

Newport™

HT70 Ventilator with Accessories Plus Model



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1 Introduction

1.1 Overview

Thank you for using the Newport™ HT70 family of ventilators. With the Newport™ HT70 ventilator, you not only get a great ventilator, you get the support of Covidien. We have dedicated our efforts to providing ventilators that are easy to use, clinically versatile, and cost-effective.

We know that ventilatory support is critical in emergency situations. But for many of our customers, it is also a part of their daily lifestyle. The Newport™ HT70 ventilators offer home care users the expanded mobility that allows them to experience more freedom in their lives than many have known before.

This manual was designed to be comprehensive and still very user-friendly. For the best performance from the ventilator, please take the time to review this manual completely.

1.2 Brief Device Description

The Newport™ HT70 family of ventilators are state-of-the-art ventilators that combine ruggedness, ease of use, and clinical proficiency with exceptional mobility to provide ventilatory support for infant, pediatric, and adult patients in emergency care, transport, subacute care, and home care applications. They are also ideal for emergency preparedness applications.

The compact, lightweight ventilator is built for hard work with a durable polymer exterior and robust overall design that stands up to harsh environments.

This ventilator defines ease of use with all essential controls at your fingertips using a simple membrane button and touch screen combination. There are no complicated menus or difficult sequences to follow to make necessary adjustments for common operations.

A three-tiered management domain system makes it very easy for caregivers to manage all controls while providing quick access to the more essential elements in transport situations and significantly enhanced safety and simplicity in the homecare environment.

1.2.1 Sophisticated Clinical Capabilities

In addition to its durability and ease of use, the Newport™ HT70 ventilator offers the complete array of clinical capabilities needed for managing patients.

The twin micro-piston pump's ability to deliver a variable flow enables the ventilator to provide a full range of operating modes and breath types with servo-controlled, leak-compensated PEEP. Leak compensation helps to improve triggering and avoid auto-triggering when a leak is present. The ventilator may be used with an endotracheal tube, tracheal tube, face mask, nasal mask or prongs, or mouthpiece.

There are two models for the HT70 series of ventilators:

- **HT70M:** HT70, with oxygen sensor; includes built-in oxygen monitor with alarms
- **HT70PM:** HT70 Plus, adds on-airway flow sensor option with graphics, flow trigger, and exhaled volumes

The HT70M model provides monitoring of inspiratory tidal volume (every breath), inspiratory minute volume, total respiratory rate, peak pressure, mean pressure, and baseline (PEEP) pressure. Real-time patient circuit pressure is shown at all times on the airway pressure gauge on the face panel. A comprehensive alarm system is built-in to alert the user to violations of user-set or ventilator safety limits. A built-in oxygen sensor allows monitoring of O₂ with high and low O₂ alarms.

The HT70PM model adds an on-airway flow sensor with on-screen graphics, exhaled tidal and minute volume monitoring/alerts, and flow trigger. (This manual describes the HT70PM model.)

Gas delivery to the patient may be enriched with oxygen (21%–100%) using either the optional air oxygen entrainment (50 psi) mixer or optional low flow oxygen reservoir.

1.2.2 Exceptional Mobility

The ventilator's unique design provides maximum mobility and safety for short- or long-distance transport of critically ill patients and also for patients who are going about their normal activities of daily life. This exceptional mobility is derived from two sources: patented, power-conserving dual-micro-piston technology that eliminates the need for an external compressed gas source, and the internal dual battery system, which allows virtually continuous use from battery power through hot-swappable technology.

The ventilator's micro-pistons use a fraction of the power that is consumed by turbines and blowers. This enables longer battery use time. Our patented system also uses considerably less supplemental oxygen than turbine or blower systems, again improving mobility for transport or homecare use. The superior technology of our micro-piston system over the turbine and blower systems allow the ventilator to ventilate safely over a wide range of environmental conditions and altitudes.

The ventilator's twin micro-piston internal pump is made of mechanically moving components. As with any other gas delivery system made of moving components, it may emit a minor level of

noise during operation. This is not a malfunction and does not affect the performance of the ventilator.

The internal dual battery system consists of two independent but coordinated lithium ion batteries: the Power Pac battery, located on the back of the ventilator and the backup battery inside the ventilator. The internal dual battery system can provide up to 10 hours of operation at standard settings when new and fully charged. This system assures continued support during transport, daily activities or power outages.

The detachable Power Pac is “hot-swappable.” That is, if more battery time is needed, a depleted Power Pac can easily be removed from the back of the ventilator and replaced with a recharged Power Pac without interrupting ventilation. No tools are needed. The secondary backup battery maintains operation without interruption when the Power Pac is swapped out and also provides a minimum of 30 minutes of full operation when all other power sources are depleted. The Power Pac weighs 2 pounds and is charged anytime the ventilator is connected to an external power source (AC or DC). It can also be charged separately.

The ventilator may be operated from a variety of AC (100–240 V AC @ 50/60 Hz) or DC (11-16 V DC) external power sources or from the internal dual battery system. The optional DC auto lighter power adapter accessory enables connection to an automobile-type DC outlet. Any time the ventilator is connected to external power, both batteries in the internal dual battery system are charging, whether or not the ventilator is in use.

1.2.3 Travel Certified

The Newport™ HT70 ventilator has been tested for and meets requirements for use in helicopter and fixed wing transport and for use on commercial airlines. Before traveling, be sure to speak with your airline representative about their particular concerns and clear all of your equipment with them well before your departure. The labeling that the FAA requires is located on the bottom of the ventilator.

1.3 Intended Use

Newport™ HT70 family of ventilators is intended to provide continuous or intermittent positive pressure mechanical ventilatory support for the care of individuals who require mechanical ventilation through invasive or noninvasive interfaces.

Specifically, the Newport™ HT70 family of ventilators is applicable for infant, pediatric, and adult patients greater than or equal to 5 kg (11 lbs) in hospital, sub-acute, emergency department, and home care environments as well as for transport and emergency response applications.



Note:

Federal law (U.S.) restricts sale by or on the order of a physician.

1.4 Ventilator Configurations

Covidien offers two configurations for the HT70 family of ventilators (see [Table 1-1](#)). In addition, the front control panel labeling is available in various languages and regional power cords (for example, North American, European, etc.) can be specified. See your Covidien representative for details.

Table 1-1. HT70 Ventilator Configurations

Part number	Description	Distinguishing features
HT70PM	HT70 Plus	Full featured with flow sensor, graphics, and built-in oxygen monitor with alarms
HT70M	HT70, with oxygen sensor	Includes built-in oxygen monitor with alarms

1.5 Warnings, Cautions, and Notes

Please review all warnings and cautions outlined in this manual before operating the ventilator.

Use of the product requires full understanding and strict observation of all chapters of these instructions. The equipment is only to be used for the purposes specified under Intended Use and in conjunction with appropriate patient observation and monitoring. Observe all warnings and cautions that appear in this manual and on equipment labels.



WARNING:

A warning describes a condition that can cause injury.



Caution:

A caution describes a condition that can cause damage to equipment.



Note:

A note emphasizes information that is important or convenient.

1.5.1 General Warnings



WARNING:

The design of the Newport™ HT70 ventilator, the operating and service manuals, and the labeling on the ventilator take into consideration that the purchase and use of the equipment is restricted to trained professionals, and that certain inherent characteristics of the ventilator are known to the operator. Instructions, warnings, and caution statements are therefore limited to the specifics of the Newport™ HT70 ventilator.

**WARNING:**

This manual excludes references to various hazards that are obvious to medical professionals and operators of this equipment, including consequences of product misuse and potential adverse effects in patients with abnormal conditions.

**WARNING:**

Transport of patients with the Newport™ HT70 ventilator requires that medical staff have a good working knowledge of the ventilator and methods for problem resolution. Proper emergency backup equipment must be immediately available during transport.

**WARNING:**

Product modification or misuse can be dangerous. Covidien disclaims all liability for the consequences of product alterations or modifications, as well as for the consequences that might result from the combination of this ventilator with other products, whether supplied by Covidien or by other manufacturers, unless such a combination has been specifically endorsed by Covidien.

**WARNING:**

There is a risk of explosion if used in the presence of flammable anesthetics.

**WARNING:**

A patient connected to a ventilator requires the constant attention of trained caregivers to the patient's condition.

**WARNING:**

The ventilator offers a variety of breath delivery options. Throughout the patient's treatment, the clinician should carefully select the ventilation mode and settings to use for that patient, based on clinical judgment, the condition and needs of the patient, and the benefits. As the patient's condition changes over time, periodically assess the chosen modes and settings to determine whether or not those are best for the patient's current needs.

**WARNING:**

Ventilator alarms are a critical element in the safety net of patient care. It is extremely important for patient safety that caregivers immediately identify and correct alarm violations.

**WARNING:**

Do not pause, disable, or decrease the volume of the ventilator's audible alarm if patient safety could be compromised.

**WARNING:**

Always have an alternate power source and means of ventilation available when the ventilator is in use in case of a mechanical or system problem.



WARNING:

If a fault is detected in the ventilator and its life support functions are in doubt, immediately discontinue use; use an alternative method of ventilation until the fault has been corrected. Contact your service provider immediately.



WARNING:

Do not block the emergency gas intake (on the bottom panel) or the fresh gas intake port (on the right side panel).



WARNING:

Always use appropriate monitors to ensure sufficient oxygenation and ventilation (such as a pulse oximeter and/or a capnograph) when the Newport™ HT70 ventilator is in use on a patient.



WARNING:

The optional air/oxygen entrainment mixer and low flow oxygen reservoir are designed to operate with medical-grade oxygen.



WARNING:

Ensure that the oxygen source is not empty before and during the use of the optional air/oxygen entrainment mixer or low flow oxygen reservoir.



WARNING:

To avoid putting stress on the internal pump and compromising gas delivery to the patient, ensure that the air/oxygen entrainment mixer is not connected to the gas intake port on the ventilator when performing a circuit check. Ensure that the oxygen supply is enabled any time the optional air/oxygen entrainment mixer is secured in place while ventilating.



WARNING:

Calibrated oxygen monitoring at clinically appropriate levels is required for patient safety when supplemental oxygen is in use.



WARNING:

Always plug the Newport™ HT70 ventilator into an external power supply source whenever it is available, even when the ventilator is not in use, to keep the internal dual battery system fully charged and to ensure best battery performance. Check battery capacity on the front panel before detaching from external power.



WARNING:

When installing a replacement Power Pac during battery operation, always ensure that the charge level LED on the replacement pack is green, indicating 90% or higher charge level.

-
-  **WARNING:**
Always ensure that the green external power LED lights when the ventilator is connected to an external AC or DC power source.
-  **WARNING:**
To maintain grounding integrity when using AC power, only connect to properly grounded receptacles.
-  **WARNING:**
Use only the Covidien-supplied AC power supply (p/n SP-PWR3204P) with the Newport™ HT70 ventilator and Power Pac (p/n BAT3271A).
-  **WARNING:**
Always disconnect the external power supply prior to servicing.
-  **WARNING:**
After servicing the Newport™ HT70 ventilator, it must pass the operational verification procedure (OVP) before it is returned to patient use. See the service manual.
-  **WARNING:**
Do not use electrically conductive breathing circuits. Always use clean and dry breathing circuits.
-  **WARNING:**
Always use a clean, dry filter in the following locations: a standard bacteria filter on the gas output, a prox line (bacteria) filter on the proximal pressure tubing port, and an intake (bacteria) filter behind the filter cover.
-  **WARNING:**
Adding attachments or other components or sub-assemblies to the ventilator breathing circuit system can increase the patient's work of breathing and/or add resistance to patient exhalation.
-  **WARNING:**
Always ensure that the audible alarm loudness level is set at a volume that can be heard by the caregiver. Do not use the ventilator in an environment where audible alarms cannot be heard by the caregivers.
-  **WARNING:**
The functioning of this machine may be adversely affected by the operation of other medical equipment (such as high frequency surgical (diathermy) equipment, defibrillators, or short-wave therapy equipment in the vicinity).



WARNING:

To avoid the risk of ventilator malfunction, operate the ventilator in an environment that meets specifications. Reference *Environment* on page 9-8.



WARNING:

This device has undergone EMC testing and found to be in conformance with EN 60601-1-2. These requirements are designed to provide reasonable protection against harmful interference in a typical medical installation, as well as in homecare environments. The equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with these instructions, may cause interference to other devices in the vicinity. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference with other devices, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving device.
- Increase the separation between the equipment.
- Connect the equipment to an outlet on a circuit different from that to which the device(s) is (are) connected.
- Consult the manufacturer or Covidien-trained service personnel for help.

1.5.2 General Cautions



Caution:

Do not place liquids on or near the ventilator.



Caution:

Damage can occur if the Newport™ HT70 ventilator is exposed to extreme temperatures. Do not store the ventilator in areas where it may be exposed to temperatures below -40°C (-40°F) or above 65°C (149°F).



Caution:

To avoid the risk of electric shock, the ventilator should not be opened by anyone other than an approved service provider.

1.5.3 General Notes



Note:

The Newport™ HT70 ventilator has been designed to accommodate connectivity with nurse call/monitoring systems. Because it is not possible to anticipate every configuration of hardware and software associated with

nurse call/monitoring systems, it is the user's responsibility to confirm proper functionality of the system when used in conjunction with the ventilator. Verification of alarms, alerts, and patient data transmissions is required. If the system performance is not as expected, contact Covidien Technical Services for assistance troubleshooting the set-up. Do not use the ventilator with a nurse call/monitoring system until the functionality of the ventilator/system combination has been confirmed.

1.6 Revision History

The part number, revision level, and date on the documentation indicate its version. The revision level and date change when a new edition is printed in accordance with the revision history of the documentation. Minor corrections and updates incorporated at reprint do not cause the revision number to change. The document part number may change when extensive technical changes are incorporated into the document.

1.7 Warranty Information

The information contained in this document is subject to change without notice. Covidien makes no warranty of any kind with regard to this material, including, but not limited to, the implied warranties or merchantability and fitness for a particular purpose. Covidien shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

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2 Overview of Controls, Screens, and Connectors

2.1 Front Panel Overview

The Newport™ HT70 ventilator front panel consists of easy access membrane buttons, LED indicators, and the patient connection manifold. The center touch screen panel provides access to alarm and parameter settings. The HT70PM model has the added port for connecting the on-airway flow sensor. This manual describes the HT70PM full features.

Reference *Figure B-1*.

2.2 Touch Screen Overview (Hospital Domain)

The ventilator's touch screen includes direct access to essential screens for setting patient parameters and alarms. Simple menu navigation allows access to advanced features and utility screens.

Reference *Figure B-3*.



Note:

While operating on internal battery power, when the Power Save feature is on and there are no active alarms, the touch screen will go to sleep after 2 minutes. Just touch the screen or any membrane button to bring it back into view.

