

Life Scope® BSM-6000 Series Bedside Monitor and BSM-1700 Series Transport Monitor Clinical Reference Guide

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Introduction

This Clinical Reference Guide is designed to assist you to learn the monitors' basic operations during the pre-implementation training class or as a self-study tool as you use the system on your clinical unit. It is also designed as a reference tool when you need a refresher for infrequently performed procedures.

The procedures in this guide reflect Life Scope® BSM-6000 series bedside monitor and the BSM-1700 series transport monitor. Both are based on the use of the monitor in an adult or pediatric environment. The BSM-1700 series monitor operates similarly to the BSM-6000 series and any differences between the two will be explained at the end of this guide. Otherwise, the basic operations are nearly identical to each other and this guide will serve to reflect both BSM's.

The Clinical Reference Guide is an adjunct to the Operator's Manual and does not replace it. Please refer to that manual for critical, technical, and other specific information, and for additional information as directed in this guide.

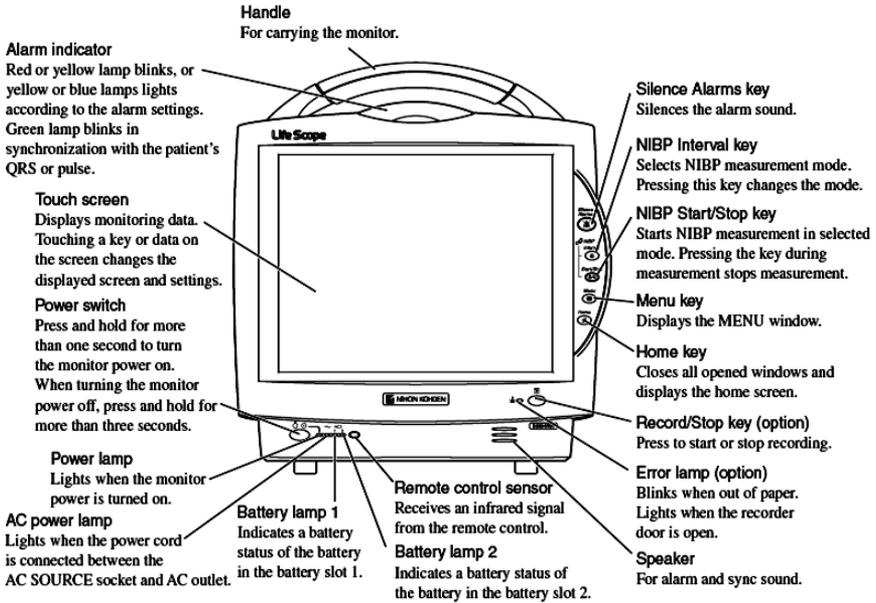


Whenever you see this icon in this guide, a one touch "shortcut" is available for the particular function. That shortcut is described with the icon.

For additional assistance, please contact your hospital biomedical services representative. For technical or clinical product assistance, a toll-free customer support service is provided at 1-800-325-0283.

Life Scope® BSM-6000 Series Bedside Monitor

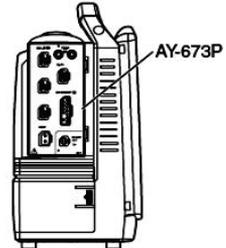
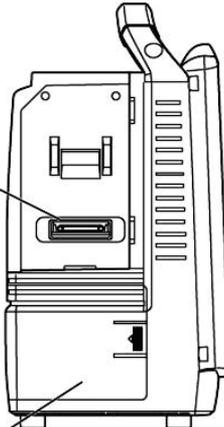
Front Panel



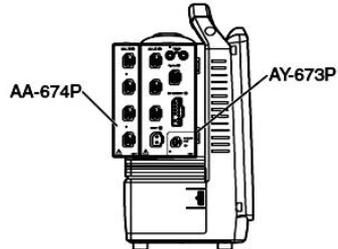
Left Side Panel

Input unit socket
Connects the AY-631P/AY-633P/AY-651P/AY-653P/AY-661P/AY-663P/AY-671P/AY-673P input unit.

Battery pack holder
For an SB-671P battery pack.

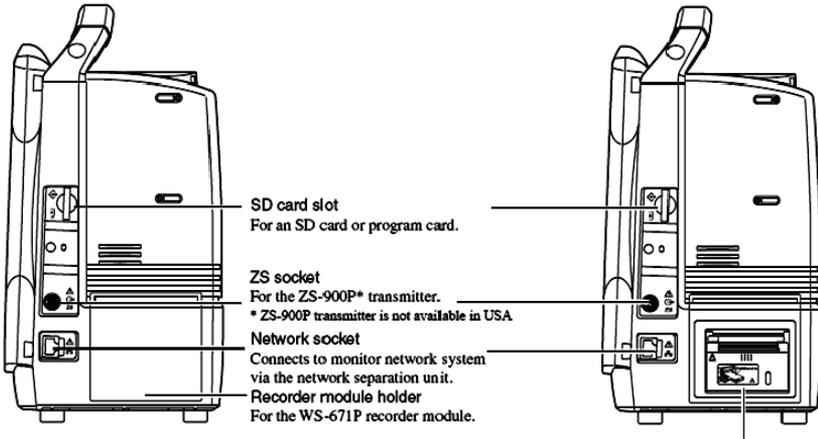


When the AY-673P input unit installed



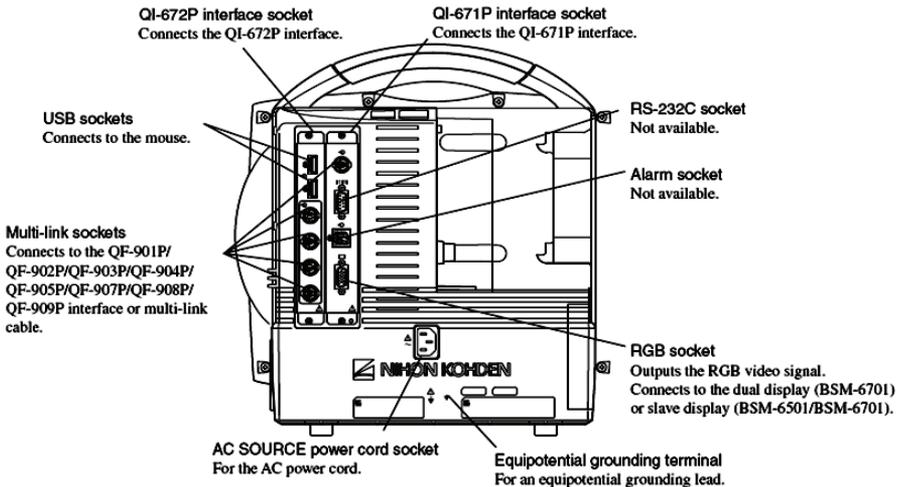
When the AY-673P input unit and AA-674P smart expansion unit are installed

Right Side Panel



When the WS-671P recorder module is installed

Rear Panel

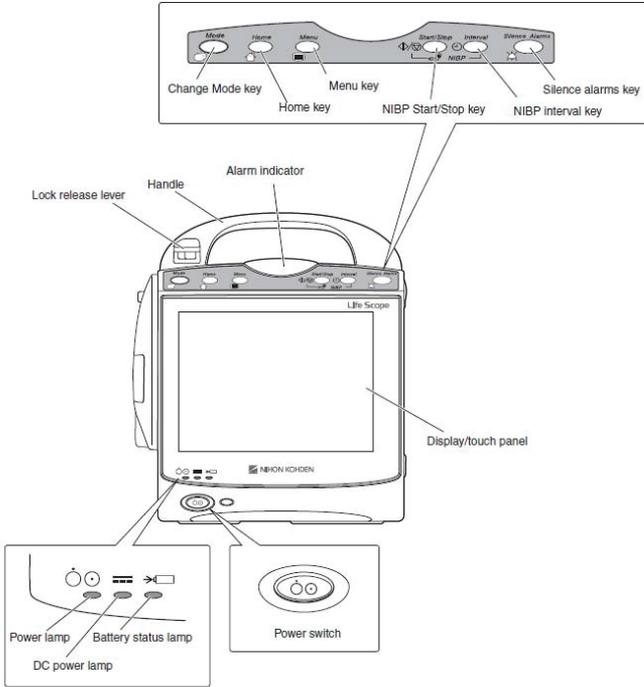


The monitor operates on AC power with optional batteries for backup. When the monitor is operating on battery, the screen brightness can be dimmed to conserve power.

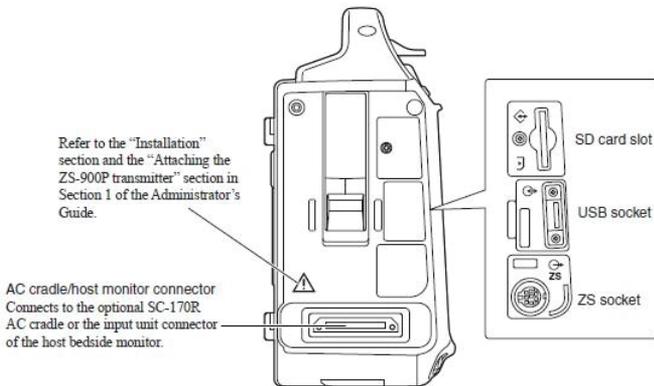
The batteries are recharged when the monitor is connected to AC power, and they should be changed every year. Refer to the Operator's Manual for additional information.

BSM-1700 Series Transport Monitor

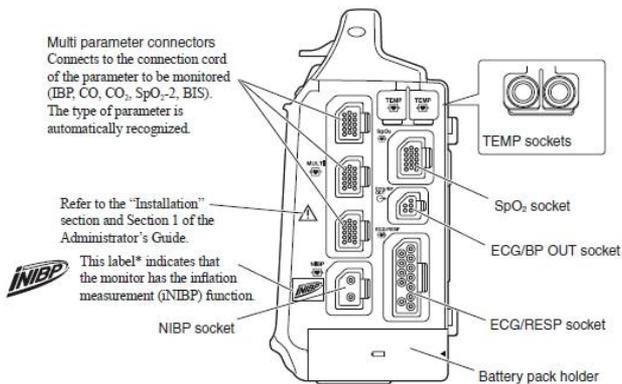
Front Panel



Left Side Panel

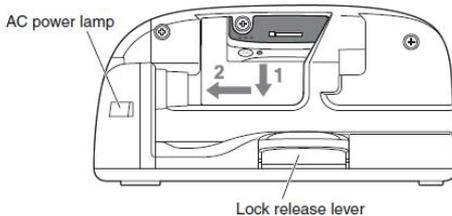


Right Side Panel

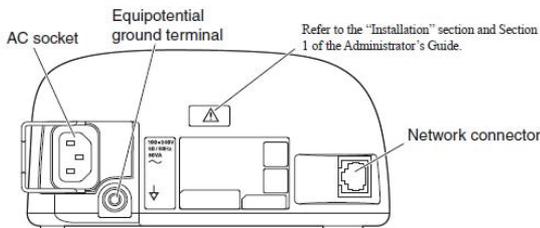


SC-170R AC Cradle

Front



Rear



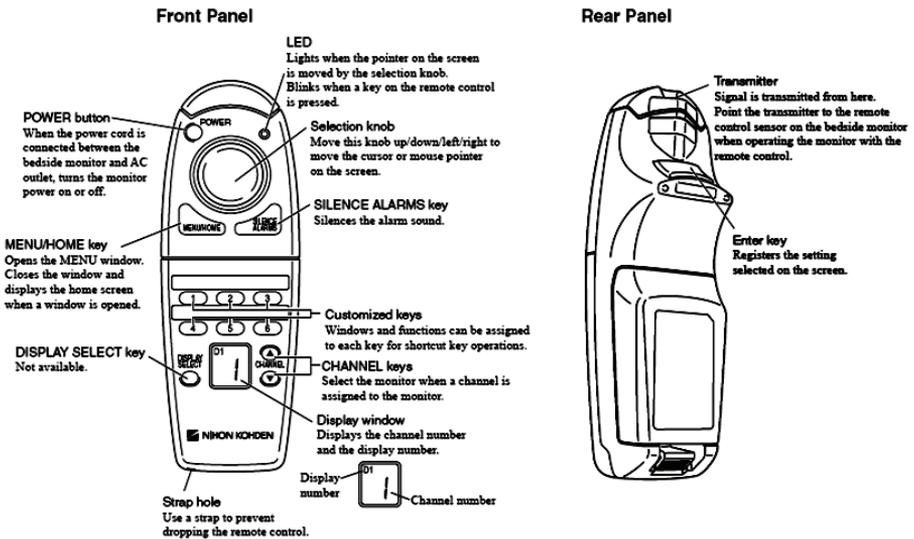
The BSM-1700 series monitor can operate on either battery power or DC power supplied by the optional cradle. Battery life is approximately 4-5 hours. When not in use, it is recommended to keep the BSM-1700 docked in the cradle and plugged in to charge.

Basic Operating Concepts

Normally, the monitoring screen is displayed on the bedside monitor. Key operations are performed on the touch screen display using a gentle touch with the fingertip or touch pen, the infrared remote controller, or a computer mouse that is connected to the USB port: 1) Touch (or click) the **PARAMETER VALUE** to enter the parameter menus; 2) Touch (or click) the **PATIENT NAME** area to enter the **PATIENT INFO** menu; 3) Touch a **FUNCTION KEY** in the upper left corner to access frequently used functions.

The BSM-6000 and -1700 Series bedside monitors have an optional infrared remote controller:

RY-910PA Remote Controller



The MENU window can be displayed by pressing the MENU key on the front panel or on the remote controller. When you access a function on the monitor, the menu is displayed in a tabbed "file folder" format. Touch or click on the tab to access the individual menu. The monitoring screen can be displayed at any time by pressing the HOME key on the front panel or on the remote controller.

Admission Procedure

The Life Scope BSM 6000 Series bedside monitor is ready for data collection once the power is turned ON.

1. Press the power switch and release — the monitoring screen appears after monitor warms up.
2. Verify the alarm settings and input unit (see VITAL SIGNS, PARAMETER, and ARRHYTHMIA ALARMS section in this guide).
3. Connect the patient.
4. Enter patient demographic information (optional).
 - a. Press the MENU key
 - b. Touch the ADMIT button in the PATIENT section on the menu
OR Touch the patient name field at the top of the screen
 - c. Select the patient type (Adult, Pediatric, or Neonate), if necessary.
 - i. Selecting each patient type will set the vital sign alarm limits, arrhythmia alarm settings, NIBP initial cuff inflation pressure, invasive pressure scales, QRS detection type, and trend graph scales, based on the patient type.
 - d. Touch the NAME data button and/or touch the PATIENT ID
 - e. Enter the patient name and/or number using the on-screen keyboard.
 - f. DEL clears all characters to the right of the cursor.
 - g. BS erases to the left of the cursor, one character at a time.
 - h. Touch the ENTER button to enter the patient name or number.
 - i. If demographics are entered after patient monitoring has commenced, do not press the ADMIT key. Data loss could occur if this action is performed post demographic entry.

Press the HOME key to return to the monitoring screen. If the bedside monitor is a part of a network with a central nursing station (CNS), the information can be entered at the central station using the ADMIT/DISCHARGE menu.

Discharge Procedure

The discharge procedure is performed between patients to delete information from the bedside monitor and the CNS and to reset default alarm settings on both monitors. When this procedure is not performed, the most current 24 hours of data is stored in memory. The amount of time that data is stored after power is turned off on the bedside monitor depends on the setup functions. Once the information is deleted, it **CANNOT** be retrieved.

To discharge a patient:

1. Press the MENU key
2. Touch the ADMIT button in the PATIENT section in the menu



OR Touch the patient name field at the top of the screen

3. Touch the DISCHARGE tab
4. Touch YES to confirm. This procedure readies the monitor for the next patient's admittance.
5. Turn the monitor power off, if needed (press and hold the power switch for 3 seconds until the display blanks).

A "COMMUNICATION LOSS" message displays on the central station when the bedside monitor is turned off.

Suspend Monitoring

The SUSPEND MONITORING function is used to suspend data processing and alarms during temporary interruptions in monitoring. No patient information is deleted with this procedure, but the monitoring screen remains active and alarms are suspended while the patient is disconnected.

1. Disconnect the patient from the monitor.
2. Press the MENU key.
3. Touch the SUSPEND MONITORING button in the ALARM section.

The menu closes and the "SUSPEND MONITORING ALL ALARMS OFF" message appears. Monitoring resumes automatically once the patient is reattached, depending on the configured time interval.

