

OPERATOR'S MANUAL

Veterinary Patient Monitor VPM-25

Distributes by:

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Revised Date: 2025-05

Part Number-Revision: A7916-0

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- The manual will be replaced if any pages are missing or collation is incorrect.

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- Please contact your local distributor about the warranty period.
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 - Damage sustained to the Covetrus product(s) caused by product(s) from another company excluding products delivered by Covetrus.
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 - Device modifications or use of accessories not recommended by Covetrus.
 - Damage caused by accidents or natural disasters (earthquakes, flooding, etc.).
 - Damage resulting from usage where caution statements and operating instructions shown in this manual have not been followed.
 - Damage due to neglect of specified maintenance checks.
- This warranty only covers the hardware of the VPM-25. The warranty does not cover the following selections:
 - Whatever damage or loss results from the attachment of accessories or their operation.
 - In the event of a defect in the product, contact our sales outlet or EU representative as noted on the back cover.
- The VPM-25 conforms to the EMC standard IEC60601-1-2.

Note: Mobile phones should not be used in the vicinity of the VPM-25.

Note: Any device not complying with the EMC standard that is used with the VPM-25 renders the VPM-25 as non-compliant to the EMC standard.

Trademark & Patent

Product brand names shown in this manual are likely to be the trademark, the registered trademark or the patent of the company concerned.

This monitor is equipped with epoch-making ECG monitoring function incorporating the cutting edge software for analysis of electrocardiograms developed by the University of Glasgow in UK, which includes signal processing, diagnostic interpretation of electrocardiograms from individuals of all ages and analysis of cardiac rhythm.



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SAFETY INFORMATION

General Safety Information

This section contains important safety information related to general use of the VPM-25 multi-parameter Veterinary Patient Monitor. Other important safety information appears throughout the manual. The VPM-25 will be referred to as the monitor throughout this manual.

Important! Before use, carefully read this manual, accessory directions for use, all precautionary information and specifications.

Warning

Warnings alert you to potential serious outcomes (death, injury, or adverse events) to the patient or user.

 WARNING	Do not take into or use the monitor in locations where highly combustible anesthetics or flammable gases are used or in high-pressure oxygen rooms or inside oxygen tents, as this may cause a flammable explosion.
 WARNING	When using the monitor with a commercial electric power source, use the monitor with an electric power wall socket with a grounding wire for medical use. Not doing so could cause electric shock.
 WARNING	Do not connect grounding wire to gas pipes. This could cause fire.
 WARNING	This monitor is intended for use by trained and qualified veterinary personnel only.
 WARNING	This monitor cannot be used when MRI is in progress. If MRI is in use, keep patient attachments away from patients to prevent accidents.
 WARNING	The monitor conforms to the requirements of the EMC standard (IEC60601-1-2), and may therefore be used simultaneously with pacemakers and other electrical simulators. It should, however, be noted that the VPM-25 may be affected by electrical scalpels and microwave therapeutic apparatus. Please check operation of the monitor during and after use of such equipment.
 WARNING	Do not take mobile phones or transceivers into a room where this monitor is installed, as such devices may cause accidents.
 WARNING	In order to avoid accidents, do not use any unauthorized accessories or options, and do not use a sensor if its cable is damaged.
 WARNING	Thoroughly read the instruction manuals supplied with accessories and options to ensure correct use. This instruction manual does not carry the caution selections for such equipment.
 WARNING	Do not open cover or disassemble this monitor. Doing so could cause electric shock or fire. It is prohibited by law to modify the monitor without authorization.
 WARNING	Do not use power source other than the specified voltage, (100-240V~50/60Hz) as this may cause fire or electric shock.
 WARNING	Pre-use inspection and preventive maintenance must be performed for safe use.
 WARNING	The monitor may be used with electrical surgical equipment. Follow the instruction manuals for medical instruments – notably electrosurgical and diathermy instruments – when used, as their high-frequency energy units may cause burns to patients via attachments.

⚠ WARNING	This monitor is protected against the discharge of a defibrillator. However, do not touch the monitor when a defibrillator is being discharged (electrified), as doing so may cause electric shock.
⚠ WARNING	The following cautions apply when connecting the monitor with other equipment. 1. Ensure that the connected equipment is in accordance with the IEC60601-1 or IEC safety standards, so that the system complies with IEC60601-1. 2. Employ additional protective measures (e.g. additional protective earthing) as necessary.
⚠ WARNING	Do not connect devices that do not meet medical safety standards (such as commercial PCs), as they may cause electric shock. This monitor meets the restricted level of leakage current required for medical devices. Therefore, this monitor cannot be connected to a device that would give a combined total of leakage current beyond the restricted level.
⚠ WARNING	Do not place anything on top of this monitor. If something is spilled over the monitor or gets into it, such spillage may cause fire or electric shock. If fluid spills on the monitor accidentally, disconnect power cord, wipe dry immediately, and have the monitor serviced to make sure that no hazard exists.
⚠ WARNING	Do not place heavy objects on the power cord, as doing so may cause fire or electric shock.
⚠ WARNING	Before conducting maintenance work, turn the power OFF and unplug the power cord from the wall socket to prevent electric shock.
⚠ WARNING	When the following occur, turn the power OFF immediately and unplug the power cord from the wall socket. Continued use in such situations may cause fire or electric shock. • There is smoke or a strange odor leaking out of the device. • The device has been dropped or impacted by an object. • Liquid or foreign matter gets inside the device. • Device failure has occurred. Also, when any of the above occurs, promptly do the following: 1. Check to see that the power cord has been unplugged from the wall socket. 2. Place an “Out of Order” sign on the device and do not use it.
⚠ WARNING	If the case appears damaged, do not use it.
⚠ WARNING	Do not connect more than one patient to the monitor. Do not connect more than one monitor to a patient.
⚠ WARNING	The patient monitor is a prescription device and is to be operated by qualified personnel only.
⚠ WARNING	As with any medical equipment, carefully route patient cabling to reduce the possibility of patient entanglement or strangulation.
⚠ WARNING	Never lift the monitor by the sensor cable, blood pressure hose, power cord, or any other accessory. Such accessories could detach, causing the monitor to fall on the patient.
⚠ WARNING	Do not position the monitor so it is difficult to operate the disconnection device when a separable plug is used as isolation.
⚠ WARNING	Do not touch signal input, signal output or other connectors and the patient simultaneously.
⚠ WARNING	The monitor may remain attached to the patient during defibrillation or during use of an electrosurgical unit; however, the monitor is defibrillator-proof, and readings may be inaccurate during defibrillation and shortly thereafter.
⚠ WARNING	Do not cover the vent holes to not to generate heat matter.

⚠ WARNING	Do not cover the speaker.
⚠ WARNING	Keep the monitor out of reach of babies and children to avoid any accidents.
⚠ WARNING	The monitor might be damaged due to improper grounding of electrosurgical equipment when the monitor is used with an electrosurgical equipment.
⚠ WARNING	In order to avoid accidents, do not use the device, leadwire or probe if its cables, device, or connectors are damaged.
⚠ WARNING	If find signs of unintentional equipment changes or attacks from outside, please contact qualified service personnel or your local supplier.
⚠ WARNING	Do not make any clinical judgments based on this monitor's measurements only.

Cautions

Caution statements identify conditions or practices that could result in damage to the equipment or other property.

⚠ CAUTION	This monitor is for veterinary use only, NOT for use on humans.
⚠ CAUTION	Federal law restricts this device to sale by or on the order of a physician.
⚠ CAUTION	The monitor may not operate properly if it is operated or stored at conditions outside the ranges stated in this manual, or subjected to excessive shock or dropping.
⚠ CAUTION	When connecting the patient monitor to any instrument, verify proper operation before clinical use. Both the monitor and the instrument connected to it must be connected to a grounded outlet.
⚠ CAUTION	Accessory equipment connected to the monitor's data interface must be certified according to IEC60950 for data-processing equipment or IEC60601-1 for electromedical equipment. All combinations of equipment must be in compliance with IEC60601-1 system requirements. Anyone who connects additional equipment to the signal input or signal output port configures a medical system and is therefore responsible that the system complies with the requirements of IEC60601-1 and the electromagnetic compatibility system standard IEC60601-1-2. If in doubt, consult Covetrus Technical Support Representative.
⚠ CAUTION	Risk of explosion if battery is replaced by an incorrect type.
⚠ CAUTION	Where the integrity of the external protective conductor in the installation or its arrangement is in doubt, equipment shall be operated from its internal electrical power source.
⚠ CAUTION	Keep the monitor out of reach of babies and children to avoid any accidents.
⚠ CAUTION	Do not rely entirely on the monitor readings for patient clinical assessment.
⚠ CAUTION	Patients' physiological conditions or some medical procedure could interfere with the monitor's measurements.
⚠ CAUTION	Pulling the cable could cause the disconnection of the cable from the monitor and can cause the error for the measurement.
⚠ CAUTION	Before accepting any displayed data as a current measurement, display motion shall be looked for.
⚠ CAUTION	If each key control or touch screen control results in some audible tone and that invalid key controls or touch screen controls are ignored, contact qualified service personnel or your local supplier for assistance.
⚠ CAUTION	The battery may be depleted due to self-discharge for a long storage. Recharge the battery when the device is initially installed.
⚠ CAUTION	The partial charge of a battery results in a shortened battery life.
⚠ CAUTION	The nurse call feature is not functional whenever the monitor alarms are paused.
⚠ CAUTION	The nurse call function needs to be tested after it has been set up in your facility. The nurse call feature should be tested whenever setting up the monitor in a location that uses nurse call. One way to test the nurse call function is to create an alarm condition (for example, sensor disconnect) and verify that your facility's nurse call system is activated.
⚠ CAUTION	Electromagnetic interference – This product is designed and built to minimize electromagnetic interference with other devices. However, if interference is noticed between another device and this monitor: - Remove interfering device from room.

	- Plug monitor into an isolated circuit. - Increase separation between monitor and interfering device. - Contact service personnel if interference persists.
 CAUTION	Before disposing of equipment, delete the data in order to prevent personal information from being leaked.

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INTRODUCTION

 WARNING

Patient conditions may result in erroneous readings. If the measurements are suspect, verify the reading using another clinically accepted measurement method.

Intended Use for the VPM-25

The monitor is intended to be used to monitor electrocardiography (ECG), heart rate (HR), noninvasive blood pressure (NIBP) - systolic, diastolic and mean arterial pressures, functional arterial oxygen saturation (SpO₂), pulse rate (PR), respiration rate (RR), capnography (EtCO₂ and InCO₂) and temperature (TEMP) for veterinary patients ranging from cats to horses in special procedure labs and other areas of a veterinary hospital or clinic where Veterinary Patient Monitoring systems are needed. This monitor is intended for use by trained and qualified veterinary personnel only. The VPM-25 is suitable for continuous operation.

Note: The medically skilled and trained user can be clinicians like doctors and nurses who know how to take and interpret a patient's vital signs. These clinicians must take direct responsibility for the patient's life. This can include care-givers or medically trained interpreters who are authorized under the appropriate clinical facility procedures to support patient care. Any inappropriate setting, especially the alarm limit or alarm notification settings, can lead to a hazardous situation that injures the patient, harms the patient, or threatens the patient's life. This equipment should only be operated by trained users who can adjust the settings of the Veterinary Patient Monitor.

Indications For Use

	Indications	Contraindications
Electrocardiography	The electrocardiography is used to monitor electrocardiography waveform and pulse rate.	No known contraindications
Non-invasive Blood Pressure	Noninvasive blood pressure monitoring is intended for detection of hypertension or hypotension and monitoring BP trends in patient conditions.	Noninvasive blood pressure is not intended for use with severe arrhythmia. Noninvasive Blood Pressure is not intended for patients who are experiencing convulsion or tremors.
Pulse Oximetry	Pulse oximetry monitoring is intended to be used to monitor functional arterial oxygen saturation and pulse rate.	Pulse oximetry is not intended for use with severe peripheral vascular disease and severe anemia (decreased Hemoglobin).
End-Tidal CO ₂	EtCO ₂ monitoring is indicated for detection of trends in the level of expired CO ₂ . It is used for monitoring breathing efficacy and treatment effectiveness in acute cardiopulmonary care.	No known contraindications
Temperature	Temperature monitoring is indicated for use in patients who require continuous monitoring of body temperature.	No known contraindications
Respiration	Respiration monitoring is intended to be used to monitor respiration rate.	No known contraindications

About This Manual

This manual explains how to set up and use the VPM-25 monitor.

Read the entire manual including the *Safety Information* section, before you operate the monitor.

Identifying the VPM-25 Configurations

The following table identifies VPM-25 configurations and how they are indicated. The reference number and serial number are located on the bottom of the monitor.

All information in this manual, including the illustrations, is based on the monitor configured with ECG, NIBP (Suntech), SpO₂, Temperature, Capnography (EtCO₂ and InCO₂), Battery, Printer, Wired communication and Wireless communication. If the relevant functions do not exist, please verify your unit configuration.

Item Code	Description
2802733	Vet patient monitor VPM-25 Standard with EU/UK/ANZ power Cord
2802734	Vet patient monitor VPM-25 with EU/UK/ANZ power Cord + Printer

Features for the VPM-25

Physical

The VPM-25 is a multi-parameter Veterinary Patient Monitor which can be battery-operated when an AC power source is not available.

The monitor for Standard configuration is Veterinary Patient Monitor measuring 261 × 206 × 171 (mm) (W × H × D) and weighting about 3.77 kg.

Electrical

The monitor is powered by an internal battery pack that typically provides 1 hour of monitoring from fully charged new battery. The batteries are continuously recharged when the monitor is connected to AC power source. Refer to the **Battery Operation** section for details.

Display

The monitoring screen is a color LCD that shows all graphic and numeric patient information as well as status conditions and warning messages.

Note: The monitor is functioning as indicated by the display while measurements are being made.

Touch screen

The Touch screen provides user interaction with the display and the monitor functions. Ppressing the Touch screen allows the user to navigate and make changes to the display elements and monitor functions. Refer to the **Using the Monitor** section for details.

Auxiliary Input / Output(s)

The monitor provides USB ports, RJ11 port and HDMI port.

Note: LAN port and Wireless LAN are options and are not available on all monitor. The option may be ordered if needed. Please contact your local supplier for ordering information.

DESCRIPTION OF THE MONITOR

Front Panel Components

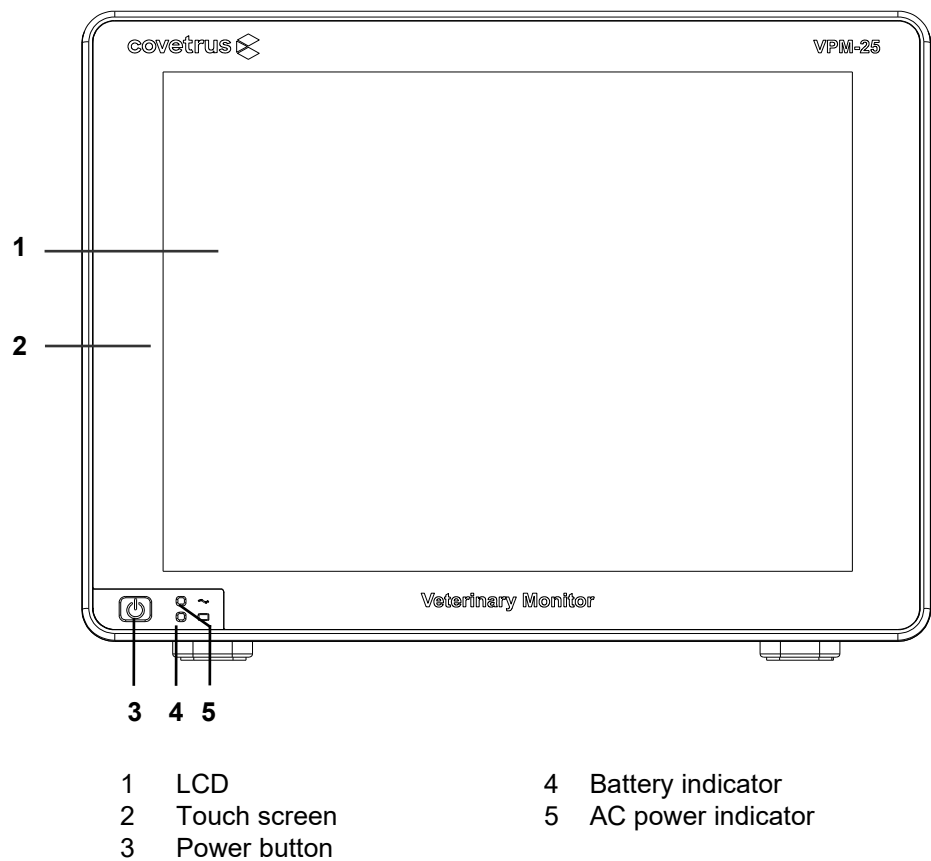
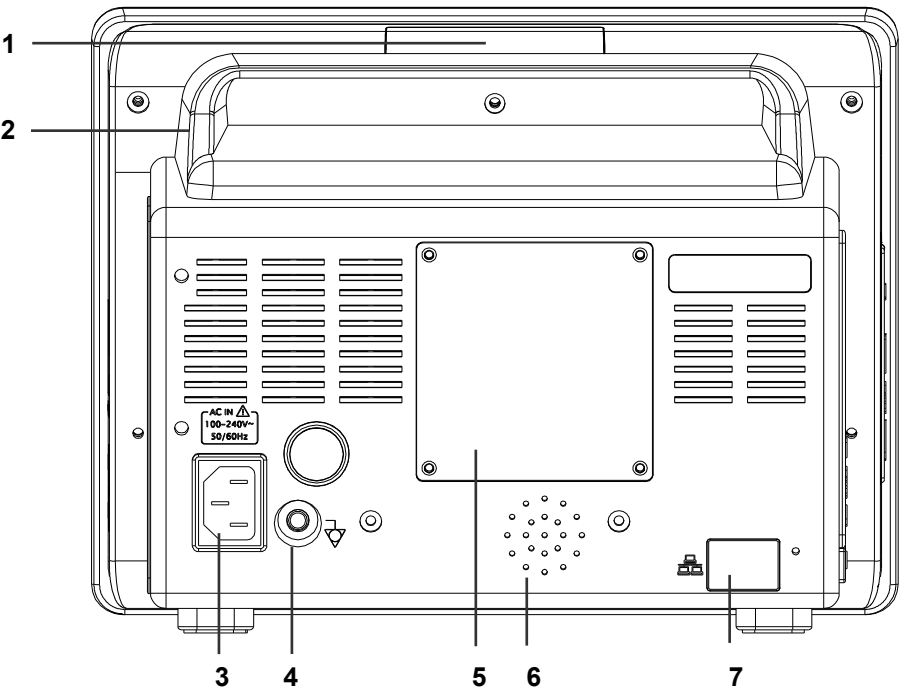


Figure 1. Front Panel Components

Table 1. VPM-25 Controls

Controls	Description
	Power Button turns on the monitor by pressing the Power Button for approximately 1 second. turns off the monitor by pressing the Power Button for approximately 1 second.

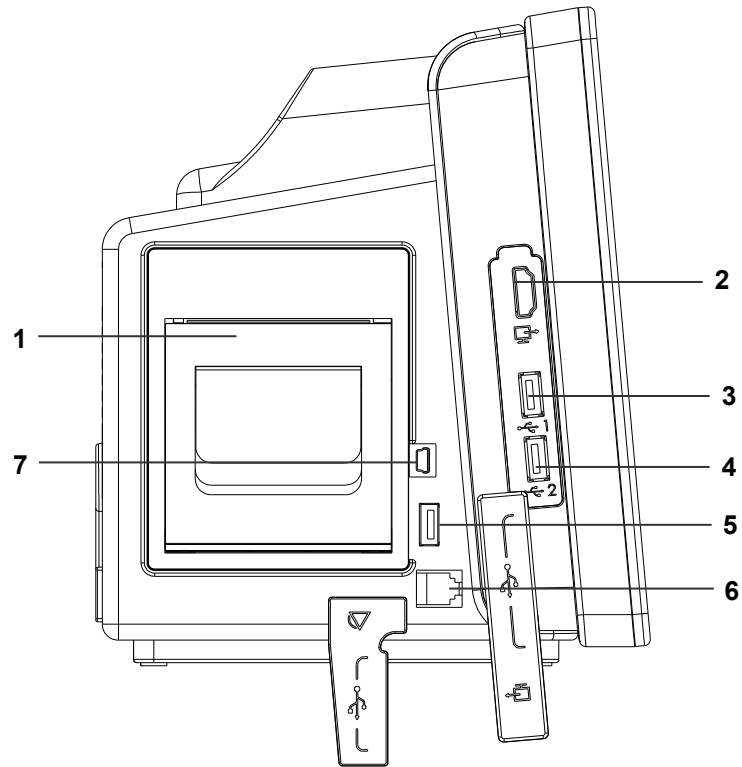
Rear Panel Components



- | | | | |
|---|------------------------|---|---------------|
| 1 | Alarm indicator | 5 | Battery cover |
| 2 | Handle | 6 | Speaker |
| 3 | AC power connector | 7 | LAN port |
| 4 | Equipotential terminal | | |

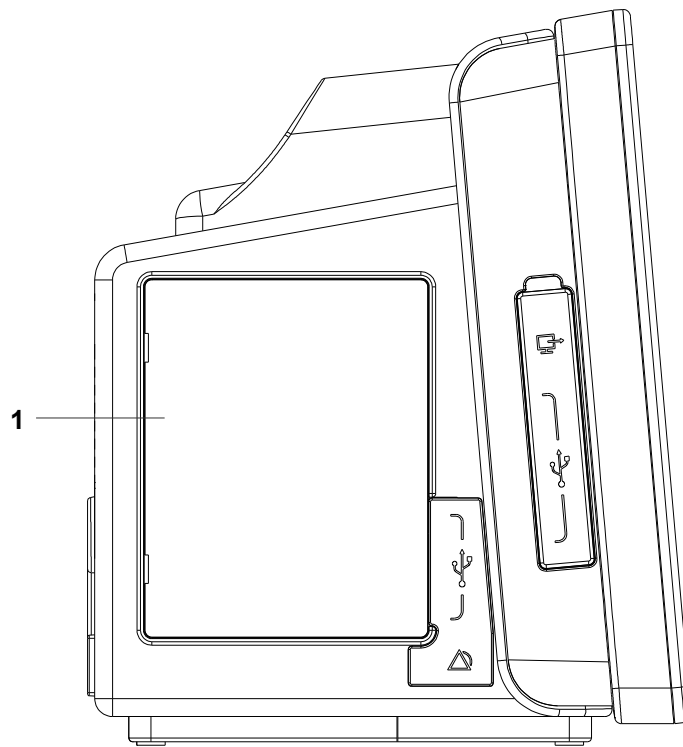
Figure 2. Rear Panel Components

Left Panel Components



- | | | | |
|---|-------------------------|---|---------------------------------------|
| 1 | Printer | 5 | USB 3 port (USB A type) (option) |
| 2 | HDMI port | 6 | Nurse call port (RJ11 type) (option) |
| 3 | USB 1 port (USB A type) | 7 | USB 4 port (Mini USB B type) (option) |
| 4 | USB 2 port (USB A type) | | |

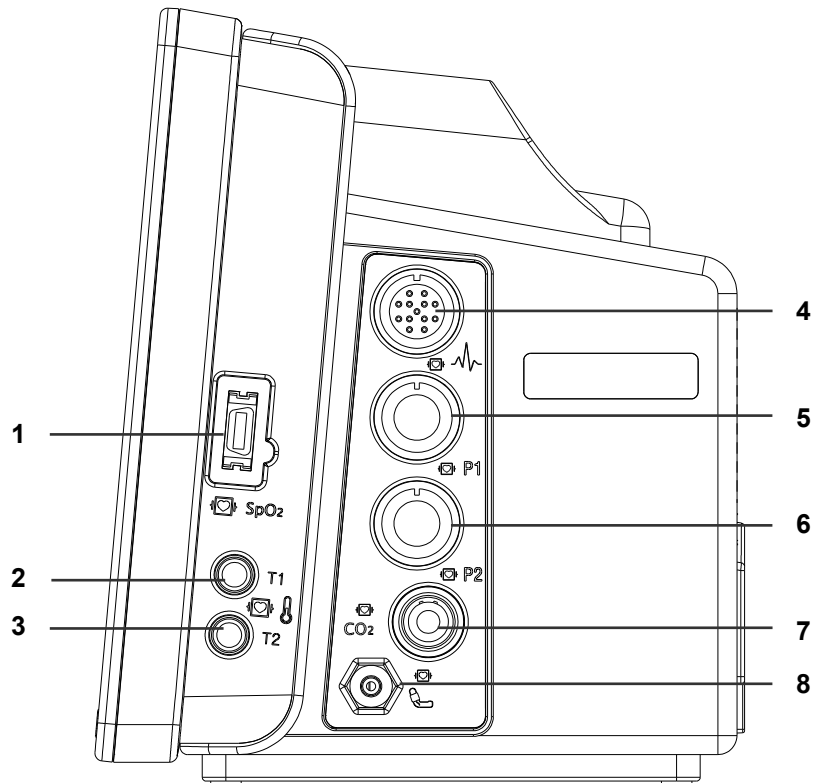
Figure 3. Left Panel Components (Installed the fully-loaded)



1 Printer option cover

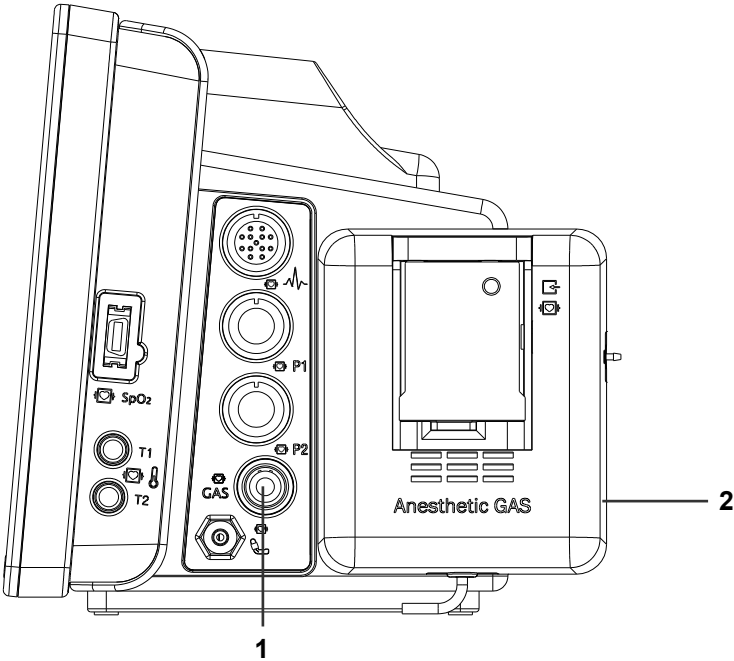
Figure 4. Left Panel Components (Standard)

Right Panel Components



- | | | | |
|---|----------------------------|---|--------------------------------------|
| 1 | SpO ₂ connector | 5 | IBP1 connector (option) |
| 2 | TEMP1 connector | 6 | IBP2 connector (option) |
| 3 | TEMP2 connector | 7 | NIBP connector |
| 4 | ECG connector | 8 | EtCO ₂ connector (option) |

Figure 5. Right Panel Components (Installed the fully-loaded)



- 1 GAS connector (option) 2 Anesthetic GAS(option)

Figure 6. Right Panel Components (Installed the fully-loaded)

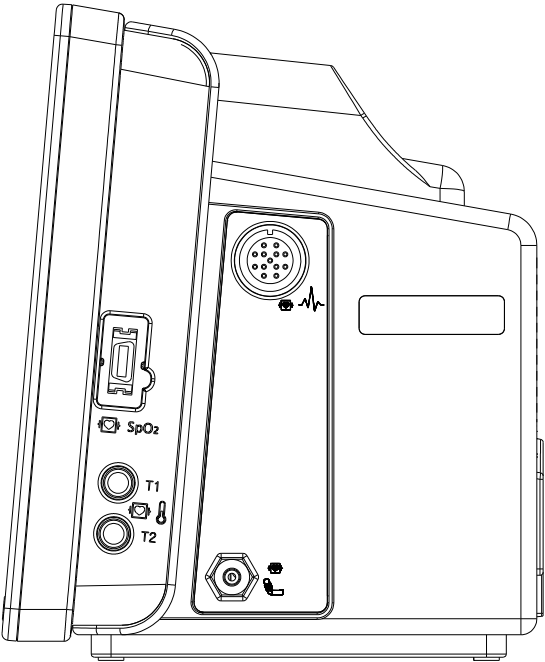
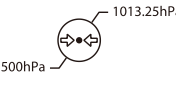
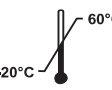
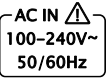
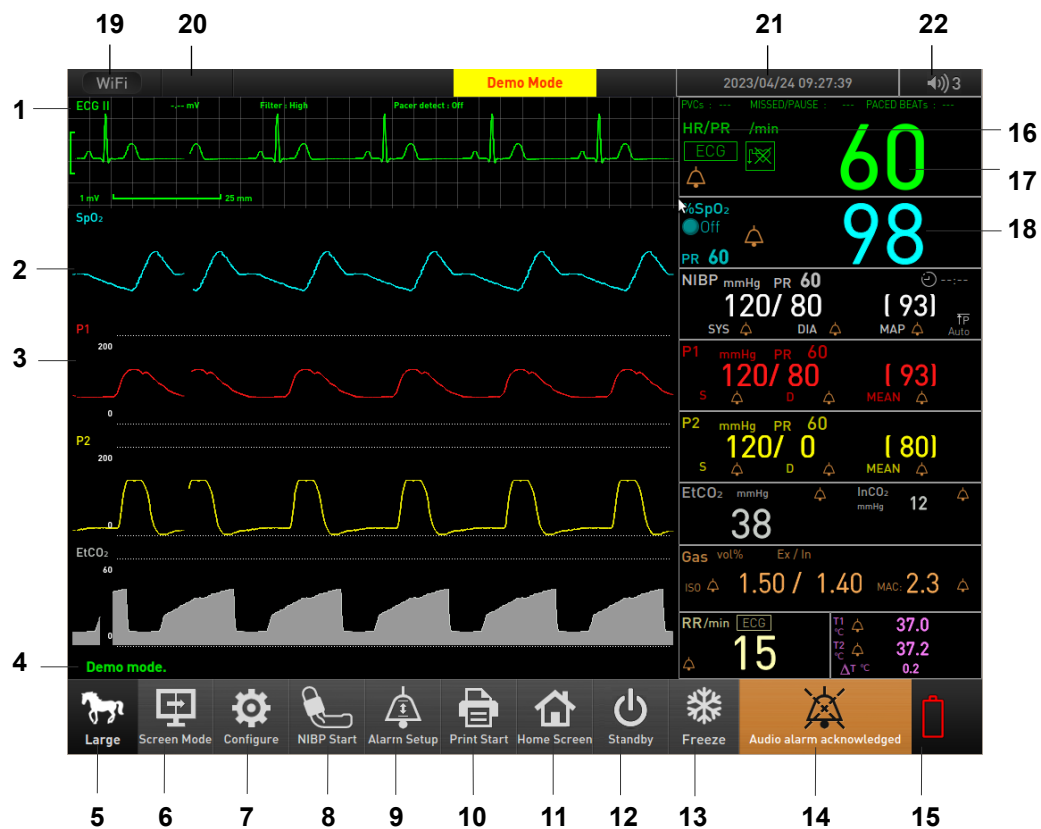


Figure 7. Right Panel Components (Standard)

Table 2. Panel and Label Symbols

Symbols	Description	Symbols	Description
	Battery charging indicator		
	AC indicator	IPX2	Dust and water resistance
	Type CF- Defibrillator proof		Follow instructions for use
	ECG connector		Disposal instructions
T1  T2	Temperature connector		Manufacturer
 SpO2	SpO2 connector		Date of manufacture
	NIBP connector	REF	Reference number
 CO2	EtCO2 connector	SN	Serial number
 GAS	GAS connector		Environmental shipping/storage atmospheric pressure limitations
 P1  P2	IBP connector		Environmental shipping/storage humidity limitations
	HDMI port		Environmental shipping/storage temperature limitations
	USB port		Fragile-handle with care
	LAN port		This way up
	Nurse call port		Keep dry
	Equipotential terminal	UKCA	UKCA mark
 AC IN 100-240V~ 50/60Hz	AC power input rating	CE	CE mark

Displays

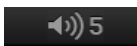


- | | |
|----------------------------------|--------------------------------|
| 1 Title of waveform parameter | 12 Standby button |
| 2 Waveform | 13 Freeze/Defreeze button |
| 3 Waveform area | 14 Audio Alarm Paused button |
| 4 Alarm/Informative message area | 15 Battery status icon |
| 5 Patient mode button | 16 Title of numeric parameter |
| 6 Screen mode change button | 17 Numeric value |
| 7 Setup menu button | 18 Numeric area |
| 8 NIBP Start/Stop button | 19 Communication status |
| 9 Alarm setup menu button | 20 Bed number |
| 10 Print Start/Stop button | 21 Date/Time setup menu button |
| 11 Home screen button | 22 Sound setup menu button |

Figure 8. Displays

Table 3. Display Symbols 1

Symbols	Description	Symbols	Description
ECG	ECG waveform	InCO₂	InCO ₂ (Inspired carbon dioxide concentration) parameter title
II	ECG lead pair	kPa	NIBP, IBP, EtCO ₂ or InCO ₂ unit: kPa
[	ECG size bar	%	SpO ₂ , EtCO ₂ or InCO ₂ unit: %
	ECG reference bar	RR	Respiration parameter title
SpO₂	SpO ₂ waveform		Respiration source: ECG
P1 P2	IBP waveform or parameter title		Respiration source: EtCO ₂
RESP	Impedance respiration waveform	T1 T2	Temperature parameter title
[	RESP 1Ω size bar	°C	Temperature unit: Celsius
EtCO₂	EtCO ₂ (End-tidal carbon dioxide concentration) waveform or parameter title	°F	Temperature unit: Fahrenheit
HR/PR	HR/PR parameter title		Temperature delta T
/min	HR/PR or RR unit		Alarm Active
	HR source: ECG		Audio alarm off
	PR source: SpO ₂		Audio alarm pause
 	PR source: IBP		Audio alarm acknowledged
	PR source: NIBP		Limit alarm audio off
	HR/PR status icon (Pacer on)		No alarm
	HR/PR status icon (Pacer off)		Patient mode: Large
%SpO₂	SpO ₂ parameter title		Patient mode: Medium
PR	PR value of SpO ₂ , NIBP or IBP		Patient mode: Small
NIBP	NIBP parameter title		Screen mode change

Symbols	Description	Symbols	Description
S SYS	Systolic (SYS) pressure of NIBP or IBP		NIBP initial pressure
D DIA	Diastolic (DIA) pressure of NIBP or IBP		Configure menu
MEAN MAP	Mean (MAP) pressure of NIBP or IBP		NIBP start
mmHg	NIBP, IBP, EtCO ₂ or InCO ₂ unit: mmHg		NIBP stop
	NIBP elapsed time		Alarm setup menu
	NIBP interval		Print start
	Battery status		Print stop
	Bed number		Home screen
	Time display		Standby
	Communication status		Freeze/ Defreeze
	Alarm volume		

Note: The user verifies that all symbols and all information on screen can be legible.

Table 4. Display Symbols 2

Parameter	Symbols	Parameter	Symbols
HR/PR	□	EtCO ₂	◇
SpO ₂	x	InCO ₂	◇
NIBP	>— —<	IBP1	┆┆
RESP	+	IBP2	← →
Temperature 1	T	Gas(In)	○
Temperature 2	T	Gas(Ex)	○

Table 5. Display Colors

Function	Color
ECG Waveform	Green 
SpO ₂ Waveform	Cyan 
Respiration Waveform	Delightful Yellow 
EtCO ₂ Waveform	Gray 
ECG	Green 
NIBP	White  / Gray 
IBP1	Red 
IBP2	Yellow 
SpO ₂	Cyan 
Respiration Rate	Delightful Yellow 
EtCO ₂	Gray 
Temperature	Pink 
Gas	Earthly yellow 
General background	Black 
HR/PR graphical trend	Green 
NIBP graphical trend	White 
SpO ₂ graphical trend	Cyan 
RESP graphical trend	Purple 
TEMP graphical trend	Pink 
EtCO ₂ graphical trend	Yellow 
Gas graphical trend	Earthly yellow 
Informative message	Black background, Green font 
Low priority alarm message	Black background, Yellow font 
Medium priority alarm message	Black background, Yellow font 
High priority alarm message	Black background, Red font 
Battery status icon (normal)	Green 
Battery status icon (low battery)	Yellow  or Red  (refer to Table 9)

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SETTING UP THE MONITOR

⚠ WARNING	To ensure accurate performance and prevent device failure, do not expose the monitor to extreme moisture, including direct exposure to rain. Such exposure may cause inaccurate performance or device failure. Refer to <i>Specification</i> section.
⚠ WARNING	The monitor should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, the monitor should be observed to verify normal operation in the configuration it is to be used.
⚠ WARNING	To avoid losing alarm audio, do not cover the holes for the speaker.
⚠ WARNING	Make sure that the monitor speaker is not obstructed. Failure to do so could result in an inaudible alarm tone.
⚠ CAUTION	Recharging the battery is strongly recommended when the battery has not been recharged for 2 or more months.
⚠ CAUTION	Follow local government ordinances and recycling instructions regarding disposal or recycling of device components, including battery.
⚠ CAUTION	If the case appears damaged, do not use the monitor and contact Covetrus Technical Support Representative.

Unpacking and Inspection

The monitor is shipped in one carton. Examine the carton carefully for evidence of damage. Contact Covetrus Technical Support Representative immediately if any damage is discovered. Refer to the **Maintenance** section for instructions on returning damaged items.

*Note: Refer to the **Performance Verification** section in the service manual for detailed information.*

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 1m from the user. Also the viewpoint is at any point within the base of a cone by an angle of 30° to the center of the monitoring display.

If each key control or touch screen control results in some audible tone and that invalid key controls or touch screen controls are ignored, contact qualified service personnel or your local supplier for assistance.

List of Components

The following items are standard in the package.

Table 6. Standard Accessories

Items	Qty
VPM-25 monitor	1 EA
Operator's manual (ENG)	1 EA
AC power cord UK	1 EA
AC power cord EU	1 EA
AC power cord AU	1 EA
ECG 3 lead Wire (EU Snap Type) for VPM-25	1 EA
ECG 3 lead Trunk Cable (EU Snap Type for VPM-25	1 EA
Cuff Hose (3m, Rectus) for VET	1 EA
NIBP Cuff Size 1 (3-6cm) for VET	1 EA
NIBP Cuff Size 2 (4-8cm) for VET	1 EA
NIBP Cuff Size 3 (6-11cm) for VET	1 EA
NIBP Cuff Size 4 (7-13cm) for VET	1 EA
NIBP Cuff Size 5 (8-15cm) for VET	1 EA
Small Cuff (17~25cm) for VET	1 EA
SpO ₂ reusable sensor	1 EA
SpO ₂ extension cable	1 EA
USB Stick	1 EA

Optional items may be ordered if needed. Contact your local supplier for pricing and ordering information.