2.3 Internal Dual Battery System Overview

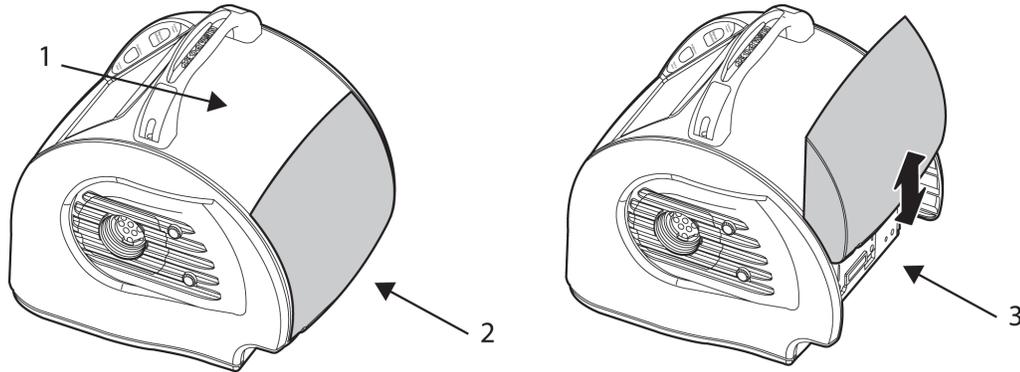
The internal dual battery system can provide up to 10 hours of operation when new and fully charged (under standard conditions shown in Chapter 7) and consists of two independent but coordinated lithium ion batteries: the hot-swappable Power Pac battery and the secondary backup battery. When external power is lost, the ventilator will run on the Power Pac until the Switching to Backup Battery alarm activates. The backup battery will then provide a minimum of 30 minutes of emergency back-up power. The backup battery portion of the system also maintains operation without interruption whenever the Power Pac is swapped out.

The Power Pac can be recharged independently from the ventilator. Push the button on the bottom edge of the Power Pac to show charge condition (green = approximately 90% or higher charge level, amber = charge not completed, red = battery depleted). Always attach the Power

Pac to the ventilator and then turn on the ventilator to verify the actual charge level percentage (shown in the message display).

Proper care and maintenance of the internal dual battery system will ensure the longest life and best usage performance. Reference [Internal Dual Battery System](#) on page 7-1 for complete details on the internal dual battery system.

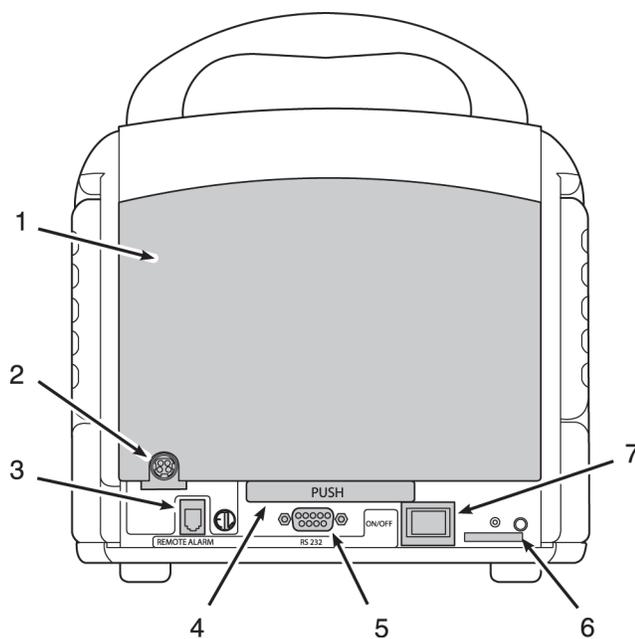
Figure 2-1. Internal Dual Battery System



- 1 Backup battery (inside the case)
- 2 Power Pac battery (exchangeable)
- 3 Release latch

2.4 Rear Panel Overview

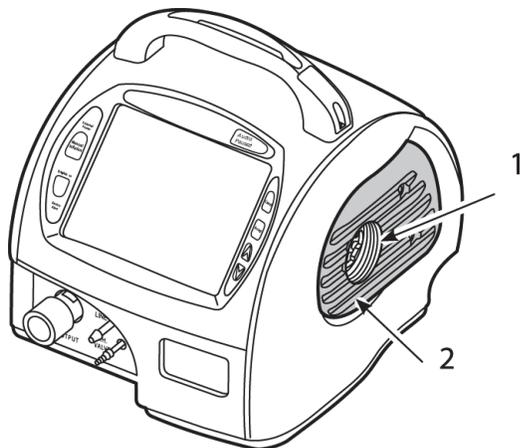
Figure 2-2. Newport™ HT70 Ventilator Rear Panel



- | | | | |
|---|---|---|---|
| 1 | Power Pac battery pack | 5 | RS-232 output
(external communication port to communicate with central monitoring systems) |
| 2 | External power supply input | 6 | Serial number label |
| 3 | Remote alarm output
(connects to nurse call systems) | 7 | On/off power switch
(momentary switch to turn the ventilator on/off) |
| 4 | Release latch
(push to remove battery pack) | | |

2.5 Right Side Overview

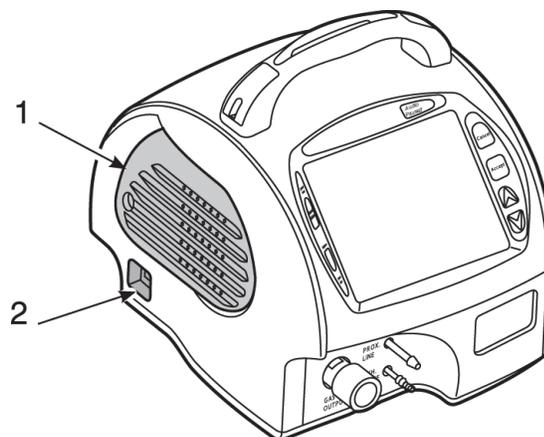
Figure 2-3. Newport™ HT70 Ventilator (Right Side)



- 1 Fresh gas intake port / oxygen accessories' connection / optional oxygen accessories / bio-filter connection
(allows attachment of the optional air oxygen entrainment mixer, low flow oxygen reservoir, or bio-filter)
- 2 Air intake filter cover
(allows visual inspection of the air intake filter through the transparent cover)

2.6 Left Side Overview

Figure 2-4. Newport™ HT70 Ventilator (Left Side)

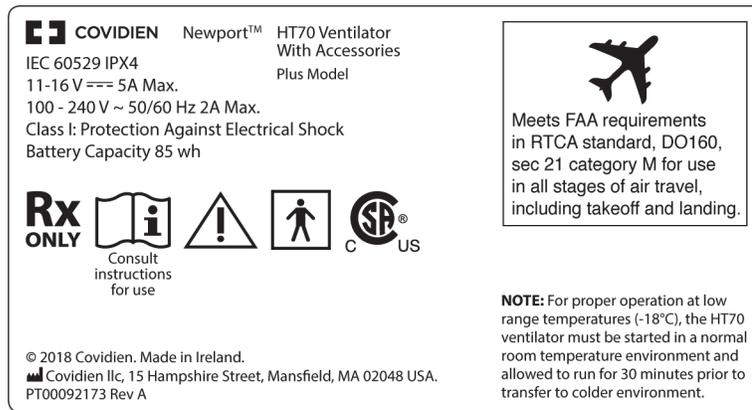


- 1 Cooling fan cover
(protects the internal fan)
- 2 USB ports (2)
(allow the attachment of optional accessories such as a flash drive for downloading the trends and event history files or uploading new software)

2.7 Bottom Panel Label

The bottom panel of the ventilator includes a label that contains information regarding agency approvals and power ratings. Here you will find the model number and manufacturing information.

Figure 2-5. Newport™ HT70 Ventilator Bottom Panel Labeling



VEN_12586_A



Note:

The serial number for the unit is located on the lower rear panel near the power switch.

3 Setup and Pre-Use Preparations

3.1 Unpacking the Ventilator

Remove all of the items from the shipping box and inspect each Newport™ HT70 ventilator part and component for completeness. Verify that there is no shipping damage. To obtain information about a warranty, if any, contact Covidien Technical Services or your local representative.

Table 3-1. Newport™ HT70PM Ventilator Parts

Quantity	Part number	Part
1	HT70PM-XX-XX	Ventilator
1	10157030	Operator's manual
1	SP-PWR3204P	AC power supply with pinch release
1	PWRXXXX	Country-specific power cord
1	HT460300	Air intake filter, disposable (pkg. of five filters)
1	HT6004701	Prox. inline filter, disposable (pkg.of five filters)
1	FLT3302P-C	Bacteria filter
2	KIT3420A	Adult/ped flow sensor

Table 3-2. Optional Accessories

Part number	Part
KIT3420A	Adult/ped flow sensor kit (pkg. of four sensors)
RSV3215A	Low flow oxygen reservoir
MXL70A-XX-XX	Air/oxygen entrainment mixer (country specific)
FLT3209P-C	Mixer filter (for air/oxygen entrainment mixer)
SP-ADP3203P	DC auto lighter power adapter
BAT3271A	Power Pac battery pack with LED
SP-PWR3204P	AC power supply with pinch release (use to recharge extra batteries) (requires country-specific power cord)

Table 3-2. Optional Accessories (Continued)

Part number	Part
PWR3207P	NA-North American-style power cord (use with power supply)
PWR3210P	UK-British-style power cord (use with power supply)
PWR3211P	EU-Euro-style power cord (use with power supply)
CBL3223A	Remote alarm cable (1/4 in. phono jack connector)
CRT3250A	HT70 cruiser cart
MNT3208A	Single e-cylinder mount
MNT3209A	Dual e-cylinder mount
10104494	Aequitron remote alarm cable (only available in the U.S.)

Contact Covidien or your Covidien representative for more details on available accessories.

3.2 Assembling the Ventilator

1. After unpacking the ventilator, check to see that you have all the accessories needed and that no damage occurred during shipping.
2. Assemble the cart using the instructions provided with the cart.
3. Securely position the ventilator on the pedestal mount of the cart.

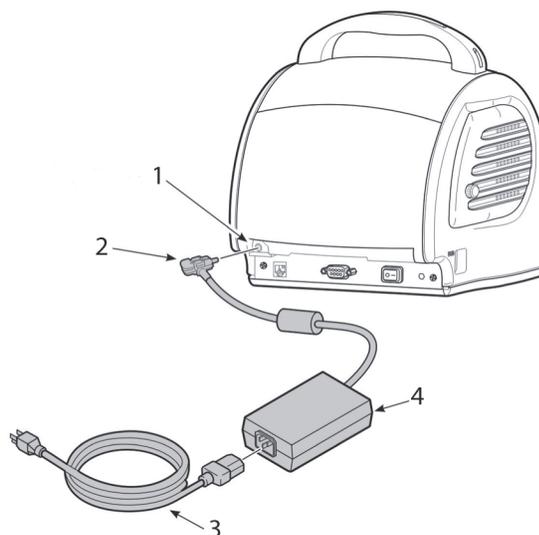


Caution:

Take care to assemble the cart correctly to assure that the ventilator and accessories remain secure and are not damaged.

3.3 Connecting to AC Power

The ventilator comes with an AC power supply that includes an AC power adapter with pinch-release power plug. The detachable AC power cord can be ordered in country-specific configurations. Only use the approved AC power supply to connect the ventilator to AC power.

Figure 3-1. Newport™ HT70 Ventilator and Power Supply

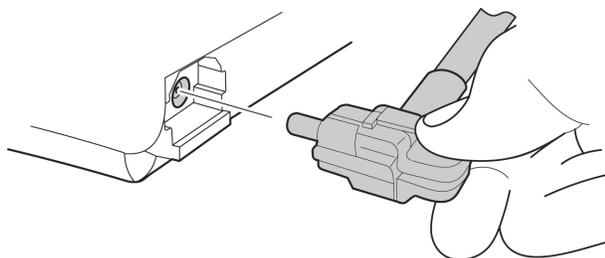
- | | | | |
|---|-----------------------------|---|------------------|
| 1 | External power supply input | 3 | AC power cord |
| 2 | Pinch release power cable | 4 | AC power adapter |

Insert the pinch-release power plug from the AC power adapter into the external power supply input located on the lower left corner of the Power Pac battery pack. Ensure that the cord is to the right of the plug and that it locks in place securely. Plug one end of the power cord into the adapter and the other end into a properly grounded outlet.

To remove the AC power supply from the external power supply input, gently pinch the connector to release the locking pin and then pull the plug out.



Caution:
Do not twist the power plug or it may be damaged.

Figure 3-2. Pinch-Release Power Plug

When the ventilator is connected to external power, both batteries in the internal dual battery system are charged simultaneously.

**Note:**

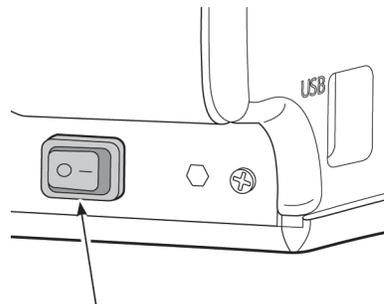
Check the battery charge gauge on the touch screen to ensure that both the Power Pac battery and the secondary backup battery are fully charged before disconnecting from external power.

The Power Pac can also be connected to external power independently of the ventilator. Before installation on a Newport™ HT70 ventilator, check the battery charge LED on the bottom edge of the battery to ensure that the green LED is lit, indicating that the charge level is approximately 90% or above. Attach the Power Pac to the ventilator and turn the ventilator on to verify the actual charge level percentage (shown in the message display area).

3.4 Using the Power Switch

The momentary-type power switch is located on the left side rear of the ventilator along the bottom edge.

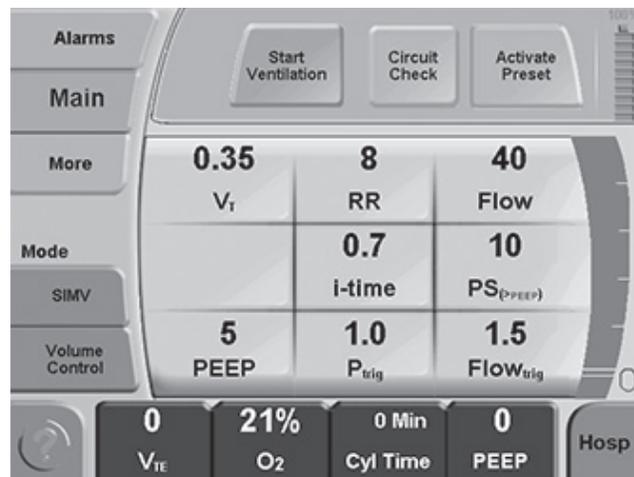
Figure 3-3. Power Switch



3.4.1 Turning on the Power

1. To turn on the ventilator, press the power switch once and wait for the startup screen to appear, as shown in [Figure 3-4](#).

Figure 3-4. Startup Screen



**Note:**

At this time, the ventilator is in standby condition. Setting changes and the circuit check can be made in standby condition, prior to beginning ventilation.