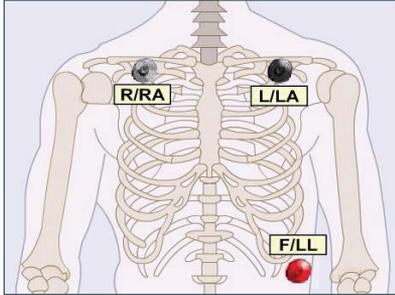


A SUSPEND MONITORING function button may be present on the screen and/or the remote for a one-touch function.

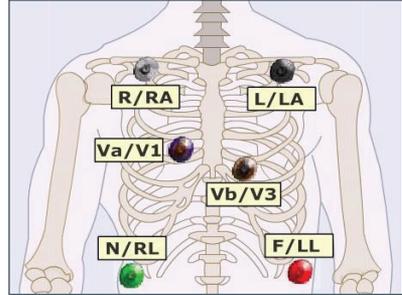
ECG Monitoring

ECG Signal Acquisition – Electrode Placement

The Life Scope G9 bedside monitor is equipped to use 3, 6, or 10 electrodes to monitor heart rate, rhythm, and ST segments, as well as impedance respiration.



3 Electrode Placement



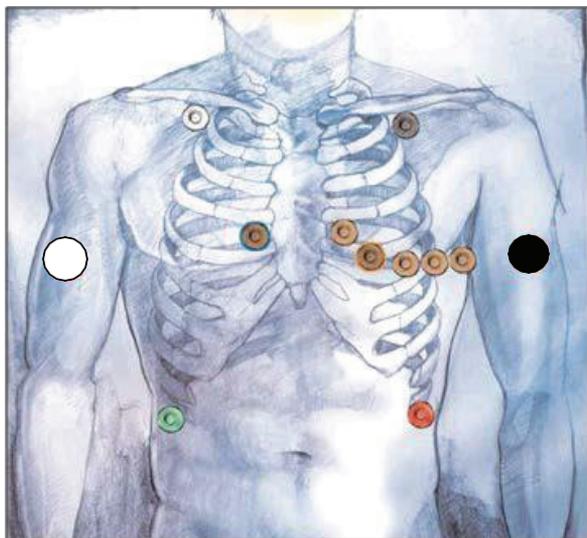
6 Electrode Placement

Chest electrodes may be placed in any chest lead position, depending on the monitoring requirements. V1 and V3 are shown. V1 is useful for arrhythmia monitoring. V3 is the most sensitive lead for anterior wall ischemia. Other V-leads are useful for ST segment and arrhythmia monitoring as well.

Chest Lead	Position
R/RA (white)	Midclavicular line 2 fingers below R clavicle
L/LA (black)	Midclavicular line 2 fingers below L clavicle
N/RL (green)	R anterior-axillary line at edge or lower rib
F/LL (red)	L anterior-axillary line at edge of lower rib
*V1 (blue)	4th inter-costal space(ICS), right sternal border
V2	4th ICS, left sternal border
*V3 (orange)	Halfway between V2 and V4
V4	5th ICS, left mid-clavicular line
V5	Anterior axillary line at same level as V4
V6	Mid-axillary line at same level as V4

*Default V leads

The 10-electrode ECG cable is used to perform diagnostic-quality 12-lead electrocardiograms, as with an ECG cart. Electrode placement for the procedure on the bedside monitor should be the same as the cart procedure to provide consistency for serial comparison between ECGs. Electrode placement is suggested here but should be decided by individual hospital protocols. Tab or patch electrodes may be used.



10 Electrode Placements

Limb electrodes should be placed on the actual limbs if the hospital protocols require this placement for diagnostic 12-lead ECG samples.

Continuous 12-lead monitoring is difficult with the limb leads on the extremities because of the motion artifact, so use the torso limb placement for continuous monitoring, when possible.

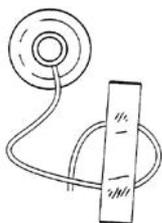
See the 12-lead ECG section in this guide for the 12-lead procedure.

ECG Signal Acquisition – Skin Preparation

The ECG waveform is monitored for heart rate, arrhythmias, ST segment measurements, and pacemaker activity. Electrical impulses are conducted through the gel on the ECG electrodes, so moist gel is required for proper detection. Inadequate detection can cause electrical noise on the ECG tracing and inaccurate interpretation by the monitor. We recommend that electrodes be changed at least daily to promote adequate signal detection but follow the recommendations of your electrode manufacturer and/or hospital policy.

Proper skin preparation is also important for respiration monitoring, as the respiration parameter uses the same electrodes. It is most important to remove hair and dead skin cells for accurate detection, and to remove skin oils so the electrodes will adhere to the patient's skin.

1. Select the electrode site according to the diagram above.
2. Trim excess hair according to hospital protocols.
3. Gently abrade skin areas with dry gauze to remove dead skin cells.
4. If skin is oily, clean the site with soap/water and friction and then wipe off with dry gauze. You may use an alcohol prep according to your policy, if needed.
5. Attach the lead wire to the electrode.
6. Attach the electrode to the patient, pressing the circumference of electrode to secure it.
7. Position the ECG cable to prevent tangling.



Stress Loop: The lead wires can transmit electrical interference to the monitor; to minimize this interference with patient movement, fasten the individual lead wire to the skin with surgical tape.

ECG Parameter Operations

The heart rate is calculated by using a moving average or by counting each individual beat. The AVERAGE mode uses an average of 12 beats and updates them with each new beat to display the new average every 3 seconds. The INSTANT mode updates the heart rate with each beat and displays the new rate every 3 seconds.

The ECG menu allows adjustments while monitoring ECG. To access the ECG parameter menu, touch the heart rate value.

MAIN Tab Options:

Sensitivity - Increases or decreases the size of the ECG tracings.

1. Touch x1/4, x1/2, Auto, x1, x2, or x4. Ensure correct electrode placement and then select the option to display the QRS at > 5 mm tall.
 - a. Auto allows the monitor to set a sensitivity that is required for detection based on the previous 16 beats.

Lead - The top lead is analyzed for arrhythmias when SINGLE arrhythmia analysis is selected; the top two leads are analyzed with MULTIPLE. Ensure correct electrode placement and then select the option to display the lead with QRS complexes that are > 5 mm tall.

Touch the desired lead to display in the top position — unavailable leads are grayed out.

Alarms - HEART RATE/VPC/ST

Increase, decrease, or turn OFF alarm limits

1. Touch limit and then  to increase
2. Touch limit and then  to decrease **OR**



Change alarm limit by touching and dragging the slider.

LEARN

Initiates a “relearn” of the patient’s dominant QRS for arrhythmia processing and the “LEARNING” message is displayed on screen. Use this function whenever the patient’s rhythm has changed, incorrect detection occurs, or to store a new dominant template in the MAIN or ARRHYTHMIA ANALYSIS tabs.

ST ALARMS tab: allows for setting alarms on all monitored leads.

Provides alarm settings for individual or ALL leads. Individual settings set alarms relative to iso point; ALL sets relative to current ST measurements.

Arrhythmia Analysis

Arrhythmia alarms occur when ARRHYTHMIA ANALYSIS is turned on in the ARRHYTH ANALYSIS tab, the individual arrhythmia alarm is turned to ON, and the monitor detects an arrhythmia event. Single (top) or multiple (top two) ECG leads are selected for analysis in the ARRHYTH ANALYSIS tab.

To view or change these settings:

1. Touch the heart rate value.
2. Touch the ARRHYTH tab.
3. Touch the ON button for the arrhythmia events you want to alarm.

OTHER Tab Options:

Filters – DIAG, MONITOR, MAXIMUM

Filters reduce AC interference on the ECG waveform. MONITOR should be chosen for routine patient monitoring.

HUM Filter – ON/OFF

HUM filters reduce interference on the ECG waveform during battery operation. ON should be chosen for routine patient monitoring with the monitor plugged into AC power.

Number of Electrodes

Signals the monitor to the type and numbers of ECG lead wires. Choose STANDARD for Nihon Kohden lead blocks. Use INDIV 6 or INDIV 10 when using individual or disposable lead wires.

ECG Measurement – ON/OFF

This option is available if SpO₂ and pulse rate monitoring are needed and can only be turned off if no ECG signal is detected. Turn OFF to view only SpO₂ and SpO₂ PR when patient is connected to SpO₂ probe and monitor.

Sync Pitch – FIXED, SpO₂, PRESS

Provides a variable change in the audible tone as the SpO₂ value changes. FIXED does not change as the value changes.

Sync Source – ECG, SpO₂, PRESS

Provides the sync sound from the selected pulse source. If the QRS SYNC function is enabled, a green light on top of the monitor also flashes with each pulse.

When SpO₂ or PRESS is selected, the associated pulse rate is displayed in the corresponding color when the PR is ON. This is helpful in OR when the cautery is in use. SYNC SOUND VOLUME is controlled in MENU > VOLUME.

HR Display Mode – AVERAGE, INSTANT

Two modes that can be used to calculate heart rate:

AVERAGE – Monitor detects 12 consecutive beats (including VPCs), averages the R-R intervals, and uses this average to calculate the current HR. When a new beat is detected, the HR is recalculated using the latest 12 beats. The HR display is updated every 3 seconds.

INSTANT – HR is calculated based on the last 2 beats and is updated every 3 seconds.

Pacing

Detection – ON/OFF

Turn this to ON when the patient has a pacemaker. This tells the monitor to detect the pacer spike and look for capture following that spike. False arrhythmia alarms could occur if detection is left OFF with an internal pacemaker present.

Mark – ON/OFF

Turn this ON to enhance the pacer spike ON SCREEN. The enhanced spike is not printed.

Auto Lead Change – ON/OFF

This option is available with the 6 or 10 electrode cable. This allows for the monitored lead to automatically change between lead I, II, and III if lead wires or electrodes become disconnected for more than 5 seconds.

ECG 2/3 Waves Tab:

This allows you to select the numbers of ECG leads to display (1, 2, or 3), the lead to display in each position, and to change the sensitivity on the second and third leads. Choose the primary (top) ECG lead in the ECG MAIN tab.

V-Leads Tab:

This allows you to assign the V-leads for the Va and Vb chest leads when using the 6 electrode cable. Once the leads are assigned, they become available on the ECG 2/3 Waves tab.

ST Point Tab:

This allows you to adjust the measurement points from the default settings and the markers show the iso, r-wave, j-point, and ST point. Use the < > keys for changes.

ECG Monitoring - Troubleshooting (see operator manual)

Problem	Possible Cause	Action
Inaccurate HR	QRS is too small	Change sensitivity so QRS is > 5 mm tall
	QRS is not detected correctly	Change to different lead with a tall QRS and small T wave (View all leads of available ECG in the 12-Lead Analysis tab)
Arrhythmia alarm occurs frequently when HR is normal	Dominant QRS is not appropriate for arrhythmia monitoring	Learn ECG or change the ECG lead
	Patient moved or EMG noise is superimposed	Move electrodes to positions with less muscle. Use stress loops.
ECG waveform does not appear on screen when electrodes are properly attached	NUMBER OF ELECTRODES setting in ECG MENU is not correct	Set correct number of electrodes for attached ECG cable. Use STANDARD unless individual lead wires are used.
AC interference on the waveform	Electrode is dry	Change electrode(s)
	ECG FILTER is set to DIAGNOSTIC	Set ECG FILTER to MONITOR or MAXIMUM
Baseline wandering	Baseline is not stable due to respiration or movement	Move electrodes to positions with less muscle. Consider stress loops.
	The electrode is dry	Change electrodes
	Contact resistance between skin and electrode is high	Abrade skin gently with dry gauze before applying electrodes
	The ECG filter is set to DIAGNOSTIC	Set the ECG filter to MONITOR or MAXIMUM
Inaccurate pacemaker detection or false VPC calls for paced beats	Pacemaker impulse is not detected and/or paced beats are labeled as ventricular	Ensure PACING DETECTION is ON. Display a different ECG lead, such as V1. Try alternate electrode placement: Move LL up and RA down.

Non-Invasive Blood Pressure (NIBP) Data Acquisition

The Nihon Kohden NIBP monitor uses the occlusive-oscillometric method to measure systolic, diastolic, and mean arterial non-invasive blood pressure. *This method may yield different results from direct, invasive arterial pressure.*

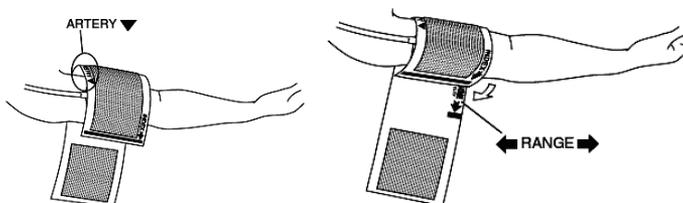
The initial adult inflation volume is 180mmHg, pediatric is 140mmHg, and then subsequent inflations are 30mmHg above the last systolic reading. ADULT/CHILD is displayed in the NIBP numeric area when that hose/cuff is connected.

The monitor automatically detects the neonatal hose when connected and displays a "NEONATAL" message in the NIBP numeric area. The initial neonatal inflation volume is 70-100mmHg (based on system configuration), and then subsequent inflations are 30mmHg above the last systolic reading.

The NIBP is measured from the change in amplitude pattern of pulsatile oscillation in cuff pressure as the cuff pressure is reduced from above systolic to below diastolic pressure. The systolic pressure is the pressure at which the pulsatile oscillation suddenly increases, and the diastolic pressure is the pressure at which the pulsatile oscillation suddenly decreases. The mean arterial pressure is the point where maximum pulsatile oscillation occurs.

INACCURATE READINGS MAY OCCUR DURING PATIENT MOVEMENT.

Cuff selection should be based on the size of the patient's arm. The American Heart Association recommends that the cuff width be 40% of the circumference of the upper arm. *Inappropriate cuff size can result in inaccurate NIBP results.*



NIBP Parameter Operations

1. Ensure the appropriate cuff size for the patient and position extremity at heart level, as readings may vary with a cuff higher or lower than this position. *Monitor automatically identifies hose connected (ADULT/CHILD, NEONATE) and displays that on screen.*
2. Press the NIBP INTERVAL key to display the automatic interval options and select the desired interval.
3. Press the NIBP START/STOP key to initiate reading.



Single NIBP readings can be started at any time using the NIBP START/STOP key

To access the NIBP parameter menu, touch the NIBP value.

MAIN Tab Options:

Initial Cuff Pressure Type:

This allows you to choose ADULT or CHILD to adjust the initial inflation pressure. Subsequent inflations are 30mmHg over the last systolic reading.

Measurement Interval – Manual to 8-hour

Touch the desired interval and then press the NIBP START/STOP key to initiate the automatic readings. Inflation may start automatically if configured to do so.

- STAT mode takes continuous readings for 10 minutes as set in the setup menu (view in NIBP Mode tab).
- SIM mode is available in the OR mode and allows for staged readings as set in the setup menu (view in NIBP Mode tab).



NIBP intervals may be set using the NIBP INTERVAL key.

Alarms – SYSTOLIC, DIASTOLIC, MAP

Increase, decrease, or turn OFF alarm limits

1. Touch limit then  to increase
2. Touch limit then  to decrease

Set value to ABOVE MAXIMUM or BELOW MINIMUM to turn alarm OFF.

PWTT Tab: ON/OFF – choose to set the trigger time in minutes. Available with NK SpO₂ monitors and allows for automatic blood pressure readings when SpO₂ indicates a change in blood pressure.

OTHER Tab Options:

Target Cuff Pressure – Adjusts inflation volume. Use this for patient comfort before the cuff inflates.

Display Oscillation Graph – Graph shows the detected pulse amplitude on a pressure scale and can be used to determine if the reading was affected by patient movement or other interference. Can be turned ON/OFF. (Graph only displayed on home screen if there is enough room.)