Table 7. Optional Accessories

Items	Qty
E-Probe 3 lead(Extra Small) for US	-
E-Probe 3 lead(Extra Small) for EU	-
E-Probe 3 lead(Small) for US	-
E-Probe 3 lead(Small) for EU	-
E-Probe 3 lead(Medium) for US	-
E-Probe 3 lead(Medium) for EU	-
ECG 3 lead wire US type for VET	-
ECG 3 lead wire EU type for VET	-
ECG 5 lead wire US type for VET	-
ECG 5 lead wire EU type for VET	-
ECG 3 lead Trunk Cable US type for VET	-
ECG 3 lead Trunk Cable EU type for VET	-
ECG 5 lead Trunk Cable US type for VET	-
ECG 5 lead Trunk Cable EU type for VET	-
ECG 5 lead Cable US type for VET	-
ECG 5 lead Cable EU type for VET	-
ECG 12 lead Cable US type for VET	-
ECG 12 lead Cable EU type for VET	-
ECG 12Lead, Snap, US type	
ECG 12Lead, Snap, EU type	
ECG 12Lead, Grab, US type	
ECG 12Lead, Grab, EU type	
ECG 5Lead, Snap, US type	

Items	Qty
ECG 5Lead, Snap, EU type	
ECG 5Lead, Grab, US type	
ECG 5Lead, Grab, EU type	
ECG 3Lead, Grab, US type	
ECG 3Lead, Grab, EU type	
ECG 3Lead, Snap, US type	
ECG 3Lead, Snap, EU type	
ECG 3Lead Trunk Cable, US type, Nicolay	
ECG 3Lead set, Snap, US type, Nicolay	
ECG 3Lead set, Grab, US type, Nicolay	
ECG 5Lead Trunk Cable, US type, Nicolay	
ECG 5Lead set, Snap, US type, Nicolay	
ECG 5Lead set, Grab, US type, Nicolay	
ECG 12Lead Trunk Cable, US type, Nicolay	
ECG 12Lead set_1, Snap, US type, Nicolay	
ECG 12Lead set_2, Snap, US type, Nicolay	
ECG 12Lead set_1, Grab, US type, Nicolay	
ECG 12Lead set_2, Grab, US type, Nicolay	
ECG 3Lead Trunk Cable, EU type, Nicolay	
ECG 3Lead set, Snap, EU type, Nicolay	
ECG 3Lead set, Grab, EU type, Nicolay	
ECG 5Lead Trunk Cable, EU type, Nicolay	
ECG 5Lead set, Snap, EU type, Nicolay	
ECG 5Lead set, Grab, EU type, Nicolay	
ECG 12Lead Trunk Cable, EU type, Nicolay	
ECG 12Lead set_1, Snap, EU type, Nicolay	
ECG 12Lead set_2, Snap, EU type, Nicolay	
ECG 12Lead set_1, Grab, EU type, Nicolay	
ECG 12Lead set_2, Grab, EU type, Nicolay	
ECG 3Lead, Snap, EU type / OEM-X0025-CP0048	
ECG 3Lead, Grab, EU type / OEM-X0025-CP0054	
ECG 3Lead, Snap, US type / OEM-X0025-CP0055	
ECG 3Lead, Grab, US type / OEM-X0025-CP0056	
Coreray Animal SpO2 sensor/Nell	
Coreray Animal SpO2 sensor/MD1	
SpO2 reusable sensor (WA103)	-
SpO2 reusable sensor (WA107)	-
SpO2 extension cable MEX03	-
SpO2 extension cable C708-69/131050081	-
SpO2 extension cable OEM-X0025-CP0047	-
NIBP Cuff Size 1 (3-6cm) for VET	-
NIBP Cuff Size 2 (4-8cm) for VET	-
NIBP Cuff Size 3 (6-11cm) for VET	-
NIBP Cuff Size 4 (7-13cm) for VET	-
NIBP Cuff Size 5 (8-15cm) for VET	-
Small Cuff (17~25cm) for VET	-
Cuff Hose (3m, Rectus) for VET	-
Temperature probe TRAS-2252 for Adult (400series Skin type)	-
Temperature probe TRAG-2252 for Adult (400series Rectal type)	-
Temperature probe T700-AS for Adult (700series Skin type)	-
EtCO2 CAPNOSTAT5 Main Stream sensor (Respironics module)	-
EtCO2 LoFlo Side Stream Module and Cable (Respironics module)	-
EtCO2 disposable LoFlo CO2 Nasal Cannula for Adult (Respironics module)	-

Items	Qty
EtCO ₂ disposable LoFlo CO ₂ Nasal Cannula for Pediatric (Respironics module)	-
EtCO ₂ disposable LoFlo CO ₂ Nasal Cannula for Infant (Respironics module)	-
EtCO ₂ disposable LoFlo CO ₂ Nasal Cannula w/O ₂ for Adult (Respironics module)	-
EtCO ₂ disposable LoFlo CO ₂ Nasal Cannula w/O ₂ for Pediatric (Respironics module)	-
EtCO ₂ disposable LoFlo CO ₂ Nasal Cannula w/O ₂ for Infant (Respironics module)	-
EtCO ₂ disposable LoFlo CO ₂ Oral/Nasal Cannula for Adult (Respironics module)	-
EtCO ₂ disposable LoFlo CO ₂ Oral/Nasal Cannula for Pediatric (Respironics module)	-
EtCO ₂ disposable LoFlo CO ₂ Oral/Nasal Cannula w/O ₂ for Adult (Respironics module)	-
EtCO ₂ disposable LoFlo CO ₂ Oral/Nasal Cannula w/O ₂ for Pediatric (Respironics module)	-
EtCO ₂ disposable LoFlo Airway Adapter for Adult / Pediatric (Respironics module)	-
EtCO ₂ disposable LoFlo Airway Adapter for Infant / Neonatal (Respironics module)	-
EtCO ₂ disposable LoFlo Airway Adapter w/naion for Adult / Pediatric (Respironics module)	-
EtCO ₂ disposable LoFlo Airway Adapter w/naion for Infant / Neonatal (Respironics module)	-
EtCO ₂ disposable Straight Sampling Line (Respironics module)	-
EtCO ₂ disposable Straight Sampling Line w/naion (Respironics module)	-
EtCO ₂ disposable Airway Adapter for Adult (Respironics module)	-
EtCO ₂ disposable Airway Adapter for Infant / Neonatal (Respironics module)	-
EtCO ₂ reusable Airway Adapter for Adult (Respironics module)	-
EtCO ₂ reusable Airway Adapter for Infant / Neonatal (Respironics module)	-
EtCO ₂ disposable Airway Adapter w/mouthpiece for Adult (Respironics module)	-
EtCO ₂ Cable Holding clips (Respironics module)	-
EtCO ₂ Capno-S+ Sidestream (Kingst module)	-
EtCO ₂ Capno-M Mainstream (Kingst module)	-
EtCO ₂ Water filter T4F (Kingst module)	-
EtCO ₂ Module receptacle (Kingst module)	-
EtCO ₂ Sampling Line (Kingst module)	-
EtCO ₂ T shape Airway adapter (Kingst module)	-
EtCO ₂ A1 airway adapter for Adult (Kingst module)	-
EtCO ₂ A1N airway adapter for Infant / Neonatal (Kingst module)	-
EtCO ₂ Capno-S+ Sidestream Nasal tube for Adult/Pediatric (Kingst module)	-
EtCO ₂ Capno-S+ Sidestream Nasal tube for infant (Kingst module)	-
EtCO ₂ Capno-S+ Sidestream CO ₂ /O ₂ Nasal tube for Adult/Pediatric (Kingst module)	-
EtCO ₂ Capno-S+ Sidestream CO ₂ /O ₂ Nasal tube for infant (Kingst module)	-
Printer	-
Printer paper	-
1 hr battery pack for VPM-25	-
InfoX-W	-
InfoX-E	-
InfoX-N	-

Power Cable Connections

 WARNING	Do not connect to an electrical outlet controlled by a wall switch because the monitor may be accidentally turned off.
 CAUTION	If the integrity of the AC power source is in doubt, the monitor must be operated from its internal battery.

AC Power

Make sure that the AC outlet is properly grounded and supplies the specified voltage and frequency (100-240V~, 50-60 Hz).

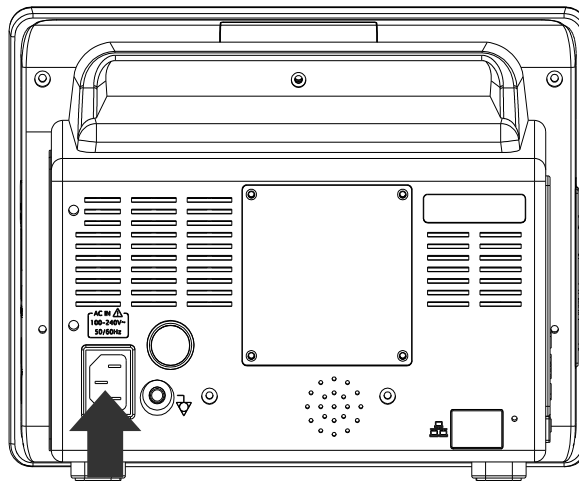


Figure 9. AC Power Connection

1. Connect the female connector end of the AC power cord to AC power connector on the monitor's rear panel.
2. Plug the male connector end of the AC power cord into a properly grounded mains outlet.
3. If necessary, connect grounding wire. Connect the grounding wire connector to the equipotential terminal on the rear panel. Now attach the clip end of the grounding wire to the medical equipment grounding terminal on the wall.
4. Verify that the Battery Charging Indicator on the monitor's front panel is lit only in the battery pack inserted device.

Note: Even if the monitor is not turned on, the Battery Charging Indicator is lit when the AC power cord is connected into a mains outlet.

Note: If the monitor is power variation, alarm should be generated.

Note: If the Battery Charging Indicator is not lit, check:

- the power cord
- the AC power connector
- the power/ mains outlet
- No Battery

If the Battery Charging Indicator still is not lit although no problem is found, contact qualified service personnel or your local supplier for assistance.

Battery Operation

⚠ CAUTION	Recharging the battery is strongly recommended when it has not been fully recharged for 2 or more months.
⚠ CAUTION	When the voltage of the battery is very low, it is a possibility of not operating.
⚠ CAUTION	The battery may be depleted due to self-discharge for a long storage. Recharge the battery when the device is initially installed.

Note: It is recommended that the monitor remain connected to AC power source when not in use. This will ensure a fully charged battery whenever it is needed.

Note: As the battery is used and recharged over a period of time, the amount of time between the onset of the low battery alarm and the monitor shut-off may become shorter. It is recommended for service personnel to check periodically or replace the internal battery if necessary.

Note: Partial charge of a battery results in a shortened service life.

Operating the Monitor on Battery Power

The monitor has an internal battery that can be used to power the monitor when AC power source is not available. The Battery Status Indicator appears on the display when the monitor is on battery power.

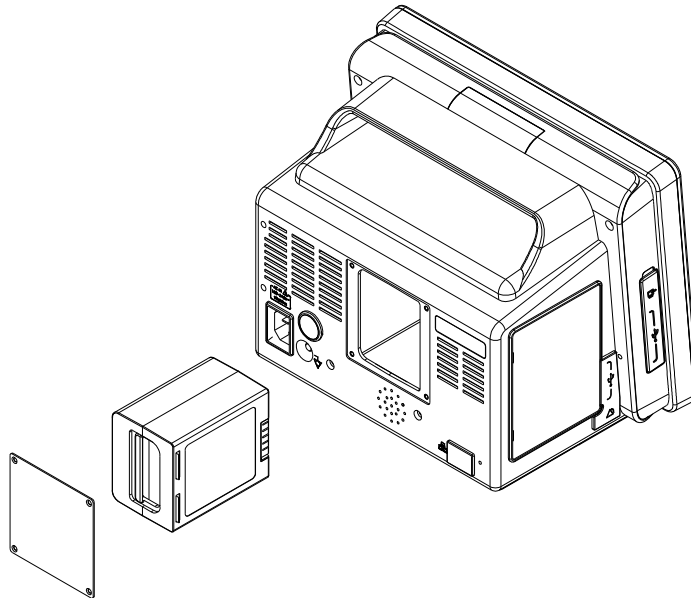


Figure 10. Battery Placement

Following is the method of battery replacement.

1. Turn off the monitor.
2. Remove the battery cover.
3. Carefully remove the battery.
4. Insert the new battery into the main unit carefully.
5. Put on the battery cover.

Table 8. Front Panel Indications for Power Source

Power Connections	Front Panel Indications
AC power source	AC input icon and On Charging icon appear on Power Status area. AC indicator and Battery indicator are lit.
Battery	Battery level percentage appears on Power Status area. Normal Battery icon appears on Power Status area.

A new, fully charged optional battery will provide 1 hour (Li-Ion, 10.8V / 3400mAh) monitoring operation under the following conditions:

- Operation of ECG/Respiration, NIBP, SpO₂ and 2TEMP
- No audible alarm sound
- No data output (communication) devices are attached
- No printing out
- All monitoring parameters are active with one NIBP measurement per 15 minutes
- Brightness default
- Ambient temperature is 25°C

Battery Status Indication

When operating on battery, the battery status icon in the lower part of the display indicates the battery charge condition. See Table 9.

Table 9. The Monitor Battery Status Icon

Battery Status Icons	Battery Status Icon Color
	Green (full charged)
	Green ($\leq 3/4$ of full charged)
	Green ($\leq 2/4$ of full charged)
	Green ($\leq 1/4$ of full charged)
	Yellow (≤ 15 minutes)
	Red (≤ 5 minutes)

The Battery Status Icon will light with yellow when the remaining battery power is only enough for 15 minutes of operation.

This alarm audio cannot be paused while running on battery power. Connecting the monitor to AC power source will pause the alarm.

The Battery Status Indicator (critical low) will flash with red when remaining battery power is only enough for 5 minutes of operation. After that, the monitor will automatically shut down. Connect the monitor to an AC power source to avoid any loss of trend data or settings.

A high priority alarm occurs for about 5 minutes before the monitor shuts off. The alarm message '**Critically Low-Battery Condition**' will appear and the visual alarm indicator will flash with red.

Charging a Low Battery

⚠ CAUTION The partial charge of a battery results in a shortened battery life.

1. Connect the monitor to AC power source to charge a low or depleted battery (see the **Setting up the Monitor** section).
2. Verify that the **Battery Charging Indicator** is lit with orange.

Table 10. Front Panel Indications for Battery Status

Charging status	Battery Charging Indicator
Full charged	Green
On charging	Orange
Charging error	Flash
Not installed	OFF

Note: Even if the monitor is turned off, the Battery Charging Indicator is lit while the battery is recharged.

Note: A full charge of a depleted battery takes over 6 hours per battery.

Note: It might be blocked to charge the battery when the ambient temperature is above 35°C. (or when the battery pack temperature is above about 45°C.)

Measurement Cable Connections

 WARNING	For best product performance and measurement accuracy, use only accessories supplied or recommended by Covetrus. Use accessories according to the manufacturer's directions for use and your facility's standards. Use only accessories that have passed the recommended biocompatibility testing in compliance with ISO10993-1.
 WARNING	Sensor connector should not be connected to anything other than a sensor.
 CAUTION	Do not pull the cable. Pulling the cable could cause the disconnection of the cable and could cause the error for the measurement especially SpO₂ and NIBP.

Note: Both frequent checks by the operator on a daily basis and more comprehensive technical checks less frequently are covered by this requirement in order to detect mechanical damage and damage to cables, etc.

ECG Cables and Leads

1. Connect an ECG cable to the ECG connector on the monitor's right panel as describe in the **Monitoring the ECG** section.
2. Attach the ECG lead wire to the end of the cable, if necessary.

NIBP Hoses and Cuffs

1. Select an appropriate size cuff for the patient. (Refer to the **Monitoring the NIBP** section.)
2. Connect the hose to the NIBP connector making sure to tighten the connector in the clockwise direction.
3. Attach the cuff to the end of the hose.

SpO₂ Cables and Sensors

1. Select an appropriate sensor for the patient and desired application. (Refer to the **Monitoring the SpO₂** section.)
2. Connect the extension cable to the SpO₂ connector on the monitor's right panel.
3. Attach the sensor to the end of the cable.

Temperature Probe

1. Select the appropriate probe(s) for the desired application. (YSI 400 and 700 Series)
2. Connect the temperature probes to the Temperature connector on the monitor's right panel.

EtCO₂ Sensor (if configured with EtCO₂ option)

1. Select the appropriate CO₂ sensor for the desired application.
2. Connect the CO₂ sensor to the CO₂ connector on the monitor's right panel.
3. Attach the CO₂ sampling unit to the CO₂ sensor's connector. (Refer to the **Capnography Monitoring** section.)

Monitor Accessories

Keyboard

The monitor supports USB type qwerty keyboard and numeric keyboard.

Note: Special characters except for dash (-), dot (.) and comma (,) are not allowed.

Mouse

The monitor supports USB type mouse. When the mouse is connected, mouse pointer is displayed on the screen. User can interact with the monitor using mouse without touching.

Barcode Reader

The monitor supports barcode reader. When the barcode reader is connected to the monitor, barcode icon is displayed on the screen. Users can enter the patient ID using barcode reader. Product setting and serial number can be entered with barcode reader.

External Interface

The monitor provides external connectors to support communication with external equipment and functions such as a nurse call, software upgrades, barcode reader or PC connection. Refer to Figure 3. The monitor, with its optional built-in network (LAN) module or Wireless module, functionally performs the same as a monitor connected to the central system. The monitor with a network (LAN, Wi-fi) can send and receive patient data through the central system.

 WARNING	Any connections between this monitor and other devices must comply with applicable medical systems safety standards such as IEC 60601-1. Failure to do so could result in unsafe leakage and grounding conditions.
 WARNING	The external interface function (wired network, wireless network and interface for communication) should not be used as the primary source of alarm notification. The audible alarms of the monitor, used in conjunction with clinical signs and symptoms, are the primary sources for notifying medical personnel that an alarm condition exists.
 WARNING	Please contact qualified service personnel or your local supplier if unintentional equipment changes or attacks from outside is found.

Note: This equipment is to be used on wireless network (Wi-Fi) and the communication wirings (LAN interface or Nurse Call Interface (RJ11)) are limited to inside of the building.

Setting Network

Wired Connection

To connect the monitor to the LAN (Local Area Network) using a wired connection, plug a LAN cable into the LAN port on the rear panel of the monitor. (See Figure 2)

To connect the monitor to the external monitor using a wired connection, plug a HDMI cable into the HDMI port on the left panel of the monitor. (See Figure 3)

Wireless Connection

The monitor can connect to a network using a wireless network. The wireless connection can only be set by authorized personnel via the Service Menu.

Note: The VPM-25 Veterinary Patient Monitor is intended to connect the network or connect to Central Monitoring System using wired, wireless.

Cable Connection

⚠ CAUTION	The nurse call feature is not functional whenever the monitor alarms are paused.
⚠ CAUTION	The nurse call function needs to be tested after it has been set up in your facility. The nurse call feature should be tested whenever setting up the monitor in a location that uses nurse call. One way to test the nurse call function is to create an alarm condition (for example, sensor disconnect) and verify that your facility's nurse call system is activated.

Nurse Call Interface

The nurse call feature of the monitor is operational when the monitor is powered by AC power or battery power. The nurse call feature of the monitor works in conjunction with the nurse call system of your institution when the monitor sounds an audible alarm.

The monitor provides the nurse call interface of relay closure type. The interface functions when the monitor is operating either on AC power or battery power.

The remote location is signaled anytime there is an alarm audio. If the alarm audio has been turned off or paused, the nurse call function is also turned off.

Nurse Call

Connecting pins 1 and 2 provides a Normally close (N.C.) and connecting pins 2 and 3 provides a Normally Open (N.O.). Pin 2 is a common lead for both relays.

The Pin layouts of Nurse Call interface are 6-pin. The pin layout and description of 6 pin are illustrated below.

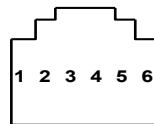


Figure 11. Nurse Call Interface Pin Layout

Table 11. Nurse Call Interface Connections

Pin #	Signal
1	Nurse call normally close
2	Nurse call common lead
3	Nurse call normally open
4	Not Connected
5	Not Connected
6	Not Connected

USB Interface

The monitor can update the main program and transmit the various type of data (patient information, trend, error log or setting value) to PC through USB. The monitor accessory, Barcode reader, can be connected to the monitor through USB.

The USB unit consists of 2 Host. USB Host A, B will be used for the connector of USB Host.

The monitor supports barcode reader through USB port. When the barcode reader is connected to the monitor, barcode icon is displayed on the screen. Users can enter the patient ID using barcode reader. Product setting and serial number can be entered with barcode reader.

HDMI Interface

The HDMI 19-pin will be used for the connector of the device. The monitor will transmit the display to external display equipment through HDMI. The monitor and external display equipment are displayed as same screen.

USING THE MONITOR

⚠ WARNING	If the Power-On Self-Test (POST) is not completed successfully, do not try to use the monitor.
⚠ WARNING	Each time the monitor is used, check alarm limits to make sure that they are appropriate for the patient being monitored.
⚠ WARNING	If different alarm presets are used for the same or similar equipment in any single area, e.g. an intensive care unit or cardiac operating room, a potential hazard can exist.
⚠ WARNING	Look for display motion before accepting any displayed data as a current measurement.
⚠ WARNING	Keep patients under close surveillance when monitoring. It is possible, although unlikely, that radiated electromagnetic signals from sources external to the patient and the monitor can cause inaccurate measurement readings. Do not rely entirely on the monitor readings for patient assessment.
⚠ CAUTION	When power is turned on, the monitor automatically starts the Power-On Self-Test (POST), which tests the monitor circuitry and functions. During Power-On Self-Test (POST), confirm that the monitor display turns on. If the monitor display does not function properly, do not use the monitor. Instead, contact qualified service personnel or your local supplier.
⚠ CAUTION	Check the display to see if all symbols and information can be legible on the screen.
⚠ CAUTION	Check the display periodically.
⚠ CAUTION	If the monitor is stored for long periods in an unused state, be sure to turn off the power.

Note: If the processor does not recover by software or hardware defect after reset, the monitor shall generate alarm buzzer sound. Turn off the monitor when pressed power button for about 8 seconds.

Note: The post passing tone sounds when the monitor completes the Power-On Self-Test (POST). This functions as an audible confirmation that the speaker is performing properly. If the speaker does not function, the alarm warning sounds cannot be heard.

Note: If the monitor screen and sound do not function properly, do not use the monitor. Please contact qualified service personnel or your local supplier.

Note: After turning power on, the user should check the battery status indicator and check whether the display or indicator is operated properly.

Turning On and Off the Monitor

Before using the monitor, confirm that the monitor is working properly and is safe to use as described below.

1. Turn on the monitor by pressing the **Power Button** for about 1 second.
2. The monitor performs POST and the checksum. The bar shall be displayed on the bottom of the screen to indicate the progress rate of checksum for system software. The initializing screen appears during POST. The initializing screen displays the logo and the version of system.
3. If there is no error, alarm indicator is lit during POST and the POST pass tone sounds after POST is completed. Confirm that alarm indicator is lit during POST and the normal screen appears after the POST pass tone sounds.

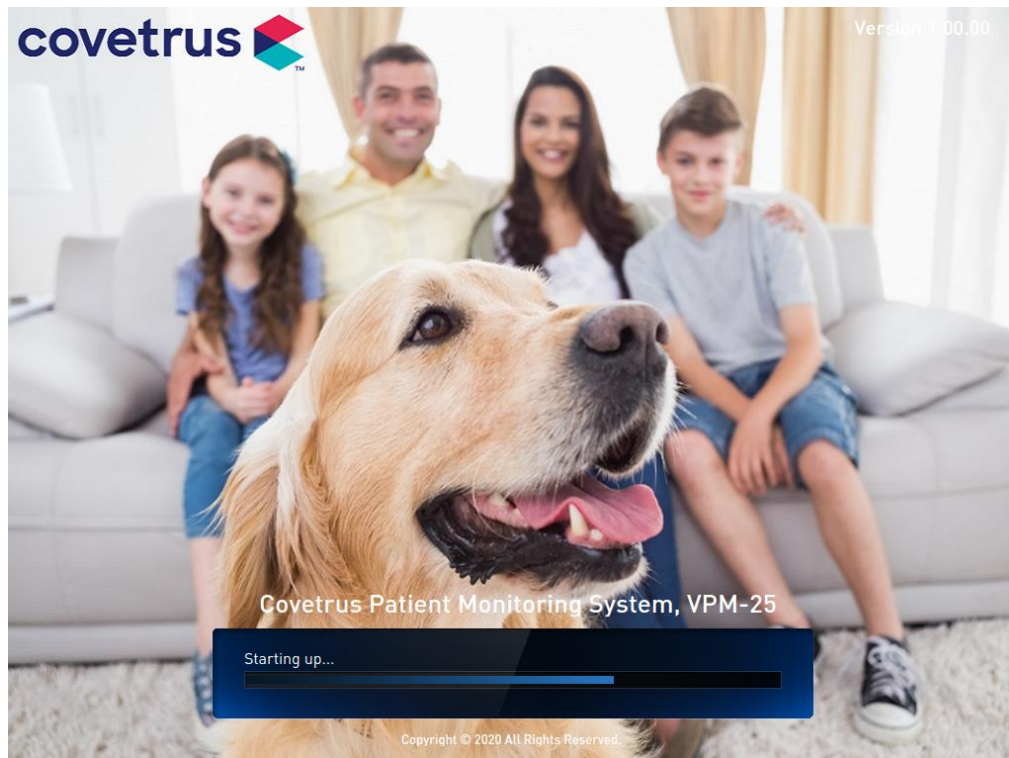


Figure 12. Initial Screen

Note: The system version shown above is only an example.

4. To turn off the monitor, press the **Power Button** for about 1 second.

Note: If the monitor detects an internal problem during POST, the monitor will display an error code. If an error code is displayed, contact qualified service personnel or your local supplier for assistance.

Setting Date and Time

User may set the date and time displayed on the screen and printed out printer paper.

1. Press **Configure** menu using touch screen. Select **Date/Time setup Menu**.
2. When touch **Date/Time setup Menu**, the relevant menu will appear. Press the desired format or number using touch screen.

Table 12. Date/Time setup Menu

Level 1 Menu	Level 2 Menu or Response
DATE/TIME MENU	
Data type	YY/MM/DD
	MM/DD/YY
	DD/MM/YY
Year	Number Keyboard display
	Confirm
	Cancel
Month	Number Keyboard display
	Confirm
	Cancel
Day	Number Keyboard display
	Confirm
	Cancel
Hour	Number Keyboard display
	Confirm
	Cancel
Minute	Number Keyboard display
	Confirm
	Cancel
Second	Number Keyboard display
	Confirm
	Cancel
Back	-

Setting Basic Setup Parameters

This procedure will allow you to set **Patient setup**, **Display setup**, **Alarm setup**, **Printing setup**, **Screen mode**, **Sound setup**, **Date/Time setup** and **Service mode**.
Select **Configure** menu using touch screen.

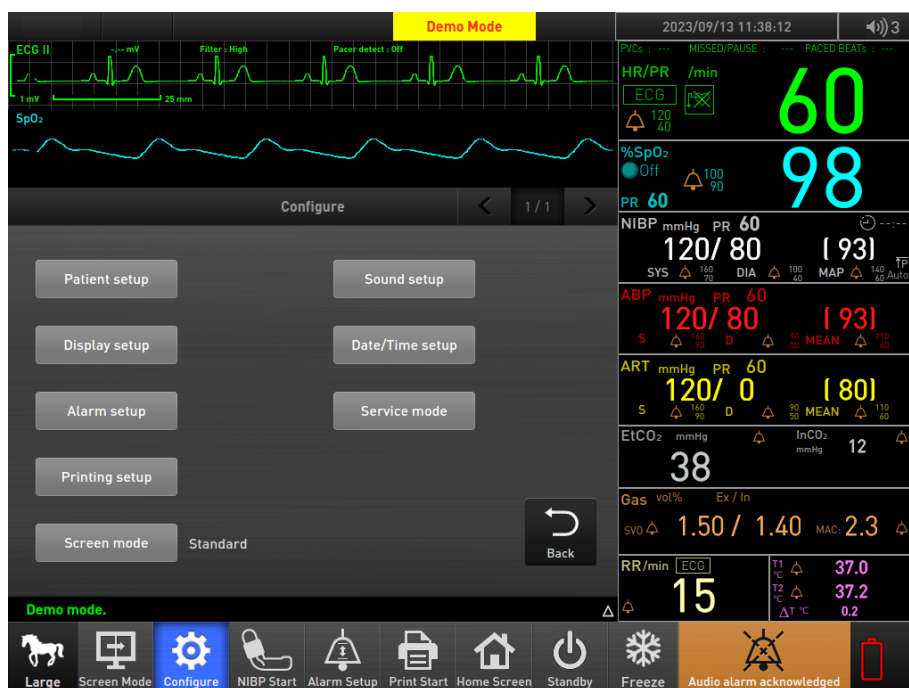


Figure 13. Configure Menu

Table 13. Configure Menu

Level 1 Menu	Level 2 Menu or Response	Level 3 Menu or Response
Configure		
Patient setup	Patient mode	Large, Medium, Small
	Patient ID	Keyboard display
	Name	Keyboard display
	Birthdate	Number Keyboard display
	Gender	Male, Female, Other
	Confirm	-
	Cancel	-
<i>Note: When patient information is set, the user can select New, Modify or Discharge.</i>		
Display setup	Menu timeout	Off, 10 sec, 20 sec
	Number of waveform setting	4, 5, 6, 7, 8, 9, 10, 11, 12
	LCD brightness	1, 2, 3, 4, 5
	EWS display	On, Off
	Temp menu	On, Off
	EtCO ₂ menu	On, Off
	ECG, SpO ₂ , NIBP, RESP, TEMP, EtCO ₂ color	Color 1 ~ 17, Back
	Back	-
Alarm setup	Alarm limit display	On, Off
	Audio alarm pause/off	Start, Stop

Level 1 Menu	Level 2 Menu or Response	Level 3 Menu or Response
Printing setup	Printing speed	25mm/s, 50mm/s
	Alarm printing	On, Off
	Printing time	10 sec, 20 sec, Continuous
	Periodic printing	Off, 5 min, 10 min, 15 min, 30 min, 60 min, 120 min
	Printing waveform 1~3	Off, ECG I, ECG II, ECG III, ECG aVR, ECG aVL, ECG aVF, ECG V(Chest Lead), SpO ₂ , Respiration, EtCO ₂
	Back	-
Screen mode	Standard, Big number, Tabular trend, Graphical trend, Event review	-
Sound setup	Alarm volume	1~5
	HR/PR tone volume	Off, 1~5
	KEY beep volume	Off, 1~5
	Back	-
Date/Time setup	Date type	YY/MM/DD, MM/DD/YY, DD/MM/YY
	Year	Number keyboard display, Confirm, Cancel
	Month	Number keyboard display, Confirm, Cancel
	Day	Number keyboard display, Confirm, Cancel
	Hour	Number keyboard display, Confirm, Cancel
	Minute	Number keyboard display, Confirm, Cancel
	Second	Number keyboard display, Confirm, Cancel
	Back	-
Service Mode	Number keyboard display, Confirm, Cancel	-
Back	-	-

Note: If there is no activity for Menu timeout setting time, the monitor will return to main screen.

Patient setup

Patient mode

To select Patient Mode using touch screen and choose an appropriate mode: Large, Medium, Small.

Patient ID

To select ID using touch screen and enter the keyboard display.

Name

To select Name using touch screen and enter the keyboard display.

Birthdate

To select Birthdate using touch screen and enter the keyboard display.

Gender

To select Gender using touch screen and choose an appropriate mode: Male, Female, or Other.

Note: When patient information is set, the user can select New, Modify or Discharge. If the user selects new mode, add new patient information. If the user selects Modify mode, the user can modify the patient information. If the user selects Discharge mode, the patient information can be deleted.

Display setup

Menu timeout

To select Menu reset counter using touch screen and choose an appropriate mode: Off, 10 sec or 20 sec.

Number of waveform setting

To select Number of waveform setting using touch screen and choose an appropriate mode: 4 ~ 12.

LCD brightness

To select LCD brightness using touch screen and choose an appropriate mode: 1, 2, 3, 4 or 5.

EWS display

To select whether to show the EWS area on the measurement screen using the touch screen and select the appropriate mode: On, Off.

TEMP menu

To select whether to show the TEMP area on the measurement screen using the touch screen and select the appropriate mode: On, Off.

EtCO₂ menu

To select whether to show the EtCO₂ area on the measurement screen using the touch screen and select the appropriate mode: On, Off.

ECG, SpO₂, NIBP, RESP, TEMP, EtCO₂ Color

To select ECG, SpO₂, NIBP, RESP, TEMP, EtCO₂ color using touch screen and choose an appropriate mode: Color 1 ~ 17.

Alarm setup

Alarm limit display

To display the alarm limit displayed in Numeric menu: On or Off.

Audio alarm pause/off

According to Service menu, to pause by selecting Audio alarm: Start or Stop.

Printing setup

Printing speed

To select Printing speed using touch screen and choose an appropriate mode: 25 mm/s or 50 mm/s.

Alarm printing

To select Alarm printing using touch screen and choose an appropriate mode: On or Off.

Printing time

To select printing time using touch screen and choose an appropriate mode: 10 sec, 20 sec or Continuous.

Periodic printing

To select Periodic printing using touch screen and choose an appropriate mode: Off, 5, 10, 15, 30, 60 or 120 min.

Printing waveform 1 ~ 3

To select Printing waveform 1 ~ 3 using touch screen and choose an appropriate mode: Off, ECG I, ECG II, ECG III, ECG aVR, ECG aVL, ECG aVF, ECG V(Chest Lead), SpO₂, Respiration, EtCO₂.

Screen mode

To select Screen mode using touch screen and choose an appropriate mode: Standard, Big number, Tabular trend, Graphical trend, Event review.

Sound setup

Alarm volume

To select Alarm volume using touch screen and choose an appropriate mode: 1, 2, 3, 4 or 5.

HR/PR tone volume

To select HR/PR tone volume using touch screen and choose an appropriate mode: Off, 1, 2, 3, 4 or 5.

KEY beep volume

To select KEY beep volume using touch screen and choose an appropriate mode: Off, 1, 2, 3, 4 or 5.

Date/Time setup

Date type

To select Date type using touch screen; YY/MM/DD. MM/DD/YY or DD/MM/YY.

Year

To select Year using touch screen and enter year from the Number keyboard display.

Month

To select Month using touch screen and enter month from the Number keyboard display.

Day

To select Day using touch screen and enter day from the Number keyboard display.

Hour

To select Hour using touch screen and enter hour the Number keyboard display.

Minute

To select Minute using touch screen and enter minute the Number keyboard display.

Second

To select Second using touch screen and enter second the Number keyboard display.

Service mode

Service mode can only be entered by authorized personnel via the *Service Mode*.

Setting the Main Screen

You may select the main screen to be displayed; **Standard**, **Big number**, **Tabular trend**, **Graphical trend**, **Event Review**.

1. Press **Configure** menu and then select the **Screen mode** soft key using touch screen.
2. Select **Standard**, **Big number**, **Tabular trend**, **Graphical trend**, **Event review**.
3. To return to menu or to change to other screen when press **Configure** menu of the bottom of the screen.

