does not interfere with the function of the suction catheter.**

3) Connector and Measurement Accessory

BM3



BM5, BM7



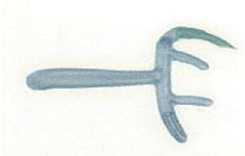
LoFlo Sidestream CO2 sensor and connector

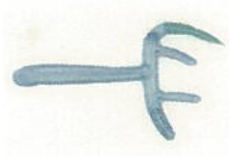
Sidestream sensor

Sidestream sensor connector

Sidestream EtCO2 Accessories

Non-Intubation Sidestream Accessories			
Part	**Picture**	**Description**	**type**
3468ADU-00		Nasal CO2 sampling cannula	Adult
3468PED-00		Nasal CO2 sampling cannula	Child

3468INF-00		Nasal CO2 sampling cannula	Neonate
3470ADU-00		Oral/Nasal CO2 sampling cannula	Adult
3470PED-00		Oral/Nasal CO2 sampling cannula	Child
3469ADU-00		Nasal CO2 sampling cannula w/O2 delivery	Adult
3469PED-00		Nasal CO2 sampling cannula w/O2 delivery	Child
3469INF-00		Nasal CO2 sampling cannula w/O2 delivery	Neonate
3471ADU-00		Oral/Nasal CO2 sampling cannula w/O2 delivery	Adult

3471PED-00		Oral/Nasal CO2 sampling cannula w/O2 delivery	Child

Intubation Accessories			
3473ADU-00		Airway adapter kit w/ dehumidification tubing	Adult /Child (ET tube Size > 4.0 mm)
3473INF-00		Airway adapter kit w/ dehumidification tubing	Child/Neonate (ET tube Size <= 4.0 mm)

CAPNOSTAT 5 Mainstream CO2 sensor and connector

Mainstream Sensor

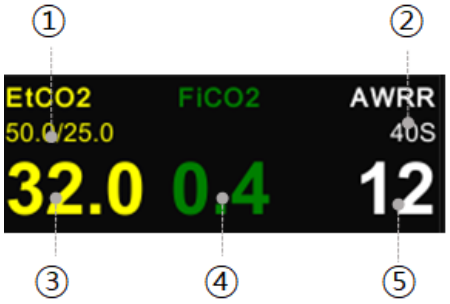
Mainstream Sensor Connector

Mainstream EtCO2 Accessories

Intubation patient airway adaptor		
Model	**Picture**	**Description**
6063-00		Adult/Neonate(disposable)
312-00		Neonate(Disposable)
7007-00		Adult/Neonate (Reusable)
7053-00		Neonate(Reusable)

Warning	**The disposable airway adapters are designed for single use only and cannot be reused. Reuse may cause inaccurate readings, erratic readings, or no readings at all. Also, reuse may cause an increased risk of cross contamination among patients.** **The reusable airway adapters can be reused but to avoid infection, it shall be reused only after sterilized.**

4) Display



① EtCO2 CO2 alarm high/low limit value

② Apnea alarm set time in seconds

③ Display CO2 concentration value at exhalation

④ Display the carbon dioxide concentration value at inhalation

⑤ Show respiratory rate per minute

5) How to Sample

Connecting the CAPNOSTAT® 5 CO2 sensor to the host system

1. Insert the CAPNOSTAT 5 CO2 sensor connector into the receptacle of the host monitor as shown in Figure 1.

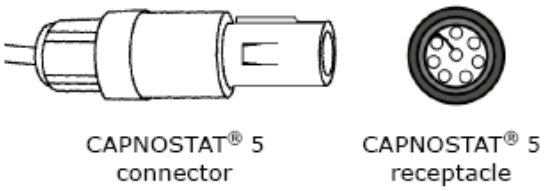


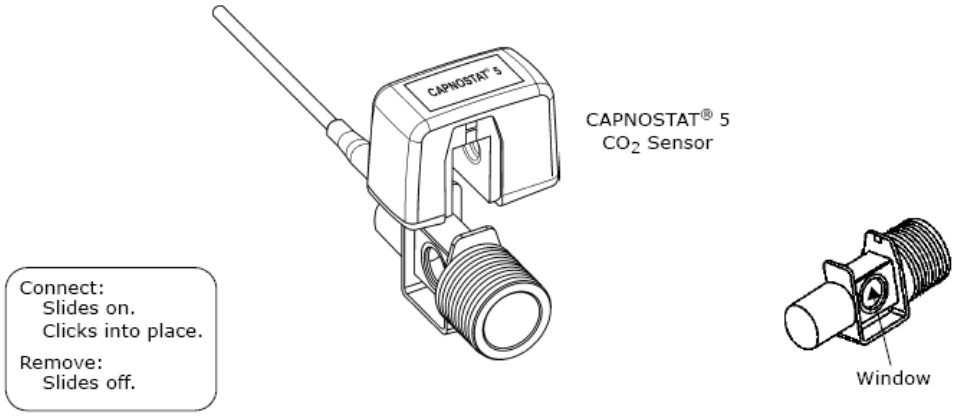
Figure 1

2. Make sure the arrows on the connector are at the top of the connector, and line up the two keys of the connector with the receptacle and insert.
3. To remove the connector, grasp the body portion of the connector back and remove.

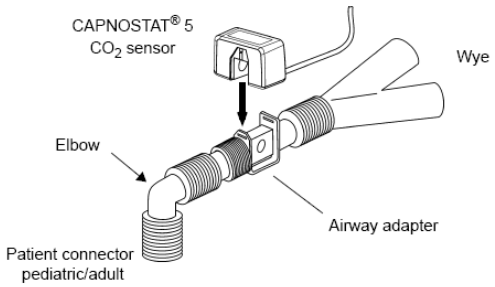
Caution	**Do not remove by pulling cable.**

Connecting the mainstream CO2

1. Connect the CAPNOSTAT 5 CO2 sensor to the Respironics Novametrix CO2 adapter as shown below. The airway adapter clicks into place when seated correctly.



2. Shown below is the CAPNOSTAT 5 CO2 Sensor with a patient circuit



Connecting the sidestream CO2 (LoFlo Sample Kit)

1. The sample cell of the sampling kit must be inserted into the sample cell receptacle of the LoFlo CO2 Module as shown in Figure 1. A "click" is heard when the sample cell is properly inserted.

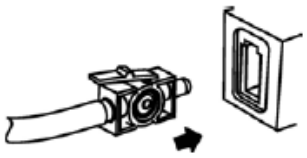


Figure 1

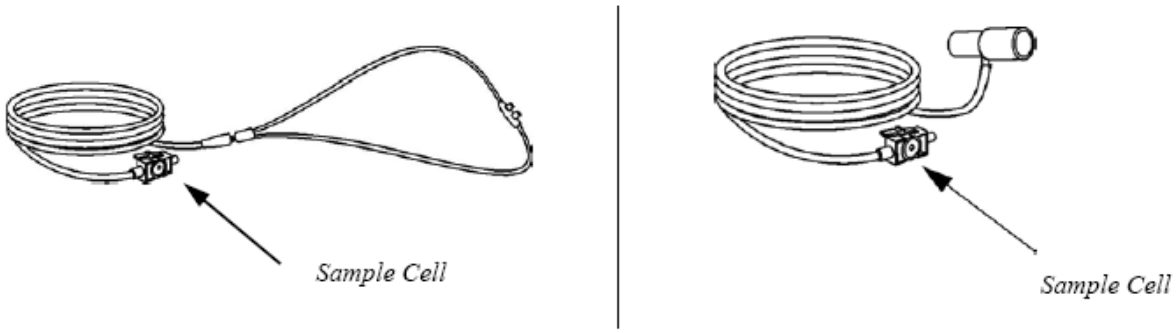


Figure 2

2. Inserting the sample cell into the receptacle automatically starts the sampling pump.
3. Removal of the sample cell turns the sample pump off.
4. To remove the sampling kit sample cell from the sample cell receptacle, press down on the locking tab and pull the sample cell from the sample cell receptacle.

6) EtCO2 Setting Menu

Menu	Description	Available settings
A. EtCO2		
A-1. Alarm	EtCO2 alarm setup menu	
A-1-1. Parameter alarm limit	ETCO2, FICO2, AWRR, APNEA parameter alarm level, action setup	
A-1-2. Technical alarm condition	ETCO2-module off ETCO2-check adaptor ETCO2-check line ETCO2-chekc line disconnect ETCO2-CO2 invalid ETCO2-over range ETCO2-zero required ETCO2-system fault ETCO2-temp unstable	
A-2. Display option	EtCO2 parameter wave display setup	
A-2-1. Sweep speed	Waveform sweep speed setup	6.25mm/s, 12.5mm/s, 25mm/s
A-2-2. Scale	Display waveform scale setup. The selectable value is the maximum pressure range shown in the waveform. When you select a range value, the selected pressure range value is displayed below the dotted line above the two dotted lines in the left middle of the wave window.	40mmHg (5.3 vol%) 50mmHg (6.6 vol%) 60mmHg (7.9 vol%) 80mmHg (10.5 vol%) 100mmHg(13.2vol%) 150mmHg(19.7vol%)
A-2-3. Fill	Choose whether to fill the waveform inside	On / Off
A-2-4. Gas pressure unit	Choose gas pressure unit	mmHg kPa vol%
A-2-5. Use one gas unit	Choose to set the pressure unit for each gas type Unit setting menu by gas type appears when off	On / Off
A-3. Apnea detect	APNEA detection menu	On / Off

A-4. Module information		
A-4-1. Sensor PN	The sensor part number	PNXXXXXX
A-4-2. OEM ID	The id is a 7bit identifier which is set at the factory to a unique value for each OEM.	0X01
A-4-3. sensor SN	The serial number of the module.	
A-4-4. H/W version	The hardware version number of the module.	
A-4-5. Total usage time	Total use time of the module.	
A-4-6. Last zero time	This is the total time that has elapsed with the sensor in service the last zero.	Min. display
A-4-7. Pump total time	This is the total time the pump has been on.(LoFlo only)	Min. display
A-4-8. Pump max time	This value indicates the maximum rated lifetime of the sampling pump. (LoFlo only)	Min. display
A-5. Module setup		
A-5-1. Current period	This setting is used to set the calculation period of the ETCO2 value. The end-tidal CO2 value is the highest peak CO2 value of all end of expirations (end of breaths) over the selected time period. If less than two breaths exist in the selected time period, the value will be the maximum ETCO2 value for the last two breaths.	1 breath, 10 sec, 20 sec
A-5-2. Balance gas	This setup mode to setup the gas in the measurement. the type of gas that is mixed with the breathing gas measuring	Room air N2O Helium
A-5-3. Sleep mode	Sleep mode is used to save power when the host monitor is in standby mode. There are two sleep modes available for the Capnostat. Using Sleep Mode 1 maintains the heaters so the Capnostat is able to run immediately after exiting the sleep mode. Mode 2 will require the Capnostat to go through its warm up	Normal mode Turnoff mode Power saving

	sequence when exiting this mode and a delay will be introduced until the system has stabilized.	
A-5-4. BARO. pressure	This setting is used to set current Barometric Pressure.	760mmHg
A-5-5. Gas temperature	This setting is used to set temperature of the gas mixture. This setting is useful when bench testing using static gasses where the temperature is often room temperature or below.	35.0 °C
A-5-6. O2 compensation	Use this setting to correct for the compensation of the gas mixture administered to the patient.	
A-5-7. Anesthetic agent	Anesthetic agent is ignored when the balance gas is set to helium.	
A-5-8. Zero type	This function is used to initiate a When performing a zero on room air, this setting should be set to room air (the default). Only change to nitrogen (N2) when performing a zero on 100% N2 gas; this is provided for use in a laboratory environment.	Room air N2
B-1. Zeroing	This function is used to initiate a Capnostat zero. A zero is used to correct for differences in airway adapter types. The Capnostat zero must be performed free of any CO2 Set the Host to the zeroing function. Connect the CAPNOSTAT 5 CO2 Sensor Place the CAPNOSTAT 5 CO2 Sensor onto a clean and dry CO2 adapter that is exposed to room air and away from all sources of CO2, including the ventilator, the patient's breath and your own. Start the adapter zero and "ZEROING" will be displayed until the zeroing	

	process is done. The maximum time for a CAPNOSTAT zero is 30seconds. The typical time for a zero is 15~20seconds. During the generation of alarm signals, the CAPNOSTAT 5 CO2 sensor does not automatically zero.	
C-1. Module reset	EtCO2 module initializing.	

