Propaq® M Operator's Guide

March 2011

9650-0803-01 Rev. B

EC REP
ZOLL International Holding B.V.
Newtonweg 18
6662 PV ELST
The Netherlands
Tel.: +31 (0) 481 366410
Fax: +31 (0) 481 366411

Table of Contents

Chapter 1 General Information

Chapter 2 Product Overview

Chapter 3 Monitoring Overview

Chapter 4 Trends

Chapter 5 Alarms

Chapter 6 Monitoring ECG

Chapter 7 Monitoring Respiration (Resp) and Heart Rate (HR)

Chapter 8 Monitoring Non-Invasive Blood Pressure (NIBP)

Chapter 9 Monitoring Pulse Oximetry (SpO2)

Chapter 10 Monitoring CO2

Chapter 11 Monitoring Invasive Pressures (IBP)

Chapter 12 Monitoring Temperature

Chapter 13 Monitoring 12-Lead ECG

Chapter 14 Patient Data

Chapter 15 Cleaning and Maintenance

Appendix A Specifications

Appendix B Accessories

Chapter 1
General Information

Product Description

The ZOLL® Propaq® M unit is an easy-to-use portable monitor that has the following monitoring capabilities: ECG, Pulse Oximeter, Non-invasive Blood Pressure, IBP, CO2, Temperature, and Respiration. It has been designed for all portable monitoring situations and its rugged, compact, lightweight design makes it ideal for transport situations. It is powered by auxiliary power and an easily replaced battery pack that is quickly recharged in the device when it is connected to auxiliary power. In addition, the unit's battery may be recharged and tested using a ZOLL *SurePower™ Battery Charger Station*.

Note: Some of the monitoring functions of the Propaq M are optional features. See the complete list of options in Fig. 1-1. Optional features are specified as "optional" within this guide.

The unit has a large colorful LCD display of numerics and waveform data that provides easy visibility from across the room and at any angle. ECG, plethysmograph, and respiration waveform traces can be displayed simultaneously, giving easy access to all patient monitoring data at once. The display screen is configurable, so you can choose the best visual layout to fit your monitoring needs.

The Propaq M has a patient data review and collection system that allows you to view, store, and transfer patient data. The Propaq M unit contains a USB port, which you can use to transfer data to a PC.

Propaq M Optional Features

The following features are optional in the Propaq M unit.

Figure 1-1 Propaq M Optional Features

Optional Feature
12 Lead ECG
SpO_2 (Nellcor™)
NIBP (with Smartcuf® and SureBP™)
EtCO2 (Oridion® Microstream®)
Temperature
Invasive Pressures (3 Channels)

How to Use This Manual

The Propaq M Operator's Guide provides information operators need for the safe and effective use and care of the Propaq M product. It is important that all persons using this device read and understand all the information contained within.

Please thoroughly read the safety considerations and warnings section.

Procedures for daily checkout and unit care are located in Chapter 15: “Cleaning and Maintenance.”

Operator’s Guide Updates

An issue or revision date for this manual is shown on the front cover. If more than three years have elapsed since this date, contact ZOLL Medical Corporation to determine if additional product information updates are available.

All users should carefully review each manual update to understand its significance and then file it in its appropriate section within this manual for subsequent reference.

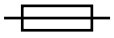
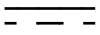
Product documentation is available through the ZOLL website at www.zoll.com. From the Products menu, choose Product Manuals.

Unpacking

Carefully inspect each container for damage. If the shipping container or cushion material is damaged, keep it until the contents have been checked for completeness and the instrument has been checked for mechanical and electrical integrity. If the contents are incomplete, if there is mechanical damage, or if the monitor does not pass its self-test, U.S.A. customers should call ZOLL Medical Corporation (1-800-348-9011). Customers outside of the U.S.A. should contact the nearest ZOLL authorized representative. If the shipping container is damaged, also notify the carrier.

Symbols Used on the Equipment

Any or all of the following symbols may be used in this manual or on this equipment:

Symbol	Description
	Attention, consult accompanying documents.
	Fragile, handle with care.
	Keep dry.
	This end up.
	Temperature limitation.
	**Conformité Européenne** Complies with medical device directive 93/42/EEC.
	Defibrillator-proof type CF patient connection.
	Fusible link.
	Alternating current (ac).
	Direct current (dc).
	Auxiliary power adapter operation.
	Earth (ground).
	Negative input terminal.

Symbol	Description
	Positive input terminal.
	Power On/Off
	Protective earth (ground).
	Contains lithium. Recycle or dispose of properly.
	Keep away from open flame and high heat.
	Do not open, disassemble, or intentionally damage.
	Do not crush.
	Do not discard in trash. Recycle or dispose of properly.
	Return to a collection site intended for waste electrical and electronic equipment (WEEE). Do not dispose of in unsorted trash.
	Date of manufacture.
	Use by.
	Latex-free.
	Do not reuse.
	Do not fold.

Symbol	Description
	Not sterile.
	Manufacturer.
	Authorized representative in the European Community.
	Serial Number.
	Catalogue number.
	Consult instructions for use.
	Battery charging status.

Conventions

This guide uses the following conventions:

Within text, the names and labels for physical buttons and softkeys appear in **boldface** type (for example, “Press the **IBP** quick access key”).

This guide uses uppercase italics for audible prompts and for text messages displayed on the screen (for example, *INITITALIZING*).

Warning!	**Warning statements alert you to conditions or actions that can result in personal injury or death.**

Caution	Caution statements alert you to conditions or actions that can result in damage to the unit.

Propaq M Indications for Use

The Propaq M is intended for use by trained medical personnel who are familiar with basic monitoring, vital sign assessment, and the use of the Propaq M. The Propaq M is also intended for use by (or on the order of) physicians at the scene of an emergency or in a hospital emergency room, intensive care unit, cardiac care unit, or other similar areas of a hospital. The usage may be in an ambulance or at the scene of an emergency. It is also intended to be used during the transport of patients. The Propaq M will be used whenever it is required to monitor any of those functions that are included (as options) in the device. The Propaq M unit can be used on pediatric patients (as described in the following table) and on adult patients (21 years of age or older) with and without heart dysfunction.

Pediatric Patient Subpopulation	Approximate Age Range
Newborn (neonate)	Birth to 1 month of age.
Infant	1 month to 2 years of age.
Child	2 to 12 years of age.
Adolescent	12 to 21 years of age.

ECG Monitoring

The Propaq M is intended for use to monitor and/or record 3-, 5-, or 12-lead ECG waveform and heart rate, and to alarm when heart rate is above or below limits set by the operator. The patient population will range from newborn (neonate) to adult, with and without heart dysfunction.

Non-Invasive Blood Pressure Monitoring

The Propaq M is intended for use to make non-invasive measurements of arterial pressure and heart rate, and to alarm if either parameter is outside of the limits set by the user. Measurements are made using an inflatable cuff on the patient's arm or leg. The patient population will range from newborn (neonate) to adult.

Temperature Monitoring

The Propaq M is intended for use to make continuous temperature measurements of rectal, esophageal, or surface temperatures, and to alarm if the temperature is outside of the limits set by the user. The patient population will range from newborn (neonate) to adult.

$Sp0_2$ Monitoring

The Propaq M is intended for use to monitor pulse rate and oxygen saturation of arteriolar hemoglobin, and to alarm if either parameter is outside of the limits set by the user. Measurements are made non-invasively at remote sites such as a finger, toe, ear lobe, bridge of nose, etc. The patient population will range from newborn (neonate) to adult.

Respiration Monitoring

The Propaq M is intended for use to continuously monitor respiration rate and to alarm if the rate falls outside of the range set by the operator. Because the measurement method actually measures respiratory effort, apnea episodes with continued respiratory effort (such as obstructive apnea) may not be detected. It is not intended to be used as an apnea monitor. The patient population will range from newborn (neonate) to adult.

CO_2 Monitoring

The Propaq M is intended for use to make continuous noninvasive measurement and monitoring of carbon dioxide concentration of the expired and inspired breath and breath rate. The patient population will range from newborn (neonate) to adult.

Invasive Pressure Monitoring

The Propaq M is intended for use to display and make continuous invasive pressure measurements from any compatible pressure transducer. The primary intended uses are arterial blood pressure, central venous pressure and intracranial pressure monitoring. Any contra-indications of the particular transducer selected by the user shall apply. The patient population will range from newborn (neonate) to adult.

Propaq M Product Functions

ECG Monitoring

The patient's ECG is monitored by connecting the patient to the unit via a 3-, 5-, or 12-lead patient cable. The ECG waveform is presented on the display along with the following information:

- averaged heart rate, derived by measuring R to R intervals
- lead selection - I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6 (with ECG cable)
- ECG size - 0.125, 0.25, 0.50, 1.0, 2.0, 4.0 cm/mV, AUTO
- status messages

The ECG bandwidth is user selectable.

Batteries

Propaq M models use an easily replaced rechargeable lithium-ion battery pack (the *Propaq* Battery Pack). A new, fully charged battery pack typically delivers more than 8 hours of ECG monitoring. Use of other options (such as higher screen brightness or shorter NIBP intervals) reduces this time.

When a *LOW BATTERY* icon appears on the display and the unit emits three beeps in conjunction with the displayed battery icon, the battery must be replaced and recharged.

You can charge the battery by either of the following methods:

- **Internal charging** — plug the Propaq M into an auxiliary power adapter to automatically begin charging the installed battery pack. The front panel battery indicator operates as follows:

When the indicator is:	It means:
Steady yellow	Battery is charging.
Steady green	Battery is charged.
Alternating yellow and green	The charge state cannot be determined or a battery charging fault has been detected.
Not lit	No battery in device.

Note: Upon power up, it takes approximately 45 seconds for the LEDs on the battery to accurately display run time.

- **External charging** — use the ZOLL SurePower™ Battery Charger with the Propaq M battery adapter to charge the battery pack and test the battery's capacity. For details, refer to the *Propaq Battery Pack Guide*.

The Recalibration LED icon ( ) lights for approximately 10 seconds (after you press and release the Display button) if the battery needs to be calibrated. If the Recalibration LED lights, the runtime indicator will not display run time for that battery. For best performance of the battery, you should recalibrate the battery as soon as possible.

To manually recalibrate the SurePower Battery Pack, you can insert the battery into the SurePower Charger Station and perform a Manual Test (for more information, see the ZOLL *SurePower Charger Station Operator's Guide*).

After you recalibrate the battery, the Recalibration LED will only flash when you press the Display button.

Ready For Use (RFU) Indicator

The Propaq M has an RFU indicator on the front panel that indicates if the device is ready for use. The RFU indicator has three states which are described in the following table.

State	Description	Action
Ready for Use 	The device is ready for use. Patient monitoring is functional and the battery is above the low battery capacity.	None required.
Flashing	One or more of the following has occurred: • The battery is not properly installed. • A low battery is installed. • A battery fault has occurred. • There is no battery installed while connected to auxiliary power. • One or more patient monitoring parameters have failed self-test (NIBP, SpO2, CO2, IBP, or Temp). • The front panel button self-test failed. • The speech database self-test failed.	Install a fully charged battery in the unit and check the RFU indicator again. If the RFU indicator continues to flash, remove the unit from service and contact the appropriate technical personnel or the ZOLL Technical Service Department.
Do Not Use 	One or more of the following has occurred: • The battery is not properly installed. • No battery is installed and auxiliary power is not present. • A very low battery (below software shutdown limit) was installed. • ECG or other critical self-tests have failed.	Install a fully charged battery in the unit and check the RFU indicator again. If the RFU indicator continues to display the Do Not Use symbol, remove the unit from service and contact the appropriate technical personnel or the ZOLL Technical Service Department.

Warnings

General

These operating instructions describe the functions and proper operation of the Propaq M products. They are not a substitute for a formal patient care training course. Operators should obtain formal training from an appropriate authority before using this monitor for patient care.

Proper operation of the unit and correct electrode placement is critical to obtaining optimal results. Operators must be thoroughly familiar with proper device operation.

Allow ample slack in cables to make sure that cables do not tug at electrodes.

Do not disassemble the unit. A shock hazard exists. Refer all problems to authorized service personnel.

Follow all recommended maintenance instructions. If a problem occurs, obtain service immediately. Do not use the monitor until it has been inspected by appropriate personnel.

The Propaq M unit might not perform to specifications when stored at the upper or lower extreme limits of storage temperature and then immediately put into use. The Propaq unit should not be stored or used outside of the environmental limits provided in Appendix A of this manual.

Avoid using the Propaq M adjacent to, or stacked on, other equipment. If unavoidable, verify that the unit operates normally in this configuration before clinical use.

The Propaq M should be installed and put into service according to the EMC information in Appendix A of this manual.

The use of transducers and cables other than those specified in this manual and related Propaq M option manual inserts may result in increased emissions or decreased immunity of the Propaq M.

Do not use or place the unit in service if the Ready For Use indicator (at the upper right of the front panel) displays a red circle with a line through it.

Carefully route patient cables to avoid tripping over them, or inadvertently pulling the unit onto the patient.

Always inspect the unit for damage if it has been dropped.

Only authorized personnel should use the Supervisor menus.

If uncertain about the accuracy of any measurement, first check the patient’s vital signs by alternate means, and then make sure the monitor is functioning correctly.

ECG Monitoring

Implanted pacemakers might cause the heart rate meter to count the pacemaker rate during incidents of cardiac arrest or other arrhythmias. Dedicated pacemaker detection circuitry may not detect all implanted pacemaker spikes. Check the patient's pulse; do not rely solely on heart rate meters. Patient history and physical examination are important factors in determining the presence of an implanted pacemaker. Pacemaker patients should be carefully observed. See “Pacemaker Pulse Rejection:” on page A-3 of this manual for disclosure of the pacemaker pulse rejection capability of this instrument.

Use only ECG electrodes that meet the AAMI standard for electrode performance (AAMI EC-12). Use of electrodes not meeting this AAMI standard could cause the ECG trace recovery after defibrillation to be significantly delayed.

Do not place electrodes directly over an implanted pacemaker.

The Propaq M unit detects ECG electrical signals only. It does not detect a pulse (effective circulatory perfusion). Always verify pulse and heart rate by physical assessment of the patient. Never assume that the display of a nonzero heart rate means that the patient has a pulse.

Excessive artifact can result due to improper skin preparation of the electrode sites. Follow skin preparation instructions in Chapter 6: “Monitoring ECG.”

Do not operate the Propaq M in conjunction with electrocautery or diathermy equipment. Such equipment, as well as equipment that emits strong radio frequency signals, can cause electrical interference and distort the ECG signal displayed by the monitor, thereby preventing accurate rhythm analysis.

Shock Hazard: Use of accessories, other than those specified in the operating instructions, may adversely affect patient leakage currents.

Certain line-isolation monitors may cause interference on the ECG display and may inhibit heart rate alarms.

Pulse Oximeter

Keep the ZOLL finger probe clean and dry.

SpO_2 measurements may be affected by certain patient conditions: severe right heart failure, tricuspid regurgitation or obstructed venous return.

SpO_2 measurements may be affected when using intravascular dyes, in extreme vasoconstriction or hypovolemia or under conditions where there is no pulsating arterial vascular bed.

SpO_2 measurements may be affected in the presence of strong EMI fields, electrosurgical devices, IR lamps, bright lights, improperly applied sensors; the use of non-ZOLL sensors, or damaged sensors; in patients with smoke inhalation, or carbon monoxide poisoning, or with patient movement.

Tissue damage can result if sensors are applied incorrectly, or left in the same location for an extended period of time. Move sensor every 4 hours to reduce possibility of tissue damage.

Do not use any oximetry sensors during MRI scanning. MRI procedures can cause conducted current to flow through the sensors, causing patient burns.

Do not apply SpO_2 sensor to the same limb that has an NIBP cuff. The SpO_2 alarm may sound when the arterial circulation is cut off during NIBP measurements, and may affect SpO_2 measurements.

In some instances, such as obstructed airway, the patient's breathing attempts may not produce any air exchange. These breathing attempts can still produce chest size changes, creating impedance changes, which can be detected by the respiration detector. It is best to use the pulse oximeter whenever monitoring respirations, to accurately depict the patient's respiratory condition.

Noninvasive Blood Pressure

Only a physician can interpret pressure measurements.

Blood pressure measurement results may be affected by the position of the patient, his or her physiological condition and other factors.

Substitution of a component different from that supplied by ZOLL (e.g., cuff, hoses, etc.) may result in measurement error. Use only ZOLL-approved cuffs and hoses. To avoid the risk of intravenous line misconnection and possible introduction of air into a patient’s blood, do not modify the NIBP system or hoses with Luer Lock adapters.

Do not use a blood pressure cuff on the limb being used for IV infusion or for SpO_2 monitoring.

Accurate pressure readings may not be achieved on a person experiencing arrhythmias, shaking, convulsions or seizures. Medication may also affect pressure readings. The correct size cuff is essential for accurate blood pressure readings.

Blood pressure hoses must be free of obstructions and crimps.

If the patient’s cuff is not at heart level, an error in measurement may result.

When monitoring blood pressure at frequent intervals, observe the cuffed extremity of the patient for signs of impeded blood flow.

Do not monitor one patient’s NIBP while monitoring another patient’s ECG.

Blood pressure measurement may be inaccurate if taken while accelerating or decelerating in a moving vehicle.

If an NIBP measurement result is questionable or “motion” indication is displayed, repeat the measurement. If the repeated measurement result is still questionable, use another blood pressure measurement method.

Do not use the NIBP on cardiopulmonary bypass patients.

IBP

To ensure compatibility and electrical safety, accessory pressure sensors should comply with ANSI/AAMI BP-22 and IEC 60601-2-34 for IBP or ANSI/AAMI NS28 for ICP.

Follow instructions supplied with any accessory pressure sensor regarding calibration and removal of trapped air.

Avoid touching metal parts of any transducer while it is in contact with the patient.

Do not reuse any components that are labeled for single use only.

Transducers should be rated to withstand an accidental drop of at least a meter onto a hard surface.

Transducers that are subject to immersion in liquids should be rated as watertight.

CO_2

During MRI scanning, the monitor must be placed outside the MRI suite. When the monitor is used outside the MRI suite, EtCO_2 monitoring can be implemented using a long FilterLine® which permits placement of the monitor outside the MRI suite.

When using the monitor with anesthetics, nitrous oxide or high concentrations of oxygen, connect the gas outlet to a scavenger system.

Use only Oridion Microstream CO_2 sampling lines.

Microstream CO_2 sampling lines are labeled for single patient use only. Do not reuse sampling lines.

If using the CO_2 Monitor for extended critical care, replace the airway adapter every 24 hours or when it becomes occluded.

CO_2 readings and respiratory rate can be affected by sensor application errors, certain ambient environmental conditions, and certain patient conditions.

Respiration

Do not operate the Propaq M with any other monitor with respiration measurements on the same patient. The two devices could affect the respiration accuracy.

The device should not be used as an apnea monitor.

Ferromagnetic Equipment

Biomedical equipment and accessories, such as ECG electrodes, cables, and oximeter probes contain ferromagnetic materials. Ferromagnetic equipment must not be used in the presence of high magnetic fields created by magnetic resonance imaging (MRI) equipment.

The large magnetic fields generated by an MRI device can attract ferromagnetic equipment with an extremely violent force, which could cause serious personal injury or death to persons between the equipment and the MRI device.

Battery

Although the device can operate with auxiliary power alone, ZOLL strongly recommends that you operate the unit with a battery installed at all times. Operating the unit with a battery provides a backup in case of ac power shortage. The battery can be automatically recharged while it is installed in the unit. Keep a fully charged spare battery pack with the monitor at all times.

Test battery packs regularly. A battery that does not pass the ZOLL charger's capacity test might cause the Propaq M unit to shut down unexpectedly.

If the Low Battery indication occurs at any time during operation, immediately replace the battery pack.

If the *LOW BATTERY* icon appears, plug the Propaq M unit into a power source or install a fully charged battery pack. When the warning low battery shutdown prompt appears, immediately replace the battery pack with a fully charged pack or plug the Propaq M unit into a power source, as unit shut down due to a low battery condition is imminent.

If mistreated, a battery pack might explode. Do not disassemble a battery pack or dispose of it in fire.

Operator Safety

Do not use the Propaq M in the presence of oxygen-rich atmospheres, flammable anesthetics, or other flammable agents (such as gasoline). Using the unit in such environments might cause an explosion.

Do not use the unit in standing water. Electrical safety might be compromised when the monitor is wet.

The use of accessory equipment that does not comply with the equivalent safety requirements of the Propaq M could reduce the level of safety of the combined system. When choosing accessory equipment, consider the following:

- Use of the accessory in the patient vicinity.
- Evidence that the safety certification of the accessory has been performed in accordance with the appropriate IEC (EN) 60601-1 and/or IEC (EN) 60601-1-1 harmonized national standards.

Always check that the equipment functions properly and is in proper condition before use.

Patient Safety

This equipment should be connected to only one patient at a time.

To ensure patient safety, do not place the monitor in any position that might cause it to fall on the patient.

Use only high-quality ECG electrodes.

Do not use ECG electrodes if the gel is dried, separated, torn or split from the foil; patient burns may result from using such electrodes.

Check the expiration date on the electrode packaging. Do not use electrodes after their expiration date.

Excessive body hair or wet, diaphoretic skin can inhibit electrode coupling to the skin. Clip excess hair and dry any moisture from the area where an electrode is to be attached.

Carefully route the patient cables away from the patient's neck to reduce the possibility of patient entanglement or strangulation.

To avoid electrosurgery burns at monitoring sites, ensure proper connection of the electrosurgery return circuit so that a return path cannot be made through monitoring electrodes or probes.

During electrosurgery, observe the following guidelines to minimize electrosurgery unit (ESU) interference and provide maximum operator and patient safety:

- Keep all patient monitoring cables away from earth ground, ESU knives, and ESU return wires.
- Use electrosurgical grounding pads with the largest practical contact area.

Always ensure proper application of the electrosurgical return electrode to the patient.

Check electrical leakage levels before use. Leakage current might be excessive if more than one monitor or other piece of equipment is connected to the patient.

Cautions

If the unit is to be stored longer than 90 days, remove the battery pack.

Do not sterilize the monitor, or its accessories unless the accessories are labelled as sterilizable.

Do not immerse any part of the monitor in water.

Do not use the monitor if excessive condensation is visible on the device. Wipe only the outside with a damp cloth.

Do not use ketones (such as acetone or MEK) on the monitor.

Avoid using abrasives (including paper towels) on the display window.

To achieve the specified level of protection against spilled or splashed liquids, thoroughly dry all exposed surfaces of this device prior to operation or connections to auxiliary power.

If liquids enter the device connectors, remove all liquid from the connectors and allow the device to dry thoroughly prior to use.

Grounding reliability can be achieved only when the equipment is connected to a receptacle marked "HOSPITAL ONLY," "HOSPITAL GRADE," or equivalent. If the grounding integrity of the line cord or ac receptacle is questionable, operate the monitor using battery power only.

Do not connect to an electrical outlet controlled by a wall switch or dimmer.

For accurate ECG information, and to protect against noise and other interference, use only internal current-limiting ECG cables specified or supplied by ZOLL.

For continued safety and EMI performance, use only the line cord supplied by ZOLL.

Electrical installation of the room or the building in which the monitor is to be used must comply with regulations specified by the country in which the equipment is to be used.

Dispose of battery packs in accordance with national, regional and local regulations. Battery packs should be shipped to a reclamation facility for recovery of metal and plastic compounds as the proper method of waste management.

Restarting the Monitor

Certain events require the Propaq M products to be restarted after they shut off or become inoperative (for example, when the battery runs down and the unit shuts off).

In such a case, always try to restore monitor operation as follows:

1. Press the power switch on the top of the unit to turn it off.
2. If necessary, replace a depleted battery with a fully charged pack, or connect the monitor to auxiliary power.
3. Press the power switch on the top of the unit to turn it back on.

This sequence is necessary to restart the monitor and can also be used to clear some fault messages when immediate use of the monitor is required.

If the Propaq M unit is powered off for less than 2 minutes, all patient monitoring parameter settings will be retained. If the unit has been powered off for at least two minutes, it will be considered a New Patient and all of the patient-specific parameters (alarm limits, etc.) will be reset to their default values.

Notification of Adverse Events

As a health care provider, you may have responsibilities under the Safe Medical Devices Act (SMA), for reporting to ZOLL Medical Corporation, and possibly to the FDA, the occurrence of certain events.

These events, described in 21 CFR Part 803, include device-related death and serious injury or illness. In addition, as part of our Quality Assurance Program, ZOLL Medical Corporation requests to be notified of device failures or malfunctions. This information is required to ensure that ZOLL Medical Corporation provides only the highest quality products.

Software License

Note: Read this Operator's Guide and License agreement carefully before operating any of the Propaq M products.

Software incorporated into the system is protected by copyright laws and international copyright treaties as well as other intellectual property laws and treaties. This software is licensed, not sold. By taking delivery of and using this system, the Purchaser signifies agreement to and acceptance of the following terms and conditions:

1. **Grant of License:** In consideration of payment of the software license fee which is part of the price paid for this product ZOLL Medical Corporation grants the Purchaser a non-exclusive license, without right to sublicense, to use the system software in object-code form only.
2. **Ownership of Software/Firmware:** Title to, ownership of and all rights and interests in the system software and all copies thereof remain at all times vested in the manufacturer, and Licensors to ZOLL Medical Corporation and they do not pass to purchaser.
3. **Assignment:** Purchaser agrees not to assign, sublicense or otherwise transfer or share its rights under the license without the express written permission of ZOLL Medical Corporation.

4. **Use Restrictions:** As the Purchaser, you may physically transfer the products from one location to another provided that the software/firmware is not copied. You may not disclose, publish, translate, release or distribute copies of the software/firmware to others. You may not modify, adapt, translate, reverse engineer, decompile, crosscompile, disassemble or create derivative works based on the software/firmware.

NO IMPLIED LICENSE

Possession or purchase of this device does not convey any express or implied license to use the device with replacement parts which would, alone, or in combination with this device, fall within the scope of one or more of the patents relating to this device.

Service

The Propaq M only requires recalibration of the CO_2 module. Service is required after 20,000 hours of use of the CO_2 module. Appropriately trained and qualified personnel should, however, perform periodic tests of the monitor functionality to verify proper operation.

If a unit requires service, contact the ZOLL Technical Service Department.

For customers In the U.S.A.		For customers outside the U.S.A.
Telephone:	1-800-348-9011 1-978-421-9655	Call the nearest authorized ZOLL Medical Corporation representative.
Fax:	1-978-421-0010	To locate an authorized service center, contact the International Sales Department at ZOLL Medical Corporation 269 Mill Road Chelmsford, MA 01824-4105 Telephone: 1-978-421-9655

When requesting service, please provide the following information to the service representative:

- Unit serial number
- Description of the problem
- Department using the equipment and name of the person to contact
- Purchase order to allow tracking of loan equipment
- Purchase order for a unit with an expired warranty
- Sample ECG or other stripcharts demonstrating the problem (if available and applicable), less any confidential patient information.

Returning a unit for service

Before sending a unit to the ZOLL Technical Service Department for repair, obtain a service request (SR) number from the service representative.

Remove the battery pack from the unit. Pack the unit with its cables and battery in the original containers (if available) or equivalent packaging. Be sure the assigned service request number appears on each package.

For customers	Return the unit to
In the U.S.A.	ZOLL Medical Corporation 269 Mill Road Chelmsford, MA 01824-4105 Attention: Technical Service Department (*SR number*) Telephone: 1-800-348-9011
In Canada	ZOLL Medical Canada Inc. 1750 Sismet Road, Unit #1 Mississauga, ON L4W 1R6 Attention: Technical Service Department (*SR number*) Telephone: 1-866-442-1011
In other locations	The nearest authorized ZOLL Medical Corporation representative. To locate an authorized service center, contact the International Sales Department at ZOLL Medical Corporation 269 Mill Road Chelmsford, MA 01824-4105 Telephone: 1-978-421-9655

The ZOLL Serial Number

Each ZOLL product displays a serial number that contains information about that product. From left to right, ZOLL serial numbers are structured as follows:

- A two-character product code
- A three-character date-of-manufacture code
- A product serial number of six or more alphanumeric characters

The first two characters of the date-of-manufacture code give the last two digits of the year (for example, “06” appears for products manufactured in 2006). The last character of the date-of-manufacture code gives the month in which the product was manufactured. The month appears in the form of a single alphanumeric character: “A” for January, “B” for February, “C” for March, and so on through “L” for December.

The product serial number is a unique set of alphanumeric characters that ZOLL assigns to each individual unit.

Chapter 2
Product Overview

Monitor Controls and Indicators

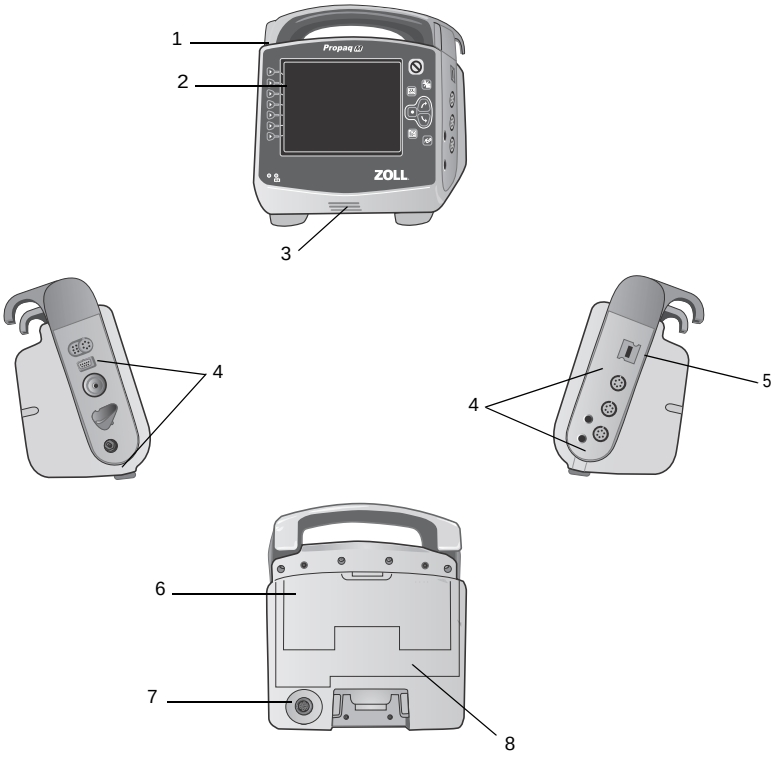


Table 2-1. Propaq Unit Features

	Item	Description
1	Handle	Integrated carrying handle.
2	Front panel	Includes the display screen and primary controls.
3	Speaker	Emits R-wave detection beeps and alarm tones.
4	Patient connectors	For details, refer to “Patient Cables and Connectors” on page 2-6.
5	USB device connector	For connecting the Propaq monitor to a USB device. For details, refer to “Storing, Transferring, and Reviewing Patient Data” on page 15-1.
6	Battery compartment	Holds a rechargeable lithium ion battery pack.
7	Auxiliary power connector	For connecting the device to an auxiliary power adapter.
8	Dock connector	For connecting the device to a docking station.

The Front Panel

The front panel of the Propaq M device includes the display screen, quick access keys, battery and auxiliary power indicators, and Ready For Use (RFU) indicator. See Figure 2-1. Refer to Table 2-2 on page 2-2 for information about the controls and indicators.

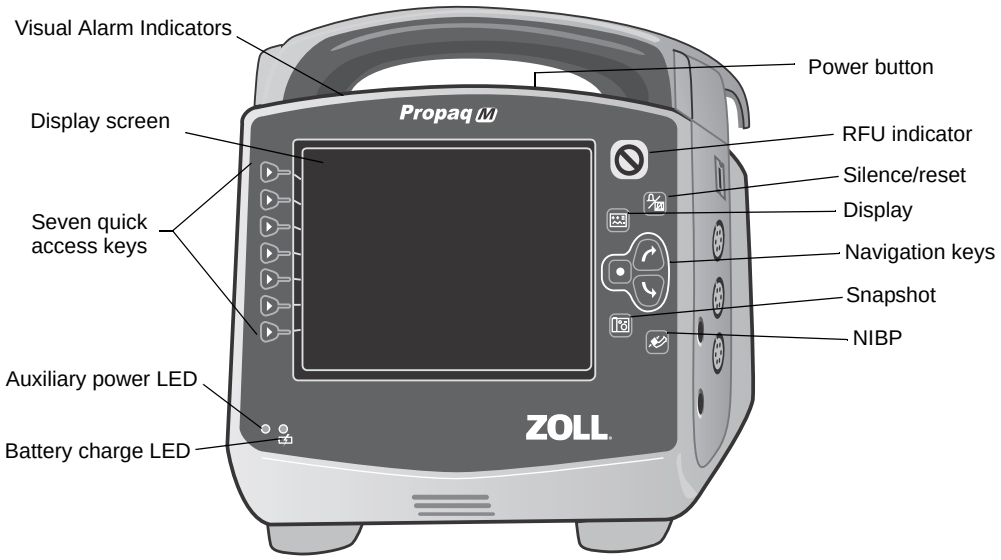


Figure 2-1. Propaq M Front Panel

Table 2-2. Propaq Controls and Indicators

Control or Indicator	Description
Display screen	Shows settings, physiological waveforms and other information for each monitored parameter, messages, time, and quick access key labels.
Quick access keys	Seven buttons control different functions of the unit. Labels for the quick access keys appear on the monitor display to the right of each key.
Auxiliary power LED	Illuminated when the unit is plugged in to an auxiliary power adapter.

