ZOE Medica

Nightingale Monitoring System

MPC User's Guide

Zoe Medical, Inc.
460 Boston Street
Topsfield, MA 01983

Nightingale Monitoring System MPC User's Guide
Part Number 122-0002, Revision N

Zoe Medical, Inc.
460 Boston Street
Topsfield, MA 01983 U.S.A.

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Caution: United States Federal law restricts this device to sale by or on the order of a physician.

Before using any Zoe Medical monitoring device, be sure to read carefully and understand all manuals provided with the device.

All Zoe Medical monitoring devices are intended for use only by qualified medical personnel.

User Assistance

If you have a question or need help operating the Nightingale MPC, please contact Zoe Medical Customer Support:

Email: customersupport@zoemedical.com

Phone: (978) 887-4013

For the latest information about answers to frequently asked questions, please consult our web site:

www.zoemedical.com

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General Information

This User's Guide provides healthcare professionals the information required for safe and effective use of the Nightingale MPC (Multi-Patient Console). The Nightingale MPC serves as a central monitoring station for the Nightingale Monitoring System. The Nightingale MPC connects to a network of bedside patient monitors, allowing you to view information from up to 32 patients at once.

For the sake of brevity, the term MPC is sometimes used in this document to refer to the Nightingale MPC.

The Nightingale PPM3 (Personal Patient Monitor) is a small, lightweight patient monitor designed to acquire physiological waveforms and parameters, and to transmit this data to a Nightingale MPC central monitoring station. For the sake of brevity, the term PPM3 is sometimes used in this document to refer to the Nightingale PPM3.

The 740 SELECT is also a small, lightweight patient monitor designed to acquire physiological waveforms and parameters, and to transmit this data to a Nightingale MPC central monitoring station. It is specially designed with a handle to facilitate easy use during transport.

Before using the MPC, be sure to read carefully and understand all sections of this User's Guide. Failure to read and understand the instructions may lead to misuse of the MPC, which could result in harm to the patients.

Typographical Conventions in this User's Guide

This guide contains warnings, cautions, and notes to help call your attention to the most important safety and operational aspects of the system. To help identify these items when they occur in the text, they are shown using the following typographical conventions:

WARNING – Statements that call attention to the possibility of injury, death, or other serious adverse reactions associated with the use or misuse of the device.

CAUTION – Statements that call attention to the possibility of a problem with the device associated with its use or misuse. Such problems include device malfunction, device failure, damage to the device or damage to other property.

Note – Statements that provide supplemental information.

Indications for Use

The Zoe Medical Nightingale Monitoring System is indicated for use in adult & pediatric patient populations.

The Zoe Medical Nightingale Monitoring System facilitates the monitoring of:

- ECG
- Impedance respiration
- Non-Invasive blood pressure
- Invasive blood pressure
- Body temperature
- Functional arterial oxygen saturation (SpO_2)
- End-tidal & inspired CO_2

The Zoe Medical Nightingale Monitoring System is a prescription device intended to be used by healthcare professionals in all areas of a healthcare facility.

1. Overview

This chapter provides an overview of the MPC, including a diagram showing how the MPC fits into the Nightingale Monitoring System, and a description of how this User's Guide relates to other Nightingale Monitoring System documents. This chapter also provides a basic overview of the MPC user interface and a list of the MPC's main features.

1.1. System Diagram

The main components of the Nightingale Monitoring System are shown in the following diagram:

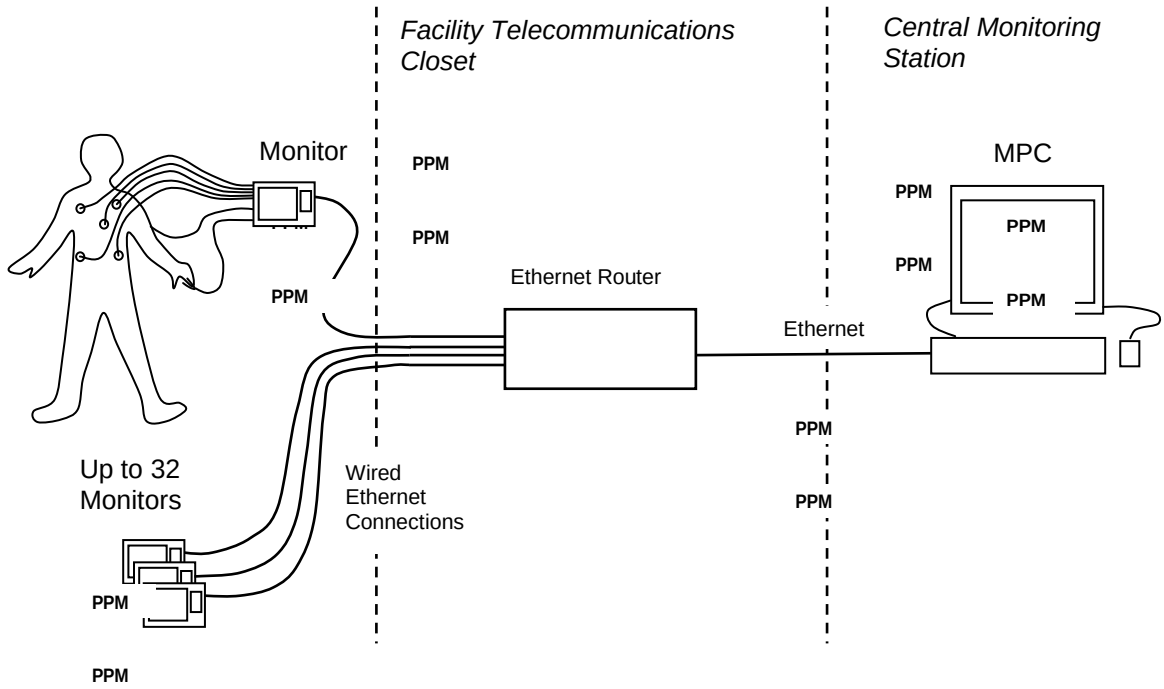

Figure 1. Nightingale Monitoring System

A bedside patient monitor that connects to the MPC may be either PPM3 or a 740 SELECT. The router provides a connection between the monitors and the MPC.

1.2. Scope of this User's Guide

This User's Guide provides healthcare professionals the information required for the safe and effective use of the Nightingale MPC.

For information about how to use the PPM3, please consult the Nightingale PPM3 User's Guide.

For information about how to use the 740 SELECT, please consult the 740 SELECT User's Guide.

1.3. MPC User Interface

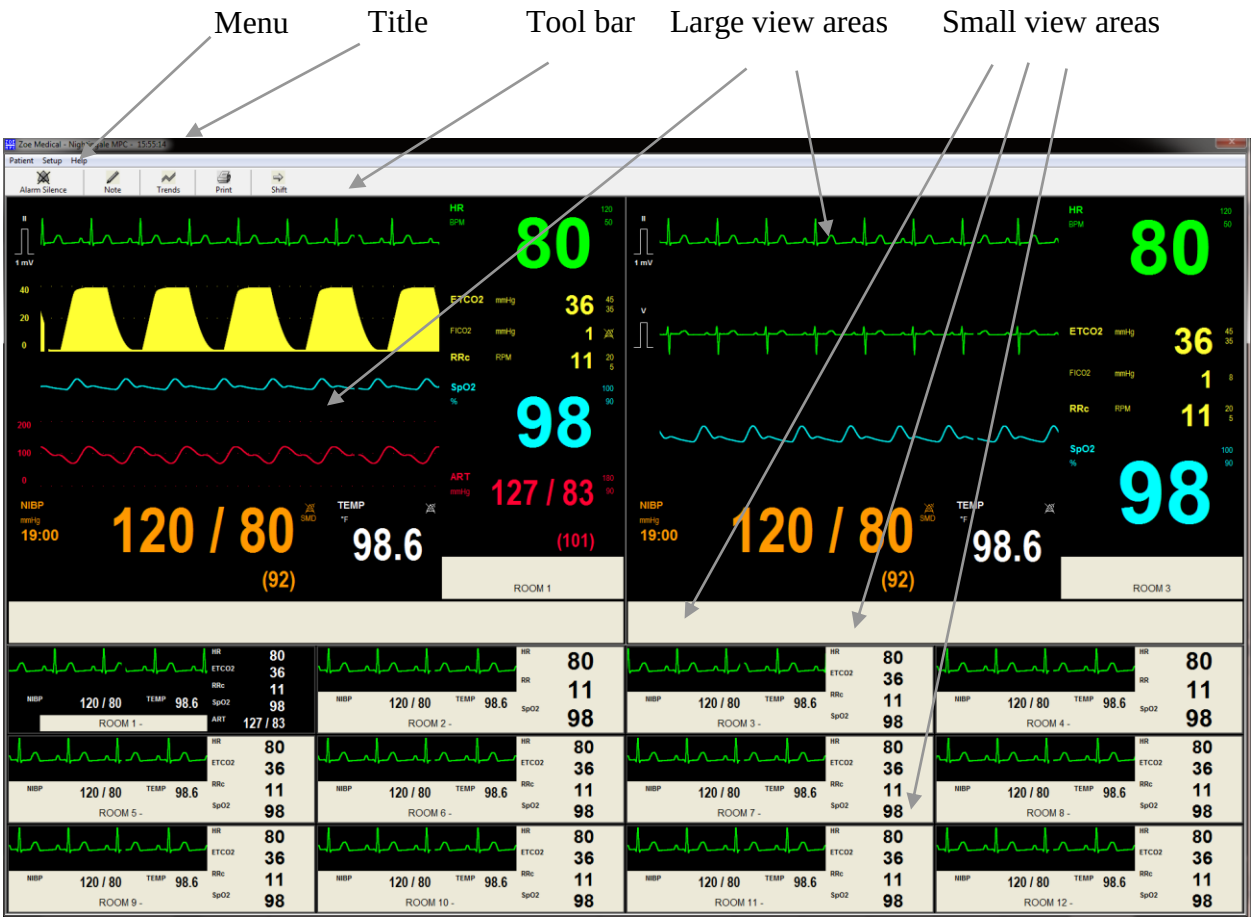

Figure 2. Sample of Main MPC Display Screen

The MPC user interface makes use of a keyboard and mouse (for input) and a display screen and speaker (for output). You can make selections and changes settings by means of a standard Windows-style graphical user interface. The MPC display takes up the entire screen with a single window, which cannot be minimized, closed, resized, or moved.

WARNING – The MPC alarm sounds come through the PC speaker. Ensure that the speaker is set to a volume that is audible in your setting, and that the speaker volume control is covered so it cannot be changed accidentally.

WARNING – Since the MPC software runs on a Windows platform, it can be interrupted by pressing CTRL-ALT-DEL. This will suspend monitoring for all the connected monitors. Take care not to press these keys.

The window title includes the text "Zoe Medical– Nightingale MPC," along with a display of the current time.

The window contains a menu at the top with menu items for "Patient," "Setup," and "Help."

Below this menu is a tool bar consisting of a row of buttons for common tasks – "Alarm Silence," "Note," "Trends," "Print," and "Shift."

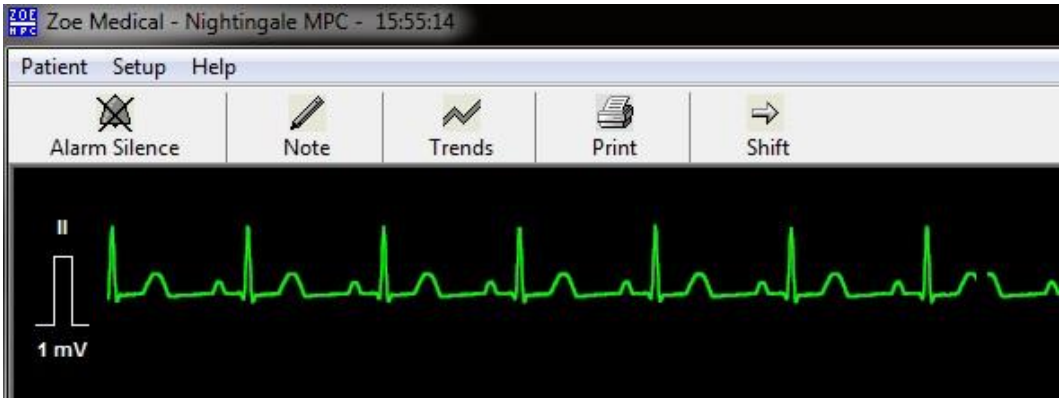

Figure 3. Close Up View of MPC Title, Menu, and Tool Bar Buttons

The main display window contains two large view windows (the "primary view" on the left and the "secondary view" on the right). The main display window contains a number of small view windows.

Each of the small view windows displays information from a single connected monitor. Every monitor in the Nightingale Monitoring System is assigned a "Monitor ID," which may be simply a number, such as "Monitor 12," or some text that identifies where the monitor is located, such as "Room 302." Every monitor is also assigned to a specific small view area of the MPC display. This assignment is done by the Zoe service technician when the system is first installed.

The information from a monitor is always displayed in the same small view window (i.e., you cannot change the assignment of monitors to small view windows).

The large view windows contain four areas: a waveform display area, a parameter display area, (which has two segments), a patient name area, and a message area.

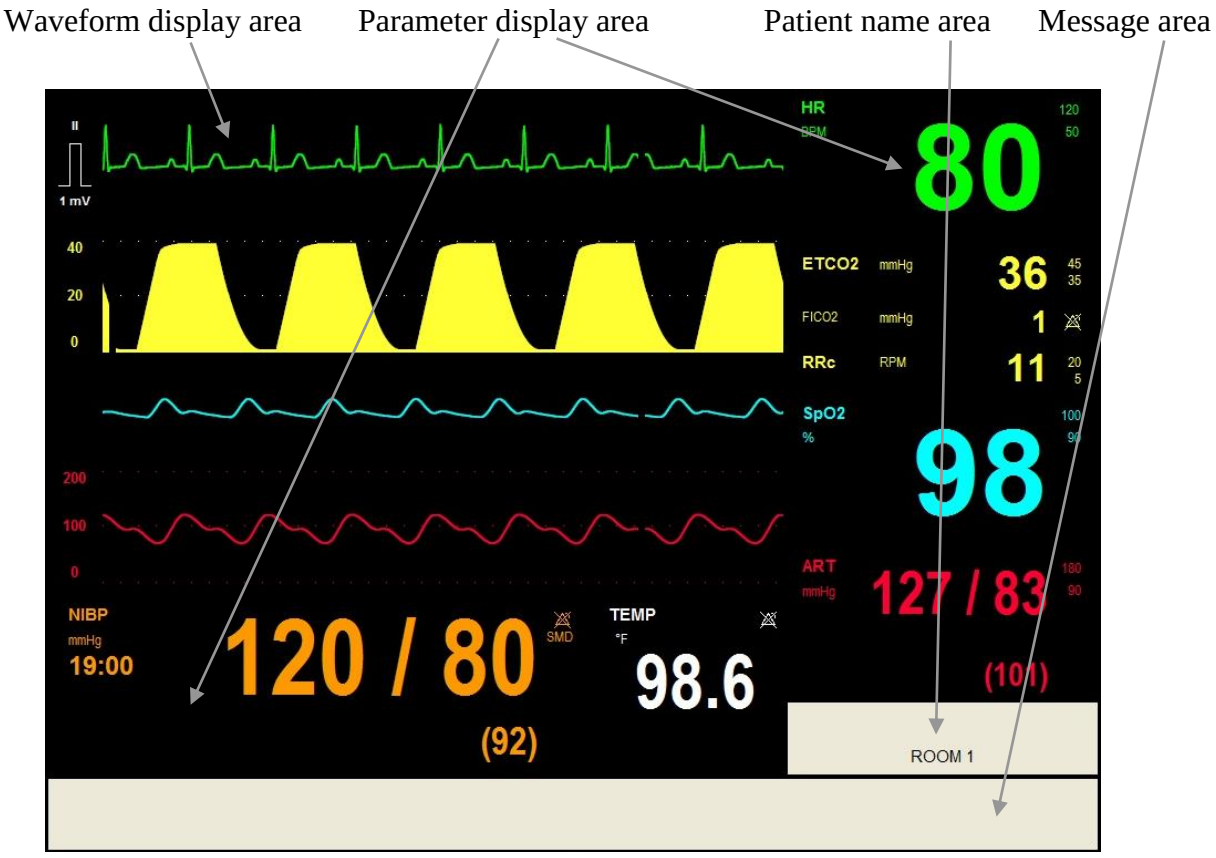

Figure 4. Sample of MPC Large View Window

The small view windows contain three areas: a waveform display area, a parameter display area, and a patient name area.

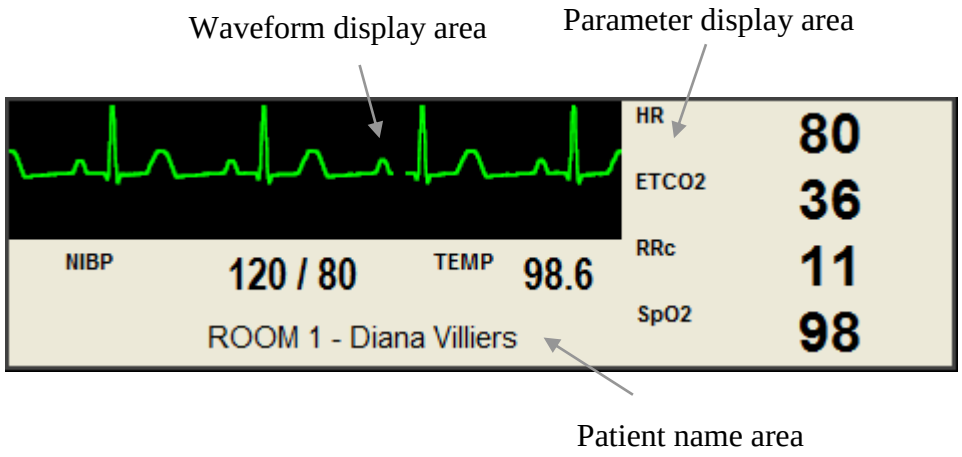

Figure 5. Sample of MPC Small View Mindow (Normal)

You can select one of the monitors for display in the primary large view window by clicking on the small view window for that monitor.