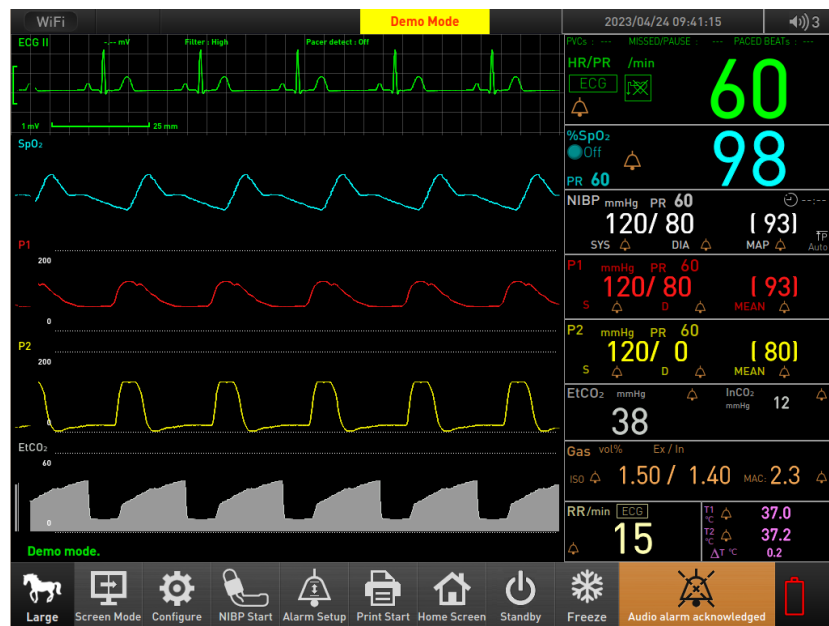


Figure 14. Standard Screen

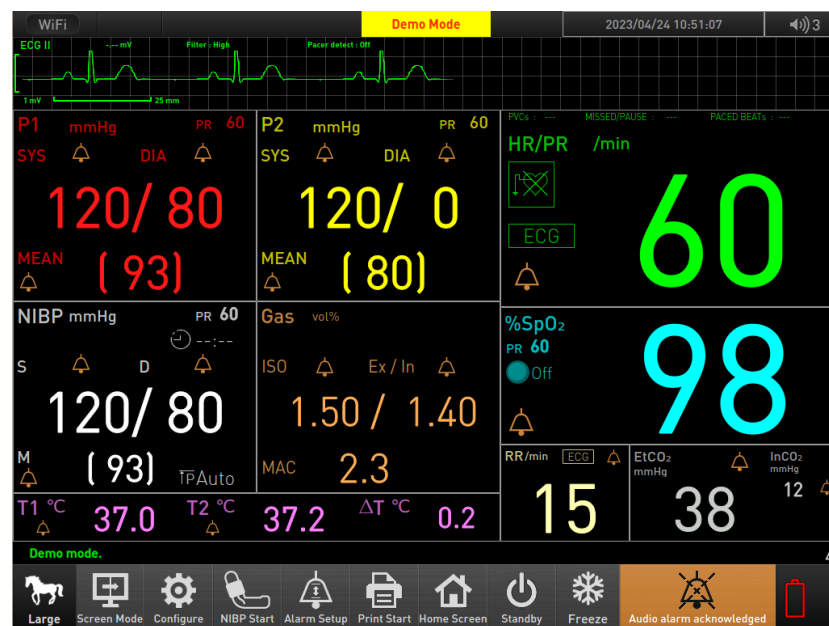
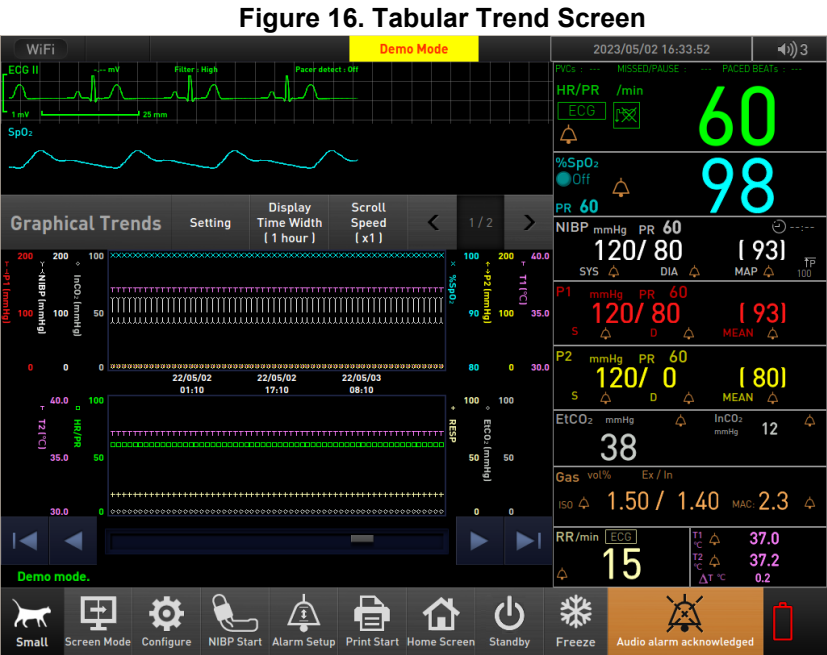
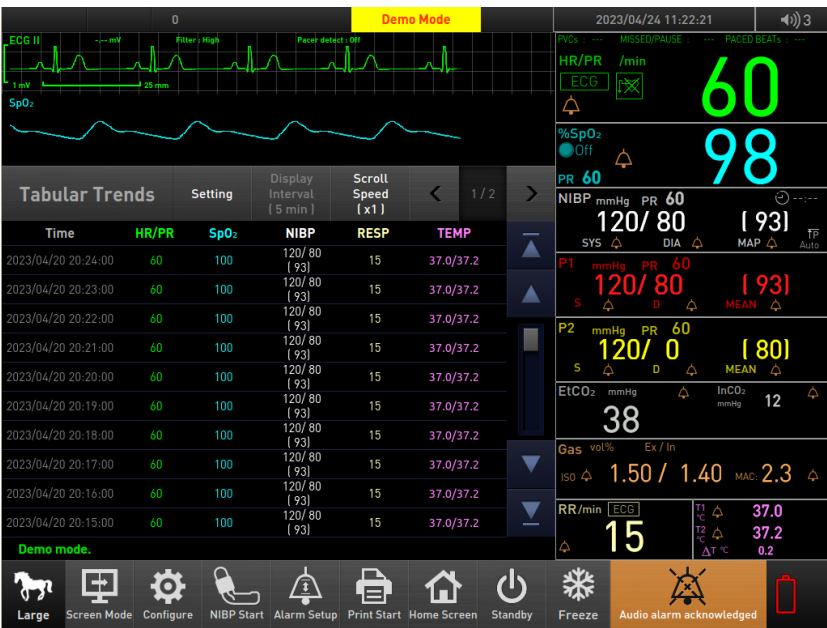


Figure 15. Big Number Screen



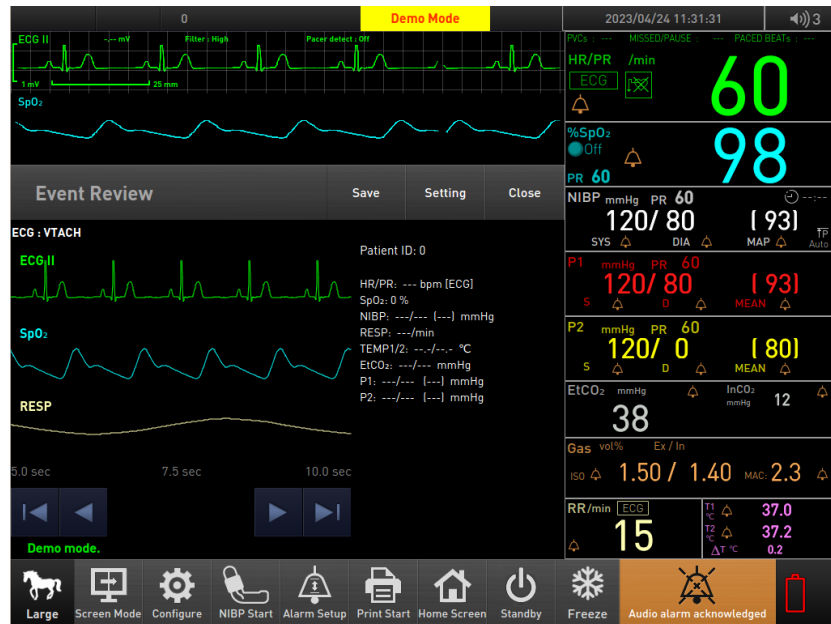


Figure 18. Event Review Screen

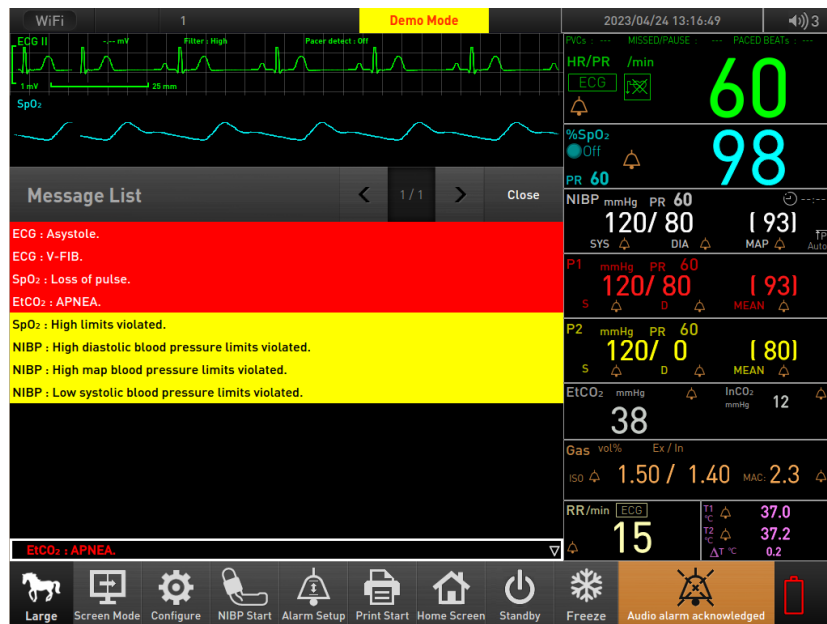


Figure 19. Message List Screen

Standby mode

You can put the device into **Standby mode** by using the Standby button at the bottom.

Note: The alarm does not sound in standby mode.

Note: You can exit the Standby mode by touching the screen.

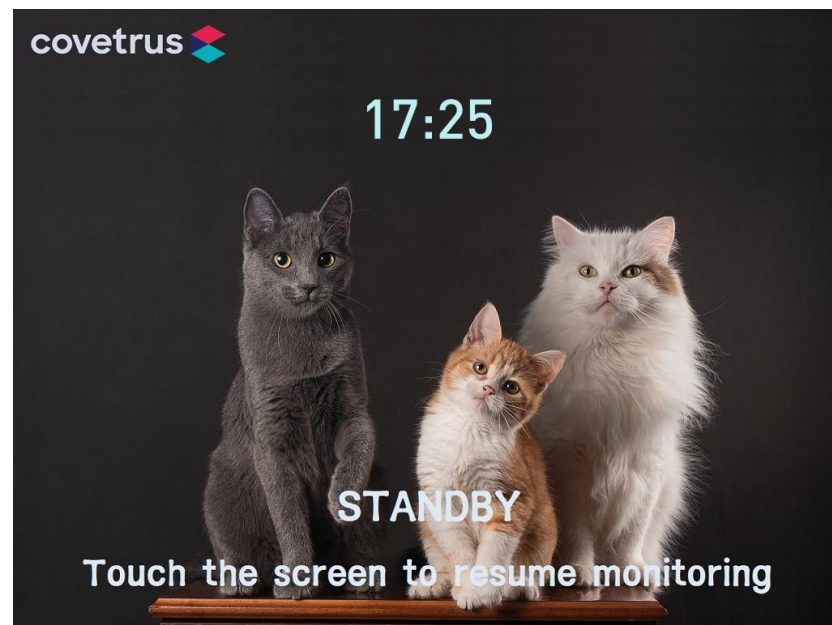
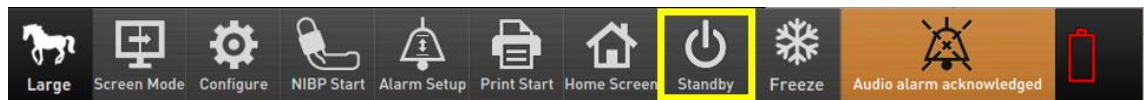


Figure 20. Standby mode Screen

MONITORING THE ECG

⚠ WARNING	For best product performance and measurement accuracy, use only accessories supplied or recommended by Covetrus. Use accessories according to the manufacturer's directions for use and your facility's standards.
⚠ WARNING	Line isolation monitor transients may resemble actual cardiac waveforms and thus off the heart rate alarms. Such transients may be minimized by proper electrode and cable placement, as specified in this manual and electrode directions for use.
⚠ WARNING	Do not use damaged ECG leads. Do not immerse ECG leads completely in water, solvents, or cleaning solutions. Do not sterilize ECG leads by irradiation, steam, or ethylene oxide. Follow the manufacturer's directions for use.
⚠ WARNING	Do not use ECG electrodes with expired dates. Do not use defective ECG electrodes. These might cause improper performance.
⚠ WARNING	The monitor may be damaged while using it with electrosurgical unit due to improper grounding of electrosurgical unit.
⚠ WARNING	ECG cables may be damaged if they are connected to a patient during defibrillation. Cables that have been connected to a patient during defibrillation should be checked for functionality before using again.
⚠ WARNING	It is possible for the patient to receive a burn due to an improperly connected electrosurgical unit. Additionally, the monitor could be damaged or measurement errors could occur. Place the ECG cable and leads as far as possible from the site of the electrosurgical unit and from the electrosurgical cables. This will minimize interference and the risk of burns to the patient.
⚠ WARNING	For pacemaker patients, the monitor may continue to count pacemaker rate during occurrences of cardiac arrest or some arrhythmias. To reduce the likelihood of this, ensure that the Pacer Detect setting is On in the ECG waveform menu when monitoring such patients. Do not rely entirely upon the monitor alarms. Keep pacemaker patients under close surveillance.
⚠ WARNING	To ensure patient safety, the conductive parts of the ECG electrodes (including associated connectors) and other patient-applied parts should not contact other conductive parts, including earth ground, at any time.
⚠ WARNING	The monitor is not suitable for direct cardiac application.

Note: The user should check that the monitor is functioning while measurements are being made and check display periodically.

General

The process of depolarization and repolarization of the myocardium generates electric potentials that are sensed by ECG electrodes on the skin surface. These electrodes are typically attached to the patient's body. The monitor processes and amplifies these signals and presents the ECG waveform on the screen. Also, the monitor computes the minute heart rate at least every second by moving average. In addition to the acquisition of the QRS complex, the circuitry performs a number of other functions. The monitor can display:

- Heart rate in beats per minute
- Detection of a "lead off" condition if an electrode is disconnected or poorly connected
- Detection of the presence of pacemaker signals within the ECG waveform complex

Setup Connections

Animal Preparation and Lead Contact

Note: Covetrus recommends the use of silver/silver chloride electrodes (Ag/AgCl). When dissimilar metals are used for different electrodes, the electrodes may be subject to large offset potentials due to polarization, which may be severe enough to prevent obtaining an ECG trace. Using dissimilar metals may also increase recovery time after defibrillation.

1. Select the electrodes to be used. Use only one type of electrode on the same patient to avoid variations in electrical resistance. Prepare the electrode sites according to the electrode manufacturer's instructions. See Figure 21 and 22 for electrode placement configurations.

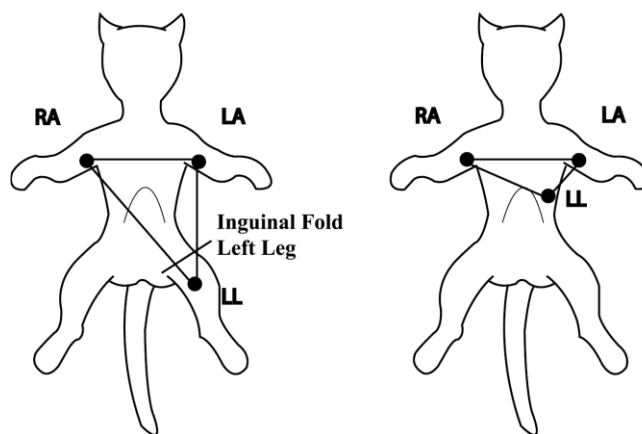


Figure 21. Standard 3 Electrode Placement

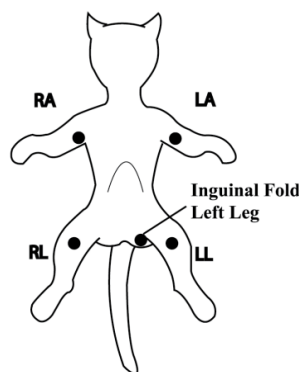


Figure 22. 5 Electrode Placement

2. Connect the ECG cable to the ECG connector on the monitor's right panel.
3. Attach the leads to the electrodes, and then apply the electrodes to the patient, using the color-code guide in Table 14. Verify that the desired Lead Selection is active in the ECG waveform area. Refer to Table 15. Lead II is best suited for most monitoring situations.

Table 14. ECG Lead Colors

Lead	AAMI	IEC
1. Right Foreleg	White (RA)	Red (R)
2. Left Foreleg	Black (LA)	Yellow (L)
3. Left Hind leg	Red (LL/ LF)	Green (F)
4. Right Hind leg	Green (RL)	Black (N)
5. V (explore)	Brown (V)	White (C)

Table 15. ECG Lead Pairs

Lead-Selection	Electrode Differential (AAMI)	Electrode Differential (IEC)
I	RA LA	R L
II	RA LL	R F
III	LA LL(LF)	L F
V (explore)	(RA+LA+LL)/3 Chest (V)	(R+L+F)/3 Chest (C)
aVR	– (Lead I + Lead III)/2	– (Lead I + Lead III)/2
aVL	(Lead I – Lead III)/2	(Lead I – Lead III)/2
aVF	(Lead II + Lead III)/2	(Lead II + Lead III)/2

Arrhythmia Monitoring

Arrhythmia monitoring provides information on your patient's condition, including heart rate, PVC rate, rhythm, and ectopics. If arrhythmia detection is enabled, the monitor calculates the number of premature ventricular contractions (PVCs) per minute and displays the value on the monitor. The PVC value is used as a base measurement for several of the arrhythmia alarms.

The monitor displays arrhythmia status messages as follows:

- **Rhythm status message:** Asystole, VFIB/VTACH, Ventricular tachycardia, Ventricular rhythm, Ventricular Bigeminy, Ventricular Trigeminy, Paced, Unknown Rhythm, Learning, Bradycardia, Tachycardia
- **Ectopic status message:** PVCs, MISSED/PAUSE, RUN PVCs, PAIR PVCs, R-on-T PVCs, MULTIFORM PVCs

When arrhythmia message is set to **On**, Rhythm status message and Ectopic status message are continuously displayed in the ECG waveform. When arrhythmia message is set to **Off**, both messages are not displayed. For more information about messages, refer to the **Alarms and limits** section.

The table below indicates the heart rate ranges for sinus and Ventricular rhythm.

Note: Do not rely on the clinical judgment to determine an arrhythmia except for the asystole.

Table 16. Heart Rate Ranges for Sinus and Rhythms.

Rhythm	Heart Rate Range		
	Large	Medium	Small
Bradycardia	15 to 40	15 to 50	15 to 90
Normal	40 to 120	50 to 160	90 to 200
Tachycardia	> 120	> 160	> 200

Selecting ECG Lead for Arrhythmia Monitoring

When 3 leads are attached, an ECG lead displayed on ECG waveform area is used for the arrhythmia detection. When 5 leads are attached, an ECG lead displayed on ECG waveform area and Lead I or II are used for arrhythmia detection. At this time, Lead I or II is selected by the monitor at random.

Arrhythmia Relearning

The monitor can perform the arrhythmia relearn, and when start the relearning, the learning rhythm message is displayed and the monitor relearn the ECG rhythm. The arrhythmia relearn is automatically begun when return after the lead-off or change the lead.

Arrhythmia Alarms

The monitor detects arrhythmia alarm condition by comparing ECG data to a set of pre-defined criteria. An alarm can be triggered by a rate exceeding the alarm limits, an abnormal rhythm, or an ectopic event. For more information about the alarm condition, refer to the **Alarm and limits** section.

ST Monitoring

The monitor performs ST level analysis on normal and atrially paced beats and measures ST level elevations and depressions. This information can be displayed in the form of ST value snippets on the monitor. A positive ST value indicates ST segment elevation; a negative value indicates depression.

ST Measurement Point

ST level is measured by calculating average the range of 60 ms, 62 ms, 64 ms, 66 ms, 68 ms, 70 ms, 72 ms, 74 ms, 76 ms, 78 ms, 80 ms after J point. ST measurement point can be changed by QTc value according to heart rate.

ST Alarms

ST alarms are triggered when ST value exceeds its alarm limit. The monitor can detect alarms on each ST lead separately, so you can set high and low ST alarm limits individually for each ST lead. Set the high and low alarm limits based on your assessment of the patient's clinical condition unit protocols, physician orders or medication specified limits. A good guideline is 0.1 mV or -0.1 mV from the patient's ST, or follow your hospital protocol. In the **HR/PR menu**, select the alarm to be adjusted.

Description of HR/PR Menu Functions

SpO₂ or NIBP as shown by the icon in the HR/PR numerical area.

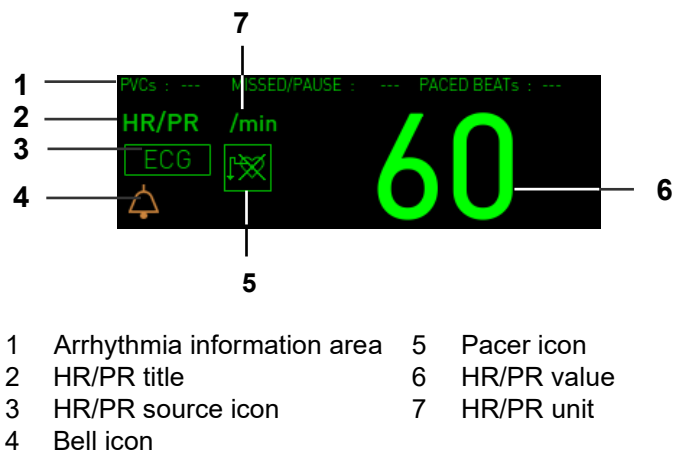


Figure 23. HR/PR Display

Table 17. HR/PR Menu

Level 1 Menu	Level 2 Menu or Response
HR/PR MENU	
HR/PR Source	Auto (HR > SpO ₂ PR > NIBP PR), HR, PR (SpO ₂), PR (NIBP)
Pacer detect	On, Off
Arrhythmia setup	Arrhythmia Message, Arrhythmia relearn, All Arrhythmia alarm, Asystole, Asystole time, V-FIB, VTACH, VTACH rate, Ventricular rhythm, Tachy, Brady, Run, Run beats, Bigeminy, Trigeminy, Couplet, Pause, Pause threshold, Frequent, Frequent beats, R on T PVCs, Multiform PVCs
Filter mode	Interpretation (0.05 ~ 150 Hz), Low (0.05 ~ 40Hz), Med (0.5 ~ 40Hz), High (0.5 ~ 30Hz)
(HR/PR Alarm Limits Adjustment)	
▲	Upper Alarm Limit
▼	Lower Alarm Limit
(Limit Alarm audio off)	On, Off, Back
Back	-

HR/PR Source

You may select **Auto**, **HR**, **PR (SpO₂)** or **PR (NIBP)** to decide the source of the heart rate or pulse rate. If you select **Auto**, the monitor automatically derives the heart rate or pulse rate from one of the monitoring parameters in this order of priority: HR, PR (IBP), PR (SpO₂) or PR (NIBP). When **HR** is selected, the heart rate is measured from ECG. When **PR (SpO₂)** or **PR (NIBP)** is selected, the pulse rate is measured from PR (SpO₂) PR (IBP1), PR (IBP2) or PR (NIBP). The color of the HR/PR icon and HR/PR source icon will be changed according to the current source. If the pulse rate is derived from NIBP, the value will be displayed for only 180 minutes after the NIBP measurement, then the value will be removed

from the display. The HR/PR tone volume can be adjusted in the **Configure** menu. Refer to the **Using the Monitor** section.

Pacer detect

Pacer Pulse Detection should always be On for patients with pacemakers (refer to the warning in this section). When Pacer Pulse Detection is On, the monitor detects and filters pacemaker-generated signals so that they will not be calculated in determining a patient's heart rate. When monitoring patients without pacemakers, Pacer pulse detection should be set to Off to avoid misdiagnosis.

Arrhythmia setup

Arrhythmia setup can be selected from Arrhythmia Message, All Arrhythmia alarm, Asystole, V-FIB, VTACH, Ventricular rhythm, Tachy, Brady, Run, Bigeminy, Trigeminy, Couplet, Pause, Frequent, R on T PVCs, Multifiform PVCs. If the user displays parameter, each parameter can be set to 'On'. Arrhythmia relearn can relearn ECG. Asystole time, VTACH rate, Run beats, Pause threshold, Frequent beats can set alarm conditions.

Filter mode

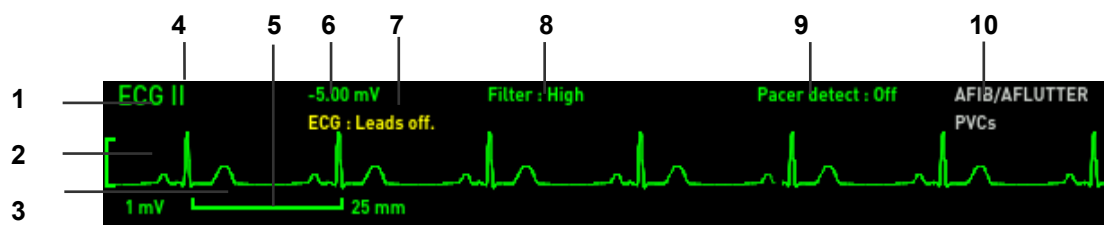
The monitor can filter ECG waveform noise with different ranges of frequency response: The user can select filter mode, Interpretation (0.05 Hz to 150 Hz), Low (0.05 Hz to 40 Hz), Med (0.5 Hz to 40 Hz) or High (0.5 Hz to 30 Hz).

Limit alarm audio off

When limit alarm audio off is set to On, the alarm audio for limit alarm is went off.

Description of ECG Waveform Menu Functions

From the ECG waveform area, users can make to check ECG change. The waveform area contains the waveform and features relevant to ECG measurement. The area provides different features based on the configuration or the waveform select.



1	ECG waveform icon	6	ST level
2	ECG size bar	7	ECG waveform message
3	ECG waveform	8	Filter mode
4	ECG lead pair	9	Pacer detect
5	ECG reference bar	10	Arrhythmia message

Figure 24. ECG Waveform Display

Table 18. ECG Waveform Menu

Level 1 Menu	Level 2 Menu or Response
ECG WAVEFORM MENU	
Lead Select	I, II, III, aVR, aVL, aVF, V
Arrhythmia setup	Arrhythmia Message, Arrhythmia relearn, All Arrhythmia alarm, Asystole, Asystole time, V-FIB, VTACH, VTACH rate, Ventricular rhythm, Tachy, Brady, Run, Run beats, Bigeminy, Trigeminy, Couplet, Pause, Pause threshold, Frequent, Frequent beats, R on T PVCs, Multifform PVCs
Sweep Speed	6.25 mm/s, 12.5 mm/s, 25.0 mm/s, 50.0 mm/s
Size (mm per 1mV)	Auto, 1.25 mm/mV, 2.5 mm/mV, 5.0 mm/mV, 7.5 mm/mV , 10.0 mm/mV, 15.0 mm/mV, 20.0 mm/mV, 40.0 mm/mV
Pacer Detect	On, Off
ST level measurement position	60 ms, 62 ms, 64 ms, 66 ms, 68 ms, 70 ms, 72 ms, 74 ms, 76 ms, 78 ms, 80 ms
Filter Mode	Interpretation (0.05 ~ 150 Hz), Low (0.05 ~ 40 Hz), Med (0.5 ~ 40 Hz), High (0.5 ~ 30 Hz)
Waveform select	Blank, ECG, SpO ₂ , Respiration, EtCO ₂
Back	-

Lead Select

The user can set the selected ECG waveform. The monitor automatically detects the attached lead and the available ECG lead selection is displayed when the lead select menu is selected. For example, Lead Select shows only Lead I, II and III when 3 leads are attached. You can select the desired ECG lead. For more information about the lead selection, refer to Table 15.

- 3 Lead user selectable: I, II, III
- 5 Lead user selectable: I, II, III, aVR, aVL, aVF, V

Arrhythmia setup

Arrhythmia setup can be selected from Arrhythmia Message, All Arrhythmia alarm, Asystole, V-FIB, VTACH, Ventricular rhythm, Tachy, Brady, Run, Bigeminy, Trigeminy, Couplet, Pause, Frequent, R on T PVCs, Multiform PVCs. If the user displays parameter, each parameter can be set to 'On'. Arrhythmia relearn can relearn ECG. Asystole time, VTACH rate, Run beats, Pause threshold, Frequent beats can set alarm conditions.

Sweep Speed

The user-selectable sweep speed determines the speed at which the ECG waveform trace moves across the screen. **Sweep Speed** can be selected from 6.25 mm/s, 12.5 mm/s, 25.0 mm/s and 50.0 mm/s.

Size

The user-selectable ECG waveform size allows you to adjust the amplitude of an ECG waveform. The size can be selected from Auto, 1.25 mm/mV, 2.5 mm/mV, 5.0 mm/mV, 7.5 mm/mV, 10.0 mm/mV, 15.0 mm/mV, 20.0 mm/mV, 40 mm/mV. When the size is set to Auto, The monitor automatically determines the optimal size of the ECG waveform to fit the space.

Pacer Detect

Pacer Pulse Detection should always be On for patients with pacemakers (refer to the warning in this section). User can toggle Pacer pulse detection mode via Patient Information Menu and ECG menu in Waveform Menu of Configure Menu. When Pacer Pulse Detection is On, the monitor detects and filters pacemaker-generated signals so that they will not be calculated in determining a patient's heart rate. When monitoring patients without pacemakers, Pacer pulse detection should be set to Off to avoid misdiagnosis.

ST level measurement position

The user can set ST level measurement position, 60 ms, 62 ms, 64 ms, 66 ms, 68 ms, 70 ms, 72 ms, 74 ms, 76 ms, 78 ms or 80 ms.

Filter Mode

The monitor can filter ECG waveform noise with different ranges of frequency response: The user can select filter mode, Interpretation (0.05 ~ 150 Hz), Low (0.05 ~ 40 Hz), Med (0.5 ~ 40 Hz) or High (0.5 ~ 30 Hz).

Note: The clause 50.102.8 Frequency and impulse response and 50.102.15 Heart rate range, accuracy and QRS detection range of IEC60601-2-27 are tested only for Interpretation (0.05 ~ 150 Hz), Low (0.05 ~ 40 Hz) of ECG filter mode menu.

Waveform Select

The user can select the waveform. The selected waveform can be displayed on any waveform area. If a module is not installed, the corresponding module waveform will be not displayed in menu list.

MONITORING THE NIBP

⚠ WARNING	For best product performance and measurement accuracy, use only accessories supplied or recommended by Covetrus. Use accessories according to the manufacturer's directions for use and your facility's standards.
⚠ WARNING	Connect the proper cuff and hose firmly into the socket and do not use damaged cuff and hose.
⚠ WARNING	Inaccurate measurements may be caused by incorrect cuff application or use. This can include placing the cuff too loosely on the patient using the incorrect cuff size, or not placing the cuff at the same level as the heart, leaky cuff or hose or excessive patient motion.
⚠ WARNING	In some cases, rapid, prolonged cycling of an oscillometric, noninvasive blood pressure monitor cuff has been associated with any or all of the following: ischemia, purpura, or neuropathy. Periodically observe the patient's limb to make sure that the circulation is not impaired for a prolonged period of time. Also make sure the cuff is placed according to directions in this manual and the cuff directions for use.
⚠ WARNING	Do not place the cuff, the catheter or SpO ₂ sensor on an extremity being used for intravenous infusion or any area where circulation is compromised or has the potential to be compromised.
⚠ WARNING	As with all automatically inflatable blood pressure devices, continual cuff measurements can cause injury to the patient being monitored. Weigh the advantages of frequent measurement and/or use of STAT mode against the risk of injury.
⚠ WARNING	Ensure the patient is quiet with minimal movement during NIBP readings; minimize the patient's shivering.
⚠ WARNING	Never place the cuff on an extremity being used for intravenous infusion or any area where circulation is compromised or has the potential to be compromised. Never fit NIBP system with Luer Lock adapters not specified by Covetrus.
⚠ WARNING	Never use an large monitor setting or cuff for an NIBP measurement on a small patient. Large inflation limits can be excessive for small patients, even if a small cuff is used.
⚠ WARNING	Too frequent measurements can cause injury to the patient due to blood flow interference.
⚠ WARNING	The cuff should not be applied over a wound as this can cause further injury.
⚠ WARNING	Pressurization of the cuff can temporarily cause loss of function of simultaneously used monitoring equipment on the same limb.
⚠ WARNING	Do not attach the cuff to a limb being used for IV infusions or any other intravascular access, therapy or an arterio-venous (A-V) shunt. The cuff inflation can temporarily block blood flow, potentially causing harm to the patient.
⚠ WARNING	Any blood pressure reading can be affected by the measurement site, the position of the patient, exercise, or the patient's physiologic condition. Environmental or operational factors which can affect the performance of the monitor and/or its blood pressure reading are common arrhythmias such as atrial or ventricular premature beats or atrial fibrillation, arterial sclerosis, poor perfusion, diabetes, age, pregnancy, pre-eclampsia, renal diseases, patient motion, trembling and

	shivering.
⚠ WARNING	Ignore the SpO ₂ alarm generates during NIBP measurement because the SpO ₂ measurement values might be inaccurate temporarily during the NIBP measurement.
⚠ CAUTION	In the automatic mode, the monitor displays results of the last blood pressure measurement until another measurement starts. If a patient's condition changes during the time interval between measurements, the monitor will not detect the change or indicate an alarm condition.
⚠ CAUTION	Any excessive patient motion may cause inaccurate measurements of non-invasive blood pressure. Minimize motion to improve blood pressure measurements.
⚠ CAUTION	Do not apply the blood pressure cuff to the same extremity as the one to which the SpO ₂ sensor is attached. Cuff inflation can disrupt SpO ₂ monitoring and lead to nuisance alarms.
⚠ CAUTION	Make sure that heavy objects are not placed on the cuff hose. Avoid crimping or undue bending, twisting, or entanglement of the hose.
⚠ CAUTION	A compressed or kinked connection hose may cause continuous cuff pressure resulting in blood flow interference and potentially harmful injury to the patient.

Note: Blood pressure measurements can be affected by the position of the patient, the patient's physiological condition and other factors.

Note: Blood pressure measurements determined with the monitor are equivalent to those obtained by a trained observer using the cuff/stethoscope auscultatory method, within the limits prescribed by the American National Standard for manual, electronic and automated sphygmomanometers.

Note: 5 minutes should elapse before the first reading is taken.

Note: The user should check that the monitor is functioning while measurements are being made and check display periodically.

Note: Check the display before accepting any displayed data as a current measurement.

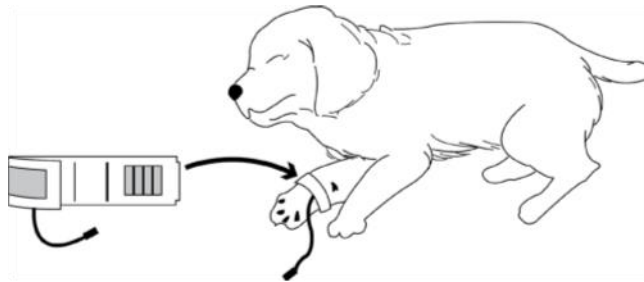
Note: Check the cuff/hose connection and do not use the damaged cuff/hose. Follow the manufacturer's directions for use.

Setup Connections

When performing the NIBP measurements, including hypertension blood pressure measurements, it is important to follow suitable procedures to ensure valid, accurate results. Follow these procedures:

Note: 5 minutes should elapse before the first reading is taken.

1. Measure the patient's limb and select a proper size cuff. As a general rule, cuff width should span approximately two-thirds of the distance between the patient's elbow and shoulder.
2. Connect the cuff hose to the connector on the monitor's right panel. (See Figure 5)
3. To connect, slide the connector of the cuff into the cuff hose.
4. Connect a cuff to the cuff hose and push the connector to lock the hoses together. Firm connection must be made.
5. Patient should be lying on the right or left side. This help ensure that the cuff is at heart level, which is best for measurement accuracy.



6. The patient is less likely to retract the front limb when the cuff gently squeezes it during the measurement. The cuff should be placed so that its artery marker aligns with the limb's artery.
7. If the patient seems more comfortable seated, position the cuff as described above and hold up the limb during the BP measurement. This will help keep the cuff at heart level and relax the patient's muscles.
8. If the patient appears agitated enough to bite or scratch, or is standing, the base of the tail is an acceptable alternate location.

Note: Obtaining NIBP readings can be more difficult in patients with arrhythmias. These arrhythmias increase the beat-to-beat pressure fluctuations, which increases the variability of the NIBP readings. Temporarily verify pressure using another method if it becomes difficult to obtain readings in the presence of arrhythmias.

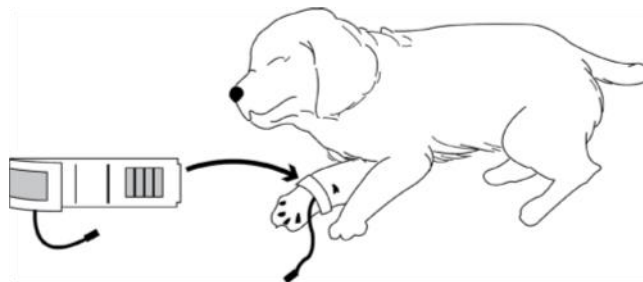
Cuff Placement

Cuff Placement for Cat

1. A cat may be left in its owner's lap to keep it calm. Measurements are best done in an area of the hospital away from noise and bright lights.
2. The animal may be held so that the front limbs are free for cuff placement. In conscious, the tail may be the most appropriate location for placement of the cuff.
3. Cats may be most comfortable in sternal recumbency making the tail a more preferable site. For the median artery on the foreleg, place the cuff around the forelimb, between the elbow and carpus.
4. It is not necessary to center the cuff over the artery which is on the medial side of the leg because of the fully encircling bladder design.
5. Hair need not be clipped except when heavily matted. In cats less than five (5) pounds when measurements are difficult to obtain, place the cuff around the leg above the elbow to obtain measurements from the brachial artery.
6. Measurements from the coccygeal artery may be used by placing the cuff around the base of the tail but not in anesthetized patients.

Cuff Placement for Dog

1. For measurements in dogs, it is preferable to use the right lateral, sternal or dorsal recumbent positions. That is not a problem in anesthetized patients, but it may be difficult to get large dogs to cooperate for proper positioning when conscious.
2. If the dog is in a position, place the front paw on the operator's knee and take measurements from the metacarpus.
3. Sites for cuff placement are the metacarpus, metatarsus and anterior tibial. In anesthetized patients, most surgeries are done on the posterior part of the body so the metacarpal area of the forelimb is most convenient. In situations where this is not possible, the cuff should be wrapped around the metatarsus just proximal to the tarsal pad or around the hind leg just distal to the hock.
4. The tail site should not be used for cuff placement during anesthesia. It is not necessary to center the cuff over the artery because of the fully encircling bladder design.
5. If the hair over the artery site is too thick or matted for good contact, it should be clipped.



NOTE: To achieve the most accurate readings, it is important to keep the cuff on a horizontal plane with the heart.

Large Animals

1. A large animal such as a horse should be in a stock, standing still, or lying down. For horses and cows, the cuff can be wrapped around the base of the tail using the coccygeal artery on the ventral surface.

⚠ WARNING

When monitoring over an extended period of time, or at frequent intervals, periodically observe the patient's limb to make sure that the circulation is not impaired for a prolonged period of time.

Cuff size selections

1. Wrap the cuff around the patient's limb and make sure the index line falls within the range marker. If two different cuff sizes fit the patient, choose the larger size.

Table 19. Cuff Size

Part code	Circumference (cm)	
A0911	Cuff Size 1 (3-6cm) for VET	Suntech
A0912	Cuff Size 2 (4-8cm) for VET	
A0923	Cuff Size 3 (6-11cm) for VET	
A0914	Cuff Size 4 (7-13cm) for VET	
A0915	Cuff Size 5 (8-15cm) for VET	
A0916	CUFF Small(17-25cm)	

NIBP Measurement Modes

Blood pressure measurements can be made in following modes:

- **MANUAL mode:** Single measurement of systolic (SYS) / diastolic (DIA) /mean arterial (MAP) pressure.
- **AUTO mode**
 - **Long Term Interval mode:** Continuous measurement. The break time is for approximately 30 seconds during the unlimitedness period.
 - **Short Term Interval mode:** Continuous measurement for set interval (every 1 minute for 12 minutes).
 - **Short Term Auto (STAT) mode:** As many measurements as possible within a 5 minutes period. After measuring by STAT mode, about 2.5 minutes after the measurement is completed, the next measurement will be started.

To Initiate MANUAL Measurement Mode

1. Press the **NIBP Start/Stop Button**.

A single blood pressure measurement will be made. The measurement will be displayed for 180 minutes unless another measurement is initiated. A manual NIBP reading can be obtained in AUTO mode by pressing **NIBP Start/Stop Button** between two AUTO measurements without the cancellation of AUTO mode.

To Initiate Automatic (AUTO) Measurement Mode

1. Select the desired automatic mode interval from **NIBP Menu**, accessed via the NIBP numerical area. The initial measurement starts to press NIBP start button on measurement screen.
2. An NIBP reading can be cancelled by pressing the **NIBP Start/Stop Button** during the AUTO measurements.

*Note: When the time interval is set to 1 minute, the initial measurement will be activated by pressing the **NIBP Start/Stop Button**. Then the measurement interval will be automatically converted to Off after 12 minutes elapsed.*

The NIBP numerical area will display the **NIBP Auto Mode Interval** and **NIBP Elapsed Time Icon**. The interval is the time from when one measurement starts to when the next measurement starts. The measurement value will be displayed until another measurement starts. When AUTO mode is cancelled, the last measurement will be displayed for 180 minutes.

In AUTO mode, the monitor attempts to meet the requirement of SVRP (Safe Venous Return Pressure) as long as starting a new reading does not violate the requirement of being 30 seconds below SVRP between readings. A new blood pressure reading will not start until the 30 second period has elapsed. When CONT or 1 minute are selected in the **NIBP Menu**, this SVRP can be shortened over 2 seconds since CONT is the intensive measurement during the short term which is 5 minutes and 1 minute is the auto measurement during the short term which is 12 minutes.

Automatic setting pressure value

In AUTO mode, the cuff pressure is automatically calculated used the previous systolic. If the last systolic blood pressure value does not exist, inflation value is set to initial value.

To Initiate Continuous (CONT) Measurement Mode

To initiate Continuous (CONT) measurement mode, Auto interval is set to 'Cont'. The initial measurement will be activated by pressing the **NIBP Start/Stop Button**. The measurement interval will automatically be converted to Off after 5 minutes elapsed. Also, if the **NIBP Start/Stop Button** is pressed during CONT mode, the measurement will be canceled and the interval will be converted to Off.

