DYNASCOPE 1000 Series
Patient Monitor

DS-1200 system

Ver. 01

Operation Manual

* Before using the product, please read this manual thoroughly.
* Store this manual where it can be always referred to.

FUKUDA DENSHI

This manual is for the DS-1200 System Version 01.

⚠CAUTION	Federal Law restricts this device to sale by or on the order of a physician.

CAUTION

- Only physician or persons instructed by physicians are allowed to use the equipment.
- The information contained in this document is subject to change without notice due to improvement in the equipment.

If this manual has pages missing or out of order, contact Fukuda Denshi for replacement.

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Preface

Introduction

Thank you for purchasing this product. Read the "Safety Precautions" thoroughly before use to ensure correct and safe use of the product.

Before using or installing this product, read this manual thoroughly.

Important Notice

For Safe Operation of the Device

(1) Before using this device, read this operation manual.

(2) Fukuda Denshi cannot predict all the dangers which may be caused by misusage of this product or environmental condition.

(3) For using this device, there are many items that "should be performed", "should not be performed", and "cannot be performed". It is not possible to cover all these items in this manual or warning labels. Therefore, it is necessary to also follow the general safety precaution other than the items described in this manual.

(4) To prevent accidents, usage other than intended, or usage, cleaning, and maintenance not described in this manual should not be performed.

(5) When using this device, follow the respective regulation to minimize the probability of accidents.

Intended Use of this Device

This equipment is designed for the following <Intended Use>.

<Intended Use>

This equipment is intended for measuring parameters such as ECG, respiration, NIBP, pulse rate, SpO_2, SpCO, SpMet, pulse wave, temperature, BP, CO, respiration gas (concentration of CO_2, N_2O, volatile anesthetic agent, O_2), spirometry, BIS, brain wave, and monitors patient condition by displaying/printing the measurement data on this equipment or central monitor and generates alarm as required.

This equipment is intended for monitoring one patient. It is not intended for monitoring multiple patients.

The 12-lead ECG analysis function is intended to follow up adult and pediatric patients for before/after surgery and after the procedure.

For specification of this equipment, refer to "Chapter 14 Specification" of this manual.

This equipment is intended to be used by healthcare professionals. Users should have a thorough knowledge of the function and operation before using this equipment. The maintenance of this equipment should be performed by skilled personnel who received a training of possible hazards and measures to avoid those hazards. Also, your local regulation must be followed. If this equipment is used for the purpose other than intended, or if the user does not follow the safety instructions, the following hazard may result.

- Hazard to the Life and Health of the Patient or the User

- A Problem Related to Medical Practice
- Damage to the Equipment

Copyright

(1) The copyright of this manual is owned by Fukuda Denshi. No part of this document may be copied or transmitted in any form without the prior written permission of Fukuda Denshi Co., Ltd.

(2) This manual includes the description for the optional devices that can be connected.

(3) The illustration in this manual may differ with the actual device.

(4) If you lose or damage this manual, contact your nearest sales representative. Using the device without this manual may cause accidents.

(5) When handing over this device, make sure to also pass this manual to the next owner.

Maintenance, Repair, Replacement

Fukuda Denshi is liable for the safety, reliability, and performance of its device only if;

- Maintenance, modifications, and repairs are carried out by authorized personnel or organization.
- Components are used in accordance with Fukuda Denshi operating instructions.

A full technical description of the DS-1200 System is available from your local Fukuda Denshi sales representative.

Contact

If you need more detailed information or information about security risk, please contact following.

(1) Fukuda Denshi Co., Ltd., Head Office

3-39-4 Hongo, Bunkyo-ku, Tokyo, Japan
Tel: +81-3-5684-1455 Fax: +81-3-3814-1222
E-mail: info@fukuda.co.jp
Website: https://fukuda.com/

(2) Fukuda Denshi USA, Inc.

17725-C NE 65th Street Redmond, WA 98052 USA
Toll Free: +1-800-365-6668
Local: +1-425-881-7737
Fax: +1-425-869-2018

- If a serious incident has occurred in relation to this device, please report it to the manufacturer and to the competent authority of the country where the user and/or the patient is established.
- In case you need the contact information for your national competent authority, please ask the manufacturer or the distributor from whom you purchased the device.

About This Manual

Expression Used in This Manual

❑Meaning of the Symbols

Type of Precaution	Description
⚠ DANGER	Failure to follow this message may cause immediate threat of death or serious injury.
⚠ WARNING	Failure to follow this message may result in death or serious injury.
⚠ CAUTION	Failure to follow this message may cause injury or failure to the device.
NOTE	"Note" is used to emphasize important information.
REFERENCE	"Reference" is used to provide useful information.
☞	Indicates the reference page for the procedure and precaution.
*	Used in a table which indicates that there is detailed explanation outside the table.

❑Indications for the Screens and Keys

The keys displayed on the monitor screen are indicated by [ ].
(Ex.: [Display Config.], [Manual Printing], etc.)

The expressions displayed on the monitor screen are indicated by " " .
(Ex.: "Volume", "Admit/Discharge", etc.)

The messages displayed on the screen are indicated by < >.
(Ex: <Searching>, <Alarm Suspend>, etc.)

Composition of This Manual

The operation manual is composed of the following chapters.

Chapter Title	Description
Preface	Outline and purpose of this manual (Important Notice, About This Manual)
Safety	Warning, Precautions for Safety
1.General Description	Composition, features, menu configuration of this device
2.Name of Parts and Their Functions	Name and function of each part, external appearance
3.Operation Procedure and Screen Examples	Operation procedure, home display, window, procedure to return to the previous display, user key setup
4.Preparation	Installing the recording paper, power ON/OFF, time/date, daily checks
5.Admit/Discharge	Entering patient information (name, age, etc.) at admittance, discharging the patient, user mode selection, suspend monitoring
6.Alarm Function	General description of alarm function, alarm-related setups
7.Monitoring	Measurement condition setup of the monitoring parameters, size/scale setup, etc. Setup of the stop watch, connector
8.Review Function	Arrhythmia analysis, 12-lead analysis, trend, recall, NIBP list, ST measurement, hemodynamics, lung function, alarm history, other bed display, full disclosure waveform

Chapter Title	Description
9. Printing	Recorder output function
10. System Configuration	Setup of the display configuration, tone/volume, color, etc.
11. Troubleshooting	Message list, maintenance and troubleshooting of this device
12. Setup Item/Default Value	Setup details and default value
13. Accessories	List of accessories and optional accessories of this device.
14. Specification	Specification and performance of this device

The maintenance manual is composed of the following chapters.

Chapter Title	Description
Preface	Outline and purpose of this manual (Important Notice, About This Manual)
Safety	Warning, Precautions for Safety
1.Installation of the Unit	Precautions about the operating environment, system construction
2.Network System Construction	Network connection and setup
3.Using the External Media	Procedure to use the external media
4.Connection to the External Devices	External device connection/setup, magnetic card reader usage
5.Initial Settings	Initial setup, administrator setup, alarm/measurement setup, user I/F, user mode registration
6.Setup Item/Default Value	Default and backup of setup items
7.Replacement Parts	Precautions about the periodic replacement parts, consumable parts
8.Cleaning/Disinfecting/Storing	Procedure to handle, clean, store this device
9. Maintenance Check	Daily and periodic checks, self-diagnosis function, software version software install

Safety

About the Safety Precautions

The Meaning of Each Safety Precaution

Read this manual thoroughly before use to ensure correct and safe use of the product.
Be sure to follow the precautions indicated below, as these are important messages related to safety.

Type of Precaution	Description
DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.

Graphic Symbols

Refer to the following for the meaning of the symbol indicated on the equipment.

Symbol	Description
	Follow operating instructions (Warning); indicated in blue. Failure to follow operating instructions could place the patient or operator at risk.
	Follow operating instructions (Information); Indicates the need to refer to the related accompanying documents before operation.
	General precaution
	Caution
	Potential Equalization Terminal Indicates the terminal to equalize the potential difference when interconnecting the devices.
	Protective Earth Indicates the protective earth inside the equipment.
	Alternating Current (Main Power Input Indicator)
	Indicates that the equipment is in normal operation.
	Indicates that the equipment is in standby mode.
	Type CF Applied Part with Defibrillation-Proof Indicates the degree of protection against electric shock is Type CF Applied Part with defibrillation-proof.
	Type BF Applied Part with Defibrillation-Proof Indicates the degree of protection against electric shock is Type BF Applied Part with defibrillation-proof.
	Signal Output
	GAS Input Part

Symbol	Description
	GAS Output Part
	Signal Input Part
	TCP/IP Network Connector Connects to TCP/IP network.
	RS-232C Connector Connects the related device.
	Indicates prohibited actions. Refer to the instruction.
	Indicates mandatory or instructed actions. Refer to the instruction.
	Battery
	Date of Manufacture Indicates the date of manufacture.
	Name and Address of Manufacturer Indicates the name and address of manufacturer.
	WEEE (Waste Electrical and Electronics Equipment) Indicates a separate collection for electrical and electronic equipment.
IPX1	Waterproof (IPX1): Protection against water drops.
IPX2	Waterproof (IPX2): Protection against water drops falling vertically over 15 degrees range.
	Alarm Silence
	NIBP Start/Stop
	NIBP Periodic Measurement
	Lock
	Unlock
	Signal Input/Output Indicates the connector which inputs/outputs the signals.
	USB Connector Indicates the USB connector.

Precautions for Safe Operation of Medical Device

⚠ CAUTION

- Users should have a thorough knowledge of the operation before using this device.
- Do not use the device in an environment where protective earth and wiring is questionable.

❑Precautions about the Location of Installation and Storage of the device

- Set the monitor to the user's intended position where the user can easily recognize the visual and audible monitoring conditions. Normally it is recommended to set at a distance of one (1) m from the user.
- Install or store in a place where the device will not be exposed to splashing water.
- Install or store in an area where environmental conditions such as atmospheric pressure, temperature, humidity, ventilation, sunlight, dust, sodium, and sulfur will not adversely affect the system.
- Place the device on a stable surface where there is no inclination, vibration, or shock (including during

transportation).

- Do not install or store in an area where chemicals are stored or gases are evolved.
- Verify the power frequency, voltage and allowable current (or power consumption).
- Ensure the grounding is proper by connecting the accompanying power cable to the hospital grade outlet.
- Make sure to secure the device during usage.
- Do not place this device or accessories in any position that might cause it to fall on the patient.
- Do not place this device where the controls can be changed by the patient.
- Do not place this device on electrical device that may affect the device.
- To minimize wireless interference, other electrical device that emits radio waves should not be in close proximity to this device.

❑Precautions Before Using the device

- Verify the power voltage. Charge the battery pack fully before operating the system with the battery pack.
- Check the cable connection and polarity to ensure proper operation of the device.
- Make sure the power system has adequate earth ground.
- Ensure that all cables are firmly and safely connected.
- Pay special attention when the device is used in conjunction with other devices as it may cause erroneous judgment and dangerous situation.

❑Precautions During Using the device

- Always observe the device and patient to ensure safe operation.
- If any abnormality is found on the device or with the patient, take appropriate measures under the safe conditions, such as ceasing operation of the device.
- Do not allow the patient to come in contact with the device.
- On start-up of the system, verify that the start-up tone generates and alarm indicator lights.
- For the connectors which are not Type BF, CF applied part, do not touch them and the patient at the same time.

❑Precautions After Using the device

- Unplug all the cables from the patient before turning off the power.
- When unplugging the cables, make sure to pull from the connector part of the cable and avoid applying excessive force.
- Clean the accessories and cables, and keep them together in one place.
- Keep the device clean to ensure proper operation for the next use.
- Before cleaning, be sure to turn off the power and unplug from all the power cables.

❑Precaution when device Failure Occurs

- If the device is damaged and in need of repair, the user should not attempt service. Label the unit "OUT OF ORDER" and contact your nearest service representative.

❑Precaution about Disassembling/Remodeling the device

- Do not disassemble or remodel the device.
- If water or other liquids enter the device, cease using the device and contact your nearest service representative.

❑Precautions about Maintenance Check

- Make sure to periodically check the device, accessories, and cables.
- Before reusing the device that has been left unused for a while, make sure that the device operates normally

and safely.

❑Precautions when Using with Other device

- To prevent patient from burn injury, verify proper attachment of patient ground plate, ECG electrode type when using the electrosurgical knife, and verify paste volume, output energy when using the defibrillator. Also, verify that each device is properly grounded.

Precautions about the Maintenance

⚠ WARNING

- Never open the housing while the device is in operation or connected to hospital grade outlet as it may result in electric shock.

⚠ CAUTION Precautions about Safety Check

- For safe operation of the device, regular inspection and maintenance are required. Once a year, check all cables, devices, and accessories for damage, earth impedance, earth and leakage currents, and all alarm functions. Also, ensure that all safety labels are legible. Maintain a record of these safety inspections.
- Immediate maintenance has to be carried out for the following case.
  - When the device was subjected to extreme mechanical stress, e.g. after a heavy fall.
  - When the device was subjected to liquid spill.
  - When the monitoring function is interrupted or disturbed.
  - When parts of the device enclosure are cracked, removed, or lost.
  - When any connector or cable shows signs of deterioration.

Precautions about the Network System

Medical Telemetry

⚠ CAUTION Precautions about the Installation

- The medical institution (hereinafter referred as "Institution") must decide the telemetry installation plan for the medical institution in order to prevent interference between transmitters (telemetry based on destination country's radio law). When telemetry has already been installed and been used, radio format, frequency, and antenna power are required to be examined to prevent interference.
- When using telemetry which requires zone location, the institution is to set up the zones as an operation unit for each transmitter to prevent electronic interference between telemetry throughout the Institution.
- When using telemetry which requires zone location, display and identify each prepared zone in the device.
- When laying receiver antenna for each transmitter, the Institution has to examine the installation so that electronic interference does not occur.
- Based on the above examination result, the Institution should place each receiver antenna as required.

⚠ CAUTION Precautions about the Management

- The institution appoints a person to manage the wireless channels for the whole medical institution. And when using telemetry which requires zone location, the Institution should nominate a person to manage the wireless channels in each zone (a "Coordinator"). However, when using such telemetry in a local medical institution, one person can perform both functions.
- Select a telemetry coordinator who understands the characteristics and functionality of telemetry systems, and

is skilled in operating telemetry.

- When installing telemetry, the Coordinators have to understand the precautions for use of the telemetry in advance.
- The Coordinator takes responsibility of wireless channel management and transmitter storage for the whole Institution by giving proper instruction.
- The Coordinator should create a management log (hereinafter referred to as the "log"), which contains a list of the management status of the wireless channels for the whole Institution. When changing a wireless channel, register it in the log and give proper instructions to the user.
- The Coordinator assumes responsibility for managing the wireless channels, storing, and managing telemetry.
- The Coordinator assigns the transmitter to the user, and provides enough education for use inside the zone.
- The telemetry user verifies operation of the transmitter/receiver before use.
- The telemetry user, if using the telemetry in a zone location, follows the instructions of the Coordinator for the zone and gives instructions to the patient if required.
- When interference or breakdown occurs in telemetry communication, the user is required to inform the Coordinators of the problems. The Coordinators are to deal with the problem properly and/or contact their nearest Fukuda Denshi representative for service.

Precautions when Using with Other Device

Pacemaker

⚠ WARNING

- Minute ventilation rate-adaptive implantable pacemakers can occasionally interact with certain cardiac monitoring and diagnostic equipment, causing the pacemakers to pace at their maximum programmed rate. The cardiac monitoring and diagnostic equipment may possibly send wrong information. If such event occurs, please disconnect the cardiac monitoring and diagnostic equipment, or follow the procedures described in the operation manual of the pacemaker. For more details, contact FUKUDA DENSHI personnel, your institution's professionals, or your pacemaker distributors.
- Rate meters may continue to count the pacemaker rate during occurrences of cardiac arrest or some arrhythmias. Do not rely entirely upon rate meter alarms. Keep pacemaker patients under close surveillance.

Reference

"Minute Ventilation Rate-Adaptive Pacemakers"
FDA alerts health professionals that minute ventilation rate-adaptive implantable pacemakers can occasionally interact with certain cardiac monitoring and diagnostic equipment, causing pacemakers to pace at their maximum programmed rate.
[Based on a safety bulletin issued by FDA Center for Devices and Radiological Health on October 14, 1998]

Non-Explosion Proof

⚠ DANGER

- Never operate the device in the presence of flammable anesthetics, high concentration of oxygen, or inside hyperbaric chamber. Also, do not operate the device in an environment in which there is a risk of explosion. Explosion or fire may result.

Defibrillator

⚠ WARNING

- When defibrillating, keep away from the electrodes or medicament applied to the patient chest. If this is not possible, remove the electrodes or medicament before defibrillating.
  If the defibrillator paddles are directly in contact with the electrodes or medicament, an electrical shock may result by the discharged energy.
- When defibrillating, make sure that the electrodes, sensor cables, or relay cables are firmly connected to the device.
  Contacting the metal part of the disconnected cable may result in electrical shock from the discharged energy.
- When defibrillating, do not touch the patient and the metal part of the device or cables.
  Electric shock may result from the discharged energy.
- This device will return to standard operating mode within 10 seconds after defibrillating. However, when in diagnosis mode, it may require 10 seconds or more after defibrillation to display the normal ECG waveform as the time constant setting is large.
  The stored data will not be affected. The measurement accuracy will temporarily decrease during defibrillation, but it will not compromise the safety of patient and the device.
- The QRS synchronized signal is not intended to be used as synchronized signal for defibrillator.

Electrosurgical Instrument

⚠ WARNING

- The monitoring system contains protection against interference generated by electrosurgical instruments. However, depending on the operating conditions, surgery site with respect to the location of ECG electrodes, ground plate attachment condition, or the type of instrument used, it may cause burn injury at the electrode site or noise on the ECG. The noise is generated at the tip of the electrosurgical knife and is difficult to completely eliminate because of the frequency components of the ECG. To reduce electrosurgical interference, take the following precautions:

  Location:

  Locate the electrosurgical unit as far as possible from this device and the patient cable. This will help reduce interference on the ECG through the monitor or cables.

  Power Supply:

  Connect the electrosurgical unit to a power supply that is different from that of this device. This will help prevent interference through the power cable.

  Electrode Placement

  The amount of noise interference is considerably different depending on the electrode position and surgery site. Place the ECG electrodes as far away as possible from the surgery site and the ground plate. Do not place electrodes in the path between the surgery site and the ground plate. If the electrodes are placed in this path, the amount of interference will be quite large. Position (+) and (–) electrodes as close as possible to each other.
  To reduce the hazard of burns during high-frequency surgical procedure, ensure that electrodes, sensorsand transducers never come into contact with the high-frequency surgical units.

  Ground Plate

  When using electrosurgical instruments, make sure the contact between the patient and the ground plate is secure. If the connection is incomplete, the patient may suffer from burn at the electrode site.The electrode should also be attached as far away from the surgery site as possible to decrease the risk of burns.To decrease risk of burns, make sure that the cables, sensors and transducer are located in a place where an electrosurgical instrument will not contact.
- The stored data will not be affected. The measurement accuracy will temporarily decrease during electrosurgery, but it will not compromise the safety of patient and the device.

- When using the electrosurgery-proof type ECG relay cable, the impedance respiration cannot be measured, and its numeric data and waveform will not be displayed. When measuring in an environment where electrosurgery is not performed, make sure to use the standard ECG relay cable.
- As this device utilizes capacitive touch panel, the energy from the electrosurgical knife may pass through the cable to the touch panel causing unintentional touch panel control. Locate the cables as far away as possible from the touch panel.

MRI (Magnetic Resonance Imaging)

⚠ WARNING

MR Unsafe-Keep away from magnetic resonance imaging (MRI) device.

- Do not use this device in magnetic resonance imaging (MRI) environments.
- When conducting MRI test, remove the electrodes and sensors connected to the patient (test subject). This device may be pulled towards the MRI device. Also, the local heating caused by the induced electromotive force may cause burn injury to the patient or performance degradation, failure, damage of this device. For details, refer to the operation manual for the MRI testing device.

Precautions about Connections to Peripheral Devices

To use the device safely and to ensure maximum performance of the device, connection of other manufacturer's device to this device is not authorized, unless the connection is explicitly approved by Fukuda Denshi. It is the user's responsibility to contact Fukuda Denshi to determine the compatibility and warranty status of any connection made to another manufacturer's device.

⚠ WARNING

- When multiple devices are connected to the patient, it may be necessary to take measures for connection (use of separation device), power supply (use of isolation power), grounding (additional protective earth). If these measures are not properly taken, a leakage current may flow between the devices, or the total amount of leakage current may exceed the limit specified on IEC 60601-1-1.
- Only the peripheral devices specified by Fukuda Denshi should be connected with the given procedure. Use of an unspecified device may cause electric shock to the patient and/or operator due to excessive leakage current.

⚠ CAUTION

- Although the peripheral device connectors on the DS-1200 System are, with some exceptions, isolated from the power supply, the connecting peripheral devices should comply with IEC 60601-1. It is the user's responsibility to verify that the overall system complies with IEC 60601-1-1.
- To prevent danger of electric shock, always position the peripheral devices away from the patient.
- Network device including printer and hub should be located outside the "Patient Environment". If located inside the "Patient Environment", it may result in electric shock to the patient or the operator.
- Combinations of medical device with non-medical device must comply with IEC 60601-1-1 or IEC 60601-1. Never use a multiple portable socket-outlet or extension cable when connecting the devices unless it is supplied specifically for use with that device.

Precautions for Using the Device

This System

⚠ DANGER

- When connecting to other devices, contact your nearest representative.
  Danger such as electric shock may result to the patient and operator.

⚠ WARNING Warnings about the System

- Do not connect any device or cable not authorized by Fukuda Denshi to any I/O connector. Also, do not connect any damaged device or cable. The device cannot deliver its maximum performance, the device may be damaged and safety cannot be ensured.
- If the device is used under an environment not fulfilling the specified condition, not only that the device cannot deliver its maximum performance, the device may be damaged and safety cannot be ensured. If using the device under condition other than specified, contact your nearest representative.
- Use only the supplied 3-way AC power cable. Use of other cables may result in electric shock to the patient and the operator.
- The power cable must be connected to a hospital grade outlet.
- When using multiple ME device simultaneously, perform equipotential grounding to prevent potential difference between the devices. Even a small potential difference may result in electric shock to the patient and the operator.
- Carefully route the cables to avoid patient entanglement and strangulation.
- When lifting this device, hold the bottom part of the main unit.
- Damage to the LCD may cause leakage of liquid crystal. In such case, do not touch the leaked liquid crystal with bare hands, or put it into your mouth as it may cause intoxication. If the liquid crystal accidentally enters the eyes or mouth, wash off immediately with water and consult a physician.
- To ensure safety, avoid stacking multiple devices or placing anything on the device during operation.
- To prevent injury, follow the directions below:
  - Avoid placing the device on liquid on surface with visible liquid spills.
  - Do not soak or immerse the device in liquids.
  - Do not sterilize the device.
  - Use cleaning solutions only as instructed in this operation manual.
  - Do not disinfect the device while monitoring patient.

⚠ WARNING Warnings about the monitoring

- The patient classification selection influences the precision of the QRS detection and NIBP measurement. Make sure the proper selection is made.
- The pacemaker usage setting influences the precision of the QRS detection and arrhythmia analysis. Make sure the correct selection is made.
- If the QRS pace mask function is set to [OFF], [10ms] / [20 ms], the pace pulse may be erroneously be detected as a QRS complex and HR alarm or asystole alarm may not generate due to incorrect HR (counting pace pulse as QRS complex). Set this function to [OFF], [10ms]/ [20ms] only if you are sure that pacing failure will not occur, or when the patient can be constantly monitored.
- Before bathing the patient, make sure to remove the sensor and device from the patient.
- When measuring the SpO_2 of patient with high fever or peripheral circulatory insufficiency, check the sensor attachment periodically and change the attachment site. The temperature of the attachment site will rise due to the sensor heat which may result in burn injury.

- For the following case, accurate measurement of SpO_2 may not be possible.
  - Patient with excessive abnormal hemoglobin (COHb, MetHb)
  - Patient with the pigment injected to the blood
  - Patient receiving CPR treatment
  - When a sensor is applied to a limb with NIBP cuff, arterial catheter, or intracatheter
  - When measuring at site with venous pulse
  - Patient with body motion
  - Patient with small pulse
- When a patient is receiving a photodynamic therapy, measuring SpO_2 on a same site for a long duration may cause blisters from the irradiation light of the SpO_2 sensor. Make sure to periodically change the sensor attachment site.
- Before the measurement, make sure the patient classification (Adult/Child/Neonate) is properly selected. Otherwise, correct measurement cannot be performed, and congestion or other injury may result.
- When the system alarm is suspended, all the alarm will be suspended even if the parameter alarm is set to [ON]. Also, the alarms will not be stored as recall events.
- If the upper/lower alarm limit of the parameter is set to [OFF], or if , arrhythmia alarm is set to [OFF], alarm will not function even if the system alarm is enabled. Pay attention when setting them [OFF].
- Objective and constant arrhythmia detection is possible through the fixed algorithm incorporated in this unit. However, excessive waveform morphology change, motion artifact, or the inability to determine the waveform pattern may cause an error, or fail to make adequate detection. Therefore, physicians should make final decisions using manual printing, alarm printing and recall waveform for evaluation.
- The RR/APNEA alarm will not be generated unless the numeric data box corresponded to the selected RR/APNEA alarm source is displayed. Make sure to display the numeric data box for the RR/APNEA alarm source.
- The SpO_2 respiration measurement is not intended for use as an APNEA monitor.
- When selecting [0] for "Volume" or [Timer] for "Display" for the Night Mode, pay attention not to miss any important alarm by simultaneously monitoring the patient on central monitor or other monitors.
- When the alarm sound is suspended, the alarm sound will not generate for the fixed amount of time. Pay attention not to miss any important alarm by simultaneously monitoring the patient on central monitor or other monitors.
- If the safety of the patient cannot be ensured, do not suspend the alarm or decrease the alarm volume.
- The oxygenator mode is intended to prevent alarms during cardiopulmonary bypass surgery. Pay special attention when using this mode as the alarm generation will not be the same as to the standard monitoring mode.
- If the "Alarm Setting" under the Oxygenator Mode Setup is set to [All OFF], all vital alarm will not generate regardless of the alarm setting of each parameter. Also, if [Sel. Parameter] is set, vital alarm for unselected parameter will not generate. Pay attention to not miss any significant change of the patient's vital sign as the alarms will not be generated during the Oxygenator Mode.
- Once the cardiopulmonary bypass is finished, make sure to cancel the Oxygenator Mode and return to the standard monitoring mode.

WARNING Warnings about the CO_2 Monitoring (HC-110, HC-120)

- Only one of either HC-110/HC-120 can be connected.
- When using a sampling line for intubated patients with a closed suction system, do not place the airway adapter between the suction catheter and endotracheal tube. This is to ensure that the airway adapter does not interfere with the functioning of the suction catheter.
- To prevent cross-infection, do not allow the sampling gas to return to the breathing system.
- To protect the hospital staffs from unnecessary anesthetic agent when using the HC-110, it is strongly

recommended to connect the exhaust hole to the gas exhaust system in the hospital.

- Loose or damaged connections of the sampling line may compromise ventilation or cause an inaccurate measurement of respiratory gases. Securely connect all components and check connections for leaks according to standard clinical procedures.
- Do not cut or remove any part of the sampling line. It could lead to erroneous readings.
- If too much moisture enters the sampling line (i.e., from ambient humidity or breathing of unusually humid air) when using the HC-110, <Check Sample Line> will be displayed in the message area. Replace the sampling line once this message is displayed.
- Carefully route the sampling line to reduce the possibility of patient entanglement or strangulation.
- Do not lift the HC-110 by the sampling line, as the sampling line could disconnect from the device, causing the device to fall on the patient.
- CO_2 readings and respiratory rate can be affected by sensor application errors, certain ambient environmental conditions, and certain patient conditions.

WARNING Warnings about the Gas Monitoring (MG-110/120)

- Make sure to use only the specified Mindray Medical Sweden AB product.
  (☞"Anesthetic Gas Concentration Measurement (Manufactured by Mindray Medical Sweden AB)" P13-10)
- Be careful not to damage the water trap during operation as bacteria and/or mucus may contaminate the equipment.
- The airway adapter, sampling line, flow sensor are disposable products that are intended for single patient use only. Do not reuse them on other patients as it may cause cross-infection.
- To prevent cross-infection, do not allow the sampling gas to return to the breathing system.
- When using a sampling line for intubated patients with a closed suction system, do not place the airway adapter between the suction catheter and endotracheal tube. This is to ensure that the airway adapter does not interfere with the functioning of the suction catheter.
- Do not use the equipment with the flammable anesthetic agents.
- To protect the hospital staffs from unnecessary anesthetic agent, it is strongly recommended to connect the exhaust hole to the gas exhaust system in the hospital.
- The sampling line may get clogged by internal condensation.
- The contents of the water trap should be handled as a potential infection hazard.
- Do not use adult/pediatric type water traps and/or sampling lines with neonates to avoid high sampling flow.
- Connect only DRYLINE gas sampling lines to the water trap. Note that there may be other compatible tubing present, e.g. IV-lines.
- Do not use DRYLINE neonatal sampling lines (blue luer lock nuts) with DRYLINE adult water traps as this could result in incorrect measurement data.
- Do not use DRYLINE adult sampling lines (colorless luer lock nuts) with DRYLINE neonatal water traps as this could result in incorrect measurement data.
- Only combine the SPIRIT Flow Sensors and DRYLINE Water Traps as specified. Other combinations might lead to incorrect measurements.
  (☞"Connecting to the Respiration Circuit" P7-89)
- Use the adult flow sensor for a patient whose tidal volume is above 150 mL.
- Use the pediatric flow sensor for a patient whose tidal volume is below 300 mL.
- Make sure to use the correct flow sensor depending on the patient conditions, adult or pediatric and the tidal volume.
- Do not confuse the gas sampling line with other compatible tubing, e.g. IV-lines.

WARNING Warnings about the 12-Lead ECG Analysis Function

- The 12-Lead ECG analysis function is designed to acquire and interpret ECG data from a resting, supine

patient. If ECG signals from moving or shaking patients are acquired, erroneous 12-lead interpretation result may occur. Always ensure that the patient is kept motionless during 12-lead ECG signal acquisition and analysis.

- The 12-lead ECG analysis function is intended for use with adult and pediatric patients.
- All computerized ECG analysis results should be reviewed by a physician before making decision for the patient treatment.

⚠ WARNING Warnings about the BIS Monitoring

- Clinical judgment should always be used when interpreting BIS in conjunction with other available clinical signs. Reliance on BIS alone for intra-operative anesthetic management is not recommended.
- BIS values should also be interpreted cautiously with certain anesthetic combinations, such as those relying primarily on either ketamine or nitrous oxide/narcotics to produce unconsciousness.
- As with any monitored parameter, artifacts and poor signal quality may lead to inappropriate BIS values. Potential artifacts may be caused by poor skin contact (high impedance), muscle activity or rigidity, head and body motion, sustained eye movements, improper sensor placement and unusual or excessive electrical interference.

⚠ CAUTION Precautions about the System

- Do not assess the patient's condition only with the information from this device. A clinical judgment based on the information from the device should be made by a doctor who fully understands functions of the device, in a comprehensive manner combined with clinical findings and other test results.
- Do not assess the patient's condition only with the alarm from this device. When the alarm is set to OFF or if the alarm priority is low, a sudden change of the patient may not be noticed.
- If an alarm generates, check the patient's condition first and ensure the safety. Depending on the alarm, take appropriate measures to remove the problem. If the problem lies with the alarm setting, set the alarm properly.
- When measuring for a long period of time, make sure not to compress the patient with the lead cables and the electrodes. Compressing the same site for a long duration may inhibit the blood flow and generate compression necrosis and burn injury.
- Use only the spare parts specified for this device. Otherwise, proper function cannot be executed.
- Do not use the touch panel with the film attached. It may cause malfunction or damage the touch panel.
- For quality improvement, specifications are subject to change without prior notice.
- This device utilizes LED for the backlight. Since this LED deteriorates by the life cycle, the display may become dark, scintillate, or may not light by the long term use. In such case, contact your nearest service representative.
- This device is intended to be used for only one patient.
- The installation of this device should be performed by our service representative or a person who is well acquainted with this device.
- If not using the device for a long period, disconnect the power cable and lithium-ion battery.
- Although the LCD utilizes highly accurate picture elements, occasionally, there may be a few pixels which do not light or constantly light. Please note that this is not an device failure, and will not affect monitoring operation.
- Exposing LCD panel to intense light may deteriorate display property. Do not expose the panel to direct sunlight or strong ultra violet (UV) light.
- The lithium-ion battery can only be charged in the specified operational temperatures of the device. Refer to the operation manual of the lithium-ion battery (BTO-005) for details.

⚠ CAUTION Precautions about the ECG Monitoring

- If any electrodes get detached from the patient after being connected to the lead cable and patient monitor, pay attention that the metal part of the electrode does not get in touch with any metal parts of the bed or any conductive parts. Also, the operator should not touch any conductive parts with bare hands. Otherwise, it may

cause electric shock to the patient and/or operator due to excessive leakage current.

- The indication for continuous use of the electrode is about one day.
- Replace the electrode if the skin contact gets loosen due to perspiration, etc.
- When an electrode is attached to the same location for a long period, some patients may develop skin irritation. Check the patient's skin condition periodically and change the electrode site as required.
- For stable arrhythmia detection and ECG monitoring, verify proper electrode placement, lead, waveform size, and filter mode selection. If not properly selected, it may cause erroneous detection.
- The threshold level for arrhythmia detection changes with ECG waveform size. Set a proper waveform size for monitoring.
  - When the ECG waveform size is x1/4, x1/2, or x1, the arrhythmia detection level is 250 μV.
  - When the ECG waveform size is x2 or x4, the arrhythmia detection level is 150 μV.
- The leads for arrhythmia detection, central monitor display, printing are fixed as ECG1 and ECG2. Set the most appropriate leads with high QRS for ECG1 and ECG2, especially for arrhythmia detection. If the QRS amplitude for the set lead is low, it may cause erroneous arrhythmia detection.
- In ESIS Mode, artifacts such as electrosurgical noise or EMG can be largely reduced, but QRS amplitude attenuation, waveform distortion, or ST segment change may occur compared with other filter modes.
- The ESIS mode cannot completely reduce the electrical noise, and may erroneously detect the pacemaker spike. This mode should be selected only when a high frequency noise largely affects the HR measurement.
- There are some cases when the pacemaker pulse cannot be detected depending on the pacemaker type, pulse voltage, pulse width, electrode lead type (unipolar, bipolar), or electrode placement which causes the pacemaker pulse amplitude to decrease, and disables the pacemaker pulse detection.
- If signals similar to a pacemaker pulse are present, such as electric blanket noise or excessive AC frequency noise, these may be erroneously detected and displayed as a pacemaker pulse.
- When a spontaneous QRS and pacemaker pulse overlap (ex. fusion beat, etc.), QRS detection cannot be performed properly. In this case, the heart rate is degraded.
- If a pacemaker pulse is continuously detected due to AC frequency interference, QRS detection will be suspended and the heart rate will be reduced. Arrhythmia will not be detected either.

⚠ CAUTION Precautions about the ST Measurement

- The ST algorithm has been tested for accuracy of the ST segment data. The significance of the ST segment changes need to be determined by a clinician.
- For the lead which the electrode is detached, the reference waveform setup cannot be performed. Check if the electrode is appropriately attached, and perform the setup again.

⚠ CAUTION Precautions about the 12-Lead Analysis

- Interpretation and Minnesota codes given by this device do not instruct the physician as to the kind and degree of cardiac disease. Accordingly, four value judgments are given for ECG waveform and although "abnormal" indicates a large possibility of organic cardiac disease, there are cases where no cardiac disease exists despite an abnormal ECG (that is, an abnormal ECG may be caused by something other than heart).
  On the other hand, care should be taken in the event any preclinical coronary arteriosclerosis could be present despite a normal ECG interpretation.
  Therefore, for a proper diagnosis, the ECG should be integrated with other interpretations.
- ECG Recording by the Mason-Likar System
  The 12-lead ECG recorded with the torso placement of the limb leads (Mason-Likar 12-lead system) may differ from the standard 12-lead ECG. Moreover, waveforms may differ somewhat also in a supine position and a standing position (sitting position).
  Fukuda Denshi recommends to carry out the recording of the ECG by taking into consideration the waveform differences according to electrode positions or postures.
- For the model installed with ECG analysis program
  The ECG analysis program is intended to analyze the standard 12-lead ECG waveforms. Therefore, the

analyzed result for waveforms recorded with the torso placement of the limb leads (Mason-Likar 12-lead system) may differ from that of the standard 12-lead ECG waveforms.

- Select "Used" for the pacemaker setting on the patient admit/discharge menu if a patient has a pacemaker.
- The threshold values for classification of 12-lead ECG interpretation and Minnesota code are set by age and sex as follows:
  1. Male and Female of ages 19 years old and above
  2. Male of age 12 through 18 years old
  3. Female of age 12 through 18 years old
  4. Male and Female of ages 3 through 11 years old
  5. Male and Female of ages below 2 years old
- If no patient information (i.e. Default : "Class." [Adult], "Sex": undetermined, and "Age" [0]) has been entered, the system algorithm will handle the patient as a "35 years old male".
- Before the analysis, make sure the patient classification ([Adult] / [Child]) is properly selected. If [Neonate] is selected, the 12-lead ECG analysis will not function.
- Enter the age of patient if known. If no age information (i.e. Default: [0]) has been entered, the system algorithm will handle the patient as "35 years old".
- Enter the sex of patient if known. If no sex information (i.e. Default: undetermined) has been entered, the system algorithm will handle the patient as "Male".
- If the patient classification is set as [Child] and no age (i.e. Default: [0]) has been entered, the system algorithm will handle the patient as "less than 2 years old""

⚠ CAUTION Precautions about the SpO_2 Monitoring

- Use only the sensor/relay cable specified by Fukuda Denshi. Otherwise, it may cause measurement error.If the sensor is damaged, stop using it.
- If the nail is rough, dirty, or manicured, accurate measurement will not be possible. Change the finger or clean the nail before attaching the sensor.
- If irritation such as skin reddening appears with the sensor use, change the attachment site or stop using the sensor.
- Do not apply the sensor too tight. At the same time, check the blood flow constantly so that congestion is not generated at the peripheral site.
- Do not use tape to attach the sensor.
- Even attachment for a short duration may inhibit the blood flow and generate compression necrosis or burn injury. Also, blood flow inhibition may prevent correct measurements.
- Check the sensor attachment site constantly in every 4 hours when probes or reusable sensor are used, and at least every 8 hours when single patient use sensors are used. Be especially careful of a patient with bad perfusion. If the sensor attachment position is not changed constantly, skin irritation or skin necrosis due to compression may be developed. For the patient with bad perfusion, check the sensor attachment position at least every 2 hours.
- As skin for neonate, premature infant is immature, change the sensor attachment site more frequently depending on the condition.
- Direct sunlight to the sensor area can cause a measurement error.Place a black or dark cloth over the sensor if using in direct sunlight.
- When not measuring, unplug the relay cable and sensor from the SpO_2 connector. Otherwise, the outside light may affect to falsely display measurements.
- The pulse wave is normalized for SpO_2 measurement, and does not indicate perfused blood volume. Check proper probe attachment by observing the pulse wave.
- Precautions for Reusable Sensors
  The light-emitting part of the sensor should be over the root of the fingernail or as instructed per the related sensor instruction manual. Do not insert the finger too far into the sensor as it may hurt the patient. For details,

refer to the SpO_2 sensor instruction manual.

- Precautions for Single-Patient-Use Type Sensors
  The sensor can be reused on the same patient as long as the adhesive tape attaches without slippage. But do not reuse on other patients to avoid cross contamination. It is intended for single patient use only. For details, refer to the SpO_2 sensor instruction manual.
- If "---" is displayed for the SpO_2 numeric data, make sure that the sensor is properly attached.
- Measuring on a limb with NIBP cuff, arterial catheter, or intracatheter may result in incorrect measurement.
- Venous congestion may cause under reading of actual oxygen saturation. Therefore, assure proper venous outflow from monitored site. Sensor should not be below heart level (e.g. sensor on hand of a patient in a bed with arm dangling to the floor).

⚠ CAUTION Precautions about the NIBP Monitoring

- Do not apply the NIBP cuff to site of injury. An injury may be worsened by the measurement.
- Do not apply the NIBP cuff to the arm on side treated axillary lymph nodes dissection. It may lead to lymphatic edema by the cuff pressure.
- Measuring on a limb with SpO_2 sensor, arterial catheter, or intracatheter may result in incorrect measurement.
- An operator must not get away from a patient during the NIBP measurement. However, when getting away from the patient is necessary, do not activate the Alarm Suspend and Silence functions in order not to miss any sudden changes in the patient's condition.
- Pay attention when measuring the NIBP of patient with bleeding disorders or hyper coagulation. The cuff inflation may cause petechia or circulatory failure by the blood clot.
- For the following situation, measurements will be terminated.
  - When the measurement time has exceeded 160 seconds for adult and child, 80 seconds for neonate.
  - When the inflation value has exceeded 300mmHg for adult, 210mmHg for child, and 150mmHg for neonate.
- If used with the incorrect patient classification, it will not only cause erroneous measurement, but the inflating level for the adult may be applied to child or neonate causing dangerous situation to the patient.
- The continuous measurement and 1-minute interval measurement will automatically stop after 12 minutes (maximum 15 minutes).
- If the mean MAP display is set to OFF, the MAP alarm will not be generated. Also the MAP data will not be displayed for the tabular trend or the NIBP list.

⚠ CAUTION Precautions about the BP Monitoring

- Do not reuse / re-sterilize the disposable type transducers.
- If using a reusable blood pressure transducer, disinfect it according to the manufacturer's guidelines.
- The long-term use of the blood pressure transducer, tube and catheter may increase the risk of infection. Perform periodic replacement with new one. The guidelines of the CDC (Disease Control and Prevention) recommend replacing within 96 hours.
- If the ambient temperature of the blood pressure transducer has changed greatly, the zero balance may cause the drift. Perform the zero balance again.
- An operator must not get away from a patient during the BP measurement. However, when getting away from the patient is necessary, do not activate the Alarm Suspend and Silence functions in order not to miss any sudden changes in the patient's condition.
- Be sure to perform Daily Check. Use of faulty device might harm the patient or operator.
- If the Device Status Alarm occurs or if you feel the unusual operation of the device, perform the inspections to confirm the safety or contact our service representative.
- If the transducer get disconnected, pay attention that the metal part of the transducer does not get in touch with any metal parts of the bed or any conductive parts. Also, the operator should not touch the conductive parts with bare hands. Otherwise, it may result in electric shock to the patient and/or operator.

- When the power is turned ON, the BP value will not be displayed until zero balance is performed. Make sure to perform the zero balance. Once the zero balance is performed, the zero balance information will be maintained, and the BP value will be displayed.
- Each time the blood pressure transducer or tubing is replaced, the zero balance procedure is required to ensure accurate measurements.
- The zero balance procedure is required for the following case.
  - When starting the measurement.
  - When the position of the heart has changed due to body movement.
  - When the position of the transducer has changed.
  - When measuring for a long period of time and there is a possibility of measurement error due to change in ambient temperature, etc.
  - When a connector is connected/disconnected, or a transducer is replaced.
- Note that Systolic Pressure (SYS) = Peak Systolic Pressure (PSP) for the graphic trend, data base, and alarm setup.
- When ECG is not measured, Peak Diastolic Pressure (PDP) cannot be calculated.
- The undisplayed BP data (SYS/DIA/Mean) will not generate a BP alarm or be displayed in the tabular trend. Select the appropriate display type according to the monitoring purpose.

⚠ CAUTION Precautions about the CO_2 Monitoring (HC-110)

- Conduct CO_2 calibration for the following case.
  If the CO_2 gas calibration is not performed at a specified interval, CO_2 measurement accuracy may be affected and also subsequent gas calibration may not be possible.
  - When the accumulated measurement time exceeds 1,200 hours from the first use.
    However, if the first calibration was performed before the accumulated measurement time reaches 720 hours, another calibration is required when the accumulated measurement time exceeds 1,200 hours from the first calibration.
  - When 12 months has elapsed or the accumulated measurement time has exceeded 4,000 hours from the previous calibration.
  - When $EtCO_2$ measurement is not stable or accuracy is degraded compared with other measuring device.
  - When the patient monitor was not used for a while, or when $EtCO_2$ was not measured for a while.
- Perform the calibration 5 minutes after turning ON the power on the HC-110.
- Do not disconnect the sampling tube during calibration. If disconnected, calibration will cease.
- Dispose of calibration gas according to the regulation of each medical institution.
- Microstream™ $EtCO_2$ sampling tubes are designed for single patient use, and are not to be reused. Do not attempt to clean, disinfect, sterilize or flush any part of the sampling tube as this can cause damage to the monitor or lead to cross-infection.
- Dispose of sampling tubes according to standard operating procedures or local regulations for the disposal of contaminated medical waste.
- Before use, carefully read the Directions for Use for the Microstream™ $EtCO_2$ sampling tube.
- Only use Microstream™ $EtCO_2$ sampling lines to ensure the monitor functions properly.
- The nominal accuracy indicated in Table 5: CO_2 Measurement Accuracy, above, is not reduced by more than 4% of the reading in the presence of interfering gases, as detailed in ISO 80601-2-55 [S2] clauses 201.12.1.101.3, 201.101. The gases include Heliox with up to 80% Helium and with up to 15% Oxygen, Ethanol, Isopropanol and Acetone at up to 0.1%, as well as Methane at up to 1%, and Oxygen.
- The purchase or possession of this product does not explicitly or implicitly permit the use of this product with replacement parts. Whether the equipment is used alone or in combination with other parts, it is protected by the patent rights of the related devices.

- Microstream™and FilterLine™ are trademarks of a Medtronic company. Oridion Medical 1987 Ltd. is a Medtronic company. The US Patents for the nanoMediCO$_2$™ module are listed at: US Patents: www.covidien.com/patents

⚠ CAUTION Precautions about the CO_2Monitoring (HC-120 Gas Unit I/F Module)

- The disposable airway adapter should be opened just before use.
- Do not reuse the disposable airway adapter. If sterilized, it will become unusable.
- The airway adapter should be attached with the thicker side facing to the patient. If attached oppositely, it may damage the CO_2 sensor or airway adapter.
- Dispose of calibration gas according to the regulation of each medical institution.

⚠ CAUTION Precautions about the BIS Monitoring

- The conductive parts of sensors and connectors should not contact other conductive parts, including earth.
- To reduce the hazard of burns in the high-frequency surgical neutral electrode connection, the BIS sensor should not be located between the surgical site and the electrosurgical unit return electrode.
- The BIS sensor must not be located between defibrillator pads when a defibrillator is used on a patient connected to the patient monitor.
- Continuous impedance checking may need to be disabled if the 1 nA, 128 Hz impedance check signal interferes with other device (e.g., evoked potential monitors).
- Considerations when using Electro-Convulsive Therapy (ECT) device during BIS monitoring: Place ECT electrodes as far as possible from the BIS sensor to minimize the effect of interference. Certain ECT device may interfere with the proper function of the BIS monitoring system.

⚠ CAUTION Precautions about the Alarm

- Alarm messages will be displayed according to the priority. (Level S > Level H > Level M > Level L> Level N)
- For the same alarm level, the alarm message for the newer alarm will be displayed. However, arrhythmia alarm will be displayed according to the arrhythmia priority.
- The arrhythmia alarm message other than Tachy, Brady, Ext Tachy, Ext Brady will continue to be displayed for 30 seconds after the alarm is resolved.
- When "LEAD OFF", "Check Electrodes" is displayed, HR alarm or arrhythmia alarm will not function. If this condition is left unresolved, a sudden change of the patient may not be noticed. Take prompt action when the lead-off condition is detected.
- When CO_2 is measured on the HC-120 Gas Unit I/F module and HC-110 CO_2Gas module, the upper EtCO_2alarm will not generate if the upper limit is set to 100 mmHg/13.4 kPa and above as the measurement range is 0 to 99 mmHg / 0 to 13.3 kPa.
- Whether to use the SpO_2 second alarm function and its threshold selection should be based on the patient's clinical indication/portent and medical evaluation.
- If the second alarm setup is set to [OFF], the second alarm integral value will be set to 0.
- Pay attention not to set the alarm volume too low to avoid missing any important alarms.
- On a wired network, the alarm generated on the bedside monitor will be output to the network with a maximum delay of 1 second, and to the central monitor with a maximum delay of 2.5 seconds.
- If the NIBP alarm is turned OFF under the Oxygenator Mode, NIBP auto mode measurement and NIBP measurement at alarm occurrence will not be performed.
- If the same or similar devices with different alarm settings are used in the same facility or same department, pay attention not to misjudge the alarms.
- To ensure that the alarm setup is appropriate for the patient being monitored, check the setup each time this device is used.

⚠ CAUTION Precautions about the System Setup

- When the waveform and numeric data display for each parameter is set to OFF, the alarm and trend input will be also suspended.

- If the HR/PR source is set to [BP], and if BP waveform/numeric data is set to [Disp. OFF], the PR value will not be displayed.
- If the HR/PR source is set to [SpO_2], and if SpO_2 waveform/numeric data is set to [Disp. OFF], the PR value will not be displayed.
- If the RR source is set to [CO_2/GAS], and if CO_2 waveform/numeric data is set to [Disp. OFF], the RR value will not be displayed.
- If the RR source is set to [CO_2/GAS], and if GAS waveform/numeric data is set to [Disp. OFF], the RR value will not be displayed.
- Do not set the same remote control ID to multiple monitors in the same floor. Otherwise, the remote control operation may control multiple monitors at the same time.
- After the remote control setup, check that the remote control unit is properly operating.
- If the time/date is not correctly set, or changed during monitoring, malfunction may occur with NIBP measurement, periodic printing, trend, NIBP list data, and age calculation from the birth date.
- If the time/date is changed, the time/date for all the saved patient data (trend, list, recall, etc.) will also change. The printed time/date before changing and the displayed time/date after changing will differ.Also, the data transmitted to the central monitor before the time/date is changed will be displayed on the central monitor with the previous time/date.

⚠ CAUTION Precautions about the Multigas Module Data Monitoring (MG-110/ MG-120)

- The MG-110/MG-120 require warm up of about 10 minutes to correctly measure the data.
- If the power supply is interrupted due to power failure, etc., MG-110/ -120 multigas unit will initialize and enter into warm-up mode even if the power interruption is within 30 seconds.
- About the Gas Calibration
  The zero calibration will automatically start when the MG-110/ MG-120 are connected.
  After the warm-up completes, gas calibration will be performed every 4 hours during stable operation.
  During warm-up, gas calibration interval will become shorter than during normal operation.
  During gas calibration, measurement data will not be updated.
  Calibration gas is not required during gas calibration.
- Dispose of calibration gas according to the regulation of each medical institution.
- Make sure the sampling line and flow sensor is securely connected to prevent any leakage.
- The gas leakage inside or outside the equipment will cause measurement error. Make sure to check for leakage before usage.
- An environment with alcoholic vapor may adversely affect the measurement readings.
- CO_2, N_2O or anesthetic agent in the atmosphere around the MG-110/ MG-120 may adversely affect the measurement readings.
- SPIRO and ventilator cannot be used simultaneously.
- During the warming up process, the date of the last measurement accuracy check cannot be updated. Perform the measurement accuracy check after the warming up process is completed.
- If the accuracy check is performed using a low pressure gas, the accuracy of gas measurement will be reduced. Make sure to perform the accuracy check using the specified calibration gas before its expiration date.
- If the error persists, refer to your nearest service representative.
- About the MG-110 Series
  - The adult flow sensor dead space is 6.9 mL and the flow resistance is 1.8 cmH_2O at 60 L/min.
    The pediatric flow sensor dead space is 0.75 mL and the flow resistance is 0.9 cmH_2O at 10 L/min.
    Adjust ventilation accordingly.
  - To prevent condensation, the patient breathing circuit, flow sensor and pressure tubing should not be directly exposed to cooling equipment such as fans or cooling blankets.
  - Leakage of gas from the patient breathing system may occur if the pressure or gas sampling lines are not

connected to the MG-110.

- The pressure tube and gas sampling lines of the flow sensor should always be routed from the patient circuit to the MG-110 such a way as to avoid kinking.
- Flow sensors that have suffered damage to sensor head, tubing or tubing connector must not be used.
- If liquid has entered the pressure tubes, it can be removed by gently tapping or shaking the flow sensor.

⚠ CAUTION Precautions about the Patient Admit/Discharge

- If monitoring of a new patient is started without discharging the previous patient, data of the new patient will be added to the data of the previous patient which will result in inaccuracy.
- The user mode setting (alarm/display configuration) will remain effective even when the power is turned OFF or when the patient is discharged. Before monitoring, make sure the current user mode is suitable for the patient's condition.
- Resuming monitoring will also resume the alarm in suspension.

⚠ CAUTION Precautions about the External Media

- Use only the specified external media.
- Use only the external media formatted on this device.
- Make sure to power cycle the system after the setup data is read from the USB memory.
  By power cycling the system, the read data will become effective.
- Reading the patient data from the USB memory will erase all previous patient data stored in the patient monitor.

⚠ CAUTION Precautions about the Maintenance

- When cleaning the touch panel, never use strong-acidic cleaning solution.
- To clean the touch panel, use an optional cleaning cloth, eyeglass cleaning cloth, soft cotton cloth, or non-woven cloth (pulp, rayon, polyethylene, etc.).
- Clean the device frequently so stains can be removed easily.
- To prevent injury, it is recommended to wear gloves when cleaning the device.
- Pay attention not to allow chemical solution to enter the device or connectors.
- Do not use organic solvents, thinner, toluene or benzene to avoid damaging the resin case.
- Do not polish the device with abrasive or chemical cleaner.
- When disinfecting the entire room using a spray solution, pay close attention not to get any solution into the device or connectors.
- Use only neutral detergent to clean the device. The surface resin coating may damage, resulting in discoloration, scratches, and malfunction.
  Example:
  chemical cloth, scrub brush, abrasive, polishing powder, hot water, volatile solvent and chemicals (cleanser, thinner, benzine, benzol, and synthetic detergent for house and furniture), or sharp-edged tools
- Do not open the housing.
- Do not allow alcohol or other liquids to enter the device.
- Replace the periodic replacement parts periodically as specified.

Wired Network (DS-LANIII)

⚠ WARNING

- Do not connect unspecified device to the wired network.
- Do not mix devices with DS-LANII and DS-LANIII setting in the same wired network. The network may cease and proper monitoring may not be possible.

⚠ CAUTION

- If performing wired network transmission, configure the display so that the numeric data corresponded to the waveform is displayed. If not, the displayed waveform or numeric data may not be transmitted.
- The default setting of bed ID is "000". If connected to a wired network with the bed ID unchanged, monitoring on the central monitor will not be possible.
- When connecting to a wired network, make sure that there are no other bedside monitors with the same ID. If there is more than one bedside monitor with the same bed ID, the duplicated bedside monitors cannot be monitored on the central monitor.
- When connected to the DS-LAN III network, set the bed ID in the range from "001" to "100" .
- The alarms that can be notified to the central monitor depend on the model type and software version of the central monitor. For details, refer to the operation manual of the central monitor.
- There are following restrictions when connecting the DS-1200 System to the wired network.
  - The BP measurement unit setting should be the same for all central monitors and bedside monitors. If the setting is different among the monitors, data such as BP waveform, BP numeric data, NIBP numeric data, NIBP list will not be transmitted. It will be treated as not measured data, and will not be displayed on the central monitor. The alarm limit setup from the central monitor cannot be performed either.
  - DS-1200 System cannot be connected to the DS-LAN II.
  - The PR_IBP alarm will not be transmitted to the central monitor.
  - If the "RR/APNEA alarm source" is other than [Impedance] (or, if [Auto] selects a setting other than [Impedance]), the RESP waveform will not be transmitted on a wired network.
  - If the "RR/APNEA alarm source" is other than [CO_2/GAS] (Or, if [Auto] selects a setting other than [CO_2/GAS]), the CO_2 waveform will not be transmitted on a wired network.
  - For the numeric data displayed as "xxx", maximum or minimum value of measurable range will be transmitted.
  - The numeric data displayed as "--- " will be treated as not measured data.
  - If the measurement unit of CO_2 concentration is mmHg and [99mmHg] is selected for "Upper Limit of CO_2 (mmHg) Transmission" ([Initial Settings]>[System]>[DS-LAN]), the CO_2 value of 100 mmHg or above will be transmitted as 99 mmHg.
- As the DS-1200 System does not have the 12-lead ST display function, waveforms and other data will not be displayed for these displays on the central monitor connected to the DS-LAN network.
- When connected to the wired network, the time/date will synchronize with the central monitor. Even if the time/date is changed on the DS-1200 System, it will be corrected to the time/date of the central monitor.
- The ST display will be distorted on the central monitor if the ECG lead (ECG1 or ECG 2) is changed on the DS-1200 System. Redrawing the ST display will return the display to normal.
- On the central monitor, the respiration waveform and RR value based on the RR/APNEA alarm source selected on the DS-1200 System will be displayed. The monitored RR and APNEA will be the same for the central monitor and the DS-1200 System.

Wireless Network System

⚠ DANGER

- When monitoring a patient using wireless telemetry, make sure the patient data is properly received at the central monitor. Pay special attention when the channel ID at the bedside monitor is changed.

⚠ WARNING

- A password can be set to access the channel ID setup menu to allow only the telemetry channel administrator to change the channel ID.
- Some type of wireless combinations may generate interference with other telemetry.
- Before selecting a channel, verify it will not interfere with other channels.

- Inform the supervisor of the use of telemetry channels to avoid interference with other telemetry.
- If transmitters are used in a neighboring medical facility, your facility and the neighboring facility must make agreements on the setting of the telemetry channels to prevent telemetry interference.

⚠ CAUTION Precautions about the Telemetry

- When performing telemetry transmission, configure the display so that the numeric data corresponded to the waveform is displayed. If not, the displayed waveform or numeric data may not be transmitted.
- The setup of channel ID and group ID should be performed only by the telemetry channel administrator or our service representative. Users should not perform this procedure as malfunction may occur.
- When the measurement unit of BP is "kPa", corresponding waveform and numeric data will not be transmitted. When using a wireless network, use "mmHg" for the BP measurement unit.
- BP waveform with a scale above the set scale can not be properly transmitted. When transmitting the BP waveform, pay attention to the displayed BP scale.
- If the measurement unit of CO_2 concentration is mmHg and [99mmHg] is selected for "CO_2 (mmHg) Upper Limit of Transmission" ([Initial Settings]>[System]>[Telemeter]), the CO_2 value of 100mmHg or above will be transmitted as 99mmHg.

RTC and Data Backup

⚠ CAUTION

- This device is equipped with a built-in clock. When the power of this device is turned OFF, this clock is backed up by a lithium primary battery. If incorrect time is displayed when turning ON the power, a low battery may be the cause. In such case, contact Fukuda Denshi service representative for replacing the battery.
- When the power is turned OFF, the data will not be protected.

Precautions about the Ventilator Monitoring

⚠ WARNING

- The ventilator alarm sound is set to OFF at factory default setting.
  The alarm sound can be turned ON on the Tone/Volume setup screen.
- If the DS-1200 System does not generate an alarm even though the ventilator is generating an alarm, or if any other malfunction occurs, immediately check the ventilator, DS-1200 System, cable, and replace the cable if necessary. If the malfunction persists, stop using the equipment.
- The alarm generation on the DS-1200 System is not guaranteed if the alarm other than specified generates at the ventilator.
  (☞Maintenance Manual "Ventilator Measurement and Alarm Input" P4-1)

⚠ CAUTION

- The ventilator operation should be performed by well-trained and authorized personnel.
- When connecting this equipment and the ventilator, use only the specified connection cable.
- Verify that this equipment and the ventilator are properly connected.
- When connecting the cable, verify that the main power of this equipment and the ventilator is OFF.
- When Servo-i/s or SV-300 is connected, RESISTANCE (Insp, Exp), COMPLIANCE, P-V loop, F-V loop display function is not available.
- When FLOW-i is connected, P-V loop, F-V loop display function is not available.

Precautions about the SpO_2 Sensor

⚠ DANGER Danger of Burn Injury Caused by the SpO_2 Sensor

- When monitoring SpO_2, make sure to use only the specified sensor/relay cable. If any other sensor/relay cable is used, a high temperature rise of the sensor may place the patient in danger of burns.
  If there are any questions regarding the sensor/relay cable use for SpO_2 measurements of this device, please contact Fukuda Denshi service representative.

Precautions about the Masimo Model

⚠ CAUTION

- The purchase or possession of this product does not explicitly or implicitly permit the use of this product with replacement parts. Whether the device is used alone or in combination with other parts, it is protected by the patent rights of the related devices.

Precautions about the NIBP Cuff

⚠ CAUTION

- Some of the NIBP cuffs used for this device contain natural rubber latex which may cause allergic reactions. (FDA: Medical Alert on Latex Products, "Allergic Reactions to Latex-Containing Medical Devices", Food & Drug Administration, 10903 New Hampshire Avenue, Silver Spring, MD 20993, 1991.)

Precautions about Disposing of the Device, Accessories, or Components

⚠ CAUTION

- When disposing of this device, accessories, or components, use an industrial waste distributor. Do not dispose of as ordinary waste.
- When disposing of the battery, separate it from other wastes and contact your nearest service representative.

Precautions about Transportation

⚠ CAUTION

- When transporting this device, pack it with specified packing materials.
  Also, transport it under appropriate environment condition.
  (☞Operation Manual "Specification" P14-1)

Monitoring after Power Failure

When the power failure is less than 30 seconds, monitoring will resume with the display mode and patient information unchanged. When the power failure is 30 seconds or more, monitoring will resume with the default display mode set by the user, or the display mode which was last set.

MG-110/120, HC-110/120 will start up from the warm-up mode. The warm-up time differs for each unit.

To Prepare for Emergency Use

Accessories/Optional Accessories

- The ECG electrodes are consumable products. Always prepare extra supplies of electrodes.
- Verify that there is no wire break on the patient cable once a week.

Battery Pack

- Even if the battery pack is not in use, the remaining capacity decreases due to self-discharge.Make sure to verify once a week that the battery pack is fully charged.
- To fully charge the empty battery pack, it takes 5 hours during operation, and 2.5 hours when the power is OFF and AC cable is connected.
- The performance of the battery deteriorates with repeated use. To ensure performance of the battery, it is recommended to replace it once a year.

Electromagnetic Compatibility

This equipment complies with IEC 60601-1-2: 2014, safety standard regarding the electromagnetic disturbances of medical electrical equipment. To ensure maximum performance against the electromagnetic disturbances, make sure to follow the precautions for installation and usage described in this manual.

- This equipment is intended for use in the medical facility (except in the vicinity of MRI device), and satisfies the immunity level for professional healthcare facility environment stipulated in IEC 60601-1-2: 2014.
- When using this equipment, interference with other medical electrical equipments or non-medical electrical equipments may occur. Make sure that no interference is present before usage.
- This equipment is a ME equipment which intentionally receives RF energy of specific reception frequency. RF electromagnetic radiation from other equipment for the intended specific reception frequency band may cause radio interference. Make sure that the reception is properly made in the used environment.
- To ensure basic safety and essential performance related to electromagnetic disturbances during the expected service life of this equipment, "Daily Check" and "Periodic Check" must be performed.
  (Refer to "Chapter 9 Maintenance Check" of the Maintenance Manual.)

⚠ CAUTION

- Do not use any unauthorized equipment or cables as they may not comply with the EMC standard.

Precautions for Safe Operation under Electromagnetic Influence

If any sorts of electromagnetic wave, magnetic field, or static electricity exist around the device, noise interference or malfunction of the device may occur. If any unintended malfunction or noise occurs during monitoring, check the magnetic influence and take appropriate countermeasures.

The following are examples of the common cause and countermeasures.

⚠ DANGER Static Electricity

In a dry environment (room), static electricity is likely to occur. Take the following countermeasures.

- Both operator and patient should remove any static electricity before entering the room.
- Humidify the room.

⚠ WARNING Cellular Phone

- The radio wave may cause malfunction to the equipment.
  Cellular phones and radio sets should be turned off in the room (building) where medical device is located.

⚠ WARNING Lightning

A lightning nearby may induce excessive voltage to the equipment. If any danger is suspected;

- Use the uninterruptible power supply system.

⚠ CAUTION High frequency noise interference from other device through the power outlet

- Check where the noise is originated and remove it using filtering device, etc.
- Stop using the device that is originating the noise.
- Use other power outlet.

⚠ CAUTION

- If this equipment is installed close to, or stacked with other equipment, malfunction may occur. Make sure to verify that the equipment operates properly in a used location.
- Use of accessories, probes, or cables other than specified may cause increase in electromagnetic emission or decrease in electromagnetic immunity resulting in malfunction of the equipment.
- The portable RF communications equipment (including antenna cable and peripheral equipment such as external antenna) with the specified cable should be used in a location at least 30 cm apart from any part of this equipment. Otherwise, it may result in performance degradation of this equipment.

EMC Guidance

⚠ DANGER

- If portable transmitter or wireless LAN equipment is used in a place closer than 30 cm from the equipment, the electromagnetic influence may largely exceed the compliance level and may cause unexpected phenomenon such as noise interference on the waveform, etc.
- If this equipment is installed close to, or stacked with other equipment, malfunction may occur. Make sure to verify that the equipment operates properly in a used location.
- This equipment should be used in a location specified by each medical institution.

If any unexpected noise interference on the waveform or failure to the peripheral device occurs, stop using the equipment and follow the instruction of the technical engineer.

The following is the information relating to EMC (Electromagnetic Compatibility).
(When using this equipment, verify that it is used within the environment specified below.)

This equipment complies with IEC 60601-1-2: 2014 for the following system configuration.

- Main Unit: DS-1200
- Multigas Module: MG-110, MG-120
- CO_2 Module: HC-110
- Gas Unit I/F Module HC-120
- BISx Module: BISx
- Multi Module: HM-800
- SpO_2 Module: HG-810, HG-820
- Multiport Module: HP-800
- Lithium-ion Battery: BTO-005

❑Compliance to the Electromagnetic Emissions

The DS-1200 System is intended for use in the electromagnetic environment specified below. The customer or the user of the DS-1200 System should assure that it is used in such an environment.

Emission Test	Compliance
Mains Terminal Disturbance Voltage CISPR 11	Group 1 Class A
Electromagnetic Radiation Disturbance CISPR 11	Group 1 Class A

⚠ CAUTION

- The emission performance of this equipment is suitable for use in industrial environment and hospital environment (CISPR 11 Group 1 Class A). Do not use in home environment (generally, CISPR 11 Group 1 Class B is required).

❑Compliance to the Electromagnetic Immunity

The DS-1200 System is intended for use in the electromagnetic environment specified below. The customer or the user of the DS-1200 System should assure that it is used in such an environment.

The EMC Standard or Test Level	Immunity Test Level
Electrostatic discharge (ESD) IEC 61000-4-2	±8 kV Contact ±2 kV, ±4 kV, ±8 kV, ±15 kV air
Radiated RF EM Fields IEC 61000-4-3	3V/m 80 MHz to 2.7 GHz 2 Hz 80%AM
Immunity test specifications for RF wireless communications IEC 61000-4-3	See below.
Electrical fast transient/burst IEC 61000-4-4	±2 kV AC Mains ±1 kV output lines Repetition frequency 100 kHz
Surge: IEC 61000-4-5	±0.5 kV, ±1 kV Normal mode (Phase Angle 0°, 90°, 180°, 270°) ±0.5 kV, ±1 kV, ±2 kV Common mode (Phase Angle 0°, 90°, 180°, 270°)
Conducted disturbances induced by RF fields IEC 61000-4-6	3 V 0.15 MHz to 80 MHz 2 Hz 80%AM 6 V 0.15 MHz to 80 MHz (ISM bands) 2 Hz 80%AM
Power Frequency Magnetic Field IEC 61000-4-8	30 A/m 50 Hz, 60 Hz
Voltage dips, Voltage Interruptions and Voltage Fluctuations IEC 61000-4-11	0% UT; 0.5 cycles (Phase 0°, 45°, 90°, 135°, 180°, 225°, 270°, 315°) 0% UT; 1 cycle, 70% UT; 25 cycles (Phase Angle 0°) 0% UT; 250 cycles

⚠ CAUTION

- In the electromagnetic distrubances test evoked from the radiated RF electromagnetic field and RF electromagnetic field is performed with 2 Hz modulation frequency which is close to the frequency component of the vital parameter.

Immunity test specifications for RF wireless communications equipment

Test Frequency (MHz)	Modulation	Immunity Test Level (V/m)
710, 745, 780	PM, 217 Hz	9
810, 870, 930	PM, 18 Hz	28
1720, 1845, 1970	PM, 217 Hz	28
2450	PM, 217 Hz	28
5240, 5500, 5785	PM, 217 Hz	9

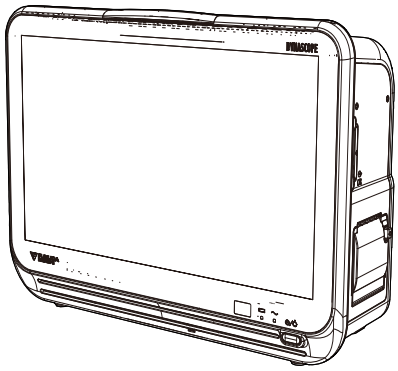
⚠ CAUTION

- The assumed service TETRA 400 of the test frequency of 385 MHz is a service in Europe, and this product, which is intended for use in the United States, has not been tested as it will not be radiated in close proximity.
- The assumed service GMRS 460, FRS 4600 of the test frequency of 450 MHz is a wireless device for general and leisure use, and this product, which is intended for use in a professional healthcare facility environment, has not been tested as it will not be radiated in close proximity.

Chapter 1 General Description

Composition of the System

Following model types are available for DS-1200 system main unit depending on a type of SpO_2unit, recorder and telemeter function.



Model	SpO_2 Unit	Recorder	Telemeter
DS-1200N	Medtronic		-
DS-1200NR	Medtronic	Yes	-
DS-1200NT	Medtronic	-	Yes
DS-1200NRT	Medtronic	Yes	Yes
DS-1200M	Masimo	-	-
DS-1200MR	Masimo	Yes	-
DS-1200MT	Masimo	-	Yes
DS-1200MRT	Masimo	Yes	Yes

[DS-1200N] is a generic term for DS-1200N (N/NR/NT/NRT)
[DS-1200M] is a generic term for DS-1200M (M/MT/MR/MTR)

Features

- Various displays such as enlarged numeric data, trend, or ventilator can be selected according to monitoring conditions.
  The operation can be performed with the touch panel. Also, frequently used keys can be programmed as user key.
- The alarm indicator notifies the alarm with different flashing patterns corresponding to the alarm level so that the users can easily identify the alarm level of the generating alarm.
- Remote control is possible using the optional remote control unit.
- The device can be operated with a battery (optional).
- By using the multiparameter amplifier, the device is capable of monitoring parameters in combination of BP (max. 8 ch.), temperature (max. 8ch.), and CO (max. 1ch.).
  In addition to ECG, respiration, SpO_2 (pulse wave), BP, NIBP, temperature and CO, it is also possible to measure CO_2, anesthetic gas concentration, O_2 measurement, N_2O concentration and BIS as optional function.
- 28 types of arrhythmia can be analyzed.
- By using the optional SpO_2 Module (HG-810/HG-820), arterial oxygen saturation can be also measured.

- This system uses pulse oximetry to measure and display functional oxygen saturation in the blood. There are three model types with different built-in SpO_2modules, which are Medtronic, Masimo.
- SpCO, SpMet, SpHb and PVI are optional parameters which can be measured on the DS-1200M or HG-810 with the built-in Masimo SpO_2 module.
  SpOC measurement is optional function available when using the DS-1200M.
- RR_$SpO_2$is a parameter which can be measured on the DS-1200N with the built-in Medtronic SpO_2module.
- By using the optional HP-800 Multiport Module, or connecting the ventilator to STATUS port on the main unit, airway flow, airway pressure waveform, minute ventilation, airway resistance , etc. can be monitored. Also, ventilator alarm can be notified to the central monitor via wireless and wired network. The following ventilators can be connected.
  - SV-300/300A
  - SERVO-i, SERVO-s, SERVO-U/n/air
  - PURITAN-BENNETT Ventilator 740/760, 840
  - Evita 4/Evita XL/Evita 2 dura
- Wired network (DS-LANIII) is possible via the Ethernet LAN cable.
  DS-LANIII is a network based on 100BASE-TX with transmission speed of 100 Mbps and maximum transmission distance of 100 m.
- By attaching the module to the built-in slot, monitoring parameters can be added.
- By using the optional Multi Module (HM-800), the monitoring parameters can be added.
- By connecting the optional multigas module (MGU-110/MGU-120), CO_2concentration, anesthetic gas concentration, O_2measurement, N_2O concentration can be measured. The following anesthetic agents can be measured.
  - Halothane
  - Isoflurane
  - Sevoflurane
  - Enflurane
  - Desflurane
- By connecting the Gas Unit I/F Module (HC-120) or CO_2 Gas Module (HC-110), CO_2 concentration can be measured.
- By using the HP-800 Multiport Module, or by connecting the FLOW-i Anesthesia Delivery System to Status II port or to COM1 to COM4 port on the main unit, CO_2 concentration, anesthetic gas concentration (ISO, SEV, DES), O_2 concentration, N_2O concentration, airway flow, airway pressure waveform, minute ventilation, airway resistance, etc. can be monitored.
- By connecting the anesthesia system Apollo to STATUS II port on the DS-1200 main unit, CO_2 concentration, anesthetic gas concentration (ISO, SEV, DES), O_2 concentration, N_2O concentration and minute ventilation can be monitored.
- By using the HP-800 Multiport Module, or connecting the oximeter to Status II port or to COM 1 to 2 port on the main unit, SvO_2, CO, etc. can be monitored. The following Oximeter/CCO measurement device can be connected.
  - Vigilance
  - Vigilance CEDV
  - Vigilance II
  - Vigileo
  - PiCCO2
  - EV-1000
  - PulsioFlex (Connects to COM1 to COM4 port)
- By connecting A-2000 BIS Monitor/A-3000 BIS Vista (Medtronic) to the HP-800 Multiport Module, STATUS II port on the DS-1200, COM1 or 2 on the DS-1200, the patient's wakeful state can be monitored.

- By using the HP-800 Multiport Module, or by connecting the INVOS 5100C Cerebral Oximeter (Medtronic), NIRO-200NX (HAMAMATSU PHOTONICS K.K.) to Status II port or to COM1 or COM2 port on the main unit, regional cerebral oxygen saturation data can be monitored.
- By connecting the following transcutaneous blood gas monitors to COM1 or COM2 ports, transcutaneous blood gas partial pressure can be monitored.
  - TCM4
  - TCM5 FLEX
- By connecting the following SpO_2 monitors to COM1 or COM2 ports, SpO_2 can be monitored.
  - Root (Masimo)

Menu Configurations

The menu configuration of this device is as follows.

❑Menu Screen

The menu screen is a group of shortcut keys to jump to each menu.
The menu is composed of the following 9 groups and can be accessed from the menu screen.

Function Groups	Displayed Menu
Patient Admit/Discharge	Admit/Discharge
Basic Setup	Maximum of 9 functions are displayed.
Alarm	Maximum of 9 functions are displayed.
Parameter	Maximum of 18 functions are displayed.
Data Review	Maximum of 9 functions are displayed.
Waveform Review	Maximum of 9 functions are displayed.
Calculation	Maximum of 5 functions are displayed.
Other Bed	Other bedside monitors connected to the DS-LAN will be displayed.
Initial Settings	Initial settings menu will be displayed.
Maintenance	Maintenance menu will be displayed.

REFERENCE

- Other than the "Initial Settings", the items to be displayed on the menu screen can be customized by groups.
  (☞Maintenance Manual "Menu Setup" P5-20)

❑Patient Admit/Discharge

Admit/Discharge	Mode Selection
	ID, Name, Class., Sex, Team, Birth Date, Age, Height, Weight, BSA, Blood Type (ABO, Rh), Pacemaker, Impedance Meas., Admit Date/Time
	Monitor Suspend
	Full Disclosure Waveform
	Discharge

❑Basic Setup

Display Configuration	Layout, Palette, Detail Setup, Meas Location Size, Wave (Sweep Speed), Short Trend, User Key
Manual Printing	Basic (Printer, Waveform, Print Duration, Delay Time), 12-Lead (12-Lead Waveform Printing Format, 12-Lead Analysis Results Format, Position, Wave Format, Print Calibration, Printer Auto Scale), Other Setup (Graphic Printing, Recall Printing), Common (QRS Classific., Speed, Calibration: Print Calibration, Print NIBP Data)
Auto Printing	Alarm Printing (Print, Printer, Waveform, Print Duration), Periodic Printing (Print, Printer, Periodic Interval, Waveform, Print Duration), Common (QRS Classific, Speed, Print Calibration, Print NIBP Data)
Tone/Volume	Vital Alarm Sound, Ventilator Alarm Sound, Status Alarm Sound, Tone Source, Key Sound, Other Bed Alarm Sound, Boot/Shutdown, Other
Time/Date	Time, Date
Color	Waveform/Numeric Data, Palette, User Key
Brightness	Brightness
Night Mode	Night Mode, Detail Setup (Volume, Display, Alarm Indicator, External Monitor During Night Mode)

❑Alarm

Basic	The parameters to be displayed are selectable.
	Alarm Suspend, Mode Select, Print, All Auto
Circulatory	Alarm Settings of HR, Ext Tachy, Ext Brady, PR, SpO_2, Ext SpO_2, NIBP, BP, TEMP
	Alarm Suspend, Mode Select, Print, All Auto
Respiratory/Gas	Alarm for RR, APNEA and gas can be set.
	Alarm Suspend, Mode Select, Print, All Auto
Arrhythmia	Arrhythmia Alarm, Detail Setup
ST	ST Alarm, Waveform Review (ST), Update Ref. Wave
QT	Update Ref. Wave
List	List of alarm ON/OFF setting and lower/upper limits, Meas. List/All List, Print Setup, Recall Setup
Detail Setup	Alarm Suspend Time, Alarm Silence Time, Alarm Silence, Alarm Sound Suspend, Status Alarm Control, Alarm Limit Display

❑Parameter

ECG	Arrhy., Arrhy. Alarm Setup, ST Setup, HR
	Size, Lead, Optimize Size, Alarm Assist, Disp. ON/OFF
	Detail Setup Filter Mode, Pacemaker Pulse, Drift Filter, 3-lead Override, Synchronized Mark/Tone, Pace Pulse Mask Time, AC Filter, ST/ VPC/Arrhy. Alarm Display, Pacemaker, HR Average, Auto Lead, ECG Analog Output, ECG waveform display during Lead-OFF
RESP	Size, Common Setup (RR Synchronized Mark, RR/Apnea Alarm Source), RR, Apnea, Alarm Assist, Display ON/OFF
	Impedance Setup CVA Detection, Impedance Measurement, Impedance Detection Lead, Impedance Detection Level, Detection Signal Adjustment
NIBP	NIBP Auto Mode, NIBP S, M, D, Alarm Assist, Cancel Error
	Detail Setup Patient Classification, Dyna Alert, Oscillograph, PR Display, NIBP Erase Time, Measure at Alarm, Quick Measurement, Sight Inflation, End Tone, Auto Mode with Start/Stop Key, Time Display, Periodic Measurement Starting Time, Oscill. Print, Target Inflation Value, Measurement Mode, Pump Operation Mode

BP		BP Zero (BP1 to BP8), Scale Selection, Label, Alarm Assist, Display ON/OFF
		Detail Setup Synchronized Mark/Tone, Display Type, Wave Filter, Mean Wave, Respiration Filter, IBP Analog Output, Alarm during NIBP, ART Catheter Check Message
SpO_2		Size, Label, Alarm Assist, Disp. ON/OFF
	DS-1200N/HG-820	Detail Setup Alarm during NIBP, Synchronized Mark/Tone, Second Alarm, SpO_2 Averaging
	DS-1200M/HG-810	Detail Setup Alarm during NIBP, Synchronized Mark/Tone, SpO_2 Averaging, Pulse Sensitivity, FAST SAT, PI Display, Signal IQ Wave
Sp*		SpCO, SpMet, SpHb Setup
Sp*	RR_SpO_2	Common Setup RR Synchronized Mark, RR/Apnea Alarm Source), Display ON/OFF, Alarm Assist, RR, Apnea
TEMP		Label, ΔT Setting, Alarm Assist, T1 to T8 Disp. ON/OFF
GAS		Scale, Gas Calibration, Detail Setup (Flow Rate, Wave Clip, CO_2 Source Priority)
CO_2		Scale, Airway Adapter Calibration, Alarm Assist, Disp. ON/OFF
		Detail Setup $EtCO_2$ Peak Duration, N_2O Compensation, Atmospheric Pressure, O_2 Compensation, Anesthetic Compensation, CO_2 Source Priority
BIS		Scale, Alarm Assist, TREND-E
		Common Setup Short Trend 2nd Parameter, Smoothing Rate, Continuous Impedance Check, EEG Filter
External Device		Vigilance/Vigileo, VENT, INVOS
Scoring		Score Calculation, History, Settings
SI		SI Alarm

❑Data Review

Graphic Trend	Latest Data, Alarm Review, Trend Group, Alarm Disp. Sel., Print
Tabular Trend	Latest Data, Alarm Review, List Group, Setup, Print, Print (All)
Recall	Latest Data, Display Selection, Setup, Delete Sel.
OCRG	Latest Data, Resp. Wave, Impedance, Resp. Wave Size, Print
Alarm History	Latest Data, Display Selection, Print

❑Waveform Review

Zoom Wave	Latest Data, Alarm Review, Meas., Print, Delete
ST	ST Waveform, Reference Waveform, Setup, Slide Show, Size, Latest Data, Print
12-lead	Latest Data, Review, Start Analyze, Setup, Print
Full Disclosure Waveform	Latest Data, Alarm Review, Slide Show, Time Search, Size/Scale, Setup, Alarm Display, Print

❑Calculation

Hemodynamics	Input Data, Edit, calculation results list, New Regist., Index Display, Print
Lung Function	Input Data, Edit, calculation results list, New Regist., Index Display, Print
CO	Meas., Edit, Setup, Hemodynamics, Average CO Input, Delete Sel.
Drug Calculation	Drug, Drug Amount, Diluent Amount, Flow Rate, Weight

❑Other Bed

Other Bed List	Area Selection (Area 1 to 5), Other Bed Alarm Sound, Alarm Display, Area Setup (Area 1 to 5), Bed List
Other Bed Display	Area Selection (Area 1 to 5), Other Bed Alarm Silence, ON/OFF of menu title display, Waveform Selection

❑Initial Settings

Alarm	-	Alarm System, Basic Alarm Parameter, Asystole, VF, VT Alarm, Oxygenator Mode Setup, Buzzer Tone at Speaker Failure, Suspend Arrhy. Analysis during Noise Interference, Lower Limit for Alarm Volume, Alarm Indicator, Alarm Level, HR/PR Lower Limit during Alarm Auto Setting, Alarm Threshold Limit, Alarm Auto Setup
Measurement	User Label	BP User Label, TEMP User Label
	Unit	CO_2, BP, CVP, TEMP, ST, Height/Weight
	Other	NIBP Start 5min. early, MAP Calc.(ART, NIBP), Arrhythmia Analysis Filter, Synchronized Mark/Tone Priority, HR/PR Source Priority, Gas Display during Undetected Breath, Catheter Manufacturer for CC Input
User I/F	Display/Print	Date Format, BP Alarm Increment, Trend Clip, BP Printing Scale, Night Mode Cancel, ST Display Lead Setup, VENT Display Parameters, Hemo/ etc Display Parameters, Auto Display Configuration, Dim All Data Other than Numeric, All Window Opaque, Printer Message Display, Message Icon, Operation Guide Display, Notification when Changing Device Configuration, Sync wave size/scale of extended display with main unit, 12-lead Analysis Filter Display, Waveform Size Display, Shift Time (Day Shift, Twilight Shift, Night Shift), Key Group Setup, Event Label Setup, RR Alarm Increment, Patient Name on the Information Display Area, External Device Numeric Data Box Operation, Drug Calculation, Monitor Suspend Label, Monitor Suspend Timer
	Power ON/ Discharge	Check Discharge at Power ON, Discharge Mode, NIBP Resume Auto Mode by Manual Meas., Backup Setting at Power ON/Discharge
	Menu	Items to be displayed on the menu screen can be selected.
	Key Mask	Items not to be displayed on the menu screen can be selected.
	Remote Control	Remote Control Key Function, Room ID/Bed ID
	Operation	Auto Hide Window
External Device Connection	Main Unit Port HP-800	COM Port, Status II Port, HP-800 Numbering Ventilator (SV-300, SERVO-i/s, SERVO-U/n/air, PB, Evita), SvO_2/ CCO (Vigilance, PiCCO, Pulsio Flex), Anesthesia Delivery System (FLOW-i, Apollo), Other (PC Comm., ORC, Barcode Reader, Magnetic Card Reader, BIS, INVOS, TCM4/TCM5, Root, NIRO), PC Comm. (DS-5000), Trend Data Setup
	Magnetic Card Reader	Data digits for each patient information, Auto Reference to Central Monitor when Reading Patient ID
	Network	Main Unit (IP Address, Sub-Network Mask, Default Gateway), Printer (network printer, IP address, MAC address, printer specification, paper size)
	Status Output	Alarm Output Setup
	Analog Output	Analog Output Setup, Synchronized Signal Output
System	DS-LAN	Room ID/Bed ID, CO_2 (mmHg) Upper Limit of Transmission
	Telemeter	Tele. ON/OFF, Channel/Group ID, Telemetry Wave, CO_2(mmHg) Upper Limit of Transmission
	Unit Module	Settings for multiamplifier, SpO_2 connector
	Other	AC Filter, Search Patient ID, Numeric Data External Output
User Mode Registration	-	Registering/Changing/Initializing the User Mode, Link with Patient Classification

Administrator Setup	Key Lock	Key lock for each function can be set.
	Password Setup	Password for each administrator level can be registered/changed.

❑Maintenance

Maintenance	Program Version, External Media, GAS Calibration, Parts Usage Time, Install, Module Install, Test Menu

Chapter 2 Name of Parts and Their Functions

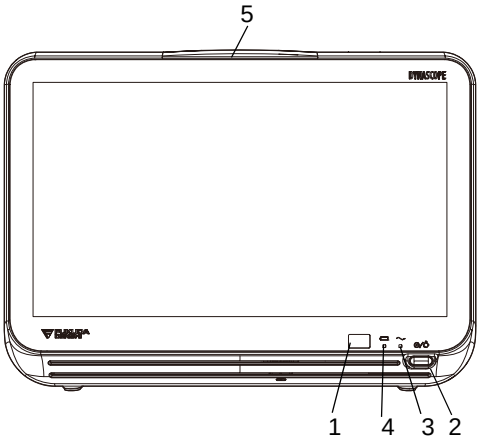
Name of Parts and Their Functions

WARNING

- Do not connect a unit or cable not authorized by Fukuda Denshi to any I/O connector. If done so by mistake, the device cannot deliver its maximum performance and the connected units may be damaged, resulting in a safety hazard.

Main Unit DS-1200

❑Front Side



1 Remote Control Sensor
Receives the infrared remote control signal.

2 Standby Switch
Sets ON/OFF of the standby condition.

3 Power Supply LED
Indicates the power supply status. Light will be off when the AC power is not supplied to the monitor.
Orange: Standby mode
Green: In normal operation
Light Off: During battery operation (AC power cable is disconnected.)

4 Battery Charging LED
Indicates the battery charging status. During battery operation, the LED will not light.
Orange: Charging
Green: Charging is complete
Light Off: During battery operation, or when battery is not installed, or when battery charging is ceased (due to temperature, etc.)

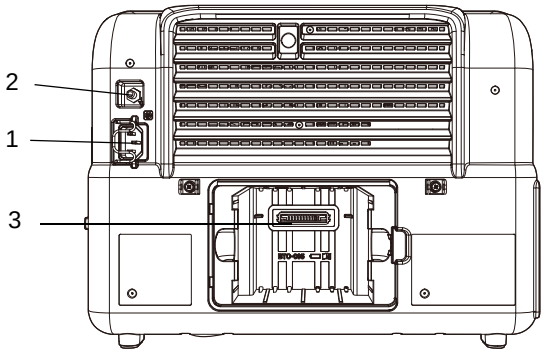
5 Alarm Indicator
Lights/blinks when the alarm generates.

❑Rear Side

1 Power Supply Connector
Connects the power supply cable.

2 Potential Equalization Terminal
For equipotential connection.

3 Battery Installing Position
Installing the specified lithium-ion battery.



❑Right Side

1 ECG Connector
Connects the specified cable.

2 Multiparameter Connector
Connects the specified cable.

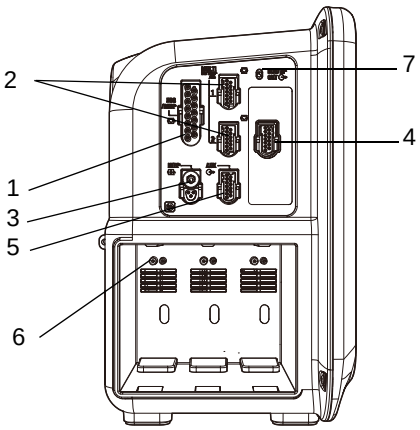
3 NIBP Connector
Connects the specified cable.

4 SpO_2Connector
Connects the specified cable.

5 AUX Connector
Connects the specified device.

6 Module Connector
Inserts the specified module.

7 Analog Output Connector
Outputs the ECG and BP waveforms.



❑Left Side

1 USB Connector
Connect the USB barcode reader or USB memory authorized by Fukuda Denshi.

2 DS-LAN Connector
Connects to the wired network using the Branch Cable (CJ-520/ CJ-522).

3 Serial Connector (COM1, 2)
Connects the specified equipment.

4 Status Input/Output Connector (Status II)
Connects the specified equipment.

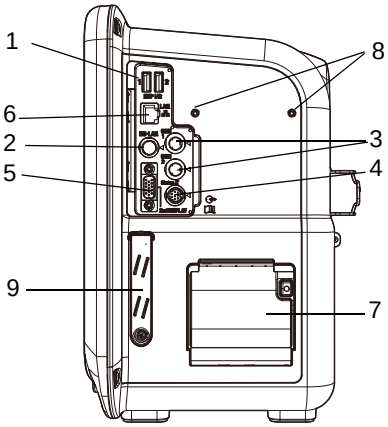
5 VIDEO Output Connector
Connects the external monitor.

6 TCP/IP Connector
Connects to TCP/IP network.

7 Recorder

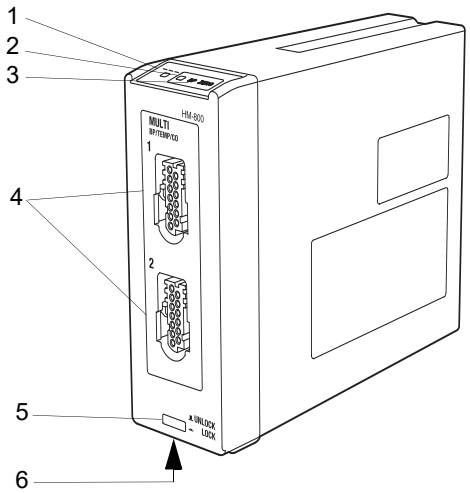
8 HTC Fixing Position
Unusable

9 Maintenance Cover



Multi Module: HM-800

❑Front Side



1 Power Supply LED

Indicates the power ON/OFF status.

2 BP Zero Balance LED

Lights during BP zero balancing.

3 BP Zero Balance Key

Starts BP zero balance.

4 Multiparameter Connector

(cables specified by Fukuda Denshi) for BP, TEMP or CO.

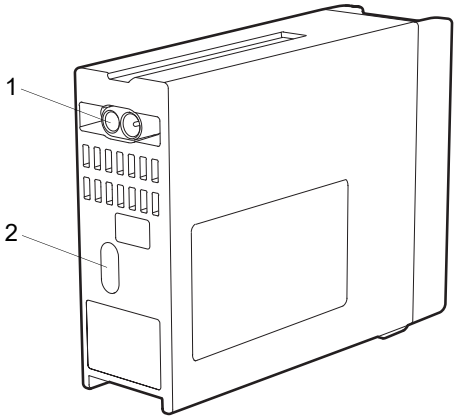
5 Release Lock Button

Press to lock the release lever.

6 Release Lever

Press here to remove the expansion modules from the (main unit).

❑Rear Side



1 Power Input Connector

(main unit).

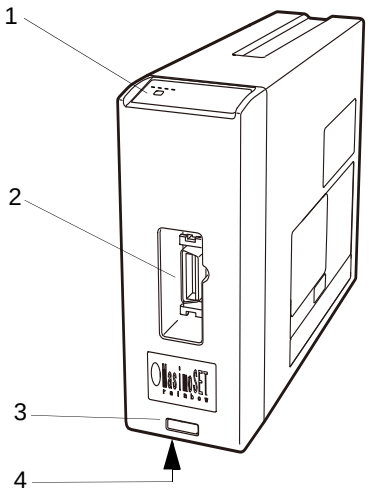
2 Infrared Communication Port

(main unit) via IrDA.

SpO_2 Module (HG-810/HG-820)

HG-810 (Masimo model) and HG-820 (Medtronic model) can be used for the SpO_2 modules. The following shows the example of HG-810.

❑Front Side



1 Power Supply LED

Indicates the power ON/OFF status.

2 SpO_2 Connector

Connects the SpO_2 sensor, or relay cable (patient cable).

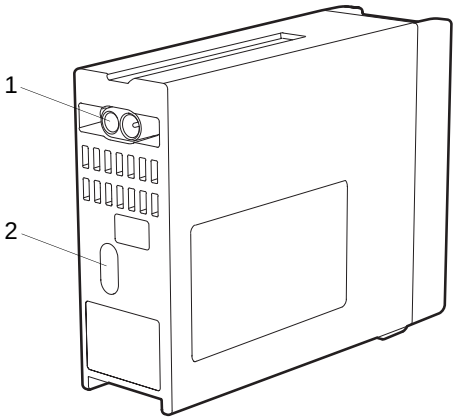
3 Release Lock Button

Press to lock the release lever.

4 Release Lever

Press here to remove the expansion modules from the (main unit).

❑Rear Side



1 Power Input Connector

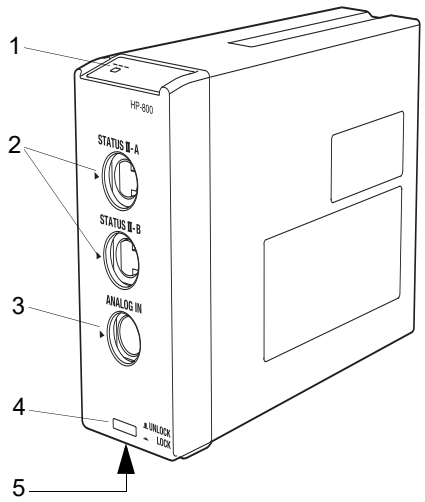
(main unit).

2 Infrared Communication Port

(main unit) via IrDA.

Multiport Module: HP-800

❑Front Side



1 Power Supply LED

Indicates the power ON/OFF status.

2 Status Input/Output Connector

Performs serial communication with the external device, and inputs alarm status of the external device.

3 Analog Input Connector

Inputs analog signal of the external device.

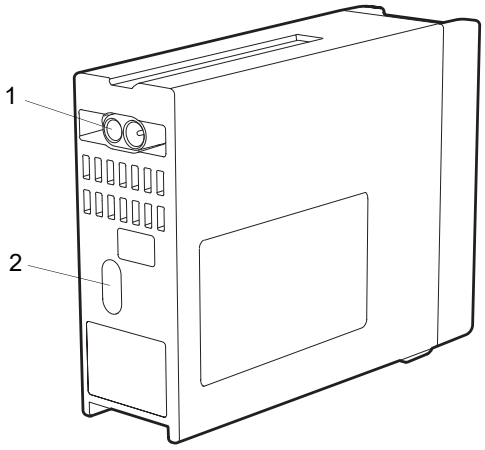
4 Release Lock Button

Press to lock the release lever.

5 Release Lever

Press here to remove the expansion modules from the (main unit).

❑Rear Side



1 Power Input Connector

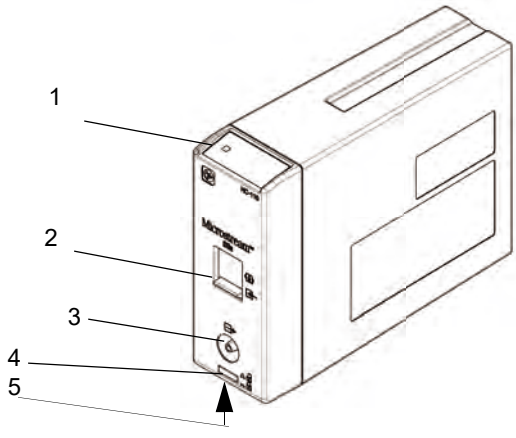
(main unit).

2 Infrared Communication Port

(main unit) via IrDA.

CO_2 Gas Module HC-110

❑Front Side



1 Power Supply LED

Indicates the power ON/OFF status. It will light in green while the power is ON.

2 Sampling Tube Connector

Connects the sampling tube manufactured by Medtronic.

3 Outlet

Connects the gas exhaust system and exhausts sampling gas.

4 Release Lock Button

Press to lock the release lever.

5 Release Lever

Press here to remove the expansion modules from the main unit.

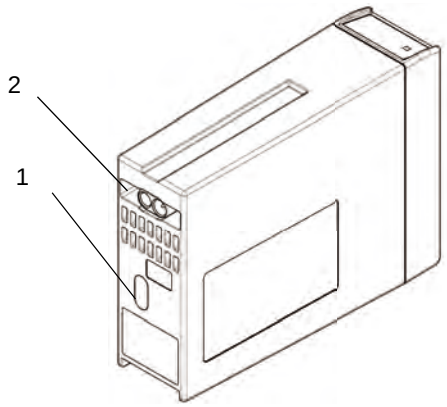
❑Rear Side

1 Power Input Connector

Supplies power while connecting to the main unit.

2 Infrared Communication Port

Communicates with the main unit via IrDA.



⚠ CAUTION

- Do not block the outlet as it may cause damage to the device.

Gas Unit I/F Module HC-120

❑Front Side

1 Power Supply LED

Indicates the power ON/OFF status. It will light in green while the power is ON.

2 Sensor Input Connector

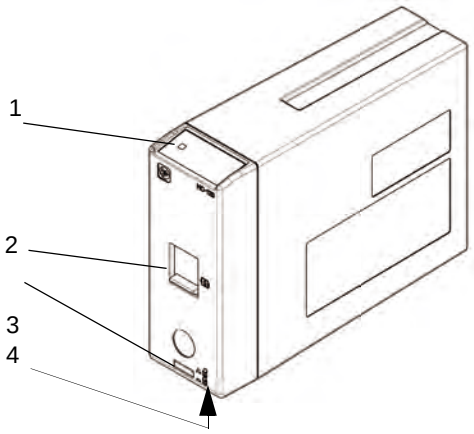
Connects the Philips CO_2 sensor (Capnostat 5).

3 Release Lock Button

Press to lock the release lever.

4 Release Lever

Press here to remove the expansion modules from the main unit.



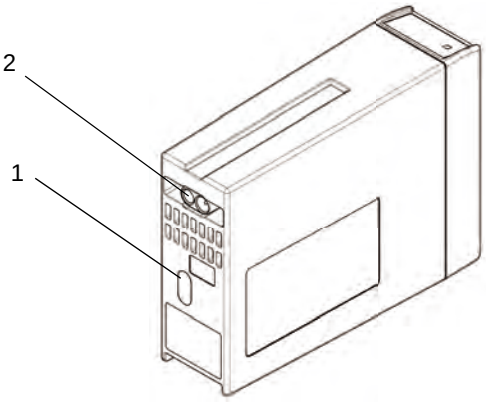
❑Rear Side

1 Power Input Connector

Supplies power while connecting to the main unit.

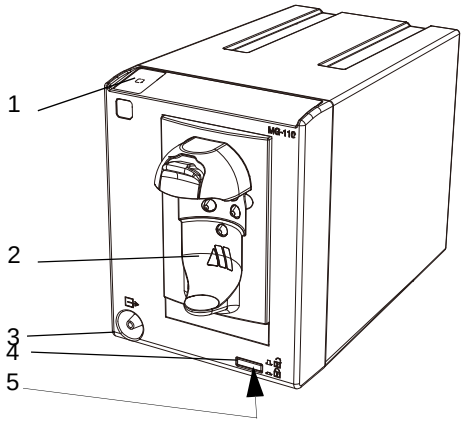
2 Infrared Communication Port

Communicates with the main unit via IrDA.



Multigas Module MG-110

❑Front Side



1 Power Supply LED

Indicates the power ON/OFF status. It will light in green while the power is ON.

2 Water Trap Receptacle

Connects the Mindray water trap.

3 Outlet

Connects the gas exhaust system and exhausts sampling gas.

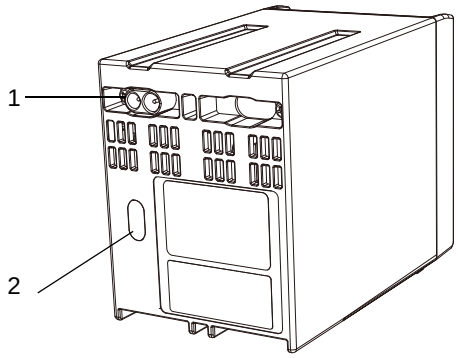
4 Release Lock Button

Press to lock the release lever.

5 Release Lever

Press here to remove the expansion modules from the main unit.

❑Rear Side



1 Power Input Connector

Supplies power while connecting to the main unit.

2 Infrared Communication Port

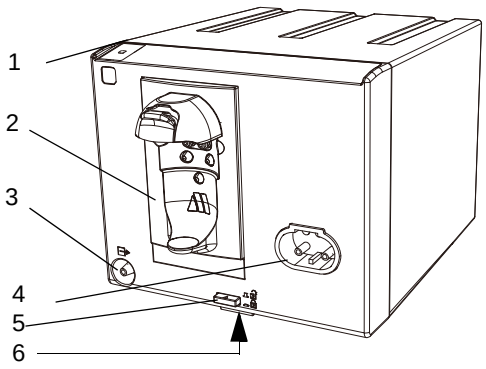
Communicates with the main unit via IrDA.

⚠ CAUTION

- Do not block the outlet as it may cause damage to the device.

Multigas Module MG-120

❑Front Side



1 Power Supply LED

Indicates the power ON/OFF status. It will light in green while the power is ON.

2 Water Trap Receptacle

Connects the Mindray water trap.

3 Outlet

Connects the gas exhaust system and exhausts sampling gas.

4 Flow Sensor Connector

Connects the Mindray flow sensor.

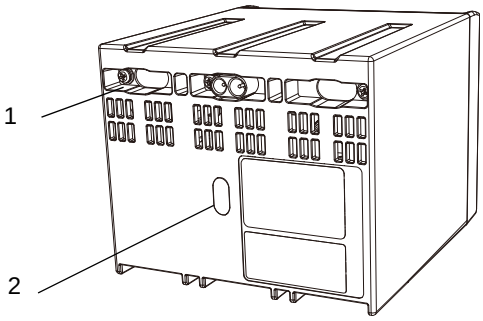
5 Release Lock Button

Press to lock the release lever.

6 Release Lever

Press here to remove the expansion modules from the main unit.

❑Rear Side



1 Power Input Connector

Supplies power while connecting to the main unit.

2 Infrared Communication Port

Communicates with the main unit via IrDA.

⚠ CAUTION

- Do not block the outlet as it may cause damage to the device.

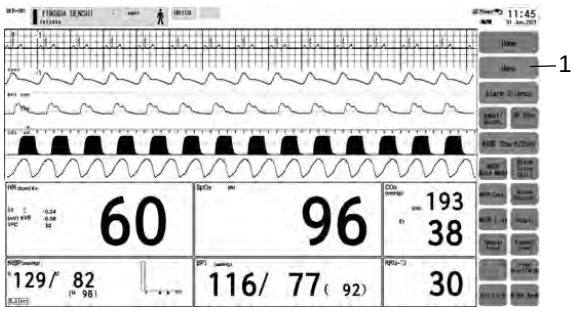
Chapter 3 Operation Procedure and Screen Examples

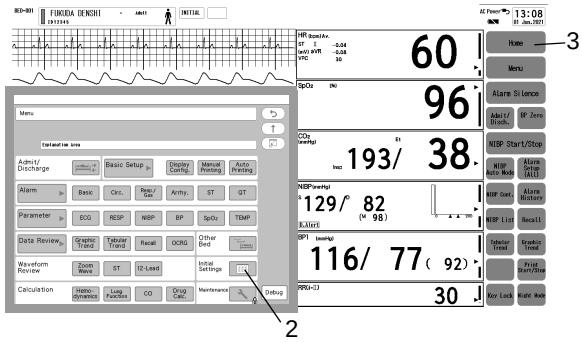
Operation Procedure

Operation of this device is performed using fixed keys and touch keys.

Touch Key

❑General Key Control





1 Pressing the [Menu] key will switch the display with a pip sound.

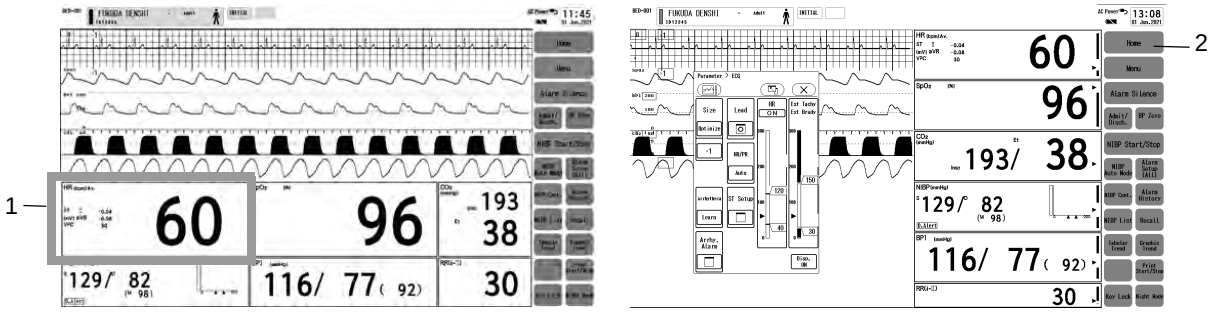
2 The touch key will respond by pressing any part of the key.

3 Pressing the [Home] key at any time will return the display to the home display.

REFERENCE

- The above is an example of the screen. The user keys can be customized and can be placed to any position.
  (☞"To Configure the Display" P10-4)

❑Key Control for Each Parameter



1 Press the numeric data box area.
The touch key will respond by pressing any part of the numeric data box.

2 Pressing the [Home] key at any time will return the display to the home display.

REFERENCE

- Frequently used touch keys can be programmed as user key. The user keys can be positioned to the user key display area and also to the numeric data area.
(☞"For Easier Use" P3-25)

Home Display

About the Home Display

The display can be configured according to the monitoring purpose.
The display layout can be selected from the following combinations of display location and size of numeric data box.

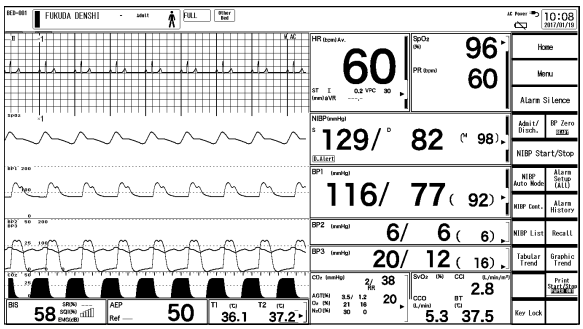
Display Location of Numeric Data	Numeric Data Box Size	Features
Right/Left	Right/Left: 1 column/ 2 columns Bottom: 1 row/2 rows	By selecting 2 columns, more numeric data can be monitored. Also, 12-lead ECG can be displayed on the waveform display area.
Right/Left+Bottom		
Bottom	2 rows to 6 rows	The waveform display area or numeric data can be enlarged.

The user key location can be selected from left, right, or bottom. By selecting the layout of 2 columns on left/right, more user keys can be displayed.

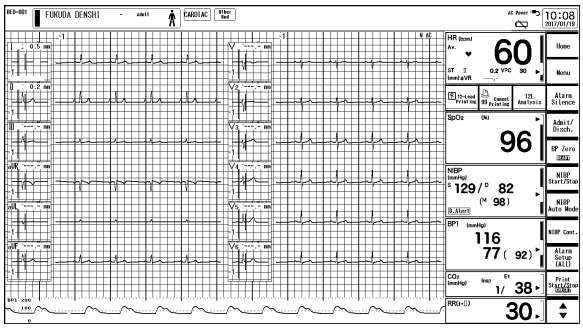
REFERENCE

- The display layout can be configured/registered according to the monitoring waveform and numeric data as necessary.
(☞"To Configure the Display" P10-4)

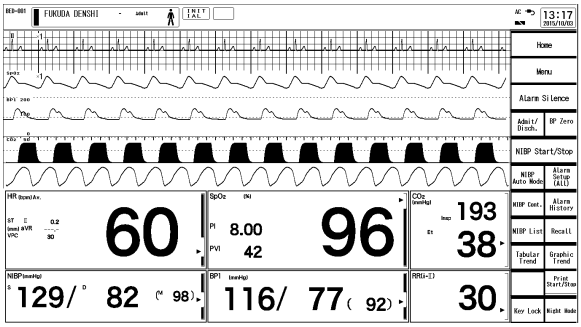
❑Display Example



Standard (Box Layout: Right)



12-Lead (Box Layout: Right)



Standard (Box Layout: Bottom 5 rows)

On this system, 9 main modes and 6 sub modes can be preprogrammed according to the monitoring purpose. By registering the configuration to each mode, the display configuration setups at admittance of patient can be simplified by just selecting one of the modes.
(☞"To Select the User Mode" P5-10)
It is recommended to program the display mode in rough classification such as patient's condition, monitoring purpose (ICU or surgery), and if necessary, perform unique setup for each patient.

❑Oxygenator Mode

⚠ WARNING

- The oxygenator mode is intended to prevent alarms during cardiopulmonary bypass surgery. Pay special attention when using this mode as the alarm generation will not be the same as to the standard monitoring mode.
- If the "Alarm Setting" under the Oxygenator Mode Setup is set to [All OFF], all vital alarm will not generate regardless of the alarm setting of each parameter. Also, if [Sel. Parameter] is set, vital alarm for unselected parameter will not generate. Pay attention to not miss any significant change of the patient's vital sign as the alarms will not be generated during the Oxygenator Mode.
- Once the cardiopulmonary bypass is finished, make sure to cancel the Oxygenator Mode and return to the standard monitoring mode.

⚠ CAUTION

- If the NIBP alarm is turned OFF under the Oxygenator Mode, NIBP auto mode measurement and NIBP measurement at alarm occurrence will not be performed.

Oxygenator mode can be used to prevent frequent alarm generation when oxygenator is used for extracorporeal circulation during cardiac surgery.
During oxygenator mode, "Oxygenator Mode" will be displayed on the screen, alarm generation will be stopped, and low priority parameter will be displayed with decreased brightness.

The main difference of standard monitoring mode and oxygenator mode is as follows.

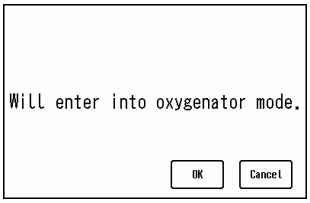
	Standard Monitoring Mode	Oxygenator Mode
Vital Alarm	will be generated.	will not be generated, or only the alarm for specified parameter will be generated.*
Equipment Status Alarm	will be generated.	will be generated for specified parameter.
NIBP Periodic Measurement	will be performed.	If [NIBP] is not selected on Oxygenator Mode Setup, periodic measurement will not be performed. It will not be performed even if NIBP measurement is requested from the central monitor.
Night Mode	Night mode can be used.	Night mode cannot be used.
*It is also possible to set the same alarm function with the standard monitoring mode.		

REFERENCE

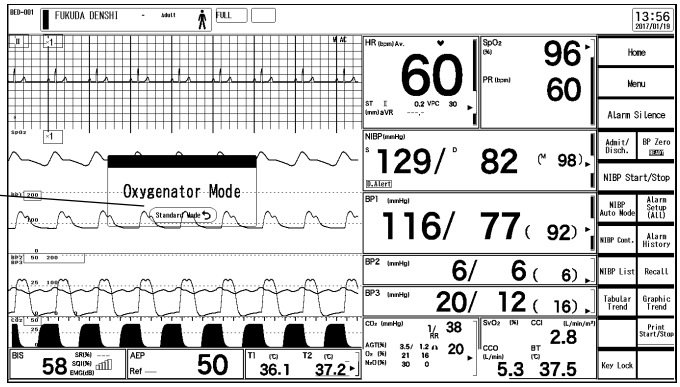
- The oxygenator mode setup can be performed under [Menu>Initial Settings>Alarm>Oxygenator Mode Setup].
  (☞Maintenance Manual "Alarm Related Setup" P5-4)

1 Press the [Oxygenator] key on the user key.

▸ The confirmation window will be displayed.



2 Press the [OK] key to change the monitoring mode to oxygenator mode.



3 Press the [Standard Mode] inside the message window to return to the standard monitoring mode.

REFERENCE

- The message window can be dragged to any position within the waveform area.
- The message window will not be displayed by selecting [OFF] for "Oxygenator Mode Message" (Menu>Initial Settings>Oxygenator Mode Setup).

Displayed Items

Other than waveforms and numeric data, patient name, alarm message, status message, etc. will be displayed on the screen.

❑Numeric Data, Waveform, Patient Name, etc.

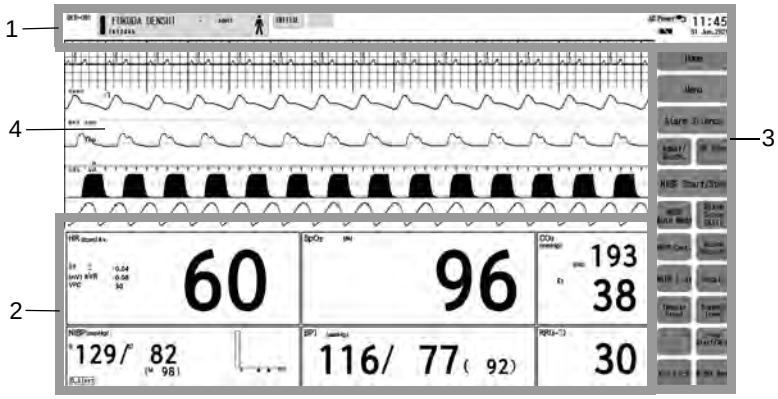
1 Information Display Area

Room/Bed ID, Patient Name, Patient Class., current time, messages, etc., will be displayed.

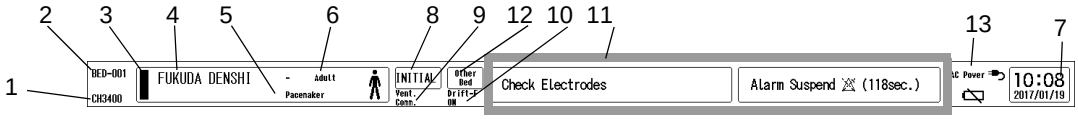
2 Numeric Data Area

3 User Key Area

4 Waveform Area



❑Information Display Area



1 Telemetry Channel (When a telemetry installed model)

Displays the telemetry channel ID.

2 Room/Bed ID

Displays the 3-digit Room ID and 3-digit (000–999) Bed ID.

3 Nurse Team Color

Displays the color of the nurse team set on the "Admit/Discharge" menu.

4 Patient Name

The patient name set on the "Admit/Discharge" menu will be displayed.
The patient name can be hidden from the display area by selecting [OFF] for "Patient Name on the Information Display Area" (Initial Settings>User I/F>Display/Print).

5 Pacemaker Usage

When [Used] is set for "Pacemaker" on the "Admit/Discharge" menu, <Pacemaker> will be displayed.

6 Patient Classification

The patient classification (Adult, Child, Neonate) set on the "Admit/Discharge" menu will be displayed.

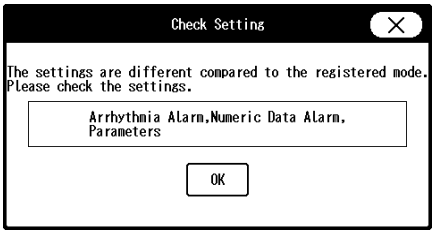
7 Date/Time

Displays the current date (month, day) and time (hour, minute).

8 Set Mode

The currently selected user mode will be displayed. Sub mode will be also displayed if selected.

When the alarm settings are changed, the alarm settings list will be displayed.



9 Ventilator Connection Status

Displays the connection status of the ventilator.
<Vent. Comm.>: Communication with the ventilator is in progress.
<Vent. Offline>: Communication with the ventilator is interrupted.
<Vent. Disable>: Communication with the ventilator is disabled.
No display: Ventilator is not set for "External Device" setting.

10 Drift Filter

When drift filter is set to ON, "Drift-F ON" will be displayed.

11 Message Area

When an alarm generates, a message will be displayed.

By pressing the message display area, the alarm message history can be verified.

12 Other Bed Status

Displayed when connected to central monitor.

Pressing the [Other Bed] key will display the Other Bed display.

13 Power Supply/Battery

The power supply status and battery charging status (when battery is installed) will be displayed.

❑Waveform Area

1 ECG

2 ECG Lead

3 ECG Size

The waveform size display of ECG, RESP, SpO_2 can be selected from [Numeric]/[Bar]/[Bar (10 mm)].
[Initial Settings > User I/F > Display/Print > Waveform Size Display] (☞Maintenance Manual "Display/Print Setup" P5-12)

4 SpO_2 Waveform

5 SpO_2 Size

6 BP Label

7 BP Scale

8 BP Waveform

9 Respiration Waveform

10 RESP Size

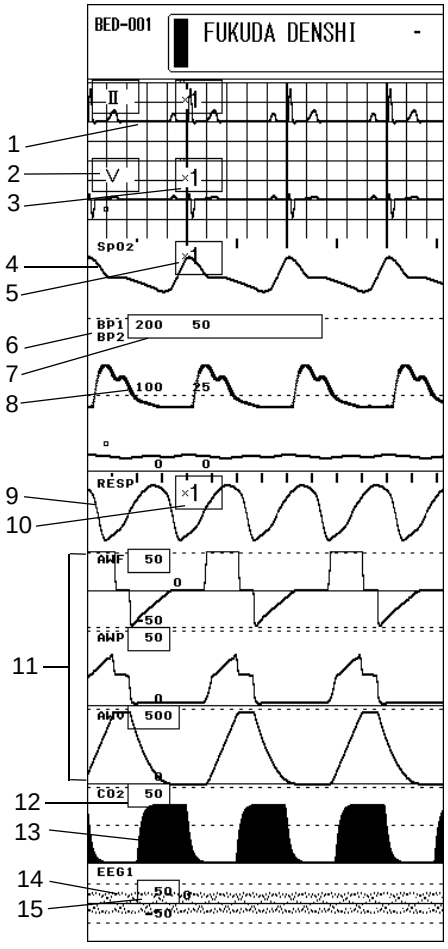
11 AWF, AWP, AWV Waveform and Scale

12 CO_2 Scale

13 CO_2 Waveform

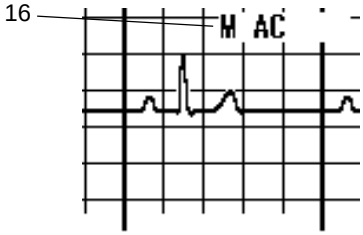
14 EEG Waveform

15 EEG Scale



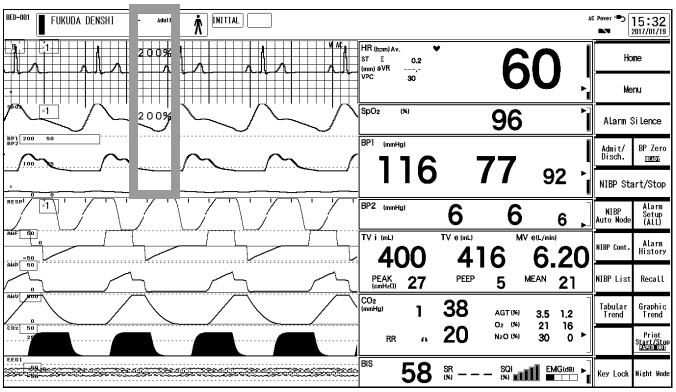
16 ECG Filter, Filter Mode Display

AC: AC Filter ON,
DF: Drift Filter ON,
M: Monitor Mode, E: ESIS Mode,
D: Diagnosis Mode, S: ST Display Mode



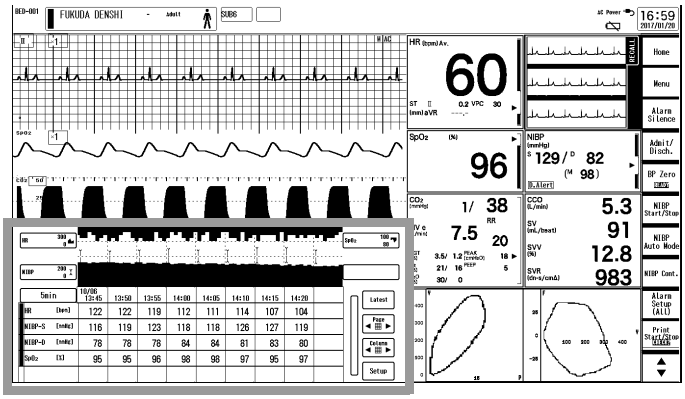
❑Enlarged Waveform

By selecting [ON] for "Zoom" under [Menu>Basic Setup>Display Config.], the waveform display can be enlarged. The waveform display can be enlarged for ECG, pulse wave, and respiration waveforms. <200%> will be displayed for the enlarged waveform. Also, the sweep speed will be doubled.

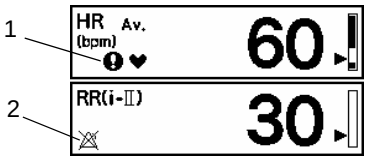


❑Graphic/Tabular Trend Display

By selecting [ON] for "Graphic/Tabular Trend" under [Menu>Basic Setup>Display Config.>Detail Setup], graphic/tabular trend can be displayed below the waveform display area. It cannot be displayed if "Bottom" is set for the display layout.
(☞"Review Function" P8-1)



❑Numeric Data Box Display (for all parameters)



1 Message Icon

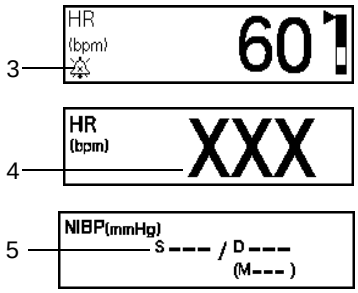
When the numeric data box size is too small to display the message inside, a message icon will be displayed instead to indicate that message is present.
(☞Maintenance Manual "Display/Print Setup" P5-12)

2 Alarm OFF Mark

Indicates that the alarm is set to OFF.

3 Alarm Silence Mark

Indicates that the alarm is silenced.



4 Out of Measurement Range (XXX)

Indicates that the measurement is out of range.