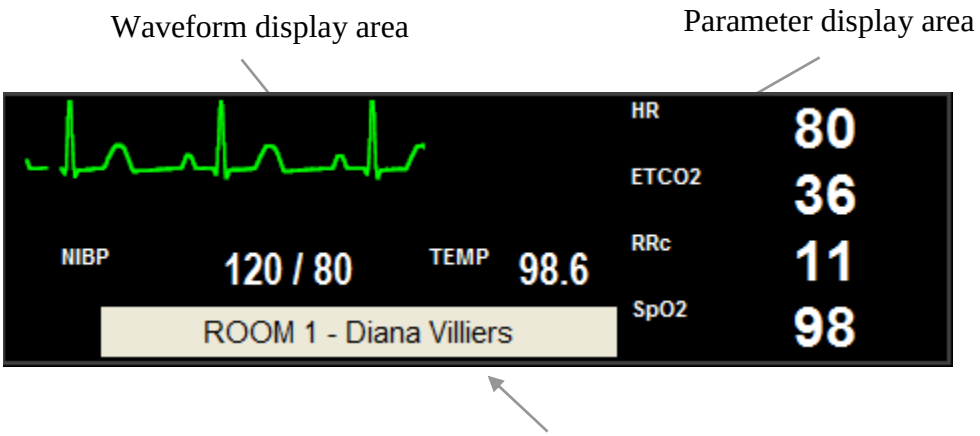

Figure 6. Sample of MPC Small View Window (When Selected)

You can copy the monitor display in the primary large view window to the secondary large view window by clicking on the "Shift" button.

1.4. Main Features of the MPC

The Nightingale MPC provides a rich set of features to help you monitor the vital signs of patients, respond to alarm conditions, and review patient trends and reports. The following list identifies the main tasks you will encounter in daily use. For each of these tasks, you can find detailed information in the corresponding chapter of this User's Guide:

- Admitting a Patient
- Changing Patient Information
- Changing Parameter Settings
- Changing Waveform Settings
- Managing Alarms
- Viewing Trends
- Printing Reports
- Standby Mode
- Transport Mode
- Discharging a Patient

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2. Admitting a Patient

Before a patient is admitted to a monitor, the small view area for that monitor is blank except for the name area which displays the monitor's Monitor ID. In order to admit a patient, you must first select the patient's monitor into the primary view by clicking on the small view for that monitor.

Once you have selected the correct monitor into the primary view area, you can bring up the Patient Admit/Edit dialog box by clicking on the patient name area of the primary view.

Note – You can also bring up the Patient Admit/Edit dialog box via the "Patient", "Admit/Edit" menu selections.

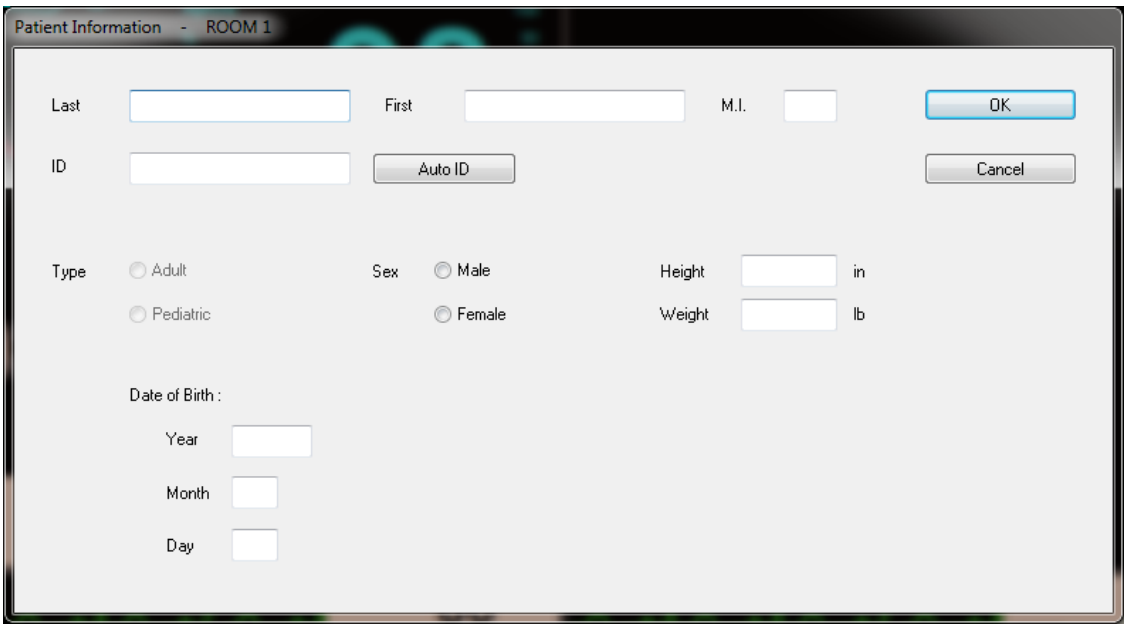


Figure 7. Patient Admit/Edit Dialog Box

In order to admit a patient, you need to supply at least the patient ID.

Note – In order to provide the highest possible quality of patient record, you should consider entering all the information requested by the Patient Admit/Edit dialog box.

When you have entered the information, press OK. If you press Cancel, the patient will not be admitted. The patient name area in both the small view and the large view will change to display the patient's name.

If you want to admit a patient quickly, or if you need to admit a patient before all the actual patient information is available, you can press the "Auto ID" button. This will create an automatic ID for the patient (based on a combination of the monitor ID and the current date and time). You can change the name, ID, and other fields when the actual patient information becomes available. The trend data and reports that were stored under the automatic patient ID will automatically be associated with the actual patient ID after you enter it.

WARNING – After admitting a patient, you should verify that the name you entered is displayed on the monitor connected to that patient. This is to avoid any chance of accidentally admitting a patient for a different monitor than the one to which the patient is actually connected.

3. Changing Patient Data

If you ever need to change any of the information you entered at the time when a patient was admitted, you can bring up the Patient Admit/Edit Dialog Box again to make the changes. In order to change the information for a patient, you must first select the patient's monitor into the primary view by clicking on the small view for that monitor.

WARNING – Always be sure that you check which patient is selected in the primary view before changing any information. This is to avoid any chance of making changes to information for one patient while thinking that you are making the changes for another patient.

Once you have selected the correct monitor into the primary view area, you can bring up the Patient Admit/Edit dialog box by clicking on the patient name area of the primary view.

Note – You can also bring up the Patient Admit/Edit dialog box via the "Patient", "Admit/Edit" menu selections.

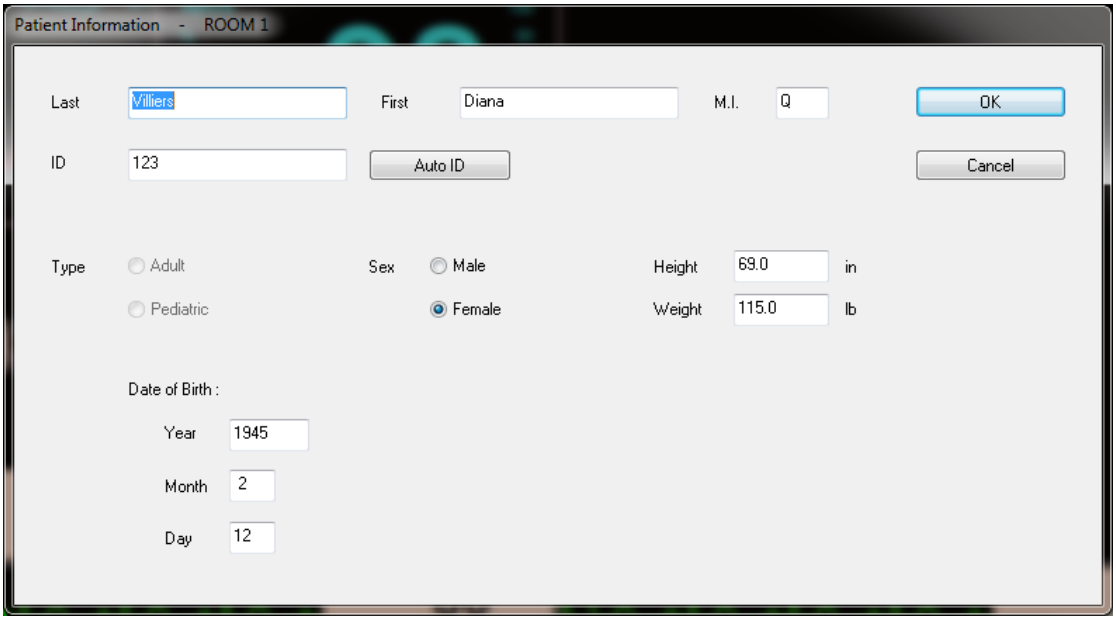


Figure 8. Patient Admit/Edit Dialog Box

When you have entered the changes you wanted to make, click OK, or to exit without making any changes to the patient information, click Cancel. If you change the patient ID, the trend data and reports that were stored under the original patient ID will automatically be associated with the new patient ID.

4. Changing Parameter Settings

The baseline parameter settings for newly admitted patients come from the factory default parameter settings. See the applicable bedside monitor user guide for a complete listing of the factory default parameter settings.

This chapter addresses with how you adjust the parameter settings relative to the default settings for the needs of a specific patient.

In order to view and then change parameter settings for a specific patient, you must first select the patient's monitor into the primary view by clicking on the small view for that monitor.

WARNING – Always be sure that you check which patient is selected in the primary view before changing any settings. This is to avoid any chance of making changes to settings for one patient while thinking that you are making the changes for another patient.

Once you have selected the correct monitor into the primary view area, you can bring up the Setup Parameters dialog box by clicking on the parameter area of the primary view.

Note – You can also bring up the Setup Parameters dialog box via the "Setup", "Parameters" menu selections.

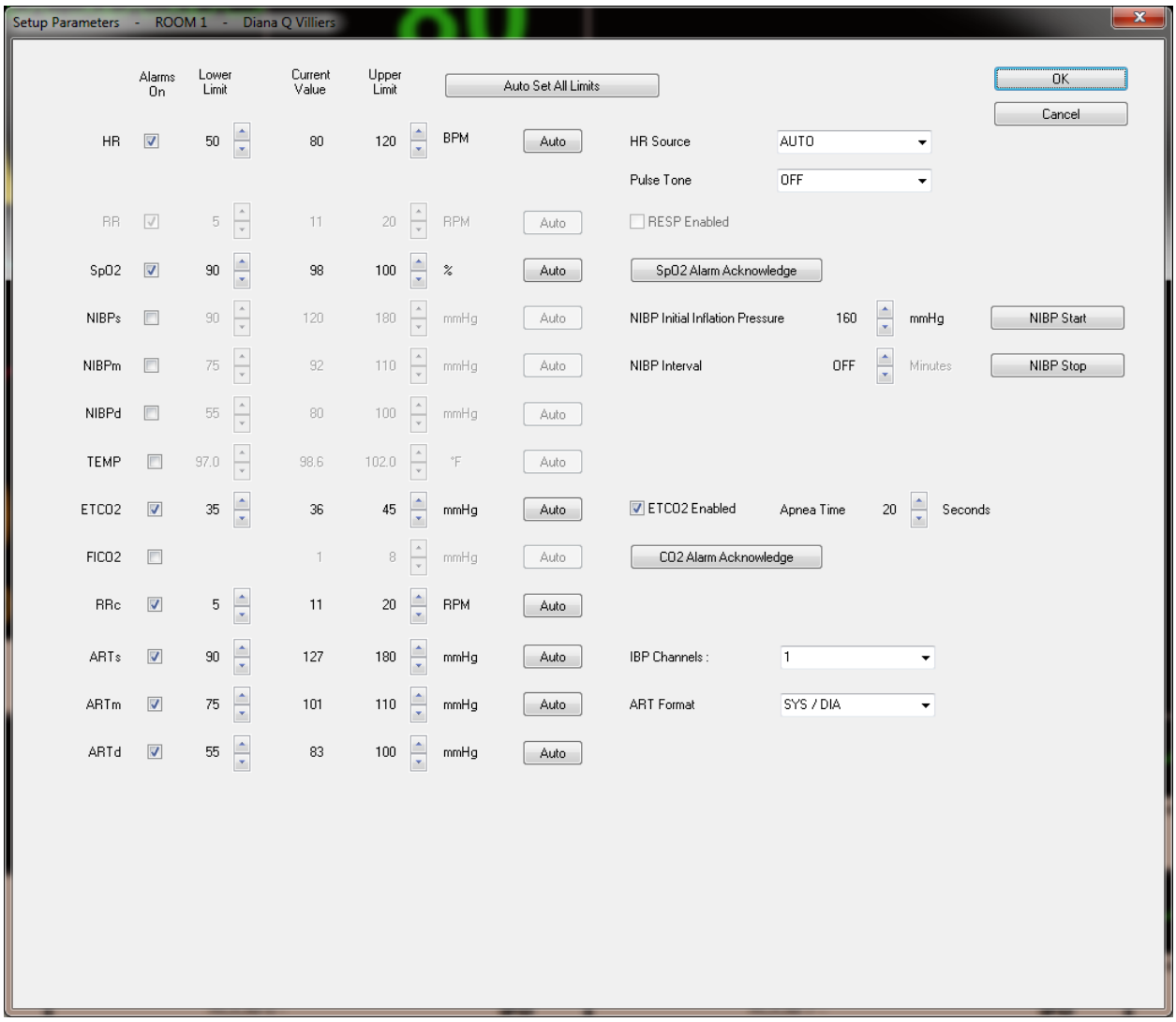


Figure 9. Setup Parameters Dialog Box

The Setup Parameters dialog box allows you to change the alarm limits for all the monitored parameters. It also allows you to specify whether or not to disable alarms for a given parameter.

Note – For a discussion of how the alarm limits and the alarms enabled/disabled settings affect the alarm behavior of the system, please refer to the Managing Alarms chapter.

The Auto Set All Limits button, along with the individual Auto buttons, provides a quick way of setting alarm limits. When you press the Auto button for a given parameter, the MPC automatically computes alarm limits based on the current value (if it has a current value that is numeric). When you press the Auto Set All Limits button, the MPC automatically computes alarm limits for all the parameters that have numeric values, just as if you hit the Auto button for each parameter separately. The rules the MPC uses for computing the alarm limits automatically are as follows:

Parameter	Lower limit adjustment	Upper limit adjustment
HR/PR, RR, ETCO2, RRc, NBPs, NBPm, NBPd, P1s, P1m, P1d	Changed to 80% of the current parameter value (or the nearest allowable value given alarm limit rules)	Changed to 125% of the current parameter value (or the nearest allowable value given alarm limit rules)
$FICO_2$	N/R	Changed to 125% of the current parameter value (or the nearest allowable value given alarm limit rules)
IPI	Changed to 75% of the current parameter value (or the nearest allowable value given alarm limit rules)	N/R
SpO_2	Changed to 95% of the current parameter value (or the nearest allowable value given alarm limit rules)	Changed to 105% of the current parameter value (or the nearest allowable value given alarm limit rules)
Temp	Changed to 98% of the current parameter value (or the nearest allowable value given alarm limit rules)	Changed to 101% of the current parameter value (or the nearest allowable value given alarm limit rules)

WARNING – Be sure to verify that that the alarm limits are set to appropriate values before exiting the Setup Parameters dialog box, especially if you are using the automatic limit setting feature.

The HR Source control tells the monitor which signal to use for computing HR. When the HR Source is set to Auto, the monitor will select from the best available signal, in the priority order: ECG, SpO2, NIBP, ART.

Setting name	Default value	Possible values
HR Source	Auto	Auto, ECG, SpO2, NIBP, ART

The Pulse Tone Source control tells the monitor whether or not to generate an audible tone for each beat that is detected during monitoring.

Setting name	Default value	Possible values
Pulse Tone Source	Off	Off, On

The NBP Start button provides a way for you to start an NBP measurement for a patient remotely. It has the same effect as pressing the NBP Start Stop key on the monitor when no measurement is in progress. The NBP Stop button provides a way for you to stop an NBP measurement remotely. It has the same effect as pressing the NBP Start Stop key on the monitor when a measurement is in progress

The NBP initial inflation pressure control allows you to specify the pressure to which the NBP cuff will be inflated at the beginning of an NBP measurement. The monitor inflates the cuff to this pressure the first time it takes a measurement on a patient. Once the monitor has made a valid measurement, it will use the computed systolic pressure from that measurement when inflating the cuff for subsequent measurements. This setting may be helpful if the monitor is having difficulty obtaining blood pressure readings on patients whose systolic pressure may be greater than 200 mmHg.

The NBP Interval control allows you to set up the monitor to take NBP measurements automatically at set time intervals. To take the monitor out of interval mode, change the setting to OFF.

Note – If the monitor loses its connection to the MPC while NBP interval mode is on, the monitor will exit interval mode.

Note – For a full discussion of how the NBP measurements work, please refer to the applicable bedside monitor user's manual.

When you have entered the changes you wanted to make, press OK. If you press Cancel, the dialog box will disappear and the settings will keep the values they had when you first brought up the dialog box.

All of the settings in the Setup Parameters dialog box can also be changed via the bedside monitor menus. When a monitor is connected, the settings at the monitor are copied to the MPC, so that both the monitor and the MPC are operating with the same setting values. You can change a setting at either the MPC or at the monitor, and the change will be reflected at the other end.

The range of possible choices for the parameter settings may be found in the Parameter Settings table in the applicable bedside monitor user manual.

Note – All Parameter Settings go back to their factory default values when you discharge the patient.

5. Changing Waveform Settings

The baseline waveform settings for newly admitted patients come from the factory default waveform settings. See the applicable bedside monitor user guide for a complete listing of the factory default waveform settings.

This chapter addresses with how you adjust the waveform settings relative to the factory default waveform settings for the needs of a specific patient.

In order to view and then change waveform settings for a specific patient, you must first select the patient's monitor into the primary view by clicking on the small view for that monitor.

WARNING – Always be sure that you check which patient is selected in the primary view before changing any settings. This is to avoid any chance of making changes to settings for one patient while thinking that you are making the changes for another patient.

Once you have selected the correct monitor into the primary view area, you can bring up the Setup Waveforms dialog box by clicking on the waveform area of the primary view.

Note – You can also bring up the Setup Waveforms dialog box via the "Setup", "Waveforms" menu selections.