Note	**For mainstream CO2, connect the sensor to the adapter and wait 2 minutes before zeroing the adapter.**

7) Status Message

Following is a list of some of the message that may appear on the monitor when monitoring CO2. The message should clear when normal operating criteria are met or a solution is found.

Status Message	Cause	Solution
Sensor over temp	The sensor temperature is greater than 40'C	Make sure sensor is not exposed to extreme heat(heat lamp,etc.)
Sensor faulty	One of the following conditions exist Capnostat Source Current Failure EEPROM Checksum Faulty Hardware Error	Check that the sensor is properly plugged in. Reinsert or reset the sensor if necessary.
Sensor warm up	Sensor under temperature , Temperature not stable, Source Current unstable	This error condition is normal at startup. This error should clear when the warm up is complete.
Check sampling line	This error occurs whenever the pneumatic pressure is outside the expected range.	Check that the sampling line is not occluded or kinked. Replace the sample line
Zero required	Zero Required , Zero Error	To clear, check airway adapter and clean if necessary. If this does not correct the error, perform an adapter zero. If you must adapter zero more than once, a possible hardware error may exist.

Co2 out of range	The value being calculated is greater than the upper CO2 limit(150mmHg)	If error persists, perform a zero.
Check airway adapter	Usually caused when the airway adapter is removed from the Capnostat or when there is an optical blockage on the windows of the airway adapter. May also be caused by failure to perform Capnostat zero to when adapter type is changed.	To clear, clean airway adapter if mucus or moisture is seen. If the adapter is clean, perform a Capnostat zero.
Module off	It occurs when the equipment and module are separated. Message output	Verify module connections Service request

8) CO2 Measurement Failure

CO2 value is not output, or numerical error.

Troubleshoot procedure

1. Check the connection between the main unit and the module.
2. Check the module line connection with the filter line or airway.
3. Replace filter line or airway.
4. Service Request.

Note	**In the following monitoring conditions, the measured values may be inaccurate. Read the measured values carefully.** ● **When using this in an environment of using nitrous oxide gas of high concentration** ● **When using this in an environment where abrupt temperature change takes place** ● **When using this in an environment with severely high humidity.**

Caution	● **The measured values may be inaccurate when using the patient monitor**

	for patients who have very fast or irregular respiration. ● **When measuring CO2 from the patient under the anesthesia, check it when gas mixture comes in. Otherwise, the measured result values may be inaccurate.** ● **When using an anesthesia machine that uses a volatile anesthetic, CO2 values may be inaccurate.**

PART 14. Invasive Blood Pressure (BM5,BM7 only)

1) Overview

It converts the changes in resistance components, which are caused by the changes in the blood flow in the blood vessels, into electrical signals, and measures the minimum, maximum, and average blood pressures through signal processing.

2) Precaution

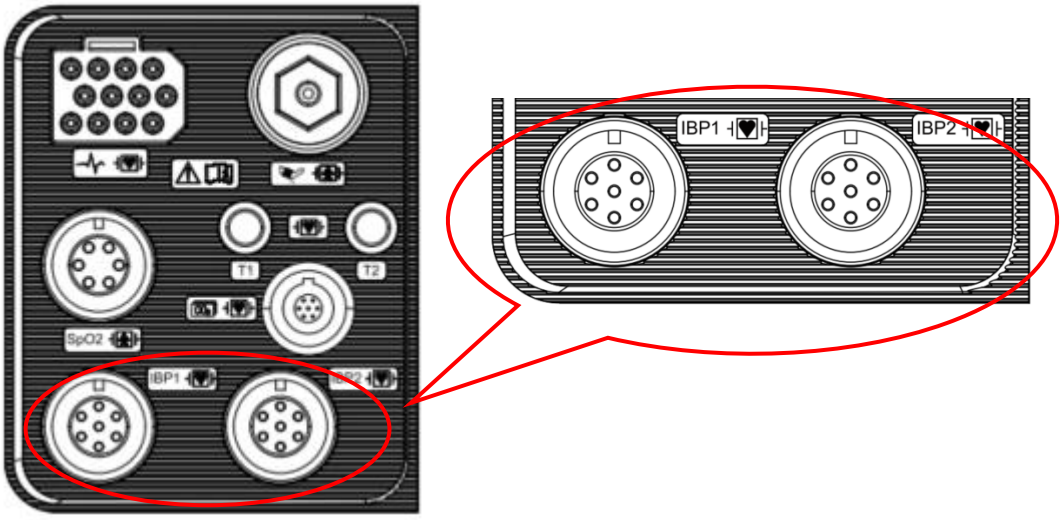
The following precautions apply to IBP procedures. See the hospital's clinical guidelines for details.

Warning	● **All parts, except Transducer, should not be conductive. Otherwise discharge energy may induce a shock to operators during cardioversion.** ● **Single-use accessories are not to be reused.** ● **Use of non-approved transducers may compromise this protection.**

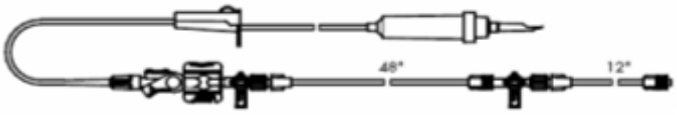
Note	● **Check if there is a scratch on the catheter balloon before using.** ● **Do not reuse disposal parts and accessories.** ● **Do not use saline packs with passed expiration dates.** ● **Do not use the pressure measurement kits in torn packages.** ● **Remove all air in the saline pack by squeezing it. Otherwise, it may cause errors in blood pressure band and may go into the blood vessels.**

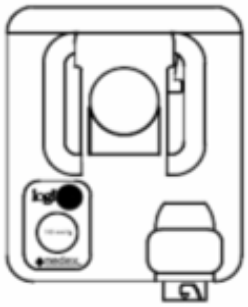
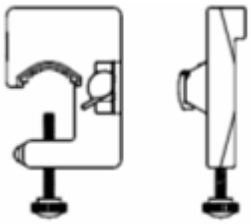
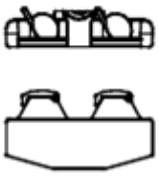
3) Connector and Measurement kit

IBP connector

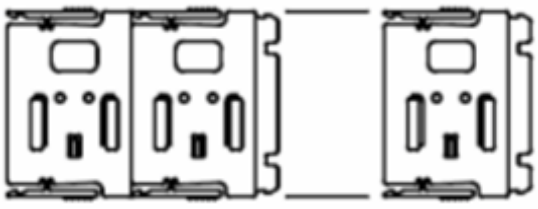


Reusable pressure transducers cartridges and monitoring kit

Model No.	Description
MX9604A	Logical® 60°(152㎝) single monitoring kit
	
MX960	Logical® transducer mounting plate

	
MX261	Logical® clamp for transducer bracket
	
MX262	Logical® braket for two transducer mounting plates
	

Disposable pressure transducers cartridges and monitoring kit

Model No.	Description
MX9504T	TranStar® 60° single line monitoring kit
MX800	Modular transducer mounting plate
	
MX240	Pole clamp for mounting a transducer plate

MX4810	C-fuser® 1000ml Pressure Infusor complete unit with squeeze bulb and pressure gauge

4) Display

① Measuring Position: Position of blood pressure measurement

② Systolic blood pressure: Indicates the maximum blood pressure

③ Diastolic blood pressure: Indicates the minimum blood pressure

④ Pulse rate

⑤ High Alarm Limit: Indicating configured high alarm limit of blood pressure

⑥ Low Alarm Limit: Indicating configured low alarm limit of blood pressure

⑦ Mean Blood Pressure: Indicating mean blood pressure value

5) Procedures

Zeroing

1. Close the transducer stopcock on the patient's side.
2. Open the venting stopcock on the air side.
3. Press the knob switch on the monitor panel.
4. Draw a line with the current input data in IBP area of wave window according to the wave base line. Align the wave line with the data.
5. Set the data as '**0**' on the parameter screen.
6. Check if **Zero referenc**e is carried out. (Check the pressure parameter on the message

window.)

7. Close the venting stopcock on the air side.
8. Open the transducer stopcock on the patient side. The pressure value should be displayed on the pressure parameter screen in a few seconds.

Disconnected alarm

Disconn alarm menu will be displayed when measurement label is set for ART, FEM and UAP.

This function will be activated upon the following two conditions.

1. In case **Mean pressure** is not higher than 25mmHg.
2. In case the **Disconnect alarm** is set '**ON'**.

Medium alarming sound will be generated when the **Dissconnected alarm** is activated, and the alarming message "**Dissconnected**" will be displayed on the parameter screen.

CAL. TRANSDUC:

A function to adjust a Transducer error on the monitor.

A function to adjust an error value based on the other index manometer.

How to Adjust

1. Select a menu by pressing the knob switch key.
2. Measure blood pressure along with another index manometer.
3. Compare the measured values of 'mmHg' for both manometers.
4. Adjust the error value on the parameter menu screen by turning knob switch.
5. Terminate the menu by pressing the knob switch key again.

6) List & Description of IBP Measurement Parameter Label

Parameter window, Scales menu window or Alarm limits pop-up menu appears according to the Labels.

IBP displays the measuring positions based on 10 labels shown in the below table.

Select "User Defined" for a measuring position not in the listed positions.

Parameter Window

Select '**Other**' for a measuring position not in the listed positions.

Label	Description	Display Value
ART	Arterial blood pressure(alternative)	systolic, diastolic, and mean
FEM	Femoral pressure	systolic, diastolic, and mean
PAP	Pulmonary artery pressure	systolic, diastolic, and mean
CVP	Central venous pressure	mean
LAP	Left atrial pressure	mean
RAP	Right atrial pressure	mean
ICP	Intracranial pressure	mean
OTHER	Other (BP1,BP2)	mean
UAP	Umbilical arterial pressure	systolic, diastolic, and mean
UVP	Umbilical venous pressure	mean

The table below shows the default waveform size settings by label.