NIBP Monitoring – Troubleshooting (see operator manual)

Problem	Possible Cause	Action
Cuff inflation pressure is < 10mmhg or NIBP data disappears for a few seconds	Cuff hose is not connected to monitor socket properly	Connect hose to monitor properly
Cuff does not inflate when NIBP START/ STOP key is pressed	Hose is not connected to socket	Connect the hose to socket firmly
Abnormal measurement results are displayed	Cuff size is incorrect	Select cuff size appropriate to patient's size
	Cuff is not wrapped correctly	Position cuff snugly on patient's arm
	Patient movement	Take readings without patient movement
	Measurement on wrong site	Position cuff over artery
Auto measurement does not start even when time interval has passed	Time interval is set incorrectly or NIBP START/STOP key was not pressed to set interval	Check interval and press NIBP START/STOP key
Cuff suddenly inflates	Measurement mode is set to AUTO	Check time interval
	NIBP measurement is triggered by PWTT	PWTT TRIGGERED NIBP is set to a threshold on the SYSTEM SETUP screen

Problem	Possible Cause	Action
"MEASURE TIME OUT" message	Patient movement or irregular pulse	Reposition, retry, or use another method
"SYSTOLIC OVER" message is displayed	Blood pressure is higher than the NEONATAL mode can detect	Change to the ADULT/CHILD hose and use the appropriately sized cuff for the infant.
Cannot measure NIBP	Noise interfered with calculation of NIBP	Remove cause
	Pulse wave is unstable due to arrhythmias	Check blood pressure using alternative methods
	Cuff or hose has leak	Change cuff or hose
Blood congestion occurs	Measuring over long periods of time at intervals less than 2.5 minutes	Increase measuring interval
		Use alternate site for NIBP measurements
Thrombus occurs	Sickle cell patients	NIBP is contraindicated on sickle cell anemia patients
NIBP data on the screen is dark	10 minutes elapsed from last reading	NIBP data returns to normal brightness with next reading
"CHECK CUFF AND HOSE" message is displayed	Cuff or hose has leak or is hose is bent or obstructed	Check cuff and hose for leaks or straighten hoses
	Patient moved during measurement	Wait for patient to stop moving and measure again
"PATIENT MOVEMENT REMEASURING" message is displayed	Patient moved during measurement or pulse is too small to detect.	Wait for patient to stop moving and measure again
	Cuff is not appropriate for patient or is attached incorrectly	Check that cuff is appropriate and positioned correctly

Pulse Oximetry (SpO₂) Data Acquisition

The Nihon Kohden SpO₂ monitor uses a SpO₂ cable, which accepts reusable or disposable probes. The monitor comes in three options for pulse oximetry: Nihon Kohden, Nellcor OxiMax, and Masimo. The menu options vary slightly depending on the algorithm used.

Nihon Kohden probes are obtained from Nihon Kohden, but Nellcor and Masimo probes are obtained from those companies directly. There are many options for probes from each company, ranging from neonate to adult, and it is important to use the appropriate probe for the size and age of the patient. There are options for probes that are used on the ear and forehead, in addition to the traditional foot or hand and finger probes. See the operator manual for additional information.

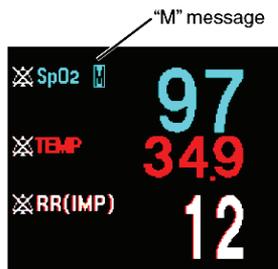
The probe is positioned with the photo emitter (cable side) on top so light is passed through the measurement site to the photo detector directly opposite the emitter. Results are best if used on fingers without nail polish or acrylic nails. Ambient light may affect readings, so placing the extremity under cover may improve detection.

When measuring SpO₂ for long periods of time, it is recommended that the site be alternated to relieve pressure on the measuring digit.

Change site every four hours for reusable and every four to eight hours for disposable probes. Discontinue use of probe if skin irritation occurs or signs of circulatory compromise.

The SpO₂ monitor is able to “read through” motion and alerts you to this condition by placing an “M” on the screen.

The Masimo version uses this symbol to indicate a “low Signal IQ” that is discussed below.



SpO₂ Parameter Operations

To access the SpO₂ parameter menu, touch the SpO₂ value.

MAIN Tab Options:

Sensitivity - X1/8 to X8 – AUTO finds the appropriate size and adjusts the size of the SpO₂ waveform on the screen and on the recording paper. Touch the setting and observe the waveform in the SpO₂ window.

Alarms - SpO₂ Alarm Limits

Increase, decrease, or turn OFF alarm limits.

1. Touch limit then  to increase
2. Touch limit then  to decrease

Set value to ABOVE MAXIMUM or BELOW MINIMUM to turn alarm OFF.

OTHER Tab Options:

Sync Source - ECG, SpO₂, PRESS

Provides the sync sound from the selected pulse source. If the QRS SYNC function is enabled, a green light on top of the monitor also flashes with each pulse. *WHEN SpO₂ OR PRESS IS SELECTED, THE ASSOCIATED PULSE RATE IS DISPLAYED IN THE CORRESPONDING COLOR WHEN THE PR IS ON.* This is helpful in OR when the cautery is in use. SYNC SOUND VOLUME is controlled in MENU>VOLUME.

Sync Pitch - FIXED, SpO₂, PRESS

Provides a variable change in the audible tone, as the SpO₂ value changes and can be configured in one of two ways. FIXED does not change as the value changes.

SPO ₂ VALUE	Sync Pitch of Sync Sound
100 to 81%	High to low pitch, in 1% steps
100 to 40%	High to low pitch, in 1% steps
Less than 81% or less than 40%	Low Pitch

Nihon Kohden Monitors Only

Response - FAST, NORMAL, SLOW

There are three response modes in the Nihon Kohden version of the BSM. Each uses a different time to ensure accurate measurements according to patient conditions. When measurement conditions are unstable, the response becomes slower in all modes.

FAST: Select this mode for special applications that require a fast response time, such as with short apnea episodes.

NORMAL: Select this for normal monitoring.

SLOW: Select this when you need to suppress a rapid change in SpO₂.

Masimo Monitors Only

Perfusion Index

Indicates the percentage of pulsatile (arterial) to non-pulsatile (venous) signals. The range of Perfusion Index is 0.02% (very weak pulse strength) to 20% (very strong pulse strength). Placing the sensor at the site with the highest Perfusion Index number improves the performance during motion.

Perfusion Index Display

To display the Perfusion Index, press the SpO₂ tab, then NUMERIC DISPLAY. Press ON/OFF tab for PI DISPLAY. The PI will be displayed next to the associated SpO₂ value.

Signal IQ

The signal quality indicator is used to identify the occurrence of the pulse and the associated signal quality of the measurement. The Signal IQ, shown as a vertical line, coincides with the peak of the arterial pulsation on the waveform. The height of the line indicates the quality of the measured signal. When the signal quality is very low, the height of the line becomes low and a "M" is displayed along with the SpO₂ value on the monitor.

Averaging Time (SEC) - 2, 4, 8, 10, 12, 14, 16

This is the averaging time for the SpO₂ value. The monitor samples the pulse continuously and displays the average SpO₂ based on this selection. Longer average times produce more stable numbers. Shorter average times display more changes in the SpO₂ values and may detect rapid changes in the patient's condition.

Sensitivity Mode - MAX, NORMAL, APOD

These settings provide more options for improving readings. MAX should be used when obtaining the reading is most difficult. It is designed to detect with the weakest signals. NORMAL provides the best combination of sensitivity and probe-off detection. APOD (adaptive Probe Off Detection) is the least sensitive for low perfusion states but is the best detection for "probe-off" conditions.

Fast Sat - ON/OFF

Enables rapid tracking by minimizing averaging times. This setting is helpful during induction, intubation, and sleep studies.

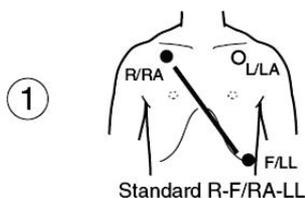
SpO₂ Monitoring – Troubleshooting (see operator manual)

Problem	Possible Cause	Action
Unstable SpO ₂ value	Probe size is not appropriate	Use correct probe
	Probe is on same limb as NIBP	Use another limb
	An ESU is used	Locate ESU as far as possible from probe; wait for pulse wave to stabilize
	Measuring on venous pulse	Reposition probe
SpO ₂ value on monitor and CO ₂ oximeter do not match	Probe is not positioned appropriately	Position probe with emitter and detector facing each other
	Site is inappropriate	Attach probe to site 6-14 mm thick
	Measuring site is not clean	Remove nail polish or use alternate site
	Too much abnormal hemoglobin (HbCO, Methb, etc.)	Cannot measure correctly
	Dye is injected in blood	Cannot measure correctly
	Measuring during CPR	Cannot measure correctly
Probe is damaged	Probe is disinfected by an unspecified procedure	See manufacturer's recommendations for specified procedure
	Probe is used repeatedly	Replace probe
"SpO ₂ MODULE FAILURE" message appears	Probe is damaged	Turn off monitor, replace probe, turn on monitor
"DETECTING PULSE" message is displayed for a long time	Detected pulse is too small to measure.	Reposition probe; consider Masimo controls for average time, sensitive Mode, and Fast Sat
Noise on waveform	Light interference	Cover site with blanket
	Line frequency on monitor is incorrect	Set line frequency correctly
No SpO ₂ data on screen	SpO ₂ connection cord is not connected	Connect OEM-10 connection cord
"M" message appears	Displayed with considerable body or probe movement	Change probe site; consider Masimo controls for average time, sensitive mode, and Fast Sat

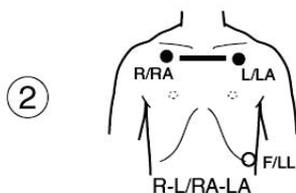
Respiration (RESP) Data Acquisition

The Nihon Kohden monitor uses the ECG monitoring system to detect respiration using the thoracic impedance method. This method measures changes in impedance between the right arm and left leg electrodes (ECG Lead II - R and F) or right arm and left arm electrodes (ECG Lead I - R and L). Movement in the chest and abdomen influences measurement, and amplitude varies greatly depending on placement of the electrodes.

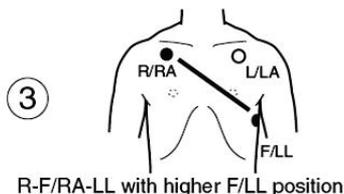
Repositioning of the ECG electrodes may be necessary for optimal respiration monitoring.



It is preferable to place the LL electrode on the lowest left rib at the anterior axillary line. This position is used for most patients when the LL electrode positioning is important for ECG monitoring. Select R-F.



Movement of the chest influences respiration measurement. This position is used for patients with rapid, shallow respirations. Select R-L.



This position is used for improved respiration detection and is recommended when respiration monitoring is a priority. The respiration amplitude is larger and more easily detected. The LL electrode is positioned higher on the chest at the 5th ICS, left mid-axillary line. Select R-F.



The flashing lungs are the breath indicators. When the monitor detects the rise (inspiration) and fall (exhalation) in a respiratory cycle, it flashes the lungs and adds the breath to its rate. The rate displayed is a moving number that updates every three seconds and is based on the previous detected breaths.

The keys to accurate respiratory detection are 1) fresh electrodes; 2) the recommended electrode placement; 3) the appropriate respiratory lead selection; and 4) the appropriate sensitivity for the patient.

RESP (RR) Parameter Operations

To access the RESP parameter menu, touch the RR value.

MAIN Tab RESP Options:

Imp Resp Lead - R-L (ECG lead I) /R-F (ECG lead II) Selects RESP measurement electrode (see RESP Introduction in this guide)

Sensitivity - X1/4 To X4

Determines the size of RESP waveform onscreen and the recording paper

Alarms - RESP/APNEA/CO₂ Alarm Limits Increase, decrease, or turn OFF alarm limits

1. Touch limit then \triangle to increase
2. Touch limit then ∇ to decrease

Set value to ABOVE MAXIMUM or BELOW MINIMUM to turn alarm OFF.

Apnea alarm is set for seconds (s) without respiration detection.

When alarm limit is turned OFF, there is no APNEA alarm.

OTHER Tab Options:

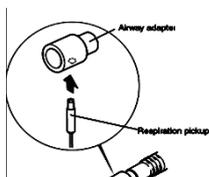
Imp Resp Measure - ON/OFF

Turns RESP monitoring ON or OFF.

Waveform, value, and alarms are unavailable when turned OFF

Resp/CO₂ Sweep Speed - 1 mm/s, 6 mm/s, 12.5 mm/s, 25 mm/s Displays RESP waveform in compressed or expanded format. 25 mm/s is real time format.

An alternate method for measuring respiration is the thermistor method. In this case, a separate sensor and monitoring cable is attached to the patient's nose or ventilator circuit, which is attached to the multi-function socket on the monitor. This method measures and compares temperature changes caused by respiration. The menus are the same.



RESP Monitoring - Troubleshooting (see operator manual)

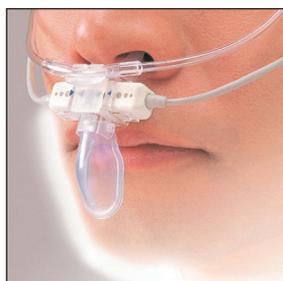
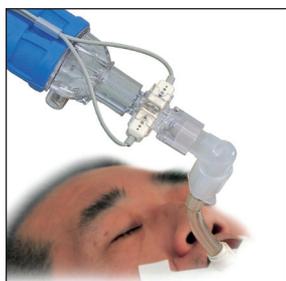
Problem - Impedance	Possible Cause	Action
Waveform is not displayed	IMP RESP MEASURE is turned OFF	Set to ON using RESP > Other MENU
Waveform is a flat line	ECG leads or electrodes are not positioned correctly	Connect them correctly
	Electrode is dry	Change electrodes
	Skin-electrode contact impedance is high	Gently abrade electrode site with dry gauze prior to electrode placement
RESP waveform and rate are not stable	ECG electrode positions are not appropriate for RESP measurement	Reposition electrodes using recommended placement
	Electrode is dry	Change electrodes
RESP rate is not accurate	RESP waveform amplitude is too small	Change RESP sensitivity to amplitude > 5mm
	Respiratory rate is rapid or shallow	Change RESP signal R- F or R-L through the RESP MENU
	Electrode is not in proper position	Position LL electrode higher (5 th ICS) and monitor R-F lead

Problem - Thermistor	Possible Cause	Action
Waveform not displayed	Malfunction of RESP pickup	Replace pickup
Amplitude of waveform too small or rate is not accurate	Position of pickup is not correct	Reposition pickup or increase sensitivity to > 5mm
	Wrong pickup is used for airway	Use pickup that is appropriate for airway
	Temperature of inspired air is too warm	Use impedance method. Monitor cannot detect RESP

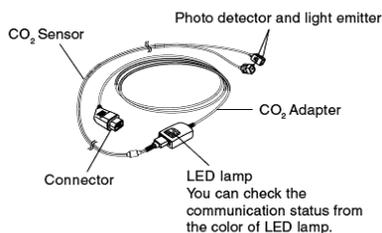
End Tidal CO₂ Data Acquisition Using the TG-920P CO₂ Sensor

The Nihon Kohden monitor uses the semi-quantitative mainstream method to monitor carbon dioxide levels in the patient's exhaled breath. A disposable airway adapter is used with the CO₂ sensor for intubated and non-intubated patients.

For intubated patients, the adapter is placed on the endotracheal or tracheal tube or close to the patient within the airway circuit. For the non-intubated patient, the adapter is placed on the patient as a nasal cannula with the mouth guide positioned within 1 cm of the lower lip to detect exhaled air from the mouth.



The CO₂ sensor detects the infrared light from the light emitter which passes through the expired air in the airway adapter. The sensor then measures the partial pressure of the expired CO₂, and the CO₂ adapter processes the electrical signal of the infrared into digital data which is sent to the bedside monitor.



cap-ONE® TG-920P Sensor

Alveolar levels of CO₂ and approximate end-tidal exhaled levels are used for normal reference values; 35-45 mmHg.

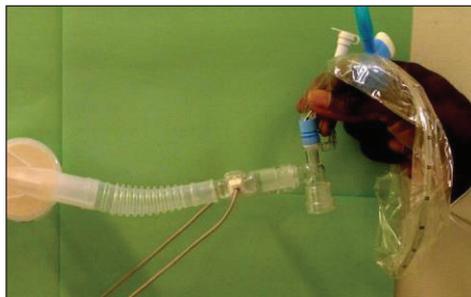
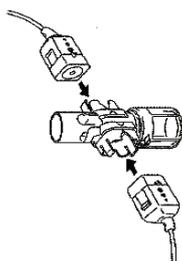
Expect ETCO₂ values to be 3-5 mmHg lower than alveolar levels due to the dead space in the airway. CO₂ and RESP values are displayed on the monitor along with a CO₂ waveform.

The sensor performs a self-calibration when it is first attached to the patient and periodically during the inspiration phase of the respiratory cycle. The sensor assumes a zero level of CO₂ during this time, so if any CO₂ is available during this calibration process, CO₂ values could be higher than actually displayed.

Please refer to the operator manual of the bedside monitor for additional information.

For intubated patients, the sensor cable must be positioned parallel to the floor to keep the adapter's transparent windows upright so the exhaled breath can be analyzed. This also prevents moisture and secretions from settling and obscuring the windows.