Table 2-2. Propaq Controls and Indicators (continued)

Control or Indicator	Description
Battery charge LED	Indicates battery status: Steady yellow: Battery is charging. Steady green: Battery is charged. Alternating green and yellow: The charge state cannot be determined or a battery charging fault has been detected. No light: Battery is not installed.
Visual alarm indicators	Red, yellow, and green lights located on the top of the unit that flash on and off when the unit is powered up and are used to in i dc ate a patient alert, equipment alert, and data transfer.
NIBP button 	Starts/stops an NIBP measurement.
Snapshot button 	Records 24 seconds of numeric and waveform data.
Navigation keys 	 The up (clockwise) arrow will cause the cursor to travel in an upward direction if the cursor is being used to navigate through a vertical list or in a clockwise direction if the cursor is being used to navigate around the full screen. Likewise, the down (counterclockwise) arrow will cause the cursor to travel in a downward direction if the cursor is being used to navigate through a vertical list or in a counterclockwise direction if the cursor is being used to navigate around the full screen. The up (clockwise) and down (counterclockwise) arrows may also be used to modify parameter settings.  The Select button acts based on what is highlighted.
Display button 	Cycles through three available display modes or functions as an Escape button when in a menu.
Silence/Reset button 	Silences the current alarm tone for 90 seconds or resets a silenced alarm tone.
RFU indicator 	Shows the status of the unit, based on its most recent readiness check. A red circle with a line through it indicates that the unit's readiness has been compromised and that it may not be ready for therapeutic use.
Power button 	Located on the top of the unit, this button turns the unit on and off.

Display Screen

The front panel includes a color display which shows:

- Date and time
- Patient mode
- Battery status indicator
- Time elapsed (since unit was turned on)
- Quick access keys
- Waveform source
- Color-coded waveforms and ECG lead identifiers
- SpO_2 numeric data
- Heart rate numeric data
- Respiration rate numeric data
- Temperature numeric data
- Non-invasive blood pressure numeric data
- $EtCO_2$ numeric data
- Invasive pressure numeric data
- Messages and prompts

Figure 2-2 shows the layout of parameter values, waveforms, system data, and quick access key labels.

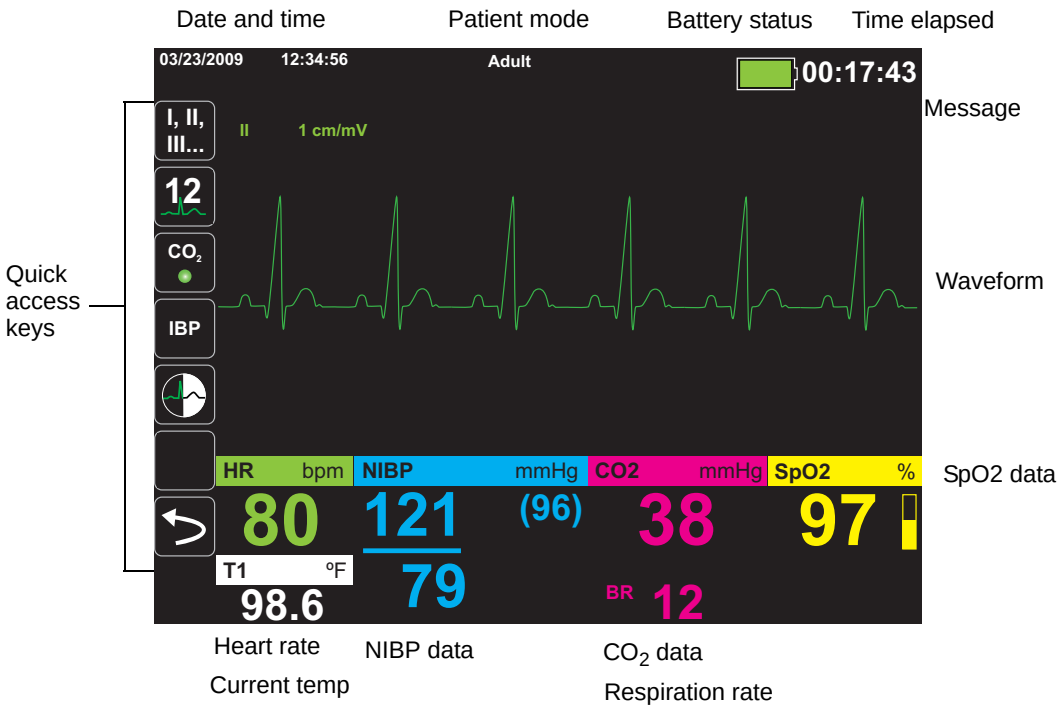


Figure 2-2. Propaq M Display Screen

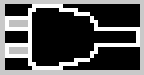
Color coding

To differentiate information for various parameters, the unit displays each type of information in a specific user-configurable color.

Battery Status and Auxiliary Power Indicators

The battery status indicator displays various battery icons to indicate the approximate remaining unit run time based on the charged state of the battery. Additionally, these icons provide indications of the status of the battery connection and communication with the unit. The auxiliary power indicator indicates that the unit is being powered by the auxiliary power adapter.

Upon powering up the Propaq M unit, the battery capacity will be displayed within approximately 15 seconds under normal conditions.

Icon	Status	Indication/Action
	Auxiliary power adapter is connected	The unit is being powered by the auxiliary power adapter.
	No battery detected	Either there is no battery in the unit while it is being powered by the auxiliary power adapter, or the device cannot detect that the battery is connected.
	Low battery capacity	Replace the battery soon.
	Communication failure	The unit is unable to establish communication with the battery and the battery capacity is unknown. Check the battery contacts.
	Battery fault	A battery fault has been detected. Replace the battery.
	Battery Level 1	The battery has less than one hour of remaining battery capacity.
	Battery Level 2	The battery has greater than one hour of remaining battery capacity.
	Battery Level 3	The battery has greater than two hours of remaining battery capacity.
	Battery Level 4	The battery has greater than three hours of remaining battery capacity.
	Battery Level 5	The battery is fully charged.

Patient Cables and Connectors

The left and right sides of the unit include sets of connectors for patient cables.

Note: The SPO_2, NIBP, CO_2, Temperature, and IBP functions are optional. If your unit does not include these options, it does not have the applicable connectors.

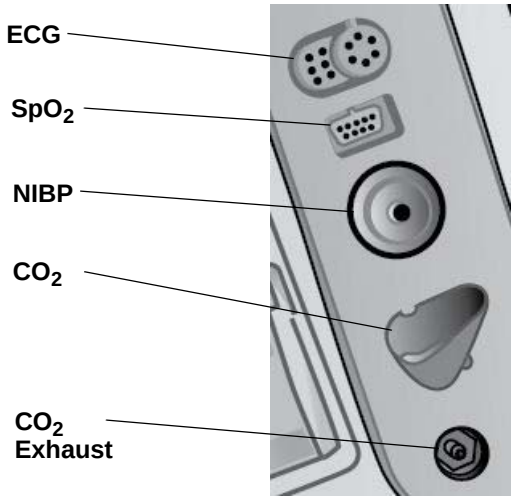


Figure 2-3. Patient Cable Connectors on Left Side of Unit

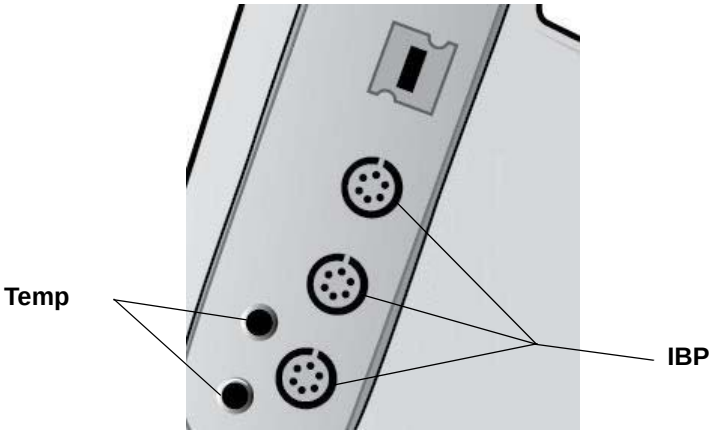


Figure 2-4. Patient Cable Connectors on Right Side of Unit

Connector	Description
ECG	For connecting 3- or 5-lead ECG cable (12-lead monitoring is optional).
SpO_2	For connecting Nellcor pulse oximeter cable.
NIBP	For connecting NIBP hose.
CO_2	For connecting CO_2 sampling line.
Temp	For connecting temperature probe(s).
IBP	For connecting IBP cable(s).

Auxiliary Power Adapter

The auxiliary power adapter is used as backup power to operate the Propaq M. When it is connected to the Propaq, it powers the unit and charges the battery that is installed in the Propaq. When the power cord is plugged in and the auxiliary power connector is inserted into the back of the Propaq unit, the auxiliary power LED on the front panel illuminates and the auxiliary power icon displays at the top of the display screen.

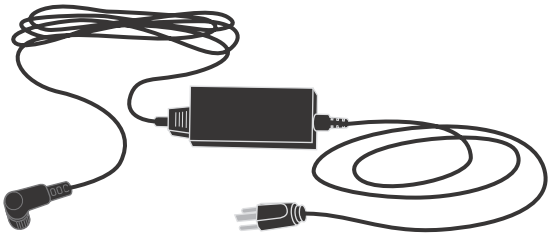


Figure 2-5. Auxiliary Power Adapter

To connect the auxiliary power adapter, insert the auxiliary power connector into the black input connector on the back of the unit. To disconnect the auxiliary power adapter, grasp the connector collar, turn it to the left, and pull it out.

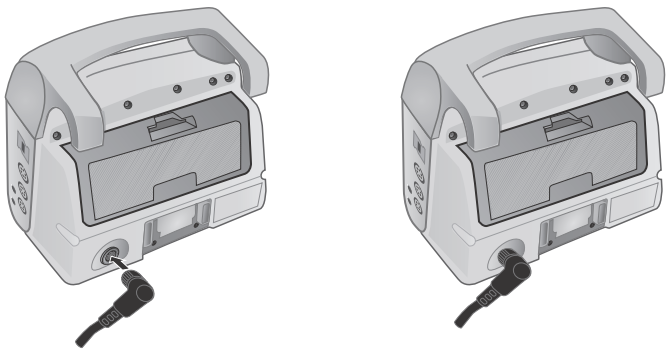


Figure 2-6. Connecting the Auxiliary Power Adapter

Navigating the Display Screen

You can access the Propaq functions using the quick access keys that are located on the left side of the display screen, and the navigation keys that are located on the right side of the front panel.

Quick Access Keys

The seven quick access keys on the left side of the display screen are an easy way to access the functionality of the Propaq. When you press the last key (right arrow), five more keys are displayed.

First level keys Second level keys

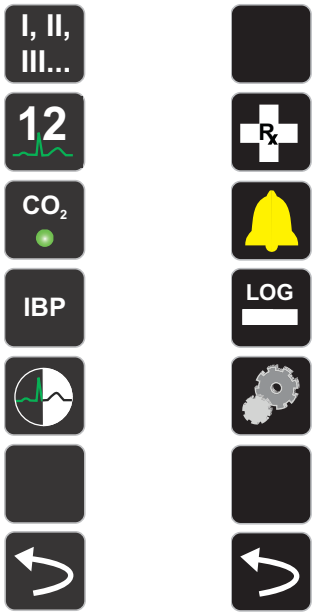


Table 2-3. Propaq Quick Access Keys

Quick access key	Description
Lead 	Selects the ECG input source for the first waveform trace.
12 lead 	Displays the 12-lead monitoring screen.
CO_2 	Turns CO_2 on and off.
IBP 	Displays IBP setup and zero buttons.

Table 2-3. Propaq Quick Access Keys

Quick access key	Description
Brightness 	Changes the brightness setting -- toggles through high contrast display (white background), color display (black background), and night vision goggle (NVG) friendly display.
More/Back 	Goes to the next or previous level of quick access keys.
Treatment 	Displays the current clinical treatment options.
Alarms 	Displays the Limits option to allow the user to view/set all parameter alarm limits and the Alarm Suspend button.
Log 	Opens the Log Control panel.
Setup 	Displays the Setup menu to allow the user to configure settings such as ECG, display/volume, trends, operational checklist, and supervisor.
Treatment Summary 	Displays treatment summary cases.
Trend Settings 	Displays settings for trend display format, trend on interval, and trend on alarm.
Transfer Log 	Transfers the current data in the log to a USB drive.
Clear Log 	Deletes the current data in the log.
Acquire 	Collects 10 seconds of 12-lead data.
Stop Acquisition 	Stops acquisition of 12-lead data.
Patient Information 	Allows you to enter information to accompany 12-lead data: patient name, age, gender, and ID.

Table 2-3. Propaq Quick Access Keys

Quick access key	Description
Row Up 	Allows you to move to the previous row when entering patient information.
Row Down 	Allows you to move to the next row when entering patient information.
12-Lead Review 	Reviews all your 12-lead captured data.
12-Lead Review Next 	Goes to the next page of the 12-lead snapshot you are reviewing.
Exit 12-Lead 	Exits the 12-lead monitoring screen.
Stat Set 	Sets all alarm limits relative to the patient's current vital signs.
Alarm Cancel 	Suspends the current alarm.
Limits 	Displays the current alarm settings.
IBP Setup 	Brings up the IBP Control Panel for the corresponding channel (P1, P2, or P3).
IBP Zero 	Zeroes the IBP transducer for the corresponding channel (P1, P2, or P3).

Navigation Keys

Use the navigation keys (up/clockwise arrow, down/counterclockwise arrow, and action button) to navigate through windows and make selections.

Using Up/Clockwise and Down/Counterclockwise Arrows

Use the up/clockwise down/counterclockwise arrows to do the following:

- Move clockwise and counterclockwise through the main display windows.
- Move up and down in a window.
- Change parameter settings.

Using the Select Button

Use the Select button to do the following:

- Display the settings window while a parameter is highlighted in the main window.
- Select options from a window.

Display Brightness

The monitor can display in three different brightness modes:

- high contrast with white background (for optimal display in bright sunlight)
- color with black background (numerics and waveforms are easy to read)
- night vision goggle (NVG) friendly (display and alarm LEDs prevent interference with goggles)

Common Tasks

The section contains procedures for the following tasks:

- “Changing the Display Brightness” on page 2-11.
- “Replacing a Battery Pack on the Propaq M” on page 2-12.
- “Using Treatment Buttons” on page 2-13.

Changing the Display Brightness

The following procedure shows how to select the different brightness options.

1. Press the power switch to turn the unit on.
2. Press the Brightness quick access key () repeatedly to toggle through the brightness options until you find your selection.

Note: Selecting a higher brightness setting (such as 70%) will deplete the battery pack at a faster rate than when choosing a lower brightness setting (such as 30%). To select the brightness setting, go to the Setup>Display/Volume>Display Brightness menu to adjust the display percentage.

Replacing a Battery Pack on the Propaq M

This section describes how to replace a battery pack on the Propaq M.

Replacing a Battery Pack on the Propaq M

To remove a battery pack, use your fingers to grasp and raise the latch and pull the battery pack out of the compartment.

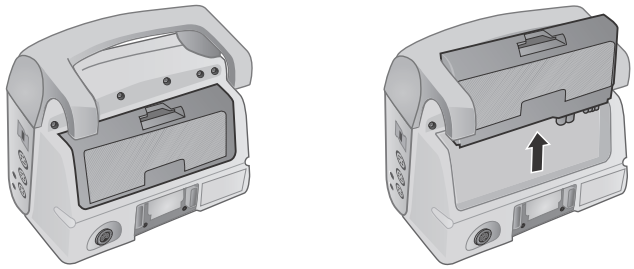


Figure 2-7. Removing a Battery Pack

To install a battery pack:

1. Line up the battery so it will slide into the battery well.
2. Push the battery into place.

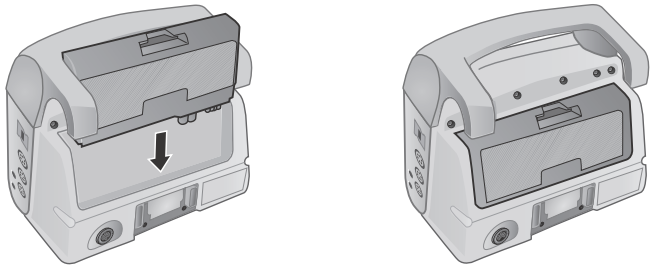


Figure 2-8. Installing a Battery Pack

Using Treatment Buttons

Pressing the Treatment quick access key () causes the unit to display preconfigured buttons that contain clinical actions. These buttons allow you to add a treatment snapshot (which itemizes drugs or treatments administered to the patient) to a Treatment Summary Report. The following is a list of preconfigured treatment buttons:

- O2
- ASA
- Nitro
- Morph
- IV
- B Block
- Lido
- MgSO4
- Valium
- Sedate

Customizing Treatment Buttons

You can also customize up to 9 treatment buttons by pressing the Setup quick access key (), and then selecting Supervisor>Log>Treatment Options. Highlight **Define Custom Labels**, and then can customize up to 9 buttons.

Chapter 3
Monitoring Overview

This chapter provides an overview of the Propaq M unit's monitoring functions. It describes the types of vital sign monitoring that Propaq M provides, and the flexibility that the Propaq M unit gives you in displaying a patient's vital signs information.

Propaq M Monitoring Functions

The Propaq M unit provides an array of standard, and optional, monitoring functions, and allows you to view the vital signs measurements that these functions provide in a variety of formats. The Propaq M unit also allows you to set alarm limits for each monitoring function. Should a patient's vital signs measurements go outside of these limits, the Propaq M issues an audible alarm tone and displays visual alarm indications to alert you.

If the Propaq M unit is powered off for less than 2 minutes, all patient monitoring parameter settings are retained. If the Propaq M unit is powered off for 2 minutes or longer, the unit operates as if there is a New Patient and all patient-specific parameters (alarm limits, etc.) are reset to their default values.

The Propaq M unit can monitor the following patient vital signs:

- ECG
- Heart Rate
- Respiration Rate
- Temperature
- Invasive Pressures (IBP)
- Non-invasive Blood Pressure (NIBP)
- Capnography (CO_2)
- Pulse Oximetry (SpO_2)

ECG

An ECG waveform trace appears at the top of the display area. You can specify that the unit display the waveform trace of any available ECG source, such as ECG Leads **I**, **II**, or **III**, and so on, in this area. You can configure the Propaq M unit to display up to four ECG waveform traces. In addition to being able to specify the ECG source for each waveform trace, you can adjust the display scale of those traces to make them easier to view.

Heart Rate

A Heart Rate meter gives the patient's heart rate in Beats Per Minute (**bpm**). By default, the Propaq M unit derives the heart rate from the patient's ECG, but can be configured to use other monitoring functions to derive the patient's heart rate.

Respiration Rate

A Respiration Rate meter gives the patient's respiration rate in Breaths Per Minute (**br/min**). The Propaq M unit can be configured to derive the respiration rate from the patient's ECG or from the optional CO_2 monitoring function.

Temperature

The Temperature (**Temp**) meter can display temperature measurements from up to two temperature probes. The Propaq M unit provides two separate temperature monitoring channels and, if both are used, displays the monitored temperatures, in degrees F or C, one after the other, followed by the difference between those temperatures.

Invasive Pressures (IBP)

The Propaq M unit provides three separate channels for monitoring arterial, venous, or intracranial pressure using internal probes. The pressure measurements for each pressure channel appear on in a labeled (**P1**, **P2**, **P3**) numeric display.

Non-Invasive Blood Pressure (NIBP)

The Propaq M unit provides patented Smartcuf motion-tolerant technology for NIBP monitoring. NIBP monitoring measures the patient's systolic, diastolic, and mean blood pressure through an inflatable blood pressure cuff that the Propaq M unit inflates/deflates. NIBP measurements can be taken automatically or on-demand by pressing the NIBP button (),on the face of the Propaq M unit. The blood pressure measurements appear on in a labeled (**NIBP**) numeric display.

Capnography (CO_2)

CO_2 monitoring measures the CO_2 concentration in a patient's exhaled breath (End Tidal Carbon Dioxide --$EtCO_2$). CO_2 monitoring can also measure a patient's breath rate and the CO_2 concentration in the gasses supplied to intubated patients (Fractional Inspired Carbon Dioxide -- $FiCO_2$). Since $FiCO_2$ represents the amount of CO_2 present during inhalation, it also serves as an indicator for rebreathing in non-intubated patients. CO_2 monitoring can be used for both intubated and non-intubated patients.

The $EtCO_2$, breath rate, and $FiCO_2$ measurements appear in a labeled (**$EtCO_2$**) numeric display. The $EtCO_2$ and $FiCO_2$ measurements can appear as values given in millimeters of mercury (mmHg). You can also specify that the Propaq M unit display a CO_2 capnogram in the waveform trace display area.

Pulse Oximetry (SpO_2)

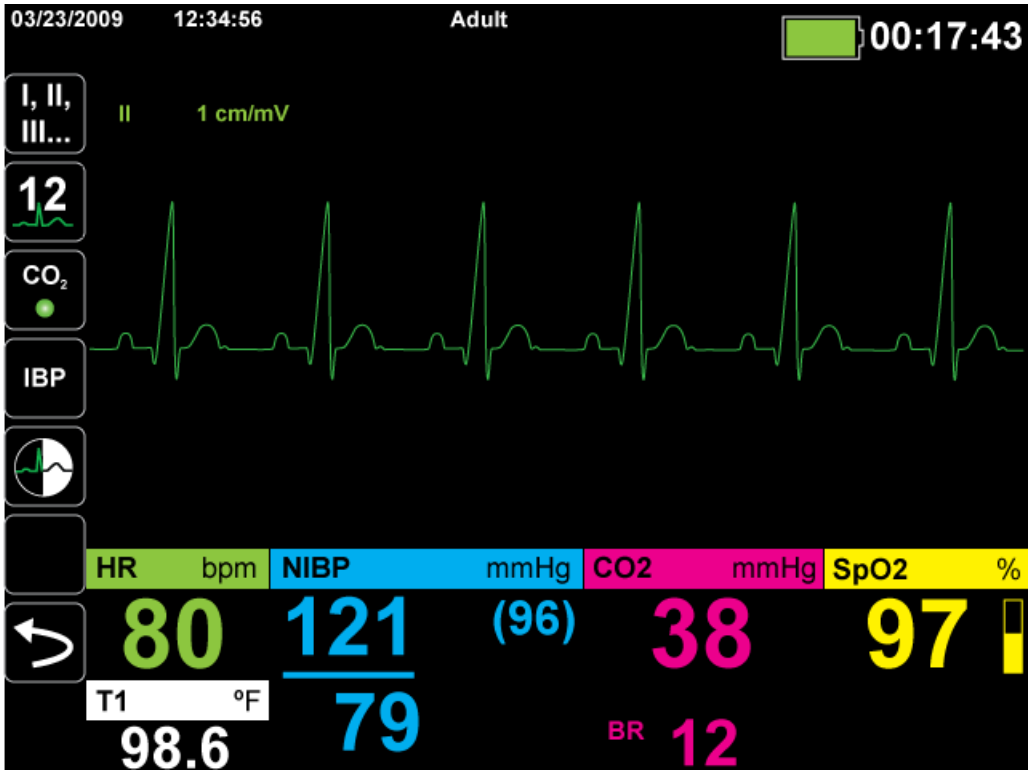
Pulse Oximetry monitoring measures the oxygen saturation (SpO_2) of arterial blood at a peripheral site such as a finger or toe. SpO_2 monitoring determines the ratio of oxygenated hemoglobin to total hemoglobin in arterial blood and displays this ratio as percent SpO_2 in a labeled (**SpO_2**) numeric display. You can also specify that the Propaq M unit display an SpO_2 plethysmograph in the waveform trace display area.

Monitoring Display Options

The Propaq M unit gives you great flexibility in how you display a patient's vital signs information. By pressing the **Display/Home** button (),on the front panel, you can successively display the patient's vital signs information in these three windows:

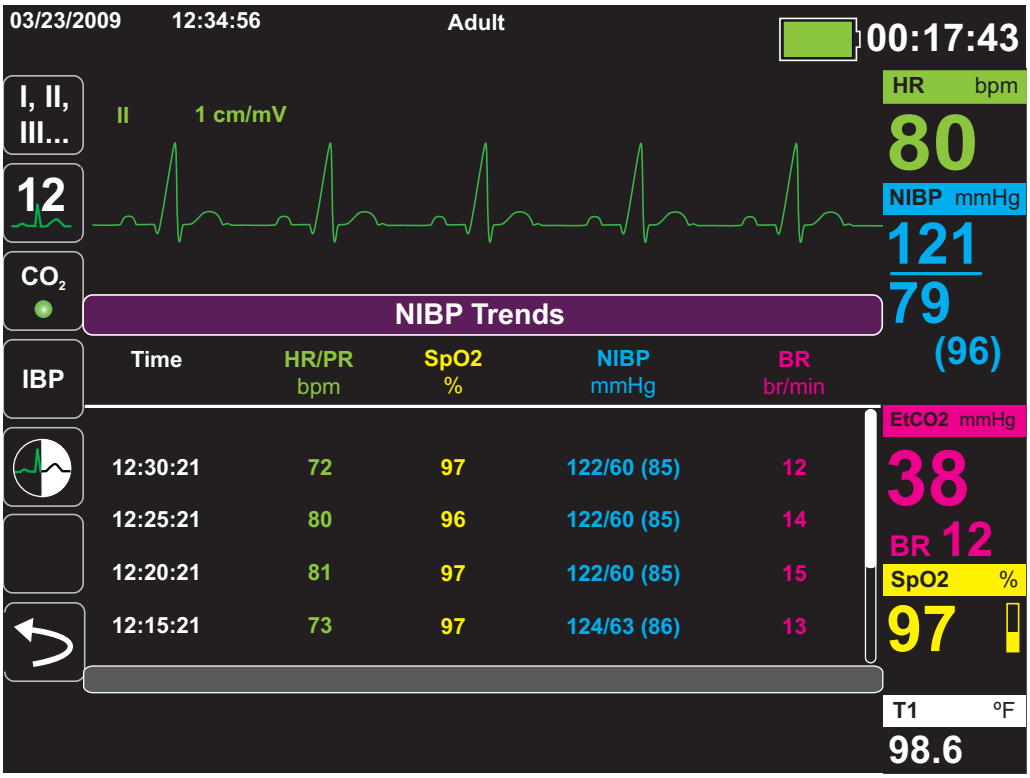
- **Waveform Display window**, which initially displays an ECG waveform trace and numeric displays for each monitoring function.
- **Trends Status window**, which displays a report listing vital signs measurements that the Propaq M unit logs automatically, and the primary ECG waveform trace.
- **Large Numerics Display window**, on which large numeric displays of all vital signs measurements appear.

The Waveform Display window appears when you power on the Propaq M unit. Initially, the Waveform Display window displays a single ECG waveform trace. All other monitored values appear in numeric display areas at the bottom of the screen:

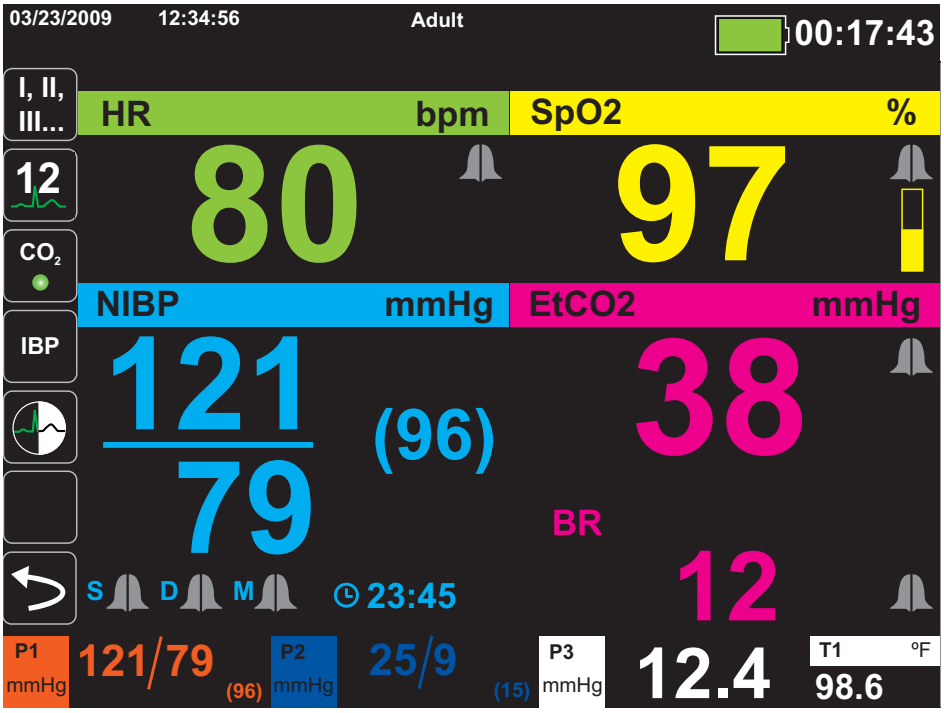


You can display up to four waveform traces that you specify on the Waveform Display window. You will determine how to add waveform traces to this window later in this chapter.

Press the **Display/Home** button when viewing the Waveform Display window, and the unit displays the Trends Status window. The Trends Status window reports the patient's vital sign measurements, which the Propaq M logs automatically at a configurable interval (see the following chapter, *Trends*, for more detailed information about the **Trends** Status window). The primary ECG waveform trace appears above the **Trends** report:


03/23/2009
12:34:56
Adult
00:17:43
I, II, III...
II
1 cm/mV
12
CO2
NIBP Trends
IBP
Time
HR/PR bpm
SpO2 %
NIBP mmHg
BR br/min
12:30:21 72 97 122/60 (85) 12
12:25:21 80 96 122/60 (85) 14
12:20:21 81 97 122/60 (85) 15
12:15:21 73 97 124/63 (86) 13
HR bpm
80
NIBP mmHg
121
79
(96)
EtCO2 mmHg
38
BR 12
SpO2 %
97
T1 °F
98.6

Press the **Display/Home** button when viewing the Trends Status window and the Large Numerics Display window appears. The patient's vital signs measurements appear in large labeled numeric displays; no waveform trace appears on this screen:



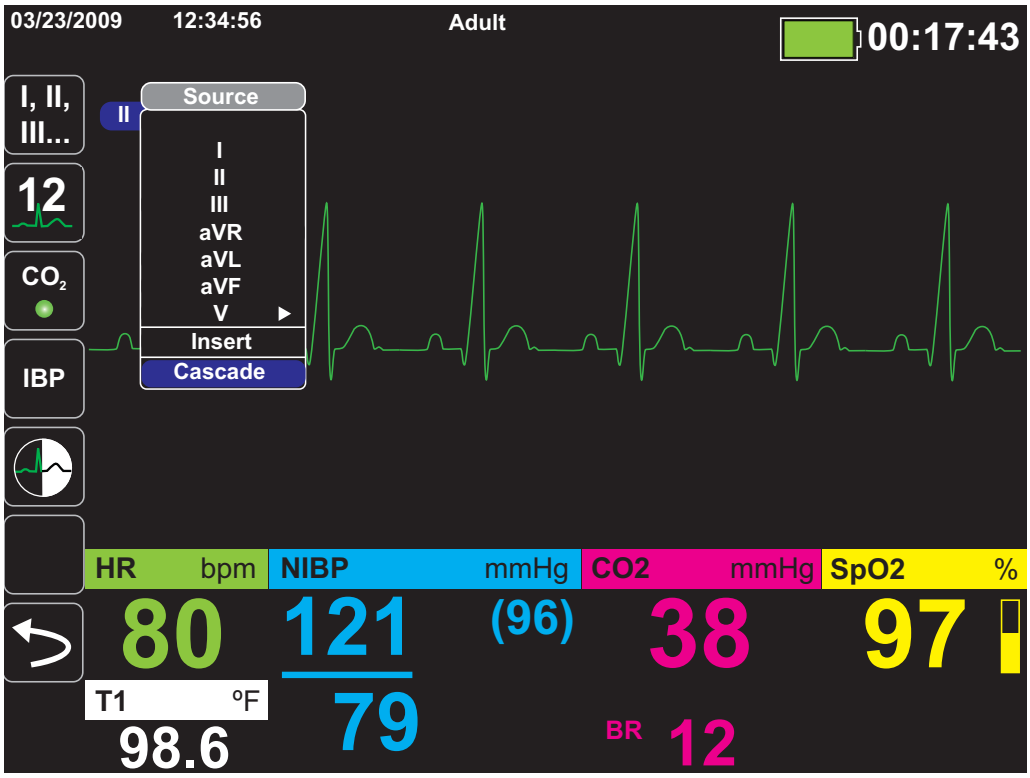
Press the **Display/Home** button to redisplay the Primary Display window.

Configuring the Waveform Display

You can display up to four waveform traces on the Waveform Display window. The first waveform trace always uses an ECG lead as its source (such **as** Leads **I**, **II**, or **III**, and so on). As you insert the remaining three traces, you can specify that the traces use an ECG lead as the waveform source, or that the trace derive its waveform from other available monitoring functions (such as **Resp**, **CO2**, **SpO2** or IBP channels **P1**, **P2**, or **P3**).