Parameter	Adult			Neonatal		
	Low	High	Scale	Low	High	Scale
ART-S	70	150	160	40	100	100
ART-D	40	100		20	50	
ART-M	50	115		30	70	
ART-PR	50	150		50	170	
FEM-S	70	150	160	40	100	100
FEM-D	40	100		20	50	
FEM-M	50	115		30	70	
FEM-PR	50	150		50	170	
UAP-S	70	150	160	40	100	100
UAP-D	40	100		20	50	
UAP-M	50	115		30	70	
UAP-PR	50	150		50	170	
PAP-S	20	50	60	40	100	60
PAP-D	5	30		20	50	
PAP-M	10	40		30	70	

PAP-PR	50	150		50	170	
CVP-S	0	300	30	0	300	30
CVP-D	3	15		3	15	
CVP-M	0	300		0	300	
CVP-PR	50	150		50	170	
RAP-S	0	300	30	0	300	30
RAP-D	3	15		3	15	
RAP-M	0	300		0	300	
RAP-PR	50	150		50	170	
LAP-S	0	300	30	0	300	30
LAP-D	3	15		3	15	
LAP-M	0	300		0	300	
LAP-PR	50	150		50	170	
UVP-S	0	300	30	0	300	30
UVP-D	3	15		3	15	
UVP-M	0	300		0	300	
UVP-PR	50	150		50	170	
ICP-S	0	300	30	0	300	30
ICP-D	3	15		3	15	
ICP-M	0	300		0	300	
ICP-PR	50	150		50	170	
BP1(BP2)-S	0	300	30	0	300	30
BP1(BP2)-D	3	15		3	15	
BP1(BP2)-M	0	300		0	300	
BP1(BP2)-PR	50	150		50	170	

7) IBP Setting Menu

Menu	Description	Available Settings
A. IBP menu		
A-1. Alarm	IBP alarm settings menu	
A-1-1. Parameter alarm limit	IBP-SYS, MEAN, DIA, PR parameter alarm , level , activate setup	
A-1-2. Technical alarm condition	IBP-cableoff IBP-disconnect	
A-2. BP filter	Menu to set the filter to be applied when measuring OFF: 0Hz ~ 40Hz	12Hz 20Hz OFF

	12Hz: 0Hz ~ 12Hz Generally recommended for monitoring 20Hz 0Hz ~ 20Hz It is used to process higher frequency waveform components, and when this filter is used, the pressure value can rise.	
A-3. Display option	IBP waveform display setting	
A-3-1. Sweep speed		6.25mm/s, 12.5mm/s, 25mm/s, 50mm/s
A-3-2. IBP label	Menu to set measuring position ART, FEM, PAP, RAP, LAP, UAP, UVP, CVP, ICP, USERDEFINED	
A-3-3. Scale	Menu to set size of measurement waveform on screen.	
A-3-4. Pulse rate	Menu to set display of blood pressure pulse	
B-1. Zeroing	Menu to set zero-point of transducer. If zero adjustment is not performed, "**IMBALANCE**" message is displayed in the waveform window.	

8) Troubleshooting

Trouble shooting for a case that blood pressure value is not displayed on screen

Description	Action to Take
In case of '**out of measurement range**' situation	Check the measurement conditions.
In case blood pressure transducer is damaged	Replace the damaged transducer with new one

Trouble shooting for a case the measured value is different from the expected value

Description	Action to Take

In case there are air bubbles in tubes	Remove the air bubbles
In case an extension tube is connected	Remove the extension tube
In case of using blood pressure transducer with a different sensitivity	Check position of transducer
For other cases	Perform zero-point adjustment

PART 15. Printer

1) Overview

The printer mounted outside the monitor prints the observed results including trend and alarm data. Recording can be on-time or continuous and it is printed at the speed of 25mm/s. Recordings are identified by the patient's name, ID as well as the date and time of the recording request. The monitor can automatically trigger alarm recordings for life-threatening alarms and limit violations if the Record function is enabled on the alarm limits table.

The thermal paper is used for printing. The size of the thermal paper roll is 58mm wide and 38mm in diameter. Any thermal paper of same dimension can be used with the printer.

Caution	**Due to the nature of thermal paper, heat is generated under continuous operation. It is recommended to let the printer cool down for 10 minutes after every five minutes of printing.**

2) Printer Setting Menu

Menu	Description	Available settings
A. Print Setup menu		
A-1. Printer setup		
A-1-1. Use of printer	Printer activation	ON / OFF
A-1-2. Printer speed	Printer speed select	25 mm/s 50 mm/s
A-1-3. Waveform1	Channel 1 waveform select	OFF, SPO2, RESP, ETCO2, LEAD I, LEAD II, LEAD III, aVR, aVL, aVF, V, IBP1 [1], IBP2 [1],
A-1-4. Waveform2	Channel 2 waveform select	
A-1-5. Waveform3	Channel 3 waveform select	
A-1-6. Print key	In the PRINTER Key menu, press the printer key to set the output point as shown below REAL TIME: Prints the data from the point where the PRINTER key was	Real time Delay (5sec)

	pressed. DELAY: Prints data before 5seconds when PRINTER key is pressed	
A-1-7. Printing period	Set the time for printing the printout on normal printout. If you do not stop manually after pressing the PRINTER KEY, the output will be output only for the following period of time.	Continue, 10sec, 20sec, 30sec

[1] : BM5, BM7 only

Note	**The waveforms of IBP1 [1], IBP2 [1], and ETCO2 on paper look different from the waveforms on screen. This is because the waveforms on paper can be scaled while the waveforms on screen cannot.**

[1] : BM5, BM7 only

3) Storage theThermal Paper

To avoid print quality degradation or attenuation of printouts, follow these precautions.

Note	**These precautions apply to both unused paper as well as paper that has already ran through the printer.**

- Store the paper in cool, dark locations. Temperature must be below 27°C (80°F). Relative humidity must be between 40% and 65%.
- Avoid exposure to bright light or ultraviolet sources such as sunlight, fluorescent, and similar lighting which causes yellowing of paper and fading of tracings.
- AVOID CONTACT WITH: cleaning fluids and solvents such as alcohols, ketones, esters, ether, etc.
- DO NOT STORE THERMAL PAPER WITH ANY OF THE FOLLOWING:
  - ✓ Carbon and carbonless forms.
  - ✓ Non-thermal chart papers or any other products containing tributyl phosphate, dibutyl phthalate, or any other organic solvents. Many medical and industrial charts contain

these chemicals.

- ✓ Document protectors, envelopes, and sheet separators containing polyvinyl chloride or other vinyl chlorides

- DO NOT USE: mounting forms, pressure-sensitive tapes or labels containing solvent-based adhesives.

To assure maximum trace image life, thermal paper should be stored separately in: manilla folders, polyester, or polyimide protectors

Plastic document protectors, envelopes, or sheet separators made of polystyrene, polypropylene, or polyethylene does not degrade thermal traces in themselves. However, these materials do not protect against fading from external causes.

Paper manufacturers advise us that these thermal products should retain their traces when properly imaged and stored for about 3-5 years.

If your retention requirements exceed these guidelines, we recommend you consider alternate image storage techniques.

4) Changing the Paper

1. Open the printer window.
2. Insert the paper roll offered with the monitor into the printing unit. Place the roll in a proper way so that the printed paper can roll out upwards.
3. Press the printer window until it is properly shut. Improper closure may cause failure in printing.

PART 16. Maintenance and Troubleshooting

1) Maintenance Safety Information

Warning	**Modifications to the patient monitor are not permitted.**

Caution	● **To avoid electric shock, if the housing is damaged, stop using the patient monitor and contact your service representative.** ● **If the responsible individual hospital or institution neglects to follow the recommended maintenance schedule in the use of the patient monitor, excessive equipment failure and health risks.** ● **The patient monitor contains no user serviceable parts.** ● **Safety checks or maintenance related to disassembling the patient monitor must be performed by qualified service representative. Failure to do so may result in excessive monitor failure or hazards to operators.** ● **Service representative should possess a working knowledge of the test tools and make sure that test equipment and cables are applicable.** ● **The battery and AC cords must be removed for repair.**

2) Equipment Inspection

You should perform a visual Inspection before every use, and in accordance with your hospital's policy with the monitor switched off:

- Examine unit exteriors for cleanliness and general physical condition. Make sure the housings are not cracked or broken, everything is present, there are no spilled liquids, and there are no sign of abuse.
- If the EtCO2 and Multi-gas module are mounted on the monitor, make sure that they are locked into place and do not slide out without releasing the locking mechanism.
- Inspect all accessories (cables, transducers, sensors and etc.). If any show signs of damage, do not use.
- Switch the monitor on and make sure the backlight is bright enough. Check that screen is at its full brightness. If the brightness is not adequate, contact your service representative or your supplier.

Warning	**Using the patient monitor adjacent to or stacked with other devices should be avoided because it could result in improper operation. If such use is necessary, the patient monitor and the other devices should be observed to verify that they are operating normally.**

3) Cables Inspection

- Examine all system cables, the power plug for damage. Make sure that the prongs of the plug do not move in the adaptor. If damaged, replace it with an appropriate Bionet power cord and adaptor.
- Inspect the parameter cables and ensure that they make good connection with the monitor. Make sure that there are no breaks in the insulation.
- Apply the transducer or electrodes to the patient with the monitor switched on, and flex the patient cables near each end to make sure that there are no intermittent faults.

Warning	**To avoid contaminating or infecting personnel, the environment or other equipment, make sure to disinfect and decontaminate the patient monitor**

	appropriately before disposing of it in accordance with your country's laws for equipment containing electrical and electronic parts. For disposal of parts and accessories such as thermometers, where not otherwise specified, follow local regulations regarding disposal of hospital waste.