To Stop Blood Pressure Measurements

User may press the **NIBP Start/Stop Button** at any time to stop the current measurement and deflate the cuff. If an automatic measurement is underway, the next measurement will start at the next interval after the current measurement stops.

Description of the NIBP Menu Functions

From the NIBP area, users can make blood pressure measurements: Systolic (SYS), diastolic (DIA) and mean arterial (MAP) pressure. NIBP area contains data and features relevant to noninvasive blood pressure measurement. The area provides different features based on the mode users are using.

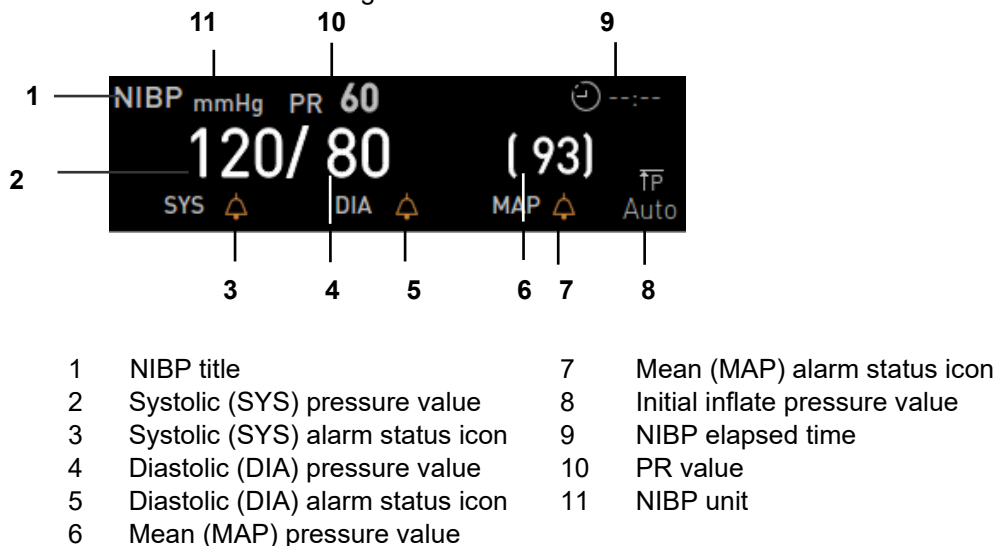


Figure 25. NIBP Display

Table 20. NIBP Menu

Level 1 Menu	Level 2 Menu or Response
NIBP MENU	
Initial inflate pressure	Large/Medium mode: 120 mmHg (16.0 kPa), 140 mmHg (18.7 kPa), 160 mmHg (21.3 kPa), 180 mmHg (24.0 kPa), 200 mmHg (26.7 kPa), 220 mmHg (29.3 kPa), 240 mmHg (32.0 kPa), 260 mmHg (34.7 kPa), 280 mmHg (37.3 kPa), Auto Small mode: 80 mmHg (10.7 kPa), 100 mmHg (13.3 kPa), 120 mmHg (16.0 kPa), 140 mmHg (18.7 kPa)
Auto interval	Off, Cont, 1 min, 2 min, 2.5 min, 5 min, 10 min, 15 min, 30 min, 60 min, 120 min
(SYS, MAP, DIA Alarm Limits Adjustment)	
▲	Upper Alarm Limit
▼	Lower Alarm Limit
(Limit Alarm audio off)	On, Off, Back
Back	-

*Note: Initial inflate pressures shown above are for Large patient mode. In order to set alarm limits to Small mode, change Patient mode via the **Patient mode menu**.*

*Note: The NIBP unit can only be changed by authorized personnel via the **Service Mode**.*

Initial inflate pressure

The inflating pressure can be set from 120 to 280 mmHg for Horse/dog (Large/Medium mode), or from 60 to 280 mmHg for cat (small mode).

Auto interval

When the auto interval setting is 'Off', the measurement value of 'SYS', 'DIA', and 'PR' is displayed as '---' and 'MAP' is displayed as current pressure when the measurement starts. When the auto interval setting is not 'Off', the measurement value of 'SYS', 'DIA', and 'PR' is displayed as previous measurement value and 'MAP' is displayed as current pressure when the measurement starts.

Limit alarm audio off

When limit alarm audio off is set to On, the alarm audio for limit alarm is went off.

MONITORING THE SpO₂

 WARNING	For best product performance and measurement accuracy, use only accessories supplied by Covetrus. Use accessories according to the manufacturer's directions for use and your facility's standards.
 WARNING	Tissue damage can be caused by incorrect application or use of a SpO ₂ sensor. Harm can be caused, for example, by wrapping the sensor too tightly, by applying supplemental tape, or by leaving a sensor on too long in one place. Inspect the sensor site as directed in the sensor directions for use to ensure skin integrity, correct positioning and adhesion of the sensor.
 WARNING	Inaccurate measurements may be caused by: ● incorrect sensor application or use ● significant levels of dysfunctional hemoglobin (such as carboxyhemoglobin or methemoglobin) ● intravascular dyes such as indocyanine green or methylene blue ● exposure to excessive illumination, such as surgical lamps (especially ones with a xenon light source), bilirubin lamps, fluorescent lights, infrared heating lamps, or direct sunlight ● excessive patient movement ● high-frequency electrosurgical interference and defibrillators ● venous pulsations ● placement of a sensor on an extremity with a blood pressure cuff, arterial catheter, or intravascular line ● patient conditions such as hypotension, severe vasoconstriction, severe anemia, hypothermia, cardiac arrest, or shock ● arterial occlusion proximal to the sensor ● unspecified environmental conditions ● unspecified length of the extension cable
 WARNING	Do not attach any cable to the sensor port connector that is intended for computer use.
 WARNING	Misapplied sensors with excessive pressure for prolonged periods may damage the patient.
 WARNING	Do not use any other cables to extend the length of the approved interface cable. Increasing the length will degrade signal quality and may lead to inaccurate measurements.
 WARNING	Do not pull the cable because pulling the cable could cause the disconnection of the cable from the monitor and can cause the error for the measurement.
7  WARNING	Do not use a damaged sensor or cable. Do not alter the sensor or cable in any way. Alternations or modification may affect performance and/or accuracy. Never use more than one cable between the pulse oximeter and the sensor to extend the length.
 WARNING	Sensors exposed to ambient light when incorrectly applied to a patient may exhibit inaccurate saturation readings. Securely place the sensor on the patient and check the sensor's application frequently to help ensure accurate readings.
 WARNING	Do not rely solely on SpO ₂ reading: assess the patient at all times. SpO ₂ readings may be inaccurate in the presence of significant levels of carboxyhemoglobin or methemoglobin, in patients with restricted blood flow to the extremities (such as those in severe shock or hypothermia), or in the presence of excessive motion.
 WARNING	Failure to apply the sensor properly may reduce the accuracy of the SpO ₂ measurement.

⚠ WARNING	Inspection the sensor application site at least every two hours for changes in skin quality, correct optical alignment, and proper sensor application. If skin quality is compromised, change the sensor site. Change the application site at least every four hours. More frequent checking may be required due to individual patient's condition.
⚠ WARNING	Severe anemia, methemoglobin, intravascular dyes that change usual blood pigmentation, excessive patient movement, venous pulsations, electrosurgical interference, exposure to irradiation and placement of the sensor on an extremity that has a blood pressure cuff, intravascular line, or externally applied coloring (such as nail polish) may interfere with oximeter performance. The operator should be thoroughly familiar with the operation of the oximeter prior to use.
⚠ WARNING	The pulsations from intra-aortic balloon support can be additive to the pulse rate on the oximeter pulse rate display. Verify patient's pulse rate against the ECG heart rate.
⚠ WARNING	Prolonged, continuous use of a sensor may cause irritation, blistering, or pressure necrosis of the skin. Check the sensor site regularly based on patient condition and type of sensor. Change the sensor site if skin changes occur. Do not use tape to hold the sensor in place as this may cause inaccurate readings or damage to the sensor or skin.
⚠ WARNING	Carefully route patient cabling to reduce the possibility of patient entanglement or strangulation.
⚠ WARNING	Carboxyhemoglobin and methemoglobin may erroneously increase SpO ₂ readings. The amount that SpO ₂ increases is approximately equal to the amount of carboxyhemoglobin or methemoglobin that is present.
⚠ CAUTION	The sensor disconnect error code and associated alarm indicate the sensor is either disconnected or the wiring is faulty. Check the sensor connection and, if necessary, replace the sensor, extension cable or both.
⚠ CAUTION	Reusable sensors may be used on the same site for a maximum of 4 hours, provided the site is inspected routinely to ensure skin integrity and correct positioning.

Note: The user should check that the monitor is functioning while measurements are being made and check display periodically.

Note: Check the display motion before accepting any displayed data as a current measurement.

Setup Connections

When selecting a sensor, consider the patient's weight and activity, adequacy of perfusion, availability of sensor sites, need for sterility and anticipated duration of monitoring. Refer to Table 21, or contact Covetrus sales department for ordering information.

1. Select the proper sensor for the patient.
2. Connect the extension cable to the SpO₂ connector on the monitor's right panel and lock it.



3. Connect the sensor to the extension cable and lock it.
4. Carefully apply the sensor to the patient, as described in the sensor directions for use. Observe all warnings and cautions in the directions for use.

Note: Refer to directions for use to ensure the proper placement for various types of SpO₂ sensors.

Note: Periodically check to see that the sensor remains properly positioned on the patient and that skin integrity is acceptable. Refer to the sensor directions for use.

Table 21. SpO₂ Sensors

Item	Model	Patient Size
SpO ₂ reusable sensor for oral	WA103	-
SpO ₂ reusable sensor for rectal	WA107	-

Description of SpO₂ Menu Functions

From the SpO₂ area, users can make pulse oximetry measurement. SpO₂ area contains data and features relevant to SpO₂ measurement. The area provides different features based on the configuration.

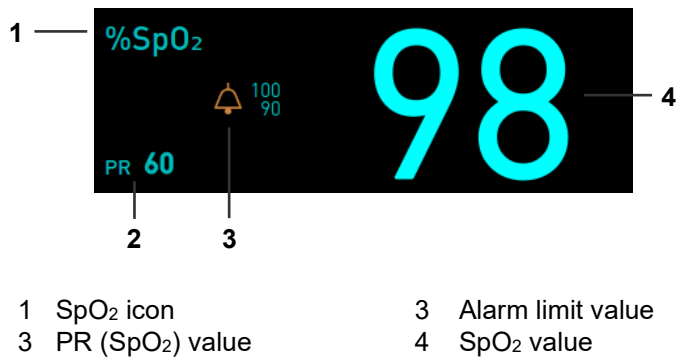


Figure 26. SpO₂ Display

Table 22. SpO₂ Menu

Level 1 Menu	Level 2 Menu or Response
SpO ₂ MENU	
(Alarm Limits Adjustment)	
▲	Upper Alarm Limit
▼	Lower Alarm Limit
(Limit alarm audio off)	On, Off, Back
Back	-

Limit alarm audio off

When limit alarm audio off is set to On, the alarm audio for limit alarm is went off.

Description of SpO₂ Waveform Menu Functions

From the SpO₂ waveform area, users can make to check pulse oximetry change. The waveform area contains the waveform and features relevant to SpO₂ measurement. The area provides different features based on the configuration or the waveform select.

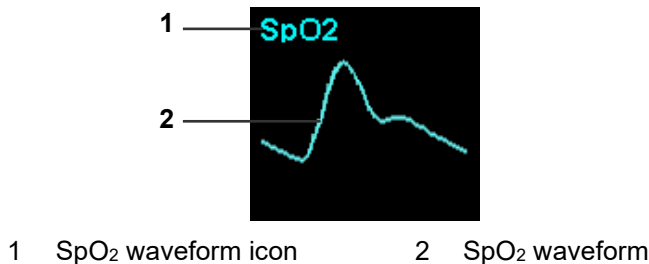


Figure 27. SpO₂ Waveform Display

Table 23. SpO₂ Waveform Menu

Level 1 Menu	Level 2 Menu or Response
SpO₂ WAVEFORM MENU	
Sweep Speed	6.25 mm/s, 12.5 mm/s, 25.0 mm/s, 50.0 mm/s
Waveform Select	Blank, ECG, SpO ₂ , Respiration, EtCO ₂
Back	-

Sweep Speed

The user-selectable Sweep Speed determines the speed at which the SpO₂ waveform trace moves across the screen. **Sweep Speed** can be selected from 6.25 mm/s, 12.5 mm/s, 25.0 mm/s and 50.0 mm/s.

Waveform select

The user can select the waveform. The selected waveform can be displayed on any waveform area. If a module is not installed, the corresponding module waveform will be not displayed in menu list.

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MONITORING THE RESPIRATION

 WARNING	For best product performance and measurement accuracy, use only accessories supplied or recommended by Covetrus. Use accessories according to the manufacturer's directions for use and your facility's standards.
 WARNING	The monitor does not detect apnea when the respiration signal is measured by trans-thoracic impedance.
 WARNING	Keep patients under close surveillance when monitoring respiration. Respiration signals are relatively more sensitive to interference from radiated electromagnetic signals. Thus, it is possible, although unlikely, that radiated electromagnetic signals from sources external to the patient and monitor can cause inaccurate respiration readings. Do not rely entirely on the monitor respiration readings for patient assessment. If measured waveforms are not appropriate readings, check external conditions to ensure there is no equipment causing electromagnetic interference.
 WARNING	Do not to rely on the clinical judgment to determine the Apnea when the impedance respiration is used.

Note: The user should check that the monitor is functioning while measurements are being made and check display periodically.

General

The Patient's respiration is detected by using two of the three leads of the ECG electrodes and cable. Real-time respiratory information is presented as a waveform and numeric data; Impedance respiration source.

The airway respiration measurement uses gases coming into the airway adapter in case of the CO₂ equipped. The monitor detects respiration rate by computing each breath cycle from the continuous EtCO₂ waveform; Airway respiration source.

Setup Connections

Refer to the **Monitoring the ECG** section for how to acquire the respiration signal by patient impedance using the ECG electrodes, leads and cable. The performance of impedance respiration can be improved by the particular placement of the Left Hind leg (LL) and Right Foreleg (RA) electrodes. (See Figure 21)

Refer to the **Monitoring the Capnography** section to detect the respiration signal by the airway adapter in case that the CO₂ equipped.

Description of Respiration Menu Functions

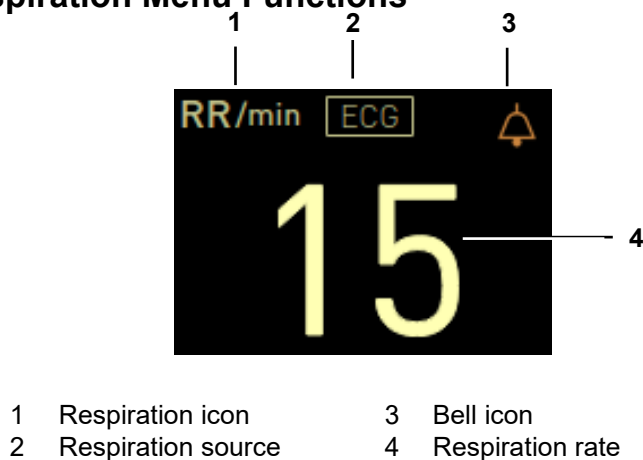


Figure 28. Respiration Display

Table 24. Respiration Menu

Level 1 Menu	Level 2 Menu or Response
RESPIRATION MENU	
Respiration	On, Off
RR Source	Auto, ECG, EtCO ₂
Apnea time setting	20 sec, 30 sec
Filter mode	Low (~2 Hz), Med (~1 Hz), High (~0.5 Hz)
(Alarm Limits Adjustment)	
▲	Upper Alarm Limit
▼	Lower Alarm Limit
(Limit alarm audio off)	On, Off, Back
Back	-

Respiration

When respiration is set to On, the measurement value for respiration rate and respiration waveform are displayed on the screen. And when the respiration is set to Off, respiration rate is not measured and respiration value is displayed with "---". Also, the waveform of Respiration is not displayed.

RR Source

User can select either AUTO, ECG, EtCO₂ for source of the respiration rate. If the AUTO is selected, the monitor will automatically drive the respiration rate from one of the monitoring parameters in this order of priority; Impedance and Airway.

Note: The user can select EtCO₂ as the source when EtCO₂ option is installed.

Apnea time setting

User can select 20 sec or 30 sec as Apnea time setting. If a patient breath is not detected when the APNEA alarm is being set, the alarm will be generated.

Filter mode

Users can select Low (~2 Hz), Med (~1 Hz), High (~0.5 Hz) as the filter mode setting. Measurement accuracy increases depending on the setting.

Limit alarm audio off

When limit alarm audio off is set to On, the alarm audio for limit alarm is went off.

Description of Respiration Waveform Menu Functions

From the respiration waveform area, users can make to check respiration change. The waveform area contains the waveform and features relevant to respiration measurement. The area provides different features based on the configuration or the waveform select.

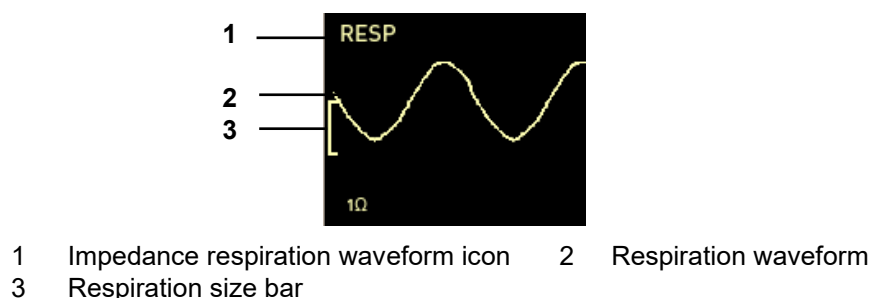


Figure 29. Respiration Waveform Display

Table 25. Respiration Waveform Menu

Level 1 Menu	Level 2 Menu or Response
RESPIRATION WAVEFORM MENU	
Sweep Speed	6.25 mm/s, 12.5 mm/s, 25.0 mm/s, 50.0 mm/s
Size	Auto, 1.25, 1.7, 2.5, 5.0, 7.5, 10.0, 15.0, 20.0 (mm/Ω)
Filter mode	Low (~2 Hz), Med (~1 Hz), High (~0.5 Hz)
Waveform select	Blank, ECG, SpO ₂ , Respiration, EtCO ₂
Back	-

Note: When each module is not installed, corresponding waveform will not be displayed.

Note: The Respiration Waveform Menu is only enabled when Respiration is set to On.

Sweep Speed

The user-selectable sweep speed determines the speed at which the respiration waveform trace moves across the screen. **Sweep Speed** can be selected from 6.25 mm/s, 12.5 mm/s, 25.0 mm/s and 50.0 mm/s.

Size

Size allows you to adjust the waveform size. When the size is set to Auto, the monitor automatically determines the optimal size of the respiration waveform to fit the space.

Filter mode

Users can select Low (~2 Hz), Med (~1 Hz), High (~0.5 Hz) as the filter mode setting. Measurement accuracy increases depending on the setting.

Waveform select

The user can select the waveform. The selected waveform can be displayed on any waveform area, if the module to measure respiration is installed and Respiration is set to On, the respiration waveform is displayed automatically. If a module is not installed, the corresponding module waveform will be not displayed in menu list.

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MONITORING THE CAPNOGRAPHY

⚠ WARNING	For best product performance and measurement accuracy, use only accessories supplied or recommended by Covetrus. Use accessories according to your facility's standards and the manufacturer's recommendation. Always refer to the manufacturer's Directions for Use for instruction about operation, cleaning, and replacement.
⚠ WARNING	The EtCO ₂ readings do not always correlate closely with blood gas values, especially in patients with pulmonary disease, pulmonary embolism or inappropriate ventilation.
⚠ WARNING	If uncertain about the accuracy of any measurement, first check the patient's vital signs by alternate means, and then make sure the VPM-25 is functioning correctly.
⚠ WARNING	The VPM-25 should not be used as an apnea monitor.
⚠ WARNING	To ensure patient safety, do not place the VPM-25 in any position that might cause it to fall on the patient.
⚠ WARNING	To ensure accurate performance and prevent VPM-25 failure, do not expose the VPM-25 to extreme moisture, such as rain.
⚠ WARNING	The use of accessories, transducers, sensors and cables other than those specified may result in increased emission and/or decreased immunity of the equipment and/or system.
⚠ WARNING	CO ₂ readings and respiratory rate can be affected by sensor application errors, certain ambient environmental conditions, and certain patient conditions.
⚠ WARNING	The VPM-25 is a prescription device and is to be operated by qualified healthcare personnel only.
⚠ WARNING	Ensure that the components of the airway are secure. If they become loose, external air may be sucked in the tube and the sampling gas will be diluted, causing incorrect measurement values.
⚠ WARNING	Ensure that selection of a volatile anesthetic is done carefully. If an improper selection is made, the measurement values may be incorrect.
⚠ WARNING	Do not use accessories other than which are specified. Different sampling tube lengths or inside diameters may have an effect on the measurement.
⚠ WARNING	The mainstream/sidestream capnography module should not be used in the presence of flammable anesthetics or other flammable gases. Use of this device in such an environment may present an explosion hazard.
⚠ WARNING	Do not use device without rectifying a gas calibration failure, as correct measurement readings will not be obtained.
⚠ WARNING	Do not use device on patients that cannot tolerate the withdrawal of 50 cc/min $\pm$ 10cc /min from airway.
⚠ WARNING	CO ₂ should not be measured in the presence of aerosolized pharmaceuticals.
⚠ WARNING	Do not use a damaged airway adapter.
⚠ WARNING	To ensure accurate performance and prevent the VPM-25 failure, do not connect the exhaust tube to the ventilator circuit.
⚠ WARNING	Flow-related readings may significantly affected by a gas leak, such as that caused by an un-cuffed endotracheal tube or a damaged sidestream sensor and mainstream sensor.
⚠ CAUTION	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 VPM-25 in high-altitude environments, it is advisable to

	consider adjusting EtCO ₂ alarm settings accordingly.
⚠ CAUTION	Do not operate the Capnostat sensor when it is wet. Do not immerse the device in water.
⚠ CAUTION	Do not operate the Capnostat sensor if it appears to have been damage or if it fails to operate properly.
⚠ CAUTION	If the patient's airway is configured with a closed suctioning system, make sure the airway adapter is placed closed to the suctioning system (on the ventilator side). This will help ensure that the sampling adapter is not impaired during and after suctioning.
⚠ CAUTION	The disposable airway adapter, nasal and nasal/oral sampling cannulas, and the airway adapter kit are intended for single patient use. Do not reuse or sterilize these disposable adapters, because system performance will be compromised.
⚠ CAUTION	Do not insert any object other than the sidestream sample cell into the inlet port of the CO ₂ module.
⚠ CAUTION	Inspect the mainstream CO ₂ sensor and airway adapter connection to ensure correct positioning.
⚠ CAUTION	Position sidestream airway adapter with the tubing in an upright position. This help keep patient secretions from pooling into the tubing.
⚠ CAUTION	To prevent moisture from during into the mainstream airway or into the sidestream airway adapter tubing, do not place the adapter in a gravity dependent position.
⚠ CAUTION	It is recommended that the mainstream airway adapter and the sidestream airway adapter be removed from the circuit whenever an aerosolized medication is delivered. The increased viscosity of the medication may contaminate the sensor windows, causing the sensor to fail prematurely.

General

The VPM-25 capnography option supports mainstream and sidestream gas analysis designed to measure the concentration of carbon dioxide in a gas mixture and to aid in determining the patient's ventilatory, circulatory, and metabolic status. Mainstream (nondiverting) and sidestream (diverting) capnography are highly accurate methods of measuring respiratory gas values.

Setup Connections

The VPM-25 has one capnography sensor receptacle which may be used for a mainstream capnography sensor or a sidestream capnography sensor.

Note: Capnography is not analyzed during unit warm-up however, the capnography does display to indicate that the VPM-25 is working properly.

Note: The typical initial warm-up period can take up to two minutes. This time varies based of the temperature of the sensor at the start of the initial warm-up.

Note: The airway adapter may require cleaning or replacement if the capnograph is used on patients that emit excessive mucous.

Calibrating the CO₂ Sensor

You must calibrate the CO₂ sensor the first time it is connected to the VPM-25, when the CO₂ sensor is changed. You do not need to calibrate the sensor when you power on the VPM-25. Once calibrated, the sensor may be disconnected and reconnected without calibration.

Note: To maintain optimum performance of the sensor and capnograph, you should perform a sensor calibration verification at least once a week.

Mainstream Operation

Mainstream monitoring uses an external, self-calibrating CO₂ sensor to ensure continuous monitoring without interruption of connection. Reusable, lightweight, or single-use airway adapters are available for both cat, dog and horse (low dead space) patients. Respiration can be monitored via an airway adapter and endotracheal or tracheostomy tube using the mainstream function of the module.

The external capnography device includes a small, lightweight sensor that continuously measures the end-tidal and minimum carbon dioxide levels in the patient's airway. The sensor head contains a small infrared transducer that accurately measures the CO₂ in the airway. The sensor is connected to the airway by a disposable or reusable airway adapter. These adapters are available in small and large animal size.

Press the Mainstream CO₂ sensor onto the airway adapter. It will click into place when properly seated. Keep the windows of the adapter in the vertical position as shown during use. This will keep water and patient secretions from pooling on the windows.

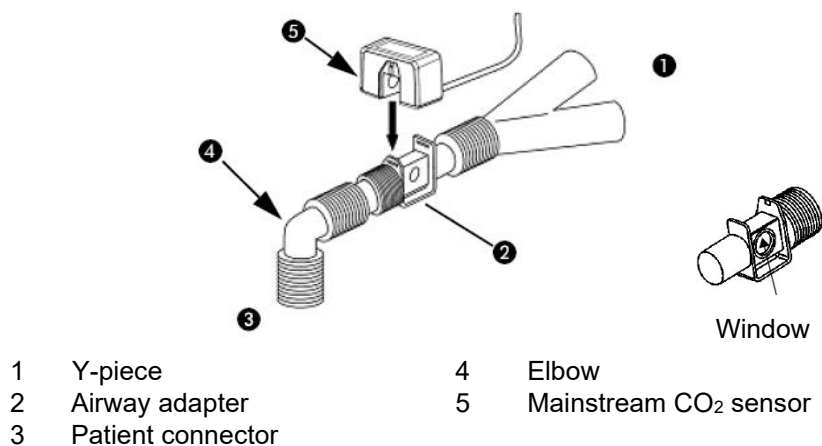


Figure 30. Connection for mainstream

Sidestream Operation

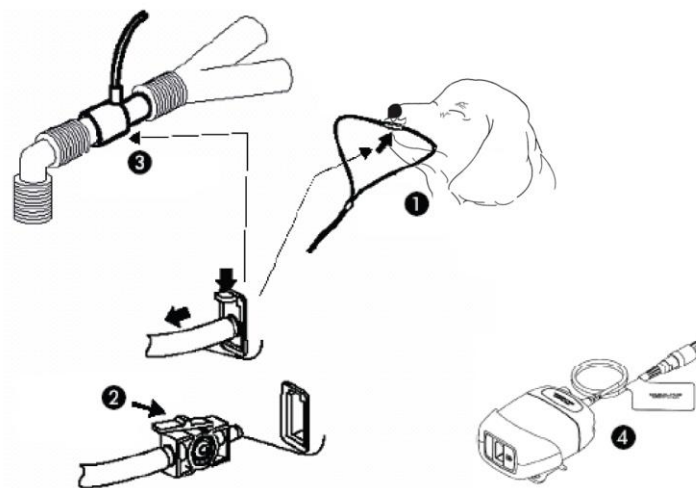
Sidestream monitoring uses an external, sidestream sensor that plug into the capnography port on the VPM-25.

Wait two minutes to allow the sensor to initialize and warm up

Sampling lines are then plugged into the sensor receptacle. Respiration can be monitored for intubated or non-intubated patients via an airway adapter, nasal cannula, or nasal/oral cannula using the sidestream function of the module. Sidestream monitoring diverts patient gases at a rate of 50 ml/min (± 10 ml/min).

The sidestream sampling line consists of a sample cell on one end that into the sidestream sensor receptacle on the VPM-25. The other end of sampling line is connected to the patient either via a cannula or a sample-T, as shown in Figure 31.

Note: For connection method for exhaust tube, follow the instruction in the directions for use of sidestream sensor.



- | | | | |
|---|---------------|---|-----------------------------------|
| 1 | Cannula | 3 | Sampling-T |
| 2 | Sampling cell | 4 | Sidestream CO ₂ sensor |

Figure 31. Connection for sidestream

Description of EtCO₂ Menu Functions

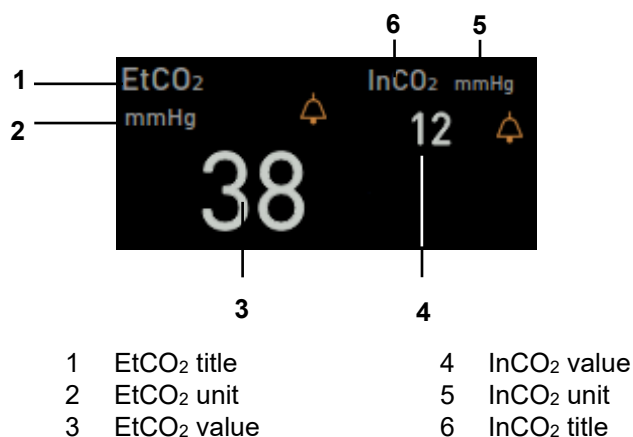


Figure 32. EtCO₂ Display

Table 26. EtCO₂ Menu

Level 1 Menu	Level 2 Menu or Response
EtCO₂ MENU	
EtCO ₂	On, Off
Average measurement	1breath, 10sec, 20sec
EtCO ₂ menu Off	-
(EtCO ₂ , InCO ₂ Alarm Limits Adjustment)	
▲	Upper Alarm Limit
▼	Lower Alarm Limit
(Limit alarm audio on/off)	On, Off, Back
Back	-

*Note: The EtCO₂ unit can only be changed by authorized personnel via the **Service Menu**.*

EtCO₂

When EtCO₂ is set to On, The measurement value for EtCO₂ and EtCO₂ waveform are displayed on the screen. And when the EtCO₂ is set to Off, EtCO₂ is not measured and the value for EtCO₂ and InCO₂ value is displayed with '---', the waveform of EtCO₂ is also not displayed.

Average Measurement

User can select 1breath, 10sec or 20sec as average measurement time range. If selecting average measurement time range, EtCO₂ average measurement value will be calculated.

EtCO₂ menu Off

Press this button, EtCO₂ numeric area and waveform area are not displayed on the measurement screen.

Limit alarm audio on/off

When limit alarm audio on/off is set to On, the alarm audio for limit alarm is went off.

Description of EtCO₂ Waveform Menu Functions

From the EtCO₂ waveform area, users can make to check EtCO₂ change. The waveform area contains the waveform and features relevant to EtCO₂ measurement. The area provides different features based on the configuration or the waveform select.

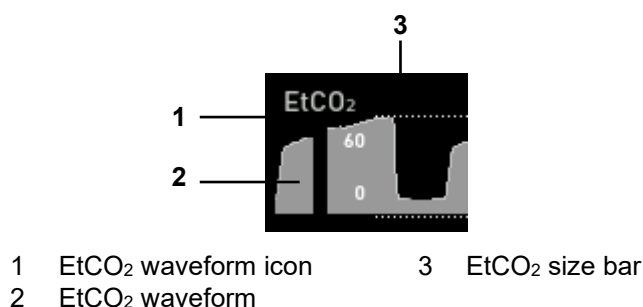


Figure 33. EtCO₂ Waveform Display

Table 27. EtCO₂ Waveform Menu

Level 1 Menu	Level 2 Menu or Response
EtCO₂ WAVEFORM MENU	
Sweep Speed	6.25 mm/s, 12.5 mm/s, 25.0 mm/s, 50.0 mm/s
Scale	Auto, 0 ~ 40 mmHg, 0 ~ 60 mmHg, 0 ~ 80 mmHg
Waveform select	Blank, ECG, SpO ₂ , Respiration, EtCO ₂
Back	-

Note: When each module is not installed, corresponding waveform will not be displayed.

Note: The EtCO₂ Waveform Menu is only enabled when EtCO₂ is set to On.

Sweep Speed

The user-selectable sweep speed determines the speed at which the EtCO₂ waveform trace moves across the screen. **Sweep Speed** can be selected from 6.25 mm/s, 12.5 mm/s 25.0 mm/s and 50.0 mm/s.

Scale

The user-selectable EtCO₂ waveform size allows you to adjust the amplitude of an EtCO₂ waveform without affecting the signal gain. The waveform size cannot be adjusted while the scales are displayed.

Waveform select

The user can select the waveform. The selected waveform can be displayed on any waveform area, if EtCO₂ module is installed and EtCO₂ is set to On, the EtCO₂ waveform is displayed automatically. If a module is not installed, the corresponding module waveform will be not displayed in menu list.

MONITORING THE TEMPERATURE

⚠ WARNING	For best product performance and measurement accuracy, use only thermometer recommended by Covetrus. Use accessories according to the manufacturer's directions for use and your facility's standards.
⚠ WARNING	Do not use damaged temperature sensors. Do not use damaged probe. Follow the manufacturer's directions for use.
⚠ WARNING	Using a probe at the wrong site produces inaccurate measurements and can cause patient injury.

Note: The user should check that the monitor is functioning while measurements are being made and check display periodically.

General

Measurement of patient temperature is accomplished by processing the signal from a probe containing a resistance element whose impedance is temperature dependent. These devices are called thermistors. The measuring time required to obtain accurate readings at the specific body site is about 20 seconds.

Setup Connections

The monitor is designed to accept signals from the temperature probes, YSI 400 series and 700 series for skin, rectal or etc.

1. Insert a body temperature probe into the temperature connector on the monitor's right panel. (See Figure 5)
2. Follow the directions for use accompanying the temperature probe.

Table 28. Temperature Sensors

	Sensor series	Model	Description
YSI sensors	YSI 400 series or compatible	YSI-401	Mono, rectal type
		YSI-409B	Mono, skin type
		TRAS-2252	Mono, skin type
		TRAG-2252	Mono, rectal type
	YSI 700 series or compatible	T700-AS	Stereo, skin type

Note: Temperature probes compatible with YSI 400 series and YSI 700 series offered by Covetrus for use can be found in Table 32.

Description of Temperature Menu Functions

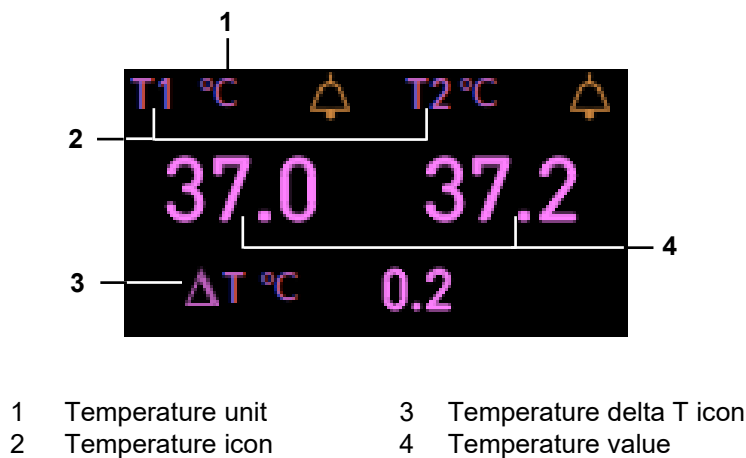


Figure 34. Temperature Display

Table 29. Temperature Menu

Level 1 Menu	Level 2 Menu or Response
TEMPERATURE 1 MENU	
Temp menu Off	-
(TEMP1, TEMP2 Alarm Limits Adjustment)	
▲	Upper Alarm Limit
▼	Lower Alarm Limit
(Limit alarm audio off)	On, Off, Back
Back	-

*Note: The temperature unit can only be changed by authorized personnel via the **Service Menu**.*

Temp menu Off

Press this button, Temp numeric area is not displayed on the measurement screen.

Limit alarm audio off

When limit alarm audio off is set to On, the alarm audio for limit alarm is went off.

TRENDS

General

The trend data is stored in USB memory. When the monitor turns on and starts to measure vital signs, the monitor saves data at 1 minute interval. Also, the monitor saves all physiological alarm conditions, NIBP measurements and error events and each parameter data. The data remains even if the monitor is powered off. After the monitor has stored 14,400 trend data, the monitor begins to store the new data over the oldest data.

Trend Data Printout

Trend data in either graphical or tabular format may be displayed or printed if a printer module is installed (see **Printing** section).

Using the touch screen

1. Touch the **Screen mode** button.
2. Touch the **Tabular trends** or **Graphical trends**.
3. Touch the setting, display speed or scroll speed to set the trends display.
4. Touch the Print start/stop button.

Tabular Trend Data

The monitor presents trend information in tabular format for all monitored parameters. The newest data appears at the bottom of tabular trends. For the NIBP trends, the data may display the latest measurement.

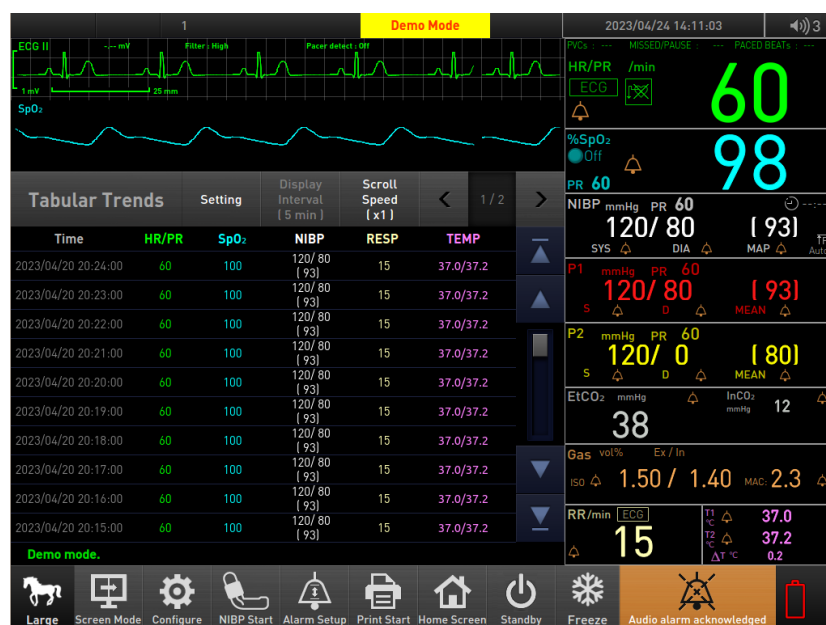


Figure 35. Tabular Trend Screen

To scroll or change viewing options, touch the **Setting**, **Display interval** or **Scroll speed** button. The monitor displays the **Tabular Trend Menu**.

Table 30. Tabular Trend Menu

Level 1 Menu	Level 2 Menu or Response
TABULAR TREND SCREEN – Scroll speed	
Scroll speed	x1, x10, x100
TABULAR TREND SCREEN – Display interval	
Display interval	1 min, 2 min, 5 min, 10 min, 15 min, 30 min, 60 min
TABULAR TREND MENU	
Trend data clear	Yes, No
Display order	Ascending, Descending
Display selection	Standard, NIBP, Alarm, ALL
Back	-

Scroll speed

The scroll speed can be selected from x1, x10 or x100. When scroll speed is set to 'x1', scrolling an item per scroll. When scroll speed is set to 'x10', scrolling 10 items per scroll. When scroll speed is set to 'x100', scrolling 100 items per scroll.