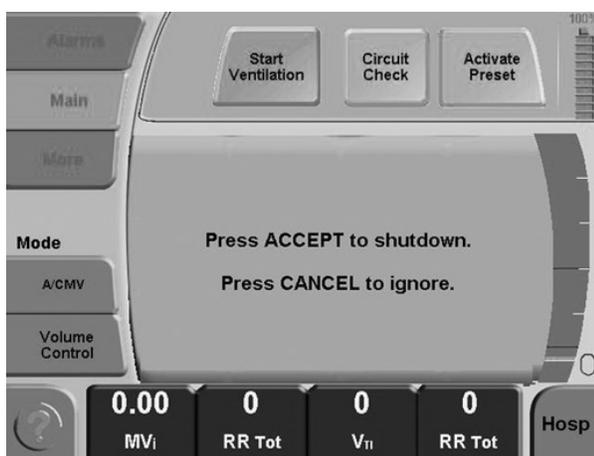
2. To start ventilation, touch the *Start Ventilation* button at the top of the Startup screen.

3.4.2 Turning Off the Power

1. To turn the ventilator off, press the power switch once.

The message "Press ACCEPT to Shutdown or CANCEL to Ignore." is shown (see [Figure 3-5](#)).

Figure 3-5. Shutdown Screen



2. Press the *Accept* button to turn off the ventilator. Press *Cancel* to return the ventilator to its previous state.
3. Press *Audio Paused* to mute the Shut Down alarm.

3.5 Making Parameter Changes

Most parameters are changed with a simple touch/adjust/accept method:

1. Activate the control by touching it (the button will appear highlighted).
2. Use the *Up/down* buttons to adjust the setting.
3. Press the *Accept* button to accept the change. To reject the change and return to the previous setting, press the *Cancel* button.

Several adjustments can be made before accepting the changes. When satisfied with the changes, accept them all by pressing the *Accept* button once. In the case of a mode or breath type

change, select the Main screen for view, change the mode or breath type, and then adjust all visible parameters prior to pressing the *Accept* button.



Note:

If a parameter is touched and adjusted but *Accept* is not pressed within 20 seconds of the last button touched, the parameter will revert to the original setting.

3.6 Attaching a Patient Circuit

Always use a clean and dry patient circuit.

Always use a proximal inline filter (part number HT6004701 or equivalent) at the prox line connector to protect the internal transducers from moisture or other contaminants.

Always use a bacteria filter (part number FLT3302P-C or equivalent) on the gas output connector.

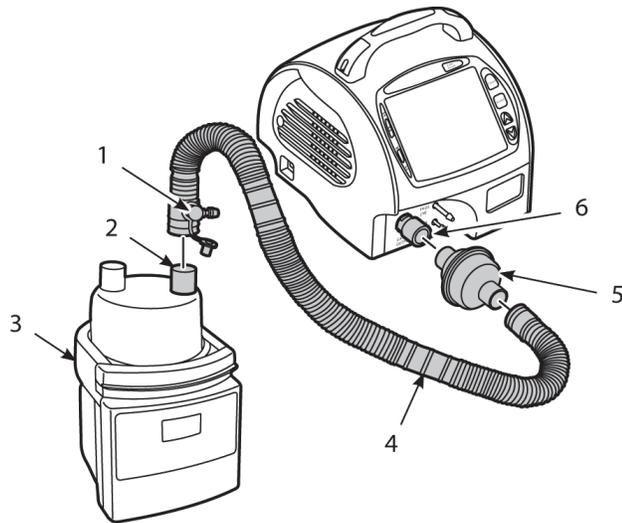
Always orient the exhalation valve for the correct flow orientation. Valves used in a single-limb circuit have arrows that point toward the patient, and valves that are used in J-style or two-limb circuits have arrows that point away from the patient.

When using the on-airway flow sensor, orient it so that the blue tubing is toward the patient.

The Newport™ HT70 ventilator will perform to specification when Covidien-recommended breathing circuits and exhalation valves are used. Covidien cannot guarantee the safe use of breathing circuits or exhalation valves that are not recommended.

3.6.1 With a Third-Party Humidifier

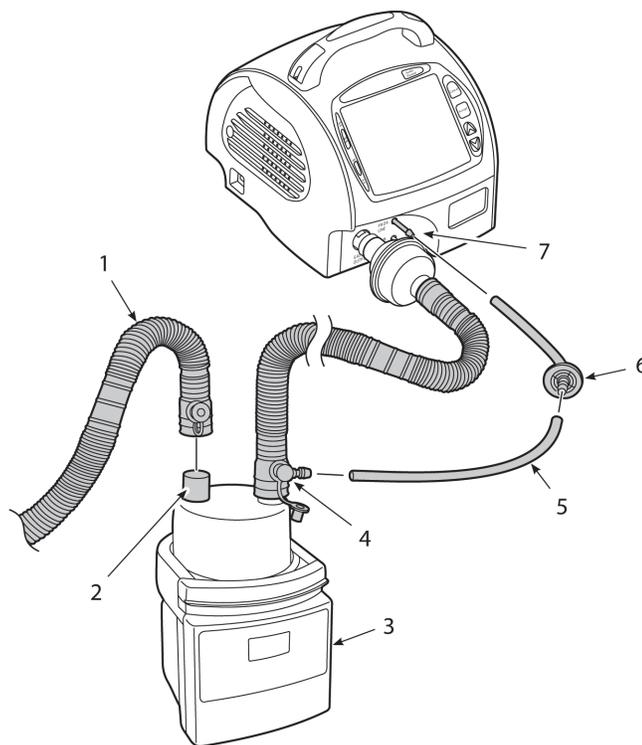
When using a humidifier with the ventilator, be sure to follow the manufacturer's instructions for use. Refer to [Figure 3-6.](#) , [Figure 3-7.](#) , [Figure 3-8.](#) , and [Figure 3-9.](#) during the following set-up procedure.

Figure 3-6. Patient Circuit Components (Third-Party Humidifier)

1	Prox line pressure port	4	Short section of breathing circuit
2	Inlet port	5	Bacteria filter
3	Humidifier	6	Gas output connector

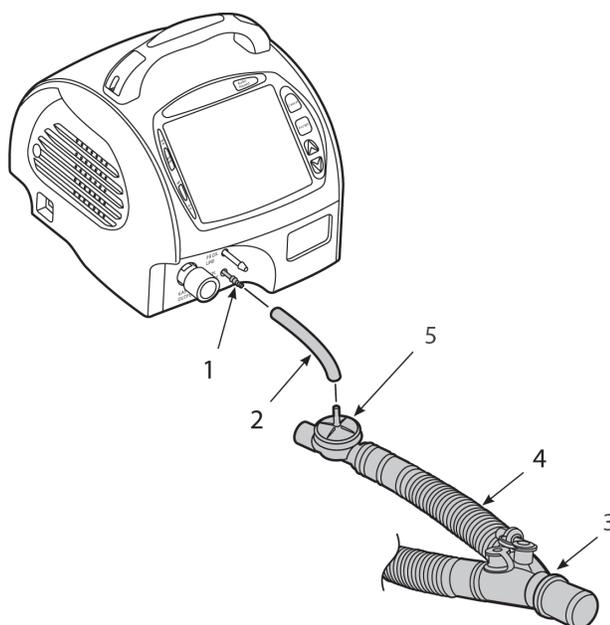
1. Attach a bacteria filter to the gas output connector on the ventilator.
2. Locate the short piece of the 22 mm ID circuit tubing. Connect the end that includes the prox line pressure port to the inlet port of the humidifier.
3. Attach the other end of the breathing circuit to the bacteria filter on the gas output connector.

Figure 3-7. Patient Circuit Connection to Humidifier



- | | | | |
|---|-------------------|---|---------------------|
| 1 | Breathing circuit | 5 | Prox line |
| 2 | Outlet port | 6 | Prox inline filter |
| 3 | Humidifier | 7 | Prox line connector |
| 4 | Pressure port | | |

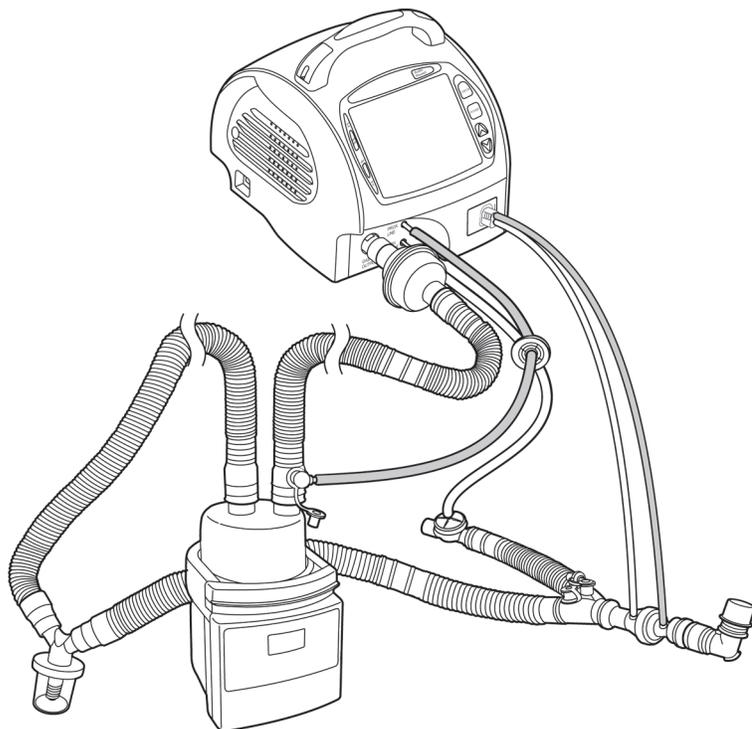
4. Locate the 22 mm ID end of the main breathing circuit. Attach this end to the outlet port of the humidifier chamber.
5. Attach the prox inline filter with tubing to the prox line connector.
6. Attach one end of the prox tubing to the prox inline filter.
7. Attach the other end of the prox tubing to the prox line pressure port on the circuit tubing that is connected to the inlet port of the humidifier chamber.

Figure 3-8. Patient Circuit Connection to Patient Wye (Setup with Humidifier)

1	Exhalation valve connector	4	Breathing circuit
2	Exhalation valve tubing	5	Exhalation valve
3	Patient wye connector		

8. Attach one end of the exhalation valve tubing (smallest clear tubing) to the exhalation valve connector.
9. Attach the other end of the exhalation valve tubing to the connector on the exhalation valve at the end of the circuit.
10. Attach flex tube (not shown), if used, on the patient wye connector.
11. If using the on-airway flow sensor, plug the connector into the front panel port. Attach the flow sensor with the blue tubing toward the patient onto the patient connection of the circuit. Use the 15/22 mm adapter supplied with the flow sensor to attach to the patient interface as needed. Use the circuit clip supplied with the flow sensor to secure the flow sensor lines to the main breathing circuit tubing.

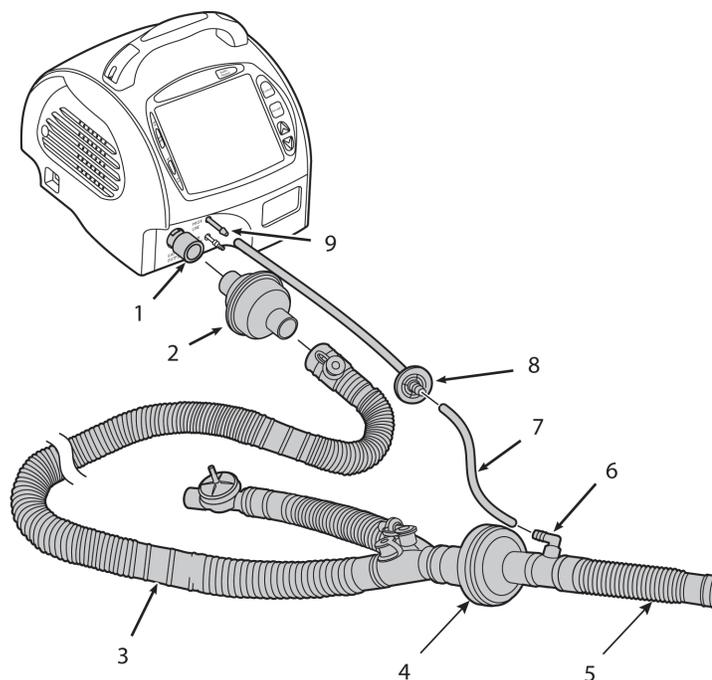
Figure 3-9. Patient Circuit with Humidifier (Completed Setup)



12. If a temperature probe is used, insert probes into the ports at either end of the tubing that connects the humidifier and the patient wye connector.
13. Perform the circuit check. If the circuit includes an end cap, use it during the first step of the circuit check. Reference [Circuit Check Button](#) on page 4-5 for instructions.

3.6.2 With an HME (Artificial Nose)

Figure 3-10. Patient Circuit Components (HME)



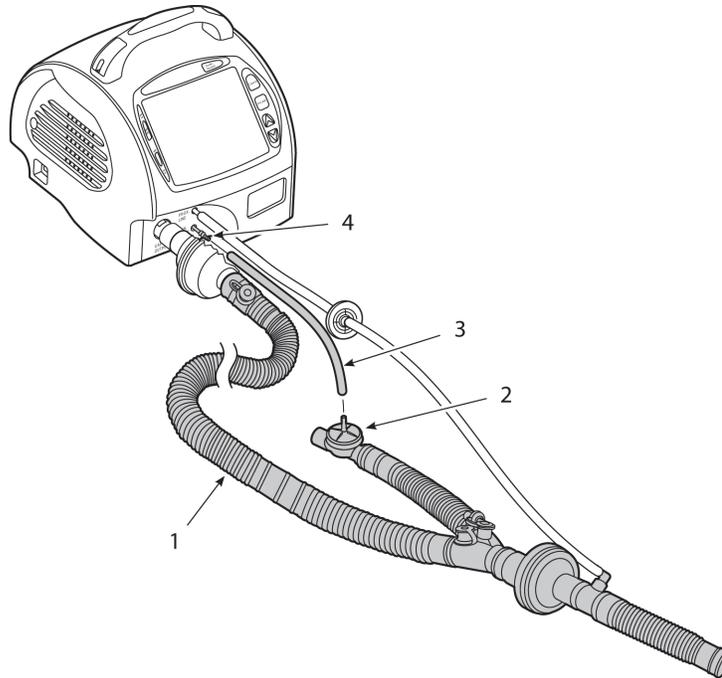
1	Gas output connector	6	Pressure tee adapter (patient side)
2	Bacteria filter	7	Prox line tubing
3	Breathing circuit	8	Prox inline filter
4	HME	9	Prox line connector
5	Flex tube (optional)		

Reference [Figure 3-10.](#) , [Figure 3-11.](#) , and [Figure 3-12.](#) during the following set-up procedure.