4) Maintenance Task and Test Schedule

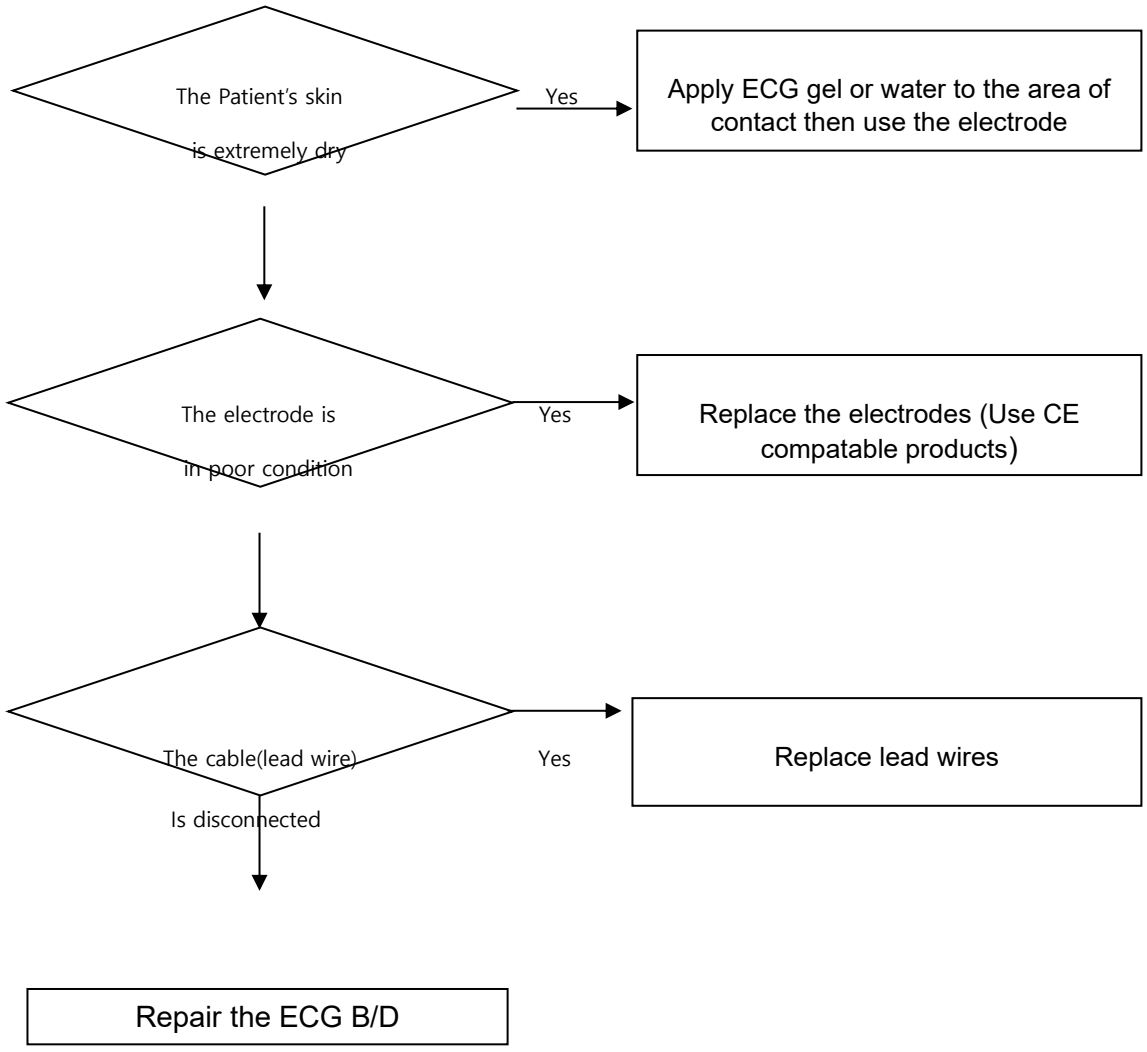
All maintenance tasks and performance tests are documented in detail in the service document.

Maintenance and test schedule	Frequency
Monitor tests	
Safety checks. Selected tests on the basis of IEC 60601-1	At least once every two years, or as needed, after any repairs where the power supply is removed or replaced, or if the monitor has been dropped
Monitor maintenance	
Check ECG synchronization of the monitor and defibrillator (only if hospital protocol requires use of monitor during defibrillation)	At least once every two years, or as needed.
Backlight replacement (integrated displays only).	35,000 - 40,000 hours (about four years) of continuous usage, or as needed.
Parameter module tests	
Performance assurance for all measurements not listed below.	At least once every two years, or if you suspect the measurement values are incorrect.
Parameter module maintenance	
NIBP calibration	At least once every two years, or as specified by local laws.
Mainstream and sidestream CO2 calibration check	At least once a year, or if you suspect the measurement values are incorrect.
Battery maintenance	
Battery	See the section on Maintaining Batteries in PART 1.

5) Troubleshooting

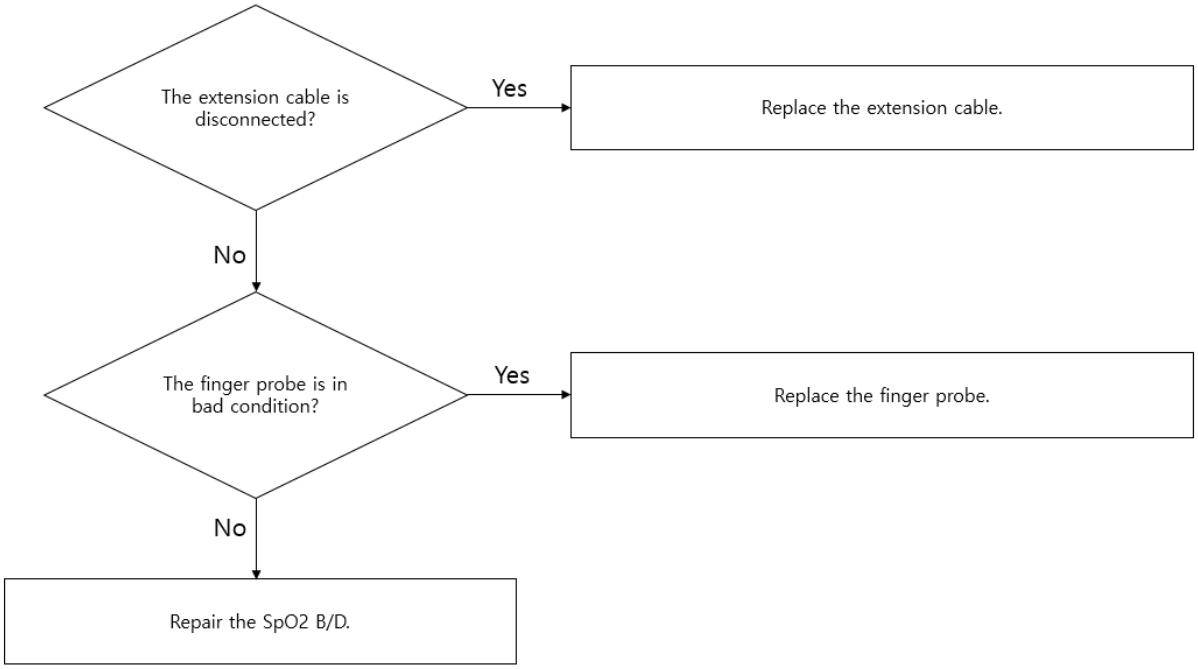
Noise in ECG

Check that the filter settings are appropriate.
Check whether the electrode is attached well.
Check if the gel on the electrode is dry



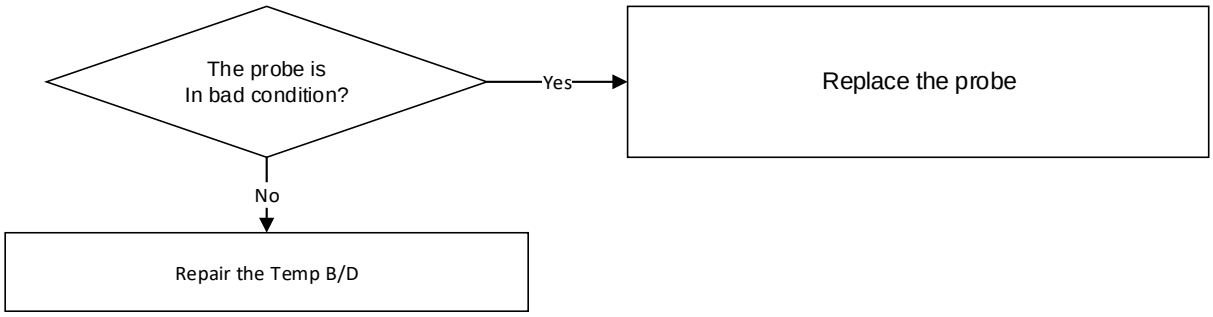
SpO2 malfunction

Connectors of the equipment's are in bad condition?