5 Invalid (---)

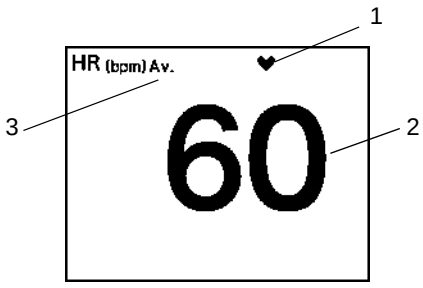
Indicates that the NIBP measurement ended erroneously, or NIBP erase time has elapsed.

❑Numeric Data Box Display (for each parameter)

REFERENCE

- The following numeric data box is displayed when the corresponding parameter is selected on the "Numeric Data Selection" window under "Display Config.". (☞"Numeric Data Selection" P10-2)

HR, HR/PR



1 HR/PR Synchronization Mark

When HR or PR according to the setting of "Synchronized Mark/ Tone" is detected, HR/PR synchronized mark will be displayed inside the corresponding numeric data box.

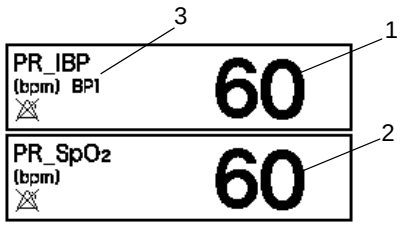
2 HR/PR Value

The HR/PR value will be displayed. When the value exceeds the measurable range, "xxx" will be displayed.

3 HR Average (Instant/Average, or no display)

Displays the averaging method of HR. ("HR Average" setting on ECG setup.)
When the patient classification is [Adult] or [Child], and “HR Average is set to [Analysis], ""Inst." or" Av" will not be displayed.

PR, HR/PR

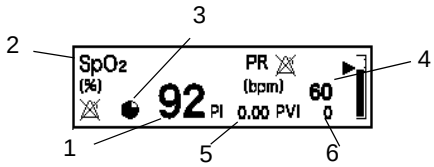


1 Pulse Rate (BP)

2 Pulse Rate (SpO_2)

3 PR_IBP Source

SpO_2



1 SpO_2 Value

The arterial oxygen saturation will be displayed.

2 SpO_2 Label

The label set for SpO_2 will be displayed.

3 Second Alarm Indicator (Medtronic Only)

When the second alarm is set, the second alarm indicator is displayed.

4 Pulse Rate

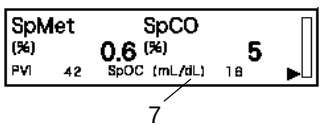
The pulse rate is displayed. When the value exceeds the measurable range, "xxx" will be displayed.

5 PI Value (Masimo only)

The perfusion index will be displayed.

6 PVI Value (Masimo only, optional)

The pleth variability index will be displayed.

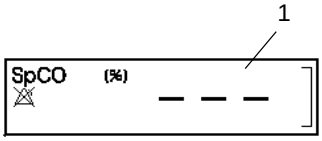


7 SpOC Value (optional)

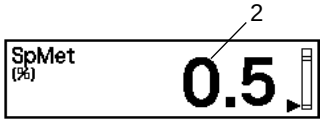
The arterial oxygen content will be displayed.

[SpCO/SpMet/SpHb] (Masimo only, optional)

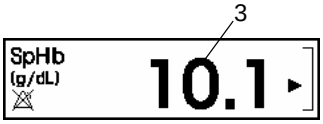
1 SpCO Value: The carboxyhemoglobin concentration will be displayed.



2 SpMet Value: The methemoglobin concentration will be displayed.



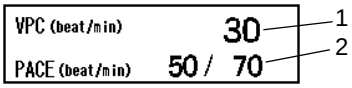
3 SpHb Value: The total hemoglobin concentration will be displayed.



VPC

1 VPC (1 min)

The VPC rate for the last 1 minute will be displayed. <---> will be displayed during arrhythmia learning.



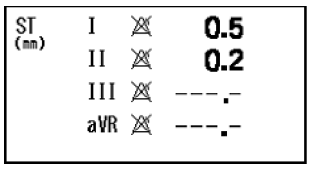
2 Pace Beats (1 minute) / Total Beats (1 minute)

Pace beats and total beats for the last 1 minute will be displayed. <---> will be displayed during arrhythmia learning.

ST

ST Level

The ST value for 4 leads can be displayed in the ST data box.
3 groups (A, B, C) of lead combination can be programmed.
For the following case, "---" will be displayed.



- Learn
- During lead-off condition
- When "N" or "S" is not detected for QRS within 30 seconds.
- When reference waveform is not set for ST measurement.

REFERENCE

- The leads displayed inside the ST level box can be changed.
  (☞Maintenance Manual "Display/Print Setup" P5-12)

ΔST

ΔST measurement value will be displayed on the ST measurement box.

The ST value for 4 leads can be displayed in the ST data box.
3 groups (A, B, C) of lead combination can be programmed.
For the following case, "---" will be displayed.

- HR Measurement Box
- VPC Measurement Box
- ST-A to ST-C Measurement Box

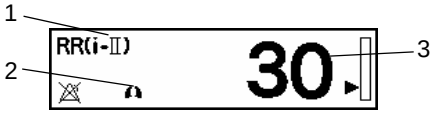
REFERENCE

- The leads displayed inside the ST level box can be changed.
  (☞Maintenance Manual "Display/Print Setup" P5-12)

RR Value (Impedance Respiration)

1 Impedance Detection Lead

The set detection lead (I/II) will be displayed.



2 RR Synchronized Mark

When the respiration of the set RR source is detected, a synchronized mark will be displayed inside the corresponding numeric data box.

3 Respiration Rate

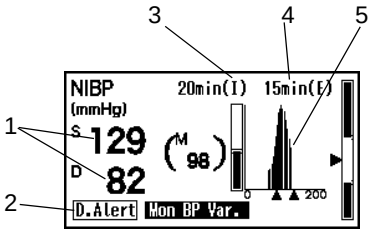
The impedance RR, CO_2 RR, and ventilator RR will be displayed. When the value exceeds the measurable range, "xxx" will be displayed.

When the impedance measurement is set to OFF, impedance RR will not be displayed.

NOTE

- To display the respiration rate for each respiration source (impedance/CO_2/ventilator/SpO_2), set the corresponding numeric data box on the display configuration setup menu.

NIBP



1 NIBP Value/Cuff Pressure

The NIBP measurement value (SYS / DIA / MAP) will be displayed.

The mean NIBP display can be set to ON or OFF on the NIBP setup menu. The value will be displayed as "---" when the preprogrammed NIBP erase time has elapsed.

During measurement, a cuff pressure will be displayed.

2 Dyna Alert Message

This message will be displayed when the Dyna Alert is effective.

3 NIBP Measurement Interval

The NIBP measurement interval will be displayed.

4 Elapsed Time/Measured Time

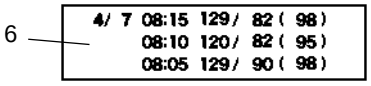
The elapsed time or measured time will be displayed.
The display can be selected under [Menu>Parameter>NIBP>Detail Setup>Time Display].

5 Oscillation Graph

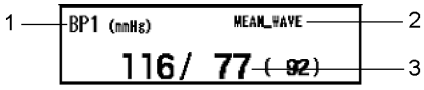
The horizontal axis in the graph shows the cuff pressure, and vertical axis shows the pulse amplitude with reference to maximum pulse amplitude.

6 NIBP List

The NIBP list of the latest 3/6/9/12/18 data and measured date/time will be displayed. The number of displaying data depends on the size of numeric data box.



Blood Pressure



1 BP Label

The label set for the blood pressure will be displayed.

2 <MEAN_WAVE>

<MEAN_WAVE> is displayed when [ON] is set for "Mean Wave" under [Menu>Parameter>BP>Detail Setup].

3 Blood Pressure

The BP measurement value (SYS/DIA/MEAN) will be displayed. On the BP setup menu, the display type (S/D/M, S/D, M) can be selected. When the value exceeds the measurable range, "xxx" will be displayed. If BP zero balance is not performed, "---" will be displayed, and if transducer is not connected, nothing will be displayed.

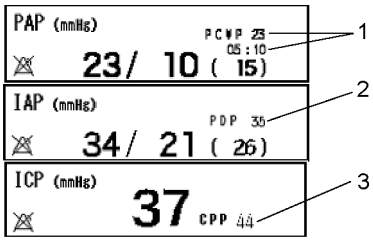
PAP/ IAP/ ICP

1 PAWP Value, PAWP Measured Time

When the BP label is PAP, PAWP (Pulmonary Capillary Wedge Pressure) and measured time can be displayed.

2 PDP Value

When the BP label is IAP, PDP (Peak Diastolic Pressure) of IABP can be measured. Note that Systolic Pressure (SYS) = Peak Systolic Pressure (PSP).



3 CPP Value

When the BP label is ICP, labeling the artery pressure as ART will allow measuring the CPP (Cerebral Perfusion Pressure). CPP = Mean Arterial Pressure – Mean Intracranial Pressure If the CPP value is negative value, or zero balance has not been performed for ICP or ART, "---" will be displayed, and if ICP or ART has not been measured, nothing will be displayed. Also, alarm cannot be set for CPP.

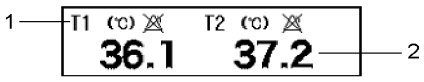
Temperature

1 TEMP Label

The label set for the temperature will be displayed.

2 TEMP Value

The temperature will be displayed. 400 series temperature sensor can be used. When the value exceeds the measurable range, "xxx" will be displayed. When 700 is used, "---" will be displayed.



Blood Temperature

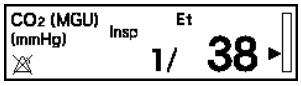
By using the thermodilution catheter for the CO measurement, blood temperature can be displayed. When the value exceeds the measurable range, "xxx" will be displayed.

$EtCO_2$/ $InspCO_2$

$InspCO_2$ Value/$EtCO_2$ Value

The end-tidal CO_2 concentration and inspiratory CO_2 concentration measurement value will be displayed.

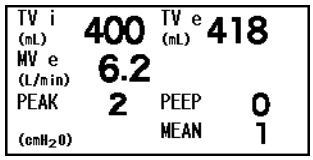
The measurement unit can be selected from mmHg / kPa / % under the "Initial Settings" menu.



Ventilator

Ventilator Data

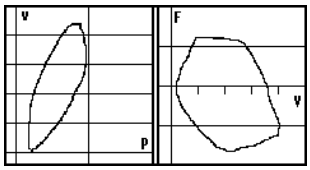
When a ventilator is connected, ventilator measurement data will be displayed.



P-V, F-V

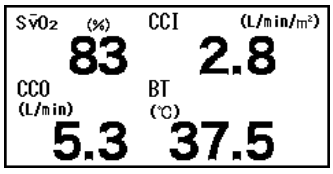
P-V, F-V Loop

By connecting the ventilator, multigas module (MG-120 with SPIRO unit), or FLOW-i, P-V loop (airway pressure / ventilation) and F-V loop (airway flow / ventilation) can be monitored on the ventilator display.

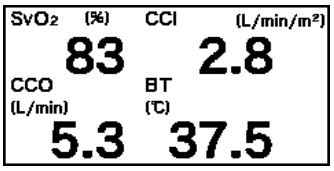


SvO_2/CCO Measurement Device

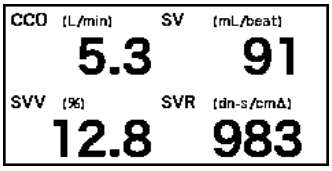
SvO_2, CO



SvO_2, CO, CI



CO, SV, SVV



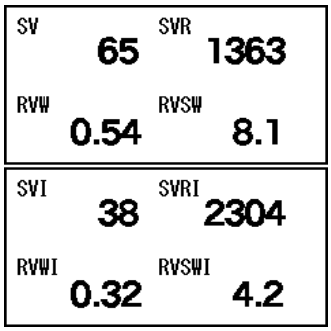
SvO_2/CCO Data

When SvO_2/CCO Measurement Device (Vigilance/Vigilance CEDV/VigilanceII/Vigileo/ PiCCO2/ EV-1000/ PulsioFlex) is connected, the measurement data (SvO_2, CO, etc.) acquired from these devices will be displayed. The displayed data will differ depending on the used SvO_2/CCO Measurement Device and measurement mode.

Oximeter/CCO Measurement Device	Displayed Data			
Vigilance (CCO mode/ STAT OFF/Index OFF)	SvO_2 ($ScvO_2$)	CCO	EDV	BT
Vigilance (CCO mode/ STAT ON/Index OFF)	SvO_2 ($ScvO_2$)	CCO STAT	EDV STAT	BT
Vigilance (CCO mode/ STAT ON/Index OFF)	SvO_2 ($ScvO_2$)	CCI	EDVI	BT
Vigilance (CCO mode/ STAT ON/Index ON)	SvO_2 ($ScvO_2$)	CCI STAT	EDVI STAT	BT
Vigilance (ICO mode)	SvO_2 ($ScvO_2$)	CO AVG	CI AVG	-
PiCCO2/PulsioFlex	$ScvO_2$	CCO	CCI	BT

Hemodynamic Data

Hemodynamic Data (Vigilance)



Based on the CCO data measured by the Vigilance (or Vigilance CEDV/ Vigilance/Vigileo), the following hemodynamic data are calculated and displayed every second based on the following condition. However the following condition should be met.

- It is measured on Vigilance with CCO mode. (It will not be displayed during ICO mode.)
- SvO_2 parameter key (oximeter numeric data box) is displayed.
- BP label is set as ART, PAP, CVP.
  (If the unit is "kPa", the data is converted to "mmHg" for calculation.)

Data	Description	Formula
SV	Stroke Volume (mL/beat)	$\frac{CCO \times 1000}{HR}$
SVR	Systemic Vascular Resistance (dynes*sec*cm^{-5})	$\frac{(MAP - CVP) \times 79.90}{CCO}$
RVW	Right Ventricular Work (kg*m)	CCOx(MPAP-CVP)x0.0136
RVSW	Right Ventricular Stroke Work (g*m)	SVx(MPAP-CVP)x0.0136
SVI	Stroke Volume Index (mL/beat/m^2)	$\frac{SV}{BSA}$
SVRI	Systemic Vascular Resistance Index (dynes*sec*cm^{-5}•m^2)	SVRxBSA
RVWI	Right Ventricular Work Index (kgm/m^2)	$\frac{RVW}{BSA}$
RVSWI	Right Ventricular Stroke Work Index (g*m/m^2)	$\frac{RVSW}{BSA}$

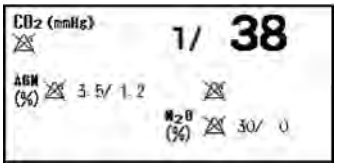
NOTE

- The hemodynamic data based on Vigilance data will not be stored in the list. For the Vigilance list, the data directly acquired from the Vigilance will be stored.

Multigas Module Data

Multigas Module Data

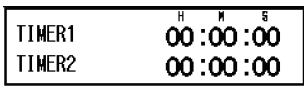
When multigas module is connected, the numeric data measured by the connected multigas module (CO_2 /anesthetic gas/O_2 /N_2O concentration) will be displayed.



TIMER

Stopwatch Key

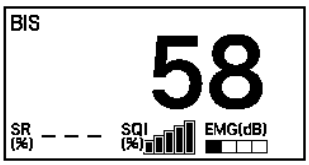
Functions as stopwatch.



BIS

BIS Value

By connecting the BISx module through the I/F cable, or by connecting the BIS monitor, BIS data (BIS, SQI, EMG, SR) will be displayed. If SQI value is below 50%, the BIS value will be displayed in gray. If SQI value is below 15%, the BIS value and SR value will disappear.
EMG and SQI will be displayed in bar graph.



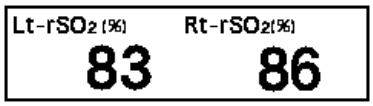
Bar Graph	SQI (0 to 100) [%]	EMG (30 to 55) [dB]
1	1 to 20	30 to 38
2	21 to 40	39 to 47
3	41 to 60	48 to 55
4	61 to 80	55 and above
5	81 to 100	-

The alarm bar will be displayed only when measurement is performed on BISx.

INVOS

INVOS 5100C Measurement Data

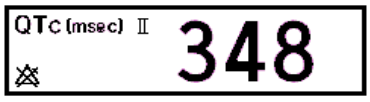
When connected to INVOS 5100C, regional cerebral oxygen saturation value will be displayed.
Lt- indicates left brain, and Rt- indicates right brain.



QTc

QTc Measurement Data

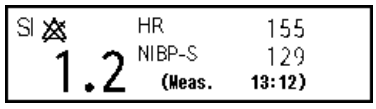
The QTc measurement value will be displayed.



SI

SI Measurement Data

The SI measurement value will be displayed.

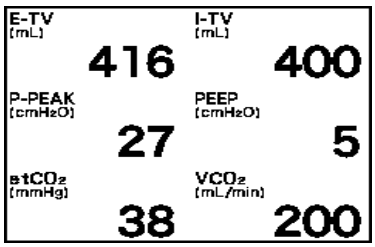


❑User Selectable Numeric Data (Ventilator, Hemodynamics, Transcutaneous Blood Gas)

For the following numeric data, the data to be displayed in the numeric data box are selectable by the users.

- Ventilator Data
- Hemodynamics Data
- Transcutaneous Blood Gas Partial Pressure Data

The number of displaying data depends on the size of numeric data box.Small: 2Medium: 4Large: 6Two types of user selectable numeric data (A, B) can be set

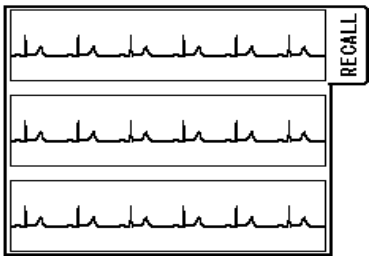


REFERENCE

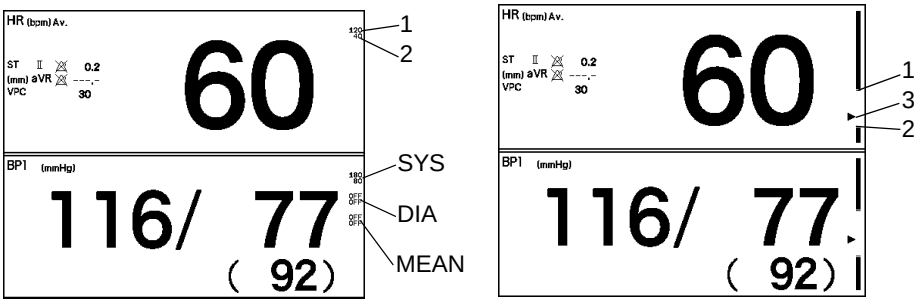
- The parameters to be displayed can be set under [Initial Settings>User I/F>Display Print] for [VENT Display Parameters] or [Hemo/etc Display Parameters].

❑Extended Function (Recall List)

The recall data will be displayed in a list format.
By selecting a data from the list, an enlarged waveform of the corresponding data will be displayed.



❑Alarm Limit Display



The alarm limit can be displayed beside each numeric data.The display type can be selected from [Graph]/[Numeric]/[OFF] for "Alarm Limit Display" under [Menu>Alarm>Detail Setup].

If ON is selected for the individual alarm, the alarm limit will be displayed.

The upper and lower limit will be displayed at upper and lower row respectively.

For BP and NIBP, each alarm limit of systolic BP (SYS), diastolic BP (DIA), mean BP (MEAN/MAP) will be displayed from the top.

ON/OFF of alarm limit display can be selected. (☞"List of Alarm Settings" P6-6)

1 Upper Alarm Limit

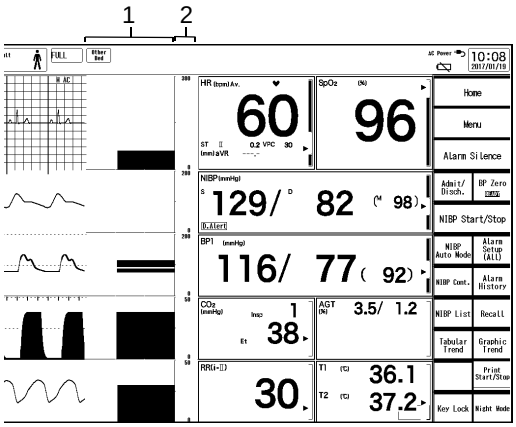
2 Lower Alarm Limit

3 Current Measurement Value

NOTE

- If the alarm limit display for BP is [Graph], systolic value will be displayed.
- Depending on the numeric data box type, alarm limit may not be displayed.
- If the SpO_2 lower alarm limit is set to 85%SpO_2 or below, the alarm limit value will be displayed regardless of the "Alarm Limit Display" setting.

❑Short Trend Display



1 Short Trend Display

On the waveform display area, short trend can be displayed.

The parameters to be displayed for short trend can be set under [Menu>Basic Setup>Display Config.].

The short trend width can be enlarged/reduced to the pressed position on the waveform area.The short trend width can be selected from 7 levels.

The graph displayed in red indicates the alarm occurrence point. Pressing the short trend of an alarm generated parameter will display the recall screen.

2 Trend Scale

The short trend scale will be displayed between the short trend and numeric data. The displayed scale will be in accordance with the scale set on the "Trend" screen.

For the following parameters, the short trend scale can be synchronized with the corresponding waveform scale by selecting [Waveform] for "Short Trend Scale" under [Menu>Display Config.>Detail Setup].

- BP, PEAK, VT, CO_2, O_2, Agent

For operation procedure on the short trend display, refer to ☞"Short Trend" P8-11.

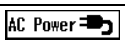
❑Displayed number of waveform and numeric data

Layout	Maximum Displayed Waveforms	Display Duration (25 mm/s)	Maximum Displayed Boxes
Right/Left, 1 column	27 (22)	13 (11)	11
Right/Left, 1 column+bottom	20	13 (11)	15
Right/Left, 2 columns	27 (22)	10 (8)	22
Right/Left, 2 columns+bottom	20	10 (8)	25
Bottom, 2 rows to 6 rows	18 to 10	16 (3)	10 to 30

*: ( ) indicates when LC-8016TC is connected.

Description of the Display

The following symbols are used for this device.

Symbol	Description
	Alarm OFF Indicates the alarm is OFF.
	Alarm Silence Indicates the alarm is silenced when the alarm system is IEC mode.
	HR Synchronized Mark This mark flashes synchronizing to the heartbeat.
	RR Synchronized Mark This mark flashes synchronizing to the inspiration.
	Message Icon Indicates that an alarm message is present for that parameter. Whether or not to display this icon can be selected under "Initial Settings".
	Key Lock Mark Indicates that the item requires a password to change the setting.
	Key Unlocked Mark Indicates that the key is unlocked
	Indicates that the device is connected to AC power source.
	Indicates the remaining battery level. This icon (full green) indicates that the battery is fully charged. *While charging, the corresponding battery level icon flashes.
	This icon (2/3 green) indicates that the battery is less than full, but still usable.
	This icon (1/3 yellow) indicates that the battery level is low and needs to be charged.
	This icon (1/3 red) indicates that the battery level is very low and flashes to alert the low battery status. Immediate battery charge is required. Technical alarm will generate.
	This icon (red frame) indicates that the battery is almost depleted and it flashes to alert that charging is necessary. Make sure to charge the battery immediately.
	This icon (black frame with a slash) indicates that the battery is not installed. Pay attention as power will not be supplied if AC power cable is disconnected during this state.

Messages and Sound

This section explains about the message displayed on the home display.

There are vital alarm message and equipment status alarm message which will be displayed at the top of the home display.

The alarms are classified to Level S (top priority), Level H (high priority, urgent), Level M (medium priority, caution), Level L (low priority, status), and Notification, and the message will be displayed according to the priority of Level S > Level H > Level M > Level L > Notification.

The displayed messages will flash in red and white for Level S, red for Level H, yellow for Level M, blue for Level L, and white for Notification.

Alarm Priority, Level		Description	Displayed Color/ Background
Top Priority	S	Top Priority Alarm	Red/ White White/ Red
High Priority	H	Life Threatening Alarm	White/ Red
Medium Priority	M	Cautionary Alarm	White/ Yellow
Low Priority	L	Status Alarm	White/ Blue
Notification	N	Notification Alarm	White/ Grey

⚠ CAUTION

- S alarm can be selected only when "Fukuda Tone" is selected.

Alarm sound can be selected from "IEC tone" , "Melodic tone" , or "Fukuda tone" . Each alarm sound will operate as follows.

IEC tone

Alarm Priority, Level		Description	Burst Interval
High Priority	H	Life Threatening Alarm	About 2.5 sec.
Medium Priority	M	Cautionary Alarm	About 4.5 sec.
Low Priority	L	Status Alarm	About 16 sec.

IEC tone complies to IEC60601-1-8.

Melodic Tone

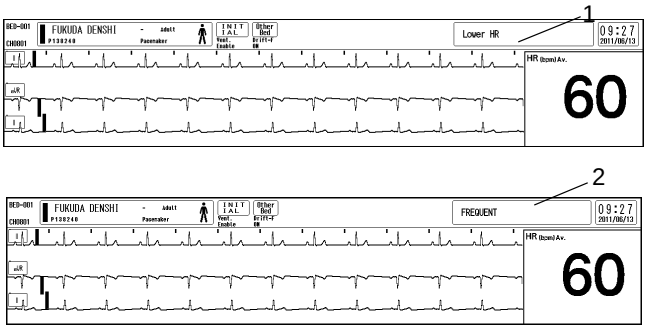
Alarm Priority, Level		Description	Burst Interval
High Priority	H	Life Threatening Alarm	About 2.5 sec.
Medium Priority	M	Cautionary Alarm	About 4.5 sec.
Low Priority	L	Status Alarm	About 16 sec.

Fukuda tone

Alarm Priority, Level		Description	Burst Interval
Top Priority	S	Top Priority Alarm	About 2.5 sec.
High Priority	H	Life Threatening Alarm	About 2.5 sec.
Medium Priority	M	Cautionary Alarm	About 4.5 sec.
Low Priority	L	Status Alarm	About 16 sec.

❑Vital Alarm Message

The vital alarm message is generated when a measurement exceeds the alarm limit,or when arrhythmia is detected.



1 Numeric Data Alarm Message

2 Arrhythmia Alarm Message

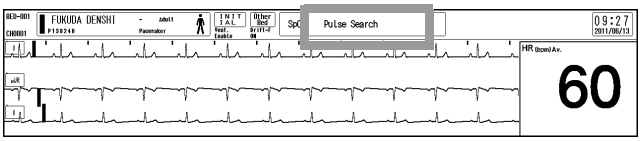
There are 2 types of vital alarm messages; numeric data alarm and arrhythmia alarm. If both alarms occur at the same time, the numeric alarm message and arrhythmia alarm message will be displayed alternately in 2-seconds intervals. The alarm messages will be displayed according to the priority. If the priority level is the same, the newer alarm message will be prioritized.

⚠ CAUTION

- The arrhythmia alarm message other than Tachy, Brady, Ext Tachy, Ext Brady will continue to be displayed for 30 seconds after the alarm is resolved.

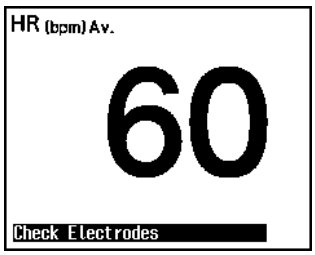
❑Equipment Status Alarm Message

The equipment status alarm message will be displayed when proper monitoring cannot be performed.
The alarm messages will be displayed according to the priority. If the priority level is the same, the newer alarm message will be prioritized.



❑Numeric Data Box Message

The measurement status of each parameter will be displayed inside the corresponding numeric data box.

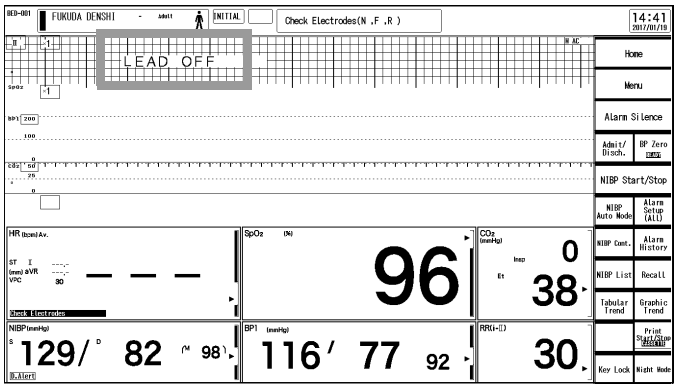


❑Lead-Off Message

If the ECG electrodes used for HR measurement orarrhythmia analysis are detached, the status will be notified.

WARNING

- When <Lead Off> is displayed, HR alarm or arrhythmia alarm will not generate. If this condition is left unresolved, a sudden change of the patient may not be noticed. Take prompt action when the lead-off condition is detected.



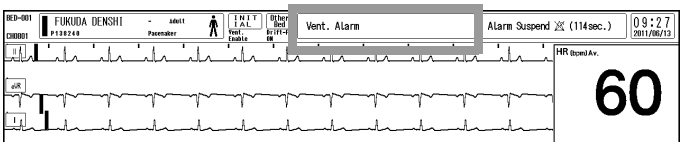
❑Ventilator Alarm Message

When a ventilator is connected to this equipment, ventilator alarm and connection status alarm will be displayed on the equipment status alarm message area.

The alarm message with the higher alarm level will be displayed.

⚠ WARNING

- The ventilator alarm sound is set to OFF (factory default).
- The alarm sound can be turned ON under [Menu>Tone/Volume]. (☞"Tone/Volume" P10-18)



❑Ventilator Alarm Factor Message

For SV-300, SERVO-i/s, SERVO-U/n/air, ventilator alarm factor if specified will be notified and displayed on the central monitor.

⚠ CAUTION

- Depending on the central monitor type and software version, ventilator alarm factor may not be displayed. For details of the central monitor type and software version, refer to your nearest service representative.
- The ventilator alarm factors are displayed only on the central monitor. These will not be displayed on the bedside monitor.

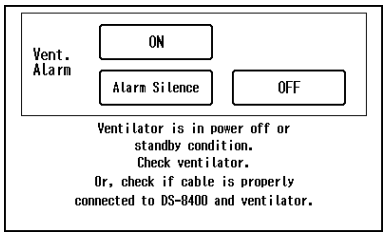
❑Ventilator Disconnected Confirmation Window

A confirmation window will be displayed when a ventilator cable is disconnected from the Main Unit , or when the power of the ventilator is turned OFF.

[ON] will continue communication with the ventilator during ventilator alarm condition. Check the ventilator power and cable connection.

[Alarm Silence] will silence the ventilator alarm for 2 minutes.
If the ventilator alarm condition remains after 2 minutes, the alarm will generate again.

[OFF] will disable the ventilator alarm until the ventilator connection status recovers.



⚠ CAUTION

- Check occasionally the communication status of this equipment and the ventilator.
- Verify that a ventilator alarm is not generated, and that the <Vent. Comm.> message is displayed.
  This confirmation window will be displayed until the displayed key is pressed or proper communication with the ventilator is resumed. When the communication is resumed, the window will automatically close.
  When disconnecting the ventilator and this equipment, make sure to select [OFF] on the confirmation window which will be displayed when the power of the ventilator is turned OFF, or when the cable is disconnected.

Window Display

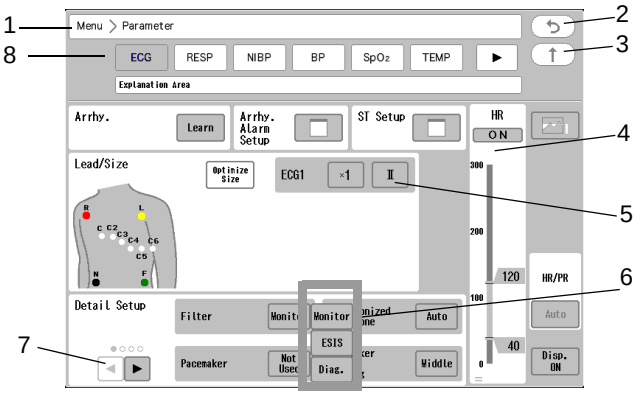
About the Window Display

The screens that are displayed when operating this system are referred to as windows. (The windows that appear by pressing the numeric data area are called floating windows, as they can be moved to any desired position.)

The target window can be displayed by using various method, such as selecting the menu items, pressing a parameter key or using a short cut key such as user key.

Display

The common items on the window are explained below.



1 Hierarchical Level Display

The hierarchical level of the current window is displayed. The level is expressed using the ">" symbol.

This area also functions as keys, making it possible to return from the lowermost to topmost window in a one-touch operation.

2 Previous Display

Pressing this key will return the display to the previous window.

3 Upper Level Key

Returns to the upper level display.

4 Key Lock Icon

Key lock icon will be displayed for the setup item that is locked.

To unlock the setup item, enter the password.

It will return to locked condition after 30 seconds if no key operation is performed.

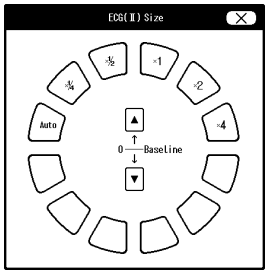
- : Locked
- : Unlocked

NOTE

- The color of each key lock icon indicates its administrative level, and a higher level password must be entered to unlock it.

5 Setup Item

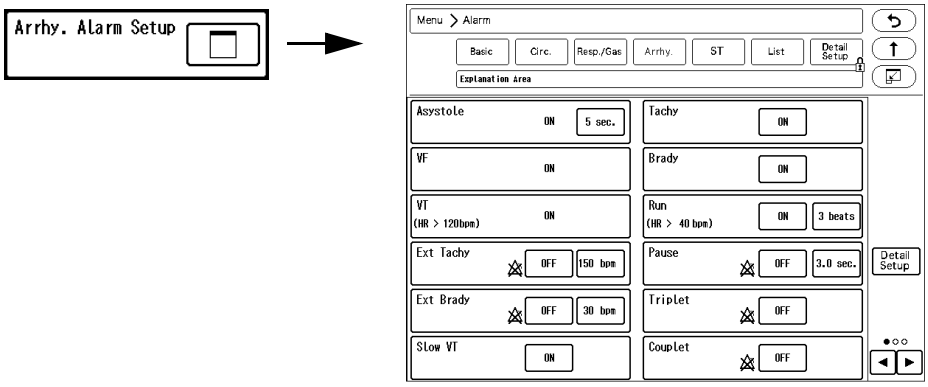
Most of the setups can be performed by selecting from the dropdown list.
The dropdown list will close when a selection has been made.
Pressing the item again or selecting a different item will also close the dropdown list.



Some menu may display a subwindow to perform the setup.
To close the subwindow, press either the ( ) key, [Home] or [Prev. Disp.] key.

Pressing the key with the "[ ]" icon will display another window.To return to the original display, press the ( ) key.

♦ Example of an item which displays another screen



6 Dropdown List

Select one from the displayed selection list.

7 Page Switch Key

This key will appear when the setup items or display data are on multiple pages.

The currently displayed page is indicated by "●".

8 Tab Display Area

These are the tabs to display the screens under the same menu level. The screens under the same menu level can be switched by one-touch operation of these tabs without returning to the main menu.

For example, to change the blood pressure scale after changing the ECG waveform size, it is not necessary to return to the main menu.
For the review screens, the date/time of each review data are linked which allows to switch the display of the tabular trend, graphic trend, waveform of the same date/time in one-touch operation.

Floating Window Screen Display

The descriptions of the floating window which is displayed by pressing the numeric data area are as follows.
The displayed items on the floating window depends on the parameter, but there are some common items as follows.

1 Window Title

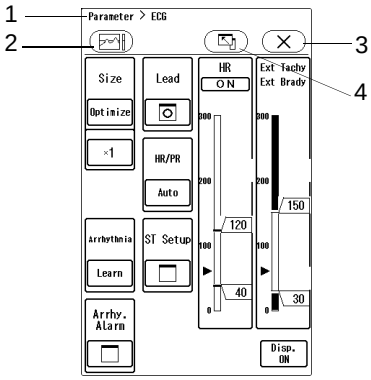
The windows can be moved to any desired position by dragging the window title.

2 Alarm Assist Key

The alarm assist screen will be displayed. On the alarm assist screen, maximum of 24 hours of trend data for the corresponding parameter will be displayed, and alarm threshold can be adjusted by checking the trend data.
(☞"Alarm Assist Screen" P6-14)

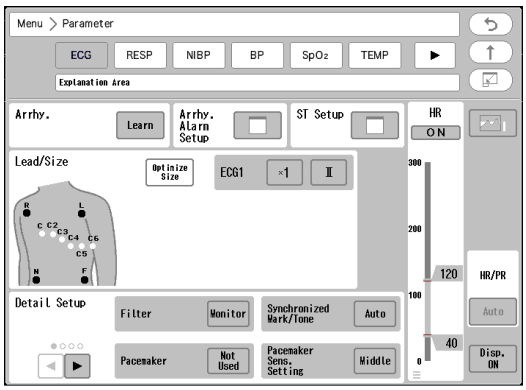
3 Close Key

Press the (×) key to close the window.



4 Detail Key

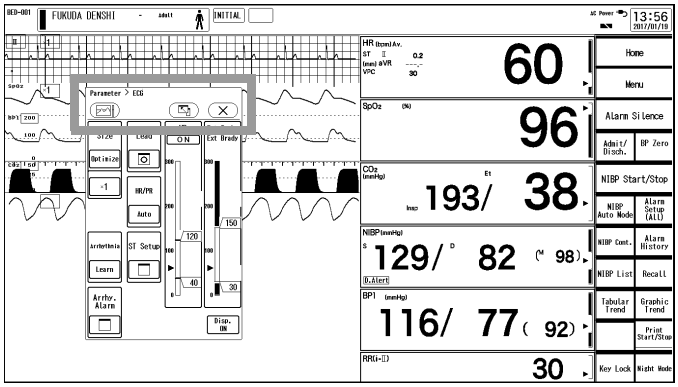
On the floating window, minimum items are displayed. Press the key to display more detailed items.



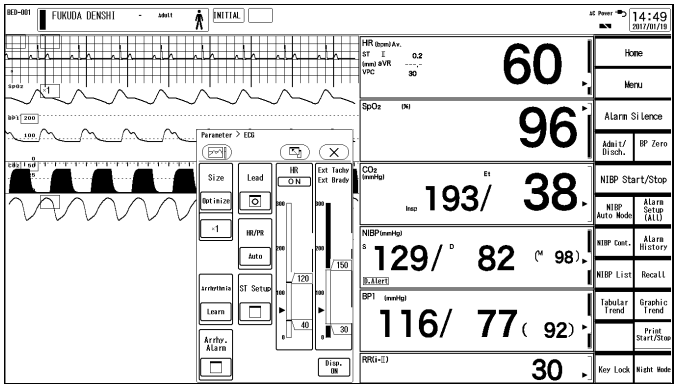
Transfer Window

The floating window displayed by pressing the numeric data area can be moved by dragging the window title. This operation is possible on the touch panel.

1 Press the window title.



2 Place the finger on the window title and drag to the desired position.

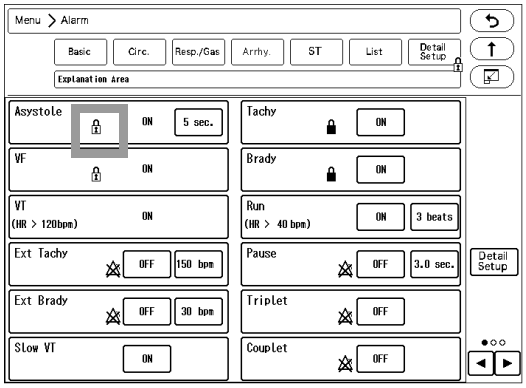


NOTE

- The floating window cannot be overlapped to the numeric data area or information display area.
- The window which is displayed from "Menu" cannot be moved.
- The displayed position of the floating window will be stored until the power is turned OFF.

Operation Restriction

To restrict the operator to change the setup items, key lock function can be used.
(☞Maintenance Manual "Key Lock" P5-2)
For the items that are key locked, the settings cannot be changed unless the password is entered.
The unlocked condition will return to locked condition if operation has not been performed for about 30 seconds.
For the key locked item, 🔒 icon will be displayed. (shown on right)
When the password is entered and key is unlocked, the icon will change to 🔓.



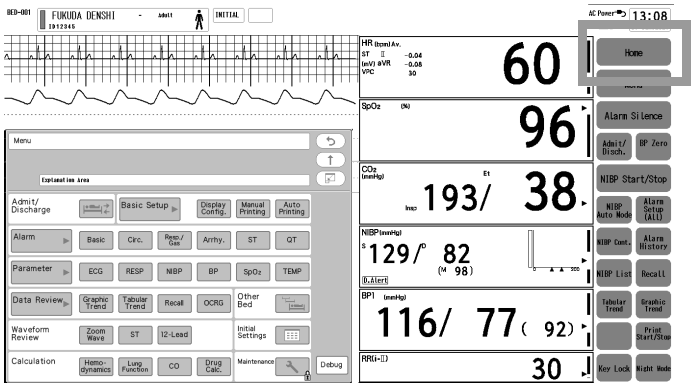
NOTE

- There are 3 key lock levels.
- The level is distinguished by the color of 🔓 which are "Red (Manager) > "Yellow (Administrator)" > "Green (User)", and the upper level password can unlock the lower level key lock.

Procedure to Return the Display

❑To Return to Home Display

Press the [Home] key to return to the home display.



❑To Return to the Previous Display

Press the ⮌ key of each setup window to return to the previous display.

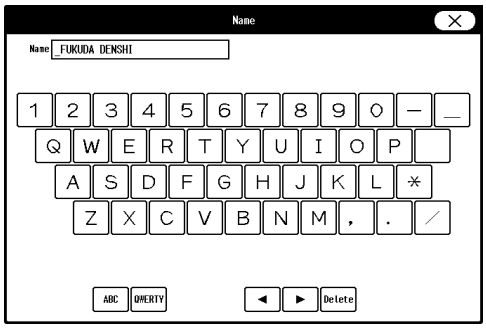
To Enter Characters

Alphanumeric characters and symbols can be entered using the displayed keyboard.
The procedure to enter characters is explained below using the example of patient admit menu.

❑Entering Alphanumeric Characters

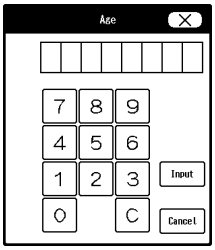
Enter alphabets, numerics, or symbols.

1 Press [ABC] or [QWERTY] to switch the displayed keyboard.
Enter the alphanumeric characters.



❑Entering Numerics

For age, telemetry channel ID, etc., only numbers can be entered.
In such case, only numeric keys will be displayed.
Enter the numbers.



For Easier Use

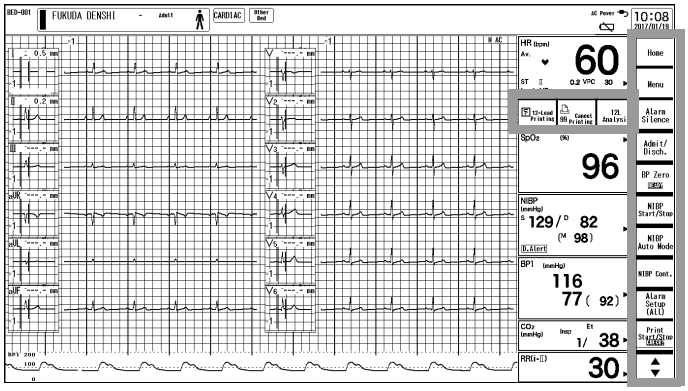
The user keys and menu can be customized according to the monitoring purpose.

REFERENCE

- From the preprogrammed user mode, the display configuration and alarm settings can be selected according to the monitoring purpose.
  (☞Maintenance Manual "User Mode Registration" P5-27)

User Key

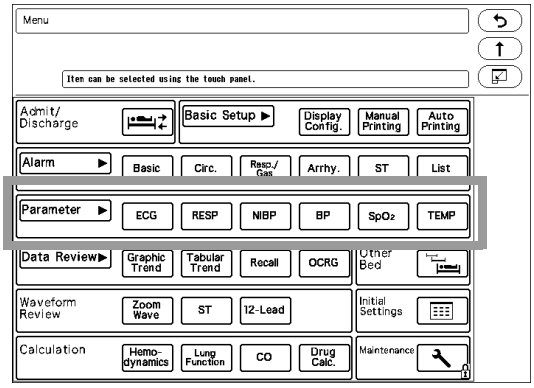
The user keys can be customized according to the monitoring purpose.
(☞"To Configure the Display" P10-4)

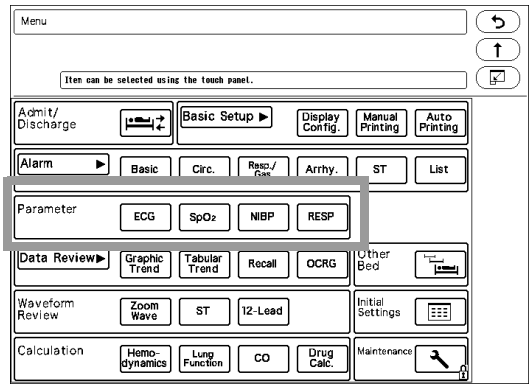


By assigning the [▲▼] to the user key area, 2 pages of user keys can be registered, and pressing the [▲▼] allows to switch the pages.The user key can be enlarged by using 2 display areas.
The user key can be also assigned to the numeric data area. It is useful if the key related to numeric data is assigned near the numeric data.

Menu Screen

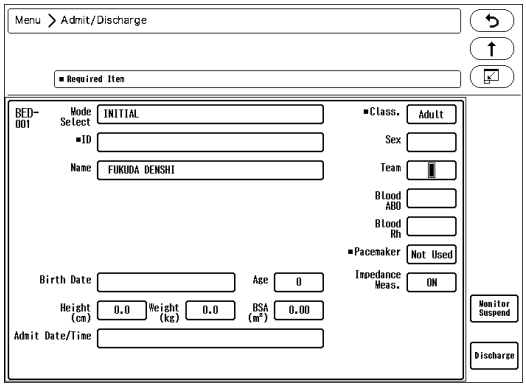
The key position can be changed and unnecessary keys can be deleted on the "Menu" screen.
(☞Maintenance Manual "Display/Print Setup" P5-12)

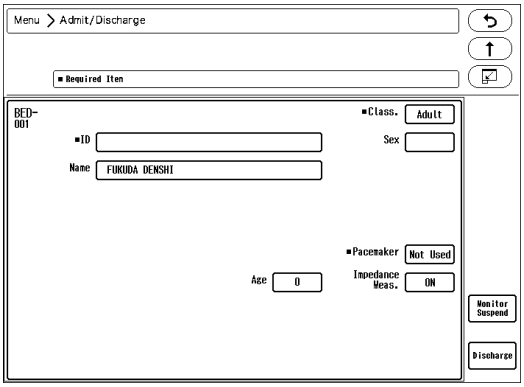




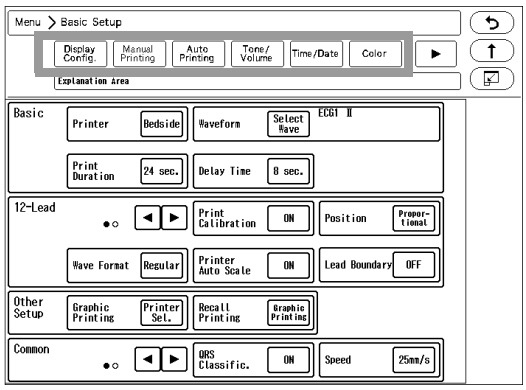
To Delete the Unnecessary Keys (Key Mask)

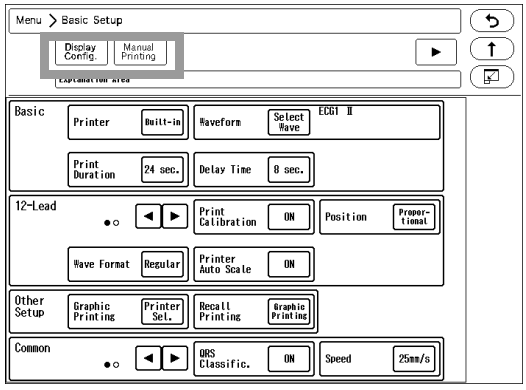
Unused keys, items, tabs can be masked.
(☞Maintenance Manual "Key Mask" P5-21)





Example on "Admit/Discharge" Screen





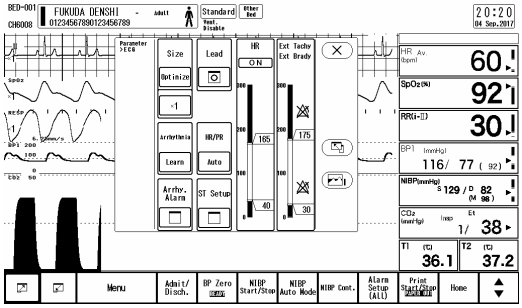
Example on Tab Display

Display on the External Monitor

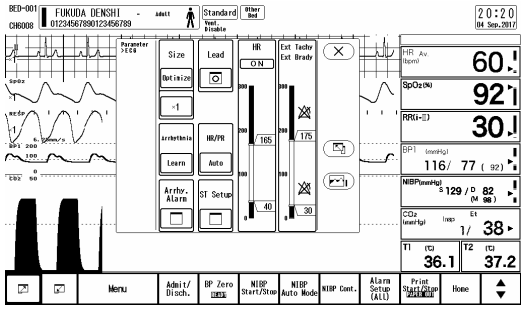
For the DS-1200 System, in addition to the main display, another display unit can be used for extended display.

External Monitor Display

The monitoring can be performed on two display units.
However, operation is not possible on the external monitor.



<Main Display>



Display on the External Monitor

CAUTION

- With the default setting, menu cannot be displayed on the external monitor even if it is displayed on the main display.

Chapter 4 Preparation

Daily Check

Before using the device, perform the daily check.
Take necessary measures for the items with the "NG" judgment, and use the device only if the judgments for all the items are "OK".

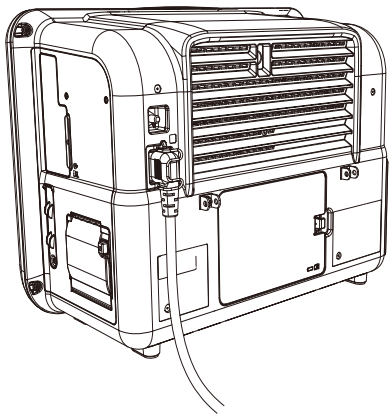
To Start Monitoring

This section explains about the procedure to turn the power ON and start monitoring.

⚠ CAUTION

- If not using the equipment for a long period, disconnect the power cable and lithium-ion battery.
- During transportation, hold the bottom of the device and make sure that the device does not fall. The operator may be injured or the equipment may be damaged.

1 If operating with AC power supply, verify that the power supply cable is properly connected to the main unit.
If operating with battery, verify that the lithium-ion battery (BTO-005) is properly installed in the main unit.
(☞Maintenance Manual "Installing the Battery Pack (BTO-005)" P1-6)

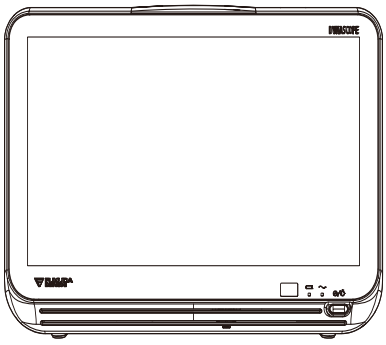


- When connected to the AC power source with battery installed, charging will automatically start.
  1 Rapid Charge (when the equipment is not in operation): 2.5 hours
  2 Normal Charge (when the equipment is operating): 5 hours

⚠ WARNING

- Do not connect a battery other than the lithium-ion battery (BTO-005).

2 Turn ON the standby switch on the main unit.



- The system will turn ON and monitoring will start.
- The power supply LED on the front side of the main unit will light.
  1 Power Supply LED
  Green: Power ON
  Orange: Standby Mode
  Light Off: During battery operation
  2 Battery Charging LED
  Green: Charging is complete
  Orange: Charging
  Light Off: During battery operation, or when battery is not installed, or when battery charging is ceased (due to temperature, etc.)

NOTE

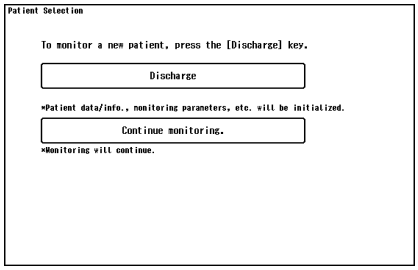
- The operation after the power is turned ON will be according to the setting made on [Initial Settings] > [User I/F] > [Power ON/Discharge]. However, if the power was turned OFF for less than 30 seconds, the setting before the power was turned OFF will remain.

REFERENCE

- The power ON/OFF operation of the main unit of the DS-1200 and the expansion unit module synchronizes with the standby switch operation (ON/OFF) on the display area.

Check Discharge When Start Monitoring a New Patient

If the previous data is remained when the monitoring is started by pressing the standby switch, a discharge confirmation window will be displayed.



❑Check Discharge

1 Select from [Discharge] / [Continue].

- [Discharge]: The previous data will be deleted.
- [Continue]: The monitoring will start with the previous data retained.

NOTE

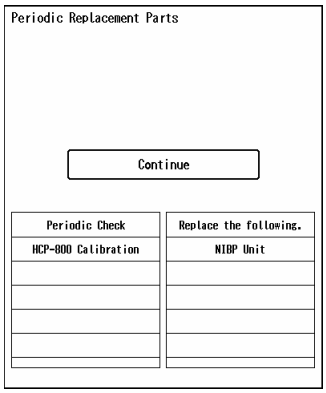
- If the standby switch was turned OFF for less than 30 seconds, the discharge confirmation screen will not be displayed. To perform the discharge procedure, press the [Discharge] key on the "Admit/Discharge" screen.
  (☞"Discharge" P5-9)
- To start monitoring a new patient, select [Discharge] and enter the new patient information on the "Admit/Discharge" screen.

REFERENCE

- Whether or not to display the discharge confirmation window can be selected.
  (☞Maintenance Manual "Power ON/Discharge" P5-17)

❑Periodic Replacement Message

When the periodic replacement period approaches for each part, a message will be displayed to notify the user.



REFERENCE

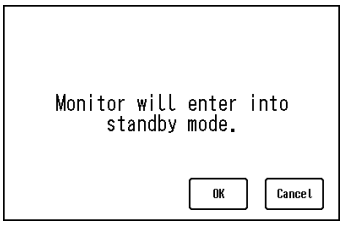
- The parts which the replacement period will be notified are the NIBP unit in the and the CO_2 unit in the HC-110.
  (☞Maintenance Manual "Periodic Replacement" P7-1)
- Even if it is set not to display the discharge confirmation screen, the confirmation message for parts replacement will be displayed when the replacement period approaches.

To Stop Monitoring

This section explains about the procedure to stop monitoring.

1 Turn OFF the standby switch on the display area.

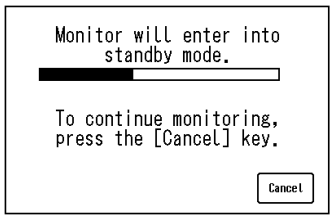
▸ A standby confirmation message will appear.



2 Press [OK] to enter into standby mode.

▸ A 10-seconds progress bar will be displayed.

▸ Press the [Cancel] key to stop entering into standby mode. Only the [Cancel] key will be effective while the progress bar is displayed.



3 When 10 seconds has elapsed without pressing the [Cancel] key, the display will turn OFF and monitoring will stop.

⚠ CAUTION

- If the remaining battery capacity becomes extremely low during battery operation, monitoring will automatically stop.
- If not using the device for a long period, disconnect the power cable and lithium-ion battery.

NOTE

- When the power is turned OFF, graphic/tabular trend data (Vigilance, ventilator), recall, ST measurement, OCRG data will be erased after 5 minutes.

Clock Setup

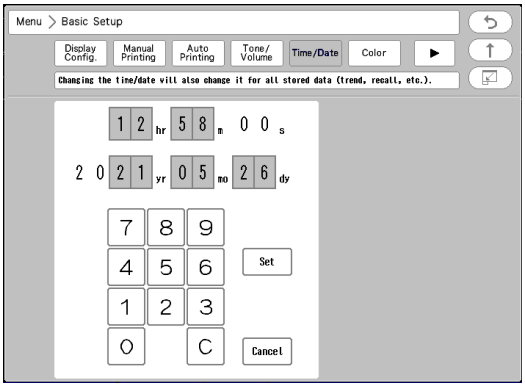
This section explains about the time/date setup procedure.

⚠ CAUTION

- If the time/date is not correctly set, or changed during monitoring, malfunction may occur with the NIBP measurement, periodic printing, graphic/tabular trend data, and age calculation from the birth date.
- The time/date can not be set while connected to a wired network system. The time/date will synchronize with the central monitor.
- If the time/date is changed, the time/date for all the saved patient data (trend, list, recall, etc.) will also change.
  The printed time/date before changing and the displayed time/date after changing will differ. Also, the data transmitted to the central monitor before the time/date is changed will be displayed on the central monitor with the previous time/date.

1 Press the [Menu], [Time/Date] ("Basic Setup") keys.
Or, press the time/date on the information display area at the upper part of the screen.

▸ The Time/Date setup window will be displayed.



2 Press on the area to perform the setup.

▸ A blue frame will be displayed on the selected area.

▸ When the screen is first displayed, the blue frame will be positioned on "hour".

3 Use the numeric keys to enter the numerics.

▸ The blue frame will automatically move to the next item.

4 Enter the current date/time and press the [Set] key.

▸ The entered date/time will be set.(The number of seconds will be set to "00".)

▸ Press [Cancel] to cancel the time/date setup.

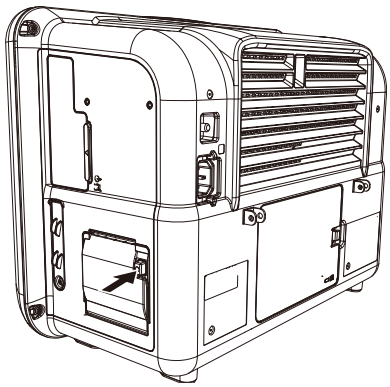
Installing the Recording Paper

⚠ CAUTION

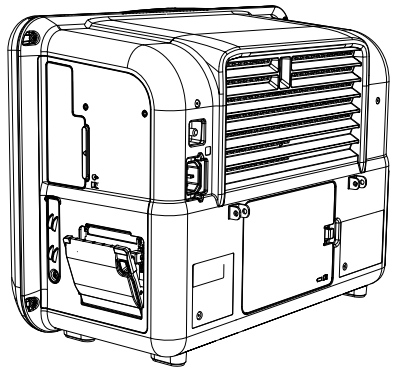
- About the Recording Paper
  - Use only "OP050-02DR" for the recording paper.
    If the surface treatment and thickness of the recording paper are different, it may result in poor print quality.
- Storing the Recording Paper
  Since the recording paper is thermal type, inappropriate storage may change the quality of the printed content, and make it illegible.
  When storing the recording paper, follow the precautions below.
  - Store in a place where light is shut off and avoid direct sunlight.
  - Do not leave the paper in a high temperature (50 °C/122 °F and above).
  - Do not store the paper in a polyvinyl chloride bag.
  - Do not superpose the papers until the diazo copy is completely dried.
  - Do not expose the paper to alcohol, hydrochloric acid, or ester ketone.
  - Avoid using adhesive agents other than water based glue.
- Installing the Recording Paper
  - When installing the recording paper, pay attention not to touch the thermal head or sensor. The temperature of those parts rises immediately after printing and may cause burn injury. Also, it may cause failure to the thermal head and sensor.
  - Do not operate the equipment with wet hand. Doing so may short the thermal head.
  - Do not touch metal part inside the recorder. Do not touch the patient while replacing the recording paper.

Install the recording paper with the following procedure.

1 Press the Open/Close Lever.

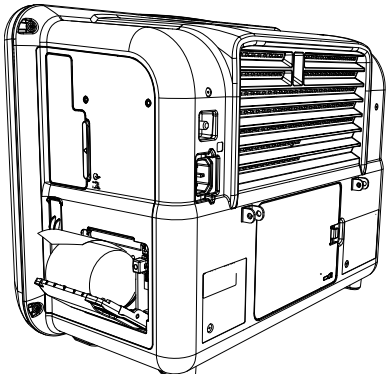


▸ The paper holder will open.



2 Set the Paper.

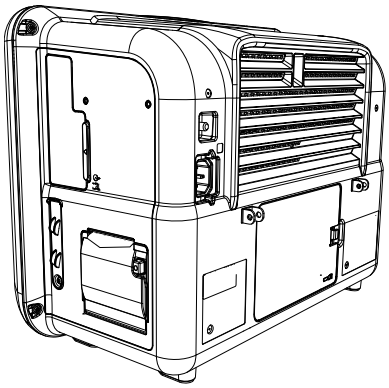
The outside surface of the paper is heat-sensitive. Make sure to place the outside surface of the paper facing up.



NOTE

- Place the paper so that the "FUKUDA DENSHI" logo is outside and facing up.

3 Close the paper holder.



NOTE

- Push until it locks into place with a click sound.

Chapter 5 Admit/Discharge

This menu allows setup of admitting, discharging, suspend monitoring of a patient, and selection of the user mode (display configuration) according to the monitoring purpose.

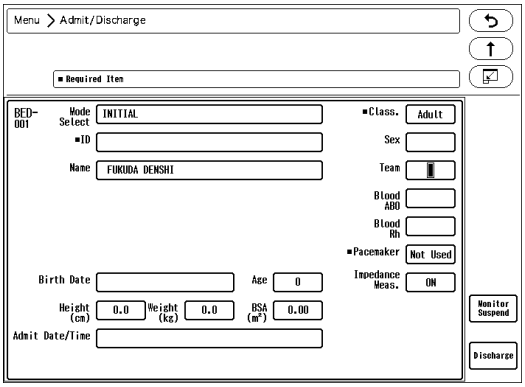
⚠ CAUTION

- If monitoring of new patient is started without performing a discharge procedure of the previous patient, new data will be added to the previous data which will result in inaccuracy.

To Display the "Admit/Discharge" Screen

1 Press the [Menu], "Admit/Discharge" icon.

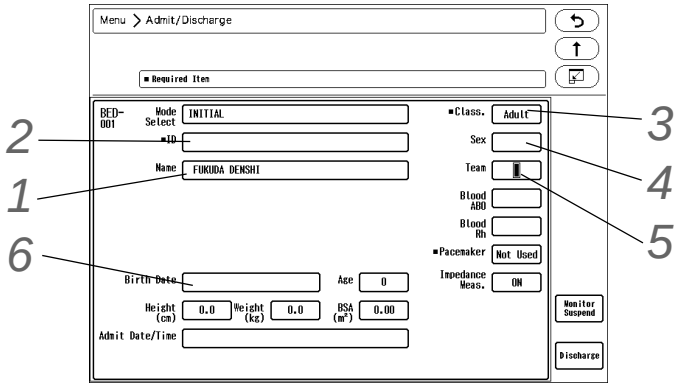
▸ The "Admit/Discharge" screen will be displayed.



Admit

This section explains the admit procedure.
This menu allows entering of patient's name, ID, age, and selection of patient classification (adult, child, neonate) and pacemaker usage (used, not used) which affects the monitoring accuracy.

Entering the Patient Information



1 Enter the patient name.

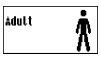
Up to 16 characters of alphabets, numbers, or symbols can be used. The entered name will be displayed on the home display. (☞"To Enter Characters" P3-24)

2 Enter the patient ID.

Up to 20 characters of alphabets, numbers, or symbols can be used. After entering the ID, press the [Set] key. If the [Set] key is not pressed, the entered ID will not be finalized. (☞"To Enter Characters" P3-24)

3 Select the patient classification from [Adult] / [Child] / [Neonate].

▸ The selected patient classification and icon will be displayed on the home display.

For adult: 

For child: 

For neonate: 

- The patient classification affects the accuracy of NIBP measurement, HR measurement, and RR measurement. It also affects the delay time to generate the measurement data alarm.
- The alarm delay time is the function to prevent frequent generation of the measurement data alarm by holding the alarm generation for the duration of each delay time.
  The alarm delay occurs for HR/PR, BP, RR, SpO_2, TEMP, $EtCO_2$/$InspCO_2$, Tachy, Brady, Ext Tachy, Ext Brady.

		Adult	Child	Neonate
NIBP Measurement Range	SYS	30 mmHg to 280 mmHg	30 mmHg to 180 mmHg	30 mmHg to 130 mmHg
	MAP	15 mmHg to 235 mmHg	15 mmHg to 160 mmHg	15 mmHg to 100 mmHg
	DIA	10 mmHg to 200 mmHg	10 mmHg to 150 mmHg	10 mmHg to 90 mmHg
Heart Rate		0 bpm, 12 bpm to 300 bpm		0 bpm, 30 bpm to 300 bpm
Filter Mode	Monitor	0.5 Hz to 40 Hz		1.6 Hz to 40Hz
	ESIS	1.6 Hz to 15 Hz		1.6 Hz to 15 Hz
	Diagnosis	3 electrodes: 0.05 Hz to 100 Hz		
		4, 5, 10 electrodes: 0.05 Hz to 150 Hz		
Impedance Respiration		1.5Hz		2.5Hz
Alarm delay time		5 sec.		0 sec.

⚠ WARNING

- The patient classification selection influences the precision of the QRS detection and NIBP measurement. Make sure the correct selection is made.
- The NIBP air hose corresponded to the set patient classification must be used to perform NIBP measurement. (However, if the patient classification is child, NIBP air hose for adult can be used.)

⚠ CAUTION

- When "Link with Patient Class." is set to [ON], and patient classification is changed, the main mode will change to the selected mode on the "Link Settings". (☞Maintenance Manual "To Program the User Mode" P5-28)

4 Select the sex from [Male]/[Female].

5 Select the color of the nurse team.

6 Enter the patient's age.

There are two ways to enter the patient's age. One is to enter the birth date which will automatically calculate the age, and the other is to directly enter the age using the numeric keypad. If [Neonate] is selected for patient classification, age will be displayed in days.

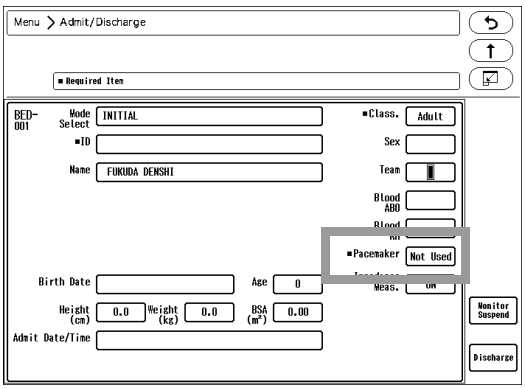
❑When Pacemaker is Used

WARNING

- The pacemaker usage setting influences the precision of the QRS detection and arrhythmia analysis. Make sure the correct selection is made.

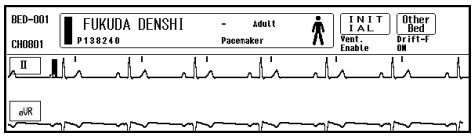
If [Used] is selected for "Pacemaker", the monitor will detect the pacing pulse (pacemaker pulse) to perform the following process.

- The artificial pacemaker pulse will be displayed.
- When pacing waveform does not appear (pacing failure), erroneously detecting the pacemaker pulse as QRS will be prevented.
- The arrhythmia analysis will detect pacing beat as P (Pacemaker Beat) or F (Fusion Beat) to prevent erroneous judgment of VPC.



1 Press the key for "Pacemaker", and select from [Used]/[Not Used].

▸ When [Used] is selected, <Pacemaker> will be displayed at the upper part of the home display.



Entering Patient Information from the Magnetic Card

By using the magnetic card reader, patient information can be entered from the magnetic card. The admittance process will speed up compared to manually entering each information.

NOTE

- To automatically enter the patient information from the magnetic card or barcode, it is necessary to perform the setup in advance. (☞Maintenance Manual "Using the Magnetic Card Reader" P4-19)

1 Read the data from the magnetic card or barcode.

▸ The acquired data will be displayed.

2 Press the [Change only patient info.]/[Cancel] key.

▸ [Change only patient info.] : Replaces the current patient information with the newly acquired information.

▸ [Cancel] : Cancels the acquired data.

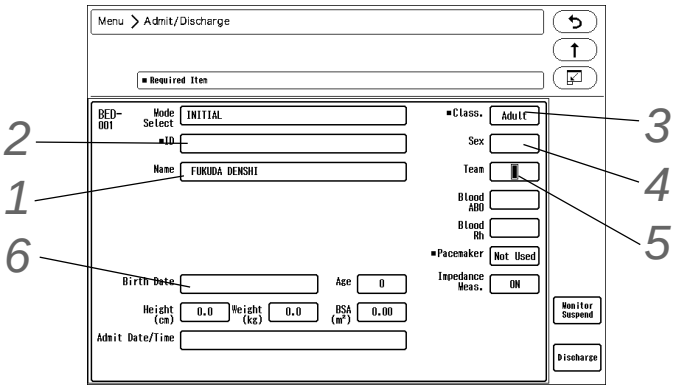
NOTE

- Make sure the patient is discharged before replacing the patient information.
- The item which the information was not acquired from the magnetic card or barcode will be left blank. For the blank item, manually enter the information.

Admit

This section explains the admit procedure.
This menu allows entering of patient's name, ID, age, and selection of patient classification (adult, child, neonate) and pacemaker usage (used, not used) which affects the monitoring accuracy.

Entering the Patient Information

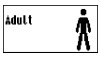


1 Enter the patient name.
Up to 16 characters of alphabets, numbers, or symbols can be used. The entered name will be displayed on the home display. (☞"To Enter Characters" P3-23)

2 Enter the patient ID.
Up to 20 characters of alphabets, numbers, or symbols can be used. After entering the ID, press the [Set] key. If the [Set] key is not pressed, the entered ID will not be finalized. (☞"To Enter Characters" P3-23)

3 Select the patient classification from [Adult] / [Child] / [Neonate].

▸ The selected patient classification and icon will be displayed on the home display.

For adult: 

For child: 

For neonate: 

- The patient classification affects the accuracy of NIBP measurement, HR measurement, and RR measurement. It also affects the delay time to generate the measurement data alarm.
- The alarm delay time is the function to prevent frequent generation of the measurement data alarm by holding the alarm generation for the duration of each delay time.
  The alarm delay occurs for HR/PR, BP, RR, SpO_2, TEMP, $EtCO_2$/$InspCO_2$, Tachy, Brady, Ext Tachy, Ext Brady.

		Adult	Child	Neonate
NIBP Measurement Range	SYS	30 mmHg to 280 mmHg	30 mmHg to 180 mmHg	30 mmHg to 130 mmHg
	MAP	15 mmHg to 235 mmHg	15 mmHg to 160 mmHg	15 mmHg to 100 mmHg
	DIA	10 mmHg to 200 mmHg	10 mmHg to 150 mmHg	10 mmHg to 90 mmHg
Heart Rate		0 bpm, 12 bpm to 300 bpm		0 bpm, 30 bpm to 300 bpm
Filter Mode	Monitor	0.5 Hz to 40 Hz		1.6 Hz to 40Hz
	ESIS	1.6 Hz to 15 Hz		1.6 Hz to 15 Hz
	Diagnosis	3 electrodes: 0.05 Hz to 100 Hz		
		4, 5, 10 electrodes: 0.05 Hz to 150 Hz		
Impedance Respiration		1.5Hz		2.5Hz
Alarm delay time		5 sec.		0 sec.

WARNING

- The patient classification selection influences the precision of the QRS detection and NIBP measurement. Make sure the correct selection is made.
- The NIBP air hose corresponded to the set patient classification must be used to perform NIBP measurement. (However, if the patient classification is child, NIBP air hose for adult can be used.)

CAUTION

- When "Link with Patient Class." is set to [ON], and patient classification is changed, the main mode will change to the selected mode on the "Link Settings". (☞Maintenance Manual "To Program the User Mode" P5-28)

4 Select the sex from [Male]/[Female].

5 Select the color of the nurse team.

6 Enter the patient's age.

There are two ways to enter the patient's age. One is to enter the birth date which will automatically calculate the age, and the other is to directly enter the age using the numeric keypad. If [Neonate] is selected for patient classification, age will be displayed in days.

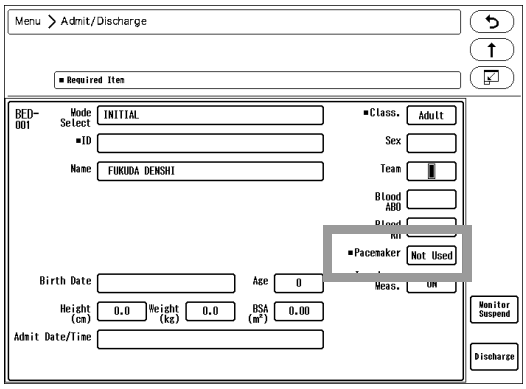
❑When Pacemaker is Used

WARNING

- The pacemaker usage setting influences the precision of the QRS detection and arrhythmia analysis. Make sure the correct selection is made.

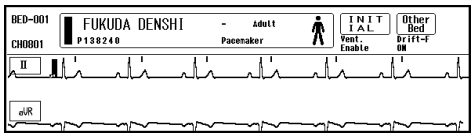
If [Used] is selected for "Pacemaker", the monitor will detect the pacing pulse (pacemaker pulse) to perform the following process.

- The artificial pacemaker pulse will be displayed.
- When pacing waveform does not appear (pacing failure), erroneously detecting the pacemaker pulse as QRS will be prevented.
- The arrhythmia analysis will detect pacing beat as P (Pacemaker Beat) or F (Fusion Beat) to prevent erroneous judgment of VPC.



1 Press the key for "Pacemaker", and select from [Used]/[Not Used].

▸ When [Used] is selected, <Pacemaker> will be displayed at the upper part of the home display.



Entering Patient Information from the Magnetic Card

By using the magnetic card reader, patient information can be entered from the magnetic card. The admittance process will speed up compared to manually entering each information.

NOTE

- To automatically enter the patient information from the magnetic card or barcode, it is necessary to perform the setup in advance. (☞Maintenance Manual "Using the Magnetic Card Reader" P4-18)

1 Read the data from the magnetic card or barcode.

▸ The acquired data will be displayed.

2 Press the [Change only patient info.]/[Cancel] key.

▸ [Change only patient info.] : Replaces the current patient information with the newly acquired information.

▸ [Cancel] : Cancels the acquired data.

NOTE

- Make sure the patient is discharged before replacing the patient information.
- The item which the information was not acquired from the magnetic card or barcode will be left blank. For the blank item, manually enter the information.

Entering Patient Information from the Patient Data Server (When DS-LANIII is used)

When the central monitor is connected to the patient data server, and the DS-LANIII network is used, patient information can be automatically entered by searching on the patient data server.

CAUTION

- When "Link with Patient Class." is set to [ON], and patient classification is changed by acquiring patient information from the patient data server, the Main Mode will change to the selected mode on the "Link Settings". (☞Maintenance Manual "To Program the User Mode" P5-28)

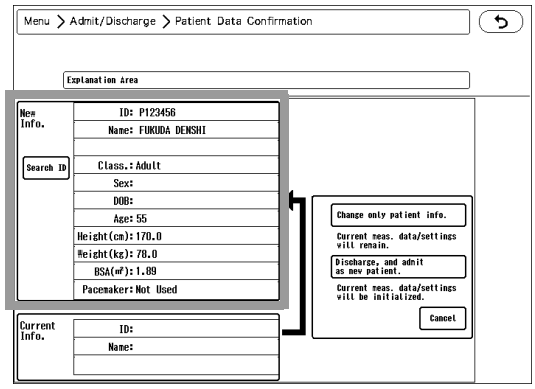
❑When Using the Patient Data Server and Magnetic Card Reader (or Barcode Reader)

NOTE

- Select [ON] for "Auto Reference to Central Monitor when Reading Patient ID" under [Initial Settings>Magnetic Card Reader] in advance.
  (☞Maintenance Manual "Magnetic Card Reader Setup" P4-18)

1 Read the data from the magnetic card or barcode.

2 The acquired patient information from the patient data server will be displayed in the "New Information" area.



If there is no applicable patient information, current patient information will be displayed in the "New Information" area.

3 Select whether or not to enter the searched patient information.

Select from [Change only patient info.] / [Discharge and admit as new patient.] / [Cancel].

[Change only patient info.] will replace the current patient information to the newly acquired information.

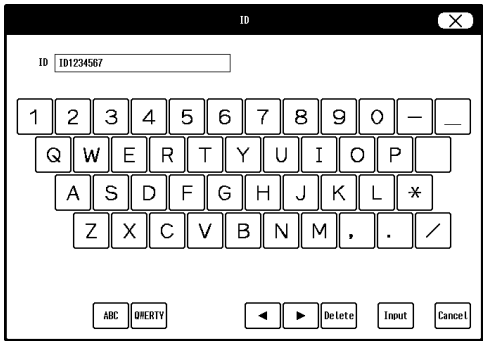
[Discharge and admit as new patient.] will initialize the current patient data/monitoring condition and admit the searched patient as new patient.

[Cancel] will invalidate the acquired data.

NOTE

- The item not acquired from the patient data server will be left blank.
- For the blank item, manually enter the information.

❑When Magnetic Card Reader (or Barcode Reader) is not Used



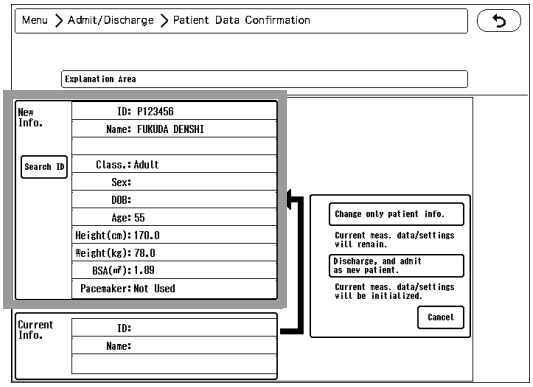
1 Press the [Menu], "Admit/Discharge" icon, [ID].
"ID" window will be displayed.

2 Enter the patient ID.

3 Press the [Search ID] key and start searching on the patient data server.

1 Use the touch keys to enter the ID.

2 Based on the entered patient ID, patient information will be searched on the patient data server through the DS-LANIII network.
The searched patient information will be displayed under "New Information" .



4 Select whether or not to enter the searched patient information.

Select from [Change only patient info.] / [Discharge and admit as new patient.] / [Cancel]. [Change only patient info.] will replace the current patient information to the newly acquired information. [Discharge and admit as new patient.] will initialize the current patient data/monitoring condition and admit the searched patient as new patient. [Cancel] will invalidate the acquired data.

The item not acquired from the patient data server will be left blank. For the blank item, manually enter the information.

NOTE

- The item not acquired from the patient data server will be left blank.
- For the blank item, manually enter the information.

Discharge

This section explains about the discharge process.
This procedure will erase the patient name, ID, age, and past measurement data such as tabular / graphic trend, and recall.
By pressing the [Rapid Discharge] key preprogrammed as user key, a discharge process can be performed.

Discharging Procedure

⚠ CAUTION

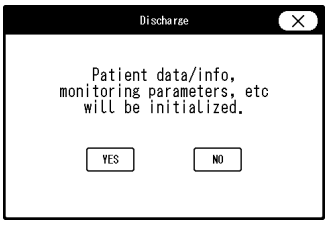
- If monitoring of new patient is started without discharging the previous patient, the measurement data of the previous and new patient will become mixed up on the recall and trend data.
- When the discharge process is performed, patient data such as recall and trend will be initialized. The parameter and alarm settings will be reset according to the settings made under [Menu>Initial Settings>User I/F>Power ON/Discharge).
  When the discharge process is performed on the central monitor, alarm will be reset according to the setting on "Admit Setup" of the central monitor.
  (☞Maintenance Manual "Power ON/Discharge" P5-17)
- If the power is turned OFF or if the system enters into standby mode soon after the discharge procedure, the patient may not be discharged on the central monitor.
  If it is necessary to turn OFF the power or enter into standby mode after the discharge procedure, select [Standby] for "Discharge Mode" under [Initial Settings>User I/F>Power ON/Discharge].

NOTE

- Depending on the setting made for "At Discharge" under ([Initial Settings>User I/F>Power ON/Discharge], some items may not be initialized.
  (☞Maintenance Manual "Power ON/Discharge" P5-17)
- If the discharge procedure is performed during stopwatch operation, the counting will stop and will be reset to "00:00:00" .
- The monitoring condition after discharge can be set on "Discharge Mode" under [Initial Settings>User I/F>Power ON/Discharge].

1 Press the [Discharge] key on the "Admit/Discharge" screen.

- The discharge confirmation window will be displayed. (shown on right)
- To cancel the discharge process, press the [No] key or close the discharge confirmation window.



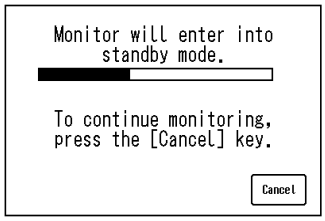
2 Press the [Yes] key.

- The patient data, patient information will be initialized.

Data	Description
Patient Data	Trend, Tabular Trend, Recall, ST, OCRG, CO, Hemodynamics, Lung Function, P-V/F-V control data will be erased. The settings for recall, tabular trend, graphic trend, vigilance list will remain.

Data	Description
Patient Information	Erases the data of patient name, ID, sex, age. The patient classification will not be initialized.
Measurement Condition	The learned arrhythmia waveform data will be deleted. The BP zero-balance condition will be initialized. The NIBP target inflation value will be initialized to the default value of each patient classification.

- If [Standby] is selected for "Discharge Mode" under [Initial Settings>User I/F>Power ON/Discharge], standby progress window will be displayed. Pressing the [Cancel] key will cancel the process to enter into standby mode.
  After 10 seconds, discharge procedure will be performed and the system will enter into standby mode.



REFERENCE

- For details, refer to [Initial Settings>User I/F>Power ON/Discharge].
  (☞Maintenance Manual "Power ON/Discharge" P5-17)

User Mode

This section explains about the user mode selection.
From the preprogrammed user mode, an appropriate user mode can be selected according to the monitoring purpose.

⚠ CAUTION

- The selected user mode will be stored even after the power is turned OFF or discharge process is performed.
  Before monitoring, make sure the current user mode is suitable for the patient's condition.
  (☞Maintenance Manual "User Mode Registration" P5-27)

REFERENCE

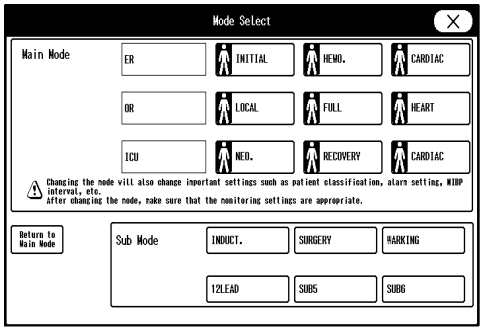
- For the user mode, up to 9 main modes of display configuration and alarm settings can be registered according to the patient's age and monitoring purpose.
  Also, for temporarily changing the display configuration (ex. when checking the 12-lead ECG), 6 sub modes of display configuration can be registered.
  (☞Maintenance Manual "User Mode Registration" P5-27)

To Select the User Mode

1 Press the [Menu], "Admit/Discharge" icon, "Mode Select" key. Or, press the mode key on the information display area at the upper part of the screen.

- The "Mode Select" window will be displayed. (shown on right)

2 Select the main mode or sub mode appropriate for the patient.



WARNING

- After changing the mode, make sure that the monitoring setting is appropriate.
  When the mode is changed, patient classification, alarm settings, etc. will be changed.

REFERENCE

- The selected user mode will be stored even after the power is turned OFF. If a new patient is admitted without changing the user mode, the monitoring will start with the previous user mode.
- The mode setting after the discharge operation can be set under [Initial Settings>User I/F>Power ON/Discharge].
- To change from the sub mode to the main mode, press [Return to Main Mode].
- Refer to "Setup Item/Default Value" for the default setting of each mode.
  (☞Maintenance Manual "User Mode Registration" P5-27)

Suspend Monitoring

This section explains about the monitoring suspend/resume function.
Monitoring suspend function can be used when a patient temporarily leaves the bed. If the monitoring is ceased by turning the power OFF, recall and ST data will be erased.
By using the monitoring suspend function, measurement, alarm, printing will be suspended but data and settings will remain, which allows to resume monitoring smoothly.

By using the monitor suspend label function, different labels in different colors according to the patient's destination can be displayed during the monitoring suspended condition.
To remind the user to resume monitoring, alarm will generate after the preprogrammed duration (15 min./30 min./1 hr/1.5 hr/2 hr) for "Monitor Suspend Timer".

REFERENCE

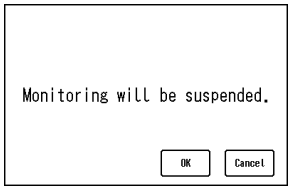
- The monitor suspend label can be set on the Initial Settings menu.
  (☞Maintenance Manual "Monitor Suspend Setup" P5-16)

To Suspend Monitoring

❑When "Monitor Suspend Label" is not set:

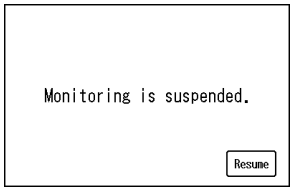
1 Press the [Menu], "Admit/Discharge" icon, [Monitor Suspend] keys.

- The monitor suspend confirmation window will be displayed.
- If [Cancel] is pressed, monitoring will not be suspended and the confirmation window will close.



2 Press the [OK] key.

- The screen will automatically return to the home display with "Monitoring is suspended" message and [Resume] key.
- On the home display, numeric data and waveform display will be suspended.



REFERENCE

- When the monitoring is suspended, telemetry transmission will cease. Note that the

square wave will be displayed on the central monitor indicating the too far condition of the telemetry.

- The stopwatch counting will continue even when the monitoring is suspended.
- The setting can be changed even when the monitoring is suspended.

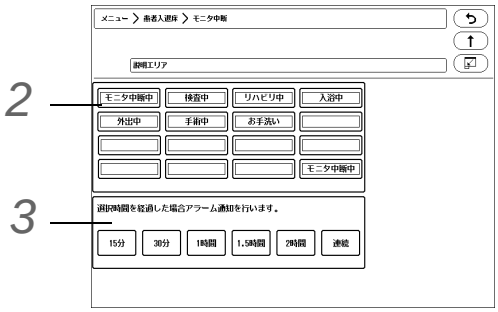
❑When Both "Monitor Suspend Label" and "Monitor Suspend Timer" are set

1 Press the [Menu], "Admit/Discharge" icon, [Monitor Suspend] keys.

- The "Monitor Suspend" screen will be displayed.

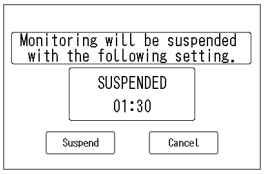
2 Select the label to be displayed during the monitoring suspended condition.

- The monitoring suspend duration selection will be displayed after selecting the monitoring suspend label.



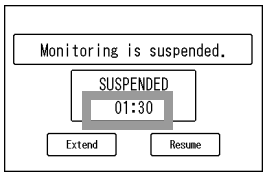
3 Select the monitoring suspend duration from [15Min.]/[30Min.]/[1Hr.]/[1.5Hr.]/[2Hr.]/[Continuous].
[Continuous] will start to suspend monitoring without setting the duration.

- Confirmation window to suspend monitoring will be displayed. (shown on right)
- Pressing the [Suspend] key will suspend the monitoring.



4 Verify that the monitoring is suspended on the home display.
The selected label with the set color will be displayed on the home display.

- On the home display, the time will start counting for the set duration.
- When the set duration completes, alarm sound will generate, and alarm indicator will light.



REFERENCE

- To extend the monitoring suspended duration, press [Extend] to display the timer selection.

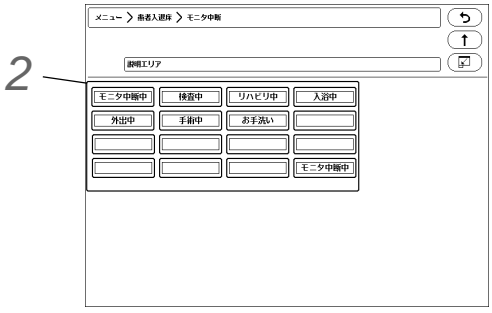
❑When "Monitor Suspend Label" is set, but "Monitor Suspend Timer" is not set:

1 Press the [Menu], "Admit/Discharge" icon, [Monitor Suspend] keys.

- The "Suspend" screen will be displayed.

2 Select the label to be displayed during the monitoring suspended condition.

- A confirmation message will be displayed.
- Pressing the [Suspend] key will suspend the monitoring.
- The selected monitor suspend label with the set color will be displayed on the home display.



To Resume Monitoring

CAUTION

- Resuming monitoring will also resume the suspended alarm.

1 Press the [Resume] key.

▸ The "Monitoring is suspended" message will disappear and monitoring will resume.

Chapter 6 Alarm Function

Alarm

To Set the Arrhythmia Alarm

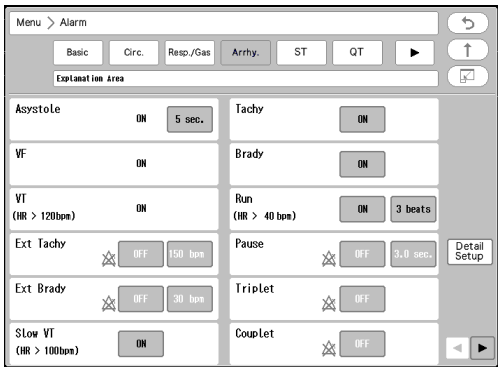
The arrhythmia alarm can be turned ON or OFF, and arrhythmia detection level can be set.

WARNING

- Set the appropriate upper and lower alarm limit for each parameter according to the monitoring condition.
- When the system alarm is suspended, all the alarms will be suspended even if the parameter alarm is set to ON. Also, the alarms will not be stored as recall events.
- If the upper/lower alarm limit of the parameter is set to OFF, or if arrhythmia alarm is set to OFF, alarm will not function even if the system alarm is enabled. Pay attention when setting them OFF.

1 Press the [Menu], [Arrhy.] ("Alarm") key.

▸ The arrhythmia alarm setup screen will be displayed.



2 Set ON/OFF of each arrhythmia.

▸ [ON]: Arrhythmia alarm will generate.

▸ [OFF]: Alarm will not generate.

NOTE

- <Arrhythmia alarm OFF> will be displayed when the Asystole, VF, VT, Slow_VT, Tachy, Brady, Ext Tachy, Ext Brady, or HR alarm is OFF.
- If [Always ON] is selected for "Asystole, VF, VT Alarm" under "Initial Settings", the Asystole, VF, VT alarm cannot be set to OFF.
  (☞Maintenance Manual "Alarm Related Setup" P5-4)
- If [Check when OFF] is selected for "Asystole, VF, VT Alarm" under "Initial Settings", a confirmation window will be displayed when the Asystole, VF, VT alarm is set to OFF.
- If the patient classification is "Child" or "Neonate", AFib cannot be detected.

REFERENCE

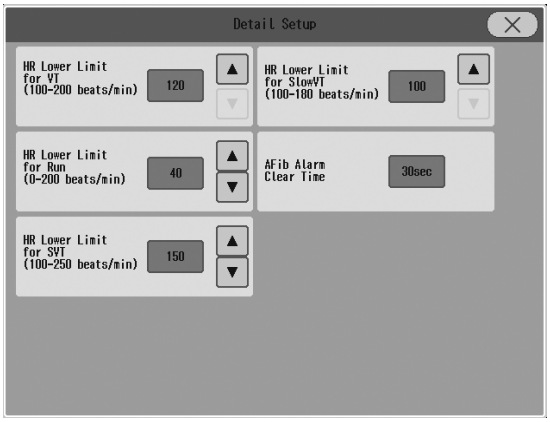
- The arrhythmia detection level for tachycardia (Tachy), bradycardia (Brady), extreme tachycardia (Ext Tachy), extreme bradycardia (Brady) alarms link with the upper and lower alarm limit for HR/PR.
  - The tachycardia (Tachy) alarm generates when the value exceeds the HR/PR upper alarm limit. When the upper alarm limit is OFF, alarm will not generate.
  - For the Ext Tachy alarm, the alarm threshold level cannot be set below that of Tachy alarm.
  - The bradycardia (Brady) alarm generates when the value exceeds the HR/PR lower alarm limit. When the lower alarm limit is OFF, alarm will not generate.
  - For the Ext Brady alarm, the alarm threshold level cannot be set above that of Brady alarm.

3 Select the level to detect each arrhythmia.

Item	Description
Asystole	3 sec. to 10 sec.
Run	2 beats to 8 beats
Pause	1.5 sec. to 5 sec.
Frequent	1 bpm to 50 bpm/ min.
Ext Tachy	22 bpm to 300 bpm
Ext Brady	20 bpm to 295 bpm

Item	Description
R on T	200 ms to 600 ms
SVT	2 beats to 10 beats
Irregular RR	10, 15, 20%
S Frequent	1 bpm to 50 bpm
Pacer Not Capture	80 ms to 480 ms
Pacer Not Pacing	20 bpm to 200 bpm
AFib	1 - 100%

4 Press the [Detail Setup] key, and set HR Lower Limit for VT, HR Lower Limit for RUN and HR Lower Limit for SVT.



1 "HR Lower Limit for VT"
   - If the HR is same or above the set value, VT alarm will generate.

2 "HR Lower Limit for RUN"
   - If the HR is same or above the selected value, RUN will generate.

3 "HR Lower Limit for SVT"
   - If the HR is same or above the set value, SVT alarm will generate.

4 " HR Lower Limit for Slow VT"
   - If the HR is same or above the set value, Slow VT alarm will generate.

5 "AFib Alarm Clear Time"
   - When the set time has elapsed, the alarm level of the AFib alarm changes to N (Notification Alarm).

❑Arrhythmia Priority

- To ensure that serious arrhythmia is not missed, a proprietary arrhythmia priority order is used for each category of VPC, tachycardia, and bradycardia.
- The arrhythmia alarm will be displayed according to the alarm level and arrhythmia priority.
- If arrhythmia alarms of the same alarm level and same category generate at the same time, the alarm of the higher arrhythmia priority will be displayed.
- If arrhythmia alarms of the same alarm level and different category generate at the same time, the newer alarm will be displayed.

REFERENCE

- The alarm level can be changed. (☞Maintenance Manual "Alarm Related Setup" P5-4)

Alarm Level	VPC	Tachycardia	Bradycardia
S	None (Can be set only when the alarm system is "Fukuda Tone" .)		
H	Asystole		
	VF		
	VT		
	Ext Tachy		Ext Brady
M	SlowVT	Tachy	Brady
	Run	SVT	Pause
	-	AFib	
L	Triplet	S Couplet	Pacer Not Capture
	Couplet	S Frequent	Pacer Not Pacing
	R on T	S VPC	Prolonged RR
	Multiform	Irregular RR	
	Vent Rhythm		
	Bigeminy		
	Trigeminy		
	Frequent		
	VPC		

SpO_2 Second Alarm Setup

The SpO_2 second alarm function is available when the DS-1200N or HG-820 is connected.

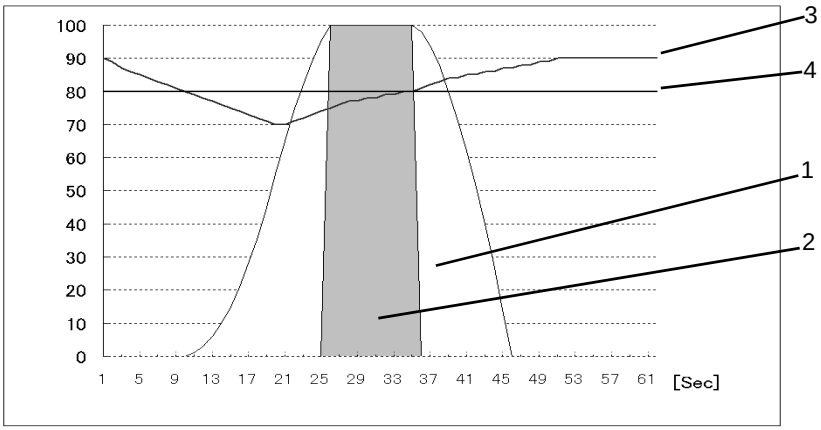
When the SpO_2 value is unstable around the lower alarm limit, the frequently generated alarm may be bothersome. The second alarm function controls these frequent alarms.

This function generates the alarm only when the integral value (the accumulation of difference between the alarm limit and SpO_2 value at every second) reaches the preprogrammed second alarm threshold value.

NOTE

- The SpO_2 SEC alarm function utilizes SatSeconds ™ technology of Medtronic. SatSeconds™ is a trademark of Medtronic.

The integral value of the second alarm is calculated as follows.



1 Integral Value

2 Alarm Generation

3 SpO_2 Value

4 Alarm Limit

On this graph, the second alarm threshold value is set as 100.

The SpO_2 value begins to fall below the alarm limit from approximately 10 seconds. At the same time, the integral value begins to increase. (Alarm limit) – (SpO_2 value) is accumulated each second.

At approximately 25 seconds, the integral value reaches 100 and the alarm is generated.

The SpO_2 value begins to fall below the alarm limit at approximately 36 seconds. At the same time, the integral value begins to decrease. [(Alarm limit) – (SpO_2 value)]x 2 is subtracted each second.

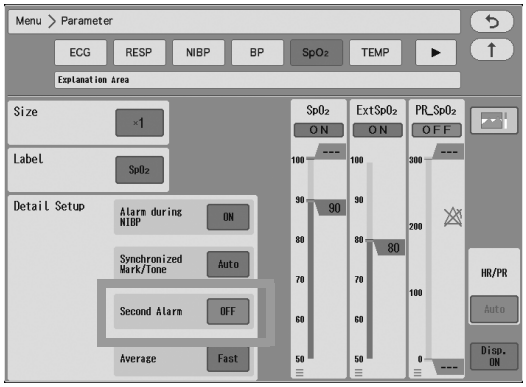
Also, there is a safety net when setting the second alarm function. This safety net is for the case when the SpO_2 value frequently falls below the alarm limit but does not last long enough to reach the second alarm threshold.

If the SpO_2 value falls below the limit 3 times or more during the last 60 seconds, an alarm will be generated even if the second alarm threshold is not reached.

⚠ CAUTION

- Whether to use the second alarm function and its threshold selection should be based on the patient's clinical indication portent and medical evaluation.
- SEC alarm setup is set to [OFF], the second alarm integral value will be set to 0.

1 Press the [Menu], [SpO_2] ("Parameter") keys to display the "SpO_2" setup screen.



2 Set the "Second Alarm".

- [10]/ [25]/ [50]/ [100]: A circular second alarm indicator will be displayed inside the numeric data box.
  As the integral value increases, the indicator will begin to fill, and when it is completely filled, an alarm will be generated.
- [OFF]: Second alarm indicator will not be displayed.

ST Alarm Setup

Set the ST upper limit and lower limit for the reference waveform.

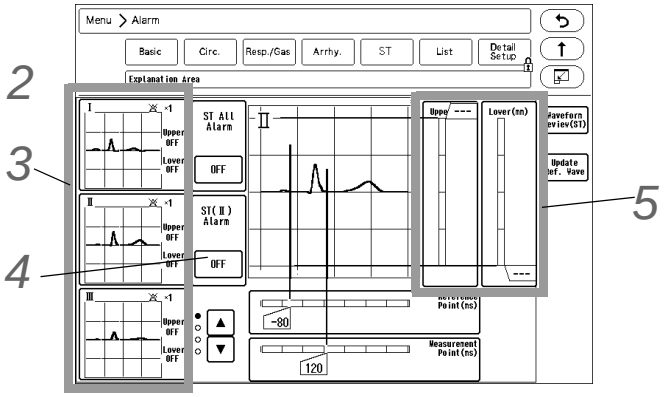
The upper and lower limit can be set in 1 mm/0.1 mV increments.

The alarm setup for ST and ΔST will be saved, respectively. 12L ST all alarm setups ON/ OFF are common for ST and ΔST.

- Alarm judgment for the measurement value selected for the "Display Numeric" setting in Detail Setup will be performed. ☞"Reference Waveform Setup" P8-26
- When the setting for "Display Numeric" is switched while the alarm is generating, the alarm judgment will be performed for the switched measurement value.

1 Press the [Menu], [ST] ("Alarm") key.

- The ST alarm setup screen will be displayed.



2 Select [ON]/[OFF] for "ST All Alarm" .

- [OFF]: Alarms will not generate even if the alarm for each lead is set to ON.

3 Select the lead to set the alarm limit.

- The selected lead will be displayed large at the right.

4 Select [ON]/[OFF] of ST alarm for each lead.

5 /XXX Slide the / \XXX and set the upper, lower limit (±20 mm / ±2.0 mV) .

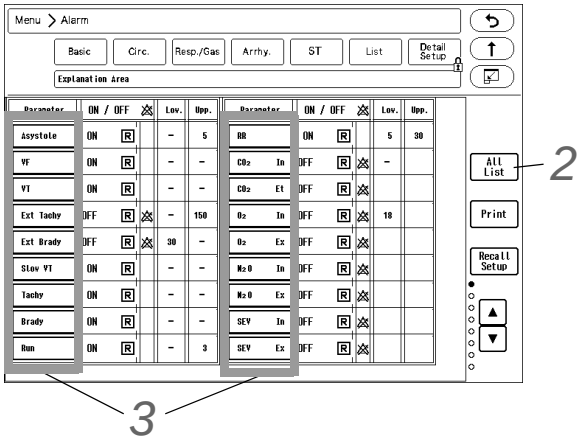
- Alarm will be set to OFF if the value -20 mm / +2.0 mV or lower is selected.
- Alarm will be set to OFF if the value +20 mm / +2.0 mV or above is selected.

List of Alarm Settings

The alarm settings can be verified in list format. The alarm settings for each parameter can be changed on this list.

1 Press the [Menu], [List] ("Alarm") key.

- The alarm settings list will be displayed.



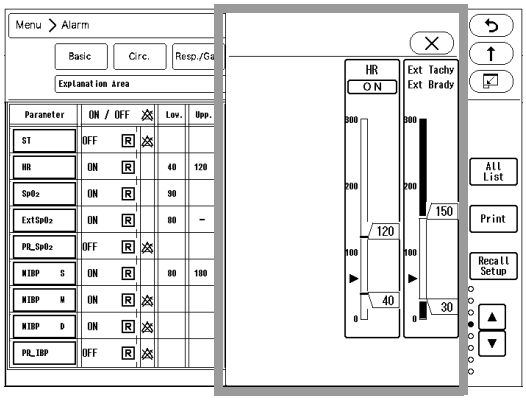
2 Select from [All List] / [Meas. List].

- [All List]: The settings for all the parameters will be displayed.
- [Meas. List]: The settings for only the measured parameters will be displayed.

3 Change the alarm threshold.

1 Select a parameter.

- The alarm setup window will be displayed.



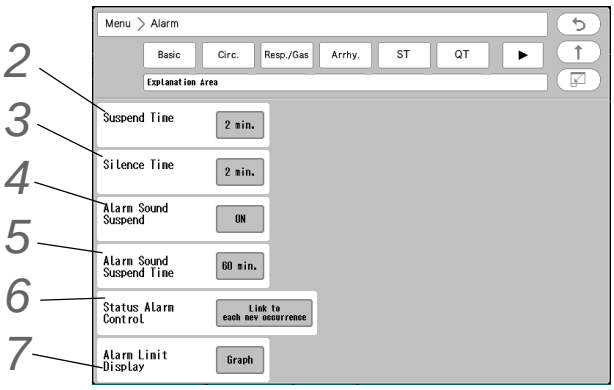
2 Press /XXX / \XXX to set the threshold level.

Detail Setup

The alarm-related setup such as alarm suspend time and alarm silence time can be performed.

1 Press the [Menu], [Detail Setup] ("Alarm") keys.

- The alarm detail setup screen will be displayed.



2 Select [1 min.] / [2 min.] for "Suspend Time".

3 Select [1 min.] / [2 min.] for "Silence Time".

4 Set the "Alarm Sound Suspend" function.

- [ON]: The alarm sound suspend function will turn ON.
- [OFF]: The alarm sound suspend function will turn OFF.

5 Select the "Alarm Sound Suspend Time" from 1 min, 2 min, 5min, 10min, 30min, 60min, 90min, 120min, 240min, 360min.

6 Set the "Status Alarm Control".

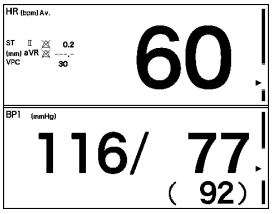
REFERENCE

- The alarm silence time for the level L device status alarm ("Check electrodes", "NIBP Check patient type, air hose", etc.) can be set.
  (☞"Device Status Alarm Message" P11-7)

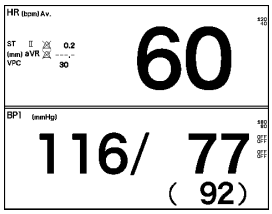
- [Link to Alarm Silence Time]: When the [Alarm Silence] key is pressed at occurrence of device status alarm, alarm will be silenced for fixed amount of time set for "Silence Time".
  If the alarm factor still remains at completion of silence time, the alarm sound will generate again.
  If the same alarm occurs during the alarm silence time, the alarm sound will not generate.
  If a new alarm occurs during the alarm silence time, the alarm sound for the new alarm will generate.
- [Link to each new occurrence]: When the [Alarm Silence] key is pressed at occurrence of device status alarm, the alarm will be silenced as long as the alarm factor remains regardless of the "Silence Time" setting.
  While the same device status alarm is generated, the alarm will remain silenced.
  If the alarm factor is resolved during the alarm silence time, the alarm will be canceled.
  If the same alarm generates again during the alarm silence time, the alarm sound will generate.

7 Select [Graph]/[Numeric]/[OFF] for "Alarm Limit Display".

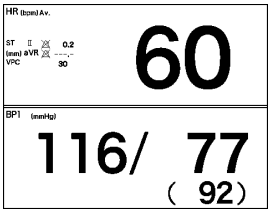
▸ The upper and lower alarm limit will be displayed on the home display.



Graph



Numeric



OFF

NOTE

- The alarm limit for the parameter with the alarm turned OFF will not be displayed regardless of this setup.
- If the alarm limit display for BP is [Graph], systolic value will be displayed.
- Depending on the numeric data box type, alarm limit may not be displayed.
- If the SpO_2 lower alarm limit is set to 85%SpO_2 or below, the alarm limit value will be displayed regardless of the "Alarm Limit Display" setting.

Alarm Limit Setup

This section explains the procedure to enable/suspend the system alarm, and to set the upper/lower alarm limit for each parameter.

On this system, 9 modes can be preprogrammed according to the monitoring purpose. By preprogramming the alarm setting to each mode, the alarm setups at admittance of patient can be simplified by just selecting a mode. It is recommended to program the mode in rough classification such as patient's age, monitoring purpose (ICU or surgery), and if necessary, perform unique setup for each patient.

To Set the System Alarm (ON or Suspend)

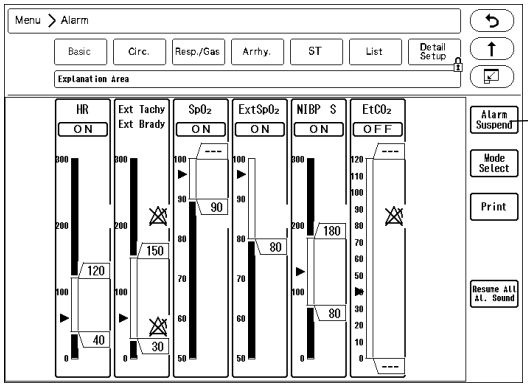
The system alarm can be enabled or suspended.
The system alarm enabled condition is when the alarm suspended condition is canceled, and alarm limit and alarm ON/OFF setting for each parameter are effective. The system alarm cannot be disabled.

⚠ WARNING

- When the system alarm is suspended, all the alarms will be suspended even if the parameter alarm is set to ON. Also, the alarms will not be stored as recall events.
- If the upper/lower alarm limit of the parameter is set to OFF, or if arrhythmia alarm is set to OFF, alarm will not function even if the system alarm is enabled. Pay attention when setting them OFF.

1 Press the [Menu], [Basic] or [Circ.] or [Resp./Gas] ("Alarm") keys.

- The alarm setup screen will be displayed.

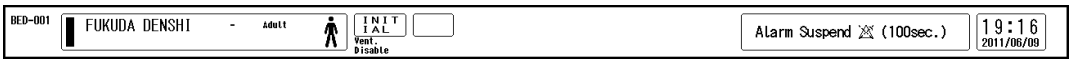


2 Select whether to enable or suspend the alarm.

To Suspend the Alarm

1 Press the [Alarm Suspend] key.

- The key will change to blue.
- The alarm will suspend temporarily.
- <Alarm Suspend (xxx sec.) > will be displayed.



- <xxx s> indicates the remaining time. The system alarm will be enabled when the suspended time completes.

To Enable the System Alarm

1 Press the [Alarm Suspend] key while in alarm suspended condition.

- The key will change to gray.
- The alarm limits and ON/OFF settings for each parameter will become effective.
- The alarm suspended condition will be canceled.

To Silence or Suspend the System Alarm Sound

The alarm sound can be suspended for fixed amount of time. There are two ways to suspend the alarm sound, which are "Alarm Silence" and "Alarm Sound Suspend".
The "Alarm Silence" function suspends the alarm sound for fixed amount of time (1 min. / 2 min.).
The "Alarm Sound Suspend" function suspends the alarm generation in advance such as during surgery when the alarm generation is expected. Alarm monitoring will continue even while the alarm sound is suspended. The alarm sound suspend duration can be selected from 1 min, 2 min, 5min, 10min, 30min, 60min, 90min, 120min, 240min, 360min.

1 To silence the alarm, press the [Alarm Silence] key (user key).

- The alarm sound will be silenced for fixed amount of time.
- If the alarm factor still remains at completion of silence time, the alarm sound will generate again.

2 To suspend the alarm sound, press the Alarm Silence key (user key) for more than 3 seconds.

- The alarm sound will be suspended for fixed amount of time.
- During the alarm sound suspended duration, the alarm sound will not generate.

NOTE

- If the [Alarm Silence] key is pressed while the alarm sound is generated, it will bring the system to "Alarm Silence" condition and not the "Alarm Sound Suspend" condition.
- During the "Alarm Sound Suspend" duration, other bed alarm sound will not generate.

❑Precautions about Silencing the Alarm

The alarm silence function is effective for each parameter. Once the alarm cause is resolved, the alarm silence condition for that parameter will be canceled.

When [Fukuda Tone] is set for "Alarm System" under [Menu>Setup>Initial Settings], and if another alarm with the lower priority occurs during the alarm silence duration, alarm sound will not generate. The recall and alarm printing will function.

When [Fukuda Tone] is set for the "Alarm System" and equipment status alarm is silenced, the alarm sound for the lower priority numeric and arrhythmia alarm will generate.

When [Melodic Tone] or [Standard Tone] is set for the "Alarm System" and if another alarm with lower priority occurs, the alarm sound will generate.

If the [Alarm Silence] key is pressed for the alarm of another parameter which occurred during the alarm silence condition, the alarm silence duration for the first alarm will not be extended.

The alarm silence condition for all parameters will be canceled for the following case.

- When the power is turned ON.
- When the system alarm status (enable/suspend) is changed.
- When the monitoring is suspended on the "Admit/Discharge" screen.
- When the user mode is changed.
- When the patient is discharged.
- When [Resume All Al. Sound] key on the alarm setup screen is pressed.

The alarm silence condition for each parameter will be canceled for the following case.

- When the alarm cause is resolved for that parameter.
- When the alarm silence time for the parameter is completed.
- When automatic alarm is set for the parameter.
- When the alarm is turned OFF for the parameter.

If [Link to each new occurrence] is set for "Status Alarm Control" (Menu>Alarm>Detail Setup), the alarm sound will not generate until the alarm condition changes even the set alarm silence duration completes.

❑Precautions about Suspending the Alarm Sound

During the alarm sound suspended duration, recall and alarm printing will function.

The alarm sound suspended condition will cease in the event of any of the following.

- Discharge
- When OFF is set for "Alarm Sound Suspend".
- When the ventilator alarm is generated.
- When resumed from monitor suspend condition.
- When the [Alarm Silence] key is pressed.

❑About the Alarm Mute Function

When "Alarm Mute" is set to [ON], all the alarms will be silenced.(☞Maintenance Manual "Alarm Related Setup" P5-4)

- "Alarm Mute" function can be turned ON/OFF under the "Initial Settings" menu.
- By using the "Alarm Mute Reminder" function, a reminder message, <Alarm is silenced.>, and a reminder sound can be displayed/generated after preprogrammed duration.
- During the alarm mute duration, recall and alarm printing will function.

WARNING

- During the alarm mute duration, alarm sound will not generate. Pay attention not to miss any important alarm by simultaneously monitoring the patient on central monitor or other monitors.

Alarm Limit Setup for Each Parameter

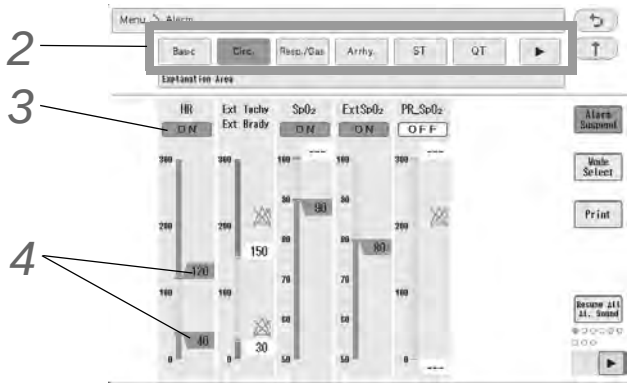
The alarm for each parameter can be turned ON or OFF, and upper and lower alarm limit can be set.

WARNING

- Set the appropriate upper and lower alarm limit for each parameter according to the monitoring condition.
- When the system alarm is suspended, all the alarms will be suspended even if the parameter alarm is set to ON. Also, the alarms will not be stored as recall events.
- If the upper/lower alarm limit of the parameter is set to OFF, or if arrhythmia alarm is set to OFF, alarm will not function even if the system alarm is enabled. Pay attention when setting them OFF.
- When the numeric data acquired from FLOW-i is displayed, the following alarms cannot be set. Also, alarm will not generate.
  $InspCO_2$/$EtCO_2$, $InspO_2$/$ExpO_2$, $InspN_2O$/$ExpN_2O$, InspAgent/ExpAgent, MAC, ExpMV, PEAK, PEEP

1 Press the [Menu], and then the key for "Alarm".

▸ The alarm setup menu will be displayed.



2 Select the parameter group from the tab.

REFERENCE

- The standard parameters will be displayed on the Menu screen. The parameters to be displayed here are selectable.
  (☞Maintenance Manual "Alarm Related Setup" P5-4)

3 Select ON/ OFF for the individual alarm.

▸ [ON]: Alarm of the corresponding parameter will generate.

▸ [OFF]: Alarm of the corresponding parameter will not generate.

4 Set the upper/ lower limit.

1 Slide the /XXX/ \XXX\ keys on the right side of the bar.

- /XXX/ : Adjusts the upper limit.
- \XXX\ : Adjusts the lower limit.
- By releasing the finger from the key, fine-tune keys will appear for a fixed period of time.

REFERENCE

- ▶ indicates the current measurement value.

5 Adjust the limit or use [Auto] for automatic setup.

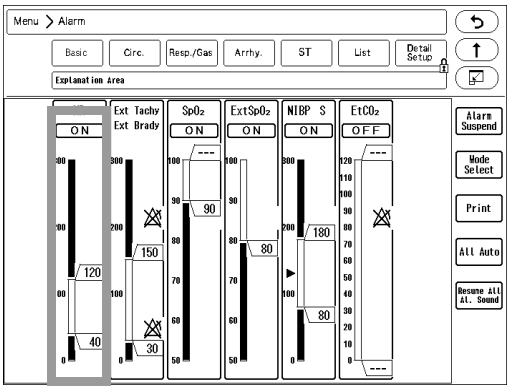
- 自動 : Sets the upper and lower alarm limit automatically.

REFERENCE

- [Auto] key will be displayed only when [Enable] is set for "Auto Alarm Setup" under "Initial Settings".
- To maintain the alarm setting even after the power is turned OFF or after the discharge procedure, store the setting to one of the alarm modes, or select "Backup" for "Alarm" on the "Backup at Discharge" menu (Monitor Setup).
  (☞Maintenance Manual "Display/Print Setup" P5-12.)

About the Alarm Threshold Limit

By setting the alarm threshold limit ("Initial Settings") in advance, the alarm threshold can be limited within the preprogrammed range. When the alarm threshold limit function is enabled, threshold limit will be displayed beside the alarm bar.
(☞Maintenance Manual "Alarm Related Setup" P5-4)



Above is an example of alarm threshold limit setting where HR is set to [Enable], and upper and lower limits are set to 180 bpm and 40 bpm respectively.

NOTE

- The alarm threshold limit can be set for each parameter. When enabling this function, make sure the upper and lower limits are set appropriately.
- When the alarm threshold limit function is enabled, pressing the [Auto] key for alarm settings will set the alarm threshold within the limit range.

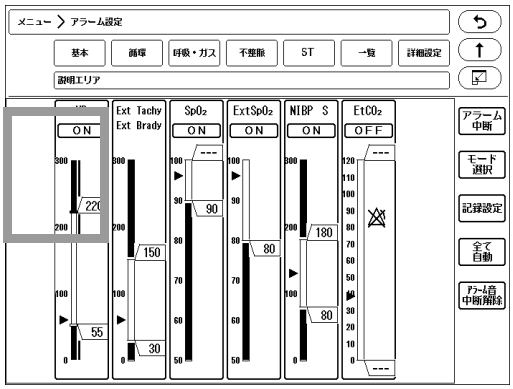
❑Limit Deactivating Mode

Even when the alarm threshold limit function is enabled, the alarm threshold outside the limit can be temporarily set. This is called the "Limit Deactivating Mode."

By pressing the up arrow key ▲ for 2 seconds at the upper threshold limit, the limit can be deactivated. The arrow keys will turn to blue indicating that the upper threshold limit can be exceeded.

In the same way, by pressing the down arrow key ▼ for 2 seconds at the lower threshold limit, the limit can be deactivated. The arrow keys will turn to blue indicating that the lower threshold limit can be exceeded.

When the alarm threshold is set within the limit range, the limit deactivating mode will end.



Above is an example of HR upper threshold limit being deactivated. The upper limit keys are turned to blue indicating that the upper limit 180 bpm can be exceeded.

NOTE

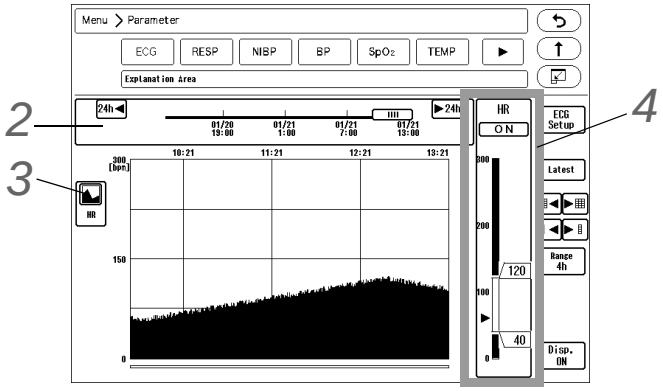
- If the alarm threshold set on the central monitor exceeds the threshold limit set on the DS-1200, the alarm threshold set on the central monitor will be applied. Make sure to check the alarm setting on the DS-1200 as the alarm threshold limit status will be changed to "Limit Deactivating Mode".
- f the monitor mode is changed, and the alarm threshold of the current monitor mode exceeds the threshold limit, this alarm setting will be applied. Make sure to check the alarm setting on the DS-1200 as the alarm threshold limit status will be changed to "Limit Deactivating Mode".

Alarm Assist Screen

On the alarm assist screen, maximum of 24 hours of trend data for the corresponding parameter will be displayed. Alarm limit can be set by using the past trend data as reference.

1 To display the alarm assist screen, press [Menu], select a parameter, and press [ ] on the corresponding parameter setup screen.
Or, press the numeric data box on the home display, and press [ ] on the corresponding parameter setup screen.

- The alarm assist screen will be displayed.



2 Select the time range on the time bar.

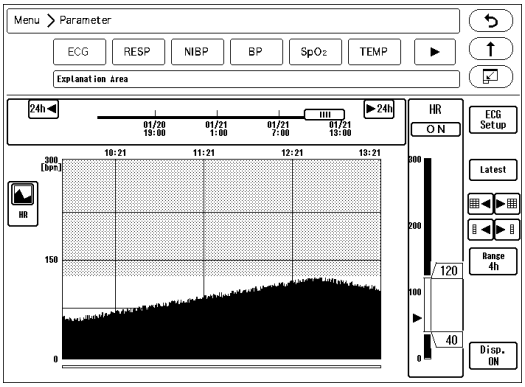
- Dragging the slider to the right will display newer data, and dragging it to the left will display older data.
- Pressing [24h] will switch the display by 24 hours.

3 Select the trend display type from [●], [▙], [Y], etc.

4 Set the upper and lower alarm limit.

1 Press [/XXX]/ [\XXX] on the right of the bar.

- Alarm zone will be displayed on the trend.



- The displayed alarm zone will slide by sliding the [/XXX] or [\XXX].
- The displayed alarm zone will also slide by pressing the [▲]/[▼].

2 Set the alarm limit by using the alarm trend as reference.

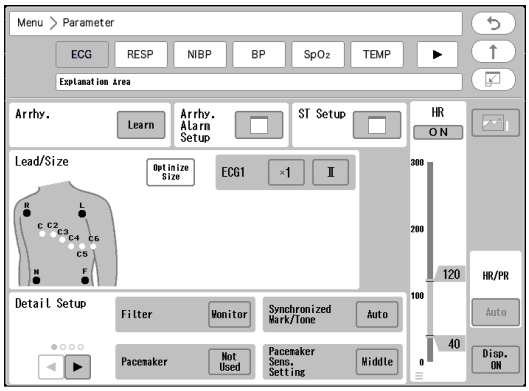
Chapter 7 Monitoring

To Display the Parameter Setup Screen

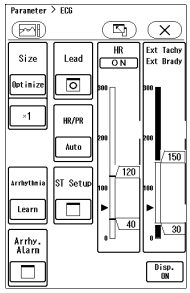
This section explains how to display the "Parameter Setup" of monitoring parameters.

1 Press the [Menu], and then select the parameter to perform the setup.
Or, press the numeric data box on the home display, and press (↗) on the corresponding parameter setup screen.

▸ The "Parameter Setup" screen will be displayed.



▸ When the numeric data box on the home display is pressed, a floating window for the basic setup such as size/scale will be displayed.
To display the "Parameter Setup" screen for detailed setup, press (↗).



ECG

This section explains the procedure for ECG measurement preparation and monitoring condition setup.

Before Attaching the Electrodes

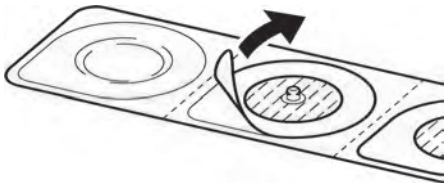
⚠ CAUTION

- Make sure to use electrodes of the same type.
  If different types of electrodes are used at the same time, the difference between the polarization potential from each electrode may interfere monitoring.
- ECG measurement part is Type CF applied part, but it is not intended to directly apply on patient's heart.