Intubated - Disposable adapter YG-111T. Single patient use – the dead space volume is 4ml. Do not use on children less than 3 years of age or 7kg. Change the adapter every 24 hours.



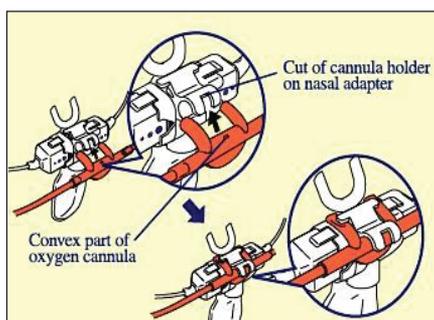
When using the CO₂ sensor in a ventilator circuit with an inline suction catheter, position the disposable airway adapter to the side of the circuit so that the catheter does not go through the adapter, as this could damage the windows. Place the adapter on the patient side of the filter and as close to the airway as possible.

The non-intubated disposable adapter (YG-122T) is for single patient use – the dead space volume is 1.2ml. Do not use on children less than 3 years of age or 10kg. Change the adapter every 24 hours.

The YG-122T adapter can be used for oral and nasal monitoring, with and without oxygen delivery. By removing the oral cup, it can be used for nasal monitoring with and without oxygen delivery.

Nasal only detection would be used during oral based procedures where the oral cup would interfere with oral access.

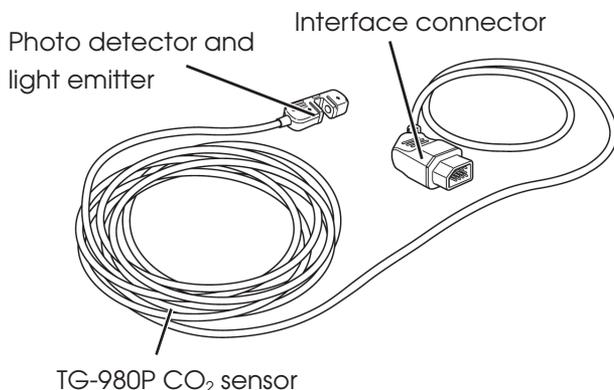
Only the Hudson RCI® oxygen cannula #1103 can be used with the cap-ONE.



Caution: Using the CO₂ sensor with an oxygen mask is not recommended unless the O₂ delivered is greater than 5 L/min, and then with caution. CO₂ may be retained within the mask and actual CO₂ levels may be higher than displayed.

End Tidal CO₂ Data Acquisition Using the TG-980P/TG-970P cap-ONE Sensor

Nihon Kohden also uses the new TG-980P/TG-970P cap-ONE sensor to offer additional CO₂ monitoring solutions for adult, pediatric, and infant patient populations in a smaller, lighter size. This sensor uses the same infrared technology as the TG-920P sensor; the only difference is that the sensor **MUST** be calibrated before use.



For intubated patients, the adapter is placed on the endotracheal or tracheal tube or close to the patient within the airway circuit.

For the non-intubated patient, the pediatric or infant oxygen mask is placed on the patient to detect exhaled air from the nares and mouth.



Change the adapter every 24 hours or sooner if it becomes dirty.

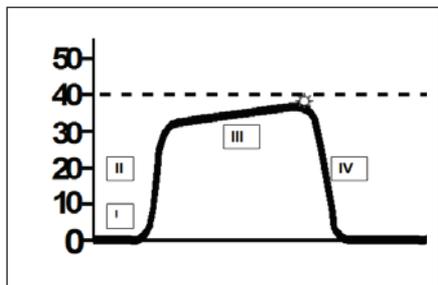
For specific disposable airway adapter indications, please consult the operator's manual for each specific airway adapter.

CO₂ Parameter Operations for TG-980-P/TG-970-P

To access the CO₂ parameter menu, touch the CO₂ value once the TG-980-P/TG-970-P CO₂ cable is plugged into any yellow multi-port socket:

The airway adapter must be first calibrated to the dead space before patient use. Connect the airway adapter (intubated or mask) to the CO₂ sensor.

1. Select ZERO CAL tab.
2. Connect adapter and select AIR CAL under the SELECT CALIBRATION METHOD.
Then "EXPOSE SENSOR TO AIR" message appears.
3. Expose the airway adapter to air and touch the YES to start calibration.
4. When the "CALIBRATION COMPLETE" message is displayed, the calibration is complete and can be placed on the patient.



Normal CO₂ waveform

Phase I – Respiratory baseline

Phase II – Expiratory upstroke

Phase III – Expiratory plateau

EtCO₂ - ☀ peak EtCO₂ level – measured value

Phase IV – Inspiratory downstroke

CO₂ Parameter Operations

To access the CO₂ parameter menu, touch the CO₂ value:

The monitor assumes that inspired CO₂ levels are 0 mmHg, so actual values may be higher than displayed if re-breathing is occurring.

MAIN Tab CO₂ Options

Alarms - RESP/APNEA/CO₂ Alarm Limits

Increase, decrease, or turn OFF expired and inspired CO₂ alarm limits:

1. Touch limit then  to increase
2. Touch limit then  to decrease

Set value to ABOVE MAXIMUM or BELOW MINIMUM to turn alarm OFF.

When alarm limit is turned OFF, there is no APNEA alarm

See the operator manual for additional information.

SCALE Tab: 0-20, 0-40, 0-60, 0-80

Adjusts the scale and waveform lines for the waveform. Higher values require a higher scale.

Touch the desired button to select a preset scale or drag the slider bar to set a different one.

GAS COMP Tab: AIR, O₂ + AIR, O₂ + N₂O

When N₂O is mixed in the inspiration or when a high concentration of oxygen is inspired, the sensitivity of the CO₂ absorbing infrared ray is affected, and, as a result, measurements cannot be performed correctly. When using anesthetic gas or a respirator, set the inspiration composition. The monitor corrects the concentration automatically according to the setting.

1. When not using gas that influences measurement, touch AIR.
2. When using respirator and anesthesia device, touch O₂ + AIR
 - a. Set O₂ ratio using top function dial.
3. When using anesthetic gas, touch O₂ + N₂O.
 - a. Set O₂ and N₂O ratios using top function dials.

OTHER Tab Options:

Resp/CO₂ Sweep Speed – 1 mm/s, 6 mm/s, 12.5 mm/s, 25 mm/s Displays the RESP or CO₂ waveform in compressed or expanded format. 25 mm/s is the real time format.

CO₂ Monitoring - Troubleshooting (see operator manual)

Problem	Possible Cause	Action
Measured value is low	CO ₂ is mixed in inspiration	Refer to "Measurement error" section in operator manual
	Airway adapter is dirty	Replace disposable adapter
	Measurement is performed where atmospheric pressure is low, i.e. high altitude	Consider atmospheric pressure when making evaluation
Measured value is high	Anesthetic gas is used	Set correct gas composition
Measured value is inaccurate	Oscillation	Check respirator and remove cause
	Suctioning procedure	Wait for at least 20 seconds after suctioning, detect inspiration again, and correct error
	100% O ₂ is administered	Value is expected to be 10% less than actual value
	Jackson Rees or Mapleson D respiration circuit is attached to patient	Cannot measure correctly
	Respiration rate of patient is very high or irregular	Cannot measure correctly
Respiration waveform does not appear	Oscillation	Check respirator and remove cause
	Airway adapter is disconnected from sensor	Replace CO ₂ sensor or adapter
Red LED on CO ₂ sensor blinks	Sensor is faulty	Replace sensor
	Apnea for longer than 20 sec.	Red LED blinks when apnea is longer than 20 sec., regardless of alarm settings

Temperature (TEMP)

Continuous temperature monitoring is available on the bedside monitor. Two temperatures can be monitored simultaneously using YSI 400 series probes and cables and the TEMP ports on the monitor. Two additional temperatures can be monitored, for a total of four, by adding the temperature connection cord. The connection cord is connected to a multi-parameter socket and temperature values are displayed on the HOME screen.

TEMP Parameter Operations

To access the TEMP parameter menu, touch the TEMP value.

MAIN Tab Options:

Alarms – Temp Alarm Limits

Increase, decrease, or turn OFF alarm limits.

1. Touch limit then  to increase
2. Touch limit then  to decrease

Set value to ABOVE MAXIMUM or BELOW MINIMUM to turn alarm OFF.

Change alarm limit by touching and dragging the scrollbar.

LABEL Tab:

Allows labeling of the temperature monitoring site(s)

1. Touch LABEL tab
2. Touch TEMP 1 or TEMP 2 button
3. Touch desired label button

OTHER Tab:

▲ T SITES –

Allows viewing changes (delta) between two temperatures.

Touch the desired button on the left and then the SELECTABLE ITEM on the right to set selections.

Monitoring Screen Options

LARGE NUMERICS -

Allows the current monitored data to be displayed in an enlarged format. To access the LARGE NUMERICS menu:

1. Press the MENU key.
2. Touch the LARGE NUMERICS button on the menu. Press the HOME key to return to monitoring screen



OR Touch the LARGE NUMERICS key in the upper left corner of the screen, if one is available

SLEEP -

Allows the screen to be darkened, alarms to be suspended in the room, and the sync sound to be turned off. Monitoring with alarms continues when the bedside monitor is connected to a CNS. When connected to a CNS, the audible alarms will be heard only at the CNS.

To access SLEEP MODE menu:

1. Press the MENU key.
2. Touch the SLEEP button.
3. Touch the YES button to confirm.

To turn off SLEEP MODE, touch the display or any hard key.

TOUCHKEYS OFF -

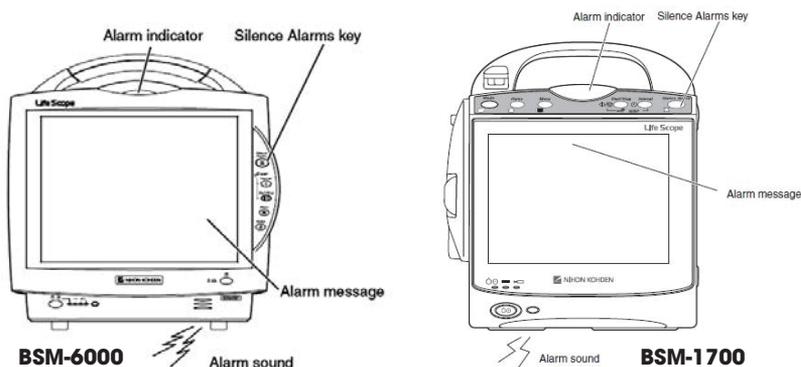
Allows the touch screen to be deactivated for cleaning.

1. Press the MENU key.
2. Touch the TOUCHKEYS OFF button.
3. Touch the YES button to confirm.

To reactivate the touch screen, press any hard key.

Vital Signs, Parameter and Arrhythmia Alarms

There are four types of alarms: vital signs, arrhythmias, parameter, and other. When the monitor detects an abnormal patient condition, it can generate an alarm sound, a screen indication, and alarm lamp indication. Recordings can also be obtained.



There are three alarm levels and patient and technical alarms.
Refer to the operator manual for detailed information.

Level	Sound	Display	Lamp	Cause
CRISIS	Continuous "pips"	Blinking highlighted numeric data	Flashing red	Vital signs or high level arrhythmia conditions
WARNING	Continuous "bing bong"	Highlighted numeric data	Flashing yellow	Vital signs or arrhythmia conditions
ADVISORY	Single "bong" every 20 or 120 seconds	Non- highlighted message	None	Lower level arrhythmia or technical conditions (i.e. probe off)

Silence Alarms

The SILENCE key silences an active alarm for 2 or 3 minutes, which was determined when your monitors were installed. An “ALARMS SILENCED” message appears briefly and an icon appears in the upper right corner of screen for the duration of the silence.

Suspend Alarms

The SUSPEND ALARMS button in the MENU suspends future alarms for 2 minutes such as during electrode changes and an “ALARMS SUSPENDED” message with the remaining suspension time is displayed. Press the SUSPEND ALARMS button again to reactivate alarms before the set suspension time.

Suspend Monitoring

The SUSPEND Monitoring button in the MENU places the monitor into a standby mode when the patient is disconnected from the monitor. A “SUSPEND MONITORING” message is displayed. Monitoring automatically resumes when the patient is reconnected, with the exception of NIBP readings. Press the NIBP START key to restart readings.

Alarm Master

For fast and easy alarm setup, a group of alarms can be set together at one time. There is one alarm master for vital signs and one alarm master for arrhythmias. These alarm masters serve as the unit default settings for each new patient and each patient type (neonate, pediatric, and adult).

Alarm master settings were determined when your monitors were installed, but individual alarm settings can still be changed on the VITAL ALARM and ARRHYTHM ALARM windows or on the alarm setting tab of each parameter menu.

Alarm Volume

Alarm volume can be adjusted to a preset minimum, if desired.

1. Press MENU key.
2. Touch the VOLUME button in Setup section.
3. Touch  to increase volume **OR**
Touch  to decrease volume

Interbed Alarms

INTERBED ALARMS are broadcast through the monitoring network to other bedside monitors. Each bedside monitor can be programmed to receive INTERBED ALARMS based on caregiver preferences.

When an interbed alarm occurs, the highlighted bed name appears in the upper right corner of the HOME screen. Up to 20 beds can be monitored by each bedside monitor at one time.

To select beds to monitor in interbed:

1. Press the MENU key.
2. Touch the INTERBED button.
3. Touch the SELECT BEDS tab.
 - a. Touch the desired position in the SELECTED BEDS section.
 - b. Touch GROUP, or unit, and then the desired bed.

Use the VACANT button to deselect the desired bed from the slot.

To change the INTERBED ALARM controls, touch the SETTINGS tab

- a. Touch the ON button to enable the AUTO INTERBED DISPLAY (VIEW OTHER BEDS tab) when alarms occur in any monitored bed.

The VIEW OTHER BEDS tab shows vital signs for all monitored beds. Touch the desired bed to display the waveforms with the numerics.

Noise Detection

When body movement “noise” is detected on the ECG waveform, a “CANNOT ANALYZE” message is displayed on the screen and arrhythmia processing is suspended. When continuous noise is detected for more than 30 seconds, a continuous WARNING alarm is generated, indicating that ECG monitoring has been interrupted.

Eliminate the source of the noise (this is usually changing electrodes) to resume ECG monitoring. You may also try repositioning the electrodes and/or using stress loops.

Detached Electrode

When an electrode or lead-wire becomes detached during ECG monitoring, a “CHECK ELECTRODES” message is displayed with an audible alarm.

Vital Signs Alarms

Vital signs alarms occur when a high or low parameter limit is exceeded. These limits are set in individual parameter menus or in the ALARM LIMITS tab on the main menu.

1. Press the MENU key.
2. Touch ALARM LIMITS button in PATIENT section.
3. Touch the parameter button for the limit you want to change.
 - a. Touch limit then  to increase
 - b. Touch limit then  to decrease

Set value to ABOVE MAXIMUM or BELOW MINIMUM to turn alarm OFF.



OR touch the APPLY MASTER button then YES to apply the master settings for this patient.

ST Alarms

ST alarms occur when an ST measurement level is reached or exceeded. ST is measured in mm, or mV (which is 10 times larger than mm.) One mm = 1/10 of one mV. These limits are set in the ECG > ST ALARMS menu (see the ECG section in this guide).

Arrhythmia Alarms

Arrhythmia alarms occur when ARRHYTHMIA ANALYSIS is enabled, the individual arrhythmia alarm is turned ON, and the monitor detects an arrhythmia event.

These alarms are set as defaults in the monitor configuration screens, but they may be changed in the ECG parameter menu or in ARRHYTHM ALARMS on the MAIN menu.

1. Press the MENU key.
2. Touch the ARRHYTHM ALARMS button in the PATIENT section.
3. Touch ON button for the arrhythmia event you want to alarm.
4. Alarm occurs when the set number is reached.

OR touch the APPLY MASTER button then YES to apply master settings for this patient.

Atrial Fibrillation Alarm

An atrial fibrillation (A-Fib) alarm is available for A-Fib lasting longer than two minutes. If a patient enters an episode of A-Fib, the monitor will initially indicate "Irregular RR", then the monitor will alarm for A-Fib after about two minutes and show A-Fib on the monitor. When a patient converts to normal sinus rhythm (NSR) that lasts longer than two minutes, the End A-Fib alarm will activate (an additional delay may be set by your administrator). Consult with your Nihon Kohden representative for further network requirements.