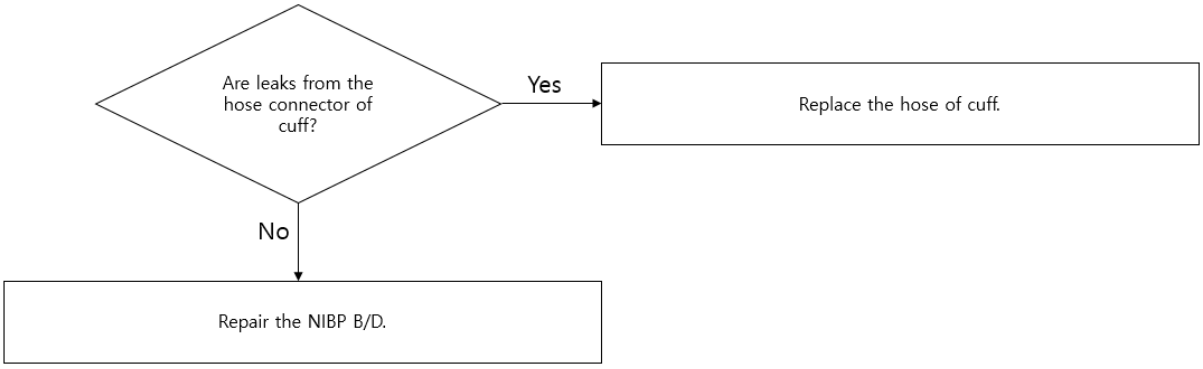
Temperature malfunction

If the temperature cannot be measured, check the connection with the equipment

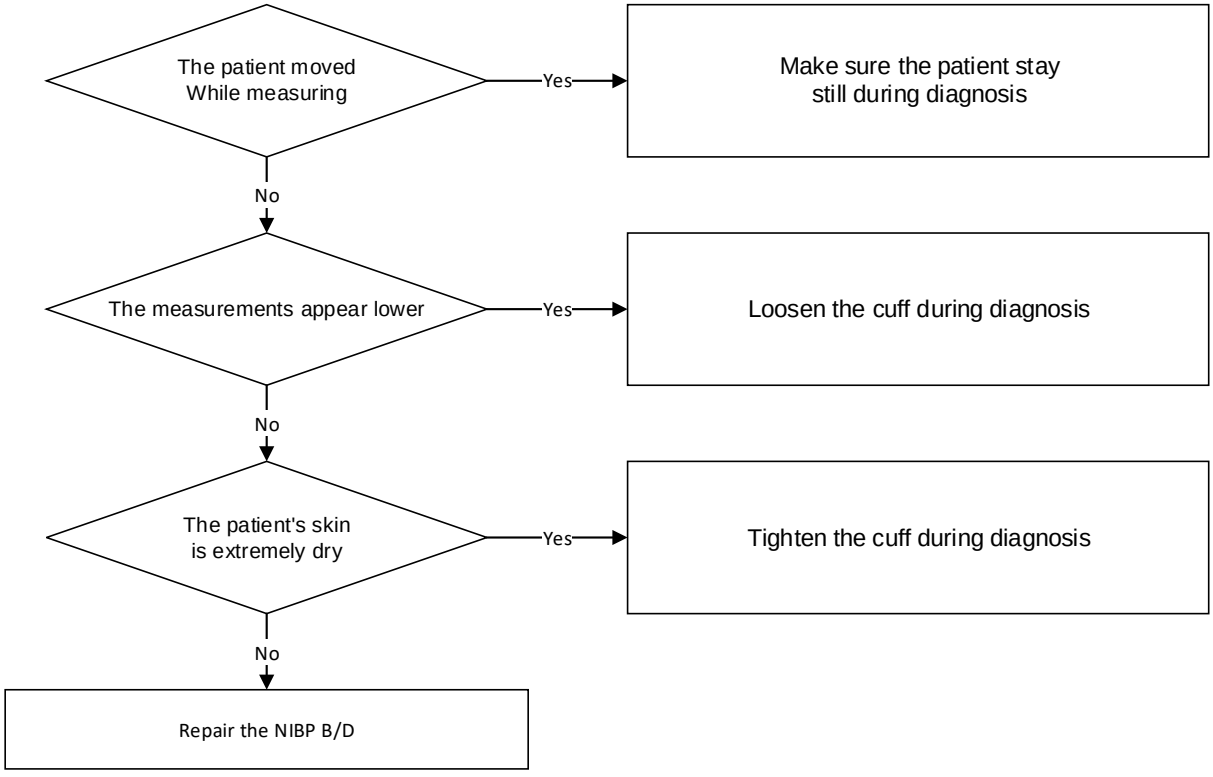


NIBP malfunction

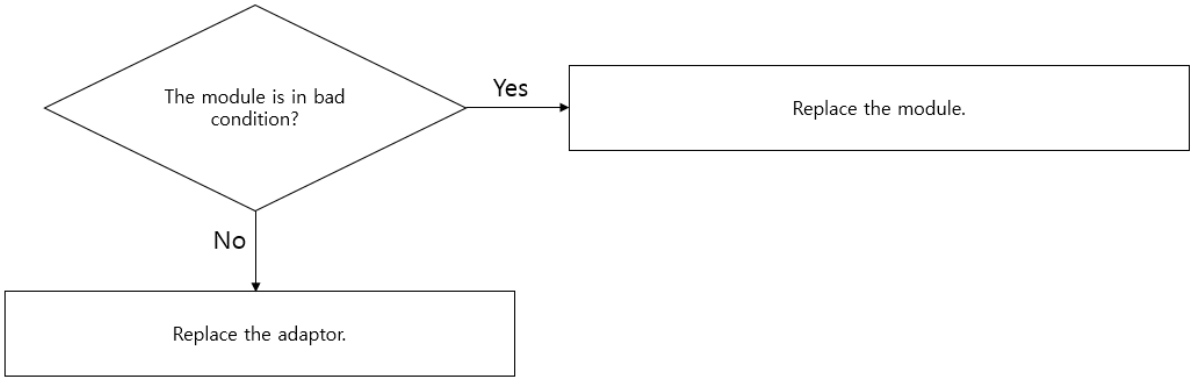
Connector connection status, confirmation that the hose is normally connected



Abnormality in NIBP measurements

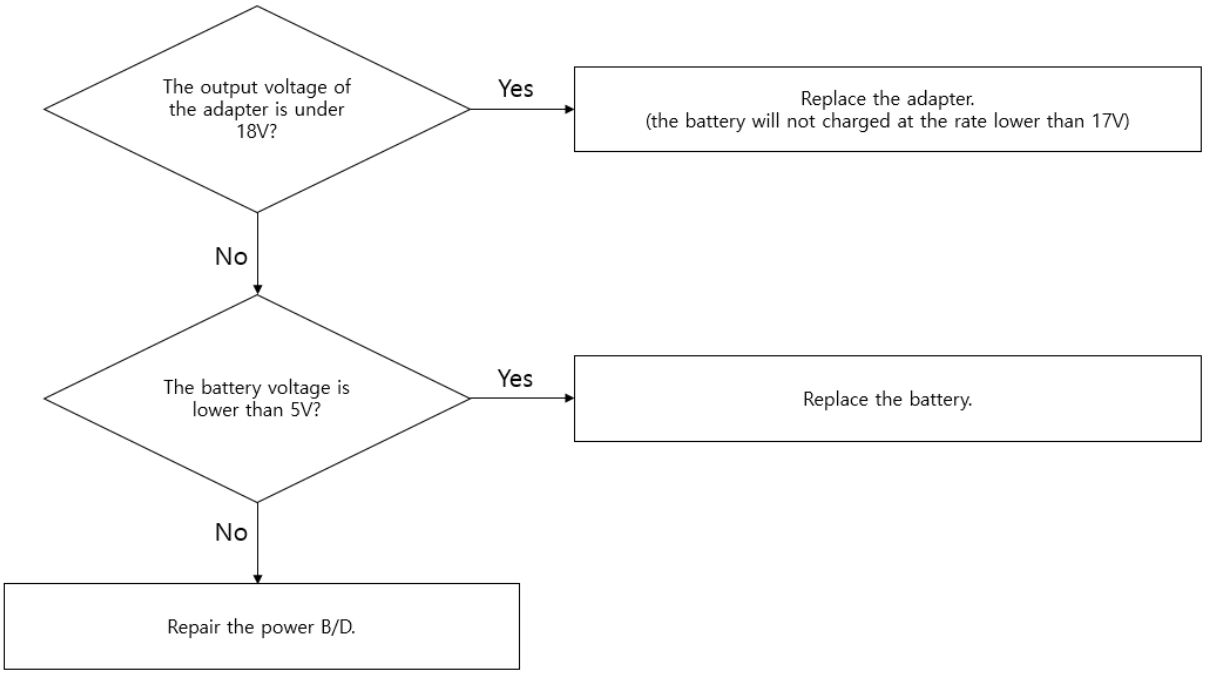


EtCO2 malfunction

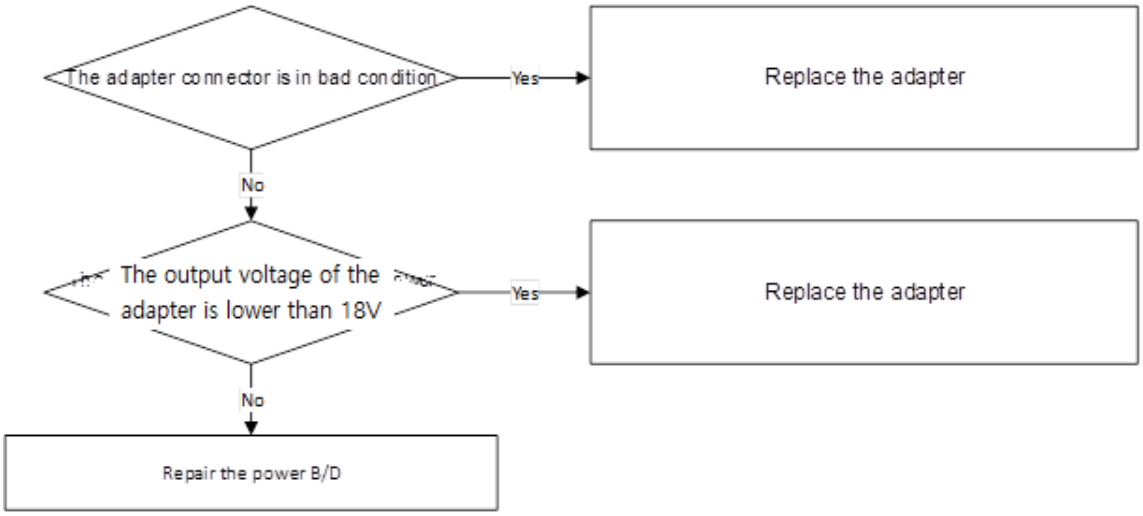


Failure in battery recharge

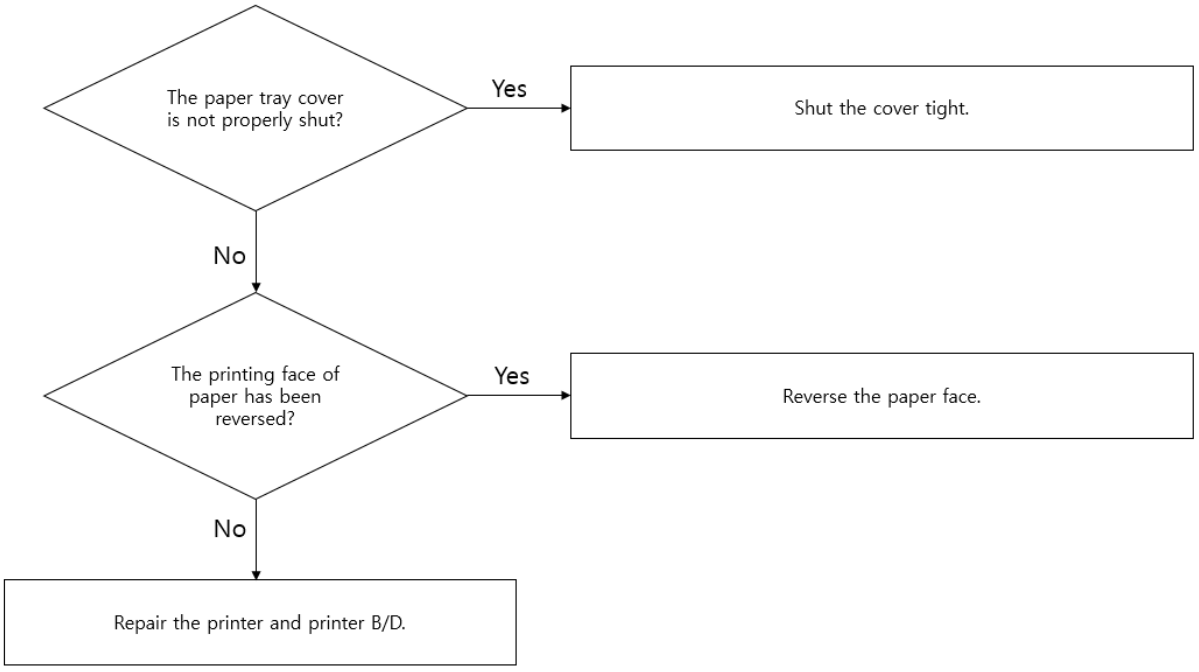
(the battery does not fully recharge in 6 hours or more)