1. Attach a bacteria filter to the gas output connector on the ventilator.
2. Locate the 22 mm ID end of the breathing circuit. Attach this end to the bacteria filter.
3. Attach the HME to the patient wye connector.
4. Attach a pressure tee if the on-airway flow sensor is not used.
5. Attach a flex tube, if used, to the patient side of the pressure tee or on-airway flow sensor adapter.
6. Attach the prox inline filter with tubing to the prox line connector.
7. Attach one end of the prox tubing to the prox inline filter.

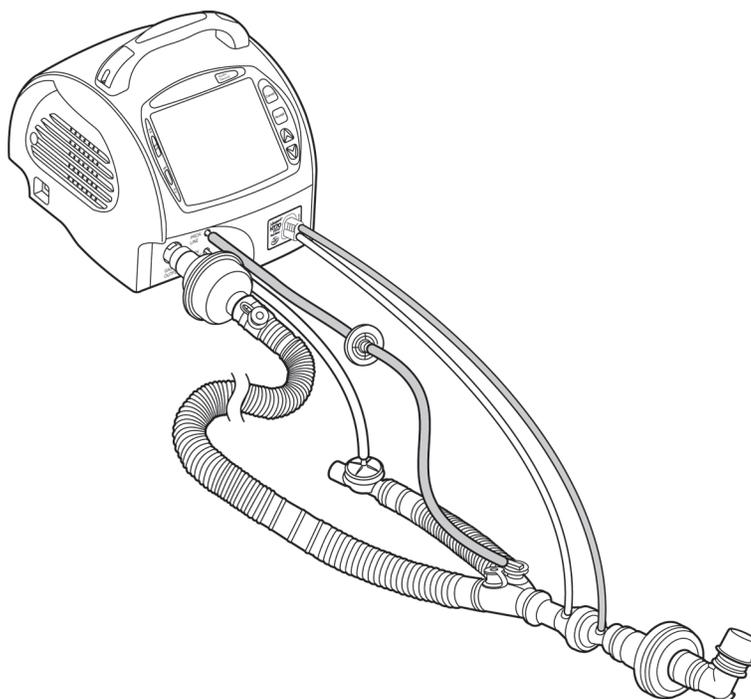
8. Attach the other end of the prox tubing to the port located on the wye connector (on-airway flow sensor in use) or to the pressure tee adapter on the patient side of the HME.

Figure 3-11. Patient Circuit Connection to Exhalation Valve (Setup with HME)



- | | | | |
|---|-------------------|---|----------------------------|
| 1 | Breathing circuit | 3 | Exhalation tubing |
| 2 | Exhalation valve | 4 | Exhalation valve connector |

9. Attach one end of the exhalation valve tubing (smallest clear tubing) to the exhalation valve connector.
10. Attach the other end of the exhalation valve tubing to the connector on the exhalation valve.
11. If using the on-airway flow sensor, plug the connector into the front panel port. Attach the on-airway flow sensor with the blue tubing toward the patient to the wye connector of the circuit. Use the 15/22 mm adapter supplied with the on-airway flow sensor to attach to the patient interface as needed. Use the circuit clip supplied with the on-airway flow sensor to secure the on-airway flow sensor lines to the main breathing circuit tubing.

Figure 3-12. Patient Circuit with HME (Completed Setup)

12. Perform the circuit check. If the circuit includes an end cap, retain it for use in the circuit check. Reference [Circuit Check Button](#) on page 4-5 for instructions.

3.6.3 Using the On-Airway Flow Sensor

The Newport™ flow sensor is a disposable, single-patient use on-airway flow sensor that can be used for pediatric to adult patients. Use the 15/22 mm adapter supplied with the on-airway flow sensor to attach to the patient interface as needed. Use the circuit clip supplied with the on-airway flow sensor to secure the on-airway flow sensor lines to the main breathing circuit tubing.

Set up the patient breathing circuit as described in [Attaching a Patient Circuit](#) for the appropriate usage (with or without humidifier or HME). Plug the on-airway flow sensor connector into the port on the front panel of the ventilator. Attach the on-airway flow sensor to the patient end of the breathing circuit with the blue tubing toward the patient.

When it is connected, the ventilator will recognize the on-airway flow sensor and enable these added features:

- Flow trigger
- Exhaled volume monitoring
- High Tidal Volume alarm
- High and Low Expiratory Minute Volume alarms

**Caution:**

When giving nebulizer treatments through the ventilator circuit, be sure to remove the flow sensor from the circuit. This will protect the flow sensor from medication buildup.

3.7 Connecting Optional Accessories

Connect optional accessories, such as the air/oxygen mixer, low flow oxygen reservoir, or biofilter, to the right side of the ventilator at the fresh gas intake port.

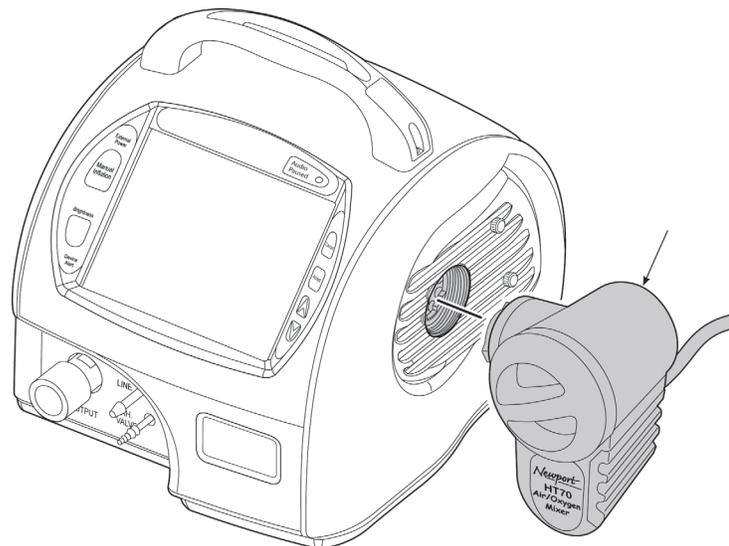
For external DC power use, connect the DC auto lighter cable into the external power supply input on the rear of the Power Pac battery pack.

**WARNING:**

Do not block the fresh gas intake port on the right side of the Newport™ HT70 ventilator. Use only approved accessories.

3.7.1 Air/Oxygen Entrainment Mixer

Figure 3-13. Air/Oxygen Entrainment Mixer



The air/oxygen entrainment mixer (part number MXL70A-XX-XX), which is used to blend atmospheric air with 50 psi medical-grade oxygen, attaches to the fresh gas intake port on the filter cover (right side of the ventilator). Attach the mixer's high pressure hose to an active source of medical-grade, 100% oxygen, before attaching the mixer to the ventilator. The mixer should not be attached to the ventilator before the circuit check is completed. Make sure that the oxygen source gas is always on while using the mixer during ventilation.

Use the mixer's control knob to adjust oxygen enrichment of the gas delivered to the patient circuit from 21% to 100%. The mixer does not need readjustment when the PEEP and bias flow settings or patient's minute volume change.

Use a calibrated oxygen monitor with alarms (such as the one that is built into the ventilator) to assure that the O₂ that is delivered by the ventilator into the patient circuit matches the prescribed value.

Check the mixer filter (part number FLT3209P-C) at the time of setup and weekly during use. Replace when dirty. Reference *Air/Oxygen Entrainment Mixer* on page 8-2.

Table 3-3. Pneumatic Requirements

Oxygen	35–65 psig (2.4–4.5 Bar)
Maximum accuracy	40–50 psig (2.8–3.4 Bar)

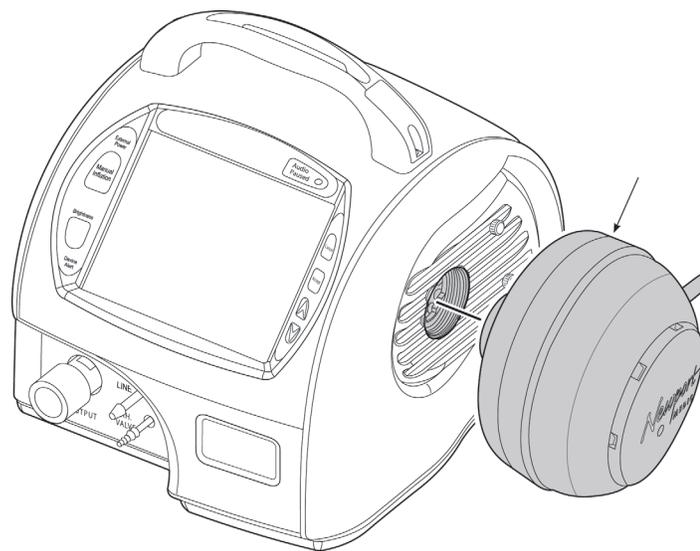


Note:

Oxygen source gas must be medical-grade, 100% oxygen.

3.7.2 Low Flow Oxygen Reservoir

Figure 3-14. Low Flow Oxygen Reservoir

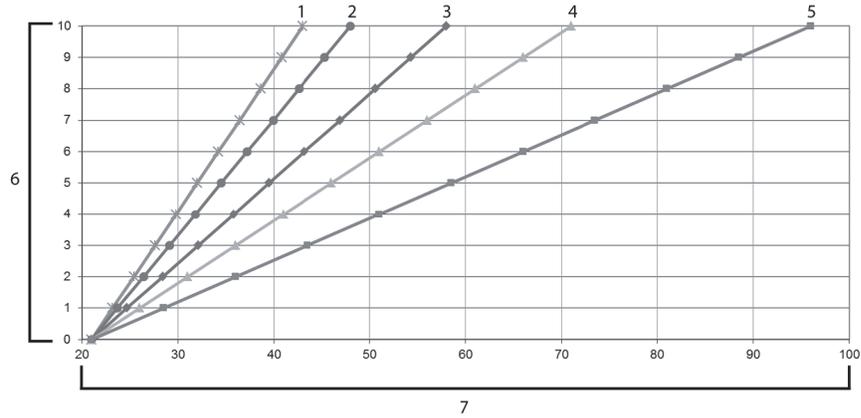


The low flow oxygen reservoir (part number RSV3215A), which is used to blend atmospheric air with 1–10 L/min of medical-grade oxygen, attaches to the fresh gas intake port on the filter cover (right side of the ventilator). Attach oxygen supply tubing between the oxygen flow meter and the small bore connector on the reservoir. Attach the reservoir to the ventilator.

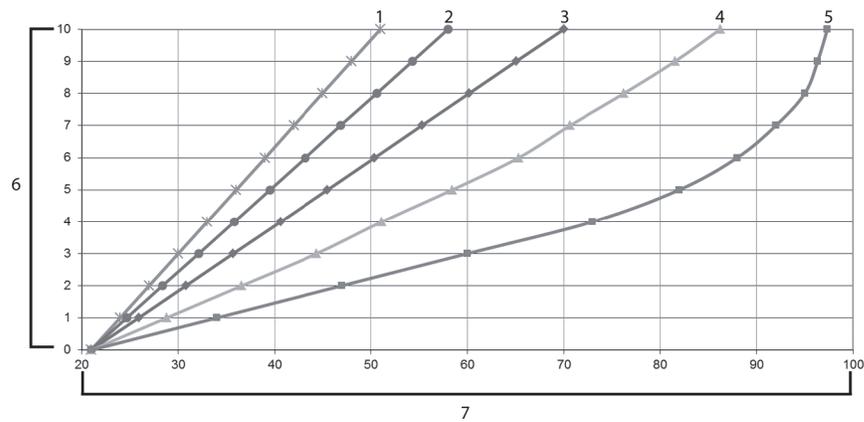
Use the oxygen flow meter to adjust oxygen enrichment of the gas delivered to the patient circuit. When the low flow reservoir is in use, the percent of oxygen that is delivered from the ventilator

into the breathing circuit will vary, depending on the use of bias flow and PEEP, the delivered minute volume, and the percent O₂ of the source gas.

Figure 3-15. Oxygen Supply Flow Versus Desired Percent of Oxygen (For Use With PEEP)



- | | | | |
|---|---------------------|---|--------------------------------------|
| 1 | Min vol i 25 liters | 5 | Min vol i 5 liters |
| 2 | Min vol i 20 liters | 6 | Oxygen supply flow, L/min |
| 3 | Min vol i 15 liters | 7 | Desired percent of oxygen enrichment |
| 4 | Min vol i 10 liters | | |

Figure 3-16. Oxygen Supply Flow Versus Desired Percent of Oxygen (For Use Without PEEP)

1	Min vol i 25 liters	5	Min vol i 5 liters
2	Min vol i 20 liters	6	Oxygen supply flow, L/min
3	Min vol i 15 liters	7	Desired percent of oxygen enrichment
4	Min vol i 10 liters		

Use the graphs in [Figure 3-15](#) and [Figure 3-16](#) for estimating the liter flow of supplemental oxygen needed to attain a particular O_2 percentage. Note that the first graph applies when PEEP is on (and NIV off) and the second graph applies when PEEP is off. The graphs are also printed on the instructions for use that are packaged with the reservoir.

To keep a constant percentage of O_2 , the flow meter will need readjustment when PEEP is turned on or off, the bias flow setting is changed (PEEP and NIV on), or the patient's minute volume changes.

Use a calibrated oxygen monitor with alarms (such as the one that is built into the ventilator) to assure that the percent of O_2 that is delivered by the ventilator into the patient circuit matches the prescribed value.

Table 3-4. Pneumatic Requirements

Oxygen	0–10 L/min
--------	------------

**WARNING:**

Using an oxygen concentrator in place of medical-grade oxygen will result in lower oxygen percentage levels than what is printed on the graphs. Use a calibrated oxygen monitor to verify the level of oxygen enrichment.

**Caution:**

Water in the oxygen supply can cause equipment malfunction and damage.

3.7.3 DC Auto Lighter Power Adapter

The DC auto lighter power adapter (part number SP-ADP3203P) is used to plug the ventilator into any vehicle's DC power outlet (12 V DC to 16 V DC). The external DC source of power will not only power the ventilator but also charge both batteries in the internal dual battery system.

This cable can also be used to connect the ventilator to other external batteries (12 V DC to 16 V DC) when combined with an alligator clip adapter that is available from common consumer electronics retailers.

To use the DC auto lighter power adapter, insert the adapter's pinch-release power plug into the external power supply input located on the lower left corner of the Power Pac battery pack. Ensure that the cord is to the right of the plug and that it locks in place securely. Plug the other end of the adapter into a vehicle autolighter power outlet (12 V DC to 16 V DC).

To remove the DC auto lighter power adapter from the external power supply input, gently pinch the connector to release the locking pin and then pull the plug out.

3.7.4 Aequitron Remote Alarm Cable

**Note:**

The Aequitron remote alarm cable is only available in the U.S.

The Aequitron remote alarm cable allows the user to connect the Newport™ HT70 ventilator to the Aequitron 6217 remote alarm assembly.