1 If necessary, shave the electrode sites to remove excessive hair.

2 Clean the electrode sites with an alcohol swab or other skin preparation.

3 Peel off the backing of electrode, and attach to the patient.



NOTE

- Pay attention not to touch the electrode gel.

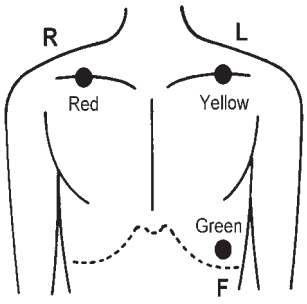
Electrode Placement

Depending on the lead cable type, 3-electrode/4-electrode/5-electrode/10-electrode placements are available. Using the 4-electrode, 5-electrode or 10-electrode application allows simultaneous monitoring of 2 ECG waveforms, and high accuracy of arrhythmia analysis can be attained. (1 to 12 waveforms can be displayed depending on the number of electrodes.)
Also, the displayed lead type can be changed.

❑For 3-electrode lead cable (1 waveform monitoring)

Lead Type: [I]/[II]/[III]

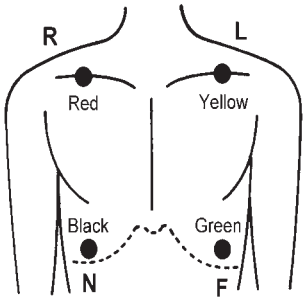
Symbol	Color	Electrode Site
RA	White	On the right infraclavicular fossa
LA	Black	On the left infraclavicular fossa
LL	Red	On the left midclavicular line, near the supracrestal line.



❑For 4-electrode lead cable (Maximum 6 waveforms monitoring)

Lead Type: [I]/[II]/[III]/[aVR]/[aVL]/[aVF]

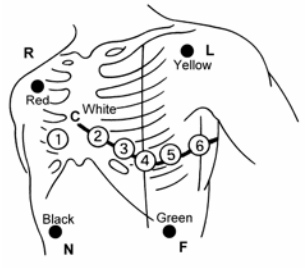
Symbol	Color	Electrode Site
RA	White	On the right infraclavicular fossa
LA	Black	On the left infraclavicular fossa
LL	Red	On the left midclavicular line, near the supracrestal line.
RL	Green	On the right midclavicular line at the same height as LL.



❑For 5-electrode lead cable (Maximum 7 waveforms monitoring)

Lead Type: [I]/[II]/[III]/[aVR]/[aVL]/[aVF]/[V]

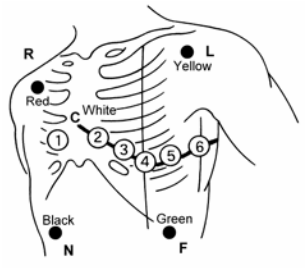
Symbol	Color	Electrode Site
RA	White	On the right infraclavicular fossa
LA	Black	On the left infraclavicular fossa
LL	Red	On the left midclavicular line, near the supracrestal line.
RL	Green	On the right midclavicular line at the same height as LL.
V	Red/Brown	Chest electrodes (V1 to V6)



❑For 10-electrode lead cable (Maximum 12 waveforms monitoring)

Lead Type: [I]/[II]/[III]/[aVR]/[aVL]/[aVF]/[V1]/[V2]/[V3]/[V4]/[V5]/[V6]

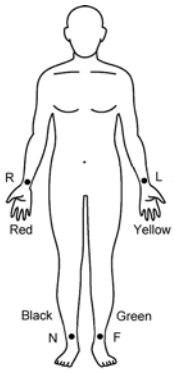
Symbol	Color	Electrode Site
RA	White	On the right infraclavicular fossa
LA	Black	On the left infraclavicular fossa
LL	Red	On the left midclavicular line, near the supracrestal line.
RL	Green	On the right midclavicular line at the same height as LL.
V	Red/Brown	The fourth intercostal space at the right sternal border.
V2	Yellow/Brown	The fourth intercostal space at the left sternal border.
V3	Green/Brown	On the midway between V2 and V4.
V4	Blue/Brown	The fifth intercostal space on the left midclavicular line.
V5	Orange/ Brown	On the left anterior axillary line at the same horizontal level as V4.
V6	Violet/Brown	On the left midaxillary line at the same horizontal level as V4.

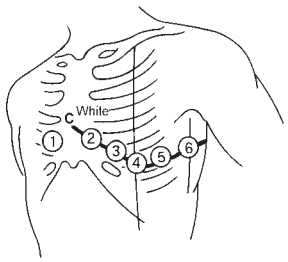


NOTE

- Electrode Placement for 12-Lead ECG Analysis
  When acquiring 12-lead ECG signals, Fukuda Denshi recommends placing the limb electrodes anywhere along the arms and legs as shown below.
  However if it is difficult, use the Mason-Likar 12-lead system.
  To reduce the waveform differences from the standard 12-lead, Fukuda Denshi recommends that the torso placement of the RA and LA electrodes be near as possible to each arm, in the infraclavicular fossae, within the area unaffected by myoelectricity.)

Symbol	Color	Electrode Site
RA	White	On the right arm
LA	Black	On the left arm
LL	Red	On the left leg.
RL	Green	On the right leg.
V	Red/Brown	The fourth intercostal space at the right sternal border.
V2	Yellow/Brown	The fourth intercostal space at the left sternal border.
V3	Green/Brown	On the midway between V2 and V4.
V4	Blue/Brown	The fifth intercostal space on the left midclavicular line.
V5	Orange/ Brown	On the left anterior axillary line at the same horizontal level as V4.
V6	Violet/Brown	On the left midaxillary line at the same horizontal level as V4.





Type of Electrodes and Lead Cable

There are various types of disposable electrodes for ECG measurement depending on the connection method with the lead cable and materials which the electrodes are made of. Make sure to use the appropriate electrodes which will make full use of the characteristics.
Do not reuse/resterilize the disposable electrodes.
For details of usable lead cables, refer to ☞"ECG, Impedance Respiration Measurement (Manufactured by Fukuda Denshi)" P13-1

Connection to the Patient Monitor

⚠ CAUTION

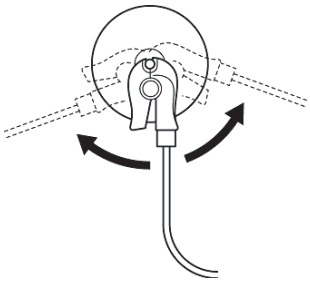
- The indication for continuous use of the electrode is about one day.
- Replace the electrode if the skin contact gets loosen due to perspiration, etc.
- When an electrode is attached to the same location for a long period, some patients may develop skin irritation. Check the patient's skin condition periodically and change the electrode site as required.
- When using the electrosurgery-proof type ECG relay cable, the impedance respiration cannot be measured, and its numeric data and waveform will not be displayed. When measuring in an environment where electrosurgery is not performed, make sure to use the standard ECG relay cable.

NOTE

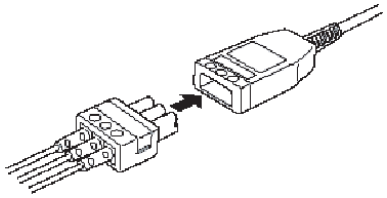
- Use only the specified relay cables, lead cables, and electrodes.
- The conductive parts of electrodes and associated connectors for applied parts, including the neutral electrode, should not contact other conductive parts including earth.

1 Clip on the lead cable end to the electrode convex part.

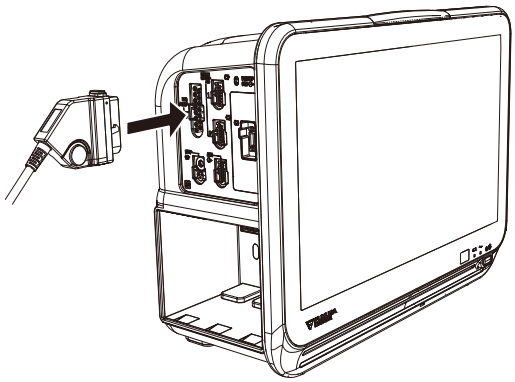
2 Turn right and left to verify that it is securely connected.



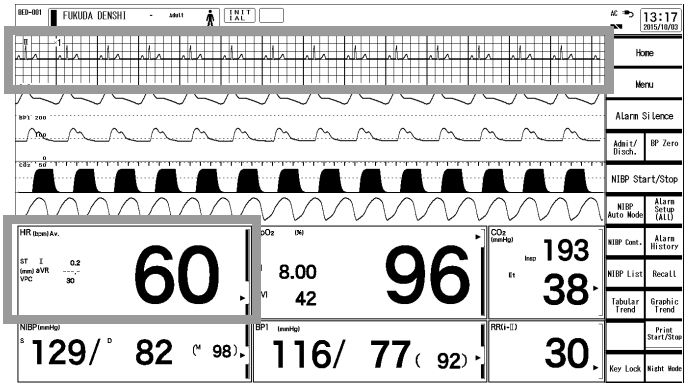
3 Connect the lead cable to the relay cable.



4 Plug in the relay cable to the ECG input connector (green).



▸ ECG waveform and HR data will be displayed on the monitor.

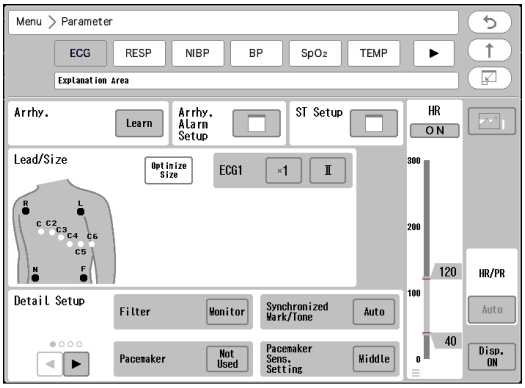


5 Adjust the waveform size and position, and change the monitoring lead as necessary.

(☞"ECG Parameter Setup" P7-6)

ECG Parameter Setup

Press the [Menu], [ECG] keys to display the "ECG" setup screen.



❑Adjustment of Waveform Size and Baseline Position

Adjust the waveform size and baseline position.

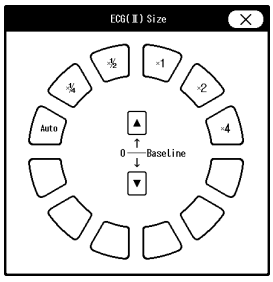
⚠ CAUTION

- The threshold level for arrhythmia detection changes with ECG waveform size. Set a proper waveform size for monitoring. When the ECG waveform size is x1/4, x1/2, or x1, the arrhythmia detection level is 250 μV. When the ECG waveform size is x2 or x4, the arrhythmia detection level is 150 μV.Arrhythmia: Detection Level
- Automatic size/position of the ECG is effective only at the time the [Auto] key is pressed. This does not continuously adjust the size and position.
- The setting is not possible if the waveform is not displayed. "To Configure the Display" P10-4Refer to and change the display configuration.
- The threshold level for HR detection changes with ECG waveform size. Set a proper waveform size for monitoring.

REFERENCE

- By setting the [ECG Size (All Leads)] key as user key, ECG size for all leads can be changed at once.
  (☞"User Key Setup" P10-10)

1 Press the key for "ECG1" to "ECG12", and display the "Size" selection window.



- When the display layout is "12-Lead", the waveform size can be set differently for limb leads and chest leads.

2 Select the waveform size for displaying/printing.

- [Auto]: Automatically adjusts the ECG amplitude to 10 mm. The automatic adjustment is effective only when the [Auto] key is pressed.

Waveform Size	x1/4	x1/2	x1	x2	x4
Voltage (10 mm)	4mV	2mV	1mV	500 μV	250μV

3 If the waveform is difficult to see due to ECG amplitude, press ▲/▼ and set the baseline position to 0 mV.
The baseline position for the waveform display and printing will be adjusted.

❑Lead Selection

Set the monitoring lead.

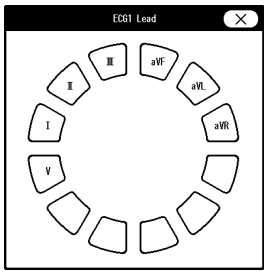
⚠ CAUTION

- The leads for arrhythmia detection, central monitor display, printing are fixed as ECG1 and ECG2. Set the most appropriate leads with high QRS for ECG1 and ECG2 for arrhythmia detection.
- The alarms for HR, Tachy, Brady will not be generated when the electrode for ECG1 or ECG2 lead is detached, and for 30 seconds after the electrode is reattached.

1 Press the key for "ECG1" to "ECG12", and display the "Lead" selection window.

▸ When the display layout is "12-Lead", select the lead for ECG1 and ECG2 on the lead selection window.

2 Select the ECG monitoring lead.



❑HR Alarm Setup

Set the HR alarm.
(☞"Alarm Limit Setup for Each Parameter" P6-11)

NOTE

- Set the upper limit in the range of 22 bpm to 300 bpm. The upper limit alarm will become OFF if the value exceeds 300 bpm.
- Set the lower limit in the range of 20 bpm to 295 bpm. If a value below 20 bpm is set, the lower alarm will turn OFF.
- Ext Tachy alarm threshold cannot be set below HR upper alarm limit, and Ext Brady alarm threshold cannot be set above HR lower alarm limit.

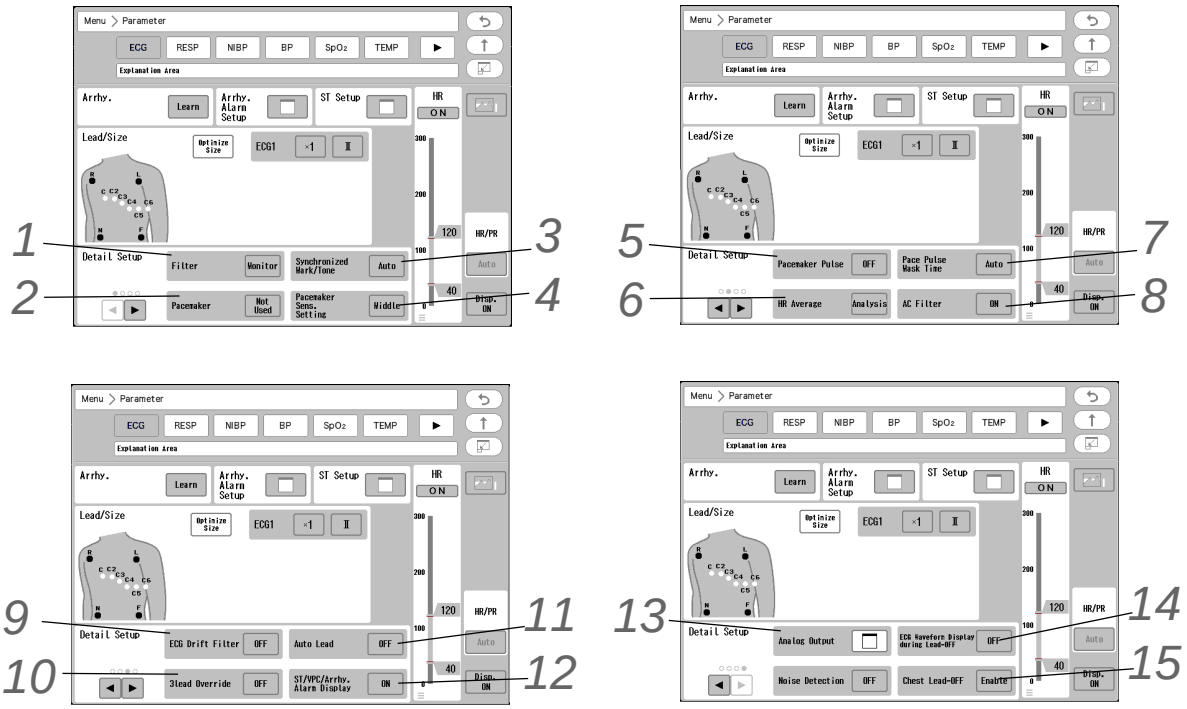
REFERENCE

- To use the auto setting, [Enable] should be selected for "Alarm Auto Setup" under "Initial Settings". (☞Maintenance Manual "Alarm Related Setup" P5-4)
- When [Auto] is set, the upper and lower limit will be automatically set to +40 bpm and -40 bpm to the current value respectively. The lower limit will be clipped to the setting made for "HR/PR Lower Limit during Alarm Auto Setting"(Menu>Initial Settings>Alarm).
- When [Enable] is set for "Alarm Threshold Limit" under "Initial Settings", and auto setting is used, the upper and lower alarm limit will be clipped to the set limit.
  However if "HR/PR Lower Limit during Alarm Auto Setting" is also set, HR lower alarm limit will be clipped to the larger value.
- Ext Tachy will be set to HR upper limit+10 bpm, Ext Brady will be set to HR lower limit-10 bpm. When the set value exceeds 300 bpm for the upper limit and 20 bpm for the lower limit, the setting will be clipped to 300 bpm and 20 bpm respectively.
- When [Auto] is set for Ext Tachy, Ext Brady, the same setting, HR upper limit+10 bpm, HR lower limit-10 bpm, will be set respectively.

❑Arrhythmia Alarm Setup

Set the arrhythmia alarm.
(☞"To Set the Arrhythmia Alarm" P6-1)

❑Detail Setup



1 Set the filter mode.

- Select from [Monitor]/[ESIS]/[Diag.] according to the monitoring purpose.
- Each mode has different frequency characteristic.
- The selected filter mode will be printed along with other data.
- On the waveform area, "M" (Monitor), "S" (ST), "E" (ESIS), or "D" (Diagnosis) will be displayed.

⚠ CAUTION

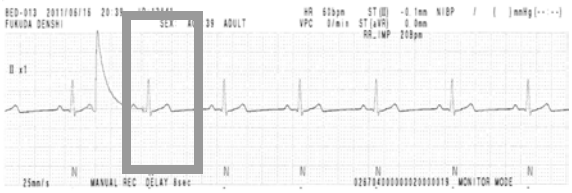
- The ESIS mode cannot completely reduce the electrical noise, and may erroneously detect the pacemaker spike.
- The ESIS mode should be selected only when a high frequency noise largely affects the HR measurement.
- In ESIS Mode, artifacts such as electrosurgical noise or EMG can be largely reduced, but QRS amplitude attenuation, waveform distortion, or ST segment change may occur compared with other filter modes.

Monitor Mode (Frequency Characteristic: Adult/Child 0.5 to 40Hz, Neonate 1.6 to 40Hz)	This is the standard mode for ECG monitoring. The highest frequency is set to 40 Hz to reduce the artifact caused by EMG, etc.
ESIS Mode (Frequency Characteristic: Adult/Child/ Neonate 1.6 Hz to 15 Hz)	By selecting this mode during electrosurgery, noise can be largely reduced.

Diagnosis Mode (Frequency Characteristic: 3-electrode Adult/Child/ Neonate 0.05 Hz to 100 Hz 4, 5,10-electrode Adult/Child/Neonate 0.05 Hz to 150 Hz)	Select this mode if ST measurement or high frequency ECG monitoring is performed. As the lowest frequency is set to 0.05 Hz, ST level can be accurately measured.

NOTE

- When the filter mode is changed, a notch will appear on the ECG waveform due to the change in frequency characteristic as shown below.



2 Select [Used]/[Not Used] for "Pacemaker".

- [Used]: Pacemaker pulse will be detected and pace pulse mask function will be performed for set duration.
- [Not Used]: Pacemaker pulse will not be detected.

3 Set the "Synchronized Mark/Tone".

- [OFF]: Synchronized mark will not be displayed.
- [Auto]: The priority will be according to the setting of "Synchronized Mark/Tone Priority" [Menu>Initial Settings>Meas.>Other].
  (☞Maintenance Manual "Other Setup" P5-10)
  [ECG]: The synchronized mark will be displayed in the priority of "ECG > SpO_2-1 > SpO_2-2 > BP". Also, the synchronized tone will be set to ON.
  [SpO_2]: The priority of synchronized mark will be set in the order of SpO_2-1>SpO_2-2>ECG>BP. Also, the synchronized tone will be set to ON.
- [ECG]: HR synchronized mark will be displayed. Also, the synchronized tone will be set to ON.
- [SpO_2-1]/[SpO_2-2]: SpO_2 synchronized mark will be displayed.
  Also, the synchronized tone will be set to ON.
- [BP]: BP synchronized mark will be displayed. Also, the synchronized tone will be set to ON.

4 Set the Pacemaker Sens.

Select from [Top] / [High] / [Med.] / [Low] depending on the pacemaker detection conditions.

5 Set the "Pacemaker Pulse".

⚠ CAUTION

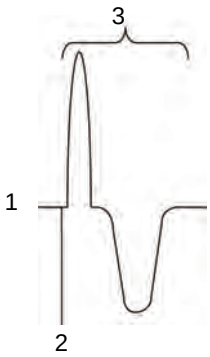
- Precautions about Pacemaker Pulse Detection
  - There are some cases when the pacemaker pulse cannot be detected depending on the pacemaker type, pulse voltage, pulse width, electrode lead type (unipolar, bipolar), or electrode placement which causes the pacemaker pulse amplitude to decrease, and disables the pacemaker pulse detection.
  - If signals similar to a pacemaker pulse are present, such as electric blanket noise or excessive AC frequency noise, these may be erroneously detected and displayed as

a pacemaker pulse.

- When a spontaneous QRS and pacemaker pulse overlap (ex. fusion beat, etc.), QRS detection cannot be performed properly. In this case, the heart rate is degraded.
- If a pacemaker pulse is continuously detected due to AC frequency interference, QRS detection will be suspended and the heart rate will be reduced. Also, arrhythmia will not be detected.

REFERENCE

- Pacemaker Pulse Detection Algorithm



1 ECG Signal Input
ECG signal will be input.

2 Pacemaker Pulse Detection and Suspension of QRS Detection
Detects the high frequency and large amplitude signal as pacemaker pulse.
When pacemaker pulse is detected, QRS detection will be suspended for fixed amount of time to avoid erroneous detection of pacemaker pulse as QRS.

3 Canceling of Arrhythmia Detection
Arrhythmia detection of the waveform following the pacemaker pulse will be canceled.

▸ Select from [ON] or [OFF].
[ON]: The pacemaker artificial pulse will be displayed on to the ECG waveform with a different color. "Pacemaker Pulse" will be automatically set to [ON] when [Used] is selected for "Pacemaker" on the "Admit/Discharge" screen.
[OFF]: The pacemaker artificial pulse will not be displayed.

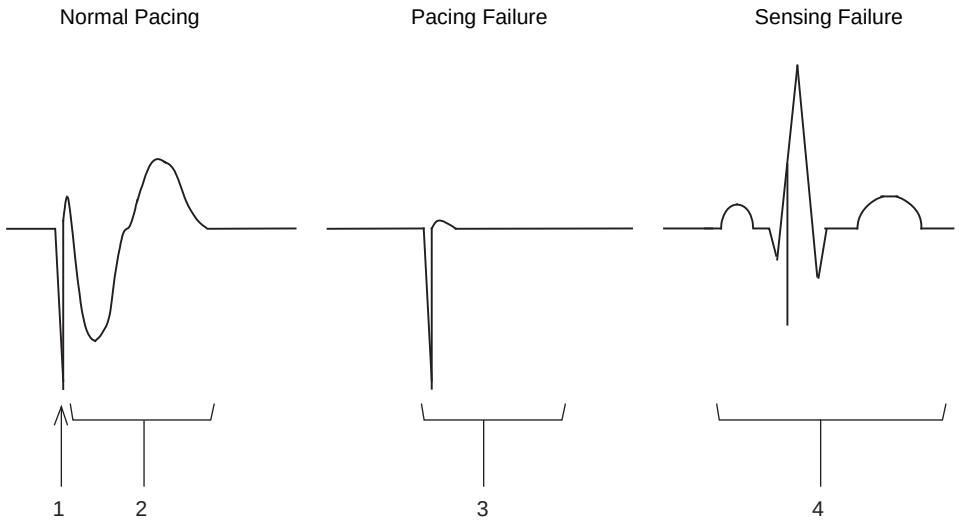
6 Set the "Pace Pulse Mask Time".

WARNING

- When [OFF]/[10ms]/[20ms] is set for "Pace Pulse Mask Time" , the pace pulse may be erroneously detected as a QRS complex, and even when the patient's HR is decreasing, HR or asystole alarms may not generate. Set this function to [OFF]/[10ms]/[20ms] only if you are sure that pacing failure will not occur, or when the patient can be constantly monitored.

REFERENCE

- For the patients using pacemakers, there are cases when the pacing waveform may not occur in spite of the pacing stimulus. This condition is called "pacing failure". To avoid detecting pacemaker pulses as a QRS complex, this monitor has a function to mask the pace pulse for a fixed amount of time starting from the detection of the pacing stimulus. This function is called "pace pulse mask" .
  But if the pacemaker does not detect the patient's spontaneous heartbeat (sensing failure), and the pacing stimulus is applied at the same timing as QRS, this pace mask function may erroneously mask the QRS and cause the heart rate measurement to decrease.
  To avoid this, QRS pace pulse mask function can be set to [OFF]/[10ms]/[20ms] for correct measurement of the heart rate. (Default setting : Auto)



1 Pacemaker Pulse

2 Pacing waveform caused by pacemaker pulse

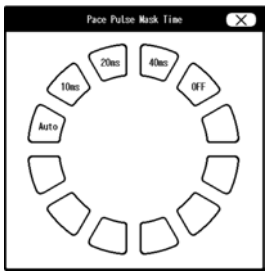
3 No waveform in spite of pacing stimulus

4 Pacemaker pulse and spontaneous heartbeat occurring at the same time

1 Press the key for "Pace Pulse Mask Time".

2 Select the mask time depending on the pace spike amplitude or presence of fusion beat.

- [Auto]: Pace pulse mask time will be automatically set according to the pace pulse amplitude.
- [OFF]: Pace pulse mask time will be set to 0 ms.



7 Set the "AC Filter".

If the ECG waveform is interfered with AC noise, the AC filter cuts off the frequency component (50 Hz/60 Hz).

- [ON]: AC filter which attenuates the AC noise of 50 Hz to 60 Hz will be set. "AC" will be displayed in the waveform area.
- [OFF]: AC filter will not be set.

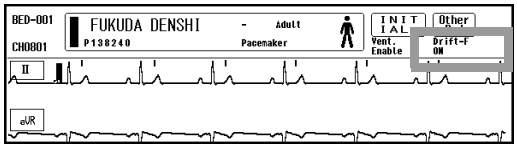
8 Set the "HR Average".

- [Instant]: HR measured from RR interval of each heartbeat will be displayed.
- [Average]: HR measured from 6 seconds of heartbeat for adult and child, and 3 seconds of heartbeat for neonate will be displayed.
- [Arrhythmia]: HR will be calculated based on the arrhythmia analysis. 4 seconds delay will occur compared to when [OFF] is selected. It may improve the HR detection when T wave or noise is interfering.
  When two ECG waveforms (ECG1 and ECG2) are measured, HR will be calculated by merging ECG1 and ECG2.
  If artifact is present on one of the waveforms, HR will be calculated using only the stable ECG waveform.
  If artifact is present on both of the waveforms, HR value will be displayed as "---".
  When ECG electrodes are detached, arrhythmia analysis cannot be performed, and <Lead OFF> message will be displayed. Alarm sound will also be generated.

9 Set the "Drift Filter".

- [ON]: Only the amplitude with frequency component under 1 Hz will be attenuated to prevent the ECG baseline drift.
  The patient signal display will delay about 0.5 seconds.

On the home display, "Drift-F ON" will be displayed in the information area, and "DF" will be displayed in the waveform area.



- [OFF]: ECG drift filter will not be set.

10 Set the "3lead Override".

NOTE

- When a relay cable for 5-lead or 10-lead is used with a 3-lead cable, it will be judged as lead-off condition and <LEAD OFF> message will be displayed.
  If a 3-lead cable is intentionally used, select [ON] for "3lead Override" to avoid displaying the <LEAD OFF> message.
- If [ON] is selected for "3-lead Override" even though 4-lead, 5-lead, or 10-lead relay cable is used with all the lead cables and electrodes connected, it will be acknowledged as only 3 electrodes are used and only one waveform will be displayed.
  Also, artifact may interfere to the waveform or lead-off information may become incorrect.
  When using the "3lead Override" function, use only 3 electrodes of LA, RA and LL. Also, remove electrodes other than LA, RA and LL.

- Select from [ON] or [OFF].

11 Set the "Auto Lead". The automatic lead switching will be performed for ECG 1 and ECG 2.

During Lead OFF

Lead Cable Type	Detached Electrode	Auto Lead Selected	
		ECG1	ECG2
4-electrode	RA	III	III
	LA	II	II
5-electrode	RA/RA+V	III	III
	LA/LA+V	II	II
	V	II	aVR
10-electrode	RA/RA+V	III	III
	LA/LA+V	II	II
	V,V2 to V6	II	aVR

- [ON]: When lead-off condition occurs, the lead will automatically switch.
  Also, <Check Electrodes> will be displayed.
- [OFF]: The lead will not automatically switch even when lead-off condition occurs.

12 Set the "ST/VPC/Arrhy. Alarm Display".

- [ON]: If 2 or more boxes are used for ECG numeric data display, ST level, VPC, arrhythmia alarm factor will be displayed inside the ECG numeric data box.
- [OFF]: ST level, VPC, arrhythmia alarm factor will not be displayed inside the ECG numeric data box.

13 Select the lead for ECG analog output.

- [Disp. Lead]: The lead of the displayed waveform will be output.
- [Selected Lead]: The lead selected on "Output Lead Sel." window will be output.

14 Set the "ECG Waveform Display during Lead-OFF".
When the lead-OFF condition is detected, whether or not to display the waveform for detached lead can be selected.

- [ON]: The input waveform will be displayed even during lead-off condition.
- [OFF]: Baseline will be displayed during lead-off condition.

15 Set the "Chest Lead-OFF".
Whether or not to detect the chest lead OFF condition can be selected. If set to [Enable], chest lead OFF condition will be notified by an alarm generation.

- [Enable]: Chest lead OFF condition will be notified by an alarm generation.
- [Disable]: Chest lead OFF condition will not be notified by an alarm generation.

NOTE

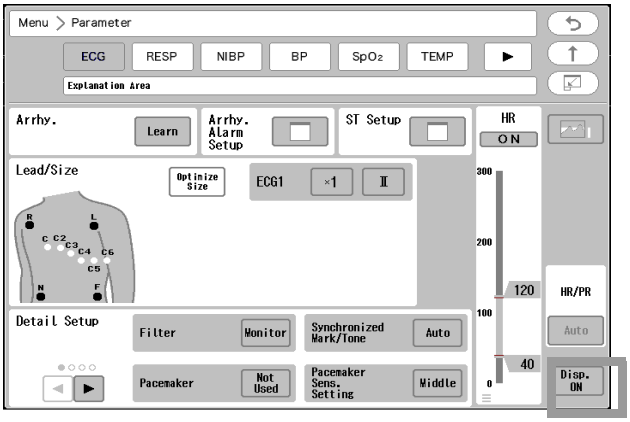
- If chest lead is set for ECG1/ECG2, chest lead OFF condition will be notified by an alarm generation even if [Disable] is set for "Chest Lead-OFF".

❑ON/OFF of Parameter Display

Select ON/OFF for parameter display.

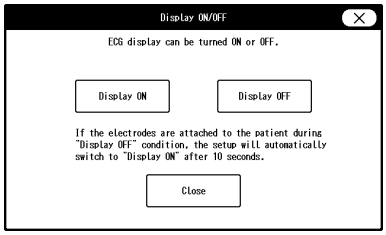
⚠ CAUTION

- When the waveform and numeric data display is set to OFF, the alarm generation and tabular trend input will also cease.



1 Press the [Disp. ON] key.

- The "Display ON/OFF" confirmation window will be displayed.



2 Select from [Display ON] or [Display OFF].

- [Display ON]: Waveform and numeric data will be displayed.
- [Display OFF]: Waveform and numeric data will not be displayed. A message will be displayed inside the numeric data display area.

- When ECG electrodes are attached to the patient with the ECG display set to OFF, the ECG waveform and

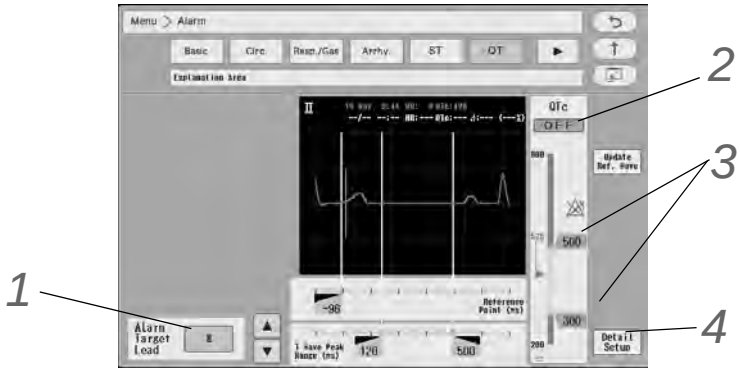
numeric data will be automatically displayed after 10 seconds.

QT Measurement

This section explains about the QT reference waveform and QT alarm function.

QT Alarm Setup

Set the QT alarm.



1 Select the lead to set the alarm limit.

- The selected lead will be displayed large at the right.
- For the lead not selected on the screen, switch the page using [▲]/[▼].

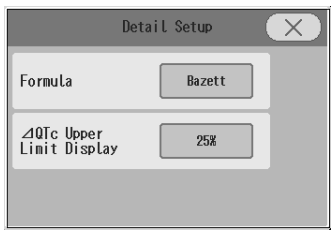
2 Select [ON]/[OFF] for "Qtc Alarm" .

3 Slide the numeric value on the right side of the bar to set the upper/lower limit. It can be set in 4 msec increments.

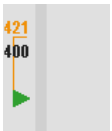
- Upper Limit: Set in the range of 204 msec to 800 msec.
- Lower Limit: Set in the range of 200 msec to 796 msec.

4 Set the details.

- Formula: Select from Bazett/Fridericia/Framingham.
- ΔQTc Upper Limit Display: Use the numeric keys to enter in the range of 0% to 100%.



The set value of the ΔQTc upper limit display will be displayed in orange which can be used for indication of the alarm threshold setting.



Respiration

This section explains about the respiration measurement by the impedance, CO_2, ventilator, or SpO_2 method and the measurement condition settings.

WARNING

- The SpO_2 respiration measurement is not intended for use as an APNEA monitor.

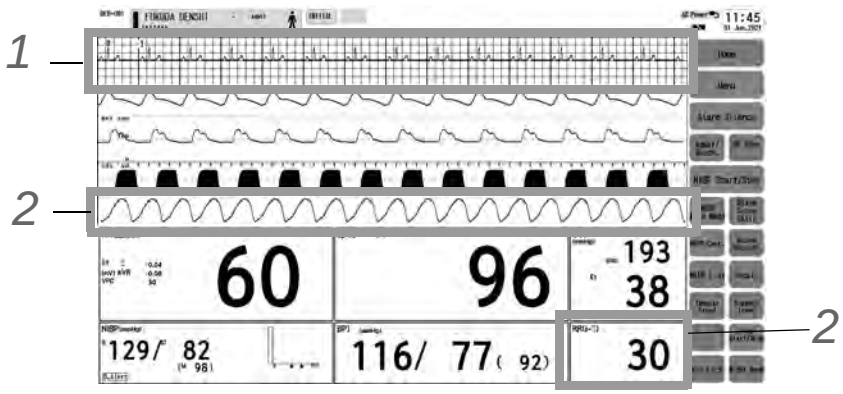
CAUTION

- When a defibrillator is used during respiration monitoring, a large offset voltage will be placed on the ECG electrodes, which may cause interruption of monitoring for a few seconds.
- When using the electrosurgery-proof type ECG relay cable, the impedance respiration cannot be measured, and its numeric data and waveform will not be displayed. When measuring in an environment where electrosurgery is not performed, make sure to use the standard ECG relay cable.

Respiration Monitoring (Impedance Method)

1 Check that the displayed ECG waveform is stable.
The respiration waveform is detected from ECG II or ECG I lead explained in the previous section. Therefore, a stable ECG waveform is necessary to acquire respiration waveform.

2 Verify that the respiration waveform and respiration rate is displayed on the home display.

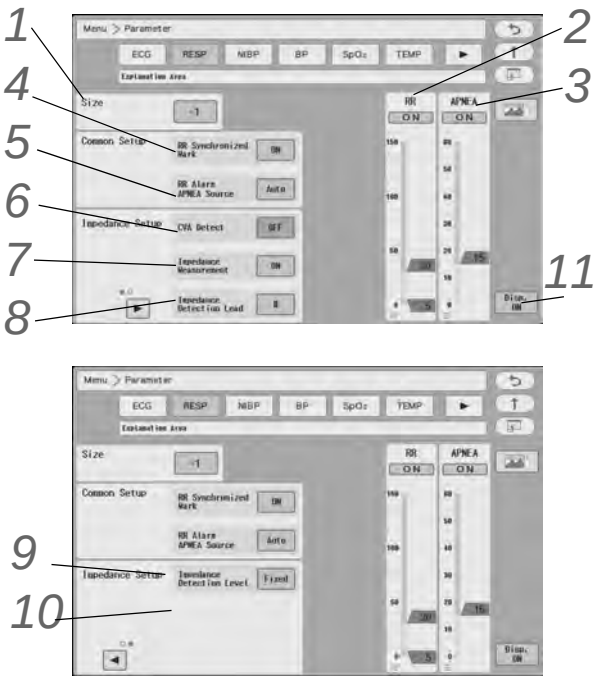


NOTE

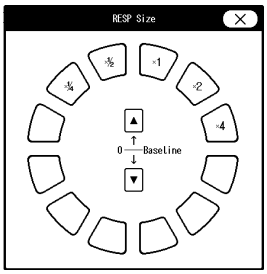
- Adjust the detection lead, waveform size, baseline position, and sweep speed for optimum waveform display.
(☞"To Configure the Display" P10-4)
- To change the lead, press the lead name on the waveform area, and display the lead selection window.

RESP Parameter Setup

Press the [Menu], [RESP] keys to display the "RESP" setup screen.



1 Press the key for "Size" to adjust the waveform size and baseline position.



- Select from [x1/4] / [x1/2] / [x1] / [x2] / [x4].
- If the waveform is difficult to see due to impedance waveform amplitude, set the baseline position to 0 Ω. The baseline position for printing will not change. Use the ▲/▼ keys to adjust the baseline position.

2 Set the RR alarm.
(☞"Alarm Limit Setup for Each Parameter" P6-11)

NOTE

- The same RR alarm setting will be applied for impedance, CO_2, ventilator, gas unit, and SpO_2 measurement.
- For RR measured from CO_2 waveform, alarm will not generate unless 2 or more respiration is detected within 30 seconds after the power is turned ON, monitoring is resumed, CO_2 unit is connected, or a patient is discharged.
- Set the upper limit within the following range for each patient classification.
  Adult: 10 Bpm to 150 Bpm
  Child/ Neonate: 4 Bpm to 150 Bpm
  The upper limit alarm will turn OFF if the value above 150 Bpm is set.
- Set the lower limit within the following range for each patient classification.
  Adult: 5 Bpm to 145 Bpm
  Child/ Neonate: 2 Bpm to 148 Bpm
  If a value below 5 Bpm / 2 Bpm is set, the lower alarm will turn OFF.
- For the impedance respiration, RR alarm will not generate when the electrode of detection lead is detached and for 30 seconds after the electrode is reattached.
- When Capnostat 5 is used, RR alarm will not generate unless 2 or more respiration is detected after completion of the airway adapter calibration.

REFERENCE

- To use the auto setting, [Enable] should be selected for "Alarm Auto Setup" under "Initial Settings". (☞Maintenance Manual "Alarm Related Setup" P5-4)
- When [Auto] is set, the upper and lower limit will be automatically set to +20 Bpm and -20 Bpm to the current value respectively.
- The adjustable increment for upper and lower limit depends on the patient classification and "RR Alarm Increment" setting under "Initial Settings" > "User I/F".

	Alarm Increment (Initial Settings > User I/F)	
	Normal	Small
Adult	5 Bpm increment	1 Bpm increment
Child/Neonate	2 Bpm increment	1 Bpm increment

- When [Enable] is set for "Alarm Threshold Limit" under "Initial Settings", and auto setting is used, the upper and lower alarm limit will be clipped to the set limit.

3 Set the APNEA alarm.
(☞"Alarm Limit Setup for Each Parameter" P6-11)

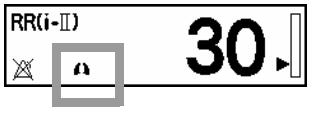
NOTE

- The same APNEA alarm setting will be applied for impedance, CO_2, and ventilator measurement.
- If the alarm is based on the apnea time measured from CO_2 waveform, apnea alarm will not generate unless 2 or more respiration is detected within 30 seconds after the power is turned ON, monitoring is resumed, CO_2 unit is connected, or a patient is discharged.
- Set the upper limit in the range numeric of 10 to 60 sec. The upper limit alarm will turn OFF if a value above 60 seconds is set.
- For the impedance respiration, apnea alarm will not generate when the electrode of detection lead is detached and for 30 seconds after the electrode is reattached.
- When Capnostat 5 is used, apnea alarm will not generate unless 2 or more respiration is detected after completion of the airway adapter calibration.

REFERENCE

- To use the auto setting, [Enable] should be selected for "Alarm Auto Setup" under "Initial Settings". (☞Maintenance Manual "Alarm Related Setup" P5-4)
- When [Auto] is set, the apnea alarm setting registered for the currently selected mode will be applied.
- The upper limit can be set in 1 second increment. There is no lower limit.
- When [Enable] is set for "Alarm Threshold Limit" under "Initial Settings", and auto setting is used, the upper and lower alarm limit will be clipped to the set limit.

4 Set the "RR Synchronized Mark".



- [ON]: The mark synchronized to impedance respiration or CO_2 waveform will be displayed.
- [OFF]: Synchronized mark will not be displayed.

5 Set the "RR/APNEA Alarm Source".
The parameter to display the RR synchronized mark and to generate the RR/APNEA alarm can be selected from impedance, CO_2/multigas module, ventilator, and SpO_2.

WARNING

- The RR/APNEA alarm will not be generated unless the numeric data box corresponded to the selected RR/APNEA alarm source is displayed. Make sure to display the numeric data box for the parameter set as the RR/APNEA alarm source.
- The SpO_2 respiration measurement is not intended for use as an APNEA monitor.

CAUTION

- If the "RR/APNEA Alarm Source" setting is other than [Impedance] (or, if [Auto] selects a setting other than [Impedance]), the RESP waveform will not be transmitted on a wired network.
- RR_SpO_2 is a parameter which can be measured on the HG-820.

- [Impedance]: RR alarm will be generated based on the impedance respiration curve. The RR synchronized mark based on impedance respiration will be displayed.
- [CO_2/ GAS]: When multigas module/ FLOW i is used, RR alarm will be generated based on the RR measured by the multigas module/FLOW-i.
  If multigas module is not used, RR alarm will be generated based on the RR measured by the HC-120 (Capnostat 5) or HC-110. The RR synchronized mark based on CO_2 waveform will be displayed.
- [Ventilator]: RR alarm will be generated based on the RR measured by the ventilator. The RR synchronized mark based on ventilator measurement will be displayed.
- [SpO_2]: RR alarm will be generated based on the RR measured by the SpO_2 module. The RR synchronized mark will not be displayed.
- [Auto]: The measurable parameter will be selected in the priority of CO_2/GAS or FLOW-i>ventilator>impedance>SpO_2, and generates the alarm if the corresponded numeric data box is displayed on the home display.

6 Set the "CVA Detect".

REFERENCE

- When the amplitude of the respiration waveform decreases due to causes such as respiratory pause, the ECG waveform may be superimposed on to the respiration waveform, making the RR equal to the HR. This condition is called CVA (Cardio-Vascular Artifact), and is detected using the CVA detection function.
- This function will be effective only when [Impedance] is set as the "RR/APNEA Alarm Source" or, when [Auto] selects impedance respiration.
- If the ECG waveform is superimposed on to the respiration waveform with HR (RR) of 30 Bpm or above for 20 seconds (10 seconds for neonates) or more and if the "CVA Detect" is set to [ON], the <CVA detected> message will be displayed, and an alarm sound will be generated.

- [ON]: When CVA is detected, alarm will generate and message will be displayed.
- [OFF]: CVA detection will not be performed.

7 Set the "Impedance Measurement".

WARNING

- If a patient is using an adaptive (minute ventilation) pacemaker, "Impedance Measurement" should be set to OFF.
  The respiration measurement using the impedance method conducts high-frequency and weak current between the ECG electrodes attached to the patient, and measures the

potential difference between the electrodes caused by thoracic movement using the synchronous rectification system. For the patient using the adaptive (minute ventilation) pacemaker, the pacemaker measurement signal and the high-frequency current of this device interferes with each other which causes incorrect respiration measurement.

- [ON]: Standard impedance respiration measurement will be performed.
- [OFF]: Impedance respiration measurement will not be performed and impedance respiration waveform and RR data will not be displayed. A high-frequency current which is a measurement signal will not be conducted.

8 Set the "Impedance Detection Lead".
Select the respiration detection lead from [I] or [II].

9 Set the "Impedance Detection Level".

- [Fixed]: The respiration detection level will be set according to the displayed waveform size. By increasing the displayed waveform size, low amplitude will become more detectable.
- [Auto]: The respiration detection level will be automatically set according to the current respiration amplitude.

10 Set the Detection Signal Adjustment.
When the respiration waveform is not stable due to causes such as the electrode impedance, switch ON/ OFF to adjust the setting to detect the respiration waveform.

- [ON]: Operates with consideration for phase lag in the respiration signal.
- [OFF]: Operates as a normal respiration waveform detection method.

NOTE

- The Detection Signal Adjustment setting is initialized to [OFF] when the patient is discharged.

11 Select ON/OFF for parameter display.
(☞"ECG Parameter Setup" P7-6)

BP

This section explains about the procedure of BP1 to BP 8 measurement preparation and measurement condition setup.

⚠ CAUTION

- Do not reuse / re-sterilize the disposable type transducers.
- If using a reusable blood pressure transducer, disinfect it according to the manufacturer's guidelines.
- The long-term use of the blood pressure transducer, tube and catheter may increase the risk of infection. Perform periodic replacement with new one. The guidelines of the CDC (Disease Control and Prevention) recommend replacing within 96 hours.
- If the ambient temperature of the blood pressure transducer has changed greatly, the zero balance may cause the drift. Perform the zero balance again.
- An operator must not get away from a patient during the BP measurement. However, when getting away from the patient is necessary, do not activate the Alarm Suspend and Silence functions in order not to miss any sudden changes in the patient's condition.
(☞"To Set the System Alarm (ON or Suspend)" P6-8)
(☞"To Silence or Suspend the System Alarm Sound" P6-9)

- Be sure to perform Daily Check. Use of faulty device might harm the patient or operator. (☞"Daily Check" P4-1)
- If the Device Status Alarm occurs or if you feel the unusual operation of the device, perform the inspections to confirm the safety or contact our service representative. (☞"Device Status Alarm Message" P11-7)
- The BP value will not be displayed until zero balance is performed after the power is turned ON. Make sure to perform the zero balance.
  Once the zero balance is performed, the zero balance information will be maintained, and the BP value will be displayed.

BP Monitoring

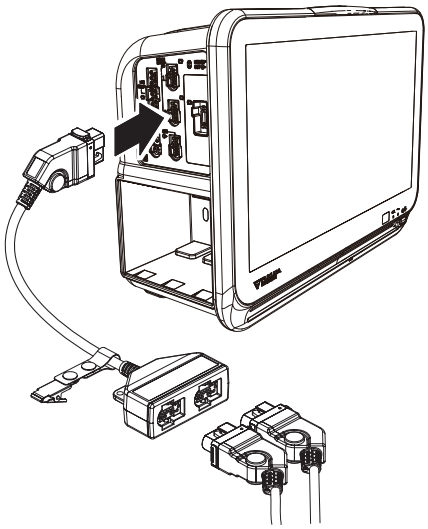
DS -1200 utilizes multiparameter amplifier input method which allows monitoring of 2 channels of BP through the 2ch BP conversion cable, CJO-P01B-DJ0.5. The BP relay cable can be directly connected to the multiparameter connector.
The measurement is also possible using the HM-800/HM-801 Multi Module
(☞"Multiparameter Connector Setup for BP, TEMP, CO Measurement" P7-114)

1 Connect the 2ch BP interface cable to the .

For Connection via 2ch BP Conversion Cable (CJO-P01B-DJ0.5):

1 Connect the interface cable to the multiparameter connector via 2ch BP conversion cable (CJO-P01B-DJ0.5).

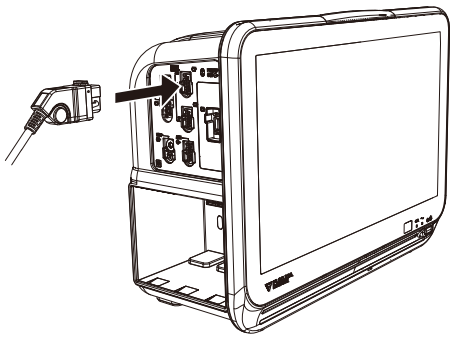
1 Multiparameter Connector
2 2ch BP Conversion Cable CJO-P01B-DJ0.5
3 1ch BP Relay Cable CJO-P01B-S**



For Direct Connection:

1 Connect the BP relay cable directly to the multiparameter connector.

- 1ch BP Relay Cable CJO-P01B-S**
- 2ch BP Relay Cable CJO-P01B-D**



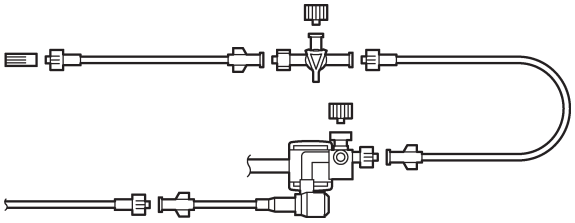
2 Assemble the BP measurement device.

REFERENCE

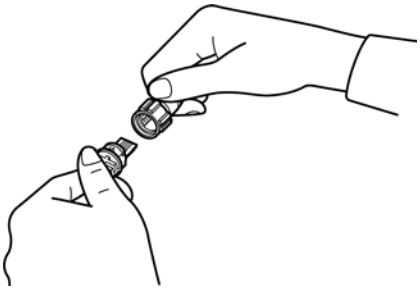
- The following procedure explains the case when a BP transducer (LS575 series) is used. If using other transducers, refer to the operation manual for the corresponding transducer.

1 Inspect transducer packaging for damage prior to opening.

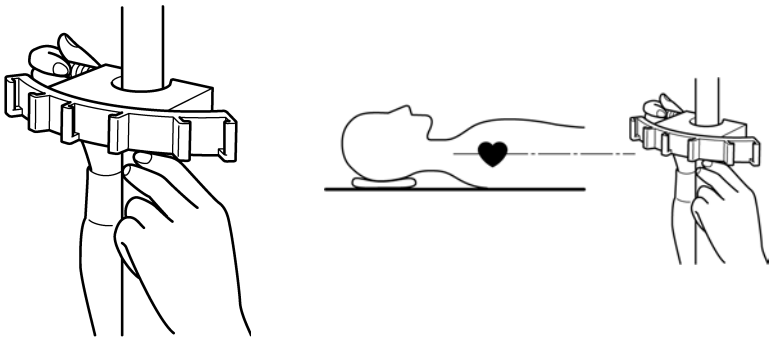
2 Verify that each connector is securely connected.



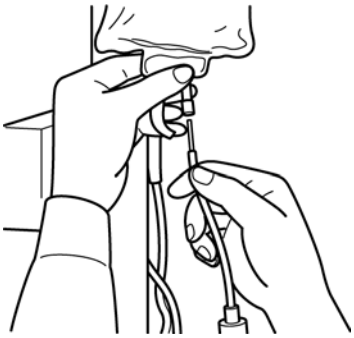
3 Connect the BP relay cable to the transducer.



4 Align the bracket to patient's heart position (about 1/2 of the chest depth).

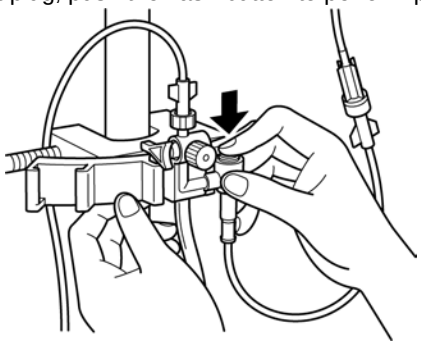


5 Inject 1000 units of heparin into the saline bag, mix thoroughly and puncture the infusion line through the same hole.

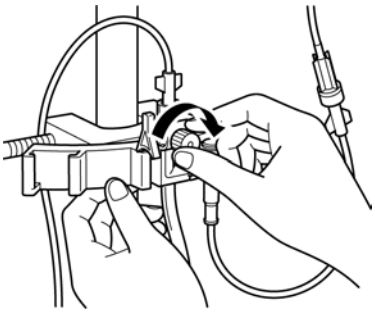


6 Set the saline bag to pressure bag, and hang from the infusion device. Fill saline to about 1/3 of the drip.

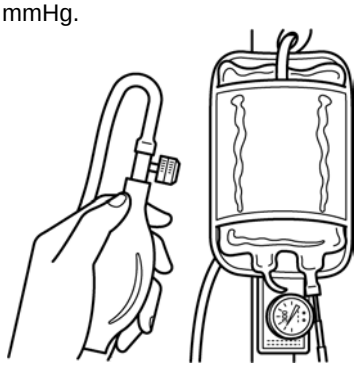
7 After loosening the zero-port plug, push the flash button to perform priming to remove air bubbles.



8 Verify that all air bubbles are removed, and tighten the zero-port plug. Turn on the zero-port plug side of the open-air three-way valve.



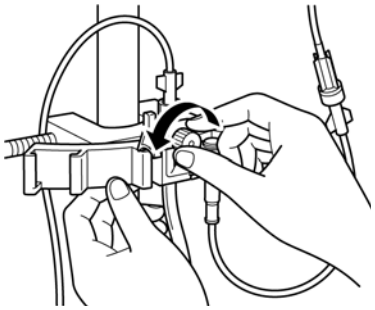
9 Inflate the pressure bag to 300 mmHg.



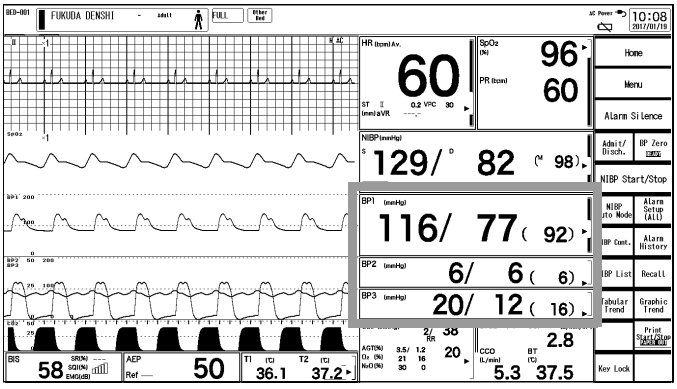
10 Set the BP device and wait for about 5 minutes.

3 Perform zero balance.

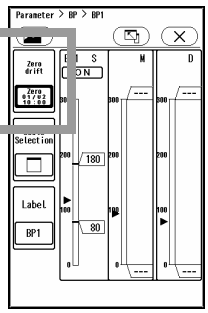
1 Loosen the zero-port plug on open-air three-way valve one-half turn.



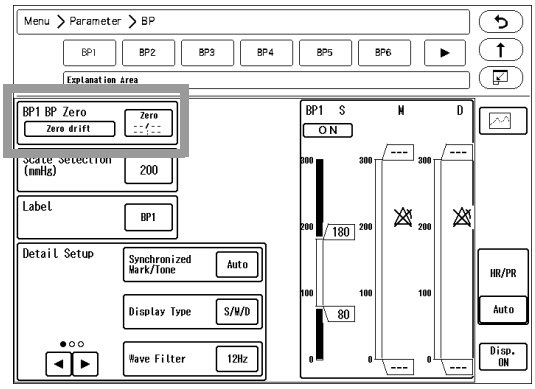
2 Press the BP numeric data box (parameter key) on the home display.



▸ The BP floating window will be displayed.



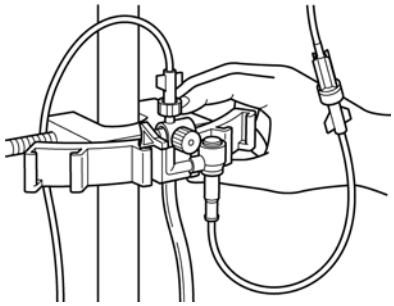
3 Press the [Zero] key on the BP floating window or BP parameter setup screen.



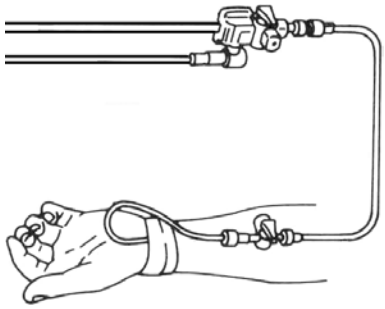
▸ Zero balance will start.

▸ When the BP zero balance is complete, the completed date/time will be displayed inside the [Zero] key.

4 Turn off the zero-port plug side of the open-air three-way valve.



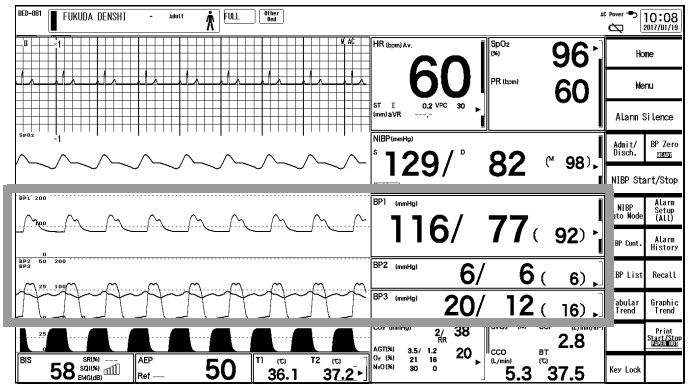
5 Connect the catheter to the end of monitoring line.



▸ The measurement preparation is completed, and BP measurement will start.

4 Press the [Home] key on the user key.

5 Verify that the BP waveform and numeric data is displayed on the home display.

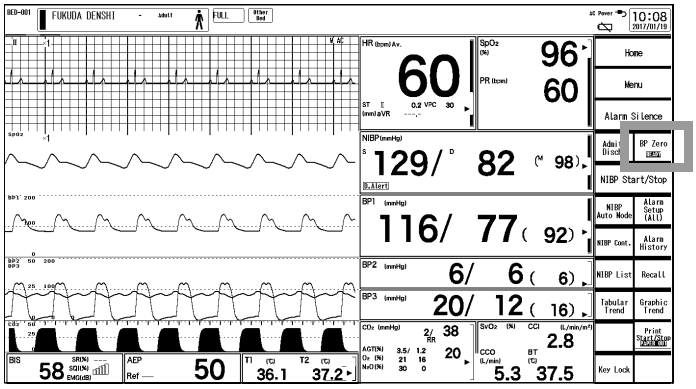


CAUTION

- The zero balance procedure is required for the following case.
  - When starting the measurement.
  - When the position of the heart has changed due to body movement.
  - When the position of the transducer has changed.
  - When measuring for a long period of time and there is a possibility of measurement error due to change in ambient temperature, etc.
  - When a connector is connected/disconnected, or a transducer is replaced.

Zero Balance of All Pressure Lines (User Key)

The zero balance for all the displayed BP can be performed using the user key.
If any of the BP is in progress of measurement, perform the zero balance on each BP parameter setup screen.



1 Open the three-way valve of all the pressure transducers to air.

- <READY> will be displayed inside the user key.

2 Press the [BP Zero] key on the user key.

3 Verify the BP waveform is positioned at zero, and "0" is displayed for the BP value.

- <COMPLETE> will be displayed when the procedure is complete.
- <FAILED> will be displayed when the process fails.
- <DRIFT> will be displayed when the BP relay cable is not connected.

NOTE

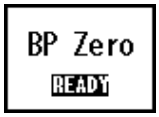
- If <FAILED> is displayed, the three-way valve may not be opened to air, artifact is present, or the transducer may be defective. Check the cause and try the zero balance procedure again.
- If <DRIFT> is displayed, verify that all the connections are secure.

4 Close the three-way valve when the zero balance is complete.

⚠ CAUTION

- When the transducer or tubing is replaced, make sure to perform the zero balance. Otherwise, accurate measurement will not be performed.
- <READY> will not be displayed unless the three-way valves of all pressure transducers are opened to air. If the status is not displayed, or if <MEASURE> is displayed, check if the three-way valve of pressure transducers are opened to air.

BP zero status displayed inside the user key



No display	: Open transducer to air
MEASURE	: Open transducer to air
READY	: Ready to perform zero balance.
BP ZERO	: BP zero in progress
FAILED	: Zero failed
COMPLETE	: Zero complete
DRIFT	: Zero drift

Zero Balance of All Pressure Lines ([BP Zero] Key)

[BP Zero] key on the HS-8000 or Multi Module, zero balance can be performed for all the BP even if not displayed.

- When the BP zero balance properly completes, a beep sound will generate for 1 second and LED will light in blue.
- When the BP zero balance fails, a beep sound will generate for 3 seconds and LED will flash in blue.

NOTE

- Using the [BP Zero] key will allow to perform zero balance for all the BP even if not displayed on the home display.
  For the BP channel with the transducer in progress of measurement, zero balance will not be performed.

Zero Balance for Each Pressure Line

1 Open the three-way valve of the pressure transducer to air.

2 Verify that "Zero ready" is displayed on the BP parameter setup screen for BP1 to BP8, and press the [Zero] key.

3 Verify the BP waveform is positioned at zero, and "0" is displayed for the BP value.

- A message, "Zero complete" will be displayed when the procedure is complete.
  When the BP zero balance is complete, the completed date/time will be displayed at the lower part of the [Zero] key.
- A message, "Zero failed" will be displayed when the process fails.
- A message, "Zero drift" will be displayed when the BP relay cable is not connected.

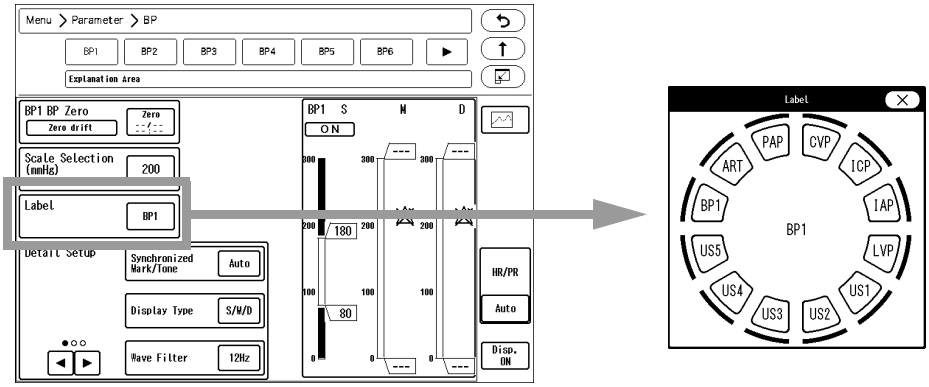
NOTE

- If a message, "Zero failed" is displayed, the three-way valve may not be opened to air, artifact is present, or the transducer may be defective. Check the cause and try the zero balance procedure again.
- If a message, "Zero drift" is displayed, verify that all the connections are secure.

4 Close the three-way valve when the zero balance is complete.

BP Parameter Setup

❑Label Setup



1 Press key for "Label", and display the "Label" window.

2 Select from [BPx]/[ART]/[PAP]/[CVP]/[ICP]/[IAP]/[LVP]/[USx].

REFERENCE

- Description of Each Label:
  ART (Arterial Pressure)
  PAP (Pulmonary Artery Pressure)
  CVP (Central Venous Pressure)
  ICP (Intra-cranial Pressure)
  IAP (Intra-aortic Balloon Pumping Pressure)
  LVP (Left Ventricular Pressure)
  US1 to US5: User labels (3 characters) which can be set on the "Initial Settings".
  (☞Maintenance Manual "User Label Setup" P5-9)

NOTE

- US3 to US5 cannot be selected for the device connected to DS-LAN III.

❑When the BP Label is ART

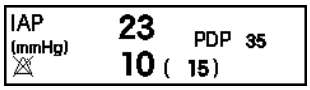
By selecting [ON] for "ART Catheter Check Message" [Menu>Parameter>BP1 (ART)>Detail Setup], an alarm will be generated when the catheter is disconnected.
(☞"Set the "ART Catheter Check Message".." P7-32)

⚠ CAUTION

- The default setting of “ART Catheter Check Message” is [OFF].
- When “ART Catheter Check Message” is set to [ON], alarm will generate when the transducers are opened to air.

❑When the BP Label is IAP

PDP (Peak Diastolic Pressure) of IABP can be displayed in addition to systolic, diastolic, and mean pressure. Note that Systolic Pressure (SYS) = Peak Systolic Pressure (PSP).

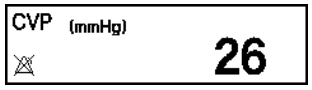


⚠ CAUTION

- Note that Systolic Pressure (SYS)=Peak Systolic Pressure (PSP) when reviewing graphic trend, data base, or when setting the alarm.
- When ECG is not measured, PDP cannot be calculated.

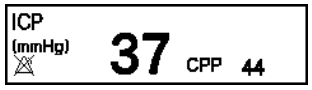
❑When the BP Label is CVP

The measurement unit can be selected from "mmHg", "kPa" or "cmH_2O".
The measurement unit can be selected on the "Initial Settings" menu. The selected unit will be displayed on the BP numeric data box.
(☞Maintenance Manual "Measurement Unit" P5-10)



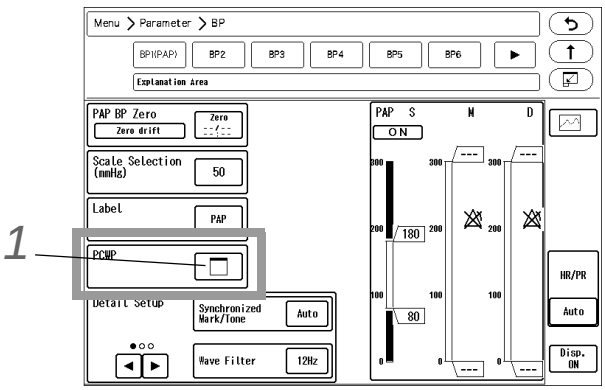
❑When the BP Label is ICP

CPP (Cerebral Perfusion Pressure) can be measured.
CPP = Mean Arterial Pressure – Mean Intracranial Pressure
If the CPP value is negative, the data will not be displayed. Also, alarm cannot be set for CPP.



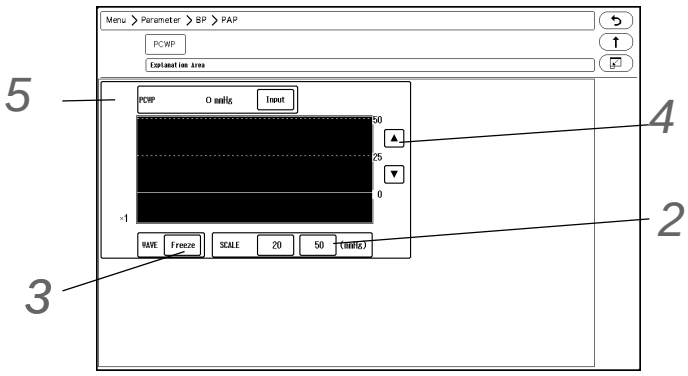
❑PAWP Measurement

When PAP is set as BP label, the mean value can be displayed as PAWP (Pulmonary Capillary Wedge Pressure).



1 Press the key for "PAWP".

▸ PAWP measurement screen will be displayed.
On the PAWP screen, the current BP waveform and RESP waveform will be displayed.



2 Select the waveform scale from [20]/[50] as necessary.

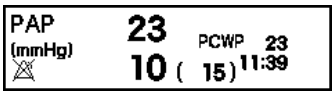
3 Touch [Freeze].

▸ The displayed waveform will freeze and cursor will be displayed. The cursor point indicates the current mean pressure.

4 [↑] Use the / [↓] keys to set the PAWP value.

5 Press the [Input] key after setting the PAWP value.

▸ The PAWP value will be displayed inside the PAP (BP label) numeric data box with the measurement time. It will be also displayed on the trend data.



❑Scale Setup

⚠ CAUTION

- When wireless network is used, BP waveform with a scale above the set scale will not be properly transmitted. The displayed BP scale should be within the set scale.

NOTE

- Select the full scale for displaying and printing.
- The scale selection will differ depending on the label as shown below.
- Change the scale before the freeze operation, as the waveform will be deleted if the scale is changed after the freeze operation.

BP Label	Scale														
	5	10	15	20	30	40	50	75	100	150	200	250	300	mmHg	
	1	2	3	4	5	6	8	12	16	20	24	32	40	kPa	
														20	40 cm H_2O
BP1 to BP8 User Label				Yes			Yes	Yes	Yes	Yes	Yes	Yes	Yes		
ART, IAP, LVP							Yes	Yes	Yes	Yes	Yes	Yes	Yes		
PAP				Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
CVP		Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ICP	Yes	Yes	Yes	Yes			Yes	Yes	Yes	Yes	Yes	Yes	Yes		

1 Press the key for "Scale Selection", and display the scale selection window.

2 Select the scale from the displayed selection.

❑Alarm Setup

1 Set the BP alarm.

(☞"Alarm Limit Setup for Each Parameter" P6-11)

NOTE

- Set the upper limit in the range of 2 mmHg to 300 mmHg / 0.2 kPa to 40.0 kPa. If a value above 300 mmHg / 40.0 kPa is set, the upper alarm will turn OFF.
- Set the lower limit in the range of 0 mmHg to 295 mmHg / 0 kPa to 39.5 kPa. If a value below 0 mmHg / 0 kPa is set, the lower alarm will turn OFF.
- Alarm will not generate until 30 seconds has passed after the zero balance or after the transducer has been opened to air.

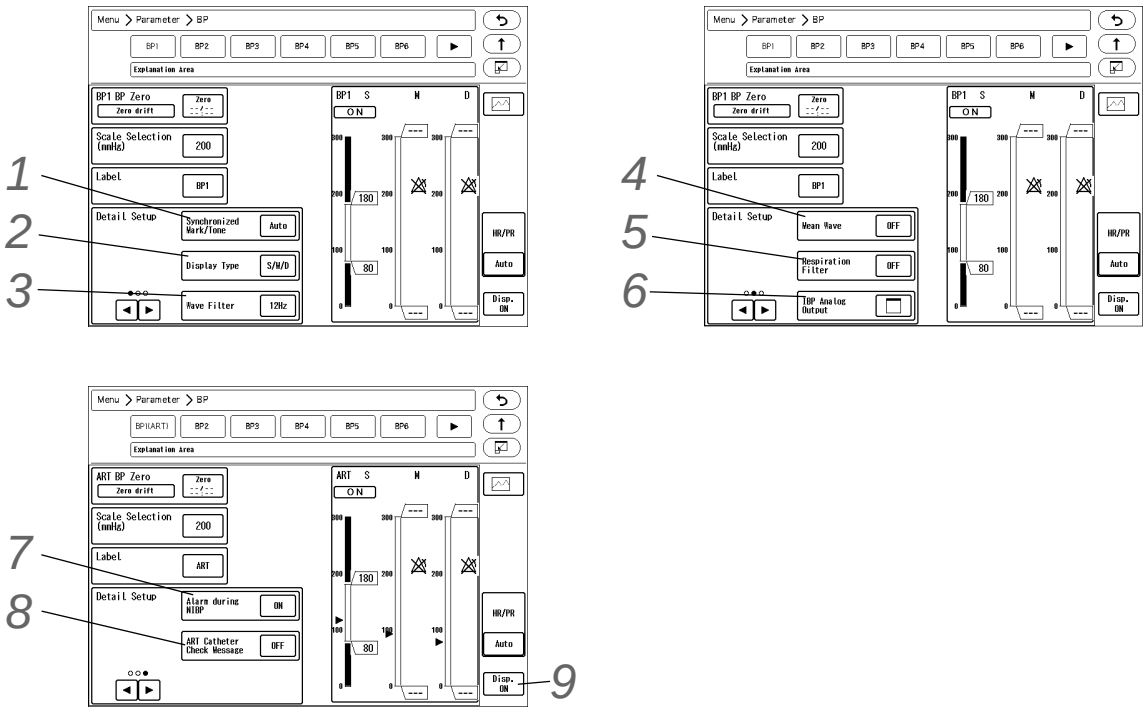
REFERENCE

- Select ON/OFF of BP alarm and set the upper and lower alarm limit for systolic (S), diastolic (D), and mean (M) BP.
- The alarm limit should be set for each unit (mmHg/kPa).
- The adjustable increment will be according to the "BP Alarm Increment" setting. (Normal/Small).
  (☞Maintenance Manual "Display/Print Setup" P5-12)
- The adjustable increment for upper and lower limit changes from 50 mmHg / 7 kPa.
- When [Auto] is set for the BP label of BP1/ART, the upper and lower limit will be automatically set to +40 mmHg / +5 kPa and -20 mmHg / -3 kPa respectively to the current value.
- When [Auto] is set for the BP label other than BP1/ART, the upper and lower limit will be automatically set to +20%, –20% respectively to the current value.
- To use the auto setting, [Enable] should be selected for "Alarm Auto Setup" under "Initial Settings". (☞Maintenance Manual "Alarm Related Setup" P5-4)
- When [Enable] is set for "Alarm Threshold Limit" under "Initial Settings", and auto setting is used, the upper and lower alarm limit will be clipped to the set limit.

	"BP Alarm Increment" Setup	
	If [Normal] is selected;	If [Small] is selected;
0 mmHg to 50 mmHg	2 mmHg increment	1 mmHg increment
50 mmHg to 300 mmHg	5 mmHg increment	
0 kPa to 7 kPa	0.2 kPa increment	0.1 kPa increment
7 kPa to 40.0 kPa	0.5 kPa increment	

❑Detail Setup (BP Parameter)

Press the [Menu], [BP] keys to display the "BP" setup screen.
The "BP" setup screen can be also displayed by pressing the detail key ( ) on the BP floating window.



1 Set the "Synchronized Mark/Tone". (BP1/ART)

The parameter to display the HR synchronized mark can be selected from ECG, SpO_2, and BP (BP1 or ART). If BP1 and ART are measured simultaneously, ART will be prioritized.

- [Auto]: The synchronized mark will be displayed in the priority of "ECG > SpO_2-1 > SpO_2-2 > BP".
- [ECG]: HR synchronized mark will be displayed.
- [SpO_2-1]/[SpO_2-2]: SpO_2 synchronized mark will be displayed.
- [BP]: BP synchronized mark will be displayed.
- [OFF]: Synchronized mark will not be displayed.

NOTE

- If the corresponding BP (BP1/ART) is not measured, PR (BP) will be displayed as "---".

2 Set the "Display Type".

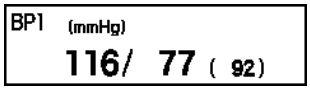
⚠ CAUTION

- The undisplayed BP data will not generate a BP alarm or be displayed in the tabular trend. Select the appropriate display type according to the monitoring purpose.

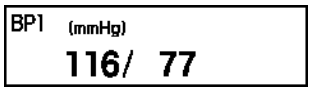
NOTE

- The display type of numeric data can be selected from [S/M/D]/[S/D]/[M]. The BP alarm will not be generated unless the data is displayed.
- If the BP label is CVP, IAP, PAP, ICP, the display type is fixed.

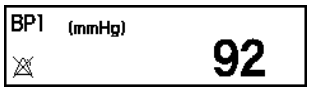
- [S/D/M]: The systolic/diastolic/mean BP value will be displayed.



- [S/D]: The systolic/diastolic BP value will be displayed.



- [M]: The mean BP value will be displayed.



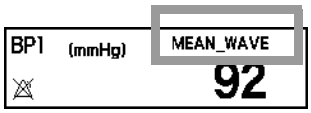
3 Select the "Wave Filter" from [6Hz]/[8Hz]/[12Hz]/[40Hz].

NOTE

- Select the appropriate filter from 6 Hz, 8 Hz, 12 Hz, 40 Hz. An artifact may interfere on the BP waveform depending on the combination of BP measurement circuit.

4 Set the "Mean Wave".

- [ON]: The mean BP waveform will be displayed and <MEAN_WAVE> will be displayed inside the numeric data box.



5 Set the "Respiration Filter".

The BP waveform baseline drift caused by the respiration influence can be prevented by setting ON the respiration filter.

- [ON]: Respiration Filter will turn ON.
- [OFF]: Respiration Filter will turn OFF.

6 Select the output signal for "IBP Analog Output".

7 Set the "Alarm during NIBP".

- [ON]: BP alarm will generate even during NIBP measurement.
- [OFF]: BP alarm will not generate during NIBP measurement and for 30 seconds after the measurement.

8 Set the "ART Catheter Check Message"..

- [ON]: When the BP label is "ART" and the catheter is disconnected, check message will be displayed.
- [OFF]: ART catheter check message will not be displayed.

⚠ CAUTION

- The setting is common for all BP channels. When setting is changed for BP1, the same setting will be applied for BP2 to 8.
- The default setting of "ART Catheter Check Message" is [OFF].
- When "ART Catheter Check Message" is set to [ON], alarm will generate when the transducers are opened to air.

9 Select ON/OFF for parameter display.

(☞"ECG Parameter Setup" P7-6)

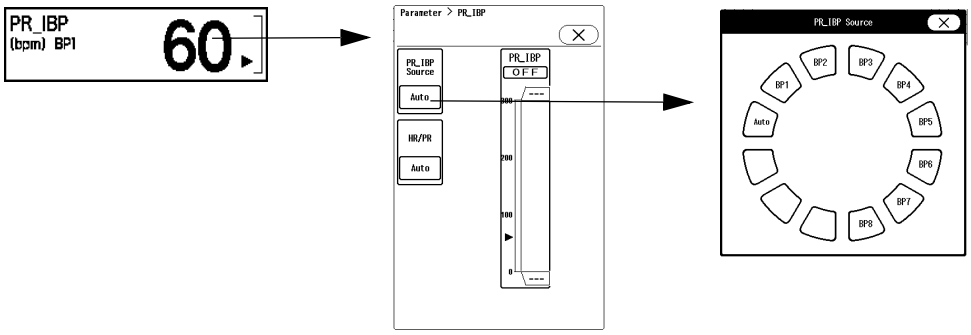
⚠ CAUTION

- When the waveform and numeric data display is set to OFF, the alarm generation and tabular/graphic trend input will also cease.
- If the display of waveform/numeric data labeled as BP1/ART is set to OFF, the BP pulse

rate will not be displayed.

❑BP Source Selection for PR_IBP

Select the BP source for the pulse rate measurement.
The PR_IBP source can be set by displaying the PR_IBP floating window, and pressing the key for "PR_IBP Source".



Selecting [Auto] will measure the pulse rate from ART or BP1.

Non-Invasive Blood Pressure

The procedure of NIBP measurement and measurement condition setup are explained.

⚠ CAUTION

- For the following situation, measurements will be terminated.
  - When the measurement time has exceeded 160 seconds for adult and child, 80 seconds for neonate.
  - When the inflation value has exceeded 300 mmHg for adult, 210 mmHg for child, and 150 mmHg for neonate.
- If used with the incorrect patient classification, it will not only cause erroneous measurement, but the inflating level for the adult may be applied to child or neonate causing dangerous situation to the patient.
- The following factors may affect the NIBP value.
  - Body motion, arrhythmia, convulsion, low pulse pressure, slow pulse
  - Continuous noise such as cardiac massage
  - Noise from the electrosurgical instrument

Lineup of Cuffs

REFERENCE

- According to the AHA (American Heart Association) guideline, the appropriate cuff width is 40% of the arm circumference.
  Select the appropriate cuff from the following selections.
  For other usable cuffs, refer to ☞"Invasive Blood Pressure Measurement (Manufactured by Fukuda Denshi)" P13-2

NIBP Monitoring

WARNING

- Before the NIBP measurement, make sure the patient classification ([Adult]/[Child]/[Neonate]) is properly selected on the "Admit/Discharge" menu. Otherwise, correct measurement cannot be performed, and congestion or other injury may result.

CAUTION

- Correct NIBP measurement cannot be performed if oxygenator is used or if the pulse is difficult to detect.
- Pay attention when measuring the NIBP of patient with bleeding disorders or hypercoagulation. The cuff inflation constricting the arm may cause petechia or circulatory failure with blood clot.
- Do not apply the cuff to the arm or thigh where vein is secured. The blood may backflow causing the chemical injection to cease.
- Properly arrange the cuff and air hose.
- Check the condition of cuff-applied part on the patient during measurement so that the blood circulation will not be blocked over long period of time by the squashed or bent cuff hose.
- Check the patient's condition constantly while measuring over a long period of time with interval of 2.5 minutes or less. Also, periodically check the blood circulation while performing periodic measurement over a long period of time. Congestion or rash may occur at the measuring site.
- Make sure to check the patient's condition constantly when repeatedly using continuous measurement as it may cause dysfunction of patient's circulation.
- When the cuff is not applied to the patient, pay attention not to leave the cuff unattended. If periodic or continuous measurement is set, the cuff will automatically inflate and may cause the rubber bag inside the cuff to burst. When not performing the NIBP measurement, set the NIBP measurement interval OFF and disconnect the air hose from the NIBP connector.
- The following factors may affect the NIBP value.
  - Body motion, arrhythmia, convulsion, low perfusion
  - Continuous noise such as cardiac massage
  - Periodic electromagnetic noise
- If the cuff inflation may adversely affect the patient's blood flow or wound, attach the cuff to an appropriate position under physician's instruction.
- Do not apply the NIBP cuff to the arm of the mastectomized side. It may cause swelling or other circulatory failure.
- Do not perform NIBP measurement to patient who is pregnant including preeclampsia. Accurate measurement may not be possible.
- Before measurement, make sure the following conditions are not applied to the patient. Otherwise accurate measurement may not be possible.
  - Peripheral circulatory insufficiency, very low BP, or hypothermia (poor blood flow of the measurement part)
  - An aneurysm is developed.
  - Body motion such as convulsion, venous pulse, or trembling
- Do not apply the cuff in the following areas.
  - The part receiving IV drips or blood transfusions.
    The blood may backflow affecting the treatment.

- The part attaching the SpO_2 sensor or IBP catheter.
  It may affect the measurement value.
- The part where a shunt is created for the hemodialysis therapy.
  The shunt may be damaged and affect the patient's condition.

- Pay special attention to neonates and children as they are not able to express their intention. Otherwise this may result in an accident or trouble.

NOTE

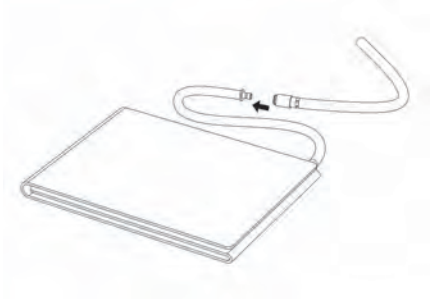
- When the [NIBP Start/Stop] key is pressed or when the NIBP measurement interval is changed, the standby mode will be canceled and the NIBP periodic measurement will start.

1 Select the appropriate cuff type for the patient.
(☞"Non-Invasive Blood Pressure Measurement (Manufactured by Fukuda Denshi)" P13-3)

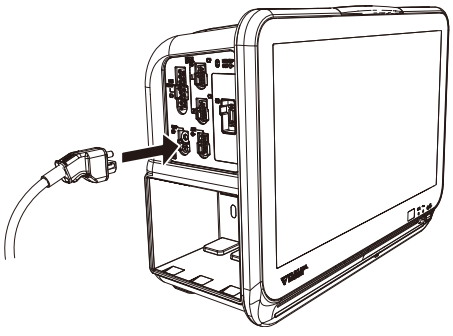
⚠ CAUTION

- Select the appropriate cuff size which best fits the arm circumference.
  If the cuff size is inappropriate, it may cause measurement error.
- When larger cuff is used for the patient, the BP value will be indicated lower than actual value. When smaller cuff is used form the patient, the BP value will be indicated higher than actual value.
- Do not use a cuff which is worn out or damaged on the exterior.
  The cuff may burst during inflation.
- When using to multiple patients or the patient who has infectious diseases, follow the specified procedure of the medical facility. Otherwise infectious diseases may be caused.
- Only use cuffs and air hoses specified by Fukuda Denshi to connect to the equipment. Othrewise it may result in malfunction or failure.

2 Connect the cuff to the air hose.



3 Connect the air hose to the NIBP connector.



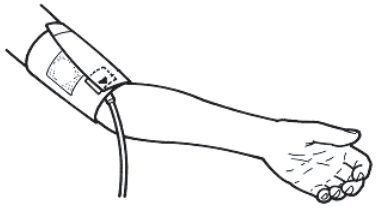
⚠ CAUTION

- Make sure that the cuff and air hose connection is secure.
  If there is any air leakage, correct NIBP measurement cannot be performed.

NOTE

- The neonate cuff should be connected to air hose for neonate. Other cuffs should be connected to air hose for general use. DS-1200 automatically determines the patient classification (neonate or adult/child) according to the connected air hose. If the air hose is not connected to the cuff connector, the measurement will not start.

4 Apply cuff to the patient.

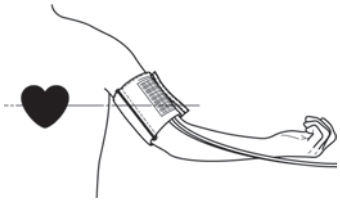


NOTE

- Position the ARTERY ▼ mark over the artery on the patient's arm and wrap the cuff around.
- One or two fingers should just fit in between the cuff and arm.

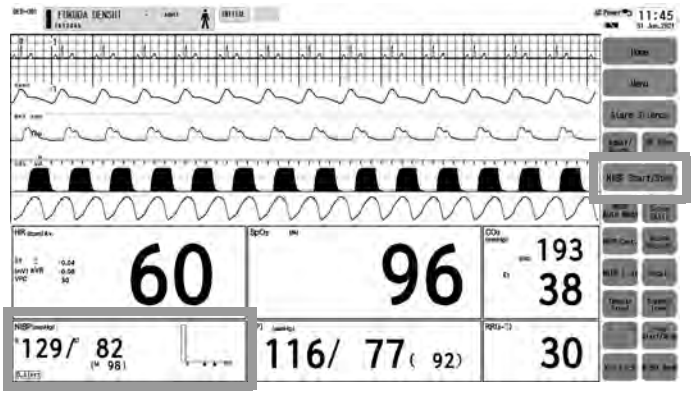
REFERENCE

- Align the cuff height and heart position to eliminate an error caused by the blood weight. It is most appropriate to measure with the patient lying down or comfortably seated, and arms naturally extended.



- Let the patient rest for 5 minutes or more before taking measurements.
- Before/During measurement, make sure the following conditions are not applied to the patient. Accurate measurement may not be possible
  - The attachment position of the cuff is higher or lower than the patient's heart. (If the cuff is applied on the location that is 10 cm higher or lower than the heart location, the BP value may change maximum 7 to 8 mmHg.)
  - Talking during the measurement.
  - The cuff is applied on the thick clothes.
  - The measurement part is compressed due to rolling up the clothes.
  - Legs Uncrossed.
  - Feet flat on the floor (When the patient is seated.)

5 Press the [NIBP Start/Stop] key (user key).



- Cuff inflation and measurement will start.
- Upon completion, the measured value will be displayed inside the NIBP numeric data box.

REFERENCE

- About the Oscillometric Method
- Arterial pulsations by heart contraction will be captured as the cuff pressure and the BP will be measured.
  When pressurize the cuff wrapped around the upper arm, the blood circulation will be restricted but oscillate by capturing the arterial pulsations. When gradually decreasing the cuff pressure, the oscillation of the cuff pressure will be getting larger to achieve a peak, and when further decreasing the cuff pressure, the oscillation will be getting smaller. The BP value will be determined by saving/ calculating the cuff pressure and oscillation increase/ decrease of the cuff pressure obtained during this process. The cuff pressure at the point where the oscillation sharply increases is generally referred to as the systolic blood pressure, and the cuff pressure at the point where the oscillation sharply decreases is referred to as the diastolic blood pressure. The cuff pressure at the point where the oscillation is peak is referred to as the mean arterial pressure.
  On the pressor measurement method, the BP value will be determined with the same method but the BP value will be determined by using the oscillation of the cuff pressure obtained during the cuff pressure process.
  Unlike determining the BP value instantaneously by the auscultatory method or microphone type automated sphygmomanometer, the oscillometric method measures the blood pressure by detecting the pulse oscillation change by the cuff pressure as mentioned above, so that noise is less likely interfered.
- The systolic, diastolic, mean blood pressure will be displayed on the monitor. The measurement will start with the following factor.
  - When the [NIBP Start/Stop] key (user key) is pressed.
  - At the selected measurement interval.
  - For fixed amount of time after the NIBP Cont. key (user key) is pressed. (Max. 15 min.)
  - If "NIBP Measurement at Alarm Occurrence" is set ON, and the set parameter generates an alarm.
  - When the change in patient's circulation condition is detected from the time difference of ECG and SpO_2 waveform.

Inflation Mode Setup

The maximum inflation value and measurement duration needs to be changed according to the patient classification. The inflation mode will automatically change according to the patient classification setting. Set the appropriate patient classification on "Admit/Discharge" menu or "Detail Setup" menu under NIBP parameter setup.

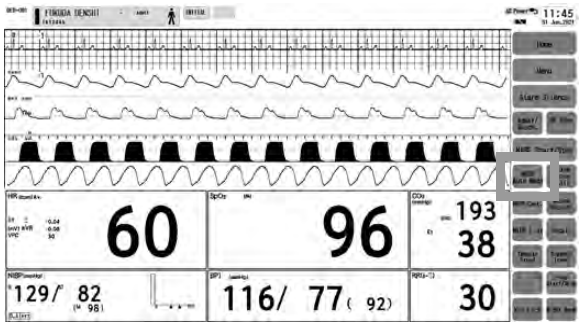
The NIBP measurement on this device is provided with forced exhaust system for safety purpose. When the maximum inflation value is reached or when the fixed measurement duration is exceeded, the system will automatically start to exhaust. The maximum inflation value, maximum measurement duration, initial inflation value, measurement range, and alarm limit range for this exhaust system is set according to the patient classification setting.

Patient Classification	Target Inflation Value	Maximum Inflation Value	Maximum Measurement Duration
Adult	100 mmHg to 290 mmHg (Default: 180 mmHg)	300 mmHg	160 sec.
Child	100 mmHg to 200 mmHg (Default: 140 mmHg)	210 mmHg	160 sec.
Neonate	100 mmHg to 140 mmHg (Default: 100 mmHg)	150 mmHg	80 sec.

NIBP Auto Mode Setup

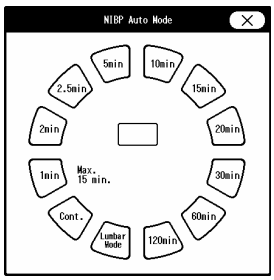
Non-invasive blood pressure can be measured automatically at selected time intervals.

If continuous measurement is started during the NIBP auto mode, the auto mode will automatically resume when the continuous measurement completes.



1 Press the [NIBP Auto Mode] key on the home display.

▸ The "NIBP Auto Mode" window will be displayed.



2 Select the measurement interval from the displayed selection.

⚠ CAUTION

- When [1min] is selected, the 1-minute interval measurement will start from the time the selection is made.

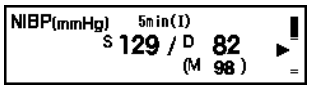
- The 1-minute interval measurement will automatically stop after 12 minutes (maximum of 15 minutes when re-measured), and 2.5-minutes interval measurement will start.
- The continuous mode will continuously measure for 12 minutes (maximum of 15 minutes when re-measured). When the measurement completes, 2.5 minute interval measurement will start.
- When "Auto Mode with Start/Stop Key" is set to [ON], the auto mode measurement needs to be started manually.
- When using the continuous mode or Lumbar mode for measurement, make sure that the setting is according to the intended purpose.
  (☞"About the Lumbar Mode" P7-40)
- The Lumbar mode is recommended for use during spinal anesthesia. It should be used with sufficient safety measures.

NOTE

- 1-minute interval measurement cannot be stopped by pressing the [NIBP Start/Stop] key (user key). To stop the 1-minute interval measurement, select [OFF] or other interval on "NIBP Auto Mode" window.
- When the NIBP auto mode interval is [Cont.]/[1min]/[2min]/[2.5min]/[5min]/[Lumbar Mode], NIBP measurement cannot be started from the central monitor.
- When the [NIBP Start/Stop] key is pressed or when the NIBP measurement interval is changed, the standby mode will be canceled and the NIBP periodic measurement will start.

▸ The measurement will automatically start at selected interval.

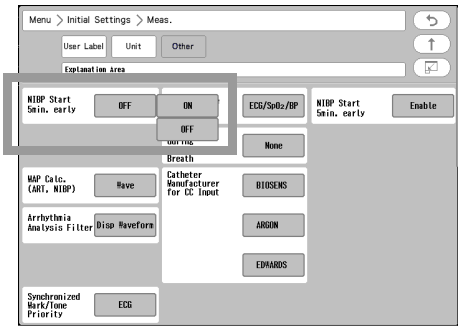
▸ The selected interval will be displayed inside the numeric data box.



REFERENCE

- Select [OFF] if not performing the auto mode measurement.
- The measurement starting point can be selected from [Time] (start from 0 min.) or [Meas.] (start from actual measured time).
  (☞"NIBP Parameter Setup" P7-44)

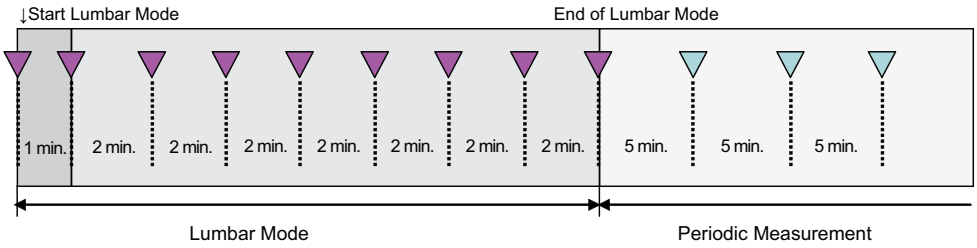
♦When [60min]/[120min] is selected for the measurement interval when "NIBP Start 5 min. early" is set to [ON], the measurement will start 5 minutes before the set time. If outputting the data to PC or other external device using the PC communication function of this system, an error may be generated to the NIBP measurement time depending on the input interval of the external device. This system outputs the data at completion of NIBP measurement, and if the external device inputs the data at 60 minutes interval, 60 minutes time lag will occur. By starting the measurement 5 minutes early, this time lag between the external device can be minimized.
[Menu > Initial Settings > Meas. > Other]



- On the "Initial Settings", whether or not to backup the NIBP measurement interval at discharge/power ON can be selected. (OFF/Backup/OFF→2.5min./OFF→5min.)

❑About the Lumbar Mode

The Lumbar mode is intended for use during spinal anesthesia.
The Lumbar mode performs the measurement as follows.



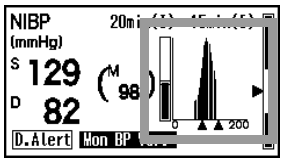
If [Lumbar] is selected when the measurement is not performed, the first measurement will start.
If [Lumbar] is selected during the measurement, the current measurement will be counted as the first measurement. The second measurement will start after 1 minute, and after 7 times of 2-minute interval measurement, the Lumbar mode will end. The Lumbar mode can be manually stopped by selecting other interval or selecting [Lumbar] again.
When the Lumbar mode ends, 5-minute interval measurement will automatically start.

⚠ CAUTION

- Pressing the [NIBP Start/Stop] key during measurement will only stop the measurement and not the Lumbar mode. To stop the Lumbar mode, select other interval or select [Lumbar] again.
- The manual measurement can be performed in between the Lumbar mode measurement. The Lumbar mode measurement will not start if the manual measurement is still in progress when the next Lumbar mode measurement time arrives.

Oscillation Graph Display

When the NIBP numeric data box size is 2-box size or larger, and "Oscillograph" is set to ON on the "NIBP" setup screen, the oscillation graph will be displayed inside the NIBP numeric data box. (☞"NIBP Parameter Setup" P7-44)



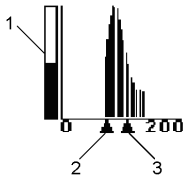
The description of the oscillation graph is as follows.

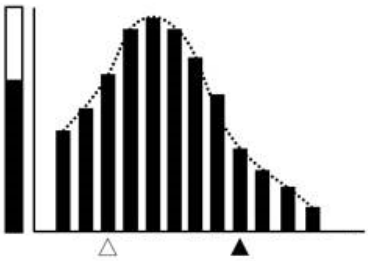
The horizontal axis shows the cuff pressure, and vertical axis shows the pulse amplitude with reference to maximum pulse amplitude.
The bar graph shown at left indicates the size of maximum pulse amplitude compared with the reference value. For example, if the maximum pulse amplitude is 1/2 of the reference value, the bar graph will be half Fill in.

1 Bar Graph

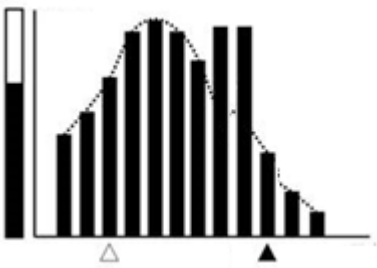
2 DIA Value

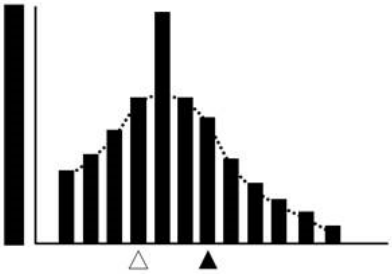
3 SYS Value





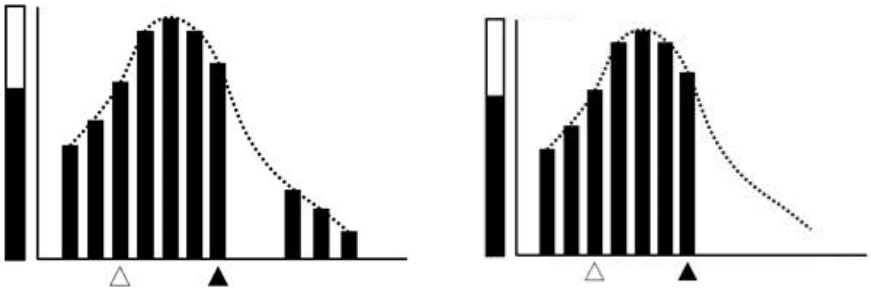
- Oscillation Graph (When NIBP measurement is unreliable.)
  When NIBP measurement is unreliable, the measurement value will not be displayed correctly.
  When noise interferes in the measurement





When noise interferes, the amplitude will be measured higher than actual value and the measurement value may not be displayed correctly.

When pulse is not detected.



When pulse is not detected, amplitude may not detected and the measurement value may not be displayed correctly.

Dyna Alert Function Status

The Dyna Alert function is a technology to prevent accidents which may occur by sudden BP change during the non-measured duration by estimating the variation of circulatory dynamics.

This function is available for the DS-1200N with the Medtronic SpO_2 module.

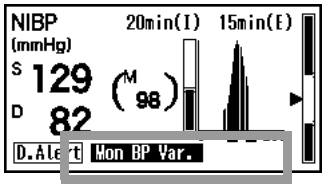
When [ON] is selected for "Dyna Alert", NIBP measurement will automatically start when the Dyna Alert estimated value exceeds the alarm limit. The function will activate with the following condition.
(☞"Dyna Alert" P7-47)

- Patient Classification: Adult (20 kg or above)
- Cuff Applied Site: Upper Arm
- SpO_2 Sensor Attachment Site: Fingertip
- NIBP Measurement Interval: 5 minutes to 60 minutes

⚠ CAUTION

- When the SpO_2 sensor is applied to the toe or forehead, the circulatory dynamics variation monitoring by the Dyna Alert may not properly function.
- The circulatory dynamics variation monitoring by the Dyna Alert is effective only on the DS-1200N with the Medtronic SpO_2 module.

In the NIBP numeric data box, the following mark and message indicating the status of the Dyna Alert function will be displayed.



D.Alert Color of Mark	Message	Status	Dyna Alert Function Status*1
Gray	DA Setup: OFF	Dyna Alert (DA) is set to OFF.	Disable
	Patient: Child	NIBP measurement is performed on child.	Disable
	Patient: Neonate	NIBP measurement is performed on neonate.	Disable
	Pacemaker: ON	Pacemaker setting is set to ON.	Disable
	Interv.: <5min.	NIBP interval is set to Cont., 1min, 2min, or 2.5min.	Suspended
	Interv.: >60min.	NIBP interval is set to 120min.	Suspended
	Interv.: OFF	NIBP interval is set to OFF.	Suspended
	Measuring BP*2	Invasive blood pressure is measured.	Suspended
Yellow	Measure NIBP	Initialization of Dyna Alert is complete, and the NIBP measurement has not been performed since the power is turned ON.	Suspended
	Poor ECG Signal	ECG signal failure due to lead-off, noise, etc.	Disable
	Poor PTG Signal	PTG (Photoplethysmograph) signal failure due to sensor off, noise, severe low perfusion, etc.	Disable
	DA-NIBP Suspended	Within 2.5 minutes from previous Dyna Alert NIBP measurement.	Suspended
	Measuring NIBP	NIBP measurement other than Dyna Alert is in progress.	Disable
	Initializing	Waiting for stable signal after starting Dyna Alert.	Disable
Green	PTG Low Perfusion	PTG amplitude is 200 unit or above, and below 800 unit.	Enable
	Mon. BP Var.	Dyna Alert is properly monitoring circulatory dynamics variation.	Enable
Pink	Measuring DA-NIBP	Dyna Alert NIBP measurement is in progress.	Disable

*1: Disable: Circulatory dynamics variation is not monitored.

Suspended: Circulatory dynamics variation is monitored. But the display suspends the measurement when NIBP measurement is requested. When the suspending factor is resolved, the measurement will resume as quickly as possible.

Enable: Circulatory dynamics variation is monitored. The display control software responds to NIBP measurement request as quickly as possible.

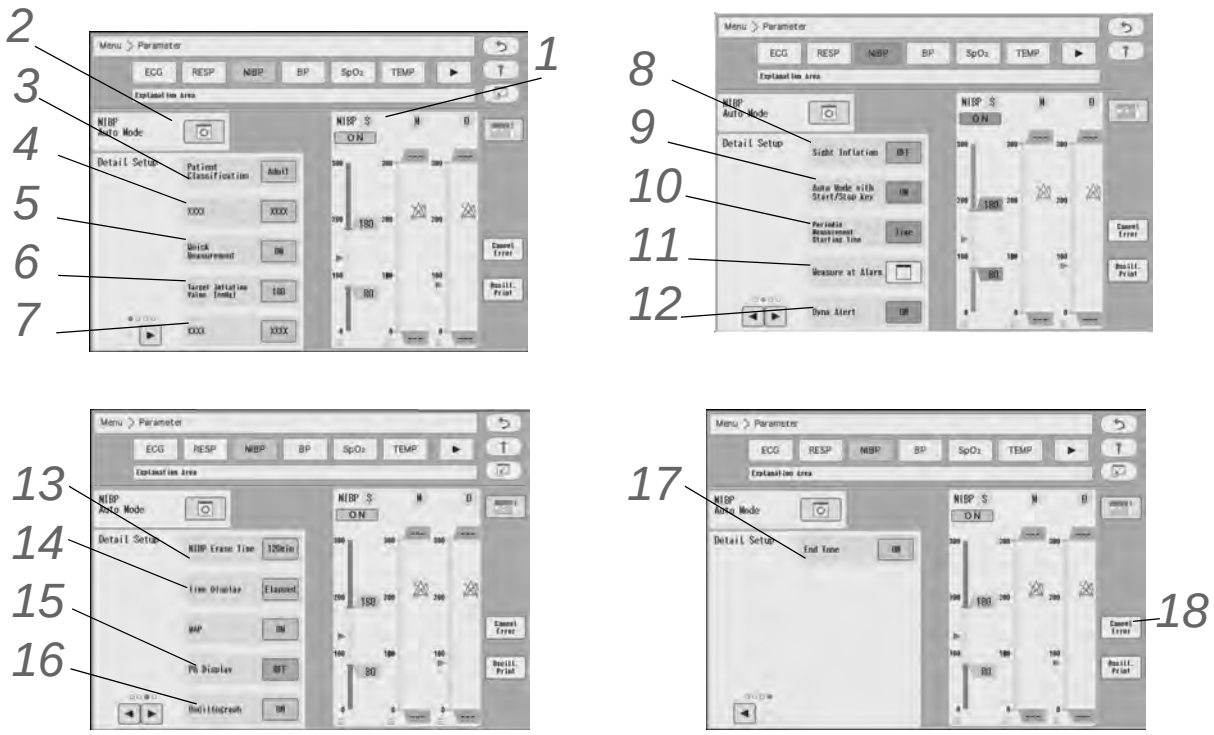
*2: "Measuring BP" indicates the status when IBP (BP1 or ART) measurement is possible and can be displayed on the monitor.

⚠ CAUTION

- When using the Dyna Alert function, be aware of these risks and do not increase the NIBP interval time by relying only on the Dyna Alert function.
- After the Dyna Alert NIBP measurement, the next Dyna Alert NIBP measurement cannot be performed for 2.5 minutes.
- The Dyna Alert will not properly function for the following cases.
  - If peripheral circulatory insufficiency or very low BP is developed.
  - If highly-frequent arrhythmia is generated.
  - If an oxygenator is used.
  - If a large noise from body movement or electric surgery device is interfering.
  - If autonomic nerve or circulatory dynamics is largely affected by medication.

NIBP Parameter Setup

Press the [Menu], [NIBP] keys to display the "NIBP" setup screen.



1 NIBP Alarm

(☞"Alarm Limit Setup for Each Parameter" P6-11)

NOTE

- Set the upper limit in the range numeric of 15 to 300 mmHg/2.0 to 40.0 kPa. Setting a value above 300 mmHg/40.0k Pa will turn OFF the alarm.
- Set the lower limit in the range of 10 to 295 mmHg/1.5 to 39.5 kPa. The alarm will turn OFF if a value below 10 mmHg/1.5k Pa is set.

REFERENCE

- Set ON/OFF of NIBP alarm, upper and lower alarm limits of systolic (S), diastolic (D), mean (M) NIBP.
- When [Auto] is set, the upper and lower limit will be automatically set to +40 mmHg / +5 kPa and -20 mmHg / -3 kPa respectively to the current value.
- To use the auto setting, [Enable] should be selected for "Alarm Auto Setup" under "Initial Settings". (☞Maintenance Manual "Alarm Related Setup" P5-4)
- When [Enable] is set for "Alarm Threshold Limit" under "Initial Settings", and auto setting is used, the upper and lower alarm limit will be clipped to the set limit.
- The alarm limit should be set for each unit (mmHg/kPa).
- The upper/lower limit can be set in 5 mmHg / 0.5 kPa increment.

2 NIBP Auto Mode

NIBP measurement will be performed automatically at selected time intervals.

3 Patient Classification

The patient classification setting is linked with that on the "Admit/Discharge" screen. The inflation value and measurement duration will differ according to the patient classification setting.

(☞"Inflation Mode Setup" P7-38)

WARNING

- The patient classification selection influences the precision of the QRS detection and NIBP measurement. Make sure the correct selection is made.
- The NIBP air hose corresponded to the set patient classification must be used to perform NIBP measurement. However, if the patient classification is child, NIBP air hose for adult can be used.

4 Measurement Mode

Select [Deflation] or [Inflation].

- [Deflation]: The BP value will be determined during the depressurization.
- [Inflation]: The BP value will be determined during the pressurization.

NOTE

- When "Neonate" is selected for the patient classification, [Inflation] will be invalid and the measurement will be performed with [Deflation] setting.

5 Quick Measurement

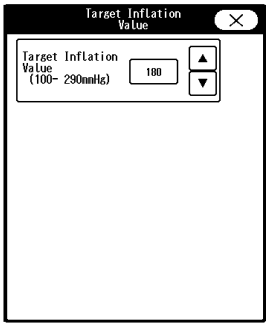
[ON]: NIBP measurement will be performed in duration of about 20 seconds to 25 seconds in case of adult patient.

NOTE

- The quick measurement setting will be effective only when the patient classification is adult or child. If the patient classification is neonate, standard NIBP measurement will be performed regardless of the quick measurement setting.
- When [Inflation] is selected for the Measurement Mode, the Quick Measurement setting will become invalid.

6 Target Inflation Value

The window to set the target inflation value will be displayed.
Set the target inflation value using the up/down keys. The indication of target inflation value is SYS + 40 mmHg for adult/child, SYS + 30 mmHg for neonate.



Patient Classification	Target Inflation Value	Maximum Inflation Value	Maximum Measurement Duration
Adult	100 mmHg to 290 mmHg (Default: 180 mmHg)	300mmHg	160 sec.

Child	100 mmHg to 200 mmHg (Default: 140 mmHg)	210mmHg	160 sec.
Neonate	100 mmHg to 140 mmHg (Default: 100 mmHg)	150mmHg	80 sec.

For the following case, the target inflation value will be automatically set to the default value of each patient classification.

- At Discharge
- When the patient classification is changed

⚠ CAUTION

- When the "Sight Inflation" is [OFF], the target inflation value after the first periodic measurement will be automatically set based on the previous measurement value.
- When the "Sight Inflation" is [ON], the target inflation value after the first periodic measurement will be set based on the sight inflation function. (☞"Sight Inflation" P7-46)

7 Pump Operation Mode

Select [Normal] or [Silent]. [Silent] will inflate with decreased speed to reduce the pump inflating sound.

NOTE

- When [Inflation] is selected for the measurement mode, [Silent] will not operate.

8 Sight Inflation

[ON]: Sight inflation function will turn ON.
The inflation target level will be automatically estimated during the inflation, and starts to deflate after the target level is reached.
If [ON] is selected for "Sight Inflation", the target inflation value will be increased in case such as sudden increase of blood pressure to prevent the re-inflation.

[OFF]: Sight inflation function will turn OFF.
It will inflate to the target level set according to the previous measurement result.

NOTE

- The sight inflation function can be used only during the NIBP auto mode measurement.
- The sight inflation function cannot be used when [Inflation] is selected for the measurement mode.
- The sight inflation function cannot be used when the patient classification is "Neonate".
- The sight inflation function cannot be used when performing the 1-minute interval measurement or continuous measurement.
- When performing manual measurement/measurement at alarm occurrence, it will inflate to the set target inflation value regardless of the sight inflation setting.

9 Auto Mode with Start/Stop Key

NIBP measurement will be performed automatically at selected time intervals.

- [OFF]: When the power is turned ON, NIBP auto mode will resume even after the patient is discharged regardless of whether the next patient is admitted or not.
- [ON]: When the power is turned ON, NIBP auto mode will resume by starting a manual measurement for the newly admitted patient. Until the NIBP auto mode is resumed or the interval is changed, "Standby" will be displayed inside the NIBP numeric data box.

NOTE

- If the power OFF duration was within 30 seconds, the NIBP auto mode will resume at power ON even when the above setting is [ON].
- When the [NIBP Start/Stop] key is pressed or when the NIBP measurement interval is changed, the standby mode will be canceled and the NIBP periodic measurement will start.

10 Periodic Measurement Starting Time

The starting time of periodic measurement can be set.

- [Time]: The periodic measurement will start from the integral multiple of the selected interval starting from 0min.
- [Meas.]: The periodic measurement will start from the actual starting time.

	Measurement time when [Time] is selected:	Measurement time when [Meas.] is selected:
When the interval is [15min.] and the measurement is started on 15:11:15	15:11:15 15:15:00 15:30:00 15:45:00	15:11:15 15:26:15 15:41:15 15:56:15
When the interval is changed to [30min.] on 15:58	16:00:00 16:30:00 17:00:00	16:26:15 16:56:15 17:26:15

11 Measure at Alarm

NIBP measurement will start at alarm generation.

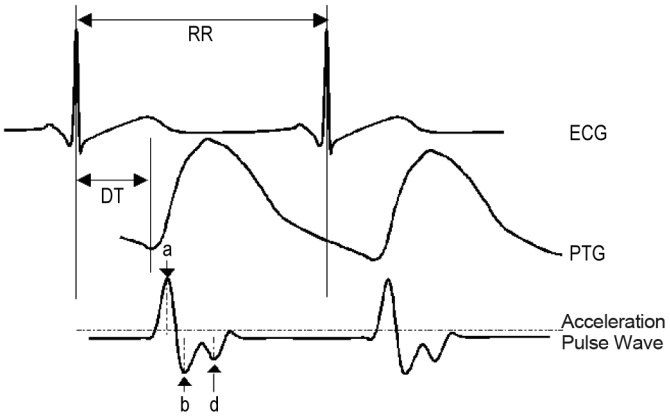
Select [ON] for "NIBP Measurement at Alarm Occurrence", and select the alarm factor to start the NIBP measurement. Multiple parameters can be selected.

⚠ CAUTION

- If the NIBP measurement has not been performed since the power was turned ON, NIBP measurement at alarm occurrence will not be performed.

12 Dyna Alert

[ON]: Dyna Alert function will turn ON when DS-1200N is used.



Parameters used for Dyna Alert Function

⚠ CAUTION

- When the PTG (SpO_2) sensor is applied to the toe or forehead, the circulatory dynamics variation monitoring by the Dyna Alert may not properly function.

- The circulatory dynamics variation monitoring by the Dyna Alert is effective only on the DS-1200N with the Nellcor SpO_2 module.

REFERENCE

- About the Dyna Alert: Using a cuff allows to measure the blood pressure noninvasively, but on the other hand, there is a demerit of not being able to perform the measurement continuously. Therefore, there is always a risk of sudden blood pressure change in between the periodic measurements.

13 NIBP Erase Time

NIBP data will be erased after the set duration (5min/10min/30min/60min/120min).

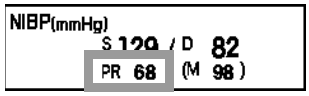
14 Time Display

The time for the NIBP measurement will be displayed.

- [Elapsed]: The elapsed time from the previous NIBP measurement will be displayed.
- [Meas.]: The NIBP measured time will be displayed.

15 PR Display

[ON]: PR will be displayed.



NOTE

- PR will be displayed only. It will not generate an alarm, or be displayed for the tabular trend.

16 Oscillograph

[ON]: Oscillation graph will be displayed inside the numeric data box.
[Oscill. Print] key will be also displayed.

[Oscill. Print]: Oscillation graph will be output on the Recorder Unit.

[OFF]: Oscillation graph will not be displayed.

[Real Time]: Oscillation graph will be updated during the measurement.

NOTE

- The oscillation graph can be displayed when the NIBP numeric data box size is 2-box size or larger, and "Oscillograph" is set to [ON] on the "NIBP" setup screen.

17 End Tone

[ON]: A buzzer tone will be generated when the NIBP measurement completes.

18 Cancel Error

By pressing [Cancel Error] , the measurement error can be canceled.

NOTE

- Make sure that the NIBP measurement can be properly performed after solving the cause of the NIBP system error message. If the message still remains, device failure can be considered.

(☞"Non-Invasive Blood Pressure" P11-35)

Pulse Oximetry

This section explains the procedures and settings of SpO_2 measurement.
When using the HG-810/HG-820, it is necessary to set the SpO_2 channel manually.
(☞Maintenance Manual "Unit Module Setup" P4-16)

SpO_2 Monitoring

⚠ WARNING

- When measuring the SpO_2 of patient with high fever or peripheral circulatory insufficiency, check the sensor attachment periodically and change the attachment site.The temperature of the attachment site will rise due to the sensor heat which may result in burn injury.
- For the following case, accurate measurement may not be possible.
  - Patient with excessive abnormal hemoglobin (COHb, MetHb)
  - Patient with the pigment injected to the blood
  - Patient receiving CPR treatment
  - When a sensor is applied to a limb with NIBP cuff, arterial catheter, or intracatheter
  - When measuring at site with venous pulse
  - Patient with body motion
  - Patient with small pulse
- When a patient is receiving a photodynamic therapy, measuring SpO_2 on a same site for a long duration may cause blisters from the irradiation light of the SpO_2 sensor. Make sure to periodically change the sensor attachment site.
- Do not connect unspecified sensor or cable to any I/O connector. If done so by mistake, not only that the device cannot deliver its maximum performance, the device may be damaged and safety cannot be ensured.
- If any measurement seems questionable, first check the patient's vital signs by alternate means and then check the pulse co-oximeter for proper functioning.
- For the following case, accurate measurement of SpO_2 may not be possible.
  - Improper sensor application
  - Elevated levels of COHb or MetHb: High levels of COHb or MetHb may occur with a seemingly normal SpO_2. When elevated levels of COHb or MetHb are suspected, laboratory analysis (CO-Oximetry) of a blood sample should be performed.
  - Elevated levels of bilirubin
  - Elevated levels of dyshemoglobin
  - Vasospastic disease, such as Raynaud's, and peripheral vascular disease
  - Hemoglobinopathies and synthesis disorders such as thalassemias, Hb s, Hb c, sickle cell, etc.
  - Hypocapnic or hypercapnic conditions
  - Severe anemia
  - Very low arterial perfusion
  - Extreme motion artifact
  - Abnormal venous pulsation or venous constriction

- Severe vasoconstriction or hypothermia
- Arterial catheters and intra-aortic balloon
- Intravascular dyes, such as indocyanine green or methylene blue
- Externally applied coloring and texture, such as nail polish, acrylic nails, glitter, etc.
- Birthmark(s), tattoos, skin discolorations, moisture on skin, deformed or abnormal fingers. etc.

- Dyes or any substance containing dyes that change usual blood pigmentation may cause erroneous readings.
- The SpO_2 data should not be used as the sole basis for diagnosis or therapy decisions. It must be used in conjunction with clinical signs and symptoms.
- Do not use the SpO_2 data to monitor apnea condition.
- This device may be used during defibrillation, but this may affect the accuracy or availability of the SpO_2 parameters and measurements.
- This device may be used during electrocautery, but this may affect the accuracy or availability of the SpO_2 parameters and measurements.
- The SpO_2 data cannot be used for arrhythmia analysis.
- SpO_2, SpCO, SpMet, and SpHb are empirically calibrated in healthy adult volunteers with normal levels of carboxyhemoglobin (COHb) and methemoglobin (MetHb).

⚠ CAUTION

- If irritation such as skin reddening appears with the sensor use, change the attachment site or stop using the sensor.
- When attaching the sensor with tape, do not wrap the tape too tight. At the same time, check the blood flow constantly so that congestion is not generated at the peripheral site.
- Even attachment for a short duration may inhibit the blood flow and generate compression necrosis or burn injury. Also, blood flow inhibition may prevent correct measurements.
- If SpO_2 values indicate hypoxemia, a laboratory blood sample should be taken to confirm the patient's condition.
- If the <SpO_2 Low Perfusion> message is frequently displayed, find a better perfused monitoring site. In the interim, assess the patient and, if indicated, verify oxygenation status through other means.
- Change the application site or replace the sensor and/or patient cable when a <Replace Sensor>, <Replace Cable>, <Low Signal IQ> is displayed on the monitor. These messages may indicate that patient monitoring time is exhausted on the patient cable or sensor.
- Replace the cable or sensor when a <Replace Sensor> or <Low Signal IQ> message is consistently displayed while monitoring consecutive patients after completing troubleshooting steps listed in this manual.
- If using pulse oximetry during full body irradiation, keep the sensor out of the radiation field. If the sensor is exposed to the radiation, the reading might be inaccurate or the device might read zero for the duration of the active irradiation period.
- The device must be configured to match your local power line frequency to allow for the cancelation of noise introduced by fluorescent lights and other sources.
- Variation in hemoglobin measurements may be profound and may be affected by sampling technique as well as the patient's physiological conditions. Any results exhibiting inconsistency with the patient's clinical status should be repeated and/or supplemented with additional test data. Blood samples should be analyzed by laboratory devices prior to clinical decision making to completely understand the patient's condition.
- Check the sensor attachment site constantly in every 4 hours when probes or reusable sensor are used, and at least every 8 hours when single patient use sensors are used.Be

especially careful of a patient with bad perfusion. If the sensor attachment position is not changed constantly, skin irritation or skin necrosis due to compression may be developed. For the patient with bad perfusion, check the sensor attachment position at least every 2 hours.

- As skin for neonate, premature infant is immature, change the sensor attachment site more frequently depending on the condition.
- Direct sunlight to the sensor area can cause a measurement error. Place a black or dark cloth over the sensor if using in direct sunlight.
- When not measuring, unplug the relay cable and sensor from the SpO_2 connector.Otherwise, the outside light may affect to falsely display measurements.
- If "– – –" is displayed for the numeric data, make sure that the sensor is properly attached.
- Before bathing the patient, make sure to remove the sensor and device from the patient.

❑Precautions when using the Masimo Rainbow SET Sensor

⚠ WARNING

- As with all medical device, carefully route patient cabling to reduce the possibility of patient entanglement or strangulation.
- Do not place this device or accessories in any position that might cause it to fall on the patient.
- Do not start or operate this device unless the setup was verified to be correct.
- Do not use this device during magnetic resonance imaging (MRI) or in an MRI environment.
- Do not use this device if it appears or is suspected to be damaged.
- Explosion hazard: Do not use this device in the presence of flammable anesthetics or other flammable substance in combination with air, oxygen-enriched environments, or nitrous oxide.
- To ensure safety, avoid stacking multiple devices or placing anything on the instrument during operation.
- To protect against injury, follow the directions below:
  - Avoid placing the device on surfaces with visible liquid spills.
  - Do not soak or immerse the device in liquids.
  - Do not sterilize the device.
  - Use cleaning solutions only as instructed in this operation manual.
  - Do not attempt to clean the device while monitoring patient.
- To protect from electric shock, always remove the sensor and completely disconnect this device before bathing the patient.
- If any measurement seems questionable, first check the patient's vital signs by alternate means and then check this device for proper functioning.
- Inaccurate SpCO and SpMet readings can be caused by the following.
  - Improper sensor application
  - Intravascular dyes, such as indocyanine green or methylene blue
  - Abnormal hemoglobin levels
  - Low arterial perfusion
  - Low arterial oxygen saturation levels including altitude induced hypoxemia
  - Elevated total bilirubin levels

- Motion artifact

- Inaccurate SpHb and SpOC readings can be caused by the following.
  - Improper sensor application
  - Intravascular dyes, such as indocyanine green or methylene blue
  - Externally applied coloring and texture such as nail polish, acrylic nails, glitter, etc.
  - Elevated PaO_2 levels
  - Elevated levels of bilirubin
  - Low arterial perfusion
  - Motion artifact
  - Low arterial oxygen saturation levels
  - Elevated carboxyhemoglobin levels
  - Elevated methemoglobin levels
  - Hemoglobinopathies and synthesis disorders such as thalassemias, Hb s, Hb c, sickle cell, etc.
  - Vasospastic disease such as Raynaud's
  - Elevated altitude
  - Peripheral vascular disease
  - Liver disease
  - EMI radiation interference
- Inaccurate SpO_2 readings can be caused by the following.
  - Improper sensor application
  - Elevated levels of COHb or MetHb: High levels of COHb or MetHb may occur with a seemingly normal SpO_2. When elevated levels of COHb or MetHb are suspected, laboratory analysis (co-oximetry) of a blood sample should be performed.
  - Intravascular dyes, such as indocyanine green or methylene blue
  - Externally applied coloring and texture such as nail polish, acrylic nails, glitter, etc.
  - Elevated levels of bilirubin
  - Elevated levels of dyshemoglobin
  - Low arterial perfusion
  - Motion artifact
- Interfering Substances: Dyes or any substance containing dyes that change usual blood pigmentation may cause erroneous readings.
- This device is intended only as an adjunct device in patient assessment. It should not be used as the sole basis for diagnosis or therapy decisions. It must be used in conjunction with clinical signs and symptoms.
- This device may be used during defibrillation, but this may affect the accuracy or availability of the parameters and measurements.
- This device may be used during electrocautery, but this may affect the accuracy or availability of the parameters and measurements.
- This device should not be used for arrhythmia analysis.
- SpCO readings may not be provided if there are low arterial saturation levels or elevated methemoglobin levels.
- SpO_2, SpCO, SpMet, and SpHb are empirically calibrated in healthy adult volunteers with normal levels of carboxyhemoglobin (COHb) and methemoglobin (MetHb).