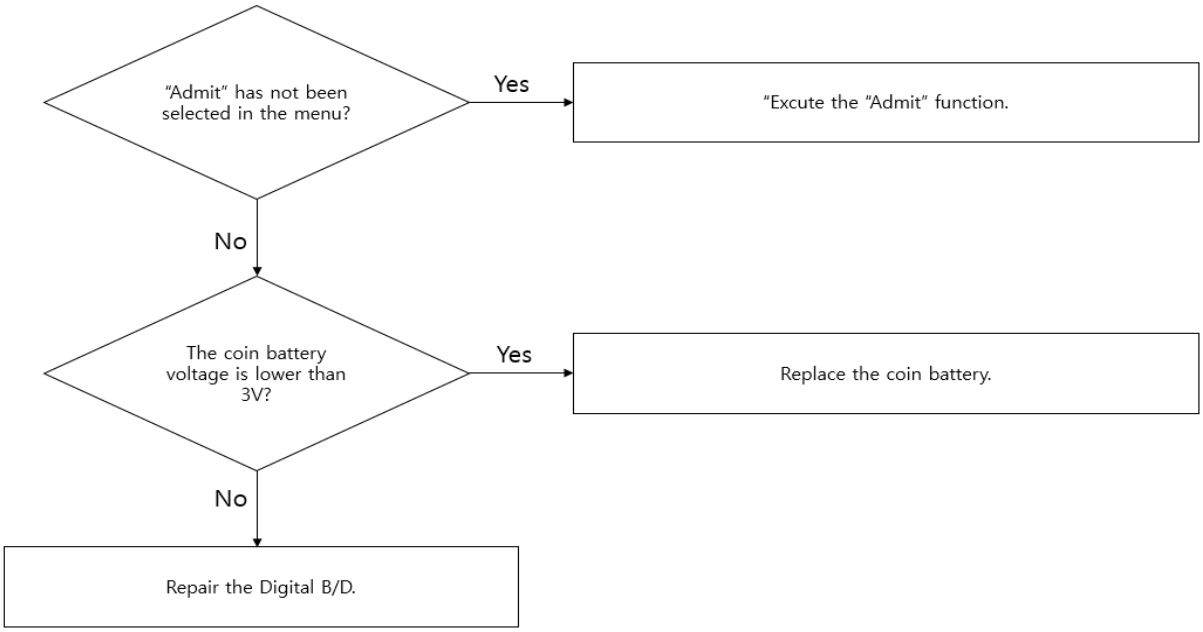
Power failure



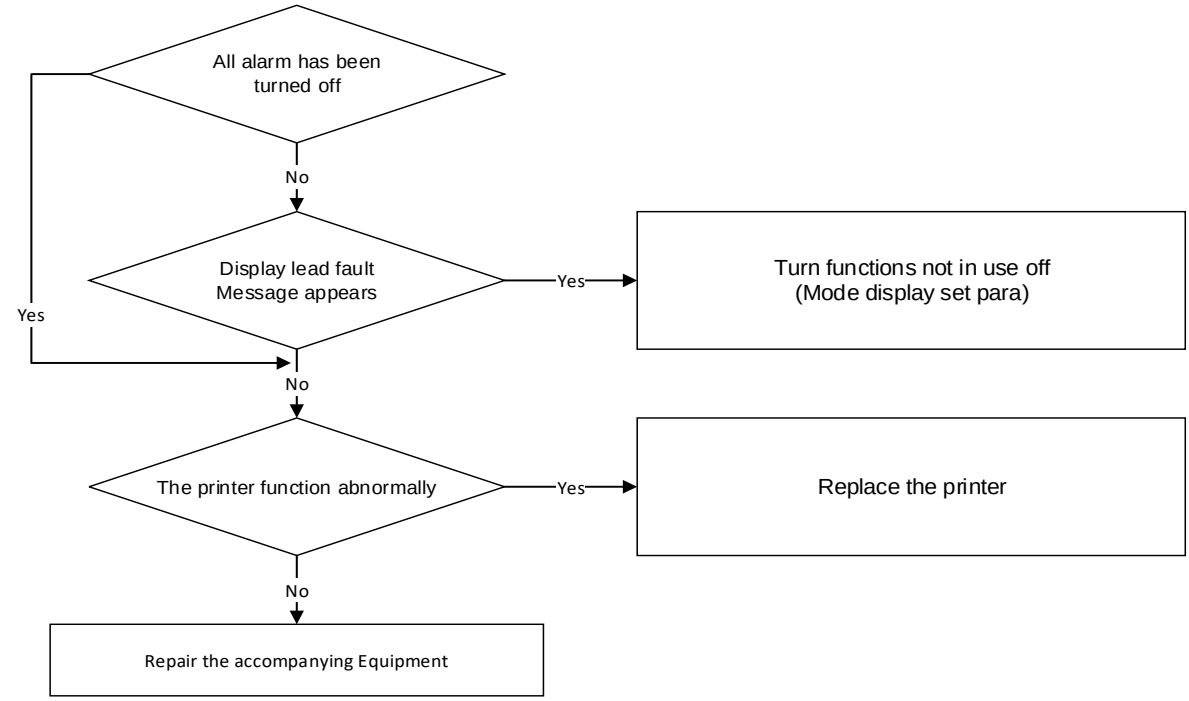
Print failure



Data storage failure



Periodic Noises



Cyber security issues

1. If equipment is stolen or lost, immediately report it to the hospital staff or manufacturer. When reported of a loss, the hospital network administrator must take measures to prevent the device from accessing hospital network.
2. If a cyber security threat is detected while using the equipment, immediately disconnect it from the network and contact the hospital staff or manufacturer.

※ For manufacturer contact information, please refer to the table of contents of How to contact us.

Storage lifetime issues

If the storage is nearing the end of its life, the following warning message appears when booting the monitor or admitting the patient.

If the warning message appears, contact the customer center or the purchasing agent to check the monitor.

The storage has expired. Contact the customer center or the store where you purchased the product and inspect the equipment

PART 17. Cleaning and Care

1) Overview

Clean the monitor and accessories daily or after each patient use according to your hospital's standard protocol or procedures below.

Bionet does not claim the right to the following chemical efficacy, disinfectant method, the ability of the drug to inhibit bacterial infection, environmental impact, safe handling or precautions related to use. For more information on these topics, see the information provided by the detergent manufacturer.

2) Monitor and Accessories

Moisture can damage the monitor and accessories. (For example, around connectors or EtCO2 modules).

Please read the following instructions carefully before cleaning the monitor or accessories.

- Do not spray detergent on the monitor or peripheral devices. Wipe it off with a damp cloth.
- Disinfect the surface with diluted alcohol gauze.
- Dry thoroughly with a lint-free cloth.

Caution	• **Do not wet or rinse the patient monitor and accessories. Disconnect the monitor from the power source if you accidentally spilled liquid on it. Contact your technician for stability before operating the patient monitor.** • **To prevent damage to the patient monitor, do not use sharp tools or abrasives. Never leave the electrical connector soaked in water or other liquids. When cleaning, be careful not to let the liquid stick to the edge of the screen.**

All Patient Cables

- Clean the patient cables with a gauze pad moistened with a soap solution.
- To disinfect patient cables, wipe the cables with a gauze moistened with diluted alcohol or a glutaraldehyde-based disinfectant.
- Ethylene oxide is suitable for intensive disinfection (almost sterilization), but it shows that the service life of cables and lead wires is reduced.
- Dry thoroughly with a lint-free cloth.

Caution	• **Do not use disinfectants that contain phenol as they can spot plastics. Do not autoclave or clean the accessories with strong aromatic, chlorinated, ketone, ether, or ester solvents. Never have the electrical connectors soaked.** • **When cleaning, do not apply excessive pressure or bend the cable unnecessarily. Excessive pressure can damage the cables.**

Reusable ECG Electrodes

Clean the electrode cup regularly with a toothbrush. When removing gel-like residues, use a soft brush with flowing water. Wipe the electrode with a soapy cloth moistened with soapy water.

- Sterilize the electrodes by soaking the diluted alcohol in cloth.
- Dry thoroughly with a lint-free cloth.

Reusable SpO2 sensor

Use clean SpO2 sensor by wiping it with soapy water gauze. Disinfect the sensor by wiping with 70% alcohol solution. Allow the sensor to dry completely with a lint-free cloth before applying to the patient.

Reusable Temperature Probe and Cables

Do not use excessive pressure or flex the cables as this can stretch the covering and break the internal wires.

- Clean the Probe with a 3% hydrogen peroxide or 70% alcohol.
- Quickly soak the cables in a detergent solution.
- Make sure the tip of the probe is firmly connected.

Capnostat Sensor

Wipe the sensor surface and sensor window with a damp cloth. Do not attempt to wet the sensor or disinfect it with hot water Allow to dry completely with a lint-free cloth. Make sure the sensor window is clean and dry before use.

IBP Transducer (BM5, BM7 only)

Handle transducers and other pressure accessories with care. Do not apply excessive pressure to the conversion board. Do not expose the transducer to water, steam, dry heat sterilization, ether, chloroform, or other similar chemicals. Always protect the connector from water.

Warning	**Never boil or autoclave the cables. Vinyl withstands temperatures up to 100°C but begins to soften at around 90°C. Handle gently when hot and wipe away from the tip toward the cables.**

Caution	**Decisions on disinfection should be made by your organization in accordance with the integrity of the wires or lead wires.**

Note	**The equipment should be inspected regularly once a year. For inspection items, refer to the user manual or service manual.**

Carefully inspect the monitor and sensor after cleaning the monitor. Do not use damaged or old monitor.

Clean the exterior of the monitor at least once a month using a soft cloth moistened with lukewarm water or alcohol. Do not use lacquer, thinners, ethylene, or oxidizers that could damage the monitor.

Make sure that the cables and accessories are free from dust and dirt. Then wipe them with a soft cloth moistened with 40 ° C water. Please wipe it with clinical alcohol at least once a week.

Do not soak the accessories in liquid or detergent. Also. prevent any fluid from seeping into the monitor or probe.

Caution	• **Do not dispose of the disposable probe in a potentially hazardous area.** • **Always be careful about environmental pollution.**

Caution	**There is a backup battery inside the system.** **When disposing of the battery, dispose of it in an appropriate place to protect the environment.**

Warning	**When replacing the backup battery, check the battery electrode.**

If you suspect the installation or disposition of the external ground wire, operate the monitor by means of the internal power supply.

If the monitor is not used for a certain period, remove the backup battery to avoid any safety hazard.

PART 18. Technical Specifications

1) Overview

The patient monitor is not user installable. Qualified service representative must install it.

The patient monitor is intended to be used for monitoring, recording, and alarming of multiple physiological parameters of adults, pediatrics, and neonates in health care facilities. The monitor is to be used by trained health care professionals.

The patient monitor is intended for use in health care facilities. the BM series Monitor is additionally intended for use in transport situations within the hospital setting.

2) EMC Compatibility (EMC)

Much of the information below has been borrowed from the requirements set forth in the Electromagnetic Compatibility Standard IEC 60601-1-2 for medical electrical equipment issued by the International Electro technical Commission and is available from a variety of sources. Although primarily aimed at equipment manufacturers, most of the information contained here is useful for users interested in medical equipment.

The information contained in this section (such as separation distance) are general information about the Bionet's patient monitor. The numbers provided here are not guaranteed but are provided with reasonable assurance of error-free operation. This information may not apply to other medical and electrical systems, and older equipment may be particularly susceptible to interference.