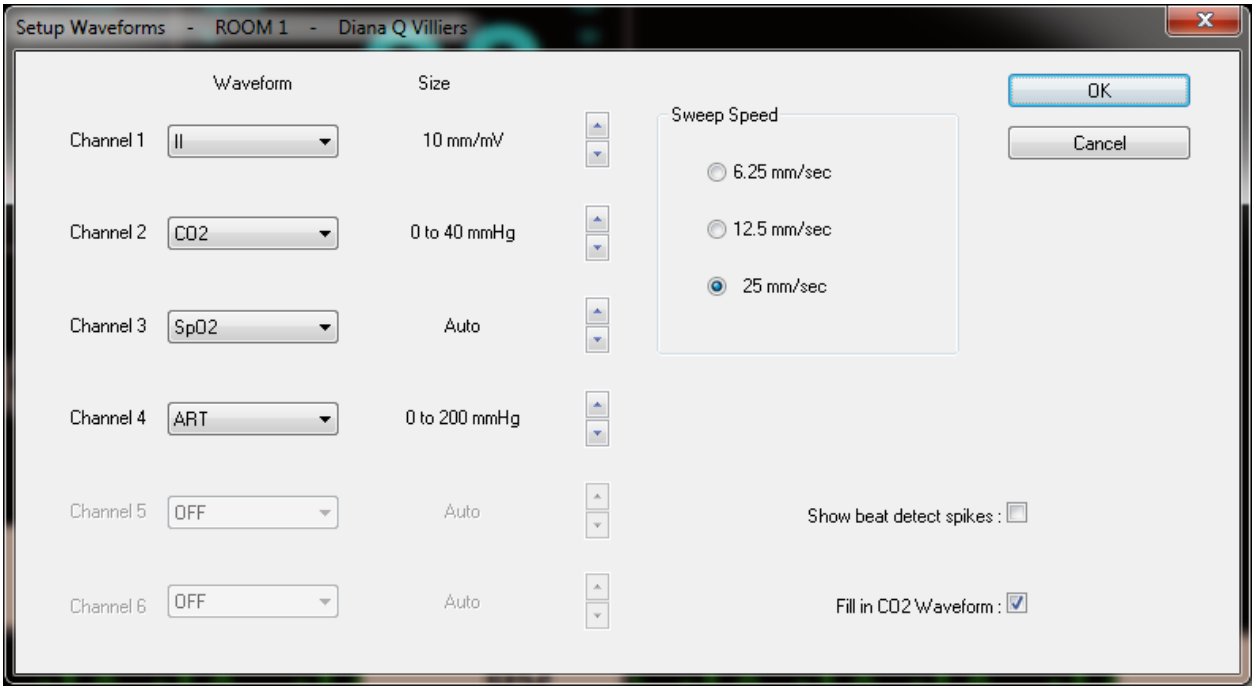


Figure 10. Setup Waveforms Dialog Box

The Setup Waveforms dialog box allows you to choose which physiological waveform to display in each of the five display channels (or three without IBP Monitoring enabled) in the large view waveform area. The waveform you choose for the top display channel will also be the waveform displayed in the small view waveform area for this patient. You can also choose the size for the ECG, CO_2, and P1 waveforms (the others are scaled automatically to fit the display). The Setup Waveforms dialog box also allows you to set the sweep speed for the erase bar, to specify whether or not you want to see beat detect spikes in the waveforms (to indicate where the monitor has detected a beat), and to specify whether or not you want the CO2 waveform to be drawn filled in.

When you have entered the changes you wanted to make, press OK. If you press Cancel, the dialog box will disappear and the settings will keep the values they had when you first brought up the dialog box.

All of the settings in the Setup Waveforms dialog box can also be changed via the bedside monitor menus. When a monitor is connected, the settings at the monitor are copied to the MPC, so that both the monitor and the MPC are operating with the same setting values. You can change a setting at either the MPC or at the monitor, and the change will be reflected at the other end.

The range of possible choices for the waveform settings may be found in the Waveform Settings table in the applicable bedside monitor user manual.

Note – All Waveform Settings go back to their factory default values when you discharge the patient.

6. Understanding Messages

This section provides tables that explain all the messages that may appear in the message area of the large patient views.

6.1. Non-physiological Messages

Message	Possible Cause	Suggested Action
Monitor connection lost	The communication link to the monitor has been interrupted	Check to make sure that the Power and Communications cable is still securely connected to the monitor. Check to make sure that the Communications Jack is still securely connected to the wall plate marked "Nightingale Monitoring System" Talk to the MPC operator and check to make sure that the MPC is still operating normally. If none of these steps is successful, contact Zoe Medical Customer Support
Battery low	Monitor battery is getting low	Reconnect the monitor to power

6.2. ECG and Heart Rate Monitoring Messages

Message	Value	Possible Cause	Suggested Action
HR < [lower limit]	[number]	The patient's heart rate has fallen below the current lower alarm limit.	Check the patient and provide any necessary clinical care. Change the alarm limit if it is no longer clinically appropriate.
HR > [upper limit]	[number]	The patient's heart rate has risen above the current upper alarm limit.	Check the patient and provide any necessary clinical care. Change the alarm limit if it is no longer clinically appropriate.
HR asystole	ASY	No QRS detected for last 4 seconds	Check the patient and provide any necessary clinical care. Check the ECG lead being used to calculate the heart rate (the top displayed lead) – make sure that the QRS amplitude on this lead is at least 0.5 mV. Change to another ECG lead to get adequate QRS amplitude. Reposition or change electrodes if no lead gives adequate QRS amplitudes. Remember the importance of good skin preparation techniques.
HR ventricular fibrillation	VF	No organized ventricular rhythm detected	Check the patient and provide any necessary clinical care. Check the ECG lead being used to calculate the heart rate (the top displayed lead) – make sure that the QRS amplitude on this lead is at least 0.5 mV. Change to another ECG lead to get adequate QRS amplitude. Reposition or change electrodes if no lead gives adequate QRS amplitudes. Remember the importance of good skin preparation techniques.

Message	Value	Possible Cause	Suggested Action
HR lead off	[blank]	Unplugged cable Broken cable Loose lead wire Faulty lead wire Dried out electrode Inoperable ECG circuit Intentional removal by clinician	Check to make sure electrodes are still securely attached to the patient, and reattach if necessary. Remember the importance of good skin preparation techniques. Check to make sure all the lead wires are still connected to the electrodes. Check to make sure the lead wires are securely connected to the monitor. Check to make sure there are no broken lead wires. Press Alarm Silence in the event of intentional removal by clinician Turn monitor off, then back on If message persists, contact Zoe Customer Support.
HR artifact	---	Patient movement Electrical noise from auxiliary equipment Bad electrode contact	Calm the patient. Isolate the patient from auxiliary equipment, if possible. Check to make sure electrodes are still securely attached to the patient, and reattach if necessary. Remember the importance of good skin preparation techniques.

6.3. Respiration Monitoring Messages

Message	Parameter Value	Possible Cause	Suggested Action
RR < [lower limit]	[number]	The patient's respiration rate has fallen below the current lower alarm limit.	Check the patient and provide any necessary clinical care. Change the alarm limit if it is no longer clinically appropriate.
RR > [upper limit]	[number]	The patient's respiration rate has risen above the current upper alarm limit.	Check the patient and provide any necessary clinical care. Change the alarm limit if it is no longer clinically appropriate.
RR out of range (too high)	---	The patient's respiration rate has risen above the maximum value the monitor can accurately detect. Electrical noise from auxiliary equipment Monitor confused by signal artifact	Check the patient and provide any necessary clinical care. Isolate the patient from auxiliary equipment, if possible. Check to make sure electrodes are still securely attached to the patient, and reattach if necessary. Remember the importance of good skin preparation techniques.
RR lead off	[blank]	Unplugged cable Broken cable Loose lead wire Faulty lead wire Dried out electrode Inoperable respiration detection circuit Intentional removal by clinician	Check to make sure electrodes are still securely attached to the patient, and reattach if necessary. Remember the importance of good skin preparation techniques. Check to make sure all the lead wires are still connected to the electrodes. Check to make sure the lead wires are securely connected to the monitor. Check to make sure there are no broken lead wires. Press Alarm Silence in the event of intentional removal by clinician. Turn monitor off, then back on If message persists, contact Zoe Customer Support.
RR artifact	---	Patient movement Electrical noise from auxiliary equipment Bad electrode contact	Calm the patient. Isolate the patient from auxiliary equipment, if possible. Check to make sure electrodes are still securely attached to the patient, and reattach if necessary. Remember the importance of good skin preparation techniques.

6.4. Pulse Oximetry Monitoring Messages

Message	Parameter Value	Possible Cause	Suggested Action
SpO_2 < [lower limit]	[number]	The patient's oxygen saturation has fallen below the current lower alarm limit.	Check the patient and provide any necessary clinical care Change the alarm limit if it is no longer clinically appropriate
SpO_2 > [upper limit]	[number]	The patient's oxygen saturation has risen above the current upper alarm limit.	Check the patient and provide any necessary clinical care Change the alarm limit if it is no longer clinically appropriate
HR < [lower limit] Note – When HR is sourced from SpO_2 the Pulse Rate is labeled in cyan as "HR (SpO2)" in the HR parameter box. PR alarm conditions annunciate as HR alarms.	[number]	The patient's pulse rate has fallen below the current lower alarm limit.	Check the patient and provide any necessary clinical care Change the alarm limit if it is no longer clinically appropriate
HR > [upper limit] Note – When HR is sourced from SpO_2 the Pulse Rate is labeled in cyan as "HR (SpO2)" in the HR parameter box. PR alarms use the HR alarm limit settings. PR alarm conditions annunciate as HR alarms.	[number]	The patient's pulse rate has risen above the current upper alarm limit.	Check the patient and provide any necessary clinical care Change the alarm limit if it is no longer clinically appropriate
SpO_2 check sensor placement	---	Sensor has become detached from patient or is not fully inserted on patient's finger Sensor has been intentionally removed by the clinician Excessive ambient light Bad sensor (no red light coming from sensor)	Check to make sure the sensor is attached fully and securely to the patient Select "SpO_2 Alarm Pause" in the Setup SpO_2 menu Cover the sensor with opaque material, such as a towel, to reduce ambient light Reattach the sensor, possibly on a smaller or larger finger Replace sensor if there is no red light coming from it.

Message	Parameter Value	Possible Cause	Suggested Action
SpO_2 weak signal	---	Poor perfusion Large tissue mass Nail polish Bad SpO_2 sensor	Check the patient and provide any necessary clinical care Warm the patient's extremities if needed Reattach the sensor on a smaller finger Remove any nail polish that may be interfering with the red light Replace the SpO_2 sensor
HR weak signal Note – When HR is sourced from SpO_2 the Pulse Rate will be labeled in cyan as "HR (SpO2)" in the HR parameter box. A weak pulse rate signal will annunciate as "HR weak signal."	---	Poor perfusion Large tissue mass Nail polish Bad SpO_2 sensor	Check the patient and provide any necessary clinical care Warm the patient's extremities if needed Reattach the sensor on a smaller finger Remove any nail polish that may be interfering with the red light Replace the SpO_2 sensor
SpO_2 replace sensor	---	Bad SpO_2 sensor Incorrect set-up within the monitor.	Replace the SpO_2 sensor. Contact Zoe Customer Support.
SpO_2 unplugged	[blank]	SpO_2 sensor not connected to SpO_2 cable	Check to make sure the SpO_2 sensor is securely connected to the SpO_2 cable on the monitor
SpO_2 artifact	---	Patient movement or coughing Hemodynamic interference Small tissue mass	Calm the patient Reattach the sensor on another finger with less movement Reattach the sensor on a larger finger

6.5. NBP Monitoring Messages

Message	Value	Possible Cause	Suggested Action
NBPs < [lower limit]	[number]	The patient's systolic pressure has fallen below the current lower alarm limit.	Check the patient and provide any necessary clinical care. Change the alarm limit if it is no longer clinically appropriate.
NBPs > [upper limit]	[number]	The patient's systolic pressure has risen above the current upper alarm limit.	Check the patient and provide any necessary clinical care. Change the alarm limit if it is no longer clinically appropriate.
NBPm < [lower limit]	[number]	The patient's mean pressure has fallen below the current lower alarm limit.	Check the patient and provide any necessary clinical care. Change the alarm limit if it is no longer clinically appropriate.
NBPm > [upper limit]	[number]	The patient's mean pressure has risen above the current upper alarm limit.	Check the patient and provide any necessary clinical care. Change the alarm limit if it is no longer clinically appropriate.
NBPd < [lower limit]	[number]	The patient's diastolic pressure has fallen below the current lower alarm limit.	Check the patient and provide any necessary clinical care. Change the alarm limit if it is no longer clinically appropriate.
NBPd > [upper limit]	[number]	The patient's diastolic pressure has risen above the current upper alarm limit.	Check the patient and provide any necessary clinical care. Change the alarm limit if it is no longer clinically appropriate.
NBP weak signal	---	Poor limb perfusion Improper cuff placement Cuff size too large for the patient	Check the patient and provide any necessary clinical care Check to make sure the cuff is wrapped properly, with the "artery" mark lined up over the brachial artery Check the limb circumference against the recommended range as printed on the cuff, to insure the cuff is not too big

Message	Value	Possible Cause	Suggested Action
NBP artifact	---	Persistent patient movement or coughing Hemodynamic interference (varying pulse amplitudes due to breathing or valvular problem) Hose is clogged or leaking	Check the patient and provide any necessary clinical care Calm the patient Move the cuff to another limb with less movement If no obvious patient motion, switching to the other limb may still help in the case of hemodynamic interference Check the cuff and hose for signs of damage
NBP cuff leak	---	Leaky cuff or hose	Check for leaks in the cuff or hose and replace if necessary
NBP blocked hose – check patient	---	Pinched Hose	Check the patient and insure that the cuff is deflated Check for kinks or obstructions in the hose Replace hose if necessary
NBP measurement time exceeded	---	The measurement time limit (2¼ minutes) was exceeded, usually due to motion artifact	See suggestions for "NBP artifact" Repeat the measurement
NBP needs service	---	Monitor has detected a hardware problem	Check the patient and insure that the cuff is deflated Turn the monitor off, then on. If message persists, contact Zoe Customer Support.
NBP cannot measure	---	Initial inflation pressure may not have been high enough (if patient's systolic pressure is above 200 mmHg) Patient movement	Repeat the measurement (monitor will automatically adjust to using a higher initial inflation pressure if needed)

6.6. CO_2 Monitoring Messages

Message	Parameter Value	Possible Cause	Suggested Action
$ETCO_2$ < [lower limit]	[number]	The patient's $ETCO_2$ parameter value has fallen below the current lower alarm limit.	Check the patient and provide any necessary clinical care. Change the alarm limit if it is no longer clinically appropriate.
$ETCO_2$ > [upper limit]	[number]	The patient's $ETCO_2$ parameter value has risen above the current upper alarm limit.	Check the patient and provide any necessary clinical care. Change the alarm limit if it is no longer clinically appropriate.
$FICO_2$ > [upper limit]	[number]	The patient's $FICO_2$ parameter value has risen above the current upper alarm limit.	Check the patient and provide any necessary clinical care. Change the alarm limit if it is no longer clinically appropriate.
RRc < [lower limit]	[number]	The patient's respiration rate has fallen below the current lower alarm limit. No breath has been detected for 30 seconds.	Check the patient and provide any necessary clinical care. Change the alarm limit if it is no longer clinically appropriate.
RRc > [upper limit]	[number]	The patient's respiration rate has risen above the current upper alarm limit.	Check the patient and provide any necessary clinical care. Change the alarm limit if it is no longer clinically appropriate.
RRc out of range (too high)	---	The patient's respiration rate has risen above the maximum value the monitor can accurately detect. Monitor confused by signal artifact.	Check the patient and provide any necessary clinical care.
CO2 beyond accuracy range	---	The patient's CO_2 values have risen above the upper limit of the monitor's accuracy range.	Continue to monitor. Check the patient and provide any necessary clinical care.
IPI < [lower limit]	[number]	The patient's IPI parameter value has fallen below the current lower alarm limit.	Check the patient and provide any necessary clinical care. Change the alarm limit if it is no longer clinically appropriate.
CO_2 Warming Up	---	CO_2 module is preparing to acquire data.	Allow more time.

Message	Parameter Value	Possible Cause	Suggested Action
IPI age range not set	---	For pediatric patients, the age range must be set to correctly determine IPI.	Set the age range in the CO_2 setup screen.
CO_2 Unplugged	---	CO_2 sampling line is not connected.	Connect the CO_2 sampling line to the monitor. Disable CO_2 monitoring in the monitor Parameters menu if these parameters are no longer clinically required.
CO_2 Occluded Line	---	CO_2 sampling line cannot be cleared due to moisture or other obstruction.	Replace the sampling line. If connected to scavenging system, disconnect to see if message disappears.
CO_2 Purging Line	---	Microstream module is trying to clear excess humidity	If the message disappears, resume usage. If the purging operation is unsuccessful or the Occluded Line message appears, disconnect the line and reattach. If the problem continues, replace the sampling line.
CO2 no sampling line	---	CO_2 sampling line has become unplugged from the connector on the front of the module.	Reconnect the sampling line.
CO2 check adapter	---	1) The lens within IRMA airway adapter has become fogged or blocked. 2) IRMA airway adapter has become unplugged from the sensor.	Replace or reconnect the airway adapter.
CO2 check sensor	---	CO_2 module has reported an internal error.	Disconnect the module or adapter from the monitor and then reconnect, or power-cycle the monitor. Contact Customer Support if the problem continues.
CO_2 Problem Detected	---	CO_2 interface has encountered a problem.	Check the CO_2 subsystem including sampling line and exhaust port. Verify that the exhaust port is not blocked.