Arrhythmia Troubleshooting - Interventions

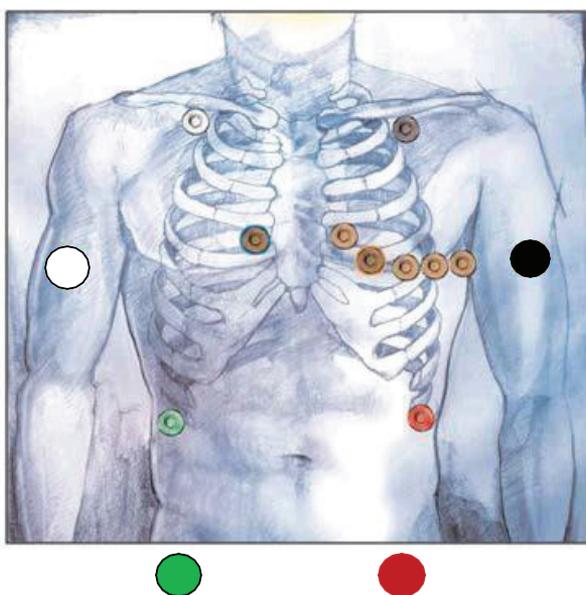
Problem	Possible Cause	Action
Heart rate is undercounted	R wave amplitude is less than 5mm	Select the ECG lead and/or sensitivity that provides a QRS amplitude of >5 mm tall.
Heart rate is being double counted	Large P or T wave is being counted as a QRS	Monitor another lead, which will display a smaller P or T wave. The QRS must be more than double the size of the T or the P wave.
Rhythm is classified as Asystole when ECG rhythm is NSR	R wave amplitude is less than 0.5 mV (one large box) and monitor is unable to sense and count QRS complexes	Change monitored lead to one with a larger R wave.
	Narrow QRSs can be counted as pacing spikes.	Turn pace detection to OFF.
Difficulty in monitoring a paced rhythm	Pacing detection is turned OFF	Turn Pacing detection to ON and reposition RA electrode lower and LL electrode higher on chest.
	Pacer spike is too small, and monitor is unable to detect	Monitor another lead, such as V1. Try alternate electrode placement: Move LL up and RA down.
	Pace spike is too large, and monitor is calling Asystole	Monitor a lead that displays a pacer spike smaller than the QRS. Turn ECG filter to Maximum for a cleaner waveform display.
Monitor not alarming for arrhythmias	Is there NOISE or artifact?	Monitor suspends arrhythmia monitoring during NOISE/CANNOT ANALYZE situations. Correct the problem that is causing the noise.
	Arrhythmia detection is turned to OFF.	Turn arrhythmia detection to ON
	Individual arrhythmia alarm is turned to OFF.	Turn individual alarm ON.
Monitor is falsely alarming for movement and artifact	Are electrodes fresh and secure?	Change electrodes at least every 24hrs
	Are electrodes placed correctly?	Place electrodes between bones and clear of large muscles
	Are lead wires secured with stress loops?	Secure lead wires with stress loops
	Is cable stabilized?	Secure ECG cable to prevent movement between wires and electrodes
		Change ECG filter to Maximum
Monitor is not storing arrhythmia alarms	Arrhythmia detection is turned OFF	Turn arrhythmia detection to ON
	Arrhythmia recall is turned OFF	Turn Arrhythmia Recall to ON

12-Lead Electrocardiogram/ST Analysis

The 10 electrode ECG cable is used to perform single diagnostic-quality 12-Lead electrocardiograms (ECG), as with an ECG cart, or to continuously monitor 12-leads of ECG. A diagnostic interpretation is obtained with the 12-lead ECG and it can be printed on standard 8 ½" x 11" paper when the monitor has access to a laser printer.

Electrode placement for bedside monitor 12-lead ECGs should be the same as the cart procedure to provide consistency for serial comparison between ECGs. Limb electrodes should be moved from the torso, but protocols should be decided by each individual hospital.

Up to six 12-lead ECG samples can be saved in the bedside monitor.



Chest Lead	Position
R/RA (white)	Midclavicular line, 2 fingers below R clavicle
L/LA (black)	Midclavicular line, 2 fingers below L clavicle
N/RL (green)	R anterior-axillary line at edge of lower rib
F/LL (red)	L anterior-axillary line at edge of lower rib
V1	4th intercostal space, right sternal border
V2	4th intercostal space, left sternal border
V3	Halfway between V2 and V4
V4	5th intercostal space, left mid-clavicular line
V5	Anterior axillary line at same level as V4
V6	Mid-axillary line at 5th intercostal space

12-Lead ECG Procedure

1. Explain the procedure to the patient and connect the 12-lead cable to the monitor.
2. Apply electrodes and lead-wires according to the hospital policy.
3. Press the MENU key.
4. Touch the 12 LEAD ANALYSIS button. The display allows you to check for waveforms in each lead. Check electrodes/lead-wires if waveforms are absent.
5. Ensure that the patient's age and gender appear on the right side of screen, as this is used in the interpretation of the 12-lead ECG.

If it does not, touch the PATIENT INFO button and enter it.

6. Ask the patient to lie still and touch the START button.

The monitor will acquire ECG data for about 20 seconds and an "ANALYZING PLEASE WAIT" message is displayed. The 12-lead is completed when this message disappears.

To view and print the 12-lead ECG sample:

1. Touch the 12 LEAD button to display the 12-lead review window.

The most current 12-lead sample is highlighted when you open this window. The ANALYSIS tab provides the waveform view with the ST measurements, the REPORT tab provides the interpretation, and the AVERAGE tab provides the average waves with the actual measurement points that were used.

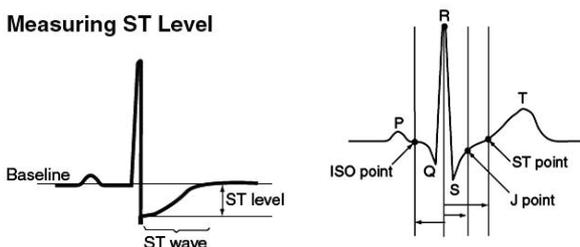
2. Display the REPORT tab and then touch PRINT to record (to strip recorder) or print (to laser printer).
3. Touch the desired PRINT option button.

Press the HOME key to return to the monitoring screen.

ST Analysis

Your Nihon Kohden bedside monitor is equipped to continuously monitor your patient's ST segments as a part of the ECG monitoring system. ST segment monitoring can be another valuable vital sign in patient care. Early detection of ST segment changes can trigger timely intervention for cardiac ischemia or circulatory compromise.

Measuring ST Level



The ST level is the amplitude between the baseline and the ST wave. The ECG waveform is averaged for 15 seconds to remove artifacts. The baseline and the ST wave are detected from the averaged ECG and the ST level is measured and displayed in millimeters or milli-Volts, which is 10 times larger than mm. One mm = 1/10 of one mV.

***Note: If there are too many arrhythmias or noise is superimposed on the ECG, or the heart rate is below 32, ST level measurement may not be performed, and the ST level is not displayed.*

ST analysis is performed on the display lead of ECG when using the 3-electrode cable, on eight leads when using the 6-electrode cable and on all 12-leads when using a 10-electrode cable.

All leads of ECG can be viewed in the 12 LEAD ANALYSIS menu.

ST Alarms

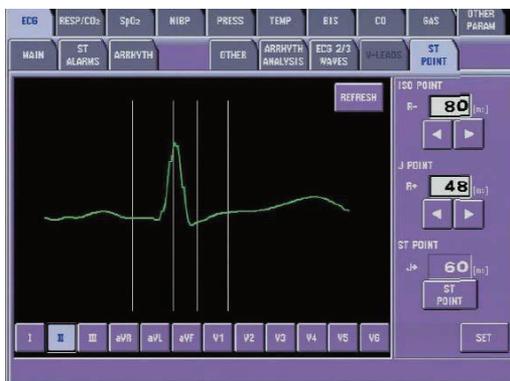
ST alarm limits can be set by individual lead(s) or by setting all leads in the ST ALARMS menu. Individual lead limits are set as +/- mm from the isoelectric line. All leads set the limit from the current ST positions. See the ECG section in this guide.

To Change the ST Measurement Points

It may become necessary to change the ST measurement points. Some instances might be: rapid heart rates, extremely slow heart rates, conduction abnormalities, or any situation when the ST measurements are not what you expect.

To change the ST measurement points:

1. Touch the heart rate value to enter the ECG parameter setup menu.
2. Touch the ST POINT tab.



Use the ISO POINT arrows to move ISO POINT CURSOR (before QRS). Use the J POINT arrows to move J POINT CURSOR. Use the ST POINT arrows to move ST POINT CURSOR

3. Touch SET button to apply new measurement settings.

To View Minute to Minute Stored ST Data

1. Press the MENU key.
2. Touch the ST button in the REVIEW section.

To set a reference sample:

1. Touch the desired sample set.
2. Touch the SAVE AS REF button.

Touch the timeline arrows to scroll through time and the up and down arrows to scroll through samples.

Invasive Blood Pressures (IBP)

Invasive blood pressure and/or intracranial pressure may be monitored on some bedside monitors. Up to seven multi-connector ports are provided for invasive pressure monitoring, depending on your monitor.

The IBP connection cord has a memory chip for saving the site label and zero balance values. Attach the labeled connection cord to port to display the invasive line label on screen.

IBP Parameter Operations

To enter the IBP menu, touch the IBP value on the screen.

Set Up/Zero IBP (Invasive Blood Pressure)

 Insert Monitor may have an ALL ZERO key in the upper left corner

1. Insert cable(s) into yellow port(s). The screen will ask "DO YOU NEED TO ZERO?" Select YES if necessary.
2. Open transducer stopcock(s) to air, off to pt.
3. Touch ALL ZERO or individual parameter ZERO CAL button and watch for zero values and date and time of zeroing with each parameter label in this menu.
4. Close stopcock(s), then replace caps.
5. Set scales for individual parameters in these same SCALE/ZERO CAL menus.

ICP line **MUST** be zeroed using the ZERO CAL button.

A "ZERO UNSTABLE" message indicates that pressure was sensed during the procedure and that it was not successful. Repeat procedure, close the stopcock, and then apply the dead-end cap to transducer stopcock.

Resume IBP Monitoring

When replacing IBP cables into BSM and zeroing is not required:

1. Insert pressure cable(s) into yellow port(s).
2. Screen changes to ask, "DO YOU NEED TO ZERO?"
3. Select NO.

IBP cable retains ZERO reference and is used in this instance.

Draw Blood from the Arterial Pressure Line

It is important to close the stopcock to the transducer in order to draw a sample from the patient. Drawing causes negative pressure in the line, and if the stopcock to the transducer is open, the negative pressure on the transducer could cause the monitor to reject the current zero state and show the message "DO YOU NEED TO ZERO?" on the screen. Select NO in this instance to maintain the current zero.

When using an in-line sample set, if you choose to leave the transducer stopcock open, try withdrawing the samples slowly to retain the zero and prevent the message "DO YOU NEED TO ZERO?" from appearing.

MAIN Tab Options:

Each IBP parameter has its own tab within the MAIN tab. A ZERO ALL and a ZERO CAL button are displayed here. The ZERO ALL key will zero all lines together or individual lines separately, based on which transducers are open to air. The ICP line MUST be zeroed using the ZERO CAL button.

Alarm Limits -

1. Touch the desired pressure tab.
2. Touch the desired parameter.
 - a. Touch  to increase high or low limit
 - b. Touch  to decrease

Set value to ABOVE MAXIMUM or BELOW MINIMUM to turn alarm OFF.

SCALE Tab

The blood pressure waveform corresponds to the color of the displayed IBP values (ART, PAP, CVP, etc.) The scale control assigns the value to the scale lines that are displayed as SEPARATE or COMMON or DUAL scales through the OTHER tab. To change the values of the scale lines:

1. Touch the SCALE tab.
2. Touch the desired pressure tab.
3. Touch the desired scale button based on the current IBP value or touch and drag the slider bars to create your own scale.

Change IBP Label (On Screen and in Cable)

1. Touch IBP parameter value.
2. Touch the LABEL tab.
3. Touch the appropriate IBP position key.
4. Touch the appropriate label name.

Note: Trends are displayed using the label names. If you change the label on the IBP (such as from ART to FEM), you must adjust the settings in the TRENDS menu to display the new label in the list.

OTHER Tab Options:

Sync Source – ECG, SpO₂, PRESS

Provides the sync sound from the selected pulse source. If the QRS SYNC function is enabled, a green light on top of the monitor also flashes with each pulse. *WHEN SpO₂ OR PRESS IS SELECTED, THE ASSOCIATED PULSE RATE IS DISPLAYED IN THE CORRESPONDING COLOR WHEN THE PR IS ON.* This is helpful in OR when the cautery is in use. SYNC SOUND VOLUME is controlled in MENU>VOLUME

Sync Pitch – FIXED, SpO₂, PRESS

Provides a variable change in the audible tone as the SpO₂ value changes. FIXED does not change as value changes.

Systolic BP Value	Pitch of Sync Sound
> 120 mmHg	High pitch
120 to 20 mmHg	High pitch to low pitch in 5 mmHg steps
< 20 mmHg	Low pitch

Calculation Method – STANDARD, PEAK

There are two modes for calculating IBP values:

STANDARD – Values calculated by a moving average. The monitor averages eight consecutive pulses and displays as IBP values. When a new pulse is detected, the value is recalculated using the latest eight pulses. The IBP display is updated every three seconds.

PEAK – Highest pulse wave in eight consecutive pulses is measured for systolic, diastolic and mean values. Values are updated every three seconds. This mode could be helpful when IABP is used.

CPP Display - ON/OFF

This allows the monitor to display the cerebral perfusion pressure (CPP) when ICP and ART are both monitored on the BSM. Touch the desired button to activate it.

Numeric Display -

Allows for systolic/diastolic/mean or mean on-screen display for invasive pressures. Touch the desired display option for each pressure.

Press Scale (IBP Display) - SEPARATE, COMMON, DUAL

Allows for changes in the display of the IBP waveforms on the HOME screen. Touch the desired button to activate it.

Separate - IBP waveforms are displayed in their own scale lines

Common - All IBP waveforms are displayed within common scale lines but with their own line scales as indicated by the scale value in each IBP color.

Dual - High IBP pressures are displayed within one set of scale lines and the low IBP pressures are displayed within another set of scale lines. This may be helpful to separate the ART pressure from the PAP during insertion procedures.

CVP Auto ET Mode - ON/OFF

When using ETCO₂ monitoring combined with a CVP line, turn ON CVP Auto ET Mode, as this feature will use the CO₂ signal to calculate the end tidal CVP mean resulting in a more stable CVP value with less variation from respiration.

PPV/SPV Display -

Select either PPV (Pulse Pressure Variation) or SPV (Systolic Pressure Variation) to see on home screen when using an ART line. PPV indicates the variability of the difference between systolic and diastolic pressure in one beat in the respiration cycle. SPV indicates the variability of systolic pressure in the respiration cycle.

*PPV or SPV is accurately measured when the patient is using a ventilator and when the patient is not moving and no arrhythmias are present. In the following cases, PPV or SPV is not accurate or cannot be measured:

- Patient movement
- Spontaneous respiration
- Arrhythmia
- Respiration rate less than 6 breaths/min
- Ventilation volume less than 8ml/kg
- Acute right heart failure

IBP Monitoring – Troubleshooting (see operator manual)

Problem	Possible Cause	Action
Acquired blood pressure is different from estimated value	Air bubbles in pressure circuit	Remove air bubbles
	An extra tubing is attached to circuit	Remove extra tubing
	Transducer is positioned incorrectly	Reposition pressure transducer to Phlebostatic axis.
	Pressure transducer with different sensitivities is used	Check transducer
	Other causes	Re-zero transducer
No IBP value appears on screen	Measurement is OUT OF RANGE	Check the measuring condition
	Pressure transducer or pressure cable is damaged	Replace cable or transducer
NO IBP waveform is on screen	Pressure scale set incorrectly	Adjust pressure scale around current IBP value
“ZERO IMBALANCE” message is displayed	Zero balance is not adjusted	Perform ZERO procedure
“ZERO IMBALANCE” message is displayed after drawing blood with an inline draw set	The negative pressure has negated the zero	Turn off stopcock between the transducer and the reservoir port prior to drawing sample
“ZEROING COMPLETE” message is displayed	Zero procedure is completed	IBP monitoring is available
“CHECK SENSOR” message is displayed	Pressure transducer is disconnected from pressure cable or is faulty	Connect cable to transducer
“ZERO UNSTABLE” message is displayed	Transducer is exposed to pressure during zero balance procedure	Re-zero with transducer open to air
	Dead-end cap is reapplied to transducer stopcock prior to closing stopcock after zero procedure	Close stopcock prior to reapplying dead-end cap
“CONNECTOR OFF” message is displayed	IBP cable has been removed	Press SILENCE ALARMS key. IBP parameter is removed from screen

PA Catheter Insertion

Prepare Monitor

1. Set up and zero the PAP transducer (see above).
2. Change the IBP display on the HOME screen, if desired.
 - a. Touch the PAP value.
 - b. Touch OTHER tab.
 - c. Touch COMMON press scale – *This puts all pressure waveforms on a common scale to appear larger on the HOME screen. Reset to the appropriate display scale once catheter is placed, if desired.*
 - d. Touch SCALE and set ART scale to 0-50 – *This removes the ART waveform from the common scale for PA catheter insertion. Reset to appropriate scale in ART menu once catheter is placed.*
 - e. Press the HOME key.
3. See Record Rhythm Strip in this guide to record ECG and PAP waveforms to the built-in recorder.