This cable must be connected to both the nurse call and USB output ports on the ventilator. The other end of this cable must be connected to the original extension cable (not to the Aequitron unit itself).

The ventilator must be configured to Norm Close (see [Figure 4-13](#)). In addition, see the general notes regarding nurse call connectivity on page [1-8](#).

Complete a self-test after the cable has been installed and at regular intervals to ensure the Aequitron system is operating as intended. A self-test consists of inducing an alarm and confirming the Aequitron unit emits an audio alarm, as well as confirming the audio alarm ceases once the alarm in the ventilator has been reset.

4 Navigating the Screens

4.1 Touch Screen (Graphical User Interface) Layout

The touch screen display is color coded so that it is very easy to differentiate between basic ventilation settings (which are green), alarm settings (which are red), and monitored values (which are yellow on a blue background). The More and Utility settings are in blue.

If the Power Save feature is enabled, the Newport™ HT70 ventilator's touch screen will go dark if not touched for 2 minutes (while running on internal battery). To bring it back into full view, just touch the screen or a membrane button.

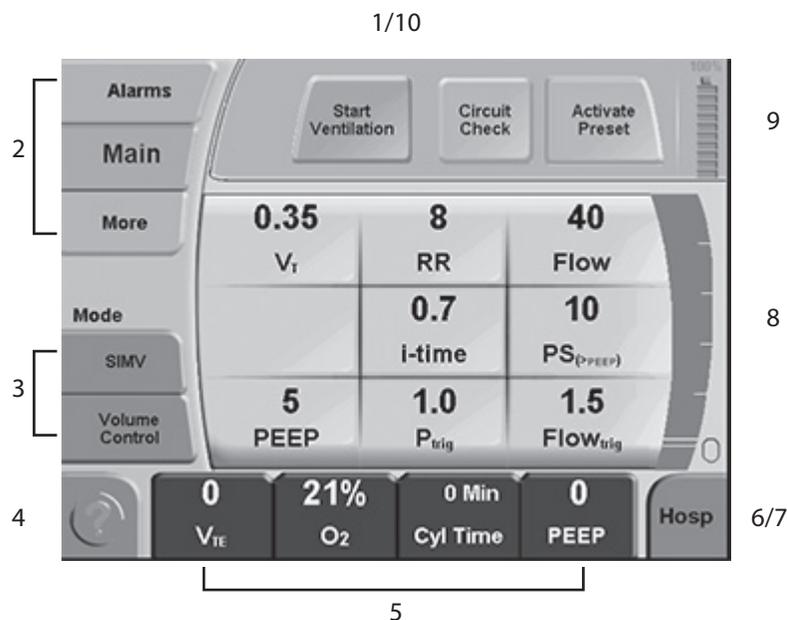
4.1.1 Primary Screen Navigation

The buttons for accessing Alarms, Main, and More screens, as well as the buttons for selecting mode and breath type, are consolidated along the left margin. Monitored values are shown across the bottom margin, and the pressure bar graph rises and falls along the right. This leaves plenty of room for the display in the middle of the screen.

The name of the active screen is written in larger letters than the other two screens. To change to a different screen view, just touch one of the other screen buttons. There is no need to press *Accept*.

4.2 Primary Screen Buttons and Displays

Figure 4-1. Primary Screen Buttons and Displays



1. **Startup screen selection buttons:** While in standby condition, there are three additional buttons in the message and alerts display window. They disappear when the *Start Ventilation* button is touched. Reference *Startup Screen Navigation (Standby Condition Only)* on page 4-4 for a full description.
2. **Screen selection buttons:** Touch the *Alarms*, *Main*, or *More* buttons to open these screens in the center display area. Simply touch the desired button and the screen changes. The *Accept* button does not need to be pressed. See sections 4.5, 4.6, and 4.7 for details on these screens.



Note:

From the *More* screen, the Trends, Events, Waves* and Utility screens can be viewed. Return to the *Main* screen from any of these screens by touching the screen selection button labeled *Main*.

*only available on the HT70PM

3. **Breath type/mode selection buttons:** Touch the *Breath type* button to toggle between Volume Control and Pressure Control. Press *Accept* to confirm the selection. Touch the *Mode* button to scroll through the selections *A/CMV*, *SIMV*, or *SPONT*. Press *Accept* to confirm the selection.
4. **Help button:** Touch the *Help* (question mark) button, and then touch any feature or button on the touch screen. The center panel shows an explanation of the features or controls. Touch any button except the *Help* button to close the tutorial.
5. **Monitor data display buttons:** The *Monitor data* buttons are located at the bottom of the screen. To choose and change the parameters shown, touch any one of the buttons to select it. The full monitoring screen appears and shows all 12 monitored parameters. Touch the desired parameter to show. That parameter will automatically appear in the *Monitor data* display button that was selected.

The parameters can be arranged in the order desired. The Monitor screen will remain, showing the monitored parameters, for 3 minutes to allow viewing and checking of all monitored values until an alternate selection is made, or a different screen button is pressed (*Alarms, Main, or More*). The values on the monitor screen do not update while the screen is shown.

**Note:**

For monitor display selections, the *Accept* button does not need to be pressed to complete a change.

6. **Domain button:** The level of accessibility for ventilator controls is determined by the domain selection. The user interface can be set up in one of three domains: basic, transport, and hospital. The basic domain is a simplified screen for use in the long-term care or homecare setting. The transport domain is specifically designed to assist during transport applications. The hospital and transport domains provide full access to all ventilation and alarm settings, as well as to the special screens and menus. Full access is recommended for use in acute care settings and for the initial setup of patients in long-term care before switching to basic domain. Reference *Domain Navigation* on page 4-22 for more details.
7. **Autolock button:** The Autolock function is enabled from the Utility screen. When Autolock is enabled, the touch screen will automatically lock 40 seconds after the last button was touched. When this occurs, a lock icon will appear in the lower right corner in place of the *Domain* button. To unlock the screen, simply touch and hold the lock icon for 3 seconds.
8. **Pressure bar:** The pressure bar appears on every screen. It indicates dynamic pressure in the patient circuit with a green bar that rises and falls. The High and Low Pressure alarm settings are indicated with red lines, and the peak pressure of the last breath is indicated with a green line.
9. **Battery charge level display:** A battery icon is shown in the upper right corner of the screen. This icon indicates the percent of charge level remaining on the battery that is currently operating the ventilator—either the Power Pac battery pack (blue icon) or the backup battery (red icon).
10. **Messages and alerts display:** In standby condition, there are three start-up buttons that appear in this area. They disappear when the ventilator is in ventilating condition. While in standby or while ventilating, messages, including alarm alerts, are shown in the message display area of the screen in order of priority. Active alarms are shown first followed by latched alarms that have not been cleared by the user.

**Note:**

To clear alarm messages, press the *Audio Paused/Reset* button (located on the top of the panel). As each alarm message is cleared, the alarm message with the next priority will appear in the message display area. Continue pressing to clear all alarm messages. Press and hold for 3 seconds to clear all at once.

4.3 Ventilator Settings Adjustment

Most ventilator settings are changed by touching a parameter to highlight it, using the up and down arrows to change the set value, and then pressing *Accept* to confirm the change. Pressing and holding the arrow button makes the change happen more rapidly. Other parameters are

changed by toggling, meaning that the same button is touched repeatedly to change the value, and then the change is confirmed by pressing *Accept*. In either case, press the *Accept* button after each setting change or make multiple changes and then press *Accept*.

If you decide not to make the changes you started, press the *Cancel* button instead of pressing *Accept* or just wait and the values will revert back to the original settings.

The mode and mandatory breath type selections determine which Main screen breath delivery parameters are active and available for adjustment. Follow these steps when setting up ventilation:

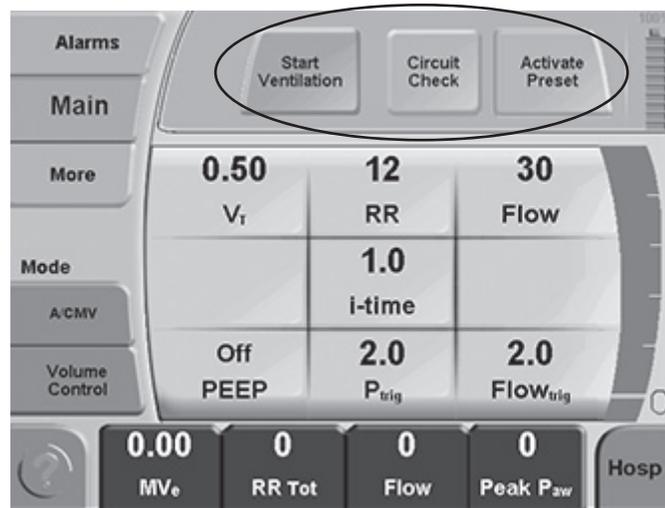
1. While the Main screen is in view, start by selecting the mode and mandatory breath type along the left margin of the screen.
2. Adjust all Main screen parameters that are visible.
3. Press the *Accept* button to implement the mode/breath type and relevant parameters change.
4. Visit the More screen to turn NIV on or off.
5. When NIV is turned on while PEEP is in use, the bias flow adjustment window appears so that bias flow can also be adjusted.
6. Adjust the other relevant ventilation parameters on the More screen.
7. Visit the Alarm screen to adjust/check alarm parameters.

4.4 Startup Screen Navigation (Standby Condition Only)

When the ventilator is turned on, it goes through a short self-test before entering standby condition. During the short self-test, confirm the alarm sounds and the LEDs light.

While in standby, the Startup screen is available. In standby, ventilator settings can be adjusted. The Startup screen includes three buttons in the top message area: *Start Ventilation*, *Circuit Check*, and *Activate Presets*.

Figure 4-2. Startup Screen (Standby condition)



4.4.1 Circuit Check Button

Perform the circuit check each time the breathing circuit or exhalation valve is replaced. While the ventilator is in standby condition, touch the *Circuit Check* button and follow the instructions on the screen. The test is a simple, two-step automated process.



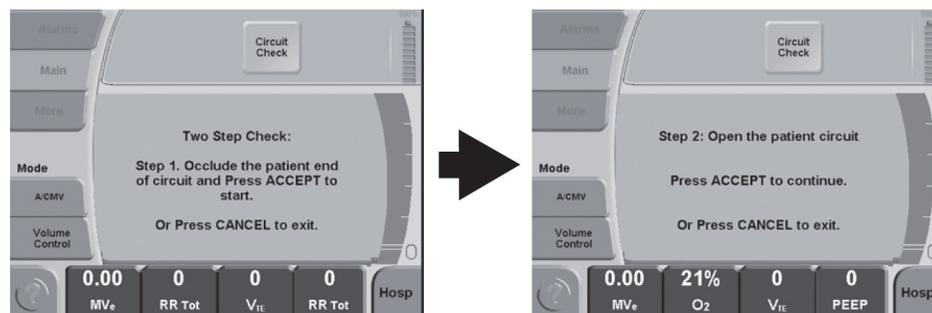
Note:

The circuit check is not available during ventilation.

To perform a circuit check:

1. Touch the *Circuit Check* button at the top of the touch screen, and follow the on-screen instructions.

Figure 4-3. Circuit Check Screens



2. For Step 1, occlude the patient connection end of the circuit. (Do not use a test lung.)
3. Press the *Accept* button to confirm and start the circuit check.
4. For Step 2, open the patient connection end of the patient circuit.
5. Press the *Accept* button to continue the circuit check.

6. If the test passes, the message “Circuit Check PASSED Press Accept to Confirm” will be shown.
7. When the circuit check is completed, adjust patient settings as needed, and touch the *Start Ventilation* button to begin ventilation.
8. To cancel the circuit check and return to the Startup screen, press the *Cancel* button.

If the circuit check fails:

1. The message “Circuit Check FAILED Press Accept to Continue” will be shown.
2. Press the *Accept* button to return to the Startup screen.
3. Check that all breathing circuit connections are properly connected and leak free.
4. Verify that the air oxygen entrainment mixer is not attached to the fresh gas intake port.
5. Touch the *Circuit Check* button to redo the test.

If the circuit check fails repeatedly, try a different circuit.



WARNING:

Do not use the Newport™ HT70 ventilator if the circuit check fails, inadequate ventilation may result. Use an alternate method of ventilation. Contact Covidien Technical Services.



Note:

The circuit check results are logged into the event history and retained after turning off the ventilator.

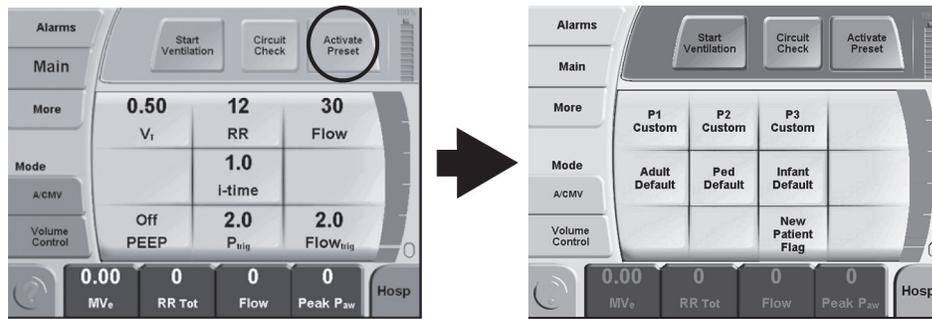
4.4.2 Activate Preset Button

While in standby, ventilation and alarm settings can be adjusted manually or they may be adjusted using custom or default preprogrammed parameter sets (presets) for adult, pediatric, and Infant patients. From the Activate Preset screen, touch the *New Patient Flag* button to enter a “new patient” flag in the events history log. The ventilator must be in standby condition to activate a preset or enter a new patient flag.

To use a preset:

1. Touch the *Activate Preset* button.

Figure 4-4. Activate Presets



2. Touch one of the six preset buttons that appear on the screen. Default preset settings are based on factory set defaults. Custom preset settings must be established by the user.
3. Press the *Accept* button to implement the settings.

To establish custom parameters for a preset, first set all parameters and alarms as desired for the patient. Then go to *More>Utility>Custom Settings>Set Custom Preset* to select a custom preset button. For instructions on how to customize the custom patient presets, reference [Set Custom Presets](#) on page 4-20.

**WARNING:**

Do not preset different alarm limits for the same or similar equipment within a single area, as patient safety may be compromised.

**Note:**

If you do not want to use a preset, press the *Main*, *More*, and *Alarms* buttons and adjust ventilation and alarm parameters.

4.4.3 Start Ventilation Button

Touch the *Start Ventilation* button to exit the standby condition and begin ventilation.



WARNING:

Ensure that all settings are appropriate for the patient prior to starting ventilation. Note that during standby condition, the monitored O₂ is not representative of the set O₂ or the O₂ that will be delivered during ventilation. After starting ventilation, use a calibrated oxygen monitor (such as the one that is built-in to the ventilator) to verify that the air oxygen entrainment mixer setting or liter flow attached to the low flow oxygen reservoir is delivering the prescribed O₂.