6.7. IBP Monitoring Messages

Message	Parameter Value	Possible Cause	Suggested Action
P1s < [lower limit] P1m < [lower limit] P1d < [lower limit]	[number]	The patient's invasive systolic/diastolic/mean pressure has fallen below the current lower alarm limit.	Check the patient and provide any necessary clinical care. Verify that the values are not due to artifact by checking the position of the patient, cables and transducer. Zero set the pressure if necessary. Change the alarm limit if it is no longer clinically appropriate.
P1s > [upper limit] P1m > [upper limit] P1d > [upper limit]	[number]	The patient's invasive systolic/diastolic/mean pressure has risen above the current upper alarm limit.	Check the patient and provide any necessary clinical care. Verify that the values are not due to artifact by checking the position of the patient, cables and transducer. Zero set the pressure if necessary. Change the alarm limit if it is no longer clinically appropriate.
P1 signal out of range [low] P1 signal out of range [high]	--	The invasive signal is out of range.	Verify the position of the patient, cables and transducer. Zero set the pressure if necessary
P1 unplugged	--	IBP cable or transducer not plugged	Verify that the cable and transducer are properly connected.
Unable to zero	--	Stopcock is not open	Open the stopcock and check tubing and cables
Zero required	--	IBP channel not zeroed	Zero the IBP channel
Zero required and 60 seconds has expired	--	IBP channel not zeroed	Zero the IBP channel
Calibration required	--	IBP channel requires calibration	Arrange for calibration service of the IBP channel
Calibration in progress	--	IBP channel calibration is in progress	Wait until the calibration process is completed
Cannot calibrate	--	Calibration failed	Contact Zoe Medical Customer Support
ART: Check Transducer	--	ART IBP pressure below 10mmHg	Check ART catheter to ensure that it is properly positioned and connected

6.8. Temperature Monitoring Messages

Message	Value	Possible Cause	Suggested Action
TEMP < [lower limit]	[number]	The patient's temperature has fallen below the current lower alarm limit.	Check the patient and provide any necessary clinical care. Change the alarm limit if it is no longer clinically appropriate.
TEMP > [upper limit]	[number]	The patient's temperature has risen above the current upper alarm limit.	Check the patient and provide any necessary clinical care. Change the alarm limit if it is no longer clinically appropriate.
TEMP unplugged	[blank]	Temperature probe disconnected	Check to make sure the temperature probe is connected to the temperature cable. Check to make sure the temperature cable is connected to the monitor.
TEMP out of range	---	The patient's temperature has risen above the maximum value the monitor can accurately detect. There is a problem with the connections or with the hardware.	Check the patient and provide any necessary clinical care. Check the temperature cable connections. Turn the monitor off, then on. If message persists, contact Zoe Customer Support.
TEMP needs service	---	Monitor has detected a hardware problem.	Turn the monitor off, then on. If message persists, contact Zoe Customer Support.

7. Managing Alarms

You can configure the Nightingale Monitoring System to sound an alarm when a patient's physiological parameter goes beyond a predetermined limit. For example, you can configure the system to sound an alarm when the patient's heart rate goes above 120 bpm or goes below 50 bpm. Alarm monitoring can be individually configured for each physiological parameter.

In the Nightingale Monitoring System, alarm monitoring is supported both at the MPC and at the bedside monitor. When the monitor and MPC are connected, they use the same alarm monitoring settings. If a setting is changed at either the monitor or the MPC, then the setting is updated at both the monitor and the MPC. This is also true for alarm silencing. For example, if you silence an alarm at the monitor, it is also silenced at the MPC.

The bedside monitor also sounds alarms when the remaining battery time is too low, and when the connection between the monitor and MPC is lost for some reason.

7.1. Alarm Basics

7.1.1. What the Alarm Tones Mean

If you hear a…	It represents…
Five higher-pitch tones (three quick, pause, two more) repeated every 8 seconds	A "high grade" alarm indicating an immediately life-threatening condition (e.g. asystole or ventricular fibrillation)
Three medium-pitch tones repeated every 15 seconds	A "medium grade" alarm indicating a physiological condition that may be serious (e.g. parameter limit violations)
A single lower-pitch tone repeated every 20 seconds	A "low grade" alarm indicating a technical condition (e.g. lead off)

7.1.2. What the Alarm Colors Mean

If you see a…	And …	It represents…
Red background parameter box and message area	Flashing color – twice per second	A "high grade" alarm is currently active and has not been acknowledged
	Solid color with audio paused symbol to the left of the message area	A "high grade" alarm is currently active but has already been silenced
Yellow background parameter box and message area	Flashing color – once every 2 seconds	A "medium grade" alarm is currently active and has not been acknowledged
	Solid color with audio paused symbol to the left of the message area	A "medium grade" alarm is currently active but has already been silenced
Cyan background parameter box and message area	Solid color	A "low grade" alarm is currently active and has not been acknowledged
	Solid color with audio paused symbol to the left of the message area	A "low grade" alarm is currently active but has already been silenced

Since several parameters could be alarming at the same time, the alarm tone and color will reflect the highest grade alarm condition that is currently active on the bedside monitor. Refer to the tables in Section 7.2 Alarm Conditions to see how different alarm conditions are categorized by grade.

An alarm is "acknowledged" by pressing the Alarm Silence button on the MPC or at the bedside monitor (this will place the monitor into the "audio paused" state).

7.1.3. What the Icons Mean

Icon	Icon Name	Description
	Audio Paused	A crossed-bell indicates that alarm audio annunciation tones are paused for this monitor (if a new alarm comes in while audio is paused, the alarm audio annunciation will resume automatically)
	Alarms Paused	A crossed-triangle indicates that alarms are paused for this monitor (no alarms will be annunciated for this monitor while alarms are paused)

7.1.4. How to Silence Alarms

You can silence (acknowledge) an alarm for a monitor by selecting the monitor into the primary view area, then pressing the "Alarm Silence" button on the MPC tool bar.

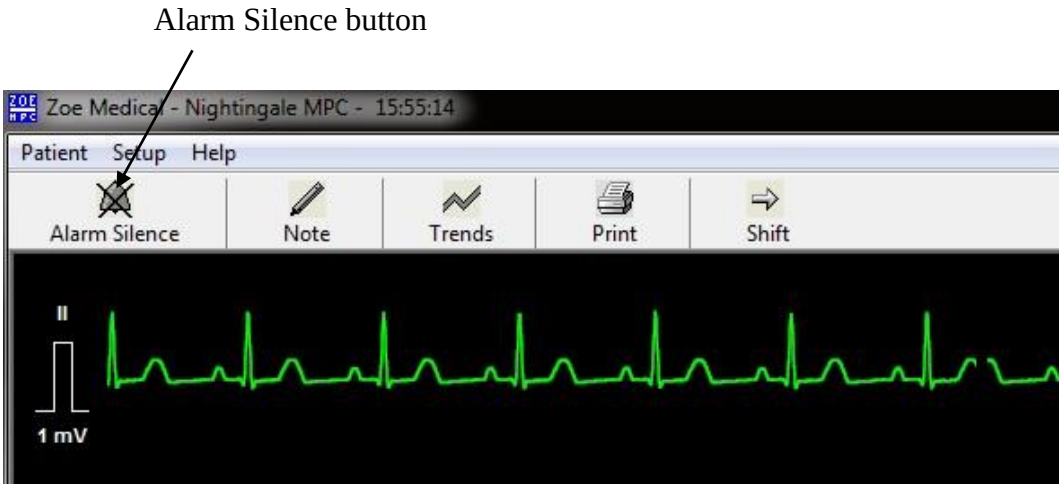


Figure 11. Alarm Silence Button

You can also silence an alarm by doing either of the following:

- Disabling alarms, either for the alarming parameter alone (using the Parameter Settings dialog box) or for the entire monitor (using the Alarm Pause button)
- If the alarm was a limit violation alarm, by changing the parameter alarm limits such that the current value is no longer out of limits

If the alarm condition that you are acknowledging is still true when you silence it, the areas of the screen that were flashing because of the alarm will change to solid color backgrounds.

Sometimes an alarm condition will have gone away before you have a chance to silence it. To see what the alarm condition was, select the monitor into the primary view area, then click on the message area to bring up the Alarm Log.

7.1.5. Alarm Log

When you click on the primary view message area, the system displays the Alarm Log dialog box. This dialog box has three main sections: one for showing the current alarm status, one for showing the alarm history, and one for showing the ECG strip associated with stored alarm events. You can use the mouse or keyboard to scroll through the list of stored alarm events, and print a hard copy if desired. You can also select the "All Alarm Events" option, which lists not only the HR alarms but also alarms for other parameters, along with any setting changes or other user interactions that affect the system alarm behavior.

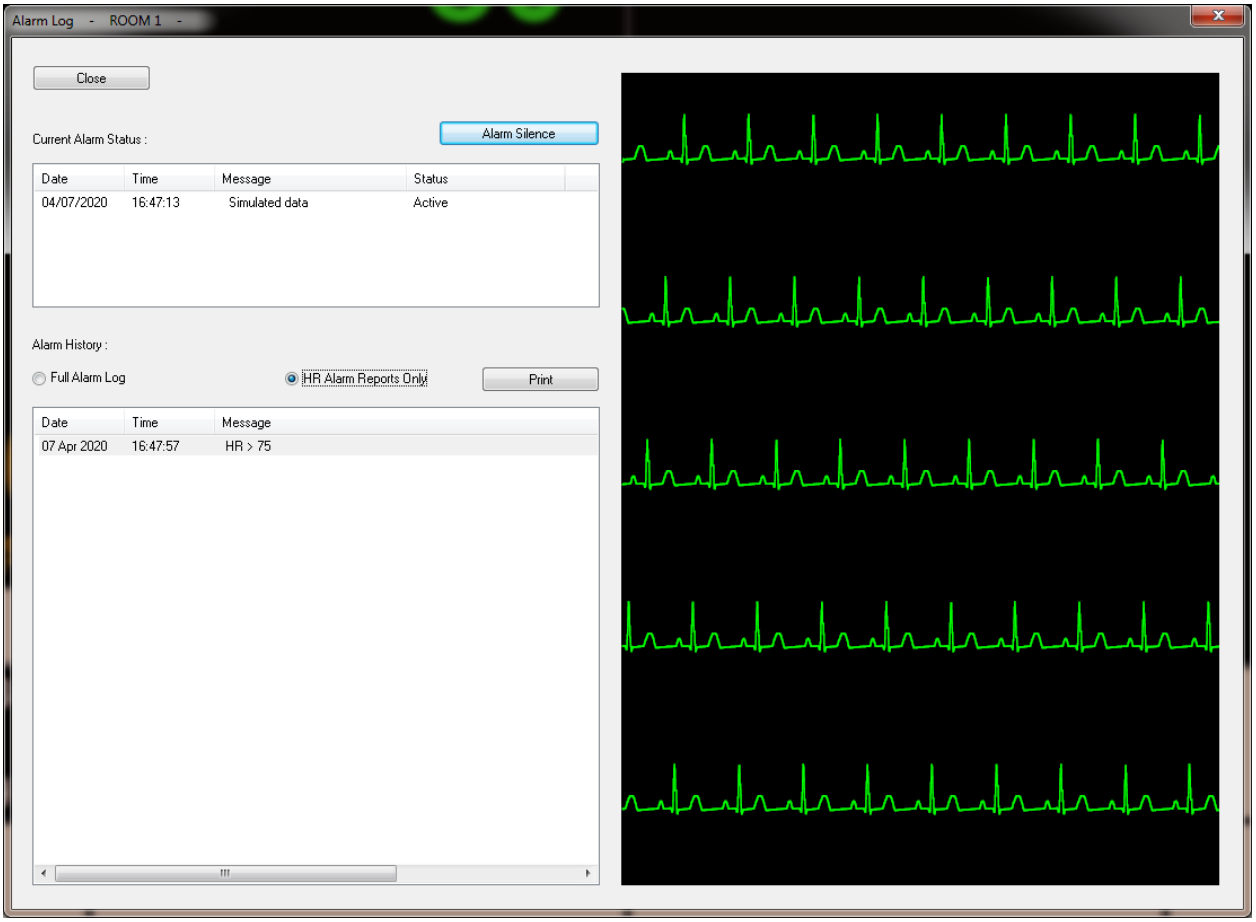


Figure 12. Alarm Log Dialog Box

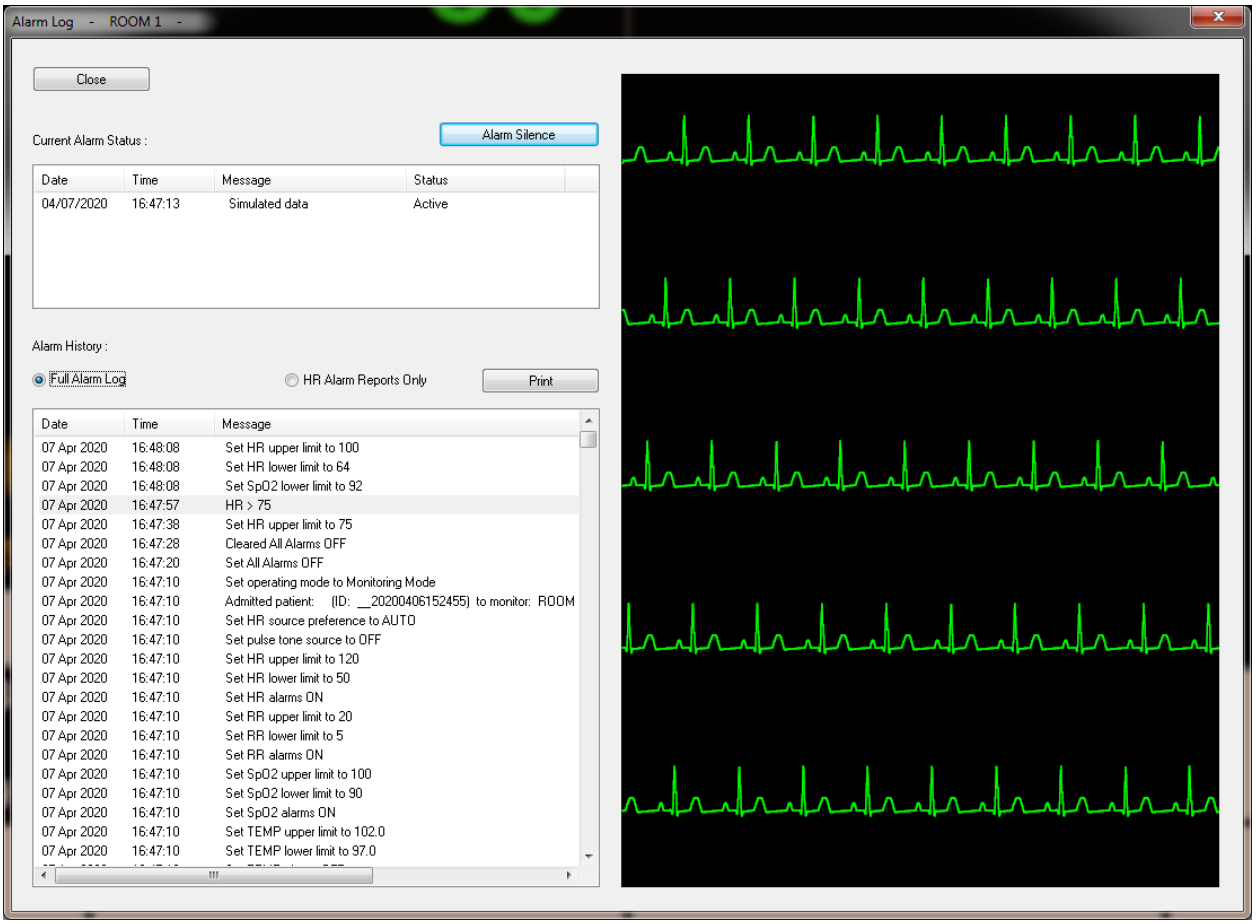


Figure 13. “All Alarm Events" Option Selected

If you press the Acknowledge button in the Alarm Log dialog box, it has the same effect as if you pressed the Alarm Silence button on the tool bar.

7.1.6. How to Pause Alarms

Sometimes you may find it helpful or necessary to pause alarms temporarily (for instance when moving or bathing a patient). You can pause the alarms for a monitor by selecting the monitor into the primary view area, then selecting "Alarm Pause" from the "Patient" menu. This will cause the Alarm Pause icon to appear in the primary view message area, and also in the small view name area for the monitor.

When you pause alarms for a monitor, a timer starts. When the timer expires, the monitor goes back to its normal state in which alarms are annunciated. You can re-enable alarms for the monitor before the timer expires by selecting "Alarm Resume" from the "Patient" menu while the monitor is selected in the MPC's primary view.

WARNING – When you pause alarms for a monitor, you will not hear any tones or see any visual indications of alarms from that monitor for as long as the alarms remain paused. The "Paused" state is meant to provide a way to avoid nuisance alarms, but it also means you need to be especially attentive to the patient's waveforms and parameter values while the MPC is in the "Paused " state.

7.1.7. Alarm Validation

Under the password-protected "Setup", "System" menu option, there is a feature called Alarm Validation that you can either enable or disable. When this feature is enabled, certain parameter limit violations are not considered to be in alarm until they have existed for a certain time period, as listed below:

Limit Violation	Alarm Validation Time
HR/PR Upper Limit	5 seconds
HR/PR Lower Limit	5 seconds
RR Upper Limit	5 seconds
SpO_2 Upper Limit	5 seconds
SpO_2 Lower Limit	5 seconds
TEMP Upper Limit	5 seconds
TEMP Lower Limit	5 seconds

The purpose of this feature is to reduce nuisance alarms in which parameter values may go out of limits for a very short time.

7.1.8. Alarm Handling at Start-up

When the monitor is initially powered-up or brought out of standby, alarms will not be annunciated for a given parameter until the lead set or probe has been applied to the patient. This prevents nuisance alarms for parameters that are not being monitored on a given patient.

7.1.9. Alarm Reports

When the monitor is connected to the MPC, an alarm report is stored at the MPC for each medium- and high-grade alarm that is annunciated for the HR parameter. This includes upper and lower limit violations, Asystole and Ventricular Fibrillation. These reports include a snapshot of the monitor's physiological parameters and an ECG waveform "strip."

When the monitor is disconnected from the MPC, the 10 most recent alarm reports are stored within the monitor. The reports are stored even if power is cycled. When the monitor is reconnected to the MPC, the reports are transferred to the MPC. Manually-generated reports (via the monitor's print key) are also stored while in Transport Mode, and are counted as part of the 10 reports.

See the discussion on the Alarm Log for more details on alarm reports.

7.2. Alarm Conditions

The tables in this section contain lists of all the conditions the MPC can detect for each parameter, along with alarm characteristics of the condition. The first row in each table contains the "normal condition" for the parameter, and the other rows contain the "alarm conditions" for the parameter.

Columns in these tables have the following meaning:

- Condition – the name of the condition
- Display value – the value displayed for the parameter when the condition is true (applies only to physiological parameters)
- Alarm grade – as defined above
- Message – the text of a message displayed in the message area when the condition is true
- Annunciation type – as defined above

Note – The delay between alarm annunciation on the bedside monitor and remote annunciation on the MPC central station should be no more than 1 sec.