Display interval

The display time interval can be selected from 1, 2, 5, 10, 15, 30, or 60 minutes. The tabular trend will be displayed in a selected interval.

Trend data clear

The user can select trend data clear. If trend data clear is set to Yes, 'Are you sure to delete all trend data?' message will be displayed. If the user deletes trend data, press Yes again.

Display order

The display order can be selected from Ascending or Descending. If Ascending is selected, the latest data will be displayed at the bottom of the list. If Descending is selected, the latest data will be displayed at the top of the list.

Display selection

The display selection can be selected from Standard, NIBP, Alarm or All.

Standard

Display saved data per 1 minute

NIBP

Display NIBP data when NIBP measurement is completed.

Alarm

Display saved data and physiological alarm condition when alarm is generated.

All

Display standard, NIBP and alarm data.

Graphical Trend Data

Trend information in graphical format for all monitored parameters is displayed in screen. The user can select each parameter to display via interaction with **Graphical Trend Menu**.

The graphical trend data of each parameter is indicated by the symbols specified in Table 3. The newest data appears at the right of graphical trend. Use the scroll function to view more data.

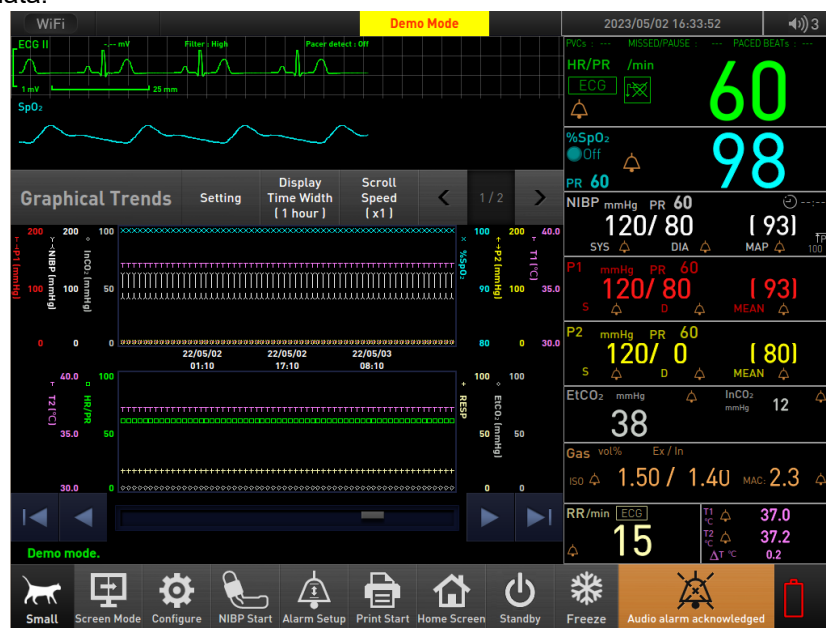


Figure 36. Graphical Trend Screen

To scroll or change viewing options, touch the **Setting**, **Display time width** or **Scroll speed** menu is highlighted. The monitor displays the **Graphical Trend Menu**.

Table 31. Graphical Trend Menu

Level 1 Menu	Level 2 Menu or Response
GRAPHICAL TREND SCREEN – Scroll speed	
Scroll speed	x1, x2, x4
GRAPHICAL TREND SCREEN – Display time width	
Display time width	1 hour, 2 hours, 4 hours, 8 hours, 12 hours, 24 hours
GRAPHICAL TREND MENU – Setting	
Trend data clear	Yes, No
Display scale	HR/PR, SpO ₂ , NIBP, Respiration rate, Temperature, EtCO ₂
Trend display	All trend display, HR/PR, SpO ₂ , NIBP, RESP, TEMP, EtCO ₂
Back	-

Scroll speed

The scroll speed can be selected from x1, x2 or x4. When scroll speed is set to 'x1', scrolling the width/4 item of the page. When scroll speed is set to 'x2', scrolling the width/2 item of 10 items per the page. When scroll speed is set to 'x4', scrolling a page.

Display time width

The display time interval can be selected from 1, 2, 4, 8, 12, 24 hours. The graphical trend will be displayed in a selected interval.

Trend data clear

The user can select trend data clear. If trend data clear is set to Yes, 'Are you sure to delete all trend data?' will be displayed. If the user deletes trend data, press Yes again.

Display scale

The display scale can be selected from HR/PR, SpO₂, NIBP, Respiration rate, Temperature, EtCO₂. Each parameter will be displayed in a display scale.

Trend display

The display selection can be selected from All trend display, HR/PR, SpO₂, NIBP, RESP, TEMP, EtCO₂. If the user displays parameter, each parameter can be set to 'On'.

Trend Data Download

Trend data can be saved in USB. If trend data is downloaded, the data will be saved in text file. Trend data can be downloaded through service menu.

Event Review

General

Event review will be stored when the event occurs. Event review can be saved before and after when the event occurs. Event data is displayed on the screen.

1. Touch the screen to enter **event review** menu.
2. If event list icon is selected, event review list will be displayed (refer to Figure 38).

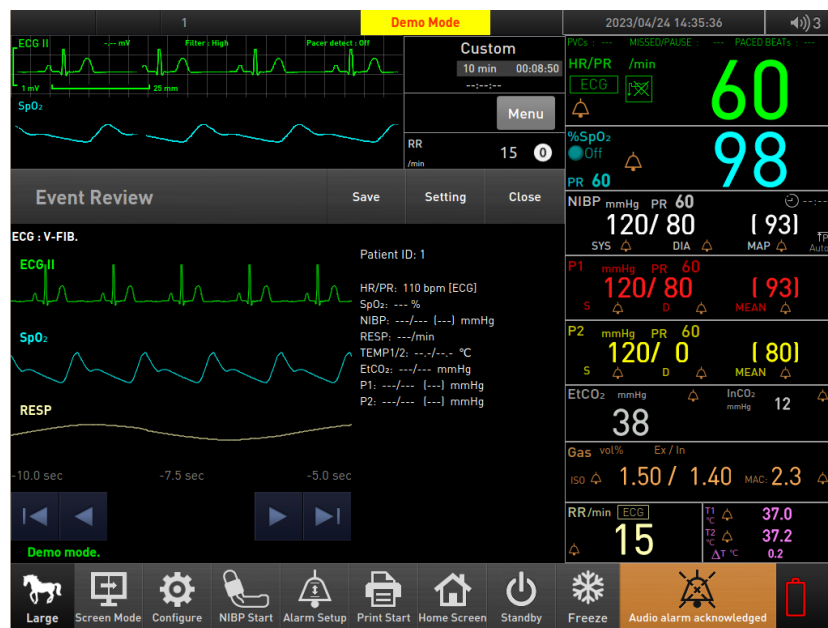


Figure 37. Event Review Waveform Display

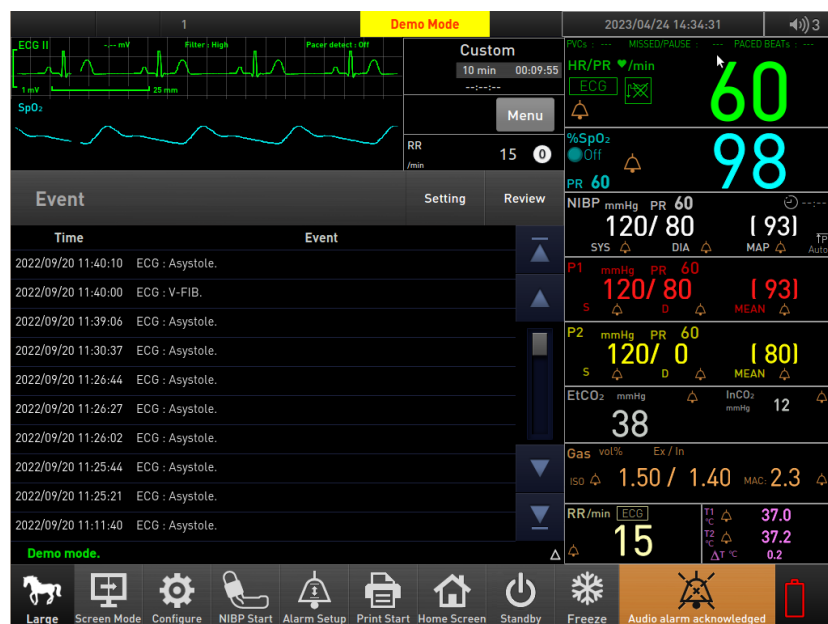


Figure 38. Event Review List Display

Table 32. Event Review Menu

Level 1 Menu	Level 2 Menu or Response
EVENT REVIEW MENU	
Clear event	Yes, No, Back
Waveform 1~3	Off, ECG I, ECG II, ECG III, ECG aVR, ECG aVL, ECG aVF, ECG V, SpO ₂ , Respiration, EtCO ₂ .
Back	-

Clear event

Executing clear event from the menu displays a delete warning and selecting Yes deletes all event reviews.

EWS (EARLY WARNING SCORE)

General

EWS is an assessment aid used to help recognize the early signs of deterioration in patients and trigger an appropriate response. EWS is used as a surveillance system for patients in hospitals, tracking their clinical condition, alerting the clinical team to any clinical deterioration and triggering a timely clinical response. EWS system will often have variations that have been modified to reflect the needs of specific patient groups.

Note: The EWS (Early Warning Score) will be referred to as EWS throughout this manual.

Note: The EWS can be operated on the monitor under the following conditions:

- *Configuration: Installed SpO₂ module*
- *Patient type: Medium, Large*

Note: Before EWS setting or operation, check that the monitor meets the above conditions. If any of the above conditions are not met, Users cannot use EWS regardless of EWS settings.

Description of the EWS Display Functions

The monitor displays the Single parameter score of each measurement in the EWS area. To display the EWS area, press the EWS button on the measurement screen. If you don't see the EWS button, set the EWS display setting to On in **Configure - Display setup**.

EWS Area

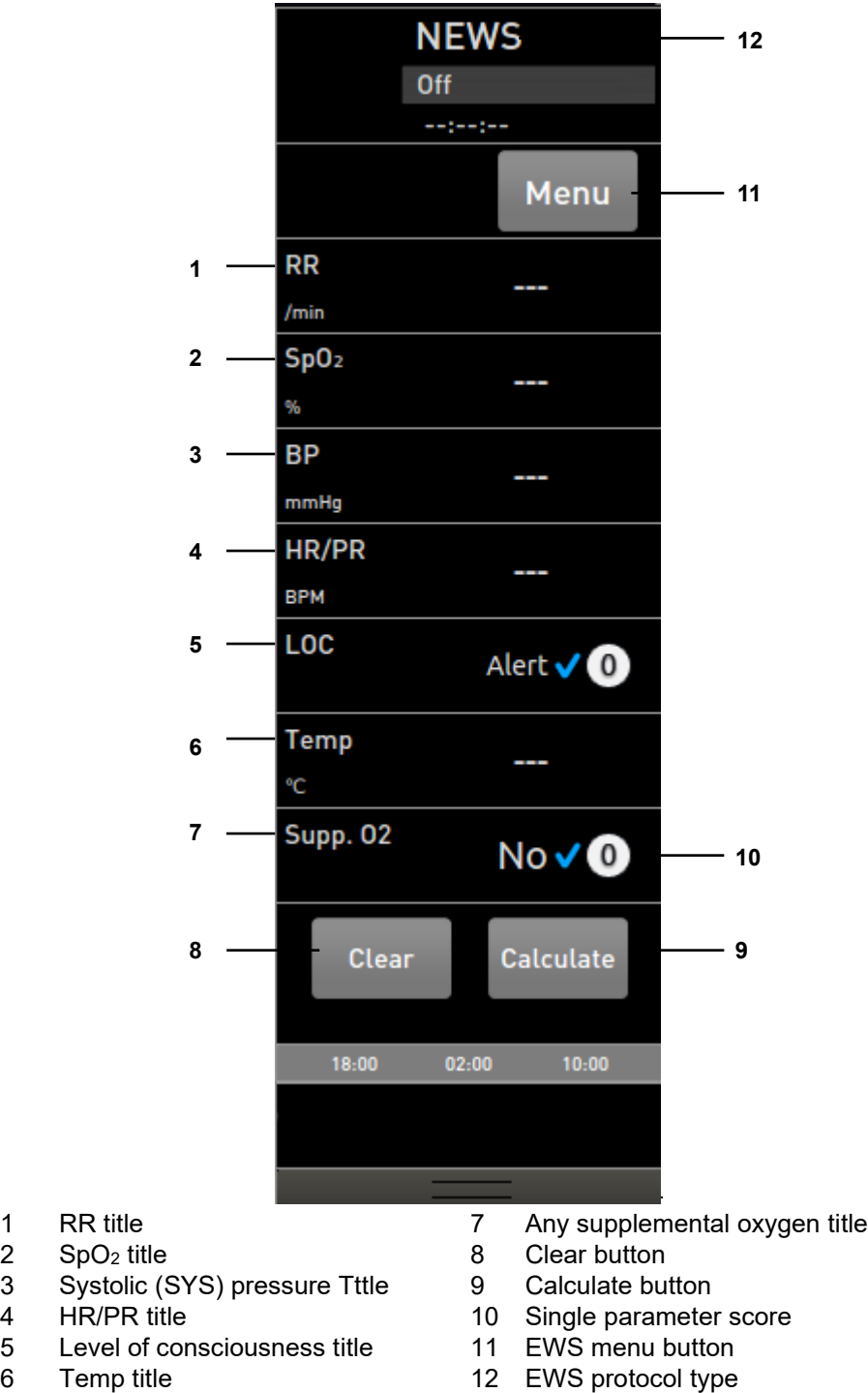


Figure 39. EWS Area

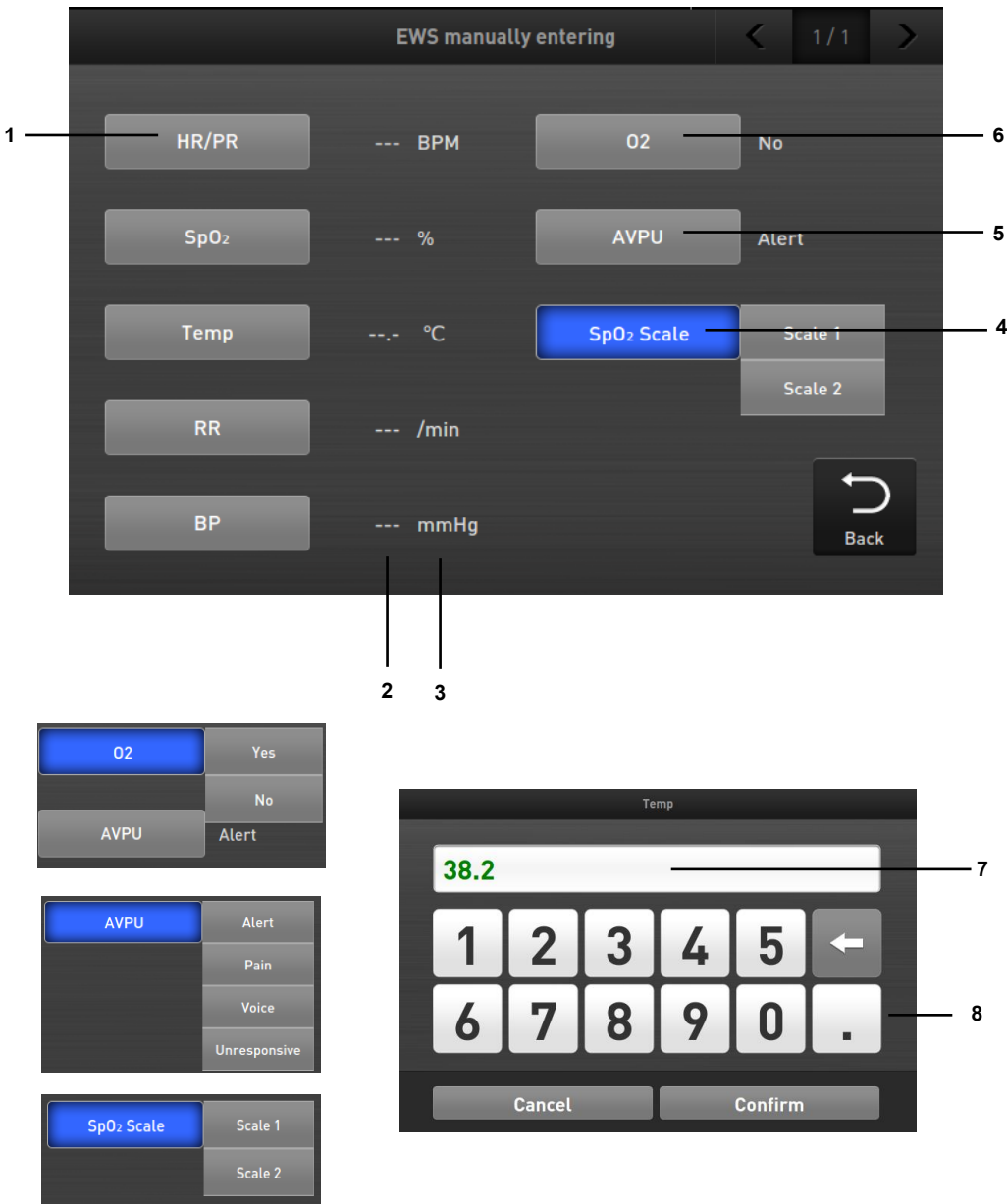
Table 33. EWS Area

Level 1 Menu	Level 2 Menu or Response
EWS Area	
EWS	Menu, Confirm/Calculate (toggle), Clear/Cancel (toggle)

EWS manually entering window

The monitor displays the EWS manual entering window when pressing the EWS area. For manual input parameters, the manual input value area is displayed and users can enter the value using numeric keyboard. When touching Oxygen supply input or Manual input value, the axiliary oxygen injection or not and the level of consciousness.

Note: SpO₂ Scale setting is displayed in EWS manullay entering window only in case of NEWS Protocol type.



- | | | | |
|---|------------------------------|---|---|
| 1 | Parameter title | 5 | Level of consciousness input |
| 2 | Measurement value | 6 | Oxygen supply input |
| 3 | Parameter unit | 7 | Manual input value |
| 4 | SpO ₂ Scale input | 8 | Number keyboard (Only manual input parameter) |

Figure 40. EWS manually entering window

Table 34. EWS manually entering window

Level 1 Menu	Level 2 Menu or Response
EWS manually entering window MENU	
HR/PR	Number keyboard display
SpO ₂	Number keyboard display
Temp	Number keyboard display
RR	Number keyboard display
BP	Number keyboard display
O ₂	Yes, No
AVPU	Alert, Pain, Voice, Unresponsive
SpO ₂ Scale	Scale 1, Scale 2 (Only NEWS2 Protocol type)
Back	-

EWS Menu

The monitor displays the EWS Menu when pressing Menu button in the EWS area. In EWS Menu, the EWS protocol can be set.

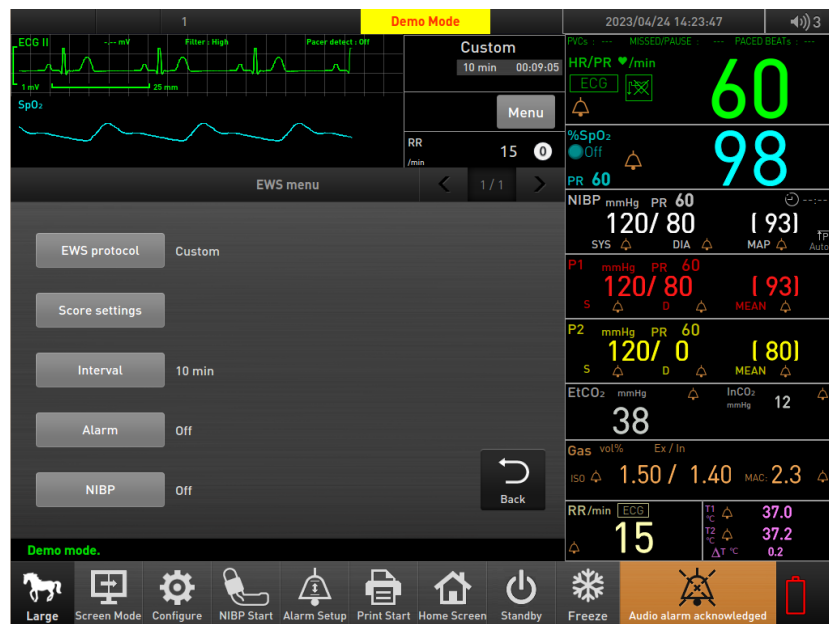


Figure 41. EWS Menu

Table 35. EWS Menu

Level 1 Menu	Level 2 Menu or Response
EWS MENU	
EWS protocol	NEWS, NEWS2, Custom
Interval	Off, 5 min, 10 min, 30 min, 1 hour, 2 hours, 3 hours, 6 hours, 12 hours, 24 hours
Alarm	On, Off
NIBP	On, Off
EWS MENU – Score settings (Only Custom protocol)	
Score settings*	BP, SpO ₂
	HR/PR, Temp
	RR
	O ₂ , AVPU
Back	-

Score settings*

The user can select (BP, SpO₂), (HR/PR, Temp), RR or (O₂, AVPU).

It can be changed the standard for the measured value for each score, and if pressing the button below the score, the detailed setting screen is displayed. When the standard for each score is changed, the reset button is activated. The Set button is activated only when the measured value continues from Low level 3 to High level 3.

Table 36. Standard sample for score settings (BP)

Low level				High level			Set button enable
3	2	1	0	1	2	3	
<= 90	91 – 100	101 – 110	111 – 219	N/A	N/A	>= 220	O
<= 90	91 – 100	101 – 105	125 – 219	N/A	N/A	>= 220	X

EWS Trend

Pressing the Calculate button in the EWS area displays the EWS result at the top. EWS Trend contents can be checked in detail by using the black bar at the bottom of the EWS area, and the score for each parameter when the EWS score is saved can be checked. After checking the response message and total score, click the Confirm button to save the trend data including the EWS total score.

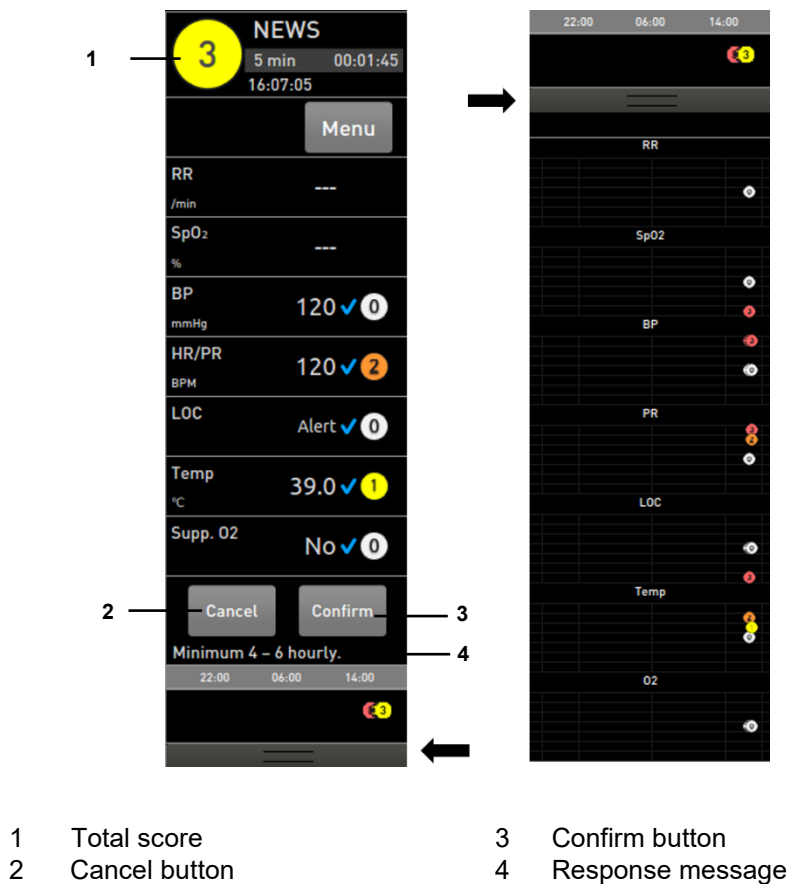


Figure 42. EWS Trend

Single parameter scoring system

The monitor displays the score of each parameter according to single parameter scoring system. Single parameter scoring system supports 4 risk levels: Normal, Low, Medium and High.

EWS protocol

The monitor provides three types of the EWS protocol, NEWS (National Early Warning Score), NEWS2 and Custom. The monitor supports basically NEWS protocol. User can set a protocol other than NEWS through Custom protocol.

Note: NEWS is developed by UK Royal Colleges to provide a national standard in the UK for EWS.

Table 37. Single parameter scoring system of NEWS/NEWS2 protocol

Parameter	Normal Level (Score 0)	Low Level (Score 1)	Medium Level (Score 2)	High Level (Score 3)
Symbols	0	1	2	3
Systolic (SYS) Pressure (mmHg)	111 to 219	101 to 110	91 to 100	≤90 or ≥220
PR (bpm)	51 to 90	41 to 51 or 91 to 110	111 to 130	≤40 or ≥131
RR (/min)	12 to 20	9 to 11	21 to 24	≤8 or ≥25
SpO ₂ (%)	≥96	94 to 95	92 to 93	≤91
Temp (°C)	36.1 to 38.0	35.1 to 36.0 or 38.1 to 39.0	≥39.1	≤35.0
Any supplemental oxygen	No	N/A	Yes	N/A
Level of consciousness	A (Alert)	N/A	N/A	V (Voice), P (Pain), or U (Unresponsive)

Setting Score of Custom protocol

Score Settings determine the each parameter range of response level at which the monitor will check the score. Users can set the each parameter range of response level. **Setting Score menu** can be accessed via the **EWS menu** of the **Configure menu**.

Users can set the blood pressure(BP), SpO₂, PR, Temp, RR range corresponding to each score (0 to 3) using numeric keyboard, '-', '≤', and '≥'. According to the supplemental oxygen and level of consciousness, users can set the score (0 to 3) for each condition.

Note: Score Settings menu is only appeared when the EWS protocol is set as Custom.

Total score and messages of EWS

The monitor displays total score and response message. The total score indicates the score of the patient by calculating the each single parameter scores. The response level according to the total score is as following table. After checking the score and message, an immediate user response is required.

Table 38. Total Score condition and message of NEWS/Custom protocol

Response level	Symbols	Condition	Message
Normal level		Total score is 0.	Frequency of monitoring : Minimum 12 hourly Continue routine EWS monitoring with every set of observations.
Low level		Total score is 1 to 4.	Frequency of monitoring : Minimum 4 – 6 hourly Inform registered nurse who must assess the patient.
Medium level		Total score is 5 to 6 or at least one single parameter score is more than 3.	Frequency of monitoring : Minimum 1 hourly Inform registered nurse who must assess the patient Urgently.
High level		Total score is 7 or more.	Frequency of monitoring : Continuous monitoring Inform registered nurse who must assess the patient immediately.

Table 39. Total Score condition and message of NEWS2 protocol

Response level	Symbols	Condition	Message
Low level		Total score is 0.	Frequency of monitoring : Minimum 12 hourly Continue routine EWS monitoring with every set of observations.
		Total score is 1 to 4.	Frequency of monitoring : Minimum 4 – 6 hourly Inform registered nurse who must assess the patient.
Low-medium level		Least one single parameter score is more than 3.	Frequency of monitoring : Minimum 1 hourly Inform registered nurse who must assess the patient Urgently.
Medium level		Total score is 5 to 6.	Frequency of monitoring : Minimum 1 hourly Inform registered nurse who must assess the patient Urgently.
High level		Total score is 7 or more.	Frequency of monitoring : Continuous monitoring Inform registered nurse who must assess the patient immediately.

Note: The single score is displayed separately for each parameter in the EWS area window, and the total score is displayed in the EWS area window.

FREEZE

General

The monitor provides a freeze mode to check previously measured waveform data. You can execute the freeze mode by pressing the Freeze button at the bottom of the measurement screen. Data from the current time to 2 minutes ago can be checked, and wave display related settings follow each parameter waveform setting. The number of displayed waveforms depends on the number of waveform settings.

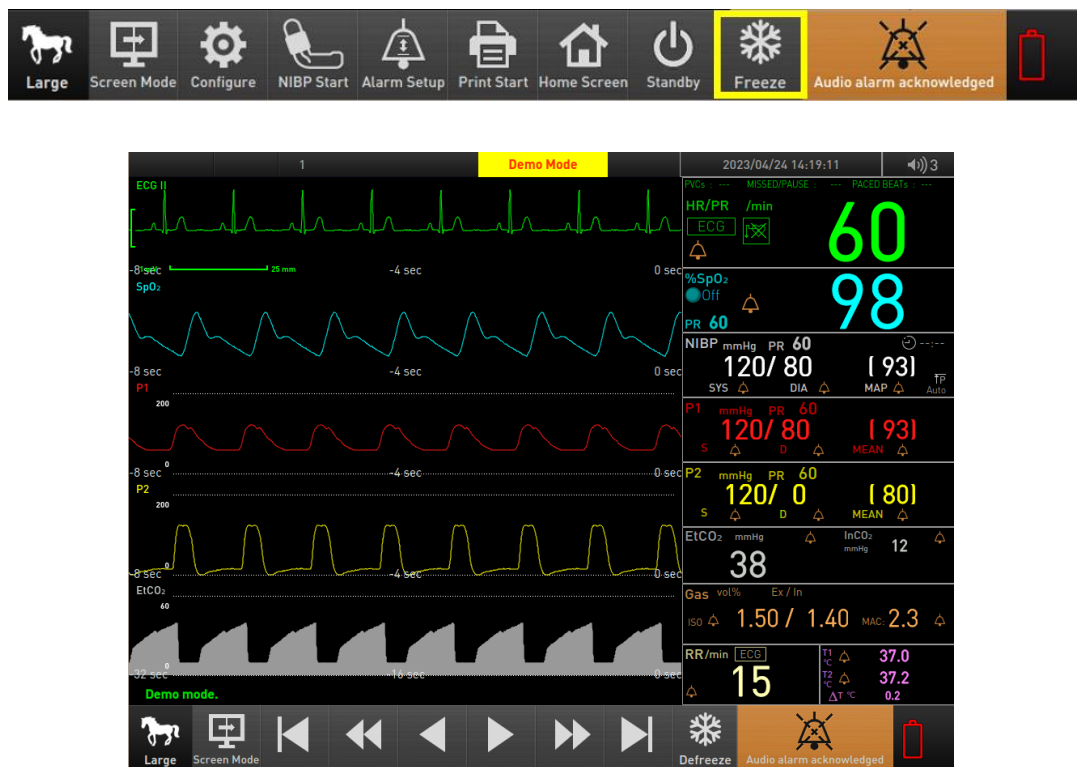
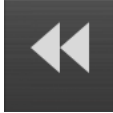
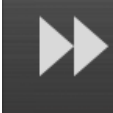
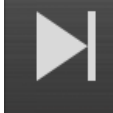


Figure 43. Freeze mode

Description of the Freeze mode Operation

In the freeze mode, only the seven buttons operate, and when touching other screen, an invalid tone is generated.

Table 40. Freeze mode - Button

					
Move to the far left Display data from 120 seconds old	Move left 1 page	Move left 1/2 page	Move right 1/2 page	Move right 1 page	Move to the far right Display the latest data

This page is intentionally left blank.

ALARMS AND LIMITS

 WARNING	Each time the monitor is used, check alarm limits to make sure that they are appropriate for the patient being monitored.
 WARNING	If different alarm presets are used for the same or similar equipment in any single area, e.g. an intensive care unit or cardiac room, a potential hazard can exist.
 WARNING	Alarm volume adjustment is related to safety to patient. If the volume of alarm sound is not loud enough for clinician to hear the clinicians are not able to recognize patient alarm. It causes patient risk.

General

When the monitor detects certain conditions that require user attention, the monitor enters an alarm state. The monitor response is indicated by:

- Visual alarm indication
- Audible alarm indication
- Physiological alarms including identification of out-of-limit vital signs
- Technical alarms

Note: The audible and visual alarms on the monitor, used in conjunction with clinical signs and symptoms, are the primary source for notifying medical personnel that a patient alarm condition exists.

Changing Alarm Volume

Users can select an alarm volume level of 1 to 5. Refer to the **Using the Monitor** section.

Alarm Priority and Messages

There are three possible priorities for visual and audible alarm: High, Medium, and Low. The high, medium and low priority messages and the informative messages are displayed in the message area. A message is displayed alternatively every 2 seconds when the monitor is in multiple alarm conditions. Refer to the **Service manual** for the recommended actions.

Table 41. Alarm Priority Condition

Alarm priority	Condition
High Priority	ECG: Asystole.
	ECG: V-FIB.
	ECG: VTACH
	SpO ₂ : Loss of pulse.
	{BP Label}: Loss of pulse.
	EtCO ₂ : APNEA.
	GAS: APNEA
	SYSTEM: Critically low-battery condition.
Medium Priority	HR/PR: High limits violated.
	HR/PR: Low limits violated.
	ECG: Signal saturation.
	ECG: Ventricular rhythm
	ECG: Tachy
	ECG: Brady

Alarm priority	Condition
	SpO ₂ : High limits violated.
	SpO ₂ : Low limits violated.
	NIBP: High systolic blood pressure limits violated.
	NIBP: High diastolic blood pressure limits violated.
	NIBP: High map blood pressure limits violated.
	NIBP: Low systolic blood pressure limits violated.
	NIBP: Low diastolic blood pressure limits violated.
	NIBP: Low map blood pressure limits violated.
	RESP: High limits violated.
	RESP: Low limits violated.
	{label}: High systolic blood pressure limits violated.
	{label}: High diastolic blood pressure limits violated.
	{label}: High mean blood pressure limits violated.
	{label}: Low systolic blood pressure limits violated.
	{label}: Low diastolic blood pressure limits violated.
	{label}: Low mean blood pressure limits violated.
	Temperature1: High limits violated.
	Temperature1 Low limits violated.
	Temperature2: High limits violated.
	Temperature2 Low limits violated.
	EtCO ₂ : High limits violated.
	EtCO ₂ : Low limits violated.
	InCO ₂ : High limits violated.
	InCO ₂ : Low limits violated.
	Gas: High insp Gas limits violated.
	Gas: High exp Gas limits violated.
	Gas: Low insp Gas limits violated.
	Gas: Low exp Gas limits violated.
	RESP: Loss of respiration signal.
Low Priority	ECG: Cable/Sensor disconnect.
	ECG: Leads off.
	ECG: Chest lead off.
	ECG: Out of range.
	ECG: Run
	ECG: Bigeminy
	ECG: Trigeminy
	ECG: Pause
	ECG: Couplet
	ECG: Frequent
	ECG: R on T PVCs
	ECG: Multiform PVCs
	SpO ₂ : Loss of pulse from SpO ₂ .
	SpO ₂ : Cable/Sensor disconnect.
	SpO ₂ : Sensor off.
	SpO ₂ : Sensor error.
	SpO ₂ : Out of range.
	Temperature1: Probe disconnect.
	Temperature2: Probe disconnect.
	Temperature1: Out of range.
	Temperature2: Out of range.
	NIBP: Abnormal cuff / EEE 11.
	NIBP: Abnormal cuff / EEE 21.
	NIBP: Measurement fail / EEE 12.

Alarm priority	Condition
	NIBP: Measurement fail / EEE 14.
	NIBP: Measurement fail / EEE 15.
	NIBP: Measurement fail / EEE 18.
	NIBP: Measurement fail / EEE 20.
	NIBP: Overpressure / EEE 19.
	NIBP: Artifact / EEE 13.
	NIBP: Artifact / EEE 16.
	NIBP: Time-out / EEE 17.
	NIBP: Out of range.
	RESP: Out of range.
	{label}: Loss of pulse from IBP.
	{label}: Out of range.
	{label}: Cable/Sensor disconnect.
	EtCO ₂ : Out of range.
	EtCO ₂ : Sensor over temp.
	EtCO ₂ : Sensor faulty.
	EtCO ₂ : Zero required.
	EtCO ₂ : Not initialized.
	EtCO ₂ : Check sampling line.
	EtCO ₂ : Factory service required.
	EtCO ₂ : Sample line disconnected.
	EtCO ₂ : Check adapter.
	Gas: Out of range.
	Gas: Cable disconnect.
	Gas: Check Adaptor.
	Gas: Unspecified accuracy.
	Gas: Sensor error.
	SYSTEM: Low battery.
	SYSTEM: Printer out of paper.
	SYSTEM: Backlight error.
	EEE606 ~ 912
Informative	SpO ₂ : Weak pulse.
	SpO ₂ : Weak signal.
	SpO ₂ : Motion interference.
	SpO ₂ : Excess infrared light.
	SpO ₂ : Electrical/Optical interference.
	SpO ₂ : High Pulse amplitude.
	SpO ₂ : Sensor: Alternate site?
	SpO ₂ : Sensor: Cover sensor site?
	SpO ₂ : Sensor: Ear/Forehead sensor?
	SpO ₂ : Sensor: Nasal/Ear sensor?
	SpO ₂ : Sensor: OxiMax adhesive sensor?
	SpO ₂ : Sensor: Secure cable.
	SpO ₂ : Sensor: Headband.
	SpO ₂ : Sensor: Warm site.
	SpO ₂ : Sensor: Bandage assembly.
	SpO ₂ : Sensor: Nail polish.
	SpO ₂ : Sensor: Sensor too tight?
	SpO ₂ : Sensor: Reposition sensor.
	SpO ₂ : Sensor: Isolate interference source.
	SpO ₂ : Sensor: Clean sensor site.
	SpO ₂ : Pulse search.
	{label}: Unable to zero calibration.

Alarm priority	Condition
	Abnormally shut down last time.
	SYSTEM: Printer is not available.
	SYSTEM: Printer is not available in LOW BATTERY condition.
	NIBP: NIBP is not available in CRITICAL LOW BATTERY condition.
	Audio alarm off.
	Audio alarm pause.
	Audio alarm pause acknowledged.
	JPG file is saved.
	Demo mode.
	Freeze mode.
	RESP: Measurement is off.
	EtCO ₂ : Measurement is off.
	EtCO ₂ : Zero in progress.
	EtCO ₂ : Sensor warm up.
	Gas: Measurement is off.

Note: There may be other informative messages that are not listed above.

Visual alarm Indication

Table 42. Visual Alarm Characteristics

Alarm Category	Color	Alarm Indicator Flashing Rate
High priority	Red	1 flashes in 0.7 seconds (approximately 1.43Hz)
Medium priority	Yellow	1 flashes in 2 seconds (approximately 0.5Hz)
Low priority	Yellow	Always on (non-flashing)

Note: Alarm Window on the center top of the front panel respond with the flashing rates described in Table 42 when an alarm occurs.

When a **high priority alarm** is activated, a non-flashing alarm message is displayed. The numerical area will flash red.

When a **medium priority alarm** is activated, a non-flashing alarm message is displayed. The numerical area will flash yellow.

When a **low priority alarm** is activated, a non-flashing alarm message is displayed. The numerical area will change to yellow.