Note:

Be sure to review all chapters of this manual before you use the Newport™ HT70 ventilator for the first time.

4.5 Alarms Screen Navigation

The Alarms screen can be accessed in all domains and in standby or ventilating condition except where noted.

Reference [Control Data Selections](#) on page 9-3 and [Alarms](#) on page 9-5 for ranges and more details for each alarm and setting.

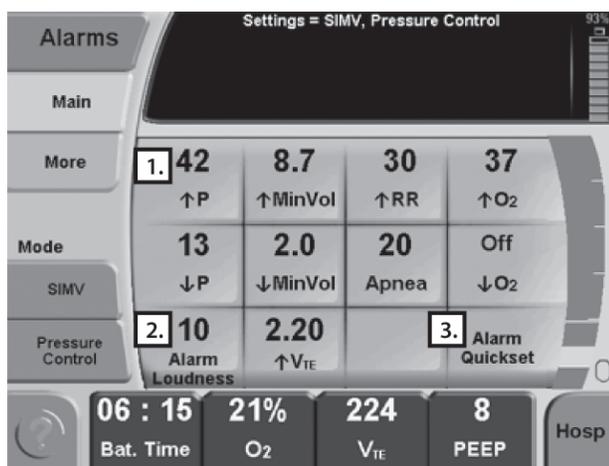
Enter the Alarms Screen

Touch the *Alarms* button.

Set Alarm Limits (Not Available in Basic Domain)

Touch an *Alarm limit* button to activate (highlight) it, and then use the up and down arrow panel buttons to adjust the limit. Press *Accept* to confirm changes or press *Cancel* to return to original settings. Multiple limits can be set before pressing *Accept*.

Figure 4-5. Alarms Screen



- | | | | |
|---|----------------------|---|----------------|
| 1 | Settable alarms | 3 | Alarm Quickset |
| 2 | Alarm Loudness level | | |

4.5.1 Settable Alarms

- | | |
|--|--|
| ↑P (High Pressure) | ↑Min Vol (High Minute Volume) |
| ↓P (Low Pressure) | ↓Min Vol (Low Minute Volume) |
| ↑RR (High Respiratory Rate) | Apnea (time adjustment) |
| ↑O ₂ (High O ₂) | ↑V _{TE} (High Exp. Tidal Volume)* |
| ↓O ₂ (Low O ₂) | |

*only available on the HT70PM when the on-airway flow sensor is in use

4.5.2 Alarm Loudness Level

Touch the *Alarm Loudness* button, and use the up and down arrow panel buttons to adjust the loudness level (from 1 to 10; 10 is loudest). Press *Accept* to confirm the selection. Always set the alarm loudness level high enough to ensure that caregivers will hear the alarm. If necessary, connect a remote alarm system (reference [Utility Screen](#) on page 4-17 for remote alarm selections) to ensure that the caregiver can always hear an alarm when it sounds.



Note:

If a high priority alarm is not acknowledged within 60 seconds, the audible alarm loudness escalates to its maximum loudness when the Alarm Loudness Escalation function is enabled. If disabled (the factory

default setting), the high priority alarm will sound at the set loudness level. To enable or disable this function, contact Covidien Technical Services or your local representative.

4.5.3 Alarm Quickset

During ventilating (not standby) condition, when there are no active alarms violations, *Alarm Quickset* will automatically set the alarm limits. Touch the *Alarm Quickset* button to enter the Alarm Quickset screen, and then press *Accept* to activate or *Cancel* to return to the Alarms screen.

When activated, Alarm Quickset monitors settings for 30 seconds and then sets the alarms. If an alarm occurs during the monitoring period, Quickset is canceled. During the 30-second period, the touch screen will not respond unless an alarm occurs or the *Cancel* button is pressed. Alarm Quickset will only activate when in ventilating condition.

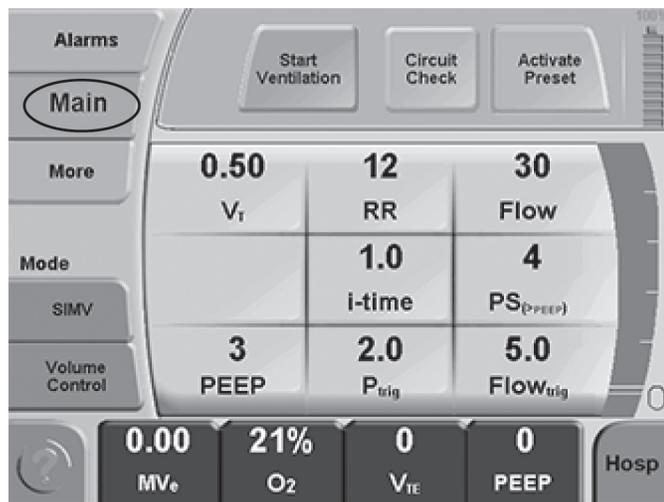
4.6 Main Screen Navigation

The Main screen can be accessed in all domains and in standby or ventilating condition.

Reference [Control Data Selections](#) on page 9-3 and [Monitor Data Selections](#) on page 9-4 for ranges and details for all parameters.

The ventilation parameters that are shown on the Main screen are determined by the mode and breath type that are selected with the *Mode/breath type* buttons along the left margin of the touch screen. Select the mode and breath type first to see the Main screen parameters that need adjustment.

Figure 4-6. Main Screen



To set ventilation parameters (not available in basic domain):

1. Touch a ventilation parameter button to activate (highlight) it.
2. Use the up and down arrow panel buttons to adjust the setting.

3. Press *Accept* to confirm changes or press *Cancel* to return to original settings.

Multiple parameters can be set before pressing *Accept*.

The list of all possible ventilation parameter settings on the Main screen include the following:

VT (tidal volume)	RR (respiratory rate)
PEEP	PS (Pressure Support)
Ptrig	PC (Pressure Control)
Flow (in Volume Control)	Flow Trig*
i-time	

*only available on the HT70PM when the on-airway flow sensor is in use



Note:

When an on-airway flow sensor is detected, both the Flow Trig and Ptrig settings are active, and the first available detection of patient effort (either flow or pressure) will trigger a breath.



Note:

For Volume Control mandatory breaths, VT, flow, and i-time are available to be set. The VT (tidal volume) is the controlling setting. Flow and i-time setting are inversely related to each other. Changing either flow or i-time causes the inversely related setting to be recalculated to match the new flow or i-time setting and the VT remains steady.

For example, if the flow rate is changed to a higher setting, the i-time will decrease to meet the new flow setting. If the i-time is changed to a longer time period, the flow rate will decrease to meet the new i-time setting.

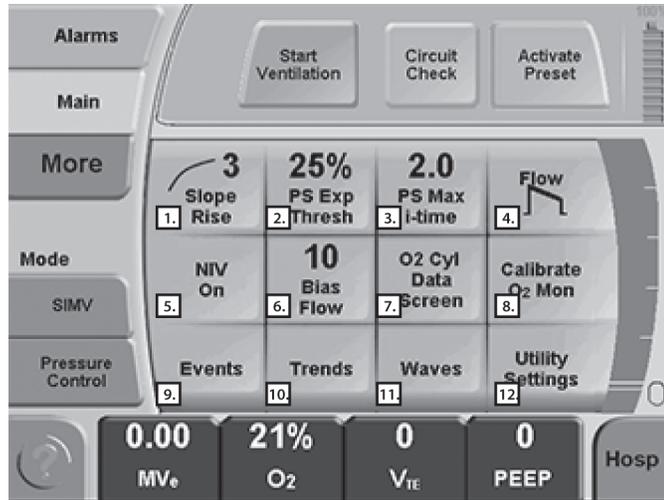
Also while in Volume Control, changing the flow waveform setting on the More screen will cause the flow to change on the Main screen. A square wave will use a lower flow, and a descending ramp waveform will use a higher flow. Always recheck the settings and monitored values after changing the flow waveform.

4.7 More Screen Navigation

The More screen is available in the hospital and transport domains and in standby and ventilating condition.

Reference *Control Data Selections* on page 9-3 and *Monitor Data Selections* on page 9-4 for ranges and more details for each parameter.

Figure 4-7. More Screen Buttons



- | | |
|-----------------------------------|--|
| 1. Slope Rise | Touch the button and use <i>Up/down</i> to adjust from 1–10 (1 is slowest) (Pressure Control and Pressure Support breaths) |
| 2. PS Exp Thresh | Touch the button and use <i>Up/down</i> to adjust from 5–85% (5% is longest) (Pressure Support breaths) |
| 3. PS Max i-time | Touch the button and use <i>Up/down</i> to adjust from 0.1–3.0 s (Pressure Support breaths) |
| 4. Flow (square or descending) | Touch the button to select square or descending ramp flow (Volume Control breaths) |
| 5. NIV | Touch the button to select NIV (Noninvasive) function on or off for all breaths |
| 6. Bias Flow | Touch the button and use <i>Up/down</i> to adjust from 3–30 L/min. Bias flow is delivered during exhalation phase when PEEP is on. |
| 7. O ₂ Cyl Data Screen | Touch the button to access screen to set up oxygen cylinder content tracking (reference Oxygen Cylinder Data Screen on page 4-16) |
| 8. Calibrate O ₂ Mon | Touch the button to access calibration screen for the internal oxygen sensor (reference Calibrate O₂ Mon Screen on page 4-17) |
| 9. Events | Touch the button to access Events screen (reference Events Screen on page 4-13) |
| 10. Trends | Touch the button to access Trends screen (reference Trends Screen Navigation on page 4-14) |
| 11. Waves* | Touch the button to access Waves screen (reference Waves Screen on page 4-15) |
| 12. Utility Settings | Touch the button to access Utility screen (reference Utility Screen on page 4-17). |

*only available on the HT70PM

Press the *Accept* button to confirm changes made to any of the parameters on the More screen.



Note:

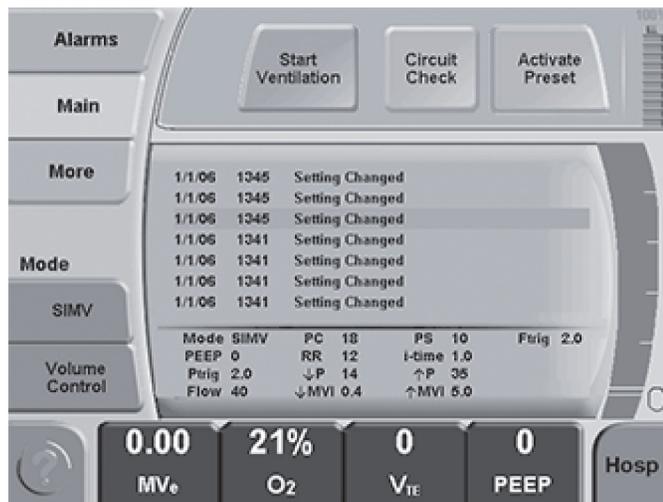
For the More screen settings, if the *Accept* button has not already been pressed, press *Cancel* at any time to revert to previous setting.

4.8 More Screen Details

4.8.1 Events Screen

The Events screen is available in the hospital and transport domains and in standby and ventilating condition.

Figure 4-8. Events Screen



The Events screen shows the last 1000 recordable events. When a new event occurs, the oldest event is cleared. Use the *Up/down* panel buttons to scroll through the list of events. Recordable events include the circuit check, parameter changes, alarm activate/deactivate, date/time changes, audio paused, alarm cleared, calibrations, screen brightness changes, new patient, and power on/off.

The alarm, technical fault, and event logs are stored in nonvolatile memory on the main CPU PCB, ensuring that this information is retained during power loss conditions or when the ventilator is turned off.

To record when a new patient is started, touch the *Activate Presets* button while in the Startup screen (standby condition), and then press the *New Patient Flag* button. The event history log will record a new patient entry.

While scrolling through events, the time and parameters in use during that event are shown.



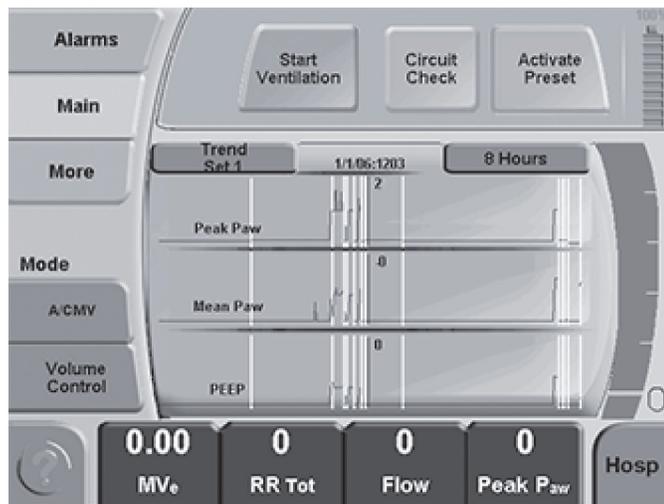
Note:

Date and time format selection is located on the Utility screen.

4.8.2 Trends Screen Navigation

The Trends screen is available in the hospital and transport domains and in standby and ventilating condition.

Figure 4-9. Trends Screen



The Trends screen shows trended data for monitored parameters. Push the up and down arrow panel buttons to move the cursor to the right or to the left.

As the cursor line moves across the graph, the time display will indicate the time at that point on the graph, and the numbers on the line will show the value for each monitored parameter. The yellow vertical bars represent time that the ventilator was off and not collecting data.

There are four sets of parameters to show.

Select a Trend Set

To change the shown parameters, touch the *Trends Set* button on top of the trends graph to scroll through these choices:

- Peak pressure, Mean pressure, and PEEP
- Tidal Volume, Resp. Rate Total, and Minute Volume
- Peak Flow, Power Pac, and Back up Batt
- Power Pac Temp, Back up Batt Temp, and Internal Temp

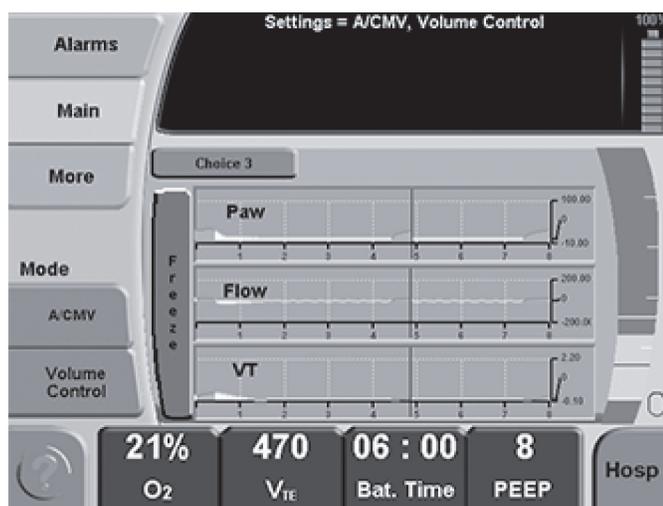
Adjust the Time Scale

Trends can be shown in time frames of 1, 2, 4, 8, 24, or 72 hours. To scroll through the time scale selections, simply touch the *Hours* button on the top of the Trends graph.