Communication Link Conditions:

Condition	Display Value	Alarm Grade	Message	Annunciation Type
Monitor connection okay	N/A	None	None	Persistent
Monitor connection lost	N/A	Low	Monitor connection lost	Persistent

Battery Conditions:

Condition	Display Value	Alarm Grade	Message	Annunciation Type
Battery okay	N/A	None	None	Persistent
Battery low	N/A	Low	Battery low	One time

HR Conditions:

Note – When HR is sourced from SpO_2, the heart rate is labeled in cyan as "HR (SpO2)" in the HR parameter box. When HR is sourced from NIBP, the heart rate is labeled in orange as "HR (NIBP)." When HR is sourced from an ART-labeled IBP, the heart rate is labeled in red as "HR (ART)."

Condition	Display Value	Alarm Grade	Message	Annunciation Type
HR within limits	<Number>	None	None	Persistent
HR < LL	<Number>	Medium	HR < LL	Persistent
HR > UL	<Number>	Medium	HR > UL	Persistent
HR Asystole	ASY	High	HR asystole	Persistent
HR Ventricular Fibrillation	VF	High	HR ventricular fibrillation	Persistent
HR Lead-off (after start-up/standby)	<Blank>	None	None	Persistent
HR Lead-off (after leads applied)	<Blank>	Low	HR lead off	One Time
HR Artifact	---	Low	HR artifact	Persistent

RR Conditions:

Condition	Display Value	Alarm Grade	Message	Annunciation Type
RR within limits	<NUM>	None	None	None
RR < LL	<NUM>	Medium	RR < LL	Persistent
RR > UL	<NUM>	Medium	RR > UL	Persistent
RR > 120 breaths/min	---	Low	RR out of range (too high)	Persistent
Lead-off (after start-up / standby)	<Blank>	None	None	Persistent
Lead-off (after leads applied)	<Blank>	Low	RR lead off	One Time
Resp Artifact	---	Low	RR artifact	Persistent

SpO_2 Conditions:

Condition	Display Value	Alarm Grade	Message	Annunciation Type
SpO_2 within limits	<NUM>	None	None	None
SpO_2 < LL	<NUM>	Medium	SpO_2 < LL	Persistent
SpO_2 > UL	<NUM>	Medium	SpO_2 > UL	Persistent

Condition	Display Value	Alarm Grade	Message	Annunciation Type
SpO_2 Bad Probe	---	Low	SpO_2 replace sensor	One Time
SpO_2 Cannot regulate LED intensity (after start-up/standby)	<Blank>	None	None	Persistent
SpO_2 Cannot regulate LED intensity (after finger in probe)	---	Low	SpO_2 check sensor placement	Persistent
SpO_2 Pulsations Too Weak	---	Low	SpO_2 weak signal	Persistent
SpO_2 Probe is disconnected (after start-up/standby)	<Blank>	None	None	Persistent
SpO_2 Probe is disconnected (after finger in probe)	---	Low	SpO_2 unplugged	One Time
SpO_2 motion artifact	---	Low	SpO_2 artifact	Persistent

PR Conditions:

Note – When PR is sourced from SpO_2, the pulse rate is labeled in cyan as "HR (SpO2)" in the HR parameter box. When PR is sourced from NIBP, the pulse rate is labeled in orange as "PR (NIBP)." PR alarm conditions annunciate as HR alarms.

Condition	Display Value	Alarm Grade	Message	Annunciation Type
PR within limits	<NUM>	None	None	None
PR < LL	<NUM>	Medium	HR < LL	Persistent
PR > UL	<NUM>	Medium	HR > UL	Persistent
PR Bad Probe	---	Low	SpO_2 replace sensor	One Time
PR Cannot regulate LED intensity (after start-up/standby)	<Blank>	None	None	Persistent
PR Cannot regulate LED intensity (after finger in probe)	---	Low	SpO_2 check sensor placement	Persistent
PR Pulsations Too Weak	---	Low	SpO_2 / HR weak signal	Persistent
PR Probe is disconnected (after start-up/standby)	<Blank>	None	None	Persistent
PR Probe is disconnected (after finger in probe)	---	Low	SpO_2 unplugged	One Time
PR motion artifact	---	Low	SpO_2 artifact	Persistent

NBP Conditions:

Condition	Display Value	Alarm Grade	Message	Annunciation Type
NBPs within limits	<NUM>	None	None	None
NBPs < LL	<NUM>	Medium	NBPs < LL	One Time
NBPs > UL	<NUM>	Medium	NBPs > UL	One Time
NBPd within limits	<NUM>	None	None	None
NBPd < LL	<NUM>	Medium	NBPd < LL	One Time
NBPd > UL	<NUM>	Medium	NBPd > UL	One Time
NBP Pulsations Too Small	---	Low	NBP weak signal	One Time
NBP Too Much Motion	---	Low	NBP artifact	One Time
NBP Leaky Cuff or Hose	---	Low	NBP cuff leak	One Time
NBP Pinched Hose	---	Medium	NBP blocked hose -- check patient	One Time
NBP Measurement Time-out (2¼ minutes)	---	Low	NBP measurement time exceeded	One Time
NBP Pump or Valve Failure or NBP Safety Timer Expired or Other H/W-related problem	---	Medium	NBP needs service	One Time
NBP Bad Profile Shape	---	Low	NBP cannot measure	One Time

CO_2 Conditions:

Condition	Display Value	Alarm Grade	Message	Annunciation Type
$ETCO_2$ within limits	<Number>	None	None	Persistent
$ETCO_2$ < [lower limit]	<Number >	Medium	$ETCO_2$ < LL	Persistent
$ETCO_2$ > [upper limit]	<Number >	Medium	$ETCO_2$ > UL	Persistent
$FICO_2$ within limits	<Number>	None	None	Persistent
$FICO_2$ > [upper limit]	<Number >	Medium	$FICO_2$ > UL	Persistent
CO_2 beyond accuracy range	---	Medium	CO2 beyond accuracy range	Persistent
$RRCO_2$ within limits	<Number>	None	None	Persistent
$RRCO_2$ < [lower limit]	<Number >	Medium	Resp < LL	Persistent
$RRCO_2$ > [upper limit]	<Number >	Medium	Resp > UL	Persistent
RR out of range (high)	---	Medium	RRc out of range (high)	Persistent
CO_2 Unplugged (after start-up/standby)	<Blank>	None	None	Persistent
CO2 Unplugged (after line connected)	<Blank>	Low	CO_2 unplugged	One Time
Power up (10 to 30 seconds)	<Blank>	None	CO_2 warming up	Persistent
In Self-Maintenance Mode (auto-zero)	<Blank>	None	CO_2 zeroing	Persistent
ISA sampling line is not connected	<Blank>	None	CO2 no sampling line	Persistent
IRMA adapter is unplugged or fogged	<Blank>	None	CO2 check adapter	Persistent
Module is purging the line	<Blank>	None	CO_2 purging line	Persistent
Line is occluded	---	Low	CO_2 occluded line	Persistent
CO_2 module malfunction	---	Low	CO2 check sensor	Persistent
CO_2 module interface problem	---	Low	CO2 problem detected	One Time
Calibration in progress	<Blank>	None	CO_2 calibrating	Persistent
Calibration completed – ok	N/A	Alert	CO_2 calibration ok	Alert
Calibration failed – supplied gas is not close to expected value	N/A	Alert	CO_2 cal failed – wrong gas	Alert
Calibration failed – occlusion during known gas sampling	N/A	Alert	CO_2 cal failed	Alert
Calibration failed – FilterLine unplugged during calibration	N/A	Alert	CO_2 cal failed	Alert

IBP (P1) Conditions:

Condition	Display Value	Alarm Grade	Message	Annunciation Type
Systolic pressure within limits	<Number>	None	None	Persistent
Systolic pressure < LL	<Number >	Medium	P1s < LL	Persistent
Systolic pressure > UL	<Number >	Medium	P1s > UL	Persistent
Mean pressure within limits	<Number>	None	None	Persistent
Mean pressure < LL	<Number >	Medium	P1m < LL	Persistent
Mean pressure > UL	<Number >	Medium	P1m > UL	Persistent
Diastolic pressure within limits	<Number>	None	None	Persistent
Diastolic pressure < LL	<Number >	Medium	P1d < LL	Persistent
Diastolic pressure > UL	<Number >	Medium	P1d > UL	Persistent
Pressure pulse rate within limits	<Number>	None	None	Persistent
Pressure pulse rate < LL	<Number >	Medium	HR < LL	Persistent
Pressure pulse rate > UL	<Number >	Medium	HR > UL	Persistent
Pressure signal out of range (low)	<Number >	Medium	P1 out of range (low)	Persistent
No pulse rate due to static pressure	---	Low	HR weak signal	Persistent
Unplugged (after start-up/standby)	<Blank>	None	None	Persistent
Unplugged (after line connected)	<Blank>	Low	P1 unplugged	One Time
Zero required (when transducer is initially connected)	<Blank>	None	P1 needs zeroing	Persistent
Zero required and 60 seconds has expired.	---	Low	P1 needs zeroing	Persistent
Zero in progress	<Blank>	None	P1 zeroing	Persistent
Zero failed – pulsatile waveform	N/A	Alert	P1 unable to zero - unstable	Alert
Zero failed – out of range	N/A	Alert	P1 unable to zero - out of range	Alert
Calibration required	<Blank>	None	P1 needs calibration	Persistent
Calibration required and 60 seconds has expired.	---	Low	P1 needs calibration	Persistent
Calibration in progress	<Blank>	None	P1 calibrating	Persistent
Calibration failed – pulsatile waveform	N/A	Alert	P1 unable to calibrate - unstable	Alert
Calibration failed – bad cal resistor	---	Low	P1 needs service	Persistent

Temperature Conditions:

Condition	Display Value	Alarm Grade	Message	Annunciation Type
TEMP within limits	<NUM>	None	None	None
TEMP < LL	<NUM>	Medium	TEMP < LL	Persistent
TEMP > UL	<NUM>	Medium	TEMP > UL	Persistent
Temp > 50 degrees C	---	Low	TEMP out of range	Persistent
TEMP probe disconnected	---	Low	TEMP unplugged	One Time
TEMP bad calibration resistor	---	Low	TEMP needs service	Persistent

7.3. Manual Self-Test of the Alarm System

You can manually self-test test the alarm system by the following steps.

- Select a monitor that is being monitored at the MPC and bring it up in the large view area on the MPC
- Turn SpO_2 alarms on (via the Parameter Setup Menu)
- At the monitor, unplug the SpO_2 sensor
- After 10 seconds, the MPC should sound a low grade alarm tone and display the message "SpO_2 unplugged."

8. Viewing Trends

8.1. Trend Data Storage

The MPC stores one trend sample per minute for each monitored physiological parameter. The term "trend sample interval" is thus defined to be 1 minute. If a parameter has one or more non-numeric values (such as LEAD OFF) during any particular trend sample interval, the sample value stored at the end of the interval will be the last non-numeric value. The only exception to this is that if the HR parameter has the value ASY or VFIB during a trend sample interval, this ASY or VFIB value is preserved and stored at the end of the interval, regardless of what other values the HR parameter may take on during the rest of the interval. If the parameter has only numeric values throughout the trend sample interval, the sample value stored will be the average of the numeric values.

The MPC stores trend samples for up to the past 14 days, for up to 32 patients.

8.2. How to View Trends

You can view the trends for a patient by selecting the patient's monitor into the primary view area, then pressing the Trends button.

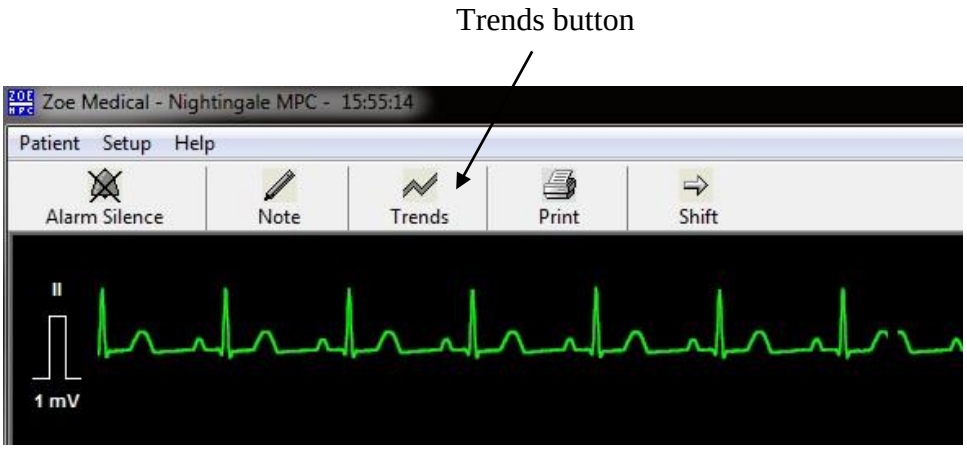


Figure 14. Trends Button

This will bring up the Trends dialog box:

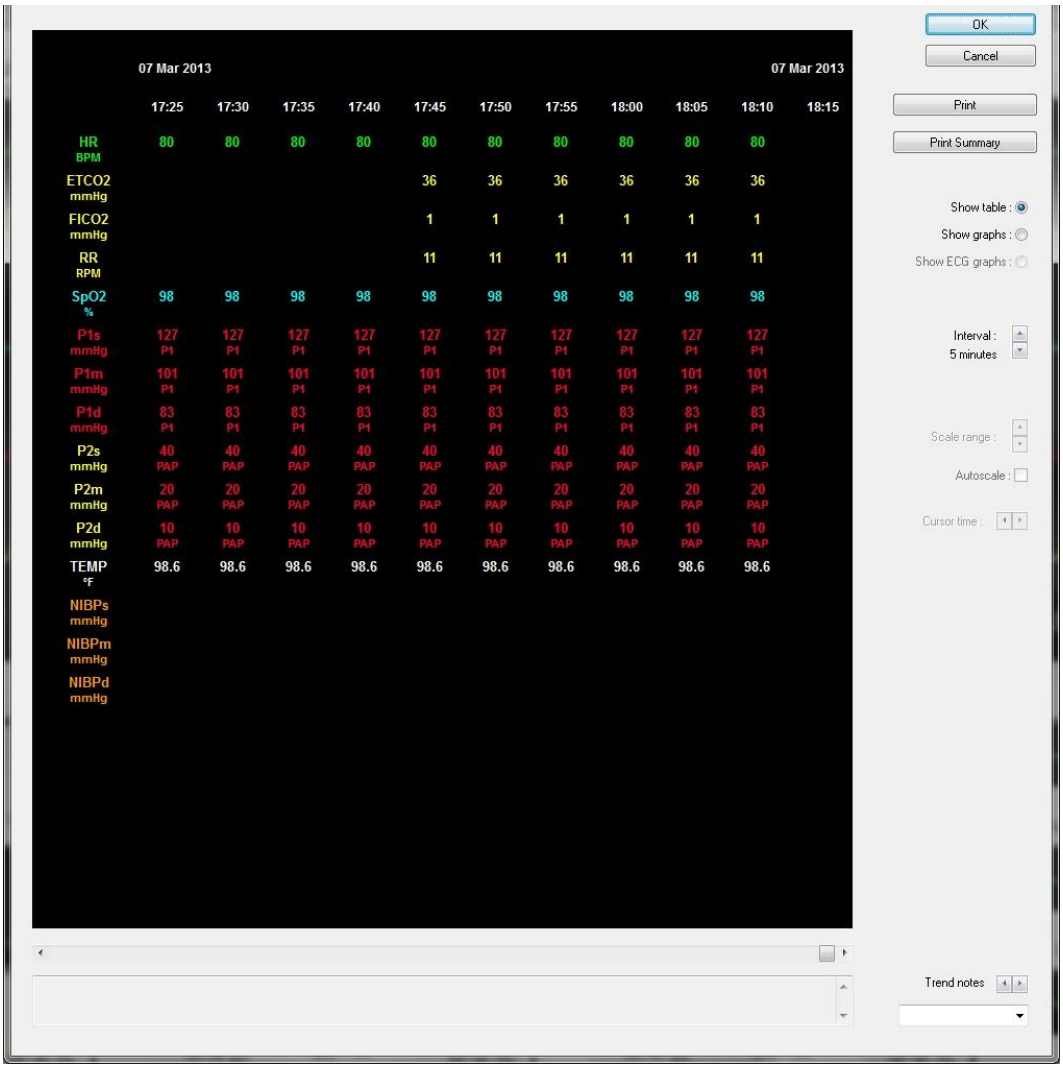


Figure 15. MPC Trend Dialog Box Showing Trend Table

The Trend dialog box allows you to view all of the patient's stored trend data in either a tabular or graphical form.

For tabular trends, you can specify the time range shown in the table (which indirectly controls the time interval between columns of the table). NBP measurements that were taken at times in between the regular column intervals

are shown in special columns with a box around the time to show that it was not a regular interval time.

The Print Summary button provides a way for you to print a Summary Report, using the time intervals as set on the trend table display. For more details about the summary report, please refer to the chapter "Printing Reports."