Audible alarm Indication

 WARNING	Do not pause or terminate the alarm audio or decrease its volume if patient safety could be compromised.
 WARNING	Make sure that the monitor speaker is not obstructed. Failure to do so could result in an inaudible alarm tone.
 WARNING	Do not cover the speaker.

Table 43. Audible Alarm Characteristics

Alarm Category	Tone Pitch	Beep Rate
		IEC60601-1-8
High priority	540 Hz	About 10 pulses per 5 sec 3/9/15sec interval burst
Medium priority	480 Hz	About 3 pulses per 1 sec 3/15/30sec interval burst
Low priority	400 Hz	About 1 pulse per 1 sec 15/30/60sec interval burst

Note: Alarm audios may be decreased in volume as described in Table 13 or temporarily paused.

Note: Audible alarm characteristics in Table 43 is default. Each alarm audio characteristic depends on audio alarm interval setting.

Note: The maximum mean time of the alarm delay is less than 10 seconds unless otherwise specified in this manual.

Verifying Visual and Audible Alarm Indication

If the monitor fails to perform as specified in this test, contact qualified service personnel or your local supplier for assistance.

User can verify the alarm operation for parameters like HR/PR, SpO₂, NIBP, EtCO₂, InCO₂, Resp and Temp by following the below procedures.

1. Connect the monitor to an AC power source.
2. Press the **Power Button** to turn on the monitor.
3. Connect the sensor to simulator and connect the cable to monitor.
4. Set the simulator to a smaller value than the lower alarm limit on the monitor.
5. Verify the following monitor reaction:
 - a. The monitor begins to track the physiological signal from the simulator.
 - b. After about 10 to 20 seconds, the monitor displays the value measured as specified by the simulator. Verify values are within the tolerances specified in the **Specification** section for each parameter (HR/PR, SpO₂, NIBP, EtCO₂, InCO₂, Resp and Temp).
 - c. Audible alarm sounds.
 - d. Alarm Indicator flashes.
 - e. "**Low limits violated**" message is displayed.
 - f. The numerical area flashes, indicating the parameter has violated default alarm limits.

Note: The maximum mean time of the alarm delay is less than 10 seconds unless otherwise specified in this manual.

Changing Alarm Limits

⚠ WARNING	Each time the monitor is used, check alarm limits to make sure that they are appropriate for the patient being monitored.
⚠ WARNING	If different alarm presets are used for the same or similar equipment in any single area, e.g. an intensive care unit or cardiac room, a potential hazard can exist.
⚠ CAUTION	Do not set the alarm limits to extreme values that can cause the alarm to become useless.

User can change alarm limits from default values, if necessary. Limit alarm audio off for each parameter may be set in two ways:

- Via interaction with **ECG, HR/PR, NIBP, SpO₂, TEMP, RESP, EtCO₂**
- Via interaction with the **Alarm setup Menu** that presents the limits in all the parameters at one time

Setting Alarm Limits via Alarm setup Menu

1. Touch to **Alarm setup Menu Icon** on the lower of the screen.
2. Select **Alarm Limits** to touch. The monitor will display all alarm limits that are currently in effect for all monitored parameters. Select the alarm limits to set.

Table 44. Alarm setup Menu

Level 1 Menu	Level 2 Menu or Response
ALARM SETUP MENU	
Alarm Limits	HR/PR, SpO ₂ , NIBP (SYS, DIA, MAP), EtCO ₂ , InCO ₂ , TEMP1, TEMP2, RESP
	Limit alarm audio off for each parameter
Alarm limit display	Off, On
Audio alarm pause/off	Start, Stop
Back	-

Alarm Limits Ranges

Table 45 describes the possible alarm limits. The monitor is shipped with factory default settings.

Note: Authorized personnel can define the way to save the power default: custom setting, backup and factory default. The detailed information is described in the service manual.

Table 45. Alarm Limits Ranges

Parameter	Range		Factory Defaults		
	Large, Medium, Small	Adjust Step	Large	Medium	Small
HR/PR high limit	25 to 400 BPM	5 BPM	120 BPM	160 BPM	200 BPM
HR/PR low limit	20 to 395 BPM	5 BPM	40 BPM	50 BPM	90 BPM
NIBP SYS high limit	45 to 265 mmHg	5 mmHg 0.6 to 0.7 kPa	160 mmHg	160 mmHg	160 mmHg
NIBP SYS low limit	40 to 260 mmHg	5 mmHg 0.6 to 0.7 kPa	70 mmHg	70 mmHg	70 mmHg
NIBP MAP high limit	30 to 225 mmHg	5 mmHg 0.6 to 0.7 kPa	140 mmHg	140 mmHg	140 mmHg
NIBP MAP low limit	25 to 220 mmHg	5 mmHg 0.6 to 0.7 kPa	60 mmHg	60 mmHg	60 mmHg
NIBP DIA high limit	25 to 200 mmHg	5 mmHg 0.6 to 0.7 kPa	100 mmHg	100 mmHg	100 mmHg
NIBP DIA low limit	20 to 195 mmHg	5 mmHg 0.6 to 0.7 kPa	40 mmHg	40 mmHg	40 mmHg
%SpO ₂ high limit	21 to 100 %	1 %	100 %	100 %	100 %
%SpO ₂ low limit	20 to 99 %	1 %	90 %	90 %	90 %
RR high limit	4 to 150 BPM	1 BPM	30 BPM	40 BPM	40 BPM
RR low limit	3 to 149 BPM	1 BPM	5 BPM	8 BPM	8 BPM
Temp1 high limit	0.1 to 50.0 °C 32.2 to 122.0 °F	0.1 °C 0.1 °F to 0.2 °F	39.0 °C 102.2 °F	39.0 °C 102.2 °F	39.0 °C 102.2 °F
Temp1 low limit	0.0 to 49.9 °C 32.0 to 121.8 °F	0.1 °C 0.1 °F to 0.2 °F	36.0 °C 96.8 °F	36.0 °C 96.8 °F	36.0 °C 96.8 °F
Temp2 high limit	0.1 to 50.0 °C 32.2 to 122.0 °F	0.1 °C 0.1 °F to 0.2 °F	39.0 °C 102.2 °F	39.0 °C 102.2 °F	39.0 °C 102.2 °F
Temp2 low limit	0.0 to 49.9 °C 32.0 to 121.8 °F	0.1 °C 0.1 °F to 0.2 °F	36.0 °C 96.8 °F	36.0 °C 96.8 °F	36.0 °C 96.8 °F
EtCO ₂ high limit	1 to 150 mmHg 0.1 to 20.0 kPa	1 mmHg 0.1 to 0.2 kPa	60 mmHg 8.0 kPa	60 mmHg 8.0 kPa	60 mmHg 8.0 kPa
InCO ₂ high limit	1 to 20 mmHg 0.1 to 2.7 kPa	1 mmHg 0.1 to 0.2 kPa	8 mmHg 1.1 kPa	8 mmHg 1.1 kPa	8 mmHg 1.1 kPa
InCO ₂ low limit	0 to 19 mmHg 0 to 2.5 kPa	1 mmHg 0.1 to 0.2 kPa	0 mmHg 0 kPa	0 mmHg 0 kPa	0 mmHg 0 kPa
ABP, AO, FAP, BAP	-45 ~ 300 mmHg	5mmHg	160 mmHg	160 mmHg	160 mmHg

SYS High limit	-6 to 40 kPa	0.6 to 0.7 kPa	(21.3 kPa)	(21.3 kPa)	(21.3 kPa)
ABP, AO, FAP, BAP	-50 ~ 295 mmHg	5mmHg	90 mmHg	90 mmHg	90 mmHg
SYS Low limit	-6.7 to 39.3 kPa	0.6 to 0.7 kPa	(12.0 kPa)	(12.0 kPa)	(12.0 kPa)
ABP, AO, FAP, BAP	-45 ~ 300 mmHg	5mmHg	110 mmHg	110 mmHg	110 mmHg
Mean High limit	-6 to 40 kPa	0.6 to 0.7 kPa	(14.7 kPa)	(14.7 kPa)	(14.7 kPa)
ABP, AO, FAP, BAP	-50 ~ 295 mmHg	5mmHg	60 mmHg	60 mmHg	60 mmHg
Mean Low limit	-6.7 to 39.3 kPa	0.6 to 0.7 kPa	(8.0 kPa)	(8.0 kPa)	(8.0 kPa)
ABP, AO, FAP, BAP	-45 ~ 300 mmHg	5mmHg	90 mmHg	90 mmHg	90 mmHg
DIA High limit	-6 to 40 kPa	0.6 to 0.7 kPa	(12.0 kPa)	(12.0 kPa)	(12.0 kPa)
ABP, AO, FAP, BAP	-50 ~ 295 mmHg	5mmHg	50 mmHg	50 mmHg	50 mmHg
DIA Low limit	-6.7 to 39.3 kPa	0.6 to 0.7 kPa	(6.7 kPa)	(6.7 kPa)	(6.7 kPa)
ART / UAP	-45 ~ 300 mmHg	5mmHg	160 mmHg	160 mmHg	160 mmHg
SYS high limit	-6 to 40 kPa	0.6 to 0.7 kPa	(21.3 kPa)	(21.3 kPa)	(21.3 kPa)
ART / UAP	-50 ~ 295 mmHg	5mmHg	90 mmHg	90 mmHg	90 mmHg
SYS low limit	-6.7 to 39.3 kPa	0.6 to 0.7 kPa	(12.0 kPa)	(12.0 kPa)	(12.0 kPa)
ART / UAP	-45 ~ 300 mmHg	5mmHg	110 mmHg	110 mmHg	110 mmHg
MEAN high limit	-6 to 40 kPa	0.6 to 0.7 kPa	(14.7 kPa)	(14.7 kPa)	(14.7 kPa)
ART / UAP	-50 ~ 295 mmHg	5mmHg	60 mmHg	60 mmHg	60 mmHg
MEAN low limit	-6.7 to 39.3 kPa	0.6 to 0.7 kPa	(8.0 kPa)	(8.0 kPa)	(8.0 kPa)
ART / UAP	-45 ~ 300 mmHg	5mmHg	90 mmHg	90 mmHg	90 mmHg
DIA high limit	-6 to 40 kPa	0.6 to 0.7 kPa	(12.0 kPa)	(12.0 kPa)	(12.0 kPa)
ART / UAP	-50 ~ 295 mmHg	5mmHg	50 mmHg	50 mmHg	50 mmHg
DIA low limit	-6.7 to 39.3 kPa	0.6 to 0.7 kPa	(6.7 kPa)	(6.7 kPa)	(6.7 kPa)
UVP / CVP / RAP / LAP / ICP / IC1 / IC2	-45 ~ 300 mmHg -6 to 40 kPa	5mmHg 0.6 to 0.7 kPa	30mmHg	30mmHg	30mmHg
UVP / CVP / RAP / LAP / ICP / IC1 / IC2	-50 ~ 295 mmHg -6.7 to 39.3 kPa	5mmHg 0.6 to 0.7 kPa	5mmHg (0.7kPa)	5mmHg (0.7kPa)	5mmHg (0.7kPa)
UVP / CVP / RAP / LAP / ICP / IC1 / IC2	-45 ~ 300 mmHg -6 to 40 kPa	5mmHg 0.6 to 0.7 kPa	20mmHg	20mmHg	20mmHg
UVP / CVP / RAP / LAP / ICP / IC1 / IC2	-50 ~ 295 mmHg -6.7 to 39.3 kPa	5mmHg 0.6 to 0.7 kPa	0mmHg (0.0kPa)	0mmHg (0.0kPa)	0mmHg (0.0kPa)
UVP / CVP / RAP /	-45 ~ 300 mmHg	5mmHg	5mmHg	5mmHg	5mmHg

LAP / ICP / IC1 / IC2 DIA high limit	-6 to 40 kPa	0.6 to 0.7 kPa	(0.7kPa)	(0.7kPa)	(0.7kPa)
UVP / CVP / RAP / LAP / ICP / IC1 / IC2 DIA low limit	-50 ~ 295 mmHg -6.7 to 39.3 kPa	5mmHg 0.6 to 0.7 kPa	-5mmHg (-0.7kPa)	-5mmHg (-0.7kPa)	-5mmHg (-0.7kPa)
PAP SYS high limit	-45 ~ 300 mmHg -6 to 40 kPa	5mmHg 0.6 to 0.7 kPa	60mmHg (8.0kPa)	60mmHg (8.0kPa)	60mmHg (8.0kPa)
PAP SYS low limit	-50 ~ 295 mmHg -6.7 to 39.3 kPa	5mmHg 0.6 to 0.7 kPa	25mmHg (3.3kPa)	25mmHg (3.3kPa)	25mmHg (3.3kPa)
PAP MEAN high limit	-45 ~ 300 mmHg -6 to 40 kPa	5mmHg 0.6 to 0.7 kPa	25mmHg (3.3kPa)	25mmHg (3.3kPa)	25mmHg (3.3kPa)
PAP MEAN low limit	-50 ~ 295 mmHg -6.7 to 39.3 kPa	5mmHg 0.6 to 0.7 kPa	0mmHg (0.0kPa)	0mmHg (0.0kPa)	0mmHg (0.0kPa)
PAP DIA high limit	-45 ~ 300 mmHg -6 to 40 kPa	5mmHg 0.6 to 0.7 kPa	15mmHg (2kPa)	15mmHg (2kPa)	15mmHg (2kPa)
PAP DIA low limit	-50 ~ 295 mmHg -6.7 to 39.3 kPa	5mmHg 0.6 to 0.7 kPa	-5mmHg (-0.7kPa)	-5mmHg (-0.7kPa)	-5mmHg (-0.7kPa)
Gas Isoflurane insp high limit	0.5 ~ 25.0 vol% 4mmHg ~ 190mmHg 0.5 ~ 25.3kPa	0.5 vol% 3 to 4mmHg 0.5 kPa	1.5 vol% 11mmHg 1.5 kPa	1.5 vol% 11mmHg 1.5 kPa	1.5 vol% 11mmHg 1.5 kPa
Gas Isoflurane insp low limit	0 ~ 24.5 vol% 0mmHg ~ 186mmHg 0 ~ 24.8kPa	0.5 vol% 3 to 4mmHg 0.5kPa	0 vol% 0 mmHg 0 kPa	0 vol% 0 mmHg 0 kPa	0 vol% 0 mmHg 0 kPa
Gas Sevoflurane insp high limit	0.5 ~ 25.0 vol% 4mmHg ~ 190mmHg 0.5 ~ 25.3kPa	0.5 vol% 3 to 4mmHg 0.5kPa	1.5 vol% 11mmHg 1.5 kPa	1.5 vol% 11mmHg 1.5 kPa	1.5 vol% 11mmHg 1.5 kPa
Gas Sevoflurane insp low limit	0 ~ 24.5 vol% 0mmHg ~ 186mmHg 0 ~ 24.8kPa	0.5 vol% 3 to 4mmHg 0.5kPa	0 vol% 0 mmHg 0 kPa	0 vol% 0 mmHg 0 kPa	0 vol% 0 mmHg 0 kPa
Gas Desflurane insp high limit	0.5 ~ 25.0 vol% 4mmHg ~ 190mmHg 0.5 ~ 25.3kPa	0.5 vol% 3 to 4mmHg 0.5kPa	1.5 vol% 11mmHg 1.5 kPa	1.5 vol% 11mmHg 1.5 kPa	1.5 vol% 11mmHg 1.5 kPa
Gas Desflurane insp low limit	0 ~ 24.5 vol% 0mmHg ~ 186mmHg 0 ~ 24.8kPa	0.5 vol% 3 to 4mmHg 0.5kPa	0 vol% 0 mmHg 0 kPa	0 vol% 0 mmHg 0 kPa	0 vol% 0 mmHg 0 kPa
Gas Isoflurane exp high limit	0.5 ~ 25.0 vol% 4mmHg ~ 190mmHg	0.5 vol% 3 to 4mmHg	1.5 vol% 11mmHg	1.5 vol% 11mmHg	1.5 vol% 11mmHg

	0.5 ~ 25.3kPa	0.5kPa	1.5 kPa	1.5 kPa	1.5 kPa
Gas Isoflurane exp low limit	0 ~ 24.5 vol% 0mmHg ~ 186mmHg 0 ~ 24.8kPa	0.5 vol% 3 to 4mmHg 0.5kPa	0 vol% 0 mmHg 0 kPa	0 vol% 0 mmHg 0 kPa	0 vol% 0 mmHg 0 kPa
Gas Sevoflurane exp high limit	0.5 ~ 25.0 vol% 4mmHg ~ 190mmHg 0.5 ~ 25.3kPa	0.5 vol% 3 to 4mmHg 0.5kPa	1.5 vol% 11mmHg 1.5 kPa	1.5 vol% 11mmHg 1.5 kPa	1.5 vol% 11mmHg 1.5 kPa
Gas Sevoflurane exp low limit	0 ~ 24.5 vol% 0mmHg ~ 186mmHg 0 ~ 24.8kPa	0.5 vol% 3 to 4mmHg 0.5kPa	0 vol% 0 mmHg 0 kPa	0 vol% 0 mmHg 0 kPa	0 vol% 0 mmHg 0 kPa
Gas Desflurane exp high limit	0.5 ~ 25.0 vol% 4mmHg ~ 190mmHg 0.5 ~ 25.3kPa	0.5 vol% 3 to 4mmHg 0.5kPa	1.5 vol% 11mmHg 1.5 kPa	1.5 vol% 11mmHg 1.5 kPa	1.5 vol% 11mmHg 1.5 kPa
Gas Desflurane exp low limit	0 ~ 24.5 vol% 0mmHg ~ 186mmHg 0 ~ 24.8kPa	0.5 vol% 3 to 4mmHg 0.5kPa	0 vol% 0 mmHg 0 kPa	0 vol% 0 mmHg 0 kPa	0 vol% 0 mmHg 0 kPa

Audio Alarm Acknowledged



WARNING

Do not pause the alarm audio or decrease its volume if patient safety could be compromised.

When an alarm occurs, users can pause the alarm audio for the audio alarm acknowledged (silenced) period (30, 60, 90, or 120 seconds) selected via the Service menu. However, visual alarms continue during this time. The factory default for audio alarm acknowledged (silenced) period is 60 seconds.

To pause the alarm audio:

1. Press the **Audio Alarm Acknowledged Button** to immediately pause the alarm tone. The alarm resumes after the alarm audio period if the alarm condition has not been corrected.
2. Check the patient and provide appropriate care.

During the audio alarm acknowledged (silenced) period, you can press the **Audio Alarm Acknowledged Button** again to re-enable the alarm audio tones. Also, if another alarm occurs during the alarm audio paused period, the alarm audio tones will be automatically re-enabled.

Note: Invalid tone occurs when there is no alarm condition or the audio alarm pause/off is activated already.

*Note: Low battery alarm or critically low battery alarm cannot be stopped by the **Audio alarm acknowledged Button** or **Audio alarm pause/off Button**.*

*Note: The alarm audios caused by some technical errors may be canceled by pressing the **Audio Alarm Acknowledged Button**. However, battery failure and physiological alarms cannot be canceled until the alarm condition is corrected.*

Audio Alarm Pause/Off

WARNING

If an alarm condition occurs while in the **Alarm Audio Off** state, the only alarm indication on the monitor will be visual displays related to the alarm condition.

When an alarm occurs, you can pause the alarm audio for the audio alarm pause period (30, 60, 90, or 120 seconds) selected via service menu. However, visual alarms continue during this time. The factory default for audio alarm pause is 60 seconds.

To initiate an alarm audio pause or off:

1. To initiate an alarm audio pause or off, press the **Configure Button** and press the **Alarm setup Button**.
2. Press the **Start Button** on **Audio alarm Pause or off menu**.
3. To cancel alarm audio pause or off condition, Press the **Stop Button** on **Audio alarm Pause or off menu**.

Note: The names of menu items are displayed differently depending on the user defined time period.

If the **Start Button** is pressed:

The audio alarm is stopped when the audio off condition, and the audio alarm paused when the audio alarm pause condition. If an alarm condition that can be cleared occurs, the audio alarm is cleared. Audio alarm off condition is started in the audio alarm off. If there is NIBP system error, the command to cancel the NIBP error is sent to the NIBP module.

If the **Stop Button** is pressed:

The audio alarm condition is changed from the Pause condition or off condition to the normal condition.

This action disables alarm audios for a user-defined **Audio Alarm Off** (When Audio alarm pause/off period is indefinite) or **Audio Alarm Pause** (when Audio alarm pause/off period is 1, 3, 5, 10, 20, 30, or 60 minutes) selected via the **Service Menu**. The factory default for alarm audio pause/off is indefinite.

Note: The periods can only be changed by authorized personnel via the Service Setting Menu.

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MENU STRUCTURE

CONFIGURE

- Patient setup
 - New
 - No
 - Yes
 - Patient Mode
 - Large
 - Medium
 - Small
 - Patient ID
 - Keyboard display
 - Name
 - Keyboard display
 - Birthdate
 - Number Keyboard display
 - Gender
 - Male
 - Female
 - Other
 - Confirm
 - Cancel
 - Modify
 - Patient Mode
 - Large
 - Medium
 - Small
 - Patient ID
 - Keyboard display
 - Name
 - Keyboard display
 - Birthdate
 - Number Keyboard display
 - Gender
 - Male
 - Female
 - Other
 - Confirm
 - Cancel
 - Discharge
 - No
 - Yes
- Display setup
 - Menu timeout
 - Off
 - 10 sec
 - 20 sec
 - Number of waveform setting
 - 4 ~ 12
 - LCD brightness
 - 1 ~ 5
 - EWS display
 - On

- - - Off
- - Temp menu
- - - On
- - - Off
- - EtCO₂ menu
- - - On
- - - Off
- - ECG color
- - - Color1 ~ 17
- - - Back
- - SpO₂ color
- - - Color1 ~ 17
- - - Back
- - NIBP color
- - - Color1 ~ 17
- - - Back
- - RESP color
- - - Color1 ~ 17
- - - Back
- - TEMP color
- - - Color1 ~ 17
- - - Back
- - EtCO₂ color
- - - Color1 ~ 17
- - - Back
- - Back
- Alarm setup
- - Alarm limit display
- - - On
- - - Off
- - Audio alarm pause/off
- - - Start
- - - Stop
- Printing setup
- - Printing speed
- - - 25 mm/s
- - - 50 mm/s
- - Alarm printing
- - - On
- - - Off
- - Printing time
- - - 10 sec
- - - 20 sec
- - - Continuous
- - Periodic printing
- - - Off
- - - 5 min
- - - 10 min
- - - 15 min
- - - 30 min
- - - 60 min
- - - 120 min
- - Printing waveform1 ~ 3
- - - Off
- - - ECG I
- - - ECG II

- - - ECG III
- - - ECG aVR
- - - ECG aVL
- - - ECG aVF
- - - ECG V(Chest Lead) / ECG V1
- - - ECG V2
- - - ECG V3
- - - ECG V4
- - - ECG V5
- - - ECG V6
- - - SpO₂
- - - Respiration
- - - EtCO₂
- - Back
- Screen mode
 - Standard
 - Big number
 - Tabular trend
 - Graphical trend
 - Event review
- Sound setup
 - Alarm volume
 - 1 ~ 5
 - HR/PR tone volume
 - Off
 - 1 ~ 5
 - Key beep volume
 - Off
 - 1 ~ 5
 - Back
- Date/Time setup
 - Data type
 - YY/MM/DD
 - MM/DD/YY
 - DD/MM/YY
 - Year
 - Number Keyboard display
 - Confirm
 - Cancel
 - Month
 - Number Keyboard display
 - Confirm
 - Cancel
 - Day
 - Number Keyboard display
 - Confirm
 - Cancel
 - Hour
 - Number Keyboard display
 - Confirm
 - Cancel
 - Minute
 - Number keyboard display
 - Confirm
 - Cancel
 - Second

- - - Number keyboard display
- - - Confirm
- - - Cancel
- - Back
- Service mode
- - Number keyboard display
- - Confirm
- - Cancel
- Back

HR/PR MENU

- HR/PR Source
- - AUTO (HR IBP PR > SpO₂ PR > NIBP PR)
- - HR
- - PR(SpO₂)
- - PR(IBP1)
- - PR(IBP2)
- - PR(NIBP)
- Pacer detect
- - On
- - Off
- Arrhythmia setup
- - Arrhythmia Message
- - - On
- - - Off
- - Arrhythmia relearn
- - All Arrhythmia alarm
- - - On
- - - Off
- - Asystole
- - - On
- - - Off
- - Asystole time
- - - 3 ~ 10 sec (1 sec step)
- - V-FIB
- - - On
- - - Off
- - VTACH
- - - On
- - - Off
- - VTACH rate
- - - 120 ~ 200 bpm (5 bpm step)
- - Ventricular rhythm
- - - On
- - - Off
- - Tachy
- - - On
- - - Off
- - Brady
- - - On
- - - Off
- - Run
- - - On
- - - Off
- - Run beats
- - - 2 ~ 8 beats (1 beat step)

- - Bigeminy
 - - On
 - - Off
- - Trigeminy
 - - On
 - - Off
- - Couplet
 - - On
 - - Off
- - Pause
 - - On
 - - Off
- - Pause threshold
 - - 1~15 (1 step)
- - Frequent
 - - On
 - - Off
- - Frequent beats
 - - 1 ~ 99 beats (1 beat step)
- - R on T PVCs
 - - On
 - - Off
- - Multiform PVCs
 - - On
 - - Off
- Filter mode
 - Interpretation (0.05 ~ 150 Hz)
 - Low (0.05 ~ 40 Hz)
 - Med (0.5 ~ 40 Hz)
 - High (0.5 ~ 30 Hz)
- Alarm setup
 - HR/PR
 - 300 ~ 25 (5 bpm step, HR/PR alarm high limit)
 - 295 ~ 20 (5 bpm step, HR/PR alarm low limit)
 - ▲ 🔔 (On/Off toggle, HR/PR Limit alarm bell)
 - (On) (Off)
- Back
- Back

SpO₂ MENU

- - Alarm setup
 - SpO₂
 - 100 ~ 21 (1 % step, SpO₂ alarm high limit)
 - 99 ~ 20 (1 % step, SpO₂ alarm low limit)
 - ▲ 🔔 (On/Off toggle, SpO₂ Limit alarm bell)
 - (On) (Off)
- Back
- Back

NIBP MENU

- Initial inflate pressure (Large / Medium mode)
 - 120 mmHg (16.0 kPa)
 - 140 mmHg (18.7 kPa)
 - 160 mmHg (21.3 kPa)
 - 180 mmHg (24.0 kPa)

- - 200 mmHg (26.7 kPa)
- - 220 mmHg (29.3 kPa)
- - 240 mmHg (32.0 kPa)
- - 260 mmHg (34.7 kPa)
- - 280 mmHg (37.3 kPa)
- - Auto
- Initial inflate pressure (Small mode)
 - - 80 mmHg (10.7 kPa)
 - - 100 mmHg (13.3 kPa)
 - - 120 mmHg (16.0 kPa)
 - - 140 mmHg (18.7 kPa)
- Auto interval
 - - Off
 - - Cont
 - - 1 min
 - - 2 min
 - - 2.5 min
 - - 5 min
 - - 10 min
 - - 15 min
 - - 30 min
 - - 60 min
 - - 120 min
- Alarm setup
 - - NIBP SYS
 - 270 ~ 35 (5 mmHg step, NIBP SYS alarm high limit)
 - 265 ~ 30 (5 mmHg step, NIBP SYS alarm low limit)
 - ▲ ● (On/Off toggle, NIBP SYS Limit alarm bell)
 - (On) (Off)
 - - NIBP MAP
 - 260 ~ 25 (5 mmHg step, NIBP MAP alarm high limit)
 - 255 ~ 20 (5 mmHg step, NIBP MAP alarm low limit)
 - ▲ ● (On/Off toggle, NIBP MAP Limit alarm bell)
 - (On) (Off)
 - - NIBP DIA
 - 250 ~ 15 (5 mmHg step, NIBP DIA alarm high limit)
 - 245 ~ 10 (5 mmHg step, NIBP DIA alarm low limit)
 - ▲ ● (On/Off toggle, NIBP DIA Limit alarm bell)
 - (On) (Off)
 - - Back
- Back

EtCO₂ MENU

- EtCO₂
 - - On
 - - Off
- Average measurement
 - - 1breath
 - - 10sec
 - - 20sec
- EtCO₂ menu Off
- Alarm setup
 - - EtCO₂
 - 1 ~ 150 (1 mmHg step, EtCO₂ alarm high limit)

- 0 ~ 149 (1 mmHg step, EtCO₂ alarm low limit)
- ▲ (On) ● (Off) (On/Off toggle, EtCO₂ Limit alarm bell)
- InCO₂
- 1 ~ 20 (1 mmHg step, InCO₂ alarm high limit)
- 0 ~ 19 (1 mmHg step, InCO₂ alarm low limit)
- ▲ (On) ● (Off) (On/Off toggle, InCO₂ Limit alarm bell)
- Back
- Back

Temperature MENU

- Temp menu Off
- Alarm setup
- TEMP1
- 50.0 ~ 0.1 (0.1 °C step, TEMP1 alarm high limit)
- 49.9 ~ 0.0 (0.1 °C step, TEMP1 alarm low limit)
- ▲ (On) ● (Off) (On/Off toggle, TEMP1 Limit alarm bell)
- TEMP2
- 50.0 ~ 0.1 (0.1 °C step, TEMP2 alarm high limit)
- 49.9 ~ 0.0 (0.1 °C step, TEMP2 alarm low limit)
- ▲ (On) ● (Off) (On/Off toggle, TEMP2 Limit alarm bell)
- Back
- Back

Respiration MENU

- Respiration
- On
- Off
- RR Source
- Auto (Airway > Impedance)
- Impedance
- Airway
- Apnea time setting
- 20sec
- 30sec
- Filter mode
- Low (~2 Hz)
- Med (~1 Hz)
- High (~0.5 Hz)
- Alarm setup
- RESP
- 150 ~ 4 (1 /min step, RR alarm high limit)
- 149 ~ 3 (1 /min step, RR alarm low limit)
- ▲ (On) ● (Off) (On/Off toggle, RR Limit alarm bell)
- Back

- Back

TABULAR TREND SETTING (on TABULAR TREND Screen)

- Scroll speed
 - X 1
 - X 10
 - X 100
- Display interval
 - 1 min
 - 2 min
 - 5 min
 - 10 min
 - 15 min
 - 30 min
 - 60 min

TABULAR TREND MENU

- Trend data clear
 - Yes
 - Yes
 - No
 - No
- Display order
 - Ascending
 - Descending
- Display selection
 - Standard
 - NIBP
 - Alarm
 - ALL
- Back

GRAPHICAL TREND SETTING (on GRAPHICAL TREND Screen)

- Scroll speed
 - X 1
 - X 2
 - X 4
- Display time width
 - 1 hour
 - 2 hours
 - 4 hours
 - 8 hours
 - 12 hours
 - 24 hours

GRAPHICAL TREND MENU

- Trend data clear
 - Yes
 - Yes
 - No
 - No
- Display scale
 - HR/PR
 - Auto
 - 0 ~ 100 bpm
 - 0 ~ 200 bpm

-
- - - 0 ~ 300 bpm
 - - SpO₂
 - - - Auto
 - - - 80 ~ 100%
 - - - 50 ~ 100%
 - - - 0 ~ 100%
 - - NIBP
 - - - Auto
 - - - 0 ~ 100 mmHg
 - - - 0 ~ 150 mmHg
 - - - 0 ~ 200 mmHg
 - - - 0 ~ 300 mmHg
 - - Respiration rate
 - - - Auto
 - - - 0 ~ 50 bpm
 - - - 0 ~ 100 bpm
 - - - 0 ~ 150 bpm
 - - Temperature
 - - - Auto
 - - - 30 ~ 40 °C
 - - - 20 ~ 50 °C
 - - EtCO₂
 - - - Auto
 - - - 0 ~ 50 mmHg
 - - - 0 ~ 100 mmHg
 - - - 0 ~ 150 mmHg

- Trend display
 - All trend display
 - On
 - Off
 - HR/PR
 - On
 - Off
 - SpO₂
 - On
 - Off
 - NIBP
 - On
 - Off
 - RESP
 - On
 - Off
 - TEMP
 - On
 - Off
 - EtCO₂
 - On
 - Off
 - Back
- Back

EVENT REVIEW MENU

- Clear event
 - Yes
 - Yes
 - No
 - No
 - Back
- Waveform 1~3
 - Off
 - ECG I
 - ECG II
 - ECG III
 - ECG aVR
 - ECG aVL
 - ECG aVF
 - ECG V (Chest Lead) / ECG V1
 - ECG V2
 - ECG V3
 - ECG V4
 - ECG V5
 - ECG V6
 - SpO₂
 - Respiration
 - EtCO₂
 - Back

ALARM SETUP MENU

- HR/PR
 - 300 ~ 25 (5 bpm step, HR/PR alarm high limit)
 - 295 ~ 20 (5 bpm step, HR/PR alarm low limit)
 - ▲ ● (On/Off toggle, HR/PR Limit alarm bell)

- (On) (Off)
- SpO₂
 - 100 ~ 21 (1 % step, SpO₂ alarm high limit)
 - 99 ~ 20 (1 % step, SpO₂ alarm low limit)
 - ▲ (On) (Off) (On/Off toggle, SpO₂ Limit alarm bell)
- NIBP SYS
 - 270 ~ 35 (5 mmHg step, NIBP SYS alarm high limit)
 - 265 ~ 30 (5 mmHg step, NIBP SYS alarm low limit)
 - ▲ (On) (Off) (On/Off toggle, NIBP SYS Limit alarm bell)
- NIBP MAP
 - 260 ~ 25 (5 mmHg step, NIBP MAP alarm high limit)
 - 255 ~ 20 (5 mmHg step, NIBP MAP alarm low limit)
 - ▲ (On) (Off) (On/Off toggle, NIBP MAP Limit alarm bell)
- NIBP DIA
 - 250 ~ 15 (5 mmHg step, NIBP DIA alarm high limit)
 - 245 ~ 10 (5 mmHg step, NIBP DIA alarm low limit)
 - ▲ (On) (Off) (On/Off toggle, NIBP DIA Limit alarm bell)
- EtCO₂
 - 1 ~ 150 (1 mmHg step, EtCO₂ alarm high limit)
 - 0 ~ 149 (1 mmHg step, EtCO₂ alarm low limit)
 - ▲ (On) (Off) (On/Off toggle, EtCO₂ Limit alarm bell)
- InCO₂
 - 1 ~ 20 (1 mmHg step, InCO₂ alarm high limit)
 - 0 ~ 19 (1 mmHg step, InCO₂ alarm low limit)
 - ▲ (On) (Off) (On/Off toggle, InCO₂ Limit alarm bell)
- TEMP1
 - 50.0 ~ 0.1 (0.1 °C step, TEMP1 alarm high limit)
 - 49.9 ~ 0.0 (0.1 °C step, TEMP1 alarm low limit)
 - ▲ (On) (Off) (On/Off toggle, TEMP1 Limit alarm bell)
- TEMP2
 - 50.0 ~ 0.1 (0.1 °C step, TEMP2 alarm high limit)
 - 49.9 ~ 0.0 (0.1 °C step, TEMP2 alarm low limit)
 - ▲ (On) (Off) (On/Off toggle, TEMP2 Limit alarm bell)
- RESP
 - 150 ~ 4 (1 /mm step, RR alarm high limit)
 - 149 ~ 3 (1 /mm step, RR alarm low limit)
 - ▲ (On) (Off) (On/Off toggle, RR Limit alarm bell)
- Back

ECG WAVEFORM MENU

- Lead Select
 - I
 - II
 - III
 - aVR
 - aVL
 - aVF
 - V1 / V (Chest Lead)
 - V2
 - V3
 - V4
 - V5
 - V6
- Arrhythmia setup
 - Arrhythmia Message
 - On
 - Off
 - Arrhythmia relearn
 - All Arrhythmia alarm
 - On
 - Off
 - Asystole
 - On
 - Off
 - Asystole time
 - 3 ~ 10 sec (1 sec step)
 - V-FIB
 - On
 - Off
 - VTACH
 - On
 - Off
 - VTACH rate
 - 120 ~ 200 bpm (5 bpm step)
 - Ventricular rhythm
 - On
 - Off
 - Tachy
 - On
 - Off
 - Brady
 - On
 - Off
 - Run
 - On
 - Off
 - Run beats
 - 2 ~8 beats (1 beat step)
 - Bigeminy
 - On
 - Off
 - Trigeminy
 - On
 - Off
 - Couplet
 - On

- - - Off
- - Pause
- - - On
- - - Off
- - Pause threshold
 - 1 ~ 15 (1 step)
- - Frequent
 - On
 - Off
- - Frequent beats
 - 1 ~ 99 beats (1 beat step)
- - R on T PVCs
 - On
 - Off
- - Multiform PVCs
 - On
 - Off
- Sweep Speed
 - 6.25 mm/s
 - 12.5 mm/s
 - 25.0 mm/s
 - 50.0 mm/s
- Size
 - Auto
 - 1.25 mm/mV
 - 2.5 mm/mV
 - 5.0 mm/mV
 - 7.5 mm/mV
 - 10.0 mm/mV
 - 15.0 mm/mV
 - 20.0 mm/mV
 - 40.0 mm/mV
- Pacer Detect
 - On
 - Off
- ST level measurement position
 - 60 ~ 80 ms (2 ms step)
- Filter Mode
 - Interpretation (0.05 ~ 150 Hz)
 - Low (0.05 ~ 40 Hz)
 - Med (0.5 ~ 40 Hz)
 - High (0.5 ~ 30 Hz)
- Waveform select
 - Blank
 - ECG
 - SpO₂
 - Respiration
 - EtCO₂
- Back

SpO₂ WAVEFORM MENU

- Sweep Speed
 - 6.25 mm/s
 - 12.5 mm/s
 - 25.0 mm/s
 - 50.0 mm/s

- **Waveform select**
 - **Blank**
 - **ECG**
 - **SpO₂**
 - **Respiration**
 - **EtCO₂**
- **Back**

RESPIRATION WAVEFORM MENU

- **Sweep Speed**
 - **6.25 mm/s**
 - **12.5 mm/s**
 - **25.0 mm/s**
 - **50.0 mm/s**
- **Size**
 - **Auto**
 - **1.25 mm/Ω**
 - **1.7 mm/Ω**
 - **2.5 mm/Ω**
 - **5.0 mm/Ω**
 - **7.5 mm/Ω**
 - **10.0 mm/Ω**
 - **15.0 mm/Ω**
 - **20.0 mm/Ω**
- **Filter mode**
 - **Low (~2 Hz)**
 - **Med (~1 Hz)**
 - **High (~0.5 Hz)**
- **Waveform select**
 - **Blank**
 - **ECG**
 - **SpO₂**
 - **Respiration**
 - **EtCO₂**
- **Back**

EtCO₂ WAVEFORM MENU

- **Sweep Speed**
 - **6.25 mm/s**
 - **12.5 mm/s**
 - **25.0 mm/s**
 - **50.0 mm/s**
- **Scale**
 - **Auto**
 - **0 ~ 40 mmHg**
 - **0 ~ 60 mmHg**
 - **0 ~ 80 mmHg**
- **Waveform select**
 - **Blank**
 - **ECG**
 - **SpO₂**
 - **Respiration**
 - **EtCO₂**
- **Back**

EWS MENU

- **EWS Protocol**
- - **NEWS**
- - **NEWS2**
- - **Custom**
- **Score settings**
- - **BP, SpO₂**
- - **HR/PR, Temp**
- - **RR**
- - **O₂, AVPU**
- - **Back**
- **Interval**
- - **Off**
- - **5 min**
- - **10 min**
- - **30 min**
- - **1 hour**
- - **2 hours**
- - **3 hours**
- - **6 hours**
- - **12 hours**
- - **24 hours**
- **Alarm**
- - **On**
- - **Off**
- **NIBP**
- - **On**
- - **Off**
- **Back**

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PRINTING

General

The monitor can print real-time measurement and trend data as follows. Printer is an option and is not available on all monitors.