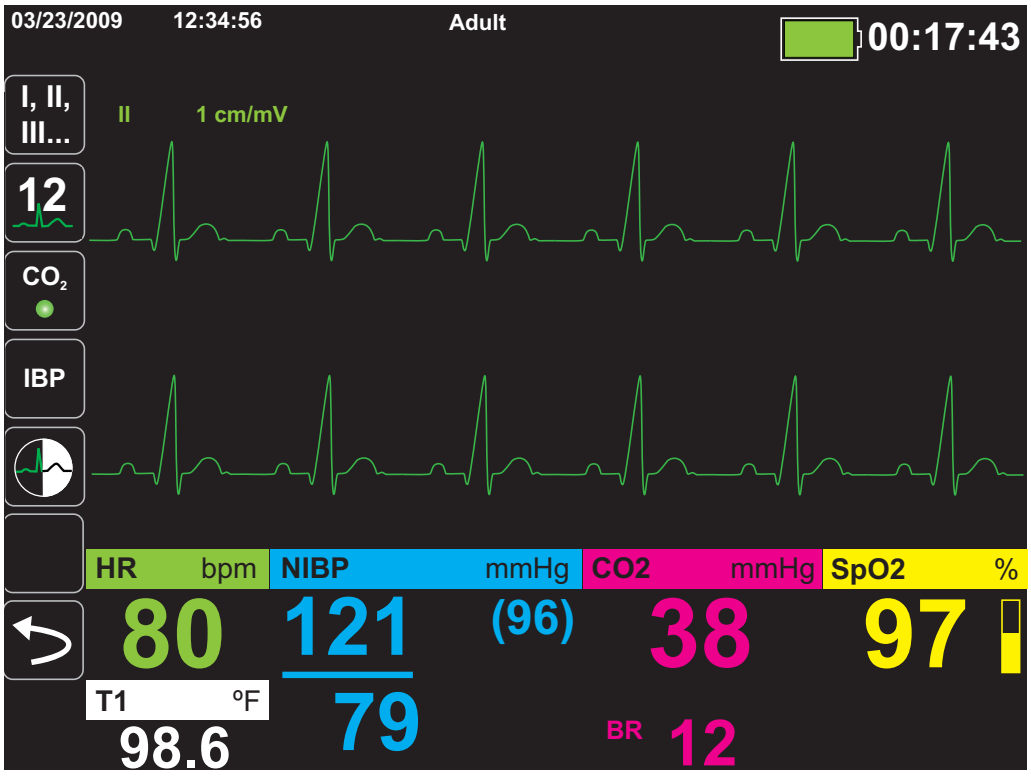
The Propaq M unit can also cascade a trace onto the adjoining trace area to double the duration of the trace display.

On the Waveform Display window, to insert a new trace (**Insert**) or cascade (**Cascade**) a displayed trace, highlight and select the trace label above the trace. In the following example, the unit is configured to cascade the ECG Lead l trace:



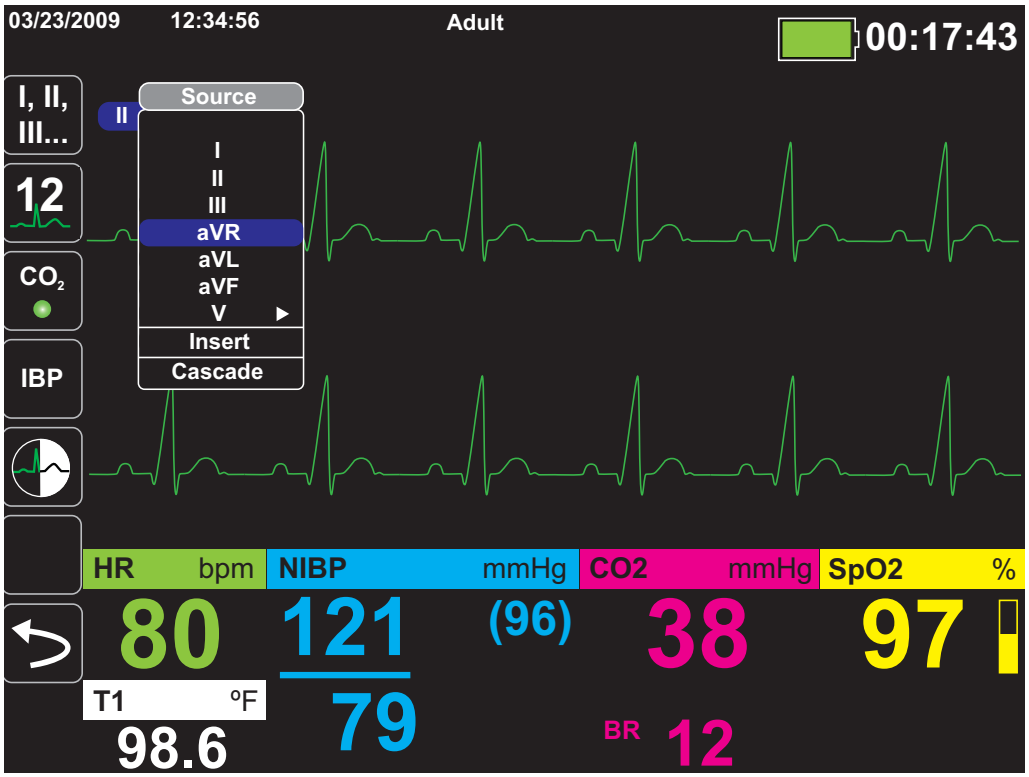
Note: The Propaq M unit automatically inserts a new waveform when you turn on a parameter (CO_2) or a new sensor signal is present (SPO2, IBP). The Propaq M unit automatically removes a waveform when you turn off a parameter or remove a sensor and the unit displays the resulting equipment alert.

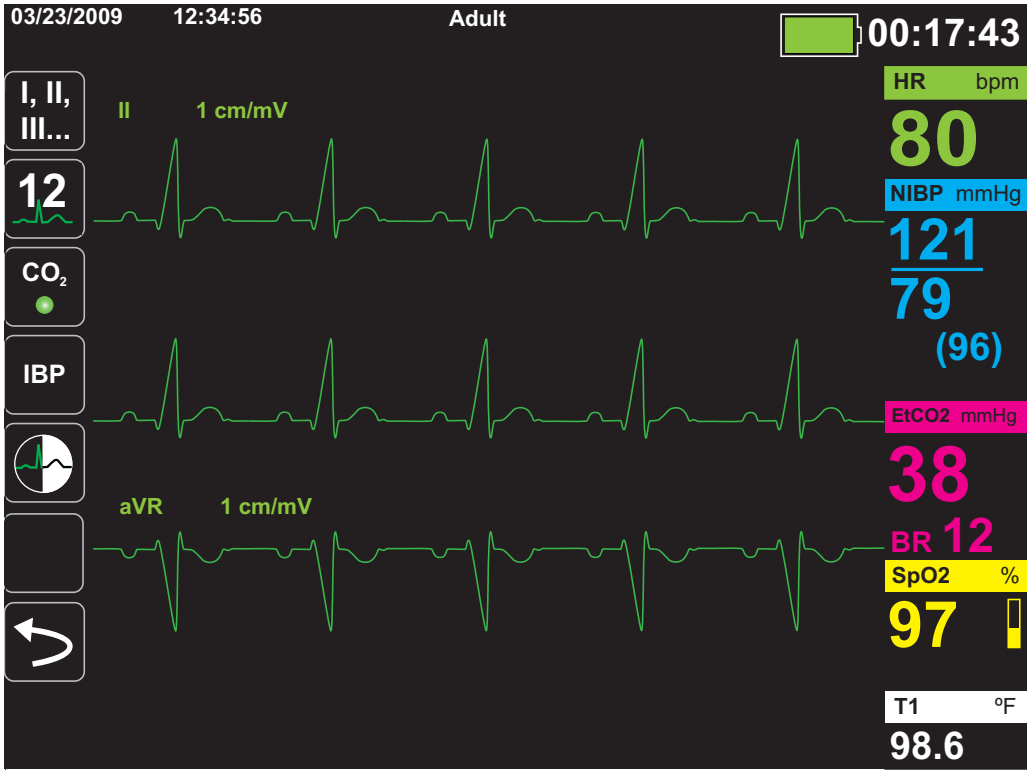
When the unit cascades the ECG Lead **II** trace, the Waveform Display window appears as follows:



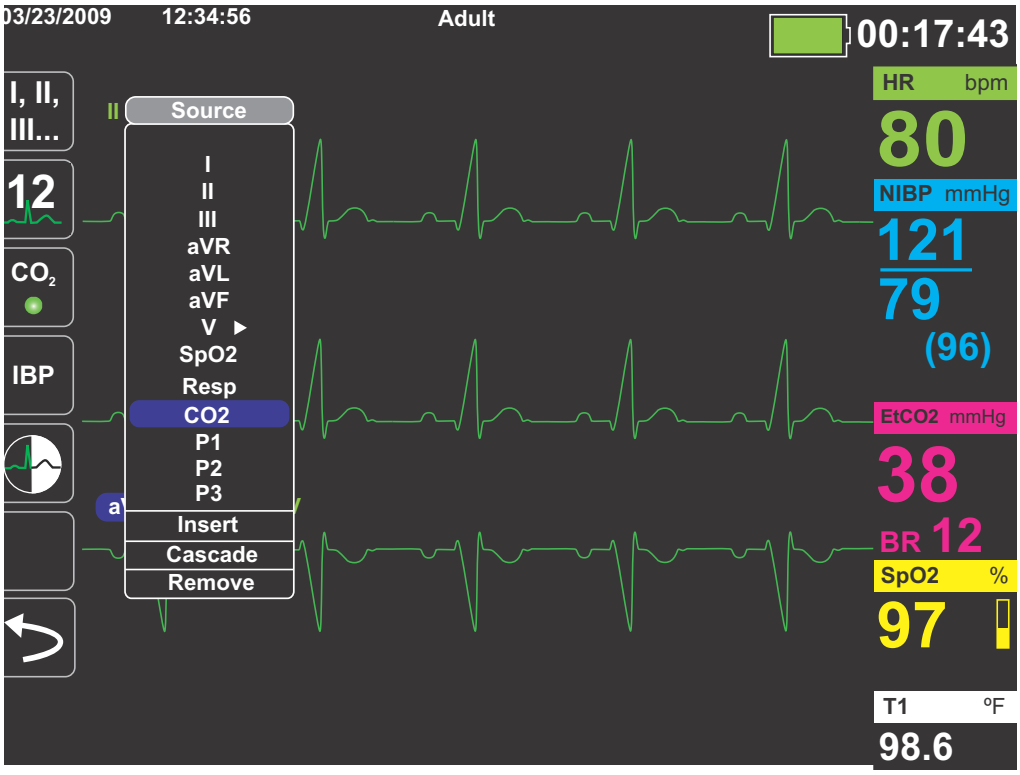
The following screens demonstrate how to insert two more waveform traces into the window. A third trace is inserted for ECG lead **aVR**, and fourth trace for **EtCO2** (a capnogram). Notice that when the third trace is inserted, the numeric displays move to the right side of the window to allow more room for the waveform traces.

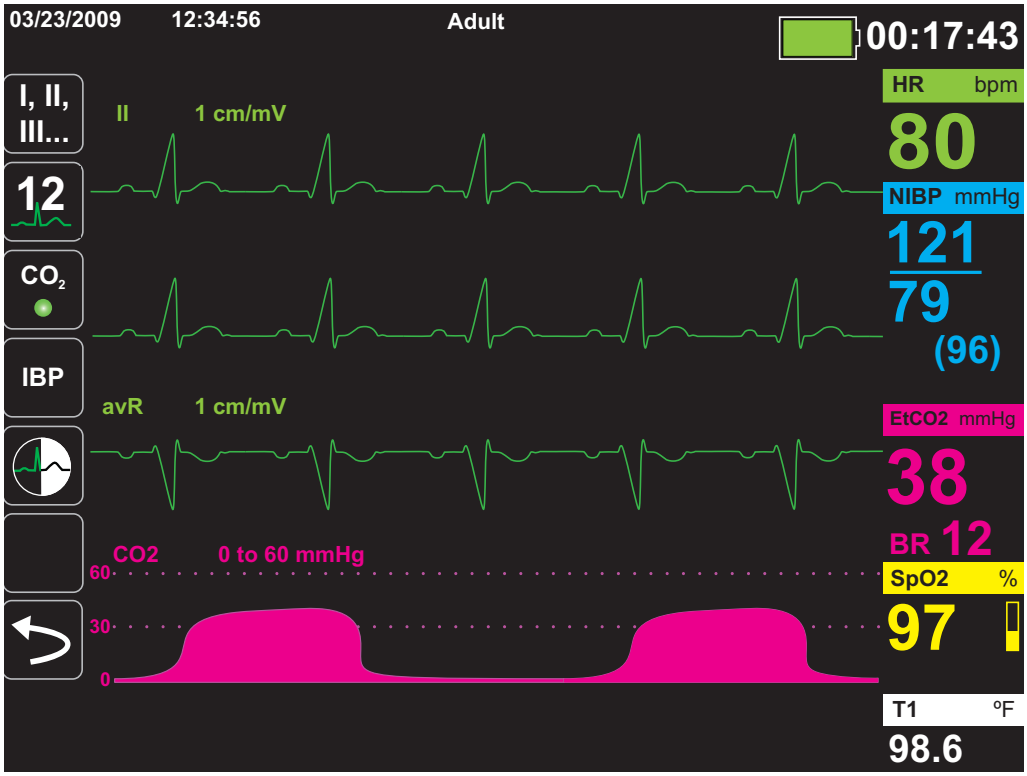
Inserting a third waveform trace for ECG lead **aVR**:





Inserting a capnogram (**CO2**) into the fourth trace area:





Chapter 4
Trends

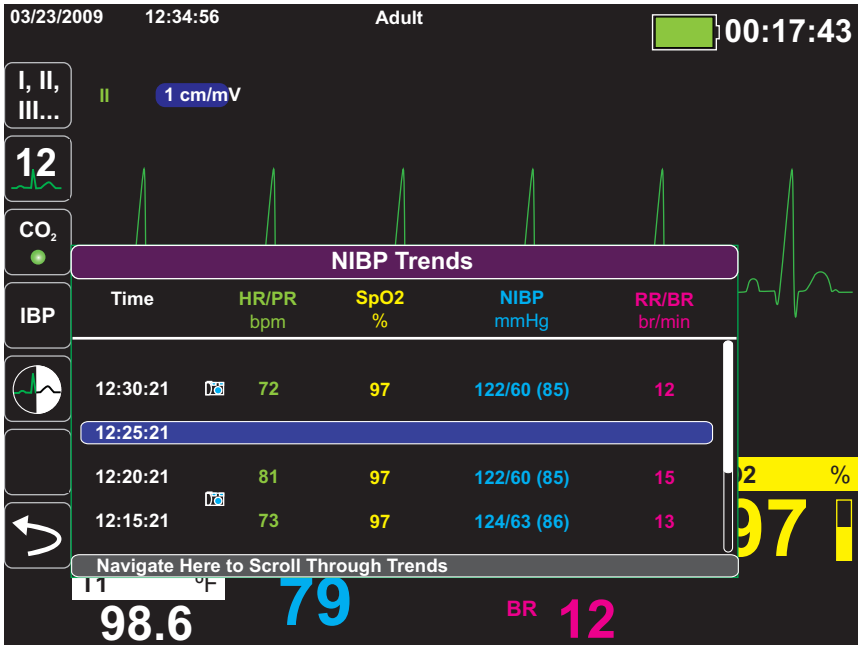
The Propaq M unit accumulates a patient's trend information by logging all monitored vital sign measurements to memory at a user-configurable interval. It also logs *all* monitored vital sign measurements whenever

- an NIBP measurement is taken and the **Trend on NIBP** option is on
- when you press the Snapshot button ()on the front panel
- when a patient alarm occurs and the **Trend on Alarm** option is on

The Propaq M unit can store at least 24 hours of trend information when logged at a 1 minute trend interval. You can view or save to external memory all logged trend information.

Displaying the Trends Status Window

The Propaq M unit displays the logged trend information in the Trends status window. Press the **Display/Home** button () to display the Trends window, the primary ECG trace, and the small numeric displays for each monitoring function:



The Trends status window displays the logged trend information and the time at which the trend measurements were logged. While trend measurements are logged to memory at a user-configurable interval, the Trends status window can display the logged information at an interval that you specify, with the exception of NIBP measurements, which are logged and reported at the times they are taken. The previous Trends status window reports the trends information at 5-minute intervals.

Displaying Trend Information

To navigate in Trends status window, highlight the **Navigate Here to Scroll through Trends** bar, then press **Select**.

Press the Up/Down buttons (') to scroll through the trend information.

Changing the Trends Status Window Display

By default, the Trends status window displays all logged trend information. It displays the numeric information for all monitoring functions, which the unit logs at a user-configurable interval, and when you take NIBP measurements, when a patient alarm occurs, and when you press the .

To configure the display of the Trends status window, press (LOG) and press the Trend Settings quick access key ( ) to display the Trends Settings control panel. On the Trends Settings control panel, select a Trend Display Format to specify the monitored vital signs that appear in the Trends status window:

Trend Format	**Vital Signs Displayed**
Resp	HR, SpO2, RR, EtCO2, FiCO2
NIBP	HR, SpO2, NIBP, RR
IBP1	HR, SpO2, IBP1, RR
IBP2	HR, SpO2, IBP2 RR
IBP3	HR, SpO2, IBP3, RR
Temp	HR, SpO2, T1, T2, ΔT

Chapter 5
Alarms

The Propaq M unit supports the detection and indication of *patient alarms* and *technical alerts*.

A patient alarm is any alarm condition that is caused by a monitored patient-related variable, such as a measured vital sign that falls outside of a configured alarm limit. Y*ou can configure patient alarm limits for each of the physiologic monitoring functions.*

A technical alert is monitored equipment-related variable that the Propaq M unit can detect, such as a disconnected sensor, internal diagnostics failures, and so on. *Technical alerts are always enabled and are not user-configurable*.

Patient alarms are always classified as high-priority alarms. Technical alerts are classified as medium or low priority alarms.

Alarm conditions from patient alarms and technical alerts are stored in the Event Log and retained with normal power down or total loss of power.

Visual Alarm Indicators

In addition to status messages that appear on the display, the Propaq M unit lights the red or yellow LED on the front panel to indicate the priority level of the highest-priority active alarm. The Propaq M LEDs indicate the priority level of the highest-priority active alarm as shown in the following table.

Active Alarm Priority	**Visual Alarm Indicator**
High Priority -- Patient Alarm	Flashing Red LED
Medium Priority -- Technical Alert	Flashing Yellow LED
Low Priority -- Technical Alert	Continuous Yellow LED

Audible Alarm Indicators

The Propaq M unit sounds an audible alarm to indicate the priority level of highest-priority active alarm. The Propaq M indicates the priority level of the highest-priority active alarm by sounding the audible alarm tones described in the following table.

Active Alarm Priority	Audible Alarm Indicator	Alarm/Alert Volume
High Priority -- Patient Alarm	Two sets of five short beep tones, repeated at 15-second intervals	Volume is adjustable, up to a maximum sound pressure of at least 70 dBA (measured at 1m)
Medium Priority -- Technical Alert	One set of three longer beep tones, repeated at 30-second intervals	Volume is 3 to 12 dBA below high priority alarm
Low Priority -- Technical Alert	A single short beep tone, not repeated	Volume is 3 to 6 dBA below the medium priority alert

Audible alarms can be silenced or suspended. More detailed information about how to silence and suspend audible alarms is included later in this chapter.

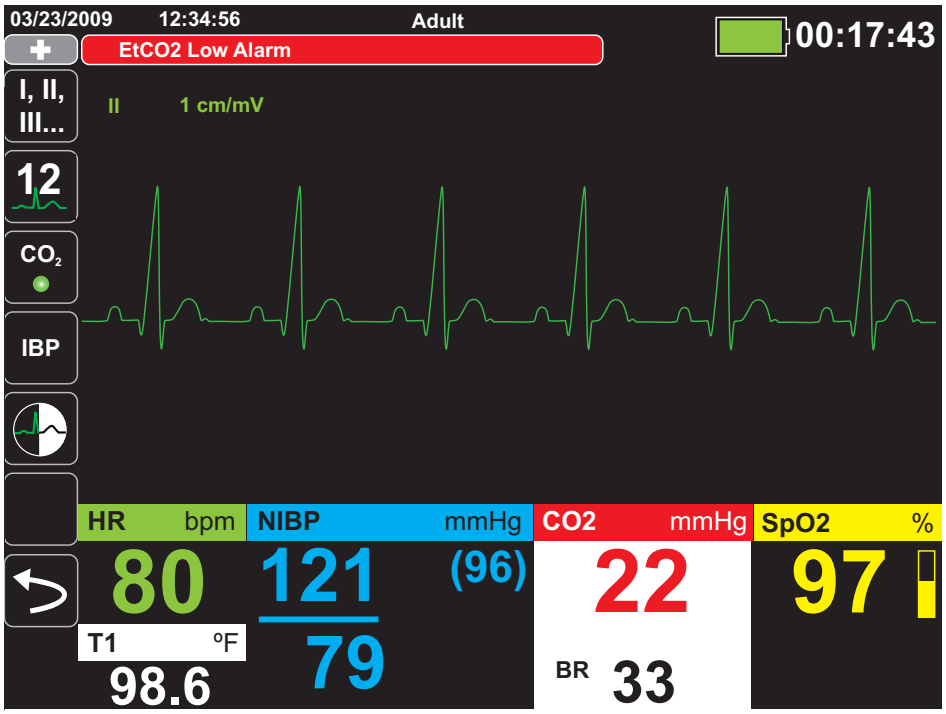
Alarm Indicator Self-test

The Propaq M unit performs a self-test of the audio and visual alarm indicators upon power-up. To ensure that the alarms and alerts are functioning properly, verify that two alarm tones are heard and the green, yellow, and red LEDs are illuminated upon power up.

Patient Alarm Display

When a patient's vital signs measurements trigger an alarm, in addition to sounding the patient alarm, the Propaq M unit displays an alarm message, and changes the display characteristics of the monitoring function's numeric display (the alarming parameter appears in red against a white background).

In the following example, the $EtCO_2$ measurement (**22** mmHg) has dropped below the lower alarm limit (**EtCO2 Low Alarm**):

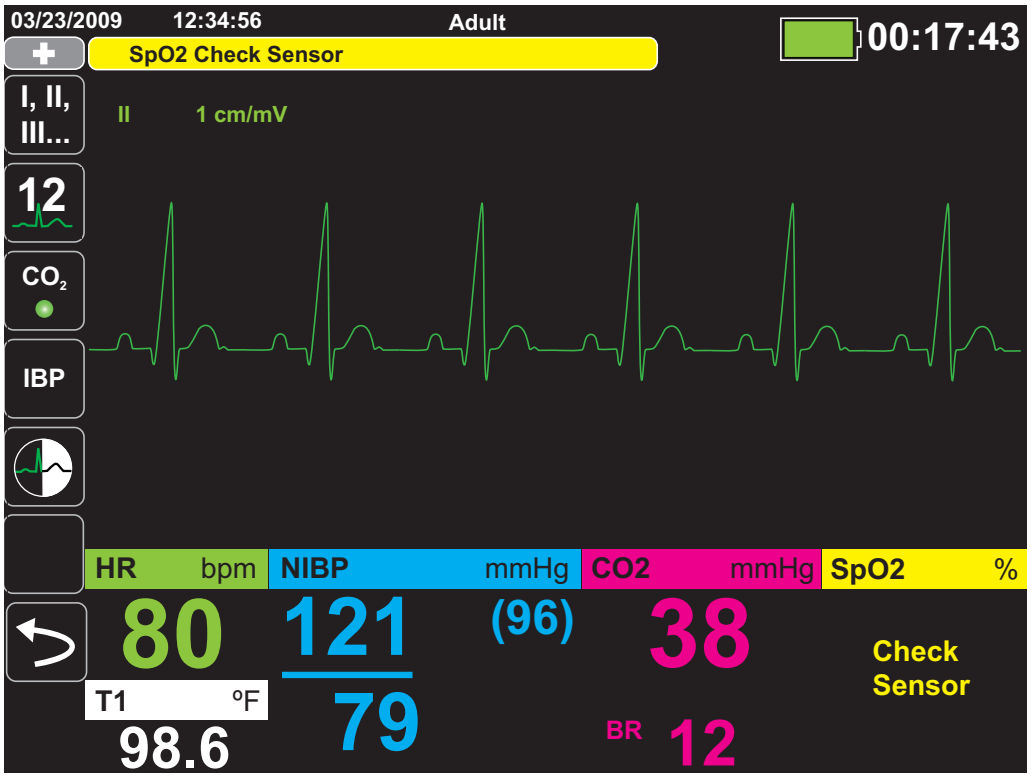


Equipment Alert Display

When a problem with the Propaq M unit or an attached sensor triggers an alert, in addition to sounding an equipment alert, the Propaq M unit displays an alert message (yellow background, black text).

Warning! **Always respond immediately to a system alarm since the patient may not be monitored during certain alert conditions.**

In the following example, an equipment alert message indicates that the SpO_2 sensor has become unattached (**SpO2 Check Sensor**) from the unit:



Responding to Active Alarms -- Silencing the Alarm

When a patient alarm is triggered and the alarm tone sounds

1. Check the patient and provide appropriate care.
2. Press the Alarm Silence/Reset button ( ) on the Propaq M unit's front panel to silence the alarm briefly (90 seconds).
3. After caring for the patient, check that the appropriate alarms are set (for more information about setting and enabling alarms, see appropriate monitoring chapters later in this manual).

Note: Pressing suspends the alarm tone for all active alarms. If the patient's vital signs measurements trigger another, different alarm, the Patient Alarm tone will sound, even if the first alarm silence period hasn't expired.

Re-enabling an Alarm

To re-enable an alarm before the alarm silence period has expired, press the **Alarm Silence/ Reset** button.

Warning! **Do not silence the audible alarm if patient safety may be compromised.**

Suspending Alarms

When caring for a patient, you may want to suspend potential or current patient alarms and equipment alerts for a period of time. To suspend patient alarms

1. Press the More quick access key ( ) to access the second set of quick access keys and press the Alarms quick access key.
2. Press the Alarms Suspend quick access key ( ).

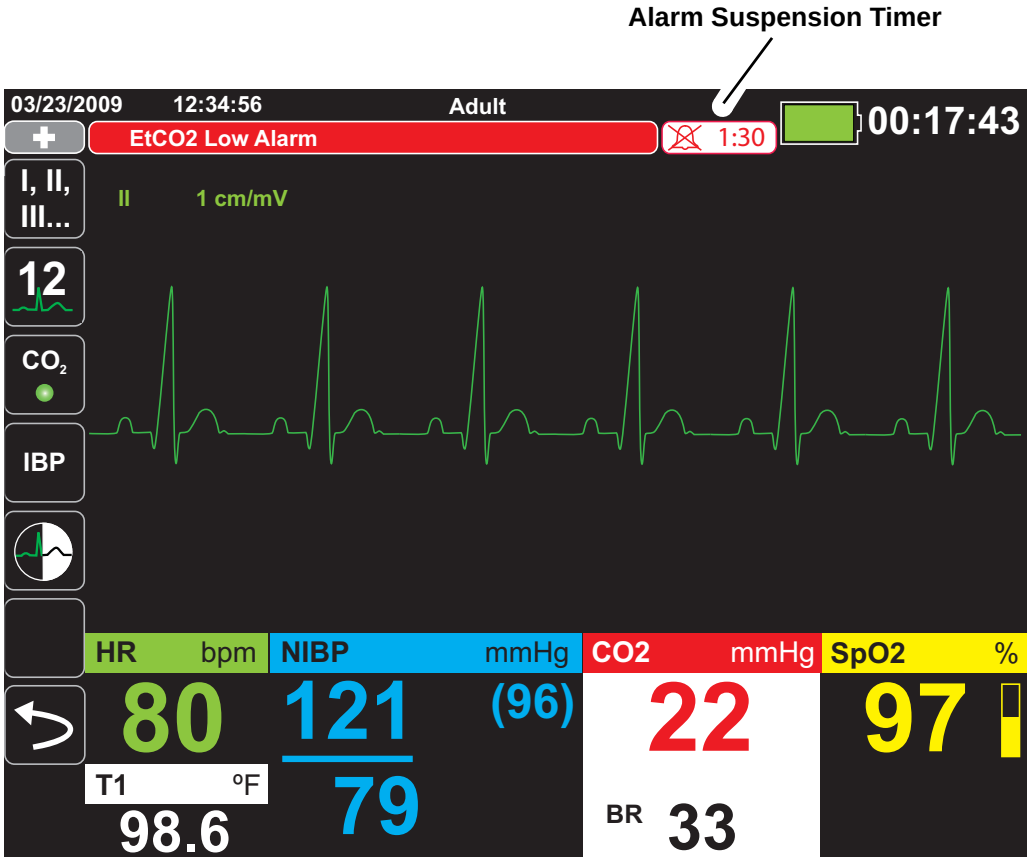
No alarms will sound while alarms are suspended; however, if an alarm occurs during the suspension period, the Propaq M unit will display visual alarm indicators -- alarm messages in the message area (white text on a red background) and red/white numeric displays).

The duration of the alarm suspension can be configured to be for 2, 4, or 15 minutes, or for an indefinite period of time. The ability to suspend alarms can also be disabled.

Warning! **When audible alarms are disabled, make sure that the patient is closely observed.**

The Alarm Suspension Timer

During an alarm suspension, the window displays an alarm suspension timer at the top of the display next to the message area:


Alarm Suspension Timer
03/23/2009
12:34:56
Adult
00:17:43
EtCO2 Low Alarm
1:30
I, II, III...
II
1 cm/mV
12
CO2
IBP
HR bpm
NIBP mmHg
CO2 mmHg
SpO2 %
80
121
(96)
79
22
97
T1 °F
98.6
BR 33

Alarm Options

The Propaq M unit provides alarm options that you can specify through the Supervisor parameter control panels (access to Supervisor is passcode-controlled).

Press the More quick access key (), press the Setup quick access key (), and select **Supervisor**. Using the navigation keys, display and select the four digits in the Supervisor passcode:

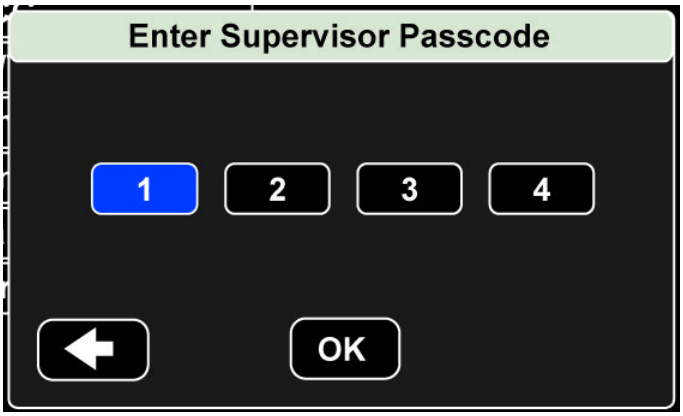


Figure 5-1 Supervisor Parameter Control Panel

Select the **Alarms** option to display the alarms parameter control panel:

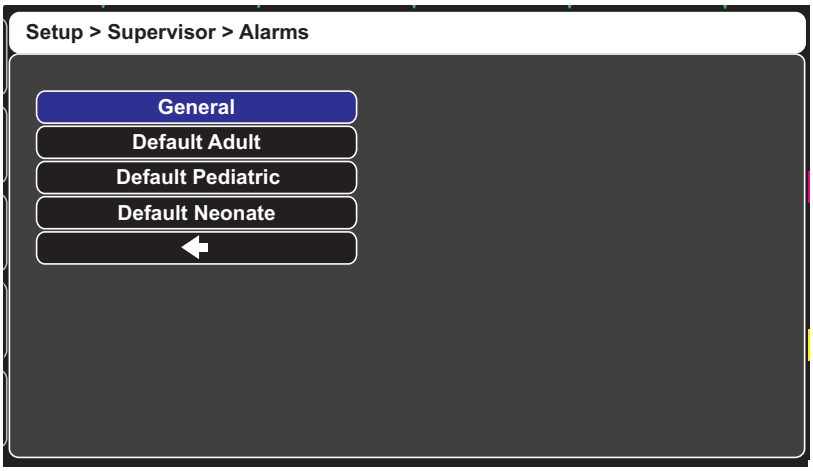


Figure 5-2 Alarms Parameter Control Panel

Selecting Default Alarm Limits

The first three options -- **Default Adult**, **Default Pediatric**, **Default Neonate** -- allow you to set *all* alarm limits to the Propaq M unit's factory-specified default values, by patient type.

Warning!

- **A potential hazard exists if different alarm limits are used for the same or similar equipment in any single area.**
- **Confirm the alarm limits are appropriate for the patient each time there is a new patient incident.**
- **Do not set alarm limits to such extreme values that render the alarm system useless.**

Setting Alarm Limits Relative to the Patient -- Stat Set Option

The Propaq M unit also allows you to set all alarm limits relative to the patient's current vital signs measurements by performing the following actions:

1. Press  .
2. Press the Alarm quick access key ().
3. Press the **Stat Set** quick access key (). The Propaq M unit sets all parameters to a new value based on the current values as follows:

Parameter (units)	Range	Upper Limit Calculation	Lower Limit Calculation
HR/PR (bpm)	Numeric < 26	Limit is unchanged	Limit = 25
	26 ≤ Numeric ≤ 99	Limit = Numeric x 1.2	Limit = Numeric x 0.8
	100 ≤ Numeric ≤ 250	Limit = Numeric + 20	Limit = Numeric – 20
	Numeric > 250	Limit = 250	Limit is unchanged
IBP (mmHg)	Numeric < 26	Limit = Numeric + 5	Limit = Numeric – 5
	26 ≤ Numeric ≤ 99	Limit = Numeric x 1.2	Limit = Numeric x 0.8
	Numeric > 99	Limit = Numeric + 20	Limit = Numeric – 20
NIBP (mmHg)	Numeric < 26	Limit = Numeric + 5	Limit = Numeric – 5
	26 ≤ Numeric ≤ 99	Limit = Numeric x 1.2	Limit = Numeric x 0.8
	Numeric > 99	Limit = Numeric + 20	Limit = Numeric – 20
RR/BR (/min)	Numeric < 26	Limit = Numeric + 5	Limit = Numeric – 5
	26 ≤ Numeric ≤ 99	Limit = Numeric x 1.2	Limit = Numeric x 0.8
	Numeric > 99	Limit = Numeric + 20	Limit = Numeric – 20

SpO2 (%)	Entire range	Limit = 100 (Adult and Pediatric) Limit = Numeric + 5 (Neonate)	Limit = Numeric – 5
EtCO2 (mmHg)	Entire range	Limit = Numeric + 10	Limit = Numeric - 5 mmHg *unless* the numeric falls below the lower alarm limit range, in which case Stat Set sets the lower limit to 15 mmHg.
FiCO2 (mmHg)	Entire range	Limit = Numeric + 5	N/A
Temp (°C)	Entire range	Limit = Numeric + 0.5	Limit = Numeric – 0.5
Temp (°F)	Entire range	Limit = Numeric + 0.9	Limit = Numeric – 0.9

Chapter 6
Monitoring ECG

This chapter describes how to use the Propaq M unit to monitor ECG.