- Do not adjust, repair, open, disassemble, or modify this device or accessories. Injury to personnel or device damage could occur. Return this device for servicing if necessary..

⚠ CAUTION

- Do not place this device where the controls can be changed by the patient.
- Electrical shock and flammability hazard: Before cleaning, always turn off the device and disconnect from any power source.
- When patients are undergoing photodynamic therapy, they may be sensitive to light sources. Pulse oximetry may be used only under careful clinical supervision for short time periods to minimize interference with photodynamic therapy.
- Do not place this device on electrical device that may affect the operation, preventing it from working properly.
- If SpO_2 values indicate hypoxemia, a laboratory blood sample should be taken to confirm the patient's condition.
- If the <SpO_2 Low Perfusion> message is frequently displayed, find a better perfused monitoring site. In the interim, assess the patient and, if indicated, verify oxygenation status through other means.
- If using this device during full body irradiation, keep the sensor out of the radiation field. If the sensor is exposed to the radiation, the reading might be inaccurate or the device might read zero for the duration of the active irradiation period.
- The device must be configured to match your local power line frequency to allow for the cancelation of noise introduced by fluorescent lights and other sources.
- To ensure that alarm limits are appropriate for the patient being monitored, check the limits each time this device is used.
- Variation in hemoglobin measurements may be profound and may be affected by sampling technique as well as the patient's physiological conditions. Any results exhibiting inconsistency with the patient's clinical status should be repeated and/or supplemented with additional test data. Blood samples should be analyzed by laboratory instruments prior to clinical decision making to completely understand the patient's condition.
- Do not submerge this device in any cleaning solution or attempt to sterilize by autoclave, irradiation, steam, gas, ethylene oxide or any other method. This will seriously damage this device.
- Electrical Shock Hazard: Carry out periodic tests to verify that leakage currents of patient-applied circuits and the system are within acceptable limits as specified by the applicable safety standards. The summation of leakage currents must be checked and in compliance with IEC 60601-1 and UL 60601-1. The system leakage current must be checked when connecting external device to the system. When an event such as a component drop or a spillage of blood or other liquids occurs, retest before further use. Injury to personnel could occur.
- Disposal of product - Comply with local laws in the disposal of the device and/or its accessories.
- To minimize radio interference, other electrical device that emits radio frequency transmissions should not be in close proximity to this device.

NOTE

- A functional tester cannot be used to assess the SpO_2 accuracy.
- High-intensity extreme lights (such as pulsating strobe lights) directed on the sensor, may not allow this device to obtain SpO_2 readings.
- When using the maximum sensitivity setting, performance of the "Sensor Off" detection may be compromised. If the device is in this setting and the sensor becomes dislodged from the patient, the potential for false readings may occur due to environmental "noise" such as light,

vibration, and excessive air movement.

- Changes or modifications shall void the warranty for this device.

NOTE

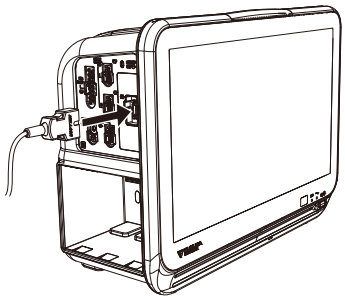
- SpCO, SpMet, SpHb, SpOC, and PVI are parameters which can be measured by the Masimo unit.
- PI can be measured on the Masimo unit.
- High-intensity extreme lights (such as pulsating strobe lights) directed on the sensor, may not allow this device to obtain SpO_2 readings.
- Do not loop the patient cabling into a tight coil or wrap around the device, as this can damage the patient cabling.
- Additional information specific to the Masimo sensors compatible with this device, including information about parameter/measurement performance during motion and low perfusion, may be found in the sensor's directions for use.

1 Prepare an appropriate probe or sensor for the patient.
(☞"Pulse Oximetry Measurement (Manufactured by Medtronic)" P13-5)
(☞"Pulse Oximetry Measurement (Manufactured by Masimo)" P13-6

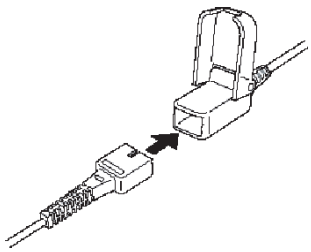
2 Connect the sensor to DS-1200N.

In Case of Medtronic Unit:

1 Connect the DOC-10 SpO_2 Relay Cable to the SpO_2 connector on the DS-1200N.



2 Insert the sensor into the SpO_2 relay cable connector, and lock it with the transparent cover.



In Case of Masimo Unit:

1 Connect the SpO_2 patient cable (LNOP®, LNCS®, M-LNCS™, Rainbow®) to the SpO^2 connector on the DS-1200M or HG-810.

2 Connect the patient cable and the sensor.
Face the metallic side of the sensor upward and align the logo with that of the patient cable.
Then, insert the sensor connector to the patient cable until a click sound is heard.

⚠ CAUTION

- The SpO_2 patient cables (LNOP®, LNCS®, M-LNCS™, Rainbow®) are for Masimo SET sensor, Rainbow SET sensor only. Connect them only to the DS-1200M or HG-810. Otherwise, the device will not properly function.

NOTE

- Pull the connector slowly to ensure it is securely connected.
- If necessary, secure the cable to the patient.

3 Attach the sensor to the patient.

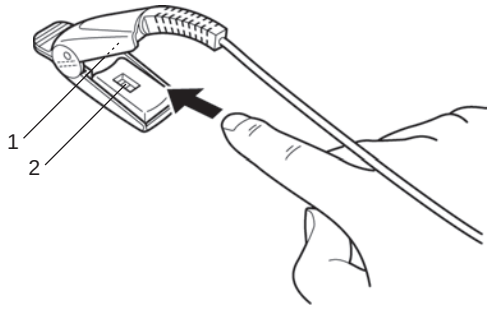
⚠ CAUTION

- If the nail is rough, dirty, or manicured, accurate measurement will not be possible. Change the finger or clean the nail before attaching the probe and sensor.

Probe Type

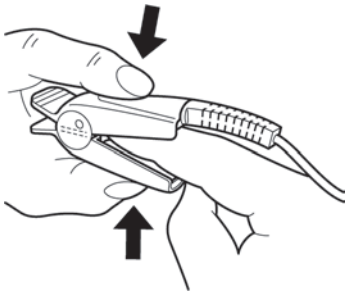
1 As shown below, the probe cable should be on the nail side.

1 Light Emitting Part
2 Light Receiving part



2 Adjust the sensor so that the light-emitting part (on cable side) is over the nail, or as instructed per the related sensor instruction manual.

3 Press the probe lightly so that the finger and the rubber cover are appressed. This is to stabilize the probe, and to avoid ambient light.



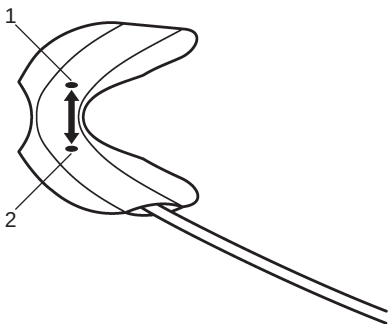
Single-Patient-Use Type

1 Clean the attachment site with alcohol, etc., and allow to dry.

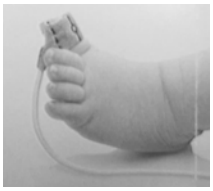
2 Align the light emitting element and light receiving element of the sensor with the measuring site in between when attaching the sensor to patient.

1 Light Emitting Element

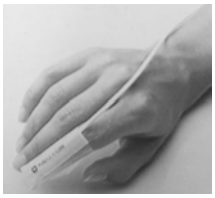
2 Light Receiving Element



3 Secure the cable with surgical tape so that the sensor does not come off when the cable is pulled.

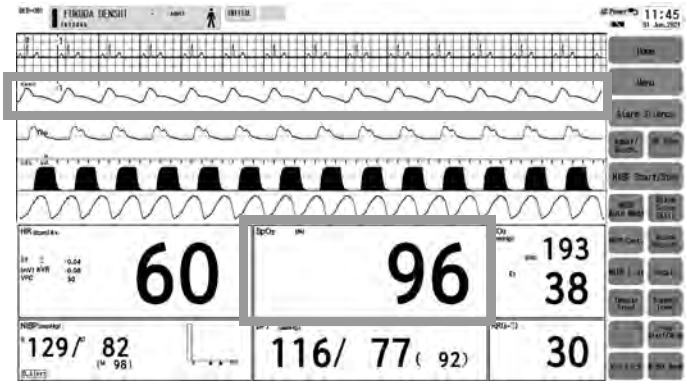


Attachment to the toe



Attachment to the finger

4 Verify that the SpO_2 measurement and SpO_2 waveform are displayed on the home display.



SpCO, SpMet, SpHb, SpOC Measurement (Masimo)

This section explains the SpCO, SpMet, SpHb, SpOC measurement procedure when using the DS-1200M or HG-810.

⚠ CAUTION

- The SpCO, SpMet, SpHb, SpOC measurements are provided only with specific rainbow sensors supporting specific parameter combinations. SpHb/SpOC/SpMet and SpCO/SpMet are each valid sensor combinations which also support PVI.
  SpHb/SpCO is not a valid sensor combination.
- For details, contact your nearest service representative.

REFERENCE

- SpCO, SpMet, SpHb, SpOC measurements are optional function.

1 Select the Rainbow sensor for the patient.
(☞"Pulse Oximetry Measurement (Manufactured by Masimo)" P13-6)

2 The measurement procedure is the same with that of the SpO_2.
Verify that the SpCO, SpMet, SpHb, SpOC value is displayed on the monitor.
(☞"SpO_2 Monitoring" P7-49)

Precautions about the Masimo Sensors and Cables

A technology called X-Cal for patient safety and reinforcement of efficiency in a clinical site is implemented for Masimo sensors and cables.
X-Cal is designed to address the following three common factors that can impact measurement accuracy and patient safety due to reliability risks.

1 Imitation Masimo sensors and cables

2 Cables and sensors used far beyond their expected life

3 Third-party reprocessed pulse oximetry sensors

If a sensor or cable that does not support X-Cal is used with an X-Cal enabled device, SpO_2 measurement will not be available.
Even if Masimo sensors or specified sensors and cables are used, SpO_2 measurement may not be available if the sensors and cables are used beyond their expected life.

❑About the Expected Life of Sensors and Cables

- The X-Cal function automatically monitors the Active Monitoring Time (actual time of SpO_2 monitoring) for each sensor and cable.If the sensors and cables are used beyond the expected life, the message, <Replace Cable> or <Replace Sensor> will be displayed.
- The measurement will not cease until it is completed even if the cable or sensor has reached end of life during the measurement.
- When a measurement with cable or sensor that has reached end of life is suspended for certain amount of time, and resumed with the same cable or sensor, a message to replace the sensor or cable will be displayed.
- The sensor or cable that has reached end of life needs to be replaced before resuming monitoring.
- The following table shows the expected life of cable and sensor. The indication of usage hours per day (24 hours/12 hours/8 hours) are also shown.

Active Monitoring Time (actual time of monitoring)

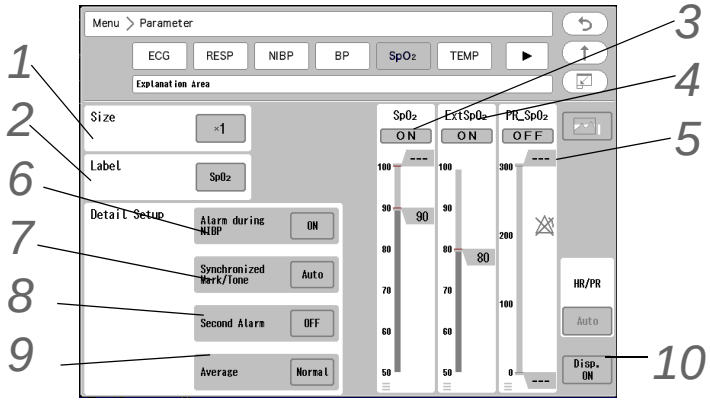
Sensors or Cables	Expected Life	When monitoring 24 hours/day	When monitoring 12 hours/day	When monitoring 8 hours/day
Single Patient Use SpO_2 "L" Sensor with replaceable tape	336 hours	14 days	28 days	42 days
Single Patient Use SpO_2 Sensor	168 hours	7 days	14 days	21 days
Reusable SpO_2 Sensor (DCI, DCIP, YI, TF-I, DBI)	8,760 hours	12 months	2 years	3 years
Patient Cable	17,280 hours	24 months	4 years	6 years

SpO_2 Parameter Setup (Medtronic)

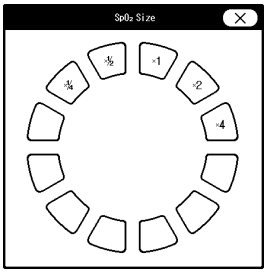
REFERENCE

- The advanced signal processing of the OxiMax algorithm automatically extends the amount of data required for measuring SpO_2 and pulse rate depending on the measurement conditions.The OxiMax algorithm automatically extends the dynamic averaging time required beyond seven (7) seconds during degraded or difficult measurement conditions caused by low perfusion, signal artifact, ambient light, electrocautery, other interference, or a combination of these factors, which results in an increase in the dynamic averaging.If the resulting dynamic averaging time exceeds 20 seconds for SpO_2, the algorithm sets the pulse search bit while continuing to update SpO_2 and pulse rate values every second.As such measurement conditions extend, the amount of data required may continue to increase.The dynamic averaging time reaches 40 seconds, and/ or 50 seconds for pulse rate. When the time exceeds 30 seconds, a low priority alarm state results.

This section explains the measurement procedure when using the DS-1200N or HG-820.
Press the [Menu], [SpO_2] keys to display the "SpO_2" setup screen.



1 Set the waveform size from ,[x1/4]/[x1/2]/[x1]/[x2]/[x4]. (shown on right)



2 Select the label from [None]/ [Auto]/ [RH]/ [LH]/ [RF]/ [LF]/ [OT].

- When [Auto] is selected, the label will be automatically assigned depending on the SpO_2 unit type and channel number.
  Medtronic 1ch: N1, 2ch: N2
  MASIMO1ch: M1, 2ch: M2

3 Set the SpO_2 alarm.
(☞"Alarm Limit Setup for Each Parameter" P6-11)

NOTE

- Whether to use the second alarm function and its threshold selection should be based on the patient's clinical indication portent and medical evaluation.
- Set the upper limit in the range of 51%SpO_2 to 100%SpO_2. If a value above 100%SpO_2 is set, the upper alarm will turn OFF.
- Set the lower limit in the range of 50%SpO_2 to 99%SpO_2. If a value below 50%SpO_2 is set, the lower alarm will turn OFF.

REFERENCE

- Also, when the SpO_2 value is unstable around the lower alarm limit, the frequently generated alarm can be corrected by setting the second alarm function.
  (☞"SpO_2 Second Alarm Setup" P6-4)
- When [Auto] is set, the upper limit will be turned OFF and the lower limit will be set to 90%SpO_2.
- To use the auto setting, [Enable] should be selected for "Alarm Auto Setup" under "Initial Settings". (☞Maintenance Manual "Alarm Related Setup" P5-4)
- When [Enable] is set for "Alarm Threshold Limit" under "Initial Settings", and auto setting is used, the upper and lower alarm limit will be clipped to the set limit.
- The upper/lower limit can be set in 1%SpO_2 increment.
- ▶ indicates the current measurement value.
- The following delay occurs for the SpO_2 alarm depending on the patient classification and second alarm setting. (For Medtronic)

	Second Alarm Setup	Patient Classification	
		Adult/Child	Neonate
SpO_2 Alarm Condition Delay	For all settings	About 7 sec. to 9 sec.	About 7 sec. to 9 sec.
SpO_2 Alarm Signal Delay	OFF	About 5 sec.	0 sec.
	10	About 5 sec. to 7 sec.	About 5 sec. to 7 sec.
	25	About 11 sec. to 13 sec.	About 11 sec. to 13 sec.
	50	About 19 sec. to 22 sec.	About 19 sec. to 22 sec.
	100	About 36 sec. to 38 sec.	About 36 sec. to 38 sec.

4 Set the Ext SpO_2 alarm.
(☞"Alarm Limit Setup for Each Parameter" P6-11)

NOTE

- Set the lower limit in the range of 50%SpO_2 to 98%SpO_2. If a value below 50%SpO_2 is set, the lower alarm will turn OFF.
- When the ExtSpO_2 alarm is ON, the lower limit of SpO_2 cannot be set below EXT SpO_2.

REFERENCE

- To use the auto setting, [Enable] should be selected for "Alarm Auto Setup" under "Initial Settings". (☞Maintenance Manual "Alarm Related Setup" P5-4)
- When [Enable] is set for "Alarm Threshold Limit" under "Initial Settings", and auto setting is used, the upper and lower alarm limit will be clipped to the set limit.
- When [Auto] is set, the lower limit will be set to "SpO_2 lower limit - 10%SpO_2".
- The lower limit can be set in 1%SpO_2 increment.
- ▶ indicates the current measurement value.
- The following delay occurs for Ext SpO_2 alarm depending on the patient classification and second alarm setting. (For Medtronic)

	Patient Classification	
	Adult/Child	Neonate
SpO_2 Alarm Condition Delay	About 7 sec. to 9 sec.	About 7 sec. to 9 sec.
SpO_2 Alarm Signal Delay	About 5 sec.	0 sec.

5 Set the PR alarm.
(☞"Alarm Limit Setup for Each Parameter" P6-11)

NOTE

- Set the upper limit in the range of 22 bpm to 300 bpm. The upper limit alarm will become OFF if the value exceeds 300 bpm.
- Set the lower limit in the range of 20 bpm to 295 bpm. If a value below 20 bpm is set, the lower alarm will turn OFF.

REFERENCE

- To use the auto setting, [Enable] should be selected for "Alarm Auto Setup" under "Initial Settings". (☞Maintenance Manual "Alarm Related Setup" P5-4)
- When [Enable] is set for "Alarm Threshold Limit" under "Initial Settings", and auto setting is used, the upper and lower alarm limit will be clipped to the set limit.
- When [Auto] is set, the upper and lower limit will be automatically set to +40 bpm and -40 bpm to the current value respectively.
- The upper and lower limit can be set in 5 bpm increments.
  It can be set in 1 bpm increment for 60 bpm and below.
- The following delay occurs for the PR alarm depending on the patient classification. (For Medtronic)
  - PR Alarm Condition Delay: <Adult/Child/Neonate> About 5 sec. to 6 sec.
  - PR Alarm Signal Delay: <Adult/Child> About 5 sec., <Neonate> 0 sec.

6 Set the "Alarm during NIBP".

NOTE

- During the NIBP measurement, the cuff inflation restricts the blood flow which disables the correct detection of the SpO_2 and PR, and may generate an improper alarm.
- Selecting [OFF] for "Alarm during NIBP" will not generate the SpO_2, Ext SpO_2, PR, SpCO (Masimo only), SpMet (Masimo only), SpHb (Masimo only) alarm until the NIBP measurement is complete.

REFERENCE

- This setup can be used when the SpO_2 sensor and the NIBP cuff is placed on the same limb for measurement.

▸ [ON]: Alarm will be generated even during NIBP measurement.

▸ [OFF]: SpO_2/PR alarm will not be generated during NIBP measurement.

7 Set the "Synchronized Mark/Tone".
(☞"ECG Parameter Setup" P7-6)

8 Set the "Second Alarm".
(☞"SpO_2 Second Alarm Setup" P6-4)

9 Set the "SpO_2 Averaging".

▸ [Fast]: Used for comparatively still patients. This should be used for most clinical procedures.

▸ [Normal]: Used for patients with a comparatively large amount of movement. SpO_2 measurements are less affected by movement, but the response time is slower.

NOTE

- When using the HG-820, the SpO_2 averaging settings are disabled and Fast is set at all times.

10 Select ON/OFF for parameter display.
(☞"ECG Parameter Setup" P7-6)

⚠ CAUTION

- When the waveform and numeric data display is set to OFF, the alarm generation and tabular/graphic trend input will also cease.
- When the waveform and numeric data display is set to OFF, the pulse rate measured by SpO_2 will not be displayed either.

REFERENCE

- When SpO_2 sensor is attached to the patient with the SpO_2 display set to OFF, and SpO_2 is measured for 10 seconds, the pulse wave and numeric data will be automatically displayed.

RR_SpO_2 Parameter Setup (Medtronic)

This section explains the RR_SpO_2 measurement procedure when using the HG-820.

CAUTION

- The RR_SpO_2 can be measured only when using the Medtronic Respiratory Sensor.
- For details, contact your nearest service representative.

1 Prepare the sensor.
(☞"Pulse Oximetry Measurement (Manufactured by Medtronic)" P13-5)

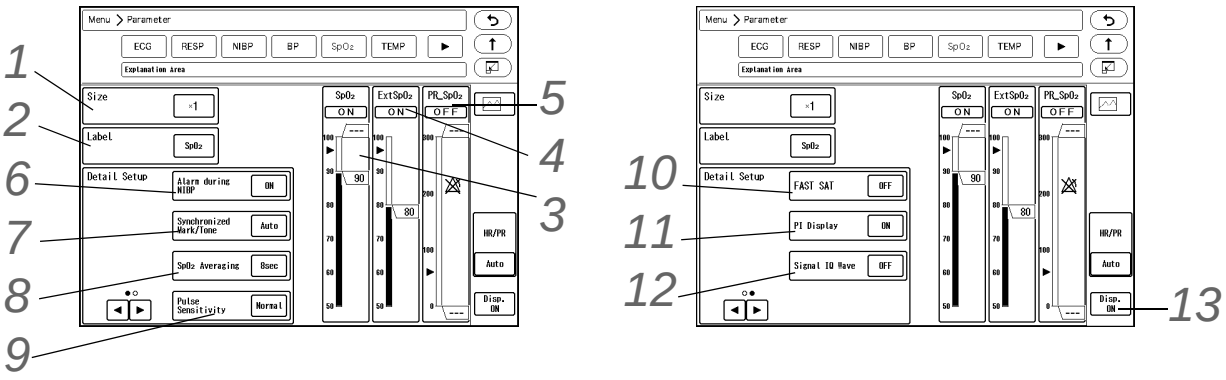
2 The measurement procedure is the same with that of the SpO_2.
Verify that the RR_SpO_2 value is displayed on the monitor.
(☞"SpO_2 Monitoring" P7-49)

SpO_2 Parameter Setup (Masimo)

This section explains the measurement procedure when using the DS-1200M or HG-810. Press the [Menu], [SpO_2] keys to display the "SpO_2" setup screen.

REFERENCE

- This setting is available when using the DS-1200M or HG-810. PVI, SpCO, SpMet, SpHb, SpOC measurements are an optional function.



1 Set the waveform size.
(☞"SpO_2 Parameter Setup (Medtronic)" P7-58)

2 Set the label.
(☞"SpO_2 Parameter Setup (Medtronic)" P7-58)

3 Set the SpO_2 alarm.
(☞"SpO_2 Parameter Setup (Medtronic)" P7-58)

REFERENCE

- The following delay occurs for the SpO_2 alarm depending on the patient classification and SpO_2 averaging duration setting (for Masimo).

	SpO_2 Averaging	Patient Classification	
		Adult/Child	Neonate
SpO_2 Alarm Condition Delay	For all settings	About 7 sec. to 9 sec.	About 7 sec. to 9 sec.
SpO_2 Alarm Signal Delay	For all settings	About 5 sec.	0 sec.

4 Set the Ext SpO_2 alarm.
(☞"SpO_2 Parameter Setup (Medtronic)" P7-58)

5 Set the PR alarm.
(☞"SpO_2 Parameter Setup (Medtronic)" P7-58)

REFERENCE

- The following delay occurs for the PR alarm depending on the patient classification. (For Masimo)
  - PR Alarm Condition Delay: <Adult/Child> About 8 sec. to 10 sec. <Neonate> About 7 sec. to 9 sec.
  - PR Alarm Signal Delay: <Adult/Child> About 5 sec., <Neonate> 0 sec.

6 Set the "Alarm during NIBP".
(☞"SpO_2 Parameter Setup (Medtronic)" P7-58)

7 Set the "Synchronized Mark/Tone".
(☞"ECG Parameter Setup" P7-6)

8 Select the SpO_2 averaging duration from [2- 4 sec.]/[4- 6 sec.]/[8 sec.]/[10 sec.]/[12 sec.]/[14 sec.]/[16 sec.].

⚠ WARNING

- Be careful when setting the "SpO_2 Averaging" duration as the SpO_2 alarm is based on the displayed SpO_2 value which is averaged from the duration set in "SpO_2 Averaging". The alarm occurrence time will be affected or may not occur for the transient value of SpO_2 depending on the set duration.

9 Select the pulse detection sensitivity from [High]/[Normal]/[APOD].

⚠ CAUTION

- When using the HG-810, [Normal] will be set if [APOD] is selected.
- If [High] is selected for pulse sensitivity, probe-off detection will become somewhat inaccurate.

NOTE

- To improve the low perfusion condition, or to perform fast tracking when the SpO_2 value changes abruptly, select [High].
- For standard use, select [Normal].

- If there is a high possibility of sensor getting disconnected, select [APOD].
- When the pulse detection sensitivity is set to [High], performance of the "Sensor Off" detection may be compromised. If the device is in this setting and the sensor becomes dislodged from the patient, the potential for false readings may occur due to environmental "noise" such as light, vibration, and excessive air movement.

10 Set the "FAST SAT".

NOTE

- To pick up the abrupt change of the value sooner, and to take advantage of the qualities of FAST SAT mode, SpO_2 averaging time will be fixed as [2- 4 sec.] when FAST SAT is set ON.

▸ [ON]: Abrupt change of the SpO_2 value can be monitored.

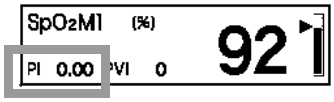
▸ [OFF]: FAST SAT mode will turn OFF.

11 Set the "PI (Perfusion Index) Display".

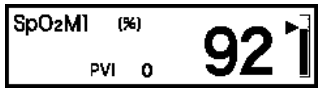
NOTE

- The perfusion index is calculated by pulsatile signal divided by apulsatile signal times 100, and indicates patient's circulation condition at the monitoring site.
- The perfusion index assists clinicians in determining optimal placement of the SpO_2 sensor. This parameter is also useful as a troubleshooting tool by helping a clinician rule out whether a questionable value may be due to low perfusion and/or a low signal to noise condition. Also, it can be used as diagnosis index to predict the patient's critical condition when at low perfusion.

▸ [ON]: PI will be displayed.



▸ [OFF]: PI will not be displayed.



REFERENCE

- Perfusion Index (PI) is a relative assessment of the pulse strength at the monitoring site. It is a ratio of the pulsatile and the non-pulsatile blood flow at the monitoring site. It can be used to find the most appropriate sensor application site by finding the site with the highest PI. Perfusion Index (PI) is displayed in the range from 0.02% to 20%.
- Pleth Variability Index (PVI) is an index of the change in PI that occurs during the respiratory cycle. It is calculated by measuring the changes in PI over a time interval where one or more complete respiratory cycles have occurred. Pleth Variability Index (PVI) is displayed in the range from 0% to 100%.

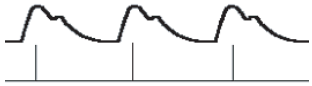
12 Select [ON]/[OFF] for "Signal IQ Wave".

NOTE

- The signal IQ wave cannot be printed.

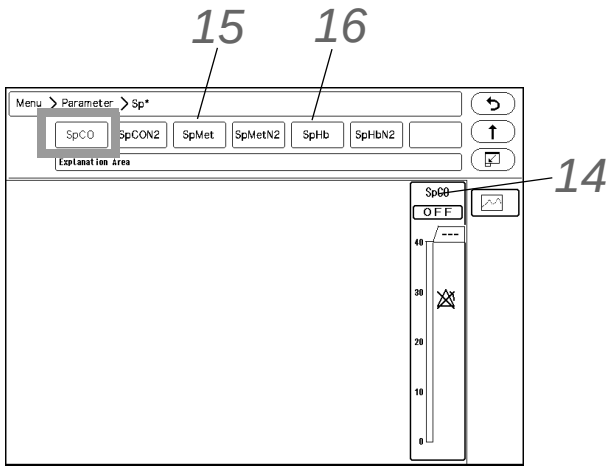
REFERENCE

- The signal IQ wave indicates the signal confidence and pulse beat. The vertical length indicates the signal confidence. A low vertical line indicates a lower signal confidence.



13 Select ON/OFF for parameter display.
(☞"SpO_2 Parameter Setup (Medtronic)" P7-58)

14 Set the SpCO alarm.
Press the [▶], [Sp*], [SpCO] keys to display the SpCO alarm setup screen.



CAUTION

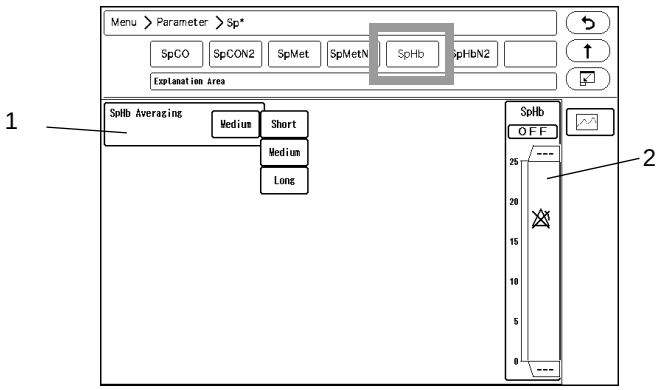
- Set the upper limit in the numeric range of 1% to 40% SpCO. If a value above 40% SpCO is set, the upper alarm will turn OFF.
- The lower limit cannot be set.
- The automatic alarm cannot be set.

15 Set the SpMet alarm.
Press the [SpMet] key to display the SpMet alarm setup screen. Set the alarm in the same procedure as SpCO.

CAUTION

- Set the upper limit in the range of 1% to 15%SpMet. The upper limit alarm will turn OFF if a value above 15%SpMet is set.
- The lower limit cannot be set.
- The automatic alarm cannot be set.

16 Set the SpHb measurement condition. Press the [SpHb] key to display the SpHb setup screen.



1 Select the SpHb averaging duration from [Short] / [Medium] / [Long].

2 Set the SpHb alarm.

CAUTION

- Set the upper limit in between 2.0 g/dL to 24.5 g/dL. The upper limit alarm will turn OFF if the value above 24.5 g/dL is set.
- Set the lower limit in between 1.0 g/dL to 24.0 g/dL. The lower limit alarm will turn OFF if the value below 1.0 g/dL is set.
- The automatic alarm cannot be set.

Temperature

This section explains the measurement procedure and measurement condition setup of temperature (T1 to T8).

TEMP Monitoring

1 Select the appropriate probe for the patient.

CAUTION

- Before the measurement, make sure that the specified probe/relay cable is used. If an unspecified probe/relay cable is used, a measurement error may occur.
- Stop using the probe if it is damaged.

NOTE

- 700 series temperature probe cannot be used.

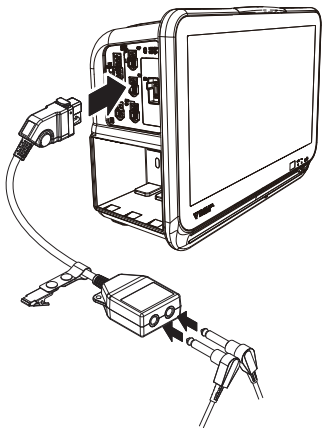
2 Connect the probe to the multiparameter connector of DS-1200N/1200M.

REFERENCE

- The DS-1200N/1200M utilizes multiparameter amplifier input method which allows monitoring of 2 channels of temperature through the 2ch temperature relay cable (CJO-P01T-DA**) connected to the DS-1200N/1200M connector.
  The measurement is also possible using the HM-800/HM-801 Multi Module .

1 Connect the 2ch temperature relay cable (CJO-P01T-DA**) to the multiparameter connector on the DS-1200N/1200M.

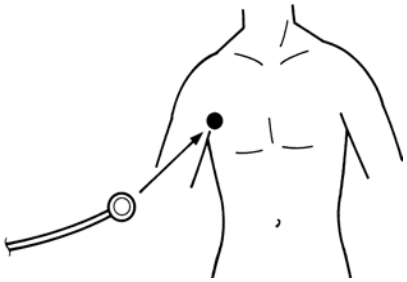
2 Connect the temperature probe to the 2ch temperature relay cable.



3 Attach the probe to the patient.

In Case of Body Surface Probe 409B:

1 Attach the probe to the body surface, and secure with surgical tape.



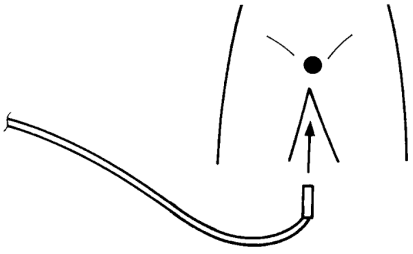
NOTE

- The probe location shown above is an example. Adjust the probe location according to the patient's condition.

In Case of Rectal Temperature Probe 401, 402:

1 Insert the probe into the rectum about 3 cm to 7 cm deep.

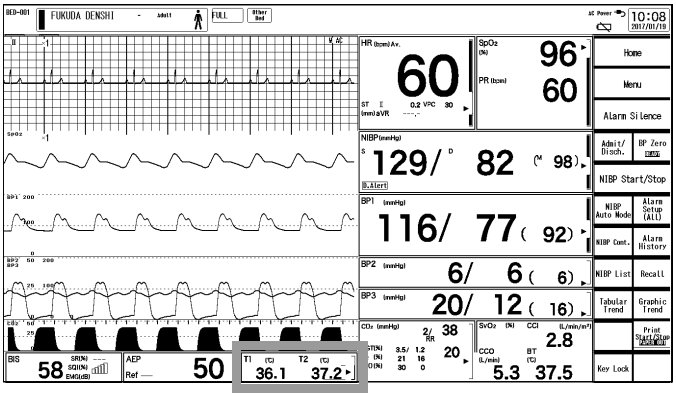
2 Secure the probe to inner thigh with surgical tape.



4 Check that the temperature is displayed.

1 Press the [Home] key on the user key.

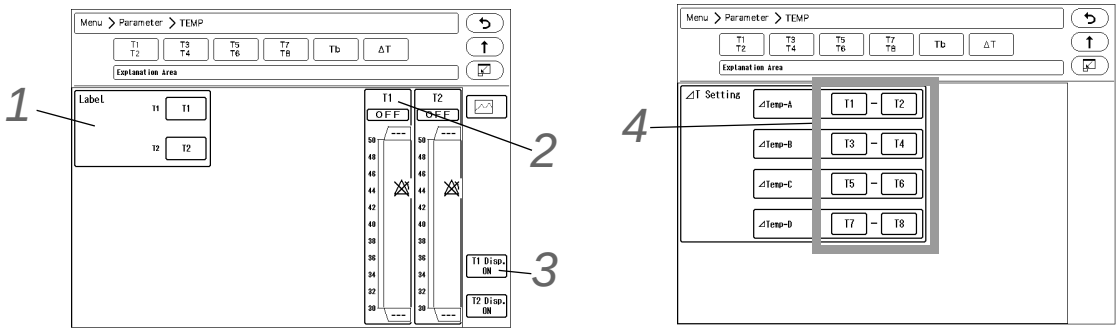
2 Verify that the measured data is displayed on the home display.
If the measured data is not displayed during the 1 channel temperature measurement, the temperature probe may be connected to incorrect channel. Connect the probe to the correct channel and verify that the measured data is displayed.



TEMP Parameter Setup

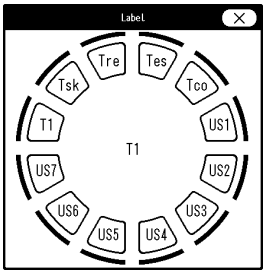
❑Parameter Setup

Press the [Menu], [TEMP] keys to display the "TEMP" setup screen.



1 TEMP Label

Select the label from [Tx] to [US7].



REFERENCE

- Description of Each Label:
  T1-T8 (Default)
  Tsk (Skin Temperature)
  Tre (Rectal Temperature)
  Tes (Esophageal Temperature)
  Tco (Core Temperature)
  US1 to US7: User labels (3 characters) which can be set on the "Initial Settings".
  (☞Maintenance Manual "User Label Setup" P5-9)

2 Temperature Alarm

(☞"Alarm Limit Setup for Each Parameter" P6-11)

NOTE

- Set the upper limit in the range of 31.0°C to 45.0°C. If a value above 45.0°C is set, the upper alarm will turn OFF.
- Set the lower limit in the range of 30.0°C to 44.0°C. If a value below 30.0°C is set, the lower alarm will turn OFF.

REFERENCE

- The upper and lower limit can be set in 0.5°C increments.
- When [Auto] is set, the upper and lower limit will be automatically set to +2.0 °C and -2 °C to the current value respectively.
- To use the auto setting, [Enable] should be selected for "Alarm Auto Setup" under "Initial Settings". (☞Maintenance Manual "Alarm Related Setup" P5-4)
- When [Enable] is set for "Alarm Threshold Limit" under "Initial Settings", and auto setting is used, the upper and lower alarm limit will be clipped to the set limit.

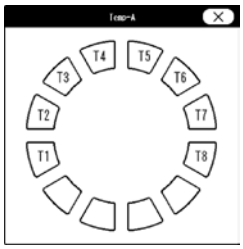
3 Display ON/OFF

(☞"ECG Parameter Setup" P7-6)

⚠ CAUTION

- When the parameter display is set to OFF, the alarm generation and tabular/graphic trend input will also cease.

4 ΔT Display



[ΔT]: ΔT setup menu will be displayed.

Select the parameter for each ΔT.

For ΔT, the difference of temperature will be displayed.

Maximum of 4 types of ΔT (ΔTemp-A to ΔTemp-D) can be registered and displayed.

NOTE

- To display on the home display, the setup on the "Display Config." is necessary. (☞"To Configure the Display" P10-4)
- The alarm cannot be set for ΔT.

Cardiac Output and Blood Temperature

When thermodilution catheter is used to measure the cardiac output, the blood temperature (Tb) can be monitored.
The CO measurement can be performed using the multiparameter connector on the DS-1200N/1200M.
The measurement is also possible using the input box.
(☞"Cardiac Output (CO)" P8-45)

Connection to the Patient Monitor

1 Select the catheter relay cable.

NOTE

- The usable catheter relay cable depends on the injectate temperature measurement method. Select the appropriate cable according to the method.
- Only one catheter relay cable can be connected.
- When using the extension tube, use the in-line sensor. Otherwise, it may result in CO measurement error due to injectate temperature rise.

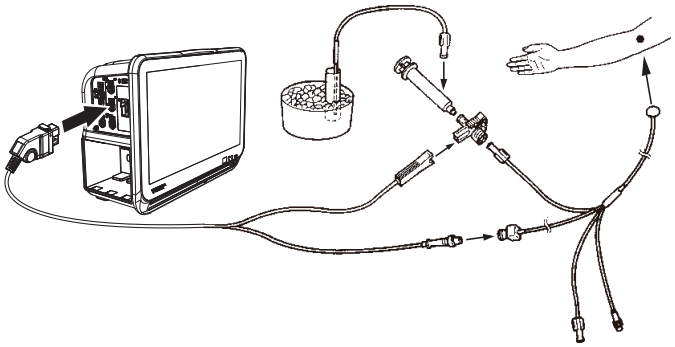
Injectate Temperature Measurement Method	Catheter Relay Cable
0°C/24°C (32°F/75.2°F) Temperature	CJO-P01C-C2.4
Flow-through Sensor	CJO-P01C-F2.4
In-line Sensor	CJO-P01C-L2.4
Injectate Temperature Probe	CJO-P01C-T2.4

REFERENCE

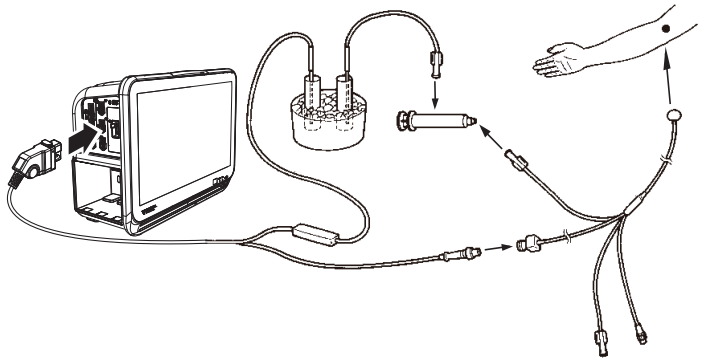
- The appropriate injectate temperature and injectate volume differs depending on the used catheter. Refer to the operation manual of the corresponding catheter.

2 Connect the catheter relay cable to the multiconnector on the DS-1200N/1200M, and connect the catheter to the catheter relay cable.

Example of In-line Sensor



Example of Injectate Probe



NOTE

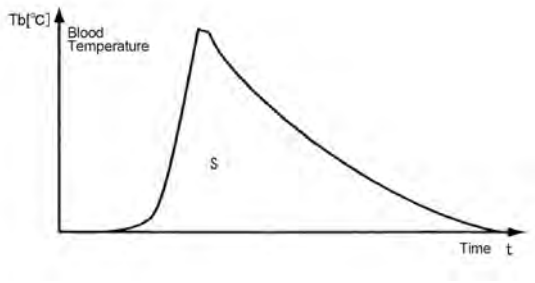
- If the injection is performed in room temperature, the blood temperature difference may not be large enough for the CO measurement of low cardiac output patient.

Cardiac Output Measurement Algorithm

Cardiac output is measured using the thermodilution method.

❑Thermodilution Method

The thermodilution catheter is inserted from the vein through the right atrium, right ventricle, and pulmonary artery. From the side hole near the catheter tip, injectate is injected quickly to the right atrium. At this time, the heart contraction and heat diffusion mixes the injectate with blood, and causes blood temperature fall.
Variable initiated by these effects are measured as time function at the pulmonary artery, and the following thermodilution curve can be drawn.
Cardiac output is calculated by applying this to the Stewart-Hamilton formula shown below.



$$CO = 60 \cdot Vi \cdot \frac{Si \cdot Ci}{Sb \cdot Cb} \cdot \frac{Ct(Tb-Ti)}{S} = CC \cdot \frac{Tb-Ti}{S}$$

CO : Cardiac Output [L/min]
Vi : Injectate Volume [L]
Tb : Blood Temperature [°C]
Ti : Injectate Temperature [°C]
Ct : Correction coefficient for injectate temperature rise inside catheter
60 : seconds
S : Area of thermodilution curve $\int_0^\infty \Delta Tb(t)dt$[°C sec]
$\Delta Tb(t)$: Temperature change of Tb after "t" seconds. [°C]
CC : Catheter Constant (Computation Constant: CC value)
Si : Specific Gravity of Injectate [g/cm^3]

Sb : Specific Gravity of Blood [g/cm^3]

Ci : Specific Heat of Injectate [cal/(g/°C)]

Cb : Specific Heat of Blood [cal/(g/°C)]

As shown above, cardiac output is directly proportional to the Injectate Volume (Vi) and the difference between Blood Temperature and Injectate Temperature (Tb - Ti), and is inversely proportional to the area of the thermodilution curve (S).

❑Hematocrit Value

Hematocrit value of 45%, (Si*Ci)/(Sb*Cb) = 1.08 is programmed for this device.

NOTE

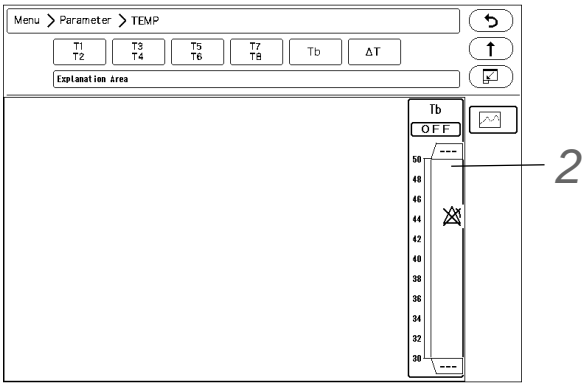
- If the hematocrit value is different, an error may be caused in cardiac output measurement.

Blood Temperature Alarm Setup

1 Press the [TEMP], [Tb] keys.

(☞"To Display the Parameter Setup Screen" P7-1)

▸ The alarm setup menu will be displayed.



2 Select ON/OFF of blood temperature alarm and set the upper and lower alarm limits.

(☞"Alarm Limit Setup for Each Parameter" P6-11)

NOTE

- Set the upper limit in the range of 31.0°C to 45.0°C. If a value above 45.0°C is set, the upper alarm will turn OFF.
- Set the lower limit in the range of 30.0°C to 44.0°C. If a value below 30.0°C is set, the lower alarm will turn OFF.

REFERENCE

- The upper and lower limit can be set in 0.5°C increments.
- When [Auto] is set, the upper and lower limit will be automatically set to +2.0 °C and -2 °C to the current value respectively.
- [Auto] key will be displayed only when [Enable] is set for "Auto Alarm Setup" under "Initial Settings".

CO_2 Concentration (Mainstream Method)

This section explains about the CO_2 concentration measurement procedure and measurement condition setup when using the Philips Capnostat 5 (Mainstream Method, Gas Unit I/F Module HC-120) .

⚠ CAUTION

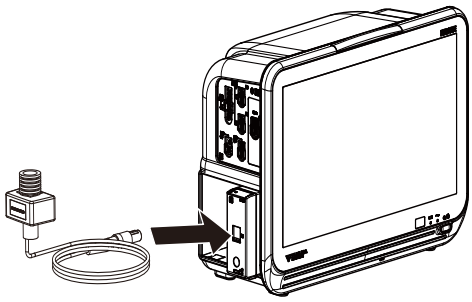
- When the multigas module (MG-110/MG-120) and HC-120 are simultaneously used, the CO_2 concentration measurement will be performed by the equipment selected for the "CO_2 Source Priority" under ([Menu] > "Parameter" [CO_2]).

Patient Application and Display

By using the HC-120 CO_2 Gas Unit Module I/F, CO_2 measurement by the Philips Capnostat 5 (Mainstream Method) can be performed.

1 Connect the HC-120 Gas Unit I/F to the connector.

2 Connect the CO_2 sensor (Capnostat5) to the sensor input connector on the HC-120.



- The CO_2 sensor will automatically begin warming up. The CO_2 sensor requires a warming up process to achieve stable operating temperature. Warm up process will require minimum of 2 minutes.
- During the warm up period, <CO_2 Warm Up> message will be displayed on the monitor.
- When the warm up completes, the message will disappear.

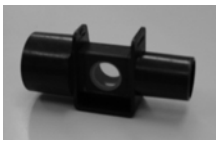
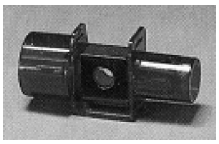
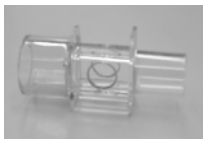
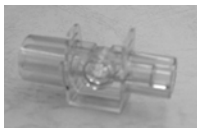
3 Prepare an airway adapter suitable for the patient.

⚠ CAUTION

- The disposable airway adapter should be opened just before use.
- Do not reuse the disposable airway adapter. Do not disassemble, clean, disinfect, or sterilize it.

NOTE

- There are 4 types of airway adapters. Select the appropriate adapter according to the used endo-tracheal tube size and operating environment.

	Airway Adapter (Adult) 7007 For patients using an endo-tracheal tube more than, or equal to 4.0 mm in diameter. Reusable Type
	Airway Adapter (Neonate) 7053 For patients using an endo-tracheal tube less than, or equal to 4.0 mm in diameter. Reusable Type
	Airway Adapter (Disposable, Adult) 6063 For patients using an endo-tracheal tube more than, or equal to 4.0 mm in diameter. Single-Use Type
	Airway Adapter (neonate) 6312 For patients using an endo-tracheal tube less than, or equal to 4.0 mm in diameter. Single-Use Type

4 Verify that the warm up is complete, and attach the CO_2 sensor to the airway adapter until a click sound is heard.

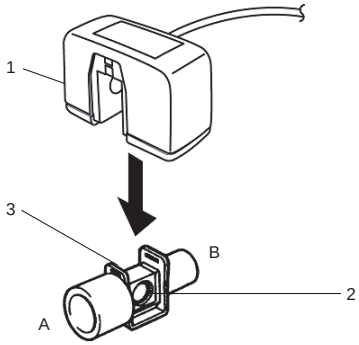
1 Capnostat 5 CO_2 Sensor

2 Window

3 Airway Adapter

A: Thick Side

B: Thin Side



⚠ CAUTION

- The airway adapter should be attached with the thicker side facing to the patient. If attached oppositely, it may damage the CO_2 sensor or airway adapter.

5 Perform the setting for the O_2 compensation, N_2O compensation, anesthetic gas compensation, atmospheric pressure Set these items each time the condition changes. (☞"CO_2 Parameter Setup" P7-76)

6 Press the [Menu], [CO_2] ("Parameter"), [Calibrate Airway Adapter] keys to calibrate the airway adapter.

- Calibration will start.
- During calibration, <Zeroing> will be displayed.
- Upon completion of calibration, a tone will be generated and <Cal. complete> will be displayed.
- If the calibration fails, an error tone will be generated and <Cal. error> will be displayed.

NOTE

- The airway adapter calibration must be performed before connecting to the respiration circuit.
  The airway adapter calibration should be also performed for the following case.
  - When the airway adapter is replaced.

- When <Zero the CO_2 Adapter> or <Check airway adapter.> is displayed.

- A clean airway adapter must be used.
  If reusing an airway adapter, clean and air-dry it. Then, wipe the window with a swab, and sterilize (EOG, etc.) before use.
- During the calibration, the measurement data will be displayed as "---". The measurement data during calibration may be included in the trend data causing discontinuity.
- Calibration cannot be performed if respiration is detected within 20 seconds before calibration. In such case, wait for 20 seconds and perform the calibration again.
- When <Cal. error> is displayed, perform the airway adapter calibration again.
- The $EtCO_2$ accuracy is checked according to the test method of ISO 80601- 2-55: 2011 (Medical electrical equipment-Part 2-55: Particular requirements for the basic safety and essential performance of respiratory gas monitors) .
- The waveform sampling rate is 100 Hz.
- The CO_2 measurement accuracy is not guaranteed for all humidity levels (non-condensing).
- The CO_2 measurement accuracy is tested at 35°C.
- The respiration rate accuracy was verified by using a solenoid test setup to deliver a square wave of known CO_2 concentration to the device. 5% and 10% CO_2 concentrations were used and respiration rate was varied over the range of the device. Pass/Fail criteria was comparison of the respiratory rate output from the sensor to the frequency of the square wave. $EtCO_2$ measurements at those rates were compared to the CO_2 readings under static flow conditions.

7 Verify that the airway adapter calibration is properly completed, disconnect the CO_2 sensor from the airway adapter temporarily, and attach the airway adapter to the patient's respiration circuit.

8 Connect the CO_2 sensor to the airway adapter.

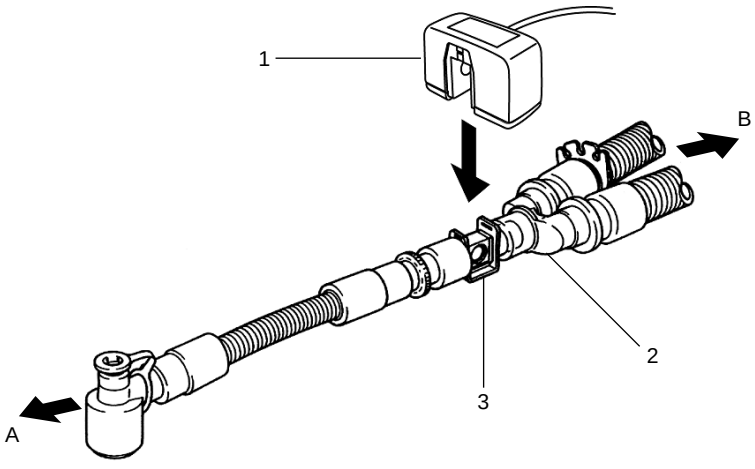
1 Capnostat 5 CO_2 Sensor

2 Y-Piece

3 Airway Adapter for Adults

A: Patient Side

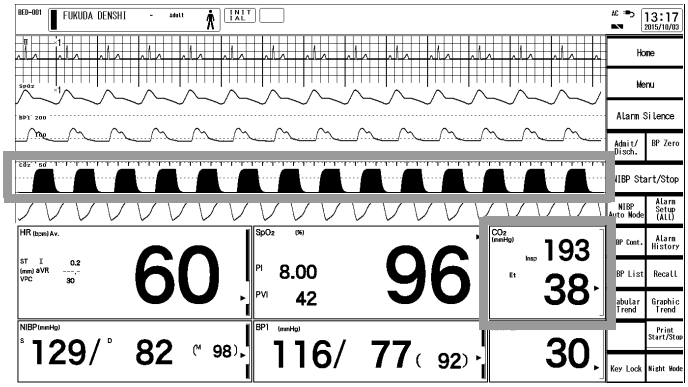
B: Device Side



NOTE

- Attach the airway adapter between the patient's circuit Y-piece and intubation tube.
- The CO_2 sensor should be facing upward.

9 Verify that the CO_2 waveform, $EtCO_2$ value, $InspCO_2$ value are displayed.

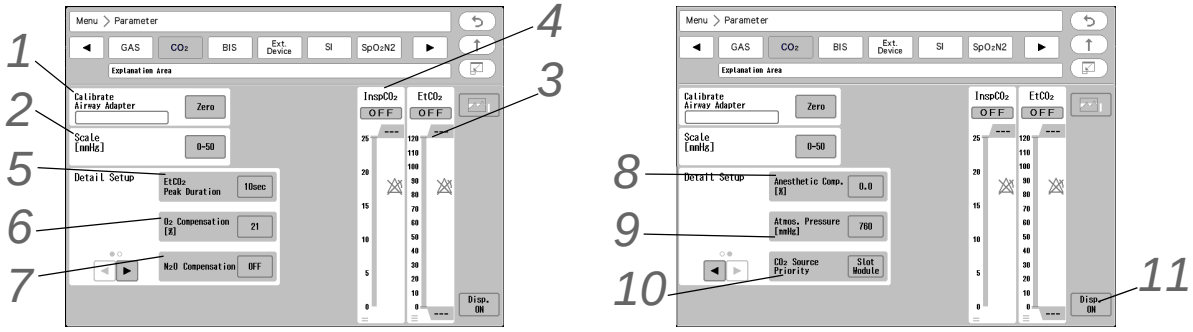


NOTE

- Set the scale, measurement unit, alarm, etc. as necessary.

CO_2 Parameter Setup

Press the [Menu], [CO_2] keys to display the "CO_2" setup screen.



1 Calibrate Airway Adapter

The airway adapter will be calibrated. (☞"Patient Application and Display" P7-73)

2 Scale

Select from [0- 50]/[0- 100] if the measurement unit is mmHg, and from [0- 4]/[0- 8]/[0- 10] if the unit is kPa or %.

3 $EtCO_2$ (End-tidal CO_2)

(☞"Alarm Limit Setup for Each Parameter" P6-11)

NOTE

- The $EtCO_2$ alarm will not generate unless 2 or more respiration is detected within 30 seconds after the power is turned ON, monitoring is resumed, CO_2 unit is connected, or a patient is discharged.
- Set the upper limit in the range of 3 mmHg to 100 mmHg/0.3 kPa to 13.3 kPa/0.3% to 13.3%.
  Setting a value above 100 mmHg/3.3 kPa/13.3% will turn OFF the alarm.
- Set the lower limit in the range of 1 mmHg to 98 mmHg/0.1 kPa to 13.1 kPa/0.1% to 13.1%.

Setting a value below 1 mmHg/0.1 kPa/0.1% will turn OFF the alarm.

- When Capnostat 5 is used, $EtCO_2$ alarm will not generate unless 2 or more respiration is detected after completion of the airway adapter calibration.

REFERENCE

- The alarm limit should be set for each unit (mmHg/kPa/%).
- The upper/lower limit can be set in 1 mmHg/0.1 kPa/0.1% increment.
- When [Auto] is set, the upper and lower limit will be automatically set to +10 mmHg / +1.3 kPa / +1.3%, and -10 mmHg / -1.3 kPa / -1.3% respectively to the current value.
- To use the auto setting, [Enable] should be selected for "Alarm Auto Setup" under "Initial Settings". (☞Maintenance Manual "Alarm Related Setup" P5-4)
- When [Enable] is set for "Alarm Threshold Limit" under "Initial Settings", and auto setting is used, the upper and lower alarm limit will be clipped to the set limit.

4 $InspCO_2$ (Inspired CO_2)

(☞"Alarm Limit Setup for Each Parameter" P6-11)

NOTE

- The $InspCO_2$ alarm will not generate unless 2 or more respiration is detected within 30 seconds after the power is turned ON, monitoring is resumed, CO_2 unit is connected, or a patient is discharged.
- Set the upper limit in the range of 1 mmHg to 4 mmHg/0.1 kPa to 0.4 kPa/0.1% to 0.4%.
  Setting a value equal to or above 4 mmHg/0.4 kPa/0.4% will turn OFF the alarm.
- When Capnostat 5 is used, $InspCO_2$ alarm will not generate unless 2 or more respiration is detected after completion of the airway adapter calibration.

REFERENCE

- The alarm limit should be set for each unit (mmHg/kPa/%).
- The upper limit can be set in 1 mmHg/0.1 kPa/0.1% increments. There is no lower limit.
- When [Auto] is set, the upper limit will be set to 3 mmHg / 0.4 kPa / 0.4%.
- To use the auto setting, [Enable] should be selected for "Alarm Auto Setup" under "Initial Settings". (☞Maintenance Manual "Alarm Related Setup" P5-4)
- When [Enable] is set for "Alarm Threshold Limit" under "Initial Settings", and auto setting is used, the upper and lower alarm limit will be clipped to the set limit.

5 $EtCO_2$ Peak Duration

[10sec]/[20sec]: Maximum $EtCO_2$ value for the selected duration will be displayed.

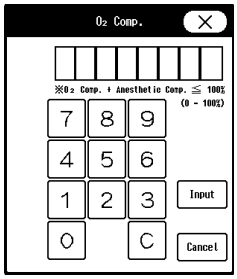
[OFF]: $EtCO_2$ value for each respiration will be displayed.

NOTE

- As the $EtCO_2$ value display is updated each second, $EtCO_2$ value for each respiration cannot be displayed if respiration rate is 60 Bpm and above.
- For the $InspCO_2$ value, minimum value of 20 seconds will be displayed regardless of the setting.

6 O_2 Compensation

By entering the used O_2 concentration value, compensation can be made to display more accurate value.
Enter the O_2 compensation value on the "O_2" screen, and press the [Set] key.



NOTE

- The value cannot be changed if the total value of O_2 compensation and anesthetic agent compensation exceeds 100%. In such case, change the O_2 compensation value after changing the anesthetic agent compensation value.

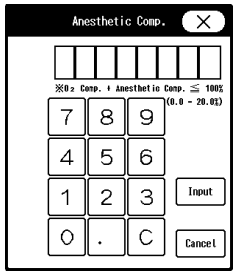
7 N_2O Compensation

NOTE

- If N_2O is present in the respiration circuit, the CO_2 value tends to be displayed higher than the actual value. By setting the N_2O compensation to [ON], this can be adjusted.

8 Anesthetic Agent Compensation

By entering the used anesthetic agent concentration value, compensation can be made to display more accurate value.
Enter the anesthetic compensation value on the "Agent" screen, and press the [Set] key.

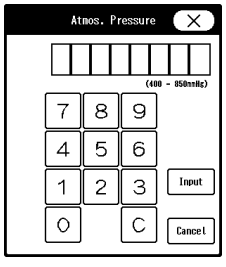


NOTE

- The value cannot be changed if the total value of O_2 compensation and anesthetic agent compensation exceeds 100%. In such case, change the anesthetic agent compensation value after changing the O_2 compensation value.

9 Atmospheric Pressure

By entering the atmospheric pressure, the pressure difference will be compensated and allows more accurate measurement.
Enter the atmospheric pressure value on the "Atmos. Pressure" screen, and press the [Set] key.



10 CO_2 Source Priority

When MG-110/MG-120 andanesthesia delivery system are simultaneously used, the CO_2 source to prioritize the measurement can be set.

- [Slot Module]: CO_2 measurement obtained by the Multigas Module will be prioritized.
- [Anes.]: CO_2 value measured by the anesthesia delivery system will be prioritized.

11 Display ON/OFF

(☞"ECG Parameter Setup" P7-6)

⚠ CAUTION

- When the waveform and numeric data display is set to OFF, the alarm generation and tabular trend input will also cease.
- When the waveform and numeric data display is set to OFF, the respiration rate measured by CO_2 will not be displayed either.

REFERENCE

- When the sampling line is applied to the patient during the "Display OFF" condition, the waveform and numeric data will be automatically displayed when 2 or more respirations are detected in 30 seconds.

CO_2 Concentration (Sidestream Method)

The HC-110 is a CO_2 Gas Module which measures CO_2 concentration. The HC-110 CO_2 Gas Module incorporates Microstream technology from Medtronic for $EtCO_2$ (End-tidal CO_2 concentration) and $InspCO_2$ (Inspiratory CO_2 concentration) measurement. This section explains about the procedure and setup of the CO_2 concentration measurement of the HC-110.

⚠ WARNING

- When using a sampling line for intubated patients with a closed suction system, do not place the airway adapter between the suction catheter and endotracheal tube. This is to ensure that the airway adapter does not interfere with the functioning of the suction catheter.
- Loose or damaged connections may compromise ventilation or cause an inaccurate measurement of respiratory gases. Securely connect all components and check connections for leaks according to standard clinical procedures.
- Do not cut or remove any part of the sampling line. It could lead to erroneous readings.
- If too much moisture enters the sampling line (i.e., from ambient humidity or breathing of unusually humid air), <Check Sample Line> will appear in the message area. Replace the sampling line when this message appears.
- Carefully route the sampling tube to reduce the possibility of patient entanglement or strangulation.
- Do not lift the HC-110 by the sampling tube, as the sampling tube could disconnect from the device, causing the device to fall on the patient.
- CO_2 readings and respiratory rate can be affected by sensor application errors, certain ambient environmental conditions, and certain patient conditions.
- If uncertain about the accuracy of any measurement, first check the patient's vital signs by alternate means, and then make sure the HC-110 is functioning correctly.
- The device should not be used as an apnea monitor.

- To ensure patient safety, do not place the HC-110 in any position that might cause it to fall on the patient.
- The use of accessories and cables other than those specified may result in increased emission and/or decreased immunity of the device and/or system.
- HC-110 is a prescription device and is to be operated by qualified healthcare personnel only.
- If calibration does not take place as instructed, the HC-110 may be out of calibration. A HC-110 that is out of calibration may provide inaccurate results.
- Do not modify this device without authorization of the manufacturer.
- Do not silence the audible alarm on the monitor if patient safety may be compromised.
- Always respond immediately to a system alarm since the patient may not be monitored during certain alarm conditions.
- Before each use, verify that the alarm limits are appropriate for the patient being monitored.
- When using the HC-110 with anesthetics, nitrous oxide or high concentrations of oxygen, connect the gas outlet to a scavenger system.
- The FilterLine may ignite in the presence of O_2 when directly exposed to laser, ESU devices, or high heat. When performing head and neck procedures involving laser, electrosurgical devices or high heat, use with caution to prevent flammability of the FilterLine or surrounding surgical drapes.
- Do not use the monitor with nuclear spin tomography (MRT, NMR, NMT) as the function of the monitor may be disturbed.
- When using a sampling line for intubated patients with suction system, do not such a way as to avoid the airway adapter between the suction catheter and endotracheal tube. This is to ensure that the airway adapter does not interfere with the functioning of the suction catheter and that the airway adapter is not damaged during suction. Damage of the airway adapter may harm the patient.
- Check CO_2 and O_2 tubing regularly during use to ensure that no kinks are present. Kinked tubing may cause inaccurate CO_2 sampling or affect O_2 delivery to patient.
- Inaccurate CO_2 readings or ineffective O_2 delivery may occur if the patient has clogged nares.
- Sampling lines are recommended for use with oxygen provided at up to 5L/min or as indicated in the sampling tube DFU. At higher levels of oxygen provision, dilution of CO_2 readings may occur, leading to lower CO_2 values.
- This product only communicates with MVPNO, MVPO, MVPOL, MVPOH, MVPOHL, MVPNOH, MVPN, MVP and ZMVPO. This product may be exposed to chemicals such as DINP that are recognized as carcinogenic by the State of California. For details, refer to the following. www.P65Warnings.ca.gov.
- Do not use the MVIIH, MVIIHH, MVIIHL or ZMVIIH together with products that have protruding internal connectors (Hamilton flow sensor, etc.), as they may damage the airway adapter.
- When using an upper endoscopy sampling tube, respiratory gases may be measured incorrectly if the oral cavity prong is not correctly inserted in the channel of the bite block. The oral cavity prong needs to be inside the channel during treatment.

⚠ CAUTION

- The Microstream™ $EtCO_2$ sampling lines are designed for single patient use, and are not to be reused. Do not attempt to clean, disinfect, sterilize or flush any part of the sampling line as this can cause damage to the monitor.
- Dispose of sampling lines according to standard operating procedures or local regulations for the disposal of contaminated medical waste.
- Before use, carefully read the Directions for Use for the Microstream™ $EtCO_2$ sampling line.

- Use only the Microstream™ $EtCO_2$ sampling line to ensure proper function of the monitor.
- Replace the sampling line according to hospital protocol or when a blockage is indicated on the device. Excessive patient secretions or a buildup of liquids in the airway tube may occlude the sampling line, requiring more frequent replacement.
- In high-altitude environments, $EtCO_2$ values may be lower than values observed at sea level, as described by Dalton's law of partial pressures. When using the monitor in high-altitude environments, it is advisable to take this into account and to consider adjusting $EtCO_2$ alarm settings accordingly.
- Read values may decrease and the waveform may become rounded when the oral RAE tube is partially blocked to align the endoscope or during suction. This becomes more pronounced at higher oxygen supply levels.

NOTE

- When connecting a sampling line to the HC-110, screw the sampling line clockwise into the connector firmly to avoid inaccurate measurement which may be caused by gas leak from the connection point.
- When <Check Sample Line> appears on the screen indicating that the sampling line connected to the HC-110 is blocked, the CO_2 pump will stop pumping the patient's breath to the monitor. In such cases, refer to the "Troubleshooting" section. First, disconnect and reconnect the sampling tube. If the message still appears, disconnect and replace the sampling tube. Once a working sampling tube is attached, the pump will automatically resume operation.
- After connecting the CO_2 sampling line to the HC-110 and patient, check that CO_2 values appear on the monitor display.
- The $EtCO_2$ accuracy is checked according to the test method of ISO 80601- 2-55: 2011 (Medical electrical device-Part 2-55: Particular requirements for the basic safety and essential performance of respiratory gas monitors).
- The waveform sampling rate is 20 samples per second.
- When using the HC module with a ventilator, under pressures over 10kPa (100cmH_2O), the module may enter into a blockage mode in order to protect the module from damage.
- Respiration rate accuracy is verified by changing respiration rate input to the module within the measurement range using a circuit that generates square wave that simulates breath by switching nitrogen gas and calibration gas for test.
- Regarding drift, please note that the periodic auto zero function compensates for drifts between components, changes in ambient temperature, and barometric conditions. This automatic process eliminates variances that might otherwise cause measurement drift.
- Following connection of the CO_2 sampling line to the monitor and patient, check that CO_2 values appear on the monitor display.
- Sampling lines with H in their names include a moisture reduction component (Nafion® or its equivalent) for use in higher humidity environments where long duration use of CO_2 sampling is required.
- Any serious incident related to device use that may occur should be reported immediately to the manufacturer, the local competent authority, and any other regulators as required.
- During setup before use, make sure the airway adapter can be easily attached to and removed easily.
- During spraying, cleaning or suction, stop the CO_2 pump according to the operation manual of the monitor (IFU) to prevent water from accumulating and blocking the sampling tube. Also, remove the connector of the sampling tube from the CO_2 port of the HC-110, especially if the CO_2 pump cannot be stopped.
- When using an upper endoscopy sampling tube, 100% of the O_2 enters the patient's nares when the O_2 luer is not connected between the sampling tube and bite block. When the O_2 luer is connected between the sampling tube and bite block (recommended), O_2 enters the

patient's nares and mouth simultaneously. O_2 is distributed so that 80% enters the patient's mouth and 20% enters the nares.

- A longer delay results in a longer response time, which causes a decrease in frequency response when using the Filter Line MRI XI.
- All Biocompatibility Reports for the sampling lines are kept in Medtronic (Covidien Jerusalem) AGILE PLM system, doc # DR0025, and will be available upon request.

REFERENCE

- Medtronic Recommended Default Alarm/Alarm Threshold

Parameter	Adult	Child	Infant/Neonate	Alarm/Alert Range
$EtCO_2$ High	60	60	50	5-99
$EtCO_2$ Low	15	15	20	0-94
$InspCO_2$ High	8	8	5	2- 98 mmHg
RR High	30	40	65	5- 150 bpm
RR Low	5	10	25	0-145 bpm*
No Breath Detected	30	20	15	10- 60 sec

* RR=0 is not a valid RR. Make sure alarms are not generated by this value.

Patient Application and Display

The CO_2 concentration can be measured by using the HC-110 CO_2 Gas Module.

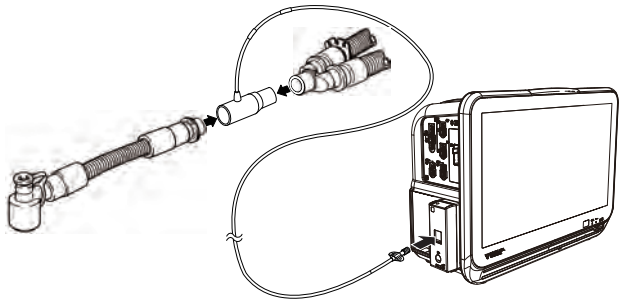
NOTE

- Accurate CO_2 concentration measurement can be acquired after 40 seconds from turning the power ON.

1 Connect the HC-110 CO_2 Gas Module to the connector.

2 Attach the airway adapter, oral/nasal sampling line or nasal sampling line to the patient.

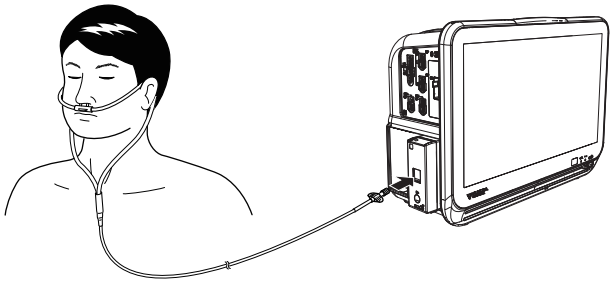
For intubated patient



1 Attach the airway adapter to respiration circuit.

2 Connect one end of the sampling line to the connector on the HC-110. Verify that all the tubes are properly connected.

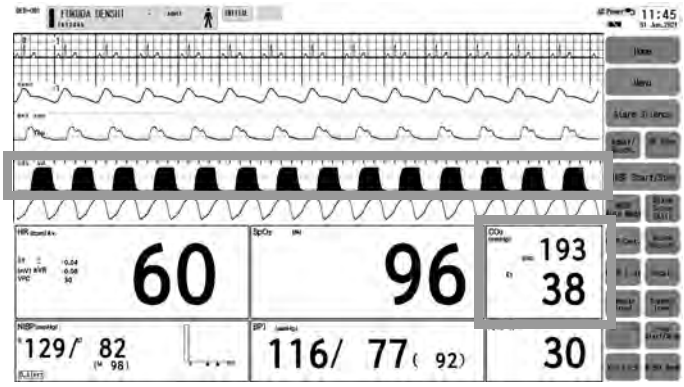
For patient using the nasal prong



1 Attach the nasal or oral/nasal patient interface of the sampling line to the patient as described in the sampling line directions for use.

2 Connect the sampling line to the connector on the HC-110.
Verify that all the tubes are properly connected.

3 Start the CO_2 concentration measurement.



▸ Verify that the CO_2 waveform, $EtCO_2$ value, $InspCO_2$ value are displayed.

⚠ CAUTION

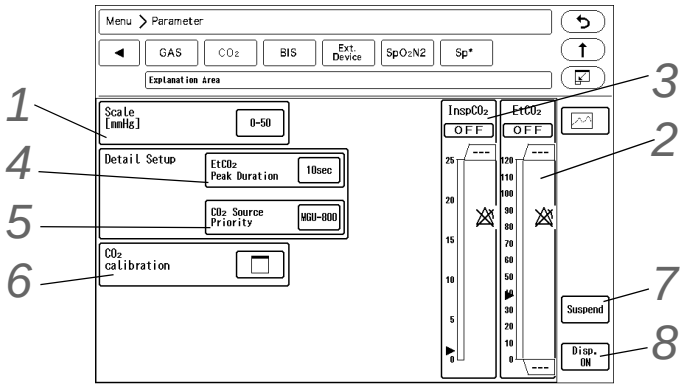
- If the power supply is interrupted due to power failure, etc., HC-110 will be initialized even if the power interruption was within 30 seconds.

NOTE

- Connecting a sampling line or nasal prong to the HC-110 will automatically start the sampling pump. To prevent the pump from deteriorating, disconnect the sampling line and nasal prong from the HC-110 when not measuring the CO_2 concentration.
- Set the scale, measurement unit, alarm, etc. as necessary.
- When ambient temperature or atmospheric pressure changes significantly, auto zeroing will function. During auto zeroing, "---" will be displayed inside the CO_2 numeric data box and CO_2 measurement cannot be performed.

CO_2 Parameter Setup

Press the [Menu], [CO_2] keys to display the "CO_2" setup screen.



1 Scale

Select from [0- 50]/[0- 100] if the measurement unit is mmHg, and from [0- 4]/[0- 8]/[0- 10] if the unit is kPa or %.

2 $EtCO_2$ (End-tidal Carbon Dioxide)

(☞"Alarm Limit Setup for Each Parameter" P6-11)

NOTE

- The $EtCO_2$ alarm will not generate unless 2 or more respiration is detected within 30 seconds after the power is turned ON, monitoring is resumed, CO_2 unit is connected, or a patient is discharged.
- Set the upper limit in the range of 3 mmHg to 100 mmHg/0.3 kPa to 13.3 kPa/0.3% to 13.3%.
  Setting a value above 100 mmHg/3.3 kPa/13.3% will turn OFF the alarm.
- Set the lower limit in the range of 1 mmHg to 98 mmHg/0.1 kPa to 13.1 kPa/0.1% to 13.1%.
  Setting a value below 1 mmHg/0.1 kPa/0.1% will turn OFF the alarm.

REFERENCE

- The alarm limit should be set for each unit (mmHg/kPa/%).
- The upper/lower limit can be set in 1 mmHg/0.1 kPa/0.1% increment.
- When [Auto] is set, the upper and lower limit will be automatically set to +10 mmHg / +1.3 kPa / +1.3%, and -10 mmHg / -1.3 kPa / -1.3% respectively to the current value.
- To use the auto setting, [Enable] should be selected for "Alarm Auto Setup" under "Initial Settings". (☞Maintenance Manual "Alarm Related Setup" P5-4)
- When [Enable] is set for "Alarm Threshold Limit" under "Initial Settings", and auto setting is used, the upper and lower alarm limit will be clipped to the set limit.

3 $InspCO_2$ (Inspired Carbon Dioxide)

(☞"Alarm Limit Setup for Each Parameter" P6-11)

NOTE

- The $InspCO_2$ alarm will not generate unless 2 or more respiration is detected within 30 seconds after the power is turned ON, monitoring is resumed, CO_2 unit is connected, or a patient is discharged.
- Set the upper limit in the range of 1 mmHg to 4 mmHg/0.1 kPa to 0.4 kPa/0.1% to

0.4%.
Setting a value equal to or above 4 mmHg/0.4 kPa/0.4% will turn OFF the alarm.

REFERENCE

- The alarm limit should be set for each unit (mmHg/kPa/%).
- The upper limit can be set in 1 mmHg/0.1 kPa/0.1% increments. There is no lower limit.
- When [Auto] is set, the upper limit will be set to 3 mmHg / 0.4 kPa / 0.4%.
- To use the auto setting, [Enable] should be selected for "Alarm Auto Setup" under "Initial Settings". (☞Maintenance Manual "Alarm Related Setup" P5-4)
- When [Enable] is set for "Alarm Threshold Limit" under "Initial Settings", and auto setting is used, the upper and lower alarm limit will be clipped to the set limit.

4 $EtCO_2$ Peak Duration

[10sec]/[20sec]: Maximum $EtCO_2$ value, minimum $InspCO_2$ value for the selected duration will be displayed.
[OFF]: $EtCO_2$ value, $InspCO_2$ value for each respiration will be displayed.

NOTE

- As the $EtCO_2$ value display is updated each second, $EtCO_2$ value for each respiration cannot be displayed if respiration rate is 60 Bpm and above.

5 CO_2 Source Priority

When MG-110/MG-120 andanesthesia delivery system are simultaneously used, the CO_2 source to prioritize the measurement can be set.

- [Slot Module]: CO_2 measurement obtained by the Multigas Unit will be prioritized.
- [Anes.]: CO_2 value measured by the anesthesia delivery system will be prioritized.

6 CO_2 Calibration

CO_2 calibration can be performed.
(☞Maintenance Manual "CO_2 Calibration (HC -110)" P9-11)

7 Suspend CO_2

[Suspend]: The pump operation will stop, CO_2 waveform and numeric data display will disappear, and "Suspended" will be displayed inside the CO_2 numeric data box.
[Resume]: Resumes CO_2 monitoring. This key will be displayed when the measurement is suspended.

⚠ CAUTION

- When the measurement is suspended, the alarm generation and trend input will be also suspended.

8 Display ON/OFF

(☞"ECG Parameter Setup" P7-6)

⚠ CAUTION

- When the waveform and numeric data display is set to OFF, the alarm generation and tabular trend input will also cease.
- When the waveform and numeric data display is set to OFF, the respiration rate measured by CO_2 will not be displayed either.

REFERENCE

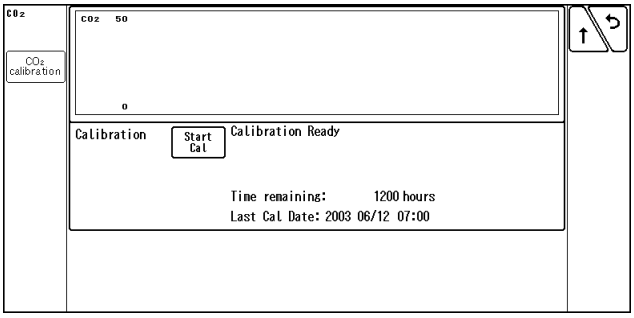
- When the sampling line is applied to the patient during the "Display OFF" condition, the waveform and numeric data will be automatically displayed when 2 or more respirations are detected in 30 seconds.

CO_2 Calibration (HC -110)

This section describes about the procedure of CO_2 gas calibration.
Perform calibration for the following case.

- When the measurement time exceeds 1,200 hours from the first use.
- When 1 year has elapsed from the last calibration; or the accumulated $EtCO_2$ measurement time exceeds 4,000 hours, whichever comes earlier.
- When error occurs to the measurement reading.

1 Press the [Menu], [CO_2] ("Parameter"), [CO_2 Calibration] to display the CO_2 calibration screen.



2 Press the [Start Cal] key and conduct calibration according to the displayed messages.

3 The message, <Feed CAL. GAS> will be displayed. Press the injection button and inject the calibration gas.

4 The message, <Cal. Gas can be removed> will be displayed. Stop pressing the injection button to cease the injection.

5 The message, "CAL. OK" will be displayed. "Last Cal. Date" will be updated to the current date.

- If any of the following messages is displayed, start the procedure again from step 2.
  <CAL. error>, <CAL GAS error>, <Auto Zero fail>, <No stable gas flow>, <CAL. failure>

6 Press the [Cal Complete] key to end the calibration.

⚠ CAUTION

- Perform the calibration 5 minutes after turning ON the power on the HC-110.
- Do not disconnect the sampling tube during calibration. If the sampling tube is disconnected, calibration will cease.
- Conduct CO_2 calibration for the following case.
  - When the accumulated measurement time exceeds 1,200 hours from the first use. However, if the first calibration was performed before the accumulated measurement

time reaches 720 hours, another calibration is required when the accumulated measurement time exceeds 1,200 hours from the first calibration.

- When 12 months has elapsed or the accumulated measurement time has exceeded 4,000 hours from the previous calibration.
- When $EtCO_2$ measurement is not stable or accuracy is degraded compared with other measuring device.
- When the patient monitor was not used for a while, or when $EtCO_2$ was not measured for a while.
- When a message, <Calibrate the CO_2 unit (HC-110)> or <The periodic calibration of the CO_2 unit (HC-110) is approaching> is displayed at power ON.

- Dispose of calibration gas according to the regulation of each medical institution.

Multigas Module, Spiro

The MG-110/ MG-120 multigas module can be connected to the DS-1200 system.
(☞Maintenance Manual "Connecting the Multigas Module" P1-3)
When the multigas module is connected, monitoring conditions for CO_2 concentration, anesthetic gas concentration, O_2 concentration, and N_2O concentration, respiration (SPIRO) can be set.
The MG -110/ MG-120 have an internal barometer and thermistor that allow compensation for changes over arange of temperature and atmospheric pressures.

WARNING

- Make sure to use only the specified Mindray Medical Sweden AB product.
  (☞"Anesthetic Gas Concentration Measurement (Manufactured by Mindray Medical Sweden AB)" P13-10)
- Be careful not to damage the water trap during operation as bacteria and/or mucus may contaminate the MG-110/ MG-120.
- The airway adapter, sampling line, flow sensor are disposable products that are intended for single patient use only. Do not reuse them on other patients as it may cause cross-infection.
- Do not use the MG-110/ MG-120 with flammable anesthetic agents.
- To protect the hospital staffs from unnecessary anesthetic agent, it is strongly recommended to connect the exhaust hole to the gas exhaust system in the hospital.
- The sampling line may get clogged by internal condensation.

CAUTION

- When the MG-110/MG-120 and HC-110/HC-120 are simultaneously used, the CO_2 concentration measurement will be performed by the equipment selected for the "CO_2 Source Priority" under ([Menu] > "Parameter"[CO_2]).
- The MG-110/MG-120 require warm up of about 10 minutes to correctly measure the data.
- If the power supply is interrupted due to power failure, etc., MG-110/ -120 multigas unit will initialize and enter into warm-up mode even if the power interruption is within 30 seconds.
- Zero Calibration:
  The zero calibration will automatically start when the MG-110/ MG-120 are connected.
  After the warm-up completes, zero calibration will be performed every 4 hours during stable operation.
  During warm-up, zero calibration interval will become shorter than during normal operation.
  During zero calibration, measurement data will not be updated.

Calibration gas is not required during zero calibration.

- Make sure the sampling line and flow sensor is securely connected to prevent any leakage.
- An environment with alcoholic vapor may adversely affect the measurement readings.
- CO_2, N_2O or anesthetic agent in the atmosphere around the MG-110/ MG-120 may adversely affect the measurement readings.
- SPIRO and ventilator cannot be used simultaneously.

NOTE

- The MG -110/ MG-120 uses a fixed correction of 11hPa (22ºC@40% RH) to compensate for the influence of water vapor in the gas sample, when converting the gas readings to ATPD. An increase in the ambient H_20 partial pressure to 30 hPa (28ºC@80% RH or 33ºC@60% RH) will cause a general error for all gases of only -2% REL.
- The $EtCO_2$ accuracy is checked according to the test method of ISO 80601- 2- 55: 2011 (Medical electrical equipment-Part 2- 55: Particular requirements for the basic safety and essential performance of respiratory gas monitors) under the condition of 60 Bpm and below with I:E ratio of 1:1.
- When the RR exceeds 60 Bpm, the $EtCO_2$ accuracy cannot be specified. (Depends on the I:E ratio.)
- The data sampling rate is 25 Hz.
- The minimum value and maximum value of the CO_2 waveform are used for the $InspCO_2$ value and $EtCO_2$ value respectively.
- For the gas measurement data, "0" will be displayed if the value becomes below the following threshold for 3 seconds or more. (Full Accuracy/during warm-up)
  CO_2: 0.1/0.3 [vol%]
  N_2O: 3/3 [vol%]
  O_2: 0/0 [vol%]
  Volatile Anesthetic: 0.15/0.3 [vol%]
- The ability to properly resolve end-tidal values can be measured by using the set-up described in ISO 80601-2-55: 2011, figure 201. 101.
  In short, the method consists of sampling gas from two different sources connected to an electrically controlled pneumatic valve to permit rapid switching between the two sources. During the test, the valve is set to switch gas source at a number of frequencies (simulating the range of specified breath rates) and for each frequency, the end-tidal value presented by the gas analyzer is noted. From a diagram of end-tidal value over frequency, the frequency at which the gas analyzer is no longer able to resolve end-tidal values according to specification is identified.

Connecting to the Respiration Circuit

❑Multigas Concentration Measurement(MG -110)

⚠ WARNING

- Do not use adult/pediatric type water traps and/or sampling lines with neonates to avoid high sampling flow.
- Connect only DRYLINE gas sampling lines to the water trap. Note that there may be other compatible tubing present, e.g. IV-lines.
- Do not use DRYLINE neonatal sampling lines (blue luer lock nuts) with DRYLINE adult water traps as this could result in incorrect measurement data.
- Do not use DRYLINE adult sampling lines (colorless luer lock nuts) with DRYLINE neonatal water traps as this could result in incorrect measurement data.

NOTE

- If [Adult] or [Child] is selected as patient classification on the "Admit/Discharge" screen, install the DRYLINE Adult/Child Water Trap (60-13100-0).
  If [Neonate] is selected as patient classification on the "Admit/Discharge" screen, install the DRYLINE Neonatal Water Trap (60- 13200-0).
  If the used water trap and the set patient classification does not match, <GAS Check Water Trap Class> will be displayed.

1 Install the DRYLINE Water Trap (Adult/Child: 60-13100-00, Neonate: 60-13200-00) aligning the lugs with the corresponding holes in the receptacle and pushing gently into place. (See below.)
Make sure that both barbs on the lugs are fully engaged by pulling the water trap, which should be firmly seated.

2 Connect the DRYLINE Airway Adapter (Straight: 60-14100-00, or Elbow: 60-14200-00) to the patient breathing system.

3 Remove the protective cap from the airway adapter and connect it to the sampling line (for adult/child: 60-15200-00, for neonate: 60- 15300-00).

4 Connect the other side of the sampling line to the inhale port of the water trap. When the water trap is half full, empty the water trap's reservoir.
(☞Maintenance Manual "Water Trap (Multigas Module)" P8-5)

WARNING

- The contents of the water trap should be handled as a potential infection hazard.

❑Multigas Concentration/Spirometry Measurement (MG -120)

WARNING

- Combination of the SPIRIT Flow Sensors and DRYLINE Water Traps as described in the table below are recommended. Other combinations might lead to incorrect measurements.

Patient Category	Patient Classification Selection on "Admit/ Discharge" Screen	SPIRIT Flow Sensor	DRYLINE Water Trap
Adult	Adult	Adult (60- 16100-00)	Adult/Child (60- 13100-00)
Child	Child	Child (60- 16200-00)	Adult/Child (60-13100-00) Neonate (60- 13200-00)
Neonate	Neonate	Child (60- 16200-00)	Neonate (60- 13200-00)

- Use the adult flow sensor for a patient whose tidal volume is above 150 mL.
- Use the pediatric flow sensor for a patient whose tidal volume is below 300 mL.
- Make sure to use the correct flow sensor depending on the patient conditions, adult or pediatric and the tidal volume.
- Do not confuse the gas sampling line with other compatible tubing, e.g. IV-lines.

1 Install the DRYLINE Water Trap.

2 Connect the end (for adult: 22/15 mm, pediatric: 15 mm) of the flow sensor, marked ← to the patient tracheal tube or similar.

3 Connect the end of the flow sensor to the patient breathing system. For best results, a heat and moisture exchanger (HME) or similar should be put between the flow sensor and the breathing system.

4 Connect the pressure line of the flow sensor to the flow sensor connector on the MG-120.

5 Connect the gas sampling line of the flow sensor (for adult: colorless, for pediatric: blue) to the gas inlet of the water trap. When the water trap is half full, empty the water trap's reservoir.
(☞Maintenance Manual "Water Trap (Multigas Module)" P8-5)

WARNING

- The contents of the water trap should be handled as a potential infection hazard.

6 To prevent accumulation of condensed fluid, the flow sensor shall be always be positioned a few degrees off the horizontal level towards the ventilator side. For the same reason, the pressure tubes shall exit the flow sensor upwards.

7 The pressure tubes should be routed in such a way that a water lock is formed by a section of tubing being positioned lower than the flow sensor connector on the MG-120.

8 A patient breathing system leakage test shall be performed according to the recommendations of the ventilator manufacturer.

⚠ CAUTION

- The adult flow sensor dead space is 6.9 mL and the flow resistance is 1.8 cmH_2O at 60 L/min.
  The pediatric flow sensor dead space is 0.75 mL and the flow resistance is 0.9 cmH_2O at 10 L/min.
  Adjust ventilation accordingly.
- To prevent condensation, the patient breathing circuit, flow sensor and pressure tubing should not be directly exposed to cooling device such as fans or cooling blankets.
- Leakage of gas from the patient breathing system may occur if the pressure or gas sampling lines are not connected to the MG-120.
- The pressure tube and gas sampling lines of the flow sensor should always be routed from the patient circuit to the MG-120 such a way as to avoid kinking.
- Flow sensors that have suffered damage to sensor head, tubing or tubing connector must not be used.
- If liquid has entered the pressure tubes, it can be removed by gently tapping or shaking the flow sensor.

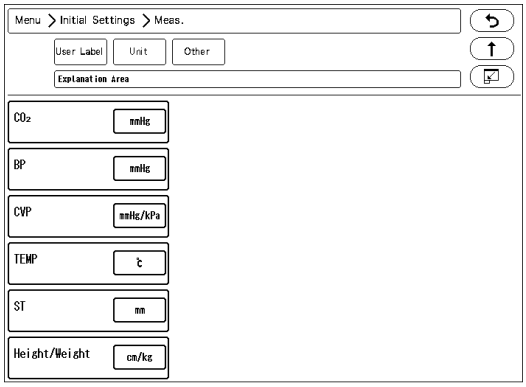
CO_2 Measurement Unit Setup

NOTE

- Even though the CO_2 measurement can be done in several units or modules, setups for the alarm limit, measurement unit and scale are common for all the units and modules.
- When a measurement unit is changed, make sure to set the alarm condition for that unit. Set the alarm for each measurement unit.

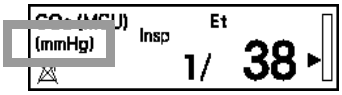
1 Press the [Menu], [Initial Settings], [Meas.], [Unit] keys.

▸ The "Unit" menu will be displayed.



2 Press the [mmHg]/[kPa]/[%] key.

▸ The data of currently set measurement unit will be displayed on the graphic/tabular trend.

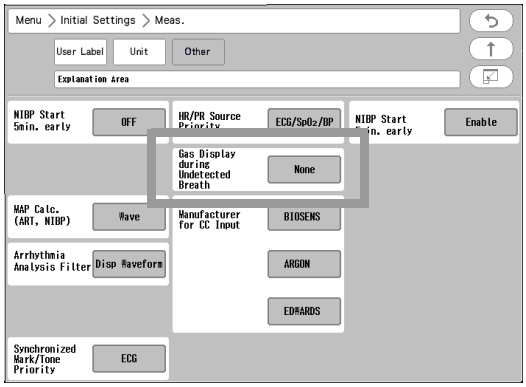


GAS Display during Undetected Breath

The gas data display when a respiration is not detected can be selected from [None] (bar display) or [Insp. Only] (displays only the inspiratory data).

1 Press the [Menu], [Initial Settings], [Meas.], [Other] keys.

▸ The "Other" menu will be displayed.



2 Press the [None]/[Insp. Only] key.

[None]: When a respiration is not detected, inspiratory and expiratory data will become invalid and bar marks will be displayed instead.

[Insp. Only] : When a respiration is not detected, only the inspiratory data will become valid and bar marks will be displayed for expiratory data.

NOTE

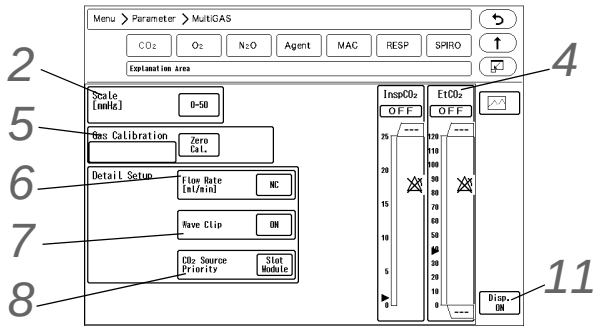
- When [Insp. Only] is selected for "GAS Display during Undetected Breath" and if only inspiratory data is displayed, inspiratory and expiratory data display on the central monitor will become invalid.
- When [Insp. Only] is selected for "GAS Display during Undetected Breath" and if only inspiratory data is displayed, the GAS alarm will not be generated.

Multigas Module Data Setup (Multigas Concentration/Spirometry Function Assessment)

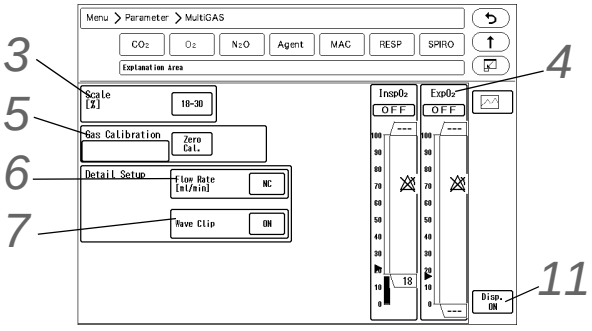
1 Press the [Menu], [GAS] "Parameter" keys.

▸ The Multigas setup screen will be displayed.

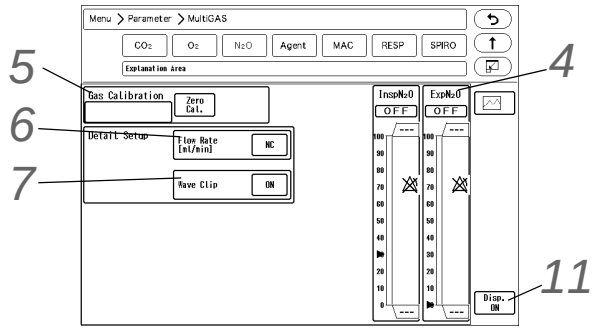
GAS_CO_2 Screen (MG-110)



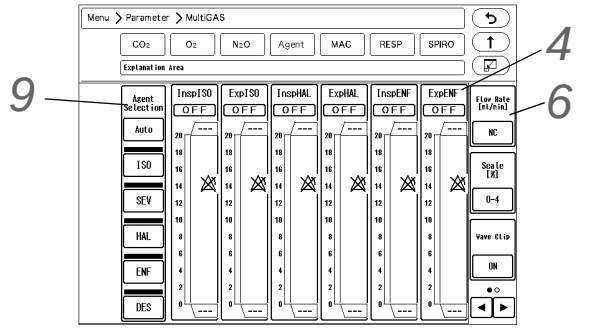
GAS_O_2 Screen (MG-110)



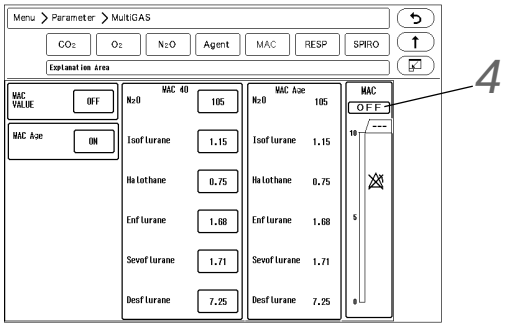
GAS_N_2O Screen (MG-110)



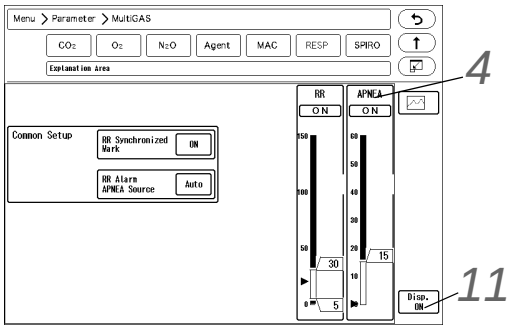
GAS_AGT Screen (MG-110)



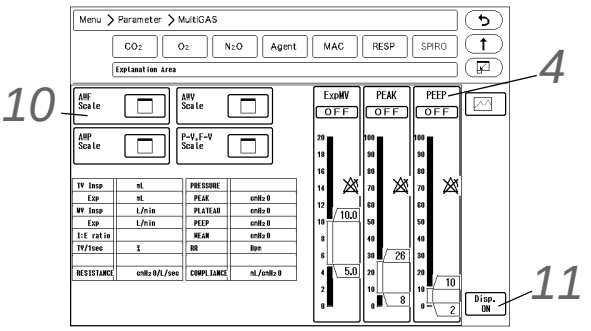
GAS_MAC Screen (MG-110)



GAS_RESP Screen (MG-110)



GAS_SPIRO Screen (MG-120)



2 Set the CO_2 waveform scale.

Select from [0- 50]/[0- 100] if the measurement unit is mmHg, and from [0- 4]/[0- 8]/[0- 10] if the unit is kPa or %.

3 Set the O_2 waveform scale.
Select from [18- 30]/[18- 60]/[18- 100]/[0- 30]/[0- 60]/[0- 100].

4 Set the alarm.
(☞"Alarm Limit Setup for Each Parameter" P6-11)

NOTE

- The following alarm will not generate unless 2 or more respiration is detected within 30 seconds after the power is turned ON, monitoring is resumed, multigas module is connected, or a patient is discharged.

$EtCO_2$ Alarm

NOTE

- Set the upper limit in the range of 3 mmHg to 100 mmHg/0.3 kPa to 13.3 kPa/0.3% to 13.3%. Setting a value above 100 mmHg/3.3 kPa/13.3% will turn OFF the alarm.
- Set the lower limit in the range of 1 mmHg to 98 mmHg/0.1 kPa to 13.1 kPa/0.1% to 13.1%. Setting a value below 1 mmHg/0.1 kPa/0.1% will turn OFF the alarm.

REFERENCE

- The alarm limit should be set for each unit (mmHg/kPa/%).
- The upper/lower limit can be set in 1 mmHg/0.1 kPa/0.1% increment.

$InspCO_2$ Alarm

NOTE

- Set the upper limit in the range of 1 mmHg to 4 mmHg/0.1 kPa to 0.4 kPa/0.1% to 0.4%. Setting a value above 4 mmHg/0.4 kPa/0.4% will turn OFF the alarm.

REFERENCE

- The alarm limit should be set for each unit (mmHg/kPa/%).
- The upper/lower limit can be set in 1 mmHg/0.1 kPa/0.1% increment.

$ExpO_2$ Alarm

NOTE

- Set the upper limit in the range of 18% to 100%.
  The alarm will turn OFF if a value above 100% is set.
- Set the lower limit in the range of 18% to 100%.
  The alarm will turn OFF if a value below 18% is set.

REFERENCE

- The upper/lower limit can be set in 2% increment.

$InspO_2$ Alarm

NOTE

- Set the upper limit in the range of 18% to 100%.

The alarm will turn OFF if a value above 100% is set.

- Set the lower limit in the range of 18% to 100%.
  The alarm will turn OFF if a value below 18% is set.

REFERENCE

- The upper/lower limit can be set in 2% increment.

ExpN$_2$O/ InspN$_2$O Alarm

NOTE

- Set the upper/lower limit in the range of 0% to 100%.
  The upper limit and lower limit will turn OFF if a value above 100% and below 0% is set respectively.

REFERENCE

- The upper/lower limit can be set in 2% increment.

AGT-E/AGT-I Alarm (MG-120)

NOTE

- The adjustable range of the upper limit differs depending on the anesthetic gas label.
  ISO, HAL, ENF: 0.5% to 6.0%
  SEV: 0.5% to 8.0%
  DES: 0.5% to 18.0%
  The alarm will turn OFF if a value above the range is set.
- The adjustable range of the lower limit differs depending on the anesthetic gas label.
  ISO, HAL, ENF: 0.5% to 6.0%
  SEV: 0.5% to 8.0%
  DES: 0.5% to 18.0%
  The alarm will turn OFF if a value below the range is set.

REFERENCE

- The upper/lower limit can be set in 0.5% increment.

MAC Alarm

NOTE

- Set the upper limit in the range of 0.1 to 9.9.
  The upper limit alarm will turn OFF if a value below 9.9 is set.

REFERENCE

- The upper limit can be set in 0.1 increments.

RR/Apnea Alarm

NOTE

- Set the APNEA upper limit in the numeric range of 10 to 60 sec. The upper limit alarm will turn OFF if a value above 60 seconds is set.
- For adults, set the upper limit of the RR alarm in the range of 10 to 150Bpm. The upper

limit alarm will turn OFF if a value above 150Bpm is set. Set the lower limit of the RR alarm in the range of 5 to 145Bpm. The alarm will turn OFF if a value below 5Bpm is set. For children and neonates, set the upper limit of the RR alarm in the range of 4 to 150Bpm. The upper limit alarm will turn OFF if a value above 150Bpm is set. Set the lower limit of the RR alarm in the range of 2 to 148Bpm. The alarm will turn OFF if a value below 2Bpm is set.

REFERENCE

- The adjustable increment for RR alarm depends on the patient classification and "RR Alarm Increment" setting. (Initial Settings>User I/F).

	Alarm Increment (Initial Settings > User I/F)	
	Normal	Small
Adult	5 Bpm increment	1 Bpm increment
Child/Neonate	2 Bpm increment	1 Bpm increment

- The apnea alarm can be set in 1 second increment.

ExpMV/PEAK/PEEP Alarm

NOTE

- For adults, set the upper limit of ExpMV alarm in the range of 4.0 L/minute to 20.0 L/minute and the lower limit in the range of 2.0 L/minute to 18.0L/minute.
  For children and neonates, set the upper limit in the range of 1.0 L/minute to 5.0 L/minute and the lower limit in the range of 0.5 L/minute to 4.5L/minute.
- Set the upper limit of PEAK alarm in the range of 10 cmH_2O to 100 cmH_2O and the lower limit in the range of 8 cmH_2O to 98cmH_2O for adults, children and neonates.
- Set the upper limit of PEEP alarm in the range of 4 cmH_2O to 50 cmH2O and the lower limit in the range of 2 cmH_2O to 48cmH_2O for adults, children and neonates.

REFERENCE

- The upper/lower limit can be set as followings.
  ExpMV alarm can be set in 0.5 L/minute increment.
  PEAK/PEEP alarm can be set in 1 cmH_2O increment.

5 Perform a zero calibration. Press the [Zero Cal.] key to start the zero calibration.

NOTE

- While performing the zero calibration, the baseline waveform is displayed.

REFERENCE

- On the patient monitor, a zeroing (zero calibration) of the multigas module is periodically performed, but it can also be performed manually when necessary.

6 Set the "Flow Rate" (sampling flow rate for the multigas module).
The selectable "Flow Rate" value differs depending on the type of used water trap (adult/child or neonate) and sampling line.

- When using a water trap for adult/child, select from [120]/[150]/[200].
- When using a water trap for neonate, select from [70]/[100]/[120].

NOTE

- If the used water trap and the set patient classification does not match, <GAS Check Water Trap Class> will be displayed.
- If <GAS Pump Regulating> is displayed, the gas sampling flow rate may be insufficient. Check the sample line for any blockage or bent. If the message is still displayed, adjust the flow rate.
- Select the appropriate water trap, sampling line, or flow sensor from 2 types according to the patient classification.

♦MG-110, water trap and flow sensor for MG-120.

- Refer to "Chapter 13 Accessories" for the usable water trap, sampling line, or flow sensor. (☞"Anesthetic Gas Concentration Measurement (Manufactured by Mindray Medical Sweden AB)" P13-10)

7 Set the "Wave Clip".

If the gas waveform amplitude exceeds the waveform display area, whether or not to clip the exceeded part can be selected.

- [ON]: The exceeded part of the waveform will be displayed in straight line at the upper or lower scale limit.
- [OFF]: The whole part of the waveform will be displayed even if it exceeds the scale. However, the exceeded part may not be displayed depending on the sweep speed of the waveform displayed above or below the gas waveform.

8 Set the "CO_2 Source Priority".

When MG-110/MG-120 andanesthesia delivery system are simultaneously used, the CO_2 source to prioritize the measurement can be set.

- [Built-in Slot]: CO_2 value measured by the built-in slot will be prioritized.
- [Anesthesia]: CO_2 value measured by the anesthesia delivery system connected as an external device will be prioritized.

9 Set the agent gas label. Select from [Auto]/[ISO]/[SEV]/[HAL]/[ENF]/[DES].

- [Auto]: The label will be automatically set according to the detected anesthetic gas.

10 When the MG-120 series is used, set the respiratory waveform scale.

11 Select ON/OFF for parameter display.

(☞"ECG Parameter Setup" P7-6)

⚠ CAUTION

- When the waveform and numeric data display is set to OFF, the alarm generation and tabular/graphic trend input will also cease.
- When the waveform and numeric data display is set to OFF, the respiration rate measured by the multigas module will not be displayed either.

❑MAC Display

The MAC value (Minimum Alveolar Concentration) can be displayed in the numeric data display area.

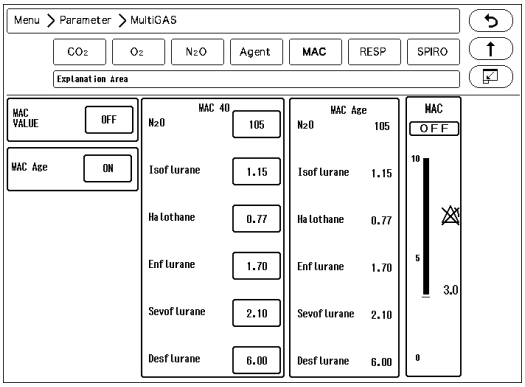
Minimum Alveolar Concentration (MAC) is defined in ISO-80601-2-55 as the concentration of anesthetic at which 50% of patients do not move in response to a surgical stimulus.

NOTE

- The MAC value will be displayed only if [ON] is set for "MAC Value". Perform the setting if necessary.

1 Press the [Menu], [GAS] "Parameter", [MAC] keys.

- The MAC value setup screen will be displayed.



2 Select ON/OFF for "MAC Value".

- [ON]: The MAC value will be displayed in the numeric data display area.
- [OFF]: The MAC value will not be displayed in the numeric data display area.
- To change the displayed default value, enter the value using the numeric keys, and press the key for the corresponding constant.

3 Select ON/OFF for "MAC Age".

- Age compensation can be performed from 1 to 95 years old. Effective MAC range is 0.6 to 1.6.
- [ON]: MAC will be calculated by the compensation formula.
- [OFF]: The measurement will not be compensated.

The MAC value is calculated from the following formula.

$$MAC = \frac{ExN_2O}{x(N_2O)} + \frac{ExPAGT}{x(PAGT)} + \frac{ExSAGT}{x(SAGT)}$$

- Ex N_2O: Expired N_2O (%)
- Ex PAGT: Expired Primary Agent (%)
- Ex SAGT: Expired Secondary Agent (%)
- X (N_2O): N_2O Constant
- X (PAGT): Primary Agent Constant
- X (SAGT): Secondary Agent Constant

The MAC value for MAC correction is calculated from the following formula.

$$MAC(age) = \frac{ExN_2O}{K(age)_{N_2O}} + \frac{ExPAGT}{K(age)_{PAGT}} + \frac{ExSAGT}{K(age)_{SAGT}}$$

- Ex N_2O: Expired N_2O (%)
- Ex PAGT: Expired Primary Agent (%)
- Ex SAGT: Expired Secondary Agent (%)
- K (age) N_2O: Age N_2O Constant
- K (age) PAGT: Age Compensation Primary Agent Constant
- K (age) SAGT: Age Compensation Secondary Agent Constant

Age compensation is calculated from the following formula.

$$MAC(age) = MAC_{40} \times 10^{-0.00269\,(age - 40)}$$

Minimum Alveolar Concentration Initial Value

N_2O, Anesthetic	Initial Value
N_2O	104
ISO	1.17
HAL	0.75
ENF	1.63
SEV	1.80
DES	6.60

* Reference for DS-1000 series constant number: “Age-related iso-MAC charts for iso¯urane, sevo¯urane and des¯urane in man [R. W. D. Nickalls and W. W. Mapleson]2003”

BIS Data (BISx)

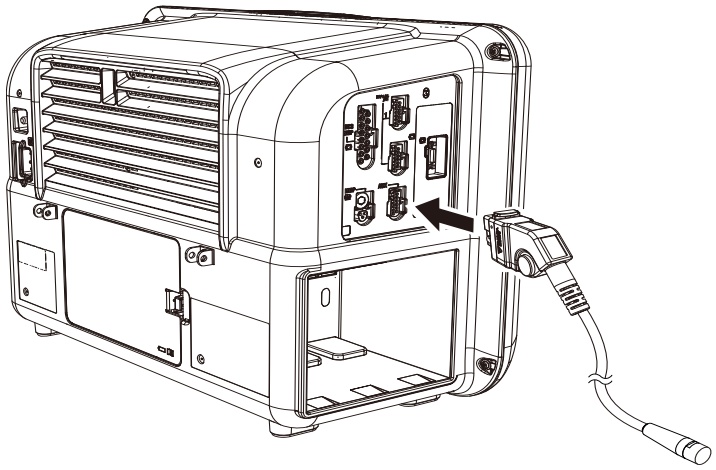
This section explains about the BIS measurement and setup procedure when using the BISx with the

Preparation for Monitoring

By connecting the BISx module, BIS data can be monitored.

1 Select the appropriate sensor for the patient.

2 Connect the BISx to the serial communication connector.



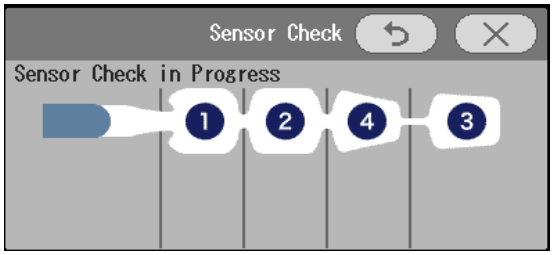
3 Attach the BIS sensor to the patient.

4 When the system detects the sensor, "Sensor Check" window will be displayed, and impedance for all the electrodes will be automatically measured.

REFERENCE

- Pressing the [Sensor Check] key will also start the sensor check process.

▸ The measured results will be displayed on the "Sensor Check" window.



▸ In this display, the impedance value for each electrode, in kilo ohms, appears on the screen along with its status.

- <PASS>: An electrode passes if the impedance for that electrode is less than 7.5 kilo ohms, and the ground electrode (electrode #2) is less than 30 kilo ohms.
- <HIGH>: The impedance value is above 7.5 kilo ohms.
  As long as the combined impedance of electrodes #1 and #3 and the combined impedance of electrodes #1 and #4 are less than 15 kilo ohms, and the ground electrode is less than 30 kilo ohms, the sensor check will be considered successful.
- <LEAD OFF>: The electrode is detached from the patient.
- <NOISE>: The signal from the electrode is outside the measurable range.

NOTE

- During the sensor check process, EEG waveform will become unstable.

5 If the impedance for all the electrodes are within variable range, <Sensor Check Passed> will be displayed on the "Sensor Check" window.

6 (X) Press the key on the "Sensor Check" window to end the sensor check process.

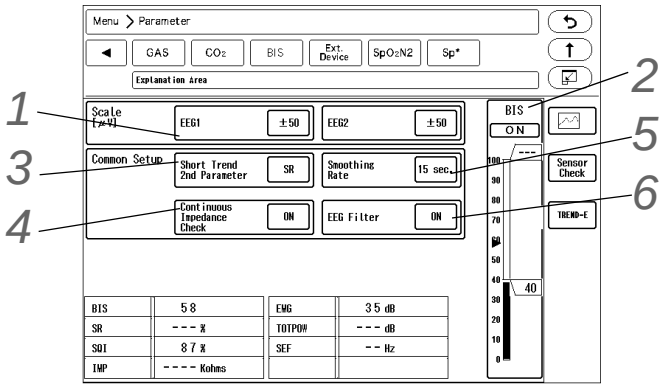
▸ BIS measurement will automatically start when the "Sensor Check" window is closed.

NOTE

- If the "Sensor Check" window is closed before <Sensor Check Passed> is displayed, <BIS Perform "Sensor Check"> will be displayed. Press the [Sensor Check] key and start the sensor check again.

BIS Setup

Press the [Menu], [BIS] keys to display the "BIS" setup screen.



1 Scale

- Select the EEG waveform scale from [±25]/[±50]/[±100]/[±250].

2 Alarm

- Select ON/OFF of BIS alarm and set the alarm limits.

3 Short Trend 2nd Parameter

- Select the second parameter for short trend from [SR]/[EMG]/[SQI].
- Selecting [OFF] will not display the second parameter for short trend.

4 Continuous Impedance Check

- Select whether or not to perform continuous impedance check.
  If [ON] is selected, the check process will continue until it passes.
  Select [OFF] if it affects other measurements.

⚠ CAUTION

- The conductive parts of sensors and connectors should not contact other conductive parts, including earth.
- To reduce the hazard of burns in the high-frequency surgical neutral electrode connection, the BIS sensor should not be located between the surgical site and the electrosurgical unit return electrode.
- The BIS sensor must not be located between defibrillator pads when a defibrillator is used on a patient connected to the patient monitor.
- Continuous impedance checking may need to be disabled if the 1 nA, 128 Hz impedance check signal interferes with other device (e.g., evoked potential monitors).
- Considerations when using Electro-Convulsive Therapy (ECT) device during BIS monitoring: Place ECT electrodes as far as possible from the BIS sensor to minimize the effect of interference. Certain ECT device may interfere with the proper function of the BIS monitoring system.

NOTE

- During the continuous impedance check, the following impedance will be measured.
- A) Combined Impedance of Signal Electrode and Reference Electrode
  This check process will not affect the EEG waveform. If the impedance value is within the allowable range, the check result will not be notified.
- B) Impedance of Ground Electrode
  This check process will be performed every 10 minutes. During this process, <Ground Check in Progress> will be displayed, as artifact interferes to the EEG waveform.

5 Smoothing Rate

- Select from [10 sec.] / [15 sec.]/ [30 sec.].

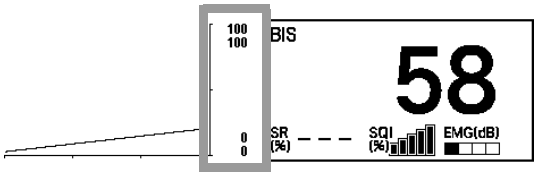
6 EEG Filter

- Select from [ON]/[OFF].

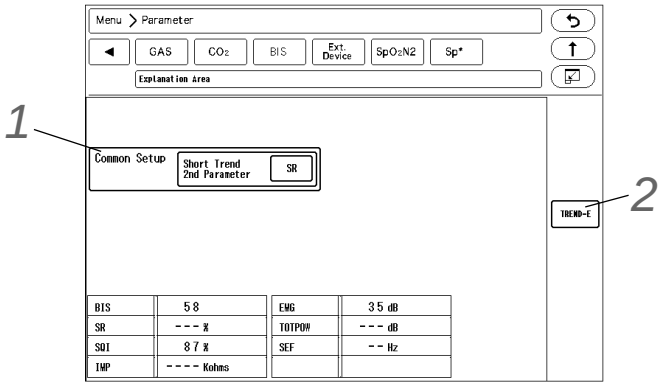
BIS Data (A-2000/A-3000)

This section explains about the BIS setup procedure when using the A-2000 BIS Monitor or A-3000 BIS Vista (Medtronic).

On the BIS setup screen, the second parameter to be displayed on the short trend can be selected.
The first parameter is fixed to BIS value.



Press the [Menu], [BIS] ("Parameter") keys to display the BIS setup screen.



1 Short Trend 2nd Parameter

- Select the second parameter for short trend from [SR]/[EMG]/[SQI].
- Selecting [OFF] will not display the second parameter.

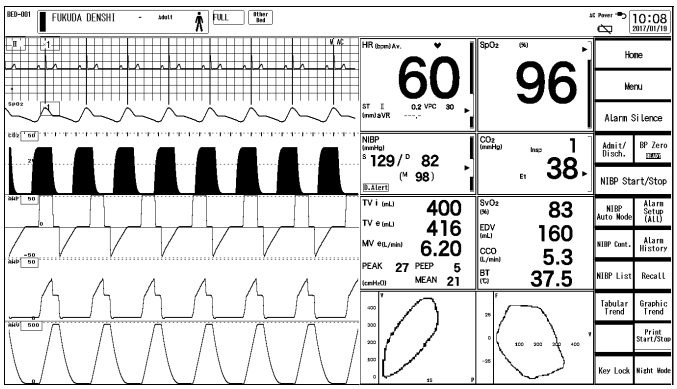
2 Trend E

- Trend E screen will be displayed.

Ventilator

By connecting a ventilator, numeric data and waveform measured by the ventilator can be displayed on the DS-1200 System.
(☞Maintenance Manual "Ventilator Connection" P4-3)

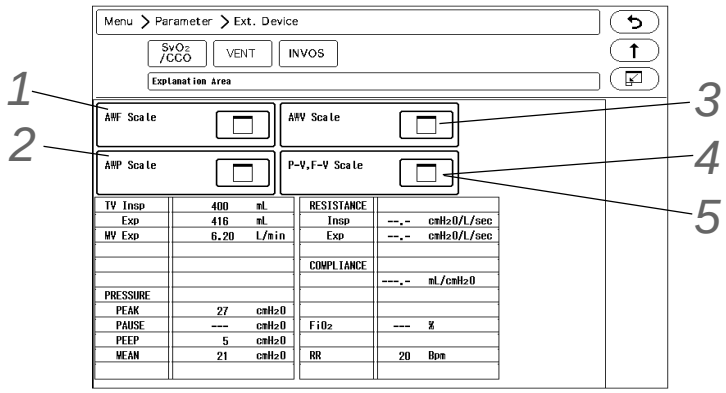
By assigning [P-V/F-V] to numeric data box, P-V (pressure-volume) loop/F-V (flow-volume) loop can be also displayed.



This section explains about the AWP/AWF/AWV scale setup procedure and P-V/F-V screen operation.

AWP/AWF/AWV Scale Setup

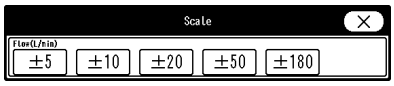
Press the [Menu], [Ext. Device], ("Parameter"), [VENT] key to display the "VENT" screen.
The ventilator measurement will be displayed, and AWF / AWP / AWV / P-V, F-V scale can be set.



REFERENCE

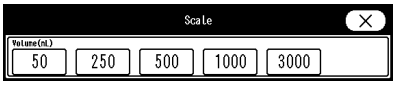
- The scale setup window can be also displayed by pressing the scale on the waveform display area or [Scale] on the user key.

1 Press the key for "AWF Scale", and set the AWF scale.



2 Press the key for "AWP Scale", and set the AWP scale.

3 Press the key for "AWV Scale", and set the AWV (Airway Volume) waveform scale.

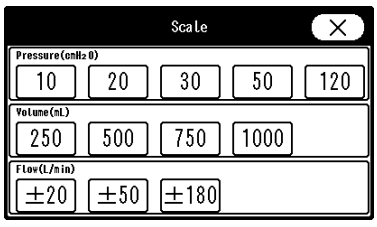


4 Press the key for "P-V, F-V Scale", and set the P-V (Pressure-Volume) scale.

- Pressure: Select from [10]/[20]/[30]/[50]/[120] (cmH_2O).
- Volume: Select from [250]/[500]/[750]/[1000] (mL).

5 Press the key for "P-V, F-V Scale", and set the F-V (Flow-Volume) scale.

- Flow: Select from [±20]/ [±50]/ [±180] (L/min) .
- Volume: Select from [250]/[500]/[750]/[1000] (mL).



P-V/F-V Loop Display

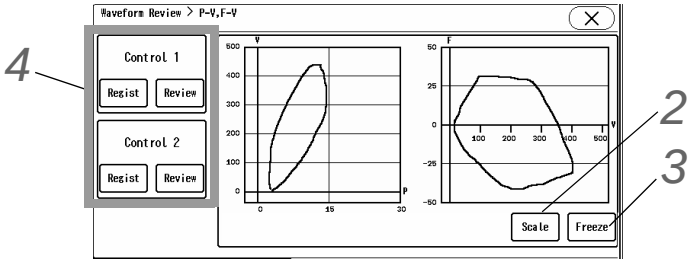
The ventilator data can be displayed in P-V/F-V loop for review.

CAUTION

- For PURITAN-BENNETT ventilator, P-V loop and F-V loop cannot be displayed or printed.

1 Press the P-V/F-V numeric data box.

- The P-V/F-V review screen will be displayed.



- P-V (pressure-volume) loop/F-V (flow-volume) loop is sampled each 60ms and displayed for each respiration. The beginning of the loop is displayed in cyan, and the rest of the loop is displayed in white.
- For the P-V loop, the horizontal axis shows AWP (unit: cmH_2O), and vertical axis shows volume (unit: mL).
- For the F-V loop, the horizontal axis shows volume (unit: mL), and vertical axis shows AWF (unit: L/min).

2 Press the [Scale] key to set the P-V/F-V scale.

- Select the scale from the displayed scale selection window.

3 To stop the loop drawing, press the [Freeze] key.

- The loop drawing will stop.
- Press the [Freeze] key again to resume the waveform trace.

4 A control loop can be registered to see the change in P-V/F-V loop.

- Press the [Regist] key to store the displayed P-V/F-V loop as a control loop.
- Press the [Review] key to display the registered control loop.
  The control loop 1 will be displayed in yellow, and control loop 2 will be displayed in green.

Anesthesia Delivery System Data

The FLOW-i can be connected to the serial port, status port of the DS-1200 System or to the HP-800.
(☞Maintenance Manual "Connection with the FLOW-i" P4-11)
When the FLOW-i is connected, monitoring conditions for CO_2 concentration, anesthetic gas concentration, O_2 concentration, N_2O concentration, and respiration can be set.