4.8.3 Waves Screen

The Waves screen is available in the hospital and transport domains and in standby and ventilating condition.*

Figure 4-10. Waves Screen



*only available on the HT70PM

The Waves screen shows real-time graphics for pressure, volume, and flow. If the on-airway flow sensor is not installed, only the pressure graph will be shown.

Choice: Touch this button at the top of the central panel to select one, two, or three graphs to view. When only one or two graphs are chosen, select which waveform to show by toggling the *Wave* button(s) at the top of the central panel.

Freeze: Touch this button to the left of the graphs to freeze the current waveform. The up/down arrows will move the cursor across the waveforms and show the value for the shown graph at that point in time. To unfreeze, touch the same button again.

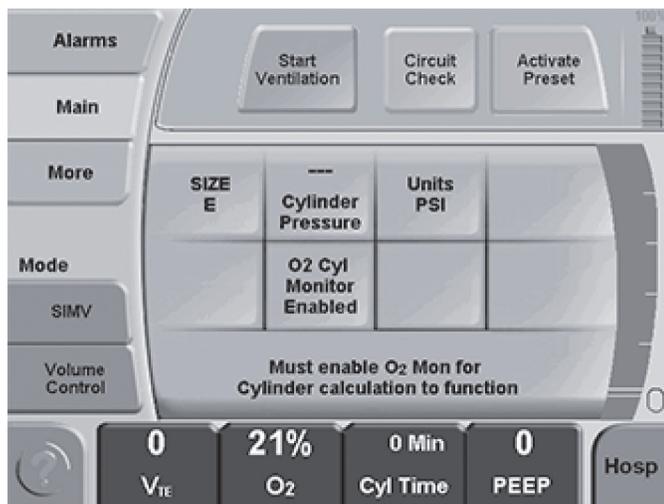
Time Scale (x-axis): To change the time scale, touch the screen anywhere in the central panel. The time axis will turn yellow. Use the up/down arrows to increase/decrease the time scale. Press *Accept* to save the new time scale.

Amplitude Scale (y-axis): To change the height of any waveform, touch the central panel anywhere in the desired graph twice. The first touch will highlight the time scale in yellow, and the second touch will highlight the y-axis. The up/down arrows can now be used to increase/decrease the height of the y-axis. Press *Accept* to save the change.

4.8.4 Oxygen Cylinder Data Screen

The Oxygen Cylinder Data screen is available in the hospital and transport domains and in standby and ventilating condition.

Figure 4-11. Oxygen Cylinder Data Screen



Estimated cylinder use time can be shown on the monitor screen if the relevant cylinder data is entered, the O₂ cylinder monitor is enabled, and the O₂ monitor on the Utility screen is enabled.

Touch *More*, and then touch *O₂ Cylinder Data Screen*. Enter the size, pressure units, and pressure for the cylinder being used. Finally, touch *O₂ Cylinder Monitor* to enable the function, and press *Accept*. The ventilator will then calculate the estimated duration of the oxygen supply, and provide a warning before the cylinder may run out. Allow the calculated display to stabilize for several minutes before starting a transport, and ensure that the estimated time is sufficient for the planned trip or outing.



Note:

The oxygen cylinder use time shown in the monitor is an estimate only. It can be affected by many factors, such as leaks in the O₂ path. Do not rely solely on this measurement. Check the oxygen cylinder remaining pressure level frequently to confirm actual oxygen consumption rate.

Size: Toggle to the size of the oxygen cylinder in use: D, E, H, M, K, 100 L, and 150 L.

Units: Toggle this button to use the desired pressure units for the oxygen cylinder (psi, ATM, or kPa).

Cylinder Pressure: Touch this button, and use the up/down arrows to enter the current pressure in the oxygen cylinder (300–2500 psi, 25–175 ATM, or 2000–17 000 kPa).

O₂ Cylinder Monitor: Toggle this button to enabled, and press *Accept* when all data has been entered.

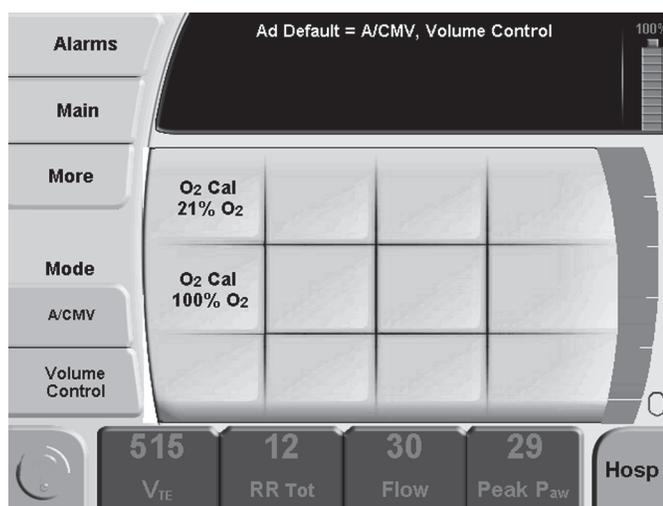
**Note:**

The O₂ monitor (Utility screen) must be enabled for this function to operate.

4.8.5 Calibrate O₂ Mon Screen

The Calibrate O₂ Mon screen is available in the hospital and transport domains and in ventilating condition.

Figure 4-12. Calibrate O₂ Mon Screen



This screen allows the user to calibrate the internal oxygen sensor. Either a single-point or a two-point calibration can be done. This can be done while on a patient if they can tolerate the desired calibration point (room air or 100% oxygen). Touch this button to go to the Calibrate O₂ Mon screen.

O₂ Cal, 21% O₂: Touch this button, and follow the on-screen directions to calibrate at room air. Ensure that no oxygen device is connected to the air intake port on the right side of the ventilator.

O₂ Cal, 100% O₂: Touch this button, and follow the on-screen directions to calibrate at 100% oxygen. Ensure that 100% oxygen is being delivered to the air intake port on the right side of the ventilator. Covidien suggests using the low flow oxygen reservoir with 10 L/min of medical-grade 100% oxygen connected to it.

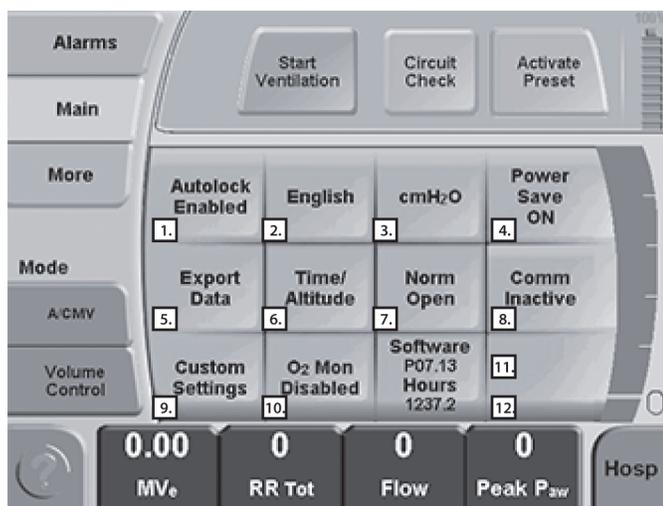
4.9 Utility Screen

The Utility screen is available in the hospital and transport domains and in standby and ventilating condition except where noted.

Access the Utility screen through the More screen, as described in [More Screen Navigation](#).

Reference [Control Data Selections](#) on page 9-3 for ranges and more details for each parameter.

Figure 4-13. Utility Screen



- | | |
|-------------------------------|---|
| 1. Autolock | Touch the button to enable or disable the Autolock function. |
| 2. Language | Touch the button to scroll through language selections. |
| 3. cmH ₂ O or mbar | Touch the button to select cmH ₂ O or mbar pressure units. |
| 4. Power Save | Touch the button to select Power Save function on or off. |
| 5. Export Data | Only available in standby condition (not when ventilating). Touch to download data to flash USB drive or computer. Follow the instructions on the screen. |
| 6. Time/Altitude | Touch the button to access Time/Altitude screen (reference Time/Altitude Screen on page 4-19). |
| 7. Remote nurse call | Touch the button to select from Norm Open (normally open), Norm Close (normally closed), and Respiration nurse call systems.
For use of the Aequitron Remote Alarm System (U.S. only), use Norm Close. |
| 8. Comm | Touch the button to select from Bernoulli enabled, Vuelink™™ enabled, Newport™ enabled, or Comm inactive for central monitoring systems. |
| 9. Custom Settings | Touch the button to access Backup Ventilation (BUV) and Custom Presets screens (reference Custom Settings Screen on page 4-20). |
| 10. O ₂ Monitor | Touch the button to enable or disable the O ₂ monitor. |
| 11. Software | The software version installed is shown here. |
| 12. Hours | The number of hours of ventilator operation is shown here. |

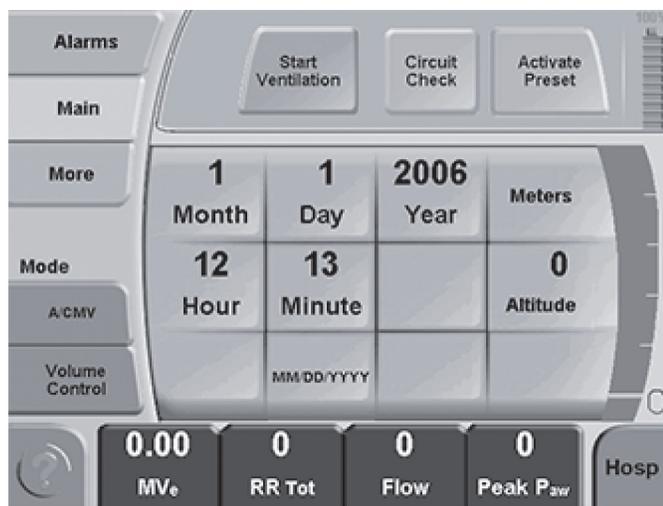
Press *Accept* to confirm changes made to any of the parameters on the Utility screen.

4.10 Utility Screen Details

4.10.1 Time/Altitude Screen

The Time/Altitude screen is available in the hospital and transport domains and in standby and ventilating condition.

Figure 4-14. Time/Altitude Screen



Access the Time/Altitude screen through the More and Utility screens, as described in [More Screen Navigation](#) and [Utility Screen](#).

Touch a button to activate (highlight) it, and then use the up and down arrow panel buttons to adjust the setting. Press *Accept* to confirm changes or press *Cancel* to return to original settings. Multiple parameters can be set before pressing *Accept*. The hours are shown as a 24-hour clock (1-12 for AM and 12-24 for PM).

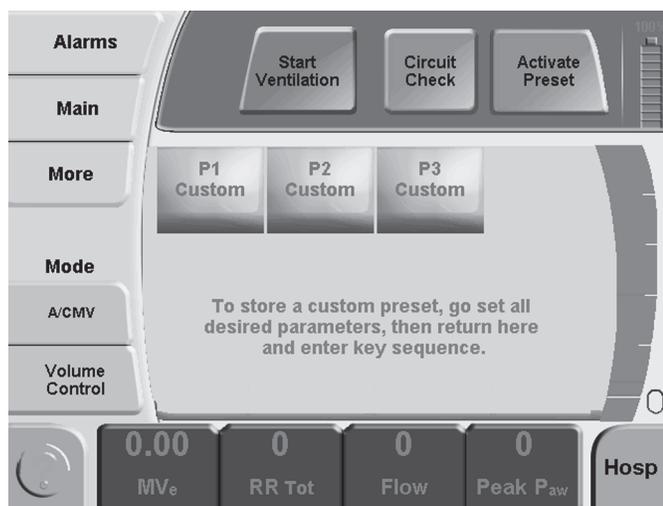
Altitude can be shown in meters or feet. The altitude adjustment is only for the accuracy of the on-airway flow sensor. If the flow sensor is used, ensure that the altitude is set.



Note:

The Newport™ HT70 ventilator automatically maintains accurate volume delivery in altitudes up to 15 000 feet. The patented twin micro-piston system is a volume displacement technology that will deliver the set volume regardless of the altitude.

Figure 4-16. Custom Presets



4. Press the Up and Down arrow buttons simultaneously.



WARNING:
Modifying custom preset settings without the authorization of a physician could result in patient injury.

5. Touch the desired custom preset (P1, P2, or P3).
6. Touch the *Accept* button to confirm the change.

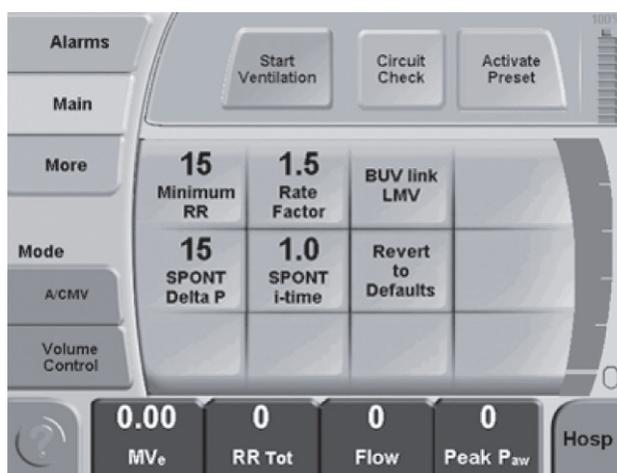
Prior to starting ventilation, presets can be enabled by touching the *Activate Presets* button on the Startup screen in the standby condition. Reference [Activate Preset Button](#) on page 4-6.



Note:
 Custom presets are retained even after the ventilator is shut down.

BUV Settings Screen

Figure 4-17. BUV Settings Screen



This screen allows customization of Backup Ventilation (BUV) to the institution’s policies or to revert to factory default for the Backup Ventilation parameters. Backup Ventilation can also be linked to the Low Minute Volume alarm (LMV), the Apnea alarm, or to both alarms. Reference [Control Data Selections](#) on page 9-3 for ranges and more details for each parameter.

The BUV Settings screen includes the following adjustable parameters:

- Minimum RR (respiratory rate)
- Rate Factor (set rate will be multiplied times this number to determine the BUV breath rate)
- SPONT (mode) delta P (pressure target above set PEEP for breath delivery)
- SPONT (mode) i-Time (i-time for BUV breaths delivered while in SPONT mode)
- BUV link (with LMV [low minute volume] alarm, Apnea alarm, or both)
- Revert to Defaults

Press the *Accept* button to confirm changes made to any of the parameters.