Note	**Medical electrical equipment requires special precautions for electromagnetic compatibility and must be installed and serviced in accordance with the EMC information in this section and in the operating instructions supplied with the patient monitor.** **Portable and mobile RF communication equipment can affect medical electrical equipment.** **Cables and accessories not specified in this manual are not certified. Using other cables and / or accessories may adversely affect safety, performance, and electromagnetic compatibility (increased electromagnetic emissions and reduced immunity).**

- **Use of this patient monitor adjacent to or stacked with other devices should be avoided because it could result in improper operation. If such use is necessary, this monitor and the other equipment should be observed to verify that they are operating normally.**

- **The patient monitor communicates over a 2.4 GHz 802.11b / g wireless network. Other equipment may interfere with data reception on this wireless network. This is also true if the equipment complies with the CISPR emission requirements. When using the patient monitor to communicate over a wireless network, be sure to check that it is compatible with existing or new wireless systems (e.g., cell phones, pager systems, cordless phones, etc.). For example, a Bluetooth-compliant device using the 2.4 GHz frequency band may interfere with the wireless communication of the patient monitor. For more information on wireless deployment, please contact your Bionet representative.**

- **Low amplitude signals such as EEG and ECG are particularly sensitive to interference from electromagnetic energy. This equipment complies with the tests listed at the bottom, but does not guarantee complete operation. The "quiet" electrical environment is better. In general, the greater the distance between electrical equipment, the lower the likelihood of interference.**

3) Manufacturer's Declaration - Electromagnetic Emission

The BM3, BM5, BM7 system are intended for use in the electromagnetic environment specified below. The customer or the user of the BM3, BM5, BM7 system must ensure that it is used in such as environment.		
Emission test	**Compliance**	**Electromagnetic environment - guidance**
Mains terminal disturbance voltage CISPR 11	GROUP1, CLASS A	The EMISSIONS characteristics of the BM3, BM5, BM7 make it suitable for use in industrial areas and hospitals (CISPR 11 class

RADIATED DISTURBANCE CISPR 11	GROUP1, CLASS A	A). If it is used in a residential environment (for which CISPR 11 class B is normally required) The BM3, BM5, BM7 might not offer adequate protection to radio-frequency communication services. The user might need to take mitigation measures, such as relocating or re-orienting the equipment.
Harmonic Current Emission IEC 61000-3-2	CLASS A	The BM3,BM5,BM7 are suitable for use in all establishments other than domestic, and may be used in domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Voltage change, Voltage fluctuations and Flicker Emission IEC 61000-3-3	Pst : 1 Plt : 0.65 Tmax : 0.5 dmax : 4% DC : 3.3%	

4) Manufacturer's Declaration - Electromagnetic Immunity

The BM3, BM5, BM7 system are designed for use in the electromagnetic environment specified below. The customer or the user of the BM3, BM5, BM7 system must ensure that it is used in such an environment.			
Immunity test	**IEC 60601 Test level**	**Compliance level**	**Electromagnetic Environment - guidance**
Electrostatic Discharge Immunity (ESD) IEC 61000-4-2	±8 kV/Contact ±2, ±4, ±8, ±15 kV/Air	±8 kV/Contact ±2, ±4, ±8, ±15 kV/Air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.

Radiated RF Electromagnetic Field Immunity IEC 61000-4-3	3 V/m 80 MHz - 2.7 GHz 80% AM at 1 kHz	3 V/m 80 MHz - 2.7 GHz 80% AM at 1 kHz	BM3, BM5, BM7 are suitable to use in professional healthcare environment. RF communication equipment is used no closer than 30 cm to any part of the BM3, BM5, BM7, including cables specified by Bionet
Immunity to Proximity Fields from RF wireless Communication s Equipment IEC 61000-4-3	28 V/m Max. 385-5785 MHz in according to table 9 in IEC 60601-1-2	28 V/m Max. 385-5785 MHz in according to table 9 in IEC 60601-1-2	Mains power quality should be that of a typical commercial or hospital environment.
Electrical Fast Transient/Burst Immunity IEC 61000-4-4	±2 kV, 100 kHz repetition frequency	±2 kV, 100 kHz repetition frequency	The quality of supplied power should be suitable for general business site or hospital environment.
Surge Immunity IEC 61000-45	Line to Line ±0.5 kV, ±1 kV Line to Ground ±0.5 kV, ±1 kV, ±2 kV	Line to Line ±0.5 kV, ±1 kV Line to Ground ±0.5 kV, ±1 kV, ±2 kV	The quality of supplied power should be suitable for general business site or hospital environment.

Immunity to Conducted Disturbances Induced by RF fields IEC 61000-4-6	3 V 0.15 MHz - 80 MHz 6 V in ISM bands between 0.15 MHz and 80 MHz 80% AM at 1 kHz	3 V 0.15 MHz - 80 MHz 6 V in ISM bands between 0.15 MHz and 80 MHz 80% AM at 1 kHz	The strength of RF field in the frequency range higher than 150 kHz~80 MHz, the strength of the RF field is smaller than 3 V.
Power Frequency Magnetic Field Immunity IEC 61000-4-8	30 A/m 60 Hz	30 A/m 60 Hz	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
Voltage dips IEC 61000-4-11	0% UT: 0.5 cycle At 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315° 0% UT; 1 cycle and 70% UT; 30 cycles Single phase: at 0º	0% UT: 0.5 cycle At 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315° 0% UT: 1 cycle and 70 % UT; 30 cycles Single phase: at 0º	Mains power quality should be that of a typical commercial or hospital environment. If the user of the BM3, BM5, BM7 requires continued operation during power mains interruptions, it is recommended that the BM3, BM5, BM7 be powered from an uninterruptible power supply, or a battery be used with the system power source.

Voltage interruptions IEC 61000-4-11:	0% UT; 300 cycles	0% UT; 300 cycles	
Note UT is the a.c. mains voltage prior to application of the test level.			

Note	• **For Type A Professional ME Equipment intended for use in domestic establishment instructions for use includes a warning.** • **This ME equipment is intended for use by professional healthcare personnel only.**

Warning	**Portable RF communications equipment (including peripherals such as antenna cables and external antennas) should be used no closer than 30 cm (12 inches) to any part of the [ME EQUIPMENT or ME SYSTEM], including cables specified by the manufacturer.**

Warning	**Using accessories and cables other than those specified or provided by the manufacturer of this theequipment could result in increased electromagnetic emissions or decreased electromagnetic immunity of the patient monitor and result in improper operation.**

5) System Specification

Physical			
Model	**BM3**	**BM5**	**BM7**
Dimension (HxWxD) (mm)	240 x 237 x 176	276 x 262 x 176	324 x 257 x 218
Weight (Kg)	Approx. 3.1	Approx. 4	Approx. 4.5
Cooling	Air flow		
Power	AC 100-240V (50/60Hz) Adapter 18 V, 2.8 A		
Power consumption	< 50Watts		
Operating Mode	Continuous		

Display	**Type**	TFT-LCD		
	Resolution	800 x 600	800 x 600	1024 x 768
	Size	8″	10.4″	12.1″
Measurement Parameter	**Common**	ECG, Heart Rate, Respiration Rate, SpO2, Pulse Rate, Systolic BP, Diastolic BP, Mean BP, EtCO2, FiCO2, Airway Respiration Rate		
	Option	Temperature x 1	Temperature x 2 IBP x 2	Temperature x 2 IBP x 2
TRACE	**Waveforms**	4 waveforms : 2*ECG, SpO2, RR or EtCO2	6 waveforms : 2*ECG, SpO2, RR or EtCO2, 2*IBP	6 waveforms : 2*ECG, SpO2, RR or EtCO2, 2*IBP
	Sweep Speed	Sweep speed: 6.25, 12.5, 25, 50 mm/sec		
Indicator		Categorized alarms (3 priority levels), Visual alarm lamp, SpO2 pulse pitch tone, Battery status, External power LED		
Interface		DC input connector : 18VDC, 2.8A LAN port for transferring data Nurse call system connector HDMI output connector USB connector		
Battery		Rechargeable Li-ion battery		
Thermal Printer (option)		Speed : 25, 50mm/sec, Paper width : 58mm		
Data Storage		168hours trends, 20cases of 10sec alarm waveform		
Language		English, Korean, French, Bulgarian, Polish, German, Chinese, Portuguese, Hungarian, Czech, Romanian, Italian, Turkish, Spanish Russian, Greek, Japanese, Kazakh, Ukrainian		
Environments				
Temperature		Operating : 5 ~ +40 °C (41 ~ 104 °F) Storage : –20 ~ +60 °C (–4 ~ +140 °F)		
Humidity		Operating: 30% ~ 85%, Storage: 10% ~ 95% (Package)		
Operating Altitude		Operating : 525 ~ 795 mmHg (70 ~ 106 kPa) Storage : 375 ~ 795 mmHg (50 ~ 106 kPa)		

ECG	
Lead Type	3-lead, 5-lead
Lead Selection	3-lead: I, II, III 5-lead: I, II, III, aVR, aVL, aVF, V
ECG waveforms	3-lead: 1 channel 5-lead: 1 channel (BM3) 5-lead: 2/7 channels (BM5, BM7)
Heart Rate Range	Adult / Pediatric: 30 ~ 300 bpm Neonate: 30 ~ 350 bpm
Heart Rate Accuracy	±1bpm or ±1%, whichever is greater
Sweep Speed	6.25, 12.5, 25, 50 mm/sec
Filter	Diagnosis: 0.05Hz ~ 150Hz Monitoring: 0.5 ~ 40 Hz Moderate: 0.5 ~ 25 Hz Maximum: 5 ~ 25 Hz
S-T Segment Detection Range	-2.0 to 2.0 mV
Arrhythmia Analysis	ASYSTOLE, VTACH, VFIB BM5, BM7 only: BIGEMINY, ACCVENT, COUPLET, IRREGULAR, PAUSE, PVC, RONT, TRIGEMINY, VBRADY, SHORTRUN
Pacemaker Detection Mode	Indicator on waveform display (user selectable)
Protection	Against electrosurgical interference and defibrillation

Respiration Performance	
Method	Thoracic impedance
Channel Selection	RA-LL BM5, BM7 only: RA-LA

Measurement Range	5 ~ 120 breaths per minute
Accuracy	±1 breath per minute
Apnea Alarm	Yes

SpO2 Performance	
SpO2 Range	0 ~ 100%
SpO2 Accuracy *The specified accuracy is the root-mean-square (RMS) difference between the measured values and the reference values.	70 ~ 100%: ±2 digits 0 ~ 69%: unspecified
Pulse Rate Range	30 ~ 254 bpm
Pulse Rate Accuracy	±2 bpm
NIBP Performance	
Method	Oscillometry with step deflation
Operation Mode	Manual/Automatic/Continuous
Measurement Range	**[Adult]** Systolic: 40 ~ 260 mmHg MAP: 26 ~ 220 mmHg Diastolic: 20 ~ 200 mmHg **[Pediatric]** Systolic: 40 ~ 230mmHg MAP: 26 ~ 183mmHg Diastolic: 20 ~ 160mmHg **[Neonate]** Systolic: 40 ~ 130mmHg MAP: 26 ~ 110mmHg Diastolic: 20 ~ 100mmHg
Accuracy	Mean error: less than ±5 mmHg Standard deviation: less than 8 mmHg

Temperature Performance	
Measurement Range	0 ~ 50℃ (32 ~ 122℉)
Accuracy	25 ~ 50℃: ±0.1℃ 0℃ to the less than 25℃: ±0.2℃
Compatibility	98ME04GA603 temperature probes
Operating Mode	0 ~ 50℃ (0 ~ 122℉)

Sidestream CO2 (Option)	
Measurement Range	0 ~ 150 mmHg, 0 ~ 19%
Accuracy	0 ~ 40mmHg ±2 mmHg, 41 ~ 70mmHg ±5% of reading 71 ~ 100mmHg ±8% of reading, 101 ~ 150mmHg ±10% of reading
Respiration Rate	2 ~ 150 breaths per minute
Respiration Accuracy	±1 breath per minute

Mainstream CO2 (Option)	
Measurement Range	0 ~ 150 mmHg, 0 to 19%
Accuracy	0 ~ 40mmHg ±2 mmHg, 41 ~ 70mmHg ±5% of reading 71 ~ 100mmHg ±8% of reading, 101 ~ 150mmHg ±10% of reading
Respiration Rate	0 ~ 150 breaths per minute
Respiration Accuracy	±1breath per minute