You can use a 3-lead, 5-lead, or 12-lead wire configuration for ECG monitoring (see Chapter 13, *Monitoring 12-Lead ECG*, for information on 12-lead monitoring).

Warning!

- **Excessive body hair or wet, sweaty skin may interfere with electrode adhesion. Remove the hair and/or moisture from the area where the electrode is to be attached.**
- **Use only electrodes that are well within the expiration date indicated on the package.**
- **Remove ECG electrodes from their sealed package immediately prior to use. Using previously opened or out-of- date electrodes may degrade the ECG signal quality.**
- **Monitoring electrodes may become polarized during defibrillator discharge, causing the ECG waveform to briefly go off screen. ZOLL Medical Corporation recommends the use of high quality silver/silver chloride (Ag/AgCl) electrodes to minimize this effect; the circuitry in the instrument returns the trace to the monitor display within a few seconds.**
- **To assure protection against the effects of defibrillator discharge, use only ZOLL-approved accessories.**
- **To avoid a shock hazard and interference from nearby electrical equipment, keep electrodes and patient cables away from grounded metal and other electrical equipment.**

- **To avoid electrosurgery burns at monitoring sites, ensure proper connection of the electrosurgery return circuit so that the return paths cannot be made through monitoring electrodes or probes.**
- **Check the operation and integrity of the Propaq M unit and ECG cable regularly by performing the Daily Operational Verification Test.**
- **Implanted pacemakers may cause the heart rate meter to count the pacemaker rate during incidents of cardiac arrest or other arrhythmias. Carefully observe pacemaker patients. Check the patient's pulse; do not rely solely on heart rate meters. Dedicated pacemaker detection circuitry may not detect all implanted pacemaker spikes. Patient history and physical exam are important in determining the presence of an implanted pacemaker.**

ECG Monitoring Setup

The proper application and placement of electrodes is essential for high quality ECG monitoring. Good contact between the electrode and skin minimizes motion artifact and signal interference.

The following procedure describes how to monitor a patient’s ECG using 3- and 5-Lead ECG cables.

To monitor a patient’s ECG using 3- and 5-Lead ECG cables, perform the following steps:

1. Prepare the patient's skin for electrode application:
2. Apply the electrode pads to the patient.
3. Connect each lead of the ECG cable to the appropriate electrode.
4. Insert the patient cable plug into the ECG input connector on the Propaq M unit.
5. Select the ECG waveforms to be displayed on the waveform trace display screen.
6. Observe the patient‘s electrocardiogram on the display, and adjust size of the ECG waveform trace, as necessary.

Preparing the Patient for Electrode Application

The proper application of electrodes is essential for high quality ECG monitoring. Good contact between the electrode and skin minimizes motion artifact and signal interference.

Before applying electrodes, prepare the patient’s skin, as necessary:

- Shave or clip excess hair at electrode site.
- Clean oily skin with an alcohol pad.
- Rub site briskly to dry.

Applying Electrodes to the Patient

The following sections show where to place electrodes when using 3- and 5-Lead cables to perform ECG monitoring. For 3-Lead ECG cables, apply electrodes as in Figure 4-1, *3-Lead Electrode Placement*. For 5-Lead ECG cables, apply electrodes as in Figure 4-2, *5-Lead Electrode Placement*.

Avoid placing electrodes over tendons and major muscle masses.

3-Lead Electrode Placement

Depending upon local usage, the ECG leads are marked either RA, LA, and LL (or R, L, and F). The following table shows the markings and color codes for the different lead sets.

AHA Color Coding	IEC Color Coding	Placement of Electrodes
RA/White Electrode	R/Red Electrode	Place near patient's right mid-clavicular line, directly below clavicle.
LA/Black Electrode	L/Yellow Electrode	Place near patient's left mid-clavicular line, directly below clavicle.
LL/Red Electrode	F/Green Electrode	Place between 6th and 7th intercostal space on patient's left mid-clavicular line.

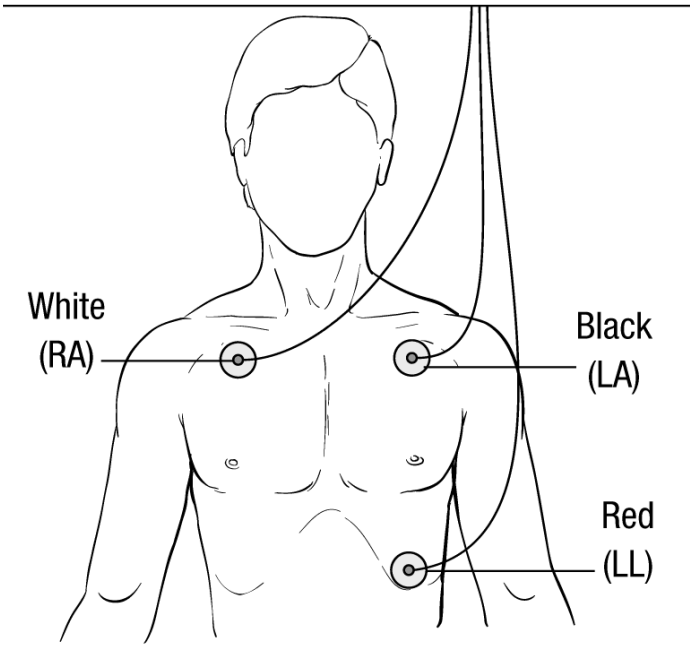


Figure 6-1 3-Lead Electrode Placement

5-Lead Electrode Placement

Depending upon local usage, the ECG leads are marked either RA, LA, LL, RL, and V or R, L, F, N and C. The following table shows the markings and color codes for the different lead sets.

AHA Color Coding	IEC Color Coding	Placement of Electrodes
RA/White Electrode	R/Red Electrode	Place near patient's right mid-clavicular line, directly below clavicle.
LA/Black Electrode	L/Yellow Electrode	Place near patient's left mid-clavicular line, directly below clavicle.
LL/Red Electrode	F/Green Electrode	Place between 6th and 7th intercostal space on patient's left mid-clavicular line.
RL/Green* Electrode	N/Black* Electrode	Place between 6th and 7th intercostal space on patient's right mid-clavicular line.
V/Brown* Electrode	C/White* Electrode	Single movable chest electrode. Place this electrode in one of the positions, V1 - V6, as shown in the following figure. V1 -- 4th intercostal space at right sternal margin. V2 -- 4th intercostal space at left sternal margin. V3 -- Midway between V2 and V4 leads. V4 -- 5th intercostal space at mid-clavicular line. V5 -- Same transverse level as V4 at left anterior-axillary line. V6 -- Same transverse level as V4 at left mid-axillary line.

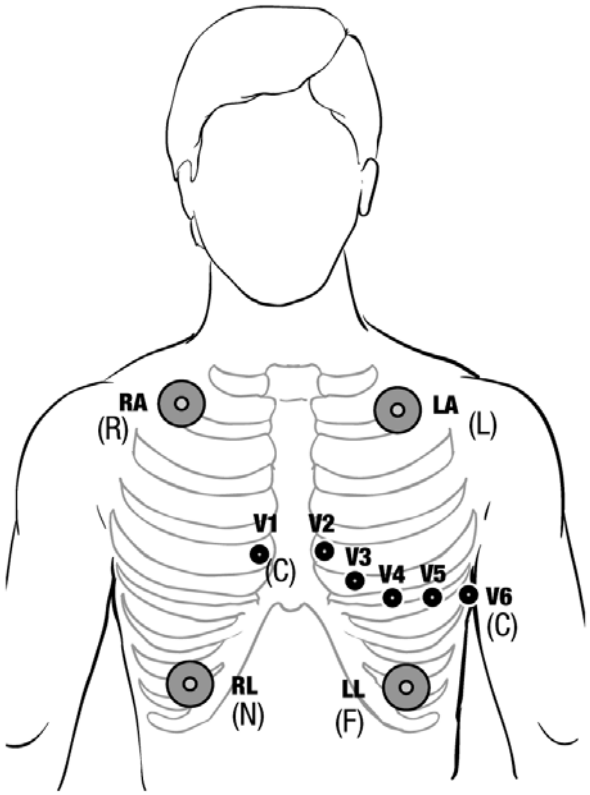


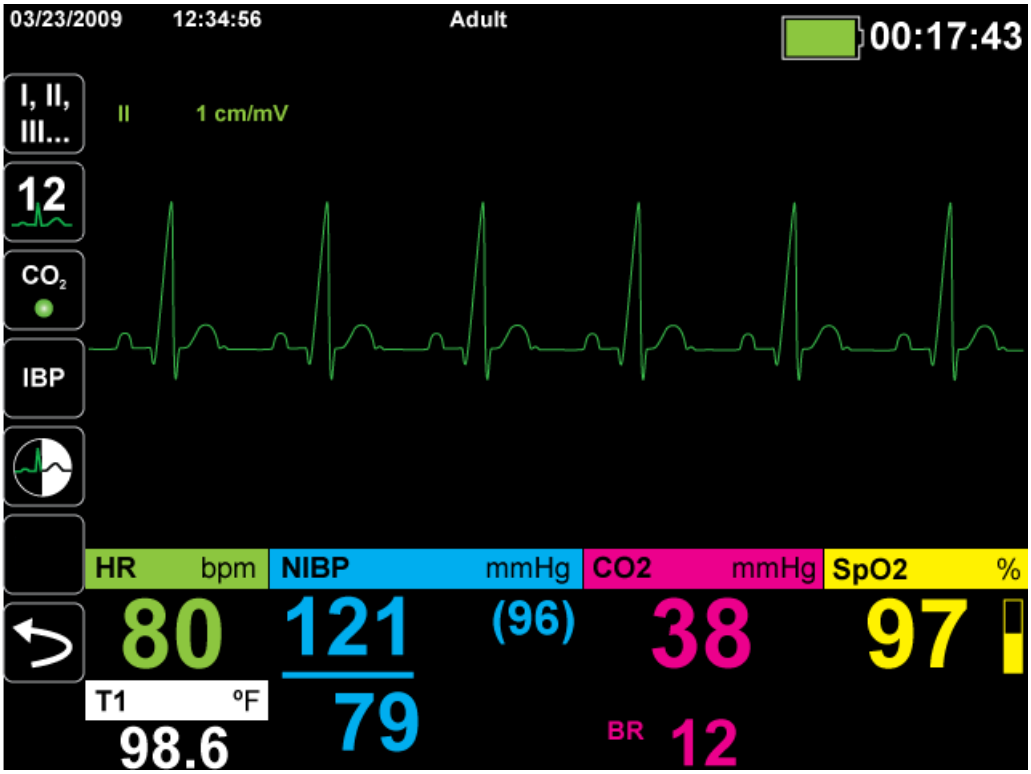
Figure 6-2 5-Lead Electrode Placement

Connecting the ECG Cable To the Propaq M Unit

The Propaq M unit accepts Welch Allyn Propaq ECG cables as well as ZOLL Propaq M ECG cables. Connect the ECG cable to the ECG connector on the left side of the Propaq M unit as follows:

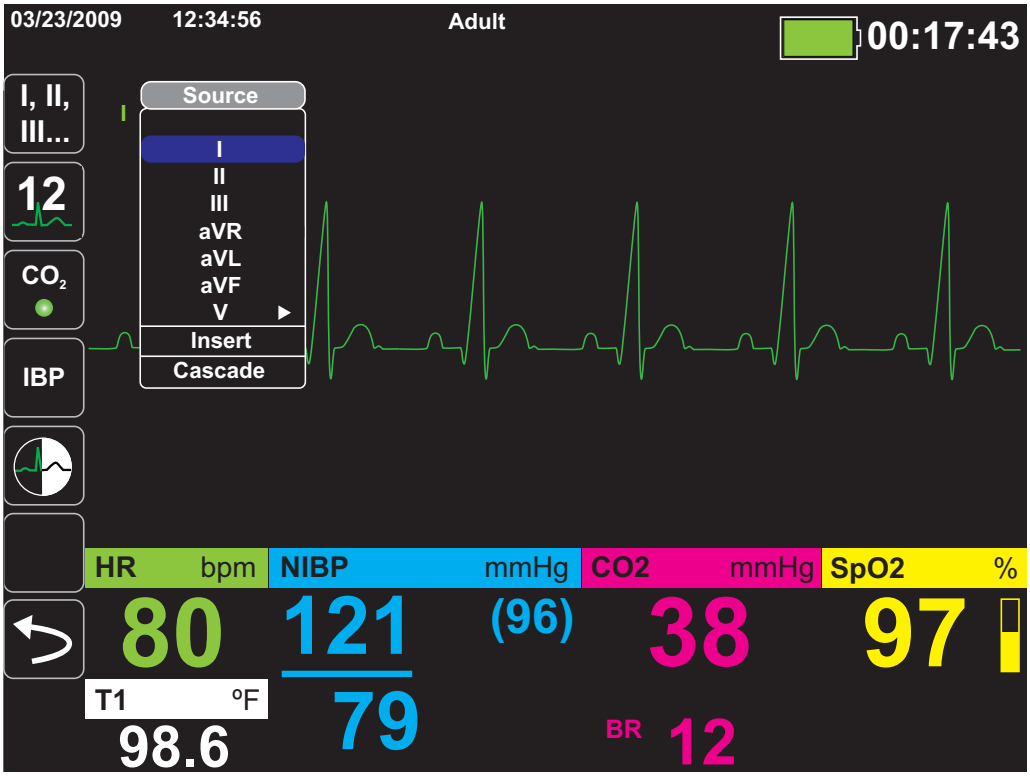
Selecting ECG Waveforms for Display

You can fit up to four waveforms on the Propaq M display. The first waveform at the top of the display is always an ECG waveform. In the following example, Lead II (RA-LL), is the source of the ECG waveform trace:



The are two ways to specify which ECG lead is the source of the primary waveform trace. One way is to press the ECG lead selection quick access kay ( ) to display the available ECG waveform sources. The available waveform sources are determined by the type of ECG cable connected to the unit.

The other way to specify the source of the primary waveform trace is to navigate to and select the source label for the primary ECG waveform (Lead **I** in the screen below). The Propaq M unit then displays the available ECG waveform sources. The following example illustrates the waveform source list that the Propaq M unit displays when a 5-lead ECG cable is connected to it. The list of available ECG waveform sources includes Leads **I**, **II**, **III**, **aVR**, **aVL**, **aVF**, and **V**. You can select Lead **II** (the default), or use the navigation keys to highlight and select another displayed ECG lead as the source for the waveform trace.



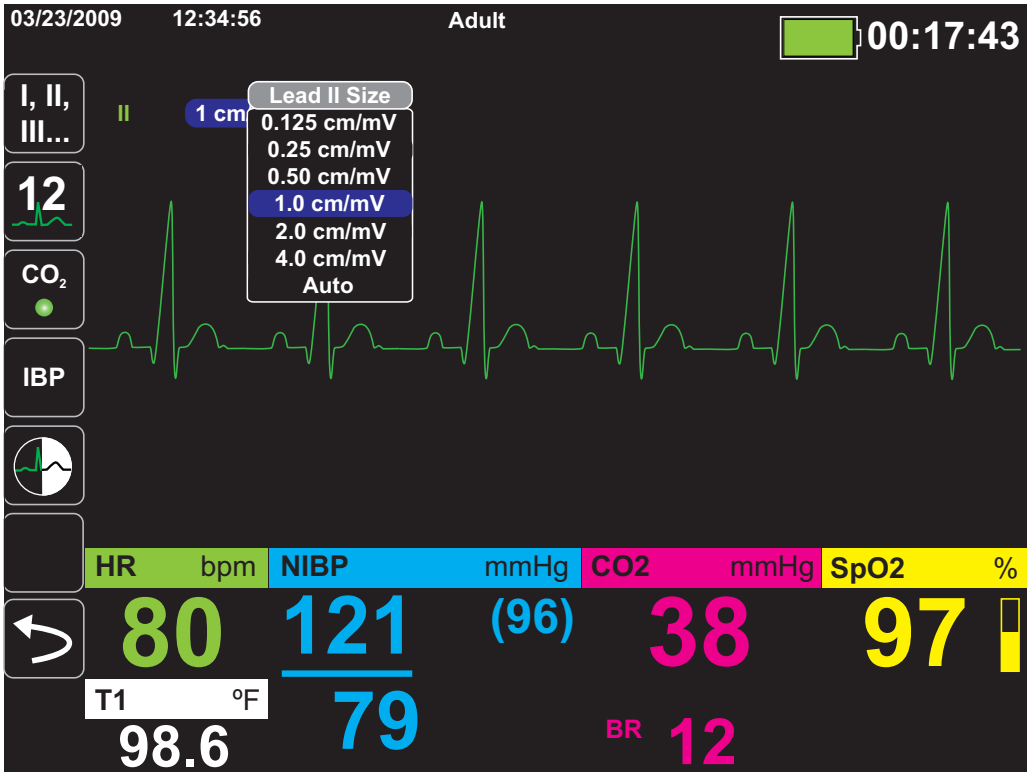
Select a current waveform source, and the unit displays the waveform immediately. If you select a waveform source that is not currently available, the unit displays the message, *LEAD FAULT.*

For more information on how to configure the display of waveforms on the Propaq M unit, see Chapter 3, *Monitoring Overview.*

Selecting the Waveform Trace Size

The Propaq M unit allows you to select the waveform trace size to adjust the size of displayed the ECG waveform.

To select the waveform size, use the navigation keys to highlight and select the trace size that appears to the right of the electrode label:



The default trace size is **1cm/mV**. You can select a larger (**2.0, 4.0 cm/mV**) or smaller (**0.125, 0.25, 0.50 cm/mV**) trace size. You can also specify that the Propaq M unit select a best-fit trace size (**AUTO**).

ECG Monitoring and Pacemakers

When the unit performs ECG monitoring on a patient with an implantable pacemaker, the unit's Pacer indicator feature can indicate the occurrence of pacemaker signals.

If the Pacer Indicator setting is **ON**, the Propaq M performs the following actions:

- detects the implantable pacemaker pulses
- blanks the pacemaker pulses from the waveform—preventing them from disturbing the ECG waveform and allowing for an accurate QRS detection
- displays vertical dashed lines to indicate the detected pacemaker signals

If the Pacer Indicator setting is **OFF**, the Propaq M does not perform the following actions:

- detect the implantable pacemaker pulses
- blank the pacemaker pulses from the waveform
- display the vertical dashed line pacer markers

You can turn the Pacer Indicator **ON**/**OFF** from the Setup->ECG menu.

There are situations where ECG artifact could simulate pacemaker signals which could cause false pacemaker detection and blanking. These situations may cause inaccurate QRS detection and it may be desirable to turn the Pacer Indicator off. Inversely, when the Pacer Indicator setting is **OFF**, implantable pacemaker signals may cause inaccurate QRS detection and it may be desirable to turn the Pacer Indicator on.

ECG System Messages

When monitoring ECG, the Propaq M unit may display the following messages:

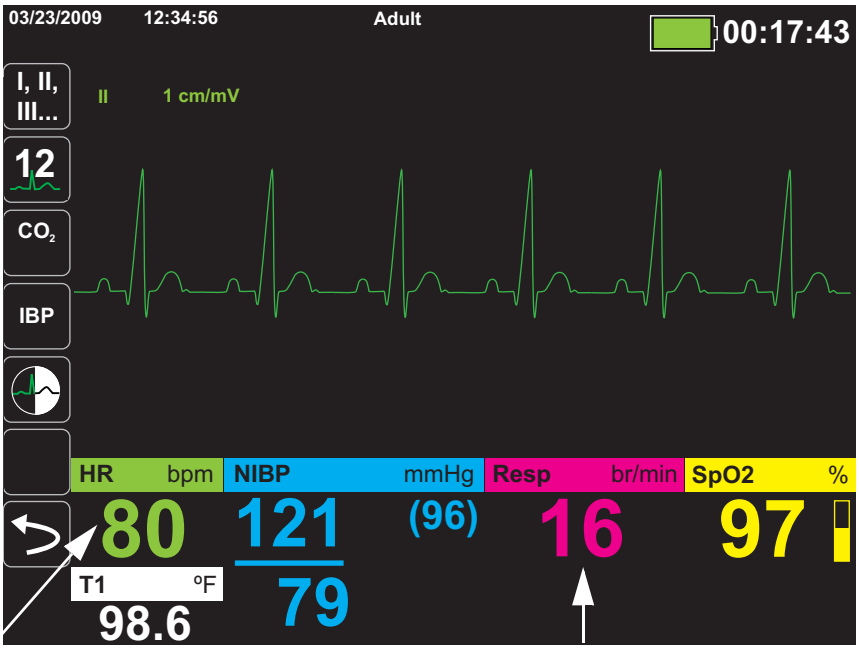
System Message	Cause
LEAD FAULT	The current ECG source lead is defective (check lead and replace, if necessary). -- OR -- An unavailable waveform source has been specified for the trace display (check specified waveform source and correct, if necessary).

Chapter 7

Monitoring Respiration (Resp) and Heart Rate (HR)

This chapter describes how to use the Propaq M unit to monitor Respiration (**Resp**) and Heart Rate (**HR**).

The Propaq M unit displays Respiration (**Resp**) and Heart Rate (**HR**) meters. The Respiration and Heart Rate meters display values that the Propaq M unit derives from measurements taken by other Propaq M monitoring functions.



Heart Rate Meter

Respiration Meter

Respiration/Breath Rate Meter

If enabled, the Propaq M unit displays the patient's respiration in the Respiration/Breath Rate Meter.

The respiration meter displays the respiration rate that it derives, by default, from the unit's CO_2 monitoring function. If CO_2 monitoring is not available, the unit derives the respiration rate through *impedance pneumography*, using a specified ECG electrode configuration. If ECG monitoring isn't functioning, the **Resp/BR** meter will not display a respiration rate.

Using Impedance Pneumography to Measure Respiration

Impedance pneumography detects respiration by applying a high-frequency, low-current AC signal to the patient and measuring the changes in impedance through ECG electrode Lead **I** (RA-LA) or Lead **II** (RA-LL). As the patient inhales and chest volume expands, impedance increases; as the patient exhales, impedance decreases.

Warning!

- **Impedance pneumography detects respiratory effort through changes in chest volume. However, No Breath episodes with continued respiratory effort may go undetected. Always monitor and set alarms for SpO_2 when using impedance pneumography to monitor respiratory function.**
- **With any monitor that detects respiratory effort through impedance pneumography, artifact due to patient motion, apnea mattress shaking, or electrocautery use may cause apnea episodes to go undetected. Always monitor and set alarms for SpO_2 when using impedance pneumography to monitor respiratory function.**
- **When using impedance pneumography, don't use the Propaq M unit with another respiration monitor on the same patient, because the respiration measurement signals may interfere with one another.**
- **Impedance pneumography is *not* recommended for use on paced patients, because pacemaker pulses may be falsely counted as breaths.**
- **Impedance pneumography is not recommended for use with high frequency ventilation.**
- **Since impedance pneumography uses the same leads as the ECG channel, the Propaq M unit determines which signals are cardiovascular artifact and which signals are the result of respiratory effort. If the breath rate is within five percent of the heart rate, the monitor may ignore breaths and trigger a respiration alarm.**

Configuring Respiration (RR/BR) Alarms and Settings

The Propaq M unit allows you to enable and disable the Respiration (**RR/BR**) Rate alarm, to set alarm limits, and to specify the ECG monitoring source for the Respiration rate.

Enabling/Disabling RR/BR Alarms and Setting Alarm Limits

When enabled, the Propaq M unit sounds alarms whenever the patient's respiration rate is above or below the specified respiration rate alarm limits.

To enable (or disable) Resp alarms and set Upper and Lower alarm limits, you can either do so through the Alarms quick access key ( ), or the **Resp Parameter Control Panel**.

To configure **RR/BR** alarms through the **Alarms** quick access key:

1. Press .
2. Press .
3. Press the **Limits** quick access key ( ). Use the navigation keys to highlight and select the **RR/BR Alarm** menu selection.
4. On the **RR/BR** Alarm Settings menu, use the navigation keys to select the fields that you want to change:
   - **Upper Limit Enable**
   - **Lower Limit Enable**
   - **Upper Limit**
   - **Lower Limit**

When you are finished changing values on the alarm menu, navigate to the Backarrow key to confirm your choices and exit the menu.

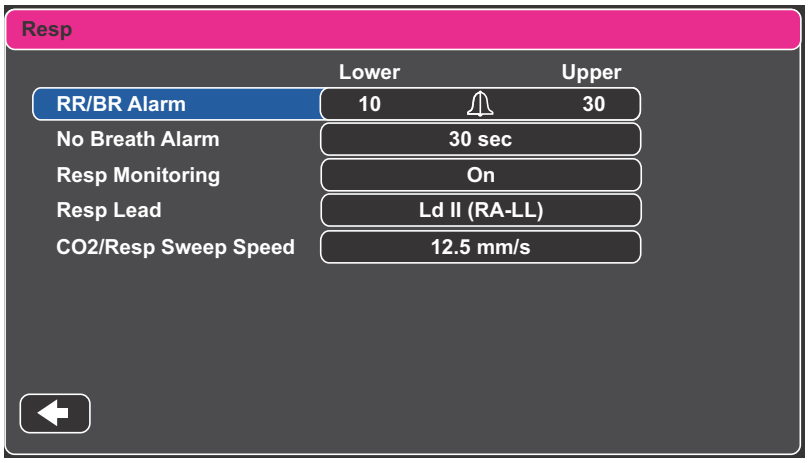
Respiration Rate Alarm Limits

Initially, the **Resp Alarm Settings** menu specifies that Resp alarms are enabled (**ON)** or disabled (**OFF),** and displays the default Upper and Lower respiration rate alarm limits. The upper and lower limits can be **ON** or **OFF** (default is **OFF**).The following table lists the default respiration rate alarm limits for adult, pediatric, and neonate patients, and gives the range in which you can set these limits:

Patient Type	Respiration Rate Default	Respiration Rate Range
Adult	Lower: 3 BPM Upper: 50 BPM	Lower: 0 to 145 BPM Upper: 5 to 150 BPM
Pediatric	Lower: 3 BPM Upper: 50 BPM	Lower: 0 to 145 BPM Upper: 5 to 150 BPM
Neonate	Lower: 12 BPM Upper: 80 BPM	Lower: 0 to 145 BPM Upper: 5 to 150 BPM

Using the Resp Parameter Control Panel

To configure alarms through the **Resp** Parameter Control Panel, use the navigation keys to highlight and select the Respiration Rate meter and display the **Resp** Parameter Control Panel:



The **Resp** Parameter Control Panel allows you to set the following parameters:

- **RR/BR Alarm** -- enable/disable the Resp alarm and set high/low alarm limits.
- **No Breath Alarm** -- sets the duration of the No Breath alarm.
- **Resp Monitoring--** enable/disable respiration monitoring.
- **Resp Lead** -- selects the Resp lead, Ld I (RA-LA) or Ld II (RA-LL), from which the Propaq M unit calculates the respiration rate. Resp Lead selection is independent of ECG Lead selection.
- **CO2/Resp Sweep Speed --** sets the respiratory sweep speed on the display.

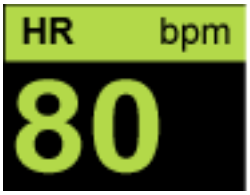
Enabling/Disabling Resp Monitoring

Select the Resp Monitoring prompt to enable or disable **Resp** monitoring. When Resp Monitoring is set to On (the default), the Propaq M unit displays the Respiration Rate meter. When set to off, Propaq M removes the Respiration Rate meter from the display.

Warning! **When using impedance pneumography, the Propaq M unit automatically rejects cardiovascular artifact (CVA). This function requires the accurate ECG R-wave detection. Therefore, always select the ECG lead with the most prominent QRS complex when using impedance pneumography to monitor respiration.**

Heart Rate Meter

The Heart Rate meter displays the heart rate that it derives from the ECG monitoring function (by default) or from a monitoring function that you specify. If the ECG (or user-specified monitor function) measurements are not available, the Heart Rate meter derives the heart rate from the following monitoring functions, if they are available, in this order: User-selected default source, ECG, IBP channel 1, SpO_2, IBP channel 2, IBP channel 3, and NIBP. The Heart Rate meter is labeled **HR** (as in the following example) if the source is ECG, and **PR** if any other source is used.



Configuring Heart Rate (HR) Meter Alarms

The Propaq M unit allows you to enable and disable the Heart Rate (HR) alarm, to set alarm limits, and to select a Heart Rate tone.

Enabling/Disabling HR Alarms and Setting Alarm Limits

When enabled, the Propaq M unit sounds alarms whenever the patient's heart rate is above or below the specified heart rate alarm limits.

To enable (or disable) HR alarms and set Upper and Lower alarm limits, you can either do so through the Alarms quick access key (), or the **HR/PR Parameter Control Panel**.

To configure HR alarms through the **Alarms** quick access key:

1. Press  .
2. Press  .
3. Press  .
4. Use the navigation keys to highlight and select **HR/PR Alarm**.
5. On the HR/PR Alarm Settings menu, use the navigation keys to select the fields that you want to change:
   - **Upper Limit Enable**
   - **Lower Limit Enable**
   - **Upper Limit**
   - **Lower Limit**

When you are finished changing values on the alarm menu, navigate to the Backarrow key to confirm your choices and exit the menu.

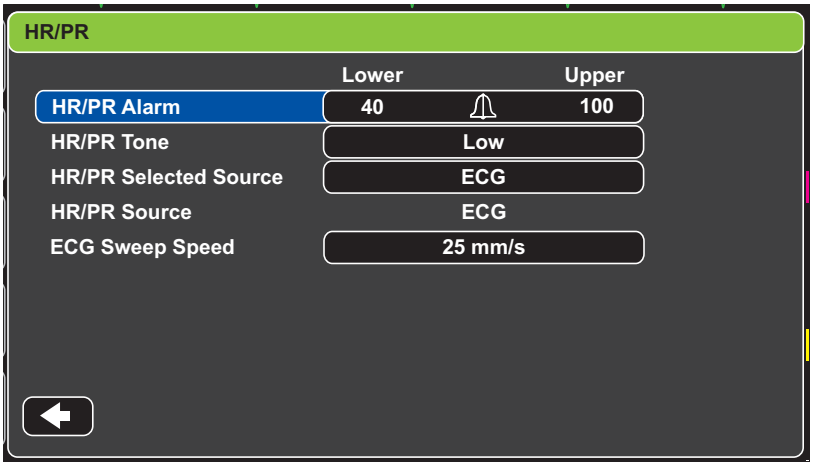
Heart Rate (HR/PR) Alarm Limits

Initially, the HR/PR Alarm Settings menu specifies that alarms are enabled (**ON)** or disabled (**OFF),** and displays the default Upper and Lower heart rate alarm limits. The upper and lower limits can be **ON** or **OFF** (default is **OFF**). The following table lists the default HR alarm limits for adult, pediatric, and neonate patients, and gives the range in which you can set these limits:

Patient Type	HR Default	HR Rate Range
Adult	Lower: 50 BPM Upper: 120 BPM	Lower: 20 to 298 BPM Upper: 22 to 300 BPM
Pediatric	Lower: 50 BPM Upper: 150 BPM	Lower: 20 to 298 BPM Upper: 22 to 300 BPM
Neonate	Lower: 100 BPM Upper: 200 BPM	Lower: 20 to 298 BPM Upper: 22 to 300 BPM

Using the Heart Rate Parameter Control Panel

To configure alarms through the Heart Rate Parameter Control Panel, use the navigation keys to highlight and select the Heart Rate meter and display the HR/PR Parameter Control Panel:



Selecting the **HR/PR Alarm** prompt displays the **HR/PR Alarm Settings Menu**, on which you can enable/disable Heart Rate alarms and set alarm limits.

Chapter 8
Monitoring Non-Invasive Blood Pressure (NIBP)

This chapter describes how to use the Propaq M unit to perform Non-Invasive Blood Pressure (NIBP) measurements using an inflatable cuff to measure arterial pressure.

The Propaq M uses the enhanced NIBP features of Welch Allyn's SureBP and patented Smartcuf motion-tolerant technology.

The SureBP monitoring software allows the Propaq M unit to take an NIBP measurement as the cuff is inflating, which saves time -- the measurement takes about 15 seconds -- and improves patient comfort.

The Smartcuf monitoring software enables the Propaq MD unit to make accurate NIBP measurements in the presence of extreme artifact, weak pulses, and some dysrhythmias by synchronizing the NIBP measurements with the patient's R-wave.

Warning!

- **Observe the patient's limb periodically to ensure that circulation is not impaired for a prolonged period of time.**
- **Never use the Propaq M to monitor NIBP on one patient while simultaneously monitoring ECG on another patient.**
- **If a non-invasive blood pressure measurement is suspect, repeat the measurement. If you are still uncertain about the measurement, use another method.**
- **Do not use NIBP without proper training. Check that the correct patient mode has been selected to ensure that the initial inflation pressure is set correctly. Patient movement, very low pulse volume, or vibration from outside sources can influence the accuracy of blood pressure measurements.**

- **Do not attempt to take NIBP measurements on patients during cardiopulmonary bypass procedures.**
- **Some or all NIBP safety functions are disabled when performing the NIBP test in the Service menu. Do not conduct NIBP tests when the cuff is attached to a patient.**

How does NIBP Work?