⚠ WARNING

- When the numeric data acquired from the anesthesia is displayed, the following alarms cannot be set. Also, these alarms will not generate.
  $InspCO_2/EtCO_2$, $InspO_2/ExpO_2$, $InspN_2O/ExpN_2O$, InspAgent/ExpAgent, MAC, ExpMV, PEAK, PEEP

⚠ CAUTION

- The anesthesia and MG-110/MG-120 cannot be used simultaneously.
- The anesthesia and ventilator cannot be used simultaneously.

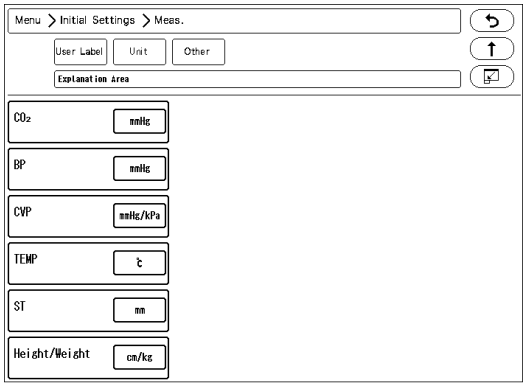
CO_2 Measurement Unit Setup

NOTE

- The CO_2 measurement unit is not linked between the anesthesia and this equipment.
- When the anesthesia is connected, CO_2 alarm cannot be set. Also, the alarm will not generate.

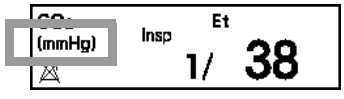
1 Press the [Menu], [Initial Settings], [Meas.], [Unit] keys.

▸ The "Unit" menu will be displayed.



2 Press the [mmHg]/[kPa]/[%] key.

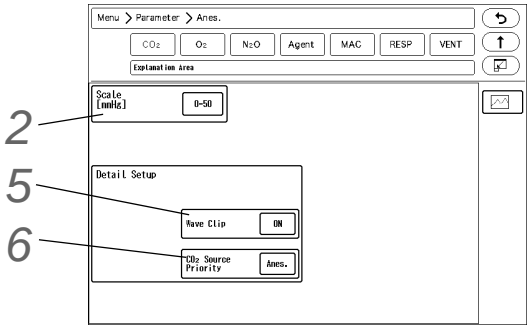
▸ The data of currently set measurement unit will be displayed on the graphic/tabular trend.



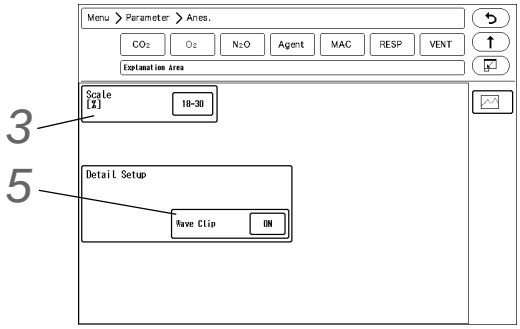
Anesthesia Delivery System Setup

1 Press the [Menu], [Anes.] "Parameter" keys.

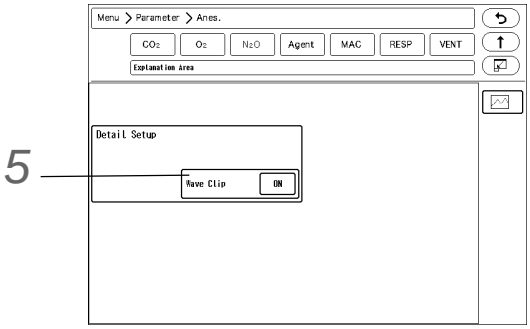
▸ The anesthesia setup menu will be displayed.



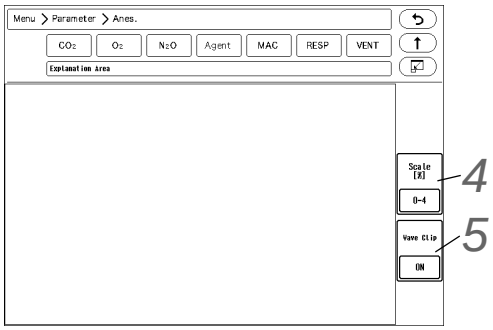
Anes. CO_2 Setup



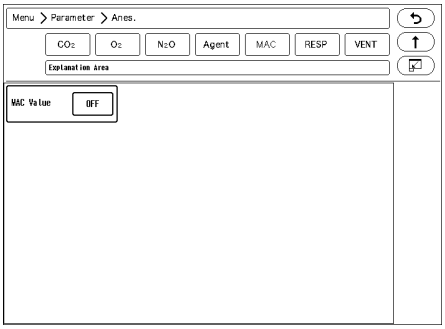
Anes. O_2 Setup



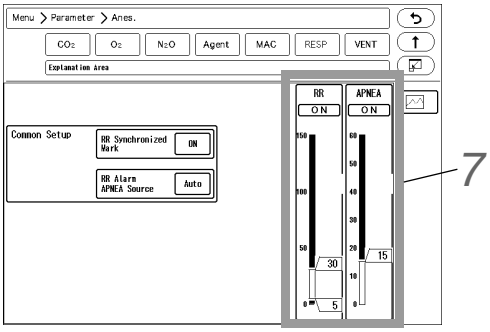
Anes. N_2O Setup



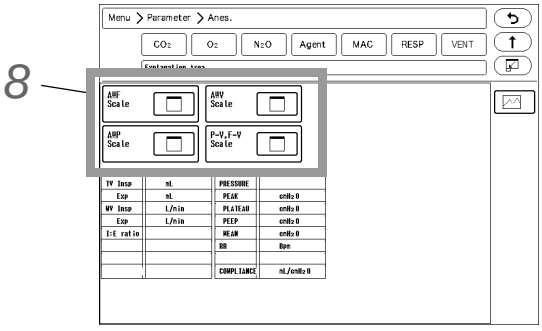
Anes. AGT Setup



Anes. MAC Setup



Anes. RESP Setup



Anes. VENT Setup

2 Set the CO_2 waveform scale.

- Select from [0- 50]/[0- 100] if the measurement unit is mmHg, and from [0- 4]/[0- 8]/[0- 10] if the unit is kPa or %.

3 Set the O_2 waveform scale.

- Select from [18- 30]/[18- 60]/[18- 100]/[0- 30]/[0- 60]/[0- 100].

4 Set the scale for anesthetic gas concentration.

- Select from [0-4]/[0-8]/[0-16].

5 Set the "Wave Clip".

If the gas waveform amplitude exceeds the waveform display area, whether or not to clip the exceeded part can be selected.

- [ON]: The exceeded part of the waveform will be displayed in straight line at the upper or lower scale limit.
- [OFF]: The whole part of the waveform will be displayed even if it exceeds the scale. However, the exceeded part may not be displayed depending on the sweep speed of the waveform displayed above or below the gas waveform.

6 Set the "CO_2 Source Priority".

When Anes. and anesthesia delivery system are simultaneously used, the CO_2 source to prioritize the measurement can be set.

- [Anesthesia]: CO_2 value measured by the anesthesia delivery system will be prioritized.
- [Built-in Slot]: CO_2 value measured by the Multigas Module will be prioritized.

7 Set the RR/APNEA alarm.

(☞"Alarm Limit Setup for Each Parameter" P6-11)

NOTE

- Only the RR/APNEA alarm can be set. The following alarms cannot be set. Also, alarm will not generate.
  $InspCO_2$/$EtCO_2$, $InspO_2$/$ExpO_2$, $InspN_2O$/$ExpN_2O$, InspAgent/ExpAgent, MAC, ExpMV, PEAK, PEEP

NOTE

- Set the upper limit of the RR alarm in the range of 10 to 150Bpm. The upper limit alarm will turn OFF if a value above 150Bpm is set.
  Set the APNEA upper limit in the numeric range of 10 to 60 sec. The upper limit alarm will turn OFF if a value above 60 seconds is set.
- Set the lower limit of the RR alarm in the range of 5 to 145Bpm. The alarm will turn OFF if a value below 5Bpm is set.

REFERENCE

- The adjustable increment for RR alarm depends on the patient classification and "RR Alarm Increment" setting. (Initial Settings>User I/F).

	Alarm Increment (Initial Settings > User I/F)	
	Normal	Small
Adult	5 Bpm increment	1 Bpm increment
Child/Neonate	2 Bpm increment	1 Bpm increment

- The apnea alarm can be set in 1 second increment.

8 Set the respiration waveform scale.

❑MAC Display

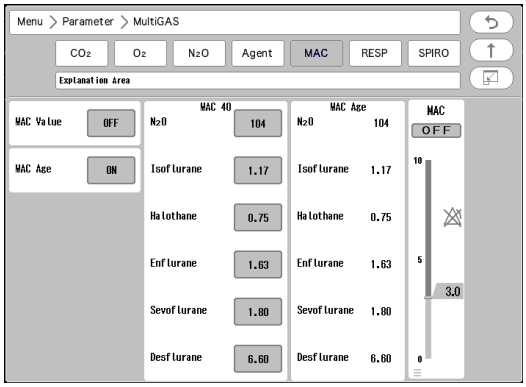
The MAC value can be displayed in the numeric data display area.

NOTE

- The MAC value will be displayed only if [ON] is set for "MAC Value". Perform the setting if necessary.

1 Press the [Menu], [Anes.] "Parameter", [MAC] keys.

▸ The MAC value setup screen will be displayed.



2 Select ON/OFF for "MAC Value".

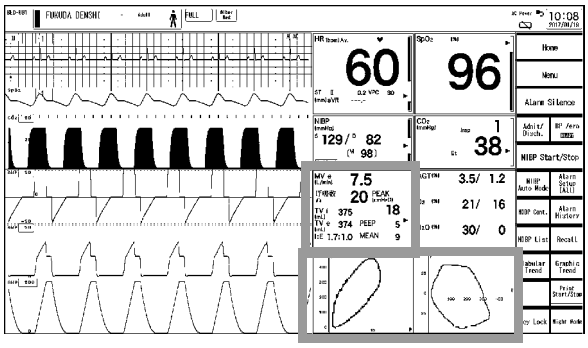
▸ [ON]: The MAC value will be displayed in the numeric data display area.

▸ [OFF]: The MAC value will not be displayed in the numeric data display area.

❑Ventilator Data Display and Setup

By connecting the FLOW-i, the numeric data and waveform measured by the ventilator can be displayed.

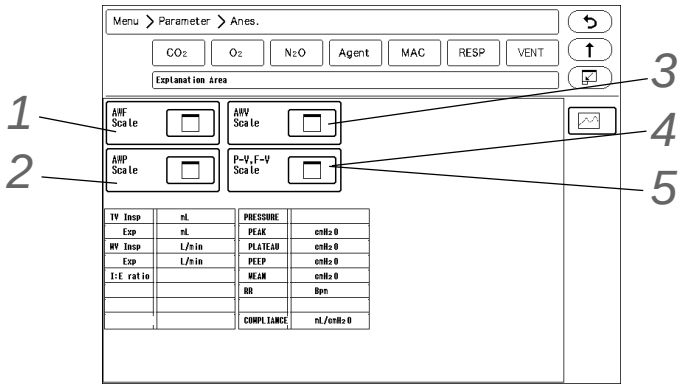
By assigning [P-V/F-V] to numeric data box, P-V (pressure-volume) loop/F-V (flow-volume) loop can be also displayed.



This section explains about the AWP/AWF/AWV scale setup procedure and P-V/F-V screen operation.

Press the [Menu], [Anes.], ("Parameter"), [VENT] key to display the ventilator screen.

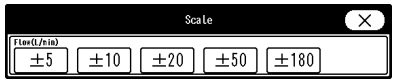
The ventilator measurement will be displayed, and AWF / AWP / AWV / P-V, F-V scale can be set.



REFERENCE

- The scale setup window can be also displayed by pressing the scale on the waveform display area or [Scale] on the user key.

1 Set the AWF scale.



1 Press the key for "AWF Scale".

▸ The scale selection for AWF (airway flow) waveform will be displayed.

2 Select from [±5]/ [±10]/ [±20]/ [±50]/ [±180] (L/min).

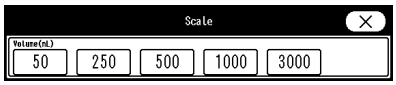
2 AWP Scale

1 Press the key for "AWP Scale".

▸ The scale selection for AWP (airway pressure) waveform will be displayed.

2 Select from [10]/[20]/[30]/[50]/[120] (cmH_2O).

3 AWV Scale

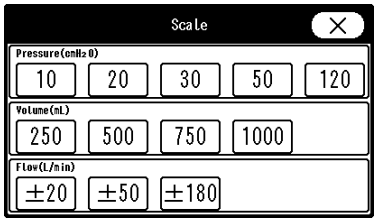


1 Press the key for "AWV Scale".

▸ The scale selection for AWV (airway volume) waveform will be displayed.

2 Select from [50]/[250]/[500]/[1000]/[3000] (mL).

4 Set the P-V Scale.



1 Press the key for "P-V, F-V Scale".

▸ The scale selection for P-V (pressure-volume) loop will be displayed.

2 Pressure: Select from [10]/[20]/[30]/[50]/[120] (cmH_2O).

3 Volume: Select from [250]/[500]/[750]/[1000] (mL).

5 Set the F-V Scale.

1 Press the key for "P-V, F-V Scale".

▸ The scale selection for F-V (flow-volume) loop will be displayed.

2 Flow: Select from [±20]/ [±50]/ [±180] (L/min) .

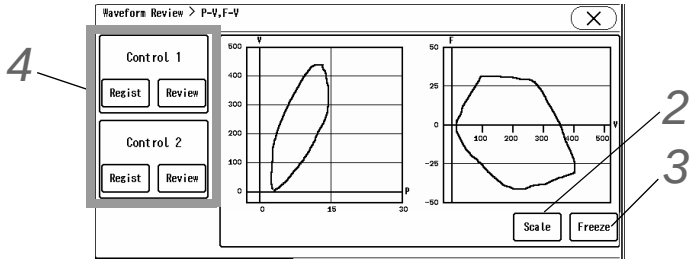
3 Volume: Select from [250]/[500]/[750]/[1000] (mL).

❑P-V/F-V Loop Review

The ventilator data of the FLOW-i can be reviewed in P-V/F-V loop display.

1 Press the P-V/F-V numeric data box on the home display.

- The P-V/F-V review screen will be displayed.



- P-V (pressure-volume) loop/F-V (flow-volume) loop is sampled each 60ms and displayed for each respiration. The beginning of the loop is displayed in cyan, and the rest of the loop is displayed in white.
- For the P-V loop, the horizontal axis shows AWP (unit: cmH_2O), and vertical axis shows volume (unit: mL).
- For the F-V loop, the horizontal axis shows volume (unit: mL), and vertical axis shows AWF (unit: L/min).

2 Press the [Scale] key to set the P-V/F-V scale.

- Select the scale from the displayed scale selection window.

3 To stop the loop drawing, press the [Freeze] key.

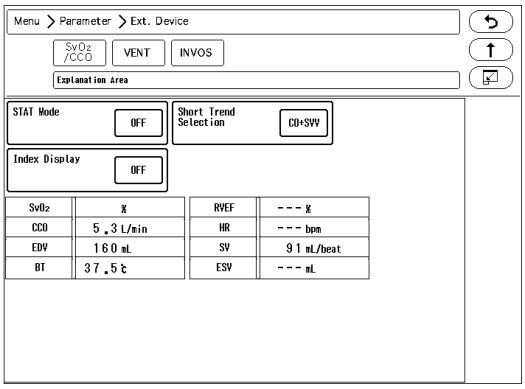
- The loop drawing will stop.
- Press the [Freeze] key again to resume the waveform trace.

4 A control loop can be registered to see the change in P-V/F-V loop.

- Press the [Regist] key to store the displayed P-V/F-V loop as a control loop.
- Press the [Review] key to display the registered control loop.
  The control loop 1 will be displayed in yellow, and control loop 2 will be displayed in green.

SvO_2/CCO Data

The DS-1200 System can display the monitoring data of oximeter/CCO measurement device, Vigilance, Vigilance CEDV, Vigilance II, Vigileo, EV-100 (Edwards Lifescience) or the hemodynamic monitoring device, PiCCO2, PulsioFlex (PULSION Medical Systems).
(☞Maintenance Manual "SvO_2/CCO Monitor Connection" P4-6)
On the SvO_2/CCO data screen, the displayed numeric data can be switched.



Display Example for ICO Mode

STAT Mode: When the Vigilance is in CCO mode, STAT mode display can be set ON or OFF.
Index Display: When the Vigilance is in CCO mode, Index Display can be set ON or OFF.

When the Vigilance is in ICO mode, the 6 latest data of ICO (Intermittent Cardiac Output) and ICI (Intermittent Cardiac Index) will be displayed.

STAT Mode / Index Display

1 Press the [Menu], [Ext. Device] ("Parameter") keys.

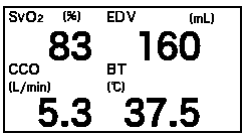
▸ The Vigilance screen will be displayed.

NOTE

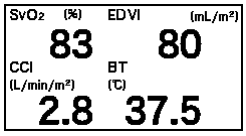
- STAT Mode: When Vigilance is in CCO mode, STAT mode display can be set ON or OFF.
- Index Display: When Vigilance is in CCO mode, Index display can be set ON or OFF.
- When the Vigilance is in ICO mode, the 6 latest data of ICO (Intermittent Cardiac Output) and ICI (Intermittent Cardiac Index) will be displayed.

2 Select [ON]/[OFF] for "STAT Mode" and "Index Display".

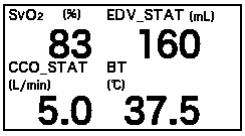
▸ STAT Mode [OFF], Index Display [OFF]: SvO_2 (or $ScvO_2$) , CCO, EDV, BT will be displayed inside the SvO_2+CO numeric data box.



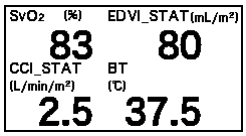
- STAT Mode [OFF], Index Display [ON]: CCI and EDVI will be displayed instead of CCO and EDV.



- STAT Mode [ON], Index Display [OFF]: CCO_STAT and EDV_STAT will be displayed instead of CCO and EDV.



- STAT Mode [ON], Index Display [ON]: CCI_STAT and EDVI_STAT will be displayed instead of CCO and EDV.



NOTE

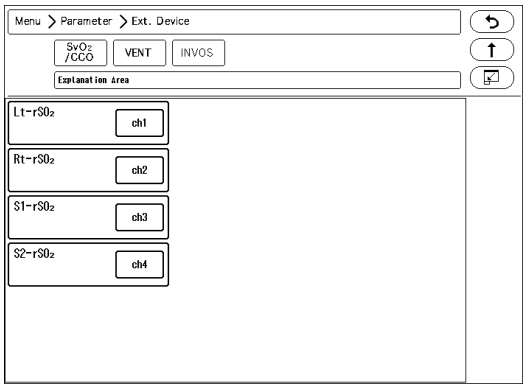
- ON/OFF of STAT mode can be changed only when Vigilance is connected.

INVOS Data

By connecting the INVOS 5100C Cerebral Oximeter (Medtronic), regional cerebral oxygen saturation (rSO_2) can be monitored non-invasively on the DS-1200 System. (☞Maintenance Manual "Connecting to the INVOS" P4-10)

On the INVOS screen (shown on right), the channel can be changed for each INVOS data.

Lt-rSO_2/Rt-rSO_2 data of the selected channel will be displayed inside the INVOS numeric data box.



Channel Number Setup for INVOS Data

In the INVOS numeric data box, measurement data of Lt-rSO_2/Rt-rSO_2 will be displayed.
On the INVOS screen, the channel for Lt-rSO_2/Rt-rSO_2 data can be selected.

1 Press the [Menu], [Ext. Device] ("Parameter"), [INVOS] keys.

- The INVOS screen will be displayed.

2 Press the [ch*] key for the INVOS label ("Lt-rSO_2" / "Rt-rSO_2" / "S1-rSO_2" / "S2-rSO_2") to set the channel.

- The dropdown list will be displayed.

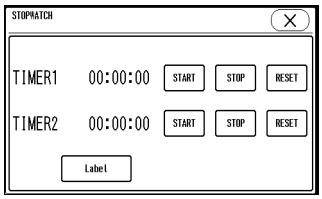
3 Select the channel from [ch1]/[ch2]/[ch3]/[ch4].

Stopwatch

The stopwatch function can be used by setting the [Stopwatch] key on the numeric data box or on the user key.

1 Press the [Stopwatch] key on the numeric data box or on the user key.

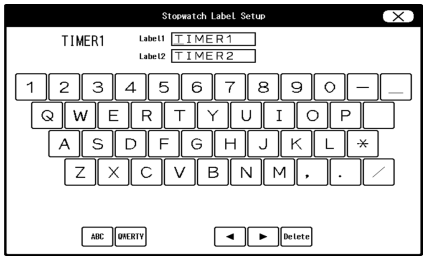
- The "Stopwatch" window will be displayed.



Label Setup

1 Press the [Label] key on the "Stopwatch" window.

- The stopwatch label setup window will be displayed.



2 Enter 8 characters using alphanumeric keypad.

Start/Stop

1 Press the [Start]/[Stop]/[Reset] key on the "Stopwatch" window.

- [Start]: The stopwatch will start.
- [Stop]: The stopwatch will suspend/resume.
- [Reset]: The stopwatch will reset to "00:00:00". If pressed during stopwatch operation, counting will resume from "00:00:00".

NOTE

- If the discharge procedure is performed during stopwatch operation, the counting will stop and will be reset to "00:00:00" .
- The stopwatch counting will continue even when the monitoring is suspended.

Multiparameter Connector Setup for BP, TEMP, CO Measurement

On the Multi Module, multiparameter connectors are provided. The quantity of multiparameter connectors are as follows.

Multiparameter Connectors	Multi Module
2 ports TEMPx4 (maximum) BPx4 (maximum) COx1 (maximum)	HM-800

By using the multiparameter connector, any combination of BP, TEMP and CO measurement can be performed according to the monitoring purpose.
By using the 2ch TEMP relay cable, 2ch BP relay cable, or 2ch BP conversion cable, 2 channels of temperature and BP can be monitored through one multiparameter connector.
By using the Multi Module with the Input Box, up to 8 channels of BP, 8 channels of TEMP and 1 channel of CO can be measured.

The multiparameter connector setup can be performed on the "Initial Settings" menu.
(☞Maintenance Manual "Unit Module Setup" P4-16)

❑HM-800

Combination of BP, TEMP, CO Channels

2 Ports	Blood Pressure	Temperature	CO
Blood Pressure Blood Pressure	4 ch (2ch)	-	-
Blood Pressure Temperature	2 ch (1 ch)	2 ch	-
Temperature Temperature	-	4 ch	-
Blood Pressure CO	2 ch (1 ch)	-	1 ch
Temperature CO	-	2 ch	1 ch

The numbers in parenthesis shows the channels when using the 1ch BP conversion cable.

SI (Shock Index)

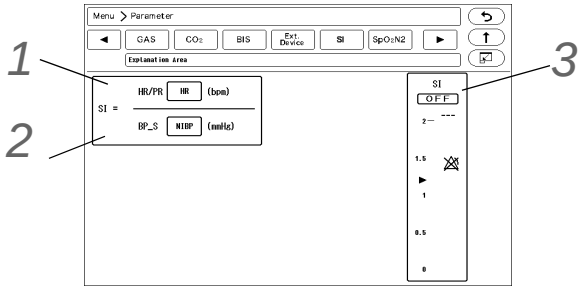
This section explains the procedure and condition for SI measurement.
SI calculation formula:

$$\text{SI (Shock Index)} = \frac{\text{HR [bpm]}}{\text{Systolic Blood Pressure [mmHg]}}$$

NOTE

- When the NIBP erase time has elapsed, NIBP numeric data will be erased, and SI will be also erased at the same time.
- When NIBP measurement ended erroneously, SI will not be calculated.
- When HR/PR, BP_S values are not measured or out of range, SI will not be calculated.
- When the BP measurement unit is kPa, SI will not be calculated.

Press the [Menu], [Parameter], [SI] keys to display the setup window of each parameter.



1 HR/PR Source

Set the [ECG], [SpO_2], [SpO_2xx]or [PR_IBP].

2 BP_S Source

Set the [NIBP] or [IBP].

3 SI Alarm

(☞"Alarm Limit Setup for Each Parameter" P6-11)

NOTE

- Set the upper limit in the range numeric of 0.5 to 2.0 sec. The upper limit alarm will turn OFF if a value below 2.0 is set.

REFERENCE

- The upper limit can be set in 0.1 increments.

Scoring Function

As an index to assist predicting possible sudden health changes for a patient, a score can be calculated based on the patient's medical history, biometric measurements, and the observations performed by the medical professional.

The following score modes can be used. The score mode can be customized by changing the parameters and score thresholds.

- NEWS2
  Improved scoring system of NEWS (National Early Warning Score) which is a scoring system released by NHS (National Health Service) on 2012.
- qSOFA (quick-Sequential Organ Failure Assessment)
  Scoring system to predict organ failure caused by sepsis, etc.

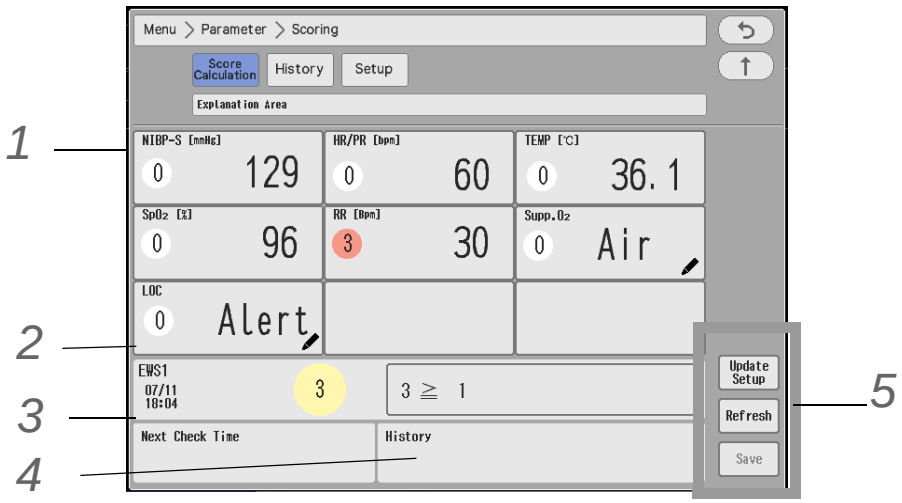
⚠ CAUTION

- A diagnosis should not be made based solely on a patient's score. A comprehensive diagnosis should be performed taking into consideration all of the patient's clinical signs and symptoms.
- NEWS2 cannot be used for patients under the age of 16.

Description of the Scoring Display

Press [Menu > Parameter > Scoring], or press the scoring numeric data box to display the scoring screen.

❑Score Calculation Display



1 Maximum of 9 parameters and scores (0 to 3) will be displayed.

▸ Pressing the parameter display area with mark will allow to enter the values manually.

2 The aggregate score (0 to 27) and calculated date/time will be displayed.
It will be displayed only if measurement data for all parameters are entered.

REFERENCE

- The background color of the score will differ depending on the score value.

- On the right side of the score, an arrow comparing with the previous score will be displayed.
  ↑: Increased from the previous score.
  →: Same with the previous score.
  ↓: Decreased from the previous score.
  An arrow will not be displayed if there is no score history.

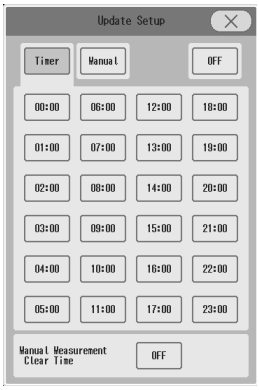
3 The time to check the next score will be displayed. (☞P7-118)

4 3 score history (aggregate score and date/time) will be displayed.

5 Description of Each Key

1 [Update Setup]: The score update timing can be set. (Timer/Manual/OFF)

- [Timer]: Select the time to automatically update. (More than one selection is possible.)
  In addition, select "Manual Measurement Clear Time" . The manually entered data will be deleted after the set time.
- [Manual]: The data will be updated according to the setting of "Time Interval until Next Check" . (☞P7-118)



2 [Refresh]: Aggregate score, individual parameter score, manually entered data will be displayed blank.

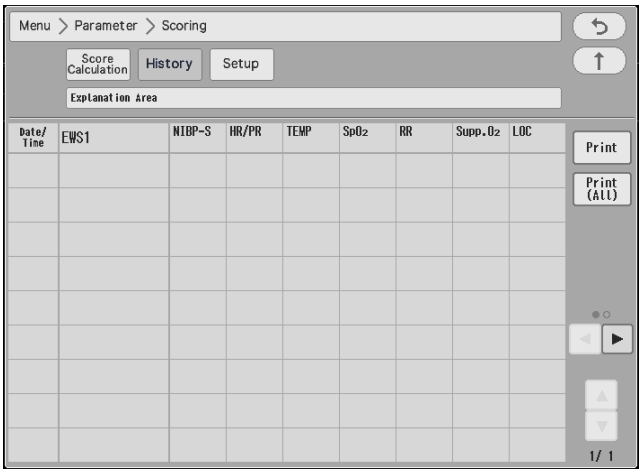
3 [Save]: Numeric data box, score history will be updated.
It will not be displayed when [OFF] is set for [Update Setup].

NOTE

- If the system is connected to a central monitor with a scoring function through DS-LAN, the [Score Mode] and [Update Setup] keys are grayed out and cannot be used.

❑Score History Display

Press [Menu > Parameter > Scoring > History] to display the score history list.

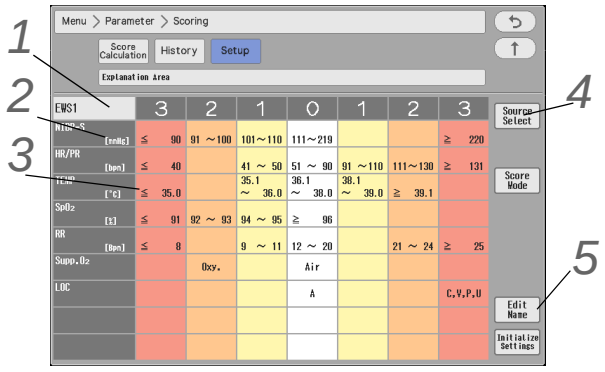


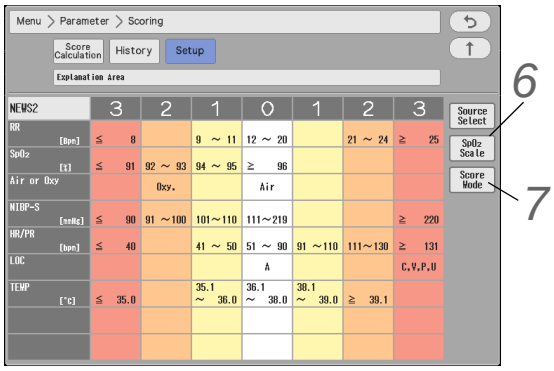
Scoring Setup

Press "Setup" in the scoring screen to display the setup menu. Score mode, parameters, score range can be set.

NOTE

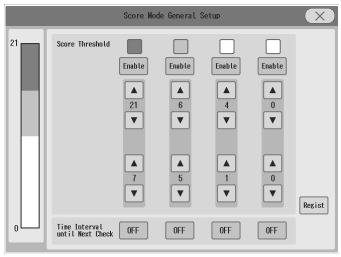
- This setting cannot be made on the bedside monitor if connected by DS-LAN network. The [Settings] key will be grayed out. Perform the setting on the central monitor.
- For the score mode 4 (NEWS2), parameters and score thresholds cannot be changed. Only [Source Select], [SpO_2 Scale] can be set.





1 Press the score mode display area to display the setup window.

- Set the thresholds for aggregate score level (1-4) and the time interval for the next re-evaluation.

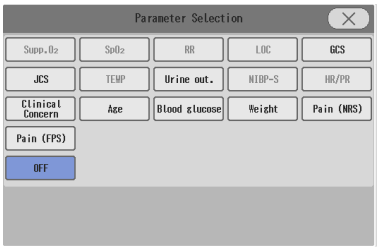


- When the score mode is set to “NEWS 2”, the thresholds for score level and interval until next check will be set as follows and these settings cannot be changed.

Aggregate Score Level	4 (Red)	3 (Orange)	2 (Yellow)	1 (White)
Score Threshold	7 to 21	5 to 6	3 in Single Parameter	0 to 4
Interval until Next Check	15 min.	1 hour	1 hour	12 hours

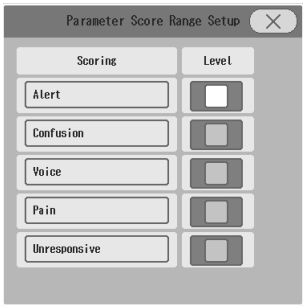
2 Press the parameter display area to display the parameter selection window.

- Select the parameters to be used.



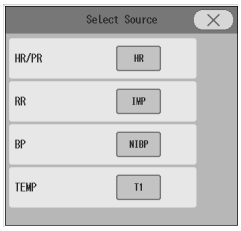
3 Press the score range display area to display the threshold setup window.

- The selection will differ depending on [Choice]/[Numeric]/[Yes/No] selection for "Scoring". The example shown on right is when [Choice] is selected.
  [Choice]: Select the level from the dropdown list.
  [Numeric]: Select Enable/Disable and threshold for each level.
  [Yes/No]: Select Yes/No from the dropdown list.

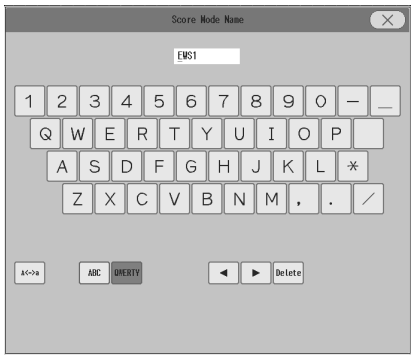


4 Press [Source Select] to display the setup window.

- Select the measurement source for HR/PR, BP, RESP, TEMP.

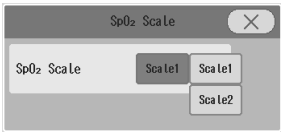


5 Press [Edit Name] to change the score mode name.



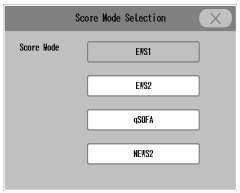
6 [SpO_2 Scale] will be displayed only for score mode 4 (NEWS2).

- Select the SpO_2 scale (Scale 1/Scale 2) from the dropdown list.



7 [Score Mode]: Select the score mode to be used.

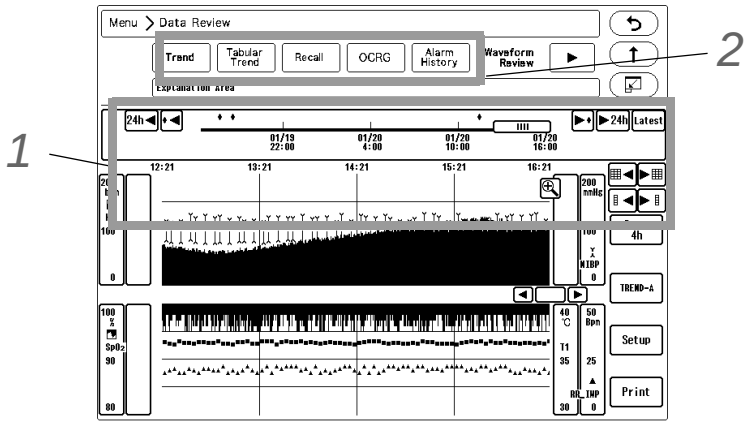
- The name of the score mode can be changed. (☞P7-119)
  EWS1, EWS2, qSOFA, NEWS2 will be displayed by default.



Chapter 8 Review Function

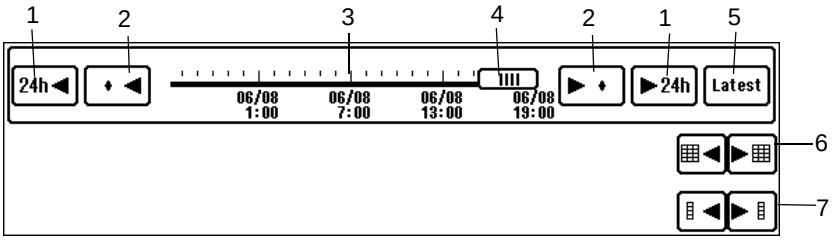
Common Operation

The common operations for all the review screens are explained below.



1 Time Bar

- Changing the time span, scrolling the time, displaying the latest data can be performed.



1 The display can be switched in 24 hours interval.

2 Pressing the [◆◀] / [▶◆] key will move the cursor to the alarm generated time.

3 The time zone for the whole data is shown. ◆ indicates the alarm occurrence point.
The lower row shows the time zone for the displayed data.
Pressing the time bar will display the data at pressed time.

4 Indicates the displayed time range with the bar length.
Dragging the slider to the right will display newer data, and dragging it to the left will display older data.

5 Pressing the [Latest] will display the latest data.

6 Pressing the [▦◀] / [▶▦] will switch the display by page.

7 Pressing the [▮◀] / [▶▮] will switch the display by 1 data/block each.

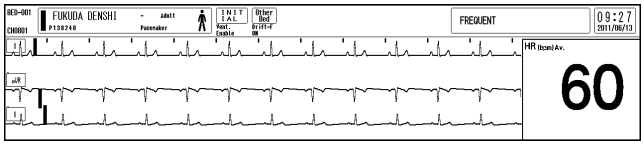
2 Displays other review data at the same time.

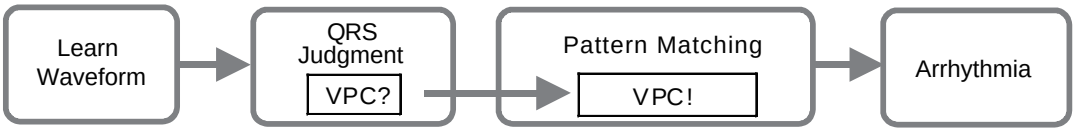
- With the displayed date/time, the review data display can be switched.
  Other review data (graphic/tabular trend) can be displayed without moving the current cursor time.

Arrhythmia Analysis

This section explains about the arrhythmia analysis.

Arrhythmia Definition





The arrhythmia detection is performed by learning the normal waveform of the patient, and determines the VPC by comparing the waveform (QRS pattern) and R-R interval for each heartbeat.
The parameters such as QRS amplitude, QRS width, QRS polarity, RR interval are compared with the normal waveform to extract the abnormal QRS.
Then, the QRS with suspected VPC is pattern matched. The noise and VPC are distinguished to determine the VPC, and generates the arrhythmia alarm.

WARNING

- Objective and constant arrhythmia detection is possible through the fixed algorithm incorporated in this monitor.
  However, excessive waveform morphology change, motion artifact, or the inability to determine the waveform pattern may cause an error, or fail to make adequate detection. Therefore, physicians should make final decisions by closely checking the data obtained by manual printing, alarm printing and recall waveform.

CAUTION

- For stable arrhythmia detection and ECG monitoring, verify proper electrode placement, lead selection, and ECG waveform size. If necessary, turn ON the AC filter.If not properly selected, it may cause erroneous detection.

❑QRS Classification

Each QRS will be classified to the following pattern.

N (Normal)	Normal QRS beat
V (VPC)	Ventricular extrasystole
P (Pacing Beat)	Pacing beat
F (Fusion Beat)	Fusion beat of pacing and spontaneous beat
S (SVPC)	Supraventricular extrasystole
? (Undetermined Beat)	Learning arrhythmia, or unmatched beat

❑Arrhythmia Type

With the QRS judgment, the following arrhythmia alarm will be generated.

Arrhythmia	Description	Detection Criteria
Asystole (Cardiac Arrest)	ON, OFF 3 sec to 10 sec., 1 sec. increments	Cardiac arrest is detected for more than preprogrammed time.
VF (Ventricular Fibrillation)	ON, OFF	A random, rapid electrical activity of the heart is detected.
VT (Ventricular Tachycardia)	ON, OFF	9 or more continuous VPC beats are detected.* 1
Slow VT	ON, OFF	9 or more continuous VPC beats are detected.* 2
Run (Consecutive VPC)	ON, OFF 2 beats to 8 beats, 1 beat increments	Continuous VPC exceeding the preprogrammed value (2 beats to 8 beats) is detected.* 3
Couplet (Couplet SVPC)	ON, OFF	2 continuous VPC beats are detected.
Pause	ON, OFF 1.5 sec. to 5.0 sec.,0.5 sec. increments	Cardiac arrest exceeding the preprogrammed duration is detected.
Bigeminy (Ventricular Bigeminy)	ON, OFF	QRS pattern of V-x-V-x-V-x is detected.* 4
Trigeminy (Ventricular Trigeminy)	ON, OFF	QRS pattern of x-x-V-x-x-V is detected.* 4
Frequent (Frequent VPC)	ON, OFF 1 beats to 50 /min. beats, 1 beat increments	VPC exceeding the preprogrammed value is detected within 1 minute.
Tachy (Tachycardia)	ON, OFF	The upper HR alarm limit is exceeded.
Brady (Bradycardia)	ON, OFF	The lower HR alarm limit is exceeded.
Ext Tachy (Extreme Tachycardia)	ON, OFF 22 beats to 300 beats/ min. 22 bpm to 60 bpm, 1 beat increments 60 bpm to 300 bpm, 5 beat increments	The upper alarm limit of extreme tachycardia is exceeded.
Ext Brady (Extreme Bradycardia)	ON, OFF 20 beats to 295 beats/ min. 20 bpm to 60 bpm, 1 beat increments 60 bpm to 295 bpm, 5 beat increments	The lower alarm limit of extreme bradycardia is exceeded.
R on T (R on T VPC)	ON, OFF 200 ms to 600 ms, 8 ms increments	VPC is detected within the preprogrammed RR interval (200 ms to 600 ms).
Multiform (Multiform VPC)	ON, OFF	2 different forms of VPC beats are detected within 4 minutes.
Vent Rhythm (Ventricular Rhythm)	ON, OFF	Continuous VPC beats with HR below the set value for "HR Lower Limit for Run" (0 bpm to 200 bpm), and same or above value of the set beats for Run (2 beats to 8 beats) are detected.
SVT (Supraventricular Tachycardia)	ON, OFF 2 beats to 10 beats, 1 beat increments	Continuous SVPC exceeding the preprogrammed value (2 beats to 10 beats) is detected.
AFib (Atrial Fibrillation)	ON, OFF 1% to 100%, 1% increments	The variation of the RR interval above the set value continues for fixed amount of time and learned P wave cannot be detected.* 5
Irregular RR (Irregular RR Interval)	ON, OFF 10% to 20%, 5% increments	RR interval variability exceeding the preprogrammed value (10% to 20%) is detected.
Prolonged RR (Prolonged RR Interval)	ON, OFF	RR interval of 1.75 times longer than the normal RR interval is detected.
Pacer Not Capture (Non-Capture)	ON, OFF 80 ms to 480 ms, 8 ms increments	HR is not detected from the pacing pulse within the set duration.

Pacer Not Pacing (Oversensing)	ON, OFF 20 beats to 200 beats/ min. 20 bpm to 150 bpm, 5 beat increments 150 bpm to 200 bpm, 10 beat increments	Pacing pulse and HR are not detected during the set instant HR.
Triplet (Triplet VPC)	ON, OFF	3 continuous VPC beats are detected.
S Frequent (Frequent SVPC)	ON, OFF 1 beats to 50 /min. beats, 1 beat increments	SVPC exceeding the preprogrammed value is detected within 1 minute.
S Couplet (Couplet SVPC)	ON, OFF	2 continuous SVPC beats are detected.
VPC (Ventricular Extrasystole)	ON, OFF	VPC is detected.
SVPC (Supraventricular Extrasystole)	ON, OFF	SVPC is detected.

*1: HR of 120 bpm to 200 bpm (increments of 10ms)

*2: HR of 100 bpm to 180 bpm (It should not exceed the value of HR Lower Limit for Slow VT -20 bpm.)

*3: HR of same or above the set value of "HR Lower Limit for RUN" (0 bpm to 200 bpm)

*4: * indicates N, P, F, ?.

*5: AFib can be detected only when the patient classification is “Adult”. If the patient classification is "Child" or "Neonate", AFib cannot be detected.

Arrhythmia Alarm Setup

Arrhythmia alarm setup procedure is explained below.
ON/OFF of arrhythmia alarm and arrhythmia detection level can be set.
When the measured value exceeds the set arrhythmia detection level, arrhythmia alarm will generate.

Arrhythmia Detection Level Setting

Item	Description
Asystole	3 sec. to 10 sec.
Run	2 beats to 8 beats
Pause	1.5 sec. to 5 sec.
Frequent	1 bpm to 50 bpm/ min.
Ext Tachy	22 beats to 300 beats
Ext Brady	20 beats to 295 beats

Item	Description
R on T	200 ms to 600 ms
SVT	2 beats to 10 beats
Irregular RR	10, 15, 20%
S Frequent	1 beats to 50 beats
Pacer Not Capture	80 ms to 480 ms
Pacer Not Pacing	20 bpm to 200 bpm
AFib	1% to 100%

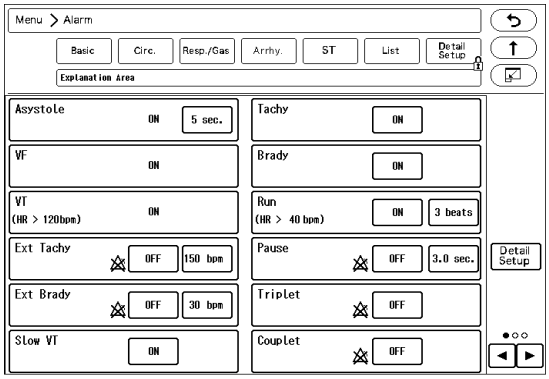
1 Press the [Menu], [Arrhy.] ("Alarm") key.

- The arrhythmia alarm setup screen will be displayed.

2 Set the detection level.
Set using the dropdown list, numeric keys, or displayed key selection.

3 Select ON/OFF for the alarm.

- [ON]: Alarm will generate.
- [OFF]: Alarm will not generate.

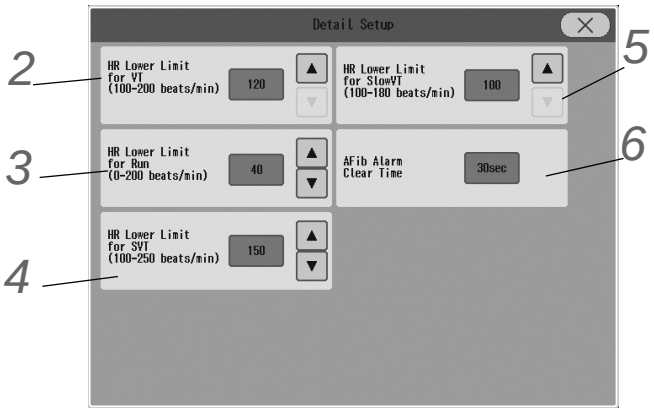


NOTE

- If the patient classification is "Adult" or "Child", Asystole, VF, VT alarm cannot be turned OFF unless [ON/OFF] is selected for "Asystole, VF, VT Alarm" under "Initial Settings".
- If the patient classification is "Neonate", VF, VT can be turned OFF regardless of the setting for "Asystole, VF, VT Alarm" under "Initial Settings".
- If the patient classification is "Child" or "Neonate", AFib cannot be detected..

❑Arrhythmia Alarm Detail Setup

On the "Detail Setup" of arrhythmia alarm, HR Lower Limit for VT, RUN, and SVT can be set.



1 Press the [Menu], [Arrhy.] ("Alarm"), [Detail Setup] key.

- The "Detail Setup" window for arrhythmia alarm will be displayed.

2 Set the "HR Lower Limit for VT".

- VT alarm will generate if the HR is same or above the set value.
  Press the [▲]/[▼] keys for "HR Lower Limit for VT" to set the HR in the range from 120 bpm to 200 bpm.
  Slow_VT alarm will generate when the HR is below the set value.

3 Set the "HR Lower Limit for Run".

- Set the Run analyzing condition for the arrhythmia analysis. Run alarm will generate if the HR is same or above the set value.
- Press the [▲]/[▼] keys for "HR Lower Limit for Run" to set the HR in the range from 0 bpm to 200 bpm.

4 Set the "HR Lower Limit for SVT".

- Set the SVT analyzing condition for the arrhythmia analysis. SVT alarm will generate if the HR is same or above the set value.
- Press the [▲]/[▼] keys for "HR Lower Limit for SVT" to set the HR in the range from 100 bpm to 250 bpm.

5 Set the "HR Lower Limit for Slow VT".

- Set the Slow VT analyzing condition for the arrhythmia analysis. Slow VT alarm will generate if the HR is same or above the set value.
- Press the [▲]/[▼] keys for "HR Lower Limit for Slow VT" to set the HR in the range from 100 bpm to 180 bpm.
- The upper limit can be set up to 20 bpm lower than the HR Lower Limit for VT.

6 Set the "AFib Clear Time".

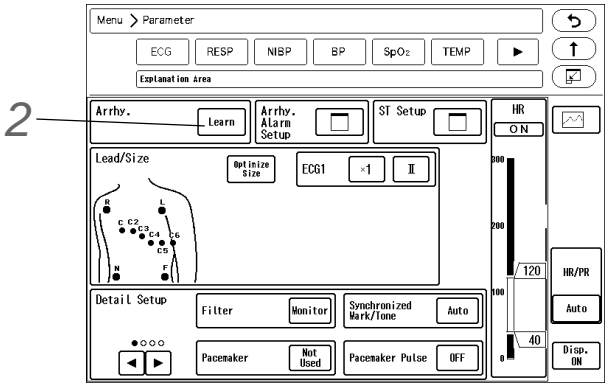
- Set the AFib analyzing condition for the arrhythmia analysis. AFib alarm level will be changed to N (Notification alarm) after the set duration. If [OFF] is selected, the AFib level will not be changed to the notification alarm.

Arrhythmia Learn

Learning the normal ECG largely affects the accuracy of arrhythmia analysis.
If any error occurs in arrhythmia detection and QRS judgment, performing arrhythmia learning will recover the original analyzing accuracy.
Arrhythmia learning will be performed for about 20 beats for the normal ECG, but it may take longer if the heartbeat is unstable.
During arrhythmia learning, arrhythmia alarm other than Asystole, VF, Tachy, Brady, Ext Tachy, Ext Brady will not generate.

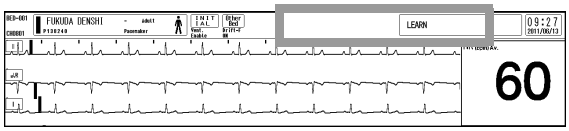
1 Press the [Menu], [ECG] "Parameter" keys.
Or, press the HR numeric data box , and press .

- The ECG setup screen will be displayed.



2 Press the [Learn] key while displayed in gray.

- The key will change to blue.
- Arrhythmia learning will start.
- During arrhythmia learning, a message will be displayed.



NOTE

- If [Used] is selected for "Pacemaker", the [Learn] key will not change to blue and <LEARN> will not be displayed, but the learning process will be performed.
- Pressing the key while arrhythmia learning is in process will not stop the process.

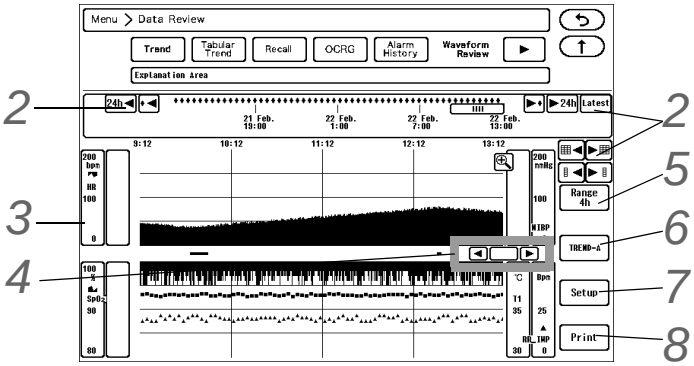
Graphic Trend

This section explains the graphic trend function and printing procedure.
If the numeric data is displayed on the home display, data will be automatically stored and displayed as trend data.

Graphic Trend Setup

1 Press the [Menu], [Trend] ("Data Review") keys.
Or, press the [Graphic Trend] key on the user key area.

▸ The graphic trend will be displayed.

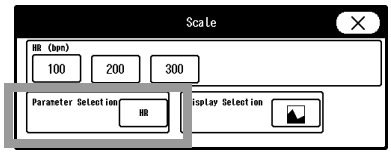


▸ 2 graphs are displayed on each page, and graphic trend of 4 parameters can be displayed simultaneously on each graph.

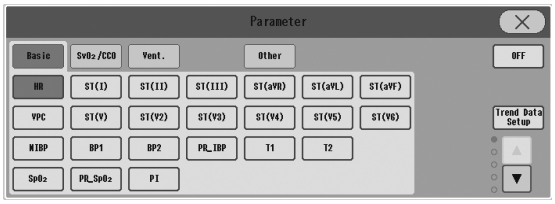
2 Changing the time span, scrolling the time, displaying the latest data
(☞"Common Operation" P8-1)

3 Set the parameter, display type, scale.

1 Press the scale area for each parameter, and display the scale selection window.



2 Press the key for "Parameter Selection", and select the parameter.



NOTE

- The selected parameter will be also registered for the trend group.
- The APNEA duration will be stored when it exceeds the upper alarm threshold level. If lower than the alarm threshold level, it will be stored as "0 (zero)".

3 Select the scale.

4 Press the key for "Display Selection", and select the display type.

4 Move the cursor.

1 ◀ ▶ Pressing the center part of will display the trend data at the cursor position.

2 The cursor will move to left and right by dragging.

3 ◀ Press / ▶ to adjust the cursor position.

▸ The data display at cursor position will be automatically erased after fixed duration.

4 Press to display the 10-minute trend data before and after the cursor position.

5 Press to return the display to the previous time range.

5 Set the display range.

REFERENCE

- The displayed data is compressed as follows depending on the display interval.
  VPC: Maximum value within the display interval
  APNEA: Maximum value within the display interval
  Other than above: Latest value within the display interval
  For example, if the 24-hour trend for the parameter with minimum resolution of 1 minute is displayed, one mark will be displayed for the 12-minute (720-second) data.
- If the display resolution is higher than the minimum resolution of the data, the same data is repeated to match the display resolution.
  Refer to the following table for resolution. The data resolution differs according to the parameter.

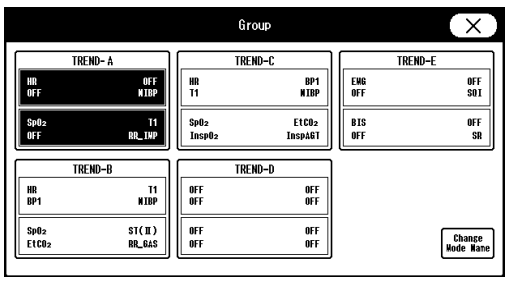
Display Resolution

Time Span	Minimum Resolution	
	Line Display	Mark Display (Mark: Small)
	10 sec. Sample	10 sec. Sample
10 min.	10 sec.	10 sec.
1 hours	10 sec.	30 sec.
2 hours	10 sec.	60 sec.
4 hours	20 sec.	120 sec.
8 hours	40 sec.	240 sec.
12 hours	60 sec.	360 sec.
16 hours	80 sec.	480 sec.
24 hours	120 sec.	720 sec.

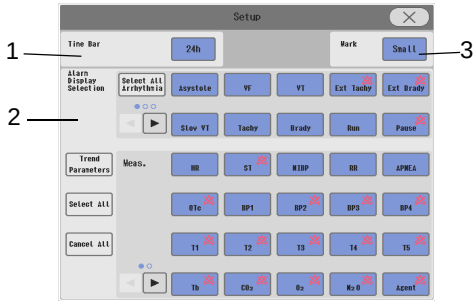
6 Press the [Trend Group] key to change the trend group.
Maximum of 5 groups with 8 parameters each can be registered, and can be selected according to the monitoring purpose.

1 Select the group.

2 To change the name of trend group, press the [Change Name] key. (☞"To Enter Characters" P3-24)



7 Perform the setup for the graphic trend display.



1 Time Bar

- Select the time bar display interval from [4h]/[8h]/[12h]/[16h]/[20h]/[24h]/[36h]/[48h].

2 Alarm Display Selection
Select the alarm display status.
If the alarm for the selected arrhythmia, parameter is generated during the displayed time range, it will be indicated in red at the alarm status display area.

- [Trend Parameters]: The displayed trend parameters will be selected.
- [Select All]: All parameters including arrhythmia will be selected.
- [Cancel All]: All selections will be canceled.
- [Select All Arrhythmia]: All arrhythmia will be selected.
- Each parameter key: Each time the key is pressed, selected/unselected status will change.

3 Mark

- Select the mark size on the graphic trend from [Small]/[Big].

8 Press [Print].

- To print the trend data, press the [Print] key, select the parameter, and press the [Enter] key.

Description for Each Parameter

Numeric Data	Description	Scale	Unit
HR	HR	100, 200, 300	bpm
VPC	VPC Counts	20, 50, 100	-
ST (I, II, III, aVR, aVL, aVF, V1 to V6)	ST Level (Absolute Value or Relative Value)	±0.2, ±0.5, ±1.0, ±2.0	mV
		±2, ±5, ±10, ±20	mm
SpO_2-1, SpO_2-2	SpO_2 Value	0 to 100, 50 to 100, 80 to 100	%SpO_2
PR_SpO_2-1, PR_SpO_2-2	SpO_2 Pulse Rate	100, 200, 300	bpm
RR_SpO_2	SpO_2 Respiration Rate	50, 100, 150	Bpm
NIBP	NIBP Value (SYS / DIA)	100, 150, 200, 300	mmHg
		16.0, 20.0, 24.0, 40.0	kPa
BP1~8	Blood Pressure (Systolic / Mean / Diastolic)	20, 50, 100, 150, 200, 300	mmHg
		4.0,8.0,16.0,20.0,24.0,40.0	kPa
		20, 40	cmH_2O
PDP	Peak Diastolic Pressure of IABP	20, 50, 100, 150, 200, 300	mmHg
		4.0,8.0,16.0,20.0,24.0,40.0	kPa
CPP	Cerebral Perfusion Pressure	20, 50, 100, 150, 200, 300	mmHg
		4.0,8.0,16.0,20.0,24.0,40.0	kPa

Numeric Data	Description	Scale	Unit
PAP	Pulmonary Artery Pressure	20, 50, 100, 150, 200, 300	mmHg
		4.0,8.0,16.0,20.0,24.0,40.0	kPa
PR_IBP	BP Pulse Rate	100, 200, 300	bpm
SI	Shock Index	2.0, 3.0	
T1 to 8	Temperature	20.0 to 45.0, 30.0 to 40.0	°C
Tb	Blood Temperature (Cardiac Output Measurement)	20.0 to 45.0, 30.0 to 40.0	°C
ΔTEMP-A to D	Temperature Difference	±10.0, ±25.0	°C
RR_IMP	Impedance Respiration Rate	50, 100, 150	Bpm
Apnea	Apnea Duration (Impedance, CO_2, Ventilator)	15, 30, 60	s (second)
$EtCO_2$, $InspCO_2$[*1]	Gas Unit CO_2 Concentration	50, 100	mmHg
		4.0,8.0,10.0	kPa, %
$ExpO_2$, $InspO_2$[*1]	Gas Unit O_2 Concentration	50, 100	%
$ExpN_2O$, $InspN_2O$[*1]	Gas Unit N_2O Concentration	50, 100	%
RR_GAS[*1]	Gas Unit Respiration Rate	50, 100, 150	Bpm
ΔO_2[*1]	ΔO_2	3.0,6.0,9.0	%
ExpAGT, InspAGT[*1]	Gas Unit Agent Concentration	4.0,8.0,10.0	%
MAC[*1]	Minimal Alveolar Concentration	2.0, 5.0	-
BIS	Bispectral Index (BIS Monitor Measurement)	25, 50, 75, 100	-
SR	Suppression Ratio (BIS Monitor Measurement)	25, 50, 75, 100	%
EMG	Electromyography (BIS Monitor Measurement)	30 to 80	dB
SQI	Signal Quality Index (BIS Monitor Measurement)	0 to 100	%
SvO_2[*2]	Mixed Venous Oxygen Saturation	0 to 100, 50 to 100, 80 to 100	%
$ScvO_2$[*2]	Central Venous Oxygen Saturation	0 to 100, 50 to 100, 80 to 100	%
CCO[*2]	Continuous Cardiac Output	6.0, 12.0, 20.0	L/min
CCI[*2]	Continuous Cardiac Index	6.0, 12.0, 20.0	$L/min/m^2$
BT[*2]	Blood Temperature (SvO_2/CCO Monitor)	20 to 45, 30 to 40	°C
RR_VENT	Ventilator Respiration Rate	50, 100, 150	Bpm
SpCO (1, 2)	Carboxyhemoglobin Concentration	20, 40, 100	%SpCO
SpMet (1, 2)	Methemoglobin Concentration	10, 15, 100	%SpMet
SpHb (1, 2)	Total Hemoglobin Concentration	10 to 20, 0 to 25	g/dL
PI(1,2)	Perfusion Index	10, 20	%
PI(1,2)	Pleth Variability Index	30, 60, 100	%
ExpMV[*1]	Expiratory Minute Ventilation Volume	6.0, 12.0, 20.0	L/min
PEAK[*1]	Peak Airway Pressure	10, 20, 50, 100	cmH_2O
PEEP[*1]	Peak End Expiratory Pressure	10, 20, 50, 100	cmH_2O
Lt-rSO_2[*2]	Regional Cerebral Oxygen Saturation	20 to 100	%
Rt-rSO_2[*2]			
S1-rSO_2[*2]			
S2-rSO_2[*2]			

*1: When the FLOW-i or Apollo Anesthesia Delivery System is used, the measurement by the anesthesia will be used.

Numeric Data	Description	Scale	Unit

*2: The external device parameters to be displayed on the graphic trend/tabular trend needs to be selected in advance on the "Trend Data Setup" window ([Data Review>Graphic Trend or Tabular Trend] or [Initial Settings>External Device>Main Unit/HP-800]).

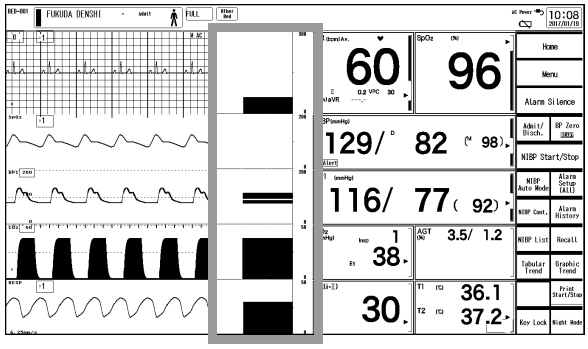
NOTE

- The apnea duration will be stored when it exceeds the upper alarm threshold level. If lower than the alarm threshold level, it will be stored as "0 (zero)".

Short Trend

The trend data can be displayed on the home display.

As the alarm occurrence point on the graph is displayed in red, the alarm data of up to 3 hours (*) can be verified on the home display.
(*: In case when the short trend data resolution is set to [30 sec.].)
Pressing the short trend of an alarm generated parameter will display the recall screen.



The short trend can be displayed for each display layout.

When 12-lead layout is displayed, ST value of each lead can be displayed in short trend.

The short trend display can be turned ON or OFF using the [Short Trend ON/OFF] user key.
(☞"User Key Selection" P10-15)

NOTE

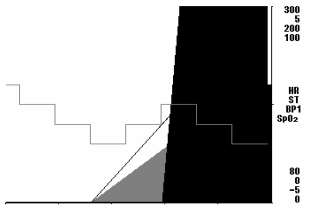
- When the cursor function or reference line function of the short trend is enabled, the alarm condition cannot be displayed.
- When the short trend of multiple parameters are displayed overlapped, only the parameter displayed on top will be displayed in red at alarm occurrence.

❑Selecting the Parameters to be Displayed

The parameters to be displayed can be changed on the "Display Config." menu.
(☞"Display Configuration" P10-1)

Also, by setting the auto display configuration, the short trend parameters can be changed automatically according to the displayed waveforms and numeric data.
(☞Maintenance Manual "Display/Print Setup" P5-12)

Maximum of 4 parameters can be displayed overlapped in the same short trend display area. (shown on right)



❑Changing the Trend Scale and Display Duration

The short trend scale will be displayed on the right or left side of the short trend.

The displayed scale will be in accordance with the scale set on the "Trend" screen.
For the following parameters, the short trend scale can be synchronized with the corresponding waveform scale by selecting [Waveform] for "Short Trend Scale" under [Menu>Display Config.>Detail Setup].

BP, PEAK, VT, CO_2, O_2, Agent

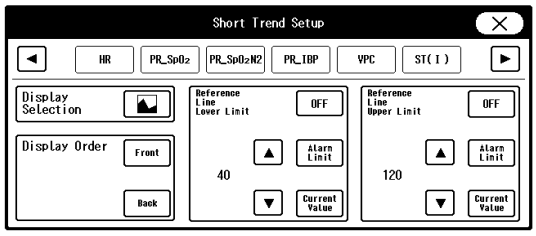
The short trend display width can be selected from 7 levels by pressing the waveform display area.

Also, by setting the "Data Resolution" (5 sec./10 sec./30 sec.) under [Display Config.] > [Detail Setup], maximum display duration (30 min./1 hr./3 hr.) can be changed. The display width can be selected from 7 levels.

❑Changing the Display for Each Parameter

The graph type and display order can be changed for each parameter.

By pressing the short trend scale area, "Short Trend Setup" window (shown on right) will be displayed.



◆"Display Selection"

Select the graph type.

- For example, there are following graph types.
  - Line
  - Filled in with black color from the baseline
  - Filled in with black color between S-D (For BP)
  - Filled in with black color from the top
- [OFF]: Graph will not be displayed.

The displayable graph types will differ depending on the parameter.

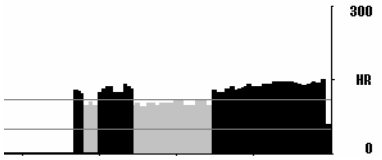
◆"Display Order"

When the parameters are displayed overlapped (ex. short trend overlap, BP overlap), the display order can be selected.

- [Front]: The display will be on the front side.
- [Back]: The display will be on the back side.

❑Displaying the Reference Line

For the short trend of the following parameters, reference lines can be displayed.



- HR (Upper/Lower Limit)
- ST (Upper/Lower Limit) *Only for the ECG1 lead
- BP1 to 4 (Upper/Lower Limit) *S/D/M can be selected for each limit.
- NIBP (Upper/Lower Limit) *S/D/M can be selected for each limit.
- $EtCO_2$ (Upper/Lower Limit)
- SpO_2 (Lower Limit)
- BIS (Upper/Lower Limit)

The data within the reference lines (including the parameters without the reference line display) will be displayed with lower brightness.

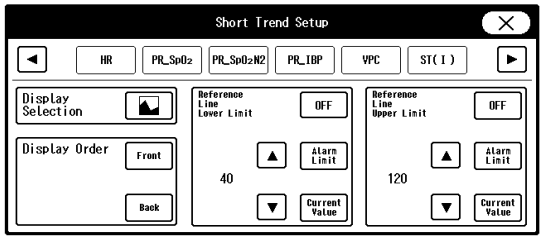
The data outside the reference lines will be displayed with higher brightness.

The reference lines can be displayed by selecting [Enable] for "Reference Line Function". (Menu>Display Config.>Detail Setup)

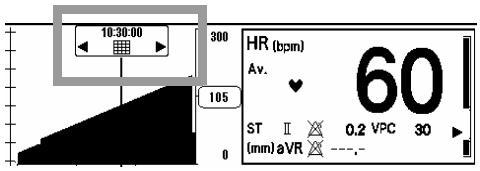
However, it cannot be displayed for the overlapped short trend. And, when the reference line function is enabled, the function to display the alarm occurrence point on the graph in red cannot be used.

When [Enable] is set for "Reference Line Function", ON/OFF and upper/lower limit of reference line display can be selected on the "Short Trend Setup" window for each parameter.

The "Short Trend Setup" window can be displayed by pressing the short trend scale area.



❑Displaying the Cursor



By displaying a cursor, the numeric data and review data at cursor position can be displayed.

The cursor can be displayed by selecting [Enable] for "Cursor Function". (Menu>Display Config.>Detail Setup)

Pressing the short trend display area will display the cursor at the last displayed position (time). If the last displayed position is cleared by scrolling, the cursor will be displayed at the latest data position.

The cursor can be moved by dragging or pressing the short trend display area.

Pressing the center part of 

will display the review data (tabular trend/graphic trend/zoom wave) at the cursor point.
(However, zoom wave can be displayed only when the full disclosure waveform function is enabled.)

The cursor cannot be displayed for the overlapped short trend. And, when the cursor function is enabled, the function to highlight the alarm generated data cannot be used.

When the cursor function is enabled, the function to enlarge/reduce the short trend display area cannot be used.

During the cursor display, the short trend data will not be updated. When the cursor is not used for 10 seconds or when other window is displayed, the cursor will be automatically cleared.

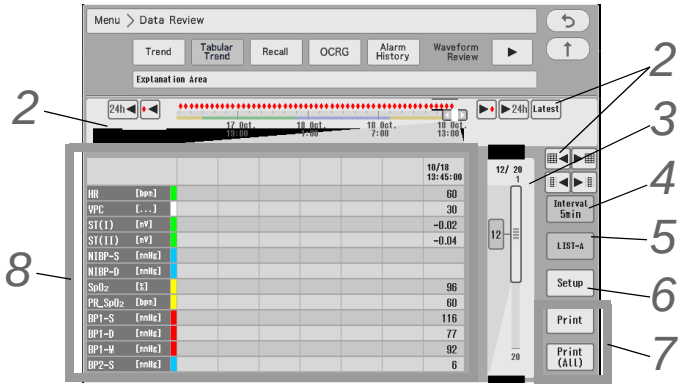
Tabular Trend

This section explains the tabular trend function and printing procedure.
If the numeric data is displayed on the home display, data will be automatically stored and displayed.

To Display/Print the Tabular Trend

1 Press the [Menu], [Tabular Trend] ("Data Review") keys.
Or, press the [Tabular Trend] key on the user key area.

▸ The tabular trend will be displayed.



2 Changing the displayed time, scrolling the time, updating the data
(☞"Common Operation" P8-1)

3 The list will be scrolled up or down to display other parameters.

4 Select the display interval.

[NIBP]: The tabular trend display interval will be according to the NIBP measurement time.

NOTE

- Maximum 240 hours of data will be stored regardless of the time bar display range.
- If the display resolution is higher than the minimum resolution of the data, the same data is repeated to match the display resolution.

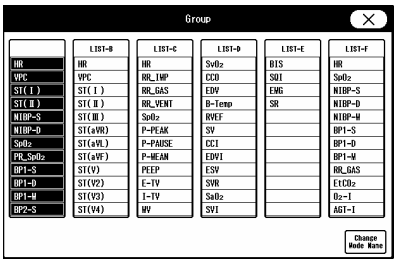
5 Press the [List-x] key to change the tabular trend group.

Maximum of 6 different groups of parameters can be registered according to the monitoring purpose.

1 Select a group from [A]/[B]/[C]/[D]/[E]/[F].

2 To change the name of trend group, press the [Change Name] key.

(☞"To Enter Characters" P3-24)



6 Set the parameters for the tabular trend.

(☞"Parameter Setup for Tabular Trend" P8-15)

7 Press the [Print]/[Print (All)] key.

- [Print]: The currently displayed tabular trend will be printed.
- [Print (All)]: All data for 12 parameters (which fits in 1 page) will be printed.

8 The displayed data time can be scrolled by dragging the data display area.

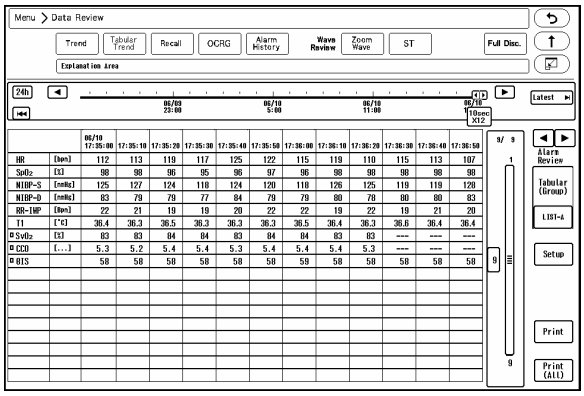
The Description of the Display

Also, if the measured data is not displayed on the home display, or BP zero balance is not performed, the data will not be displayed.

The alarm generated data will be displayed with red background.
The date column of alarm generated data will be also displayed with red background.

NOTE

- The red background will be displayed for the alarm generated parameter.
  The alarm display for the expiratory and inspiratory parameter such as $EtCO_2$ and $InspCO_2$ will be the same.
  For example, if the alarm is generated for BP-S, the background color of BP1-S, BP1-M, BP1-D will be displayed in red.

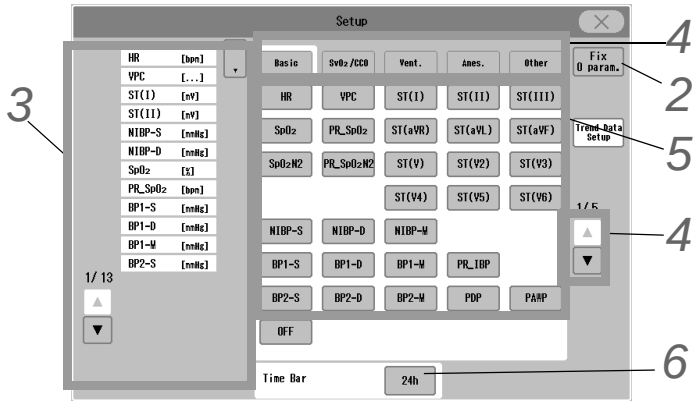


On the left side of the parameter, the color assigned for the corresponding parameter will be displayed.

Parameter Setup for Tabular Trend

1 Press the [Menu], [Tabular Trend] ("Data Review"), [Setup] keys.

- The tabular trend setup screen will be displayed.



2 Press the [Fix x param.] key to set the fixed parameters.

- Select from [0 param.] to [6 param.].
- The selected quantity of parameters will be always displayed on the tabular trend, and these data will be remained displayed even when scrolled.

3 Select the display location for the parameter. The selected location will be displayed with blue frame and will be displayed at the side.

- To change the location, directly press the desired location or drag the key up or down.
- To change the displayed page, press the ▲/▼ keys on the left.

4 Select the parameters.

1 Select the category and displaying page.

- [Basic]/[Hemodynamics]/[Vent.]/[Anes.]/[Other]: The parameters for the corresponding category will be displayed.
- ▲ /▼: The displaying page for the parameters can be selected.

Parameters for each Category

Basic	HR, VPC, ST, SpO_2-1, PR_SpO_2-1, SpO_2-2, PR_SpO_2-2, NIBP, BP1 to 8, QTc, SI, PR-IBP, PDP, PAWP, CPP, T1 to 8, Tb, CO, $EtCO_2$, $InspCO_2$, RR-GAS, RR-IMP, RR-VENT, APNEA, O_2, N_2O, Agent, E-VT, I-VT, E-MV, I-MV, P-PEAK, P-PAUSE, PEEP, P-MEAN, RES, COMP, VT 1sec, I/E RATIO, PI, PVI, SpCO, SpMet, SpHb, PI-2, PVI-2, SpCO-2, SpCO-2, SpMet-2, SpHb-2, SpOC, SpOC-2
Hemodynamics	SvO_2, $ScvO_2$, SaO_2, O_2EI, B-Temp, CCO, CCO-STAT, CCI, CCI-STAT, DO_2, RVEF, RVEF-STAT, VO_2, SV, SV-STAT, SVI, SVI-STAT, SVR, SVRI, SVV, EDV, EDV-STAT, EDVI, EDVI-STAT, MAP, ESV, ESVI, CFI, iCO, iCI, iSV, iSVI, iSVR, iSVRI, GEDV, GEDI, GEF, EVLW, ELWI, PVPI, ITBV, ITBI, VO_2e, VO_2I, VO_2Ie, iB-Temp, SQI, MAP, CVP, HR, PR, SpO_2, iMAP, iCVP, iAvgPR, DO_2I, HGB, dPmx, CO CAL
Ventilator	E-VT, I-VT, MV, SMV, P-PEAK, P-PAUSE, PEEP, P-MEAN, E-RES, I-RES, COMP, FiO_2, P-MIN, S-COMP, D-COMP, S-RR, I/E RATIO, RES, $VTCO_2$, $etCO_2$, VCO_2, Flowee, Ti, Ti/Ttot, PEEPtot, Elastance, Cdyn, D-Chara, Leakage, S-Mve//Mve, Tc, WOBvent, WOBpat, CPAP, P0.1, Edipeak, Edmin, SBI, VT/PBW
Anesthesia Delivery System	Sup.Air, $SupO_2$, $SupN_2O$
Other	BIS, SQI, EMG, SR, SEF, TOTPOW, IMP, Lt-rSO_2, Rt-rSO_2, S1-rSO_2, S2-rSO_2, $tcpO_2$, $tcpCO_2$

NOTE

- The APNEA duration will be stored when it exceeds the upper alarm threshold level. If lower than the alarm threshold level, it will be stored as "0 (zero)".
- The external device parameters to be displayed on the graphic trend/tabular trend needs to be selected in advance on the "Trend Data Setup" window ([Data Review>Graphic Trend or Tabular Trend] or [Initial Settings>External Device>Main Unit/HP-800]).
- The measurement unit of $tcpO_2$, $tcpCO_2$ can be set on the TCM4 or TCM5 FLEX. When the measurement unit is changed, the tabular trend data of $tcpO_2$ and $tcpCO_2$ on the bedside monitor will be deleted.

5 Select the parameter to be displayed for the selected location.

▸ The blue frame will move to one row below.

6 Set the time bar.

▸ Select the time bar display interval from [4h]/[8h]/[12h]/[16h]/[20h]/[24h]/[36h]/[48h].

Recall

This section explains about the recall function and the setup procedure.

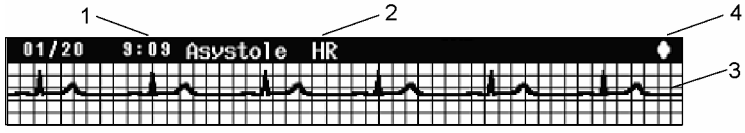
To Display the Recall Waveform

1 Date/Time at Alarm Occurrence

2 Recall Factor

3 Recall Waveform (Compressed: 12 sec.)

4 ◆Mark



When the alarm for the specified recall factor occurs, waveforms (max. 2 waveforms/12 seconds) and numeric data for each recall factor will be stored up to 300 data. On the display selection menu, the data to be displayed can be

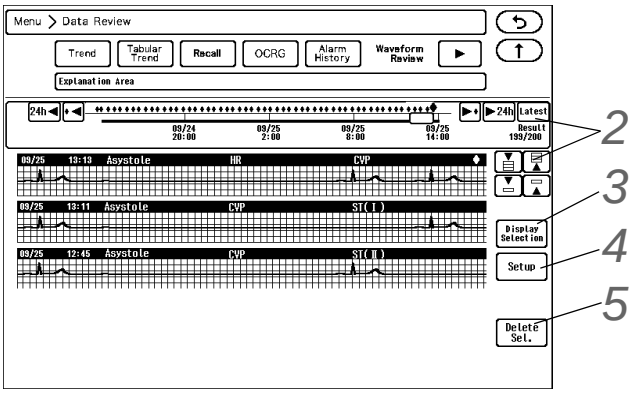
selected from the stored recall data. 5 compressed recall waveforms will be displayed. Pressing the waveform area will display the enlarged waveform.

If the recall data exceeds 300, the data will be erased from the oldest one.

The recall waveform will be acquired from the point prior to alarm occurrence so that alarm-generated point will be displayed at 7 to 8 seconds point on the 12-seconds recall waveform. ◆ mark indicates the alarm generated point.

1 Press the [Menu], [Recall] ("Data Review") keys.
Or, press the [Recall] key on the user key area.

- Recall screen will be displayed.
- 5 compressed waveforms (12 sec. per each waveform) will be displayed.
- The alarm occurrence time, the recall factor occurred at the same time, and the compressed waveform of recall waveform 1 will be displayed.



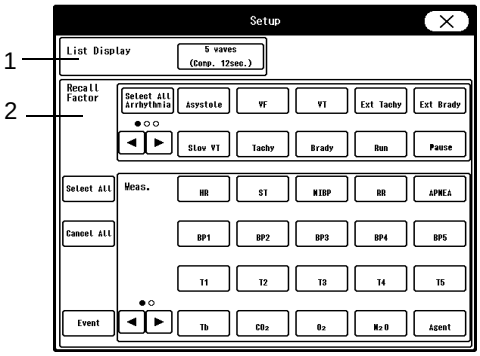
2 Changing the time span, scrolling the time, displaying the latest data
(☞"Common Operation" P8-1)

3 Press the [Display Selection] key to set the recall display.

1 The quantity of waveforms is displayed.

2 Select the recall factor.

- The key will turn blue when pressed to indicate that it is selected as the recall factor.
- [Select All]: All parameters including arrhythmia will be selected.
- [Select All Arrhythmia]: All arrhythmia will be selected.
- [Cancel All]: All selections will be canceled.



NOTE

- The "Display Selection" setting will be also applied to the recall list display on the numeric data display area.
(☞"Extended Function (Recall List)" P3-14)

4 Set the storing condition for recall data.
(☞"Recall Setup" P8-19)

5 Deleting All Recall Waveform

1 Press the [Delete Sel.] key.

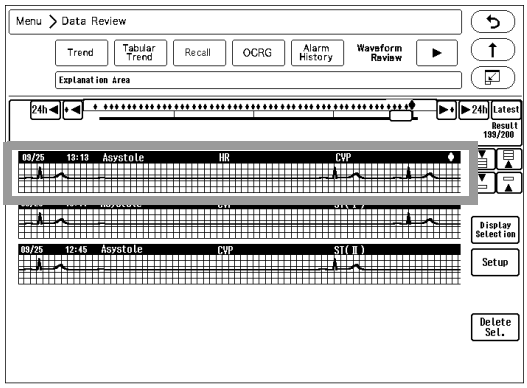
2 Select the parameters to delete. For the selected parameter, "x" will be displayed.
To select all displayed waveforms, press the [Select All] key.
To cancel the selection, select again the parameter with "x" mark. "x" mark will be cleared indicating that it has been removed from the deleting parameter selection.

3 Press [Delete]>[Delete OK] keys to delete the parameters with "x" mark.

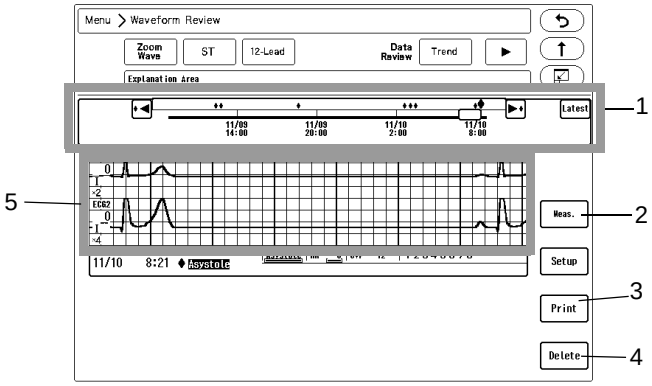
To Display/Print the Enlarged Recall Waveform

On the enlarged recall waveform display, the recall waveform will be displayed in 25mm/s and by using the cursor, the data before and after the alarm occurrence can be checked.

1 Press the waveform display area on the recall screen.



▸ The enlarged recall waveform will be displayed.



1 Shifts the recall waveform display.

2 Measurement

The measurement value will be displayed.

3 Printing the Recall Waveform

The displayed enlarged waveform and numeric data will be printed. The output printer can be selected on the "Manual Printing" setup.
(☞"Printing Setup" P9-1)

4 Deleting the Recall Waveform

The displayed recall waveform will be deleted.

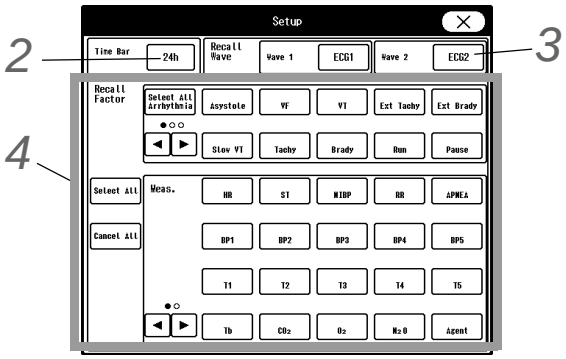
5 The waveform can be scrolled by dragging the waveform area to left and right.

Recall Setup

The storing condition at alarm occurrence can be set for the recall function.
The recall waveform and recall factor (numeric data, arrhythmia) can be selected.

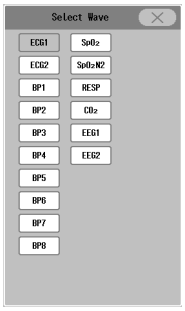
1 Press the [Setup] key on the recall screen.
(☞"To Display the Recall Waveform" P8-16)

▸ The "Setup" window will be displayed.



2 Select the time bar display interval from [4h]/[8h]/[12h]/[16h]/[20h]/[24h]/[36h]/[48h].

3 Select the recall waveform. Up to 2 waveforms can be selected for recall waveform. (shown on right)



4 Select the recall factor.
(☞"To Display the Recall Waveform" P8-16)

NOTE

- The recall waveform will start with the following delay time tracing back from the alarm occurrence.

	Adult	Child	Neonate	
			Numeric Data Alarm	Arrhythmia Alarm
Delay Time	12 sec.	12 sec.	8 sec.	12 sec.

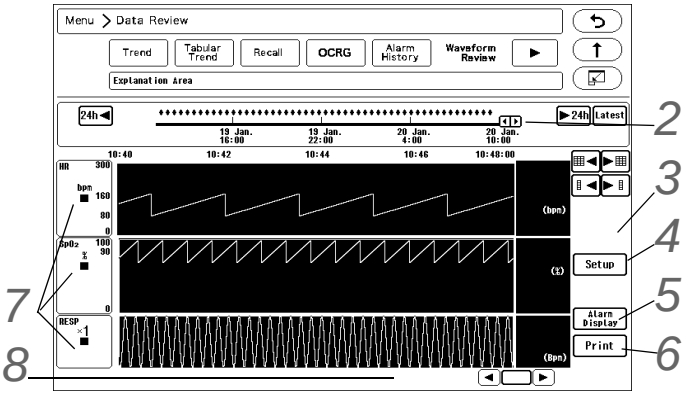
- For the parameters measured on the multigas module, the delay time is 8 seconds.
- For the AFib alarm, the delay time is 30 seconds.

OCRG

This section explains about the OCRG display.
On the OCRG display, compressed respiration waveform, HR trend and SpO_2 trend are displayed simultaneously.
By using the optional SD card, 240 hours of OCRG data can be saved.

1 Press the [Menu], [OCRG] ("Data Review") keys.

▸ OCRG screen will be displayed.



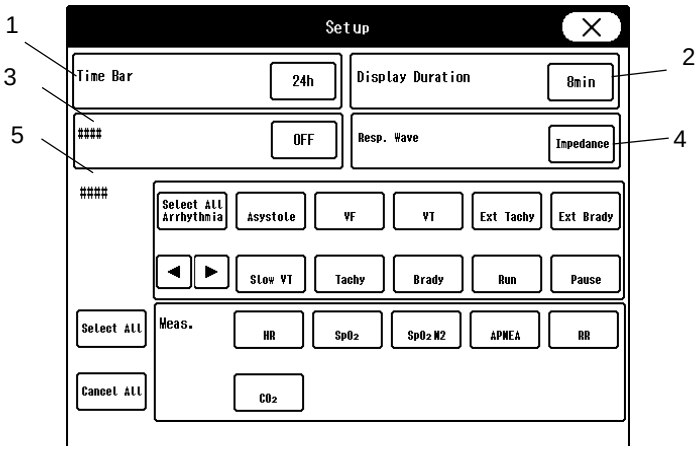
2 [◆◀] / [▶◆] will become effective by using the optional SD card. The cursor will move to the alarm generated time.

3 Real Time Update

Updates the paused OCRG review to the latest time.

4 OCRG Setup

The settings for OCRG can be performed.



1 Time Bar Setup
Select the time bar display interval from [4h]/[8h]/[12h]/[16h]/[20h]/[24h]/[36h]/[48h].

2 Display Duration
Select from [4min]/[8min]/[16min].

3 SpO_2 2ch display
Select from [ON]/[OFF].
ON: SpO_2 2ch will be displayed overlapped in the SpO_2 trend display area.
Displays in order of SpO_2 1ch > SpO_2 2ch.
OFF: Only SpO_2 1ch will be displayed in the SpO_2 trend display area.

4 Respiration Waveform
Select from [Impedance]/[CO_2].

5 Alarm Display Selection
Select the alarm factor to be displayed in the alarm display.

6 CVA Display: ON/OFF
CVA alarms can be displayed in the compressed respiration waveform area of the OCRG.

7 HR Meas. Selection (OCRG)
Select the HR average method to be displayed in the OCRG screen.

NOTE

- This can be set so that OCRG is displayed on its own, separately from the HR (judged as an alarm) that is displayed in the numeric data box.
  Refer to ☞"ECG Parameter Setup" P7-6 for details on HR average methods displayed in the numeric data box.

5 Alarm Display

The color of the alarm occurrence point can be changed for display according to the alarm factor selected on the Setting > Alarm Display Selection.

6 Printing

The currently displayed trend and compressed waveform on the OCRG screen will be printed.

7 Printing Scale, Size

Scale for HR, SpO_2, CO_2 in the trend area and waveform size for compressed respiration waveform can be changed.

Parameter	Size, Scale
HR [bpm]	[0 to 200]/ [0 to 300]
SpO_2 [%]	[0 to 100]/ [50 to 100]
Impedance RESP	[x1/4]/[x1/2]/[x1]/[x2]/[x4]
CO_2 [mmHg]	[0 to 50]/ [0 to 100]
[kPa] [%]	[4]/[8]/[10]

8 Move the cursor.

1 ◀ ▭ ▶ Pressing the center part of ▭ will display the trend data at the cursor position.

2 ▭ The cursor will move to left and right by dragging.

3 ◀ Press / ▶ to adjust the cursor position.
The numeric data on the cursor position will be displayed. The display will not be updated when the numeric data is displayed by the cursor. Press [Real Time] to resume.

Alarm History

This section explains the alarm history function and printing procedure.
The alarm generation of numeric data, arrhythmia, equipment status and change in alarm settings can be stored as alarm history. Maximum of 5000 data can be stored.

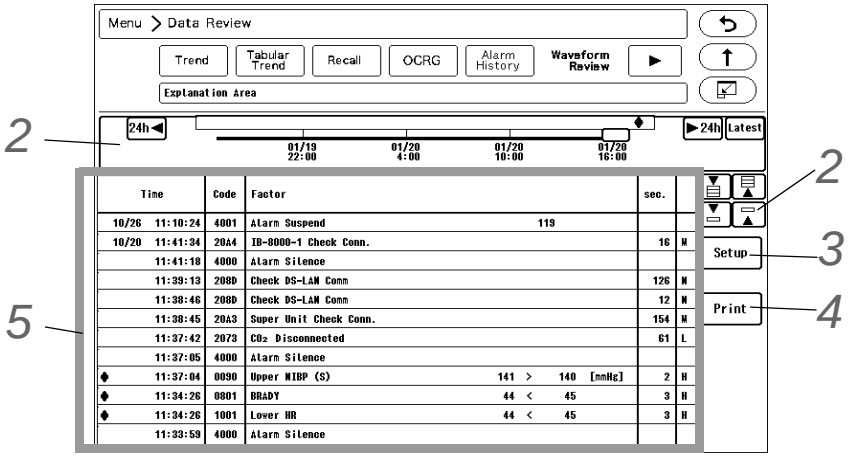
NOTE

- The alarm history cannot be deleted manually. When 5000 data is exceeded, the data will be deleted from the oldest one..

Alarm History Setup

1 Press the [Menu], [Alarm History] ("Data Review") keys.

▸ The alarm history screen will be displayed.



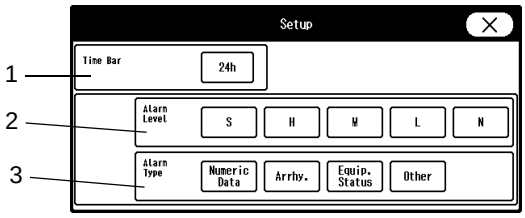
2 Changing the displayed time, scrolling the time, updating the data
(☞"Common Operation" P8-1)

3 Set the alarm history display.

1 Select the time bar display interval from [4h]/[8h]/[12h]/[16h]/[20h]/[24h]/[36h]/[48h].

2 Select the alarm level to be displayed.
The selected item will be displayed in blue.

3 Select the alarm type to be displayed.
The selected item will be displayed in blue.



4 Press the [Print] key.

▸ The currently displayed alarm history will be printed.

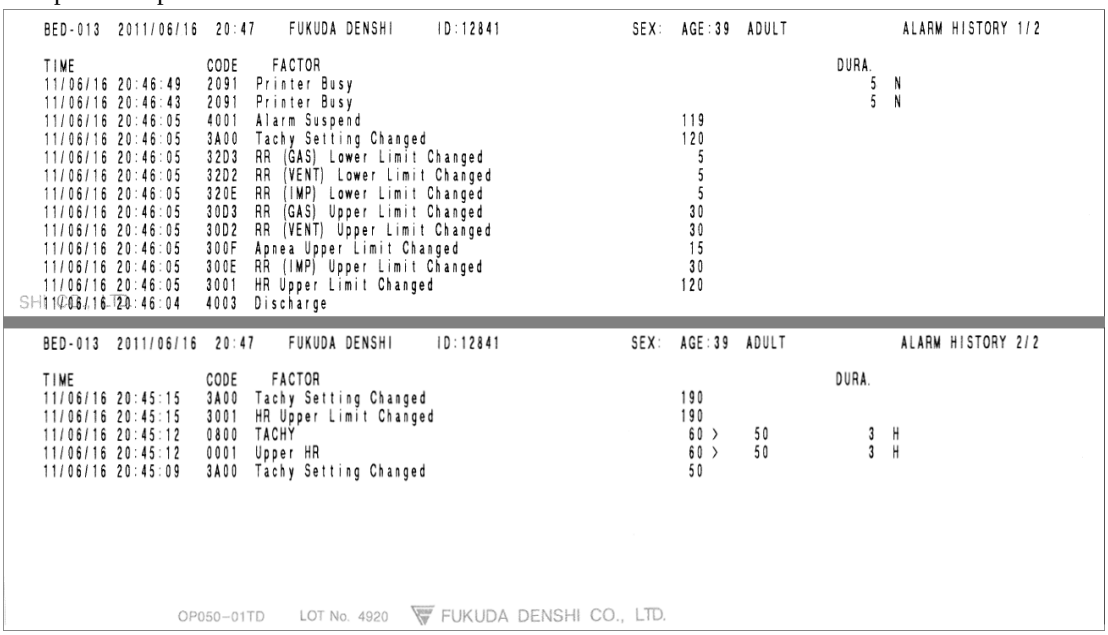
5 The displayed data can be scrolled by dragging the display area up and down.

Description for Each Item

The descriptions of each item are as follows.

Item	Details
Time	The alarm generated time or alarm setting changed time will be displayed.
Code	The code related to alarm generation or alarm setting change will be displayed in hexadecimal.
Factor	The factor for alarm generation and alarm setting change will be displayed.
	In case of numeric data/arrhythmia alarm, the numeric data and alarm setting at alarm generation will be also displayed.
	In case of device status alarm, a detailed code may be also displayed.
	In case of alarm setting change, the changed value will be also displayed.
Duration (sec.)	The duration of numeric data/arrhythmia/device status alarm generation, alarm suspend, monitor suspend, night mode will be displayed in seconds. The maximum displayable value is 99999 sec. It will not be displayed for the alarm setting change.

Print Output Example



BED-013 2011/06/16 20:47 FUKUDA DENSHI ID:12841 SEX: AGE:39 ADULT ALARM HISTORY 1/2

TIME	CODE	FACTOR			DURA.	
11/06/16 20:46:49	2091	Printer Busy			5	N
11/06/16 20:46:43	2091	Printer Busy			5	N
11/06/16 20:46:05	4001	Alarm Suspend	119			
11/06/16 20:46:05	3A00	Tachy Setting Changed	120			
11/06/16 20:46:05	32D3	RR (GAS) Lower Limit Changed	5			
11/06/16 20:46:05	32D2	RR (VENT) Lower Limit Changed	5			
11/06/16 20:46:05	320E	RR (IMP) Lower Limit Changed	5			
11/06/16 20:46:05	30D3	RR (GAS) Upper Limit Changed	30			
11/06/16 20:46:05	30D2	RR (VENT) Upper Limit Changed	30			
11/06/16 20:46:05	300F	Apnea Upper Limit Changed	15			
11/06/16 20:46:05	300E	RR (IMP) Upper Limit Changed	30			
11/06/16 20:46:05	3001	HR Upper Limit Changed	120			
11/06/16 20:46:04	4003	Discharge				

BED-013 2011/06/16 20:47 FUKUDA DENSHI ID:12841 SEX: AGE:39 ADULT ALARM HISTORY 2/2

TIME	CODE	FACTOR				DURA.	
11/06/16 20:45:15	3A00	Tachy Setting Changed	190				
11/06/16 20:45:15	3001	HR Upper Limit Changed	190				
11/06/16 20:45:12	0800	TACHY	60	>	50	3	H
11/06/16 20:45:12	0001	Upper HR	60	>	50	3	H
11/06/16 20:45:09	3A00	Tachy Setting Changed	50				

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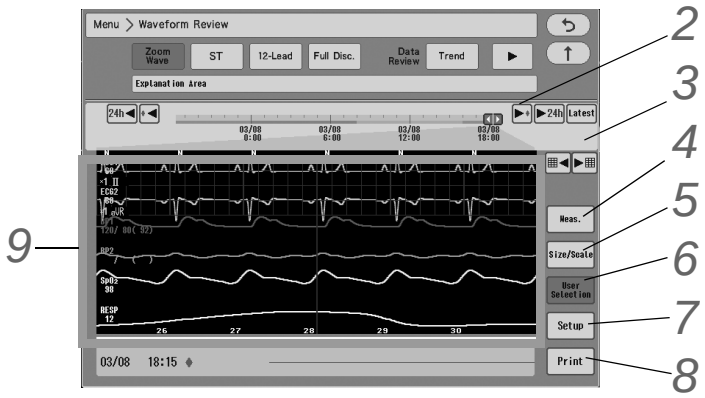
Zoom Wave

This section explains about the "Zoom Wave" window. (When using the optional SD card)
Maximum of 6 waveforms (6 seconds each) can be displayed.
The "Zoom Wave" window can be also displayed by pressing the waveform area on the "Full Disc. Wave" window.
When the SD card (optional) is not inserted, the latest enlarged recall waveform will be displayed.

1 Press the [Menu], [Zoom Wave] ("Waveform Review") key.

▸ The "Zoom Wave" window will be displayed.



2 The waveform of previous/next alarm event will be displayed.

3 Changing the time span, scrolling the time, displaying the latest data
(☞"Common Operation" P8-1)

4 The numeric data of the displayed time will be displayed.

5 The size/scale of the displayed waveform will change.

6 Switch the waveform to display.
[Limb]: Limb lead ECG waveform will be displayed.
[Chest]: Chest lead ECG waveform will be displayed.
[User Selection]: The waveform selected at procedure 6 will be displayed.

7 When [User Selection] is set at procedure 5, select the waveforms to be displayed.

8 The currently displayed waveform will be printed.
On the recorder, 12 seconds of waveform will be printed. The printing range starts from 1 second before the left end of the enlarged waveform.
On the laser printer, 10 seconds of waveform will be printed. The printing range starts from 10 seconds before the left end of the enlarged waveform.

9 The waveform can be scrolled by dragging the waveform area to left and right.

ST Measurement

This section explains about the ST measurement and QT alarm function.

To Display/Print the ST Measurement

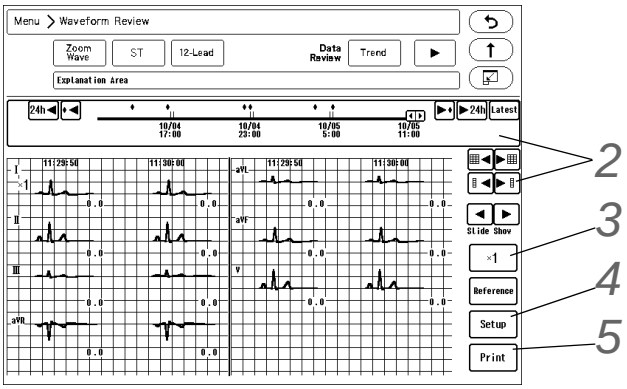
On the ST display, ECG for the selected time duration (10 sec./1 min./5 min./10 min.) will be displayed overlapped in 1 block.
If 3-lead cable is used, maximum of 8 hours of ST waveform will be displayed.

NOTE

- If 3-lead cable is used, the measurement will be performed for only the displayed leads.
- For the following case, ST level will not be displayed.
  - When learning arrhythmia.
  - When the lead is off.
  - When the reference waveform is not set.
  - When "N" or "S" is not detected for QRS within 30 seconds.

1 Press the [Menu], [ST] ("Waveform Review") key.
Or, press the [ST] key on the user key area.

▸ ST screen will be displayed.



2 Changing the displayed time, scrolling the time, updating the data
(☞"Common Operation" P8-1)

3 Changing the Displayed Waveform Size

Select from [x1/4]/[x1/2]/[x1]/[x2]/[x4].The same waveform size will be applied to all the leads. The selected size will not be applied to the ECG waveform on the home display.

4 Changing the Displayed Block Duration

The "Setup" window will be displayed and "Slide Show" (1 sec./5 sec./10 sec./20 sec./30 sec.) can be selected.

REFERENCE

- When 3-lead cable is used, 36 blocks will be displayed. When 4, 5, 10-lead cable is used, 3 blocks for each lead will be displayed.
- The duration of each block can be selected from [10 sec.]/[1 min.]/[5 min.]/[10 min.]. For the selections other than [10 sec.], the overlapped waveform for the selected duration will be displayed.

5 Printing

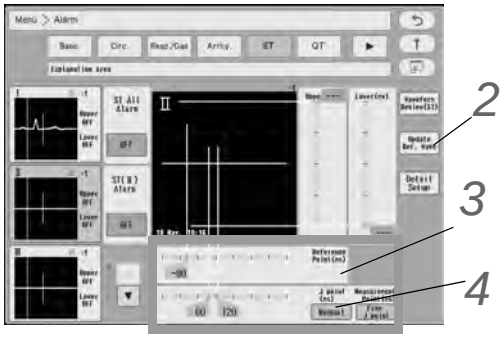
The currently displayed ST waveform will be printed.

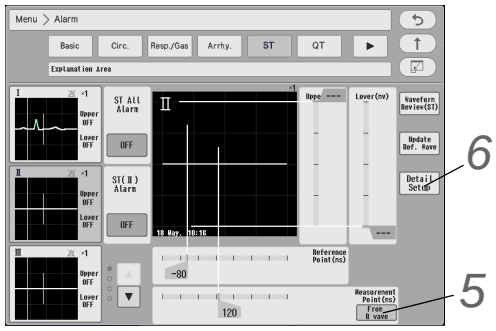
Reference Waveform Setup

The ST reference waveform will be automatically set after learning the arrhythmia.
The reference waveform can be updated manually.

1 Press the [Menu], [ST] ("Alarm") key.

▸ The ST alarm setup screen will be displayed.





2 Update the ST reference waveform. Press the [Update Ref. Wave] key.

⚠ CAUTION

- For the lead which the electrode is detached, the reference waveform cannot be set.Check if the electrode is correctly attached, and perform the setup again.

▸ 16 beats average of the ECG judged as normal QRS by arrhythmia analysis will be set as the reference waveform.

▸ While updating the reference waveform, the [Update Ref. Wave] key will be displayed in blue.

▸ The updated time of the reference waveform will be displayed.

NOTE

- While learning arrhythmia, or if VPC is present, it will take more than 16 beats to set the reference waveform.
- When the electrode quantity is changed, the reference waveform will be automatically updated.
- In case such as when the patient is discharged, the reference waveform will be automatically set.

3 Set the reference point and measurement point.

1 Slide the reference point to right and left using the xxx key.

2 Slide the measurement point to right and left using the xxx key.

NOTE

- Set the reference point in the range of –240 ms to 0 ms in increments of 10 ms from the peak of QRS to the P wave direction.
- Set the measurement point in the range of 0 ms to 560 ms in increments of 10 ms from

the peak of QRS to the T wave direction.

4 The setup for J point can be selected from [Manual] / [Auto].

- When [Manual] is selected.
  The cursor position of the J point can be changed.
  The setup range is 0 (R wave position) to 560 ms. However, the J point cannot be set to right side (larger value) of the measurement point.
  Default value is 60 ms, setup resolution of the J point is10 ms.

- When [Autol] is selected.
  The cursor of the J point will be fixed to the position which calculated from the reference waveform. The cursor cannot be moved manually.
  If J point is located at left side of the measurement point when the setup for J point is changed to [Auto], the measurement point will be moved to the same value as the J point.

5 Setup for Measurement Point

The setup for J point can be selected from [From J point] / [From R wave].

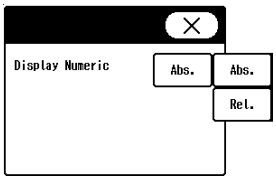
- When [From J point] is selected.
  The numeric value of the measurement point will be displayed with the distance from the J point (ms).
  The measurement point can be set up to the same value as J point.
  If J point is located at left side of the measurement point when the setup for J point is changed from [From R wave] to [From J point], the measurement point will be moved to the same value as the J point.

- When [From R wave] is selected.
  The numeric value of the measurement point will be displayed with the distance from the R wave (ms).
  The setup for J point (the cursor for changing the position, the setup for J point [Manual] / [Auto]) will not be displayed.

6 Detail Setup

Press [Detail Setup] in the "ST" setup to display the setup menu.

- Display Numeric
  Display for the ST measurement value can be switched either [Abs.] (ST) or [Rel.] (ΔST). (Default: Abs.)

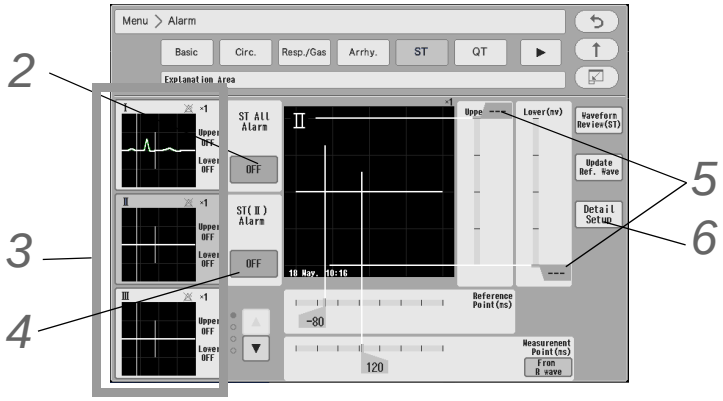


ST Alarm Setup

Set the ST upper limit and lower limit for the reference waveform.

1 Press the [Menu], [ST] ("Alarm") key.

- The ST alarm setup screen will be displayed.



2 Select [ON]/[OFF] for "ST All Alarm" .

- [OFF]: Alarms will not generate even if the alarm for each lead is set to ON.

3 Select the lead to set the alarm limit.

- The selected lead will be displayed large at the right.

4 Select [ON]/[OFF] of ST alarm for each lead.

5 Set the upper and lower alarm limit.

(☞"Alarm Limit Setup for Each Parameter" P6-11)

NOTE

- Set the upper limit in the range of -18mm to +20 mm/-1.8mV to +2.0 mV. Alarm will be set to OFF if a value of +20 mm / +2.0 mV or above is selected.
- Set the lower limit in the range of -20 mm to 18mm/-2.0 mV to 1.8mV. Alarm will be set to OFF if a value of -20 mm / -2.0 mV or lower is selected.

REFERENCE

- The upper and lower limit can be set in 1 mm/0.1 mV increments.

6 The ST level display can be selected from [Absolute Value] / [Relative Value].

12-Lead Analysis (Optional Function)

This section explains about the 12-lead analysis function. By using the 10-electrode cable, 12-lead ECG can be displayed, analyzed, stored, and printed. Maximum of 10 analyzed results can be saved.

WARNING

- The 12-Lead ECG analysis function is designed to acquire and interpret ECG data from a resting, supine patient. If ECG signals from moving or shaking patients are acquired, erroneous 12-lead interpretation result may occur. Always ensure that the patient is kept motionless during 12-lead ECG signal acquisition and analysis.
- The 12-lead ECG analysis function is intended for use with adult and pediatric patients.
- All computerized ECG analysis results should be reviewed by a physician before making decision of the patient treatment.

CAUTION

- Interpretation and Minnesota codes given by this equipment do not instruct the physician as to the kind and degree of cardiac disease. Accordingly, four value judgments are given for ECG waveform and although "abnormal" indicates a large possibility of organic cardiac disease, there are cases where no cardiac disease exists despite an abnormal ECG (that is, an abnormal ECG may be caused by something other than heart).
  On the other hand, care should be taken in the event any preclinical coronary arteriosclerosis could be present despite a normal ECG interpretation.
  Therefore, for a proper diagnosis, the ECG should be integrated with other interpretations.
- ECG Recording by the Mason-Likar System
  The 12-lead ECG recorded with the torso placement of the limb leads (Mason-Likar 12-lead system) may differ from the standard 12-lead ECG. Moreover, waveforms may differ somewhat also in a supine position and a standing position (sitting position).
  We recommend to carry out the recording of the ECG by taking into consideration the waveform differences according to electrode positions or postures.
- About the ECG Analysis Program
  The ECG analysis program is intended to analyze the standard 12-lead ECG waveforms. Therefore, the analyzed result for waveforms recorded with the torso placement of the limb leads (Mason-Likar 12-lead system) may differ from that of the standard 12-lead ECG waveforms.
- When a pacemaker is used, select [Used] for "Pacemaker" under "Admit/Discharge" menu.
- The threshold values for classification of 12-lead ECG interpretation and Minnesota code are set by age and sex as follows.
  1. Male and Female of ages 19 years old and above
  2. Male of age 12 through 18 years old
  3. Female of age 12 through 18 years old
  4. Male and Female of ages 3 through 11 years old
  5. Male and Female of ages below 2 years old
- If no patient information (i.e. Default: "Class.": [Adult], "Sex": undetermined) has been entered, the system algorithm will handle the patient as a "35 years old male".
- Before the analysis, make sure the patient classification ([Adult] / [Child]) is properly selected. If [Neonate] is selected, the 12-lead ECG analysis will not function.
- Enter the age of patient if known. If no age information (i.e. Default: [0]) has been entered, the system algorithm will handle the patient as "35 years old".
- Enter the sex of patient if known. If no sex information (i.e. Default: undetermined) has been entered, the system algorithm will handle the patient as "Male".
- If the patient classification is set as [Child] and no age (i.e. Default: [0]) has been entered, the system algorithm will handle the patient as "less than 2 years old."

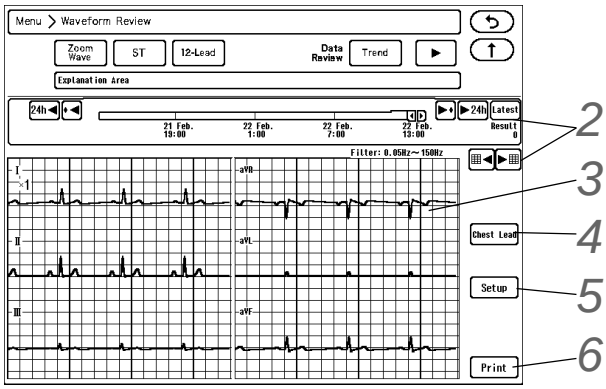
NOTE

- Electrode Placement for 12-Lead ECG Analysis
  When acquiring 12-lead ECG signals, it is recommended to place the limb electrodes anywhere along the arms and legs. (☞"Electrode Placement" P7-2)
  If it is difficult, use the Mason-Likar 12-lead system. To reduce the waveform differences from the standard 12-lead, it is recommended that the torso placement of the RA and LA electrodes be near as possible to each arm, in the infraclavicular fossae, within the area unaffected by myoelectricity.
- When the 12-lead analysis function is enabled on the DS-8007, the function will be also enabled on the DS-8400.

12-Lead ECG Display

1 Press the [Menu], [12-Lead] ("Waveform Review") key.

▸ The 12-lead screen will be displayed.



2 Changing the displayed time, scrolling the time, updating the data
(☞"Common Operation" P8-1)

3 The real-time waveforms are displayed.
The 12-lead analysis will be performed based on the displayed waveforms.

REFERENCE

- A pacemaker pulse will not be displayed on the 12-lead analysis screen even if [ON] is set for "Pacemaker Pulse".

4 The [Chest Lead]/[Limb Lead] keys will switch the display between chest lead and limb lead.

5 Setup
The 12-lead waveform size, filter, analysis method can be set.
(☞"12-Lead Analysis Setup" P8-31)

6 Printing

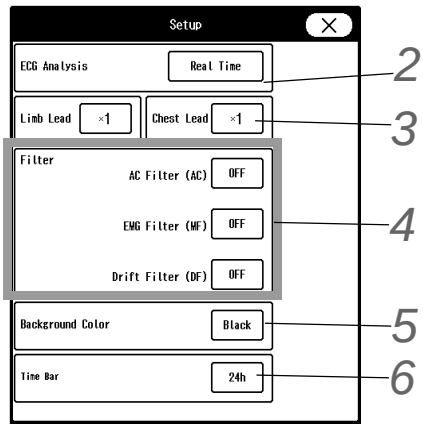
▸ The currently displayed waveform can be printed.

▸ The output printer will be according to the setting made for "12-Lead Waveform" ([Bedside]/[Laser]) under [Manual Printing>Printer Sel. (Graphic Printing)].
(☞"Manual Printing (Other Setup)" P9-6)

12-Lead Analysis Setup

1 Press the [Menu], [12-Lead] ("Waveform Review"), [Setup] key.

- The 12-lead analysis setup screen will be displayed.



2 ECG Analysis

The timing to read the waveform for ECG analysis can be set.

- [Real Time]: The waveform of 10 seconds after the [Start Analyze] key is pressed will be analyzed.
- [Review]: The waveform of 10 seconds before the [Start Analyze] key is pressed will be analyzed.

3 Waveform Size

The waveform size for the real-time waveform displayed on the 12-lead screen can be set.

- Limb Lead: The waveform size for the limb lead can be changed.
- Chest Lead: The waveform size for the chest lead can be changed.

4 Filter

The setup for the AC Filter, EMG Filter, Drift Filter can be performed.

- AC Filter: If AC noise is present, select [ON]/ [OFF] for "AC Filter". If [ON] is selected, cut-off frequency will be 75 Hz.
- EMG Filter: If EMG noise is present, select [Strong (25Hz)]/ [Weak (35Hz)]/ [OFF].
- Drift Filter: If base line drift is present, select [Strong (0.50Hz)]/ [Weak (0.25Hz)]/ [OFF].

⚠ CAUTION

- A baseline or notch will be generated on the ECG waveform (display, print, recall) during the filter setting (up to about 2.4 seconds).
- This equipment complies to the distortion test of EN 60601-2-25 when all the filters are set to OFF. The frequency characteristic is 0.05 Hz to 150 Hz when all the filters are set to OFF.]
- When a pacemaker is used, the baseline fluctuation becomes large and it may be difficult to read the electrocardiogram. Set the drift filter by checking the electrocardiogram.

5 Background Color

The background color for the 12-lead display can be set.

- [White]: Similar display with the electrocardiograph.
  Background Color: White
  Grid Color: Orange
  Waveform Color: Black (Fixed)
- [Black]: Standard color
  Background Color: Black
  Grid Color: Gray
  Waveform Color: Green (Fixed)

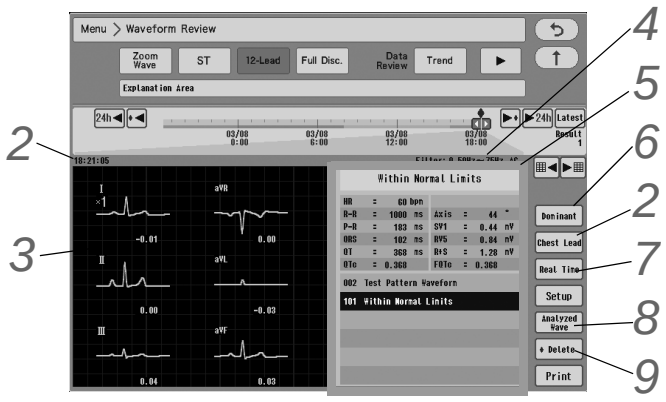
6 Time Bar

Select the time bar display interval from [4h]/[8h]/[12h]/[16h]/[20h]/[24h]/[36h]/[48h].

12-Lead ECG Analysis

1 Press the [Menu], [12-Lead] ("Waveform Review"), [Start Analyze] key.

- When the analysis completes, the analyzed result will be displayed.
  For the analyzed result, dominant waveform and analyzed result will be displayed.
- Abnormal region will be indicated by highlight display.



2 Analyzed Time

- The analyzed time will be displayed.
  During the analysis, [Start Analyze] key will change to [In Progress].
  The analysis can be suspended by pressing the [In Progress] key.

3 Dominant Waveform

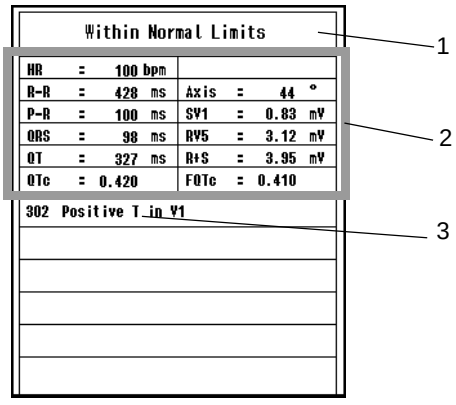
- The reference waveform used for the analysis will be displayed.The dominant waveform is the waveform at the point of ♥mark on the rhythm waveform.
- On the analyzed result, the abnormal lead with the highest grade finding will be highlighted in red.
- The dominant waveform display can be switched by pressing the [Chest Lead]/[Limb Lead] keys.

4 Filter Information

- The filter used for analysis will be displayed.
  The filter display can be selected from frequency or type (AC, MF_ST, etc.).
  (☞Maintenance Manual "Display/Print Setup" P5-12)

5 Analyzed Result

- For the analyzed result, overall judgment, numeric data, finding will be displayed.



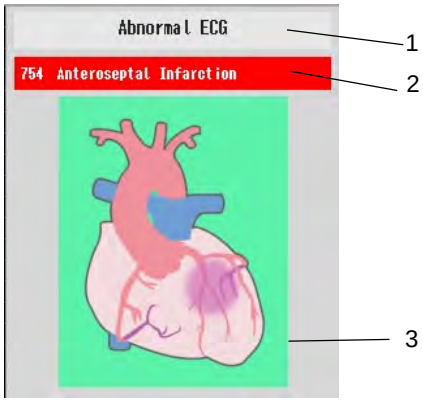
1 Overall Judgment: The highest grade judgment will be displayed.

2 Numeric Data: Main numeric data used for ECG analysis will be displayed.
The abnormal numeric data with the highest grade finding will be highlighted in red.

3 Finding: The findings by the ECG analysis will be displayed. These will be classified by colors according to the grade specified for each finding.
Grade 6: Red
Grade 4: Blue
Grade 2, 0: Black
The highest grade finding will be highlighted in color specified for each abnormality level.

6 Panorama Display

- By pressing the [Panorama] key, overall judgment, finding, abnormal site will be indicated by heart illustration.



1 Overall Judgment: The highest grade judgment will be displayed.

2 Finding: The ECG analysis finding of highest grade will be displayed.

3 Abnormal Site: The finding indicated at 2 will be displayed by a heart illustration.

- During the panorama display, [Panorama] key will change to [Numeric].
By pressing the [Numeric] key, the analyzed result display will change to numeric data display.

7 Analyze Real Time Waveform

Press the [Real Time] key to return to the 12-lead analyzed result screen.

Press the [Start Analyze] key on the 12-lead analyzed result screen.

8 Display Analyzed Waveform

Press the [Analyzed Wave] key to display the analyzed waveform.

- [Chest Lead]: Chest lead (V1 to V6) waveform will be displayed.
- [Limb Lead]: Limb lead (I to aVF) waveform will be displayed."

9 Deleting the Analyzed Result

- Press the [Delete] key to delete the displayed analyzed result.
- [Delete OK] will delete the displayed analyzed result data.
- Press [Cancel] to cancel the delete process.

12-Lead Analyzed Result Output Example

Press the [Print] key on the analyzed result screen or analyzed waveform screen.
There are following 3 types of analyzed result printing.