IBP Performance (BM5/BM7 Only)	
Channels	2
Measurement Range	-50 ~ 300mmHg

Accuracy	4 % of reading or ± 4 mmHg, whichever is greater
Pulse Rate Measurement Range	0 ~ 300bpm
Zero Balancing	Range: ±200mmHg Accuracy: ±1mmHg Drift: ±1mmHg over 24hours
Transducer Sensitivity	5μV/V/mmHg

6) Parameter Alarm Default Level

Alarm		High	Medium	Low	Message
Asystole		**0**			
VTAC/VFIB		**0**			
VTAC		**0**			
BM5,BM7 Only	SHORT RUN	**0**			
	ACC VENT	**0**			
	BIGEMINY	**0**			
	COUPLET	**0**			
	IRREGULAR	**0**			
	PAUSE	**0**			
	R ON T	**0**			
	TRIGEMINY	**0**			
	V BRADY	**0**			
	PVC	**0**			
PVC Count				**0**	
ST				**0**	
HR			**0**		
NIBP - S			**0**		
NIBP - M			**0**		
NIBP - D			**0**		
NIBP- PR				**0**	
SpO_2				**0**	
SpO_2-Rate				**0**	
RR				**0**	
RR-Apnea				**0**	

T1(℃)				**0**	
BM5,BM7 Only	T2(℃)			**0**	
	TEMP- DT			**0**	
	IBP1(S/M/D/PR)			**0**	
	IBP2(S/M/D/PR)			**0**	
EtCO2				**0**	
FiCO2				**0**	
AWRR				**0**	
APNEA				**0**	

7) Parameter Alarm Default Setting

Parameter		Adult	Pediatric	Neonate
HR		50 – 150	50 – 160	50 – 170
NIBP-S		80 – 200	60 – 160	40 – 100
NIBP-M		40 – 140	40 – 120	30 – 70
NIBP-D		20 – 120	30 – 100	20 – 60
NIBP-PR		50 – 150	50 – 160	50 – 170
SpO_2		90 – 100	90-100	88-100
SpO_2-Rate		50 – 150	50 – 160	50 – 170
RR(RESP)		10 – 30	10 – 50	15-100
RR-Apnea		0 – 20	0 – 20	0 – 20
ST		-0.4 – 0.4	-0.4 – 0.4	-0.4 – 0.4
PVC		0 – 20	0 – 20	0 – 20
Temp ˚C/˚F		34.0/93.2 - 39.0/102.2	34.0/93.2 - 39.0/102.2	34.0/93.2 - 39.0/102.2
AWRR		10 – 30	10 – 50	15 – 100
EtCO2		25 – 50	25 – 50	25 – 50
FiCO2		0 – 5	0 – 5	0 – 5
Apnea		0 - 20	0 - 20	0 - 15
BM5,BM7 Only	IBP-S (ART)	70 – 150	200	40-100
	IBP-M (ART)	50 – 115	140	30-70
	IBP-D (ART)	40 – 100	120	20-50
	IBP-PR	50 – 150	50 – 150	50 – 170
	ART- SCALE	160	160	100
	IBP-S (CVP)	0 – 300	0 – 300	0 – 300
	IBP-M (CVP)	3 – 15	3 – 15	3 – 15
	IBP-D (CVP)	0 – 300	0 – 300	0 – 300

	CVP- SCALE	30	30	30
	IBP-S (FEM)	70 – 150	70 – 150	40 – 100
	IBP-M (FEM)	50 – 115	50 – 115	30 – 70
	IBP-D (FEM)	40 – 100	40 – 100	20 – 50
	FEM- SCALE	160	160	100
	IBP-S (PAP)	20 –50	20 –50	40 – 100
	IBP-M (PAP)	10 – 40	10 – 40	30 – 70
	IBP-D (PAP)	5 – 30	5 – 30	20 – 50
	PAP- SCALE	60	60	100
	IBP-S (RAP)	0 – 300	0 – 300	0 – 300
	IBP-M (RAP)	3 – 15	3 – 15	3 – 15
	IBP-D (RAP)	0 – 300	0 – 300	0 – 300
	RAP- SCALE	30	30	30
	IBP-S (LAP)	0 – 300	0 – 300	0 – 300
	IBP-M (LAP)	3 – 15	3 – 15	3 – 15
	IBP-D (LAP)	0 – 300	0 – 300	0 – 300
	LAP- SCALE	30	30	30
	IBP-S (UAP)	70 – 150	70 – 150	40 – 100
	IBP-M (UAP)	50 – 115	50 – 115	30 – 70
	IBP-D (UAP)	40 – 100	40 – 100	20 – 50
	UAP- SCALE	160	160	100
	IBP-S (UVP)	0 – 300	0 – 300	0 – 300
	IBP-M (UVP)	3 – 15	3 – 15	3 – 15
	IBP-D (UVP)	0 – 300	0 – 300	0 – 300
	UVP- SCALE	30	30	30
	IBP-S (ICP)	0 – 300	0 – 300	0 – 300
	IBP-M (ICP)	3 – 15	3 – 15	3 – 15
	IBP-D (ICP)	0 – 300	0 – 300	0 – 300
	ICP- SCALE	30	30	30
	IBP-S (USER DEFINE)	70 – 150	70 – 150	40 – 100
	IBP1-M (USER DEFINE)	50 – 115	50 – 115	30 – 70
	IBP1-D (USER DEFINE)	40 – 100	40 – 100	20 – 50
	USER DEFINE - SCALE	160	160	100
	IBP1/2-PR	50 – 150	50 – 150	50 – 170

8) Technical Alarm Default Level

Biosignal Class	Technical Alarm		Alarm Level				Alarm On/Off	
			High	Medium	Low	Message	On	Off
ECG	BM5,BM7 Only	CABLEOFF				0	0	
	LEADFAULT					0	0	
	CHECKELECTRODE					0	0	
	HRSEARCH					0	0	
SPO2	PROBEOFF					0	0	
	CHECKPROBE					0	0	
	POORSIGNAL					0	0	
	LOSTPULSE					0	0	
	ARTIFACT					0	0	
	PULSESEARCH					0	0	
RESP	CABLEOFF					0	0	
	LEADFAULT					0	0	
	CHECKELECTRODE					0	0	
NIBP	OVERP					0	0	
	OVERTIMECP					0	0	
	INFFAILURE					0	0	
	DEFFAILURE					0	0	
	MEASERROR					0	0	
	PULSETOOWEAK					0	0	
	CHECKSENSOR					0	0	
	AIRLEAK					0	0	
	EXESSIVEMOTION					0	0	
	SYSTEMFAULT					0	0	
TEMP	TEMP-1-PROBEOFF					0	0	
	BM5, BM7 Only	TEMP-2-PROBEOFF				0	0	
IBP	BM5, BM7 Only	CABLEOFF				0	0	
		DISCONNECT				0	0	
		ZEROING				0	0	
		IMBALANCE				0	0	
ETCO2	MODULEOFF					0	0	
	CHECKADAPTER					0	0	

	CHECKLINE				**0**	**0**	
	CHECKLINEDISCONNECT				**0**	**0**	
	CO2INVALID				**0**	**0**	
	OVERRANGE				**0**	**0**	
	ZEROING				**0**	**0**	
	ZEROREQUIRED				**0**	**0**	
	SYSTEMFAULT				**0**	**0**	
	SENSORWARMUP				**0**	**0**	
	TEMPUNSTABLE				**0**	**0**	
SYSTEM	LOWBATTERY				**0**	**0**	

9) Display Default Settings

Patient Age	**Adult**	**PEDIATRIC**	**NEONATE**
Primary ECG	II	II	II
Arrhythmia	LETHAL	LETHAL	LETHAL
Detect pace	Off	Off	Off
Print waveform1	LEAD II	LEAD II	LEAD II
Print waveform2	SpO2	SpO2	SpO2
Print waveform3	RESP	RESP	RESP
Alarm print	Off	Off	Off
NIBP interval	Off	Off	Off
NIBP cuff size	Adult	PEDIATRIC	NEONATE
RR(RESP) lead	II	II	II
Alarm volume	50%	50%	50%
QRS volume	Off	Off	Off
Pulse volume	Off	Off	Off
ECG lead fault	Message	Message	Message
SpO2 probe off	Low Alarm	Low Alarm	Low Alarm
Units for height	cm	cm	cm
Units for weight	Kg	kg	kg
Temperature units	℃	℃	℃
NIBP limit type	Systolic	Systolic	Systolic
ECG filter	Monitor	Monitor	Monitor
PVC	ON	ON	ON
ST	ON	ON	ON

PART 19. Abbreviations and Symbols

Abbreviations and symbols are alphabetized by reference, which can be read while reading the manual or using the patient monitor.

1) Abbreviations

A

A	amps
AC	alternating current
ADT	adult
ARRYTHM	arrhythmia
ASYS	asystole
Auto, AUTO	automatic
AUX	Auxiliary
aVF	left foot augmented lead
aVL	left arm augmented lead
aVR	right arm augmented lead

B

BPM	beats per minute

C

C	Celsius
CAL	calibration
cm, CM	centimeter

D

D	diastolic
DC	direct current
DEFIB, Defib	defibrillator
DIA	diastolic

E

ECG	electrocardiograph
EMC	electromagnetic compatibility
EMI	electromagnetic interference

ESU	electrosurgical cautery unit

F

F	Fahrenheit

G

g	gram

H

HR	heart rate, hour
Hz	hertz

I

ICU	intensive care unit
Inc	incorporated

K

Kg, KG	kilogram
KPa	kilopascal

L

L	liter, left
LA	left arm, left atrial
LBS	pounds
LCD	liquid crystal display
LED	light emitting diode
LL	left leg

M

M mean,	minute
m	meter
MIN,	minminute
MM, mm	millimeters
MM/S	millimeters per second
MMHG, mmHg	millimeters of mercury
mV	millivolt

N

NIBP	non-invasive blood pressure
NEO, Neo	neonatal

O

OR	operating room

P

PED	pediatric
PVC	premature ventricular complex

Q

QRS	interval of ventricular depolarization

R

RA	right arm, right atrial
RESP	respiration
RL	right leg
RR	respiration rate

S

S	systolic
sec	second
SpO2	arterial oxygen saturation from pulse oximetry
SYNC, Sync	synchronization
SYS	systolic

T

Temp, TEMP	temperature

U

V

V	precordial lead
V	volt
V-Fib, VFIB	ventricular fibrillation
VTAC	ventricular tachycardia

W

X

X multiplier when used with a number (2X)

Y

Z

2) Symbols

&	and
°	degree(s)
>	greater than
<	less than
–	minus
#	number
%	percent
±	plus orminus

PRODUCT WARRANTY

Product Name	**Patient Monitor**
Model Name	**BM3 / BM5 /BM7**
Approval Number	
Approval Date	
Serial Number	
Warranty Period	**1 year from date of purchase**
Date of Purchase	
Customer section	**Hospital Name :** **Address :** **Name :** **Phone :**
Sales Agency	
Manufacturer	

※ Thank you for purchasing BM3/BM5/BM7.

※ The monitor is manufactured and passed through strict quality control and through inspection.

※ Compensation standard concerning repair, replacement, refund of the product complies with "Consumer's Protection Law" noticed by Korea Fair Trade Commission.

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