The blood pressure cuff and hose connect to the Propaq M unit through the NIBP connector on the side panel of the unit. The NIBP button on the front panel of the unit allows you to initiate and terminate blood pressure measurements, which are displayed in the NIBP area of the monitor.

The Propaq M unit's NIBP module measures the oscillometric pulses transmitted through the blood pressure cuff and hose, and calculates the blood pressure measurements accordingly. The pressure measurement proceeds as follows:

1. The cuff inflates to a preconfigured pressure (determined by patient type) above the patient's systolic blood pressure. As the cuff inflates, the Propaq M unit measures the oscillometric pulses transmitted from the cuff through the hose, and the SureBP monitoring software calculates the patient's systolic, diastolic, and mean blood pressure. Once these measurements are taken, the cuff deflates. The Propaq M unit takes these measurements in about 15 seconds.

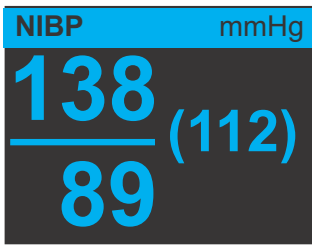
   The SureBP feature requires the use of a cuff and dual lumen hose.

2. If high artifact prevents an accurate measurement during cuff inflation, or if you use a cuff and single lumen hose, the cuff inflates to its target pressure to occlude blood flow through the arteries in the monitored limb. The cuff deflates incrementally, allowing blood to flow through the cuff and into the monitored limb. As blood flows through the partially deflated cuff, it produces pressure oscillations that are transmitted to the Propaq M unit through the hose.The Propaq M unit measures the oscillometric pulses and uses them to calculate the corresponding systolic, diastolic, and mean blood pressure. This measurement takes about 30 seconds.
3. The NIBP option automatically adjusts the blood pressure measurement procedure in response to certain error conditions such as:

Condition	Adjustment/Response
The unit cannot detect systolic pressure	The unit automatically increases the cuff inflation pressure and completes the blood pressure measurement
The unit cannot detect systolic, diastolic or mean pressure after 180 seconds	The unit aborts the blood pressure measurement and deflates the cuff
The unit detects a fault	The unit displays a corresponding error message on the monitor and aborts the measurement

The NIBP Numeric Display

When NIBP monitoring has been set up and the Propaq M unit has begun taking NIBP measurements, the systolic, diastolic, and mean blood pressure measurements appear on the NIBP numeric display as follows:



The following sections describe how to set up NIBP monitoring.

NIBP Setup and Use

To take safe and accurate NIBP measurements using the Propaq M unit, you must perform the following steps, each of which corresponds to a section in this chapter. Read each section carefully before you perform NIBP measurements.

1. Select the correct size cuff.
2. Apply the cuff to the patient.
3. Connect the inflation hose to the Propaq M unit and to the cuff.
4. Configure NIBP alarms and settings (if the current NIBP alarms and settings are not appropriate).
5. Press the NIBP button on the Propaq M unit's front panel and take the blood pressure measurement.

Selecting the NIBP Cuff

To take accurate measurements, you must use the proper sized cuff: the cuff's bladder length should be at least 80 percent of the limb circumference, while the cuff width should be equal to 40 percent of the limb circumference.

Caution Use only hoses and cuffs that are approved by ZOLL Medical Corporation. See Appendix B, *Accessories*, for a listing of the approved hoses and cuffs. Use the following guidelines when selecting the appropriate hose and cuff:

	Adult Mode	Pediatric Mode	Neonate Mode
Cuffs (typical cuff labeling)	Adult, Large Adult, Small Adult, Child, Thigh	Child, Small Child, Small Adult, Infant, Newborn	Neonate #1 to #5 -- disposable Newborn (#6), Infant (#7) **--** reusable
Recommended Limb Circumference	15 cm or greater.	7.7 to 25 cm	15 cm or less
Hoses	Adult	Adult	Neonate/Infant (Disposable Cuff only) ***** Reusable Newborn (#6) and Infant (#7) cuffs use the Adult Hose.

Caution Selection of the correct cuff is critical to the accuracy of NIBP measurements. Using a cuff that is too small results in measurements higher than the patient's actual blood pressure. Using a cuff that is too large results in measurements lower than the patient's actual blood pressure.

The Propaq M uses the same definitions of Neonates, Pediatrics, and Adults as defined in the AAMI SP10:2002 standard:

Neonate or Newborn	Children 28 days or less of age if born at term (37 weeks gestation or more); otherwise, up to 44 gestational weeks
Pediatric or Child (other than newborn)	Individuals between 29 days and 12 years of age
Adult	Individuals greater than 12 years of age

Connecting the NIBP Cuff

Connecting the NIBP cuff requires you to attach the inflation hose to the Propaq M unit and the NIBP cuff. To use the SureBP feature, which enables the Propaq M unit to measure blood pressure on cuff inflation, you must use the FlexiPort cuff and dual lumen (two-tube) adaptor and hose. You can also use a single lumen (one-tube) hose and adaptor with the Propaq M unit, but the unit will only measure blood pressure on cuff deflation.

To connect the NIBP cuff to the Propaq M unit:

1. Attach the inflation hose's threaded metal connector to the NIBP connector on the side panel of the Propaq M unit. Mesh the threads carefully so that the connector turns easily and then turn the connector in a clockwise direction until it is snug. Attach a double lumen hose as follows:

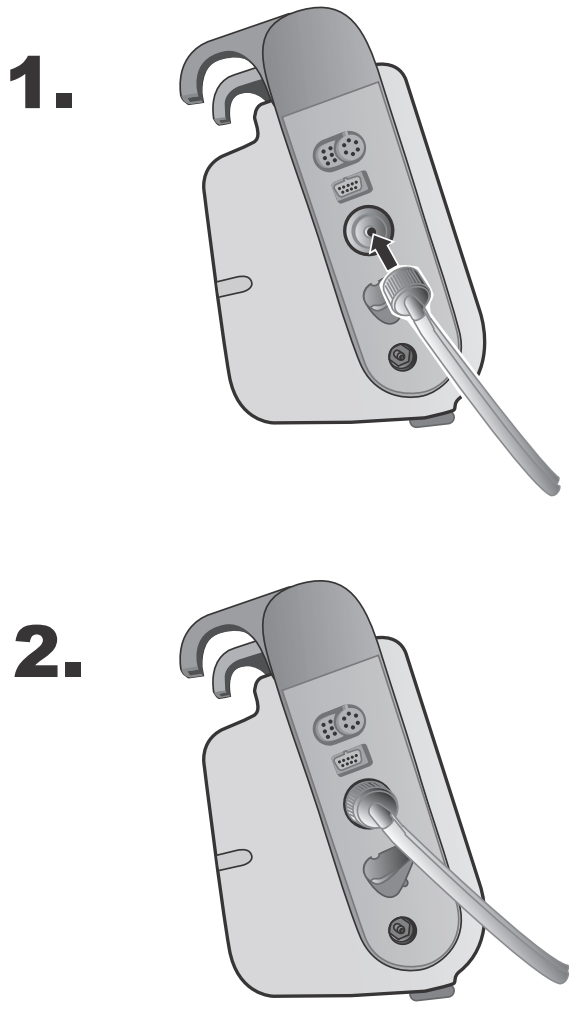


Figure 8-1 Attaching a Dual Lumen Hose to the Propaq M Unit

Attach a single lumen hose as follows:

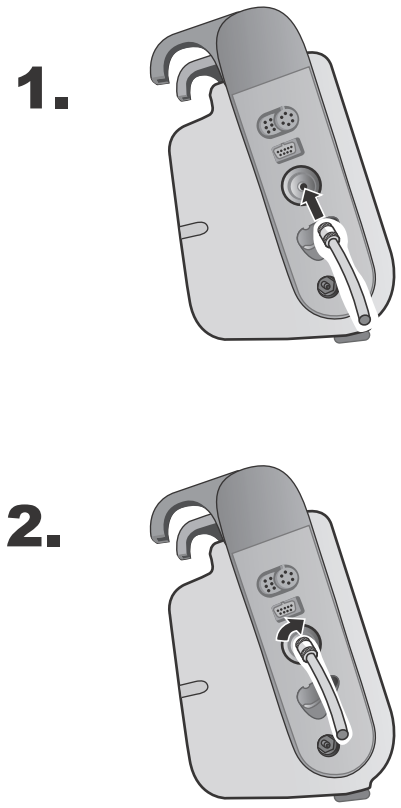
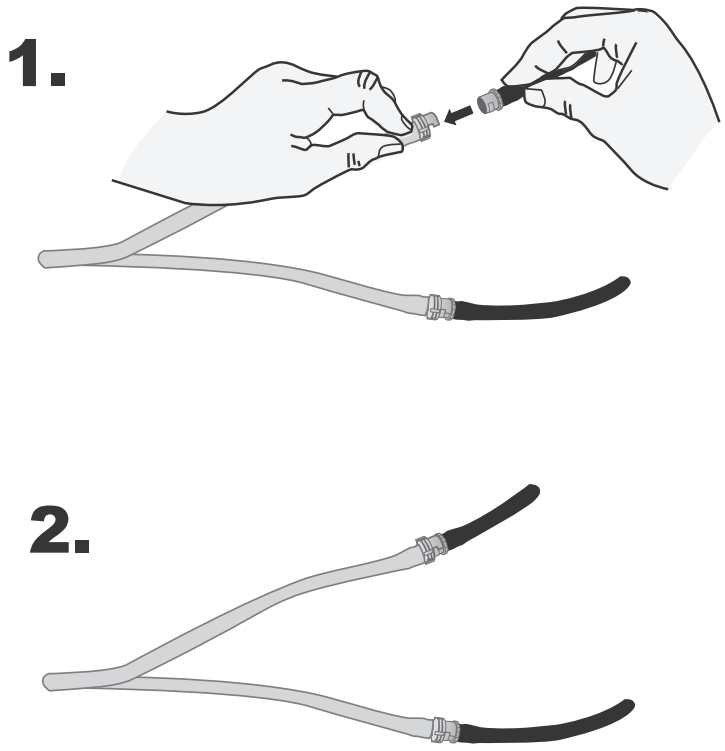


Figure 8-2 Attaching a Single Lumen Hose to the Propaq M Unit

2. Insert the plastic connectors on the NIBP hose into the cuff hose connector, and twist the connectors until they lock.



Applying the Cuff to the Patient

To apply the cuff to the patient:

1. Ensure the patient is sitting or lying down with the limb relaxed, extended, and placed on a smooth surface for support.
2. Squeeze as much air from the cuff as possible before placing it on the patient.
3. Place the cuff 2 to 5 cm above the elbow crease or 5 to 10 cm (1.9 to 3.9 in.) above the knee crease.

Warning! **Do not place the NIBP cuff on the same arm or leg as an SpO_2 sensor. Inflation of the cuff causes the SpO_2 monitor to read incorrectly. Also, do not attach the cuff to a limb being used for IV infusion. Cuff inflation might block the infusion, causing harm to the patient.**

4. Adjust the cuff so that the artery marker on the cuff is over the artery, pointing to the hand or foot.
5. Check that the cuff ends between the range lines marked on the cuff.
6. If they do not line up, use a different size cuff.
7. Wrap the deflated cuff snugly around the limb without impeding blood flow.
8. Ensure that the hose is routed to avoid kinking or compression.

Caution

- Using a cuff that is loosely applied or too small results in measurements higher than the patient's actual blood pressure.
- Using a cuff that is too large results in values lower than the patient's actual blood pressure.
- Ideally, the cuff should be at the same level as the heart. Cuff placement substantially above or below heart level will result in blood pressure measurements that are erroneously low or high.

The following illustrates one possible cuff placement for adult/pediatric patients and, to the right, possible cuff placements for neonates:

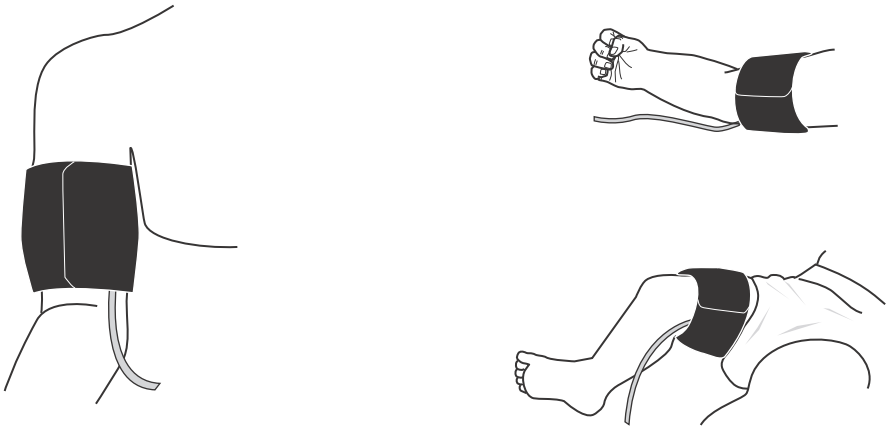


Figure 8-3 Applying Cuff to Patient

Ensuring Correct Cuff Inflation Settings

Before taking an NIBP measurement for a new patient, ensure that the cuff inflation settings are appropriate for that patient:

Check that the correct patient mode is selected. The initial Cuff Inflation Target (CIT) pressure is dependent on the patient type and the configured CIT preset. The default and configurable CIT presets for each patient type are indicated in the following table (default values are in bold).

Note: You can configure the CIT pressure from the Setup>NIBP menu.

Adult	Pediatric	Neonate
120 mmHg	80 mmHg	60 mmHg
140 mmHg	90 mmHg	70 mmHg
160 mmHg	100 mmHg	80 mmHg
180 mmHg	110 mmHg	**90 mmHg**
200 mmHg	**120 mmHg**	100 mmHg
220 mmHg	130 mmHg	110 mmHg

Adult	Pediatric	Neonate
240 mmHg	140 mmHg	120 mmHg
260 mmHg	150 mmHg	130 mmHg

In order to accurately measure systolic pressure, the CIT pressure must be high enough to occlude the underlying artery. However, setting the CIT pressure too high may unnecessarily increase the reading determination time and patient discomfort.

After each NIBP measurement, the Propaq M unit adjusts the cuff inflation pressure to optimize the next NIBP measurement.

Note: The maximum cuff inflation pressure for neonates is 153 mmHg.

Warning! **Before using the Propaq M to monitor a new patient, power down the Propaq M unit for *at least 2 minutes* to reset all patient parameters and eliminate all adjustments made for the previous patient.**

Configuring NIBP Alarms and Settings

The last step in preparing to perform NIBP measurements is to ensure that the necessary alarms are enabled (or disabled), that alarm limits are appropriate, and that the NIBP settings are correct.

Enabling/Disabling NIBP Alarms and Setting Alarm Limits

When enabled, the Propaq M unit sounds alarms whenever measurements are outside set limits for the following:

- High and Low Systolic Pressure
- High and Low Diastolic Pressure
- High and Low Mean Arterial Pressure (MAP)

To enable (or disable) NIBP alarms and set upper and lower alarm limits, you can do so through the Alarms quick access key () or the **NIBP Parameter Control Panel**.

To configure NIBP alarm limits through the Alarms quick access key:

1. Press the More quick access key ().
2. Press the Alarms quick access key ().
3. Press the **Limits** quick access key ().
4. Use the navigation keys to highlight and select the appropriate alarm menu selection. For NIBP, the alarm menu selections are **NIBP Systolic Alarm, NIBP Diastolic Alarm,** and **NIBP MAP Alarm**.
5. On the selected NIBP alarm settings menu, use the navigation keys to select the fields that you want to change. The fields are
   - **Upper Limit Enable**
   - **Lower Limit Enable**
   - **Upper Limit**
   - **Lower Limit**

6. When you are finished changing values on the alarm settings menu, select the back arrow to exit the menu.

Setting Upper and Lower Systolic Alarm Limits

Initially, the **NIBP Systolic Alarm Settings** menu specifies that the NIBP systolic pressure alarms are enabled (**ON**) or disabled (**OFF**)**,** and displays the default upper and lower systolic limits. The upper and lower limits can be **ON** or **OFF** (default is **OFF**). The following table lists the default NIBP Systolic limits for adult, pediatric, and neonate patients, and gives the range in which you can set these limits:

Patient Type	NIBP Systolic Limit Default	NIBP Systolic Limit Range
Adult	Lower: 75 mmHg Upper: 220 mmHg	Lower: 30-258 mmHg Upper: 32-260 mmHg
Pediatric	Lower: 75 mmHg Upper: 145 mmHg	Lower: 30-158 mmHg Upper: 32-160 mmHg
Neonate	Lower: 50 mmHg Upper: 100 mmHg	Lower: 20-118 mmHg Upper: 22-120 mmHg

Setting Upper and Lower Diastolic Alarm Limits

Initially, the **NIBP Diastolic Alarm Settings** menu specifies that the NIPBP diastolic pressure alarms are enabled (**ON**) or disabled (**OFF**)**,** and displays the default Upper and Lower diastolic limits. The upper and lower limits can be **ON** or **OFF** (default is **OFF**). The following table lists the default diastolic limits for adult, pediatric, and neonate patients, and gives the range in which you can set these limits:

Patient Type	Diastolic Limit Default	Diastolic Limit Range
Adult	Lower: 35 mmHg Upper: 110 mmHg	Lower: 20-218 mmHg Upper: 22-220 mmHg
Pediatric	Lower: 35 mmHg Upper: 100 mmHg	Lower: 20-128 mmHg Upper: 22-130 mmHg
Neonate	Lower: 30 mmHg Upper: 70 mmHg	Lower: 10-108 mmHg Upper: 12-110 mmHg

Setting Upper and Lower NIBP MAP Alarm Limits

Initially, the **NIBP MAP Alarm Settings** menu specifies that **NIBP MAP** alarms are enabled (**ON**) or disabled (**OFF**)**,** and displays the default Upper and Lower MAP limits. The upper and lower limits can be **ON** or **OFF** (default is **OFF**). The following table lists the default MAP alarm limits for adult, pediatric, and neonate patients, and gives the range in which you can set these limits:

Patient Type	MAP Default	MAP Range
Adult	Lower: 50 mmHg Upper: 120 mmHG	Lower: 25-230 mmHg Upper: 23-228 mmHg
Pediatric	Lower: 50 mmHg Upper: 110 mmHg	Lower: 25-140 mmHg Upper: 23-138 mmHg
Neonate	Lower: 35 mmHg Upper: 80 mmHg	Lower: 15-110 mmHg Upper: 13-108 mmHg

Using the NIBP Parameter Control Panel

Use the navigation keys to highlight and select the NIBP numeric display to display the **NIBP Parameter Control Panel**:

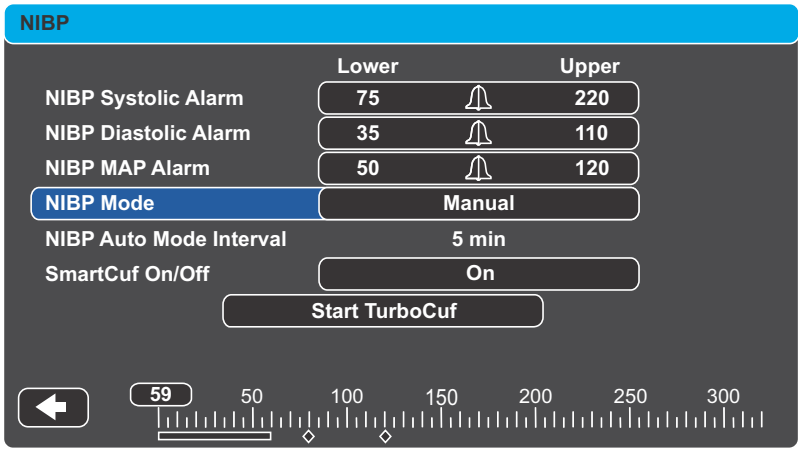


Figure 8-4 NIBP Parameter Control Menu

On the **NIBP Parameter Control Panel**, you can select an alarm configuration option (**SYS**, **DIA**, or **MAP**) to enable/disable alarms and set high and low alarm limits (as described previously).

You can also configure these NIBP options:

- NIBP Mode (**Mode**)
- NIBP Automatic Measurement Interval (**Auto Interval**)
- Enable/Disable Smartcuf motion artifact filter (**Smartcuf**)
- Start/Stop Turbocuf Measurements (**Turbocuf**)

Specify NIBP Mode

You can specify that the Propaq M unit operate in either *Manual* or *Automatic Mode*.

In Manual Mode, the Propaq M unit takes a single NIBP measurement when you press the

NIBP button on the front panel (). To repeat the NIBP measurement, you must press the NIBP key again (select **Manual**).

In Automatic Mode, the Propaq M unit takes the first of a series of NIBP measurements when the **Auto Interval** timer expires, and then repeats the NIBP measurement at this specified interval.

Note: You can press the NIBP button and manually initiate an NIBP reading at any time while in Automatic Mode. Manually initiated NIBP readings will not affect the timing of subsequent NIBP readings in Automatic Mode.

Specify the Automatic NIBP Measurement Interval

You can specify the time interval between NIBP measurements in Automatic Mode. The default interval between measurements is 5 minutes.

You can specify intervals of **1**, **2**, **3**, **5**, **10**, **15**, **30**, and **60** minutes between NIBP measurements.

Enable/Disable Smartcuf Motion Artifact Filter

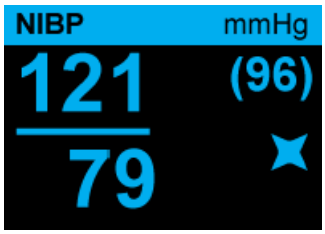
Enabling the use of the Smartcuf motion artifact filter increases the accuracy of NIBP measurements when motion artifact or weak pulses are present.

NIBP measurements can be adversely affected by many factors, such as cardiac arrthythmias, sudden changes in blood pressure, body motions such as shivering and convulsions, bumping the cuff, vibration, vehicle motion, or weak pulses. The Smartcuf filter synchronizes the NIBP reading with the R-wave of the patient's ECG to eliminate noise created by patient motion or vibration.

Note: The Propaq M unit must perform ECG monitoring when using Smartcuf.

If artifact is severe, a special symbol appears on the display:

Figure 8-5 High Artifact Symbol



By default, Smartcuf is **Enabled**.

There are situations where you may choose to disable Smartcuf. These may include

- Very extreme motion artifact
- Certain types of arrhythmias
- Situations that prevent getting a ECG signal.

NIBP measurements can still be performed with Smartcuf disabled.**Start/Stop TurboCuf**

Selecting **Start TurboCuf** starts Short-term Automatic (STAT) NIBP measurements. The Propaq M unit begins its first NIBP measurement, after which it continues to perform as many NIBP measurements as possible over a 5-minute period.

Select **Stop TurboCuf** to immediately stop STAT measurements.

Warning! **Repeated use of STAT measurements on the same patient over a short time interval can affect blood pressure readings, limit circulation to the limb, and cause injury to the patient.**

Setting the NIBP Display Format

You can specify the appearance of the NIBP numeric display format. The display format allows you to choose whether or not you will display MAP measurement (**M**) with the Systolic (**S**) and Diastolic (**D**) measurements in the in one of the following formats:

- **S/D**
- **S/D (M)** (default display)
- **(M) S/D**

Note: If a MAP alarm is active when the **S/D** format is selected, the display format will be **S/D (M)** until you clear the MAP alarm.

NIBP System Messages

When monitoring NIBP, the Propaq M unit may display the following messages:

System Message	Cause/Action
READING IN PROGRESS	The unit is taking an NIBP measurement and functioning normally.
READING STOPPED	The unit has stopped an NIBP measurement, because the operator has pressed the NIBP button and cancelled the measurement.
READING FAILED	The patient's pulse is too weak to for NIBP measurement, or the cuff requires adjustment.
ARTIFACT	Excessive artifact is preventing the NIBP measurement.
NEONATE ALERT	The unit has detected a neonate cuff when in Adult mode. Replace cuff or correct patient mode, as appropriate.
AIR LEAK	A major air leak is preventing cuff inflation. Check hose and cuff connections, replace a defective hose or cuff, as necessary, and reattempt NIBP measurement.
KINKED HOSE	An air obstruction is preventing the correct operation of the unit. Check hose for kinks. Eliminate kinks or replace hose, if necessary.
NIBP DISABLED	A system error has occurred, and the Propaq M unit should be serviced.
NIBP CALIBRATION CHECK DUE	The annual calibration check is due. You can continue to use the device, however, we recommend that you contact the ZOLL Technical Service Department or a ZOLL authorized service representative as soon as possible to perform the recommended annual NIBP calibration check.

Chapter 9
Monitoring Pulse Oximetry (SpO_2)

The Propaq M SpO_2 input is Type CF defibrillator proof.

This chapter describes how to use the Propaq M unit to monitor Pulse Oximetry (SpO_2).

The Propaq M pulse oximeter continuously and noninvasively measures the oxygen saturation (SpO_2) of arterial blood at a peripheral site, such as the foot, toe, or finger. It is used to monitor patients at risk of developing hypoxemia. This option is widely used because it is noninvasive, continuous, easily applied, and painless.

The oximeter sensor contains two emitters that transmit red and infrared light through the monitored site. This light passes through the patient's tissues and is received by a photodetector in the sensor. Because oxygen-saturated blood absorbs light differently than unsaturated blood, the amount of red and infrared light absorbed by blood flowing through the monitored site can be used to calculate the ratio of oxygenated hemoglobin to total hemoglobin in arterial blood. The monitor displays this ratio as percent SpO_2. Normal values typically range from 95% to 100% at sea level.

The quality of SpO_2 measurements depends on the correct size and application of the oximetry sensor, adequate blood flow through the sensor site, and the sensor's exposure to ambient light. For correct placement and location of the sensors, refer to the *Directions for Us*e contained in all oximetry sensor packages.

Warnings -- SpO_2, General

- **SpO_2 style pulse oximeter measurements may be affected by numerous factors such as bright lights, improperly applied probes, use of non-ZOLL approved sensors, patient conditions/movements. The clinician should use good clinical judgment when interpreting SpO_2 measurements. Should the clinician question an SpO_2 measurement, an arterial blood gas oxygen saturation measurement should be obtained.**
- **Interfering substances: Carboxyhemoglobin and methemoglobin can erroneously alter SpO_2 readings. The level of change is approximately equal to the amount of carboxyhemoglobin or methemoglobin present. Dyes or any substance containing dyes that alter arterial pigmentation might cause erroneous readings.**
- **Do not use the Propaq M pulse oximeter or oximeter sensors during magnetic resonance imaging (MRI). Induced current could cause burns. The pulse oximeter might affect the MRI image and the MRI unit might interfere with the accuracy of oximetry measurements.**
- **Carefully arrange patient cabling to reduce the possibility of patient entanglement or strangulation.**
- **Inaccurate measurements may be caused by venous pulsations.**
- **The pulse oximeter can be used during defibrillation, but the readings may be inaccurate for a short time.**

Warnings -- SpO_2, Oximeter Sensor

- **Use only ZOLL-approved Nellcor oximeter sensors. Other manufacturers' sensors might not perform properly with the Propaq M oximeter.**
- **Tissue damage can result from incorrect application or use of a sensor (for example, wrapping the sensor too tightly, applying supplemental tape, failing to periodically inspect the sensor site). To ensure skin integrity, correct positioning, and sensor adhesion, inspect the sensor site as directed in the *Directions for Use* provided with the sensor.**
- **Do not use damaged sensors or cables.**
- **Do not use a sensor with exposed optical components.**
- **Do not sterilize a sensor by irradiation, steam, or ethylene oxide. Refer to the cleaning instructions in the Directions for Use for reusable Nellcor sensors.**
- **Do not allow the sensor to remain on the same site for a prolonged period, especially when monitoring neonates. Check the application site at regular intervals (at least every 2 hours) and change the site if any compromise in skin quality occurs.**
- **Do not attach the oximeter sensor to a limb being monitored with a pressure cuff or with restricted blood flow.**
- **A poorly applied sensor might give incorrect saturation readings. A weak pulse signal on the display might indicate a poorly applied sensor or a poorly chosen monitoring site.**
- **Choose a site with sufficient perfusion to ensure accurate oximetry values.**
- **Certain nail aberrations, nail polish, fungus, and so on might cause inaccurate oximetry readings. Remove any nail polish or move the sensor to an unaffected digit.**
- **Exposure to high ambient light from surgical lamps (especially those with a xenon light source), bilirubin lamps, fluorescent lights, infrared heating lamps, or direct sunlight can affect the accuracy of oximetry readings. To prevent interference from ambient light, ensure that the sensor is properly applied. If necessary, cover the sensor with opaque material.**

SpO_2 Setup and Use

To take accurate SpO_2 measurements using the Propaq M unit, you must perform the following steps, each of which corresponds to a section in this chapter.

1. Select the correct SpO_2 sensor.
2. Apply the SpO_2 sensor to the patient.
3. Connect the sensor to the Propaq M unit.
4. Configure SpO_2 alarms and settings (if the current SpO_2 alarms and settings are not appropriate).

Pulse oximetry measurements begin as soon as the sensor is applied to the patient and connected to the Propaq M unit.

Selecting the SpO_2 Sensor

When selecting the SpO_2 sensor, consider the patient's weight, the adequacy of perfusion, the available sensor sites, and the anticipated duration of monitoring. For more information, refer to the *Accessories* section of this chapter, which provides a list of ZOLL-approved reusable and single-use SpO_2 sensors for adult, pediatric, and neonate patients. Before applying the sensor, always familiarize yourself with the *Directions for Use* that the manufacturer provides with the sensor.

Applying the SpO_2 Sensor

Choose a site that is well perfused and restricts a conscious patient's movements the least. The ring finger or middle finger of the nondominant hand is preferred.

Alternatively, you can use the other digits on the nondominant hand. Be sure the sensor's detector is fully covered by flesh. You can use the great toe or long toe (next to the great toe) on restrained patients or patients whose hands are unavailable.

To prevent interference from ambient light, ensure that the sensor is properly applied, and cover the sensor site with opaque material, if required. Failure to take this precaution in high ambient light conditions may result in inaccurate measurements.

Do not select an SpO_2 sensor site on the same arm/leg as an NIBP cuff. Inflation of the cuff will cause the SpO_2 values to read incorrectly.

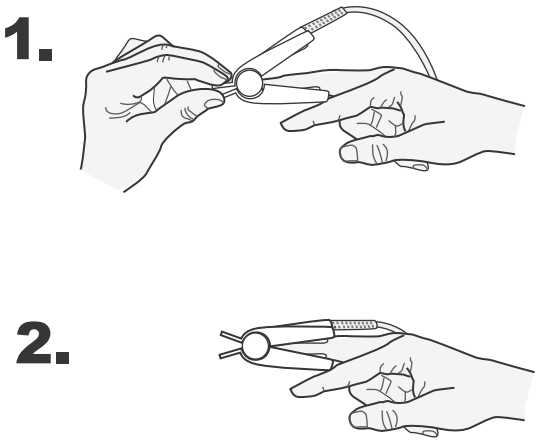
Applying a Reusable SpO_2 Sensor

The following instructions describe how to apply a reusable Nellcor DS-100A SpO_2 sensor. For all other reusable sensors, refer to the sensor packaging and the manufacturer's *Directions for Use* for instructions on how to apply the sensor.

Note: A reusable sensor is not intended for use on the thumb or across a child's hand or foot.

After selecting a monitoring site, apply the reusable DS-100A sensor as follows:

1. Place the selected digit over the sensor window, making sure that the sensor cable runs over the top of the patient's hand.
2. On finger sites, make sure the tip of the finger touches the raised digit stop inside the sensor. If the fingernail is long, it may extend over and past the finger stop.
3. Check the sensor position to ensure that the top and bottom halves of the sensor are parallel. To ensure accurate data, you must have complete coverage of the detector window (see previous figure).

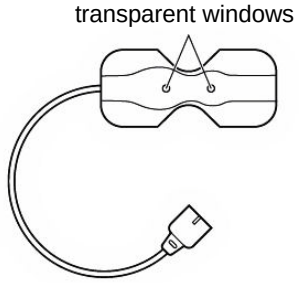


Note: With smaller digits, the digit may not need to be pushed all the way to the stop to completely cover the detector window.

Applying a Single-Use Sensor

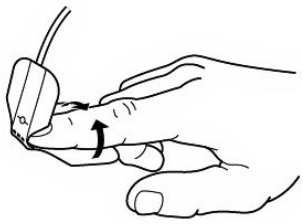
When applying a single-use SpO_2 sensor, be careful not to wrap the adhesive too tightly as this can cause venous pulsations that could lead to inaccurate saturation measurements.

1. Remove plastic backing from the sensor and locate transparent windows on the adhesive side. The transparent windows cover the optical components. An index finger is the preferred sensor location. Alternatively, apply the sensor to a small thumb, smaller finger, or great toe.

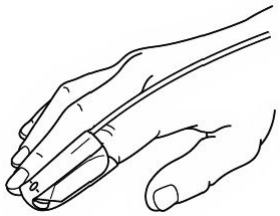


Note: When selecting a sensor site, priority should be given to an extremity free of an arterial catheter, blood pressure cuff, or intravascular infusion line.

2. Orient the sensor so the dashed line in the middle of the sensor is centered on the tip of the digit. Wrap adhesive flaps on non-cable end around the digit. Note that the cable must be positioned on the top of the hand.



3. Fold cable end over top of digit so that windows are directly opposite each other. Wrap adhesive securely around sides of digit.