To view the patient's trend data in a graphical format, select the Show graphs option. This will cause the Trend dialog box to redraw the trend data as a graph::

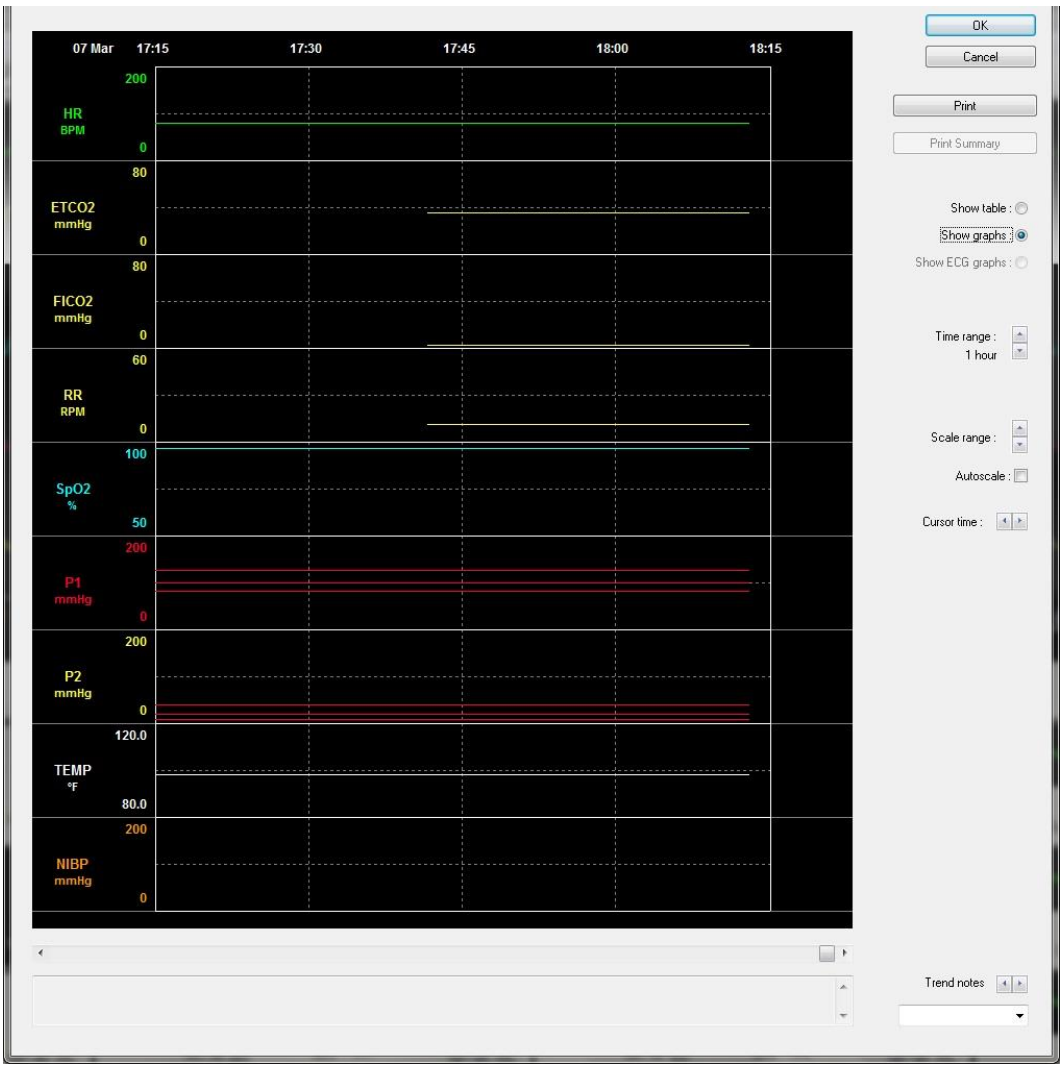


Figure 16. MPC Trend Dialog Box Showing Trend Graphs

You can change the amount of time represented by the graph using the Time range control. You can examine a different part of the patient's trend record by using the slider bar just below the graph to select a different time period.

You can change the scale range used to graph the trends using the Scale range control. You can use the Autoscale check box if you want the trend scales to be computed automatically.

Trend Settings

The following table shows the ranges for the controls on in the Trends dialog box.

Setting name	Default value	Possible values
Trend time range (in graphical view)	1 hour	1, 2, 4, 8, 12, 16, 24 hours
Trend time range (in tabular view)	100 minutes	10, 50, 100, 150 minutes 5, 10, 20 hours
Trend HR/PR scale	0 to 200 bpm	0 to150, 0 to 200, 0 to 250, Auto
Trend $ETCO_2$	0 to 80 mmHg	0 to 60, 0 to 80, 0 to 100, Auto
Trend $FICO_2$	0 to 80 mmHg	0 to 60, 0 to 80, 0 to 100, Auto
Trend RR scale	0 to 60 bpm	0 to 40, 0 to 60, 0 to 80, Auto
Trend SpO_2 scale	50 to 100%	50 to 100, Auto
Trend P1 s/d/m scale	0 to 200 mmHg	0 to 150, 0 to 200, 0 to 250, Auto
Trend P2 s/d/m scale	0 to 200 mmHg	0 to 150, 0 to 200, 0 to 250, Auto
Trend TEMP scale	80.0 to 120.0 °F	80.0 to 120.0 °F, Auto 25.0 to 50.0 °C, Auto (Note – trends show the current system display units)
Trend NBP s/d/m scale	0 to 200 mmHg	0 to 150, 0 to 200, 0 to 250, Auto

How to use the Trend Cursor

By left-clicking anywhere on the graph you can bring up a cursor, which is drawn on the graph as a one-pixel wide vertical white line. When the cursor is showing, you can see the exact values each parameter had at the time represented by the current cursor position. These values are displayed to the right of the graphs. If you hold down the left mouse button and drag the cursor across the graph, you can see the parameter values for any time on the graph. You can also use the cursor time arrow controls to move the cursor by slight increments.

For time periods when a parameter did not have a numerical value that can be graphed, the graph shows a gap. When you move the cursor over this gap, you may see the "---" symbol in the area that tells what the parameter values were at the cursor time. To get more information about what the parameter value was, you can move the mouse cursor over the "---" symbol, which causes a text message explaining the parameter value to appear temporarily in the Trend Notes window at the bottom of the Trends dialog box.

How to Zoom in on a Trend Graph

If there is a section of the graph that contains some interesting details, you can "zoom in" on this section. To do this, just left-click and drag the mouse in either the time scale area or the parameter scale area. As you do this, the part of the graph that will be zoomed in appears as a white region. When you release the left mouse button, the white region will expand to fill the whole graph.

Trend Notes

At the bottom of the Trends dialog box are several controls that allow you to see the trend notes that have been entered for the patient. You can use the arrow controls to scroll backwards and forwards through the notes, or you can use the pull down list to select a specific for review. For information about how to enter the trend notes, please refer to the section on How to Enter Trend Notes.

Trend Printing

Please refer to the following section on How to Print Trend Data.

8.3. How to Print Trend Data

To print a paper copy of the trend data, first get the data you want into view, using either the trend graph view or the trend table view. Then just press the Print button. The printed report will show the same information you see on the screen.

8.4. How to Enter Trend Notes

To enter a note that will be saved and viewable along with a patient's trend data, first select the patient's monitor into the primary view area, then press the Note button.

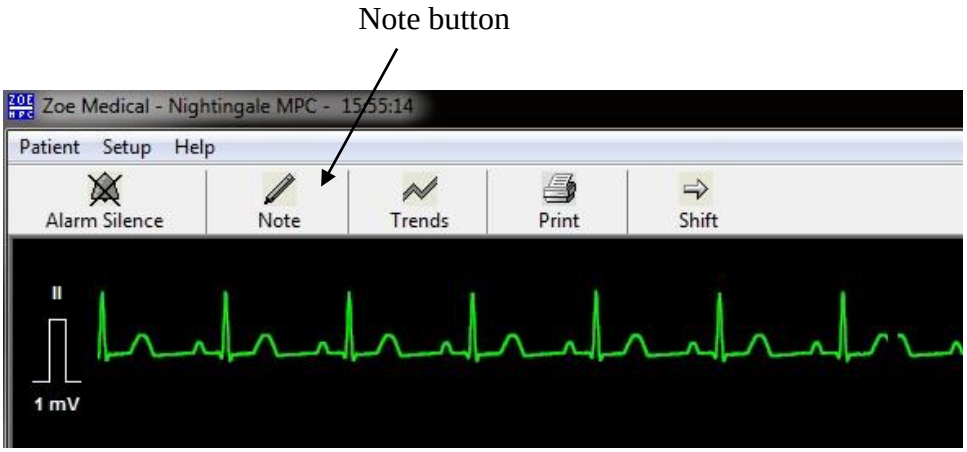


Figure 17. Note button

This brings up the Note dialog box:

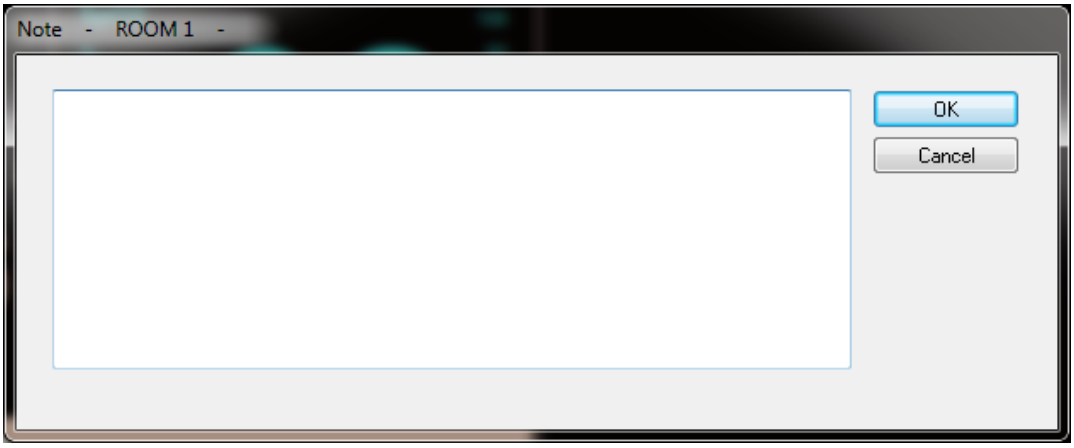


Figure 18. Note dialog box

You can type in any text you want, then press OK. If you press Cancel, the note will not be saved in the patient's record.

WARNING – Always be sure that you check which patient is selected in the primary view before entering a patient note. This is to avoid any chance of entering information in a patient note for one patient while thinking that you are entering the note for another patient. There is no way to go back and remove or change a note once it is stored. To help avoid mistakes, the name of the patient for whom the note will be stored is displayed at the top of the Note dialog box.

9. Printing Reports

9.1. Vital Signs Report

To print vital signs report for a patient, first select the patient's monitor into the primary view area, then press the "Print" button on the MPC tool bar.

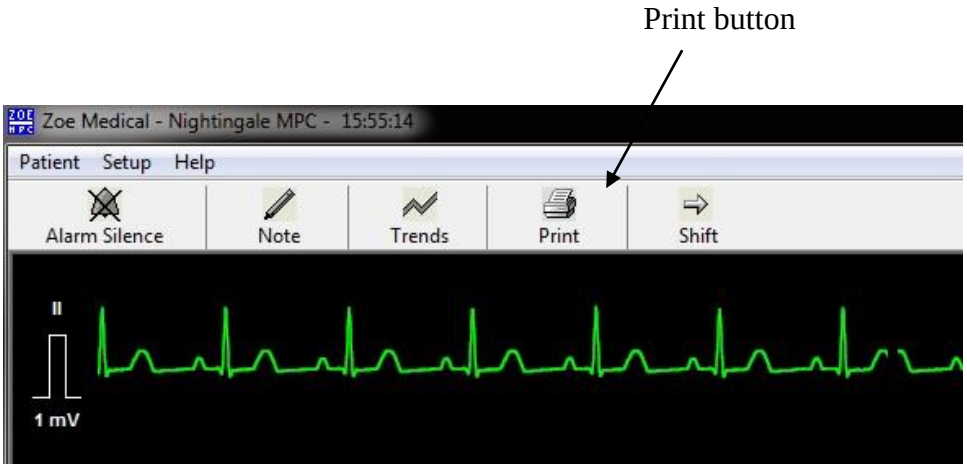


Figure 19. Print button

The vital signs report prints whichever ECG lead is currently the top ECG lead on the MPC display, or ECGII if no ECG lead is on the MPC display.
The report shows 35 seconds of data (5 strips of 7 second's worth each) on a single page. The time for the data is the 35 seconds previous to the time when you press the button.

A scanned sample of a vital signs report is shown on the following page.

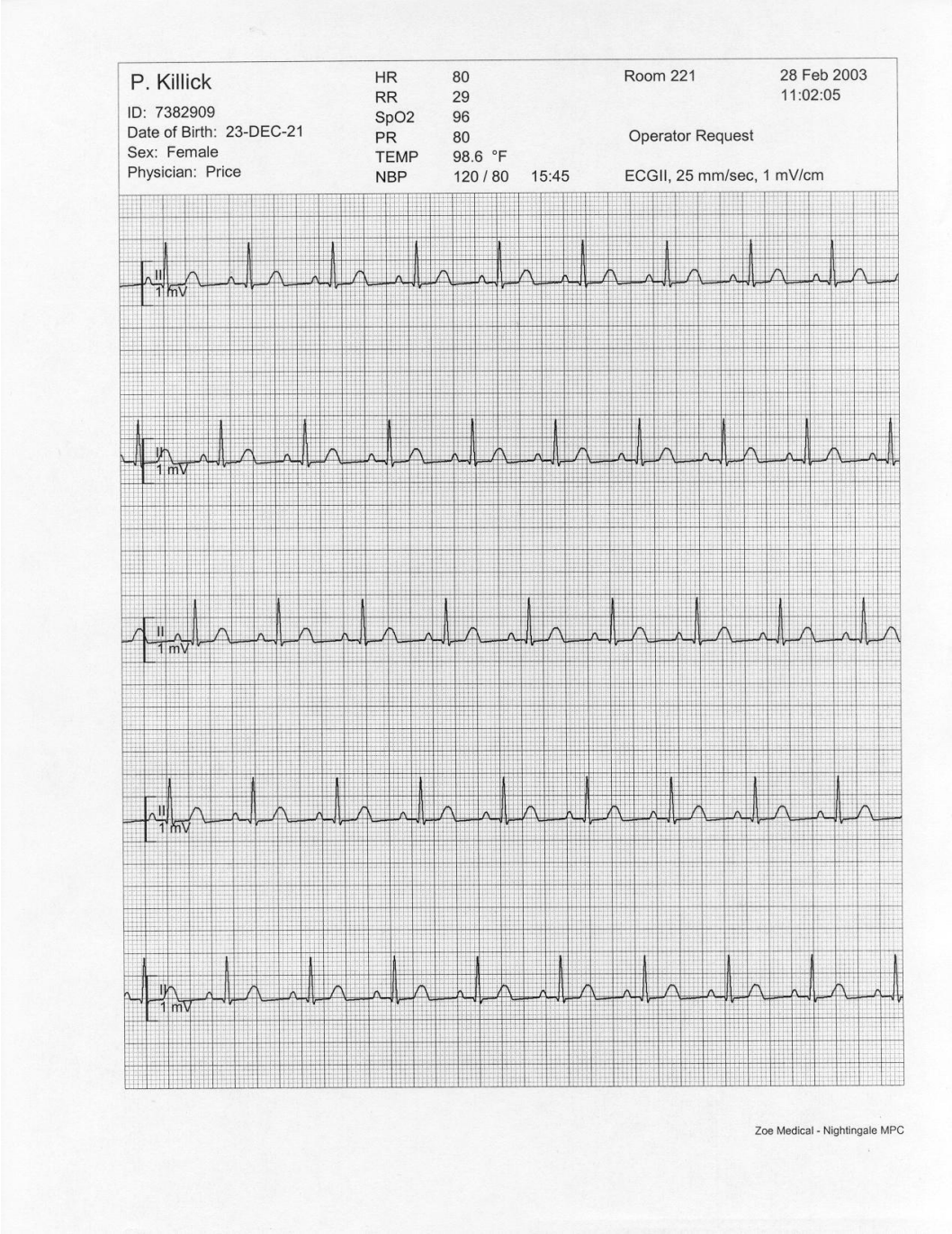


Figure 20. Vital Signs Report

9.2. Summary Report

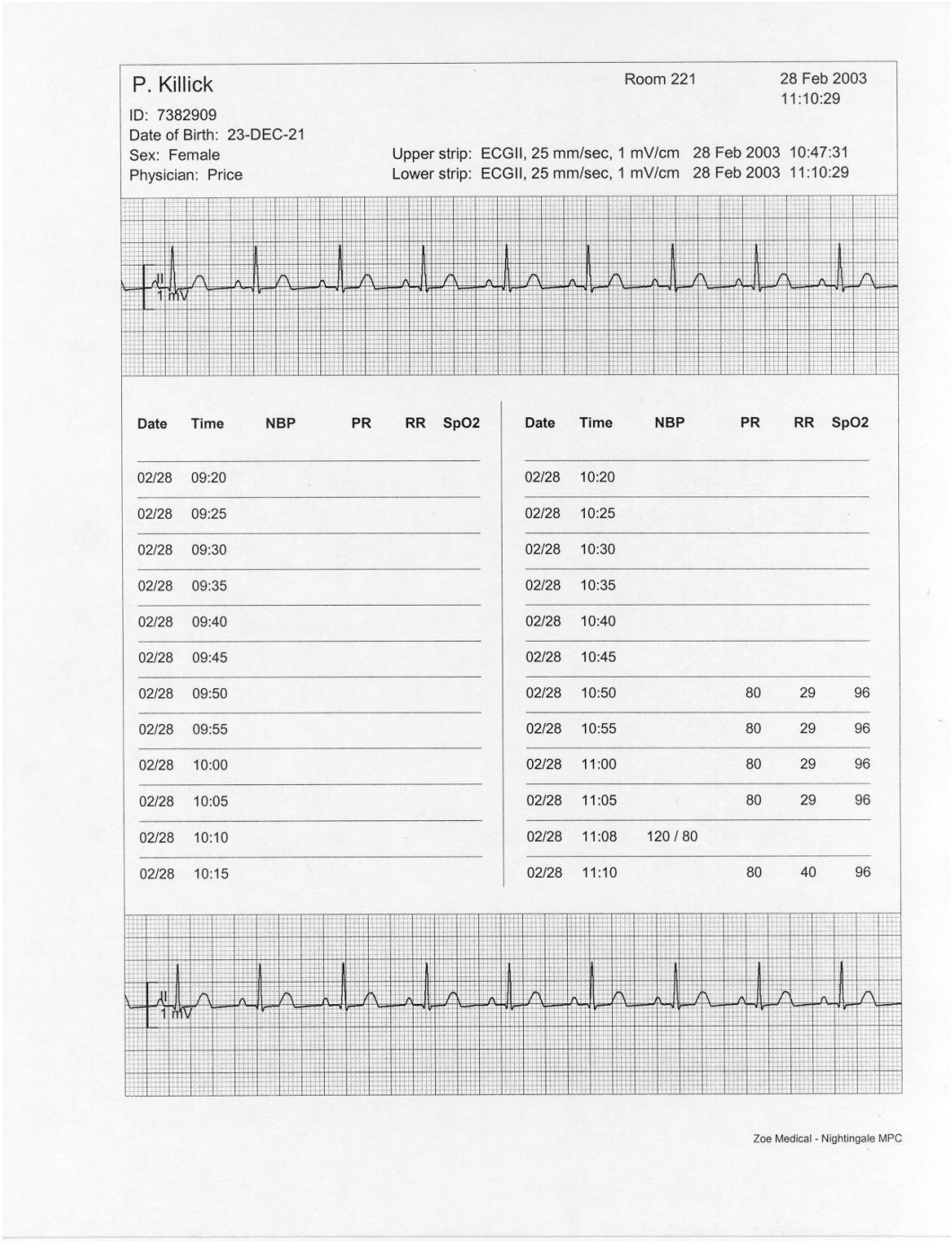
To print a summary report for a patient, first select the patient's monitor into the primary view area, then select "Print Summary Report" from the "Patient" menu. You can also print a summary report by pressing the "Print Summary" button in the trend table dialog box.