To display the PAP waveform with a cursor during the insertion, display the PCWP window by touching the PAP value and then touch the PCWP button. Touch and drag the cursor to move its position.

Perform Hemodynamic Readings

Initial Preparation

Perform this step the first time readings are performed and check the settings each shift to ensure that they have not been changed. Incorrect settings will generate inaccurate readings and calculations.

1. Insert the CO cable into the monitor and the temp probe into the closed injectate system.
2. Touch the Tb value.
3. Touch the CATHETER tab.
4. Touch EDWARDS or BD for these brands.
5. Touch the appropriate intersect box for your injectate volume and type of temperature probe.
OR Touch CONSTANT and enter the computation constant using keypad, then touch ENT.
6. Touch the HEIGHT/WEIGHT tab and verify or enter height/weight using the keypad and touch ENT.

Perform Hemodynamic Readings (continued)

Hemodynamic Calculations - CO/PCWP

ART, CVP, and PAP mean values are automatically input into the calculation window. To change these values or to enter the NIBP MAP value, touch the appropriate IBP (ART, PAP, CVP) tab, touch and drag the cursor to the appropriate value, and then touch SET to enter.

To perform CO measurements:

1. Touch the MEASURE tab.
2. Inject when "INJECT" message is displayed in the window.
3. Repeat injections as required.

To delete or record CO measurements, if necessary:

1. Touch the desired value line.
2. Touch DELETE or RECORD.

To perform a PCWP reading:

1. Touch the PCWP tab.
2. Inflate the catheter balloon.
3. Touch the FREEZE button and deflate the balloon.
4. Touch the PAP value button next to the waveform to set the cursor on the MEAN of the waveform.
5. Touch and drag the cursor or use the up/down arrows over the PCWP waveform to fine tune the value.
6. Touch SET to enter this PCWP value into the calculations.

To view and save hemodynamic calculations:

1. Touch the RESULT tab.
2. Touch the ADD button to save this calculation to the monitor's bedside memory. If calculations are not saved, they remain in this screen until another CO is performed but cannot be viewed in the Hemo List or the central monitor.
3. Touch the SHOW button to view all saved calculations.

When CO measurements cannot be performed automatically

In some cases, automatic measurements cannot be performed correctly because the temperature baseline is unstable due to noise or patient conditions, such as physiological changes. In such cases, touch the MANUAL button in the CO MEASURE window and inject within 30 seconds.

CO Monitoring - Troubleshooting (see operator manual)

Problem	Possible Cause	Action
CO value is different from expected	CO SETTINGS are incorrect	Check CO SETTINGS and input correct information
	CO injections take too long	Inject over 10-20 seconds
"DETECTING BASELINE" message is displayed	Searching for baseline temperature	Wait for baseline to be detected and INJECT message to be displayed or touch the MANUAL START button
"INJECT" message does not change to MEASURING CO	Monitor has not detected injection	Inject again. Is injectate fluid too warm?
"INJECTION TIME OUT" message is displayed	Injection wasn't completed within 4 minutes after MANUAL START button was touched	Touch MANUAL START button and inject within 30 seconds
"OUT OF RANGE" message is displayed	Calculated value is outside of measuring range	Check CO SETTINGS and re-inject Iced injectate bolus sensed by the monitor may not have reached appropriate temperature
"TI TEMP ERROR" message is displayed	Injectate temperature is different from CO SETTINGS. Room temperature may be >27 degrees C	Use appropriate temperature and settings. Move bath probe to cooler area in room
	CO temperature probe is faulty	Check all connections, tighten if necessary. Replace temperature probe if message continues to display.
Tb TEMP ERROR	Blood temperature is < 15 degrees or > 45 degrees C	
	Catheter is faulty	Replace catheter
Tb OFF	CO connection cord is not connected to catheter or cord/catheter are faulty	Check connections or change catheter /cord

Patient Data Review

The monitor stores vital sign and hemodynamic data, arrhythmia alarm events, ST segments, beat-to-beat ECG full disclosure waveform data, and 12-lead ECG's. All stored data can be reviewed at the bedside monitor, or at the central station, if applicable.

Real-time Trendgraph – Located to right of parameter value, displays the latest 30 minutes of parameter data. When enabled, this trendgraph can be dragged right or left.

Trend window – Displays trendgraphs, tabular trends, hemodynamic trends, lung (pulmonary) trend from the past 24 hours.

Graph pages 1-3 – allows up to 6 parameters on each page
table pages 1-3 – allows up to 15 parameters on each page
NIBP Trend– allows up to 10 parameters with NIBP S/D/M & PR HEMO – displays the calculations from the PCWP/CO sequence

LUNG Trend – Displays the calculations from the LUNG
FUNCTION calculator

Recall window – Displays up to 8,192 arrhythmia waveforms of 4 seconds before and 4 seconds after arrhythmia detection.

Alarm History – Displays up to 8,192 vital sign and arrhythmia alarms.

Full Disclosure – Displays up to 24 hours of up to five waveforms

ST level Recall – Displays up to 1,440 files from all ECG leads

12-Lead window – Displays the last six 12-lead ECG analysis samples.

OCRG window – Displays the last 24 hours of heart rate and pulse oximetry values and plot trends, and a compressed respiration waveform and values in a five second resolution.

Event Bar

An event bar is located beneath each of the review screens. Event categories (arrhythmia, technical, limit, or operational) can be displayed and the associated events that occur are noted in the color of the alarm associated levels.

The ◀▶ arrows move the cursor on the time line. The |◀▶| arrows skip between events. The data that is displayed in the reviews windows is associated with the event bar cursor.

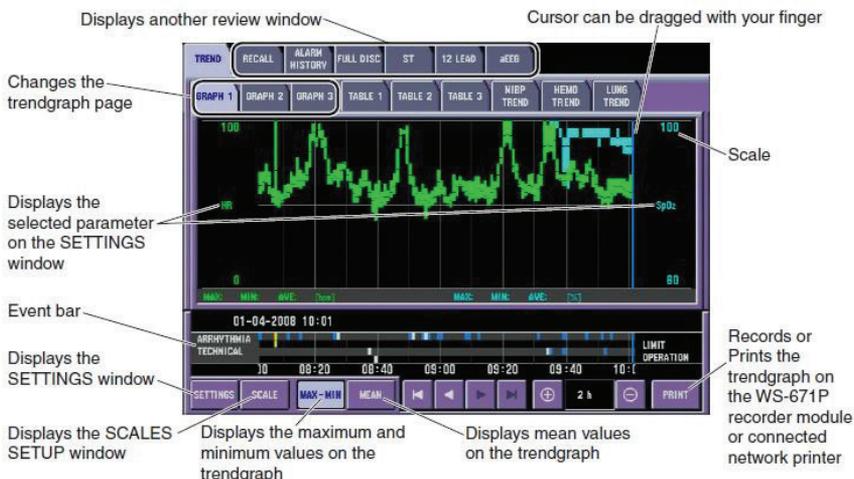
TREND Window

Allows you to display GRAPH, TABLE, or NIBP HEMO and LUNG trends

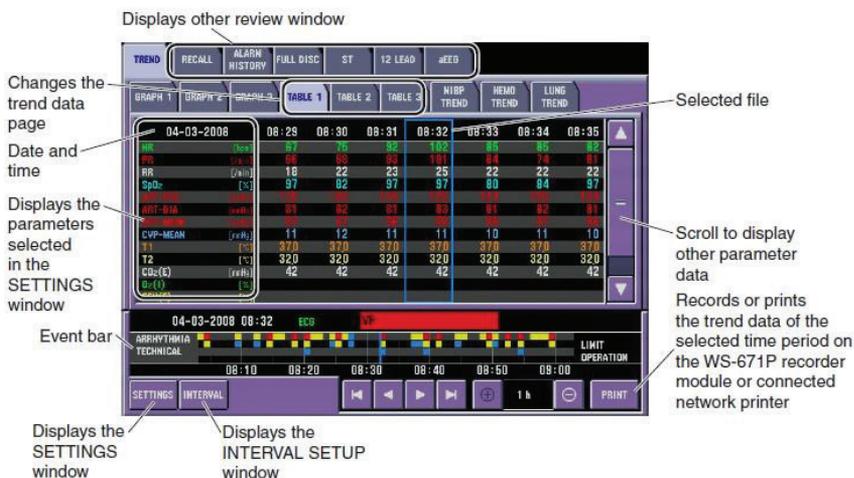
1. Press MENU key
2. Touch TREND button in the REVIEW section

Trend Graphs

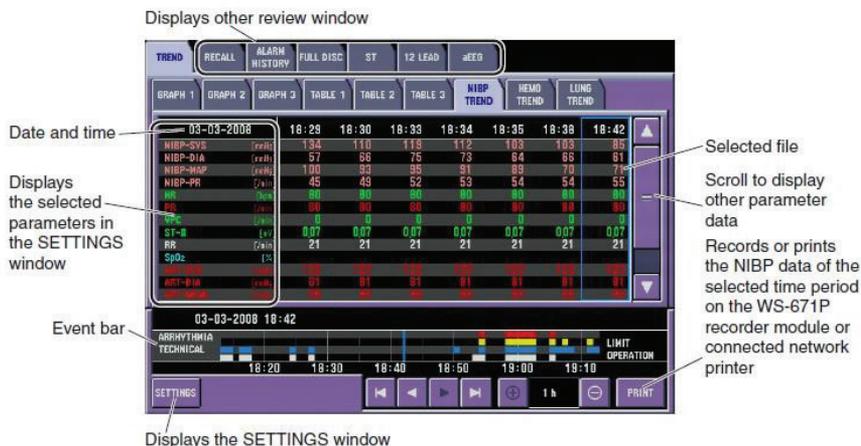
You can select up to six for each page using the SETTINGS button



Tables

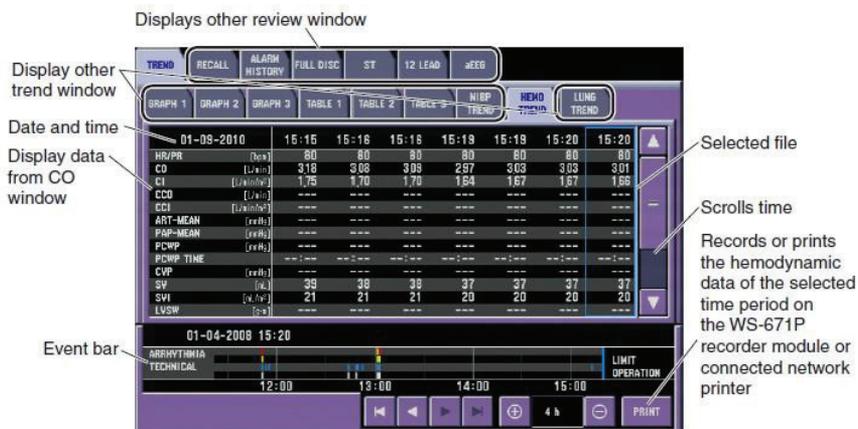


NIBP Trend



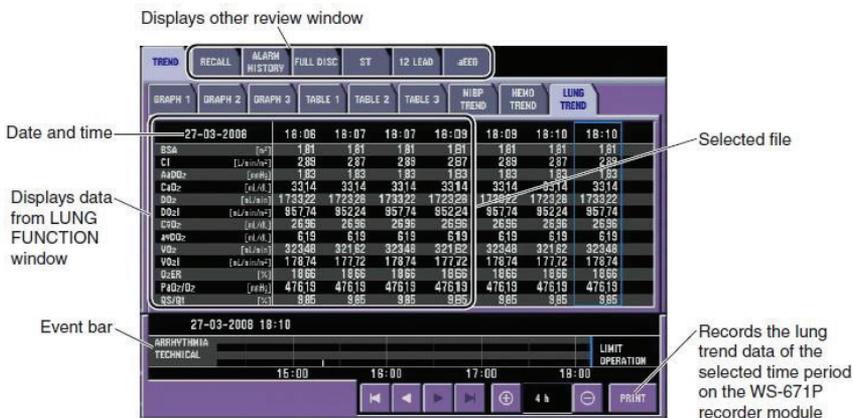
HEMO Calculations

The HEMO calculations are performed in the PCWP/CO sequence.



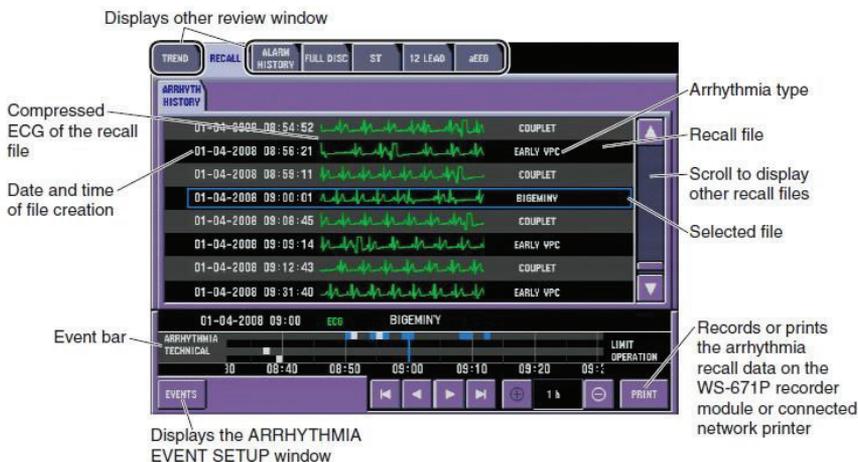
LUNG Trend

The LUNG calculations are done using the LUNG FUNCTION calculator.



Arrhythmia Recall Window

The RECALL window displays eight stored arrhythmia events. Scroll to change.

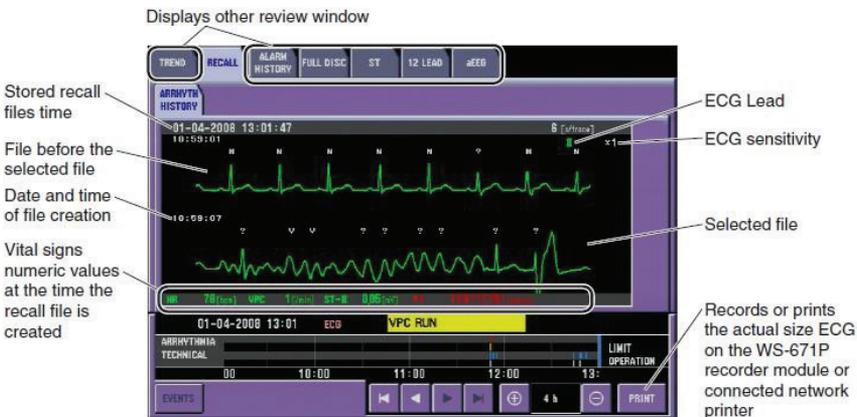


The monitor labels the beats as N "normal", S "supra-ventricular", E "early VPC", A "abnormal", P "paced", ? "impossible to classify", - "impossible to classify due to noise (or during learning)", and V, "ventricular" beats.

Displaying the Actual Size Waveform of the Selected Arrhythmia Recall File

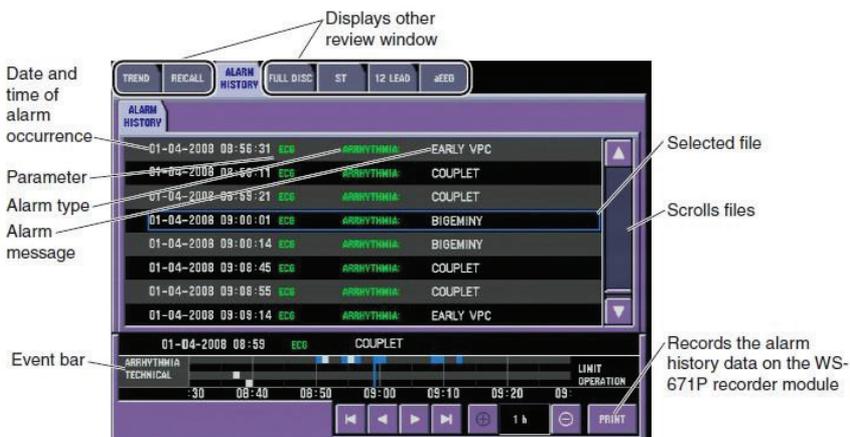
The ARRHYTHM HISTORY window displays the actual size ECG of the selected recall file with the ECG of one before and one after the selected file.