Keys displayed when [Print] key is pressed	Printer Selection for Graphic Printing		Key Display	Note
Waveform Report	12-Lead Waveform	Bedside	Yes	Standard 12-lead waveform printing Prints the analyzed waveform.
		Laser	Yes	
Panorama Report	12-Lead Analysis Result	Bedside	×	Panorama Report Displayed only when [Laser] is set as the printer for graphic printing.
		Laser	Yes	
Analyzed Report	12-Lead Analysis Result	Bedside	Yes	Standard analyzed result printing Prints the waveform and analyzed result.
		Laser	Yes	

NOTE

- If no patient information has been entered, "Adult", "35 years old", and "Male" will be printed.
- If the patient classification is set as "Child", and no age and sex information have been entered, "Child", "2 years old", and "Male" will be printed.
- The output printer will be according to the setting made for "12-Lead Analysis Result" ([Bedside]/[Laser]) under [Manual Printing>Printer Sel. (Graphic Printing)]. (☞"Manual Printing (Other Setup)" P9-6)

❑Printed Data

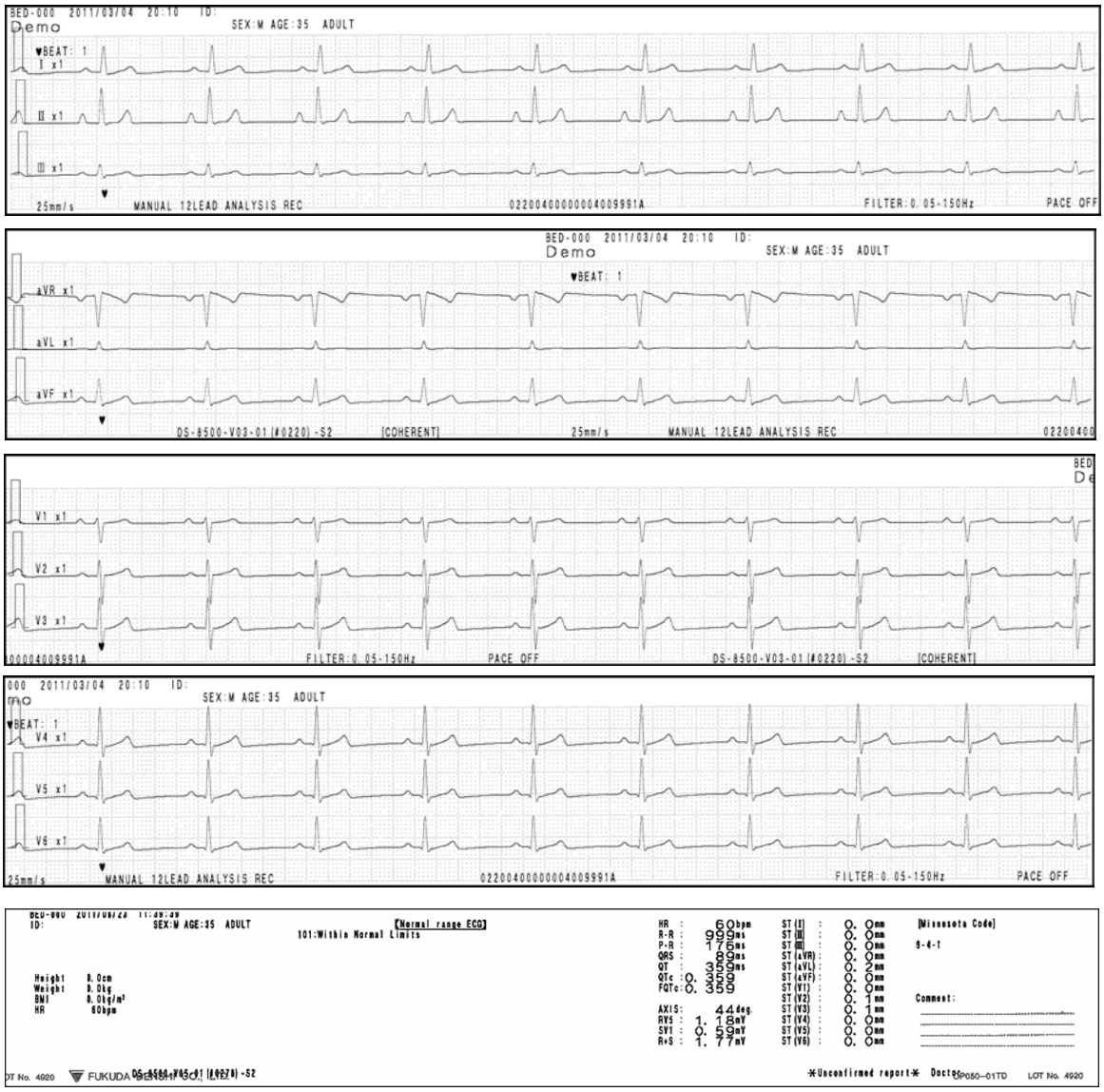
The following basic data will be printed.

Heart Rate	Heart rate obtained by basic arrhythmia measurement
QRS Interval	QRS interval of basic waveform measurement. Average value of measurements of leads I to V6. The equipotential part (I wave) at the beginning of QRS and the equipotential part (K wave) at the end of QRS are not included in QRS interval.
R-R Interval	R-R interval of basic waveform measurement. Average value calculated from all the heartbeats first, and then recalculated from the R-R interval within ±25% of that value.
P-R Interval	P-R interval of basic waveform measurement. Average value of measurements of leads I to V6.
QT Interval	QT interval of basic arrhythmia measurement. Average value of measurements of leads I to V6.
QTc Interval	QTc duration of basic arrhythmia measurement. Value calculated from the Bazett's formula $QTc = \frac{\text{Average waveform QT time}}{\sqrt{\text{Average R-R time of arrhythmia (sec.)}}}$
FQTc Interval	FQTc duration of basic arrhythmia measurement. Value calculated from the Fredencia's formula FQTc = Average QT time/ 3√Average R-R time (sec.)
QRS Axis	QRS axis of basic arrhythmia measurement. This value is calculated from the following equation: $\text{Axis}(°) = \text{Tan}^{-1}\left(\frac{\sqrt{3}(\text{II}+\text{III})}{2\,\text{I}+\text{II}-\text{III}}\right)$ where, I, II, and III are the sums of the maximum amplitude values (signed) of Q, R, S, R', and S' waves from each lead.
R V5/ V6	Maximum amplitude of R wave or R' wave of lead V5 or lead V6. Lead V5 > Lead V6: RV5 Lead V5 = Lead V6: RV6
SV1	Maximum (absolute) value of Q, S, or S' wave of lead V1.

R+S	Sum of the amplitudes of RV5/RV6 and SV1.
ST	Amplitude from the baseline. Measurement position: End of QRS wave + (QT/10) sec.

❑Printing on the Bedside Monitor Printer

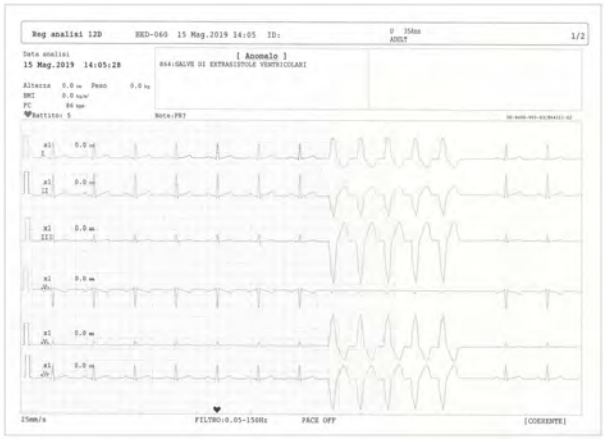
- When [Beside] is set for "12L Analysis Result" under [Manual Printing>Printer Sel.("Graphic Printing")], pressing the [Print] key will display the [Waveform Report]/[Analyzed Report] keys.
- The following is the output example when [Analyzed Report] key is pressed.



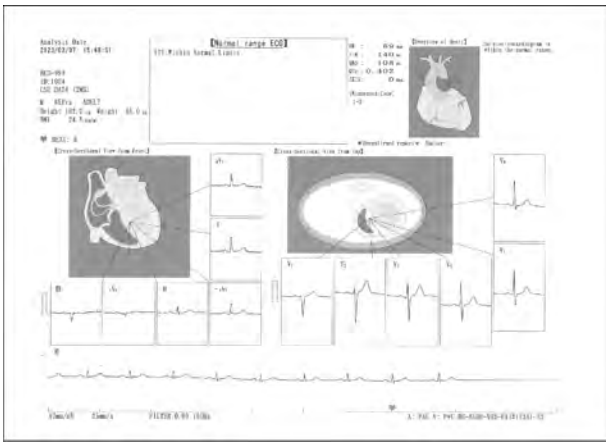
- Pressing the [Waveform Report] key will print the analyzed waveform in a standard format.

❑Laser Printer Output

- When [Laser] is set for "12-Lead Analysis Result" under [Manual Printing>Printer Sel.("Graphic Printing")], pressing the [Print] key will display [Waveform Report]/[Analyzed Report]/[Panorama Report] keys.
- Pressing the [Analyzed Report] will print the analyzed result in a format set for "12-Lead Analysis Format" under [Menu>Setup>Manual Printing]. (☞"Manual Printing (12-Lead)" P9-4)



- Pressing the [Waveform Report] will print the waveform in a format set for "12-Lead Waveform Format" under [Menu>Setup>Manual Printing]. (☞"Manual Printing (12-Lead)" P9-4)
- The following is the output example when [Panorama Report] key is pressed.



NOTE

- To print out the 12-lead analysis panorama report in color, use a laser printer with the page description language in LIPS IV. If a printer with other page description language is used, the printout will be in black and white.

Full Disclosure Waveform (Optional Function)

By using the optional SD card, 240 hours of wave data can be saved.
Up to six waveforms can be displayed. The alarm event and time will be also saved which allows to search the waveform by each factor.

⚠ CAUTION

- Use only the specified SD card.
- Turn OFF the power before removing the SD card.
- The SD card can be used only on the equipment where it was formatted.
- The SD card formatted for the central monitor full disclosure waveform data cannot be used on the DS-1200 System.

NOTE

- When the full disclosure waveform data exceeds the capacity of the SD card, the data will be deleted from the old one.
- To delete the full disclosure waveform data, perform the discharge procedure. (☞"Discharge" P5-9)

To Format the CF Card

REFERENCE

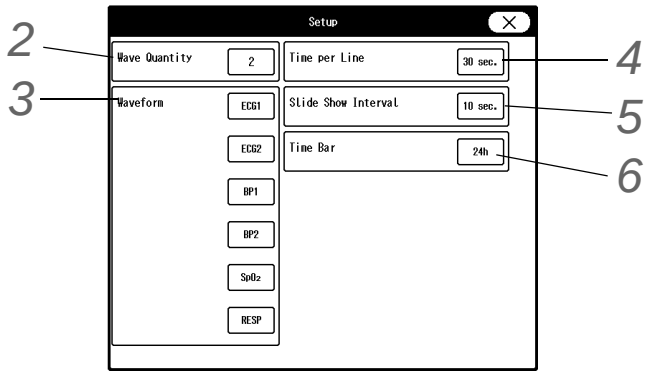
- To save the full disclosure waveform, the SD card needs to be formatted for the full disclosure waveform. (☞Maintenance Manual "Formatting the Full Disclosure Waveform Card" P3-1)

Waveform Setup

The displaying/printing waveform quantity and type of storing waveform, display duration (sec.) per line for the full disclosure waveform can be preprogrammed.

1 Press the [Menu], [Full Disc.] ("Waveform Review"), [Setup] key.

▸ The "Setup" window for full disclosure waveform will be displayed.



2 Select the quantity of displaying/printing waveforms from [1]/[2]/[3]/[4]/[5]/[6].

NOTE

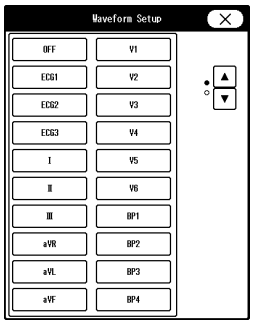
- The maximum waveform quantity that can be printed differs depending on the output printer.

3 Press the key for "Waveform". (shown on right)

4 Set the display duration per line from [10 sec.]/[30 sec.]/[1 min.].

5 Select the slide show interval from [1 sec.]/[5 sec.]/[10 sec.]/[20 sec.]/[30 sec.].

6 Select the time bar display interval from [4h]/[8h]/[12h]/[16h]/[20h]/[24h]/[36h]/[48h].



Description of the Full Disclosure Waveform Display

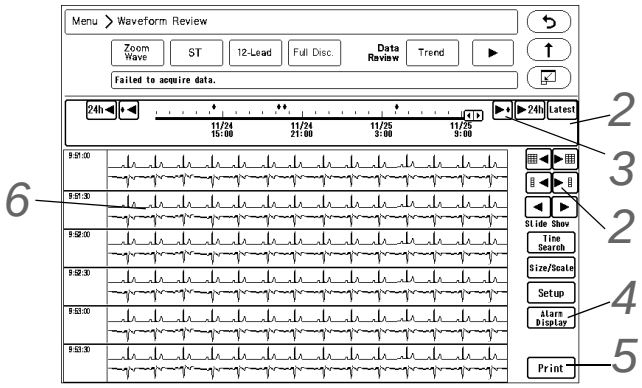
1 Press [Menu > Waveform Review > Full Disc.].

- The full disclosure waveform will be displayed.

2 Changing the time span, scrolling the time, displaying the latest data
(☞"Common Operation" P8-1)

3 Press "Alarm Review" > [◆◀] / [▶◆].

- The full disclosure waveform at alarm-generated point can be searched.



4 Press the [Alarm Display] key.

- The background color of the waveform at alarm occurrence can be changed.

NOTE

- On the full disclosure waveform display, the arrhythmia occurrence point will be displayed 7 seconds before the actual arrhythmia occurrence.

5 Press [Print].

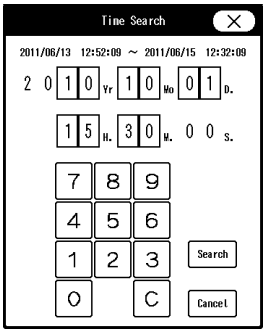
- The currently displayed waveform will be output on the printer.

6 Press the waveform area.

- Press the desired waveform area. The Zoom Wave window will be displayed.

To Search by Time

The full disclosure waveform of the specified time can be displayed.



1 Press the [Time Search] key on the full disclosure waveform display.

- The "Time Search" window will be displayed.

2 Enter the searching date/time using the numeric keys and press the [Search] key.

- Searching will start.
- The searched waveform will be displayed on the full disclosure waveform display.

Hemodynamics

This section explains the procedure for hemodynamics calculation and printing.

Calculation Data

This device can calculate and display the following parameters of hemodynamics.

Data	Item	Formula
BSA	Body Surface Area (m^2)	$h^{0.725}xw^{0.425}x71.84x10^{-4}$ (Dubois Formula)
CI	Cardiac Index (L/min/m^2)	$\frac{CO}{BSA}$
SV	Stroke Volume (mL/beat)	$\frac{CO \times 1000}{HR}$
SVI	Stroke Volume Index (mL/beat/m^2)	$\frac{SV}{BSA}$
SVR	Systemic Vascular Resistance (dynes·sec·cm^{-5})	$\frac{(MAP - CVP) \times 79.90}{CO}$
SVRI	Systemic Vascular Resistance Index (dynes·sec·cm^{-5}•m^2)	SVRxBSA
PVR	Pulmonary Vascular Resistance (dyn·sec·cm^{-5})	$\frac{(MPAP - PAWP) \times 79.90}{CO}$
PVRI	Pulmonary Vascular Resistance Index (dyn·sec·cm^{-5}•m^2)	PVRxBSA
LVW	Left Ventricular Work (kg·m)	COx(MAP-PAWP)x0.0136
LVWI	Left Ventricular Work Index (kg·m^2)	$\frac{LVW}{BSA}$
LVSW	Left Ventricular Stroke Work (g·m)	SVx(MAP-PAWP)x0.0136
LVSWI	Left Ventricular Stroke Work Index (g·m/m^2)	$\frac{LVSW}{BSA}$
RVW	Right Ventricular Work (kg·m)	COx(MPAP-CVP)x0.0136
RVWI	Right Ventricular Work Index (kg•m/m^2)	$\frac{RVW}{BSA}$
RVSW	Right Ventricular Stroke Work (g·m)	SVx(MPAP-CVP)x0.0136

Data	Item	Formula
RVSWI	Right Ventricular Stroke Work Index (g·m/m^2)	$\frac{RVSW}{BSA}$

NOTE

- The blood pressure unit for hemodynamics is "mmHg". If the unit is "kPa" or "cmH_2O", it will be converted to "mmHg" when calculating.

To Display/Print the Hemodynamics Data

10 hemodynamic data can be viewed in list format.

1 Press the [Menu], [Hemodynamics] ("Calculation") keys.

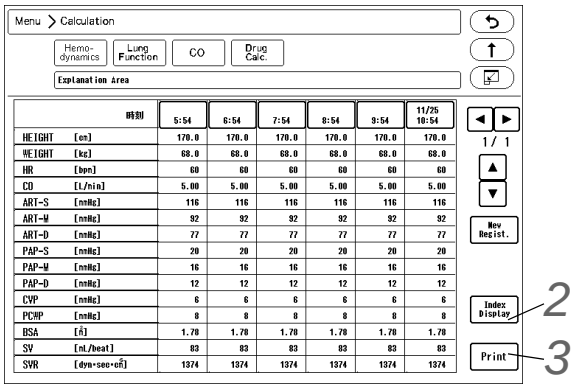
▸ The hemodynamics screen will be displayed.

2 [Index Disp] key

The display will alternately switch between "BSA, SV, SVR, PVR, LVW, LVSW, RVW, RVSW" and "CI, SVI, SVRI, PVRI, LVWI, LVSWI, RVWI, RVSWI".

3 [Print] key

The currently displayed hemodynamic data will be printed.

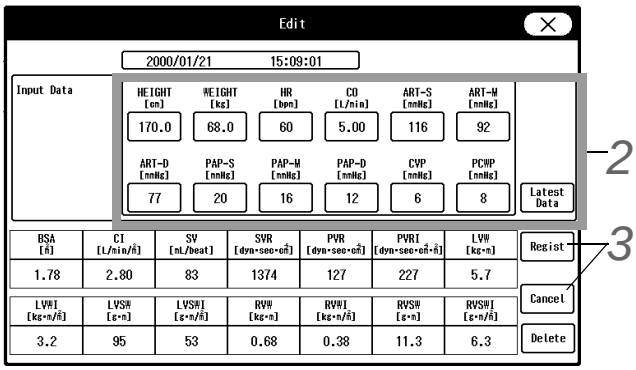


New Input of Hemodynamics Calculation

The hemodynamics calculation can be performed using the newly entered data.
The data can be entered manually using the numeric keys or automatically using the current data.

1 Press the [Menu], [Hemodynamics] ("Calculation"), [New Regist.] keys.

▸ The "Edit" window will be displayed.



▸ The current time will be displayed at the upper area.

▸ Unmeasured data will be left blank.

2 Enter the calculation data.

- Press the [Latest Data] key to display the measured data.
- Press the key for the editing data to display the numeric keys. Edit the data using the numeric keys, and press the [Set] key.
- The edited data will be displayed in , blue.

NOTE

- If the height, weight, BSA is changed on the "Admit/Discharge" screen, average CI will be recalculated. However, the hemodynamic will not be recalculated with the new CI data.

Input Data

Data	Item (Unit)	Editing Range
HEIGHT	Height (cm)	0 cm to 300 cm
WEIGHT	Weight (kg)	0 kg to 350 kg
BSA	Body Surface Area (m^2)	0 m to 9.99 m^2
CO	Cardiac Output (L/min)	0.00 L/min to 20.00 L/min
HR	Heart Rate (bpm)	0 bpm to 350 bpm
ART S	Systolic Arterial Pressure (mmHg / kPa)	0 mmHg to 350 mmHg / 0 kPa to 46.6 kPa
ART M	Mean Arterial Pressure (mmHg / kPa)	0 mmHg to 350 mmHg / 0 kPa to 46.6 kPa
ART D	Diastolic Arterial Pressure (mmHg / kPa)	0 mmHg to 350 mmHg / 0 kPa to 46.6 kPa
PAP S	Systolic Pulmonary Artery Pressure (mmHg / kPa)	0 mmHg to 100 mmHg / 0 kPa to 13.3 kPa
PAP M	Mean Pulmonary Artery Pressure (mmHg / kPa)	0 mmHg to 100 mmHg / 0 kPa to 13.3 kPa
PAP D	Diastolic Pulmonary Artery Pressure (mmHg / kPa)	0 mmHg to 100 mmHg / 0 kPa to 13.3 kPa
CVP	Central Venous Pressure (mmHg / kPa)	0 mmHg to 100 mmHg / 0 kPa to 13.3 kPa
PAWP	Pulmonary Capillary Wedge Pressure (mmHg / kPa)	0 mmHg to 100 mmHg / 0 kPa to 13.3 kPa

3 Press the [Regist.]/[Cancel] key.

- [Regist.]: The calculation will be performed using the newly entered data, and the entered data and calculation result will be registered on the list.
- [Cancel]: The entered data will be deleted.

REFERENCE

- The calculation result will not be displayed if sufficient data is not entered.
- Maximum of 10 data can be registered. If exceeded, the oldest data will be deleted.
- The edited data will be also displayed in blue on the list.

To Edit the Hemodynamics Input Data

The entered data which has been already calculated can be edited or deleted.

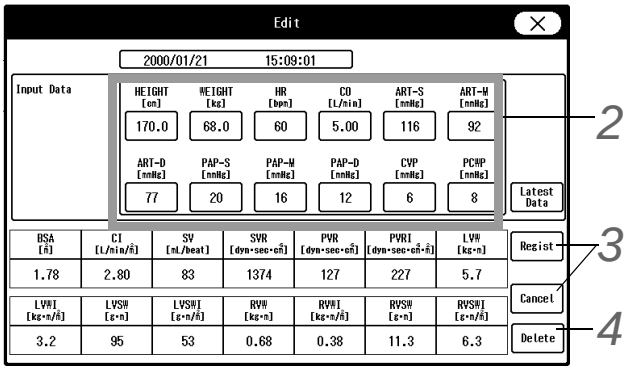
1 Press the [Menu], [Hemodynamics] ("Calculation"), and then the date/time display area for the data to edit.

▸ The "Edit" window will be displayed.

2 Edit the data.
(☞"New Input of Hemodynamics Calculation" P8-40)

3 Register the edited data.
(☞"New Input of Hemodynamics Calculation" P8-40)

4 Delete the data.
A confirmation message will be displayed. To delete the data, press the [OK] key.



Lung Function

This section explains the procedure for lung function calculation and printing.

Calculation Data

Data	Item	Formula
BSA	Body Surface Area (m^2)	$h^{0.725}xw^{0.425}x71.84x10^{-4}$
CaO_2	Arterial Oxygen Content (mL/dL)	$CaO_2=1.34xHbxSaO_2+0.003xPaO_2$
$C\bar{v}O_2$	Mixed Venous Oxygen Content (mL/dL)	$C\bar{v}O_2=1.34xHbxS\bar{v}O_2+0.003xP\bar{v}O_2$
a-vDO_2	Arteriovenous Oxygen Content Difference (vol %)	a-$vDO_2=CaO_2-C\bar{v}O_2$
DO_2	Oxygen Transport(mL/min)	$DO_2=CaO_2xCOx10$
DO_2I	Oxygen Transport Index(mL/min/m^2)	$DO_2I=CaO_2xCIx10$
$\dot{V}O_2$	Oxygen Consumption(mL/min)	$\dot{V}O_2=a\text{-}vDO_2xCOx10$
$\dot{V}O_2I$	Oxygen Consumption Index(mL/min/m^2)	$\dot{V}O_2I=a\text{-}vDO_2xCIx10$
O_2ER	Oxygen Extraction Rate (%)	$O_2ER=(CaO_2-C\bar{v}O_2)/CaO_2x100$
$AaDO_2$	Alveolar-Arterial Oxygen Difference (Torr)	$AaDO_2=P_AO_2-PaO_2$ $P_AO_2=P_IO_2-(P_ACO_2/R)x(1-F_IO_2x(1-R))$ R:Respiration Quotient (0.8 for this device) $P_IO_2=(P_B-47)xF_IO_2$
$\dot{Q}_S/\dot{Q}_t$	Shunt Rate (%)	$\dot{Q}_S/\dot{Q}_t=(Cć O_2-CaO_2)/(Cć O_2-C\bar{v}O_2)$ $Cć O_2=1.34xHb+0.003xP_AO_2$

REFERENCE

- The blood pressure unit for lung function calculation is "mmHg". If the unit is other than "mmHg", it will be converted to "mmHg" when calculating.

To Display/Print the Lung Function Data

256 lung function data can be viewed in list format.

1 Press the [Menu], [Lung Function] ("Calculation") keys.

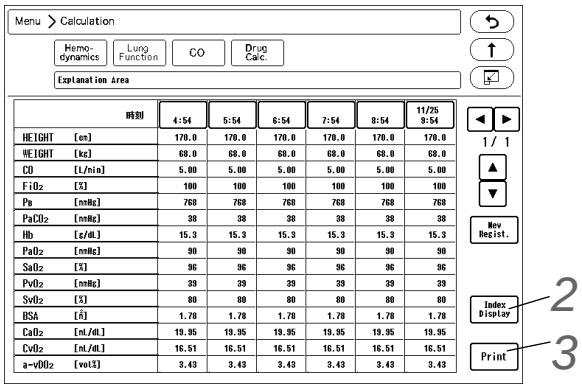
- The lung function list will be displayed.

2 [Index Disp] key

The display of BSA, CaO_2, CvO_2, a-vDO_2, DO_2, VO_2, O_2ER, $AaDO_2$, Qs/Qt will alternately switch with that of CI, DO_2I, VO_2I.

3 [Print] key

The currently displayed lung function data will be printed.

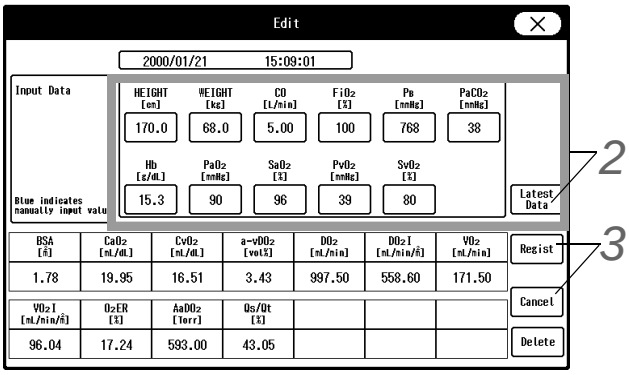


New Input of Lung Function Calculation

The lung function calculation can be performed using the newly entered data.
The data can be entered manually using the numeric keys or automatically using the current data.

1 Press the [Menu], [Lung Function] ("Calculation"), [New Regist.] keys.

- The "Edit" window will be displayed.



2 Enter the calculation data.

- Press the [Latest Data] key to display the entered data of "HEIGHT", "WEIGHT", "CO".
- Press the key for the editing data to display the numeric keys. Edit the data using the numeric keys, and press the [Set] key.
- The edited data will be displayed in blue.

NOTE

- If the height, weight, BSA is changed on the "Admit/Discharge" screen, average CI will be recalculated. However, the lung function calculation result will not be recalculated with the new average CI.

Input Data

Data	Item (Unit)
HEIGHT	Height (cm)
WEIGHT	Weight (kg)
BSA	Body Surface Area (m^2)
CO	Cardiac Output (L/min)
FiO_2	Fraction of Inspiratory Oxygen (%)
P_B	Atmospheric Pressure (mmHg)
$PaCO_2$	Partial Pressure of Arterial Carbon Dioxide (mmHg)
Hb	Hemoglobin Concentration (g/dL)
PaO_2	Partial Pressure of Arterial Oxygen (mmHg)
SaO_2	Arterial Oxygen Saturation (%)
$P\bar{v}O_2$	Partial Pressure of Mixed Venous Oxygen (mmHg)
$S\bar{v}O_2$	Mixed Venous Oxygen Saturation (%)

3 Press the [Regist.]/[Cancel] key.

- [Regist.]: The calculation will be performed using the newly entered data, and the entered data and calculation result will be registered on the list.
- [Cancel]: The entered data will be deleted.

REFERENCE

- The calculation result will not be displayed if sufficient data is not entered.
- Maximum of 256 data can be registered. If exceeded, the oldest data will be deleted.
- The edited data will be also displayed in blue on the list.

To Edit the Lung Function Input Data

The entered data which has been already calculated can be edited or deleted.

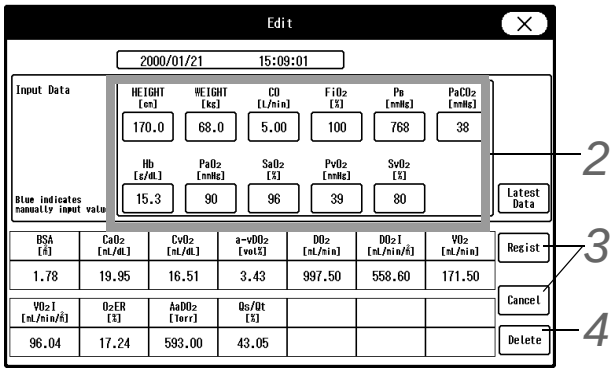
1 Press the [Menu], [Lung Function] ("Calculation"), and then the date/time display area for the data to edit.

- The "Edit" window will be displayed.

2 Edit the data.
(☞"New Input of Lung Function Calculation" P8-43)

3 Register the lung function list.
(☞"New Input of Lung Function Calculation" P8-43)

4 Delete the data.
(☞"New Input of Lung Function Calculation" P8-43)



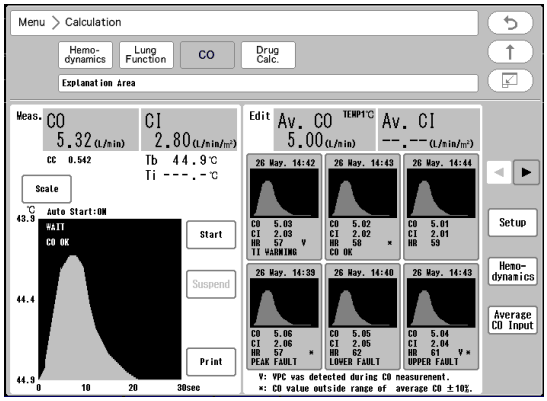
Cardiac Output (CO)

This section explains about the cardiac output measurement using the thermodilution method, setup procedure for catheter type, etc., and procedure for editing the measurement result.

To Display the CO Measurement Screen

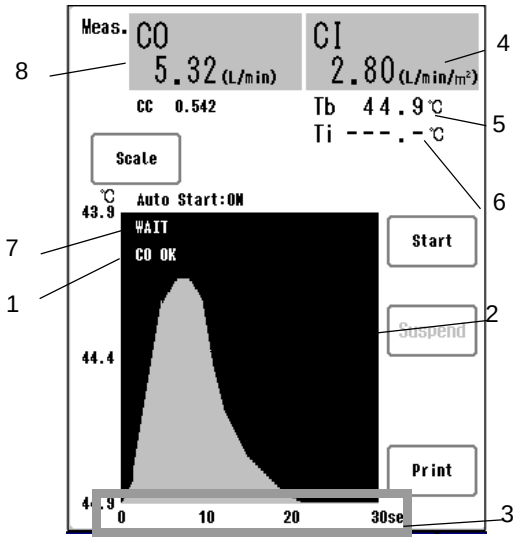
1 Press the [Menu], [CO] ("Calculation") keys.
Or, press the [CO] key on the user key area.

- The CO measurement screen will be displayed.
- The message according to the status will be displayed, and if "READY" is displayed, the measurement can be started.
  (☞"Cardiac Output Message" P11-19)



❑The Description of the CO Measurement Screen

1 Result Status
2 Thermodilution Curve
3 Time Scale
4 Cardiac Index (CI)
5 Blood Temperature
6 Injectate Temperature
7 Status Message
8 Cardiac Output (CO)

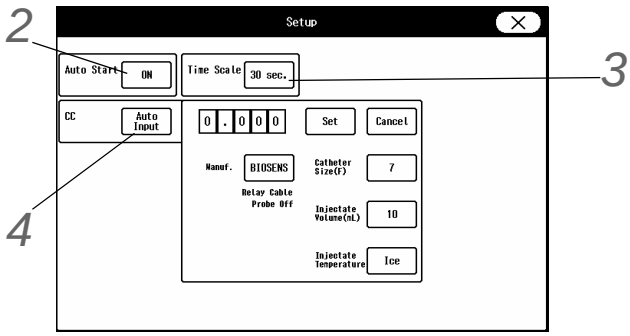


Cardiac Output Setup

Before measuring the cardiac output, set the measurement condition such as ON/OFF of auto start, time scale for thermodilution curve, injection condition, etc.

1 Press the [Menu], [CO] ("Calculation"), [Setup] keys.

- The "Setup" window will be displayed.



2 Set ON/OFF of "Auto Start" .

1 Press the key for "Auto Start".

- The dropdown list will be displayed.

2 Select from [ON] or [OFF].

- [ON]: The measurement will automatically start when the injectate is injected.
- [OFF]: The measurement will start by pressing the [Start] key.

REFERENCE

- Even when [ON] is selected, the measurement can be manually started by pressing the [Start] key.

3 Set the time scale.

1 Press the key for "Time Scale".

- The dropdown list will be displayed.

2 Select from [30 sec.]/[60 sec.].

4 Set the computation constant.

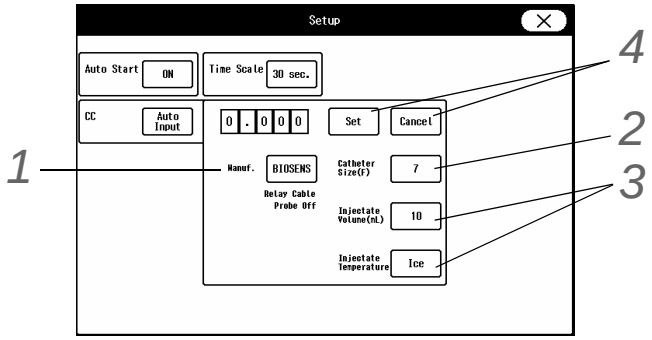
1 Press the key for "CC".

- The dropdown list will be displayed.

2 Select from [Auto Input]/[Manual Input].

- [Auto Input]: The computation constant will be automatically set according to the catheter size and the injection volume.
- [Manual Input]: The computation constant for the used catheter can be manually input with the numeric keys.

❑Auto Input of CC Value



1 Select the catheter manufacturer from [BIOSENS]/[ARGON]/[EDWARDS].

REFERENCE

- ARGON: Argon Medical Devices Japan, K.K. (formerly Becton, Dickinson and Company)
- The manufacturer name can be changed on "Catheter Manufacturer for CC Input" setting (Menu>Initial Settings>Meas.>Other).

2 Select the "Catheter Size (F) from [5]/ [6]/ [7]/ [7.5].

3 Select the "Injectate Volume (mL) " from [3]/ [5]/ [10].

▸ When the above items are selected, the computation constant will be automatically set.

When the CJ0-P01C-C2.4 Catheter Relay Cable is used:

1 Select the "Injectate Temperature" from [Ice]/ [Room].

▸ [Ice]: The measurement will be performed at 0°C.

▸ [Room]: The measurement will be performed at room temperature (24°C).

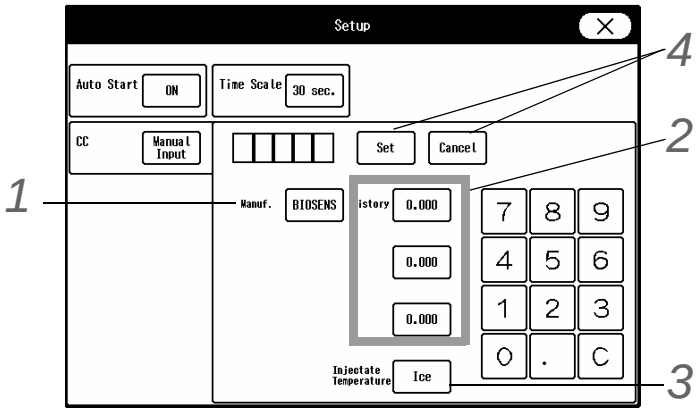
4 Press the [Set]/[Cancel] key.

▸ [Set]: CC value will be finalized.

NOTE

- If the CC value does not correspond to the used catheter, or to use the previous CC value, press the [Cancel] key, and enter the value manually.
- To automatically enter the computation constant, the catheter relay cable needs to be connected.

❑Manual Input of CC Value



1 Select the catheter manufacturer from [BIOSENS]/[ARGON]/[EDWARDS].

2 Up to 3 types of CC value can be programmed for each manufacturer.

- If previously entered value is present, press the key for "History".
- If the previously entered value is not present, enter the CC value using the numeric keys.

3 Set the "Injectate Temperature".
(☞"Auto Input of CC Value" P8-47)

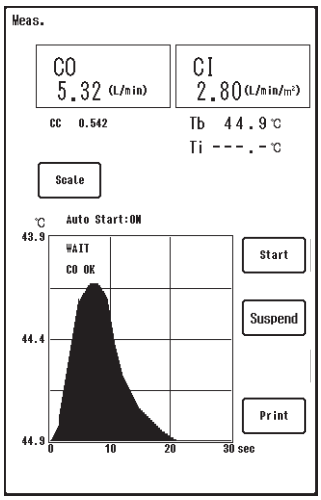
4 Press the [Set]/[Cancel] key.

- [Set]: CC value will be finalized.

CO Measurement

1 Press the [Menu], [CO] ("Calculation") keys.

- The CO measurement screen will be displayed.



- The displayed message will change from "WAIT" to "READY".

NOTE

- While "WAIT" is displayed, the measurement cannot be started. Wait until "READY" is displayed.

2 Verify that "READY" is displayed, and press the [Start] key.

▸ Pressing the key will generate a sound.

3 Inject as soon as the sound generates.

▸ When the measurement is complete, CO and CI value will be displayed.

REFERENCE

- If "Auto Start" is ON, the measurement will automatically start at injection by detecting the blood temperature.

4 When suspending the measurement, press [Suspend] key.

NOTE

- [Suspend] key can be operative only during measurement.
- [Suspend] key can be operative only when the multiparameter connector of the main unit is used for CO. (When the multiparameter connector of the HM-800 with the built-in slot module is used for CO, [Suspend] key will not be displayed.)

5 Press the [Print] key.

▸ The displayed thermodilution curve, CO, CI value will be printed.

NOTE

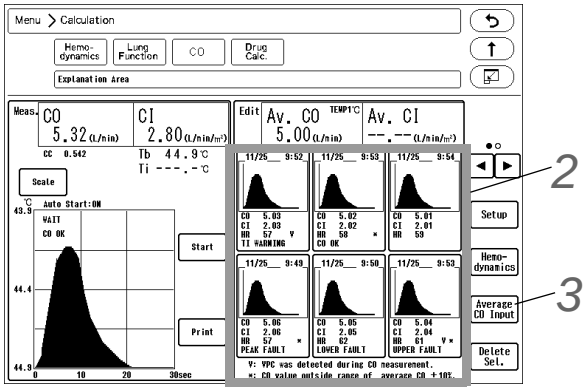
- When "WAIT" message is continuously displayed, verify that catheter relay cable is properly connected to the cardiac output module, and thermodilution catheter is securely connected.
- Before injecting, check that the Ti (injectate temperature) setting is correct.
- When repeatedly performing the measurement, inject at intervals of 30–60 seconds
- The CI value will not be displayed unless height/weight or BSA value is input on the "Admit/Discharge" screen.
  (☞"Entering the Patient Information" P5-1)
- For the following cases, measurements may be inaccurate.
  - Shunt disease, tricuspid regurgitation or pulmonic regurgitation.
  - During exercise stress
    As body temperature varies non-continuously and unevenly by exercise, constant CO value cannot be measured.
  - Excessive Arrhythmia
    As blood volume varies non-continuously due to arrhythmia, accurate CO value cannot be measured.

To Edit the CO Measurement Result

The average CO and average CI can be calculated by performing the CO measurement continuously and editing the measurement result.

1 Press the [Menu], [CO] ("Calculation") keys.

- The CO measurement screen will be displayed.
- The average CO and average CI value obtained from the measurement result will be displayed.



2 To Change the Selected Status

The selected data for the average value will be displayed in blue.
Press the graph area to change the selected status.
V Mark: VPC detected during CO measurement.
*: CO value exceeding the average CO value ±10%.

3 [Average CO Input]

The displayed average CO value will be entered to the list.

NOTE

- If the height, weight, BSA is changed on the "Admit/Discharge" screen, average CI will be recalculated.
  As the CI will not be recalculated after the hemodynamic calculation, save the average CI by hemodynamic calculation before changing the height, weight, and BSA.

Drug Calculation

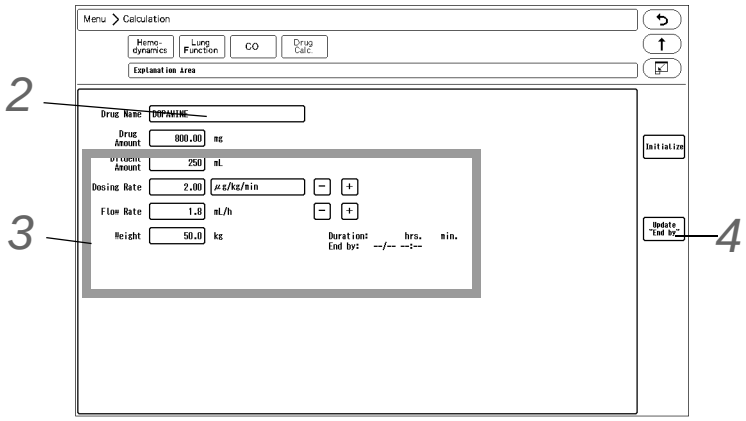
This section explains about the drug calculation function.
The drug calculation function is a function to calculate the flow rate of drug administration to the patient.
Based on the dosing rate, flow rate and dosing duration will be calculated from the weight, drug amount, diluent amount.
It is also possible to calculate the dosing rate and dosing duration from the flow rate.

REFERENCE

- Under the "Initial Settings", the drug name, and default settings for each drug (drug amount/ unit, diluent amount, dosing rate/unit) can be set. (☞Maintenance Manual "Drug Calculation" P5-25)

1 Press the [Menu], [Drug Calc.] ("Calculation") keys.

- The drug calculation menu will be displayed.

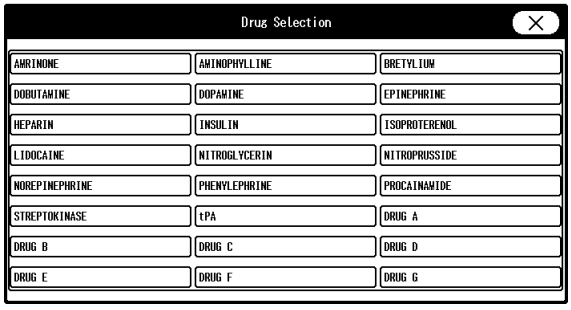


- If the weight is entered on the "Admit/Discharge" menu, the entered weight will be displayed.

NOTE

- The weight can be changed on this menu, but the changed weight will be used only for the drug calculation and will not be reflected on the "Admit/Discharge" menu.

2 Press the key for "Drug Name".



- The list of registered drugs will be displayed. Select the drug to administer to the patient.
- When a drug is selected, the drug amount, diluent amount, dosing rate/unit preset for that drug under "Initial Settings" will be automatically entered.

NOTE

- The flow rate will be automatically calculated when the value for each item is updated.

- On the initial display of the drug calculation menu, the previous calculation data will be displayed. The calculation data will be cleared when the patient is discharged.

3 Enter the value for each item.

- To change the automatically entered value, press the key for each item and manually enter the value.
- The dosing rate and flow rate can be adjusted by pressing the [+], [-] keys.

NOTE

- If the selected unit for the dosing rate requires weight, the flow rate cannot be calculated if the weight is not entered.

4 Press the [Update "End by"] key to update the estimated time of completion.

- Pressing the [Update "End by"] key will recalculate the time from the pressed time and update the estimated time of completion.

❑Calculation Formula for Flow Rate/Dosing Rate

According to the dosing rate unit, the calculation formula from the following 10 types will be automatically selected for calculation.

Dosing Rate Unit	Flow Rate Calculation Formula
mg/min	$\text{Flow Rate (mL/hr)} = \frac{\text{Dosing Rate (mg/min)} \times \text{Diluent Amount (mL)} \times 60}{\text{Drug Amount (mg)}}$
mg/hr	$\text{Flow Rate (mL/hr)} = \frac{\text{Dosing Rate (mg/hr)} \times \text{Diluent Amount (mL)}}{\text{Drug Amount (mg)}}$
mg/kg/min	$\text{Flow Rate (mL/hr)} = \frac{\text{Dosing Rate (mg/kg/min)} \times \text{Weight (kg)} \times \text{Diluent Amount (mL)} \times 60}{\text{Drug Amount (mg)}}$
mg/kg/hr	$\text{Flow Rate (mL/hr)} = \frac{\text{Dosing Rate (mg/kg/hr)} \times \text{Weight (kg)} \times \text{Diluent Amount (mL)}}{\text{Drug Amount (mg)}}$
µg/min	$\text{Flow Rate (mL/hr)} = \frac{\text{Dosing Rate (µg/min)} \times \text{Diluent Amount (mL)} \times 60}{\text{Drug Amount (mg)} \times 1000}$
µg/hr	$\text{Flow Rate (mL/hr)} = \frac{\text{Dosing Rate (µg/hr)} \times \text{Diluent Amount (mL)}}{\text{Drug Amount (mg)} \times 1000}$
µg/kg/min	$\text{Flow Rate (mL/hr)} = \frac{\text{Dosing Rate (µg/kg/min)} \times \text{Weight (kg)} \times \text{Diluent Amount (mL)} \times 60}{\text{Drug Amount (mg)} \times 1000}$
µg/kg/hr	$\text{Flow Rate (mL/hr)} = \frac{\text{Dosing Rate (µg/kg/hr)} \times \text{Weight (kg)} \times \text{Diluent Amount (mL)}}{\text{Drug Amount (mg)} \times 1000}$
units/hr	$\text{Flow Rate (mL/hr)} = \frac{\text{Dosing Rate (units/hr)} \times \text{Diluent Amount (mL)}}{\text{Drug Amount (units)}}$
IU/hr	$\text{Flow Rate (mL/hr)} = \frac{\text{Dosing Rate (IU/hr)} \times \text{Diluent Amount (mL)}}{\text{Drug Amount (IU)}}$

Dosing Rate Unit	Dosing Rate Calculation Formula
mg/min	$\text{Dosing Rate (mg/min)} = \frac{\text{Flow Rate (mL/hr)} \times \text{Drug Amount (mg)}}{\text{Diluent Amount (mL)} \times 60}$
mg/hr	$\text{Dosing Rate (mg/hr)} = \frac{\text{Flow Rate (mL/hr)} \times \text{Drug Amount (mg)}}{\text{Diluent Amount (mL)}}$
mg/kg/min	$\text{Dosing Rate (mg/kg/min)} = \frac{\text{Flow Rate (mL/hr)} \times \text{Drug Amount (mg)}}{\text{Diluent Amount (mL)} \times \text{Weight (kg)} \times 60}$
mg/kg/hr	$\text{Dosing Rate (mg/kg/hr)} = \frac{\text{Flow Rate (mL/hr)} \times \text{Drug Amount (mg)}}{\text{Diluent Amount (mL)} \times \text{Weight (kg)}}$
µg/min	$\text{Dosing Rate (µg/min)} = \frac{\text{Flow Rate (mL/hr)} \times \text{Drug Amount (mg)} \times 1000}{\text{Diluent Amount (mL)} \times 60}$
µg/hr	$\text{Dosing Rate (µg/hr)} = \frac{\text{Flow Rate (mL/hr)} \times \text{Drug Amount (mg)} \times 1000}{\text{Diluent Amount (mL)}}$

Dosing Rate Unit	Dosing Rate Calculation Formula
µg/kg/min	$\text{Dosing Rate (µg/kg/min)} = \frac{\text{Flow Rate (mL/hr) x Drug Amount (mg) x 1000}}{\text{Diluent Amount (mL) x Weight (kg) x 60}}$
µg/kg/hr	$\text{Dosing Rate (µg/kg/hr)} = \frac{\text{Flow Rate (mL/hr) x Drug Amount (mg) x 1000}}{\text{Diluent Amount (mL) x Weight (kg)}}$
units/hr	$\text{Dosing Rate (units/hr)} = \frac{\text{Flow Rate (mL/hr) x Drug Amount (units)}}{\text{Diluent Amount (mL)}}$
IU/hr	$\text{Dosing Rate (IU/hr)} = \frac{\text{Flow Rate (mL/hr) x Drug Amount (IU)}}{\text{Diluent Amount (mL)}}$

❑Unit and Setting Range (Dosing Rate, Drug Amount, Diluent Amount, Flow Rate, Weight)

Drug	Dosing Rate		Drug Amount	
	Unit (Selectable)	Setting Range	Unit	Setting Range
AMRINONE	mg/min, mg/hr, mg/kg/min, mg/kg/hr, µg/min, µg/hr, µg/kg/min, µg/kg/hr	0.01 to 1500000.00	mg	0.01 to 1500000.00
AMINOPHYLLINE				
BRETYLIUM				
DOBUTAMINE				
DOPAMINE				
EPINEPHRINE				
ISOPROTERENOL				
LIDOCAINE				
NITROGLYCERIN				
NITROPRUSSIDE				
NOREPINEPHRINE				
PHENYLEPHRINE				
PROCAINAMIDE				
tPA				
HEPARIN	units/hr		units	
INSULIN				
STREPTOKINASE	IU/hr		IU	
DRUG-A to G	mg/min, mg/hr, mg/kg/min, mg/kg/hr, µg/min, µg/hr, µg/kg/min, µg/kg/hr		mg	
	units/hr		units	
	IU/hr		IU	

Diluent Amount		Flow Rate		Weight	
Unit	Setting Range	Unit	Setting Range	Unit	Setting Range
mL	1 to 1000	mL/hr	0.1 to 1000.0	kg	0.1 to 449.9

NOTE

- The setting is not possible if it cannot be correctly calculated by the entered value.

Other Bed Display

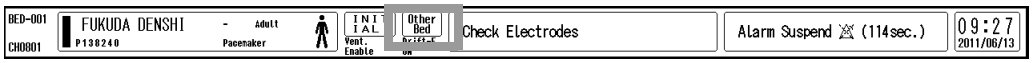
This section explains about the function to display the waveform and numeric data and to set alarms for other bedside monitors.
The other bed alarm function generates the alarm sound for the other bed on this monitor. To use this function, wired network (DS-LAN III) connection is required.

⚠ CAUTION

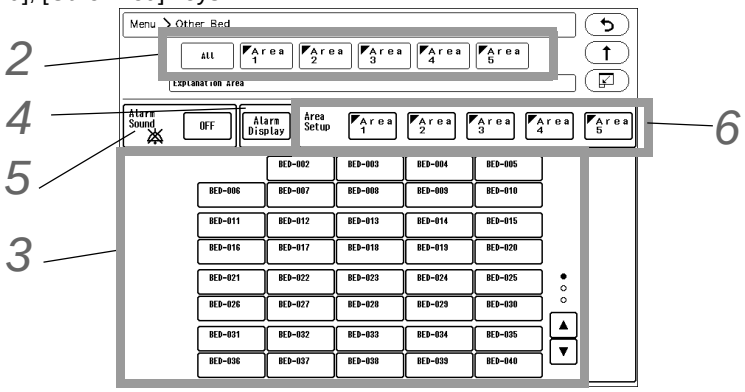
- If the number of bedside monitors displaying the same bed exceeds the limit, the bedside monitor with smaller ID will be prioritized.
- If monitoring 12-lead waveform on the central monitor, the total numbers of monitors that can display the same bed will be reduced by 1.

Other Bed Display/Alarm

The other bed display can be accessed from the menu or from the preprogrammed user key.
Also, by setting the other bed alarm to [ON], [Other Alarm] will be displayed when other bedside monitor generates an alarm. By pressing this [Other Alarm] key, the display for the other bed can be accessed.



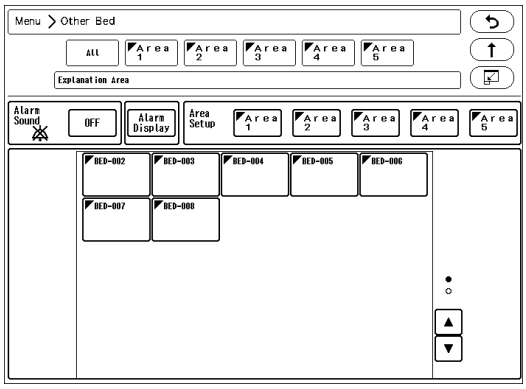
1 Press the [Menu], [Other Bed] keys.



- On the other bed selection menu, select the bed to display from maximum of 100 beds (in case of DS-LAN III) connected to the wired network. The Room / Bed ID for the alarm generating bed will be displayed in red. The other bed alarm generating bed will be indicated by an icon △ inside the Room/Bed ID key.

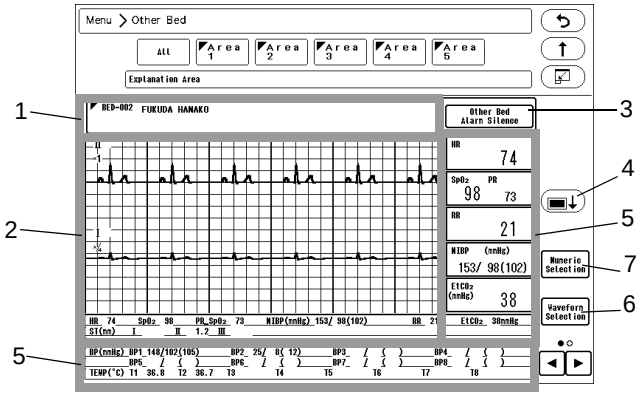
2 Select the area.

- Select the area to be displayed.
  - [All]: The beds for all the area connected to the network will be displayed.
  - [Area 1 to 5]: The beds for each area will be displayed.



3 Press the Room/Bed ID key to display the other bed.

The waveforms and numeric data for the selected bed will be displayed. If an alarm is generated for this bed, the vital alarm/arrhythmia alarm message will be displayed.



1 Message Area
The message for the other bed will be displayed.

2 Waveform Display Area
Displays maximum 6 waveforms.

3 By pressing the [Other Bed Alarm Silence] key on the other bed display, the alarm sound for the displayed bed can be silenced.

4 Pressing this key will switch ON/OFF of menu title display.

5 Numeric Data Area
The numeric data at the bottom of the screen can be switched by using the ◀/▶ keys.

6 Press the [Waveform Selection] key to select the waveforms.

- Waveform 1 is fixed as ECG, but other waveforms can be selected.
  Maximum of 6 waveforms for the DS-LAN III network can be displayed.
  Select the waveform from the waveform selection window.

7 Press the [Numeric Selection] key to display [Numeric Data Selection] window. The parameters to display on the right side of the screen can be selected.

4 Set the other bed alarm.

Press the [Alarm Display] key to change the screen to other alarm setup mode. When the mode is changed, the [Alarm Display] key will be displayed in blue. To return to the original mode, press the [Alarm Display] key again.

Select the bed to generate the other bed alarm.

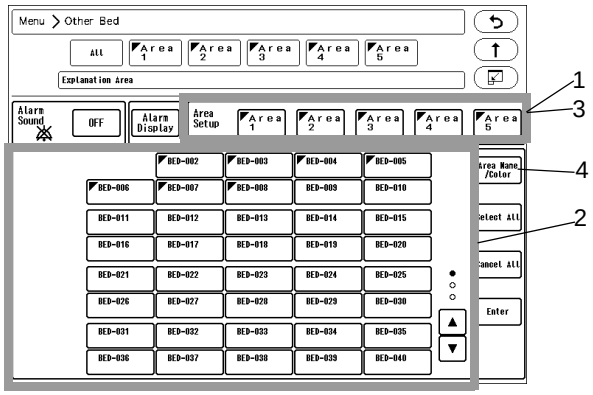
- Select the Room/Bed ID for the bed to generate the alarm. The selected bed will be indicated by blue frame. To cancel the selection, press the key for the bed again.
- [Select All], [Cancel All]: Selection/cancelation for all the beds can be performed at once.
- [Enter]: The selection will be finalized.

5 Turn ON the other bed alarm.

- [ON]: Other bed alarm will be generated.
- [OFF]: Other bed alarm will not be generated.

6 Set the area.

All the beds connected to the network can be displayed, but it is also possible to divide the beds by areas, which allows to display the beds by each area.



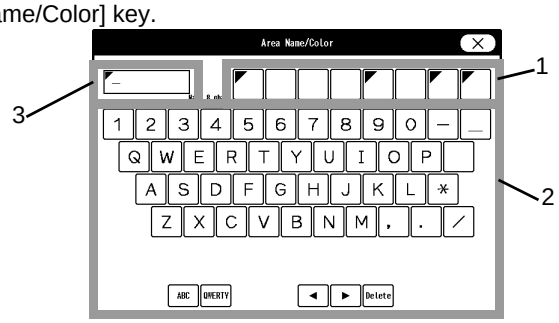
1 Press the key for "Area Setup" to change the screen to area setup mode. When the mode is changed, the key for selected area will be displayed in blue. To return to the original mode, press the key again.

2 Select the Room/Bed ID for the bed to assign to the area. The selected bed will be indicated by blue frame. To cancel the selection, press the key for the bed again.

- [Select All], [Cancel All]: Selection/cancelation for all the beds can be performed at once.
- [Enter]: The selection will be finalized.

3 Press the key for "Area Setup" to change the screen to area setup mode.

4 Press the [Area Name/Color] key.



1 Select the color to distinguish the area.
A triangle mark with the selected color will be displayed at the corner of the Room/Bed ID key.

2 Enter the area name using the numeric keys.

3 Maximum of 8 characters can be set for the area name.

Chapter 9 Printing

Printing Setup

This section describes the procedure for printing and recording.
For the DS-1200 System, the following type of printing/recording can be performed.

- Manual Printing
- Automatic Printing (Periodic Printing)
- Automatic Printing (Alarm Printing)
- Freeze Printing
- Graphic Printing (Trend, Tabular Trend, Recall, etc.)

REFERENCE

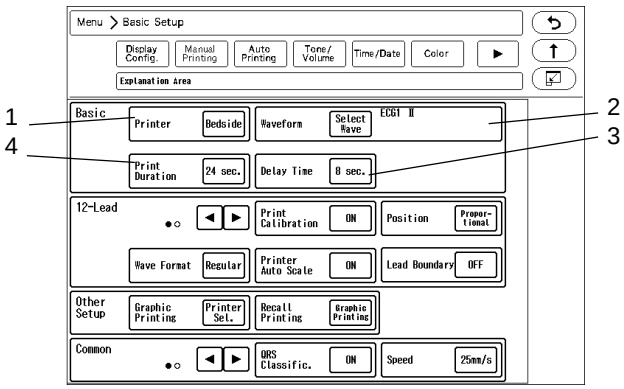
- The printed HR/PR data depends on the ECG/SpO_2/BP selection for "Synchronized Mark/Tone" under [Menu>Parameter>ECG (SpO_2, BP)]. (☞"Synchronized Mark/Tone Setup" P7-9)
- Under the following condition, the amplitude value will be printed for the ECG calibration waveform.
  *[Bar (10mm)] is set for "Waveform Size Display" under [Initial Settings>User I/F>Display/Print].
  *[ON] is set for "Print Calibration" under [Manual Printing>Common]

1 Press the [Menu], [Manual Printing] or [Auto Printing] ("Basic Setup") keys.

▸ The manual printing or automatic printing setup screen will be displayed.

Manual Printing (Basic)

The manual printing can be set to start from the time the key is pressed, or 8 sec./16 sec. prior to the time the key is pressed.
Also, the printing can be set to automatically stop after 24 seconds, or continue to print until the "Print Start/Stop" key is pressed again.
The printer can be selected from built-in printer or central monitor printer.



1 Printer

[Bedside]: Data will be printed on the recorder of the bedside monitor.

[Central]: Data will be printed on the central monitor printer.

2 Waveform

On the "Select Wave" window, 3 waveforms can be selected for printing.
The key for the selected waveform will be displayed in blue.

3 Delay Time

[None]: Printing will start from the point the [Print Start/Stop] key is pressed.
[8 sec.] / [16 sec.]: Printing will start 8 sec. or 16 sec. prior from the point the [Print Start/Stop] key is pressed.

NOTE

- If [None] is selected for the manual printing delay time, QRS classification symbol will not be printed. To print the QRS symbol, set the delay time to [8 sec.] or [16 sec.].

4 Print Duration

[24sec.]: Printing will automatically stop after 24 seconds.
[Cont.]: Printing will continue until the [Print Start/Stop] key is pressed again or until paper runs out.

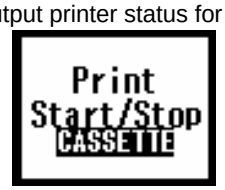
REFERENCE

- Refer to ☞"Zoom Wave" P8-24 for printing duration of recall enlarged waveform.

❑To Start/Stop the Printing

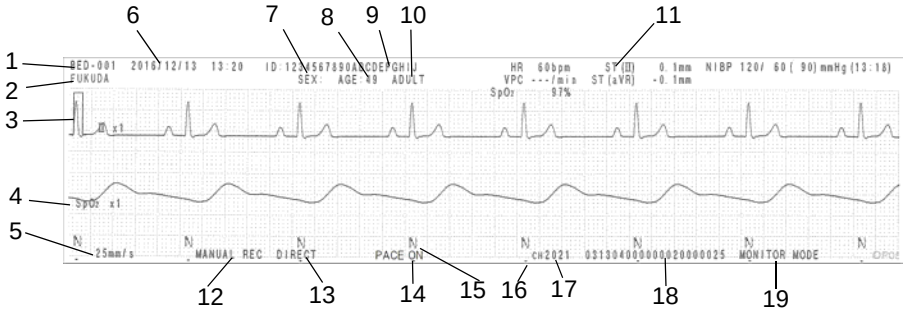
1 Press the user key.

- Pressing this key during periodic printing, alarm printing, graphic printing, or recall printing will cease the printing in process.
- Inside the [Print Start/Stop] key, the output printer status for manual printing will be displayed.



Message	Description
No	Normal Operation
PAPER OUT	There is no thermal paper.
CASSETTE	Check the cassette.
CHECK?	Other abnormality is found.

❑Example of Manual Printing



1	Bed ID	11	Numeric Data (Value at the beginning of the waveform)
2	Patient Name	12	Printing Mode
3	Waveform Type, Lead, Size	13	Delay Time
4	Waveform Type, Scale	14	Pacemaker
5	Paper Speed	15	QRS Classification
6	Print Duration	16	R Wave Trigger Mark
7	Sex	17	Telemetry Channel
8	Age	18	Device Setting ID (Refer to the next table.)
9	Patient ID	19	Filter Mode
10	Patient Classification		

The 21-digit number printed at the bottom of the paper indicates the settings of the device. At the 14th digit from the left, filter setting (AC filter, drift filter) is printed in hexadecimal number.

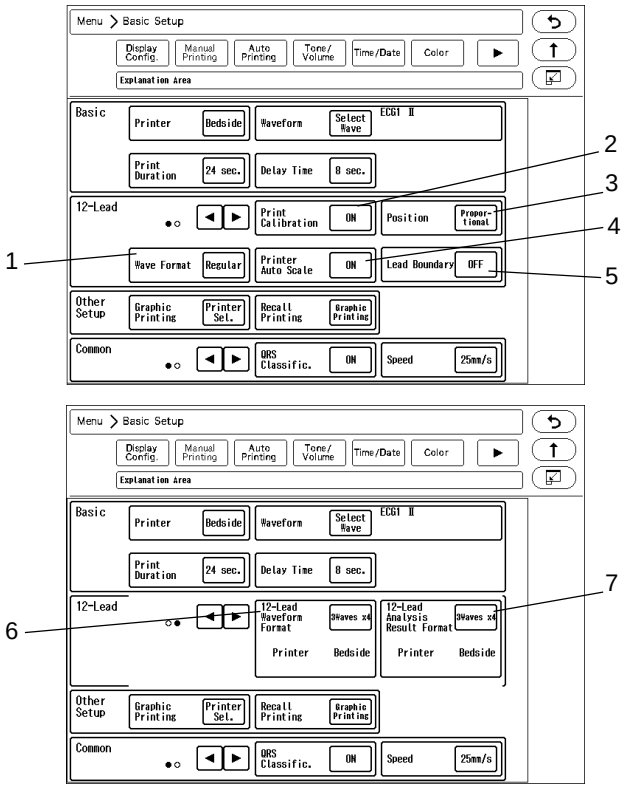
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

0			8		Drift Filter ON
1			9		Drift Filter ON
2	AC Filter ON		A	AC Filter ON	Drift Filter ON
3	AC Filter ON		B	AC Filter ON	Drift Filter ON
4			C		Drift Filter ON
5			D		
6	AC Filter ON		E	AC Filter ON	Drift Filter ON
7	AC Filter ON		F	AC Filter ON	Drift Filter ON

Filter setting is OFF for the numbers in blank.

Manual Printing (12-Lead)

The monitoring 12-lead waveform can be printed on the bedside monitor printer.The delay time is 6 seconds. The 12-lead waveform cannot be printed on the central monitor printer.



1 Waveform Format

[Regular]: Printing will start from the limb leads. (In the order of I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6)

[Reverse]: Printing will start from the chest leads. (In the order of V1, V2, V3, V4, V5, V6, I, II, III, aVR, aVL, aVF)

2 Print Calibration

[ON]: Calibration waveform will be printed. If [Bar (10mm)] is set for "Waveform Size Display" under [Initial Settings>User I/F>Display/Print], the amplitude value corresponding to the displayed waveform size will be printed.

[OFF]: Calibration waveform will not be printed.

3 Position

[Center]: Equalizes the printing width of each lead so that the waveform baseline will be at the center. The printing scale of the waveform will be also automatically adjusted.

[Proportional]: Equalizes the blank space between each lead to avoid overlapping of the waveforms. The printing scale of the waveform will be also automatically adjusted.

[OFF]: Waveform position will not be adjusted when printing.

4 Printer Auto Scale

When position adjustment is [OFF], select whether or not to automatically adjust the scale.

NOTE

- The printer scale will be adjusted in the range of x1, x1/2, x1/4. It will not be adjusted to x2 or x4 even if the amplitude is small.

[ON]: Printing scale will be automatically adjusted.

[OFF]: Printing will be performed with the displayed scale.

5 Lead Boundary

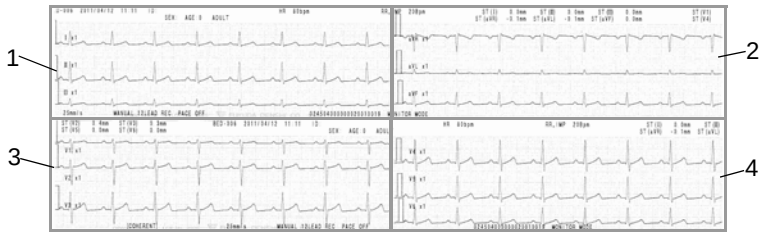
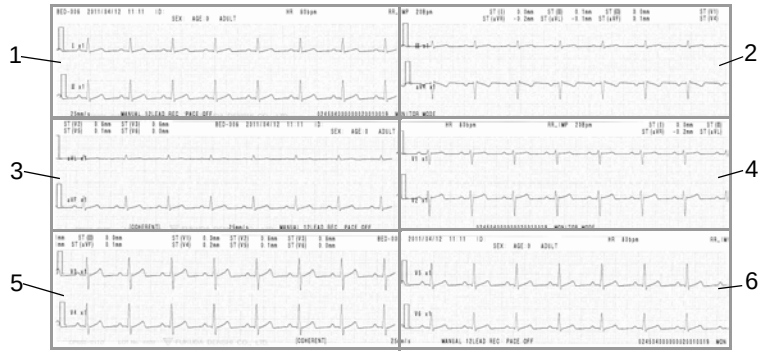
This setting will be displayed only when [Laser] is selected as the printer for "12-Lead Waveform", "12L Analysis Result".
[ON]: Lead boundary between the leads will be printed.

[OFF]: Lead boundary will not be printed.

6 12-Lead Waveform Format

When [Bedside] is set as the printer for "12-Lead Waveform", select from [3Wavesx4]/[2Wavesx6].

When [Laser] is set as the printer for "12-Lead Waveform", select from [3Wavesx4]/[3Wavesx4+Rhy.]/[6Wavesx2]/[12Waves].

Output Example	Waveform Layout	Length of Each Waveform
3 waves x 4  	First column: I,II,III Second column: aVR, aVL, aVF Third column: V1, V2, V3 Fourth column: V4, V5, V6	6 sec.
2 waves x 6  	First column: I,II Second column: III, aVR Third column: aVL, aVF Fourth column: V1, V2 Fifth column: V3, V4 Sixth column: V5, V6	6 sec.

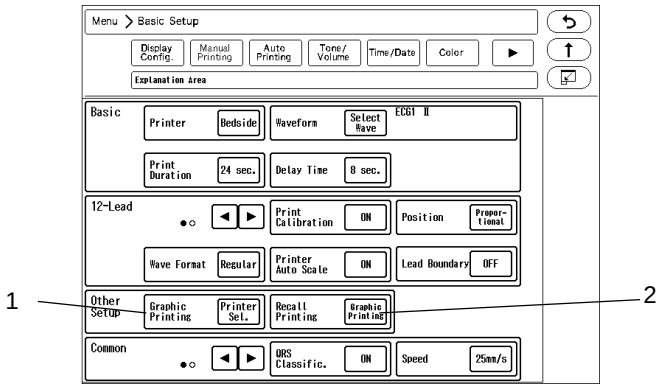
7 12-Lead Analysis Format

When [Bedside] is set as the printer for "12L Analysis Result", the format is fixed as [3Wavesx4].

When [Laser] is set as the printer for "12L Analysis Result", select from [6Wavesx2 (2 pages)]/[6Wavesx2 (1 page)]/[3Wavesx4+Rhy.].

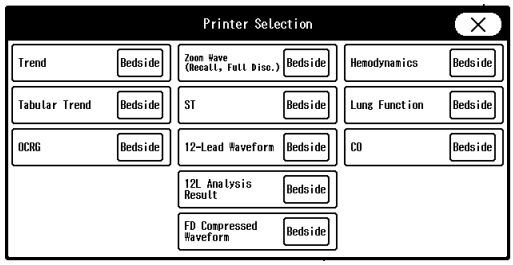
Manual Printing (Other Setup)

Select the printer for graphic printing and recall printing.



1 Press the key for [Graphic Printing] to display the "Printer Selection" window.

- [Bedside]: Data will be printed on the recorder of the bedside monitor.
- [Central]: Data will be printed on the central monitor printer.
- [Laser]: Data will be printed on the laser printer.



REFERENCE

- Graphic printing is a printing performed from the data review screen such as graphic trend and tabular trend.
- To select the laser printer, select [ON] or [DS-LAN] for "Network Printer" under [Menu > Initial Settings > External Device > Network] in advance.
  (☞Maintenance Manual "Laser Printer Setup" P4-24)

2 Recall Printing

- [Graphic Printing]: Recall data will be output on the printer selected for "Graphic Printing".
- [Manual Printing]: Recall data will be output on the printer selected for "Printer" under "Basic".

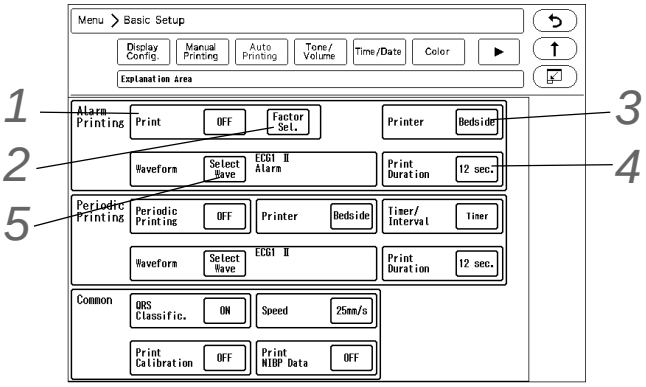
Automatic Printing (Alarm Printing)

When numeric data alarm or arrhythmia alarm occurs, printing will automatically start.

NOTE

- The alarm detection is performed each second, and if more than one alarm occurs at the same time, one data will be stored according to the alarm priority.
- Maximum of 3 alarm data can be stored. If more than 3 alarms generate, the higher priority alarm will replace the previously stored lower priority alarm. The stored data will be deleted once it is printed.
- Priority of alarm printing factor
  ASYSTOLE > VF > VT > Ext Tachy > Ext Brady > SLOW VT > TACHY > BRADY > RUN > HR (HR / PR_SpO_2 / PR_IBP) > APNEA > BP1 (or ART) > SpO_2 > NIBP > RR (RR_IMP / RR_CO_2 / RR_GAS / RR_VENT) > $EtCO_2$ > GAS (CO_2-E / CO_2-I / AGT-E / AGT-I / O_2-E / O_2-I / N_2O-I) > MAC > MV > SI > PAUSE > COUPLET > BIGEMINY > TRIGEMINY > FREQUENT > SVT > IRREGULAR RR > PROLONGED RR > S FREQUENT > S COUPLET > VPC > SVPC > NOT CAPTURE > NOT PACING > AFib > BP2 > BP3 > BP4 > BP5 > BP6 > BP7 > BP8 > ST > TEMP > Tb >

InspCO$_2$ > SpCO > SpMet > SpHb > RR_SpO$_2$> PEAK > PEEP > BIS > QT

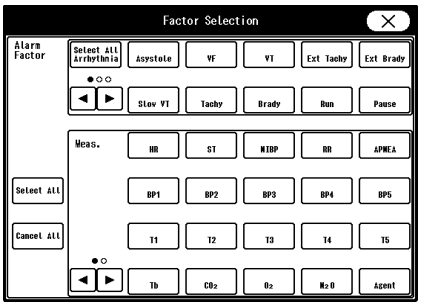


1 Alarm Printing

[ON]: Printing will automatically start at alarm occurrence.

[OFF]: Printing will not start at alarm occurrence.

2 Alarm Factor Selection



The "Factor Selection" window will be displayed.
The selected alarm factor key will be displayed in blue.
The alarm OFF mark will be displayed inside the key for the parameter in alarm OFF condition.
[Select All Arrhythmia]: All arrhythmia factors will be selected.
[All ON]: All alarm factors will be selected.
[All OFF]: All selections for the alarm factor will be canceled.

3 Printer

[Bedside]: Data will be printed on the recorder of the bedside monitor.

[Central]: Data will be printed on the central monitor printer.

4 Print Duration (☞"Manual Printing (Basic)" P9-1)

NOTE

- The delay time differs depending on the print duration.

Print Duration	Delay Time			
	Adult	Child	Neonate	
			Numeric Data Alarm	Arrhythmia Alarm
12 sec.	12 sec.	12 sec.	8 sec.	12 sec.
	8 sec. for the multigas unit alarm			
24 sec.	16 sec.	16 sec.	16 sec.	16 sec.

5 Waveform (☞"Manual Printing (Basic)" P9-1)

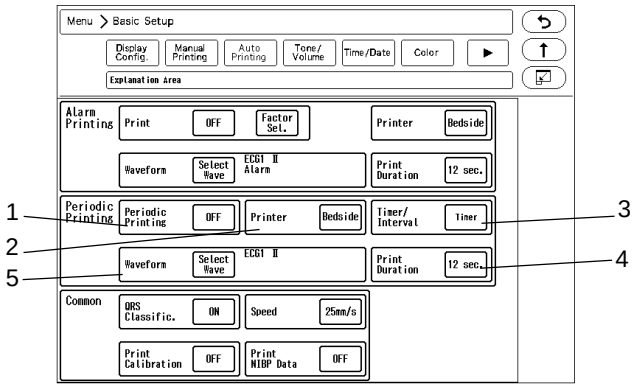
[Alarm]: Prints the waveform of the alarm factor.

Automatic Printing (Periodic Printing)

The printing will be automatically performed with the selected interval.

NOTE

- If the periodic printing is interrupted due to paper out, etc., the latest periodic printing will be performed when the printing is resumed.
- QRS classification symbol will not be printed for periodic printing.



1 Periodic Printing

[ON]: Printing will automatically start at fixed interval.

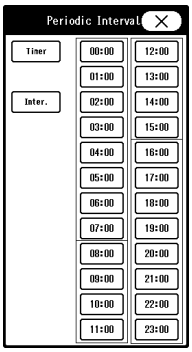
[OFF]: Turns OFF the periodic printing function.

2 Printer

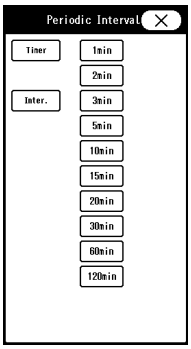
[Bedside]: Data will be printed on the recorder of the bedside monitor.

[Central]: Data will be printed on the central monitor printer.

3 Timer/Interval for Periodic Printing



Display Example for "Timer"



Display Example for "Interval"

[Timer]: Printing will automatically start at selected time.

[Interval]: Printing will automatically start at selected interval.

REFERENCE

- If [5 min.] is selected for [Interval], the time will be displayed in real time such as 10:00, 10:05, ...10:25. If [60 min.] is selected, it will be displayed as 10:00, 11:00, 12:00.

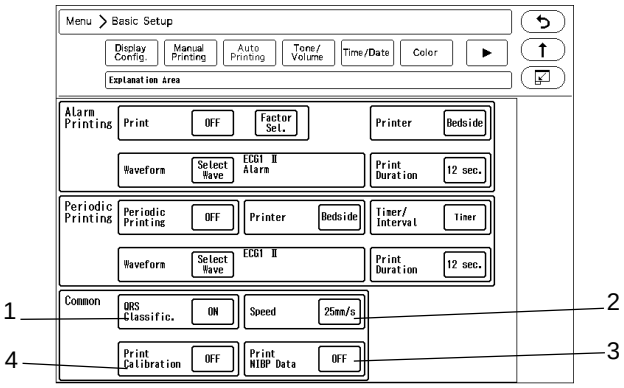
4 Print Duration

The printing will automatically stop after the selected duration.

5 Waveform (☞"Manual Printing (Basic)" P9-1)

Common Setup for Printing

The printing condition common for manual printing and automatic printing can be set.



Display Example for Automatic Printing

1 QRS Classification

[ON]: QRS classification symbol will be printed with the ECG waveform.

Symbol	Description
N (Normal)	Normal QRS beat
V (VPC)	Ventricular extrasystole
S (SVPC)	Supraventricular extrasystole
P (Pacing Beat)	Pacing beat
F (Fusion Beat)	Fusion beat of pacing and spontaneous beat
? (Undetermined Beat)	Learning arrhythmia, or unmatched beat

[OFF]: QRS classification symbol will not be printed.

NOTE

- The QRS symbol cannot be printed for manual printing if the "Delay Time" is set to [None], and for periodic printing. To print the QRS symbol, set the "Delay Time" to [8 sec.] or [16 sec.] for manual printing.
- The "S" (QRS symbol) will be printed as "N" on the central printer.

2 Printing Speed

[25mm/s]: The printing speed will be set to 25mm/s.

[50mm/s]: The printing speed will be set to 50mm/s.

3 Print NIBP Data

[ON]: Oscillation graph and NIBP data will be printed after the waveform.

[OFF]: Oscillation graph and NIBP data will not be printed.

4 Print Calibration

[Top]: Calibration waveform will be printed at the beginning of the waveform.

[Each Page]: Calibration waveform will be printed in 18.75 cm interval.

[OFF]: Calibration waveform will not be printed.

Freeze Printing

The waveform trace can be suspended and printed from 12 seconds prior to the point the waveform trace was stopped.
The waveform selected for manual printing will be printed. The print duration is 12 seconds.
To freeze the waveform display, the [Freeze] key needs to be assigned as user key.
(☞"To Configure the Display" P10-4)

1 Press the [Freeze] key on the user key.

- The waveform trace will stop.

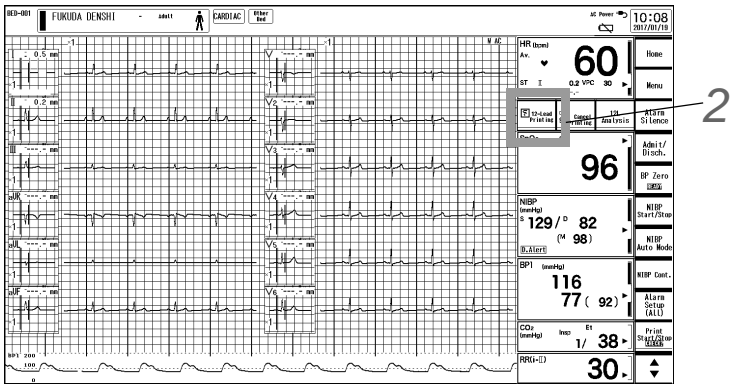
2 Press the [Print Start/Stop] key.

- The displayed waveform will be printed.
- Freeze printing will be output on the bedside monitor printer. The waveforms selected for manual printing will be printed.

12-lead Waveform Printing

When the display layout is "12-Lead", pressing the [12-Lead Print] key will start 12-lead waveform printing.

1 Select "12-Lead" for the display layout.
(☞"To Configure the Display" P10-4)



2 Press the [12-Lead Print] key.

- Printing will start.
- The printing duration of the waveforms for each format are as follows.

	Printing Format	Printing Duration	Delay Time
When printed on the bedside monitor printer:	3 waves x 4	6 sec.	6 sec.
	2 waves x 6		
When printed on the laser printer:	3Wavesx4*1	2.5 sec.	10 sec.
	6Wavesx2*1	5 sec.	
	3 wavesx4+Rhythm*1	12.5 sec.	
	12 Waves*2	10 sec.	

*1 [CONTINUOUS]: The waveform output will be in the time sequence of waveform block order.

*2 [COHERENT]: The waveform output will be in the same time phase for all waveforms.

Chapter 10 System Configuration

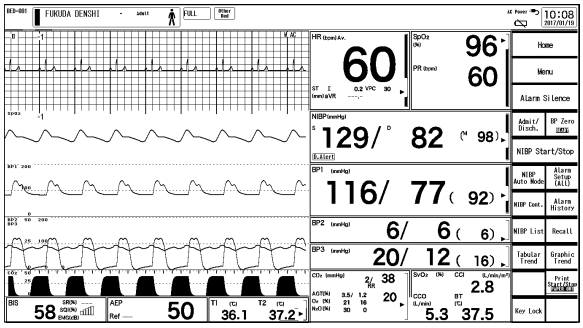
Display Configuration

This section describes about the display configuration type and the procedure to configure the display.
The waveform/numeric data display can be configured according to the monitoring purpose. Basic display layouts are as follows.

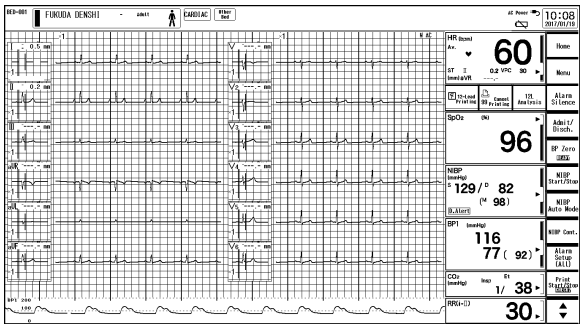
- Standard
- 12-lead
- Numeric Data/Bottom

When ECG cascade or block cascade is selected, a full disclosure waveform can be displayed. The user keys can be also assigned to the numeric data area.

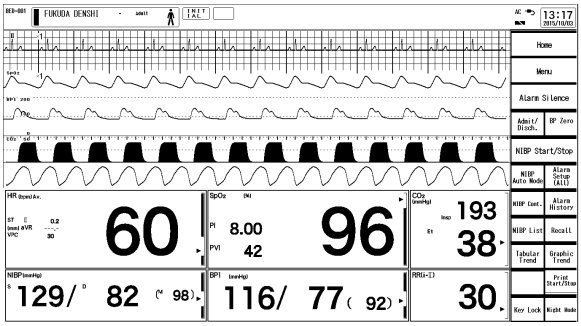
❑Display Example



Standard (Box Layout: Right)



12-Lead (Box Layout: Right)

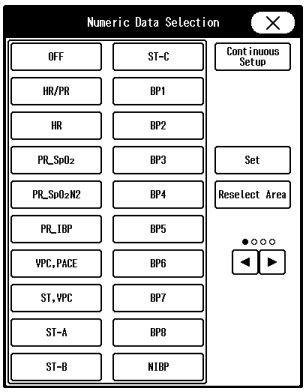


Standard (Box Layout: Bottom 5 rows)

On this system, 9 main modes and 6 sub modes can be preprogrammed according to the monitoring purpose. By registering the configuration to each mode, the display configuration setups at admittance of patient can be simplified by just selecting one of the modes.
(☞"To Select the User Mode" P5-10)
It is recommended to program the display mode in rough classification such as patient's condition, monitoring purpose (ICU or surgery), and if necessary, perform unique setup for each patient.

Numeric Data Selection

The numeric data to be displayed can be selected on the "Numeric Data Selection" window.
The parameters of the "Numeric Data Selection" window can be assigned to the numeric data box on the home display.
(☞"Numeric Data Box Display (for each parameter)" P3-8)



Example: Page 1

The Numeric Data Box Size for Each Parameter

Numeric Data	Size							
	Width[*1]	W1/2	W1			W2		
	Height[*2]	H1	H1	H2	H3	H1	H2	H3
HR/PR		x	○	○	○	○	○	○
HR		x	○	○	○	○	○	○
PR_SpO_2		x	○	○	○	○	○	○
PR_IBP		○	○	○	○	○	○	○
VPC, PACE		x	○	○	○	○	○	○
ST, VPC		x	○	○	○	○	○	○
ST-A, ST-B, ST-C		x	x	○	○	x	○	○
BP1 to BP8		x	○	○	○	○	○	○
NIBP		x	○	○	○	○	○	○
NIBP List		x	○	○	○	○	○	○
SpO_2		x	○	○	○	○	○	○
SpO_2, PR		x	○	○	○	○	○	○
SpCO		x	○	○	○	○	○	○
SpMet		x	○	○	○	○	○	○
SpHb		x	○	○	○	○	○	○
Sp*		x	○	○	○	○	○	○
RR_IMP, RR_CO_2, RR_VENT, RR_SpO_2		○	○	○	○	○	○	○
T1 to T8, Tb		○	○	○	○	○	○	○
T1/T2, T3/T4, T5/T6, T7/T8		x	○	○	○	○	○	○
ΔTEMP-A, ΔTEMP-B, ΔTEMP-C, ΔTEMP-D		○	○	○	○	○	○	○
VENT		x	x	○	○	x	○	○

The Numeric Data Box Size for Each Parameter

Numeric Data	Size							
	Width[*1]	W1/2	W1			W2		
	Height[*2]	H1	H1	H2	H3	H1	H2	H3
P-V, F-V		x	x	○	○	x	○	○
SvO_2, CO		x	x	○	○	x	○	○
SvO_2, CO, CI		x	x	○	○	x	○	○
CO, SV, SVV		x	x	○	○	x	○	○
BIS		x	○	○	○	○	○	○
INVOS		x	○	○	○	○	○	○
CO_2		x	○	○	○	○	○	○
O_2		○	○	○	○	○	○	○
N_2O		○	○	○	○	○	○	○
Agent		x	○	○	○	○	○	○
RR, CO_2, Agent, O_2, N_2O		x	x	○	○	x	○	○
CO_2, Agent, O_2, N_2O		x	x	○	○	x	○	○
RR, Agent, O_2, N_2O		x	x	○	○	x	○	○
Agent, O_2, N_2O		x	x	○	○	x	○	○
Agent, N_2O		x	○	○	○	○	○	○
GAS, SPIRO		x	x	○	○	x	○	○
SPIRO		x	x	○	○	x	○	○
HEMO		x	x	○	○	x	○	○
HEMO-I		x	x	○	○	x	○	○
STOPWATCH		x	○	○	○	○	○	○
VENT-A		x	○	○	○	○	○	○
VENT-B		x	○	○	○	○	○	○
Hemo/etc-A		x	○	○	○	○	○	○
Hemo/etc-B		x	○	○	○	○	○	○
Extended Function-A		x	x	○	○[*3]	x	○	○[*3]
SI		x	○	○	○	○	○	○
QTc		x	○	○	○	○	○	○

*1: W1/2 is about 30 mm, W1 is about 60 mm, W2 is about 120 mm

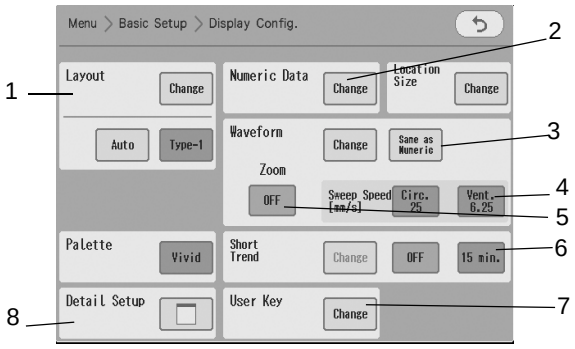
*2: H1 is about 16 mm, H2 is about 32 mm, H3 is about 48 mm (H1 is the same length as waveform areax2)

*3: For "Extended Function-A", H6 is the maximum height.

To Configure the Display

1 Press the [Menu], [Display Config.] ("Basic Setup") keys.

▸ The display configuration menu will be displayed.



1 Layout
(☞"Changing the Layout" P10-4)

2 Numeric Data
(☞"Changing the Displayed Numeric Data" P10-5)

3 Waveform
(☞"Changing the Displayed Waveform" P10-6)

4 Sweep Speed
(☞"Sweep Speed" P10-9)

5 Short Trend
(☞"Short Trend Display" P10-7)

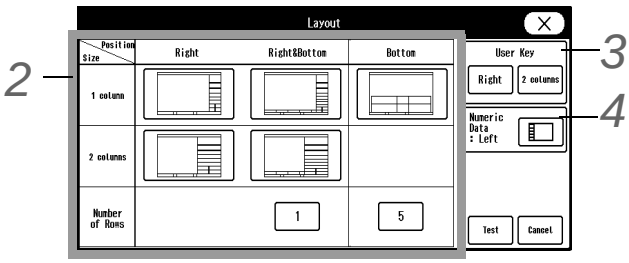
6 Zoom Wave
(☞"Enlarged Waveform Setup" P10-10)

7 User Key
(☞"User Key Setup" P10-10)

8 Detail Setup
(☞"Detail Setup" P10-11)

❑Changing the Layout

The layout can be changed with the following procedure.



1 Press [Change] for "Layout".

▸ The "Layout" window will be displayed.

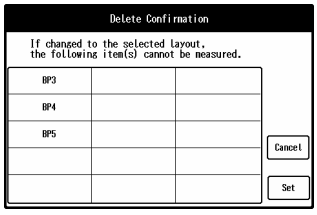
2 Select the layout to be displayed.
When Right & Bottom, "Left & Bottom" , "Bottom" is selected, select the number of rows.

3 Select the user key location from [Right], [Left], [Bottom], and select the number of columns.
When bottom 2 rows for "Right/Left & Bottom" is selected for display layout, "Bottom" cannot be selected.

4 Select the numeric data box location from [Right] or [Left].

5 The displayed parameters will be automatically located with the selected layout. Check the home display.

▸ If there are parameters which cannot be displayed due to display area, "Delete Confirmation" window will be displayed. (shown on right)
Pressing the [Set] key will set the layout with some parameters not displayed.



Pressing the [Cancel] key will return to the "Layout" window.

6 If not changing the layout, press the [Cancel] key.

❑Adjusting the Layout Automatically

The display layout can be automatically adjusted. The automatic mode can be selected from the following two types.

♦Type-1 (All Auto Mode)
The measured parameters will be automatically located according to the priority. The display layout remains the same. (The layout will change if there is not enough space to display all parameters.)
The display priority can be set on the "Auto Display Configuration" under "Initial Settings". (☞Maintenance Manual "Display/Print Setup" P5-12)

♦Type-2 (Auto Mode depending on Parameter Quantity)
The parameters will be automatically located according to the parameter quantity using the current display configuration. The display layout, numeric data location and user keys on the numeric data area remain the same.

1 Select [Type-1] or [Type-2].

2 Select [Auto] for "Layout".

NOTE

- For both [Type-1] and [Type-2], the waveform layout is equivalent to that when the [Same as Numeric] key is pressed.
- When [Auto] is selected for the display layout, the following changes are not possible.
  Changing the Displayed Waveform
  Changing the Displayed Numeric Data
  Changing the short trend parameters

❑Changing the Displayed Numeric Data

The displayed numeric data can be changed with the following procedure.

⚠ CAUTION

- When performing the telemetry or wired network transmission, configure the display so that the numeric data corresponding to the waveform is displayed. If not, the displayed waveform or numeric data may not be transmitted.

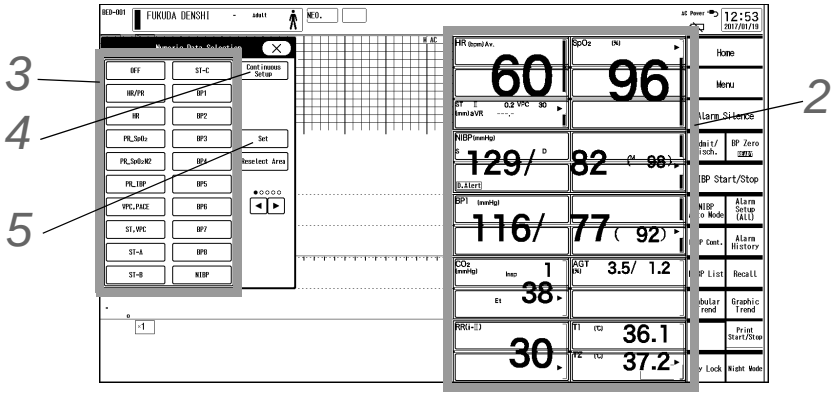
NOTE

- For HR/PR data, an alarm will be generated only for the current parameter displayed in the HR/ PR numeric data box. The Parameter alarm will not be generated unless the data is displayed.
  The parameter for the HR/PR numeric data box can be selected by pressing the key for "HR/PR" on the ECG, BP, SpO_2 parameter setup window/floating window or by pressing the [HR/PR] user key.

1 Press the [Change] key for "Numeric Data".

▸ The display will change to numeric data selection mode.

▸ The "Numeric Data Selection" window will be displayed.



2 Press the numeric data display area to change the parameter.

▸ By pressing the selected area again, the selection will be canceled.

▸ To start again from the beginning, press the [Reselect Area] key.

▸ Adjust the size of the selected area which is indicated by blue box.

3 Select the parameter on the "Numeric Data Selection" window.
Press the ▲ ◄/ ► keys to switch the displayed parameters.
(☞"Numeric Data Selection" P10-2)

4 Press [Continuous Setup] to switch to continuous setup mode.

▸ On the continuous setup mode, the numeric data box area can be sequentially selected.

5 Press the [Setup] key.

▸ The setup will be finalized.

NOTE

- The selected parameter may not be displayed depending on the combination of the parameters and size.
  In such case, "Size Error" will be displayed in numeric data area. Adjust the size.
  (☞"Numeric Data Selection" P10-2)

❑Changing the Displayed Waveform

The displayed waveform can be changed with the following procedure.

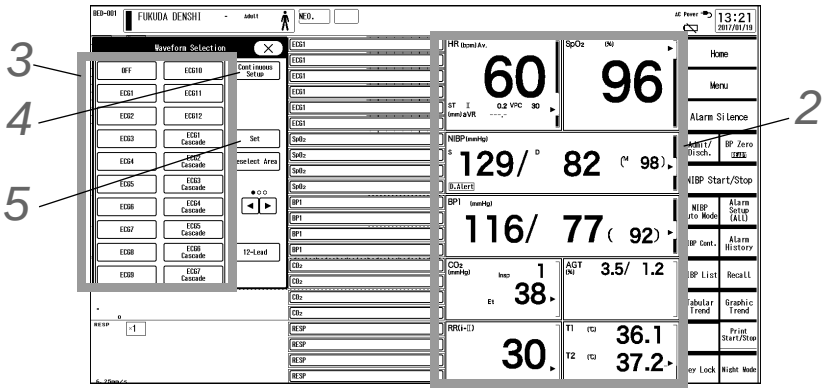
⚠ CAUTION

- When performing the telemetry or wired network transmission, configure the display so that the numeric data corresponding to the waveform is displayed. If not, the displayed waveform or numeric data may not be transmitted.

1 Press [Change] for "Waveform".

▸ The display will change to waveform selection mode.

▸ The "Waveform Selection" window will be displayed.



2 Press the waveform display area to change the parameter.

▸ By pressing the selected area again, the selection will be canceled.

▸ To start again from the beginning, press the [Reselect Area] key.

▸ Adjust the size of the selected area which is indicated by blue box.

3 Select the parameter on the "Waveform Selection" window.
Press the ▲ ◄/ ► keys to switch the displayed parameters.
(☞"Waveform Selection" P10-14)

4 Press [Continuous Setup] to switch to continuous setup mode.

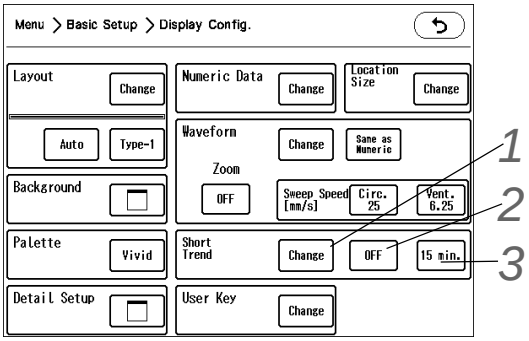
▸ On the continuous setup mode, the waveform display area can be sequentially selected.

5 Press the [Setup] key.

▸ The setup will be finalized.

❑Short Trend Display

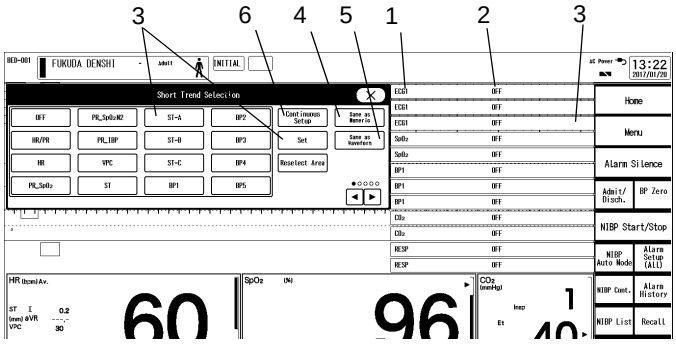
The parameters and display duration for the short trend display can be set.



NOTE

- The short trend can be displayed when the numeric data layout is "Right"/"Right&Bottom"/ "Left"/"Left&Bottom"/"Bottom".
- When 12-lead layout is displayed, ST value of each lead can be displayed in short trend.

1 Press the [Change] key to set the parameters for the short trend display.



1 The parameters for the current waveform display area will be displayed.

2 The selected short trend parameters will be displayed.

3 Select the short trend area, and assign the parameter for that area.

4 [Same as Numeric]: The same parameters for the currently displayed numeric data will be set as the short trend parameters.

5 [Same as Waveform]: The same parameters for the currently displayed waveform will be set as the short trend parameters.

6 Press [Continuous Setup] to switch to continuous setup mode. On the continuous setup mode, the short trend display area can be sequentially selected.

NOTE

- The [Change] key will be displayed when [User Setup] is selected for "Short Trend" (Display Config.>Detail Setup).
- [Same as Numeric], [Same as Waveform] will be applied for the displayed parameters at the point when the key is pressed. The short trend parameters will not automatically change when the displayed parameters are changed.

2 Select ON/OFF of short trend display.

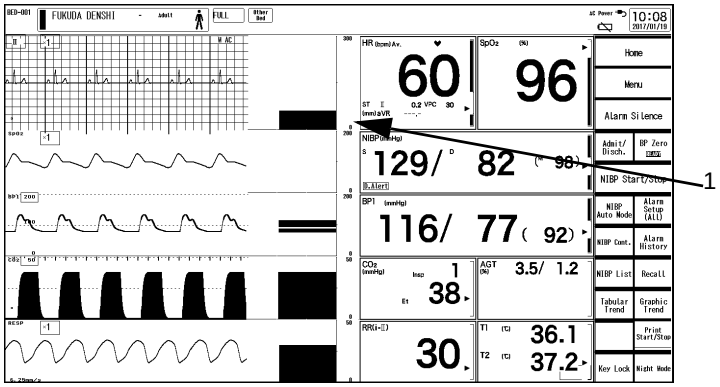
- [ON]: Short trend will be displayed on the home display.
- [OFF]: Short trend will not be displayed on the home display.
- [Overlap]: Short trend will be displayed overlapped with the waveform.

3 When [ON] or [Overlap] is selected, set the time span. The selectable duration differs depending on the short trend data resolution and display width (7 levels).

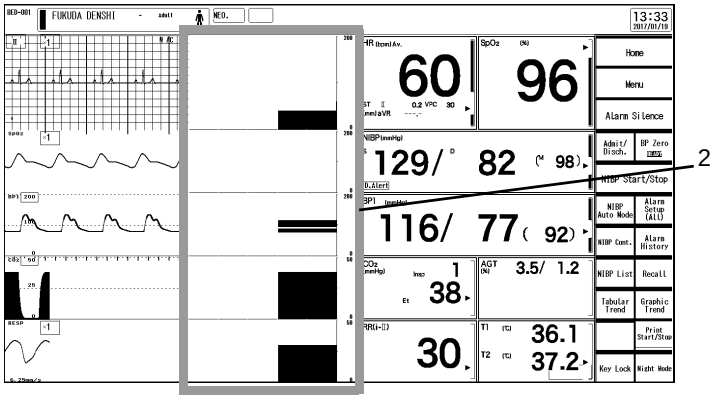
		Display Width (7 levels)						
		0	1	2	3	4	5	6
Data Resolution	5 sec.	Display OFF	5 min.	10 min.	15 min.	20 min.	25 min.	30 min.
	10 sec.	Display OFF	10 min.	20 min.	30 min.	40 min.	50 min.	60 min.
	30 sec.	Display OFF	30 min.	60 min.	90 min.	120 min.	150 min.	180 min.

4 Select the display duration for the short trend.

1 Press the waveform display area on the home display.



2 The trend display time will change to the time of the pressed position.



NOTE

- When an alarm is generated for the recall alarm factor, recall screen will be displayed.
- When the cursor function is enabled, a cursor will be displayed. The display duration can be changed under "Short Trend" (Menu > Display Config.)

❑Sweep Speed

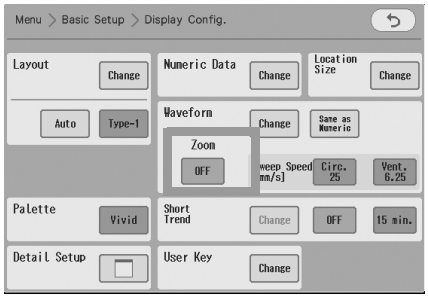
The sweep speed can be set with the following procedure. The sweep speed can be set differently for the circulatory system waveforms (ECG, BP) and respiratory system waveforms.

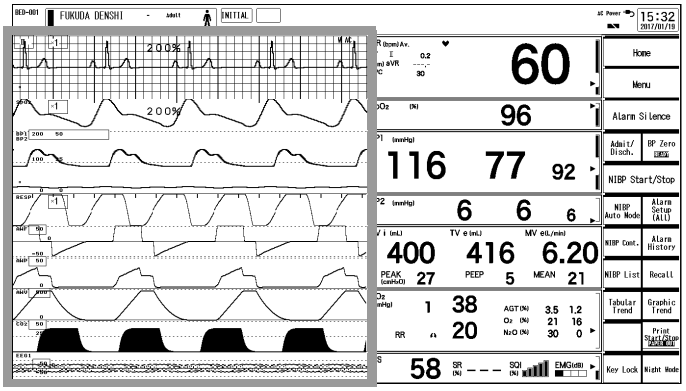
1 Select the circulatory sweep speed from [6.25]/[12.5]/[25]/[50] (mm/s).

2 Select the respiratory sweep speed from [6.25]/[12.5]/[25] (mm/s).

❑Enlarged Waveform Setup

By selecting [ON] for "Zoom", the displayed waveform size and sweep speed will be doubled.





NOTE

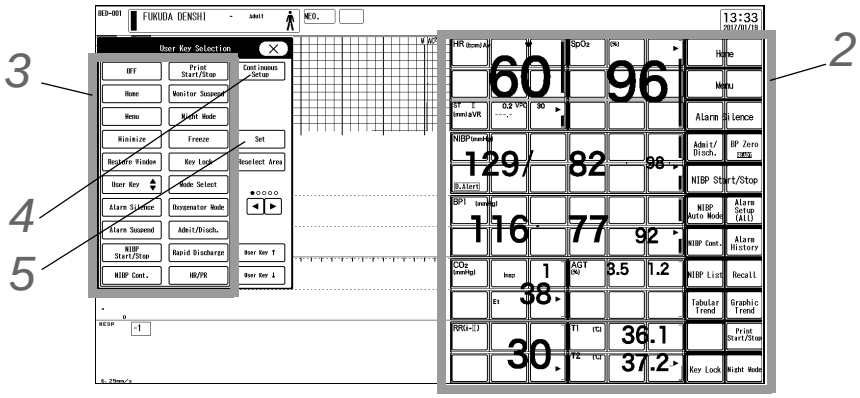
- When the sweep speed is set to [50 mm/s], "Zoom" cannot be set to [ON].
- Scale will not be enlarged.

❑User Key Setup

The user key can be set with the following procedure.

1 Press the [Change] key for "User Key".

- The display will change to user key selection mode.
- The "User Key Selection" window will be displayed.



2 Select the area to change the user key.

- By pressing the selected area again, the selection will be canceled.
- To start again from the beginning, press the [Reselect Area] key.
- Adjust the size of the selected area which is indicated by blue box.

3 Select the function to assign to the user key on the "User Key Selection" window.

NOTE

- The displayed user key can be switched between 2 displays using the [User Key Up] and [User Key Down] keys.
- Press the ▲ / ▼ keys to switch the user key selection. (☞"User Key Selection" P10-15)

4 Press [Continuous Setup] to switch to continuous setup mode.
On the continuous setup mode, the user key display area can be sequentially selected.

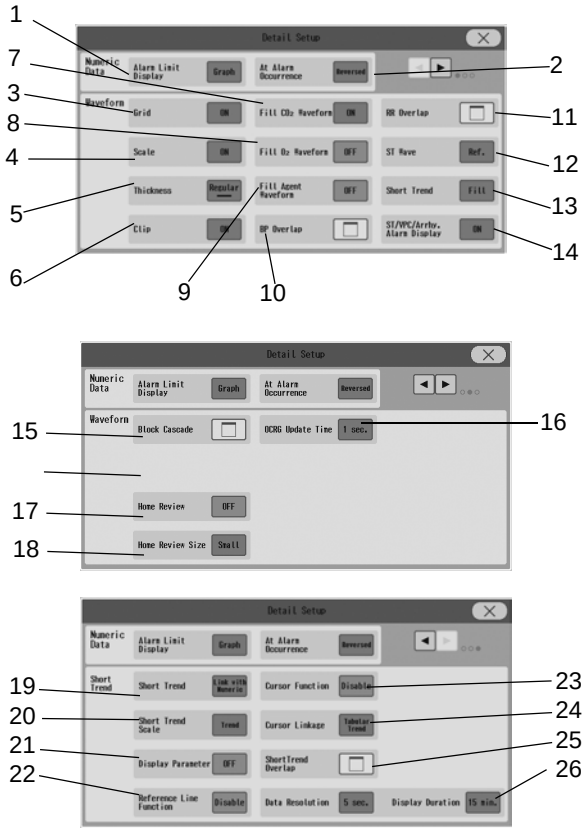
5 Press the [Setup] key.

▸ The setup will be finalized.

❑Detail Setup

1 Press the key for "Detail Setup".

▸ The "Detail Setup" window will be displayed.



1 Alarm Limit Display

The alarm limit can be displayed inside the numeric data box.

[Graph]: Alarm limit will be displayed in bar graph.
[Numeric]: Alarm limit will be displayed in numeric format.
[OFF]: Alarm limit will not be displayed.

2 At Alarm Occurrence

The numeric data display format at alarm occurrence can be selected.

[Reversed]: The numeric data will be displayed in reversed color at alarm occurrence.
[3D]: The numeric data will be displayed in 3D at alarm occurrence.

3 Grid

The ECG waveform can be displayed on the grid.

[ON]: Grid will be displayed.
[Bold]: Grid will be displayed in bold format.
[OFF]: Grid will not be displayed.

REFERENCE

- Short trend and grid cannot be displayed overlapped.

4 Scale

The scale can be selected from [ON]/[Bold1]/[Bold2].

5 Thickness

The thickness of the displayed waveforms can be selected from [Thin] / [Regular] / [Thick].

6 Clip

Whether or not to clip the overlapped waveforms of the neighboring display area can be selected.

7 Fill CO_2 Waveform

Whether or not to fill in the CO_2 waveform from the baseline can be selected.

8 Fill O_2 Waveform

Whether or not to fill in the O_2 waveform from the baseline can be selected.

9 Fill Agent Waveform

Whether or not to fill in the Agent waveform from the baseline can be selected.

10 BP Overlap

The overlapping BP waveforms can be set for each overlap group 1 to 3.

11 RR Overlap

The overlapping RR waveforms can be set.

12 12-Lead ST Wave

The ST waveform to be displayed for the 12-Lead layout can be set.
[Ref.]: The ST reference waveform will be displayed.
[Average]: The average waveform will be displayed.

13 12-Lead ST Short Trend

The display format for the ST short trend can be selected from [Plot]/[Fill]/[OFF].

14 ST/VPC/Arrhy. Alarm Display

Whether or not to display the ST value, VPC (integrated value of 1 minute), arrhythmia alarm message inside the HR numeric data box can be selected.

15 Block Cascade

The waveform combination for block cascade display can be set.

16 OCRG Update Time

Set 1 second or 2 seconds as the update time for OCRG Data in the Home Review display.

17 Home Review

[Graphic/Tabular Trend]: Graphic trend and tabular trend will be displayed in the waveform display area.

[OCRG]: OCRG will be displayed in the waveform display area.

NOTE

- Home Review is selected, the waveform set to the same display area with the review will not be displayed.

18 Home Review Size

Select the display area size for graphic/tabular trend from [Big]/[Medium]/[Small].

NOTE

- Home Review is fixed to [small].

19 Short Trend

The short trend parameters can be linked to the displayed numeric data or waveform.

[Link with Numeric]: The short trend layout will be linked to the displayed numeric data on the home display.

[Link with Waveform]: The short trend layout will be linked to the displayed waveform on the home display.
[User Setup]: User settings will be applied for the short trend layout.

20 Short Trend Scale

The short trend scale for the following parameters can be synchronized with the scale of trend or waveform.
BP / PEAK / VT/ CO_2 / O_2 / Agent

21 Display Parameter

Whether or not to display the parameter name of the displayed short trend can be set.
[ON]: Displays the parameter name with the corresponding color of the parameter.
[Gray]: Displays the parameter name in gray.
[OFF]: Parameter name will not be displayed.

22 Reference Line Function

Whether or not to display the reference lines can be set for the following parameters.
HR, ST, BP1 to 4, NIBP, EtCO_2, SpO_2, BIS
[Enable]: The reference line function will be enabled. On the "Short Trend Setup" window (displayed when short trend scale area is pressed), ON/ OFF of reference line display and reference line position can be set for each parameter.
[Disable]: The reference line function will be disabled.

NOTE

- The reference line function cannot be used for the overlapped short trend display.
- When [Enable] is selected, the function to highlight the alarm generated data cannot be used.

23 Cursor Function

Whether or not to display a cursor can be selected. By displaying a cursor, the measured data and review data (tabular trend/graphic trend/zoom wave) at the time of cursor position can be displayed.
[Enable]: The cursor function will be enabled. However, the function to enlarge/reduce the display duration by pressing the short trend area will be disabled.
[Disable]: The cursor function will be disabled.

NOTE

- The cursor function cannot be used for the overlapped short trend display.
- When [Enable] is selected, the function to highlight the alarm generated data cannot be used.
- The cursor will be displayed when the short trend area is pressed, and will be automatically cleared after a short while.

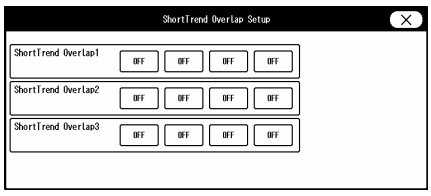
24 Cursor Linkage

When [Enable] is selected for "Cursor Function", the review data to be displayed can be selected from [Tabular Trend] / [Graphic Trend] / [Zoom Wave].

The zoom wave can be displayed only when the full disclosure waveform function is enabled.

25 Short Trend Overlap

Maximum of 4 parameters can be displayed overlapped in the same short trend area.
However 2 blocks of waveform area are required for each parameter. For example, to display 3 parameters in the same short trend area, 6 blocks of waveform area are required.



26 Data Resolution, Display Duration

Select the data resolution from [5 sec.]/[10 sec.]/[30 sec.]. The display duration will differ depending on the "Data Resolution" setting.
For [5sec.], maximum display duration is 30 minutes.
For [10sec.], maximum display duration is 1 hour.

For [30sec.], maximum display duration is 3 hours.

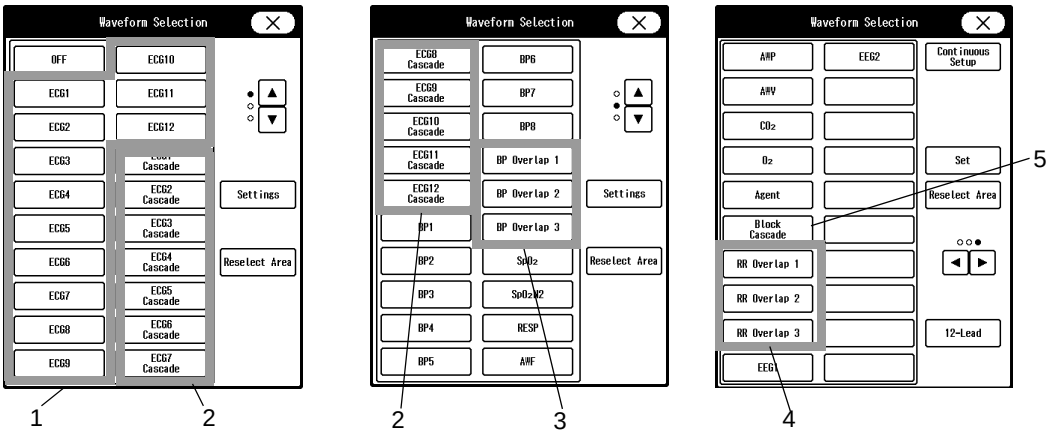
2 Press the [Home] key to check the configured display.

NOTE

- If the numeric data box is configured at the bottom of display, user keys cannot be assigned to the numeric data box area.
- After configuring the display, make sure to verify the configured display by pressing the [Home] key.
- To maintain the configured display even after the power is turned OFF or after the discharge procedure, store the configuration to one of the user modes, or select [Backup] for "Display Configuration" under Initial Settings>User I/F>At Power ON/At Discharge. (☞"To Select the User Mode" P5-10)

Waveform Selection

The waveform to be displayed can be selected on the "Waveform Selection" window.
This section explains the details of the displayed waveforms.



Page 1 *Page 2* *Page 3*

1 ECG1 to ECG12

The ECG waveform of the specified channel will be displayed. Minimum of 2 blocks are required to display the ECG waveform.

2 ECG1 to ECG12 Cascade

The ECG waveforms of the specified channel will be displayed in cascade. Minimum of 2 blocks are required to display in cascade.

3 BP Overlap 1 to 3

The BP waveform (BP1 to BP8) set on "BP Overlap Setup" will be displayed.
If the waveform display area is too small to display the assigned BP waveforms, it will be displayed in the priority from smaller channel numbers.

4 RR Overlap 1 to 3

The RR waveform (CO_2, O_2, Agent) set on "RR Overlap Setup" will be displayed.
If the waveform display area is too small to display the assigned waveforms, it will be displayed in the priority of CO_2>O_2>Agent.

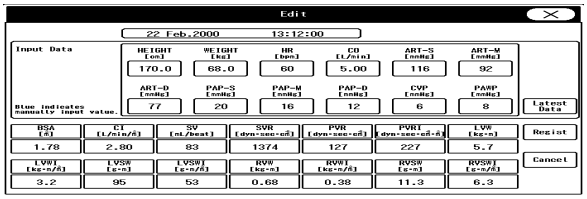
5 Block Cascade

The waveforms (2 to 6) set on the "Block Cascade Setup" will be displayed in one block.

Other than the waveforms explained above, the selected waveform on the "Waveform Selection Window" will be displayed.

User Key Selection

The user keys can be set on the "User Key Selection" window.
This section explains the function for each user key.



Example: Page 1

Page 1	
OFF	Blank key will be displayed.
Home	The display will return to the home display.
Menu	The menu screen will be displayed.
User Key ▲▼	The first and second page of the user key area will switch. This key will be located at the same position for both first and second page.
Alarm Silence	Alarm sound will be suspended for fixed amount of time. By pressing the key for more than 3 seconds while the alarm is not generated, it will bring the system to "Alarm Sound Suspend" condition.
Alarm Suspend	Alarm (sound and display) will be suspended for fixed amount of time.
NIBP Start/Stop	NIBP measurement will start/stop.
NIBP Cont.	NIBP continuous measurement will start/stop.
Print Start/Stop	Manual printing will start/stop.
Monitor Suspend	Confirmation window to suspend monitoring will be displayed.
Night Mode	Night mode will turn ON/OFF.
Freeze	Waveform trace will freeze for fixed amount of time. Pressing the [Print Start/Stop] key while in freeze condition will print the frozen waveform. Holding down the key will start the waveform trace again.
Key Lock	Touch key operation will turn ON/OFF. It can be used when cleaning the display panel.
Mode Selection	User mode selection screen will be displayed.
Oxygenator Mode	The home display will switch to oxygenator mode.
Admit/Discharge	Admit/Discharge screen will be displayed.

Page 2	
Rapid Discharge	Confirmation window to erase the data will be displayed.
HR/PR	The HR/PR numeric data box will be switched between HR and PR.
HR/PR Source	The parameter for HR/PR Source will be automatically selected.
BP Zero	Zero balance of BP1 to BP8 will be performed.
Leads	List of lead groups will be displayed, and selecting a lead group will display the lead selection window. It cannot be assigned to the numeric data area. 2 blocks are required to assign this key.
ECG Size (All Leads)	The waveform size for all ECG leads can be changed.
Scale	The home display will change to scale selection mode.
SpO_2-1 Display ON/OFF	SpO_2-1 display will turn ON/OFF.
SpO_2-2 Display ON/OFF	SpO_2-2 display will turn ON/OFF.
CO_2 Display ON/OFF	CO_2 display will turn ON/OFF.

GAS Display ON/OFF	Multigas module data display will turn ON/OFF.
Auto Display Config.	The display will be automatically configured with the currently measured parameters.
Enlarged Display	For the standard display layout, the numeric data box width will change.
Short Trend ON/OFF	Short Trend display will turn ON/OFF.
Home Review Trend	The graphic/tabular trend display will turn ON/OFF.
Home Review OCRG	The home review OCRG display will turn ON/OFF.

Page 3	
Transparent Window ON/OFF	Transparent window will turn ON/OFF.
Change Palette	Palette selection window will be displayed.
Graphic Trend	The graphic trend will be displayed.
Trend (Group)	List of trend groups will be displayed, and selecting a trend group will display the graphic trend.
Tabular Trend	The tabular trend will be displayed.
Tabular Trend (Group)	List of tabular trend groups will be displayed, and selecting a trend group will display the tabular trend.
NIBP List	NIBP list will be displayed.
Recall	Recall screen will be displayed.
Alarm History	Alarm history will be displayed.
OCRG	OCRG screen will be displayed.
ST	ST screen will be displayed.
Cardiac Output	CO measurement screen will be displayed.
Drug Calculation	The drug calculation menu will be displayed.
PAWP	PAWP measurement screen will be displayed. If BP labeled as PAP is not measured, this screen will not be displayed.
Hemodynamics	Hemodynamics screen will be displayed.
Lung Function	Lung Function screen will be displayed.

Page 4	
Full Disclosure Waveform	The full disclosure waveform will be displayed.
12-Lead Analysis	12-lead analysis screen will be displayed.
12-Lead Print	The 12-lead record setup screen will be displayed.
Tone/Volume	The "Tone/Volume" menu will be displayed.
NIBP Auto Mode	NIBP Auto Mode window will be displayed.
Alarm Setup (All)	Alarm settings for all parameters will be displayed.
Alarm Setup (Basic)	Alarm settings for basic parameters will be displayed.
Manual Printing	Manual printing setup screen will be displayed.
Display Configuration	The display configuration window will be displayed.
Other Bed	Other bed screen will be displayed.
Stopwatch	Stopwatch screen will be displayed.
Group 1 to 4	Selection list of key group 1 to 4 will be displayed.
Page 5	
Group 5	Selection list of key group 5 will be displayed.
Event	Event selection list will be displayed. The selected event will be saved as recall waveform.
Print (LBP) Cancel	Printing on the laser printer will be canceled.
Oxygenator Mode	The "Oxygenator Mode" menu will be displayed.

Main Mode 1(Initial)	Main mode 1 (Initial) will be set as the monitoring mode.
Main Mode 2 (Hemo.)	Main Mode 2 (Hemo.) will be set as the monitoring mode.
Main Mode 3 (Cardiac)	Main Mode 3 (Cardiac) will be set as the monitoring mode.
Main Mode 4 (Local)	Main mode 4 (Local) will be set as the monitoring mode.
Main Mode 5 (Full)	Main mode 5 (Fulll) will be set as the monitoring mode.
Main Mode 6 (Heart)	Main mode 6 (Heart) will be set as the monitoring mode.
Main Mode 7 (Neo.)	Main mode 7 (Neo.) will be set as the monitoring mode.
Main Mode 8 (Recovery)	Main mode 8 (Recovery) will be set as the monitoring mode.
Main Mode 9 (Cardiac)	Main Mode 9 (Cardiac) will be set as the monitoring mode.
Sub Mode 1 (Induct.)	Sub Mode 1 (Induct.) will be set as the monitoring mode.
Sub Mode 2 (Surgery)	Sub Mode 2 (Surgery) will be set as the monitoring mode.
Sub Mode 3 (Waking)	Sub Mode 3 (Waking) will be set as the monitoring mode.
Page 6	
Sub Mode 4 (12-Lead)	Sub Mode 4 (12-Lead) will be set as the monitoring mode.
Sub Mode 5	Sub Mode 5 will be set as the monitoring mode.
Sub Mode 6	Sub Mode 6 will be set as the monitoring mode.

* The default mode names are displayed inside the brackets. The mode names can be changed.

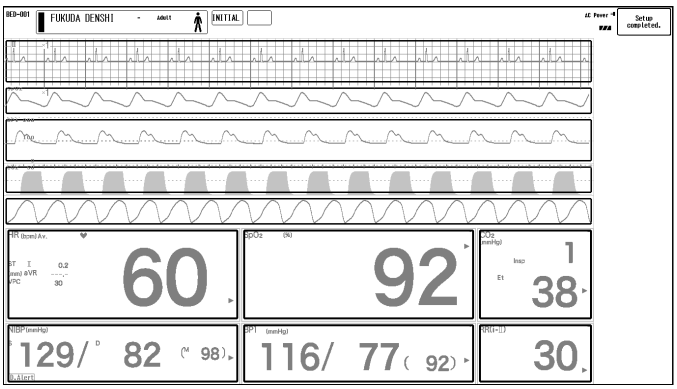
(☞Maintenance Manual "To Program the User Mode" P5-28)

WARNING

- After changing the mode, make sure that the monitoring setting is appropriate.
  When the mode is changed, patient classification, alarm settings, etc. will be changed.

Changing the Display Layout from the Home Display

Holding down the home display area will change the mode to display layout change mode.



On the display layout change mode, the following layout change can be performed.

- Changing the displayed position of the waveform/numeric data
- Changing the size of the waveform/numeric data
- Adding the waveform/numeric data
- Deleting the waveform/numeric data

❑Changing the Displayed Position of the Waveform/Numeric Data

Drag the waveform/numeric data to a desired position.
The color of the dragged position will change to yellow.
By releasing the finger where the color has changed to yellow, the data will be located to a new position.

NOTE

- By pressing the [UNDO] key which is displayed after changing the position, the previous operation can be canceled.

❑Changing the Size of the Waveform/Numeric Data

The size of the waveform/numeric data can be changed by pinch in/out operation.

NOTE

- To enlarge the size, there should be enough space on the display.
- The size can be enlarged downwards or rightwards.

❑Adding the Waveform/Numeric Data

The waveform/numeric data can be added by touching the free area, or by holding down the interspace of currently displayed waveform/numeric data.

❑Deleting the Waveform/Numeric Data

The waveform/numeric data can be deleted by flicking the corresponding display area.

❑Ending the Display Layout Change Mode

The display layout change mode can be ended by pressing the [Setup completed] key on the upper right of the screen.