Note: If the sensor does not track the pulse reliably, it may be incorrectly positioned or the sensor site may be too thick, thin, or deeply pigmented, or otherwise deeply colored (for example, as a result of externally applied coloring such as nail polish, dye, or pigmented cream) to permit appropriate light transmission. If any of these situations occurs, reposition the sensor or choose an alternate sensor for use on a different site.

Connecting the SpO_2 Sensor

To connect the SpO_2 sensor to the Propaq M unit:

1. When using a sensor extension cable, inspect the cable before use. Replace the cable if it shows any signs of wear, breakage, or fraying. Plug the sensor extension cable into the SpO_2 socket on the side of the Propaq M unit:

Figure 9-1 Connecting the SpO_2 Sensor to the Propaq M Unit

2. Lift the clear plastic protective cover from the female end of the extension cable, then plug the sensor cable's male connector into the extension cable connector -- make sure that the plug is all the way into the connector:

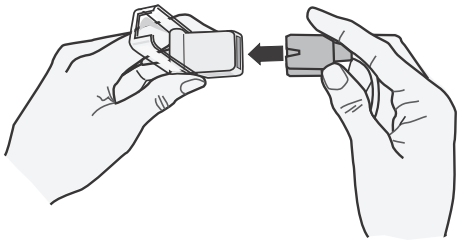


Figure 9-2 Plug the Sensor Connectors Together

3. Lower the clear plastic cover over the connection to secure it:

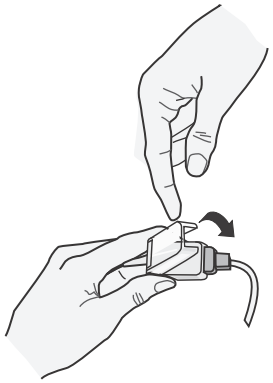


Figure 9-3 Lower Plastic Cover Over Cable Connection

Displaying SpO_2 Measurements

When the connection is made between the SpO_2 sensor and the unit, the message, *INITIALIZING*, appears in the SpO_2 display. After a brief delay, the unit displays the SpO_2 measurement. If the message, *SENSOR FAILURE*, appears, the sensor is either incompatible with the Propaq M unit, or it is not working, and you will need to replace the sensor.

A blip bar appears on the right side of the SpO_2 numeric display window. The blip bar indicates the relative pulsatile strength and quality of the SpO_2 data.

Enabling/Disabling SpO_2 Alarms and Setting Alarm Limits

When enabled, the Propaq M unit sounds alarms whenever measurements are outside set limits for the High and Low SpO_2 values.

You can enable (or disable) SpO_2 alarms and set Upper and Lower alarm limits through the Alarms quick access key ( ) or through the SpO_2 Parameter Control Panel.

To configure SpO_2 alarms through the Alarms quick access key:

1. Press the **More** quick access key ( ).
2. Press .
3. Press the **Limits** quick access key ( ).
4. Use the navigation buttons to highlight and select the appropriate alarm menu selection. For NIBP, the alarm menu selection is SpO_2 Alarm**.** On the selected SpO_2 Alarm Settings menu, use the navigation keys to select the fields that you want to change. The fields are
   - **Upper Limit Enable**
   - **Lower Limit Enable**
   - **Upper Limit**
   - **Lower Limit**
5. When you are finished changing values on the alarm menu, navigate to the Backarrow key to exit the menu.

Setting Upper and Lower Systolic Alarm Limits

Initially, the SpO2 Alarm Settings menu specifies whether the SpO2 alarms are enabled (**ON**) or disabled (**OFF**)**,** and displays the default upper and lower systolic limits. The upper and lower limits can be **ON** or **OFF** (default is **OFF**).The following table lists the default SpO_2 limits for adult, pediatric, and neonate patients, and gives the range in which you can set these limits:

Patient Type	SpO_2 Limit Default	SpO_2 Limit Range
Adult	Lower: 85% Upper: 100%	Lower: 50 - 98% Upper: 52 - 100%
Pediatric	Lower: 85% Upper: 100%	Lower: 50 - 98% Upper: 52 - 100%
Neonate	Lower: 85% Upper: 95%	Lower: 50 - 98% Upper: 52 - 100%

Using the SpO_2 Parameter Control Panel

Use the navigation keys to highlight and select the SpO_2 numeric display to display the **SpO_2 Parameter Control Panel,** on which you can select options that optimize the use of SpO_2 for the patient:

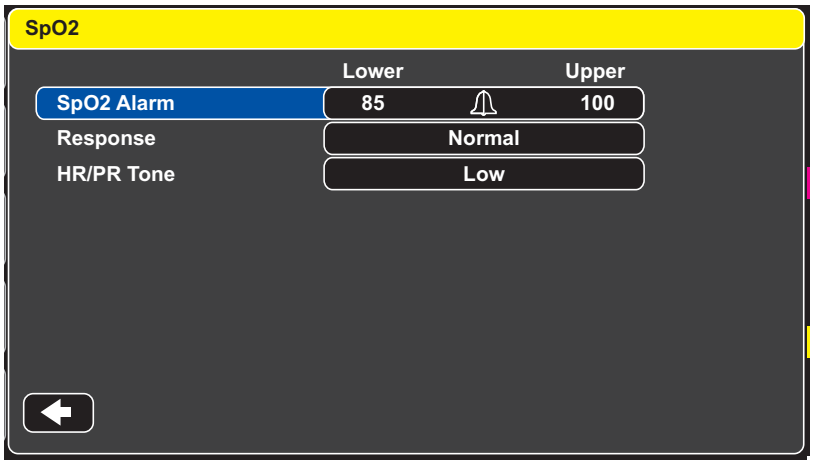


Figure 9-4 SPO_2 Parameter Control Menu

SpO_2 Response Time

The Nellcor SpO_2 module in the Propaq M unit provides a quick, non-changeable response time for use with all patients. The SpO_2 response time is 5 to 7 seconds and is similar to that observed with other Nellcor devices whose response time has been set to NORMAL.

Selecting the Heart Rate/ Pulse Rate (HR/PR) Tone

The unit allows you enable or disable the tone that the monitor uses to indicate detection of the patient's pulse: **On** or **Off** (no tone sounds). The default tone is **Off**.

SpO_2 System Messages

The Propaq M unit may display the following system messages when monitoring SpO_2:

System Message	Cause
INITIALIZING	The SpO_2 pulse oximeter is initializing.
SEARCHING	The unit is searching for a pulse.
CHECK SENSOR	The SpO_2 sensor has become disconnected from the unit, or the sensor is no longer on the patient. Check sensor and then reconnect it to the unit or reapply it to the patient.
SENSOR FAILURE	The SpO_2 sensor is defective. Replace the sensor.
LOW PERFUSION	Perfusion has dropped below 20%.
SPO2 DISABLED	A system error has occurred. The Propaq M unit cannot take SpO_2 measurements and should be serviced.

Functional Testers and Patient Simulators

Some models of commercially available bench top functional testers and patient simulators can be used to verify the proper functionality of Nellcor pulse oximeter sensors, cables and monitors. See the individual testing device's operator's manual for the procedures specific to the model of tester that you are using.

While such devices may be useful for verifying that the pulse oximeter sensor, cable, and monitor are functional, they are incapable of providing the data required to properly evaluate the accuracy of a system's SpO_2 measurements.

Fully evaluating the accuracy of the SpO_2 measurements requires, at a minimum, accommodating the wavelength characteristics of the sensor and reproducing the complex optical interaction of the sensor and the patient's tissue. These capabilities are beyond the scope of known bench top testers, including known devices which claim to measure sensor LED wavelength.

SpO_2 measurement accuracy can only be evaluated in vivo by comparing pulse oximeter readings with values traceable to SpO_2 measurements obtained from simultaneously sampled arterial blood using a laboratory CO-oximeter.

Many functional testers and patient simulators have been designed to interface with the pulse oximeter's expected calibration curves and may be suitable for use with Nellcor monitors and/or sensors. Not all such devices, however, are adapted for use with the Nellcor OxiMax™ digital calibration system. While this will not affect use of the simulator for verifying system functionality, displayed SpO_2 measurement values may differ from the setting of the test device.

For a properly functioning monitor, this difference will be reproducible over time and from monitor to monitor within the performance specifications of the test device.

Chapter 10
Monitoring CO_2

This chapter describes how to use the Propaq M unit to monitor End Tidal Carbon Dioxide ($EtCO_2$), breath rate, and Fractional Inspired Carbon Dioxide ($FiCO_2$). These options use the same connector on the Propaq M unit and may be used interchangeably.

Overview

The Propaq M unit uses the Oridion Microstream FilterLine® and Smart CapnoLine® systems to monitor CO_2.

The FilterLine and Smart CapnoLine systems draw small samples of gas from the patient's airway via a oral/nasal cannula or airway adapter, and pass these gases through an infrared sensor (located away from the patient's airway) that measures CO_2. The Microstream system can be used for CO_2 measurements on intubated and non-intubated infant, pediatric, and adult patients.

The Microstream CO_2 sensor generates infrared light, and beams it through the sampled breathing gases and determines CO_2 concentration by measuring the amount of light absorbed by gases.

The Propaq M unit displays $EtCO_2$ (the concentration of carbon dioxide detected at the end of each exhalation) and FiCO as a numerical value in millimeters of mercury (mmHg). In addition, the unit can display a capnogram. The capnogram is a valuable clinical tool that can be used to assess patient airway integrity and proper endotracheal (ET) tube placement. The unit calculates respiration rate by measuring the time interval between detected peaks of the CO_2 waveform. The technology differentiates between waveforms caused by breathing and those caused by cardiogenic oscillations and artifact.

The Propaq M is equipped with automatic barometric pressure compensation.

Warning!

- **When using a sampling line for intubated patients with a closed suction system, do not place the airway adapter between the suction catheter and endotracheal tube. This is to ensure that the airway adapter does not interfere with the functioning of the suction catheter.**
- **Do not cut or remove any part of the sample line. Cutting the sample line could lead to erroneous readings.**
- **If too much moisture enters the sampling line (i.e., from ambient humidity or breathing of unusually humid air), the message *Clearing FilterLine* will appear in the message area. If the sampling line cannot be cleared, the message *FilterLine Blockage* will appear in the message area. Replace the sampling line once the FilterLine Blockage message appears.**
- **Do NOT use the Microstream CO_2 accessories in the presence of flammable anesthetics or other flammable gases.**
- **Loose or damaged connections may compromise ventilation or cause an inaccurate measurement of respiratory gases. Securely connect all components and check connections for leaks according to standard clinical procedures.**
- **Always ensure the integrity of the patient breathing circuit after insertion of the airway adapter by verifying a proper CO_2 waveform (capnogram) on the monitor display.**

Caution

Microstream® $EtCO_2$ sampling lines are designed for single patient use, and are not to be reprocessed. Do not attempt to clean, disinfect, sterilize or flush any part of the sampling line as this can cause damage to the monitor.

Dispose of sampling lines according to standard operating procedures or local regulations for the disposal of contaminated medical waste.

Before use, carefully read the Microstream $EtCO_2$ sampling line's *Directions for Use*.

CO_2 Monitoring Setup and Use

Follow these steps to set up CO_2 monitoring:

1. Select the correct CO_2 sampling line for the patient.
2. Attach the sampling line to the unit's CO_2 inlet port.
3. Apply the Filterline airway adaptor or Smart CapnoLine Nasal or Oral/Nasal cannula to the patient.
4. Check that the Propaq M unit is set up for the correct patient type -- Adult, Pediatric, or Neonate.
5. Configure alarms (if the current alarm settings are not appropriate) and other CO_2 features.
6. Press the **CO2** quick access key () to initiate CO_2 monitoring.

Selecting the CO_2 Sampling Line

To select the correct CO_2 sampling line, you must determine the following:

- Is the patient adult, pediatric, or neonate?
- Is the patient intubated (ventilated) or non-intubated (non-ventilated)?

You can use the following Oridion Microstream accessories for CO_2 monitoring with the Propaq M unit:

Table 7-1. Oridion Microstream CO_2 Sampling Lines for use with Propaq M units

Accessory	Type	Part Number
FilterLine Set (Adult/Pediatric), box of 25	Intubated sampling line and airway adapter for short term monitoring	8300-0520-01
FilterLine H Set (Adult/Pediatric), box of 25	Intubated sampling line and airway adapter for humid environments	8300-0521-01
FilterLine H Set (Infant/Neonate), box of 25	Intubated sampling line and airway adapter for humid environments	8300-0522-01
VitaLine H Set (Adult/Pediatric), box of 25	Intubated sampling line and airway adapter for high ambient humidity	8300-0523-01
Smart Capnoline Plus with O_2 (Adult), box of 25	Non-Intubated Oral/ Nasal sampling with O_2 delivery	8300-0524-01
Smart Capnoline Plus with O_2 (Pediatric), box of 25	Non-Intubated Dual Purpose	8300-0525-01

Warning! **Use only CO_2 accessories authorized by ZOLL Medical Corporation. ZOLL Medical Corporation does not guarantee the use of non-authorized accessories.**

Connecting the CO_2 Sampling Lines

To connect the FilterLine or Smart CapnoLine:

1. Slide open the Propaq M unit's CO_2 inlet port cover.
2. Put the fitting at the end of the tubing over the CO_2 inlet port connector.
3. Turn the fitting clockwise to tighten.

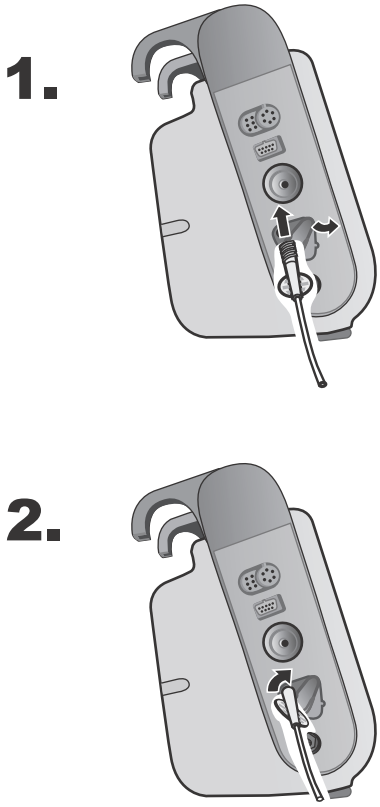


Figure 10-1 Connecting the Sampling Line Connector to the CO_2 Inlet Port

Warning!

- **The exhaust port for the Microstream CO_2 apparatus is an output for only expired gases from the patient and any connected breathing apparatus. The exhaust port is intended only for connection to gas collection equipment, such as gas scavenger devices -- *there should be no other connections to the exhaust port.***
- **When connecting the Microstream CO_2 accessory to patients who are receiving or have recently received anesthetics, connect the CO_2 exhaust port to a scavenging system, or to the patient's anesthetic machine or ventilator to prevent exposing medical staff to anesthetics.**
- **Do not lift the monitor by the FilterLine, as it could disconnect from the monitor, causing the monitor to fall on the patient.**
- **The FilterLine may ignite in the presence of high O_2 concentrations when directly exposed to laser or ESU devices. Use caution when performing these procedures.**

Note: If you use a gas scavenging system, ensure that it is installed according to the manufacturers instructions. The gas scavenging system should comply with ISO 8835-3:1997 (E).

Note: In order to avoid moisture buildup and sampling line occlusion during nebulization or suction for intubated patients, remove the sampling line luer connector from the monitor.

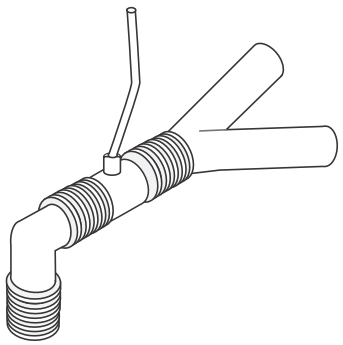
Applying a FilterLine Set

The FilterLine set is intended for the CO_2 monitoring of intubated patients.

Before attaching the airway adapter to the breathing circuit, verify that the adapter is clean, dry, and undamaged. Replace if necessary.

Caution The disposable FilterLine set is intended for single patient use. Do NOT reuse or sterilize any part of the FilterLine Set, as the monitor may be damaged by cleaning or reuse.

1. Place the airway adapter at the proximal end of the airway circuit between the elbow and the ventilator circuit wye. Do NOT place the airway adapter between the ET tube and the elbow as this may allow patient secretions to accumulate in the adapter.
2. If pooling does occur, the airway adapter may be removed from the circuit, rinsed with water and reinserted into the circuit. To prevent moisture from draining into the sample tubing, ensure that the sampling tube exits from the top of the airway adapter, not its bottom or sides. See the following figure.



Applying a Smart CapnoLine Oral/Nasal Cannula

The oral/nasal cannulas are intended for monitoring CO_2 in non-intubated patients.

Oral/nasal sampling cannulas are especially valuable for patients who are prone to mouth breathing, since most (if not all) of the CO_2 is exhaled through the mouth. If a standard nasal CO_2 sampling cannula is used on such patients, the $EtCO_2$ values and capnogram displayed will be substantially lower than the actual CO_2 levels present in the patient's expired breath.

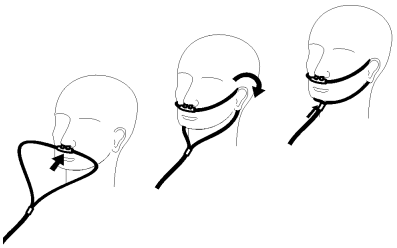
Warning!

- **The disposable Smart CapnoLine oral/nasal cannula sets are intended for single patient use. Do NOT reuse any part of this product as the monitor may be damaged by reuse of the sampling line.**
- **If oxygen is being delivered while using CO_2, be sure to use a CO_2 sampling with O_2 delivery. Using a different type of cannula will not enable oxygen delivery.**

Remove the cannula from the package. Verify that the cannula is clean, dry, and undamaged. Replace if necessary.

Placing the Cannula onto the Patient

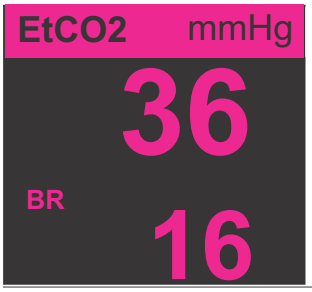
Place the oral/nasal cannula onto the patient as follows:



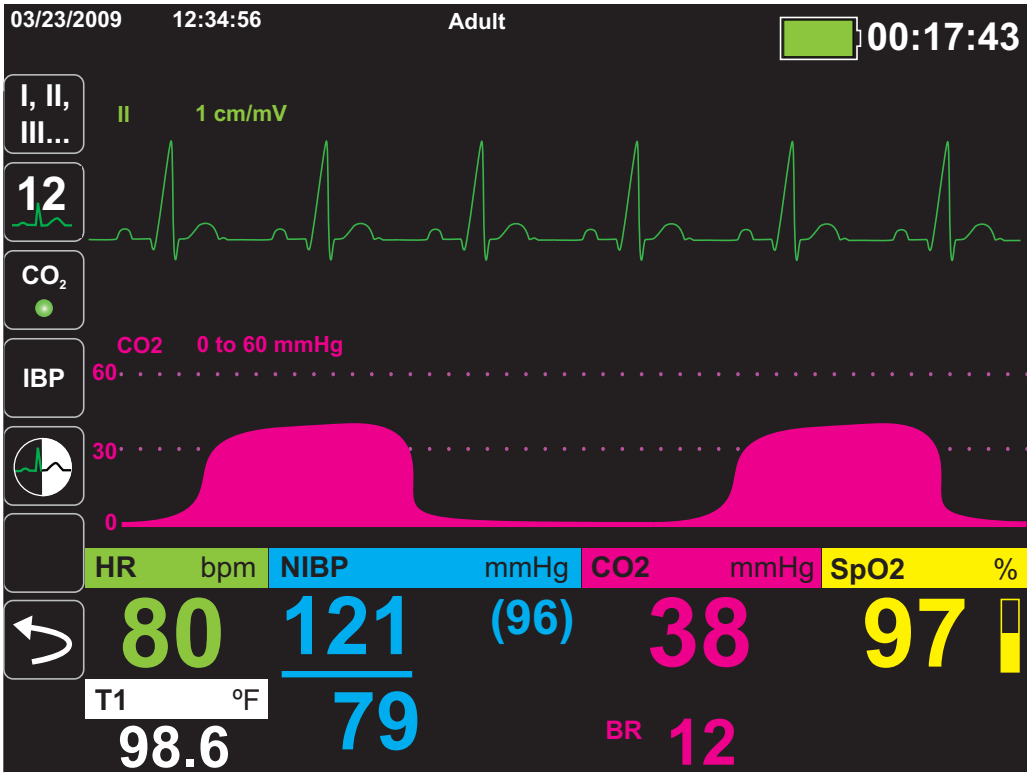
Caution Dispose of Microstream $EtCO_2$ consumables according to standard operating procedures or local regulations for the disposal of contaminated medical waste.

Measuring CO_2

Once setup is complete, press  to begin monitoring CO_2. The numeric CO_2 display appears on the screen and displays the message, *INITIALIZING*. The CO_2 display gives the current $EtCO_2$ value, and after a delay of approximately 1 minute, the patient's Respiration Rate (in Breaths/Minute), identified as **BR**:



Check that connections have been made correctly by verifying the display a proper capnogram (the waveform is inserted automatically on the waveform display window).



Setting CO_2 and Respiration Rate Alarms

The Propaq M unit sounds alarms whenever measurements are outside set limits for the following:

- High and Low $EtCO_2$
- High and Low Respiration Rate (in Breaths/Minute)
- High $FiCO_2$
- No Breath Alarm

Enabling/Disabling Alarms and Setting CO_2 Alarm Limits

You can enable (or disable) CO_2 alarms and set upper and lower alarm limits through the Alarms quick access key ( ) or the CO2 Parameter Control Panel.

To configure CO_2 alarms through the Alarms quick access key:

1. Press the More quick access key ( ).
2. Press .
3. Press the **Limits** quick access key ( ).
4. Use the navigation buttons to select appropriate alarm menu. For CO_2, the alarm menus are: EtCO2 Alarm, FiCO2 Alarm, or RR/BR Alarm.On the alarm settings menu, use the navigation keys to select the fields that you want to change. The fields are
   - **Upper Limit Enable**
   - **Lower Limit Enable (only EtCO2 and RR/BR Alarms)**
   - **Upper Limit**
   - **Lower Limit (only EtCO2 and RR/BR Alarms)**
5. When you are finished changing values on the alarm menu, select the Backarrow key to exit the menu.

Setting Upper and Lower $EtCO_2$ Limits

Initially, the EtCO2 Alarm menu specifies that the $EtCO_2$ alarms are enabled (**ON**) or disabled (**OFF**), and displays the default Upper and Lower $EtCO_2$ Limits. The upper and lower limits can be **ON** or **OFF** (default is **OFF**). The following table lists the default $EtCO_2$ limits for adult, pediatric, and neonate patients, and gives the range in which you can set these limits:

Patient Type	$EtCO_2$ Limit Default	$EtCO_2$ Limit Range
Adult	Lower: 8 mmHg Upper: 60 mmHg	Lower: 0-145 mmHg Upper: 5-150 mmHg
Pediatric	Lower: 8 mmHg Upper: 60 mmHg	Lower: 0-145 mmHg Upper: 5-150 mmHg
Neonate	Lower: 8 mmHg Upper: 60 mmHg	Lower: 0-145 mmHg Upper: 5-150 mmHg

Caution In high-altitude environments, $EtCO_2$ values may be lower than values observed at sea level, as described by Dalton's law of partial pressures. When using the Propaq M unit in high-altitude environments, it is advisable to adjust $EtCO_2$ alarm settings accordingly.

Setting Upper $FiCO_2$ Limits

Initially, the FiCO2 Alarm menu specifies that the $FiCO_2$ alarms are enabled (**ON**) or disabled (**OFF**), and displays the default upper limit. The upper limit can be **ON** or **OFF** (default is **OFF**). The following table lists the default $FiCO_2$ upper limits for adult, pediatric, and neonate patients, and gives the range in which you can set these limits:

Patient Type	Upper $FiCO_2$ Limit Default	Upper $FiCO_2$ Limit Range
Adult	8 mmHg	2-98 mmHg
Pediatric	8 mmHg	2-98 mmHg
Neonate	8 mmHg	2-98 mmHg

Setting Upper and Lower Respiratory Rate (RR/BR) Limits

Initially, the RR/BR Alarm menu specifies that RR/BR alarms are enabled (**ON)** or disabled (**OFF**), and displays the default Upper and Lower respiratory limits. The upper and lower limits can be **ON** or **OFF** (default is **OFF**). The following table lists the default Respiratory limits for adult, pediatric, and neonate patients in Breaths/Minute, and gives the range in which you can set these limits:

Patient Type	Respiration Rate Default	Respiration Rate Range
Adult	Lower: 3 BPM Upper: 50 BPM	Lower: 0 to 145 BPM Upper: 5 to 150 BPM
Pediatric	Lower: 3 BPM Upper: 50 BPM	Lower: 0 to 145 BPM Upper: 5 to 150 BPM
Neonate	Lower: 12 BPM Upper: 80 BPM	Lower: 0 to 145 BPM Upper: 5 to 150 BPM

Using the CO2 Parameter Control Panel

Use the navigation keys to highlight and select the **CO2** numeric display to display the CO2 Parameter Control Panel:

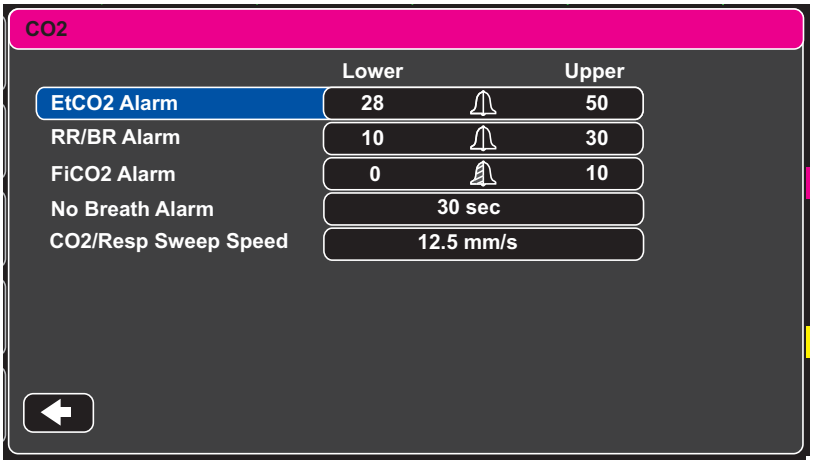


Figure 10-2 CO2 Parameter Control Menu

On the **CO2** Parameter Control Panel, you can select a CO_2 alarm (EtCO2, Breath Rate, or FiCO2). On the selected alarm settings menu, you can enable/disable alarms and set alarm limits (as described previously). You can also set the CO_2 sweep speed.

Setting the CO_2 Sweep Speed

The $EtCO_2$ sweep speed determines the X-axis scale of the capnogram. For patients with slower respiration rates, a slower sweep speed will make the capnogram easier to view. You can specify sweep speeds of 3.13, 6.25, and 12.5 mm/second. The default sweep speed is 6.25 mm/second.

System Messages

When monitoring CO_2, the Propaq M unit may display the following messages:

System Message	Cause
INITIALIZING	The unit is initializing the CO_2 monitoring function measurement, is functioning normally, and will display CO_2 measurement after a brief delay.
CHECK FILTERLINE	The sampling line is not connected. Check sampling line connection. Replace airway adaptor or cannula, if defective.
FILTERLINE OCCLUSION	The sampling or exhaust line is blocked. Check sampling and exhaust lines. Make sure that the sampling line and any inputs to the patient breathing apparatus are not connected to the exhaust port. If the current FilterLine is correctly attached, replace the FilterLine.
AUTO ZERO	The Propaq M unit displays *AUTO ZERO* when the CO_2 module performs periodic self-maintenance. During self-maintenance, the CO_2 module performs one or more of the following tests: ambient pressure measurement, auto zero, and a flow test. The CO_2 module completes its self-maintenance tests in approximately 10 seconds.
PURGING	The CO_2 module performs a purging whenever it detects an occlusion in the line or airway adaptor, and displays *PURGING* while it tries to clear the occlusion. If the CO_2 module cannot clear the occlusion within 30 seconds, the Propaq M unit issues an equipment alert and displays the message *FILTERLINE OCCLUSION.* At this point, if the current FilterLine is correctly attached, replace the FilterLine.

System Message	Cause
VALUE OVER RANGE	The CO_2 value exceeds the specified range.
CO2 DISABLED	An error has occurred with the CO_2 module, and the Propaq M unit has disabled the module for the duration of the unit's power cycle. If the problem persists, the unit may require servicing.

Patents

The capnography component of the Propaq M unit is covered by one or more of the following US patents: 6,428,483; 6,997,880;5,3000,859; 6,437,316; 7,488,229; and their foreign equivalents. Additional patent applications pending.

NO IMPLIED LICENSE

Possession or purchase of this device does not convey any express or implied license to the device with unauthorized consumable CO_2 sampling consumable products, which would, alone, or in combination with this device, fall within the scope of one or more of the patents relating to this device and/or CO_2 sampling consumable products.

Chapter 11
Monitoring Invasive Pressures (IBP)

The Propaq M IBP inputs are Type CF defibrillator proof.

This chapter describes how to use the Propaq M unit to monitor invasive pressures (IBP).

The Propaq M unit has three invasive pressure channels: P1, P2, and P3. You can use these channels to measure arterial, venous, or intracranial pressures using invasive transducers with 5uV/V/mmHg sensitivity. Each channel requires its own connector, cabling, and pressure transducer.

Invasive Pressure Transducers

The Propaq M unit is compatible with many types of invasive pressure transducers, including non disposable, disposable dome, and fully disposable transducers. See Appendix B, *Accessories*, for a list of compatible transducers. Do not use light-sensitive disposable transducers.

Use the invasive pressure transducers according to your organization's established clinical protocol and follow the manufacturer's recommendations. Always refer the manufacturer's *Directions for Use* before using a transducer.

Warning!

- **If electrocautery is used, always avoid using any transducer with a conductive (metal) case connected to its ground shield. Using a conductive transducer case that is connected to its cable shield risks high-frequency burns at the ECG electrodes if the transducer case becomes grounded to earth.**
- **Normal alarm functions will detect complete disconnections of invasive pressure transducers; however, the alarm functions will not detect a partial disconnection or the use of some incompatible transducers. Use only approved transducers and ensure that the transducers are connected properly.**
- **Before you use the Propaq M unit on a new patient, always turn it off for at least 2 minutes. This clears the previous patient's trend values, alarm limit settings, and NIBP cuff inflation pressure.**
- **Use *only* ZOLL-approved IBP sensors. Use of non-approved sensors may result in inaccurate IBP measurements.**

IBP Setup

To take safe and accurate IBP measurements using the Propaq M, you must perform the following steps, each of which corresponds to a section in this chapter. Read each section carefully before you perform IBP measurements.

1. Attach the invasive pressure transducer to the Propaq M unit.
2. Zero the transducer.
3. Set the invasive pressure alarms (according to your organization's standards).
4. Select a label for the invasive pressure channel.

Attaching the Invasive Pressure Transducer

Follow these steps when attaching the invasive pressure transducer:

1. Inspect the transducer cable. If the cable shows any signs of wear, breakage, or fraying, replace the cable. Replace the transducer dome, if necessary.
2. Apply the transducer according to your organization's procedures. Always refer the manufacturer's *Directions for Use* before using a transducer.
3. If the transducer is a disposable unit with a separate cable, connect the transducer to the transducer cable.
4. Plug the transducer cable into one of the three six-pin IBP cable connectors on the side of the Propaq M unit.

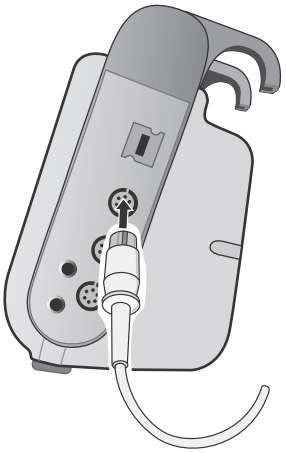


Figure 11-1 Plugging the Transducer into the Propaq M

When you plug the transducer cable into the unit, the message *ZERO PROBE* appears in the numeric display window for that IBP channel.

Zeroing the Transducer

To ensure that the Propaq M unit measures pressure accurately, you must zero the transducer before each use. If you change or disconnect a transducer, you must zero the new transducer before use. If you move a transducer to a different monitor, you must zero the transducer again, even if you have already done so on another unit. In addition to the procedure below, follow the transducer manufacturer's *Directions for Use* and your organization's established clinical protocol.

Follow these steps when zeroing a transducer:

1. Place the transducer at the same height as the patient's left atrium.
2. Close the transducer stopcock to the patient.
3. Open the transducer's venting stopcock to atmospheric air.
4. Allow the transducer a few seconds to settle.
5. Use the navigation keys to highlight and select the tranducer's IBP channel and display the IBP channel's parameter control panel:

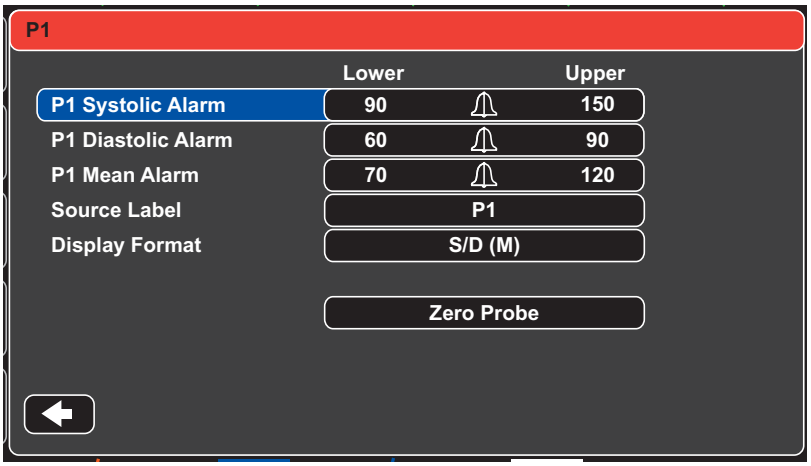


Figure 11-2 IBP Channel Parameter Control Pane

6. Select **Zero Probe**. The unit displays the message *ZEROING* in the IBP Channel's numeric display.
7. The message *ZEROED* appears in the IBP channel's numeric display.
8. Close the transducer's stopcock.
9. If the unit was unable to zero the transducer, the message *ZERO REJECTED* appears in the IBP channel's numeric display. The unit will not display pressure values for the IBP channel until it has successfully zeroed the transducer and established an acceptable zero reference.