1. Touch the or key to select the arrhythmia recall waveform which you want to display in actual size.
2. Touch the center key. The arrhythmia waveform is displayed in the actual size.

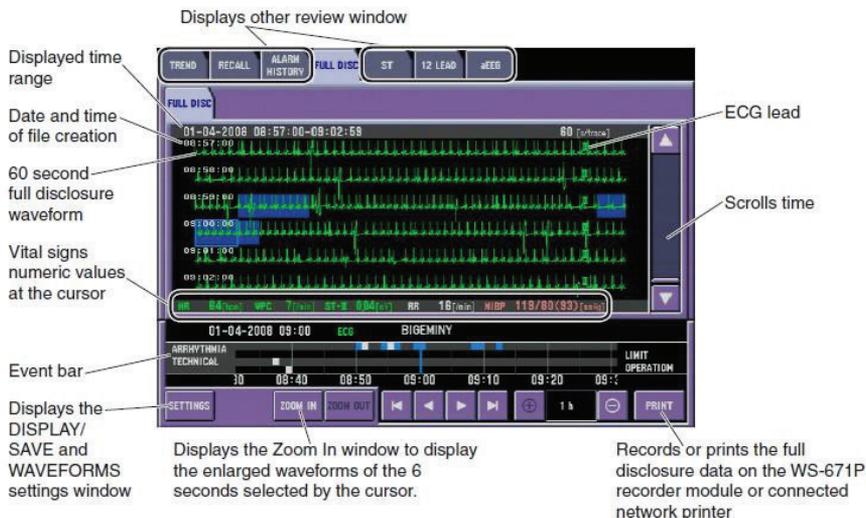


Alarm History Window

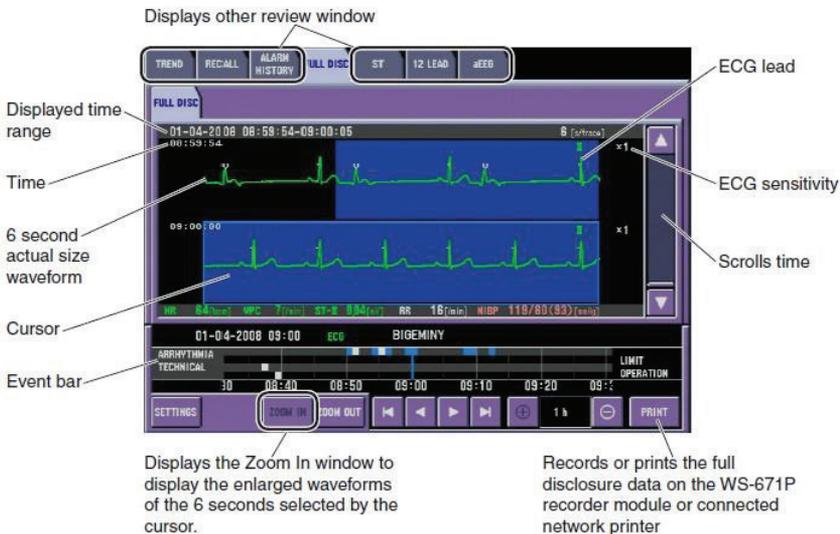
The screen displays eight stored alarms with most recent alarm at the bottom. Scroll to up/down view other alarms.



Full Disclosure Window



Zoom In Window



ST Window

Each monitored ECG lead is analyzed and stored each minute for 24 hours.



12-Lead Window

The 12-lead analysis is done using the 12-Lead Analysis function.

To see the 12 lead analysis result data, touch the 12 LEAD tab. Up to 6 files can be saved and up to 4 files can be displayed on the 12 LEAD page.



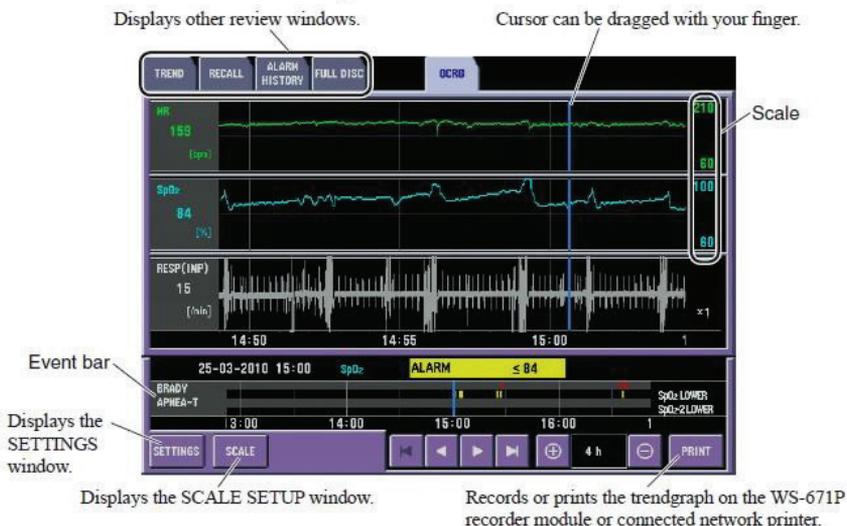
OCRG (Oxy-cardio-respiratory-gram)

The OCRG is useful for evaluating the respiratory patterns in the neonate. The heart rate, oxygen saturation level, and respiratory rate are tracked and displayed every five seconds.

The Event Bar at the bottom of the screen is used to evaluate the alarm conditions and the associated vital sign data.

The OCRG window is time-linked to all other review screens so that trend data, arrhythmia events, and full disclosure waveforms can be used in this assessment.

All OCRG data can be recorded to a bedside recorder or printed to a network laser printer.



Drug Calculations

The DRUG function is available to calculate continuous IV infusion rates and dosages.

There are three windows for drug calculations: DRUG, SETTINGS, and DOSE. Drug dosages and infusion flow rates can be calculated using 17 preset drugs or four user definable presets. See the operator manual for a listing of the preset equations.

Flow rate is calculated using this formula:

$$\text{Flow rate} = \frac{\text{Dosage} \times \text{Patient Weight} \times \text{Solution Amount}}{\text{Drug Amount}}$$

Dosage can also be calculated when flow rate is known.

When the patient's weight is entered under the ADMIT function, this information is updated into the DRUG SETTINGS window.

These items can be changed for calculation. When settings are changed, dosage and flow rate are automatically recalculated.

1. Drug Amount
2. Solution Volume
3. Dose
4. Sample Rate
5. Weight
6. Dose Step

Drug calculation data remains in the monitors' memory. Patient data is deleted with discharge (DELETE ALL) procedure or when the monitor is turned off for 30 minutes.

Drug Calculations Operations

1. Press the MENU key.
2. Touch the DRUG button.
3. Touch the DRUG tab.
4. Touch the desired drug name button **OR**
5. To enter customized drug:
 - a. Touch DRUG A-D button.
 - b. Touch EDIT button and enter the desired name using onscreen keypad, then touch ENT button to enter the drug name.
 - c. Touch the desired measurement unit for the named drug.
6. Touch the SETTINGS tab.
7. Touch the desired setting to change, and then enter the value using onscreen keypad.
8. Touch ENT button to enter the value.
9. Touch the DOSE tab.
10. Touch the desired DOSE STEP button to change the titration steps.
11. Touch PRINT to record to built-in recorder or print to laser printer, if available.

LUNG Calculations

Explanation of the Lung Trend Table

Label	Name	Unit
BSA	Body surface area	m ²
CI	Cardiac Index	L/min/m ²
AaDO ₂	Alveolar arterial oxygen tension difference	mmHg
CaO ₂	Arterial Oxygen content	mL/dL
DO ₂	Oxygen delivery	mL/min
DO ₂ I	Oxygen delivery index	mL/min
CvO ₂	Venous oxygen difference	mL/dL
avDO ₂	Arteriovenous oxygen difference	mL/dL
VO ₂	Oxygen consumption	mL/min
VO ₂ I	Oxygen consumption index	mL/min/m ²
O ₂ ER	Oxygen extraction ratio	%
PaO ₂ /O ₂	Oxygenation ratio	mmHG
Qs/Qt	Shunt fraction	%

There are two windows to the LUNG FUNCTION calculator. The DATA ENTRY window allows you to enter the information for the calculation, and the LUNG FUNCTION window displays the results and allows you to save and print them.

The monitor automatically acquires the following data when the LUNG FUNCTION window is opened:

- Patient's height and weight from the ADMIT window
- CO and CI when CO is measured
- CCO value instead of CO if it is measured
- Inspired O₂ when O₂ or anesthetic gas is monitored

Data is input into the DATA ENTRY window to complete the LUNG calculations:

Item Name	Unit	Setting Range	
Height	cm/inch	0.1 to 299.9	Automatic from ADMIT
Weight	kg/pound	0.1 to 449.9	Automatic from ADMIT
CO	L/min	0.01 to 20.0	Automatic from HEMO
O ₂	%	1 to 100	O ₂ delivery %
Atmospheric pressure	mmHg/kPa	235 to 795	Obtain from lab
PaCO ₂	mmHg/kPa	0 to 200	Obtain from ABG
Hb	g/dL, mmol/L	0.1 to 50.0	Obtain from CBC
PaO ₂	mmHg/kPa	0 to 800	Obtain from ABG
SaO ₂	%	1 to 100	Current Pulse Oximetry
PtVO ₂	mmHG/kPa	1 to 100	Obtain from mixed venous ABG
SvO ₂	%	0 to 99	Obtain from mixed venous ABG

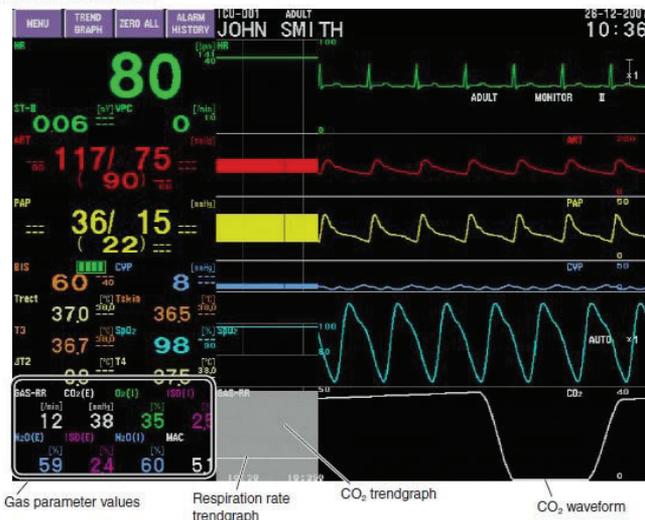
LUNG FUNCTION Operations

1. Press the MENU key.
2. Touch the LUNG FUNCTION button.
3. Touch the data button and enter the value using the keypad.
4. Touch ENT button to enter the value.
5. Touch the LUNG FUNCTION tab to display the calculations.
 - a. Touch ADD to save the calculations to the LUNG TREND review window.
 - b. Touch SHOW to display the LUNG TREND review window.
 - c. Touch PRINT to record or print the current calculation.

Anesthesia Agent Monitoring

Anesthetic agents can be monitored on the BSM when the GF-210RA agent monitor is used. The GF-210RA agent monitor warms up within 60 seconds and will automatically detect up to five agents (isoflurane, desflurane, sevoflurane, halothane, and enflurane) and the inspired and expired values for O₂, CO₂, N₂O, and respiration. Up to eight gas parameters selected in the OTHER page of the GAS window are displayed on the monitor HOME screen.

Gas Information on the Home Screen



Gas Information on the GAS Window



SCALE Tab: 0-20, 0-40, 0-80

Adjusts the scale and waveform lines for the waveforms in the MEASURE tab. Higher values require a higher scale.

Touch the desired parameter tab and then the button to select a preset scale or drag the slider bar to set a different one.

Alarms Tab: RR, APNEA, O₂, CO₂, N₂O and AGENT LIMITS

Increase, decrease, or turn OFF alarm limits:

1. Touch the limit then  to increase
2. Touch the limit then  to decrease

Set value to ABOVE MAXIMUM or BELOW MINIMUM to turn alarm OFF.

Sampling Tab: AUTO, MANUAL

Sets the sampling mode and rate of sampling for analysis.

AUTO – Volume is 200 mL/minute when the adult dryline (water trap) is used.

Volume is 100 mL/minute when the neonatal dryline is used.

MANUAL – You can select from 120-200 mL/minute for adult and 70-120 for neonatal. If a value is set outside of this range, the mode changes to AUTO. Use the slider bar to change the value and then touch SET to enter it.

ZERO CAL Tab:

The monitor periodically performs the zero calibration with air, and it takes about five seconds for this to occur. It may be necessary to perform a manual zero calibration if inappropriate data appears or before the GAS calibration procedure is performed (see the BSM service manual). To do so, touch the CAL button and observe for a “CAL COMPLETED” message.

OTHER Tab:

This screen determines what agent parameters are displayed on the BSM HOME screen. Touch the desired position on the NUMERIC DISPLAY section and then the desired SELECTABLE ITEM on the right. The parameters display on the HOME screen in this order.

MAC = the concentration that is needed to prevent movement in 50% of subjects in response to a pain stimulus. The monitor uses the non-corrective MAC method:

$$\%Et(AA1)/x(AA)+\%Et(AA2)/x(AA)+\%Et(N_2O)/x(N_2O)$$

Recording

Press the oval RECORD button located on the right front of the BSM to record ECG rhythm strips to either the bedside or central recorders.

When no bedside recorder exists, this button records to the central monitor automatically.

To set second or third channel waveforms to record whenever this button is used:

1. Press the MENU key.
2. Touch the RECORD button.
3. Touch the desired TRACE 2 or TRACE 3 recording button and then the desired parameter button to record in those positions.
4. Press the RECORD button to record.

Dual and multiple waveform recordings may be done from the central monitor as well. Single or multiple waveform strips may be printed from the FULL DISCLOSURE review on the central monitor. See the CNS operator manual for additional information.

The PRINT button on the open windows offers options to RECORD and to PRINT when a laser printer is available on the monitoring network.

Automatic Recording

On bedside monitors with built-in recorders, alarms can be set to automatically record. A recording beginning eight seconds before and ending 12 seconds after the event is generated when ALARM RECORDING function is enabled. Recording OFF icon (see above) appears in upper right corner of screen when this function disabled.

1. Press the MENU key.
2. Touch the RECORD button.
3. Touch the ON button in the ALARM RECORDING section.

* The BSM offers an option for periodic recordings to automatically record at preset times. Choose a preset time from the Periodic Recording Interval (min) keys, or enter a different interval using the FREE key. When an interval is selected, a strip recording will occur at these times on this BSM until the periodic interval is set to OFF.

Transport Function

Patient data is stored in the monitor's input unit, which may be transferred to another monitor with the patient. The monitor must be prepared prior to removing the input unit to prevent data loss or corruption.

To begin the data transport process:

1. Touch the X-PORT DATA function key (or *MENU>ADMIT>X- PORT DATA*) to open the transport dialogue screen.
2. Touch YES to prepare the input unit for disconnection. Wait for the message "REMOVE THE INPUT UNIT" and then remove the input unit (or disconnect DAU) from the BSM.
3. Place input unit (or connect DAU) into a transport monitor.

The "CONNECT INPUT UNIT" message remains on the vacated BSM until another input unit is inserted.

4. When you insert the input unit into a different monitor, you must CONFIRM the patient's information. Touch OK to use this information*.

** Patient demographics, 2 leads of ECG full disclosure, and tabular trends are stored. The invasive blood pressure cables store the last zero.*

If you insert an input unit into a monitor that has data (such as the monitor that you just vacated in this procedure), you must decide whether to use that data.

1. Touch YES to use data from the bedside monitor.

OR

2. Touch NO to delete and start over with new patient.

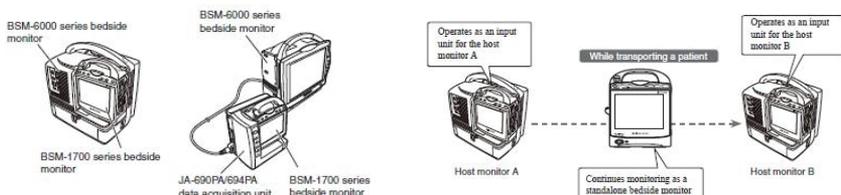
If you choose to delete the data, the ADMIT screen appears for entering new patient information.