Tone/Volume

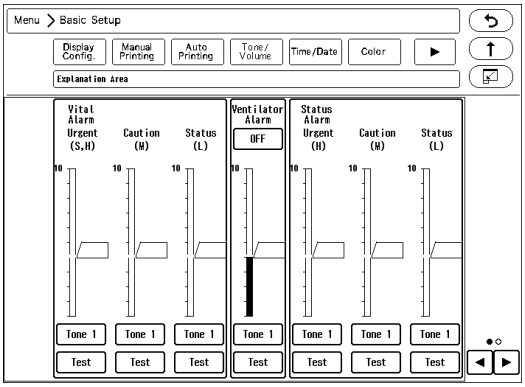
This section explains the tone/volume setup procedure for alarm sound, HR synchronized tone, key sound, and boot/shutdown sound. The tone/volume setup screen also allows to turn OFF the ventilator alarm sound.
The volume of the sound which notifies the completion of BP zero balance and NIBP measurement can be adjusted on "Other" setting.

NOTE

- The tone setup for the synchronized tone is effective only for HR and BP synchronized tone. The tone for SpO_2 synchronized sound will change according to the SpO_2 value. The tone will increase as the SpO_2 value increases, and vice versa.
- The start-up sound will always generate for the DS-1200 even when the "Boot/Shutdown" sound is set to minimum level.

1 Press the [Menu], [Sound] ("Basic Setup") keys.

▸ The "Tone/Volume" menu will be displayed.



▸ The orange section of each bar indicates the volume escalation range set under "Initial Settings > Alarm Setup > Alarm Volume Escalation" . (☞Maintenance Manual "Alarm Related Setup" P5-4)

2 Set the volume.

WARNING

- Changing the setting for "Alarm System" (Initial Settings > Alarm) will also change the alarm volume and tone setting. Make sure to check the volume and tone when the setting is changed.

CAUTION

- Pay attention not to set the alarm volume too low to avoid missing any important alarms. The alarm sound for ECG, SpO_2, CO_2 will be different from the test sound. The set volume will be applied but the set tone will not be applied to these parameters.
- When [IEC Tone] is set for the "Alarm System", the alarm volume and tone for the ventilator alarm and device status alarm will be the same with that of the vital alarm.

REFERENCE

- The volume above the set minimum volume can be set. (☞Maintenance Manual "Alarm Related Setup" P5-4)

1 Slide the up or down.

▸ When the slider is released, ▲/▼ will be displayed.

2 ▲ Press ▼.

▸ The volume will be adjusted.

REFERENCE

- The order of alarm priority is Urgent (H) > Caution (M) > Status (L). The volume is also set according to the alarm priority. The volume for high priority alarm cannot be set lower than the lower priority alarm, and vice versa.

3 Select the tone level.

NOTE

- The tone selection is different for the synchronized tone, alarm sound, and key sound.

- For the "Sync. Tone", [Selected Tone] will generate the HR synchronized tone with the selected tone. [Sync. With SpO_2 Value] will generate the HR synchronized tone with the same tone with the SpO_2synchronized tone. If the SpO_2 value is invalid, [Tone 2] will be applied.

4 Press the [Test] key to check the set volume/tone.

5 Set [ON]/[OFF] for ventilator alarm sound.

❑Alarm System

Alarm Operation	Fukuda Tone (1) Tone 1 to 4 (2) Tone 5 to 8	Melodic Tone	IEC Tone
Vital Alarm Sound			
Level H	(1) Continuous melodic tone (2) Continuous rapid tone	ECG: Continuous melodic tone with rising pitch SpO_2, O_2: Continuous melodic tone with falling pitch CO_2: Continuous melodic tone with mixed low and high pitch Other than above: Continuous melodic tone	Continuous tone
Level M	(1) Alternate high and low pitch in 5 seconds interval (2) Rapid tone in 5 seconds interval	ECG: Rising pitch in 4 seconds interval melodic tone SpO_2, O_2: Falling pitch in 4 seconds interval melodic tone CO_2: Mixed low and high pitch sound in 4 seconds interval melodic tone Other than above: 4 seconds interval melodic tone	4 seconds interval tone
Level L	(1) 15 seconds interval melodic tone (2) 15 seconds interval tone	17 seconds interval melodic tone	17 seconds interval tone
Device Status Alarm Sound			
Level H	(1) Continuous melodic tone (2) Continuous rapid tone	Continuous melodic tone	Continuous tone
Level M	(1) Alternate high and low pitch in 5 seconds interval (2) Rapid tone in 5 seconds interval	4 seconds interval melodic tone	4 seconds interval tone
Level L	(1) 15 seconds interval melodic tone (2) 15 seconds interval tone	17 seconds interval tone	17 seconds interval tone
Volume Setup			
Level H, M, L	The volume for low level alarm cannot be set higher than the higher level alarm.		
Tone Setup			
Level H	Vital Alarm: Setup can be performed. Device Status Alarm: Setup can be performed.	Vital Alarm: Setup can be performed. Device Status Alarm: Setup cannot be changed.	
Level M			
Level L			
Setup other than above			

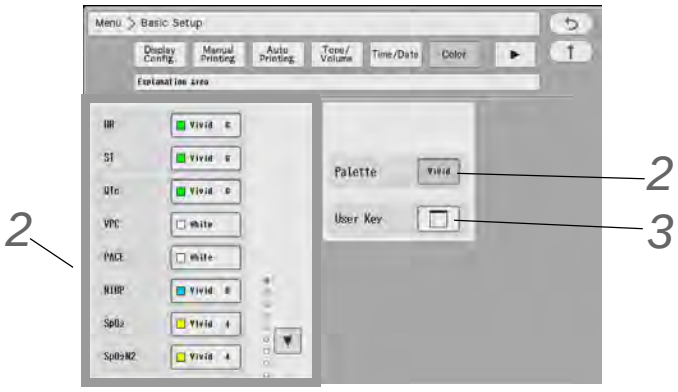
Other Bed Alarm	Sound: Continuous tone Tone: Cannot be changed. Volume: Can be adjusted.	Sound: Continuous tone Tone: Cannot be changed. Volume: Can be adjusted.	
Ventilator Alarm Sound	Sound: Continuous tone Tone: Cannot be changed. Volume: Can be adjusted.	Sound: Continuous melodic tone Tone: Cannot be changed. Volume: Can be adjusted.	Continuous tone

Color

In this section, setup procedure for the color of numeric data, waveform is explained.
The colors of the numeric data, waveform, user key can be customized.
The colors can be customized according to the various monitoring scene such as recognizable colors from a far distance or colors which will not strain your eyes by the long time monitoring.

1 Press the [Menu], [Color] ("Basic Setup") keys.

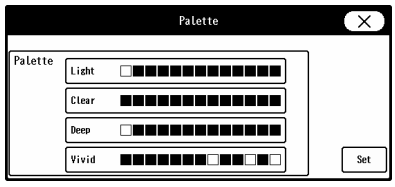
▸ The "Color" selection window will be displayed.



2 Set the color of the numeric data and waveforms

The color can be set for each parameter. 12 colors (+white) from each palette are selectable.

1 Pressing the [Palette] key will display the "Palette" selection window. (shown on right)



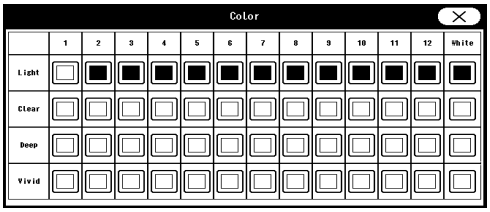
2 Select the palette from [Light] / [Clear] / [Deep] / [Vivid], and press the [Set] key.

▸ The color of the numeric data and waveform will change to the selected palette color.

3 Press ▲/▼ to switch the page.

4 Press the key for the parameter to change the color.

▸ The "Color" selection window will be displayed.



5 Select a color.

▸ The selected color for the parameter will be applied to the waveform, numeric data, graphic trend, and tabular trend.

3 Set the color of the user key.

1 Press the key for "User Key".

▸ The "User Key Color" selection window will be displayed.

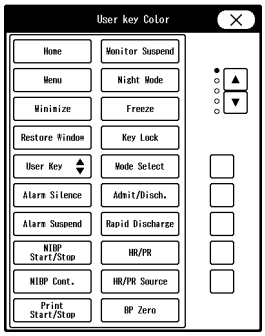
2 Press ▲/▼ to switch the page.

3 Select the user key to change the color.

▸ Pressing the key again will cancel the selection.

4 Select the color displayed on the right.

▸ The color of the user key will change.



Brightness

In this section, brightness adjustment of the monitor display is explained.

CAUTION

- This equipment utilizes LED for the backlight. Since this LED deteriorates by the life cycle, the display may become dark, scintillate, or may not light by the long term use. In such case, contact your nearest service representative.

1 Press the [Menu], [Brightness] ("Basic Setup") keys.

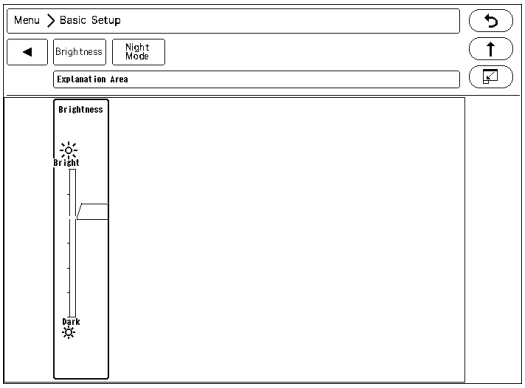
▸ The "Brightness" menu will be displayed.

2 Slide the ⟋ up or down.

▸ When the slider is released, ▲/▼ will be displayed.

3 Press the ▲/▼ keys.

▸ The brightness will be adjusted.



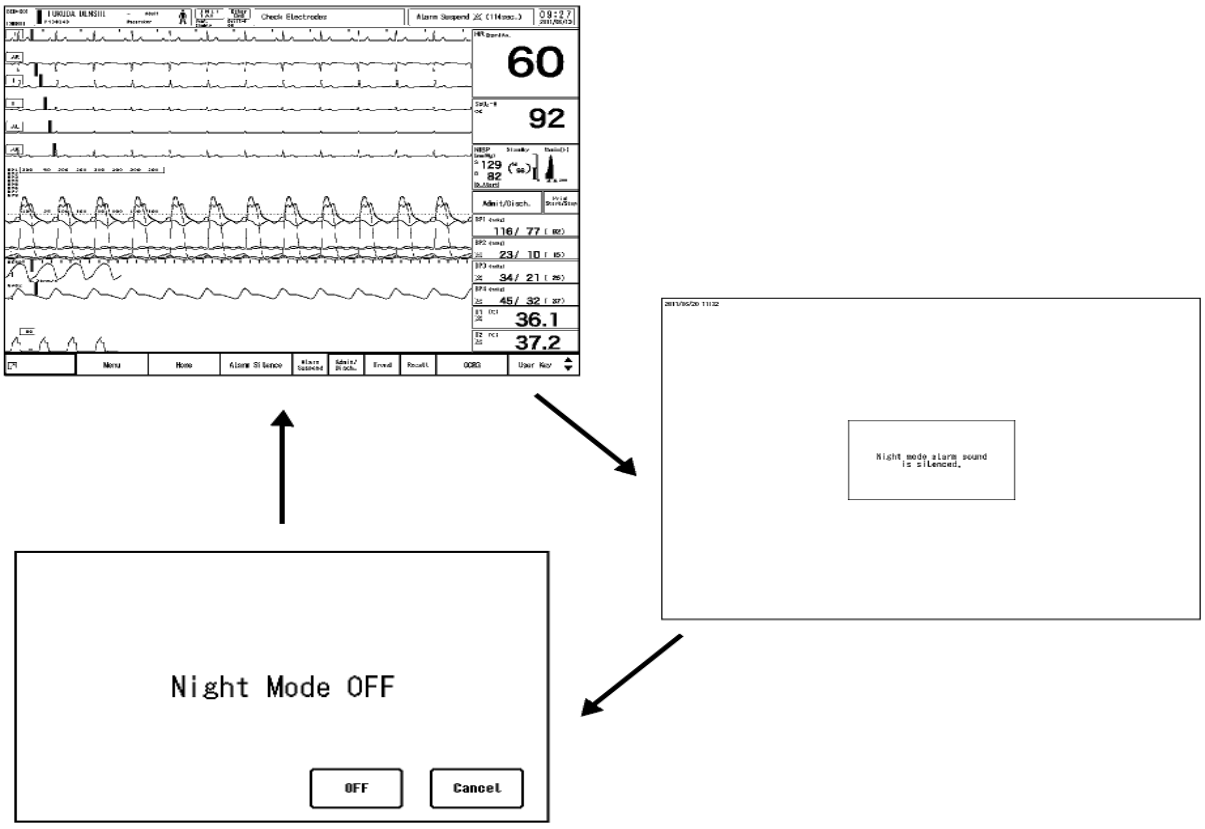
Night Mode

This section explains about the night mode setup procedure.

The night mode is a function to preset the screen brightness and alarm volume when turning OFF the light of the ward or when the patient is asleep, etc.

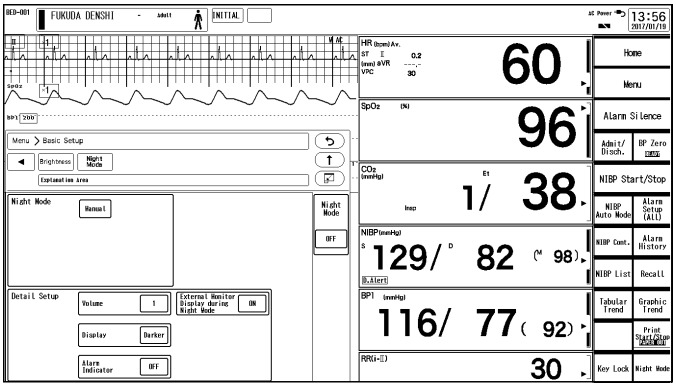
The night mode can be manually set to ON, or automatically set to ON by preprogramming the time to turn ON/OFF the night mode.

❑Operation flow when the night mode is set to "Timer"



❑Operation flow when the night mode is set to [Darker] or [Dark]

1 To manually set the night mode, select [ON] for "Night Mode" or press the [Night Mode] key on the user key area.



▸ During the night mode, "Night Mode Active" message will be displayed.

NOTE

- When the timer is set, the night mode will automatically start at the set "Start Time".

2 Cancel the night mode.

(☞Maintenance Manual "Display/Print Setup" P5-12)

NOTE

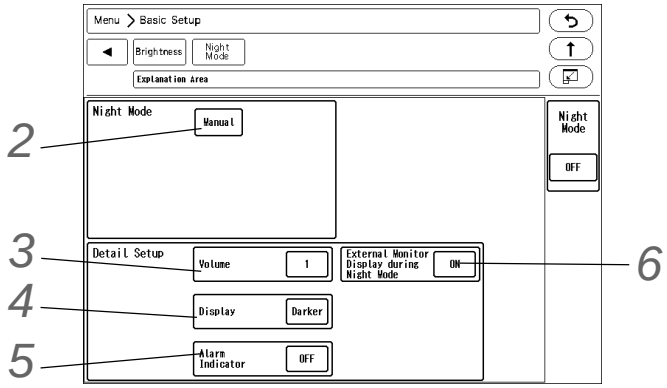
- The night mode can be manually turned ON from the menu, user key, or remote control even when the night mode is set to automatically turn ON. The night mode will automatically turn OFF at the set "End Time".
- The night mode cannot be set when the ventilator alarm is generated.
- The night mode cannot be set during the battery operation.

Night Mode

The time to start and end the night mode, and the night mode display can be set.

1 Press the [Menu], [Night Mode] ("Basic Setup") keys.

▸ The "Night Mode" menu will be displayed.



2 Set the "Start Time" and "End Time" for the night mode.

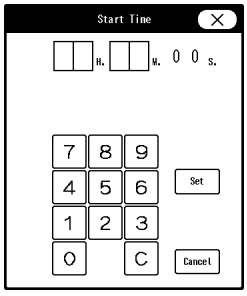
▸ [Manual]: The night mode can be turned ON or OFF manually using the user key.

▸ [Timer]: The night mode will automatically turned ON or OFF at the preprogrammed time.
The night mode can be manually turned ON from the user key or from the remote control unit even when the [Timer] is set.

When [Timer] is selected:

1 Press the key for "Start Time".

▸ The "Start Time" window will be displayed. (shown on right)



2 Use the numeric keys to enter the time.

3 Press the [Set] key.

4 Set the "End Time" with the same procedure from Step 3 to 5.

3 Set the volume.

WARNING

- When selecting [Silence], pay attention not to miss any important alarm by simultaneously monitoring the bed on other monitors such as central monitor.

- [No Change]: Standard volume will be set.
- [3]: Third level from the minimum volume will be set.
- [1]: Minimum volume will be set.
- [Silence]: Sound will be silenced.

4 Set the brightness.

WARNING

- When selecting [Time Only], pay attention not to miss any important alarm by simultaneously monitoring the patient on other monitors such as central monitor.

- [No Change]: Brightness will not change
- [Dark]: 80% of the maximum brightness will be set.
- [Darker]: 50% of the maximum brightness will be set.
- [Time Only]: Only the time will be displayed. The message will disappear after 1 minute from starting the night mode.

5 Set the alarm indicator operation.

- [ON]: The alarm indicator will light even during the night mode.
- [OFF]: The alarm indicator will not light during the night mode.

6 Set the external monitor operation.

- [ON]: Displays the home display on the external monitor.
- [OFF]: Turns OFF the external monitor display.
- [OFF (Time Only)]:
  If [Time Only] is selected for "Display": Displays the [Time Only] screen on the external monitor as well as the main unit.
  If [No Change], [Dark] or [Darker] is selected for "Display": Turns OFF the external monitor display.

Chapter 11 Troubleshooting

Message List

For the vital alarm message, there are numeric data alarm and arrhythmia alarm, and the delay time are as follows.

	Delay Time	
	Adult / Child	Neonate
HR Upper / Lower Limit	5 sec.	0 sec. to 5 sec. (It is variable depending on the setting / Increment: 1 sec.)
RR Upper / Lower Limit		
SpO_2 Upper / Lower Limit		
Tachy / Brady	5 sec.	0 sec. to 5 sec. (It is variable depending on the setting / Increment: 1 sec.)
Ext Tachy / Ext Brady		
Numeric data alarm other than above	5 sec.	None (0 sec.)
Arrhythmia alarm other than above	None (0 sec.)	None (0 sec.)

* When the "HR Average" is set to "Analysis", the delay time will be "None (0 sec.)".

REFERENCE

- The alarm delay time can be changed under [Initial Settings > Alarm > Alarm Level > Setup > Delay Time].
  (☞Maintenance Manual "Alarm Related Setup" P5-4)

Vital Alarm Message

⚠ CAUTION

- The arrhythmia alarm message other than Tachy, Brady, Ext Tachy, Ext Brady will continue to be displayed for 30 seconds after the alarm is resolved.
- The alarm level shown below is the standard level set by Fukuda Denshi.
- The alarm level can be changed under "Initial Settings > Alarm Setup > Alarm Level" .

❑Top Priority Alarm (Alarm Level S)

This level can be selected only when [Fukuda Tone] is selected under [Menu> System Config.>Initial Settings>Alarm System]. It cannot be selected when the "Alarm System" is [Melodic Tone] or [IEC Tone].

❑Life Threatening Alarm (Alarm Level H)

Measuring Parameters	Message
Respiration (Impedance, CO_2, Ventilator)	<Apnea>
SpO_2*	<Lower Ext SpO_2* Alarm>
Arrhythmia	<Asystole>
	<VF>
	<VT>
	<Ext Tachy>
	<Ext Brady>
Shock Index (SI)	<Upper SI Alarm>

❑Cautionary Alarm (Alarm Level M)

Measuring Parameters	Message
Heart Rate	<Lower HR Alarm>
	<Upper HR Alarm>
Blood Pressure	<Lower BP# Alarm> or <Lower (label) Alarm>*1
	<Upper BP# Alarm> or <Upper (label) Alarm>*1
Pulse Rate	<Lower PR Alarm>
(BP)	<Upper PR Alarm>
SpO_2*	<Lower SpO_2 # Alarm>*1
	<Upper SpO_2 # Alarm>*1
	<Lower Ext SpO_2* Alarm>
	<Upper Ext SpO_2# Alarm>
Pulse Rate (SpO_2)	<Lower PR Alarm>
	<Upper PR Alarm>
Non-Invasive Blood Pressure	<Lower NIBP Alarm>
	<Upper NIBP Alarm>
Respiration (Impedance, CO_2, GAS, Ventilator, SpO_2)	<Lower RR Alarm>
	<Upper RR Alarm>
Gas*2	<Lower CO_2-E Alarm>
	<Upper CO_2-E Alarm>
	<Upper CO_2-I Alarm>
	<Lower O_2-E Alarm>
	<Upper O_2-E Alarm>
	<Lower O_2-I Alarm>
	<Upper O_2-I Alarm>
	<Lower N_2O-E Alarm>
	<Upper N_2O-E Alarm>
	<Lower N_2O-I Alarm>
	<Upper N_2O-I Alarm>
	<Lower (AGT label)-E Alarm>
	<Upper (AGT label)-E Alarm>
	<Lower (AGT label)-I Alarm>

Measuring Parameters	Message
	<Upper (AGT label)-I Alarm>
SPIRO*2	<Lower MV Alarm>
	<Upper MV Alarm>
BIS	<Lower BIS Alarm>
	<Upper BIS Alarm>
Arrhythmia	<Pause>
	<Run>
	<Slow VT>
	<Tachy>
	<Brady>
	<Couplet>
	<SVT>
	AFib
QT Measurement	QTc Extension
	QTc Reduction

*1: # indicates the label of BP, TEMP, SpO_2.
For SpO_2, N1/N2/M1/M2/F1/F2/HR/HL/FR/FL/OT will be displayed for #.

*2: When the numeric data acquired from the Anesthesia Delivery System FLOW-i is displayed, alarm will not generate. The alarm will not generate on the central monitor either.

❑Treatment Needed Alarm (Alarm Level L)

Measuring Parameters	Message
ST1 to 12/ΔST	<Lower ST(Lead Type) Alarm> or <Lower ΔST (Lead Type) Alarm>
	<Upper ST(Lead Type) Alarm> or <Upper ΔST (Lead Type) Alarm>
SpCO*	<Upper SpCO# Alarm>*1
SpMet#	<Upper SpMet# Alarm>*1
SpHb	<Lower SpHb# Alarm> *1
	<Upper SpHb# Alarm> *1
TEMP (TEMP1 to 8)	<Lower TEMP# Alarm> or <Lower (label) Alarm>*1
	<Upper TEMP# Alarm> or <Upper (label) Alarm>*1
Blood Temperature	<Upper Tb Alarm>
	<Lower Tb Alarm>
Arrhythmia	<Couplet>
	<Bigeminy>
	<Trigeminy>
	<Frequent>
	<Triplet>
	<R on T>
	<Multiform>
	<Vent. Rhythm>
	<Irregular RR>
	<Prolonged RR>
	<S Frequent>
	<S Couplet>

Measuring Parameters	Message
	<VPC>
	<SVPC>
	<Pacer not Capture>
	<Pacer not Pacing>
SPIRO*2	<Upper PEAK Alarm>
	<Lower PEAK Alarm>
	<Upper PEEP Alarm>
	<Lower PEEP Alarm>

*1: # indicates the channel number of BP, TEMP, SpCO, SpMet, SpHb.
For SpCO, SpMet and SpHb, N1/N2/M1/M2/HR/HL/FR/FL/OT will be displayed for #.

*2: When the numeric data acquired from the Anesthesia Delivery System is displayed, alarm will not generate. The alarm will not generate on the central monitor either.

❑Notification Alarm

Measuring Parameters	Message
All Alarm	<Alarm Suspend (xxx sec.)>
Alarm Sound Suspend	<Alarm Silence (xxx min.)>
Arrhythmia	<ECG Learn>
	<ARRHY. OFF>
Oxygenator Mode	<All Alarm OFF>

NOTE

- (xxx sec) of the <Alarm Suspend (xxx sec)> message indicates the remaining time of alarm suspended duration.
- (xxx min.) of the <Alarm Silence (xxx min.)> message indicates the remaining time of alarm sound suspended duration.
- The <ARRHY OFF> message will be displayed when the Asystole, VF, VT, Slow_VT, TACHY, BRADY, EXT TACHY, EXT BRADY and HR alarm is OFF.
- The notification alarm "AFib" will be displayed when the AFib alarm has occurred after the "AFib Alarm Clear Time" .

Vital Alarm Message (Standard Setup)

⚠ WARNING

- The SpO_2 respiration measurement is not intended for use as an APNEA monitor.

⚠ CAUTION

- The arrhythmia alarm message other than Tachy, Brady, Ext Tachy, Ext Brady will continue to be displayed for 30 seconds after the alarm is resolved.
- The alarm level shown below is the standard level set by Fukuda Denshi.

❑Top Priority Alarm (Alarm Level S)

This level can be selected only when [Fukuda Tone] is selected under [Menu> System Config.>Initial Settings>Alarm System]. It cannot be selected when the "Alarm System" is [Melodic Tone] or [IEC Tone].

❑Life Threatening Alarm (Alarm Level H)

Measuring Parameters	Message
Heart Rate	<Lower HR Alarm>
	<Upper HR Alarm>
Pulse Rate (SpO_2)	<Lower PR Alarm>
	<Upper PR Alarm>
Pulse Rate (BP)	<Lower PR Alarm>
	<Upper PR Alarm>
SpO_2*	<Lower SpO_2 # Alarm>*1
	<Upper SpO_2 # Alarm>*1
	<Lower Ext SpO_2 Alarm>
	<Upper Ext SpO_2# Alarm>
Blood Pressure	<Lower BP1 Alarm>
	<Upper BP1 Alarm>
	<Lower ART Alarm>
	<Upper ART Alarm>
Non-Invasive Blood Pressure	<Lower NIBP Alarm>
	<Upper NIBP Alarm>
Respiration (Impedance, CO_2, GAS, Ventilator, SpO_2)	<Lower RR Alarm>
	<Upper RR Alarm>
	<Apnea>
Gas*1	<Lower CO_2-E Alarm>
	<Upper CO_2-E Alarm>
	<Lower O_2-E Alarm>
	<Upper O_2-E Alarm>
	<Lower O_2-I Alarm>
	<Upper O_2-I Alarm>
	<Lower N_2O-E Alarm>
	<Upper N_2O-E Alarm>
	<Lower N_2O-I Alarm>
	<Upper N_2O-I Alarm>
	<Lower (AGT label)-E Alarm>
	<Upper (AGT label)-E Alarm>
	<Lower (AGT label)-I Alarm>
	<Upper (AGT label)-I Alarm>
	<Upper MAC Alarm>
Arrhythmia	<Asystole>
	<VF>
	<VT>
	<Ext Tachy>

Measuring Parameters	Message
	<Ext Brady>
Shock Index (SI)	<Upper SI Alarm>

*1: For SpO_2, N1/N2/M1/M2/F1/F2/HR/HL/FR/FL/OT will be displayed for #.

*2: When the numeric data acquired from the Anesthesia Delivery System FLOW-i is displayed, alarm will not generate. The alarm will not generate on the central monitor either.

❑Cautionary Alarm (Alarm Level M)

Measuring Parameters	Message
Blood Pressure	<Lower BP2 to 8 Alarm> or <Lower (label other than ART) Alarm>*1
	<Upper BP2 to 8 Alarm> or <Upper (label other than ART) Alarm>*1
ST1 to 12/ΔST	<Lower ST(Lead Type) Alarm> or <Lower ΔST (Lead Type) Alarm>
	<Upper ST(Lead Type) Alarm> or <Upper ΔST (Lead Type) Alarm>'
SpCO*	<Upper SpCO# Alarm>*1
SpMet#	<Upper SpMet# Alarm>*1
SpHb	<Lower SpHb# Alarm> *1
	<Upper SpHb# Alarm>*1
TEMP (TEMP1 to 8)	<Upper TEMP# Alarm> or <Upper (label) Alarm>*1
	<Lower TEMP# Alarm> or <Lower (label) Alarm>*1
Blood Temperature	<Upper Tb Alarm>
	<Lower Tb Alarm>
BIS	<Upper BIS Alarm>
	<Lower BIS Alarm>
MV*2	<Upper MV Alarm>
	<Lower MV Alarm>
PEAK*2	<Upper PEAK Alarm>
	<Lower PEAK Alarm>
PEEP*2	<Upper PEEP Alarm>
	<Lower PEEP Alarm>
Arrhythmia	<Pause>
	<Slow VT>
	<Tachy>
	<Brady>
	<Run>
	<SVT>
	AFib
Gas	<Upper CO_2-I Alarm>
QT Measurement	QTc Extension
	QTc Reduction

*1: # indicates the channel number of BP, TEMP, SpCO, SpMet, SpHb.
For SpCO, SpMet and SpHb, N1/N2/M1/M2/HR/HL/FR/FL/OT will be displayed for #.

*2: When the numeric data acquired from the Anesthesia Delivery System FLOW-i is displayed, alarm will not generate. The alarm will not generate on the central monitor either.

❑Treatment Needed Alarm (Alarm Level L)

Measuring Parameters	Message
Arrhythmia	<Couplet>
	<Bigeminy>
	<Trigeminy>
	<Frequent>
	<Triplet>
	<R on T>
	<Multiform>
	<Vent. Rhythm>
	<Irregular RR>
	<Prolonged RR>
	<S Frequent>
	<S Couplet>
	<VPC>
	<SVPC>
	<Pacer not Capture>
	<Pacer not Pacing>

❑Notification Alarm

Measuring Parameters	Message
All Alarm	<Alarm Suspend (xxx sec.)>
Alarm Sound Suspend	<Alarm Silence (xxx min.)>
Arrhythmia	<ECG Learn>
	<ARRHY. OFF>
Oxygenator Mode	<All Alarm OFF>

NOTE

- (xxx sec) of the <Alarm Suspend (xxx sec)> message indicates the remaining time of alarm suspended duration.
- (xxx min.) of the <Alarm Silence (xxx min.)> message indicates the remaining time of alarm sound suspended duration.
- The <ARRHY OFF> message will be displayed when the Asystole, VF, VT, Slow_VT, TACHY, BRADY, EXT TACHY, EXT BRADY and HR alarm is OFF.
- The notification alarm "AFib" will be displayed when the AFib alarm has occurred after the "AFib Alarm Clear Time" .

Device Status Alarm Message

❑Top Priority Alarm (Alarm Level S)

Item	Message	Delay Time (sec.)
Ventilator	<Vent. Alarm>	1
	<VENT COMM>	1

❑Life Threatening Alarm (Alarm Level H)

Item	Message	Delay Time (sec.)
DS-1200 Main Unit	"DS-1200 Failure"	10
	"DS-1200 Check Unit"	10
	"Check Meas. Unit"	3
	"Check Multiamp. Unit"	3
	"DS-1200 Speaker Failure"	10
Battery	<Charge the battery.>	10
Telemeter	<Telemeter Failure>	3
ECG	< ECG Unit Inspection>	5
SpO_2	<Check SpO_2 Conn.>	5 or 1
Blood Pressure	<Check the ART catheter.>	1
Non-Invasive Blood Pressure	<NIBP Meas. Error (xxx-xxx)>*1	10 or 3
GAS (MG-110/MG-120)	<GAS Unit Failure>	1
SPIRO (MG-120)	<SPIRO Unit Error>	1
BIS	<BISx Failure>	1
	<BISx Incompatible>	3

*1: # indicates an error code.

❑Cautionary Alarm (Alarm Level M)

Item	Message	Delay Time (sec.)
Blood Pressure	<BP * Transducer OFF> *1	
Non-Invasive Blood Pressure	<NIBP meas. failed. (###-##)>*2	1
CO_2 (HC-110)	<CO_2 Unit Failure>	1
	<CO_2 Check Sample Line>	1
	<CO_2 Check Exhaust Port>	1
	<CO_2 Cal. Required>	1
Capnostat5 CO_2 (HC-120)	<CO_2 Sensor Failure>	1
GAS (MG-110)	<GAS Check Water Trap Class>	1
	<GAS Pump OFF>	1
	<GAS Check Sample Line>	1
	<GAS Zeroing Failed>	1
	<GAS Replace Water Trap>	1
	<GAS Check Water Trap Conn.>	1
SPIRO (MG-120)	<SPIRO Check FlowSensor Class>	1
TEMP	<Check TEMP Unit>	3
BIS (When BISx is used)	<Check BIS Sensor, Perform Sensor Check>	3
DS-1200 Main Unit	"DS-1200 Check Long-Term Battery"	10
	<Fan Failure>	3
	<Analog Unadjusted>	3
Battery	<Remove the battery. (Error Temp.)>	10
	<Replace the battery.>	10
	<Charge the battery.>	10
Built-in Slot	<Built-in Slot * Analog Unadjusted>*3	3

Item	Message	Delay Time (sec.)
	<Built-in Slot * Module Failure>*3	3
	<Built-in Slot * TEMP Unit Inspection>*3	3
Monitor Suspend	<Monitor Suspend Time-Out>	1
Full Disclosure Waveform	<Failed to write to the card.>	1
	<Replace CFast card for FD>	1

*1: On "Initial Settings" menu, the Alarm Level can be selected from Level M/L (Default: Level M)# indicates the label of BP.
* indicates the label of BP.

*2: On "Initial Settings" menu, the alarm level can be selected from Level M / L / N (Notification). (Default: Level M)
# indicates an error code.

*3: # indicates the built-in slot number.

❑Treatment Needed Alarm (Alarm Level L)

Item	Message	Delay Time (sec.)
ECG	<Check Electrodes (#, #, #)>*1*3	3
	<ECG Check Electrodes Attachment.>	3
	<Cannot Analyze>	1
	<ECG Pacing Detection Error>	1
	<ECG Artifact>	3
Impedance	<RR meas. range is exceeded.>*4	3
	<CVA detected>	Adult, Child: 20, Neonate: 10
SpO_2 (Masimo Unit)	<SpO_2- # Check Sensor Attach.>*2*3	3
	<SpO_2- # Replace Sensor>*2	1
	<SpO_2- # Low Perfusion>*2, *4	1
	<SpO_2- # Pulse Search>*2	1
	<SpO_2- # Noise Interference>*2	1
	<SpO_2- # Check Sensor>*2	1
	<SpO_2- # Check Sensor>*2	3
	<SpO_2- # Replace Cable>*2	3
	<SpO_2- # Check Cable>*2	3
	<SpO_2- # only mode>*2	1
	<SpO_2- # Check Cable, Sensor> *2	1
SpO_2 (Medtronic Unit)	<SpO_2- # Check Sensor Attach.>*2*3	3
	<SpO_2- # Replace Sensor>*2	1
	<SpO_2- # No Pulse Detected>*2	1
Temperature	<T ## Unknown Sensor>*5	3
Non-Invasive Blood Pressure	<Check NIBP cuff, hose>*6	3
	<NIBP Check patient type, air hose>	3
Capnostat5 CO_2 (HC-120)	<Check CO_2 Airway Adapter>	1
SPIRO (MG-120)	<SPIRO Check Flow Sensor>	1
BIS	<Replace BIS Sensor>	3
	<BIS Sensor Usage > 24hrs.>*4	3
	<BIS Sensor Disconnected>	1
	<BIS High Impedance, Check Sensor>	3

Item	Message	Delay Time (sec.)
	<BIS Lead Off, Check Sensor>	3
	<BIS SQI < 15%>*4	3
Cable Disconnected	<ECG Disconnected>	3
	<BP # Disconnected> *7	3
	<SpO_2- # Disconnected> *2	3
	<T ## Disconnected>*5	3
	<CO Disconnected>	3
	<CO_2 Disconnected>	3
	<BISx Disconnected>	3
DS-1200 Main Unit	"DS-1200 Check Unit"	10
	"DS-1200 Out of Operating Temp. Range"	10
Battery	Check Battery	5
Built-in Slot	<Built-in Slot Check * Module>*8	3
	<Built-in Slot Out of * Operating Temp. Range>*8	3
	<Built-in Slot * Module Disconnected>*8	3
Check Connection, Check Reception, Interference	<Check SvO_2/CCO Monitor Conn.>	1
	<Check INVOS Comm.>	1
	<Check FLOW-i Conn.>	1
	<Chk DS- LAN Comm>*4	3
	<Check ORC Comm.>	3
	<Check TCM Comm.>	1
	<Check ROOT Comm.>	1
	<Check NIRO Comm.>	1
	<Check Printer Conn.>	3
	<Check Printer Comm>	1
Full Disclosure Waveform	<Check card for full disclosure.>	1

*1: # indicates an electrode type.

*2: # indicates the label of SpO_2.

*3: On "Initial Settings" menu, the alarm level can be selected from Level H / M/ L. (Default: Level L)
The alarm level will change to Level N (notification) if the sensor is not attached when the power is turned on, the patient is discharged or the monitor recovers after being suspended.

*4: On "Initial Settings" menu the alarm level can be selected from Level L / N (Notification). (Default: Level L)

*5: # indicates the label of TEMP.

*6: On "Initial Settings" menu, the alarm level can be selected from Level M, L, N (Notification). (Default: Level L)
If [Alarm Silence] key is pressed during Level M/L alarm generation, the alarm level will change to Level N (notification).

*7: # indicates the label of BP.

*8: # indicates the built-in slot number.

NOTE

♦< NIBP meas. failed>, <Check NIBP cuff, hose>, <Connector Off>, <ECG Only 5 electrodes are used.>, <Check xx Conn.>, < SPIRO Check Flow Sensor> alarms will be canceled when [Alarm Silence] key is pressed. Pay attention not to cancel the important alarm.

❑Notification Alarm

Item	Message	Delay Time (sec.)
Operation	<Waveform Frozen (xxsec.)>*1	1
	<Key Locked (xxsec.)>*1	1
	<Night Mode Active>	1
	<Oxygenator Mode>	1
ECG	<ECG Low Amplitude>	3
	<ECG Artifact>	3
	<ECG Artifact>	3
	<Check Electrodes>*6	3
Blood Pressure	<BP # Zeroing Required>*2	1
Non-Invasive Blood Pressure	<Check NIBP cuff, hose>	3
	<Initializing NIBP>	3
SpO_2 (Masimo Unit)	<SpO_2- # Demo Mode>*3	1
	<SpO_2- # Zeroing>*3	1
	<SpO_2 Check Sensor Attach.>*3*6	3
	<SpO_2 Cable Near Expiration>	3
	<SpO_2 Sensor Near Expiration>	3
SpO_2 (Medtronic Unit)	<SpO_2- # Motion Artifact>*3	1
	<SpO_2 Check Sensor Attach.>*3*6	3
Capnostat5 CO_2 (HC-120)	<CO_2 Warming Up>	1
	<Zero the CO_2 Adapter>	1
	<Unknown CO_2 Sensor>	1
CO_2 (HC-110)	<CO_2 Suspended>	1
	<CO_2 Zeroing>	1
GAS (MG-110/MG-120)	<GAS Warm Up>	1
	<GAS Zeroing>	1
	<GAS Pump Regulating>	1
	<GAS Mixed Agents>*4	1
	<GAS Zero Cal. Required.>	1
	<GAS Cal. Required.>	1
SPIRO (MG-120)	<SPIRO Warm Up>	1
	<SPIRO Calibration Active>	1
	<SPIRO Zeroing>	1
BIS	<BIS Sensor Expired>*4	3
	<BIS Sensor Check in Progress>	3
	<BIS Ground Check in Progress>	3
	<BIS Noise>	3
	<BIS Perform "Sensor Check">	3
	<BIS SQI < 50%>	3
	<BIS Demo Sensor>	3
Recorder Unit	<Check Printer>*5	3
	<Check Paper>*5	3
	<Printer Busy>*5	1

Item	Message	Delay Time (sec.)
	<Check Cassette>*5	3
Central Printer	<Check Paper (Central)>*5	3
	<Check Cassette>*5	3
	<Printer Busy (Central)>*5	1
Central Printer (Laser Printer)	<Central Printer Check Connection>	1
	<Central Printer Check Setting>	1
	<Check Central ID>	1
DS-1200 Main Unit	"DS-1200 Check Rotary SW"	1
	"DS-1200 Check DIPSW"	1
	<Battery Charge Suspended>	10
Full Disclosure Waveform	<Failed to read full disclosure from the card.>	1
System Configuration	<Check Equip. Config.>	1
	<Some parameters are not displayed due to the display layout setting.>*7	3
	<Check System Conn.>*8	3

*1: ## indicates the remaining time.

*2: # indicates the channel number of BP.

*3: # indicates the label of SpO_2.

*4: On "Initial Settings" menu, the alarm level can be selected from Level M / L / N (Notification). (Default : Notification)

*5: The alarm generation can be inhibited depending on the setting.

*6: Displayed when lead-off or sensor-off condition remains after the power is turned ON, monitoring is resumed, or a patient is discharged.

*7: On "Initial Settings" menu the alarm level can be selected from Level L / N (Notification). (Default : Notification)

*8: On "Initial Settings" menu the alarm level can be selected from Level L / N (Notification) / OFF. (Default : Notification)

Numeric Data Box Message

❑HR

Message
<Unit Inspection>
<Upper HR Alarm>
<Lower HR Alarm>
<Lower ST Alarm>
<Upper ST Alarm>
<Upper ΔST Alarm>
<Lower ΔST Alarm>
<Cannot Analyze>
<Check Electrodes>
<Check Electrodes Attachment.>
<Pacing Detection Error>
<Out of Range>
<Low Amplitude>

Message
<Noise Interference>
<Artifact>

❑ST

Message
<Lower ST Alarm>
<Upper ST Alarm>
<Upper ΔST Alarm>
<Lower ΔST Alarm>

❑BP1 to 8

Level H for BP1 and ART, Level M for other label

Message
<Lower BP Alarm>
<Upper BP Alarm>
<Zero Required>
<Check the catheter.>
<Out of Range>

❑Pulse Rate (BP Source)

Message
<Upper PR Alarm> (BP)
<Lower PR Alarm> (BP)
<Check the catheter.>
<Out of Range>

❑NIBP

If <NIBP Meas. Error> is displayed, the message can be canceled by pressing [Cancel Error] on the NIBP setup screen, [NIBP Start/Stop] key (user key), or DS-1200 [NIBP START/STOP] key.

If the same message is repeatedly displayed, a failure of the device can be considered. Cease the measurement, and contact your nearest service representative.

(☞"<NIBP Unit Error (E**-**)> is displayed." P11-40)

Message
<NIBP Meas. Error>
<Upper NIBP Alarm>
<Lower NIBP Alarm>
<Measurement Failed.>
<Check NIBP cuff, hose>
<Check patient type, air hose>
<Initializing>
<Out of Range>

❑SpO_2 (Medtronic Model)

Message
<Unit Failure>
<Ext SpO_2 Alarm>
<Lower SpO_2 Alarm>
<Upper SpO_2 Alarm>
<Replace Sensor>
<Check Sensor Attach.>
<No Pulse Detected>
<Motion Artifact>
<Pulse Search>

❑SpO_2/SpCO/SpMet/SpHb (Masimo Model)

Message
<Ext SpO_2 Alarm>
<Lower SpO_2 Alarm>
<Upper SpO_2 Alarm>
<Upper SpCO Alarm>
<Upper SpMet Alarm>
<Lower SpHb Alarm>
<Upper SpHb Alarm>
<Replace Sensor>
<Check Sensor Attach.>
<Low Confidence>
<Pulse Search>
<Noise Interference>
<Check Sensor>
<Replace Cable>
<Check Cable>
<Check Sensor Conn.>
<Zeroing>
<SpO_2 only mode>
<Low Signal IQ>
<Low Confidence>

❑RR (SpO_2: Medtronic Model)

Message
<Unit Failure>
<RR Interference>
<Unable to calculate>
<Calculating>
<Outside Range>
<Out of Range>
<Upper RR SpO_2 Alarm>

Message
<Lower RR SpO_2 Alarm>

❑PR-SpO_2

Message
<Upper PR Alarm> (SpO_2)
<Lower PR Alarm> (SpO_2)
<Out of Range>

❑TEMP1 to 8

Message
<Upper TEMP Alarm>
<Lower TEMP Alarm>
<TEMP Unit Inspection>
<Unknown Sensor>
<Out of Range>

❑Tb

Message
<Lower Tb Alarm>
<Upper Tb Alarm>
<Out of Range>

❑RR (Impedance)

Message
<Apnea Alarm>
<Upper RR Alarm>
<Lower RR Alarm>
<CVA detected>
<RR meas. range is exceeded.>
<Out of Range>
<Suspended>

❑RR (Ventilator)

Message
<Apnea Alarm>
<Upper RR Alarm>
<Lower RR Alarm>

❑RR (Gas)

Message
<Apnea Alarm>
<Upper RR Alarm>
<Lower RR Alarm>

Message
<Out of Range>

❑CO_2 (When Gas Unit I/F HC-120 and Capnostat 5 is used)

Message
<Upper CO_2-E Alarm>
<Lower CO_2-E Alarm>
<Upper CO_2-I Alarm>
<Check airway adapter.>
<Zeroing>
<Warming Up>
<Zero CO_2 Adapter>
<Unknown Sensor>
<Out of Range>

❑CO_2 (HC-110)

Message
<Initializing>
<Check Sample Line>
<Zeroing>
<Check the Exhaust Port>
<Perform calibration.>
<GAS Unit I/F Failure>
<Out of Range>
<Upper CO_2-E>
<Lower CO_2-E>
<Upper CO_2-I>

❑Multigas (When or MG-110/120 is used)

Message
<Upper CO_2-E Alarm>
<Lower CO_2-E Alarm>
<Upper CO_2-I Alarm>
<Upper O_2-E Alarm>
<Lower O_2-E Alarm>
<Upper O_2-I Alarm>
<Lower O_2-I Alarm>
<Upper N_2O-E Alarm>
<Lower N_2O-E Alarm>
<Upper N_2O-I Alarm>
<Lower N_2O-I Alarm>
<Upper AGT-E Alarm>*
<Lower AGT-E Alarm>*
<Upper AGT-I Alarm>*

Message
<Lower AGT-I Alarm>*
<Upper MAC Alarm>
<Upper RR Alarm>
<Lower RR Alarm>
<Apnea Alarm>
<GAS Check Water Trap Class>
<GAS Check Water Trap Conn.>
<GAS Pump OFF>
<GAS Pump Regulating>
<GAS Check Sample Line>
<GAS Zeroing Failed>
<GAS Unit Failure>
<GAS Warm Up>
<GAS Zeroing>
<GAS Mixed Agents>
<GAS Zero Cal. Required.>
<GAS Cal. Required.>
<GAS Replace Water Trap>
<Out of Range (CO_2)>
<Out of Range (RR_CO_2)>
<Out of Range" (N_2O)>
<Out of Range (O_2)>
<Out of Range (Agent)>*

*: The selected or detected label will be displayed for the agent label.

❑SPIRO (When or MG-120 is used)

Message
<SPIRO Warm Up>
<SPIRO Check FlowSensor Class>
<SPIRO Check Flow Sensor>
<SPIRO Calibration Active>
<SPIRO Zeroing>
<SPIRO Unit Error>
<Out of Range VT)>
<Out of Range (MV)>
<Out of Range (PRESS)>
<Upper RR>
<Lower RR>
<Apnea>
<Upper MV>
<Lower MV>
<Upper PEAK>
<Lower PEAK>

Message
<Upper PEEP>
<Lower PEEP>

❑BIS

Message
<Upper BIS Alarm>
<Lower BIS Alarm>
<Check Sensor>
<Expired Sensor>
<Replace the sensor>
<Sensor Usage > 24hrs.>
<Check Sensor Conn.>
<Sensor Check in Progress>
<Ground Check in Progress>
<High Impedance>
<Artifact>
<Lead OFF>
<BIS Perform "Sensor Check">
<SQI < 15%>
<SQI < 50%>
<Artifacts>
<BISx Failure>
<BISx Incompatible>

Ventilator Alarm Message

❑Top Priority Alarm (Alarm Level S)

Item	Message
Ventilator	<Vent. Alarm>
Ventilator	<VENT COMM>

⚠ WARNING

- The ventilator alarm sound is set to OFF (factory default).
- The alarm sound can be turned ON on the "Tone/Volume" menu. (☞"Tone/Volume" P10-18)

Ventilator Alarm Factor

⚠ CAUTION

- For the ventilators other than Servo ventilators, ventilator alarm factor will not be notified to the central monitor.
- Depending on the central monitor type and software version, ventilator alarm factor may not be displayed. For details of the central monitor type and software version, refer to your nearest service representative.
- The ventilator alarm factors are displayed only on the central monitor. These will not be displayed on the bedside monitor.

Displayed Alarm Message	Remarks
VENT AWP	Airway Pressure Alarm
VENT MV	Minute Ventilation Alarm
VENT APNEA	Apnea Alarm
VENT CONT. HP	Continuous High Pressure Alarm
Upper VENT_FiO_2	FiO_2 Upper Limit Alarm
Lower VENT_FiO_2	FiO_2 Lower Limit Alarm
Upper VENT_CO_2	$EtCO_2$ Upper Limit Alarm
Lower VENT_CO_2	$EtCO_2$ Lower Limit Alarm
Upper VENT_RR	RR Upper Limit Alarm
Lower VENT_RR	RR Lower Limit Alarm
VENT_PEEP	PEEP Low Alarm
VENT_COMM	Power OFF, cable disconnected, standby condition, etc.
VENT_URGENT	Other high level alarm
Ventilator	Other ventilator alarm

Cardiac Output Message

❑Status Message

Message	Details
WAIT	Preparing for measurement. It will be also displayed when catheter relay cable is not connected to the CO module, or when thermodilution catheter is not connected.
READY	Ready to start the measurement.
BUSY	In process of measurement.
END	Measurement is completed.

❑Result Status

The result status will be displayed for 30 seconds after completion of measurement.

Message	Details
CO_OK	CO is correctly measured.
UPPER_FAULT	Measurement error • After the injection, the blood temperature is out of the measurement range. • The thermistor connector and relay cable are not securely connected. • The sensor or relay cable is defective.
PEAK_FAULT	Measurement error • The peak of the thermodilution curve can not be detected. • The thermistor connector and relay cable are not securely connected. • The sensor or relay cable is defective.
LOWER_FAULT	Measurement error • The blood temperature has not returned to stable condition after the measurement. • The thermistor connector and relay cable are not securely connected. • The sensor or relay cable is defective.
SENSOR_ERROR	Measurement error • The thermistor connector and relay cable are not securely connected. • The sensor or relay cable is defective.
OVER RANGE	Measurement error • The CO value is out of the calculation range.

Troubleshooting

This section explains the troubleshooting for each case.

ECG

❑<Check Electrodes> or <LEAD OFF> is displayed.

Cause 1

The electrode is detached, or is not making good electrical contact with the skin.

Solution

Check if the electrodes are properly attached.
Replace the electrodes.
Make sure that the lead cable or relay cable is not defective (wire break, etc.).
(☞"Before Attaching the Electrodes" P7-1)
(☞"Electrode Placement" P7-2)

Cause 2

Even though the "3-lead Override" (ECG Parameter Setup) is set to [ON], electrodes other than LA, RA, LL are connected.

Solution

Set the "3-lead Override" to [OFF].
Or, detach the electrodes other than LA, RA, LL.

❑<ECG Low Amplitude> is displayed.

Cause 1

The ECG amplitude is 0.25 mV or below for the waveform size of x1, x1/2, x1/4, and 0.15 mV or below for the waveform size of x2, x4.

Solution

Change the electrode site, or select a lead with higher QRS amplitude.

NOTE

- Using 4-electrode or 5-electrode instead of 3-electrode allows more accurate QRS detection.

Cause 2

The electrode contact is poor.
Electrical blanket or other noise source is near the patient.

Solution

Attach the electrodes firmly. Or, replace the electrodes.

- If the lead cable or relay cable is defective (wire break, etc.), replace it.
- If any noise source is near the patient, move it away from the patient as far as possible.

Cause 3

Even though the "3-lead Override" (ECG Parameter Setup) is set to [ON], electrodes other than LA, RA, LL are connected.

Solution

Set the "3-lead Override" to [OFF].Or, detach the electrodes other than LA, RA, LL.

❑<ECG Artifact> is displayed.

Cause 1

The electrode contact is poor.
Electrical blanket or other noise source is near the patient.

Solution

Attach the electrodes firmly.

- If the lead cable or relay cable is defective (wire break, etc.), replace it.
- If any noise source is near the patient, move it away from the patient as far as possible.

Cause 2

EMG is interfering.

Solution

- Change the electrode site to a location where the myoelectricity will be less likely to interfere.
- Select ESIS for the filter mode.

⚠ CAUTION

- Selecting ESIS for the filter mode will decrease the QRS amplitude and may result in not counting the heart rate.

Cause 3

Even though the "3-lead Override" (ECG Parameter Setup) is set to [ON], electrodes other than LA, RA, LL are connected.

Solution

Set the "3-lead Override" to [OFF].Or, detach the electrodes other than LA, RA, LL.

❑The ECG waveform is in the baseline position.

The lead-off condition may have occurred by the following causes.

Cause 1

Electrode is detached.

Solution

Place the electrodes again.If the electrode contact is poor, replace the electrode.
(☞"Before Attaching the Electrodes" P7-1)
(☞"Electrode Placement" P7-2)

Cause 2

The lead cable is disconnected from the electrode terminal.

Solution

Securely connect the lead cable.

REFERENCE

- If the error persists, wire break of the lead cable or relay cable can be considered. Contact your nearest service representative.

❑<Check Electrodes Attachment> is displayed.

Cause 1

The electrode contact with the skin is poor. There is substantial contact resistance between the electrodes.

Solution

Replace all the electrodes.Make sure to use the same type of electrodes .
(☞"Before Attaching the Electrodes" P7-1)
(☞"Electrode Placement" P7-2)

Cause 2

Even though the "3-lead Override" (ECG Parameter Setup) is set to [ON], electrodes other than LA, RA, LL are connected.

Solution

Set the "3-lead Override" to [OFF].Or, detach the electrodes other than LA, RA, LL.

❑<ECG Unit Error> is displayed.

Cause

A communication error has occurred between the ECG measuring unit.

Solution

A failure of the ECG unit can be considered. Contact your nearest service representative.

❑The measurement data is displayed as "xxx".

Cause

The heart rate is outside the measurement range.

Solution

- Check if the electrodes are properly attached.
  (☞"Before Attaching the Electrodes" P7-1)
  (☞"Electrode Placement" P7-2)
- Replace the electrode, or check the lead cable and relay cable.

❑Heart rate is not counted. Heart rate is low.

Cause

The ECG waveform amplitude is below the QRS detection level (0.3 mV).

Solution 1

Change the electrode site, or select a lead with higher QRS amplitude.

⚠ CAUTION

- Using 4-electrode or 5-electrode instead of 3-electrode allows more accurate QRS detection.
- Also, if large amount of noise is interfering, the noise may be erroneously detected as QRS.Change the electrode site and increase the ECG amplitude.

Solution 2

Increase the displayed waveform size. By increasing the waveform size, small QRS wave will become detectable. However, noise may be also detected.

❑Heart rate is not counted, and <LEAD OFF> is displayed.

Cause 1

The electrode of the displayed lead type is detached, or is not making good electrical contact with the skin.

Solution

- Check if the electrodes are properly attached.
  (☞"Before Attaching the Electrodes" P7-1)
  (☞"Electrode Placement" P7-2)
- Replace the electrode, or check the lead cable and relay cable.

Cause 2

Even though the "3-lead Override" (ECG Parameter Setup) is set to [ON], electrodes other than LA, RA, LL are connected.

Solution

Set the "3-lead Override" to [OFF].Or, detach the electrodes other than LA, RA, LL.

❑Artificial pacemaker pulse is not displayed.

Cause 1

[Not Used] is selected for "Pacemaker" on the "Admit/Discharge" menu.

Solution

Select [Used] for "Pacemaker".

Cause 2

"Pacemaker Pulse" is set to [OFF] (ECG Parameter Setup).

Solution

Select [ON] for "Pacemaker Pulse" .

Cause 3

The electrode attachment site is not appropriate.

Solution

Check the electrode attachment site.
(☞"Before Attaching the Electrodes" P7-1)
(☞"Electrode Placement" P7-2)

❑<ECG Pacing detection error> is displayed.

Cause

The pacemaker pulse is detected 16 pulses or more per second.

Solution 1

- Check if the electrodes are properly attached.
  (☞"Before Attaching the Electrodes" P7-1)
  (☞"Electrode Placement" P7-2)
- Replace the electrode, or check the lead cable and relay cable.
- If any noise source is near the patient, move it away from the patient as far as possible.

Solution 2

If the patient is not using a pacemaker, select [Not Used] for "Pacemaker"("Admit/Discharge").

❑<ECG Disconnected> is displayed.

Cause

While monitoring the ECG, the relay cable was unplugged.

Solution 1

To cease monitoring, press the [Alarm Silence] key. The message will disappear, and the alarm will be silenced.

Solution 2

To continue monitoring, plug in the ECG relay cable. The message will disappear, and the alarm will be silenced.

❑<Cannot analyze> is displayed.

Cause

"Suspend Arrhy, Analysis during Noise Interference" ("Initial Settings") is set to ON, and arrhythmia analysis is suspended for more than 30 seconds due to continuous noise or EMG interference.

Solution

Check the electrode attachment, and remove the noise source.

- Check the electrode attachment, lead cable and relay cable.
- If the electrode, lead cable, or relay cable is defective, replace them.
- If any noise source is near the patient, move it away from the patient as far as possible.
  If EMG is interfering, change the electrode site to a location where EMG will less likely to interfere.

❑Arrhythmia cannot be detected, or is judged as "?".

Cause 1

The amplitude of ECG1 or ECG2 is below the QRS detection level (250 μV and below).

Solution

Change the electrode site, or select a lead with higher QRS amplitude for both ECG1 and ECG2.When the electrode site is changed, perform the arrhythmia learn process.

Cause 2

The shapes of normal heartbeat and arrhythmia are similar.

Solution

Change the electrode site or select a lead which shows a clear difference between a normal heartbeat and arrhythmia. When the electrode site is changed, perform the arrhythmia learn process.

Cause 3

Noise is interfering with the ECG.

Solution

Check the electrode attachment, and remove the noise source.

- Check the electrode attachment, lead cable and relay cable.
- If the electrode, lead cable, or relay cable is defective, replace them.
- If any noise source is near the patient, move it away from the patient as far as possible.
  If EMG is interfering, change the electrode site to a location where EMG will less likely to interfere.

Respiration

❑<CVA detected> message is displayed.

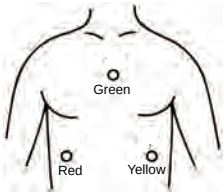
Cause

Heartbeat is interfering and superimposed on the respiration waveform.

Solution

Place the electrode as shown below where the heartbeat will be less likely to interfere.

Or, select a lead where the heartbeat will be less likely to interfere.



❑<RR meas. range is exceeded.> message is displayed.

Cause 1

Electrode is detached.

Solution

Reattach the electrode. If the electrode contact is poor, replace the electrode.
(☞"Before Attaching the Electrodes" P7-1)
(☞"Electrode Placement" P7-2)

Cause 2

The electrode contact impedance is high.

Solution 1

Reattach the electrode. If the electrode contact is poor, replace the electrode.
(☞"Before Attaching the Electrodes" P7-1)
(☞"Electrode Placement" P7-2)

Solution 2

Change the lead for respiration measurement.

❑"0" is displayed for respiration rate, or apnea alarm is generated.

Cause

The amplitude of the respiration waveform is too low.

Solution 1

Change the electrode site, or select a lead with higher QRS amplitude.

Solution 2

Increase the displayed waveform size.

❑The respiration waveform and respiration rate is not displayed.

Cause 1

The electrosurgery-proof type ECG relay cable is used.

Solution

The impedance respiration can not be measured if the electrosurgery-proof type ECG relay cable is used. If not using during electrosurgery, use the standard ECG relay cable.

Cause 2

The impedance respiration measurement is ceased.

Solution

Select [ON] for "Impedance Measurement" on "Admit/Discharge" or "RESP" setup screen.

⚠ CAUTION

- If the pacemaker with the minute ventilation measuring function is used, turn OFF the impedance respiration measurement. Otherwise, both the pacemaker and this monitor will not be able to perform accurate measurement.

❑The measurement data is displayed as "xxx".

Cause

The respiration rate is outside the measurement range.

Solution

- Check if the electrodes are properly attached.
  (☞"Before Attaching the Electrodes" P7-1)
  (☞"Electrode Placement" P7-2)
- Replace the electrode, or check the lead cable.
- Change the lead for respiration measurement.

❑The lead for respiration measurement cannot be changed.

Cause

Telemeteris used.

Solution

- If Telemeteris set, the lead will be fixed to [II].
- If the respiration amplitude for lead II is small, check the electrode attachment.
  (☞"Before Attaching the Electrodes" P7-1)
  (☞"Electrode Placement" P7-2)

Invasive Blood Pressure

❑The PDP value is displayed as "---" .

Cause

The BP measured by the HM-800/HM-801 Multi Module is labeled as [IAP].

Solution

PDP will not be calculated if the BP measured by the HM-800/HM-801 is labeled as [IAP]. When using the HM-800/HM-801, do not set the BP label to IAP. When monitoring PDP, set the BP label to [IAP].

❑<Check BP # Transducer> is displayed.

Cause 1

The BP (1 to 8) transducer is not connected.

Solution 1

To cease monitoring, press the [Alarm Silence] key. The message will disappear, and the alarm will be silenced.

Solution 2

Connect the transducer.

Cause 2

The BP relay cable or transducer is defective.

Solution 1

Replace the BP relay cable or transducer.

❑<BP* Zero Required> is displayed.

Cause

The BP zero balance has not been performed since the power is turned ON.

Solution

Open the three-way valve of the transducer to air and perform zero balance.

❑The measurement data is displayed as "---".

Cause

The BP zero balance has not been performed since the power is turned ON.

Solution

Open the three-way valve of the transducer to air and perform zero balance.

❑BP value and waveform are not displayed properly.

Cause

The BP zero-balance is unstable.

Solution 1

Open the three-way valve of the transducer to air and perform zero balance.

Solution 2

Disconnect the BP transducer from the BP relay cable, and check if there is any abnormality on the connector terminal. Make sure that there is no distortion nor substance, such as blood or medicament, attached which may cause contact failure.
If any abnormality is found, replace the BP transducer or BP relay cable.

❑The measurement data is displayed as "xxx".

Cause

The BP value is outside the measurement range.

Solution

Perform BP zero balance again.
Check if the measurement data is within the measurement range.
Check the BP relay cable and BP transducer.

❑<BP# Disconnected> is displayed.

Cause

While monitoring the blood pressure, BP relay cable was disconnected from the 2ch BP conversion cable.

Solution 1

To cease monitoring, press the [Alarm Silence] key. The message will disappear, and the alarm will be silenced.

Solution 2

To continue monitoring, plug in the BP interface cable or 2ch BP conversion cable. The message will disappear, and the alarm will be silenced.

❑The zero balance process fails.

Cause

The three-way valve may not be opened to air, or artifact is present due to movements, etc.

Solution

Check if the three-way valve is opened to air. Verify that <Zero ready> is displayed on the parameter setup screen, or <READY> is displayed on the user key before starting the zero balance.

❑<Check the ART catheter.> message is displayed.

Cause 1

During the measurement, ART catheter was disconnected.

Solution

Connect the ART catheter securely. Make sure that the ART catheter is not loose.

Cause 2

The BP relay cable or transducer is defective.

Solution

Replace the BP relay cable or transducer.

SpO_2 Measurement (Medtronic)

❑<SpO_2 Check Sensor Attach.> is displayed.

Cause

The sensor is detached from the patient.

Solution 1

Check if the sensor is properly attached to the patient.

Solution 2

Check that the light emitting and receiving parts of the sensor LED are aligned.

❑<SpO_2 Pulse Search> is displayed.

Cause 1

The amplitude of the pulse waveform is too low, or the sensor is not positioned correctly.

Solution

Check that the light emitting and receiving parts of the sensor LED are aligned.

Cause 2

The sensor has not been attached long enough to obtain stable measurement.

Solution

After the sensor attachment, wait and see for about one minute until the waveform stabilizes.

❑<SpO_2 No Pulse Detected> is displayed.

Cause

The amplitude of the pulse waveform is too low, or the sensor is not positioned correctly.

Solution

Check that the light emitting and receiving parts of the sensor LED are aligned.
Avoid the sensor from exposure to ambient light.

❑<SpO_2 Motion Artifact> is displayed.

Cause

There is excessive body motion from the patient.

Solution

Relocate the sensor to which body motion will have less influence.

❑The pulse waveform is not displayed, or interrupted.

Situation: <SpO_2 Check Sensor Attach.> is displayed.

Cause 1

The amplitude of the pulse waveform is too low, or the sensor is not positioned correctly.

Solution

Check that the light emitting and receiving parts of the sensor LED are aligned.

Cause 2

The sensor is defective.

Solution

Replace the sensor.

Cause 3

SpO_2 sensor is not firmly connected to the connector.

Solution

Make sure the SpO_2 sensor is firmly connected.

Cause 4

Sensor is exposed to light.

Solution

Place a black or dark cloth over the sensor to avoid direct sunlight. When not using the sensor for measurement, avoid placing the sensor in light or unplug the sensor from the connector.

❑SpO_2 value is unstable.

Cause 1

There is excessive body motion from the patient which disables correct measurement.

Solution 1

Have the patient lie still.

Solution 2

Relocate the sensor, or change the sensor to which the body motion will have less influence.

Cause 2

The probe size is not appropriate.

Solution

Select a probe size which is appropriate for the patient.

Cause 3

Sensor is exposed to light.

Solution

Place a black or dark cloth over the sensor to avoid direct sunlight.

❑<Super Unit SpO_2 Failure> is displayed.

Cause 1

The sensor is defective.

Solution

Replace the sensor.

Cause 2

Communication error has occurred with the SpO_2 unit.

Solution

A defective cable or SpO_2 unit failure can be considered.
Contact your nearest service representative.

Cause 3

The system was started with the sensor and cable connected.

Solution

Disconnect the SpO_2 cable and sensor from this device, and press the standby switch to enter into standby mode. Then, press the standby switch again to cancel the standby mode, and when the monitoring screen is displayed, connect the cable and sensor.

❑<SpO_2 Replace Sensor> is displayed.

Cause 1

The sensor is not connected securely.

Solution

Connect the sensor securely.

Cause 2

The sensor is defective.

Solution

Replace the sensor.

Cause 3

A wrong sensor is used.

Solution

Replace the sensor.
For details of the usable sensors, refer to your nearest service representative.

❑<SpO_2 Disconnected> is displayed.

Cause

The SpO_2 relay cable is disconnected during SpO_2 monitoring.

Solution 1

To cease monitoring, press the [Alarm Silence] key. The message will disappear, and the alarm will be silenced.

Solution 2

To continue monitoring, plug in the SpO_2 relay cable. The message will disappear, and the alarm will be silenced.

SpO_2 Measurement (Masimo)

❑<SpO_2 Replace Sensor> is displayed.

Cause 1

The sensor is not connected securely.

Solution

Connect the sensor securely.

Cause 2

The sensor is defective.

Solution

Replace the sensor.

Cause 3

A wrong sensor is used.

Solution

Replace the sensor.
(☞"Pulse Oximetry Measurement (Manufactured by Masimo)" P13-6)

Cause 4

The sensor is used beyond its expected life.

Solution

Replace the sensor.

NOTE

- The X-Cal function automatically monitors the Active Monitoring Time (actual time of SpO_2 monitoring) for each sensor and cable.
- Even if the sensor is used beyond its expected life, the measurement will not cease unless the power is turned OFF, sensor is disconnected from the cable, cable is disconnected from the monitor, or the sensor is reattached.
- When a measurement with a sensor that has reached its end of life is suspended for certain amount of time, and resumed with the same sensor, a message to replace the sensor will be displayed.
- Depending on the device, some sensors may not be recognized.

❑<SpO_2 Check Sensor Attach.> is displayed.

Cause 1

The sensor is detached from the patient.

Solution 1

Check if the sensor is properly attached to the patient.

Solution 2

Check that the light emitting and receiving parts of the sensor LED are aligned.

Cause 2

The sensor is exposed to too much ambient light. The detecting part of the sensor is not covered appropriately.

Solution 1

Turn down or turn off the light.

Solution 2

Avoid the sensor from exposure to ambient light.

Solution 3

Relocate the sensor position.

❑<SpO_2 Low Perfusion> is displayed.

Cause

The amplitude of the pulse waveform is too low, or the sensor is not positioned correctly.

Solution

Check that the light emitting and receiving parts of the sensor LED are aligned.

❑<Low Confidence> is displayed.

Cause

The amplitude of the pulse waveform is too low, or the sensor is not positioned correctly.

Solution

Check that the light emitting and receiving parts of the sensor LED are aligned.

❑<SpO_2 Pulse Search> is displayed.

Cause 1

The amplitude of the pulse waveform is too low, or the sensor is not positioned correctly.

Solution

Check that the light emitting and receiving parts of the sensor LED are aligned.

Cause 2

The sensor has not been attached long enough to obtain stable measurement.

Solution

After the sensor attachment, wait and see for about one minute until the waveform stabilizes.

❑<SpO_2 Noise Interference> is displayed.

Cause

External signal or energy is interfering with the measurement.

Solution

Remove the external interference or apply ambient shielding.

❑<SpO_2 Check Sensor>, <SpO_2 Replace Cable>, or <SpO_2 Check Cable> is displayed.

Cause 1

Unrecognizable sensor is connected.

A wrong patient cable is used.

When attached to the patient, the sensor was exposed to high-intensity light which lead to false recognition.

Solution

Reattach the SpO_2 sensor and patient cable.

Replace with a Fukuda Denshi specified patient cable and sensor.

(☞"Pulse Oximetry Measurement (Manufactured by Masimo)" P13-6)

Cause 2

The cable is used beyond its expected life.

Solution

Replace the patient cable.

NOTE

- The X-Cal function automatically monitors the Active Monitoring Time (actual time of SpO_2 monitoring) for each sensor and cable.
- Even if the cable is used beyond its expected life, the measurement will not cease unless the power is turned OFF or the cable is reconnected.
- When a measurement with a cable that has reached its end of life is suspended for certain amount of time, and resumed with the same cable, a message to replace the cable will be displayed.
- Depending on the device, some cable may not be recognized.

❑<Super Unit SpO_2 Failure> is displayed.

Cause

Communication error has occurred with the SpO_2 unit.

Solution

A defective cable or SpO_2 unit failure can be considered. Contact your nearest service representative.

❑<SpO_2 Disconnected> is displayed.

Cause

The SpO_2 relay cable is disconnected during SpO_2 monitoring.

Solution 1

To cease monitoring, press the [Alarm Silence] key. The message will disappear, and the alarm will be silenced.

Solution 2

To continue monitoring, plug in the SpO_2 relay cable. The message will disappear, and the alarm will be silenced.

❑<SpO_2 only mode> is displayed.

Cause

When the Rainbow sensor is used, SpCO, SpMet or SpHb parameter cannot be measured.

Solution 1

Remove the sensor from the patient's finger, and then reattach it.

Solution 2

Remove the sensor or patient cable from the DS-1200N/1200M, and then reconnect it to the SpO_2 connector.

❑<Low Signal IQ> is displayed.

Cause

There is excessive body motion, or sensor attached position is not appropriate.

Solution 1

Check that the light emitting and receiving parts of the sensor LED are aligned.

Solution 2

Relocate the sensor to which body motion will have less influence.

❑PVI, SpCO, SpMet, SpHb, SpOC cannot be measured.

Cause 1

PVI, SpCO, SpMet, SpHb, SpOC measurements are optional functions.

Solution

It is necessary to add these as the measuring parameters.
For details, contact your nearest service representative.

Cause 2

The used sensor cannot measure the PVI, SpCO, SpMet, SpHb, SpOC.

Solution

Use the sensor which can measure the PVI, SpCO, SpMet, SpHb, SpOC.
For details, contact your nearest service representative.

Non-Invasive Blood Pressure

❑The cuff is not inflated although the pump is operating.

Cause 1

The air hose is not firmly connected, and the air is leaking.

Solution

Check if the air hose is properly connected.

Cause 2

The cuff size does not match the selected patient type.

Solution

Use the cuff with correct size for the selected patient type.

❑The pump is not operating.

Cause

The air hose is disconnected from the NIBP connector.

Solution

Check if the air hose is properly connected.

❑The measurement data is displayed as "---" .

Cause 1

The measurement accuracy is not reliable due to body motion artifact.

Solution

During the measurement, have the patient stay still.

Cause 2

The pulse is too small to acquire reliable measurement accuracy.

Solution

Check if the cuff application is proper, and if the cuff size corresponds with the selected patient type.

Cause 3

The air hose is disconnected.

Solution

Check if the air hose is tightly connected, and then measure again. If the same message is displayed again, air leakage inside the DS-1200 can be considered.
Contact your nearest service representative.

❑<Check NIBP cuff, hose> is displayed.

Cause 1

The connection between the cuff and air hose or the air hose and NIBP connector is loose or disconnected.

Solution

If the connection is loose or disconnected, securely connect it and perform the measurement again.

If the same message is displayed again, internal air leakage can be considered. Cease the measurement, and contact your nearest service representative.

Cause 2

The cuff is compressed.

Solution

Make sure that the cuff is not subjected to compression, and measure with the patient arms extended as much as possible.

If the same message is repeatedly displayed, air system may be clogged. Cease the measurement, and contact your nearest service representative.

Cause 3

The cuff size is not suitable for the patient.

Solution

Check that the cuff size is appropriate for the patient, and that the cuff is properly attached, and measure again.

Cause 4

The cuff size and the patient classification setting do not match.

Solution

Make sure that the appropriate cuff size is used according to the patient classification setting.

❑<NIBP measurement failed (Cxx-xx)> is displayed.

Error code condition (phenomenon, or situation) and its cause are indicated below.

C01-xx Could not inflate to the specified pressure.

Cause 1

The air hose is not firmly connected, and the air is leaking.

Solution

Check if the air hose is properly connected.

Cause 2

The cuff size does not match the selected patient type.

Solution

Use the cuff with correct size for the selected patient type.

C02-00 When "Quick Measurement" is [OFF], the data could not be measured.

Cause 1

The blood pressure may not be correctly measured due to the patient's condition.

Solution

Check the patient's condition, and measure again.

Cause 2

The cuff application has become loose.

Solution

Check that the cuff size is appropriate for the patient, and then measure again after attaching the cuff properly.

C02-01 When "Quick Measurement" is [ON], the data could not be measured.

Cause 1

The blood pressure may not be correctly measured due to the patient's condition.

Solution

Check the patient's condition, set "Quick Measurement" to OFF, and measure again.

Cause 2

The cuff application has become loose.

Solution

Check that the cuff size is appropriate for the patient, and then measure again after attaching the cuff properly.

C02-02 The air hose was disconnected from the NIBP connector during the measurement.

Cause

The air hose was disconnected from the NIBP connector during the measurement.

Solution

Connect the air hose to the NIBP connector, and then measure again.

C03-xx The exhaust ventilation has ceased, or the target deflation speed was not achieved.

Cause 1

During measurement, an artifact such as body motion may have interfered.

Solution

Keep the patient still as much as possible, and measure while the patient is not moving. When performing the measurement during surgery, avoid artifact caused by the surgery.

Cause 2

During the measurement, air hose was bent or occluded by the compression.

Solution

Make sure that the air hose is not bent or compressed before the measurement.

If the error persists and C03-xx error is frequently displayed, contact your nearest service representative and notify the error code.

C04-00 to C04-03 The cuff inflation was insufficient for the patient's blood pressure.

Cause

The blood pressure has significantly increased from the previous measurement.

Solution

Check the cuff application and size and perform the manual measurement.

C04-04 Switched to the deflation measurement. (Data could not be measured by the inflation measurement.)

Cause 1

The pulse signal could not be detected, and the blood pressure may not be correctly measured.

Solution 1

Check whether the cuff for the inflation measurement is applied, or the cuff application or size.

Solution 2

Measure by the deflation measurement.

C06-xx The pulse signal detected during the measurement was unstable.

Cause 1

During the measurement, the patient has trembled or moved.

Solution

Keep the patient still as much as possible, and measure while the patient is not trembling or moving.

Cause 2

Arrhythmia has frequently occurred during the measurement.

Solution

If arrhythmia occurs many times, correct measurement cannot be performed.Measure when arrhythmia is not frequently occurring.

C07-00 The measurement time has exceeded the allowable time.

Cause

Measurement is automatically repeated due to body motion or insufficient inflation.

Solution

Check the cuff application and size, and measure while keeping the patient still as much as possible.

C08-00 The detected PR value was abnormal.

Cause

The patient has trembled or moved.

Solution

Keep the patient still as much as possible, and measure while the patient is not moving.

C09-00 The inflation value has exceeded the allowable maximum value.

Cause

The cuff was subjected to compression.

Solution

Make sure that the cuff is not subjected to compression, and measure with the patient arms extended as much as possible.

C10-xx The detected pulse amplitude was abnormal.

Cause

The cuff size is not suitable for the patient.

Solution

Check that the cuff size is appropriate for the patient, and that the cuff is properly attached, and measure again.

C11-00 Neonate cuff is detected with adult mode.

Cause

The cuff size does not match the selected patient type. (Neonate cuff is used in adult mode.)

Solution

Use the cuff with correct size for the selected patient type.

C11-01 Infant cuff is detected with adult mode.

Cause

The cuff size does not match the selected patient type. (Infant cuff is used in adult mode.)

Solution

Use the cuff with correct size for the selected patient type.

C11-02 Neonate cuff is detected with child mode.

Cause

The cuff size does not match the selected patient type. (Neonate cuff is used in child mode.))

Solution

Use the cuff with correct size for the selected patient type.

❑The time of measurement disappears and the numeric data is displayed as " - - - ".

Cause

The preprogrammed time to clear the NIBP data has elapsed.

Solution

The "NIBP Erase Time" can be selected from [5 min.], [10 min.], [30 min.], [60 min.], [120 min.], and after the set duration, the NIBP data will be displayed as "---".
Select the appropriate time which best fits the monitoring purpose.

❑The NIBP periodic measurement is ceased.

Cause

<NIBP Meas. Error (Exx-xx)> is displayed during the measurement.

Solution

When <NIBP Meas. Error (Exx-xx)> is displayed, the NIBP periodic measurement will be canceled. To resume the measurement, press the [NIBP Start/Stop] key and check that the measurement is properly performed.

NOTE

- When the NIBP Start/Stop key is pressed or when the NIBP measurement interval is changed, the standby mode will be canceled and the NIBP periodic measurement will start.

❑<NIBP Unit Error (E**-**)> is displayed.

Cause

An error has occurred on the NIBP unit.

E08-01: Communication Error (Sub CPU)
E08-02: WatchDog Timeout
E08-03: Pressure Offset Error
E08-04: Pressure Comparison Error
E08-05: Sub CPU Power Supply Failure
E08-06: Pressure Sensor Power Supply Failure
E08-07: Pressure SensorA/D Reference Power Voltage Failure
E08-08: Rapid Exhaust Error
E08-09: Air Hose Identification Error
E08-0A: Pressure Sensor +5V Power Supply Failure
E09-A: Exceeded Maximum Cuff Pressure
E09-B: Inflation Timeout
E09-C: Quick Mode Timeout
E09-D: Measurement started during the long pause
E09-E: Measurement Timeout
E09-F: Main CPU Pressure Data Transmission Timeout
E09-G: Pressure Sensor +5V Power Supply Failure
E09-H: Zero Calibration Timeout
E09-I: ROM Test Error
E09-J: RAM Test Error
E09-L: Clock Transmission Ceased
E09-M: Communication Failure at Power ON
E09-N: Pressure Comparison Error
E09-O: Maximum Inflation Timeout
E09-Q: Measurement was started before zero calibration
E09-R: Zeroing Error
E09-S: WatchDog Timeout
E09-T: +5V Digital Power Supply Failure
E09-U: Main CPU Power Supply Failure
E09-V: Pump Control Signal Failure
E09-W: Quick Exhaust Valve Control Signal Failure
E09-X: Sub CPU Constant Exhaust Valve Control Signal Failure
E09-Y: Main CPU Constant Exhaust Valve Control Signal Failure

Solution 1

These errors can be cleared by pressing the [Cancel Error] on the NIBP setup menu or [NIBP Start/Stop] key (user key).If the same message is repeatedly displayed, a failure of the device can be considered. Cease the measurement, and contact your nearest service representative.

Solution 2

When <NIBP Unit Error (Exx-xx)> is displayed, make sure that the congestion is not generated, and remove the cuff if necessary.

Temperature

❑<T* Unknown Sensor> is displayed.

Cause 1

700 series temperature probe is used.

Solution

Use the 400 series temperature probe for measurement.

Cause 2

There is a contact failure of the temperature probe.

Solution

Check if the temperature probe is properly inserted.

❑The measurement data is displayed as "xxx".

Cause

The temperature measurement is outside the measurement range.

Solution

Check if the temperature probe is properly inserted.
Replace the temperature probe, or check the temperature probe.

❑<T* Disconnected> is displayed.

Cause

While monitoring the temperature, the temperature probe was unplugged.

Solution 1

To cease monitoring, press the [Alarm Silence] key.The message will disappear, and the alarm will be silenced.

Solution 2

To continue monitoring, plug in the temperature probe. The message will disappear, and the alarm will be silenced.

❑<TEMP Unit Failure> is displayed.

Cause

An error was detected on the temperature unit.

Solution

A unit failure can be considered.Cease the measurement, and contact your nearest service representative.

Cardiac Output (CO)

❑When measured consecutively, the measurement value varies. (±10% or more)

Cause 1

The injection method is not appropriate.

Solution

Inject within 1 to 3 seconds.

Cause 2

Injection temperature is not appropriate.

Solution

If iced injectate is used, pay attention not to warm the injector with hands.

Cause 3

The thermistor location is not appropriate.

Solution

Reposition the thermistor.

Cause 4

Arrhythmia event has occurred during the measurement.

Solution

Wait until the patient has stable heart rhythm.

Cause 5

There was patient's body movement during the measurement.

Solution

Have the patient stay still during the measurement.

Cause 6

The patient's hemodynamics changed during the measurement.

Solution

Wait until the patient has stable hemodynamics.

❑Abnormal measurement value is displayed.

Cause

The catheter size, injectate volume, catheter constant (CC) is not correct.

Solution

Set the proper condition, CC value for the used catheter.

❑The blood temperature (Tb), injectate temperature (Ti) is not displayed.

Cause

The catheter is not properly connected.

Solution

Securely connect the catheter.

❑The thermodilution curve is deformed.

Cause

The injection is not smooth, steady motion.

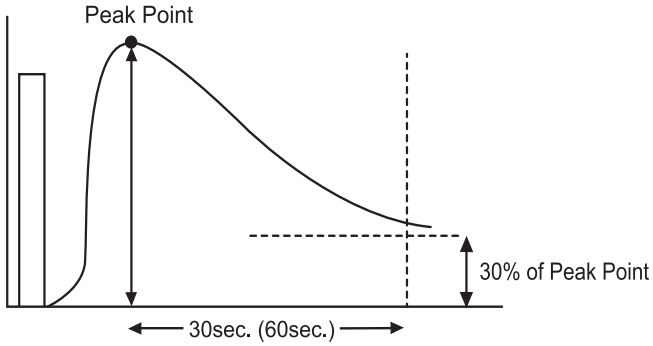
Solution

Inject promptly within 1 to 3 seconds.

❑The baseline of the thermodilution curve is displaced to the minus side. <LOWER FAULT> is displayed.

Cause

The blood temperature has not returned to stable condition after the measurement.



The thermodilution curve did not return to the cut off point soon enough. The temperature must return to a point that is 30% of the peak value within 30 seconds (or 60 seconds depending on the setup).

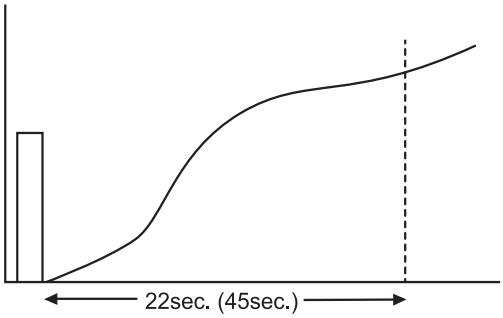
Solution

If performing continuous measurement, wait for 30 to 60 seconds and check that "Ready" is displayed before performing the next measurement.

❑The thermodilution curve is low. <PEAK FAULT> is displayed.

Cause

The peak of the thermodilution curve can not be detected.



After the measurement is started, the peak of the thermodilution curve was not determined within 22 seconds (when the time scale is "30 sec") or 45 seconds (when the time scale is "60 sec").

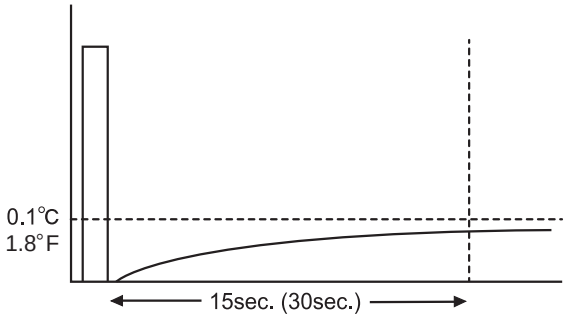
Solution

The thermistor may be contacting the pulmonary artery wall. Reposition the thermistor and measure again.

❑<UPPER FAULT> message is displayed.

Cause

After the injection, the blood temperature is out of the measurement range.



After the measurement is started, the change in blood temperature is less than 0.1°C /1.8°F for more than 15 seconds (when the time scale is "30 sec") or 30 seconds (when the time scale is "60 sec").

Solution

Use the iced injectate, and measure again.

❑<OVER RANGE> is displayed.

Cause

The CO value is out of the calculation range.

Solution

The area of the thermodilution curve is too large to calculate. Start the measurement again.

❑The measurement is interrupted, and the error message, <UPPER_FAULT>, <PEAK_FAULT>, <LOWER_FAULT> , <SENSOR_ERROR> is displayed.

Cause 1

The thermistor connector and relay cable is not securely connected.

Solution

Correct measurement cannot be performed unless the thermistor connector and relay cable is securely connected. Check the connection and perform the measurement again.

Cause 2

The sensor or relay cable is defective.

Solution

If the sensor or cable is defective, measurement can not be performed. Replace the sensor or cable and perform the measurement again.

❑<CO Disconnected> message is displayed.

Cause

The catheter relay cable was disconnected while monitoring the cardiac output.

Solution 1

To cease monitoring, press the [Alarm Silence] key. The message will disappear, and the alarm will be silenced.

Solution 2

To continue monitoring, plug in the catheter relay cable. This will clear the message and silence the alarm.

CO_2 Measurement (HC-110)

❑<CO_2 Check Sample Line> is displayed.

Cause

The sampling tube is clogged.

Solution

Replace the sampling tube.

❑<Initializing> displayed inside the numeric data box does not disappear.

Cause

An error has occurred during the initialization at power ON.

Solution

The CO_2 unit failure can be considered.

❑There is substantial measurement error.

Cause

The CO_2 calibration value is not appropriate.

Solution

Perform the CO_2 calibration again.

sampling tube

sampling tube

outlet

outlet

Recorder

❑<Check Paper> is displayed, and printing cannot be performed.
The power supply LED is lit in orange.
<PAPER OUT> is displayed inside the [Print Start/Stop] user key.

Cause

There is no paper in the printer.

Solution

Set the paper in the paper holder.

❑<Check Cassette> is displayed, and printing cannot be performed.
The power supply LED is lit in orange.
<CASSETTE> is displayed inside the [Print Start/Stop] user key.

Cause

The paper holder is open.

Solution

Firmly close the paper holder.

❑Although the paper is fed, printing is not performed.

Cause

The paper is not correctly installed. The front and backside of the paper is set oppositely.

Solution

Set the paper in the paper holder so that the logo, FUKUDA DENSHI CO.,LTD appears on the upper surface.

❑The second and third waveforms are not printed for manual printing or alarm printing.

Cause

The second and third waveforms are not set on the printing setup screen.

Solution

Set the second and third waveform on the corresponding printing setup screen.

❑<Check Printer> is displayed and printing cannot be performed.
The power supply LED is lit in orange.
<CHECK?> is displayed inside the [Print Start/Stop] user key.

Cause 1

The paper is jammed.

Solution

Open the paper holder and properly set the paper.

Cause 2

The thermal head temperature has increased or other failure exists.

Solution

Damage to the thermal head or other failure can be considered. Contact your nearest service representative.

Network Printer

❑<Central Printer Check Connection> is displayed and printing cannot be performed.

Cause

The central monitor selected as the output destination is not connected to the printer.

Solution

Check the printer setting on the central monitor, and make sure the communication with the printer is established.

❑<Central Printer Check Setting> is displayed and printing cannot be performed.

Cause

The central monitor selected as the output destination does not support the network printing function.
Or, the printer setting is set to [OFF] on the central monitor selected as the output destination.

Solution

Use the DS-7700/DS-7700W system with the software version from V06, and set the printer setting to [ON].

❑<Check Central ID> is displayed and printing cannot be performed.

Cause

The central monitor selected as the output destination does not support the network printing function.

Solution

Select the central monitor which supports the network printing function.

Wired Network (DS-LANII/ DS-LANIII)

❑The data is not displayed on the central monitor.

Cause 1

The DS-LAN setup is not correct.

Solution

Make sure that the DS-LAN Setup (DS-LAN III) for all bedside monitors and central monitors in the same network are the same. If the DS-LAN setting is changed, make sure to restart the system.

Cause 2

A central monitor which is not compatible is used.

Solution

.

- DS-5700
- DS-5800N/NX/NX^{MB}
- DS-7600/7600W with software version V05 and prior

Cause 3

Inappropriate HUB is used.

Solution

For the DS-LAN III network, use the specified switching HUB.

Cause 4

The bed ID is duplicated in the same network.

Solution

If bedside monitors with the same bed ID exist in the same network, communication is not possible. Make sure to set a unique bed ID for each bedside monitor.

Cause 5

A device not specified by Fukuda Denshi is connected to the network.

Solution

Do not connect PC, printer, or other unspecified device to the DS-LAN network.

Cause 6

The DS-LAN cable is not properly connected.

Solution

The DS-LAN connection will be performed by our service representative. Contact your nearest service representative.

❑The CO_2 waveform is not displayed on the central monitor although the CO_2 numeric data is displayed.

Cause 1

[Impedance] is selected for "RR/APNEA Alarm Source" on the RESP setup menu.

Cause 2

[Ventilator] is selected for "RR/APNEA Alarm Source" on the RESP setup screen.

Solution

Select [CO_2] for "RR/APNEA Alarm Source" on the RESP setup menu.
In this case, RR and apnea alarm will be generated based on CO_2 measurement.

❑The impedance respiration waveform is not displayed on the central monitor although the RR numeric data is displayed.

Cause 1

[CO_2] is selected for "RR/APNEA Alarm Source" on the RESP setup menu.

Cause 2

[Ventilator] is selected for "RR/APNEA Alarm Source" on the RESP setup screen.

Solution

Select [Impedance] for "RR/APNEA Alarm Source" on the RESP setup menu.

NOTE

- The impedance waveform will not be displayed if [CO_2] is set for "RR/APNEA Alarm Source". AWF, AWP waveform will be displayed.
- The CO_2 waveform will not be displayed if [Impedance] is set for "RR/APNEA Alarm Source". AWF, AWP waveform will be displayed.
- The CO_2 waveform and impedance waveform will not be displayed if [Vent.] is set for "RR/APNEA Alarm Source" .

❑<Check DS-LAN Comm.> is displayed.

Cause

The LAN cable is loose, or contact failure has occurred. The power of the central monitor has been turned OFF.

Solution

Check the LAN connection on both the main unit and wall side. Disconnect and connect it again to make sure that it is firmly connected.
Check the LAN connection on the central monitor. Disconnect and connect it again to make sure that it is firmly connected.
Turn ON the power of the central monitor.

Telemeter

❑The data cannot be received at the telemetry center.

Cause

The channel ID or group ID is not corresponded with the telemetry receiver.

Solution

Set the correct channel ID and group ID.

❑The impedance respiration waveform cannot be received at the telemetry center.

Cause 1

[CO_2] is selected for "RR/APNEA Alarm Source" on the RESP setup menu.

Cause 2

[Ventilator] is selected for "RR/APNEA Alarm Source" on the RESP setup screen.

Solution

Select [Impedance] for "RR/APNEA Alarm Source" on the RESP setup menu.

❑The BP waveform of 100 mmHg and above cannot be properly received.

Cause

The BP waveform and scale are not the same.

Solution

When the BP waveform is above 100 mmHg, set the BP scale above 100 mmHg.

❑<Telemeter Failure> is displayed.

Cause

The connection with the telemeter is interrupted.

Solution

Contact your nearest service representative.

❑<TML Ver.> message is displayed.

Cause

Installation has failed.

Solution

Check the software version of the telemeter.
If "V99-99" is displayed, perform the installation again.

Remote Control

❑The remote control does not function.

Cause 1

The remote control bed ID is not correct.

Solution

Set the correct remote control ID.

Cause 2

The section number is not correct.

Solution

Set the correct section number.

❑The remote control does not properly function.

Cause

The remote control setting on the monitor does not correspond to the function key on the remote control unit.

Solution

Make sure the remote control setting on the monitor and the function key on the remote control unit is corresponded.

General

❑Even though the numeric data displayed on the central monitor is exceeding the alarm limit, alarm does not generate.

Cause

The parameters not displayed on the display unit are displayed on the central monitor as [All Data] is selected for "Numeric Data External Output" under [Initial Settings] > [System] > [Other].

Solution 1

For the parameters which requires alarm monitoring on the central monitor, make sure to display those on the display unit.

Solution 2

For the central monitor, if monitoring is necessary for only the parameters displayed on the display unit, select [Displayed Data] for "Numeric Data External Output" under [Initial Settings] > [System] > [Other].

❑Nothing is displayed on the screen, and the power supply LED is not lit.

Cause 1

The main unit of the DS-1200 is malfunctioning.

Solution

Immediately turn OFF the power and cease the operation. Contact your nearest service representative.

❑The data is initialized each time the power is turned ON.

Cause 1

The internal switch setting is incorrect.

Solution

The internal switch setting needs to be changed. Contact your nearest service representative.

Cause 2

The battery for the backup memory is depleted.

Solution

The battery needs to be replaced. Contact your nearest service representative.

❑The display is dark, or cannot be seen clearly.

Cause 1

The night mode is set.

Solution

Cancel the night mode.

Cause 2

The service life of the LCD backlight has expired.

Solution

The LCD unit needs to be replaced. Contact your nearest service representative.

⚠ CAUTION

- The display unit utilizes LED for the backlight.
  Since this LED deteriorates by the life cycle, the display may become dark, scintillate, or may not light by the long term use. In such case, contact your nearest service representative.

❑The system does not start although the power supply cable is connected.

Cause 1

Incorrect USB memory is inserted.

Solution

Remove the USB memory, turn OFF the power, and turn ON the power again.

Cause 2

The main unit of the DS-1200 is malfunctioning.

Solution

Immediately turn OFF the power and cease the operation. Contact your nearest service representative.

❑The clock is often delayed.

Cause

The battery for the backup memory is depleted.

Solution

Check if the time is delayed when the power is turned OFF.
The battery needs to be replaced. Contact your nearest service representative.

❑The touch panel key does not function properly.

Cause 1

Due to change in installation environment, the detecting location is misaligned.

Solution

Calibration is required. Contact your nearest service representative.

⚠ CAUTION

- The calibration will be performed by our service representative. Users should not perform this procedure as incorrect calibration may cause malfunction of the device.

Cause 2

The LCD unit is malfunctioning.

Solution

Immediately turn OFF the power and cease the operation. Contact your nearest service representative.

❑<DS-1200 Failure> or <DS-1200 Check Unit> is displayed.

Cause

A hardware failure has occurred.

Solution

Immediately turn OFF the power and cease the operation. Contact your nearest service representative.

❑<DS-1200 Out of Operating Temp. Range>, <Display Unit Out of Operating Temp. Range> is displayed.

Cause

The main unit or display unit is used outside the specified environment condition.

Solution

Use the equipment in the specified environment condition (10°C to 40°C).

❑<Display Unit Failure>, <Check Display Unit> is displayed.

Cause

Display unit is malfunctioning.

Solution

Immediately turn OFF the power and cease the operation. Contact your nearest service representative.

❑<DS-1200 Check Rotary SW> is displayed.

Cause

The rotary switch setting is incorrect.

Solution

If the rotary switch is not set to "0", the equipment will not function properly.
Immediately turn OFF the power and cease the operation. Contact your nearest service representative.

❑<The settings have been changed. Reboot the unit.> is displayed when the power is turned ON.

Cause

Rebooting of the system is required.

Solution

Turn the power OFF and then turn it back ON. If the same message is repeatedly displayed, turn OFF the power and contact your nearest service representative.

❑<DS-1200 Check Long-Term Battery> is displayed.

Cause

The battery is depleted or malfunctioning.

Solution

The battery needs to be replaced. Contact your nearest service representative.

❑<Some parameters are not displayed due to the display layout setting.> is displayed.

Cause 1

The measured parameter is not set to be displayed.

Solution

On the "Display Config." setting, select the measured parameter to be displayed.

Cause 2

During auto display configuration, the quantity of measured parameters exceeded the displayable parameters.

Solution

If there are parameters which measurements are not actually performed, please disconnect their probes/cables.

❑<Check Equip. Config.> is displayed.

Cause 1

The "Multiamplifier" setting does not correspond to the connected cable.

Solution

Check the "Multiamplifier" setting (Initial Settings>System>Unit Module>Multiamplifier), and make sure that the setting corresponds to the connected cable.

Cause 2

On the "External Device" setting, the set external device is duplicated.

Solution

Check the "External Device" setting, and make sure that the selected external device is not duplicated. The external devices other than Vigilance, INVOS, and BIS cannot be duplicated.
The combinations of FLOW-i and MG-110/MG-120, FLOW-i and ventilator are not possible.

Expansion Module

❑The system does not start although the power of the DS-1200 is turned ON.

Cause 1

The power cable of the DS-1200 is disconnected.

Solution

Turn OFF the power, and make sure that the power cable is securely connected. Reconnect the cable if necessary.

Cause 2

The standby switch is set to OFF.

Solution

Turn ON the standby switch.

Cause 3

The module is defective.

Solution

Immediately turn OFF the power and cease the operation. Contact your nearest service representative.

❑<Check Conn.> is displayed.

Cause

Infrared communication port is unclean.

Solution

Remove the expansion module, clean the infrared communication port, and insert the expansion module again.

❑Power is not supplied to the expansion module.

Cause 1

The expansion module is not properly connected.

Solution

Disconnect and connect the expansion module.

Cause 2

The module is defective.

Solution

The module is defective.

Ventilator

❑<Vent. Alarm> is displayed.

Cause

The following alarm has generated on the ventilator.

- Parameter alarm such as AWP, MV, FiO_2
- Technical alarm such as battery replacement of the ventilator

Solution

Check the alarm cause of the ventilator, and take appropriate action.

❑<Vent. Offline> is displayed.
<VENT COMM> is displayed on the monitor and the ventilator.

Cause 1

The cable between the DS-1200 System and the ventilator is disconnected or not securely connected.

Solution

Make sure the cable is properly connected.

Cause 2

The power of the ventilator is turned OFF.

Solution

Turn ON the power of the ventilator.

Cause 3

The ventilator is in standby mode.

Solution

Start the ventilation on the ventilator.

Cause 4

The network setting of the monitor does not match with the ventilator.

Solution

Make sure that the network setting of the connecting devices are as follows.

SV-300/SERVO-i/SERVO-s

- No network setting.

SERVO-U/n/air

- No network setting.

VELIA, ASTRAL, VS ULTRA

- No network setting.

PB-740/760/840

- Baud Rate: 9600 bps
- Parity Bit: None
- Stop Bit: 1
- Data Bit: 8

Evita4/2dura/XL

- Communication Protocol: Medibus
- Baud Rate: 19200 bps
- Parity Bit: Even
- Stop Bit: 1

Multigas Module

❑<GAS Unit Failure> is displayed.

Cause

A hardware failure was detected on the gas unit.

Solution

Contact your nearest service representative.

❑<GAS Check Sample Line> is displayed.

Cause

The sampling line or water trap is completely occluded.
The moisture inside the sampling line is drawn towards the water trap to be removed.

Solution 1

Check if the sampling line is occluded. Remove the occlusion if found.

Solution 2

Replace the sampling line, water trap.

❑<GAS Check Water Trap> is displayed.

Cause 1

The water trap of the gas module is not inserted, or not properly attached.

Solution

Insert the water trap.
Make sure the water trap is properly connected.

Cause 2

Water trap is partly clogged or damaged.

Solution

Replace the water trap.

❑<GAS Check Water Trap Class> is displayed.

Cause

The patient classification is not corresponded to the used water trap and the sampling tube.

Solution

Make sure the patient classification is corresponded to the used water trap and the sampling tube.
When the patient classification is "Adult" or "Child", make sure to use the water trap and sampling line intended for adult/pediatric.
When the patient classification is neonate, make sure to use the water trap and sampling line intended for neonate.

❑<GAS Mixed Agents Detection> is displayed.

Cause

More than one halogenated anesthetic gas exists.

Solution 1

Make sure that multiple anesthetic gases are not used.
Make sure that the anesthetic gas carburetor setting is correct.

Solution 2

If the problem persists, contact our service representative.

❑<GAS Zeroing Failed> is displayed.

Cause

The zero calibration process has not been properly completed.

Solution

Perform the manual zero calibration again.

❑<SPIRO Unit Failure> is displayed.

Cause

The hardware failure of the SPIRO unit was detected.

Solution

Contact your nearest service representative.

❑<SPIRO Check FlowSensor Class> is displayed.

Cause 1

The flow sensor is disconnected or not securely connected.

Solution

Make sure that the flow sensor is securely connected.

Cause 2

The flow sensor is damaged.

Solution

Replace the flow sensor.

Cause 3

The used flow sensor does not correspond to the patient classification setting on the monitor.

Solution

Make sure that the used flow sensor corresponds to the patient classification setting.
When the patient classification is adult, use the flow sensor intended for adult.
When the patient classification is "Child" or "Neonate", use the flow sensor intended for pediatric.

❑<SPIRO Check Flow Sensor> is displayed.

Cause

If the flow sensor is disconnected during multigas monitoring, the message will be displayed.

Solution 1

To cease multigas monitoring, press the [Alarm Silence] key. The message will disappear, and the alarm will be silenced.

Solution 2

To continue monitoring, plug in the flow sensor. The message will disappear, and the alarm will be silenced.

SvO_2/CCO Monitor

❑The numeric data is not displayed.

Cause 1

The cable is not properly connected.

Solution

Connect the following cable securely.

SvO_2/CCO Monitor	Connection Cable	
	For Status II Connector	For Serial Connector
Vigilance	CJ-406RI-70Vigi (x1)	CJO-04RS4
Vigilance CEDV	CJ-406RI-70Vigi (x1)	CJO-04RS4
Vigilance II	CJ-402RI-70SVi (x1)	CJ-502
Vigileo	CJ-402RI-70SVi (x1)	CJ-502
EV1000	CJ-406RI-70Vigi (x1)	CJO-04RS4
PiCCO2	CJO-19RS5 (x1)	CJO-18RS5
PulsioFlex	-	CJ-725[*1]

*1: To connect the PulsioFlex PC4000, USB to RS-232C connector cable (UC-232A, ATEN) specified by PULSION Medical Systems is required.

Cause 2

The "External Device" setting is not correct.

Solution

Select [Vigilance/Vigileo], [PiCCO] or [PulsioFlex] for the port function on the "External Device" setup screen.

Cause 3

The measurement data is not displayed on the corresponding external device.

Solution

The measurement data of SvO_2, CO, etc. will not be displayed on the monitor unless the data is displayed on the used external device.Check if the data is displayed on the used external device.

Cause 4

The CCO is not measured.

Solution

The CCO/CCI data will be displayed on this device only when CCO is measured on each external device.

Cause 5

The network setting of the monitor does not match with each external device.

Solution

The network setting of the monitor is fixed to the default setting of each external device and cannot be changed. Make sure that the network setting of the connecting device is in default setting.

In Case of Vigilance/Vigileo:

Make sure that the network is set as follows.

For procedure to check the Vigilance/Vigileo network setting, refer to the operation manual for the Vigilance/ Vigileo.

- Device: IFM Out
- Baud Rate: 19200 bps
- Parity Bit: None
- Stop Bit: 1
- Data Bit: 8
- Flow Control: 2 sec.

In Case of PiCCO

Make sure that the network is set as follows.

For procedure to check the PiCCO network setting, refer to the operation manual for the PiCCO2.

- RS-232C Protocol: PiCCO2 V3.0

In Case of PulsioFlex:

Check if the network is set as follows.

For procedure to check the PulsioFlex network setting, refer to the operation manual for the PulsioFlex.

- RS232C protocol: PulsioFlex V1.0

Cause 6

The software version of Vigilance does not correspond.

Solution

If the Vigilance without the STAT function is connected, the STAT data will not be displayed. Check the software version of the Vigilance.

Cause 7

The software version of PiCCO does not correspond.

Solution

The compatible version of PiCCO2 is from V3.0. Check the version of the PiCCO2.

Cause 8

The software version of PulsioFlex does not correspond.

Solution

Check the software version of PulsioFlex. The compatible version is PulsioFlex V1.0.

BIS

❑<BISx Disconnected> is displayed.

Cause 1

The BISx is disconnected.

Solution

Verify all cable connections and connect the BISx correctly.

Cause 2

The BISx cable is defective.

Solution

Check the cable including the connector part, and replace the cable if necessary.

Cause 3

The BISx is defective.

Solution

Replace the BISx.

❑<BIS High Impedance, Check Sensor> is displayed.

Cause 1

The sensor is not fully in contact with patient's skin.

Solution

Attach the electrode firmly to patient's skin.

Cause 2

The sensor application is incorrect.

Solution

Read instructions on sensor package to ensure correct sensor placement.

Cause 3

The patient interface cable (PIC cable) is defective.

Solution

Replace the patient interface cable (PIC cable).

Cause 4

The BISx is defective.

Solution

Replace the BISx.

❑<BIS Sensor Disconnected> is displayed.

Cause 1

The sensor is disconnected.

Solution

Connect the sensor.

Cause 2

Poor or contaminated connection between the sensor and patient interface cable (PIC cable).

Solution

Clean the connection part, and connect them properly.

Cause 3

The patient interface cable (PIC cable) is disconnected.

Solution

Connect the patient interface cable (PIC cable) correctly.

Cause 4

The patient interface cable (PIC cable) is defective.

Solution

Replace the patient interface cable (PIC cable).

Cause 5

The BISx is defective.

Solution

Replace the BISx.

❑<BIS Perform "Sensor Check"> is displayed.

Cause 1

At least one element of sensor has too high impedance, and "Sensor Check" window is closed before sensor check completes.

Solution

Press the "Sensor Check" key to start the sensor check process and ensure that <PASS> is displayed.

Cause 2

The sensor application is incorrect.

Solution

Read instructions on sensor package to ensure correct sensor placement.

Cause 3

The sensor is not properly connected.

Solution

Verify that the sensor is properly connected.

Cause 4

The patient interface cable (PIC cable) is defective.

Solution

Replace the patient interface cable (PIC cable).

Cause 5

The BISx is defective.

Solution

Replace the BISx.

❑<Artifacts> is displayed.

Situation The signal quality is less than half of the level desirable for optimal monitoring conditions.

NOTE

- This message may occur as the results of artifact (non-EEG signal) such as those generated from motion (patient movement or eye blinks) or the presence of electrocautery, warming blankets, or other devices.

Cause 1

Artifact, such as those generated by motion or eyeblinks, is causing loss of EEG recognition.

Solution

If <Artifacts> appears on the display, attempt to identify and eliminate artifact source.

Cause 2

EMG bar indicates electrical activity that may be interfering with EEG recognition.

Solution

If EMG bar is illuminated, attempt to determine and eliminate cause.

Cause 3

The patient interface cable (PIC cable) is defective.

Solution

Make sure that sensor check passes. If not, replace the patient interface cable (PIC cable).

Cause 4

The BISx is defective.

Solution

Replace the BISx.

❑<BIS SQI < 15%> is displayed.

Situation The signal quality is too low to accurately calculate a BIS value.
The BIS value and other trend variables that are adversely affected by artifact are not displayed.

NOTE

- This message may occur as the results of artifact (non-EEG signal) such as those generated from motion (patient movement or eye blinks) or the presence of electrocautery, warming blankets, or other devices.

Cause 1

Artifact, such as those generated by motion or eyeblinks, is causing loss of EEG recognition.

Solution

If <BIS SQI < 15%> appears on the display, attempt to identify and eliminate artifact source.

Cause 2

EMG bar indicates electrical activity that may be interfering with EEG recognition.

Solution

If EMG bar is illuminated, attempt to determine and eliminate cause.

Cause 3

The patient interface cable (PIC cable) is defective.

Solution

Make sure that sensor check passes. If not, replace the patient interface cable (PIC cable).

Cause 4

The BISx is defective.

Solution

Replace the BISx.

❑<BISx Incompatible> is displayed.

Cause

The sensor is not compatible with the monitor configuration.

Solution

Replace the BISx.

❑<Check BIS Sensor, Perform Sensor Check> is displayed.

Cause

Problem is detected relating to sensor ground element, or sensor is using too much current.

Solution 1

Disconnect and examine sensor connection, clean any contamination, then perform "Sensor Check".

Solution 2

Replace the sensor if necessary, then perform "Sensor Check".

Solution 3

Replace the patient interface cable (PIC cable), then perform "Sensor Check".

Solution 4

Replace the BISx, then perform "Sensor Check".

❑<Replace BIS Sensor, Too Many Uses>, <Replace BIS Sensor, Invalid Sensor> is displayed.

Cause 1

Sensor has been connected and disconnected too many times.

Solution

Replace the sensor.

Cause 2

The sensor is invalid.

Solution

Replace the sensor.

❑<Sensor Usage > 24hrs.> is displayed.

Cause

The sensor was attached to the system for more than 24 hours.

Solution

Replace the sensor.

❑<BISx Failure> is displayed.

Cause

The BISx is defective.

Solution

Replace the BISx, then perform "Sensor Check".

INVOS

❑The numeric data is not displayed.<Check INVOS Conn.> is displayed.

Cause

The cable is not properly connected. The connection cable is disconnected.

Solution

Securely connect the connection cable to the serial or status connector of the main unit or the Status II connector of the HP-800.

FLOW-i

❑The numeric data is not displayed. <Check FLOW-i Conn.> is displayed.

Cause 1

The cable is not properly connected. The connection cable is disconnected.

Solution

Securely connect the connection cable to the serial or status connector of the main unit or the Status II connector of the HP-800.

Cause 2

The FLOW-i is in standby mode.

Solution

The numeric data will be displayed when the measurement is started on the FLOW-i.

Cause 2

The software version of the FLOW-i is not compatible with the DS-1200.

Solution

The compatible software version of DS-1200 is from 01- 01.
The compatible software version of FLOW-i is system software version 02 and 03 (FCI Protocol version 0004 and 0005 respectively).

PC Communication

❑<Check System Conn.> is displayed.

Cause 1

The cable is disconnected or not properly connected. The power is not supplied to the communication port.

Solution

Connect the cable securely. Check if the power is supplied to the communication port by checking the communication indicator.

Cause 2

Communication with the PC is not performed. The communication is ceased.

Solution

Resume the communication with the PC. The communication time out period is about 1 minute.

TCM4/TCM5 FLEX

❑The numeric data is not displayed.

Cause 1

The cable is not properly connected.

Solution

Connect the following cable securely.

Transcutaneous Blood Gas Monitor	Connection Cable	
	For Status II Connector	For Serial Connector
TCM4	-	CJ-726 (straight) *1
TCM5 FLEX	-	CJ-725 (cross) *2

*1: To connect the TCM4, the cable specified by Radiometer Medical ApS is required.The communication will be enabled by connecting the CJ-726 and the cable specified by Radiometer Medical ApS.

*2: To connect the TCM5 FLEX and CJ-725, D-sub 9-pin male to male gender changer (inch screw) is required.

Cause 2

The "External Device" setting is not correct.

Solution

Select [TCM4/TCM5] for the port function on the "External Device" setup screen.

Cause 3

The measurement data is not displayed on the corresponding external device.

Solution

The measurement data of $tcpO_2$, $tcpCO_2$ will not be displayed on the monitor unless the data is displayed on the used external device. Check if the data is displayed on the used external device.

Cause 4

The network setting of the monitor does not match with each external device.

Solution

The network setting of the monitor cannot be changed. Make sure that the network setting of the connecting device is as follows.For details of the network setting on the TCM4 and TCM5 FLEX, refer to Radiometer Medical ApS.

In case of TCM4:

- RS-232C Protocol: Monlink

In case of TCM5 FLEX:

- RS-232C Protocol: Monlink2.0

Cause 5

The software version of TCM4 or TCM5 FLEX does not correspond.

Solution

Check the software version of TCM4 or TCM5 FLEX.
For details of the network setting on the TCM4 and TCM5 FLEX, refer to Radiometer Medical ApS.

TCM4: Version 3.04

TCM5 FLEX: Version 1.18

❑<Check TCM Conn.> is displayed.

Cause 1

The cable is disconnected, or not securely connected.

Solution

Connect the cable correctly.

Cause 2

The power of the external device has been turned OFF.

Solution

Turn ON the power of the external device.

Cause 3

The TCM series device other than TCM4, TCM5 FLEX is connected.

Solution

Only TCM4, TCM5 FLEX can be connected. Check the model type of the external device.

Root

❑<Check System Conn.> is displayed.

Cause 1

The cable is disconnected or not properly connected. The power is not supplied to the communication port.

Solution

Connect the cable securely. Check if the power is supplied to the communication port by checking the communication indicator.

Cause 2

Communication with the PC is not performed. The communication is ceased.

Solution

Resume the communication with the PC. The communication time out period is about 1 minute.

NIRO-200NX

❑<Check System Conn.> is displayed.

Cause 1

The cable is disconnected or not properly connected. The power is not supplied to the communication port.

Solution

Connect the cable securely. Check if the power is supplied to the communication port by checking the communication indicator.

Cause 2

Communication with the PC is not performed. The communication is ceased.

Solution

Resume the communication with the PC. The communication time out period is about 1 minute.

Magnetic Card Reader/Barcode Reader

❑The magnetic card reader or barcode reader does not function.

Cause

The conversion cable (CJ-756) is not connected.

Solution

If the magnetic card reader or barcode reader is connected directly to the serial port on this device without the conversion cable, it will not function. Make sure to use the conversion cable.

External Media

❑<USB Memory/SD Card Slot: There is no card in the slot.> is displayed.

Cause

USB memory/SD card is not inserted or not correctly set in the USB memory/SD card slot.

Solution

Set the USB memory/SD card into the USB memory/SD card slot.

❑<Data Read Error. Model type or software version is not compatible. Do you want to read only the common data?> is displayed.

Cause 1

There is no data on the USB memory.

Solution

Check if the USB memory is readable. Or, check if the data is present on the USB memory. Pressing "Yes" will not start reading the compatible data.<Card access error.> will be displayed.

Cause 2

Error is detected during the read process.

Solution

The data may not be correctly written on the USB memory. Format the card again on the used equipment and try the write/read process again. Pressing "Yes" will not start reading the compatible data.

❑<Card access error.> is displayed.

Cause 1

There is not enough capacity on the USB memory to write the data.

Solution

Check the remaining card capacity.

Format the card again on the used equipment and try the write/read process again.

Cause 2

Error is detected during the write process.

Solution

Make sure that the USB memory is properly inserted and try the write process again.

Format the card again on the used equipment and try the write/read process again.

Cause 3

Unspecified USB memory is used.

Solution

Use the specified USB memory.

❑No data on the USB memory.

Cause

There is no data on the USB memory.

Solution

Check if the USB memory is readable. Or, check if the data is present on the external media.

❑<Wrong USB memory for full disclosure.>, <Failed to read full disclosure from the USB memory.>

Cause

Specified memory card is not used.
The card is not formatted.
The data stored in the card is damaged. The card has been already used on another equipment.

Solution 1

Use the recommended memory card.
Disconnect and connect the full disclosure waveform card again to make sure that it is properly inserted.
Format the card on the used equipment. (All previous data will be deleted.)

Solution 2

If the error persists, contact your nearest service representative.

❑<Replace CFast card for FD>, <Card not supported.>

Cause

Specified memory card is not used.

Solution 1

Use only the specified memory card. Make sure that the memory card is properly inserted

Solution 2

If the error persists, contact your nearest service representative.

Battery

❑<Check battery> is displayed.

Cause

The communication with the battery is unstable.Or, battery is almost empty.

Solution

If the battery level is low, charge the battery. The battery level decreases even when not in use such as during storage. If the battery level is sufficient, reinstall the battery.If the situation is none of the above, contact your nearest service representative.

Chapter 12 Setup Item/Default Value

This section lists selection, default setting, and backup status for each setup item.
The following indicates the selection, default setting and backup status for each setup item.

Patient Admit / Discharge

Item	Description	Default	At Power ON	At Discharge
Mode Selection	Main Mode 1 to 9, Sub Mode 1 to 6,	Main Mode 1	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge].	
ID	Numeric, Alphabet, Symbol (20 characters)	Blank	Backup	Initialize
Patient Name	Numeric, Alphabet, Symbol (16 characters)	Blank	Backup	Initialize
Patient Classification	Adult, Child, Neonate	Adult	Depends on the "Patient Classification" setting under [Initial Settings>User I/ F>Power ON/Discharge].	
Sex	Male, Female	No selection	Backup	Initialize
Team	Red, Orange, Yellow, Yellow-green, Green, Light Blue, Blue, Purple	Red	Backup	Initialize
Birth Date	Birth Date	Blank	Backup	Initialize
Age	0 year to 150 years or 0 day to 999 days	0 year	Backup	Initialize
Height	0.0 cm to 300.0 cm	0.0 cm	Backup	Initialize
Weight	0.0 kg to 350.0 kg	0.0 kg	Backup	Initialize
BSA	0.00 m^2 to 9.99 m^2	0.00 m^2	Backup	Initialize
Blood Type	A, B, O, AB Rh +/-	Blank	Backup	Initialize
Pacemaker	Used, Not used	Not Used	Depends on the setting under [Initial Settings>User I/F>Power ON/Discharge].	
Impedance Measurement	ON, OFF	ON	Depends on the setting under [Initial Settings>User I/F>Power ON/Discharge].	
Admit Date	Year, Month, Day	Blank	Backup	Initialize

Alarm

Item	Description	Default	At Power ON	At Discharge
System Alarm	Suspend, ON	Suspend	-	-
HR*3	ON, OFF 20 bpm to 300 bpm 5 bpm increments	ON 40 bpm to to 120 bpm	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge]. If "Main Mode" setting is [Backup]; Depends on the "Alarm" setting under [Power ON/Discharge].	
PR_IBP*3 PR_SpO_2*3	ON, OFF 20 bpm to 300 bpm 5 bpm increments	OFF OFF to OFF		
Asystole*1	ON, OFF 3 sec to 10 sec. 1 sec. increments	ON 5 sec.		
VF*1	ON, OFF	ON		
VT*1	ON, OFF	ON		
Slow_VT	ON, OFF	ON		
RUN	ON, OFF 2 beats to 8 beats 1 beat increments	ON 3 beats		
Couplet	ON, OFF	OFF		
PAUSE	ON, OFF 1.5 sec. to 5 sec. 0.5 sec. increments	OFF 3.0 sec.		
Bigeminy	ON, OFF	OFF		
Trigeminy	ON, OFF	OFF		
Frequent	ON, OFF 1 beats to 50 beats/ min. 1 beat increments	OFF, 10 bpm		
TACHY	ON, OFF	ON		
BRADY	ON, OFF	ON		
Ext Tachy*3	ON, OFF 22 beats to 300 beats/ min. 5 beat increments	OFF, 150 bpm		
Ext Brady*3	ON, OFF 20 beats to 295 beats/ min. 5 beat increments	OFF, 30 bpm		
Triplet	ON, OFF	OFF		
R on T	ON, OFF 200 ms to 600 ms 8 ms increments	OFF 320ms		
Multiform	ON, OFF	OFF		
Vent Rhythm	ON, OFF	OFF		
SVT	ON, OFF 2 beats to 10 beats 1 beat increments	OFF, 6 beats		
Irregular RR	ON, OFF 10% to 20% 5% increments	OFF 10%		
Prolonged RR	ON, OFF	OFF		
S Frequent	ON, OFF 1 beats to 50 beats/ min. 1 beat increments	OFF, 10 bpm		
S Couplet	ON, OFF	OFF		
VPC	ON, OFF	OFF		
SVPC	ON, OFF	OFF		
Pacer not Capture	ON, OFF 80 ms to 480 ms 8 ms increments	OFF 320ms		
Pacer not Pacing	ON, OFF 20 beats to 200 beats/ min. 5 beat increments	OFF, 50 bpm		

Item	Description	Default	At Power ON	At Discharge
HR Lower Limit for VT	120 beats to 200 beats/min., 10 beat increments	120	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge]. If "Main Mode" setting is [Backup]; Depends on the "Alarm" setting under [Power ON/Discharge].	
HR Lower Limit for Run *4	0 beats to , 200 beats/min 10 beat /min. increments	40 bpm		
HR Lower Limit for SVT	100 beats to 250 beats/min 10 beat /min. increments	150 bpm		
HR Lower Limit for Slow VT	100 beats to 180 beats/min. Must not exceed VT Lower Limit for HR - 20. 10 beat increments.	100 bpm		
ST1 to ST12(mm) *2	ST All Alarm ON, OFF Individual Alarm ON, OFF ±20 mm 1 mm increments	ST All Alarm OFF Individual Alarm OFF OFF to OFF		
ST1 to ST12(mV)*2	ST All Alarm ON, OFF Individual Alarm ON, OFF ±2.00mV 0.1mV increments	ST All Alarm OFF Individual Alarm OFF OFF to OFF		
BP1 (mmHg) *5	ON, OFF 0 mmHg to 300 mmHg 8 mmHg increments	ON SYS: 80 to 180 DIA: OFF to OFF MEAN: OFF to OFF	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge]. If "Main Mode" setting is [Backup]; Depends on the "Alarm" setting under [Power ON/Discharge].	
BP1 (kPa) *5	ON, OFF 0 kPa to 40.0 kPa 0.5 kPa increments	ON SYS: 10.0 to 24.0 DIA: OFF to OFF MEAN: OFF to OFF		
BP2 to BP8 (mmHg) *5	ON, OFF 0 mmHg to 300 mmHg 8 mmHg increments	OFF SYS: OFF to OFF DIA: OFF to OFF MEAN: OFF to OFF		
BP2 to BP8 (kPa) *5	ON, OFF 0 kPa to 40.0 kPa 0.5 kPa increments	OFF SYS: OFF to OFF DIA: OFF to OFF MEAN: OFF to OFF		

*1: Select [ON/OFF] for "Asystole, VF, VT Alarm" under [Menu<Initial Settings<Alarm] in advance.

*2: The same setting applies for "mm" and "mV".

*3: For HR, Ext Tachy, Ext Brady, 60 bpm or lower can be set in 1 bpm increments. For PR_SpO_2, 25 bpm or lower can be set in 1 bpm increments.

*4: "HR Lower Limit for Run" can be set in 5 bpm increments for 50 bpm and above.

*5: For BP, 50 mmHg/7.0 kPa or lower can be set in 2 mmHg/0.2 kPa increments.