1. Set **printing speed**, **alarm printing**, **printing time**, **periodic printing**, **printing acquired 12 lead**, **12 lead printing time** or **printing waveform** via the **Configure menu**.
2. To start printing, press the **Print Start Button** on the bottom of screen.
3. To stop printing during print out, press the **Print Start Button** again.

Print Speed

The print speed for is user-selectable: either 25 or 50 mm/s.

Alarm printing

If **Alarm printing** is set to On in printing setup menu, the monitor will automatically print out whenever a physiological alarm condition occurs.

Printing time

The **printing time** is user selectable: 10 sec, 20 sec or continuous.

Periodic printing

The **periodic printing** is user selectable: Off, 5, 10, 15, 30, 60 or 120 min.

Printing Waveform

In **Printing Setup** menu, printing waveform can be changed in **Printing Waveform** menu. The printing waveform can be set as **ECG (I, II, III, aVR, aVL, aVF, V, V1, V2, V3, V4, V5, V6)**, **SpO₂**, **Respiration**, **EtCO₂** or **OFF**. The monitor can print out up to 3 waveforms. The monitor will print out measurement values and waveform when the **Print Start Button** is pressed.

Print-Out Configuration

Manual Print-Out

If menu window display is displayed, the monitor will print out measurement values and waveforms as shown in Figure 44 by pressing the **Print Start Button**.

Patient Information. ID : _____ NAME : _____ Gender : _____ AGE : _____ Time. 2010-01-01 05:30:00 Printing Type: Manual HR/PR : 60/min RESP : 15/min NIBP : 120/ 80 (93) mmHg SpO2 : 98% TEMP : 36.7°C	ST Information. PVCs : 10 MISSED/PAUSE : 10 PACED BEATs : ST-I : 0.8 ST-II : -1.5 ST-III : -2.5 ST-aVL : 1.5 ST-V1 : -0.2 ST-V3 : 0.5 ST-V5 : 0.2 HR/PR Source : ECG	EtCO2 : 80mmHg InCO2 : 2mmHg ABP : 120/ 80 (93) mmHg CVP : 10/ 0 (3) mmHg
---	--	--

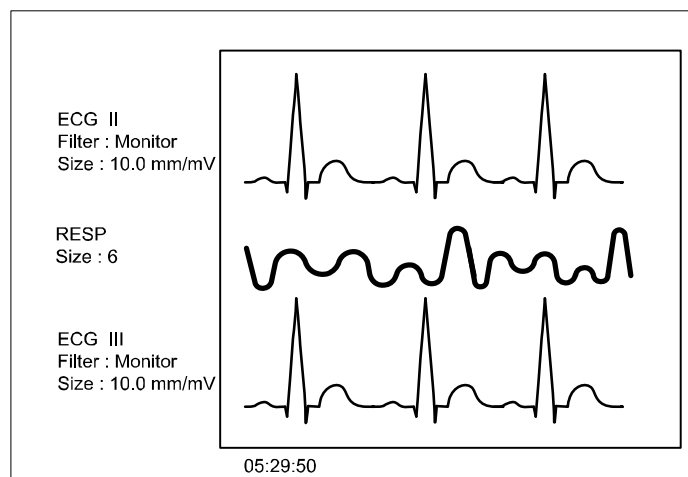


Figure 44. Manual Print-Out

Alarm Print-Out

If **alarm printing** is set to On, the monitor will print out numeric data and whenever a physiological alarm condition occurs as shown in Figure 45.

Patient Information. ID : _____ NAME : _____ Gender : _____ AGE : _____ Time. 2010-01-01 05:30:00 Printing Type: Alarm HR/PR : 60/min RESP : 15/min NIBP : 120/ 80 (93) mmHg SpO2 : 98% TEMP : 36.7°C	ST Information. PVCs : 10 MISSED/PAUSE : 10 PACED BEATS : _____ ST-I : 0.8 ST-III : -2.5 ST-aVL : 1.5 ST-V1 : -0.2 ST-V3 : 0.5 ST-V5 : 0.2 ST-II : -1.5 ST-aVR : 0.4 ST-aVF : -2.0 ST-V2 : 0.6 ST-V4 : 0.3 ST-V6 : -0.1 HR/PR Source : ECG	EtCO2 : 80mmHg InCO2 : 2mmHg ABP : 120/ 80 (93) mmHg CVP : 10/ 0 (3) mmHg
--	---	--

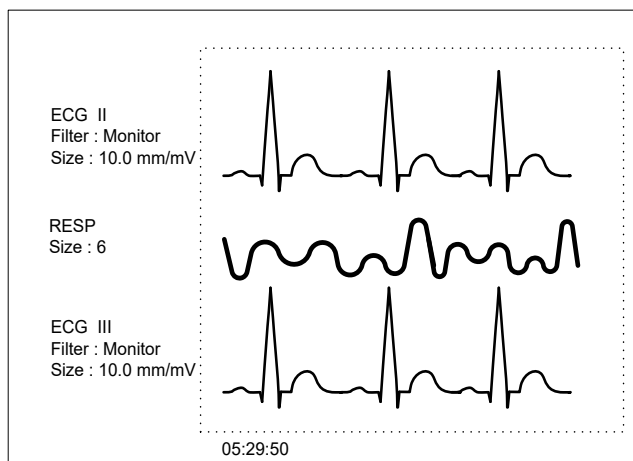


Figure 45. Alarm Print-Out

Periodic Print-Out

The user can set the **periodic printing**: Off, 5, 10, 15, 30, 60 or 120 min. The monitor will print out numeric data and waveforms at periodic printing setting time as shown in Figure 46.

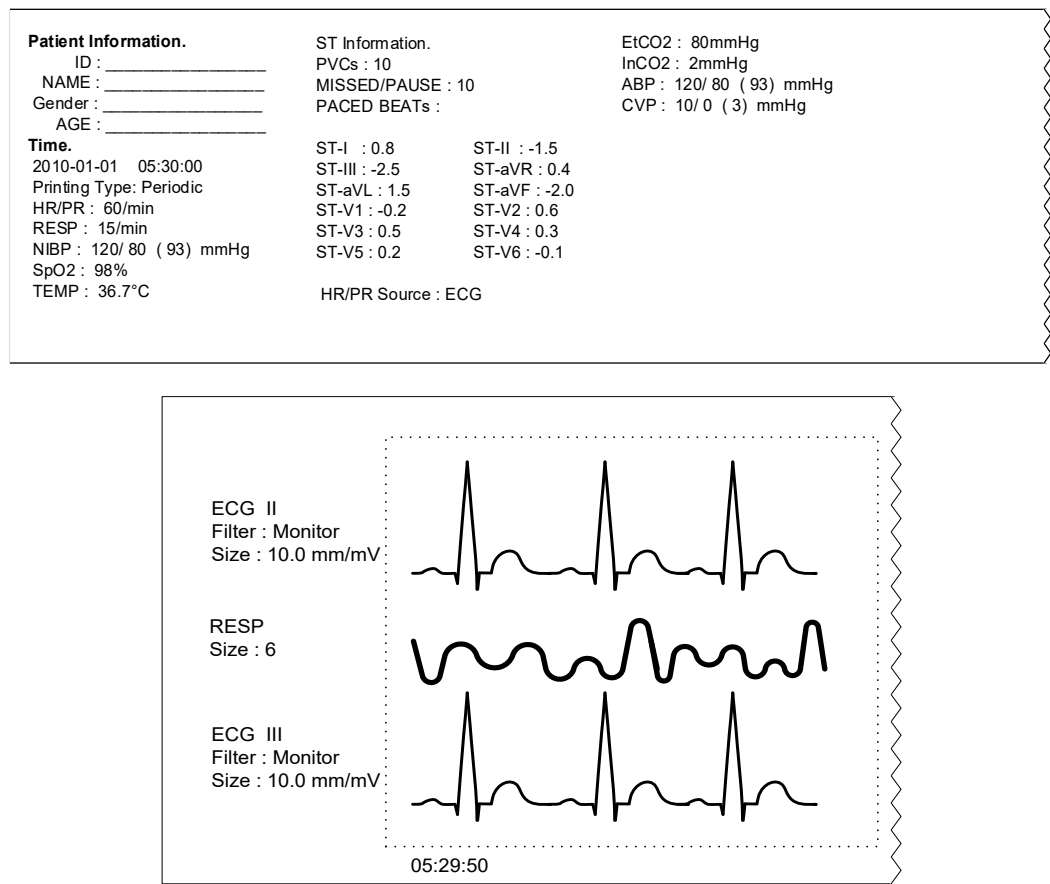


Figure 46. Periodic Print-Out

Continuous Print-Out

If **Print time** is set to **Continuous**, the monitor will print out numeric data and waveforms continuously as shown in Figure 47 by pressing the **Print Start Button**.

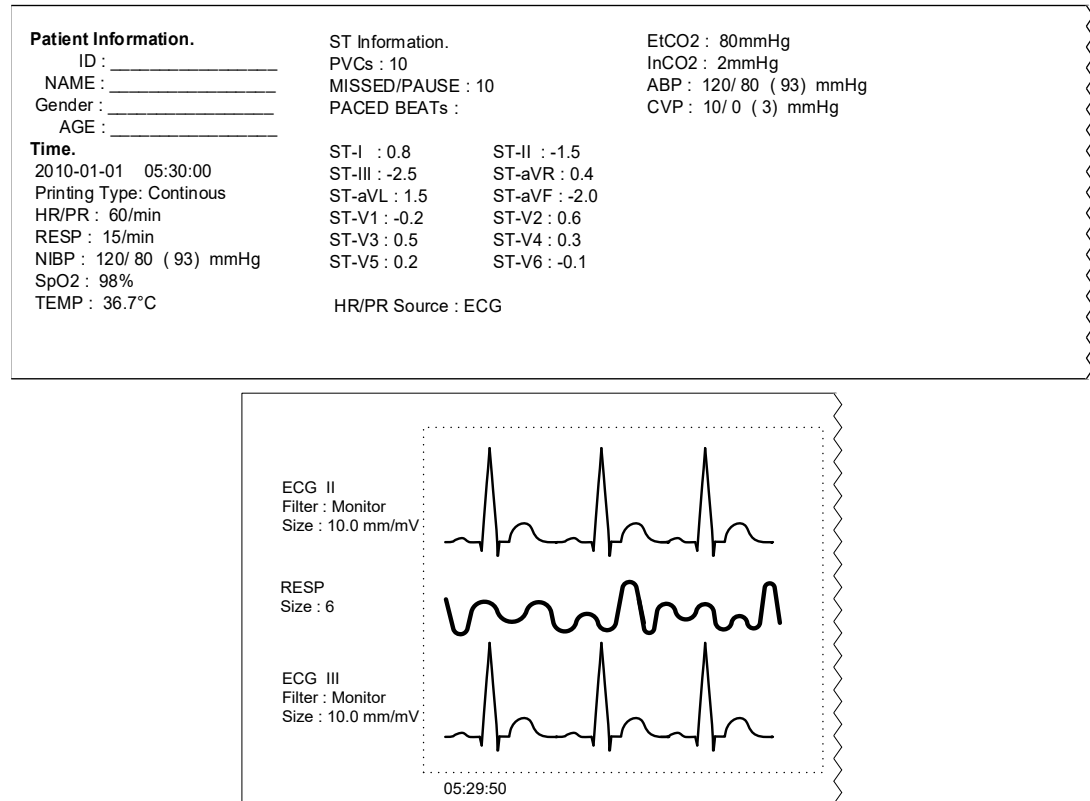


Figure 47. Continuous Print-Out

Tabular Trend Data Print Out

When tabular trend data is displayed on the screen, the monitor will print out the displayed data as shown in Figure 48 by pressing the **Print Start Button**.

TIME	ID	HR/PR	SpO ₂	RESP	NIBP SYS	NIBP MAP	NIBP DIA	TEMP1	TEMP2	EtCO ₂	InCO ₂
05:30:00	--	60	99↑	12	---	--	---	30.2 ↓	30.2 ↓	35	35
05:31:00	--	60	99↑	12	---	--	---	30.2 ↓	30.2 ↓	35	35
05:32:00	--	60	99↑	12	---	--	---	30.2 ↓	30.2 ↓	35	35
05:33:00	--	60	99↑	12	---	--	---	30.2 ↓	30.2 ↓	35	35
05:34:00	--	60	99↑	12	---	--	---	30.2 ↓	30.2 ↓	35	35
05:35:00	--	60	99↑	12	---	--	---	30.2 ↓	30.2 ↓	35	35
05:36:00	--	60	99↑	12	---	--	---	30.2 ↓	30.2 ↓	35	35
05:38:00	--	60	99↑	12	---	--	---	30.2 ↓	30.2 ↓	35	35
05:38:00	--	60	99↑	12	---	--	---	30.2 ↓	30.2 ↓	35	35
05:38:00	--	60	99↑	12	---	--	---	30.2 ↓	30.2 ↓	35	35

IBP1 SYS	IBP1 MAP	IBP1 DIA	IBP2 SYS	IBP2 MAP	IBP2 DIA
---	---	---	---	---	---
---	---	---	---	---	---
---	---	---	---	---	---
---	---	---	---	---	---
---	---	---	---	---	---
---	---	---	---	---	---
---	---	---	---	---	---
---	---	---	---	---	---
---	---	---	---	---	---
---	---	---	---	---	---

Figure 48. Tabular Trend Printing

Graphical Trend Data Print Out

When graphical trend data is displayed on the screen, the monitor will print out the displayed data as shown in Figure 49 by pressing the **Print Start Button**.

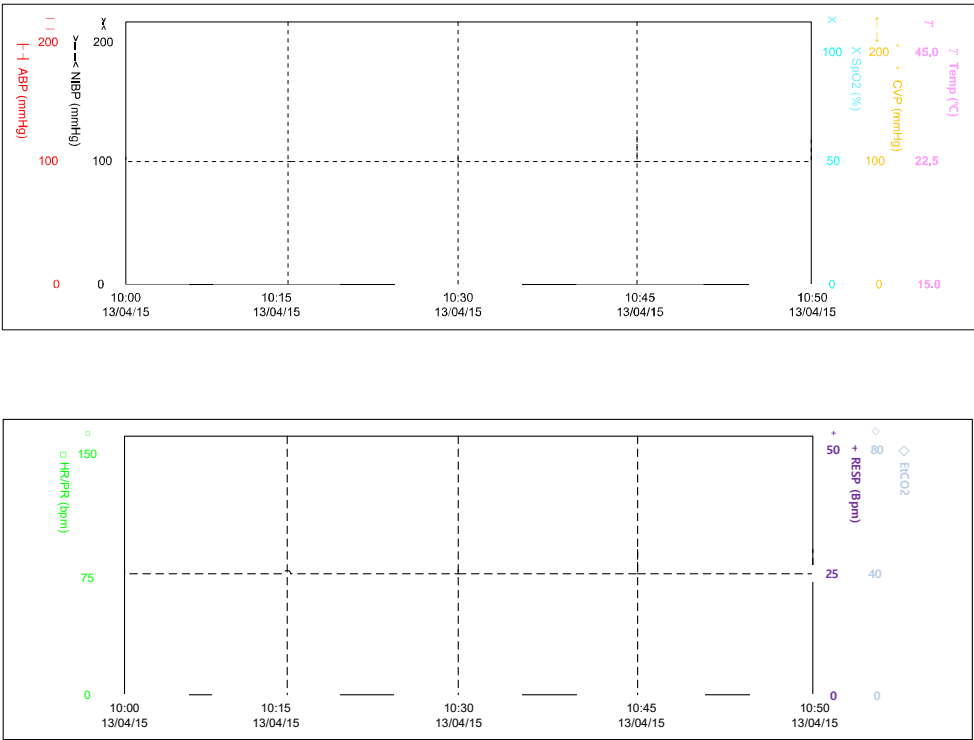


Figure 49. Graphical Trend Printing

Event review recording Print Out

When Event review screen is displayed on the screen, the monitor will print out the displayed data as shown in Figure 50 by pressing the **Print Start Button**.

TIME	Event
13/07/09 05:30:00	SpO2 : Loss of pulse
13/07/09 05:31:00	SpO2 : Loss of pulse
13/07/09 05:32:00	SpO2 : Loss of pulse
13/07/09 05:33:00	SpO2 : Loss of pulse
13/07/09 05:34:00	SpO2 : Loss of pulse
13/07/09 05:35:00	SpO2 : Loss of pulse
13/07/09 05:36:00	SpO2 : Loss of pulse
13/07/09 05:38:00	SpO2 : Loss of pulse
13/07/09 05:38:00	SpO2 : Loss of pulse
13/07/09 05:38:00	SpO2 : Loss of pulse

Figure 50. Event List Printing

Patient Information. ID : _____ NAME : _____ Gender : _____ AGE : _____ Time. 2010-01-01 05:30:00 Printing Type: Event List HR/PR : 60/min RESP : 15/min NIBP : 120/ 80 (93) mmHg SpO2 : 98% TEMP : 36.7°C	ST Information. PVCs : 10 MISSED/PAUSE : 10 PACED BEATS : _____ ST-I : 0.8 ST-III : -2.5 ST-aVL : 1.5 ST-V1 : -0.2 ST-V3 : 0.5 ST-V5 : 0.2 ST-II : -1.5 ST-aVR : 0.4 ST-aVF : -2.0 ST-V2 : 0.6 ST-V4 : 0.3 ST-V6 : -0.1 HR/PR Source : ECG	EtCO2 : 80mmHg InCO2 : 2mmHg ABP : 120/ 80 (93) mmHg CVP : 10/ 0 (3) mmHg
---	---	--

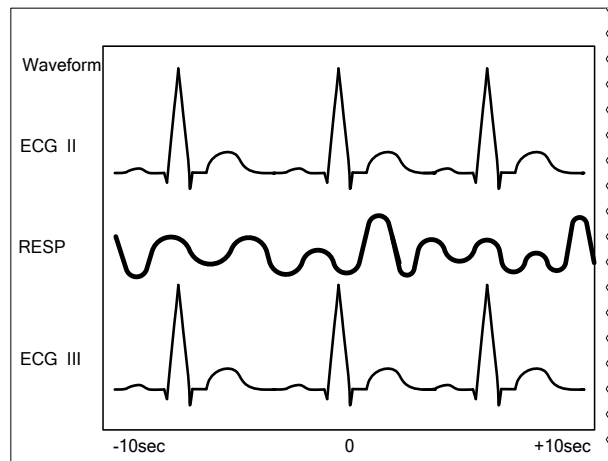


Figure 51. Event Review Printing

Setting Information Print-Out

When the monitor is in the Service Menu, the monitor will print out all internal settings as shown in Figure 52 by pressing the **Print Start Button**.

Patient Information. ID : _____ NAME : _____ Gender : _____ AGE : _____ Time. 2010-01-01 05:30:00 Setting data is below.	Monitor setup ----- Patient Mode ID Name Age Gender ECG Display Color SpO ₂ Display Color NIBP Display Color RESP Display Color TEMP Display Color EtCO ₂ Display Color IBP1 Display Color IBP2 Display Color Menu Reset Counter Number of waveform setting 12Lead waveform setting Alarm Limit setup----- HR/PR High Limit HR/PR Low Limit	SpO ₂ High Limit SpO ₂ Low Limit NIBP-SYS High Limit NIBP-SYS Low Limit NIBP-MAP High Limit NIBP-MAP Low Limit NIBP-DIA High Limit NIBP-DIA Low Limit RR High Limit RR Low Limit TEMP1 High Limit TEMP1 Low Limit TEMP2 High Limit TEMP2 Low Limit EtCO ₂ High Limit EtCO ₂ Low Limit InCO ₂ High Limit InCO ₂ Low Limit IBP1-SYS High Limit IBP1-SYS Low Limit	IBP1-Mean High Limit IBP1-Mean Low Limit IBP1-DIA High Limit IBP1-DIA Low Limit IBP2-SYS High Limit IBP2-SYS Low Limit IBP2-Mean High Limit IBP2-Mean Low Limit IBP2-DIA High Limit IBP2-DIA Low Limit Printing setup----- Printing speed Alarm printing Periodic printing 12Lead Acquire record 12Lead record time Printing waveform 1 Printing waveform 2 Printing waveform 3 Screen mode	Sound setup ----- Alarm volume HR/PR Tone volume Key beep volume Date/Time setup----- Date type Service Menu----- Power on default NIBP Unit IBP Unit TEMP Unit EtCO ₂ Unit High alarm interval Medium alarm interval Low alarm interval Language ECG Module version SpO ₂ Module version NIBP Module version RESP Module version	TEMP Module version EtCO ₂ Module version IBP1 Module version IBP2 Module version LAN Setting----- IP Subnet Mask Gateway DHCP WiFi Setting----- IP Subnet Mask Gateway SSID Channel Security type EAP ID EAP Password DHCP
---	---	--	--	---	--

Figure 52. Setting Information Printing

EXTERNAL INTERFACE

General

The monitor provides external connectors to support communication with external equipment and functions such as a nurse call, software upgrades or PC connection. Refer to Figure 2 and Figure 3. The monitor, with its optional built-in network (LAN) module, functionally performs the same as a monitor connected to the central system. The monitor with a network (LAN) can send and receive patient data through the central system.

 WARNING	Any connections between this monitor and other devices must comply with applicable medical systems safety standards such as IEC 60601-1. Failure to do so could result in unsafe leakage current and grounding conditions.
 WARNING	The external interface function (wired network, wireless network and nurse call interface) should not be used as the primary source of alarm notification. The audible alarms of the monitor, used in conjunction with clinical signs and symptoms, are the primary sources for notifying medical personnel that an alarm condition exists.

Note: This equipment is to be used on the communication wirings (LAN Interface or Nurse Call Interface) are limited to inside of the building.

Set Bed Number

The bed number identifies a particular patient bed. Up to two characters are used to identify bed number. This number displays at the bottom of the screen.

Touch the **Configure menu** icon. Select the **Configure menu** using touch screen.



Figure 53. Configure Menu

1. Select the **Service mode** using touch screen.
2. Enter the password and set the LAN setting or network setting.

Note: Only authorized personnel can enter the service mode.

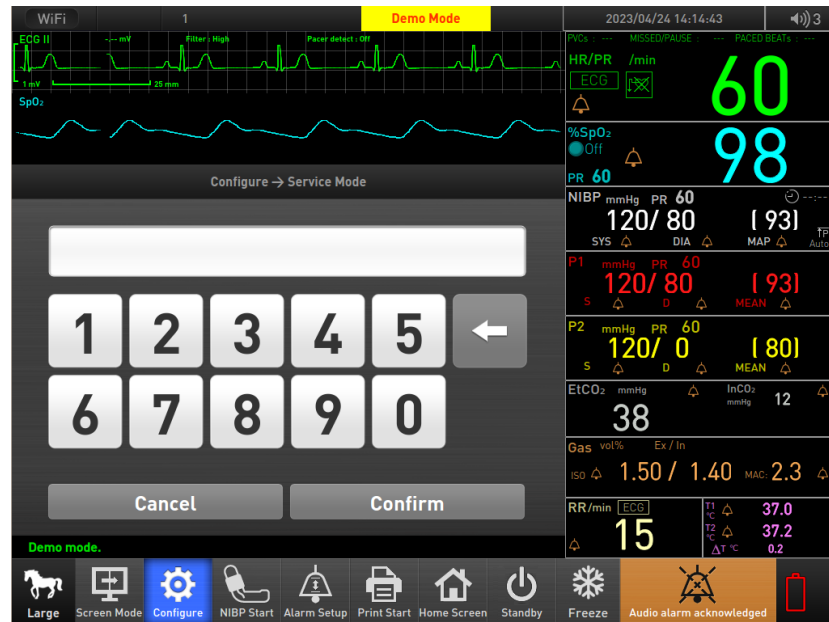


Figure 54. Service Mode

3. When entering the number 9 in front of the bed number 1 to 32 and touching the Confirm button, display the bed number at the top of the screen.

Setting Network

Wired Connection

To connect the monitor to the LAN (Local Area Network) using a wired connection, plug a LAN cable into the external communication port on the rear panel of the monitor. See Figure 2.

Wireless Connection

The monitor can connect to a network using a wireless network. The wireless connection can only be set by authorized personnel via the Service Menu.

MAINTENANCE

⚠ WARNING	The cover should be removed only by qualified service personnel. There are no internal user-serviceable parts except for the battery.
⚠ WARNING	Do not spray, pour, or spill any liquid on the monitor, its accessories, connectors, switches or openings in the chassis.
⚠ WARNING	Unplug the power cord from the monitor before cleaning the monitor.
⚠ CAUTION	Please erase the patient information before disposal of equipment for prevention of the personal data leakage.

Recycling and Disposal

When the monitor, battery, or accessories reach the end of useful life, recycle or dispose of the equipment according to appropriate local and regional regulations.

Note: The monitor should be disposed of separately from the municipal waste stream via designated collection facilities appointed by the government or the local authorities.

Note: The correct disposal of your old appliance will help prevent potential negative consequences for the environment and human health.

Note: For more detailed information about disposal of your old appliance, please contact your city office, waste disposal service or the shop where you purchased the monitor.

Returning the Monitor and System Components

Contact Covetrus Technical Support Representative for shipping instructions. Pack the monitor with sensor, cable and other accessory items in its original shipping carton. If the original carton is not available, use a suitable carton with appropriate packing material to protect the monitor during shipping. Ship the monitor according to instructions received from Covetrus.

Service

The monitor requires no routine service other than cleaning, battery maintenance and service activity which is mandated by the user's institution. For more information, refer to the monitor service manual. Qualified service personnel in the user's institution should perform periodic inspections of the monitor. If service is necessary, contact qualified service personnel or Covetrus Technical Support Representative.

Periodic Safety Checks

It is recommended that the following checks be performed every year.

- Inspect the equipment for mechanical and functional damage.
- Inspect the external safety labels for legibility.

Cleaning

The monitor may be surface-cleaned by using a soft cloth dampened with either a commercial, nonabrasive cleaner or one of the solutions listed below. Lightly wipe the top, bottom and front surfaces of the monitor.

- 70% Isopropyl alcohol
- 10% Chlorine bleach solution
- Quaternary Ammonium (fungicidal, bactericidal and virucidal against enveloped viruses)
- PDI Sani-System

For cables, sensors, cuffs and probes, follow the cleaning instructions in the directions for use shipped with those components.

Avoid spilling liquid on the monitor, especially in connector areas. If liquid is accidentally spilled on the monitor, clean and dry thoroughly before reuse. If in doubt about the monitor safety, refer the monitor to qualified service personnel for checking.

Battery Maintenance

⚠ CAUTION	Recharging the battery is strongly recommended when the battery has not been recharged for 2 or more months.
⚠ CAUTION	Follow local government ordinances and recycling instructions regarding disposal or recycling of device components, including battery.
⚠ CAUTION	Do not short-circuit the battery, as it may generate heat. To avoid short-circuiting, do not let the battery come in contact with metal objects at any time, especially when transporting.
⚠ CAUTION	Do not solder the battery directly. Heat applied during soldering may damage the safety vent in the battery's positive cover.
⚠ CAUTION	Do not deform the battery by applying pressure. Do not throw, hit, drop, fold or impact the battery.
⚠ CAUTION	Do not connect the battery reversed in positive (+) and negative (-) terminals. Do not charge the battery with polarities reversed, as it may swell or explode.
⚠ CAUTION	Do not use any chargers not specified by Covetrus.
⚠ CAUTION	Do not use the battery with other maker's batteries, different types or models of batteries such as dry batteries, nickel-metal hydride batteries, or Li-ion batteries together, as they might leak electrolyte heat or explode.
⚠ CAUTION	Do not mistreat the battery, or use the battery in applications not recommended by Covetrus.
⚠ CAUTION	Keep the battery out of reach of babies and children to avoid any accidents.
⚠ CAUTION	If there are any problems with the battery, immediately put the battery in a safe place and contact qualified service personnel.
⚠ CAUTION	The battery may be depleted due to self-discharge for a long storage. Recharge the battery when the device is initially installed.
⚠ CAUTION	The partial charge of a battery results in a shortened battery life.

If the monitor has not been used for 2 months, the Li-ion battery will need charging. To charge the battery, connect the monitor to an AC power source as described in the **Battery Operation** section.

Note: Storing the monitor for a long period without charging the battery may degrade the battery capacity. A full charge of a depleted battery takes over about 6 hours.

*Note: The service menu displays the number of deep discharge cycles seen by the battery. The monitor records a deep discharge cycle when the battery reaches the voltage at which a "Critically low battery" alarm is issued. Refer to the **Service manual** for details.*

Note: The battery should be removed from the monitor if placed in storage or if it will not be used for a long period.

It is recommended that the monitor's Li-ion battery be replaced every 6 months. Please contact to your service technician or Covetrus for assistance.

Loading Printer Paper

⚠ CAUTION Use only printer paper specified by Covetrus.

Note: The paper roll is easier to load if it is held horizontally with your thumb on top and your forefinger and/or index finger underneath it.

Load printer paper as follows:

1. Open the printer door by pulling the latch on the printer slightly and carefully. The door should tilt open. Gently pull the door open if necessary.
2. Reach in and remove the empty paper core by pulling it over gently with your thumb and index finger.
3. Insert a new paper roll oriented properly.
4. Pull the paper out towards you until approximately 2 inches (5 cm) of paper have been unrolled.
5. Align the paper with the pinch roller attached to the printer door.
6. Close the printer door.

Note: To make sure that the paper is aligned in the slot and has not been pinched in the door, pull the loose edge until a few inches of paper is showing. If the paper will not move, open the door and return to step 4.

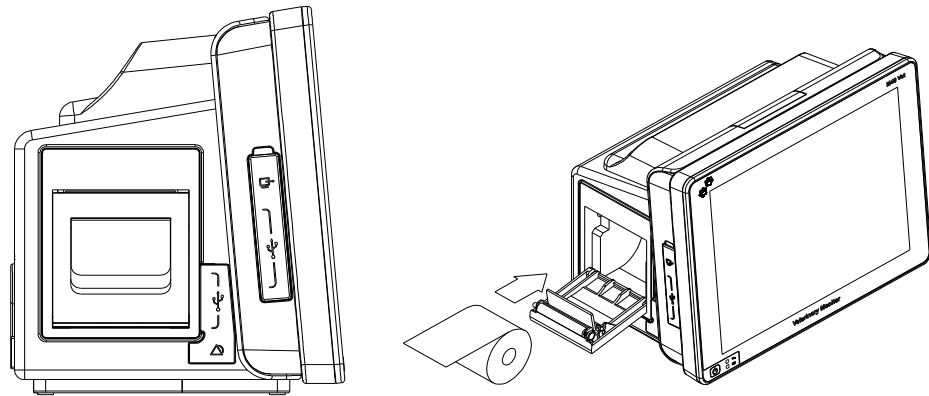


Figure 55. Printer Paper Replacement

TROUBLESHOOTING

 WARNING	If you are uncertain about the accuracy of any measurement, check the patient's vital signs by alternate means; then make sure the monitor is functioning correctly.
 WARNING	The cover should be removed only by qualified service personnel. There are no user-serviceable parts inside except for the battery.

General

If the monitor detects an error, it can display an error code. The error codes are listed in the monitor service manual. If an error code is displayed, write down the code and contact your service department. Before calling your local supplier, make sure that the battery is charged and that all power connections are in place.

Corrective Action

If you experience a problem while using the monitor and are unable to correct it, contact qualified service personnel or your local supplier. The service manual provides additional troubleshooting information for qualified personnel.

Following is a list of possible errors and suggestions for corrective action.

Error	Corrective Action
No response to Power Button press.	Press the Power On/Off button. Check the battery installation or AC connection. Check the battery charging indicator is lit. If the error continues, contact a qualified service technician.
Monitor does not power on with battery.	Check the battery installation. Check the battery charging indicator is lit. Recharge the battery for 12 hours or if it persists, replace the battery.
Low Battery / Critically Low-Battery condition.	Connect the monitor to AC power source and verify the Battery Charging Indicator. Replace the battery with new battery. If the error continues, contact a qualified service technician.
Display is deformed or not displayed.	Contact a qualified service technician.
No sound generation.	Verify the volume setting is loud enough to hear. Verify the alarm audio is not paused. If the error continues, contact a qualified service technician.
Date and Time incorrect.	Set the date and time from the Date and Time menu. Turn off the monitor and a few minutes later, turn on the monitor. Verify the data and time. If the error continues, contact a qualified service technician.
Abnormally shut down last time message.	Contact a qualified service technician.
Technical System Error (ex. EEE801~)	Do not use the monitoring system; Contact Technical Services or a qualified service technician.
Sound like buzzer is heard and the monitor cannot be turned off.	Press the Power button for about 8 seconds. Contact Technical Services or a qualified service technician.

Error	Corrective Action
Poor ECG signal quality (noisy trace, wandering baseline, etc.) or no QRS is detected.	Check that the patient is not shivering. Check the electrode quality and positioning If necessary, prepare the patient's skin and apply new electrodes. Check the connection between ECG cable and lead wire. Set the ECG Filter mode to Filter. Pre-gelled electrodes are recommended. Do not place them on body hair, bones close to skin, and layers of fat and major muscles. Relocate or turn off equipment that may be causing RFI. Change the ECG lead.
ECG Lead off	Check the electrode quality and positioning. Check the connection between ECG cable and lead wire.
Faulty of SpO ₂ Loss of pulse error	Check perfusion at the measurement site. Check that the sensor is applied properly. Make sure the sensor site has a pulse. Relocate the sensor to another site with improved circulation. If the message occurs due to NBP measurement on the same limb, wait until the NBP measurement is finished. Try another sensor.
The SpO ₂ waveform is not displayed.	Check the connection between sensor and sensor cable. Check the damages of sensor and sensor cable. Try another sensor.
SpO ₂ signal is poor:	Check the sensor and sensor positioning. Check that skin pigment causes differences. Make sure that the patient is not moving. Check the damages of sensor and sensor cable. Make sure the sensor cable is not positioned too close to power cables.
The pump operates, but the cuff does not inflate or fails to inflate fully.	Check the Patient mode (large or medium or small) Check the NIBP Hose and cuff connections, if needed. Replace the cuff.
NIBP measurements appear high/low.	Use the correct cuff size. Check the NIBP cuff positioning. The patient should not talk and not move during the BP measurements. If the error continues, contact a qualified service technician.
NIBP Measurement does not work	Check that cuff hose are not bent, stretched, compressed or loose. Prevent motion artifacts. Use the correct cuff size. If the error continues, contact a qualified service technician.
Temperature measurement does not work and measurement values are in doubt.	Check the setting of temperature unit. Check that you are using the correct probe. Check the damages of probe. Try another probe. If the error continues, contact a qualified service technician.
Impedance respiration measurement does not work and	Set the Respiration to On from Respiration menu Select appropriate gain from the Respiration menu. Check the electrode quality and positioning. Remove other electrical devices from the vicinity of the respiration measurement since they may cause interference.

Error	Corrective Action
measurement values are in doubt.	
Printer Paper won't move.	Reload paper or clear jam. If paper is wet, replace with fresh, dry roll. Use only recommended paper type. If the battery is low, connect the monitor to an AC power source.
Paper moves then stops.	Check door latch. Replace the battery with new battery. If the battery is low, connect the monitor to an AC power source. Reload paper or clear jam.
Measurement of Each option module (EtCO ₂ , IBP and Gas) does not work	Check the connection of each option module (EtCO ₂ , IBP and Gas). If the error continues, contact a qualified service technician.

EMI (Electromagnetic Interference)

 WARNING	Keep patients under close surveillance when monitoring. It is possible, although unlikely, that radiated electromagnetic signals from sources external to the patient and monitor can cause inaccurate measurement readings. Do not rely entirely on the monitor readings for patient assessment.
 WARNING	It is possible that any radio frequency transmitting equipment and other nearby sources of electrical noise may result in disruption in the monitor operation.
 WARNING	It is possible, although unlikely, that large equipment using a switching relay for its power on/off may affect monitor operation. Do not operate the monitor in such environments.

The monitor has been tested and found to comply with the limits for medical devices to the IEC60601-1-2 and the Medical Device Directive 93/42/EEC. These limits are designed to provide reasonable protection against harmful interference in a typical medical installation.

However, because of the proliferation of radio-frequency transmitting equipment and other sources of electrical noise in health care environments (such as electrosurgical equipment, defibrillator, cellular phones, mobile two-way radios, electrical appliances and high-definition television), it is possible that high levels of such interference due to close proximity or strength of a source may affect monitor operation.

 WARNING	The monitor is designed for use in environments in which the signal can be obscured by electromagnetic interference. During such interference, measurements may seem inappropriate or the monitor may not seem to operate correctly.
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Monitor disruption may be indicated by erratic readings, cessation of operation, or other incorrect functioning. If this occurs, survey the site to determine the source of this disruption. Try the following actions to see if they eliminate the disruption:

- Turn equipment in the vicinity off and on to isolate the offending equipment.
- Reorient or relocate the interfering equipment.
- Increase the separation between the interfering equipment and this equipment.

The monitor generates, uses and can radiate radio frequency energy. If the monitor is not installed and used in accordance with these instructions, the monitor may cause harmful interference with other devices in the vicinity.

If assistance is required, contact your local supplier.

Obtaining Technical Assistance

For technical information and assistance, or to order the monitor service manual, call your local supplier. The service manual provides information required by qualified service personnel when servicing the monitor.

When calling your local supplier, you may be asked to provide the software version, serial number of your monitor. The software version is displayed when monitor power is activated. The serial number is labeled on the rear panel.

FACTORY DEFAULTS

General

The monitor is shipped with factory default settings. Authorized personnel can use the procedures described in the service manual to change default settings.