Check that the unit is open to atmospheric air and that it is properly connected to the unit, then try zeroing the transducer again. The Propaq M unit will not zero the transducer if it detects pulsation in the pressure channel, if there is too much noise in the signal, or if transducer's offset is too great.

If you cannot zero the transducer after several attempts, replace the transducer or the transducer cable.

Rezeroing a Transducer

You can re-zero a transducer at any time by opening the transducer stopcock to atmospheric air.

If the unit accepts the new zero reference value, the unit displays pressure values that are based on that value and adjusts the waveform according to the new scale.

Warning! **If you select an IBP channel after the channel has been successfully zeroed and is currently monitoring a pressure waveform, the unit will display the message, *ZERO REJECTED*, in the IBP channel's numeric window. This message will preempt the display of the valid invasive pressure numerics.**

Displaying IBP Measurements

After attaching and zeroing a transducer, the Propaq M unit displays the invasive pressure's systolic, diastolic, and MEAN values in the IBP channel's numeric display and, optionally (if enabled through the unit's Waveform Select menu) the waveform for that IBP channel:

The Propaq M unit allows you to specify a label that identifies the channel's IBP measurement, and to select a display format for the numeric display.

The unit displays the waveform scales after you zero the transducer. When the unit accepts the zero reference value, it determines the waveform scales and displays them.

Conditions Affecting IBP Measurements

When reading blood pressure measurements on the IBP numeric display, keep in mind that the following conditions can affect the accuracy of IBP measurements:

- Catheter placement in the vasculature. Artifact such as catheter whip should be handled per your established clinical protocols.
- Position of the transducer stopcock, catheter, and flush port.
- Saline line flushes which will temporarily interrupt accurate pressure measurement.
- Position of the transducer relative to the patient's phlebostatic axis or catheter tip.
- Patient movement.
- Catheter clogging.
- Air bubbles in catheter or transducer dome.

Caution Flush catheter regularly while taking IBP measurements. Always view the IBP waveform to ensure that pressure measurements are based on a physiological waveform.

Enabling/Disabling IBP Alarms and Setting Alarm Limits

When enabled, the Propaq M unit sounds alarms whenever IBP measurements are outside set limits for the following:

- High and Low Systolic Pressure
- High and Low Diastolic Pressure
- High and Low Mean Arterial Pressure (MEAN)

To enable (or disable) IBP alarms and set Upper and Lower alarm limits and IBP channel, you can either use the navigation buttons to highlight and select the IBP channel display or:

1. Press the More quick access key ( ).
2. Press .
3. Press the **Limits** quick access key ( ).
4. Use the navigation buttons to highlight and select the appropriate alarm menu selection. For each IBP channel, there are alarm menus for systolic (Systolic Alarm), diastolic (Diastolic Alarm) and mean arterial pressure (Mean Alarm) alarm settings. On the selected Alarm Settings menu, use the navigation keys to select the fields that you want to change. The fields are
   - **Upper Limit Enable**
   - **Lower Limit Enable**
   - **Upper Limit**
   - **Lower Limit**
5. When you are finished changing values on the alarm menu, navigate to the Backarrow key to exit the menu.

Setting Upper and Lower Systolic (SYS) Alarm Limits

Initially, the IBP Systolic Alarm Settings menu specifies that the IBP systolic pressure alarms are enabled (**ON)** or disabled (**OFF),** and displays the default upper and lower systolic limits. The upper and lower limits can be **ON** or **OFF** (default is **OFF**). The following table lists the default NIBP Systolic limits for adult, pediatric, and neonate patients, and gives the range in which you can set these limits:

Patient Type	IBP Systolic Limit Default	IBP Systolic Limit Range
Adult	Lower: 75 mmHg Upper: 220 mmHg	Lower: -30 to 298 mmHg Upper: -28 to 300 mmHg
Pediatric	Lower: 75 mmHg Upper: 145 mmHg	Lower: -30 to 298 mmHg Upper: -28 to 300 mmHg
Neonate	Lower: 50 mmHg Upper: 100 mmHg	Lower: -30 to 298 mmHg Upper: -28 to 300 mmHg

Setting Upper and Lower Diastolic (DIA) Alarm Limits

Initially, the IBP Diastolic Alarm Settings menu specifies that the IBP diastolic pressure alarms are enabled (**ON**) or disabled (**OFF**)**,** and displays the default Upper and Lower diastolic limits. The upper and lower limits can be **ON** or **OFF** (default is **OFF**). The following table lists the default diastolic limits for adult, pediatric, and neonate patients, and gives the range in which you can set these limits:

Patient Type	IBP Diastolic Limit Default	IBP Diastolic Limit Range
Adult	Lower: 35 mmHg Upper: 110 mmHg	Lower: -30 to 298 mmHg Upper: -28 to 300 mmHg
Pediatric	Lower: 35 mmHg Upper: 100 mmHg	Lower: -30 to 298 mmHg Upper: -28 to 300 mmHg
Neonate	Lower: 30 mmHg Upper: 70 mmHg	Lower: -30 to 298 mmHg Upper: -28 to 300 mmHg

Setting Upper and Lower Mean Arterial Pressure (MEAN) Alarm Limits

Initially, the IBP MEAN Alarm Settings menu specifies that IBP MEAN alarms are enabled (**ON**) or disabled (**OFF**)**,** and displays the default Upper and Lower MEAN limits. The upper and lower limits can be **ON** or **OFF** (default is **OFF**). The following table lists the default MEAN alarm limits for adult, pediatric, and neonate patients, and gives the range in which you can set these limits:

Patient Type	IBP Mean Limit Default	IBP Mean Limit Range
Adult	Lower: 50 mmHg Upper: 120 mmHg	Lower: -30 to 298 mmHg Upper: -28 to 300 mmHg
Pediatric	Lower: 50 mmHg Upper: 110 mmHg	Lower: -30 to 298 mmHg Upper: -28 to 300 mmHg
Neonate	Lower: 35 mmHg Upper: 80 mmHg	Lower: -30 to 298 mmHg Upper: -28 to 300 mmHg

Setting IBP Source Label

In the IBP channel menu, you can select a label that identifies the source of the channel's IBP measurement. By default, the channels are labeled P1, P2, and P3.

At the Source Label prompt, you can specify that the unit display one of the following labels to identify the IBP channel:

Source Label	Description	Source Label	Description
ABP	Abdominal Aorta Pressure	**AO**	Aorta
ART	Arterial Pressure	**BAP**	Brachial Artery Pressure
CVP	Central Venous Pressure	**FAP**	Femoral Artery Pressure
ICP	Intracranial Pressure	**LAP**	Labial Artery Pressure
PAP	Pulmonary Artery Pressure	**RAP**	Radial Artery Pressure
UAP	Umbilical Artery Pressure	**UVP**	Umbilical Venous Pressure

In the following example, source labels are specified for all three IBP channels:

IBP System Messages

The Propaq M unit may display the following messages when monitoring IBP:

System Message	Cause
TRANSDUCER FAILURE	The IBP probe is damaged and needs to be replaced.
INCOMPATIBLE TRANSDUCER	The IBP probe is not compatible. See Appendix B, *Accessories*, for a list of ZOLL-approved IBP probes.
CHECK PROBE	The IBP probed has become disconnected.
ZERO PROBE	The IBP probe is connected and needs to be zeroed.
ZEROING	The IBP probe is zeroing.
IBP DISABLED	A system error has occurred, and the Propaq M unit should be serviced.
ZERO REJECTED	The IBP probe was not removed due to a pulsatile pressure signal, excessive IBP artifact or excessive transducer offset.

Chapter 12
Monitoring Temperature

The Propaq M Temperature inputs are Type CF defibrillator proof.

This chapter describes how to use the Propaq M unit to monitor temperature.

The Propaq M unit provides two temperature channels. When both channels are in use, the unit displays each channel's temperature successively, followed by the difference between the temperatures (labeled **ΔT**).

Temperature Monitoring Setup

To monitor temperature using the Propaq M unit, perform the following steps:

1. Select the temperature probe and apply it to the patient.
2. Connect the temperature probe to the Propaq M unit.
3. Configure Temperature alarms and settings (if the current Temperature alarms and settings are not appropriate).

Selecting and Applying Temperature Probes

You should use only temperature probes that are approved for use with the Propaq M unit. See Appendix B, *Accessories*, for a list of ZOLL-approved temperature probes. The use of other probes that do not match the performance specifications of the ZOLL-approved probes may produce incorrect temperature readings.

To apply the temperature probe to the patient, follow your organization's standard procedures. Always refer to probe manufacturer's *Directions for Use* before using the probe.

Warning!

- **The application and use of metal-jacketed temperature probes that come in contact with conductive objects or clinical personnel during electrocautery may cause burns at the point of contact between the patient and the temperature probe.**
- **Use *only* ZOLL-approved temperature probes. The use of non-approved probes may result in accurate measurements.**

Connecting the Temperature Probe

To connect the temperature probe, insert the probe's 1/4" plug into one of the two connection jacks on the side of the Propaq M unit.

Figure 12-1 Connecting the Temperature Probe to the Propaq M Unit

Displaying Temperature

When you connect the probe, the unit displays the temperature after a brief pause. The Propaq M unit displays temperature as a numeric value in the Temperature window. You can specify that the unit display the temperature in ° C or ° F.

Enabling/Disabling Temperature Alarms and Setting Alarm Limits

When enabled, the Propaq M unit sounds alarms whenever temperature measurements are outside set limits.

You can enable (or disable) temperature alarms and set the upper and lower alarm limits through the Alarms quick access key ( ) or the Temp Parameter Control Panel.

To configure temperature alarms through the **Alarms** quick access key:

1. Press the More quick access key ( ).
2. Press .
3. Press the **Limits** quick access key ( ).
4. Use the navigation keys to highlight and select the **T1 Alarm**, **T2 Alarm, or T Alarm** menu selection. On the Alarm Settings menu, use the navigation keys to select the fields that you want to change. The fields are
   - **Upper Limit Enable**
   - **Lower Limit Enable**
   - **Upper Limit**
   - **Lower Limit**
5. When you are finished changing values on the alarm menu, navigate to the Backarrow key to exit the menu.

Setting Upper and Lower Temperature Alarm Limits

Initially, the Temperature Alarm Settings menu specifies that the Temperature alarms are enabled or disabled and displays the default upper and lower limits. The upper and lower limits can be **ON** or **OFF** (default is **OFF**). The following table lists the default Temperature limits for adult, pediatric, and neonate patients, and gives the range in which you can set these limits:

Patient Type	Temperature Limit Default	Temperature Limit Range
Adult	Lower: 35 ° C (95.0 ° F) Upper: 37.8 ° C (100 ° F)	Lower: 0.0 - 48.0 ° C (32.0 - 120.0 ° F) Upper: 2.0 - 50.0 ° C (34.0 - 122.0 ° F)
Pediatric	Lower: 35 ° C (95.0 ° F) Upper: 37.8 ° C (100 ° F)	Lower: 0.0 - 48.0 ° C (32.0 - 120.0 ° F) Upper: 2.0 - 50.0 ° C (34.0 - 122.0 ° F)
Neonate	Lower: 35 ° C (95.0 ° F) Upper: 37.8 ° C (100 ° F)	Lower: 0.0 - 48.0 ° C (32.0 - 120.0 ° F) Upper: 2.0 - 50.0 ° C (34.0 - 122.0 ° F)

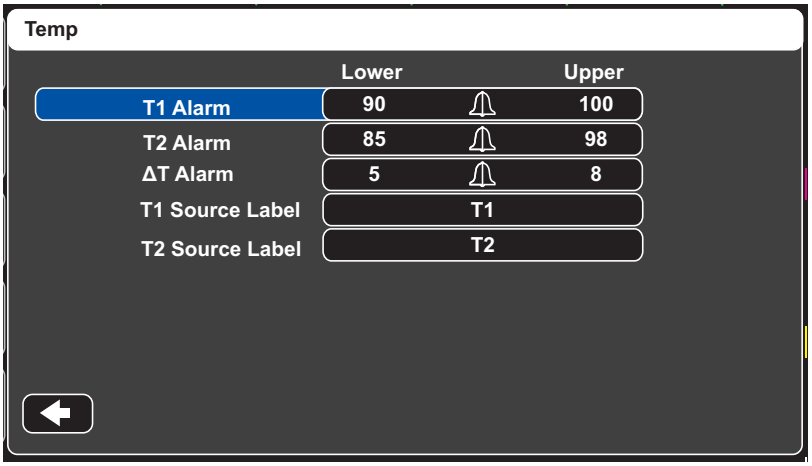
Setting Upper and Lower ΔTemperature Alarm Limits

Initially, the Δ **Temperature Alarm Settings** menu specifies that the ΔTemperature alarms are enabled (**ON**), and displays the default upper and lower limits. The upper and lower limits can be **ON** or **OFF** (default is **OFF**). The following table lists the default ΔTemperature limits for adult, pediatric, and neonate patients, and gives the range in which you can set these limits:

Patient Type	Δ Temperature Limit Default	Δ Temperature Limit Range
Adult	Lower: 0.0 ° C (5.0 ° F) Upper: 2.8 ° C (2.0 ° F)	Lower: 0.0 - 49.8 ° C (0.0 - 89.8 ° F) Upper: 0.2 - 50.0 ° C (0.2 - 90.0 ° F)
Pediatric	Lower: 0.0 ° C (5.0 ° F) Upper: 2.8 ° C (2.0 ° F)	Lower: 0.0 - 49.8 ° C (0.0 - 89.8 ° F) Upper: 0.2 - 50.0 ° C (0.2 - 90.0 ° F)
Neonate	Lower: 0.0 ° C (5.0 ° F) Upper: 2.8 ° C (2.0 ° F)	Lower: 0.0 - 49.8 ° C (0.0 - 89.8 ° F) Upper: 0.2 - 50.0 ° C (0.2 - 90.0 ° F)

Selecting the Temperature Label

Through the **Temp** Parameter Control Panel, you can configure alarms (as described previously) and select descriptive Temperature channel labels that will appear on the numeric display and on the trend report:



You can select one of the following labels for each temperature channel:

Source Label	Description
ART	Arterial temperature probe
CORE	Central body temperature or tympanic membrane temperature probe
ESOPH	Esophageal temperature probe
RECT	Rectal temperature probe
SKIN	Skin temperature probe (surface application)
VEN	Ventilator airway temperature probe
NASO	Nasopharynx or nasal/oral temperature probe

If you don't select a label, the Temperature channels appear with the default labels of T1 and T2.

Temperature System Messages

The Propaq M unit may display the following messages when monitoring Temperature.

Note: The temperature function performs a self test when initially powered on and also performs system tests automatically, every 10 seconds, while this function is active.

System Message	Cause
CHECK PROBE	The temperature probe is disconnected. Check probe and reconnect it.
PROBE FAILURE	The temperature probe is defective. Replace the temperature probe.
TEMP DISABLED	A system error has occurred. The Propaq M unit cannot take temperature measurements and should be serviced.

Chapter 13
Monitoring 12-Lead ECG

The Propaq M 12-Lead input is Type CF defibrillator proof.

This chapter describes how to use the Propaq M unit to perform 12-Lead ECG Monitoring.

The Propaq M with the 12-lead ECG Monitoring option provides simultaneous acquisition and storage of 12-lead information.

Warning!

- **12-Lead ECG monitoring is intended for the recording of 12-lead ECG signals acquired from adult and pediatric patients in the supine, resting position -- always ensure that the patient is kept motionless during 12-lead ECG signal acquisition. Use of the device to acquire ECG signals from moving or shaking patients may produce noisy signals that are difficult to interpret.**
- **Excessive body hair or wet, sweaty skin may interfere with electrode adhesion. Remove the hair and/or moisture from the area where the electrode is to be attached.**
- **Remove ECG electrodes from their sealed package immediately prior to use. Using previously opened or out-of- date electrodes may degrade the ECG signal quality.**
- **Monitoring electrodes may become polarized during defibrillator discharge, causing the ECG waveform to briefly go off screen. ZOLL Medical Corporation recommends the use of high quality silver/silver chloride (Ag/AgCl) electrodes to minimize this effect; the circuitry in the instrument returns the trace to the monitor display within a few seconds.**
- **When not in use, cover the patient cable's V-lead connector with the supplied plastic cap. Failure to do so may result in a shock hazard during defibrillation attempts.**

- **To assure protection against the effects of defibrillator discharge, use only 12-lead cables supplied by ZOLL Medical Corporation.**
- **Check the operation and integrity of the Propaq M unit and 12-lead cable regularly by performing the Daily Operational Verification Test.**
- **When attempting to interpret subtle ECG changes (such as ST segments) use only the Diagnostic frequency response setting. Other frequency response settings may cause misinterpretation of the patient's ECG.**
- **Use only ZOLL-approved accessories to ensure the Type CF defibrillator proof rating of the 12-Lead input.**
- **Implanted pacemakers may cause the heart rate meter to count the pacemaker rate during incidents of cardiac arrest or other arrhythmias. Carefully observe pacemaker patients. Check the patient's pulse; do not rely solely on heart rate meters. Dedicated pacemaker detection circuitry may not detect all implanted pacemaker spikes. Patient history and physical exam are important in determining the presence of an implanted pacemaker.**

Entering Patient Information

To enter patient information, press the 12-Lead quick access key (12), then the Patient Info quick access key ( ). The screen displays the Patient Info parameter panel, in which you can enter the patients's name, age, gender, and identification number:

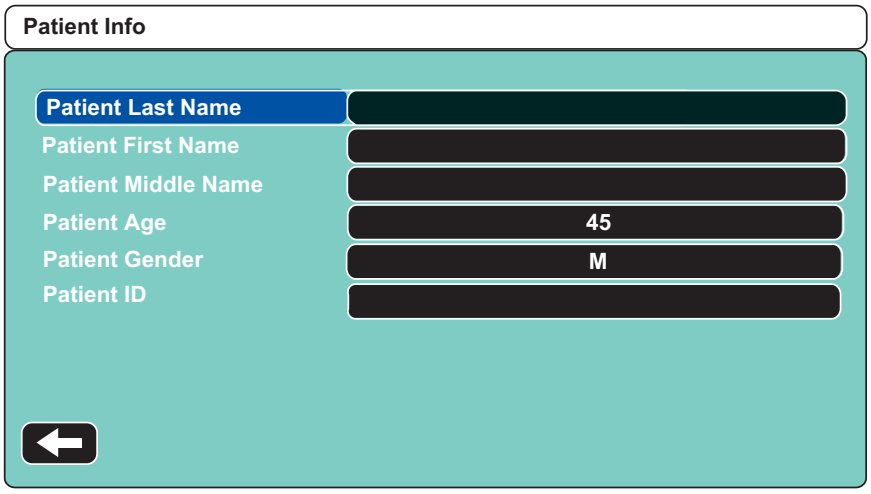


Figure 13-1 Patient Info Control Panel

The Propaq MD unit uses the name that you enter in the Patient Info panel to label the 12-lead ECG monitoring snapshots that it saves.

To enter patient information, use the navigation keys to highlight and select a parameter on the Patient Info panel, then press the Select key.

Entering the Patient Name and ID

When you select the **Patient Last Name** field (or the patient middle/last name and ID fields), the screen displays an information entry panel:

To enter a character into the parameter, highlight the character, then press Select. The screen displays the selected character in the area below the parameter name.

To navigate through the information entry panel, use the following keys:

- Use the Row Up quick access key (Row ↑) to move to the previous row on the panel.
- Use the Row Down quick access key (Row ↓) to move down one row on the panel.

Use the navigation keys on the front panel to highlight the next or previous character on the information entry panel.

You can also select the following function keys on the information entry panel:

- **Backspace** Erases the last character entered.
- **Clear** Erases all characters entered.
- **SAVE** Saves the characters entered for that parameter and returns you to the Patient Info panel.
- **Cancel** Returns you to the Patient Info panel without saving the characters entered.

Entering Patient Age and Gender

The Patient Info parameter panel provides default values for the Patient Age and Patient Gender parameters. To change a default value, highlight and select the parameter, and then specify a new value as follows:

To change Patient Age, use the navigation keys on the front panel to decrease or increase the default value (45), then press Select.

To change Patient Gender, use the navigation keys on the front panel to toggle between the default value, M (male), and F (female), then press Select.

12-Lead ECG Monitoring Setup

The proper application and placement of electrodes is essential for high quality 12-Lead ECG monitoring. Good contact between the electrode and skin minimizes motion artifact and signal interference.

To set up 12-lead ECG monitoring, perform the following steps:

1. Prepare the patient's skin for electrode application.
2. Apply the electrodes to the patient.
3. Connect each lead of the ECG cable to the appropriate electrode.
4. Connect the 12-Lead cable to the Propaq M unit.
5. Observe the patient’s electrocardiogram on the display, and adjust size of the 12-Lead ECG waveform traces, as necessary.

Preparing the Patient for Electrode Application

The proper application of electrodes is essential for high quality ECG monitoring. Good contact between the electrode and skin minimizes motion artifact and signal interference.

Before applying electrodes, prepare the patient’s skin, as necessary:

- Shave or clip excess hair at electrode site.
- Clean oily skin with an alcohol pad.
- Rub site briskly to dry.

Applying Electrodes to the Patient

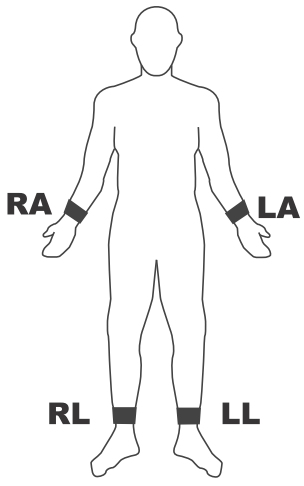
Depending on local usage, ECG lead wires are marked with certain labels. Refer to the following table for labels and color codes for the different lead sets.

Location	AHA[1] Labels	IEC[2] Labels
Right Arm	RA (white)	R (red)
Left Arm	LA (black)	L (yellow)
Right Leg	RL (green)	N (black)
Left Leg	LL (red)	F (green)
Chest	V1	C1
Chest	V2	C2
Chest	V3	C3
Chest	V4	C4
Chest	V5	C5
Chest	V6	C6

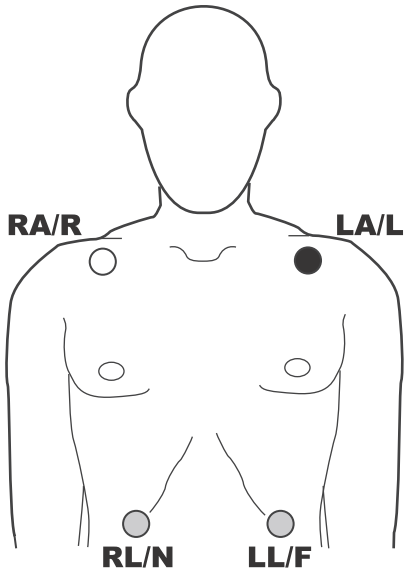
[1] American Heart Association

[2] International Electrotechnical Commission

Patients should be in a resting, supine position when performing 12-Lead ECG monitoring. ZOLL Medical Corporation recommends placing the limb electrodes anywhere along the ankles and wrists.



When it is difficult for the patient to remain motionless due to shivering, muscle tremors, or transport vehicle movement, place limb electrodes on the patient's thorax for better results. (Refer to the two diagrams for limb electrode placement).



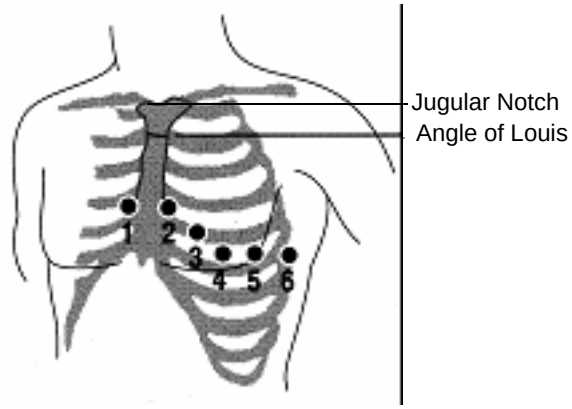
Avoid placing electrodes over tendons and major muscle masses.

Place the precordial electrodes across the chest in the following locations:

Electrode	Placement
V1/C1	Fourth intercostal space, at the patient's right sternal margin.
V2/C2	Fourth intercostal space, at the patient's left sternal margin.
V3/C3	Midway between V2/C2 and V4/C4.
V4/C4	Fifth intercostal space, on the patient's midclavicular line.
V5/C5	Patient's left anterior axillary line, at the horizontal level of V4.
V6/C6	Patient's left midaxillary line, at the same horizontal level as V4 and V5.

Locating the V1/C1 position (fourth intercostal space) is critically important because it is the reference point for locating the placement of the remaining V-leads. To locate the V1/C1 position:

1. Place your finger on top of the jugular notch (see figure below).
2. Move your finger slowly downward about 1.5 inches (3.8 centimeters) until you feel a slight horizontal ridge or elevation. This is the "Angle of Louis," where the manubrium joins the body of the sternum.



3. Locate the second intercostal space on the patient's right side, lateral to and just below the "Angle of Louis."
4. Move your finger down two more intercostal spaces to the fourth intercostal space which is the V1 position.

Note: When placing electrodes on female patients, always place leads V3-V6 under the breast rather than on the breast.

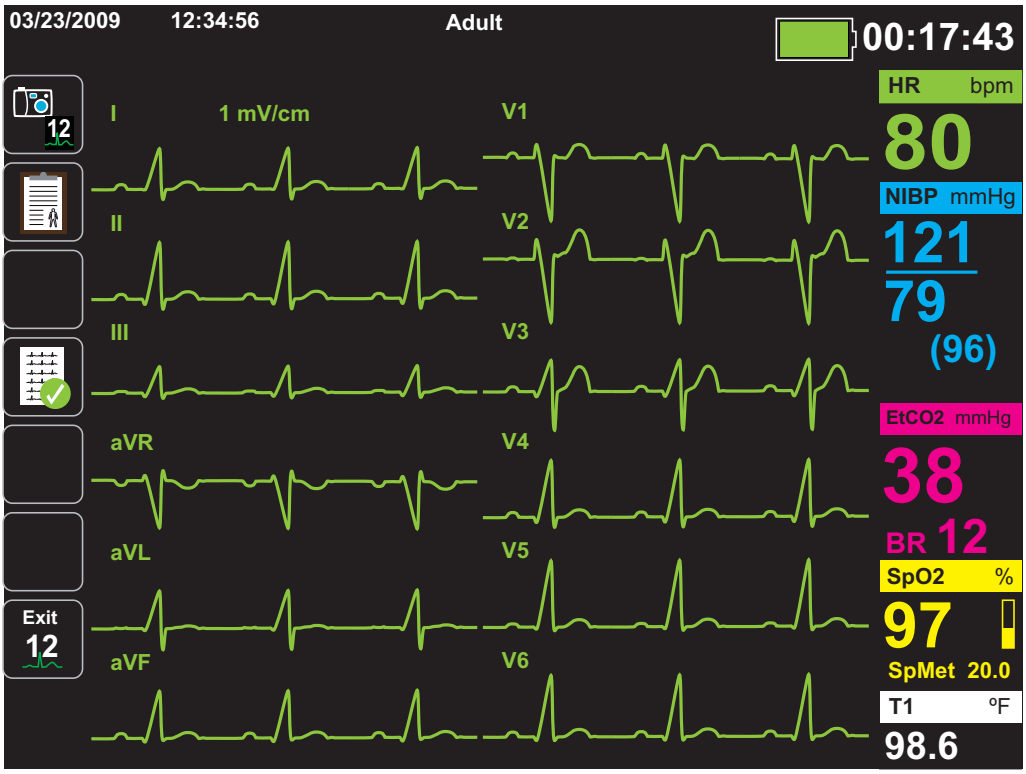
Connecting the 12-Lead Cable

Connect the 12-Lead ECG cable to the ECG input connector on the left side of the unit as follows:

Figure 13-2 Connecting the 12-Lead ECG Cable

Observing the 12-Lead Waveform Traces

To observe the 12-Lead waveform traces, press 12. The screen displays all twelve waveform traces, with the size displayed above the waveform traces:

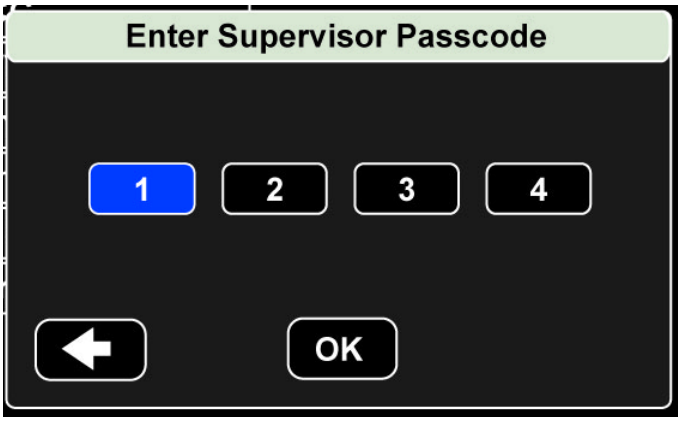


When you are done viewing the 12-Lead waveform traces, press the **Exit 12** quick access key (Exit 12) to restore the display of other monitoring functions.

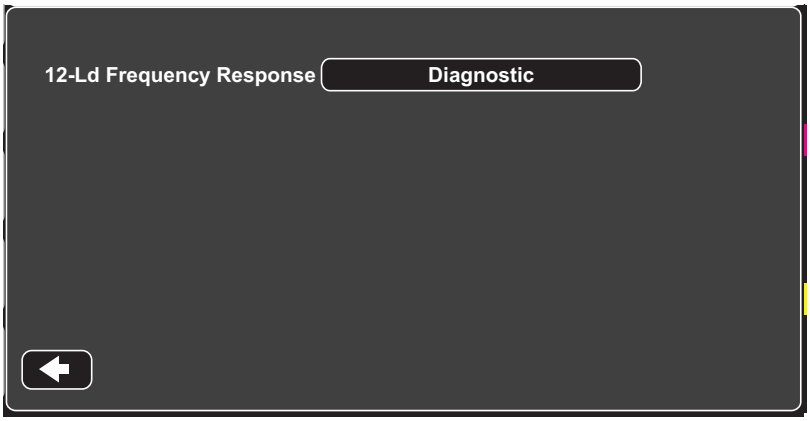
12-Lead Display Options

The Propaq M unit provides additional 12-Lead display options that you can specify through the Supervisor parameter control panels (access to Supervisor is passcode-controlled).

Press the Setup quick access key ( ), then select Supervisor. Using the navigation keys, highlight and select the four digits in the Supervisor passcode:



Select the Supervisor> ECG> 12-Lead options to display the 12-Lead parameter control panel:



Specifying the 12-Lead Frequency Response

This option allows you to specify the frequency response of the 12-Lead waveform display.

You can specify the following trace display ranges:

Display Type	Frequency Response
Diagnostic	0.05 to 150 Hz
Filtered Diagnostic	0.25 to 40 Hz

Chapter 14
Patient Data

This chapter describes procedures for storing, viewing, and transferring patient data from the Propaq M to an external system, such as a personal computer or handheld device.

Note: Before deleting log files from the Propaq M, view the files on a personal computer to verify that they have been successfully transferred.

Note: Data transfers will not be successful if the USB flash storage device is full or does not have sufficient memory available. Always use a USB flash storage device that has at least 128 MB available.

WARNING! Do not connect non-isolated equipment to the USB port while monitoring a patient.

Storing Data

The Propaq M unit stores a combination of 24 hours (at one-minute intervals) of patient trend information, one thousand time-stamped events, and 32 snapshots (24 second duration) for the patient being monitored. The actual number of trends, events, or snapshots stored could be more or less depending on the use profile. When the data storage is at capacity, the log becomes full and the patient data must be cleared or transferred before the Propaq M unit can store additional patient data. Data will not be lost if the Propaq M unit is turned off, or if the battery or auxiliary power adapter is removed.

Capturing a Data Snapshot

Press the Snapshot button ( ) on the front panel to capture a 24-second period of numeric and waveform patient data. The unit captures 12 seconds proceeding and 12 seconds following the button press.

The monitor can store a minimum of 32 snapshots, including

- Monitor snapshots
- Treatment snapshots
- Alarm snapshots

Reviewing snapshots

You can perform this procedure from any main display screen.

1. Press the Home/Display button ( ) repeatedly until the Trends window displays.
2. Use the navigation keys to get to the Trends window.
3. Press Select button to scroll through the list of trends.

Note: The snapshots have a snapshot icon next to the time stamp.

4. Select the desired snapshot from the Trends list and press Select. The snapshot numeric data displays.

Treatment Summary Report

The Treatment Summary Report is a report that shows all of the treatment events related to a patient such as alarm events and treatment snapshots.