Item	Description	Default	At Power ON	At Discharge
CVP (mmHg) (kPa) *1	ON, OFF 0 mmHg to 300 mmHg 5 mmHg increments 0 kPa to 40 kPa 0.5 kPa increments	OFF SYS: OFF to OFF DIA: OFF to OFF MEAN: OFF to OFF	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge]. If "Main Mode" setting is [Backup]; Depends on the "Alarm" setting under [Power ON/Discharge].	
CVP (cmH_2O)	ON, OFF 0 cmH_2O to 40 cmH_2O 1 cmH_2O increments	OFF SYS: OFF to OFF DIA: OFF to OFF MEAN: OFF to OFF		
RR_IMP*2 RR_VENT*2 RR_CO_2*2	ON, OFF 5 Bpm to 150 Bpm 5 Bpm increments 5 Bpm to 150 Bpm (Neonate) 2 Bpm increments	ON 5 bpm to 30 bpm		
APNEA	ON, OFF 10 sec. to 60 sec. 1 sec. increments	ON 15 sec.		
SpO_2	ON, OFF 50%SpO_2 to 100%SpO_2 1%SpO_2 increments	ON 90%SpO_2 to OFF		
EXT SpO_2	ON, OFF 50%SpO_2 to 90%SpO_2 1%SpO_2 increments	ON 80%SpO_2		
SpCO	ON, OFF 1%SpCO to 40%SpCO 1%SpCO increments	OFF		
SpMet	ON, OFF 1%SpMet to 15%SpMet 1%SpMet increments	OFF		
SpHb	ON, OFF 1.0 g/dL to 24.5 g/dL 0.1 g/dL increments	OFF		
NIBP (mmHg)	ON, OFF 10 mmHg to 300 mmHg 5 mmHg increments	ON SYS: 80 to 180 DIA: OFF to OFF MEAN: OFF to OFF		
NIBP (kPa)	ON, OFF 1.5 kPa to 40.0 kPa 0.5 kPa increments	ON SYS: 10.0 to 24.0 DIA: OFF to OFF MEAN: OFF to OFF		
TEMP1 to TEMP8 (°C)	ON, OFF 30-45°C 0.5°C increments	OFF, OFF to OFF		
Tb (°C)	ON, OFF 30-45°C 0.5°C increments	OFF, OFF to OFF		

Item		Description	Default	At Power ON	At Discharge
CO_2-E (mmHg) *3		ON, OFF 1 mmHg to 100 mmHg 1 mmHg increments	OFF	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge]. If "Main Mode" setting is [Backup]; Depends on the "Alarm" setting under [Power ON/Discharge].	
CO_2-E (kPa) *3		ON, OFF 0.1 kPa to 13.3 kPa 0.1 kPa increments	OFF		
CO_2-E (%) *3		ON, OFF 0.1 to 13.3% 0.1% increments	OFF		
CO_2- I (mmHg) *3		ON, OFF 1 mmHg to 4 mmHg 1 mmHg increments	OFF		
CO_2- I (kPa) *3		ON, OFF 0.1 kPa to 0.4 kPa 0.1 kPa increments	OFF		
CO_2-I (%) *3		ON, OFF 0.1 to 0.4% 0.1% increments	OFF		
O_2-E (%) *3		ON, OFF 18 to 100%	OFF		
O_2-I (%) *3		ON, OFF 18 to 100%	OFF		
N_2O-E (%) *3		ON, OFF 0 to 100%	OFF		
N_2O-I (%) *3		ON, OFF 0% to 100%	OFF		
ISO-E (%), HAL-E (%), ENF-E (%) *3		ON, OFF 0.5 to 6.0%	OFF	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge]. If "Main Mode" setting is [Backup]; Depends on the "Alarm" setting under [Power ON/Discharge].	
ISO-I (%), HAL-I (%), ENF-I (%) *3		ON, OFF 0.5 to 6.0%	OFF		
SEV-E (%) *3		ON, OFF 0.5 to 8.0%	OFF		
SEV-I (%) *3		ON, OFF 0.5 to 8.0%	OFF		
DES-E (%) *3		ON, OFF 0.5 to 18.0%	OFF		
DES-I (%) *3		ON, OFF 0.5 to 18.0%	OFF		
MAC*3		ON, OFF 0.1 to 9.9	OFF		
PEAK*3		ON, OFF 8cmH_2O to 100cmH_2O	OFF	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge]. If "Main Mode" setting is [Backup]; Depends on the "Alarm" setting under [Power ON/Discharge].	
PEEP*3		ON, OFF 2 cmH_2O to 50cmH_2O	OFF		
MV-E *3		Adult: ON, OFF 0.5 L/min to 20L/min Child, Neonate: ON, OFF 0.5 L/min to 5 L/min	OFF		
BIS		ON, OFF 1 to 99 increments of 1	ON 40 to OFF		
Alarm Settings (Setup)	Alarm Suspend Time	1 min., 2 min.	2 min.	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge].	
	Alarm Silence Time	1 min., 2 min.	2 min.		
	Alarm Sound Suspend	ON, OFF	ON		
	Alarm Sound Suspend Time	[1min] / [2min] /[5min] / [10min] / [30min] /[60min] /[90min] / [120min] /[240min] / [360min]	60 min.		
	Status Alarm Control	Link to alarm silence time, Link to each new occurrence	Link to each new occurrence		
	Alarm Limit Display	Graph, Numeric, OFF	Graph		

*1: For CVP, 50 mmHg/7.0 kPa or lower can be set in 2 mmHg/0.2 kPa increments.

*2: For RR, 1 Bpm increments may be applied depending on the "RR Alarm Increment" settings. (☞Maintenance Manual "User I/F" P5-12)

*3: When the numeric data acquired from FLOW-i is displayed, alarms cannot be set. Also, alarm will not generate.

NOTE

♦By selecting [Backup] for "Power ON" and "Discharge" under [Initial Settings>User I/F >Power ON/Discharge], the settings will be retained at "Power ON" and "Discharge" respectively. If [Initialize] is selected, the settings will be initialized at "Power ON" and "Discharge".

Parameter

ECG

Item	Description	Default	At Power ON	At Discharge
Leads	I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6	ECG1: II ECG2: aVR ECG3: I ECG4: III ECG5: aVL ECG6: avF ECG7: V1 ECG8: V2 ECG9: V3 ECG10: V4 ECG11: V5 ECG12: V6	*1	
Size	Auto, x1/4, x1/2, x1, x2, x4	ECG1 to ECG12 x1	*1	
Filter Mode	Monitor, Diagnosis, ESIS	Monitor	Backup	Backup
Synchronized Mark/Tone	ECG, SpO_2-1, SpO_2-2, BP, Auto, OFF	Auto	Backup	Backup
Pacemaker	*Same with "Patient Admit/Discharge" section.			
Pacemaker Pulse	ON, OFF	OFF	Backup	Backup
Pace Pulse Mask Time	Auto, 10 ms, 20 ms, 40 ms, OFF	Auto	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge].	Initialize
HR Average	Instant, Average, Arrhythmia Analysis	Arrhythmia Analysis	Backup	Backup
Drift Filter	ON, OFF	OFF	Backup	Backup
AC Filter	ON, OFF	ON	Backup	Backup
Auto Lead	ON, OFF	OFF	Backup	Backup
3-lead Override	ON, OFF	OFF	Backup	Backup
ST/VPC/Arrhy. Alarm Display	ON, OFF	ON	Backup	Backup
ECG Analog Output	Disp. Lead, Selected Lead	Disp. Lead	Backup	Backup
ECG Waveform Display during Lead-OFF	ON, OFF	OFF	Backup	Backup
Chest Lead-OFF	Enable, Disable	Enable	Backup	Backup

*1: Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/Discharge]. If "Main Mode" setting is [Backup] ; Depends on the "ECG1, ECG2 Size" setting under [Setup>Initial Settings>User I/F>Power ON/ Discharge].

RESP

Item	Description	Default	At Power ON	At Discharge
Waveform Size	x1/4, x1/2, x1, x2, x4	x1	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge].	Initialize
RR Synchronized Mark	ON, OFF	ON	Backup	Backup
RR/APNEA Alarm Source	Auto, Impedance, Vent., CO_2/GAS	Auto	Backup	Backup
CVA Detect	ON, OFF	OFF	*1	
Impedance Measurement	*Same with "Patient Admit/Discharge" section.			
Impedance Detection Lead	I, II	II	Depends on the setting under [Initial Settings>User I/ F>Power ON/Discharge].	
Impedance Detection Level	Fixed, Auto	Fixed	Backup	Backup

RESP Detection Signal Adjustment

Item	Description	Default	At Power ON	At Discharge
Detection Signal Adjustment	ON, OFF	OFF	*2	OFF

*1: Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/Discharge]. If "Main Mode" setting is [Backup]; Depends on the "CVA Detect" setting under [Power ON/Discharge].

*2: This selection will be ON only when "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge] is [Backup].

SpO_2 (General)

Item	Description	Default	At Power ON	At Discharge
Waveform Size	x1/4, x1/2, x1, x2, x4	x1	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge].	Initialize
Synchronized Mark/Tone	*Same with ECG setting.			
Alarm during NIBP	ON, OFF	ON	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge].	
Label	None/Auto/RH/LH/RF/LF/OT	None		

SpO_2 (Medtronic)

Item	Description	Default	At Power ON	At Discharge
Second Alarm	OFF, 10, 25, 50, 100	OFF	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge].	Backup
SpO_2 Averaging	Normal, Fast	Fast	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge].	Backup

SpO_2 (Masimo Unit)

Item	Description	Default	At Power ON	At Discharge
SpO_2 Averaging	2-4 sec, 4-6 sec, 8 sec, 10 sec, 12 sec, 14 sec, 16 sec	8 sec.	*1	
Pulse Sensitivity	Normal, High, APOD	Normal	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge].	
FAST SAT	ON, OFF	OFF		
Perfusion Index	ON, OFF	ON		
Signal IQ Wave	ON, OFF	OFF		
SpHb Averaging	Short, Medium, Long	Medium		

*1: Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/Discharge]. If "Main Mode" setting is [Backup] ; Depends on the "SpO_2 Averaging" setting under [Power ON/Discharge].

NIBP

Item	Description	Default	At Power ON	At Discharge
Patient Classification	*Same with "Patient Admit/Discharge" section.			
Quick Measurement	ON, OFF	ON	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge].	
NIBP Auto Mode	Cont., 1min, 2min, 2.5min, 5min, 10min, 15 min, 20min, 30min, 60min, 120min, Lumbar Mode, OFF	OFF	*1	
Dyna Alert	ON, OFF	ON	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge].	
Sight Inflation	ON, OFF	OFF		
Oscillograph	ON, OFF	OFF		
PR Display	ON, OFF	OFF		
End Tone	ON, OFF	ON		
NIBP Erase Time	5 min, 10 min, 30 min, 60 min, 120 min	120 min.		

NIBP

Item	Description	Default	At Power ON	At Discharge
Measure at Alarm	ON, OFF	OFF		
	Asystole, VF, VT, Ext Tachy, Ext Brady, Slow VT, Run, Bigeminy, Trigeminy, Pause, Couplet, Tachy, Brady, Frequent, Triplet, R on T, Multiform, Vent Rhtm, SVT, Ireg RR, Prolong RR, S Frequent, S Couplet, VPC, SVPC, Not Capt, Not Pacing	No Selection		
	HR, ST, RR, APNEA, SpO_2, BP1, BP2, BP3, BP4, BP5, BP6, BP7, BP8, T1, T2, T3, T4, T5, T6, T7, T8, Tb, CO_2, O_2, N_2O, AGENT, SpCO, SpMet, SpHb, MV, PEEP, PEAK	No Selection		
Auto Mode with Start/ Stop key	ON, OFF	ON	Backup	Backup
Time Display	Elapsed, Meas.	Elapsed Time	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge].	
Periodic Measurement Starting Time	Time, Meas.	Time		
Target Inflation Value	Adult: 100 mmHg to 290 mmHg Child: 100 mmHg to 200 mmHg Neonate: 100 mmHg to 140 mmHg	Adult: 180 mmHg Child: 140 mmHg Neonate: 110 mmHg	Backup	Initialize
Measurement Mode	Inflation, Deflation	Deflation	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge].	
Pump Operation Mode	Normal, Silent	Normal	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge].	

*1: Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/Discharge]. If "Main Mode" setting is [Backup] ; Depends on the "NIBP Auto Mode" setting under [Setup>Initial Settings>User I/F>Power ON/ Discharge].

BP1 to 8

Item	Description	Default	At Power ON	At Discharge
Scale*	20, 50, 75, 100, 150, 200, 250, 300 mmHg	200 mmHg 50 mmHg (BP2)	*2	
	4, 8, 12, 16, 20, 24, 32, 40 kPa	24 kPa 8 kPa (BP2)		
Label	BP*, ART, PAP, CVP, ICP, IAP, LVP, US1 to US5	BP* (BP1 to BP8)	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge].	
Synchronized Mark/Tone	*Same with ECG setting.			

BP1 to 8

Item	Description	Default	At Power ON	At Discharge
Display Type	S/M/D, S/D, M	S/M/D	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge].	
Wave Filter	6, 8, 12, 40 Hz	12Hz		
Mean Wave	ON, OFF	OFF		
Respiration Filter	ON, OFF	OFF		
IBP Analog Output	MPA1-1, MPA1-2, MPA2-1, MPA2-2, MPA3-1, MPA3-2	MPA1-1, MPA1-2		
ART Catheter Check Message	ON, OFF	OFF		
Alarm during NIBP	ON, OFF	ON		

*1: The scale selection will differ depending on the label.

*2: Depends on the Main Mode setting under [Initial Settings>User I/F>Power ON/Discharge]. If "Main Mode" setting is [Backup]; Depends on the "BP Scale" setting under [Power ON/Discharge].

TEMP1 to TEMP8

Item	Description	Default	At Power ON	At Discharge
Label	T*, Tsk, Tre, Tes, Tco, User 1 to User 7	T* (T1 to T8)	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge].	

ΔTEMP-A to TEMP-D

Item	Description	Default	At Power ON	At Discharge
ΔTemp-A	(T1-T8) to (T1-T8)	T1-T2	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge].	
ΔTemp-B	(T1-T8) to (T1-T8)	T3-T4		
ΔTemp-C	(T1-T8) to (T1-T8)	T5-T6		
ΔTemp-D	(T1-T8) to (T1-T8)	T7-T8		

CO_2 (Capnostat 5/HC-120)

Item	Description	Default	At Power ON	At Discharge
Scale	0-50, 0-100 mmHg	0- 50	*1	
	0- 4, 0- 8, 0- 10 kPa	0- 4		
	0-4, 0-8, 0-10%	0- 4		
$EtCO_2$ Peak Duration	10 sec, 20 sec, OFF	10 sec.	*2	
CO_2 Source Priority	Anesthesia Delivery System, Built-in Slot	Built-in Slot	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge].	
O_2 Compensation	0-100%	21%		
N_2O Compensation	ON, OFF	OFF		
Anesthetic Compensation	0.0-20.0%	0.0%		
Atmospheric Pressure	400-850mmHg	760mmHg		

*1: Depends on the Main Mode setting under [Initial Settings>User I/F>Power ON/Discharge]. If "Main Mode" setting is [Backup]; Depends on the "CO_2 Scale" setting under [Power ON/Discharge].

*2: Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/Discharge]. If "Main Mode" setting is [Backup]; Depends on the "$EtCO_2$ Peak Duration" setting under [Power ON/Discharge].

CO_2 (Medtronic/HC-110)

Item	Description	Default	At Power ON	At Discharge
Scale	0-50, 0-100 mmHg	0- 50	*1	
	0- 4, 0- 8, 0- 10 kPa	0- 4		
	0-4, 0-8, 0-10%	0- 4		
$EtCO_2$ Peak Duration	10 sec, 20 sec, OFF	10 sec.	*2	
CO_2 Source Priority	Anesthesia Delivery System, Built-in Slot	Built-in Slot	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge].	

*1: Depends on the Main Mode setting under [Initial Settings>User I/F>Power ON/Discharge]. If "Main Mode" setting is [Backup]; Depends on the "CO_2 Scale" setting under [Power ON/Discharge].

*2: Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/Discharge]. If "Main Mode" setting is [Backup]; Depends on the "$EtCO_2$ Peak Duration" setting under [Power ON/Discharge].

SPIRO, Ventilator, FLOW-i

Item	Description	Default	At Power ON	At Discharge
AWP Scale	10, 20, 30, 50, 120 cmH_2O	50 cmH_2O	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge].	
AWF Scale	5, 10, 20, 50, 180 L/min	50 L/min		
AWV Scale	50, 250, 500, 1000, 3000 mL	500 mL		
P-V, F-V Scale	Pressure: 0, 20, 30, 50, 120 Volume: 250, 500, 750, 1000 Flow: ±20, ±50, ±180	Pressure: 30 Volume: 500 Flow: ±50		

Cardiac Output (CO)

Item	Description	Default	At Power ON	At Discharge
Auto Start	ON, OFF	ON	Backup	Backup
Time Scale	30 sec., 60 sec.	30 sec.	Backup	Backup

Multigas Concentration, FLOW-i

Item	Description	Default	At Power ON	At Discharge
GAS_CO_2 Scale*	0-50, 0-100mmHg	0-50mmHg	*2	
	0- 4, 0- 8, 0- 10 kPa	0-4kPa		
	0-4, 0-8, 0-10%	0-4%		
GAS_O_2 Scale*	18-30, 18-60, 18-100, 0-30, 0-60, 0-100%	18-30%	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge].	
Agent Selection	ISO, HAL, ENF, SEV, DES, Auto	Auto		
Agent Scale*	0-4, 0-8, 0-16%	0-4%		
Flow Rate (When adult/ child water trap is used.)	120, 150, 200ml/min	200 ml/min		
Flow Rate (When neonate water trap is used.)	70, 100, 120 ml/min	120ml/min		
Wave Clip*	ON, OFF	ON		
CO_2 Source Priority	Anesthesia Delivery System, Built-in Slot	Built-in Slot		

*2: Depends on the Main Mode setting under [Initial Settings>User I/F>Power ON/Discharge]. If "Main Mode" setting is [Backup]; Depends on the "CO_2 Scale" setting under [Power ON/Discharge].

BIS (A-2000/A-3000)

Item	Description	Default	At Power ON	At Discharge
Short Trend 2nd Parameter	SR, EMG, SQI, OFF	SR	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge].	

BIS

Item	Description	Default	At Power ON	At Discharge
Scale (EEG1, EEG2)	± 25, ± 50, ± 100, ± 250	±50μV	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge].	
Short Trend 2nd Parameter	SR, EMG, SQI, OFF	SR		
Continuous Impedance Check	ON, OFF	ON	Initialize	Initialize
Smoothing Rate	10, 15, 30 sec.	15 sec.	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge].	
EEG Filter	ON, OFF	ON		

Stopwatch

Item	Description	Default	At Power ON	At Discharge
Label 1	9 alphanumeric characters	TIMER1	Backup	Backup
Label 2		TIMER2	Backup	Backup

SvO_2/CCO

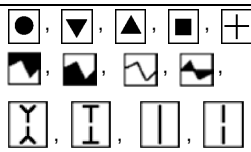
Item	Description	Default	At Power ON	At Discharge
STAT Mode	ON, OFF	OFF	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge].	
Index Display	ON, OFF	OFF		
Short Trend Selection	CO+SVV, CO, SVV	CO+SVV		

INVOS

Item	Description	Default	At Power ON	At Discharge
Lt-rSO_2	ch1, ch2, ch3, ch4	ch1	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge].	
Rt-rSO_2	ch1, ch2, ch3, ch4	ch2		
S1-rSO_2	ch1, ch2, ch3, ch4	ch3		
S2-rSO_2	ch1, ch2, ch3, ch4	ch4		

Data Review

Graphic Trend

Item	Description		Default	At Power ON	At Discharge
Trend A	HR, ST (I to V6), SpO_2, PR_ SpO_2, VPC, NIBP, BP1 to 8, PR_IBP, PDP, CPP, TEMP1 to 8, Tb, ΔTEMP-A to D, RR_IMP, APNEA, $EtCO_2$, $InspCO_2$, RR_ GAS, $ExpN_2O$, $InspN_2O$, O_2, ExpAGT, InspAGT, MAC, BIS, SR, EMG, SQI, SvO_2, $ScvO_2$, CCO, CCI, BT, RR_VENT, RR_SpO_2, $ExpO_2$, Insp O_2, PI, PVI, SpCO, SpMet, SpHb, SpOC, PEAK, PEEP, ExpMV		Upper Row: HR, NIBP Lower Row: SpO_2, TEMP1, RR_IMP	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/Discharge].	
Trend B			Upper Row: HR, BP1, TEMP1, NIBP Lower Row: SpO_2, $EtCO_2$, ST (II) , RR_GAS		
Trend C			Upper Row: HR, TEMP1, BP1, NIBP Lower Row: SpO_2, InspO $_2$, $EtCO_2$, InspAGT		
Trend D			N/A		
Trend E			Upper Row: EMG, SQI Lower Row: BIS, SR		
Time	10min, 1h, 2h, 4h, 8h, 12h, 16h, 24h		4 hours	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/Discharge].	
Display Selection					
Mark	Small, Big		Small	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/Discharge].	
Scale, Display Selection	HR, PR_SpO_2, PR_IBP	100, 200, 300 bpm	200bpm	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/Discharge].	
	ST (I to V6)	± 0.2, ± 0.5,± 1.0, ± 2.0mV ±2.0, ±5.0, ±10.0, ±20.0mm	± 0.5mV± 5.0mm		
	VPC	20, 50, 100 beats	20 beats		
	BP1 to BP8	20, 50, 100, 150, 200, 300 mmHg 4, 8, 16, 20, 24, 40 kPa	200 mmHg 24 kPa	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/Discharge].	
	PDP, CPP	20, 50, 100, 150, 200, 300 mmHg 4, 8, 16, 20, 24, 40 kPa	200 mmHg 24 kPa		
	NIBP	100, 150, 200, 300 mmHg 16, 20, 24, 40 kPa	200 mmHg 24 kPa		
	TEMP1 to TEMP8,	20.0- 45.0, 30.0- 40.0°C	30.0- 40.0°C	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/Discharge].	
	Tb	20.0- 45.0, 30.0- 40.0°C	20.0-45.0°C		

Graphic Trend

Item	Description		Default	At Power ON	At Discharge
	SpO_2	0- 100, 50-100, 80- 100%SpO_2	80- 100%SpO_2	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/Discharge].	
	SpCO	0-20, 0-40, 0-100%SpCO	0- 20%SpCO		
	SpMet	0-10, 0-15, 0-100%SpCO	0- 10%SpCO		
	SpHb	10- 20, 0-25g/dL	10-20 g/dL		
	SpOC	10- 26, 0- 36mL/dL	10- 26 mL/dL		
	RR_IMP, RR_VENT, RR_GAS, RR_SpO_2	50, 100, 150 Bpm	50 Bpm	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/Discharge].	
	APNEA	15 sec., 30 sec.	15 sec.		
	CO_2	50, 100 mmHg 4.0, 8.0, 10.0 kpa 4.0, 8.0, 10.0%	50 mmHg 4.0 kPa 4.0%		
	O_2	50, 100%	100%		
	ΔO_2	3.0, 6.0, 9.0%	3%		
	N_2O	50, 100%	100%		
	Agent	4.0, 8.0, 10.0%	8%		

Graphic Trend

Item	Description		Default	At Power ON	At Discharge
	PI	0- 10, 0- 20%	0- 10%	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/Discharge].	
	PVI	0-30, 0- 60, 0- 100%	0- 30%		
	PEAK	0- 10, 0- 20, 0- 50, 0- 100 cmH_2O	0- 20 cmH_2O		
	PEEP	0- 10, 0- 20, 0- 50, 0- 100 cmH_2O	0- 20 cmH_2O		
	MV	0.0-6.0, 0.0-12.0, 0.0-20.0L/min	0.0- 12.0L/min		
	SvO_2, $ScvO_2$	0- 100, 50- 100, 80- 100%	0- 100%		
	CCO	6, 12, 20L/min	6 L/min		
	CCI	6.0, 12.0, 20.0L/min/m^2	6L/min/m^2		
	BT	20.0- 45.0, 30.0- 40.0°C	20.0-45.0°C		
	BIS	25, 50, 75, 100	100		
	SR	25, 50, 75, 100%	100%		
	SQI	0- 100%	100%		
	EMG	30- 80 dB	30- 80 dB		
	Lt-rSO_2	20- 100	20- 100		
	Rt-rSO_2	20- 100	20- 100		
	S1-rSO_2	20- 100	20- 100		
	S2-rSO_2	20- 100	20- 100		

Tabular Trend

Item	Description	Default	At Power ON	At Discharge
Time	10sec., 30sec., 1min., 2min., 2.5min., 5min., 10min., 15min., 30min., 60min., NIBP	5 min.	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/Discharge].	
Group	A to F	A		
Fixed Parameters	0 to 6 param.	0 param.		

Tabular Trend

Item	Description	Default	At Power ON	At Discharge
Parameter Selection	[Basic] OFF, HR, VPC, ST (I to V6), SpO_2, PR_ SpO_2, NIBP-S/D/M, BP1 to 8- S/D/M, PR_IBP, PDP, PAWP, CPP, TEMP1 to 8, Tb, CO, $EtCO_2$, $InspCO_2$, RR_GAS, RR_IMP, RR_VENT, APNEA, O_2-E, O_2-I, N_2O-E, N_2O-I, AGT-E, AGT-I, AGT2-E, AGT2-I, PI, PVI, SpCO, SpMet, SpHb, SpOC, E-VT, I-VT, E-MV, I-MV, P-PEAK, P-PAUSE, PEEO, P-MEAN, RES, COMP, VT1sec, I/E RATIO			
	[Hemodynamics] SvO_2, $ScvO_2$, SaO_2, O_2EI, B-Temp, CCO, CCO-STAT, CCI, CCI-STAT, DO_2, RVEF, RVEF-STAT, VO_2, SV, SV-STAT, SVI, SVI-STAT, SVR, SVRI, SVV, EDV, EDV-STAT, EDVI, EDVI-STAT, MAP, ESV, ESVI, dPmx, CO CAL, OFF			
	[Ventilator] E-VT, I-VT, MV, SMV, P-PEAK, P-PAUSE, PEEP, P-MEAN, E-RES, I-RES, COMP, FiO_2, P-MIN, S-COMP, D-COMP, S-RR, I/E RATIO, RES			
	[Other] BIS, SQI, EMG, SR, SEF, TOTPOW, IMP, Lt-rSO_2, Rt-rSO_2, S1-rSO_2, S2-rSO_2, $tcpO_2$, $tcpCO_2$			
	Group A	HR, VPC, ST (I) , ST (II) , NIBP-S, NIBP-D, SpO_2, PR_SpO_2, BP1-S,BP1-D, BP1-M, BP2-S, BP2-D, BP2-M, $EtCO_2$, RR_GAS, RR_IMP, APNEA, TEMP1, TEMP2	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/Discharge].	
	Group B	HR, VPC, ST (I) to ST (V6)		
	Group C	HR, RR_IMP, RR_GAS, RR_VENT, SpO_2, P-PEAK, P-PAUSE, P-MEAN, PEEP, E-VT, I-VT, MV, E-RES, I-RES, COMP, O_2-I, $EtCO_2$, APNEA		
	Group D	SvO_2, CCO, EDV, B-Temp, RVEF, SV, CCI, EDVI, ESV, SVR, SaO_2, SVI, ESVI, SVRI, CCO_STAT, EDV_STAT		
	Group E	BIS, SQI, EMG, SR		
	Group F	HR, SpO_2, NIBP-S, NIBP-D, NIBP-M, BP1-S, BP1-D, BP1-M, RR_GAS, $EtCO_2$, O_2-I, AGT-I		

OCRG

Item	Description	Default	At Power ON	At Discharge
Display Duration	8, 16 min	8 min.	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/Discharge].	
Waveform	Impedance, CO_2	Impedance		
Respiration Waveform Size (Impedance)	x 1/4, x1/2, x1, x2, x4	x1		
Respiration Waveform Size (CO_2)	50, 100 mmHg	50mmHg		

Recall

Item	Description	Default	At Power ON	At Discharge
Waveform	ECG1, ECG2, BP1 to 8, SpO_2, RESP, CO_2, GAS_CO_2, EEG1 to 8	ECG1, ECG2	Backup	Backup
Recall Factor	Asystole, VF, VT, Slow VT, Run, Bigeminy, Trigeminy, Pause, Couplet, Tachy, Brady, Frequent, ExtTachy, ExtBrady, RR IREG, Prolong RR , R ON T, TRIPLET, MLTIFORM , VENT RHYTHM, NOT CAPT , NOT PACING, S COUPLET, VPC, SVT, SVPC, S FREQUENT, HR, ST, NIBP, RR, APNEA, SpO_2, PR, BP1 to 8, TEMP1 to 8, Tb, CO_2, O_2, N_2O, AGENT, SpCO, SpMet, SpHb, PEAK, PEEP, MV	All ON	Backup	Backup
List	14 waves	14 waves	Backup	Backup
Recall Display Selection	Asystole, VF, VT, Slow VT, Run, Bigeminy, Trigeminy, Pause, Couplet, Tachy, Brady, Frequent, ExtTachy, ExtBrady, RR IREG, Prolong RR , R ON T, TRIPLET, MLTIFORM , VENT RHYTHM, NOT CAPT , NOT PACING, S COUPLET, VPC, SVT, SVPC, S FREQUENT, HR, ST, NIBP, RR, APNEA, SpO_2, PR, BP1 to 8, TEMP1 to 8, Tb, CO_2, O_2, N_2O, AGENT, Event 1 to 8, SpCO, SpMet, SpHb, PEAK, PEEP, MV	All ON	Backup	Backup

ST Measurement

Item	Description	Default	At Power ON	At Discharge
Display Numeric	Abs, Rel.	Abs.	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/Discharge].	
J point	0 ms to 560 ms	60 ms		
J point	Manual, Auto	Manual		
Measurement Point	From R wave, From J point	From R wave		
Measurement Point	0 ms to 560 ms	120 ms	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/Discharge].	Initialize
Reference Point	0 ms to -240 ms	-80 ms		Initialize

ST Measurement

Item	Description	Default	At Power ON	At Discharge
ST Waveform Size	x1/4, x1/2, x1, x2, x4	x1	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge].	
Slide Show Interval	1, 5, 10, 20, 30 sec.	5 sec.		
ST Waveform Interval	10 sec., 1 min., 5 min., 10 min.	10 sec.		

NOTE

- The graphic trend, tabular trend, alarm history will be saved even after the power is turned OFF.
- The recall, ST, OCRG data will be saved even after about one hour of standby mode (AC power or battery operation).

12-lead Display

Item		Description	Default	At Power ON	At Discharge
ECG Analysis		Real Time, Review	Real Time	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge].	Initialize
Limb Lead Size		x1/4, x1/2, x1, x2, x4	x1		
Chest Lead Size		x1/4, x1/2, x1, x2, x4	x1		
Filter	AC Filter	ON, OFF	OFF		
	EMG Filter	OFF, Strong (25Hz), Weak (35Hz)	OFF		
	Drift Filter	OFF, Strong (0.50Hz), Weak (0.25Hz)	Strong (0.50Hz)		
Background Color		White, Black	Black	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge].	

Basic Setup

Tone/Volume

Item	Description		Default	At Power ON	At Discharge
Vital Alarm Sound	Urgent	Volume: 11 levels	4	Depends on the "Main Mode" setting under [Setup>Initial Settings>User I/F>Power ON/ Discharge].	
		Tone: 5 types*	1		
	Caution	Volume: 11 levels	4		
		Tone: 5 types*	1		
	Status	Volume: 11 levels	4		
		Tone: 4 types*	1		
Ventilator Alarm Sound	ON/OFF		OFF		
	Volume: 11 levels		4		
	Tone: 1 type		1		

Tone/Volume

Item	Description		Default	At Power ON	At Discharge
Status Alarm Control Alarm Sound	Urgent	Volume: 11 levels	4		
		Tone: 1 type*	1		
	Caution	Volume: 11 levels	4		
		Tone: 1 type*	1		
	Status	Volume: 11 levels	4		
		Tone: 1 type*	1		
Sync. Tone	Volume: 11 levels		2		
	Tone: 5 types		1		
	Sync. Tone: Selected Tone, Sync. with SpO_2 Value		Selected Tone		
Key Sound	Volume: 11 levels		4		
	Tone: 3 types		1		
Other Bed Alarm	Volume: 11 levels		4		
	Tone: 1 type		1		
Boot/Shutdown Sound	Volume: 11 levels		2		
	Tone: 3 types		1		
Other	Volume: 11 levels		4		
	Tone: 1 type		1		

* When [Fukuda Tone] is selected for "Alarm System", the tone can be selected from 8 levels.

Display Configuration

Item	Description	Default	At Power ON	At Discharge
Layout	Right (1 column), Right (1 column) + Bottom, Right (2 columns), Right (2 columns) + Bottom, Left (1 column), Left (1 column) + Bottom, Left (2 columns), Left (2 columns) + Bottom, Bottom (2 rows to 6 rows), Right/ Left and Bottom lower rows (1, 2)	Bottom (5 rows)	Depends on the setting under [Initial Settings>User I/F>Power ON/Discharge].	
Auto Display Config.	Type-1, Type-2	Type-1	Depends on the setting under [Initial Settings>User I/F>Power ON/Discharge].	
Palette	Refer to the Color Setup.			
Numeric Data	OFF, HR/PR, HR, PR_IBP, VPC/PACE, ST/VPC, ST-A to C, BP1 to 8, NIBP, NIBP LIST, SpO_2-1, SpO_2-1/PR_SpO_2-1, PR_SpO_2-1, RR_IMP, RR_CO_2, RR_VENT, RR_SpO_2, TEMP1 to 8, TEMP1/2, TEMP3/4, TEMP5/6, TEMP7/8, SpO_2-2, SpO_2-2/PR_SpO_2-2, PR_SpO_2-2 ΔTEMP-A to D, VENT, P-V F-V, SvO_2/CO, BIS, CO_2, O_2, N_2O, Agent, RR/CO_2/Agent/O_2/N_2O, CO_2/Agent/O_2/N_2O, RR/Agent/O_2/N_2O, Agent/O_2/N_2O, Agent/N_2O, HEMO, HEMO-I, STOPWATCH, SpCO, SpMet, SpHb, GAS/SPIRO, SPIRO, VENT-A, VENT-B, Hemo/etc-A, Hemo/etc-B, Extended Function-A	HR, SpO_2-1, NIBP, BP1, RR_IMP, CO_2	Depends on the setting under [Initial Settings>User I/F>Power ON/Discharge].	

Display Configuration

Item	Description		Default	At Power ON	At Discharge
Waveform	FF, ECG1 to ECG12, ECG1 Cascade to ECG12 Cascade, BP1 to BP8, BP Overlap 1 to BP Overlap 3, SpO_2-1, SpO_2-2, RESP, AWF, AWP, AWV, CO_2, O_2, Agent, Block Cascade, RR Overlap 1 to 3, EEG1 to 8		ECG1, SpO_2-1, BP1, RESP, CO_2	Depends on the setting under [Initial Settings>User I/F>Power ON/Discharge].	
Enlarged Waveform	ON, OFF		OFF		
Sweep Speed	Circ.: 6.25, 12.5, 25, 50 Vent: 6.25, 12.5, 25		Circ.: 25 Vent: 6.25	Depends on the setting under [Initial Settings>User I/F>Power ON/Discharge].	
Short Graphic Trend	Short Trend Selection ON, OFF, Overlap Display Length: 0, 5, 10, 15, 20, 25, 30 min.		OFF 15 min.	Depends on the setting under [Initial Settings>User I/F>Power ON/Discharge].	
User Key	OFF, Home, Menu, User Key, Main 1 to 9, Sub Mode 1 to 6, BP1 to 6 Scale, Initialize Scale, Alarm Silence, Alarm Suspend, NIBP Start/Stop, NIBP Cont., Print Start/Stop, Monitor Suspend, Night Mode, Freeze, Key Lock, Mode Select., Oxygenator Mode, Admit/Discharge, Rapid Discharge, NIBP Start/Stop, HR/PR, HR/PR Source, NIBP Cont., BP Zero, Lead, ECG Size (All Leads), Monitor Suspend, Scale, Scale (Extended Display), SpO_2 Display ON/OFF, CO_2 Display ON/OFF, GAS Display ON/OFF, Suspend CO_2, Auto Display Config., Enlarged Display, Short Trend ON/OFF, Transparent Window ON/OFF, Change Palette, Graphic Trend, Trend (Group), Tabular Trend, Tabular Trend (Group), NIBP List, Recall, OCRG, ST, Cardiac Output, PAWP, Hemodynamics, Lung Function, Full Disc. Wave, 12-Lead Analysis, Tone/Volume, NIBP Auto Mode, Alarm Setup (Basic, All), Manual Printing, Display Config., Time/Date, Stopwatch, Group 1, Group 2, Group 3, Group 4, Group 5, Event, Print (LBP) Cancel, Oxygenator Mode		Home, Menu, Alarm Silence, Admit/Disch., BP Zero, NIBP Start/Stop, NIBP Auto Mode, Alarm Setup (All) NIBP Cont., Alarm History, NIBP List, Recall, Graphic/Tabular Trend, Print Start/Stop, Key Lock, Night Mode	Depends on the setting under [Initial Settings>User I/F>Power ON/Discharge].	
Detail Setup (Numeric Data)	Alarm Limit Display	Graph, Numeric, OFF	Graph	Depends on the setting under [Initial Settings>User I/F>Power ON/Discharge].	
	At Alarm Occurrence	Reversed, 3D	Reversed		

Display Configuration

Item	Description		Default	At Power ON	At Discharge
Detail Setup (Waveform)	Grid	ON, OFF, Bold	Normal	Depends on the setting under [Initial Settings>User I/F>Power ON/Discharge].	
	Scale	ON, Bold1, Bold2	Normal		
	Thickness	Thin, Regular, Thick	Normal		
	Clip	ON, OFF	ON		
	CO_2 Wave Fill	ON, OFF	ON		
	O_2 Wave Fill	ON, OFF	OFF		
	Agent Wave Fill	ON, OFF	OFF		
	BP Overlap 1	BP1 to 8	BP1 to 4		
	BP Overlap 2, 3		N/A		
	RR Overlap 1	CO_2, O_2, Agent	CO_2, O_2, Agent		
	BP Overlap 2, 3		N/A		
	12-Lead ST Wave	Ref., Average	Ref.		
	12-Lead ST Short Trend	OFF, Fill, Plot	Fill		
	ST/VPC/Arrhy. Alarm Display	ON, OFF	ON	Backup	Backup
	Block Cascade	Waveform Quantity: 2 to 6 Displayed Waveform: OFF, ECG1 to 12, BP1 to 8, SpO_2, RESP, AWF, AWP, CO_2, O_2, Agent	Waveform Quantity: 2 Displayed Waveforms: ECG1, ECG2	Depends on the setting under [Initial Settings>User I/F>Power ON/Discharge].	
	Quantity of Displaying Waveforms	Standard, Extended	Normal		
	Graphic/Tabular Trend	ON, OFF	OFF		
	Graphic/Tabular Trend Size	Big, Medium, Small	Small		
Detail Setup (Short Trend)	Short Trend	Link with Numeric, Link with Waveform, User Setup	Link with Numeric		
	Short Trend Scale	Trend, Waveform	Graphic Trend		
	Display Parameter	ON, Gray, OFF	OFF		
	Reference Line Function	Enable, Disable	Disable		
	Cursor Function	Enable, Disable	Disable		
	Cursor Linkage	Tabular Trend, Graphic Trend, Zoom Wave	Tabular Trend		
	Short Trend Overlap 1, 2, 3		OFF, OFF, OFF, OFF		
	Data Resolution	5 sec, 10 sec, 30 sec	5 sec.		

NOTE

- By selecting [Backup] for "Power ON" and "Discharge" under [Initial Settings>User I/F >Power ON/Discharge], the display configuration settings will be retained at "Power ON" and "Discharge" respectively. If [Initialize] is selected, the settings will be initialized at "Power ON" and "Discharge".

Manual Printing

Item		Description	Default	At Power ON	At Discharge
Basic	Printer	Bedside, Central	Bedside	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/Discharge].	
	Waveform	ECG1, ECG2, ECG3, BP1 to 8, SpO_2, RESP, CO_2, O_2, Agent, AWF, AWP	ECG1		
	Print Duration	24 sec., Cont.	24 sec.		
	Delay Time	None, 8 sec., 16 sec.	8 sec.		
12-lead	12-Lead Waveform Format (Bedside)	3 wavesx4, 2 wavesx6	3 Waves x 4	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/Discharge].	
	12-Lead Waveform Format (Laser)	3 wavesx4, 3 wavesx4+Rhy., 6 wavesx2, 12 waves	3 Waves x 4		
	12-Lead Analysis Format (Bedside)	3 Waves x 4	3 waves x 4 (fixed)		
	12-Lead Analysis Format (Laser)	6 wavesx2 (2 pages), 6 wavesx2 (1 page), 3 wavesx4+Rhythm	6 wavesx2 (2 pages)		
	Position	Center, Proportional, OFF	Proportional		
	Wave Format	Regular, Reverse	Normal		
	Printer Auto Scale	ON, OFF	ON		
	Print Calibration	ON, OFF	ON		
	Lead Boundary	ON, OFF	ON		
Other Setup: Graphic Printing	Graphic Trend	Bedside, Central, Laser	Bedside	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/Discharge].	
	Tabular Trend	Bedside, Central, Laser	Bedside		
	OCRG	Bedside, Laser	Bedside		
	Zoom Wave (Recall, Full Disc.)	Bedside, Central, Laser	Bedside		
	ST	Bedside, Central, Laser	Bedside		
	12-Lead Waveform	Bedside, Laser	Bedside		
	12-Lead Analysis Result	Bedside, Laser	Bedside		
	Full Disc. Compressed Wave	Bedside, Laser	Bedside		
	Hemodynamics	Bedside, Central, Laser	Bedside		
	Lung Function	Bedside, Central, Laser	Bedside		
	CO	Bedside, Central, Laser	Bedside		
Other Setup: Recall Printing		Graphic Printing, Manual Printing	Graphic Printing	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/Discharge].	

Auto Printing

Item		Description	Default	At Power ON	At Discharge
Alarm Printing	Printing	ON, OFF	OFF	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/Discharge].	
	Factor	Alarm for each arrhythmia, parameter	All		
	Printer	Bedside, Central	Bedside		
	Waveform	ECG1, ECG2, ECG3, BP1 to 8, SpO_2, RESP, CO_2, O_2, Agent, AWF, AWP, AWV, EEG1 to 2, Alarm	ECG1, Alarm Factor		
	Print Duration	12 sec., 24 sec.	12 sec.		
Periodic Printing	Periodic Printing	ON, OFF	OFF	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/Discharge].	
	Printer	Bedside, Central	Bedside		
	Waveform	ECG1, ECG2, ECG3, BP1 to 8, SpO_2, RESP, CO_2, O_2, Agent, AWF, AWP, AWV, EEG1 to 2	ECG1		
	Periodic Interval	Interval, Timer	Timer		
	Interval	1, 2, 3, 5, 10, 15, 20, 30, 60, 120 min.	120 min.		
	Timer	0:00 to 23:00 (1:00 interval)	None		
	Print Duration	6, 12, 24 sec.	12 sec.		

Common Setup for Printing

Item	Description	Default	At Power ON	At Discharge
QRS Classification	ON, OFF	ON	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/Discharge].	
Speed	50 mm/S, 25 mm/S	25 mm/S		
Print Calibration	Top, Each Page, OFF	OFF		
Print NIBP Data	ON, OFF	OFF		

Other Setup

Item		Description	Default	At Power ON	At Discharge
Night Mode	Mode	Manual, Timer	Manual	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/Discharge].	
	Start Time	00:00 to 23:59	Start Time: 21:00		
	End Time	00:00 to 23:59	End Time: 07:00		
	Volume	No Change, 3, 1, 0	1		
	Display	No Change, Dark, Darker, Time Only	Darker		
	Alarm Indicator	ON, OFF	OFF		
	External Monitor Display during Night Mode	ON, OFF, OFF (Time Only)	ON		
Color	Palette	Light, Clear, Deep, Vivid	Vivid	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/Discharge].	
	HR	12 colors + White	6		
	ST		6		
	VPC		White		
	PACE		White		
	NIBP		8		
	SpO_2(Ch1, Ch2)		4		

Other Setup

Item		Description	Default	At Power ON	At Discharge
	SpCO (Ch1, Ch2)		4		
	SpMet (Ch1, Ch2)		4		
	SpHb (Ch1, Ch2)		4		
	CO_2		8		
	RESP		White		
	BP1, ART		1		
	PAP		4		
	CVP		8		
	ICP		7		
	IAP		12		
	LVP		2		
	US1 to US5 (BP)		White		
	BP2		8		
	BP3		4		
	BP4		6		
	BP5		2		
	BP6		12		
	BP7		9		
	BP8		7		
	TEMP1 to 8, Tb		2		
	Tsk, Tre, Tes, Tco, US1 to US7		2		
	AWF		6		
	AWP		4		
	AWV		8		
	BIS		2		
	INVOS		White		
	SvO_2+CO		White		
	Stopwatch		White		
Brightness	Brightness	7 levels	Top	Depends on the "Main Mode" setting under [Initial Settings>User I/F>Power ON/ Discharge].	
Stopwatch Label	1	9 alphanumeric characters	TIMER1	Backup	Backup
	2		TIMER2	Backup	Backup

Chapter 13 Accessories

Accessories

This section lists the accessories for the DS-1200.

WARNING

- Use only the accessories specified for this device. If unspecified products are used, proper function cannot be executed. Also, an electrical shock may result by the discharged energy or required energy cannot be provided to the patient.

CAUTION

- For quality improvement purposes, specifications may be subjected to change without prior notice.
- If any damage is found on the exterior, do not use the product regardless of whether it has been sterilized or not and be sure to dispose it properly.

- AC Power Cable CS-41
- DS-1200 System Operation Manual (This Manual)
- DS-1200 System Maintenance Manual

Optional Accessories

The following products are available as optional accessories for the DS-1200 System.
Purchase them as necessary.

CAUTION

- Use only the optional accessories specified for this device. If unspecified products are used, proper function cannot be executed.
- For quality improvement purposes, specifications may be subjected to change without prior notice.

ECG, Impedance Respiration Measurement (Manufactured by Fukuda Denshi)

Item	Model Type	Note	CSA Certified
ECG Relay Cable	CIO-05CTP-3NU	3-electrode (standard type)	Yes
ECG Relay Cable	CIO-05CTP-4NU	4-electrode (standard type)	Yes
ECG Relay Cable	CIO-05CTP-5NU	5-electrode (standard type)	Yes
ECG Relay Cable	CIO-05CTP-10NU	10-electrode (standard type)	Yes
ECG Relay Cable	CIO-08CTP-3EU	3-electrode (electrosurgery-proof type)	Yes
ECG Relay Cable	CIO-08CTP-5EU	5-electrode (electrosurgery-proof type)	Yes
ECG Relay Cable	CMC-700-3	3-electrode (clip type)	Yes
ECG Relay Cable	CMC-700-4	4-electrode (clip type)	Yes

Item	Model Type	Note	CSA Certified
ECG Relay Cable	CMC-700-5	5-electrode (clip type, 10-electrode for limbs)	Yes
ECG Relay Cable	CMC-702-5	5-electrode (clip type, 10-electrode for limbs)	Yes
ECG Relay Cable	CMC-700-5C	5-electrode (clip type, 10-electrode for chest)	Yes
ECG Relay Cable	CMF-700-3	3-electrode (clip type)	Yes
ECG Relay Cable	CMF-700-4	4-electrode (clip type)	Yes
ECG Relay Cable	CMF-700-5	5-electrode (clip type, 10-electrode for limbs)	Yes
ECG Relay Cable	CMF-700-5C	5-electrode (clip type, 10-electrode for chest)	Yes
ECG Relay Cable	CMF-702-5	5-electrode (clip type, 10-electrode for limbs)	Yes
ECG Relay Cable	CMF-700-3FA	3-electrode for FA	Yes
ECG Relay Cable	CMF-700-4FA	4-electrode for FA	Yes
ECG Relay Cable	CMF-700-5FA	5-electrode for FA	Yes
ECG Relay Cable	CIO-07CTP-3NA	3-electrode for FA	Yes
ECG Relay Cable	CIO-07CTP-4NA	4-electrode ECG for FA	Yes
ECG Relay Cable	CIO-07CTP-5NA	5-electrode ECG for FA	Yes
ECG Relay Cable	CMO-07FT-3NAB	3-electrode ECG for FA	Yes
ECG Relay Cable	CMO-07FT-4NAB	4-electrode ECG for FA	Yes
ECG Relay Cable	CMO-07FT-5NAB	5-electrode ECG for FA	Yes
ECG Relay Cable	CMO-07FTP-10NAB	10-electrode ECG for FA	Yes
ECG Relay Cable	CIO-09CTP-3NA	3-electrode for DIN type	Yes
ECG Relay Cable	CIO-09CTP-4NA	4-electrode for DIN type	Yes
ECG Relay Cable	CIO-09CTP-5NA	5-electrode for DIN type	Yes

Invasive Blood Pressure Measurement (Manufactured by Fukuda Denshi)

Item	Model Type	Note	CSA Certified
BP Relay Cable	CJO-P01B-SB3.6	1 channel, 3.6m For Merit Medical	Yes
2ch BP Relay Cable	CJO-P01B-DB0.8	2 channel, 0.8m For Merit Medical	Yes
2ch BP Relay Cable	CJO-P01B-DB4.3	2 channel, 4.3m For Merit Medical	Yes
2ch BP Relay Cable	CJO-P01B-DJ0.5	2 channel-1 channel Conversion Relay Cable	Yes

NOTE

- For other kind of BP relay cables, contact your nearest service representative.

Invasive Blood Pressure Measurement (Manufactured by Merit Medical Systems)

Item	Model Type	Note	CSA Certified
Disposable BP Transducer	DT-XX		Yes
Pressure Transducer	RT2000		Yes
Disposable Dome	DD2003		Yes
Disposable Dome	DD2000		Yes
Disposable BP Transducer	TNF-R		Yes
Disposable BP Transducer	DT4812WJ		Yes
Disposable BP Transducer	DT4812		Yes
Disposable BP Transducer	DT4812TJ		Yes

NOTE

- For details of the usable transducers, contact your nearest service representative.

Invasive Blood Pressure Measurement (Manufactured by Edwards Lifescienses)

Item	Model Type	Note	CSA Certified
TW Cable	PXFKD3	TruWave Relay Cable	Yes
TruWave disposable pressure transducers	PX600F		Yes
TruWave disposable pressure transducers	PX600F30		Yes
TruWave disposable pressure transducers	PX600I		Yes
TruWave disposable pressure transducers	PX601		Yes
TruWave disposable pressure transducers	PX602		Yes

Non-Invasive Blood Pressure Measurement (Manufactured by Fukuda Denshi)

Item	Model Type	Note	CSA Certified
Air Hose (1.5m) General	OA-80APS1.5-S	Rectus connector type, 1.5 m	Yes
Air Hose (3.5m) General	OA-80APS3.5-S	Rectus connector type, 3.5 m	Yes
Air Hose (1.5m) Neonate	OA-80NE1.5-S	Neonatal Cuff, 1.5 m	Yes
Air Hose (3.5m) Neonate	OA-80NE3.5-S	Neonatal Cuff, 3.5 m	Yes
Adult Cuff (SS size)	CUF-1000-XS	Arm Circumference 12 cm to 17 cm	Yes
Adult Cuff (S size)	CUF-1000-S	Arm Circumference 17 cm to 22 cm	Yes
Adult Cuff (M size)	CUF-1000-M	Arm Circumference 22 cm to 32 cm	Yes
Adult Cuff (L size)	CUF-1000-L	Arm Circumference 32 cm to 42 cm	Yes
Adult Cuff (LL size)	CUF-1000-XL	Arm Circumference 42 cm to 50 cm	Yes
Disposable Infant Cuff	CUF-D-INF		Yes

Item	Model Type	Note	CSA Certified
Disposable Pediatric Cuff	CUF-D-CHI		Yes
Disposable Adult Cuff (Small)	CUF-D-ADU(S)		Yes
Disposable Adult Cuff (Medium)	CUF-D-ADU(M)		Yes
Disposable Adult Cuff (Large)	CUF-D-ADU(L)		Yes
Disposable Adult Cuff (Thigh)	CUF-D-THI		Yes
Disposable Neonate Cuff #1	CUF-D-NEO 1		Yes
Disposable Neonate Cuff #2	CUF-D-NEO 2		Yes
Disposable Neonate Cuff #3	CUF-D-NEO 3		Yes
Disposable Neonate Cuff #4	CUF-D-NEO 4		Yes
Disposable Neonate Cuff #5	CUF-D-NEO 5		Yes
Disposable Cuff (S)	CUF-116S (S1)		Yes
Disposable Cuff (M)	CUF-116M (S1)		Yes
Disposable Cuff (L)	CUF-116L (S1)		Yes

Temperature Measurement (Manufactured by Fukuda Denshi)

Item	Model Type	Quantity	Note	CSA Certified
2ch Temperature Relay Cable	CJO-P01T-DA0.5	1	0.5m	Yes
2ch Temperature Relay Cable	CJO-P01T-DA4.0	1	4m	Yes

NOTE

- 700 series temperature probe cannot be used.

Temperature Measurement (Manufactured by Nikkiso-Therm)

Item	Model Type	Quantity	Note	CSA Certified
Rectal Temperature Probe (for adult)	401J	1	Contains DEHP.	Yes
Rectal Temperature Probe (for pediatric)	402J	1	Contains DEHP.	Yes
Body Surface probe	409J	1		Yes

⚠ CAUTION

- In medical use, pay attention to prevent patients from being exposed to DEHP as much as possible. Pay special attention to neonate and child patients as they will be exposed to larger amount of DEHP per body weight compare to adult patients.

Temperature Measurement (Manufactured by Medtronic)

Item	Model Type	Quantity	Note	CSA Certified
Mon-a-therm Cable	502-0400A	1		Yes
General Purpose Temperature Probe 400TM	90050	50	3mm (9FR) Disposable Contains DEHP.	Yes
General Purpose Temperature Probe 400TM	90044	50	4mm (12FR) Disposable Contains DEHP.	Yes
Skin Temperature Probe 400TM	90045	50	Disposable	Yes

Temperature Measurement (Manufactured by Smiths Medical)

Item	Model Type	Quantity	Note	CSA Certified
Level1 Temperature Probe Cable	C400-20	1		Yes
Level1 Esophageal/ Rectal Temperature Probe	ER400-9	20	Disposable Contains DEHP.	Yes
Level1 Esophageal/ Rectal Temperature Probe	ER400-12	20	Disposable Contains DEHP.	Yes
Level1 Esophageal/ Rectal Temperature Probe	ES400-9	20	Disposable Contains DEHP.	Yes
Level1 Esophageal/ Rectal Temperature Probe	ES400-12	20	Disposable Contains DEHP.	Yes
Level1 Esophageal/ Rectal Temperature Probe	ES400-18	20	Disposable Contains DEHP.	Yes
Level1 Esophageal/ Rectal Temperature Probe	STS-400	20	Disposable	Yes
Level1 Esophageal/ Rectal Temperature Probe	TTS-400	20	Disposable	Yes
Level1 Esophageal/ Rectal Temperature Probe	TTS-400J	20	Disposable	Yes
Level1 Esophageal/ Rectal Temperature Probe	TTSP-400	20	Disposable	Yes

Pulse Oximetry Measurement (Manufactured by Medtronic)

❑SpO_2, PR Measurement

Item	Model Type	Note	CSA Certified
SpO_2 DURASENSOR®	DS-100A	Reusable, for adult finger, weight: 40kg and above	Yes
SpO_2 OXISENSOR® III	D-25	Adhesive, for adult finger, weight: 30kg and above	Yes
Medtronic Oxisensor III	D-25L	Adhesive, for adult finger, weight: 30kg and above	Yes
SpO_2 OXISENSOR® III	D-20	Adhesive, for child finger, weight: 10kg to 50kg	Yes
SpO_2 OXISENSOR® III	I-20	Adhesive, for infant toe, weight: 3kg to 20kg	Yes
SpO_2 OXISENSOR® III	N-25	Adhesive, For neonate leg, weight: under 3kg For adult finger, weight: 40kg and above	Yes

Item	Model Type	Note	CSA Certified
SpO_2 OXISENSOR® III	R-15	Adhesive, for adult nose, weight: 50kg and above	Yes
MAX-FAST	MAX-FAST	Adhesive, for adult/child forehead, weight: 10kg and above	Yes
SoftCare	SC-PR	Non-adhesive wrap, weight: under 1.5kg	
SoftCare	SC-NEO	Non-adhesive wrap, weight: 1.5kg to 5kg	
Medtronic Pulse Oximetry Cable	DOC-10		Yes

NOTE

- There are various types of sensors available. For details, contact your nearest service representative.

❑SpO_2, PR, RR_SpO_2 Measurement

Item	Model Type	Note	CSA Certified
Medtronic Respiratory Sensor	10068119	For adult weighing 30kg and above	Yes

Pulse Oximetry Measurement (Manufactured by Masimo)

❑SpO_2, PR, PI, PVI Measurement

Item	Model Type	Note	CSA Certified
LNCS Patient Cable	Red LNC-01	For LNCS sensor, 0.3m, 2365	Yes
LNCS Patient Cable	Red LNC-04	For LNCS sensor, 1.2m, 2055	Yes
LNCS Patient Cable	Red LNC-10	For LNCS sensor, 2.4m, 2056	Yes
LNCS Patient Cable	Red LNC-14	For LNCS sensor, 4.2m, 2057	Yes
Masimo SET Sensor	LNCS Adtx	Adhesive Sensor for adult or child weighing more than 30kg. 1859	Yes
Masimo SET Sensor	LNCS Adtx-3	Adhesive Sensor, more than 30k. 2317	Yes
Masimo SET Sensor	LNCS Pdtx	Adhesive Sensor for child or adult weighing 10kg to 50kg. 1860	Yes
Masimo SET Sensor	LNCS Neo-L	Adhesive Sensor (L-Shape) for neonate weighing under 3kg or adult weighing more than 40kg. 1862	Yes
Masimo SET Sensor	LNCS Neo-3	Adhesive Sensor (L-Shape) for neonate weighing under 3kg or adult weighing more than 40kg. 2320	Yes
Masimo SET Sensor	LNCS Inf-L	Adhesive Sensor (L-Shape) for infant weighing 3kg to 20kg. 1861	Yes
Masimo SET Sensor	LNCS NeoPt-L	Adhesive Sensor (L-Shape) for premature neonate weighing under 1kg. 1901	Yes
Masimo SET Sensor	LNCS Inf3	Adhesive Sensor (L-Shape) for infant weighing 3kg to 20kg. 2319	Yes
Masimo SET Sensor	LNCS NeoPt3	Adhesive Sensor (L-Shape) for neonate weighing under 1kg. 2321	Yes
Masimo SET Sensor	LNCS TFA-1	Sensor for adult or child weighing more than 10kg. 3858	Yes
Masimo SET Sensor	LNCS DCI	Reusable Sensor for finger of adult or child weighing more than 30kg. 1863	Yes

Item	Model Type	Note	CSA Certified
Masimo SET Sensor	LNCS TC-I	Reusable Sensor for ear of adult or child weighing more than 30kg. 1895	Yes
Masimo SET Sensor	LNCS TF-I	Reusable Sensor for forehead of adult or child weighing more than 30kg. 1896	Yes
Masimo SET Sensor	RD SET Adt	Adhesive Sensor for adult or child weighing more than 30kg. 4000	Yes
Masimo SET Sensor	RD SET Pdt	Adhesive Sensor for child or adult weighing 10kg to 50kg. 4001	Yes
Masimo SET Sensor	RD SET Inf	Adhesive Sensor (L-Shape) for infant weighing 3kg to 20kg. 4002	Yes
Masimo SET Sensor	RD SET Neo	Adhesive Sensor (L-Shape) for neonate weighing under 3kg or adult weighing more than 40kg. 4003	Yes
Masimo SET Sensor	RD SET NeoPt	Adhesive Sensor (L-Shape) for neonate weighing under 1kg. 4004	Yes
Masimo SET Sensor	RD SET DCI	Reusable Sensor for finger of adult weighing more than 30kg. 4050	Yes
Masimo SET Sensor	RD TC-I	Reusable Sensor for ear of adult weighing more than 30kg. 4053	Yes
Masimo SET Sensor	RD SET TF-I	Reusable Sensor for forehead of adult weighing more than 30kg. 4055	Yes
Masimo SET Sensor	M-LNCS Neo	Adhesive Sensor for neonate, 2514	Yes
Masimo SET Sensor	M-LNCS NeoPt3	Adhesive Sensor for Premature Neonate, 2321	Yes
Adapter for RD Sensor	LNCS-RD	Converts from LNCS to RD, 45cm, 4015	Yes
Adapter for RD Sensor	LNCS-RD	Converts from LNCS to RD, 90cm, 4089	Yes
Masimo RD Rainbow Patient Cable	RD rainbow SET MD20-1.5	0.5m, 4071	Yes
Masimo RD Rainbow Patient Cable	RD rainbow SET MD20-05	1.5m, 4072	Yes
Masimo RD Rainbow Patient Cable	RD rainbow SET MD20-12	3.7m, 4073	Yes
RD SET Patient Cable	RD SET MD20-1.5	For RD SET Sensor, 0.5m, 4102	Yes
RD SET Patient Cable	RD SET MD20-05	For RD SET Sensor, 1.5m, 4103	Yes
RD SET Patient Cable	RD SET MD20-12	For RD SET Sensor, 3.7m, 4104	Yes

❑SpO_2, PR, PI, PVI, SpMet, SpCO Measurement

Item	Model Type	Note	CSA Certified
Masimo Rainbow Sensor	Rainbow R25	Adhesive Sensor for Adult, 2201	Yes
Masimo Rainbow Sensor	Rainbow R25-L	Adhesive Sensor (L-Shape) for Adult/Neonate, 2219	Yes
Masimo Rainbow Sensor	Rainbow R20	Adhesive Sensor for Pediatric, 2222	Yes
Masimo Rainbow Sensor	Rainbow R20-L	Adhesive Sensor (L-Shape) for Pediatric/ Infant, 2220	Yes
Masimo Rainbow Sensor Red Reusable Sensor	Rainbow DCI-dc3	Reusable Sensor, 0.9m, for adult weighing more than 30kg, 2201	Yes
Masimo Rainbow Sensor Red Reusable Sensor	Rainbow DCI-dc8	Reusable Sensor for adult, 2.4m, 2407	Yes
Masimo Rainbow Sensor Red Reusable Sensor	Rainbow DCI-dc12	Reusable Sensor for adult, 3.6m, 2202	Yes
Rainbow RC Patient Cable	Rainbow RC-1	For Rainbow Sensor, 1.2 m, 2405	Yes

Item	Model Type	Note	CSA Certified
Rainbow RC Patient Cable	Rainbow RC-4	For Rainbow Sensor, 2.4m, 2406	Yes
Rainbow RC Patient Cable	Rainbow RC-12	For Rainbow Sensor, 3.6m, 2404	Yes

❑SpO_2, PR, PI, PVI, SpMet, SpHb, SpOC Measurement

Item	Model Type	Note	CSA Certified
Rainbow RC Patient Cable	Rainbow RC-1	For Rainbow Sensor, 1.2 m, 2405	Yes
Rainbow RC Patient Cable	Rainbow RC-4	For Rainbow Sensor, 2.4m, 2406	Yes
Rainbow RC Patient Cable	Rainbow RC-12	For Rainbow Sensor, 3.6m, 2404	Yes
Masimo Rainbow Sensor	Rainbow R1 25L	Adult (more than 30 kg), Neonate (under 3 kg) (SpHb/SpMet), 2623	Yes
Masimo Rainbow Sensor	Rainbow R1 20L	Pediatric (more than 10 kg, under 30 kg), Infant (more than 3 kg, under 10 kg) (SpHb/ SpMet), 2624	Yes

NOTE

- SpCO and SpHb cannot be measured at the same time for all the sensors.s

NOTE

- There are various types of sensors available.For details, contact your nearest service representative.

CO Measurement (Manufactured by Fukuda Denshi)

Item	Model Type	Note	CSA Certified
Catheter Relay Cable	CJO-P01C-C2.4		Yes
Flow-through Sensor Relay Cable	CJO-P01C-F2.4		Yes
In-line Sensor Relay Cable	CJO-P01C-L2.4		Yes
Injectate Probe Relay Cable	CJO-P01C-T2.4		Yes

CO Measurement (Manufactured by Edwards Lifescienses)

Item	Model Type	Note	CSA Certified
SGTD Catheter (For Small Vein)	096F6		Yes
SGTD Catheter	141F7		Yes
SGTD Catheter A Chip	151F7		Yes
SGTD Catheter PU7F	174F7		Yes

CO Measurement (Manufactured by Merit Medical Systems)

Item	Model Type	Note	CSA Certified
TD Catheter	SP5107U		Yes
TD Catheter	SP5107MU		Yes
TD Catheter	SP5507U		Yes
TD Catheter	SP5106MP		Yes
TD Catheter	SP5207MP		Yes

CO_2 Concentration Measurement (Manufactured by Philips)

❑For HC-120 Gas Unit I/F with Capnostat 5 CO_2 Sensor

Item	Model Type	Note	CSA Certified
Capnostat 5 CO_2 Sensor	1015928		Yes
Single-Patient Use Adult Airway Adapter	6063-00	Single patient use, for ET tube sizes > 4.0 mm (10 per box)	Yes
Single-Patient Use Neonatal Airway Adapter	6312-00	Single patient use, for ET tube sizes = < 4.0 mm (10 per box)	Yes
Reusable Adult Airway Adapter	7007-00 7007-01	Reusable, for ET tube sizes > 4.0 mm (7007-00: 10 per box, 7007-01: 1 per box)	Yes
Reusable Neonatal Airway Adapter	7053-00 7053-01	Reusable, for ET tube sizes = < 4.0 mm (7053-00: 10 per box, 7053-01: 1 per box)	Yes

NOTE

- There are various types of sampling device available. For details, refer to our service representative.

CO_2 Concentration Measurement (Medtronic)

Item	Model Type	Note	CSA Certified
For Short Term Use			Yes
Microstream™ Advance oral/nasal filter line	MVA	Adult	Yes
	MVAL	Adult, long	Yes
	MVAO	Adult, with O_2 tube	Yes
	MVAOL	Adult, with O_2 tube, Long	Yes
	MVP	Pediatric	Yes
	MVPO	Pediatric, with O_2 tubing	Yes
	MVPOL	Pediatric, with O_2 tubing, Long	Yes
Microstream™ Advance nasal filter line	MVAN	Adult	Yes
	MVANO	Adult, with O_2 tubing	Yes
	MVANOL	Adult, with O_2 tubing, Long	Yes
	MVPN	Pediatric	Yes

Item	Model Type	Note	CSA Certified
	MVPNO	Pediatric, with O_2 tubing	Yes
Microstream™ Advance bite block filter line	MVABO	Adult-intermediate w/O_2 tubing-female connector	Yes
	MVABOL	Adult-intermediate w/O_2 tubing-female connector, Long	Yes
FilterLine™ sampling line set	MS007768	Adult-pediatric, Long	Yes
	MSXS04620	Adult-pediatric	Yes
Smart CapnoLine™ sampling line with Guardian bite block	MS012528	Adult-intermediate w/O_2 tubing maleconnector	Yes
Nasal NIV Line	MSXS04476	Neonatal	Yes
MRI FilterLine™ sampling line	MS006325	MRI, XL (9m)	Yes
For Long Term Use			Yes
CapnoLine™ H sampling line	MS008177	Adult	Yes
	MS008179	Neonatal-infant	Yes
	MS012111	Neonatal-infant w/O_2 tubing, 3m	Yes
VitaLine™ H sampling line set	MS010787	Adult-pediatric, High humidity	Yes
	MS010807	Neonatal-infant, High humidity	Yes
FilterLine™ H sampling line set	MS007737	Adult-pediatric, Long	Yes
	MS007738	Neonatal-infant, Long	Yes
	MS006324	Neonatal-infant	Yes
	MSXS04624	Adult-pediatric	Yes

Anesthetic Gas Concentration Measurement (Manufactured by Mindray Medical Sweden AB)

❑For MG-110/MG-120 Series, Artema Model

Sampling Devices

Item	Model Type	Note
DRYLINE Water Trap, Adult	60-13100-00	Non-sterile
DRYLINE Water Trap, Neonate	60-13200-00	Non-sterile
DRYLINE Airway Adapter, Straight	60-14100-00	Non-sterile, disposable
DRYLINE Airway Adapter, Elbow	60-14200-00	Non-sterile, disposable
DRYLINE Sampling Line, Adult	60-15200-00	Non-sterile, 2.5m, disposable
DRYLINE Sampling Line, Neonate	60-15300-00	Non-sterile, 2.5m, disposable
SPIRIT Flow sensor, Adult	60-16100-00	For MGU-810 series, single-use only
SPIRIT Flow sensor, Pediatric	60-16200-00	For MGU-810 series, single-use only

BIS Measurement (Manufactured by Medtronic)

Item	Model Type	Note	CSA Certified
BISx	186-0195-SF	SW 1.13	Yes
Patient Interface Cable	186-0107		Yes
BIS Pediatric Sensor	186-0200		Yes
BIS Quatro Sensor	186-0106		Yes
BIS Sensor Simulator	186-0137		Yes

⚠ CAUTION

- Avoid liquid ingress to the patient interface cable (PIC). Contact of fluids with the PIC sensor connector can interfere with PIC performance.
- To minimize the risk of patient strangulation, the patient interface cable (PIC) must be carefully placed and secured.
- When installing the BISx, it should not be closely attached to the patient. Secure it on the bedside rail or pole using a clip.
- BIS sensor is disposable. Do not reuse it.
- Do not reuse the BIS sensor for other patients. It may cause cross-infection.
- The duration for one usage should be within 24 hours.

Others (Manufactured by Fukuda Denshi)

Item	Model Type	Note	CSA Certified
AC Power Cable	CS-18	230V standard only (straight type)	Yes
AC Power Cable	CS-33	230V standard only (angle type)	Yes
AC Power Cable	CS-24	120V standard only (straight type)	Yes
AC Power Cable	CS-34	120V standard only (angle type)	Yes
Earth wire	CE-01B		
Trolley Upper Unit for monitor	OAO-8400		Yes
Trolley Lower Unit for monitor	OTO-13		Yes
GCX Attachment for Monitor	OAO-70A	For attaching to the GCX arm	
Lithium-Ion Battery Pack	BTO-005		Yes
3ch Analog Output Cable (0.5 M)	CJO-26JJ0.5		Yes
3ch Analog Output Cable (2.7 M)	CJO-26JJ2.7		
SD Card	FSD-32G	32GB	Yes
BISx IF Cable	CJO-29TR0.4	For AUX	Yes
Ethernet Branch Cable	CJ-522AG	Length 1m (For DS-LAN)	
Ethernet Branch Cable	CJ-522BG	Length 2m (For DS-LAN)	
Ethernet Branch Cable	CJ-522CG	Length 4m (For DS-LAN)	
Ethernet Branch Cable	CJ-522DG	Length 10 m (For DS-LAN)	
Ethernet Branch Cable	CJ-522EG	Length 20m (For DS-LAN)	
Recording paper	OP050-02DR		Yes

Item	Model Type	Note	CSA Certified
Magnetic Card Reader	CRF-700S-2004		
Barcode Reader	1950GHD-U		Yes
Relay Cable (Straight)	CJ-726	Straight Cable for COM Port	
RS-232C Cable	CJ-725	Cross Cable for COM Port	
Storage Box for Trolley	OAO-91A		Yes

❑External Equipment Connection Cable

Equipment	Model Type	Note
SV-300	CJ-401RI-70SV3G	For Status Port
SERVO-i /S	CJ-402RI-70SViG	For Status Port
	CJ-502G	For COM Port
Servo-U	CJO-27DJ2	For Status Port
PB 740/760/840	CJ-403RI-70PB	For Status Port
Evita (XL, 4, dura)	CJ-402RI-70SViG	For Status Port
	CJ-502G	For COM Port
BIS	CJ-407-RI-70BISG	For Status Port
	CJO-03RS4	For COM Port
Vigilance, Vigilance CEDV	CJ-406RI-70Vigi	For Status Port
	CJO-04RS4G	For COM Port
VigilanceII, Vigileo, EV1000*2	CJ-402RI-70SViG	For Status Port
	CJ-502G	For COM Port
Conversion Cable	CJ-756	CRF-700S-2004, LS2208(T) Conversion Cable
PiCCO	CJO-18RS5G	For COM Port
	CJO-19RS5G	For Status Port
Flow-i	CJ-402RI-70SVi	For Status Port
	CJ-502	For COM Port
INVOS	CJO-04RS4	For COM Port
	CJ-406RI-70Vigi	For Status Port
TCM4	CJ-726	For COM Port
PulsioFlex PC4000	CJ-725	For COM Port*1

*1: To connect the PulsioFlex PC4000, USB to RS-232C connector cable (UC-232A, ATEN) specified by PULSION Medical Systems is required.

*2: When connecting to EV1000, check whether the RS-232 output port connector is 9-pin male or 9-pin female. If the connector is 9-pin male, use CJ-406RI-70Vigi, or attach the female conversion connector supplied as standard accessory for EV1000.

Chapter 14 Specification

Specification

This section states the specification of this device.

Main Unit: DS-1200

Size (not including the protrusion.)

400(W) x 290(H) x 170(D) mm

Weight (not including the accessory)

5.0 kg (not including the recorder and battery.)

Environmental Conditions

Operating Temperature	10°C to 40°C
Operating Humidity	30% to 85% (non-condensing)
Operating Atmospheric Pressure	70 kPa to 106 kPa
Transport/Storage Temperature	-10°C to 60°C
Transport/Storage Humidity	10% to 95% (at 40°C, non-condensing)
Storage Atmospheric Pressure	70 kPa to 106 kPa

NOTE

- When using the expansion module, make sure the environmental condition meets the specifications of the module.

Safety

General Safety Standard	IEC 60601-1 Ed. 3.1:2012 (Medical Electrical Equipment- Part 1: General Requirements or Safety)
EMC Standard	IEC 60601-1-2: 2014 (Medical Electrical Equipment- Part 1- 2: General Requirements for Safety- Electromagnetic Compatibility -Requirements and Tests)
Type of protection against electric shock	Class I Equipment (During AC power operation) Internally Powered Equipment (During battery operation)
Degree of protection against electric shock	ECG/RESP, SpO_2,SpCO*,SpMet*,SpHb*, TEMP, BP, CO: Type CF Applied Part NIBP: Type BF Applied Part DS-1200M or HG-810 only
Operation Mode	Continuous Operation
Waterproof/Dustproof	DS-1200 Main Unit: IPX1, IPX2 Only when side cover and battery cover are attached.
Usage in the Presence of Flammable Gas	This device cannot be used in the presence of air or flammable anesthetic gas or oxygen or nitrous oxide and flammable anesthetic gas.
Use in environment with high concentration of oxygen	Never operate the device in an environment with a high concentration of oxygen.

NOTE

- The DS-1200 system comforms to waterproof/dustproof rating of IPX1 with the following system configuration.
  Main Unit: DS-1200
  Multigas Module: MG-110, MG-120
  CO_2 Gas Module: HC-110
  Gas Unit I/F Module: HC-120
  Multi Module: HM-800
  SpO_2 Module: HG-810, HG-820
- The DS-1200 system comforms to waterproof/dustproof rating of IPX2 with the following system configuration.
  Main Unit: DS-1200
  SpO_2 Module: HG-810, HG-820

Power Supply

Voltage	100-240 V AC DC 14.4V (when using the battery)
Power Consumption	During AC power operation: 100 VA and below
Rated Voltage	14.4V
Rated Capacity	4100 mAh
Battery Operation Time	1 hour (NIBP 15 minutes interval, the option units are not used) *The above battery operation time is based on the conditions; A new battery pack is fully charged, and the alarms are not generated.
Battery Charging Time	Rapid Charge (when the equipment is not operating): 4 hours, Normal Charge (when the equipment is operating): 8 hours

Expected Service Life

6 years	According to self-certification (☞Maintenance Manual "Periodic Replacement" P7-1)

Expansion Module: HM-800, HP-800, HG-810/820

Size

40 (W) mm x 100 (H) mm x 135 (D) mm (not including the protrusion)

Weight

HM-800	0.5 kg (not including the accessory)
HP-800	0.5 kg (not including the accessory)
HG-810/HG-820	0.5 kg (not including the accessory)

Environmental Conditions

Operating Temperature	10°C to 40°C
Operating Humidity	30% to 85% (non-condensing)
Operating Atmospheric Pressure	70 kPa to 106 kPa
Transport/Storage Temperature	-10°C to 60°C
Transport/Storage Humidity	10% to 95% (40°C, non-condensing)
Storage Atmospheric Pressure	70 kPa to 106 kPa

Safety

General Standard	IEC 60601-1 Ed. 3.1:2012 (Medical electrical equipment - Part 1: General requirements for basic safety and essential performance)
Type of protection against electric shock	Class I Equipment (DS-1200 System
Degree of protection against electric shock	TEMP, BP, CO (HM-800): Type CF Applied Part
	SpO_2, SpCO, SpMet, SpHb (HG-810): Type CF Applied Part
	SpO_2 (HG-820) : Type CF Applied Part
Protection against Ignition of Flammable Gas	Not provided

Power Supply

Voltage	DC 12 V (Supplied from the Main Unit)

Usable Life

6 years	According to self-certification

CO_2 Gas Module/ Gas Unit I/F Module: HC -110/ HC -120

Size

40 (W) mm x 100 (H) mm x 135 (D) mm (not including the protrusion)

Weight

HC-110 HC-120	0.5kg (not including the accessory)

Environmental Conditions

Operating Temperature	10°C to 35°C/50°F to 95°F
Operating Humidity	30% to 85% (non-condensing)
Operating Atmospheric Pressure	70 kPa to 106 kPa
Transport/Storage Temperature	-10°C to 60°C/14°F to 140°F
Transport/Storage Humidity	10% to 95% (40°C/104°F) (non-condensing)
Storage Atmospheric Pressure	70 kPa to 106 kPa

Safety

General Safety Standard	IEC 60601-1 Ed. 3.1:2012 (Medical electrical equipment - Part 1: General requirements for basic safety and essential performance)
EMC Standard	IEC 60601-1-2: 2014 (Medical electrical device - Part 1-2: General requirements for basic safety and essential performance Collateral standard: Electromagnetic compatibility Requirements and tests)
Type of protection against electric shock	Class I Device (DS-1200 system)/Internally Powered Device (DS-1200 system)
Degree of protection against electric shock	CO_2 : Type BF Applied Part
Usage in the Presence of Flammable Gas	This device cannot be used in the presence of air or flammable anesthetic gas or oxygen or nitrous oxide and flammable anesthetic gas.

Power Supply

Voltage	DC 12 V (Supplied from main unit)

Expected Service Life

6 years	According to self-certification (☞Maintenance Manual "Periodic Replacement" P7-1)

Multigas Module: MG -110/ MG -120

Size

MG-110	80 (W) mm x 100 (H) mm x 135 (D) mm (not including the protrusion)
MG-120	120 (W) mm x 100 (H) mm x 135 (D) mm (not including the protrusion)

Weight

MG-110	1.1kg (not including the accessory)
MG-120	1.3kg (not including the accessory)

Environmental Conditions

Operating Temperature	10 to 35°C
Operating Humidity	30% to 85% (non-condensing)
Operating Atmospheric Pressure	70 kPa to 106 kPa
Transport/Storage Temperature	-10°C to 60°C/14°F to 140°F
Transport/Storage Humidity	10% to 95% (40°C/104°F) (non-condensing)
Storage Atmospheric Pressure	70 kPa to 106 kPa

Safety

General Safety Standard	IEC 60601-1 Ed. 3.1:2012 (Medical electrical equipment - Part 1: General requirements for basic safety and essential performance)
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Type of protection against electric shock	Class I Device (DS-1200 system)/Internally Powered Device (DS-1200 system)
Degree of protection against electric shock	CO_2 : Type BF Applied Part
Usage in the Presence of Flammable Gas	This device cannot be used in the presence of air or flammable anesthetic gas or oxygen or nitrous oxide and flammable anesthetic gas.

Power Supply

Voltage	DC 12 V (Supplied from main unit)

Expected Service Life

6 years	According to self-certification (☞Maintenance Manual "Periodic Replacement" P7-1)

Performance

This section states the performance of the DS-1200 system. The EMC essential performance is indicated with ※.

Display Unit

Display Device	15.6 inch TFT Color LCD
Resolution	15.6 inch: 1366 pixel × 768 pixel, refresh frequency 60 Hz
Function Control	Touch Screen Method
Waveform Trace	Stationary Trace
Sweep Speed	ECG/SpO_2/BP/EEG (6.25 mm/s, 12.5 mm/s, 25 mm/s, 50mm/sec.) RESP/ CO_2/O_2/AG (6.25 mm/s, 12.5 mm/s, 25 mm/s)

Operation

Touch Panel	Capacitive Touch Panel

Sound Pressure

Alarm Sound (IEC Tone)	High PriorityMaximum: 70.2 dB, Minimum: 46.6 dB
	Medium PriorityMaximum: 68.6 dB, Minimum: 44.2 dB
	Low PriorityMaximum: 67.5 dB, Minimum: 40.8 dB
Alarm Sound (IEC Tone, When trolley is used.)	High PriorityMaximum: 65.3dB, Minimum: 40.8 dB
	Medium PriorityMaximum: 63.6 dB, Minimum: 39.3 dB
	Low PriorityMaximum: 62.6 dB, Minimum: 39.3 dB
HR Synchronized Tone	Maximum: 86.0 dB, Minimum: 36.0 dB
SpO_2 Synchronized Tone	Maximum: 83.0 dB, Minimum: 39.0 dB

NOTE

- The sound pressure of the alarm sounds are measured according to IEC60601-1-8:2006.Amd1:2012 6.3.3.2.

Clock Accuracy

	±2 min. per year (25°C)

Alarm

Alarm Function	For each alarm level, the respective alarm sound generates, and the alarm indicator flashes.
Alarm Indicator	Visual check is possible from 4m distance.
Alarm Display	Visual check is possible from 1 m distance.

ECG

Lead Type	Wired 3, 4, 5, 10-electrode
Frequency Characteristic	150Hz/40Hz/15Hz (3, 4, 5, 10-electrode)
Input impedance	2.5 MΩ or above
Maximum Input Voltage	10 mVp-p
Polarization Voltage	±825 mV or above
Common Mode Rejection Ratio	90 dB or above
HR Measurement Range	Adult: 0, 12 bpm to 300 bpm Neonate: 0, 30 bpm to 300 bpm
※ HR Measurement Accuracy	±3bpm

NOTE

- When the patient classification is neonate, HR measurement accuracy satisfies ±3 bpm in the test according to IEC 60601-2-27 201.12.1.101.15 under the following conditions.
  When the waveform size is set to x2 for QRS waveform (0.5 mV, 80 ms), or
  When the waveform size is set to x4 for QRS waveform (0.5 mV, 120 ms).

HR Display Response Time	Adult/Child: 6 sec., Neonate: 3 sec.
Instant HR	Calculated each second based on the latest RR interval.
Waveform Size	1/4, 1/2, 1, 2, 4
Accuracy of Input Signal Reproduction	Overall system error and frequency response is set using method A, B, C, and D.
Defibrillation Proof	Provided Resuming time is 5 seconds when tested according to IEC60601-2-25:2011 and IEC60601-2-27:2011 201.8.5.5.1.
Lead-off Detection Current	100 nA and below
Heart rate meter accuracy and response to irregular rhythm	80 bpm Ventricular Bigeminy: 80 bpm  60 bpm Ventricular Bigeminy: 60bpm  120 bpm Ventricular Bigeminy: 120 bpm  90 bpm Bidirectional Systoles: 90 bpm 
Response time of heart rate meter to change in heart rate	HR change from 80 bpm to 120 bpm: Range 4.9 sec. to 6.0 sec., Average 5.5 sec. HR change from 80 bpm to 40 bpm: Range 3.9 sec. to 5.2 sec., Average 4.6 sec.
Time to ALARM for tachycardia	Ventricular Tachycardia 1 mVpp, 206 bpm: Range 7.5 sec. to 8.3 sec., Average 7.9 sec.  Ventricular Tachycardia 2 mVpp, 206 bpm: Range 6.8 sec. to 7.6 sec., Average 7.1 sec. Ventricular Tachycardia 0.5 mVpp, 206 bpm: Range 6.8 sec. to 8.2 sec., Average 7.5 sec. Ventricular Tachycardia 2 mVpp, 195 bpm: Range 5.7 sec. to 6.4 sec., Average 5.9 sec.  Ventricular Tachycardia 4 mVpp, 195 bpm: Range 5.1 sec. to 6.2 sec., Average 5.6 sec. Ventricular Tachycardia 1 mVpp, 195 bpm: Range 5.1 sec. to 6.4 sec., Average 5.7 sec.
Active Noise Suppression	RL Drive Maximum 10.8 mV

Tall T-wave Rejection Capability	1.2 mV T-wave can be removed when tested according to IEC 60601-2-27.
Transient Characteristic	3.2 sec, 0.3 sec, 0.1 sec (time constant can be changed)

NOTE

- The impulse response satisfies the test according to IEC 60601-2-27 201.12.1.101.8 when the ECG filter is set to Diagnosis Mode.

Rejection of Pacemaker Pulse	a) Pacemaker Pulse without Over/Undershoot Capable to reject pulses of pulse width 0.1 ms to 2 ms, amplitude±2 mV to±700 mV b) Pacemaker Pulse with Over/Undershoot Rejection is not possible. c) Pacer Pulse Detector Rejection of Fast ECG Signals Slew Rate 3.2V/S
Sampling Rate	Analog Front End: 8000 samples/s/channel Digital Signal Processing: 500 samples/s/channel and above
Resolution	5 µV/LSB and below
Skew	100 µV and below

NOTE

- The starting point and ending point of QRS are measured by each lead, so I wave and K wave will not be included in the 12-lead analysis.

Respiration

Method	Impedance Method
Frequency Characteristic	1.5 Hz (adult, child) / 2.5 Hz (neonate)
Current	100 µA and below (at 20 kHz±5%)
Measurement Range	0, 4 Bpm to 150 Bpm
Measurement Accuracy	±3 Bpm

Temperature

Measurement Method	Thermistor Method
Measurement Range	0°C to 45°C
※ Measurement Accuracy	±0.3°C at 25°C to 45°C Outside above range (including specified temperature probe) ±0.4°C
No. of Channels	Maximum 8 channels
Temperature Delay Time (From temperature probe to monitor display)	10 sec. or less (Not including the time constant of temperature probe.)
Response Time	9 minutes When a temperature probe specified by Fukuda Deneshi is used.
Operating Mode	Direct Mode

SpO_2(Arterial Oxygen Saturation)

Measurement Value Update Rate	1 sec.

NOTE

- The information described on the measurement method for each unit is useful information for healthcare professionals.

Medtronic Unit

Measurement Method	2 Wavelength Pulse Wave Method Wavelength: Approx. 660nm (Red light) 890nm (Infrared light) Output: 15 mW and below
Measurement Range	1%SpO_2 to 100%SpO_2
Resolution	SpO_2 to 99%SpO_2
※ Measurement Accuracy	Adult: ±3%SpO_2 when 70%SpO_2 to 100%SpO_2 (When DS-100A is used) Neonate: ±2%SpO_2 when 70%SpO_2 to 100%SpO_2
PR Measurement Range	20 bpm to 300 bpm
PR Accuracy	±3 bpm when 20 bpm to 250 bpm
Measurement Response Time	6 sec. to 7 sec.
Respiration Rate (Pulse Wave Analysis)	
Display Range	4 Bpm to 40 Bpm
※ RR Measurement Accuracy	Mean Error: Within ±1 Bpm Mean Square Deviation: Below 3 Bpm

NOTE

- Respiration Rate (Pulse Wave Analysis)is an optional function.

Masimo Unit

Measurement Method	2 Wavelength Pulse Wave Method MASIMO LNOP/LNCS Sensor Wavelength: Approx. 660nm (Red light) 905nm (Infrared light) Output: 15 mW and below MASHIMO Rainbow Sensor Wavelength: 12 different wavelengths are used within the range of 620 nm to 1270 nm Output: 25mW and below
SpO_2	
Measurement Range	1%SpO_2 to 100%SpO_2
Resolution	SpO_2 to 99%SpO_2
※ Measurement Accuracy	Adult: ±2%SpO_2 when 70%SpO_2 to 100%SpO_2 Neonate: ±3%SpO_2 when 70%SpO_2 to 100%SpO_2
SpCO	
Measurement Range	0%SpCO to 99%SpCO
Resolution	1%SpCO
Measurement Accuracy	±3%SpCO (SpCO: 1%SpCO to 40%SpCO)
SpMet	
Measurement Range	0%SpMet to 99.9%SpMet
Resolution	0.1%SpMet
Measurement Accuracy	±1%SpMet (SpMet: 1%SpMet to 15%SpMet)
SpHb	
Measurement Range	0 g/dL to 25.0g/dL
Resolution	0.1g/dL
Measurement Accuracy	±1 g/dL (SpHb: 8 g/dL to 17 g/dL)

PI (Perfusion Index)

Measurement Range	0.02% to 20.0% (when disposable sensor is used) / 0.05% to 20.0% (when reusable sensor is used)
Minimum Display Unit	0.01%

PVI (Pleth Variability Index)

Measurement Range	0% to 100%
Calculation Time	15 sec.

SpOC

Measurement Range	0 ml/dL to 35.0ml/dL
Minimum Display Unit	0.1ml/dL

Pulse Rate

Measurement Range	26 bpm to 239 bpm
※ Measurement Accuracy	±3 bpm when 26 bpm to 239 bpm (without body motion)
Measurement Response Time	7 levels: 2 to 4 sec., 4 to 6 sec., 8 sec., 10 sec., 12 sec., 14 sec., 16 sec. (averaging duration)

NOTE

- The SpO_2 measurement accuracy is determined based on the values of the root-mean-square (rms) difference between SpO_2 readings of the pulse oximeter device and values of SaO_2 determined with a CO oximeter, by healthy adult volunteers. The pulse oximeter device measurements are statistically distributed; ±2% measurement accuracy means that only about two-thirds of pulse oximeter device measurements can be expected to fall within ±2% of the value measured by a CO-oximeter.
- PVI, SpCO, SpMet, SpHb, SpOC measurements are optional functions.

Blood Pressure

Transducer Sensitivity	5μV / V / mmHg
Measurement Range	-50 mmHg to 300 mmHg
Frequency Characteristic	DC 6Hz / 8Hz / 12Hz / 40Hz
※ Measurement Accuracy	Within ±2% or ±1mmHg of full scale, whichever is greater
Zero Balance Range	Within ±150 mmHg
PR Measurement Range	Adult: 12 bpm to 300 bpm Neonate: 30 bpm to 300 bpm
PR Accuracy	Within ± 3% or ± 1bpm, whichever is greater
Channels	Maximum 8 channels

NOTE

- The frequency response satisfies the test according to IEC 60601-2-34 201.12.1.101.3 when the filter is set to 40Hz.

NIBP (non-invasive blood pressure)
(AAMI SP10: 2002+A1:2003+A2:2006 +(R)2008 Manual, electronic or automated sphygmomanometers) (ISO81060-2:2013 Non-invasive sphygmomanometers -- Part 2: Clinical investigation of automated measurement type)

Measurement Method	Oscillometric Method
Pressure Measurement Range	0 mmHg to 300 mmHg
Resolution	1 mmHg

Pressure accuracy	±3 mmHg
BP Measurement Error according to the Clinical Performance Test	
Mean Error	Within ±5 mmHg
Standard Deviation of Error	8 mmHg and below
Error of Cuff Pressure Display	Within ±3 mmHg
※ Measurement Error (including simulator)	±10mmHg
PR Measurement Range	30 bpm to 240 bpm
Rated Cuff Pressure	Adult: 300 mmHg Pediatric: 210 mmHg Neonate: 150 mmHg
PR Accuracy	±5 beats (less than 100 beats) ±5% (more than 100 beats)
Deflation Speed	5±1 mmHg/sec. (Quick Measurement OFF) 10±2 mmHg/sec. (Quick Measurement ON)
Safety Mechanism	Adult: 300 mmHg and below Pediatric: 210 mmHg and below Neonate: 150 mmHg and below

CO_2 (Carbon Dioxide Concentration)

Philips Capnostat 5 (Gas Unit I/F and Mainstream Module)

Measurement Method	Infra-Red Solid-State Method, Mainstream Method
Measurement Range	0 mmHg to 150 mmHg
※ Measurement Accuracy	0 mmHg to 40 mmHg: ±2 mmHg 41 mmHg to 70 mmHg: ±5% 71 mmHg to 100 mmHg: ±8% 101 mmHg to 150 mmHg: ±10%

⚠ CAUTION

- For breath rates above 80 bpm, the accuracy is up to the higher of 4 mmHg or ±12 % of reading.
- The HC-120 (Philips Capnostat5) will not be affected by the respiration rate.

CO_2 value error compensation when interference gas is present

0 mmHg to 40 mmHg: Additional error of ±1 mmHg
41 mmHg to 70 mmHg: Additional error of ±2.5%
71 mmHg to 100 mmHg: Additional error of ±4%
101 mmHg to 150 mmHg: Additional error of ±5%
These are maximum error only if compensation of atmospheric pressure, O_2, N_2O, anesthetic agent are properly perfomed.

RR Measurement Range	0 bpm to 150 bpm
RR Measurement Accuracy	±1 bpm
Rise Time	60 ms and below
System Response Time	2.26 seconds
Date Sample Rate	100Hz
Drirft	±0.8mmHg (more than 4 hours after power ON.)

Medtronic Unit

Measurement Method	Infra-Red Solid-State Method, SidestreamMethod
CO_2, $EtCO_2$, $InspCO_2$ Measurement Range	0 mmHg to 99 mmHg
※ Measurement Accuracy	0 mmHg to 38 mmHg: ±2 mmHg 39 mmHg to 99 mmHg: ± { 5%×CO_2 reading +8%×(CO_2 reading - 39 mmHg)}

NOTE

- The above values relate to breath rates up to 80 bpm, and module temperatures up to 55°C.
- For breath rates above 80 bpm, the accuracy is up to the higher of 4 mmHg or ±12 % of reading. This accuracy applies for FilterLine™ P/N 006324. For module temperatures above 55°C, the nominal CO_2 measurement accuracy might be reduced by up to 1mmHg or 2.5% of CO_2 reading, whichever is greater.
- The calculation is:
  Expected reading = (barometric pressure in mmHg) x (%CO_2 (in Vol%)) x 0.97
  Example of calculating expected reading;
  The barometer indicates that the atmospheric pressure is 710mmHg.
  The gas being measured is 5% CO_2 (Vol%).
  The measurement is being done in measurement mode (not calibration mode).
  Expected reading = 710 x 0.05 x 0.97 =34.4 mmHg.

CO_2 Waveform Resolution	0.1 mmHg
$EtCO_2$, $InspCO_2$ Resolution	1 mmHg
CO_2 measurement accuracy when interference gas is present	
	0 mmHg to 38 mmHg: ± (2 mmHg + 0.04 x displayed value) 39 mmHg to 99 mmHg: ± { 0.09 x displayed value + 0.08 x (displayed value - 39 mmHg)}
RR Measurement Range	0 bpm to 150 bpm
RR Measurement Accuracy	0 bpm to 70 bpm: ±1 bpm 71 bpm to 120 bpm: ±2 bpm 121 bpm to 150 bpm: ±3 bpm

NOTE

- The respiration used for the respiratory rate measurement is simulated by a system using an N2 tank (no CO_2 in the inhalation) and a CO_2 tank (2% CO required for certain tests). A computer-activated control panel uses a solenoid to switch the module input between the two gas tanks to generate a gas CO_2 square wave. The system is capable of generating simulated respiration over the entire required range of specified respiration rates.

Flow Rate	50±5 mL/min, flow measured by volume
Data Sample Rate	20 samples/sec
Turn-On Time	30 s (typical, includes power-up and initialization time)
Calibration Interval	Initially calibrate after 1,200 operating hours, then once a year or after 4,000 operating hours, whichever comes first.

NOTE

- The initial calibration should not occur before 720 hours of use. If the initial calibration is done before 720 hours of use, the module will reset to require its next calibration after 1200 hours, instead of after 4000 hours.

System Response Time	4.3 seconds: with any 2-meter FilterLine™ 5.15 seconds: with any 4-meter FilterLine™
Delay Time	4.0 sec.
Rise Time	190 msec: with any 2-meter FilterLine™ 210 msec: with any 4-meter FilterLine™
Compensation	BTPS (standard correction used by Microstream capnography during all measurement procedures for body temperature, pressure, and saturation)
Drift	The periodic auto zero function compensates for drifts between components, changes in ambient temperature, and barometric conditions. This automatic process eliminates variances that might otherwise cause measurement drift. Therefore the capnography module does not exhibit drift of measurement accuracy.

NOTE

- This accuracy value applies for FilterLine™ Model 006324.

CO

Measurement Method	Thermodilution Method
Measurement Range	0.1 L/min to 20 L/min
Measurement Range and Accuracy	
Blood Temperature	17°C to 45°C±0.2°C
Injectate Temperature	-1°C to 35°C±0.2°C

BIS

BISx (Medtronic)	
Bispectral Index (BIS)	
Measurement Range	0% to 100%
Resolution	1%
Signal Quality Index (SQI)	
Measurement Range	0% to 100%
Resolution	0.1%
EMG	
Measurement Range	25 dB to 100 dB
Bar Graph Display Range	30 dB to 55 dB
Graphic Trend Display Range	30 dB to 80 dB
Resolution	1 dB
Suppression Ratio (SR)	
Measurement Range	0% to 100%
Spectral Edge Frequency	
Measurement Range	0.5 Hz to 30Hz
Total Power (TOTPOW)	
Measurement Range	40 dB to 100 dB
Waveform Display Scale	±25μV, ±50μV, ±100μV, ±250μV ±10%
Sweep Speeds	25mm/s ±10%
Frequency Characteristic	
Filter ON	2.0 Hz to 70 Hz, AC Filter ON (50 Hz or 60 Hz)
Filter OFF	0.25 Hz to 100 Hz, AC Filter OFF
Notch Filter	Reduces to 1/10
Input Impedance	50 MΩ or above
Noise Level	0.3 uV or below

Anesthetic Agent Concentration	MG-110/MG-120
Sidestream Method	
Measurement Method	CO_2, N_2O, Volatile Anesthetic: Infra-Red Solid-State Method O_2: Paramagnetic Method

Warm-Up Time		Multi Gas Module ISO Accuracy: 45 sec. Full Accuracy: 10 min.
Auto Zeroing		Multi Gas Module ISO Accuracy: 30 sec. Full Accuracy: 4 hours
Measurement Range	CO_2:	0vol% to 10.0vol% (0mmHg to 76mmHg, 0kPa to 10kPa)
	N_2O:	0vol% to 100vol%
	O_2:	0vol% to 100vol%
	AG Halothane:	0vol% to 5vol%
	AG Enflurane:	0vol% to 5vol%
	AG Isoflurane:	0vol% to 5vol%
	AG Sevoflurane:	0vol% to 8vol%
	AG Desflurane:	0vol% to 18vol%
	RR:	0, 2 Bpm to 100 Bpm
Measurement Accuracy *	CO_2:	0 to 1 [vol%]: ±0.1 [vol%] 1 to 5 [vol%]: ±0.2 [vol%] 5 to 7 [vol%]: ±0.3 [vol%] 7 to 10 [vol%]: ±0.5 [vol%]
	N_2O:	0 to 20[vol%]:±2[vol%] 20 to 100[vol%]:±3[vol%]
	O_2:	MG-110/MG-120 0 to 25[vol%]:±1[vol%] 25 to 80[vol%]:±2[vol%] 80 to 100[vol%]:±3[vol%]
	Volatile Anesthetic	Halothane, enflurane, and isoflurane
		0 to 1[vol%]:±0.15[vol%] 1 to 5[vol%]:±0.2[vol%]
		Sevoflurane 0 to 1[vol%]:±0.15[vol%] 1 to 5[vol%]:±0.2[vol%] 5 to 8[vol%]:±0.4[vol%]
		Desflurane 0 to 1[vol%]:±0.15[vol%] 1 to 5[vol%]:±0.2[vol%] 5 to 10[vol%]:±0.4[vol%] 10 to 15[vol%]:±0.6[vol%] 15 to 18[vol%]:±1.0[vol%]
	Respiration Rate	±1 bpm when below 60 bpm

*Measurement accuracy includes drift.

Respiration Detection	Changes with CO_2 level in 1[vol%].

Interference from other gases

Interference Gas or Vapor	Interference to Measurement Data [vol%]			
	CO_2	N_2O	O_2	Volatile Anesthetic*4
CO_2 *1*2	-	0.1	0.2	0
N_2O *1*2	0.1	-	0.2	0.1
O_2 *1*2	0.1	0.1	-	0.1
Volatile Anesthetic*1*2	0.1*3	0.1*3	1.0 *3	Secondary 0.1 (Average))
<100% Xenon	0.1	0	0.5	0
<50% Helium	0.1	0	0.5	0
Metered dose inhaler propellants	Not specified.	Not specified.	0.5	Not specified.
<0.1% Ethanol	0	0	0.5	0
Saturated Isopropanol Vapor	0.1	0	0.5	0
<1% Acetone	0.1	0.1	0.5	0
<1% Methane	0.1	0.1	0.5	0

*1: This is the maximum influence within the gas level of specified measurement accuracy. The total influence will not exceed 5% of the gas level.

*2: For CO_2, N_2O, O_2, the influence from mixed agent is the same as that from single agent.

Threshold — Volatile Anesthetic
Primary 0.15[vol%] (Full Accuracy)
0.4[vol%] (during warm-up)
For halothane, add 0.1[vol%] to above value.
Secondary 0.3[vol%] (Full Accuracy)
0.5[vol%] (during warm-up)
If primary agent is larger than 10[vol%], 5% of primary gas level.
(10% for isoflurane)
For halothane, add 0.1[vol%] to above value.

Flow Rate
70 mL/min to 200 mL/min
±10 mL/min or ±10%, whichever is greater

Delay Time
4s (When genuine accessory is used)

Rise Time (When genuine accessory is used)

CO_2 250 ms (Fall Time 200 ms)

N_2O 250ms

O_2 At flow rate of 200 mL/min: 500 ms (15% to 21%) , 700 ms (21% to 60%)

At flow rate of 120 mL/min: 600 ms (15% to 21%) , 800 ms (21% to 60%)

Halothane, Isoflurane, Sevoflurane, Desflurane, Enflurane 300 ms

Enflurane 350ms

DRYLINE Water Trap
Emptying interval (half full, worst case)
Adult/Child: 17 hours @ 200 mL/min, 37°C, 100% RH
Neonate: 20 hours @ 120 mL/min, 37°C, 100% RH

Spirometry Function Assessment MG-120

AWP [cmH_2O]

Measurement Range: -20 cm to 100 cmH_2O (Adult, Child*)

Accuracy: ±1 cmH_2O (Adult, Child*)

AWF (both direct.) [L/min]

Measurement Range: 1.5 L/min to 100 L/min (Adult) , 0.25 L/m to 25 L/min (Child*)

Tidal Volume (insp. and exp.) [ml]

Measurement Range: 150 m to 2000 m (Adult) , 15 m to 300 m (Child*)

Accuracy: ±6% or 30 mL, whichever is greater (Adult),
±6% or 4 mL, whichever is greater (Child*)

Minute Ventilation Volume (insp. and exp.) [L/min]

Measurement Range: 2 L/min to 20 L/min (Adult) , 0.5 L/min to 5 L/min (Child*)

Compliance [mL/cmH_2O]

Measurement Range: 4 m/cmH_2O to 100 m/cmH_2O (Adult) , 1 m/cmH_2O to 100 m/cmH_2O (Child*)

Airway Resistance [cmH_2O/l/s]

Measurement Range: 0 cmH_2O to 40 cmH_2O/L/s (Adult, Child*)

Airway Pressure [cmH_2O]

Peak
Plateau
PEEP
Mean
Measurement Range: -20 cm to 100 cmH_2O (Adult, Child*)

I:E Ratio

Measurement Range: 1:4.5 to 2:1

Conditions of Use for Stated Accuracy

Measurement Range (RR): 4 bpm to 35 bpm (Adult), 4 bpm to 50 bpm (Child*)

Measurement Range (I:E Ratio): 1:4.5 to 2:1

Measurement Range (Tube Length): 5.5 mm to 10 mm (Adult), 3 mm to 6 mm (Child*)

*Including neonates

Recording (Recorder Unit)

Printing Speed	50 mm/s, 25 mm/s (Error: within ±5%)
Resolution	Head Direction: 8 dots/mm Feed Direction: 40 lines/mm (at printing speed of 25mm/s)
Printing Waveforms	3 waveforms
Printing Type	Waveform, List, Graphic
Detection	Paper out, printhead temperature
Protective Circuit	Provided

Telemeter

Modulation Mode	F1D
Frequency	608 MHz to 614 MHz
Oscillation Method	PLL synthesizer method by crystal control
Channel Spacing	12.5 kHz
Occupied Frequency Bandwidth	Within 8.5 kHz
Frequency Deviation	Within ±2.5 ppm
Adjacent Channel Power Ratio	-40 dBc and below
RF Output Power	Within 2 dBm ±3.5 dB
Transmission Antenna	Printed Antenna, Gain -6.1 dBi or below

Analog Waveform Output

Output Voltage	ECG Output 1 V/mV (fixed), BP Output 1 V/100 mmHg (fixed)
Output Voltage Accuracy	within ±10% (Both ECG and BP output)
Analog Output Frequency Range	ECG Output: 0.5 Hz to 40 Hz
	BP Output: DC to 40 Hz
Delay Time	35 ms and below (ECG waveform) 35 ms and below (BP waveform: when 40 Hz is set for waveform filter)
Output Impedance	100Ω±10%
Load Impedance	1kΩ to ∞
Pacemaker Pulse	No

QRS Synchronization Output

Output Waveform	Square Wave (Positive/negative logic can be selected.)
Output Voltage	+4.3 V to +5.0 V (High Level) +0.3 V and below (Low Level)
Synchronized Signal Width	100 ms/ 60 ms / 20 ms (Selectable)
Delay Time	35 ms and below (when the "Filter" setting is [Monitor] or [Diag.])
Output Impedance	Open Collector Output (with +5 V 500Ω pull-up resistor)

NOTE

- The delay time of analog waveform output and QRS synchronization output depends on the filter setting and the input waveform type. For details, refer to your nearest service representative.
- The QRS synchronized signal is not intended to be used as synchronized signal for defibrillator. When using the QRS synchronized signal, refer to your nearest service representative.

Measurement Unit for Each Parameter

The measurement units of the displayed numeric data for this device are as follows.

Description	Parameter	Display	Unit	Default Unit
HR/PR Value	ECG	HR	bpm (beats per minute)	
	Blood Pressure	PR_IBP	bpm	
	SpO_2	PR_SpO_2	bpm	
ST Level	ECG	ST	mm, mv	mm
VPC	ECG	VPC	beat/minute	
		PACE	beat/minute	
Respiration Rate	Impedance	RR_IMP	Bpm (breaths per minute)	
	Ventilator	RR_VENT	Bpm	
	CO_2	RR_GAS	Bpm	
	SpO_2	RR_SpO_2	Bpm	
Apnea Duration	Impedance	APNEA	s (second)	
	CO_2	Apnea	s (second)	
	Ventilator	APNEA	s (second)	

Description	Parameter	Display	Unit	Default Unit
Blood Pressure	Blood Pressure	BP	mmHg, kPa cmH $_2$O (CVP only)	mmHg
Non-Invasive Blood Pressure	Non-Invasive Blood Pressure	NIBP	mmHg, kPa	mmHg
Arterial Oxygen Saturation	SpO_2	SpO_2	%	
Perfusion Index	Perfusion Index	PI	%	
	Pleth Variability Index	PVI	%	
Carboxyhemoglobin Concentration	SpCO	SpCO	%	
Methemoglobin Concentration	SpMet	SpMet	%	
Total Hemoglobin	SpHb	SpHb	g/dL	
Arterial Oxygen Content	SpOC	SpOC	mL/dL	
Temperature	Temperature	TEMP	Celcius	
End Tidal CO_2 Concentration	CO_2	$EtCO_2$	mmHg, kPa, %	mmHg
Inspiratory CO_2 Concentration	CO_2	$InspCO_2$	mmHg, kPa, %	mmHg
CO	CO	CO	L/minute	
Blood Temperature	Blood Temperature	Tb	Celcius	
Injectate Temperature	Injectate Temperature	Ti	Celcius	
Airway Flow	Airway Flow	AWF	L/minute	
Airway Pressure	Airway Pressure	AWP	cmH_2O	
Ventilatory Volume	Ventilatory Volume	AWV	mL	
Tidal Volume	Expiratory Tidal Volume	E-TV	mL	
	Inspiratory Tidal Volume	I-TV	mL	
	Ventilatory Volume per second	TV/1Sec	%	
Minute Ventilation Volume	Minute Ventilation Volume	MV	L/minute	
	Spontaneous Minute Volume	SMV	L/minute	
Compliance	Compliance	COMP	mL/cmH_2O	
Airway Resistance	Expiratory Resistance	E-RES	cmH_2O/L/sec	
	Inspiratory Resistance	I-RES	cmH_2O/L/sec	
Airway Pressure	Mean Airway Pressure	MEAN	cmH_2O	
	Peak Airway Pressure	PEAK	cmH_2O	
	Pause Airway Pressure	PAUSE	cmH_2O	
	Plateau Pressure	PLATEAU	cmH_2O	
Peak End Expiratory Pressure	Peak End Expiratory Pressure	PEEP	cmH_2O	
Fraction of Inspiratory Oxygen	Fraction of Inspiratory Oxygen	FIO_2	%	

Description	Parameter	Display	Unit	Default
Vigilance Data Vigilance Vigilance CEDV Vigilance II Vigileo	Mixed Venous Oxygen Saturation	SvO_2	%	
	Central Venous Oxygen Saturation	$ScvO_2$	%	
	Arterial Oxygen Saturation	SaO_2	%	
	Oxygen Uptake Index	O_2EI	%	
	Oxygen Transport	DO_2	mL/minute	
	Oxygen Consumption	VO_2	mL/minute	
	Stroke Volume	SV	mL/beat	
	Stroke Volume (STAT Mode)	SV_STAT	mL	
	Stroke Volume Index	SVI	mL/m^2	
	Stroke Volume Index (STAT Mode)	SVI_STAT	mL/m^2	
	HR	HR	bpm (beats per minute)	
	Mean Arterial Pressure	MAP	mmHg	
	Central Venous Pressure	CVP	mmHg	
	Continuous Cardiac Output	CCO	L/minute	
	Continuous Cardiac Output (STAT Mode)	CCO_STAT	L/minute	
	Continuous Cardiac Index	CCI	$L/minute/m^2$	
	Continuous Cardiac Index (STAT Mode)	CCI_STAT	$L/minute/m^2$	
	Systemic Vascular Resistance	SVR	$dyn\text{-}sec\text{-}cm^{-5}$	
	Systemic Vascular Resistance Index	SVRI	$(dyn\text{-}sec\text{-}cm^{-5}\text{-}m^2)$	
	Blood Temperature	BT	°C, °F	°C
	Ejection Fraction	RVEF	%	
	Ejection Fraction (STAT Mode)	RVEF_STAT	%	
	End-Diastolic Volume	EDV	mL	
	End-Diastolic Volume (STAT Mode)	EDV_STAT	mL	
	End-Diastolic Volume Index	EDVI	mL/m^2	
	End-Diastolic Volume Index (STAT Mode)	EDVI_STAT	mL/m^2	
	End-Systolic Volume	ESV	mL	
	End-Systolic Volume Index	ESVI	mL/m^2	
	Stroke Volume Variance	SVV	%	

Description	Parameter	Display	Unit	Default
Multigas Module	End-tidal Carbon Dioxide	CO_2-E	mmHg, kPa, %	mmHg
	Inspired Carbon Dioxide	CO_2-I	mmHg, kPa, %	mmHg
	End Tidal Oxygen	O_2-E	%	
	Fraction of Inspiratory Oxygen	O_2-I	%	
	Expired Nitrous Oxide	N_2O-E	%	
	Inspired Nitrous Oxide	N_2O-I	%	
	End Tidal Anesthetic Gas	AGT-E	%	
	Inspired Anesthetic Gas	AGT-I	%	

Description	Parameter	Display	Unit	Default
BIS Data	Bispectral Index	BIS	(no unit)	
	Signal Quality Index	SQI	%	
	Electromyograph	EMG	dB	
	Suppression Ratio	SR	%	
	Spectral Edge Frequency	SEF	Hz	
	Total Power	TOTPOW	dB	
	Impedance	IMP	Kohms	
INVOS 5100C Monitor Data	Regional Cerebral Oxygen Saturation (Left)	Lt-rSO_2	%	
	Regional Cerebral Oxygen Saturation (Right)	Rt-rSO_2	%	

Description	Parameter	Display	Unit	Default
PiCCO Data	Pulse Contour Cardiac Output	CCO	L/min	
	Pulse Contour Cardiac Output Index	CCI	L/min/m^2	
	Stroke Volume	SV	mL	
	Stroke Volume Index	SVI	mL/m^2	
	Stroke Volume Index	SVV	%	
	Systemic Vascular Resistance	SVR	dyn x s x cm^{-5}	
	Systemic Vascular Resistance Index	SVRI	dyn x s x cm^{-5} x m^2	
	Central Venous Oxygen Saturation	$ScvO_2$	%	
	Oxygen Delivery	DO_2	ml/min	
	Oxygen Consumption	VO_2	ml/min	

Description	Parameter	Display	Unit	Default
PulsioFlex Data	Pulse Contour Cardiac Output	CCO	L/minute	
	Pulse Contour Cardiac Output Index	CCI	L/minute/m^2	
	Stroke Volume	SV	mL/beat	
	Stroke Volume Index	SVI	mL/m^2	
	Stroke Volume Variation	SVV	%	
	Systemic Vascular Resistance	SVR	dyn x sec x cm^{-5}	
	Systemic Vascular Resistance Index	SVRI	dyn x sec x cm^{-5} x m^2	
	Central Venous Oxygen Saturation	$ScvO_2$	%	
	Oxygen Delivery	DO_2	mL/minute	
	Oxygen Consumption	VO_2	mL/minute	
	index of Left Ventricular Contractility	dPmx	mmHg/sec	
	Calibrated Cardiac Output	CO CAL	L/min	
	Heart Rate	HR	bpm (beats per minute)	

	Mean Arterial Pressure	MAP	mmHg	
	Global End-Diastolic Volume	GEDV	mL	
	Global End-Diastolic Volume Index	GEDI	mL/m^2	
	Extravascular Lung Water	EVLW	mL	
	Extravascular Lung Water Index	ELWI	mL/kg	
	Pulmonary Vascular Permeability Index	PVPI	---	
	Global Ejection Fraction	GEF	%	
	Cardiac Function Index	CFI	1/min	
	Blood Temperature	BT	°C, °F	°C
	Oxygen Delivery Index	DO_2I	mL O_2/min/m2	
	Oxygen Consumption Index	VO_2I	mL O_2/min/m2	

Description	Parameter	Display	Unit	Default
TCM4, TCM5 FLEX Data	Transcutaneous Oxygen Partial Pressure	$tcpO_2$	mmHg, kPa	*
	Transcutaneous Carbon Dioxide Partial Pressure	$tcpCO_2$	mmHg, kPa	*

*: The measurement unit of $tcpO_2$, $tcpCO_2$ can be set on the TCM4 or TCM5 FLEX. When the measurement unit is changed, the tabular trend data of $tcpO_2$ and $tcpCO_2$ on the bedside monitor will be deleted.

Alarm Limit Range for Each Parameter

The alarm can be set in the following range.

Item	Adjustable Range		[Auto] Setting *
	Lower Limit	Upper Limit	
	Adjustable Increments		
HR	20 bpm to 295 bpm	22 bpm to 300 bpm	Upper: current value +40 bpm Lower: current value -40 bpm
	25 bpm and below: 1 bpm increments 25 bpm and above: 5 bpm increments		
ST 12-Lead ST	-2.0 mV to +1.8 mV	-1.8 mV to +2.0 mV	Upper: current value +0.2 mV (+2 mm) Lower: current value -0.2 mV (-2 mm)
	0.1 mV increments		
	-20 mm to +18 mm	-18 mm to +20 mm	
	1 mm increments		
Ext Tachy	-	22 bpm to 300 bpm	HR Lower Limit +10 bpm
	50 bpm and below: 1 bpm increments 50 bpm and above: 5 bpm increments		
Ext Brady	20 bpm to 295 bpm	-	HR Lower Limit -10 bpm
	50 bpm and below: 1 bpm increments 50 bpm and above: 5 bpm increments		
RR (Adult)	5 Bpm to 145 Bpm	10 Bpm to 150 Bpm	Upper: current value +20 Bpm Lower: current value –20 Bpm
	5 Bpm increments		
RR (Child/Neonate)	0 Bpm to 148 Bpm	4 Bpm to 150 Bpm	
	2 Bpm increments		

Item	Adjustable Range		[Auto] Setting *
	Lower Limit	Upper Limit	
	Adjustable Increments		
RR_SpO_2 (Adult)	5 Bpm to 30 Bpm	10 Bpm to 35 Bpm	N/A
	5 Bpm increments		
RR_SpO_2 (Child)	6 Bpm to 32 Bpm	8 Bpm to 34 Bpm	
	2 Bpm increments		
Apnea	-	10 sec. to 60 sec.	15 sec.
	1 second increments		
BP1 to 8	0 mmHg to 295 mmHg	2 mmHg to 300 mmHg	When BP label is BP1/ART: Upper: current value +40 mmHg (+5.0 kPa) Lower: current value -20 mmHg (-3.0 kPa) When BP label is other than BP1/ART: Upper: current value +20% Lower: current value -20%
	0 mmHg to 50 mmHg: 2 mmHg increments 50 mmHg and above: 5 mmHg increments		
	0.0 kPa to 39.5 kPa	0.2 kPa to 40.0 kPa	
	0 kPa to 7.0 kPa: 0.2 kPa increments 7.0 kPa and above: 0.5 kPa increments		
CVP	0.0 cmH_2O to 38 cmH_2O	2 cmH_2O to 40 cmH_2O	
	1 cmH_2O increments		
NIBP	10 mmHg to 295 mmHg	15 mmHg to 300 mmHg	Upper: current value +40 mmHg (+5.0 kPa) Lower: current value -20 mmHg (-3.0 kPa)
	5 mmHg increments		
	1.5 kPa to 39.5 kPa	2.0 kPa to 40.0 kPa	
	0.5 kPa increments		
SpO_2	50%SpO_2 to 99%SpO_2	51%SpO_2 to 100%SpO_2	Upper: OFF Lower: 90%SpO_2
	1%SpO_2 increments		
Ext SpO_2	50%SpO_2 to 98%SpO_2	-	Upper: OFF Lower: 90%SpO_2
	1%SpO_2 increments		
$EtCO_2$	1 mmHg to 98 mmHg	3 mmHg to 100 mmHg	Upper: current value +10 mmHg (+1.3 kPa / +1.3%) Lower: current value -10 mmHg (-1.3 kPa / -1.3%)
	1 mmHg increments		
	0.1 kPa to 13.1 kPa	0.3 kPa to 15.0 kPa	
	0.1 kPa increments		
	0.1% to 13.1%	0.3% to 15.0%	
	0.1% increments		
$InspCO_2$	-	1 mmHg to 4 mmHg	3 mmHg (0.3 kPa / 0.3%)
	1 mmHg increments		
	-	0.1 kPa to 3.0 kPa	
	0.1 kPa increments		
	-	0.1% to 3.0%	
	0.1% increments		
TEMP	30.0°C to 44.0°C	31.0°C to 45.0°C	Upper: current value +2.0°C (+4.0°F) Lower: current value -2.0°C (-4.0°F)
	0.5°C increments		
	86.0°F to 111.0°F	88.0°F to 113.0°F	
	1.0°F increments		
SpCO	-	1%SpCO to 40%SpCO	N/A
	1%SpCO increments		
SpMet	-	1%SpMet to 15%SpMet	N/A
	1%SpMet increments		

Item	Adjustable Range		[Auto] Setting *
	Lower Limit	Upper Limit	
	Adjustable Increments		
SpHb	1.0 g/dL to 24.0 g/dL	2.0 g/dL to 24.5g/dL	N/A
	0.1 g/dL increments		
BIS	1 to 98	2 to 99	N/A
	increments of 1		

*: If the value exceeds the adjustable range, the limit within the range will be set.

The automatic setup will not be performed for the turned OFF limit.

About the SpO_2 Clinical Test

❑Medtronic Unit

The SpO_2 and pulse rate measurement accuracy have been validated for each range by testing on healthy adult male and female volunteers against a laboratory CO-Oximeter.

The SpO_2 accuracy has been validated for the range from 70% to 100% by testing on healthy adult male and female volunteers (age: 19 to 48 years old) with light to dark skin pigmentation. The standard deviation is ±2% which encompasses 68% of the population.

The pulse rate accuracy has been validated for the range from 70% to 100% by testing on healthy adult male and female volunteers (age: 19 to 48 years old) with light to dark skin pigmentation The standard deviation is ±3 bpm which encompasses 68% of the population.

These clinical test data are disclosed based on the data provided from Medtronic.

❑Masimo Unit

The SpO_2, SpCO, SpMet, and pulse rate measurement accuracy have been validated for each range by testing on healthy adult male and female volunteers against a laboratory CO-Oximeter.

SpO_2 and SpMet accuracy have been validated by testing on 16 neonatal NICU patients ranging in age from 7 days to 135 days old and weighing between 0.5 kg to 4.25 kg. Seventy-nine (79) data samples were collected over a range of 70% to 100% SpO_2 and 0.5% to 2.5% HbMet with a resultant accuracy of 2.9% SpO_2 and 0.9% SpMet.

The SpO_2 accuracy has been validated for the range from 70% to 100% by testing on healthy adult male and female volunteers (age: 21 to 36 years old) with light to dark skin pigmentation. Without body motion, the standard deviation is ±2% which encompasses 68% of the population. With body motion, the standard deviation is ±3% which encompasses 68% of the population. For the validation, frictional or contact motion of 1 cm to 2 cm, and random vibration of 1 Hz to 5 Hz were tested.

The pulse rate accuracy has been validated for the range from 70% to 100% by testing on healthy adult male and female volunteers (age: 24 to 37 years old) with light to dark skin pigmentation The standard deviation is ±3 bpm which encompasses 68% of the population.

The SpCO accuracy has been validated for the range from 0% to 40% by testing on healthy adult male and female volunteers with light to dark skin pigmentation. The standard deviation is ±3% which encompasses 68% of the population.

The SpMet accuracy has been validated for the range from 0% to 15% by testing on healthy adult male and female volunteers with light to dark skin pigmentation. The standard deviation is ±1% which encompasses 68% of the population.

The SpHb accuracy has been validated for the range from 8 g/dL to 17 g/dL by testing on healthy adult male and female volunteers with light to dark skin pigmentation. The standard deviation is ±1 g/dL which encompasses 68% of the population.

These clinical test data are disclosed based on the data provided from Masimo.

FUKUDA DENSHI CO.,LTD.

3-39-4 Hongo, Bunkyo-ku, Tokyo, Japan
Tel: +81-3-5684-1455 Fax: +81-3-3814-1222
https://fukuda.com/

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