The summary report combines features of a vital signs report and a trend report. At the top of the summary report is a 7-second strip, which is saved by the monitor automatically when the patient is first admitted. The monitor will save this strip when it has noticed two minutes' worth of good ECG data (that is, ECG data that is not interrupted by lead off).

The middle part of the summary report shows trend values in a tabular format. The intervals in the table are the same as the ones you last selected in the trend table screen display.

The bottom part of the summary report shows another 7-second strip, which shows the 7 seconds just prior to when you request the summary report.

A scanned sample of a summary report is shown on the following page.



P. Killick
ID: 7382909
Date of Birth: 23-DEC-21
Sex: Female
Physician: Price

Room 221
28 Feb 2003
11:10:29

Upper strip: ECGII, 25 mm/sec, 1 mV/cm 28 Feb 2003 10:47:31
Lower strip: ECGII, 25 mm/sec, 1 mV/cm 28 Feb 2003 11:10:29

Date	Time	NBP	PR	RR	SpO2
02/28	09:20				
02/28	09:25				
02/28	09:30				
02/28	09:35				
02/28	09:40				
02/28	09:45				
02/28	09:50				
02/28	09:55				
02/28	10:00				
02/28	10:05				
02/28	10:10				
02/28	10:15				

Date	Time	NBP	PR	RR	SpO2
02/28	10:20				
02/28	10:25				
02/28	10:30				
02/28	10:35				
02/28	10:40				
02/28	10:45				
02/28	10:50		80	29	96
02/28	10:55		80	29	96
02/28	11:00		80	29	96
02/28	11:05		80	29	96
02/28	11:08	120 / 80			
02/28	11:10		80	40	96

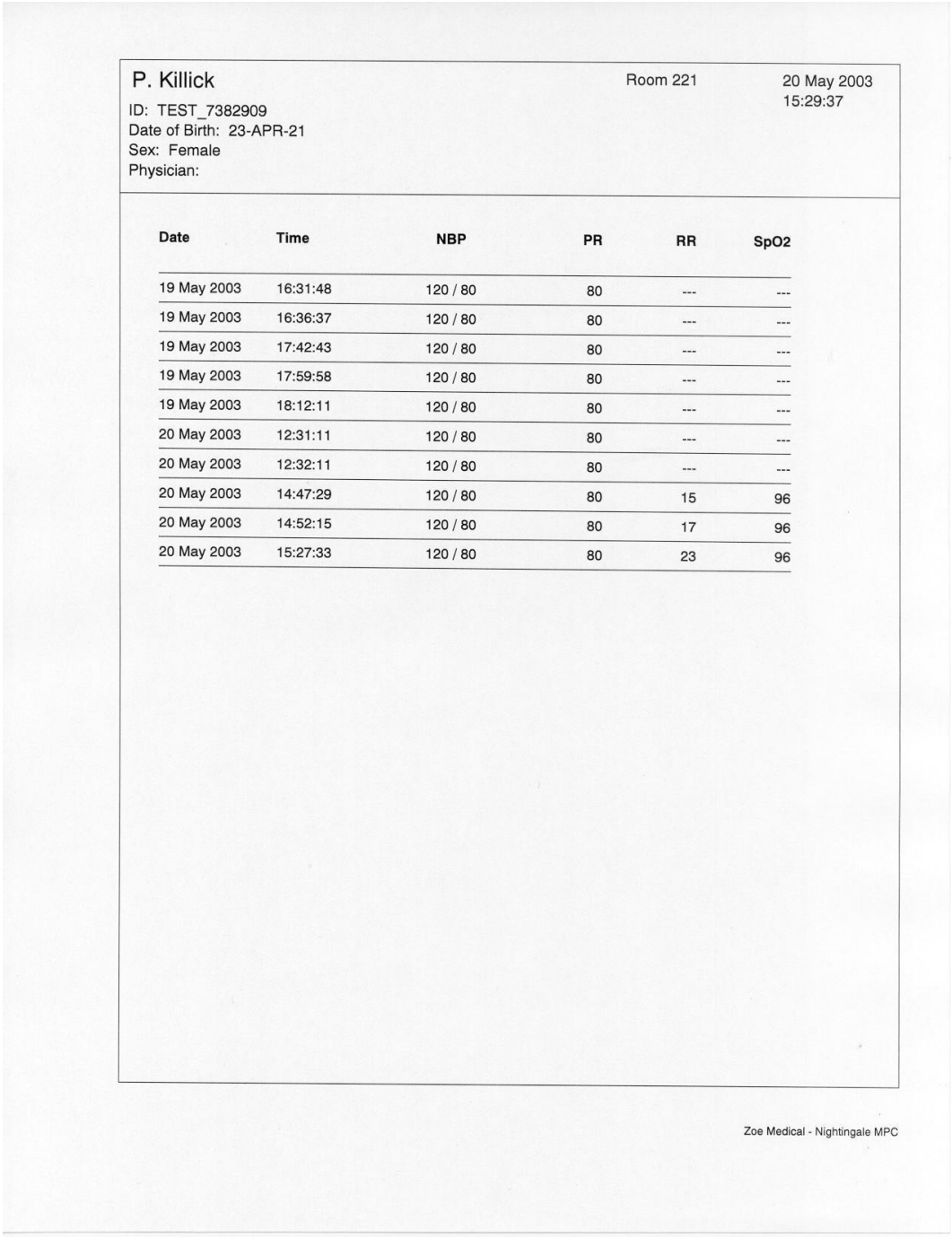
Zoe Medical - Nightingale MPC

Figure 21. Summary Report

9.3. Monitor Trend Reports

(PPM3 Only) The MPC provides a way to print simple trend reports from the monitor. If you bring up the trends display on a monitor and press the "Print All" button, the monitor sends a trend report to the MPC.

A scanned sample of a monitor trend report is shown on the following page.



P. Killick
ID: TEST_7382909
Date of Birth: 23-APR-21
Sex: Female
Physician:

Room 221

20 May 2003
15:29:37

Date	Time	NBP	PR	RR	SpO2
19 May 2003	16:31:48	120 / 80	80	---	---
19 May 2003	16:36:37	120 / 80	80	---	---
19 May 2003	17:42:43	120 / 80	80	---	---
19 May 2003	17:59:58	120 / 80	80	---	---
19 May 2003	18:12:11	120 / 80	80	---	---
20 May 2003	12:31:11	120 / 80	80	---	---
20 May 2003	12:32:11	120 / 80	80	---	---
20 May 2003	14:47:29	120 / 80	80	15	96
20 May 2003	14:52:15	120 / 80	80	17	96
20 May 2003	15:27:33	120 / 80	80	23	96

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Figure 22. Monitor Trend Report

10. Standby Mode

If you ever have a need to suspend monitoring for a patient temporarily (for example while bathing the patient, or while the patient is temporarily disconnected from the monitor), you can put the monitor into "Standby Mode."

To do this, first select the patient's monitor into the primary view by clicking on the small view for that monitor. Once you have selected the correct monitor into the primary view area, select the "Patient", "Standby" item from the MPC's main menu.

WARNING – Always be sure that you check which patient is selected in the primary view before entering Standby Mode. This is to avoid any chance of putting one patient's monitor into Standby Mode while thinking that you are putting another patient's monitor into Standby Mode.

CAUTION – Putting a monitor into Standby Mode will suspend alarm processing and trend data collection for as long as the monitor remains in Standby Mode.

After you put a monitor into standby mode, the words "Standby Mode" appear in the waveform area:

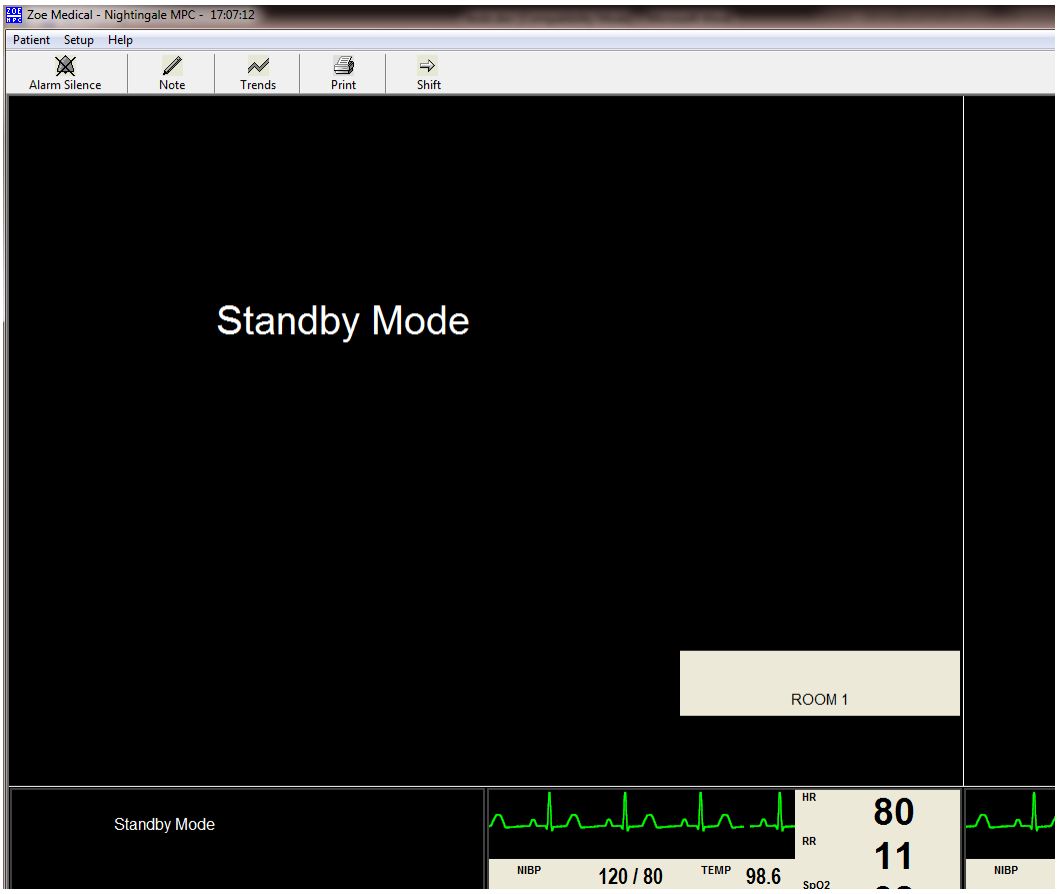

Figure 23. Portion of MPC Display Showing Standby Mode Indications

While a monitor is in Standby Mode, alarm processing is suspended. To take a monitor out of Standby Mode, select the monitor into the primary view by clicking on the small view for that monitor, then select the "Patient", "Standby" item from the MPC's main menu. Normal monitoring operations will resume. The monitor will also exit Standby Mode if someone presses a key on the monitor front panel.

11. Transport Mode

If you ever have a need to disconnect a patient's monitor from the network without discharging the patient, in order to avoid "connection lost" alarms, you can put the monitor into "Transport Mode."

To do this, first select the patient's monitor into the primary view by clicking on the small view for that monitor. Once you have selected the correct monitor into the primary view area, select the "Patient", "Transport" item from the MPC's main menu.

WARNING – Always be sure that you check which patient is selected in the primary view before entering Transport Mode. This is to avoid any chance of putting one patient's monitor into Transport Mode while thinking that you are putting another patient's monitor into Transport Mode.

CAUTION – Putting a monitor into Transport Mode will suspend central alarm processing and trend data collection for as long as the monitor remains in Transport Mode.

After you put a monitor into transport mode, the words "Transport Mode" appear in the waveform area:

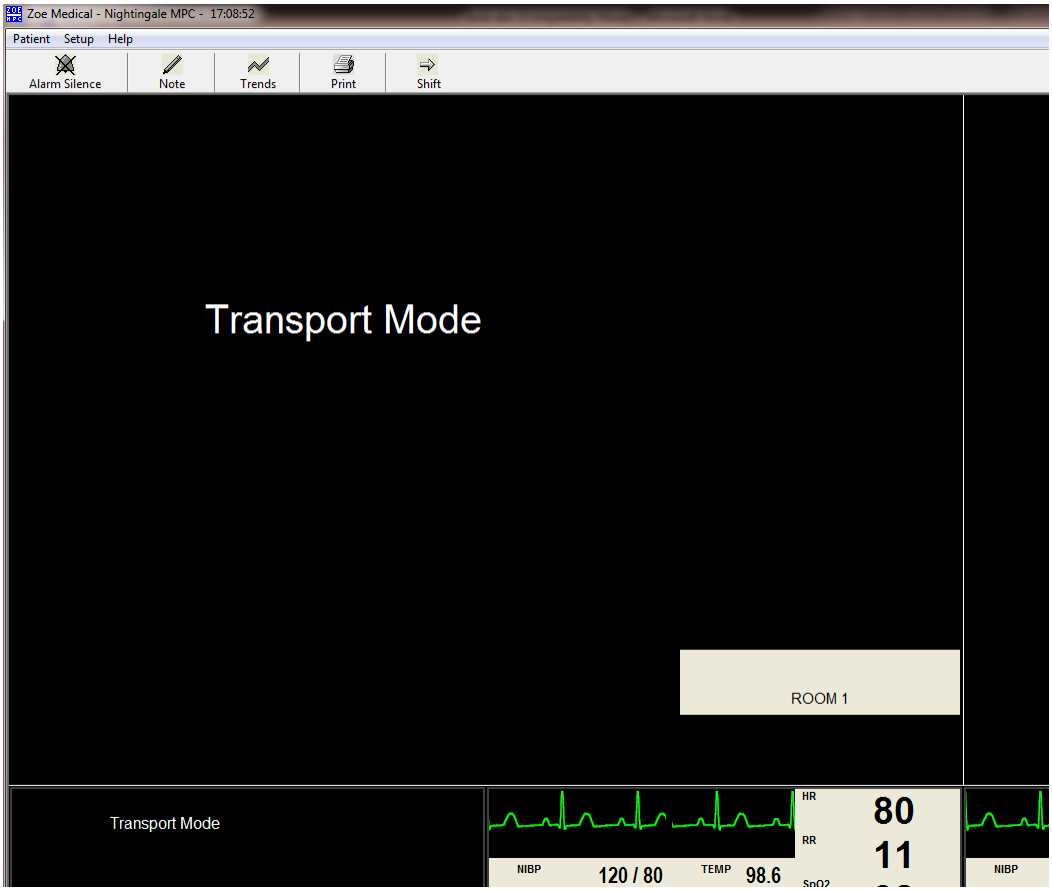

Figure 24. Portion of MPC display showing Transport Mode Indications

While a monitor is in Transport Mode, alarm processing at the MPC is suspended. To take a monitor out of Transport Mode, select the monitor into the primary view by clicking on the small view for that monitor, then select the "Patient", "Transport " item from the MPC's main menu. Normal monitoring operations will resume. The monitor will also leave Transport Mode automatically when it is reconnected to the network.

12. Discharging a Patient

When the time comes to discharge a patient, you must first select the patient's monitor into the primary view by clicking on the small view for that monitor.

WARNING – Always be sure that you check which patient is selected in the primary view before discharging. This is to avoid any chance of discharging one patient while thinking that you are discharging another patient.

Once you have selected the correct monitor into the primary view area, select the "Patient", "Discharge" item from the MPC's main menu. This will cause a message box to appear, asking you to confirm that you want to discharge the patient:

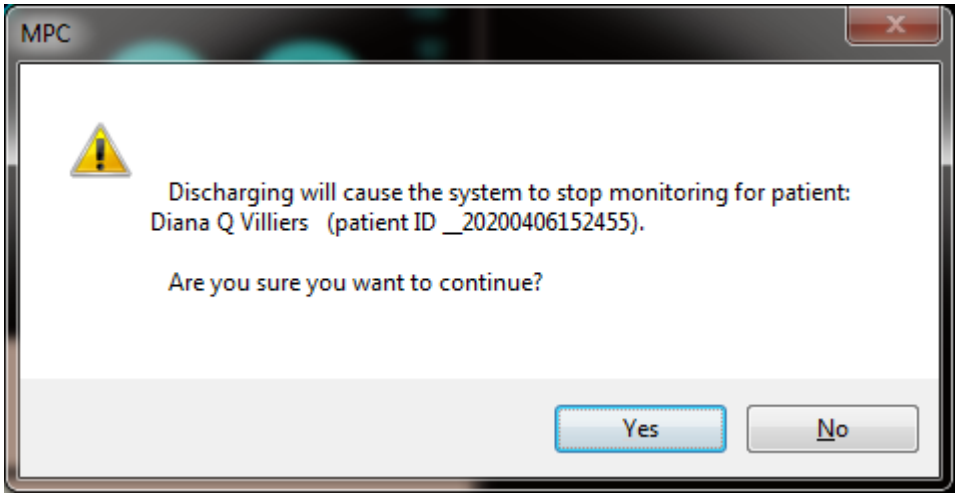

Figure 25. Discharge Confirmation Message Box

When you have confirmed that this is the patient you want to discharge, press Yes. If you press No, the patient will not be discharged.

After you discharge a patient, the patient's name is removed from the large and small view areas on the MPC, and from the monitor display.