TREATMENT SUMARY REPORT

Name: John Doe		09:14:14	New Case ID
ID: Patient 0015	Patient Mode: Adult	09:14:14	System On
Start Time: 09/14/10	09:14:14	09:14:14	Patient Mode Adult
Last Event: 09/14/10	09:43:40	09:14:14	Some Alarm Limits Disabled
Elapsed Time: 00:29:48	# Events:	09:14:20	Self Test Passed
		09:14:43	Treatment Snapshot: ASA

Total 12 Leads: 0

Dept: ICU

Unit:

S/N: 0 SW: 00.00.00.00

Transferring Data to a USB Device

You can transfer patient data from the unit using a USB transfer device.

Before you begin, insert a USB device into the Propaq M USB device port.

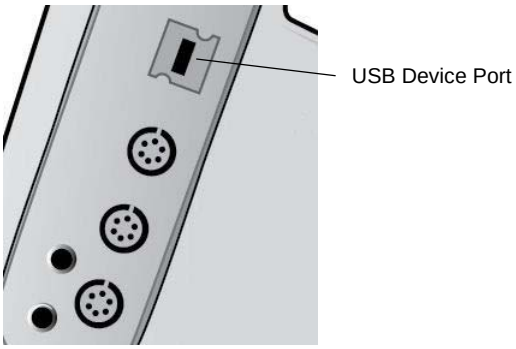


Figure 14-1. USB Port

To transfer data through the USB port:

1. Press the power switch to turn the unit on.
2. Press  .
3. Press  .
4. Press the Transfer Log quick access key () (ensure that the USB drive is connected to the device).

Note: Do not remove the USB data drive from the Propaq M unit during transfer.

5. Use the navigation keys to select **Transfer** from the Transfer the Log menu.
6. The green LED on the top of the device turns on while data is transferred to the USB device.

Note: Wait for the log transfer to complete and for the green light on the top of the Propaq M to turn off before removing the USB drive.

Note: Logging snapshots is disabled during the log transfer.

After transferring data, you must remove the USB drive and reinsert it before attempting another transfer. If the USB device does not establish communication with the Propaq M unit, try powering off the unit and then on again to establish communication.

Clearing the Log

You should clear the patient data log after transferring data to the USB device or when the log is full.

Note: Clearing the log during patient treatment results in the loss of all patient data and events recorded prior to clearing the log. Clearing the log creates a New Patient record and all patient-specific parameters (alarm limits, etc.) are set to their default values.

To clear the log:

1. Press  .
2. Press  .
3. Press the Clear Log quick access key ().

3. Use the navigation keys to select **Yes**.

Warning! **To avoid a possible shock hazard, do NOT make any electrical connections to the USB port except to connect a USB flash drive while in the vicinity of the patient.**

Chapter 15
Cleaning and Maintenance

Monitoring equipment must be maintained to be ready for immediate use. To ensure the readiness and optimum working condition of the Propaq M unit, you should perform the cleaning and maintenance instructions recommended in this chapter.

Inspection and Cleaning instructions

Before cleaning the monitor, battery, AC power adapter, or any accessories, thoroughly inspect them:

- Look for any signs of damage and any improper mechanical function of buttons or connectors.
- Gently bend and flex cables, inspecting them for damage or extreme wear, exposed wires, or bent connectors.
- Confirm that all connectors engage securely.

Immediately report any sign of damage or malfunction to your service department.

At least once per year thoroughly inspect the battery and the AC adapter power cord for damage or extreme wear. In addition to this inspection, authorized personnel should complete performance and calibration testing at regularly scheduled intervals, which should not exceed one year.

Cleaning the Propaq M unit

To clean the Propaq M unit, use a nearly dry cloth containing one of the mild cleaning agents listed below. DO NOT allow cleaning agent or water to run into the crevices or connector openings at any time. Thoroughly wipe off any excess cleaning solution from the Propaq M unit with a dry cloth. Always check monitor and connector opening for unusual wear, damage or dampness while cleaning

Use only these recommended cleaning agents:

- Warm water
- Hydrogen peroxide solution
- Liquid soap
- Wex-cide®
- Windex®
- T.B.Q.®

Never use these cleaning agents:

- Butyl alcohol
- Denatured ethanol
- Freon
- Mild chlorine bleach solution
- Isopropyl alcohol
- Trichloroethane, trichloroethylene
- Acetone
- Vesphene II
- Enviroquat
- Staphene
- Misty
- Glutaraldehyde

Cleaning the NIBP Blood Pressure Cuff

Clean the cuff with common hospital disinfectants, including Clorox® (1:10 solution), isopropyl alcohol, Lysol® solution, Phisohex®, Quatricide®, Virex® and Vesphene®. Wash gently with the solution, then rinse. DO NOT allow solution to enter cuff tubes. Allow the cuff and hose to completely dry before patient use.

Cleaning SpO_2 Sensors

Clean the SpO_2 sensors with a cloth that has been slightly dampened with one of the recommended agents listed above. DO NOT submerge the probe or its connector in any liquids or cleaning agents. Thoroughly wipe off any excess cleaning solution with a dry cloth. Allow the sensor to completely dry before patient use.

Cleaning Cables and Accessories

Cables, cuff tubing, and other accessories can be wiped clean with a damp cloth moistened in a mild detergent solution or according to manufacturer's instructions.

Recommended Minimum Preventive Maintenance Schedule

Operational Tests should be performed at regular intervals. The Operational Tests augment the automated self-tests that the Propaq M unit performs to help ensure readiness. The following Operational Tests may be performed by the user:

- Keypad Test
- LED Test
- LCD Test
- RFU Indicator Test
- Audio Test

Additional Tests may be performed by a qualified Biomedical Technician (BMET):

- Battery Test
- Fan Test
- NIBP Test
- USB Test

The Operational Test Procedures are described in the *Propaq M Service Manual.*

In addition to inspection and cleaning instructions, the following is recommended:

- Perform NIBP calibration check
- Perform CO_2 calibration check
- Perform Functional Verification Tests

These tests shall be performed every year or according to local requirements (to be performed by a qualified Biomedical Equipment Technician (BMET)) as described in the *Propaq M Service Manual*.

Guidelines for Maintaining Peak Battery Performance

- Each battery should be identified with a number or letter. An identification mark is useful in tracking battery performance.
- Keep extra batteries in the *SurePower* Charging Station where their status can be quickly determined. Illumination of the Ready light is the most positive indication of a fully charged battery.
- Always carry at least one fully charged spare battery. If no other source of back-up power is available, two spare batteries are advisable.
- Rotate spare batteries routinely. The charge level gradually diminishes in a battery after it is removed from the charger even if it is not used. Regular battery rotation helps to avoid incidents where a low battery condition is encountered because the battery has not been recharged or used in more than 30 to 90 days.
- Whenever possible, recharge a partially depleted battery. This can be accomplished following any incident that involves patient monitoring. It ensures maximum operating time for each use, without reliance on spares. The need for a spare can then serve as an alert when an aging battery fails to provide normal operating time.
- Keep discharged batteries separated from spare batteries that are charged. When removing a discharged battery from the monitor, never place it in the location intended to carry a charged spare.

Caution DO NOT leave Propaq Battery Packs in a depleted state. Damage to the battery packs can occur if they are left in a depleted state for more than 30 days.

Appendix A Specifications

This chapter provides specification information for the Propaq M Monitor.

Monitor/Display

Input: 3-lead, 5-lead, or 12-lead patient cable.

Type: Color LCD, 640 x 480 pixels, 800 MCD

Sweep Speed: 25 mm / sec or 50 mm / sec (User Selectable)

Lead Selections: I, II, III, AVR, AVL, AVF, V1-6.

Frequency Response: (User-selectable)

0.67 to 20 Hz Limited mode

0.67 to 40 Hz Monitor Mode

0.25 to 40 Hz Filtered Diagnostic Mode

0.05 to 150 Hz Diagnostic mode

Per methods a, b, and c of EC11 3.2.7.2.

Common Mode Rejection:

Complies with AAMI EC13-2002 section 4.2.9.10.

Tall T-Wave Rejection:

Meets AAMI EC13-2002, section 4.1.2.1c for 0.9 mV

T-wave (0.8 mV with diagnostic response) and 1mV QRS.

Diagnostic Signals Applied to Patient Connections:

Leads off / active noise suppression sensing circuit is < 0.1 microamps DC. The impedance /respiration detector signal frequency is 72 ± 7 kHz at 77 microamps RMS pseudo-sinewave into 100 ohms.

Heart Rate Meter: 30 to 300 BPM.

Displayed Heart Rate: Average of last 5 beat-to-beat intervals.

Heart Rate Alarms: User-selectable.

Size: 0.125, 0.25, 0.5, 1, 2, 4 cm/mv and auto-ranging.

Heart Rate Meter Response Time:

Responds to a 40 BPM step increase in heart rate within 4.5 seconds per AAMI EC-13-2002, section 4.1.2.1.f. Responds to a 40 BPM step decrease within 3.9 seconds per AAMI EC-13-2002, section 4.1.2.1.f. Response times include a 1.0-second display update interval.

Heart Rate Response to Irregular Rhythm: (AAMI EC13-2002, section 4.1.2.1.e.)

Ventricular Bigeminy: 80 BPM (expected)

Slow Alternating Ventricular Bigeminy: 60 BPM (expected)

Rapid Alternating Ventricular Bigeminy: 120 BPM (expected)

Bidirectional Systole: 45 BPM (expected)

Tachycardia Response Time:

Response time to tachycardia alarm is on average 3.4 seconds per AAMI EC-13-2002, section 4.1.2.1.g, and IEC 60601-2-27, clause 6.8.2.bb.7. Response times include a 1.0 second display update interval.

Pacemaker Pulse Rejection:
(In accordance with AAMI EC13:2002, section 4.1.4 and IEC 60601-2-27:2005, subclause 50.103.13)

- Pulses without overshoot: Rejects all pulses with amplitude of +2 mV to +700 mV and duration of 0.1 ms to 2 ms, with no tail.
- Pulses with overshoot: Rejects all pulses with amplitude of +2 mV to +700 mV and duration of 0.1 ms to 2 ms, with overshoot up to 100 ms.
- A-V sequential pulses: A-V sequential pacemaker pulses may not be rejected.
- Fast ECG signals: Approximately 50% of ECG input pulses with a slew rate of 3 V/s RTI may trigger the pacemaker pulse detector.

Electrosurgery Protection: The Propaq M is suitable for use in the presence of electrosurgery. Burn hazard protection via a 1K current limiting resistor contained in each ECG leadwire.

Impedance Pneumography

Displayed Data: Numeric breath rate, Impedance waveform

Breath rate range: Adult, Ped: 2 to 150 breaths / minute

Neonates: 3 to 150 breaths / minute

Breath rate accuracy: 2% or +/- 2 breaths / minute, whichever is greater

Displayed Breath Rate: Average of last 10 breath-to-breath rates.

Leads: Lead I (RA – LA), Lead II (RA – LL)

Sweep Speed: 3.13, 6.25, 12.5 mm/sec

Alarm settings: High and low breath rate alarm

Alarms

Heart Rate Alarms:

Audible: 5 pulse, 900 Hz tone, with a PW of 125 msec, a PRI of 250 msec, and a repetition interval of 15 seconds.

Visual: Heart Rate Alarm causes the heart rate to be displayed in red, with a white background.

The red device status LED will flash a rate of 1.7 Hz.

Lead Fault Alarm:

Audible: 3 pulse, 500 Hz, triplet tone with a PW of 200 msec, a PRI of 200 msec. The lead fault tone repeats at a repetition interval of 30 seconds.

Visual: Lead Fault condition causes a “LEAD FAULT” message to be displayed on the trace along with a dashed line the width of the trace.

Physiological Alarms (NIBP, SpO2, Resp, CO2, IP & Temp):

Audible: Same as Heart Rate Alarm

Visual: Physiological alarms cause the alarming parameter to be displayed in Red with a white background. The red device status LED will flash at a rate of 1.7 Hz.

Silence Duration: 90 seconds.

Invalid Operation Alert Tone:

A short, low-pitched tone is audible when a selected control button is unavailable for use or an invalid entry is detected. Tone frequency is 160 Hz. Duration is 250 msec.

Delays (hold off time):

Heart rate/pulse rate:

- if source is ECG, 5 seconds
- if source is SpO2, 10 seconds
- if source is IBP, 5 seconds
- if source is NIBP, no hold off

SpO2 Saturation: 10 seconds

EtCO2: 5 seconds

FiCO2: 5 seconds

IBP (Systolic, Diastolic, Mean): 2 seconds

Temperature: 2 seconds

Battery

Type: Rechargeable Lithium-Ion, 11.1Vdc, 6.6 Ah, 73Wh

Capacity:

With a new, fully charged battery operating at room temperature:

- At least 7.5 hours of continuous monitoring of ECG, SpO2, CO2, three Invasive Pressure channels, and 2 channels of Temperature, with NIBP measurements every 15 minutes (display set to 30%).

Note: Proper battery care is required to maintain maximum available capacity.

Battery Indicators:

5 Battery capacity LED indicators, Fault indicator, Recalibration indicator

Recharge Rate: 100% in 4 hours, when initiated at Low Battery indication.

General

Weight:

Without Battery: 7.2 lbs.

With Battery: 8.5 lbs.

Dimensions:

Without Handle: 8.9” x 8.7” x 6.5”

With Handle: 8.9” x 10.4” x 7.0”

Operating:

Temperature: 0 to 50° C

60° C for 6 hours after storage at room temperature

Humidity: 15 to 95% RH (non-condensing)

Vibration:

- MIL-STD 810G, Method 514.6, Profile for combined UH-1, UH-60, and CH-47 Rotary Wing Aircraft.
- EN 1789 for ambulance.

Shock: MIL-STD 810G, Method 516.6, Tested at 75 g

Drop: MIL-STD 810G, Method 516-6, Tested at 1 meter with 26 drops

IEC 60601-1, Tested at 2 meters

Altitude: 170 M to 4572 M (-557 feet to 15,000 feet)

Transport and Storage:

Temperature: -30 to 70°C

Humidity: 15 to 95% RH (non-condensing)

Atmospheric pressure: 572 mbar to 1034 mbar

Shock/vibration: ISTA 1A

Safety Classification: Class 1 and internal power per IEC/EN 60601-1

Enclosure Protection:

Solid Foreign Object: IEC 60529, IP5X

Water: IEC 60529, IPX5

Auxiliary Operating Power:

Propaq M Auxiliary Power Adapter 8300-0004

Input: 100-240V ∿ 50-60 Hz, 2A

100-115V ∿ 400 Hz, 2A

Output: 14.5V ⎓ 4.15A
80W (peak)

IP Rating: IP23

CO_2

Range: 0 to 150 mmHg

Accuracy CO_2:

CO2 Partial Pressure*	Accuracy **
0-38 mmHg	± 2 mmHg
39-99 mmHg	± (5% of reading + 0.08% for every 1 mmHg above 38 mmHg)
100-150 mmHg	± (5% of reading + 0.08% for every 1 mmHg above 38 mmHg)

* At sea level.

** Accuracy applies for breath rates of up to 80 bpm. For breath rates above 80 bpm, accuracy is 4 mmHg or ±12% of reading whichever is greater, for EtCO2 values exceeding 18 mmHg. This is tested according to and is compliant with ISO 21647. To achieve the specified accuracies for breath rates above 60 breaths/minute, the Microstream FilterLine H Set for Infant/Neonatal must be used. Above 40 C, ± 1mmHg or ± 2.5% (whichever is greater) has to be added to the tolerance of the accuracy specs.

Drift of Measurement Accuracy: Over any 24-hour period, the accuracy claims listed above are maintained.

The accuracy specification is maintained to within 4% for the following gas mixtures (all values are in Vol.%).

CO_2	N_2	O_2	N_2O	H_20	Anesthetic Agents
1.0 to 13	0 to 97.5	0 to 100	0 to 80	Dry to saturated	According to EN 21647

Respiration Range: 0 to 150 breaths per minute

Respiration Rate Accuracy:

0 to 70 bpm: ±1 bpm

71 to 120 bpm: ±2 bpm

121 to 150 bpm: ±3 bpm

Flow rate: 50 ml/min -7.5 + 15 ml/min, flow measured by volume.

Pulse Oximeter

Measurement Range: 0 to 100%

Accuracy: 70 to 100% +/- 3%, 0 to 70% unspecified

Note: Since pulse oximeter equipment measurements are statistically distributed, only two-thirds of pulse oximeter equipment measurements can be expected to fall within +/-3% of the value measured by a CO-oximeter.

Saturation Update Period: Updated once per second

SpO2 Saturation Alarm Hold Off: 10 seconds

Pulse Rate Range: 20 to 250 BPM ± 3% or 3 BPM whichever is greater

Pulse Rate Update Period: Updated once per second

Pulse Rate and Saturation Display:

Normal Response: Average of pulse rate and saturation signal over 6 to 7 seconds.

Wavelengths: Approximately 660nm and 900nm

Displayed Data:

Numeric blood oxygen saturation value

Numeric pulse rate

Pulse Amplitude bar indicator

Plethysmographic waveform

Probe Compatibility: DS-100A, D-25, R-15, D-25L, D-20, EC-4, EC-8, RS-10

Power Output: < 15 mW

Non-Invasive Blood Pressure

Technique: Non-invasive oscillometric method

Operating Modes: Automatic and manual

Automatic Intervals: 1, 2, 3, 5, 10, 15, 30 and 60 minute intervals.

Turbocuf: Maximum measurements allowable in a 5 minute period

Pressure Measurement Range:

Systolic: 20 to 260 mmHg

Diastolic:10 to 220 mmHg

Mean: 13 to 230 mmHg

Static Pressure Accuracy: +/- 3 mmHg

Pulse Rate Range:

Adult: 30 to 200 +/- 5 BPM

Pediatric:30 to 200 +/- 5 BPM

Neonatal:35 to 220 +/- 5 BPM

Default Cuff Inflation Pressure:

Adult: 160 mmHg

Pediatric:120 mmHg

Neonatal:90 mmHg

Maximum Cuff Inflation Pressure:

Adult: 270 mmHg

Pediatric:170 mmHg

Neonatal:130 mmHg

Single Fault Backup Overpressure Limit:

Adult: 308 mmHg

Pediatric:205 mmHg

Neonatal:154 mmHg

Typical Determination time without Artifact:

Measurements on the deflation: 30 to 45 seconds

Measurements on the inflation (SureBP)*: 15 to 30 seconds

* using dual lumen cuffs

Maximum Determination Time - Measurement on the Inflation

Adult: 150 seconds

Pediatric:120 seconds

Neonatal:80 seconds

Blood Pressure Validation:

Blood pressure measurements determined with this device are equivalent to those obtained by a trained observer using the cuff/stethoscope auscultation method for adults and pediatric patients and equivalent to an intra-arterial measurement for neonatal patients, within the limits prescribed by the American National Standards Institute (ANSI-AAMI SP10). To receive a copy of the report containing the AAMI SP10 results, contact the ZOLL Technical Service Department.

Invasive Pressures

Number of Channels: 3

Pressure range: -30 to 300 mmHg

Pressure Accuracy: +/- 2 mmHg or 2% of reading, whichever is greater, plus transducer error.

Pulse Rate Range: 25 to 250 BPM

Pulse Rate Accuracy: +/- 3 BPM, or +/- 3% of value whichever is greater

Pulse Rate Display: Average of last 4 beat-to-beat intervals.

Zero Adjust: + / - 200 mmHg

Transducer:

Sensitivity: 5uV/V/mmHg

Offset: +/- 125 mmHg including transducer offset

Excitation Impedance Range: 150 to 10,000 ohms

Excitation Voltage: 4.75 +/- 0.25 VDC

Connector: 6-pin circular MS3100 series

Connect to:	A	B	C	D	E
Signal Type	Sig (-)	Exc (+)	Sig (+)	Exc (-)	shield

Temperature

Number of Channels: 2

Measurement Range: 0° to 50° C

Accuracy:

± 0.1° C from 10° C to 50° C

± 0.2° C from 0° C to 10° C

Resolution: 0.1° C

Scale: Fahrenheit or Celsius.

Temperature Display Signal: 20Hz, no averaging.

Probe: YSI 400 and 700 series

Display: T1, T2, ΔT

Minimum Measurement Time: See the probe's Instructions for Use to obtain minimum measurement times for accurate readings. The Propaq M does not add any clinically significant time to obtain accurate readings.

Electromagnetic Compatibility Guidance and Manufacturer's Declaration

In-Flight Use (RTCA/DO-160):

The Propaq M unit complies with RTCA/DO-160, Environmental Conditions and Test Procedures for Airborne Equipment, using the methods in Section 21, Category M for Radiated and Conducted Radio Frequency Energy.

General Use Environments (IEC 60601-1-2):

The Propaq M unit is intended for use in the electromagnetic environment specified below. The customer or the user of the Propaq M should assure that it is used in such an environment.

Emissions Test	Compliance	Electromagnetic Environment – Guidance
RF Emissions CISPR 11	Group 1	The Propaq M unit uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF Emissions CSPR 11	Class A	The Propaq M unit is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic Emission IEC 6100-3-2	Class A	
Voltage Fluctuations/ Flicker Emissions IEC 61000-3-3	Complies	
Medical Electrical Equipment needs special precautions regarding EMC and needs to be installed and put into service according to EMC information provided in this document.		

Guidance and Manufacturer's Declaration – Electromagnetic (IEC 60601-1-2 Table 202)

The Propaq M unit is intended for use in the electromagnetic environment specified below. The customer or the user of the Propaq M should assure that it is used in such an environment.

Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic Environment – Guidance
Electrostatic Discharge (ESD) IEC 61000-4-2	± 6 kV contact ± 8 kV air	± 6 kV contact ± 8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical Fast Transient / Burst IEC 61000-4-4	± 2 kV for power supply lines ± 1 kV for input/ output lines	± 2 kV for power supply lines ± 1 kV for input/ output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	± 1 kV differential mode ± 2 kV common mode	± 1 kV differential mode ± 2 kV common mode	Mains power quality should be that of a typical commercial or hospital environment.
Voltage Dips, Short Interruptions and Voltage Variations on Power Supply Input Lines IEC 61000-4-11	<5% U_T (>95% dip in U_T) for 0.5 cycle 40% U_T (60% dip in U_T) for 5 cycles 70% U_T (30% dip in U_T) for 25 cycles <5% U_T (>95% dip in U_T) for 5 sec	<5% U_T (>95% dip in U_T) for 0.5 cycle 40% U_T (60% dip in U_T) for 5 cycles 70% U_T (30% dip in U_T) for 25 cycles <5% U_T (>95% dip in U_T) for 5 sec	Mains power quality should be that of a typical commercial or hospital environment. If the user of the Propaq M unit requires continued operation during power mains interruptions, it is recommended that the Propaq M unit be powered from an uninterruptible power supply or a battery.
Power Frequency (50/60 Hz) Magnetic Field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
Note: U_T is the AC mains voltage prior to application of the test level.			

Guidance and Manufacturer's Declaration – Electromagnetic Immunity (IEC 60601-1-2 Table 203)

The Propaq M unit is intended for use in the electromagnetic environment specified below. The customer or the user of the Propaq M should assure that it is used in such an environment.

Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic Environment – Guidance IEC 60601-1-2
			Portable and mobile RF communications equipment should be used no closer to any part of the Propaq M unit, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.
			Recommended Separation Distance
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz outside ISM bands[a]	3 Vrms	d = 1.17 $\sqrt{P}$
	3 Vrms 150 kHz to 80 MHz in ISM bands[a]	3 Vrms	d = 1.17 $\sqrt{P}$
Radiated RF IEC 61000-4-3	10 V/m 80 MHz to 2.5 GHz	10 V/m	d = 1.20 $\sqrt{P}$ 80 MHz to 800 MHz d = 2.30 $\sqrt{P}$ 800 MHz to 2.5 GHz
	3 V/m 80 MHz to 2.5 GHz (IEC 60601-2-34)	3 V/m (IBP only)	d = 4 $\sqrt{P}$ 80 MHz to 800 MHz d = 7.67 $\sqrt{P}$ 800 MHz to 2.5 GHz
Where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and *d* is the recommended separation distance in meters (m).[b] Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey[c], should be less than the compliance level in each frequency range[d]. Interference may occur in the vicinity of equipment marked with the following symbol: 			

Note 1: At 80 MHz and 800 MHz, the higher frequency range applies.
Note 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.

a. The ISM (industrial, scientific, and medical) bands between 150 KHz and 80 MHz are 6.765 MHz to 6.795 MHz; 13.553 MHz to 13.567 MHz; 26.957 MHz to 27.283 MHz; and 40.66 MHz to 40.70 MHz.
b. The compliance levels in the ISM frequency bands between 150 kHz and 80 MHz and in the frequency range 80 MHz to 2.5 GHz are intended to decrease the likelihood that mobile/portable communications equipment could cause interference if it is inadvertently brought into patient areas. For this reason, an additional factor of 10/3 is used in calculating the recommended separation distance for transmitters in these frequency ranges.
c. Field strengths from fixed transmitters, such as base stations for radio (cellular / cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast, and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the ZOLL Propaq M unit is used exceeds the applicable RF compliance level above, the Propaq M unit should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the Propaq M unit.
d. Over the frequency range 150 kHz to 80 MHz, field strengths should be less than $[V_1]$ V/m.

Recommended Separation Distances Between Portable and Mobile RF Communications Equipment and the Propaq M (IEC 60601-1-2 Table 205)

The Propaq M unit is intended for use in an environment in which radiated RF disturbances are controlled. The customer or the user of the Propaq M unit can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the Propaq M unit as recommended below, according to the maximum output power of the communications equipment.

Separation Distance According to Frequency of Transmitter (meters)

Rated maximum output power of transmitter	150 kHz to 80 MHz outside ISM bands	150 kHz to 80 MHz in ISM bands	80 MHz to 800 MHz	800 MHz to 2.5 GHz
W	$d = [3.5/3]P$	$d = [12/3]P$	$d = [12/10]P$	$d = [23/10]P$
0.01	0.12	0.40	0.12	0.23
0.1	0.37	1.26	0.38	0.73
1	1.17	4.00	1.20	2.3
10	3.69	12.65	3.79	7.27
100	11.70	40.00	12.00	23.00

For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be determined using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

Note 1: At 80 Hz and 800 MHz, the separation distance for the higher frequency range applies.

Note 2: The ISM (industrial, scientific and medical) bands between 150 kHz and 80 MHz are 6.765 MHz to 6.795 MHz; 13.553 MHz to 13.567 MHz; 26.957 MHz to 27.283 MHz; and 40.66 MHz to 40.70 MHz.

Note 3: An additional factor of 10/3 is used in calculating the recommended separation distance for transmitters in the ISM frequency bands between 150 kHz and 80 MHz and in the frequency range 80 MHz to 2.5 GHz to decrease the likelihood that mobile/portable communications equipment could cause interference if it is inadvertently brought into patient areas.

Note 4: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.

Appendix B
Accessories

The following accessories are compatible for use with the Propaq M. To order any of these items, contact your local ZOLL representative.

ECG Accessories
ECG, 3-Lead Cable, AAMI
ECG, 3-Lead Cable, IEC
ECG, 5-Lead Cable, AAMI
ECG, 5-Lead Cable, IEC
ECG, 12-Lead "Breakaway" Patient Cable Complete (Trunk Cable, 4-lead wire set with detachable 6 "V" precordial lead wire set), AAMI
ECG, 12-Lead "Breakaway" Patient Cable Complete (Trunk Cable, 4-lead wire set with detachable 6 "V" precordial lead wire set), IEC
ECG, 4-Lead "Breakaway" Trunk Cable and 4 lead wire set only, AAMI
ECG, 4-Lead "Breakaway" Trunk Cable and 4 lead wire set only, IEC
ECG, Detachable 6 precordial lead wire set for "Breakaway" 12-Lead Patient Cable, AAMI
ECG, Detachable 6 precordial lead wire set for "Breakaway" 12-Lead Patient Cable, IEC
BIO-DETEK Trace-Rite Disposable ECG Monitoring Electrodes, Nickel Brass Snap, pkg of 3
BIO-DETEK Trace-Rite Disposable ECG Monitoring Electrodes, Nickel Brass Snap, pkg of 4
BIO-DETEK Trace-Rite Disposable ECG Monitoring Electrodes, Nickel Brass Snap, pkg of 6

CO2 Accessories (Oridion Filterlines)
Smart CapnoLine Plus, Non-intubated filterline with O2 Delivery, Adult, box of 25
Smart CapnoLine Plus, Non-intubated filterline with O2 Delivery, Pediatric, box of 25
FilterLine H Set, Adult/Pediatric, box of 25
FilterLine H Set, Infant/Neonate, box of 25
FilterLine Set, Adult/Pediatric, box of 10
Vitalline H set Adult/Pediatric , box of 25
NIBP Accessories
Hoses
Hose, Adult/Pediatric, 10', w/ “twist lock” cuff connector, single lumen
Hose, Infant/Neonate, 8', w/ female luer cuff connector, single lumen
Hose, Adult/Pediatric, 10', w/ “twist lock” cuff connector, dual lumen
Single Lumen Flexiport Adapter Cable
Dual Lumen Flexiport Adapter Cable
Disposable Cuffs (Welch Allyn Blood Pressure Flexiport Cuffs)
Neonate #1, 3.3 - 5.6 cm single tube w/ male luer connector, box of 10
Neonate #2, 4.2 - 7.1 cm single tube w/ male luer connector, box of 10
Neonate #3, 5.4 - 9.1 cm single tube w/ male luer connector, box of 10
Neonate #4, 6.9 - 11.7 cm single tube w/ male luer connector, box of 10
Neonate #5, 8.9 - 15.0 cm single tube w/ male luer connector, box of 10
Neonatal Cuff Kit, one each of sizes #1 - #5, single tube w/ male luer connector, bag of 5
Cuff, Soft, Newborn, 1-Tube, MQ
Cuff, Soft, Infant, 1-Tube, MQ
Cuff, Soft, Infant, 2-Tube, MQ
Cuff, Soft, Small Child, 1-Tube, MQ
Cuff, Soft, Small Child, 2-Tube, MQ
Cuff, Soft, Child, 1-Tube, MQ
Cuff, Soft, Child, 2-Tube, MQ
Cuff, Soft, Small Adult, 1-Tube, MQ
Cuff, Soft, Small Adult, 2-Tube, MQ
Cuff, Soft, Adult, 1-Tube, MQ
Cuff, Soft, Adult, 2-Tube, MQ
Cuff, Soft, Ad Long, 1-Tube, MQ

Cuff, Soft, Ad Long, 2-Tube, MQ
Cuff, Soft, Large Adult, 1-Tube, MQ
Cuff, Soft, Large Adult, 2-Tube, MQ
Cuff, Soft, Lg Ad Long, 1-Tube, MQ
Cuff, Soft, Lg Ad Long, 2-Tube, MQ
Cuff, Soft, Thigh, 1-Tube, MQ
Cuff, Soft, Thigh, 2-Tube, MQ
Reusable Cuffs (Welch Allyn Blood Pressure Flexiport Cuffs)
Neonate #1, 3.3 - 5.6 cm single tube w/ male luer connector, box of 10
Neonate #2, 4.2 - 7.1 cm single tube w/ male luer connector, box of 10
Neonate #3, 5.4 - 9.1 cm single tube w/ male luer connector, box of 10
Neonate #4, 6.9 - 11.7 cm single tube w/ male luer connector, box of 10
Neonate #5, 8.9 - 15.0 cm single tube w/ male luer connector, box of 10
Cuff, Reus, Newborn, 1-Tube, MQ
Cuff, Reus, Infant, 1-Tube, MQ
Cuff, Reus, Infant, 2-Tube, MQ
Cuff, Reus, Small Child, 1-Tube, MQ
Cuff, Reus, Small Child, 2-Tube, MQ
Cuff, Reus, Child, 1-Tube, MQ
Cuff, Reus, Child, 2-Tube, MQ
Cuff, Reus, Small Adult, 1-Tube, MQ
Cuff, Reus, Small Adult, 2-Tube, MQ
Cuff, Reus, Adult, 1-Tube, MQ
Cuff, Reus, Adult, 2-Tube, MQ
Cuff, Reus, Ad Long, 1-Tube, MQ
Cuff, Reus, Ad Long, 2-Tube, MQ
Cuff, Reus, Large Adult, 1-Tube, MQ
Cuff, Reus, Large Adult, 2-Tube, MQ
Cuff, Reus, Lg Ad Long, 1-Tube, MQ
Cuff, Reus, Lg Ad Long, 2-Tube, MQ
Cuff, Reus, Thigh, 1-Tube, MQ
Cuff, Reus, Thigh, 2-Tube, MQ

SpO2 Accessories
Nellcor - DS-100A Durasensor (Adult), reusable
Nellcor - 8' Differential Extension Cable, Pulse Oximeter Sensor
Temperature Accessories
YSI Reusable Adult, Skin Probe
YSI Reusable Pediatric, Skin Probe
YSI Reusable Adult, Esophageal/Rectal
YSI Reusable Pediatric, Esophageal/Rectal
Sensor Adapter Cable for Disposable Probes
YSI Disposable Esophageal/Rectal Probe
YSI Disposable Skin Probe
IBP Accessories
Transducer Interface cable – Abbott
Transducer Interface cable - Edwards
Transducers: 5 μV/V/mm Hg, IEC 60601-2-34 and AAMI BP-22 compliant
Power Accessories
ZOLL Propaq M/MD Lithium Ion Rechargable Battery
SurePower Charging Station
SurePower Battery Charger Propaq M/MD Battery Adapter
Propaq M/MD Power Adapter
Replacement Power Cord – U.S.
Mounting Accessories
Propaq M/MD Interface Plate
Propaq M/MD SMEED Mount
Propaq M/MD Litter Mount
Propaq M/MD Pole Mount
Propaq M/MD Wall Mount
Propaq M/MD Shelf Mount