Parameter Ranges and Default Settings

Table 46. Parameter Ranges and Factory Defaults

Item	Initial Value	
	Range	Factory
Patient mode	Large, Medium, Small	Medium
ID	Keyboard display	Last setting value by user.
Name	Keyboard display	Last setting value by user.
Birthdate	Keyboard display	Last setting value by user.
Gender	Male, Female, Other	Male
ECG color	Color 1 ~ 17	Color1 
SpO ₂ color	Color 1 ~ 17	Color2 
NIBP color	Color 1 ~ 17	Color3  (White)
RESP color	Color 1 ~ 17	Color17 
TEMP color	Color 1 ~ 17	Color5 
EtCO ₂ color	Color 1 ~ 17	Color15 
GAS color	Color 1 ~ 17	Color11 
IBP1 color	Color 1 ~ 17	Color6 
IBP2 color	Color 1 ~ 17	Color10 
Menu timeout	Off, 10 sec, 20 sec	10 sec
Number of waveform setting	4 ~ 12	4
LCD Brightness	1, 2, 3, 4, 5	3
EWS display	On, Off	Off
IBP menu	On, Off	On
IBP2 menu	On, Off	On
Temp menu	On, Off	On
EtCO ₂ menu	On, Off	On
GAS menu	On, Off	On
Printing speed	25mm/s, 50mm/s	25mm/s
Alarm printing	On, Off	Off
Printing time	10 sec, 20 sec, Continuous	20 sec
Periodic printing	Off, 5 min, 10 min, 15 min, 30 min, 60 min, 120 min	Off
Printing acquired 12 lead	On, Off	On
12 Lead printing time	2.5 sec, 5 sec, 10 sec	2.5 sec
Printing waveform 1	Off, ECG I, ECG II, ECG III, ECG aVR, ECG aVL, ECG aVF, ECG V (Chest Lead) / ECG V1, ECG V2, ECG V3, ECG V4, ECG V5, ECG	ECG II

Item	Initial Value	
	Range	Factory
	V6, SpO ₂ , Respiration, EtCO ₂ , IBP1, IBP2, GAS	
Printing waveform 2	Off, ECG I, ECG II, ECG III, ECG aVR, ECG aVL, ECG aVF, ECG V (Chest Lead) / ECG V1, ECG V2, ECG V3, ECG V4, ECG V5, ECG V6, SpO ₂ , Respiration, EtCO ₂ , IBP1, IBP2, GAS	SpO ₂
Printing waveform 3	Off, ECG I, ECG II, ECG III, ECG aVR, ECG aVL, ECG aVF, ECG V (Chest Lead) / ECG V1, ECG V2, ECG V3, ECG V4, ECG V5, ECG V6, SpO ₂ , Respiration, EtCO ₂ , IBP1, IBP2, GAS	Respiration
Screen mode	Standard, 12Lead ECG, Big number, 12Lead record, Tabular trend, Graphical trend, Event review	Standard
Alarm volume	1, 2, 3, 4, 5	3
HR/PR tone volume	Off, 1, 2, 3, 4, 5	3
KEY beep volume	Off, 1, 2, 3, 4, 5	3
Date type	YY/MM/DD, MM/DD/YY, DD/MM/YY	YY/MM/DD
Year	Keyboard display	Last setting value by user.
Month	Keyboard display	Last setting value by user.
Day	Keyboard display	Last setting value by user.
Hour	Keyboard display	Last setting value by user.
Minute	Keyboard display	Last setting value by user.
Second	Keyboard display	Last setting value by user.
Service mode	Keyboard display	-
HR/PR source	Auto, HR, PR(IBP1), PR(IBP2), PR(SpO ₂), PR(NIBP)	Auto
Pacer detect	On, Off	Off
ST level measurement position	60ms, 62ms, 64ms, 66ms, 68ms, 70ms, 72ms, 74ms, 76ms, 78ms, 80ms	70ms
Filter mode	Interpretation (0.05 ~ 150 Hz), Low (0.05 ~ 40 Hz), Med (0.5 ~ 40 Hz), High (0.5 ~ 30 Hz)	High (0.5 ~ 30 Hz)
Arrhythmia Message	On, Off	On
Arrhythmia relearn	Enter	-
Asystole	On, Off	On
Asystole time	3 sec, 4 sec, 5 sec, 6 sec, 7 sec, 8 sec, 9 sec, 10 sec	5 sec
V-FIB	On, Off	On
VTACH	On, Off	On

Item	Initial Value	
	Range	Factory
VTACH rate	120 ~ 200 bpm	130 bpm
Ventricular rhythm	On, Off	On
Tachy	On, Off	Off
Brady	On, Off	Off
Run	On, Off	Off
Run beats	2 beats, 3 beats, 4 beats, 5 beats, 6 beats, 7 beats, 8 beats	8 beats
Bigeminy	On, Off	Off
Trigeminy	On, Off	Off
Pause	On, Off	Off
Pause threshold	1 ~ 15	8
Couplet	On, Off	Off
Frequent	On, Off	Off
Frequent beats	1 ~ 99 beats	10 beats
R on T PVCs	On, Off	Off
Multiform PVCs	On, Off	Off
Alarm limit display	On, Off	Off
Inflate inflation pressure (Large, Medium)	120 mmHg (16.0 kPa), 140 mmHg (18.7 kPa), 160 mmHg (21.3 kPa), 180 mmHg (24.0 kPa), 200 mmHg (26.7 kPa), 220 mmHg (29.3 kPa), 240 mmHg (32.0 kPa), 260 mmHg (34.7 kPa), 280 mmHg (37.3 kPa), Auto	Auto
Inflate inflation pressure (Small)	80 mmHg (10.7 kPa), 100 mmHg (13.3 kPa), 120 mmHg (16.0 kPa), 140 mmHg (18.7 kPa)	100 mmHg (13.3 kPa)
Auto interval	2min, 2.5 min, 5 min, 10 min, 15 min, 30 min, 60 min, 120 min, Off	Off
IBP1 Zero calibration all	Start, Cancel	-
IBP1 Zero calibration	Start, Cancel	-
IBP1 scale	0~50 mmHg, 0~100 mmHg, 0~200 mmHg, 0~300 mmHg, Auto	0~200 mmHg
IBP1 label	P1, ABP, ART, AO, UAP, PAP, ICP, CVP, RAP, LAP, UVP, BAP, FAP, IC1, IC2	P1 ABP
IBP2 Zero calibration all	Start, Cancel	-
IBP2 Zero calibration	Start, Cancel	-
IBP2 scale	0~50 mmHg, 0~100 mmHg, 0~200 mmHg, 0~300 mmHg, Auto	0~200 mmHg
IBP2 label	P2, ABP, ART, AO, UAP, PAP, ICP, CVP, RAP, LAP, UVP, BAP, FAP, IC1, IC2	P2-CVP
EtCO ₂	On, Off	On
GAS	On, Off	On

Item	Initial Value	
	Range	Factory
Average measurement	1breath, 10sec, 20sec	1breath
Respiration	On, Off	On
RR source	Auto, Impedance, Airway	Auto
Apnea time setting	20 sec, 30 sec	20 sec
Filter mode	Low (~2 Hz), Med (~1 Hz), High (~0.5 Hz)	Low (~2 Hz)
EWS protocol	NEWS, NEWS2, Custom	NEWS
Interval	Off, 5 min, 10 min, 30 min, 1 hour, 2 hours, 3 hours, 6 hours, 12 hours, 24 hours	Off
Alarm	On, Off	Off
NIBP	On, Off	Off
O2	Yes, No	No
AVPU	Alert, Pain, Voice, Unresponsive	Alert
SpO ₂ Scale (Only NEWS Protocol type)	Scale 1, Scale 2	Scale 1
Trend data clear	Yes, No	No
Scroll speed (Tabular trend)	x1, x10, x100	x1
Display interval	1min, 2min, 5min, 10min, 15min, 30min, 60min	5min
Display selection	Standard, NIBP, Alarm, All	All
Display order	Ascending, Descending	Descending
Trend data clear	Yes, No	No
Scroll speed	x1, x2, x4	x1
Display time width	1 hour, 2 hours, 4 hours, 8 hours, 12 hours, 24 hours	1 hour
HR/PR display scale	0~100 bpm, 0~200 bpm, 0~300 bpm, Auto	0~100 bpm
SpO ₂ display scale	80~100 %, 50~100 %, 0~100 %, Auto	80~100 %
NIBP display scale	0~100 mmHg, 0~150 mmHg, 0~200 mmHg, 0~300 mmHg, Auto	0~200 mmHg
RESP display scale	0~50 bpm, 0~100 bpm, 0~150 bpm, Auto	0~100 bpm
TEMP display scale	30~40°C, 20~50°C, Auto	30~40°C
EtCO ₂ display scale	0~50 mmHg, 0~100 mmHg, 0~150 mmHg, Auto	0~100 mmHg
Gas insp display scale	0~5.0 Vol%, 0~10.0 Vol%, 0~20.0 Vol%, 0~25.0 Vol%, Auto	0~20.0 Vol%,
Gas exp display scale	0~5.0 Vol%, 0~10.0 Vol%, 0~20.0 Vol%, 0~25.0 Vol%, Auto	0~20.0 Vol%
IBP1 display scale	0~50 mmHg, 0~100 mmHg, 0~200 mmHg, 0~300 mmHg, Auto	0~200 mmHg
IBP2 display scale	0~50 mmHg, 0~100 mmHg, 0~200 mmHg, 0~300 mmHg, Auto	0~200 mmHg

Item	Initial Value	
	Range	Factory
All trend display	On, Off	On
HR/PR trend display	On, Off	On
SpO ₂ trend display	On, Off	On
NIBP trend display	On, Off	On
RESP trend display	On, Off	On
TEMP trend display	On, Off	On
EtCO ₂ trend display	On, Off	On
GAS trend display	On, Off	On
IBP1 trend display	On, Off	On
IBP2 trend display	On, Off	On
Clear event	Yes, No	-
Waveform 1	-	ECG
Waveform 2	-	SpO ₂
Waveform 3	-	Resp
ECG lead select	I, II, III, aVR, aVL, aVF, V1/V(Chest Lead), V2, V3, V4, V5, V6	II
ECG sweep speed	6.25 mm/s, 12.5 mm/s, 25.0 mm/s, 50.0 mm/s	25.0 mm/s
ECG size	Auto, 1.25 mm/mV, 2.5 mm/mV, 5.0 mm/mV, 7.5 mm/mV, 10.0 mm/mV, 15.0 mm/mV, 20.0 mm/mV, 40 mm/mV	10.0 mm/mV
Acquire	Enter	-
12 Lead waveform setting	All 12 lead, Lead 1 ~ aVF, Lead V1 ~ V6	All 12 lead,
SpO ₂ sweep speed	6.25 mm/s, 12.5 mm/s, 25.0 mm/s, 50.0 mm/s	25.0 mm/s
IBP1 sweep speed	6.25 mm/s, 12.5 mm/s, 25.0 mm/s, 50.0 mm/s	25.0 mm/s
IBP2 sweep speed	6.25 mm/s, 12.5 mm/s, 25.0 mm/s, 50.0 mm/s	25.0 mm/s
RESP sweep speed	6.25 mm/s, 12.5 mm/s, 25.0 mm/s, 50.0 mm/s	6.25 mm/s
RESP size	Auto, 1.25 (mm/Ω), 1.7 (mm/Ω), 2.5 (mm/Ω), 5.0 (mm/Ω), 7.5 (mm/Ω), 10.0 (mm/Ω), 15.0 (mm/Ω), 20.0 (mm/Ω)	10.0 (mm/Ω)
EtCO ₂ scale	Auto, 0~40 mmHg, 0~60 mmHg, 0~80 mmHg	0~40 mmHg,
EtCO ₂ sweep speed	6.25 mm/s, 12.5 mm/s, 25.0 mm/s, 50.0 mm/s	6.25 mm/s
GAS scale	Auto, 0~10 Vol%, 0~20 Vol%	0~10 Vol%,
GAS sweep speed	6.25 mm/s, 12.5 mm/s, 25.0 mm/s, 50.0 mm/s	6.25 mm/s
Waveform select 1	Blank, ECG, SpO ₂ , Respiration, IBP1, IBP2, EtCO ₂ , GAS	ECG

Item	Initial Value	
	Range	Factory
Waveform select 2	Blank, ECG, SpO ₂ , Respiration, IBP1, IBP2, EtCO ₂ , GAS	SpO ₂
Waveform select 3	Blank, ECG, SpO ₂ , Respiration, IBP1, IBP2, EtCO ₂ , GAS	ABP
Waveform select 4	Blank, ECG, SpO ₂ , Respiration, IBP1, IBP2, EtCO ₂ , GAS	CVP
Waveform select 5	Blank, ECG, SpO ₂ , Respiration, IBP1, IBP2, EtCO ₂ , GAS	EtCO ₂
Waveform select 6	Blank, ECG, SpO ₂ , Respiration, IBP1, IBP2, EtCO ₂ , GAS	Blank
Waveform select 7	Blank, ECG, SpO ₂ , Respiration, IBP1, IBP2, EtCO ₂ , GAS	Blank
Waveform select 8	Blank, ECG, SpO ₂ , Respiration, IBP1, IBP2, EtCO ₂ , GAS	Blank
Waveform select 9	Blank, ECG, SpO ₂ , Respiration, IBP1, IBP2, EtCO ₂ , GAS	Blank
Waveform select 10	Blank, ECG, SpO ₂ , Respiration, IBP1, IBP2, EtCO ₂ , GAS	Blank
Waveform select 11	Blank, ECG, SpO ₂ , Respiration, IBP1, IBP2, EtCO ₂ , GAS	Blank
Waveform select 12	Blank, ECG, SpO ₂ , Respiration, IBP1, IBP2, EtCO ₂ , GAS	Blank

SPECIFICATION

Display

Screen Size	10.4" measured diagonally across the TFT-LCD screen
Screen Type/Color	Liquid Crystal Display (LCD) Color
Resolution	1024*768
Number of Traces	12 waveforms
External	Display the same screen (via the HDMI port)

Controls

Standard	Touch screen; Power button
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Alarms

Categories	Patient Status and System Status
Priorities	Low, Medium and High Priorities
Notification	Audible and Visual
Setting	Default and Individual
Alarm Volume Level	45 to 85 dB
Distributed Alarm	Less than 3 sec
System Delay	

Physical Characteristics and Printer

Instrument	
Dimensions	261 × 206 × 171 (mm) (W × H × D) excluding optional configuration and accessories
Weight	Approx. 3.77 kg excluding optional configuration and accessories
Degree of Protection against Electric Shock	ECG: Type CF with defibrillator protection NIBP: Type CF with defibrillator protection SpO ₂ : Type CF with defibrillator protection TEMP: Type CF with defibrillator protection EtCO ₂ : Type CF with defibrillator protection
Parts which contact the patient	ECG: ECG electrode (ECG electrode is not supplied with the monitor) NIBP: Cuff SpO ₂ : Inner rubber parts and window of SpO ₂ sensor TEMP: Temperature probe EtCO ₂ : Tube connected to EtCO ₂ airway adapter or sampling line (Tube is not supplied with the monitor)
Mode of Operation	Continuous
Liquid ingress	IPX2: Protection against water drops falling vertically over a 15° range.
Class	Class I, with internal power supply
Printer (option)	
Type	Thermal
Weight	180g (without the printer paper)
Resolution	8 dot/mm

Number of Channels	1 to 3 channels
Printer Speeds	25 mm/s and 50 mm/s

Electrical Characteristics

Instrument	
Power Requirements	AC Mains 100 to 240V~, 50/60 Hz, 130 ~160 VA
Battery (option)	
Type	Li-ion battery
Operating time	Standard (including ECG/Respiration, NIBP, SpO ₂ , 2TEMP) 3400 mAh: 1 hour (option) <i>At the following condition:</i> <i>No audible alarm sound</i> <i>No data output (communication) devices are attached</i> <i>No printing out</i> <i>All monitoring parameters are active with one NIBP measurement per 15 minutes</i> <i>Brightness default</i> <i>Ambient temperature is 25 °C</i>
Voltage/Capacity	10.8 V / 3400 mAh
Recharge	6 hours for depleted battery to 90% of battery capacity and for full recharge with monitor turned on/off.
Life Cycle	6 months, new battery fully-charged After 2 months storage the monitor would run for 50% of stated battery life.

Environmental Conditions

Operation	
Temperature	5 to 40°C (41 to 104°F)
Humidity	15 to 93% RH, non-condensing
Atmospheric pressure (Altitude)	580 to 1013.25 hPa (0 m (0 ft) to 4464.4 m (14,646 ft) at 15°C)
Transport and Storage (in shipping container)	
Temperature	-20°C to 60°C (-4°F to 140°F)
Humidity	15 to 93% RH, non-condensing
Atmospheric pressure (Altitude)	500 to 1013.25 hPa (0 m (0 ft) to 5574.44 m (18,288 ft) at 15°C)
<i>Note: The system may not meet its performance specifications if stored or used outside the specified temperature and humidity range.</i>	

Tone Definition

High Priority Alarm Tone	
Volume level	Adjustable (level 1~5)
Pitch ($\pm 5\%$)	540 Hz (IEC60601-1-8 Low), 970 Hz (IEC60601-1-8 High), 970 Hz (ICU-P),
Pulse width ($\pm 5\%$)	180 ms (IEC60601-1-8 Low) 170 ms (IEC60601-1-8 High) 950 ms (ICU-P)
Number of pulses	About 10 pulses per 3.7 sec (IEC60601-1-8 Low), About 10 pulses per 4 sec (IEC60601-1-8 High), About 1 pulse per 1.3 sec (ICU-P) 3/9/15 sec interval burst
Repetitions	Continually
Medium Priority Alarm Tone	
Volume level	Adjustable (level 1~5)
Pitch ($\pm 5\%$)	480 Hz (IEC60601-1-8 Low), 700 Hz (IEC60601-1-8 High), 800 Hz (ICU-P),
Pulse width ($\pm 5\%$)	240 ms (IEC60601-1-8 Low) 190 ms (IEC60601-1-8 High) 190 ms (ICU-P)
Number of pulses	About 3 pulses per 1 sec, 3/15/30 sec interval burst
Repetitions	Continually
Low Priority Alarm Tone	
Volume level	Adjustable (level 1~5)
Pitch ($\pm 5\%$)	400 Hz (IEC60601-1-8 Low), 520 Hz (IEC60601-1-8 High), 520 Hz (ICU-P),
Pulse width ($\pm 5\%$)	240 ms (IEC60601-1-8 Low) 190 ms (IEC60601-1-8 High) 190 ms (ICU-P)
Number of pulses	About 1 pulse per 1 sec, 15/30/60sec interval burst
Repetitions	Continually
Alarm Reminder Tone	
Volume level	Not changeable
Pitch ($\pm 5\%$)	800 Hz
Pulse width ($\pm 5\%$)	200 ms
Number of pulses	1 pulse per 1 second, 3 min, 10 min inter burst
Repetitions	Continually
HR/PR Tone	
Volume level	Adjustable (Off, level 1~5)
Pitch ($\pm 5\%$)	650 Hz (ECG), 158 ~ 662 Hz (SpO ₂)
Pulse width ($\pm 5\%$)	100 ms
Number of pulses	N/A
Repetitions	No repeat
Key Beep	
Volume level	Adjustable (Off, level 1~5)
Pitch ($\pm 5\%$)	440 Hz (valid), 168 Hz (invalid)
Pulse width ($\pm 5\%$)	110 ms

Number of pulses	N/A
Repetitions	No repeat
POST Pass Tone	
Volume level	Not changeable
Pitch ($\pm 5\%$)	Mix frequency
Pulse width ($\pm 5\%$)	3700 ms
Number of pulses	N/A
Repetitions	No repeat
<i>Note: One of 3 types about the Alarm tone can be selected in Service menu. (IEC60601-1-8 High, IEC60601-1-8 Low, ICU-P)</i>	
<i>Note: The default setting for the Alarm tone is IEC60601-1-8 High.</i>	

Measurement Parameters

ECG

Heart rate	
Measurement range	20 BPM to 400 BPM
Accuracy	±1 BPM or ±1 %, whichever is greater
ST level	
Measurement range	-5.00 mV to 5.00 mV
Measurement position	60 ms, 62 ms, 64 ms, 66 ms, 68 ms, 70 ms, 72 ms, 74 ms, 76 ms, 78 ms, 80 ms
Arrhythmia	
Rhythm status message	Asystole, VFIB/VTACH, Ventricular tachycardia, Ventricular rhythm, Ventricular Bigeminy, Ventricular Trigeminy, Paced, Unknown Rhythm, Learning, Bradycardia, Tachycardia
Ectopic status message	PVCs, MISSED/PAUSE, RUN PVCs , PAIR PVCs, R-on-T PVCs, MULTIFORM PVCs
Counting parameters	PVCs, MISSED/PAUSE, PACED BEATS
ECG (Electrocardiograph)	
Leads	3 Lead user selectable: I, II, III 5 Lead user selectable: I, II, III, aVR, aVL, aVF, V
Lead off detection	Detected and displayed
Saturation detection	Detected and displayed
Input	
Input dynamic range	±1200 mV DC
Voltage range	±0.3 mV to ±5 mV
Signal width	40 ms to 120 ms (Q to S)
Output	
Frequency response (Bandwidth)	Interpretation 0.05 Hz to 150 Hz
	Low 0.05 Hz to 40 Hz
	Med 0.5 Hz to 40 Hz
	High 0.5 Hz to 30 Hz
ECG size (sensitivity)	Auto, 1.25, 2.5, 5.0, 7.5, 10.0, 15.0, 20.0, 40.0 (<i>mm per 1mV</i>)
Display sweep speeds	6.25 mm/sec, 12.5 mm/sec, 25.0 mm/sec, 50.0 mm/sec
Defibrillator discharge Recovery	< 5 sec per IEC60601-2-27:2011
ECG (Arrhythmia Supplemental Information as required by IEC60601-2-27)	
Respiration, leads-off sensing, and active noise suppression	amp: 0.03 µA
	common: 0.25 µA
Tall T-wave rejection capability	Maximum T-Wave amplitude 1.4 mV
Accuracy of input signal reproduction	Displacement: 0.1 mV
	Slope: 0.1 mV/s
Heart rate meter accuracy and response to irregular rhythm	Provides correct heart rates, as follows
	Ventricular bigeminy: 79 to 82 bpm
	Slow alternating ventricular bigeminy: 60 to 62 bpm
	Rapid alternating ventricular bigeminy: 120 bpm
	Bidirectional systoles: 90 bpm

Response time of heart rate meter to change in heart rate	HR change from 80 to 120 bpm: 9.2 sec HR change from 80 to 40 bpm: 8.5 sec
Time to alarm for tachycardia	Vent Tachycardia 1 mVpp, 206 bpm: Amplitude 0.5 mV, Alarm activated time 5.4 sec Amplitude 1 mV, Alarm activated time 4.7 sec Amplitude 2 mV, Alarm activated time 5.6 sec Vent Tachycardia 2 mVpp, 195 bpm: Amplitude 1 mV, Alarm activated time 4.6 sec Amplitude 2 mV, Alarm activated time 5.4 sec Amplitude 4 mV, Alarm activated time 4.8 sec
Time to alarm for cardiac standstill	Average: 3.7 sec (Asystole time setting: 3 sec) Average: 10.7 sec (Asystole time setting: 10 sec)
Time base selection and accuracy	10 successive peaks: 10 mm 20 successive peaks: 20 mm 40 successive peaks: 40 mm
Pacemaker pulse rejection capability	Rejection of pacemaker pulses with amplitudes from ± 2 mV to ± 700 mV with pulse widths of 0.1 to 2msec Overshoot time constant 4 ms, Test method B (with overshoot)

Respiration

ECG Respiration	
Technique	Trans-thoracic impedance
Range	0 to 150 breaths/min
Accuracy	± 3 breaths/min
Leads	RA to LL (Lead II)
Display Sweep Speeds	6.25 mm/s, 12.5 mm/s, 25.0 mm/s
Lead Off Condition	Detected and displayed
Wave Size	Auto, 1.25, 1.7, 2.5, 5.0, 7.5, 10.0, 15.0, 20.0 (mm/ Ω)
Defibrillator Protection	Protected
EtCO ₂ Respiration	
Technique	EtCO ₂
Range	0 to 150 breaths/min
Accuracy	0 to 70 breaths/min ± 1 breaths/min
	71 to 120 breaths/min ± 2 breaths/min
	121 to 150 breaths/min ± 3 breaths/min

NIBP

Pulse Rate	
Pulse Rate Range	25 to 300 BPM
Pulse Rate Accuracy	±2BPM or ±2%, whichever is greater
NIBP (Non-Invasive Blood Pressure)	
Technique	Oscillometric Measurement (SunTech NIBP)
Measurement Modes	MANUAL, AUTO interval and STAT
NIBP AUTO Mode Intervals	Off, 1, 2, 2.5, 5, 10, 15, 30, 60, 120 minutes
Measurement Range	SYS 40 to 265 mmHg MAP 27 to 222 mmHg DIA 20 to 200 mmHg
NIBP Accuracy	Mean error and standard deviation per ANSI/ AAMI SP10: 1992 and 2002.
Pressure Display Range	0 to 300 mmHg
Pressure Display Accuracy	Within ±3mmHg
Initial Cuff Inflation	120, 140, 160, 180, 200, 220, 240, 260, 280 mmHg (16.0, 18.7, 21.3, 24.0, 26.7, 29.3, 32.0, 34.7, 37.3 kPa)
Automatic Cuff Deflation	Measurement time exceeding 180s
Overpressure Protector	300mmHg
Defibrillator Protection	Protected

SpO₂

Pulse Rate	
Range	18 to 400 BPM
Accuracy	±2 % or 2 BPM, whichever is greater
<i>Note: PR accuracy specification was proven by laboratory simulator tests, where oximeter was connected to the Oximetry simulator, set to the precise number of pulses per minute.</i>	
SpO ₂	
Range	0 to 100 %
Accuracy	70 to 100 % ±2 digits
Display Sweep Speeds	6.25 mm/sec, 12.5 mm/sec, 25.0 mm/sec, 50.0 mm/sec
Defibrillator Protection	Protected
Neonatal specifications are shown for neonatal sensors with the monitor. Saturation accuracy will vary by sensor type as specified by the manufacturer.	
<i>Note: The wavelength range of the light emitted are near 660 nm and 890 nm with the energy not exceeding 15mW.</i>	
<i>Note: SpO₂ saturation accuracy - Monitoring system measurements are statistically distributed; about two-thirds of monitoring system measurements can be expected to fall in this accuracy (ARMS) range. Reference the Clinical Studies section for test results.</i>	
<i>Note: Specification applies to monitoring system performance. Reading accuracy in the presence of low perfusion (detected IR pulse modulation amplitude 0.03% - 1.5%) was validated using signals supplied by a patient simulator. SpO₂ and pulse rate values were varied across the monitoring range over a range of weak signal conditions and compared to the known true saturation and pulse rate of the input signals.</i>	

Capnography

Capnography	
Parameter Displayed	EtCO ₂ , InCO ₂
Principle of Operation	Non-dispersive infrared (NDIR) single beam optics, dual wavelength, no moving parts.
Initialization / Warm Up Time	<i>Respironics:</i> - Capnogram displayed in less than 15 seconds, At an ambient temperature of 25° C, full specifications within 2 minutes, <i>Kingst:</i> - Mainstream: To reach designed deviation 97% within 8s, to reach designed deviation within 20s - Sidestream: To reach designed deviation 97% within 45s, to reach designed deviation within 2 min.
CO ₂ Measurement Range	0 mmHg ~ 150 mmHg (0 kPa ~ 20 kPa, 0% ~ 19.7%)
CO ₂ Rise Time/Response Time (10 - 90% of step change of final CO ₂ value)	<i>Respironics:</i> - Mainstream: Less than 60 ms - Adult reusable or single patient use Less than 60 ms - Infant reusable or single patient use - Sidestream: <3 seconds - includes transport time and rise time <i>Kingst:</i> - Mainstream: About 70ms - Sidestream: About 100 ms when the flow is 50 ml/min adult water filter with sampling line 1.5m
CO ₂ Measurement Accuracy	0-40mmHg ±2mmHg of reading 41-70mmHg ±5% of reading 71-100mmHg ±8% of reading 101-150mmHg ±10% of reading
Sampling rate	<i>Respironics:</i> 100 Hz <i>Kingst:</i> 0.1 l/min
CO ₂ Stability	<i>Respironics:</i> - Short Term Drift: Drift over four hours shall not exceed 0.8 mmHg maximum. - Long Term Drift: Accuracy specification will be maintained over a 120 hour period. <i>Kingst:</i> - Shortly drifting: drifting less than 1 mmHg, after 4 hours' power on. - Longly drifting: drifting does not influence nominal accuracy after continuous 140 hours' power on.
Respiration Rate Range	0 ~ 150 breaths/min
Respiration Rate Accuracy	±1 breath
Calibration	No routine user calibration required. Zero is proceeding when replacing adaptor.

EtCO ₂ Calculation	Averaging Selections: 1 breath, 10 seconds, 20 seconds
Compensations (Host Controlled)	<i>Respironics:</i> - Compensations for: Expired O₂, Balance gas (N₂, N₂O, He) and anesthetic agents. Uses gas compensation information and barometric pressure to correct the raw carbon dioxide value. <i>Kingst:</i> - N₂O, O₂, Agent (HOST supplied) - Barometric Pressure 400 to 860mmHg automatic
Barometric Pressure compensation	<i>Respironics:</i> - Total barometric pressure (Barometric plus Airway pressure) provided by host. - Range: 400-850 mmHg. - Recommended accuracy: $\pm 1\%$ FS <i>Kingst:</i> - -152.4 to 4572 meters (-500 to 15,000 feet) - 775 to 429 mmHg, Automatic
Response time	<i>Respironics:</i> - Sidestream: <3 sec <i>Kingst:</i> - Sidestream: <2 sec when flow is 50 ml/min adult water filter, with sampling line 1.5m
Flow control	Sidestream: 50 $\pm$ 10 ml/min
Sweep Speeds	6.25, 12.5, 25.0 mm/s
<i>Note: Respiration rate accuracy was verified by using a solenoid test setup to deliver a square wave of known CO₂ concentration to the device. 5% and 10% CO₂ 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. EtCO₂ measurements at those rates were compared to the CO₂ readings under static flow conditions.</i>	

Temperature

Thermistor Temp			
Probe Type	Thermistor probe YSI 400 series and 700 series		
Measurement Method	Thermistor		
Range	0.0 to 50.0 °C (32.0 to 122.0 °F)		
Display Accuracy	± 0.1 °C		
Probe Accuracy	± 0.1 °C		
Defibrillator Protection	Protected		
Transient response time	YSI 400:	Cooling time	about 16 sec
		Heating time	about 19 sec
	YSI 700:	Cooling time	about 11 sec
		Heating time	about 14 sec

Trends

Types	Graphical and Tabular
Memory	saves total 14,400 data saves patient information saves date and time saves alarm condition saves HR/PR data (from SpO ₂ and NIBP) saves RR data (from ECG and EtCO ₂) saves ECG, NIBP, SpO ₂ , Temp, EtCO ₂ measurements
Graphical Format	User-selectable each parameter to be desired
Tabular Format	One table for all parameters
Display	10 lists
Display interval (Tabular trend)	1, 2, 5, 10, 15, 30, 60 minutes
Display time width (Graphical trend)	1, 2, 4, 8, 12, 24 hours

Compliance

Item	Standard	Description
Electromagnetic compatibility	IEC 60601-1-2:2014+A1:2020, EN 60601-1-2:2015+A1:2021	Electromagnetic compatibility-requirements & test

Manufacturer's EMC Declaration

⚠ WARNING	For best product performance and measurement accuracy, use only accessories supplied or recommended by Covetrus. Use accessories according to the manufacturer's directions for use and your facility's standards. The use of accessories, transducers, and cables other than those specified may result in increased emission and/or decreased immunity of the monitor.
⚠ WARNING	Portable RF communications equipment (including peripherals such as antenna cables and external antennas) should be used no closer than 30 cm (12 inches) to any part of the monitor, including cables specified by the manufacturer. Otherwise, degradation of the performance of this equipment could result.

The monitor is suitable for use in the specified electromagnetic environment. The customer and/or user of the monitor should assure that it is used in an electromagnetic environment as described below;

Table 47. Electromagnetic Emissions (IEC60601-1-2)

Emission Test	Compliance	Electromagnetic Environment
RF emission CISPR 11	Group 1	The monitor must emit electromagnetic energy in order to perform its intended function. Nearby electronic equipment may be affected. The monitor is suitable for use in all establishments.
RF emissions CISPR 11	Class B	
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations/flicker emission IEC 61000-3-3	Complies	

Table 48. Electromagnetic Immunity (IEC60601-1-2)

Immunity Test	IEC 60601-1-2 Test Level	Compliance Level	Electromagnetic Environment Guidance
Electrostatic discharge (ESD) IEC 61000-4-2	± 8 kV contact ± 2, 4, 8, 15 kV air	± 8 kV contact ± 2, 4, 8, 15 kV air	Floor should be wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30 %.
Electric fast transient/burst IEC 61000-4-4	± 2 kV for power supply lines ± 1 kV for input/output lines	± 2 kV for power supply lines ± 1 kV for input/output lines	Mains power quality should be that of a typical commercial and/or hospital environment
Surge IEC 61000-4-5	± 0.5, 1 kV differential mode ± 0.5, 1, 2 kV common mode	± 0.5, 1 kV differential mode ± 0.5, 1, 2 kV common mode	Mains power quality should be that of a typical commercial and/or hospital environment
Voltage dips, short interruptions and voltage variations on power supply	Voltage dips > 95 % U T for 0.5 cycle At 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315°	Voltage dips > 95 % U T for 0.5 cycle At 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315°	Mains power quality should be that of a typical commercial and/or hospital environment. If the user of the VPM-25 requires continued operation during power mains interruption, it is recommended that the VPM-25 be powered from an uninterruptible power supply or battery.
IEC 61000-4-11	Voltage dips > 95 % U T for 1 cycle At 0°	Voltage dips > 95 % U T for 1 cycle At 0°	
	Voltage dips 30 % U T for 25/30 cycle At 0°	Voltage dips 30 % U T for 25/30 cycle At 0°	
	Voltage interruption > 95 % U T for 250/300 cycle At 0°	Voltage interruption > 95 % U T for 250/300 cycle At 0°	
Power frequency (50/ 60 Hz) magnetic field IEC 61000-4-8	30 A/m	30 A/m	It may be necessary to position the VPM-25 further from the sources of power frequency magnetic fields or to install magnetic shielding. The power frequency magnetic field should be measured in the intended installation location to assure that it is sufficiently low.
<i>Note: UT is the AC mains voltage prior to application of the test level.</i>			

Table 49. Electromagnetic Immunity (IEC60601-1-2)

Immunity Test	IEC 60601 test level	Compliance level	Electromagnetic environment guidance
The monitor is intended for use in the electromagnetic environment specified below. The customer or the user of the monitor should assure that it is used in such an environment.			
Conducted RF IEC 61000-4-6	3 Vrms 80%AM@ 2Hz 150 kHz to 80 MHz	3 Vrms	Portable and mobile RF communications equipment should be used no closer to any part of the VPM-25 including cables, than the recommended separation distance calculated from the equation appropriate to the frequency of the transmitter. Recommend separation distance $d = 1.2 \sqrt{P}$
	6 Vrms 80%AM @1kHz 150 kHz to 80 MHz	6 Vrms	$d = 0.6 \sqrt{P}$
Radiated RF IEC 61000-4-3	3 V/m 80%AM@ 2Hz 80 MHz to 2.7 GHz	3 V/m	$d = 1.2 \sqrt{P}$ 80 MHz to 800 MHz $d = 2.3 \sqrt{P}$ 800 MHz to 2.5 GHz
	10 V/m 80%AM@ 1kHz 80 MHz to 2.7 GHz	10 V/m	$d = 0.4 \sqrt{P}$ 80 MHz to 800 MHz $d = 0.7 \sqrt{P}$ 800 MHz to 2.7 GHz
	[SpO ₂ , EtCO ₂ , Temp] 20 V/m 80%AM@1kHz 80MHz to 2.5 GHz	20 V/m	$d = 0.2 \sqrt{P}$ 80 MHz to 800 MHz $d = 0.4 \sqrt{P}$ 800 MHz to 2.5 GHz
			where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in metres (m). Field strengths from fixed RF transmitters as determined by an electromagnetic site survey, ^a should be less than the compliance level in each frequency range. ^b Interference may occur in the vicinity of equipment marked with the following symbol: 
Note: At 80 MHz and 800 MHz, the higher frequency range applies. Note: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.			

Immunity Test	IEC 60601 test level	Compliance level	Electromagnetic environment guidance
^a Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radio, AM and FM radio broadcast, and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the VPM-25 is used exceeds the applicable RF compliance level above, the VPM-25 should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the VPM-25. ^b Over the frequency range 150 kHz to 80MHz, field strengths should be less than 3 V/m			

Table 50. Recommended Separation Distances

Recommended separation distance between portable and mobile RF communications equipment and the monitor				
The monitor is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the monitor can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the monitor as recommended below, according to the maximum output power of the communications equipment.				
Rated Maximum Output Power of Transmitter in watt	Separation distance according to frequency of transmitter in meter			
	150 kHz to 80 MHz $d = 1.2 \sqrt{P}$	80 MHz to 800 MHz $d = 1.2 \sqrt{P}$	800 MHz to 2.5GHz $d = 2.3 \sqrt{P}$	800 MHz to 2.5GHz (Test level 20 V/m) $d = 0.4 \sqrt{P}$
0.01	0.12	0.12	0.23	0.04
0.1	0.38	0.38	0.73	0.13
1	1.2	1.2	2.3	0.4
10	3.8	3.8	7.3	1.3
100	12	12	23	4
For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.				
Note: At 80MHz and 800MHz, the separation distance for the higher frequency range applies				
Note: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.				

Table 51. Immunity to proximity fields from RF wireless communications equipment (IEC60601-1-2)

Test frequency (MHz)	Band ^a (MHz)	Service ^a	Modulation ^b	Maximum power (W)	Distance (m)	Immunity test level (V/m)
385	360 – 390	TETRA 400	Pulse modulation ^b 18 Hz	1.8	1	27
450	430 – 470	GMRS 460, FRS 460	FM ^c ± 5 kHz deviation 1 kHz sine	2	1	28
710 745 780	704 – 787	LTE Band 13, 17	Pulse modulation ^b 217 Hz	0.2	1	9

Test frequency (MHz)	Band ^a (MHz)	Service ^a	Modulation ^b	Maximum power (W)	Distance (m)	Immunity test level (V/m)
810 870 930	800 – 960	GSM 800/900, TETRA 800, iDEN 820, CDMA 850, LTE Band 5	Pulse modulation ^b 18 Hz	2	1	28
1720 1845 1970	1700 – 1990	GSM 1800; CDMA 1900; GSM 1900; DECT; LTE Band 1, 3, 4, 25; UMTS	Pulse modulation ^b 217 Hz	2	1	28
2450	2400 – 2570	Bluetooth, WLAN, 802.11 b/g/n, RFID 2450, LTE Band 7	Pulse modulation ^b 217 Hz	2	1	28
5240 5500 5785	5100 – 5800	WLAN 802.11 a/n	Pulse modulation ^b 217 Hz	0.2	1	9
<i>Note: If necessary to achieve the IMMUNITY TEST LEVEL, the distance between the transmitting antenna and the ME EQUIPMENT or ME SYSTEM may be reduced to 1 m. The 1 m test distance is permitted by IEC 61000-4-3.</i>						
^a For some services, only the uplink frequencies are included. ^b The carrier shall be modulated using a 50 % duty cycle square wave signal. ^c As an alternative to FM modulation, 50 % pulse modulation at 18 Hz may be used because while it does not represent actual modulation, it would be worst case.						

Table 52. Cables (IEC60601-1-2)

Cables and Sensors	Maximum Length	Complies with
Power Cable	2.5 m	-RF emissions, CISPR 11, Class B/ Group 1 -Harmonic emissions, IEC 61000-3-2 -Voltage fluctuations/flicker emission, IEC 61000-3-3 -Electrostatic discharge (ESD), IEC 61000-4-2 -Electric fast transient/burst, IEC 61000-4-4 -Surge, IEC 61000-4-5 -Conducted RF IEC 61000-4-6 -Radiated RF, IEC 61000-4-3
NIBP Hose	3.2 m	
ECG Cable	3.0 m	
SpO ₂ Cable	4.0 m	
Temperature Cable	3.0 m	
EtCO ₂ cable	2.0 m	
Gas cable	0.5 m	
IBP cable	0.4 m	
Nurse Call Cable	2.5 m	
HDMI	1.5 m	