Note: When transporting data between beds on a monitoring network with a CNS, the CNS data is held in a virtual zone until the input unit is replaced onto the network. At that time, the BSM-6000 communicates with the CNS to automatically transfer that patient's data to the new CNS.

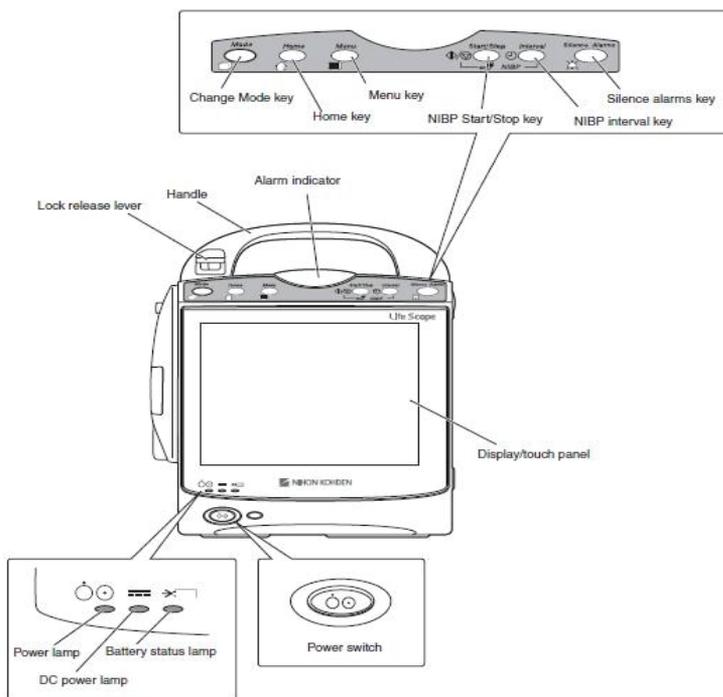
BSM-1700 Series Monitor

The 1700 series BSM can either be utilized as a stand-alone transport monitor or as an input unit/transport solution in conjunction with the BSM-6000 series models.

The 6000 and 1700 series' operate very similarly to each other and the next several pages of this guide will serve to identify the differences of the BSM-1700 series.

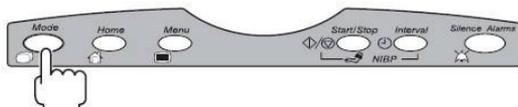


Front Panel



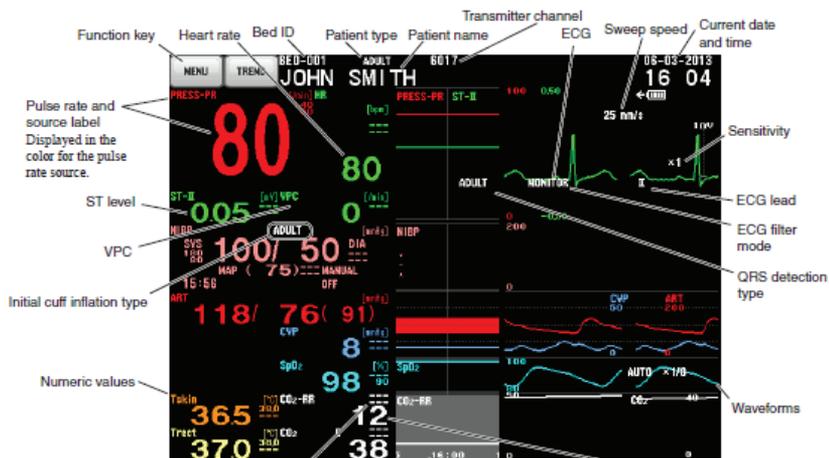
BSM-1700 Home Screen Display: Standard Mode/Transport Mode

There are two display modes: standard mode and transport mode. To switch the display mode, press the [Mode] key.



Standard Mode

All parameters are displayed on the home screen.



Alarm limit settings

For bedside monitor with Op. No. 33A, 53A and 73A, when the limit is set to OFF, "OFF" is displayed. For bedside monitor with Op. No. 33K, 53K, 63K and 73K, when the limit is set to OFF, "--" is displayed.

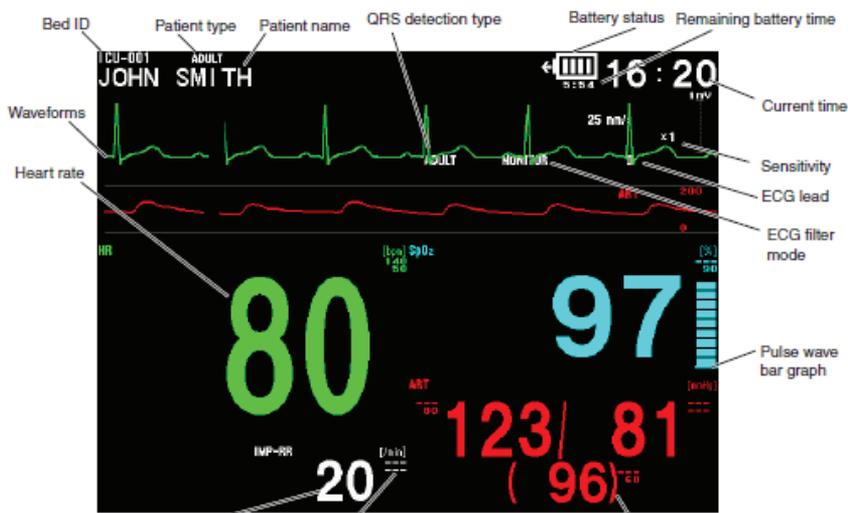
Current trendgraphs

The width of the trendgraph can be changed. OCRG can be displayed instead of trendgraphs.

Respiration rate

Respiration rate is detected from only one parameter. When several respiration parameters are monitored at the same time, the respiration rate is counted from the parameter in the following priority.
CO₂ > impedance respiration

Transport Mode



Respiration rate

Respiration rate is detected from only one parameter. When several respiration parameters are monitored at the same time, the respiration rate is counted from the parameter in the following priority.
CO₂ > impedance respiration

Alarm limit settings

For bedside monitor with Op. No. 33A, 53A and 73A, when the limit is set to OFF, "OFF" is displayed. For bedside monitor with Op. No. 33K, 53K, 63K and 73K, when the limit is set to OFF, "---" is displayed.

Blood pressure

When both the IBP and NIBP are measured, IBP is displayed.

Transport Function using the BSM-1700

When using the BSM-6000 series with the BSM-1700 transport monitor as the input unit, you must first complete a few steps prior to disconnecting the BSM-1700 from the monitor or patient data may be lost.

To begin the data transport process:

1. Touch the X-PORT DATA function key (or MENU>ADMIT>X-PORT DATA) to open the transport dialogue screen.
2. Touch YES to prepare BSM-1700 for disconnection. Wait for the message "REMOVE THE INPUT UNIT" and then remove the 1700 transport (or disconnect the 1700) from the BSM-6000.
3. The BSM-1700 automatically switches to the transport mode display once disconnected from the BSM-6000.
4. Transport patient as needed using the BSM-1700.

The "CONNECT INPUT UNIT" message remains on the vacated BSM until another input unit/BSM-1700 is inserted.

- When you insert the 1700 transport into a different monitor, you must CONFIRM the patient's information. Touch OK to use this information*.

* Patient demographics, 2 leads of ECG full disclosure, and tabular trends are stored. The invasive blood pressure cables store the last zero.

If you insert a BSM-1700 transport into a monitor that has data (such as the monitor that you just vacated in this procedure), you must decide whether to use that data.

Touch YES to use data from the bedside monitor.

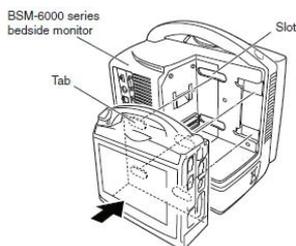
OR

Touch NO to delete and start over with new patient.

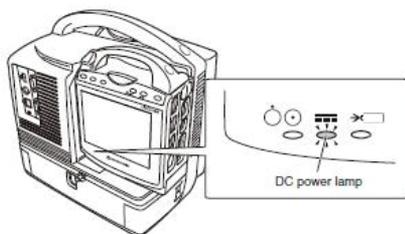
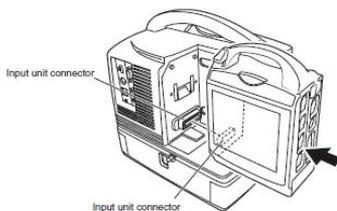
If you choose to delete data, the ADMIT screen appears for entering new patient information.

Connecting to the BSM-6000 Series Monitor

- Align the tabs on the BSM rear panel to the slot on the BSM-6000 monitor rear panel.

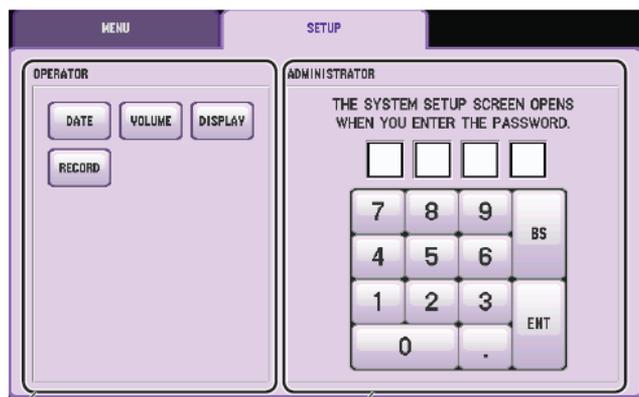
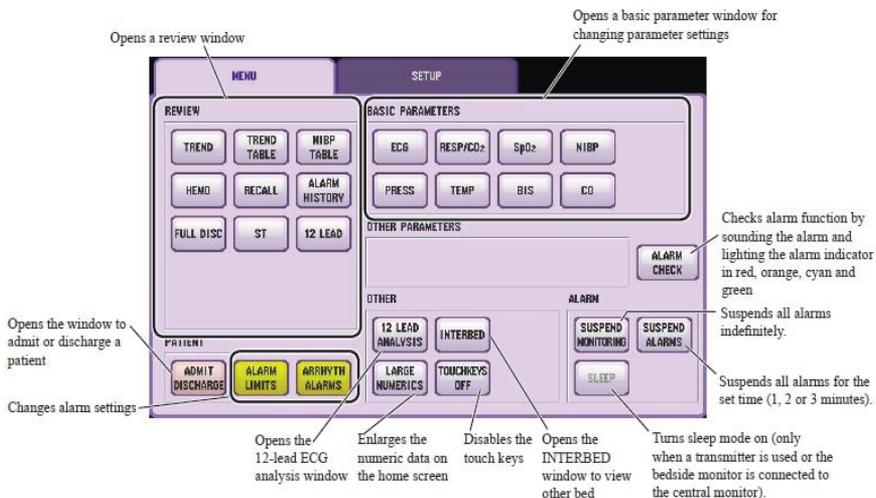


- Attach the rear panel of the BSM-1700 to the rear panel of the BSM-6000 and slide until the connector clicks.



Confirm DC power lamp on BSM-1700 front panel lights. Once connected, the BSM-1700 screen will turn off.

Menu Window



Opens the window for changing date and time, sync/ alarm sound volume, screen brightness, waves, network printer and administrator setting window.

Opens the password protected SYSTEM SETUP window and SYSTEM CONFIGURATION screen which only an administrator can access.

Using ZM-View Function

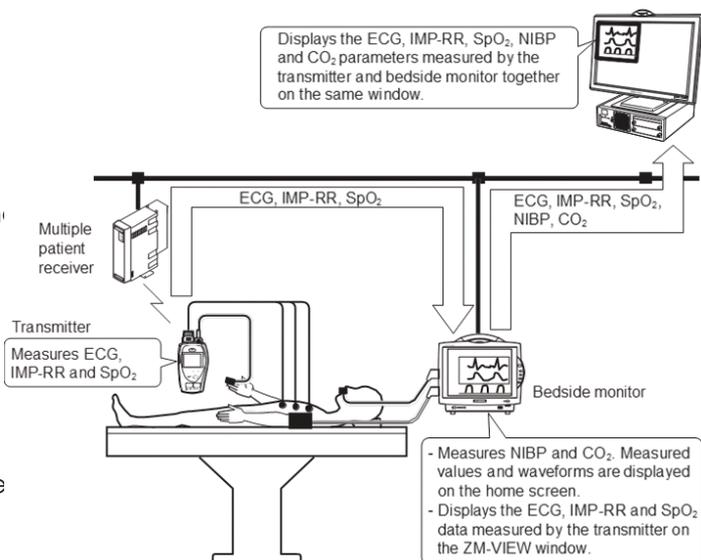
The ZM-VIEW function is only available for the BSM-6000A series.

The ZM-VIEW function enables data measured by a transmitter to be shown in the ZM-VIEW window on the bedside monitor by pairing the bedside monitor and transmitter. This function allows you to simultaneously monitor the parameters measured by the transmitter and bedside monitor for the same patient.

The parameters that can be monitored after pairing the bedside monitor and transmitter are ECG, impedance respiration (IMP-RR), SpO₂, CO₂, and NIBP. Available parameters depend on the device used for measurement.

The parameters measured by the transmitter and bedside monitor are displayed as monitoring parameters on the central monitor.

Example: ECG, IMP-RR and SpO₂ are measured by the transmitter. NIBP and CO₂ are measured by the bedside monitor.



Do **not** do any of the following while using the ZM-VIEW function:

- Admit or discharge patients
- Change the monitored bed
- Transfer patients
- Turn all alarms off
- Change devices
- Use a function key

Starting and Ending ZM-VIEW Function

1. Display the MENU window.
2. Touch the ZM-VIEW key. The SELECT BEDS window appears.
3. Assign the transmitter.
 - a. Touch the group then the transmitter to select the transmitter to pair with the bedside monitor.
 - b. Select which patient information and settings to apply: bedside monitor or transmitter. The transmitter and monitor are paired, and the ZM-VIEW window appears on the monitor screen.
4. To end using the ZM-VIEW function, touch the END key on the ZM-VIEW window. A confirmation window appears.
5. Touch the YES key on the confirmation window.

Turning the bedside monitor power off while using the ZM-VIEW function also ends the pairing.

The pairing does not end when a signal loss occurs or when the transmitter power is turned off.

WARNING

When an alarm which occurred while using the ZM-VIEW function is silenced, the alarm does not reactivate even if the Silence Alarms key is pressed while the alarm is silenced. Visually check the patient condition frequently until the selected time for the ALARM ACTIVATION DELAY setting elapses.

System Settings

The System Settings are found on the Main Menu and are set up during the installation of your bedside monitors. However, these settings can be changed, if necessary.

Date and time, alarm and sync tone volumes, screen brightness, screen display functions, and recording settings can be modified using this section of the Main Menu.

Caution: Date and time changes affect the entire network if this monitor is connected to a monitoring system with central stations.

To modify these settings:

1. Press the MENU key.
2. Touch the SETTING button.
 - a. DATE & TIME
 - i. Touch the year, month, day, hour, or minute.
 - ii. Enter the value using the onscreen keypad and touch SET.
 - b. VOLUME
 - i. Touch SYNC SOUND ON or OFF.
 - ii. Adjust SYNC VOLUME and ALARM SOUND VOLUME, using the Δ or ∇ or touch and drag the slider bar.
 - c. DISPLAY
 - i. Choose 1-3 ECG leads to display on the HOME screen.
 - ii. Choose ECG and RESP SWEEP speeds.
 - iii. Choose PRESS SCALE display.
 - d. RECORD
 - i. Choose which waveform(s) to print as the second and third waveform(s) on the built-in recorder.
 - ii. Choose ALARM RECORDING ON or OFF with built-in recorder.
 - iii. Choose PERIODIC REC INTERVAL for automatic recordings to built-in recorder.
 - iv. Choose the recording speed.

The SYSTEM tab offers additional configuration screens that are password protected and the settings were configured during the installation of your equipment.

Cleaning and Disinfecting

Please consult the Operator's Manual or the Cleaning and Disinfecting Guide for a complete list of approved cleaning and disinfecting agents.

*The use of any other disinfectant solutions may cause damage to the equipment and may void the product warranty.

For more information, please
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visit **us.nihonkohden.com**



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