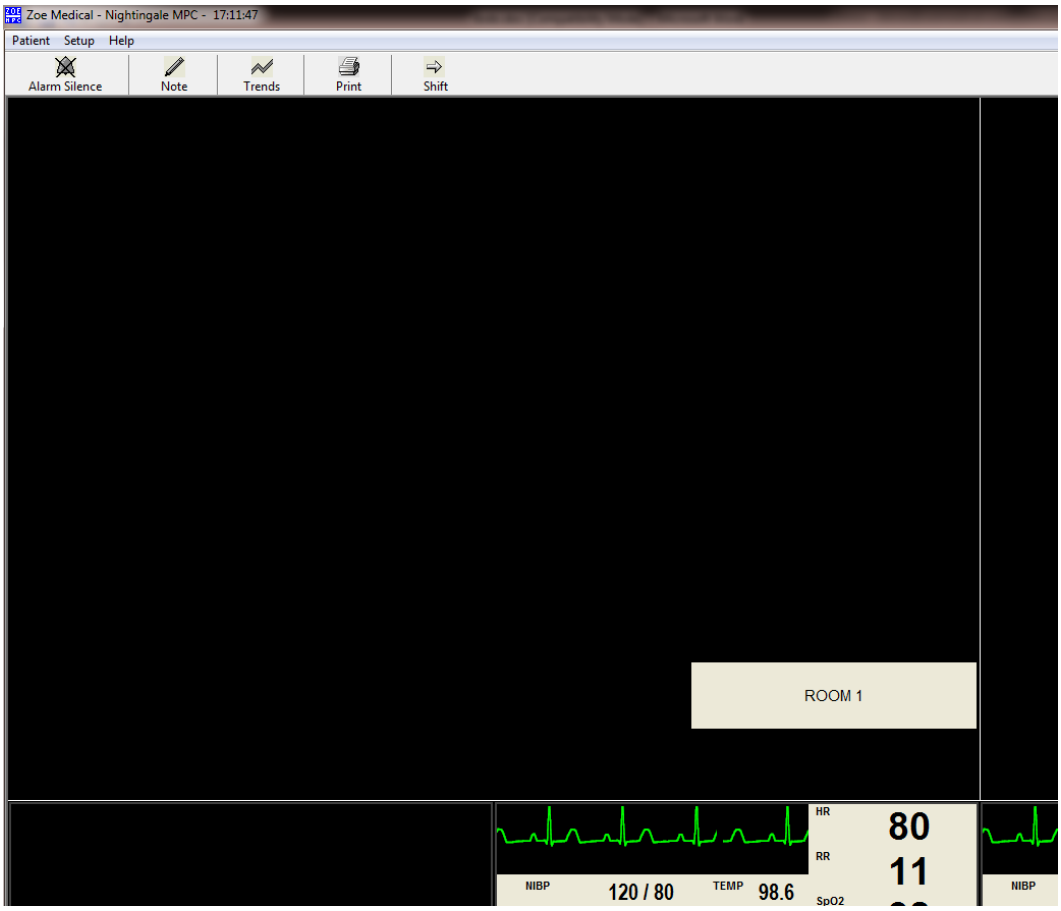

Figure 26. Portion of MPC Display Showing Areas Where a Patient Has Been Discharged

13. Troubleshooting

The following table is meant to help you solve problems that you may encounter while operating the MPC. If you are still experiencing a problem and none of these steps seem to help, please contact Zoe Customer Support:

Email: customersupport@zoemedical.com

Phone: (978) 884-4013

For the latest information about answers to frequently asked questions, please consult our web site:

www.zoemedical.com

Trouble Symptom	Possible Causes	Things to Try
The MPC PC will not run after power cycling.	There was an internal Windows operating system error	Contact your IT support
No waveforms or parameters appear from the monitor	No connection to monitor	Verify that the monitor is powered on and that the serial communications cable is securely connected to the monitor
No waveforms or parameters appear from any of the monitors	There was an internal Windows operating system error	Power cycle the MPC and be sure not to interrupt the start-up sequence when it is coming back on. If the MPC does not start working normally after this, contact Zoe Medical Customer Support
The patient name on the monitor does not match the name on the MPC	The patient was admitted to the wrong small view area	Verify that the patient is admitted into the correct small view area for the monitor
The display is flashing but there is no sound	The speaker volume has been turned down	Verify that the MPC speaker volume is not turned down
	The speakers have been disconnected	Verify that the speakers are connected to the MPC
The MPC PC is displaying an error message or has reset and is displaying a blue screen	There was an internal Windows operating system error	Power cycle the MPC and be sure not to interrupt the start-up sequence when it is coming back on. If the MPC does not start working normally after this, contact Zoe Medical Customer Support
The MPC keyboard or mouse is not working right	Keyboard or mouse failure	Replace keyboard or mouse

The MPC display is not working right	Display failure	Replace computer monitor
The MPC displays a message stating that it is unable to get disk free space.	The MPC's disk is too full and needs to be cleaned up.	Contact Zoe Medical Customer Support
The MPC displays a message stating that the disk space is getting low.	The MPC's disk is too full and needs to be cleaned up.	Contact Zoe Medical Customer Support
The MPC displays a message stating that the memory space is getting low.	The MPC's memory is too full. The condition may be due to an inadequate amount of memory installed in the PC.	Contact Zoe Medical Customer Support
The MPC displays a message stating that the CPU is too busy.	Internal system failure	Contact Zoe Medical Customer Support

13.1. Reducing EMI

The Nightingale MPC complies with regulatory standards regarding electromagnetic compatibility. The following is a list of actions that should be taken to reduce problems that are caused by electromagnetic interference (EMI):

1. Only use accessories that are listed in the Parts and Accessories section of the Service Manual.
2. Ensure that other products in the area comply to accepted emissions standards (IEC 60601-1-2).
3. Maximize the distance between electromedical devices.
4. Strictly limit the use of portable radio-frequency sources (e.g., cellular phones and radio transmitters).
5. Maintain good cable management. Try not to route cables over electrical equipment.

14. MPC System Settings

System Data Settings		
Setting name	**Default value**	**Possible values**
Current date	Current date	Any valid date
Current time	Current time	Any valid time
MPC daytime alarm volume	50	10-100
MPC nighttime alarm volume	50	10-100
"Nighttime" start time	21:00	00:00 through 23:59
"Nighttime" end time	07:00	00:00 through 23:59

15. Biomedical Support

15.1. MPC Hardware

All MPC hardware equipment that is used by the MPC operator is composed of standard off-the-shelf PC components. Recommendations for storage, cleaning, and maintenance of the MPC hardware components are supplied by the manufacturer of the PC equipment.

15.2. System Setup

The Setup System dialog box provides a way to change certain aspects of the MPC system configuration.

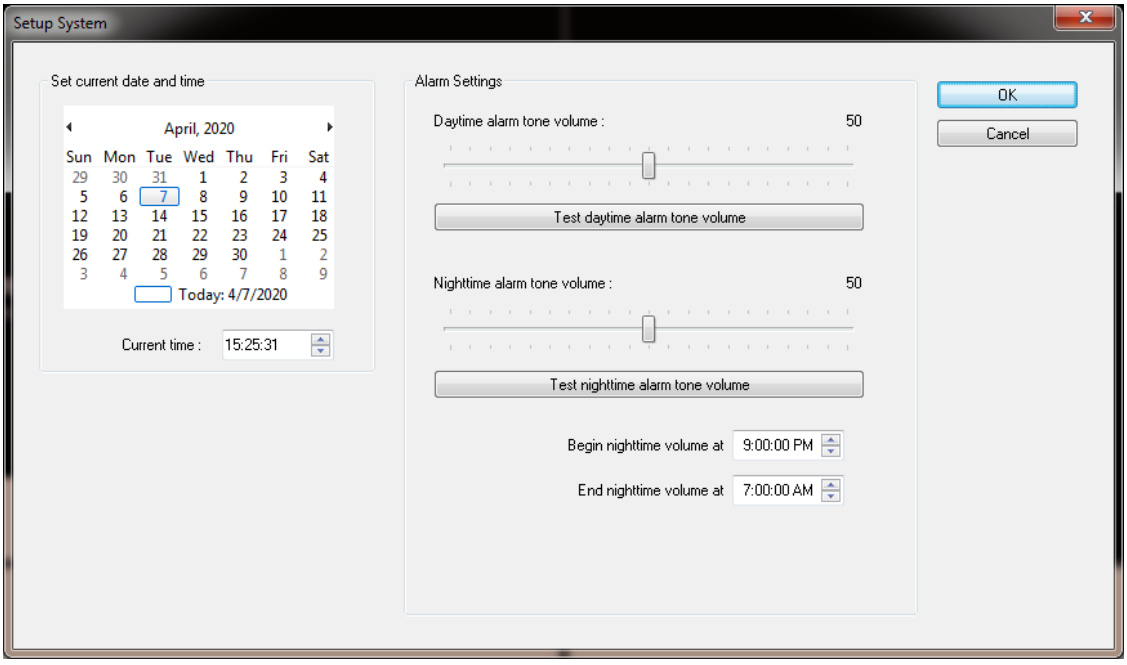

Figure 27. Setup System Dialog Box

Access to the Setup System dialog box is password protected. The password is given to responsible individual(s) at each site when the system is installed. You can also get the password by contacting Zoe Medical customer support.

Settings that can be changed via the Setup System dialog box:

Setting	Default value	Possible values
Date	Current date	Any valid date
Time	Current time	Any valid time
Daytime alarm tone volume	50	10 to 100
Nighttime alarm tone volume	50	10 to 100
"Nighttime" start time	21:00	00:00 to 23:99
"Nighttime" end time	07:00	00:00 to 23:99

15.3. Service Setup

The Service Setup dialog box provides a way to change additional aspects of the MPC system configuration that usually only have to be done when the system is installed.

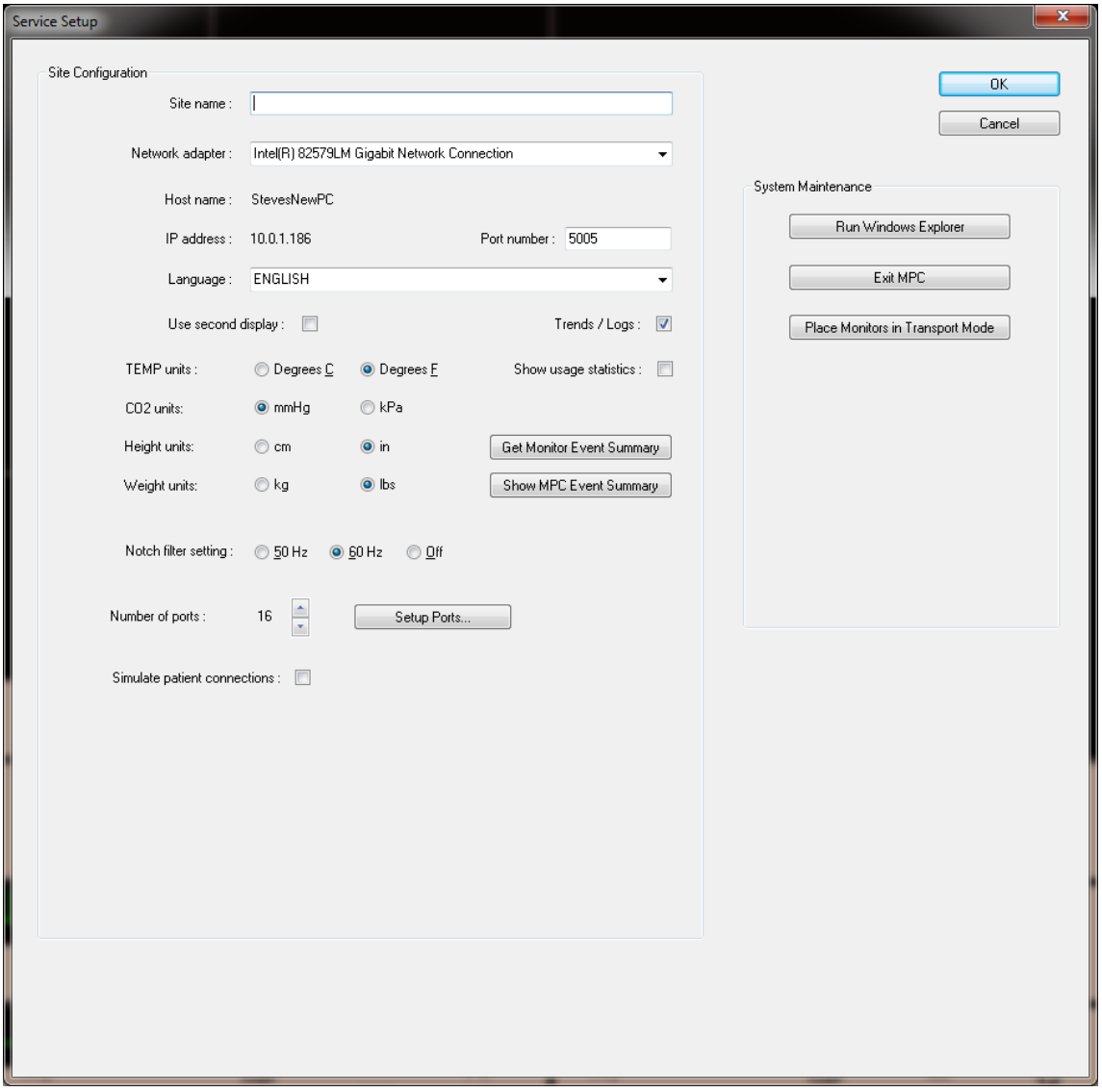

Figure 28. Service Setup Dialog Box

Access to the Service Setup dialog box is password protected. The password is given to responsible individual(s) at each site when the system is installed. You can also get the password by contacting Zoe Medical customer support.

Settings that can be changed via the Service Setup dialog box:

Setting	Default value	Possible values
Site name	<blank>	any text up to 100 characters
Port number	5005	any open Ethernet port
Language	English	English
Use second display	False	True, False
Trends / Logs	True	True, False
Show usage statistics	False	True, False
Temperature units	Degrees F	Degrees C, Degrees F
CO2 units	mmHg	mmHg, kPa
Height units	in	cm, in
Weight units	lb	kg, lb
Notch filter setting	60 Hz	50 Hz, 60 Hz, Off
Number of ports	8	1 - 32
Simulate Patient Connections	Disabled	Enabled, Disabled

Selecting the Setup Ports button brings up the following dialog box:

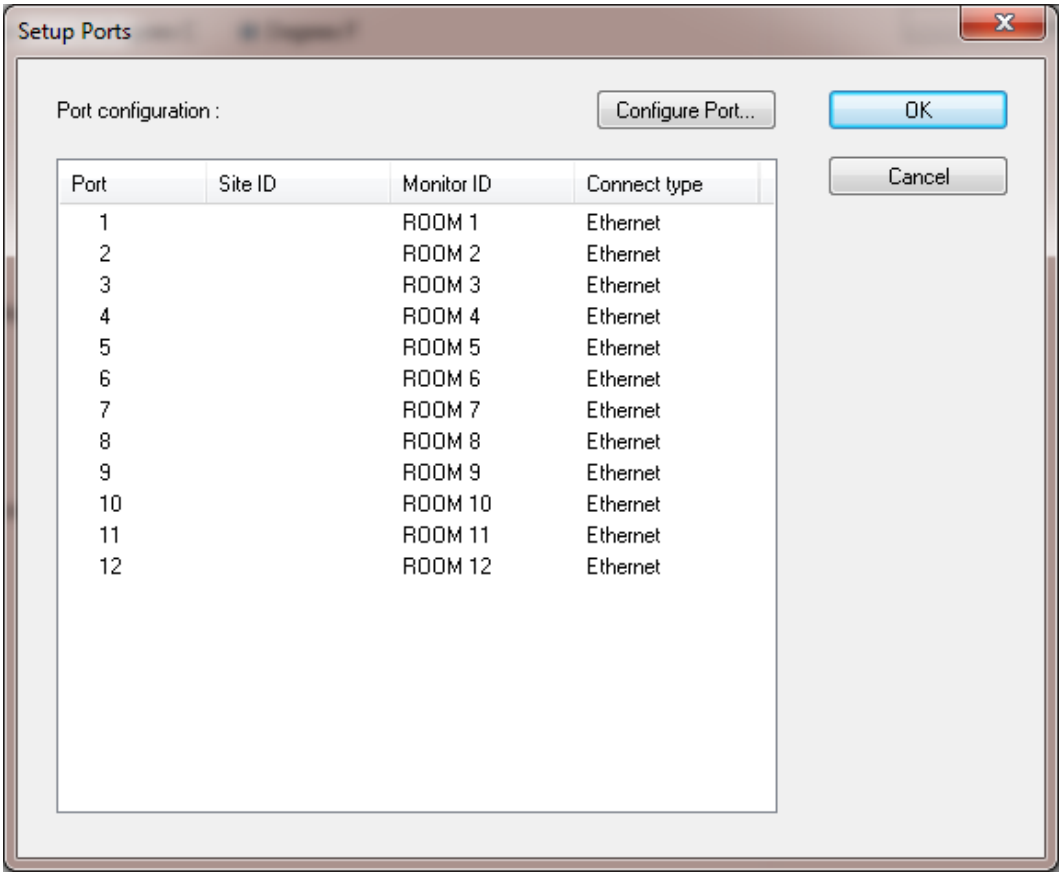

Figure 29. Setup Ports Dialog Box

When you select a port from the list and double click on it, the following dialog box appears:

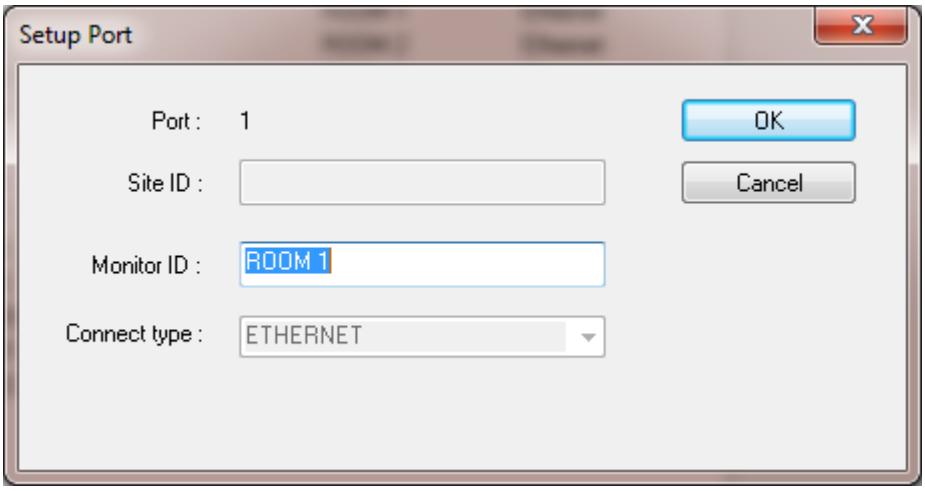

Figure 30. Setup Port Dialog Box

Through this dialog box you can change the Monitor ID associated with the port, which controls which monitor is able to connect to that port.

15.4. Maintenance

The following table shows the recommended maintenance procedure for the Nightingale MPC. These procedures should be carried out every 12 months and can be performed by the biomedical staff.

If there is a failure in one of the checks, please contact Zoe Medical Customer Service for help.

Email: service@zoemedical.com

Phone: (978) 887-4013

MPC Function	Procedure
Speaker	Use the System Setup dialog box to check the MPC speaker and verify that the volume is appropriate for the place where the MPC is being used