4.11 Domain Navigation

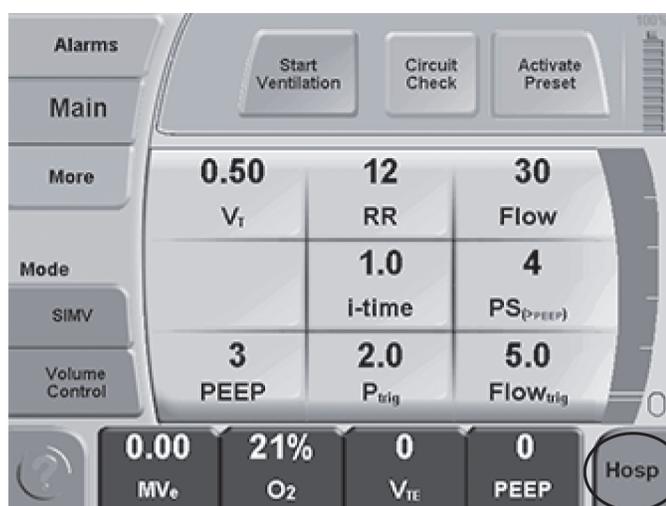
The Newport™ HT70 ventilator is designed with the flexibility of useful application in the acute care as well as long-term care environments. To make the product easy and safe to use in the full spectrum of applications, care is divided into three domains: hospital (which means acute care), transport (anytime the user is on the move with battery and supplemental oxygen supplies), and basic (for the long-term/homecare environments).

Touch the *Domain* button in the lower right corner of the touch screen to scroll through the domain choices: Hosp (hospital), Trans (transport), and Basic (basic). Press *Accept* to change to the new domain. The *Domain* button is not visible if the panel is locked.

4.11.1 Hospital Domain

The hospital domain has full access to all features and screen selections available on the ventilator. This manual describes all of the features and screen selections found in the hospital domain. The transport and basic domain features and screen selections work identically to the hospital domain with the limitations as noted in their respective sections.

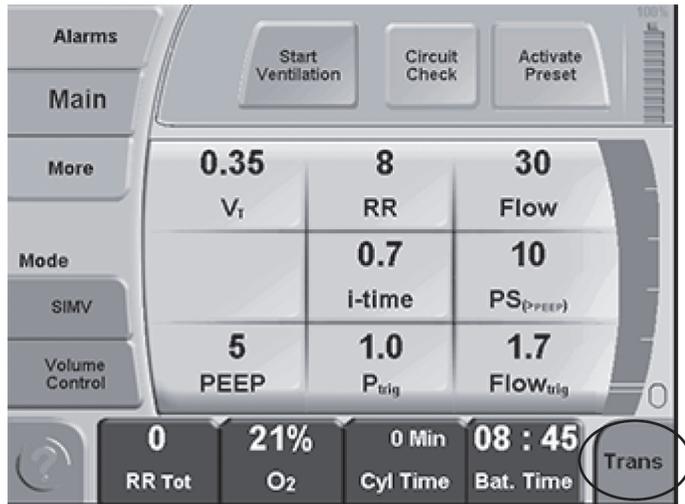
Figure 4-18. Hospital Domain Screen



4.11.2 Transport Domain

This domain gives preference to transport-related monitoring features, such as O₂ cylinder use duration and estimated battery use time.

Figure 4-19. Transport Domain Screen

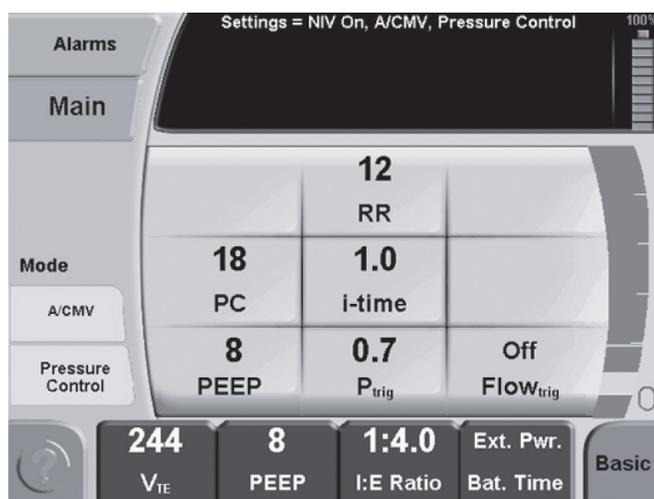


4.11.3 Basic Domain

This is a simplified screen for use in a homecare or subacute facility-type environment. The central parameter platform is replaced with a digital clock unless the *Main* or *Alarm* buttons are touched.

Figure 4-20. Basic Domain Screen (Time Display)



Figure 4-21. Basic Domain Screen (Settings Display)

The breath type and mode settings are shown. The user has access to the Main and Alarm screens and can view all monitored data by touching one of the monitor buttons at the lower margin of the screen. The More screen is not available and no settings can be changed within this domain. This helps simplify operation and protect against accidental settings changes.

If a setting change is needed or access to the More screen is required, use the *Domain* button in the lower right corner of the screen to toggle to the hospital domain. Press *Accept* to confirm the selection.

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5 Operating the Ventilator

5.1 Quick Check Procedure

This procedure is intended to assist qualified operators to establish a routine program for verifying proper operation of the Newport™ HT70 ventilator. Perform this quick check procedure each time the ventilator is prepared for new patient use. The quick check procedure should be performed every 6 months as part of the routine maintenance procedure to confirm proper ventilator operation.

HOME CARE PROVIDERS: This procedure should be performed prior to delivery of the ventilator to a patient's home.

Use a copy of the Quick Check Procedure Check-Off Sheet to record the results of each check. Reference [Quick Check Procedure Check-Off](#) on page A-1.



WARNING:

Do not use the Newport™ HT70 ventilator if it fails the quick check procedure.



Note:

If Power Save is on, the screen will go to sleep (go blank) when not used for 2 minutes. Just touch the screen anywhere to bring it back into view.

5.1.1 Equipment Needed

- 1 liter test lung with resistor (LNG800P)
- Patient breathing circuit with exhalation valve

5.1.2 Pre-Test Inspection

To perform the pre-test inspection:

1. Inspect the air intake filter through the filter cover on the right side of the ventilator. Replace the filter if it is dirty. Reference [Air Intake Filter](#) on page 8-4.
2. Examine the test lung and patient circuit to ensure that there are no holes that will cause leaks.
3. Verify that the AC power supply is in good condition.

5.1.3 Setup

To perform the set-up procedure:

1. Connect the AC power supply to an AC power source.
2. Verify that the external power LED is lit.
3. Turn the ventilator on and verify that the audible alarm sounds and the LEDs light during the self-test.
4. Connect a breathing circuit with an exhalation valve and on-airway flow sensor if used.
5. Set the ventilator to the standard test settings listed in [Table 5-1](#) , and press *Start Ventilation*.

5.1.4 Standard Test Settings

Table 5-1. Standard Test Settings

Setting	Value
Mode	A/CMV
Breath Type	Volume Control
NIV	Off
Tidal Volume	500 mL
i time	1.0 sec
RR	15 b/min
P _{trig}	1 cmH ₂ O / mbar
Flow Trig	Off
↓P Alarm	5 cmH ₂ O / mbar
↑P Alarm	99 cmH ₂ O / 97 mbar
↓Min Vol alarm	0.01 L (minimum setting)
↑Min Vol alarm	50 L (maximum setting with NIV Off)
↑VTE Alarm	1.00 L
PEEP/CPAP	0 cmH ₂ O / mbar

5.1.5 Quick Check Procedure

Do the following as part of the quick check procedure:

1. Perform a circuit check.
2. Perform a No External Power alarm check.

3. Perform an alarms and indicators check.
4. Perform a pressure gauge/PEEP check.
5. Perform a volume/minute volume/respiratory rate monitor check.
6. Perform a Power Pac battery pack and backup battery check.
7. Perform a brightness check.

Circuit Check

To perform a circuit check:

1. Touch the *Circuit Check* button at the top of the touch screen and follow the on-screen instructions.
2. For Step 1, occlude the patient connection end of the circuit. (Do not use a test lung.)
3. Press the *Accept* button to confirm and start the circuit check.
4. For Step 2, open the patient connection end of the patient circuit.
5. Press the *Accept* button to continue the circuit check.
6. If the test passes, the message "Circuit Check PASSED Press Accept to Confirm" will be shown. If the test fails, the message "Circuit Check FAILED Press Accept to Continue" will be shown.

After a failed Circuit Check, proceed as follows:

1. Press the *Accept* button to return to Startup screen.
2. Check that all breathing circuit components/connections are properly connected and leak free.
3. Verify that the air oxygen entrainment mixer is not attached to the fresh gas intake port.
4. Touch the *Circuit Check* button to redo the test.

If the circuit check fails repeatedly, try a different circuit.



WARNING:

Do not use the Newport™ HT70 ventilator if the circuit check fails; inadequate ventilation may result. Use an alternate method of ventilation. Contact Covidien Technical Services.

After performing a successful circuit check:

1. Connect the test lung to the patient connection of the circuit.
2. Touch *Start Ventilation*.

No External Power Alarm Check

To perform the No External Power alarm check:

1. Disconnect the AC power supply. Verify that there is an audible alarm and the alarm LEDs in the handle flash. Verify that the external power LED turns off, and the message area turns yellow and shows the "No External Power" alarm message. Confirm that the ventilator continues to ventilate.
2. Press the *Audio Paused/Reset* button and confirm that its LED lights yellow, the audible alarm is muted, and the message area returns to black.
3. Press the *Audio Paused/Reset* button again and confirm that the alarm message clears.
4. Reconnect the AC power supply. Verify that the external power LED lights green.

Alarms and Indicators Check

To perform a ↑P alarm check:

1. Set the High Pressure alarm limit to 20 cmH₂O/mbar. Verify that an audible alarm sounds, the "High Pressure" message shows, and that inspiration ends when pressure reaches the high limit.
2. Set the High Pressure alarm limit back to 99 cmH₂O /mbar and verify that the audible alarm stops and the alarm message remains.
3. Press the *Audio Paused/Reset* button to clear the alarm message.

To perform a ↓P alarm check:

1. Disconnect the test lung from the breathing circuit and verify that after two breaths an audible alarm sounds and the "Low Pressure" alarm message shows.
2. Attach the test lung to the breathing circuit and verify that the audible alarm ceases and the alarm message remains. Press *Audio Paused/Reset* to clear the message.

Pressure Gauge/PEEP Check

To perform a pressure gauge/PEEP check:

1. Verify that the pressure gauge moves up and down with each breath.
2. Select PEEP and Peak Paw to show in each of two *Monitor data* buttons.
3. Adjust PEEP to 5 cmH₂O. Verify that the *Monitor data* button shows a PEEP value of 4–6 cmH₂O. Reduce PEEP to 0.
4. Select Pressure Control and set PC to 20 cmH₂O. Verify that the *Monitor data* button shows a Peak Paw of 17–23 cmH₂O.

Volume/Minute Volume/Respiratory Rate Monitor Check

To perform a volume/minute volume/respiratory rate monitor check:

1. Change the breath type back to Volume Control, and confirm Tidal Volume is set to 500.
2. Select VT, Min Vol, and RR Tot to show in each of three *Monitor data* buttons. Verify that VT= 450–550, Min Vol = 6.75–8.25, and RR Tot = 13–17.

Power Pac Battery Pack and Backup Battery Check

To perform a Power Pac battery pack and backup battery check:

1. Unplug the AC power supply, and clear the alarm by pressing the *Audio Paused/Reset* button. Verify that the ventilator continues to ventilate, and the Power Pac battery gauge (blue icon) reads at least 80%. If the battery charge level is insufficient, plug the ventilator into an external power source to fully charge the internal dual battery system.
2. Remove the Power Pac battery pack. Verify that the ventilator continues to ventilate, the alarm sounds, the alarm LEDs light, and the message in the message area indicates that the backup battery is in use.
3. Verify that the battery gauge is now red (for secondary backup battery) and reads at least 80%. If the secondary backup battery charge level is insufficient, reinsert the Power Pac battery and plug the ventilator into an external power source to fully charge the system.
4. Replace the Power Pac battery pack, and verify that the audible alarm clears but the message remains.
5. Reconnect the AC power supply into the Power Pac battery pack and confirm that the external power LED turns green.
6. Press the *Audio Paused/Reset* button repeatedly until all alarm messages are cleared.

Brightness Check

Press the *Brightness* button, and verify that it scrolls through four levels of brightness. Set the brightness at desired level.

5.2 Patient Set-Up Procedure



WARNING:

Review all of the General Warnings and Cautions in Chapter 1 prior to using the ventilator.

All ventilator settings and alarm limits must be appropriate for the patient's condition, according to the therapy prescribed by a physician.

To perform a patient setup:

1. Press the momentary power switch located on the back of the ventilator to turn the ventilator on. The ventilator performs a brief self-test to ensure proper microprocessor function. During the self-test, verify that the Startup screen appears, the LEDs light, and the audible alarm sounds briefly.

2. Ensure the ventilator, patient circuit, and accessories are assembled correctly, as described in Chapter 3.
3. Make sure the ventilator has passed the quick check procedure.
4. Perform the circuit check. Resolve any issues. Reference *Circuit Check Button* on page 4-5.
5. Set all parameters per physician's prescription using manual adjustment or a custom or default preset. Reference Chapter 9 for specifications on all settings.
 - a. Select mode and breath type. Set all parameters on the Main screen and relevant parameters on the More screen.
 - b. Select safe/appropriate alarm limits on the Alarms screen.
 - c. Ensure that the alarm loudness is set loud enough for the alarm to be heard under all circumstances.
6. Place a test lung on the patient end of the breathing circuit, and press the *Start Ventilation* button on the touch screen.
7. Ensure that the ventilator starts operating appropriately.



Note:

Flow and volume are set and measured at the ambient temperature pressure saturated (ATPS) condition.



Note:

While ventilating a test lung, peak pressure for volume breaths and volume delivery for pressure breaths will be different than they will be on the patient. Pressure Support breaths will not perform the same way they do on patients. And PEEP may cause auto-triggering. These differences may cause nuisance alarms during this step.

8. When ready, remove the test lung and attach the patient connection of the breathing circuit to the patient interface.
9. Monitor the patient settings and check for appropriate alarm settings.
10. Verify that the patient trigger icon lights each time the patient initiates a spontaneous breath. Re-adjust sensitivity (Ptrig or Flow trig if using on-airway flow sensor) as necessary to ensure comfortable triggering without auto-triggering. When using PEEP while ventilating a patient with an airway leak, set NIV to on and adjust bias flow to stabilize the PEEP and eliminate auto-triggering at reasonable trigger settings.
11. Closely monitor the patient and ventilator to ensure appropriate oxygen delivery, and adequate oxygenation and ventilation.



WARNING:

Always ensure adequate monitoring is in place when ventilating patients.



WARNING:

If, at any time, the patient is not responding to ventilation appropriately, the patient should be taken off the ventilator immediately and connected to an alternate method of ventilation. Contact your health care provider or physician immediately.



Note:

To ensure best battery performance, always plug the ventilator into an external power source when it is available, even when the ventilator is not in use.

5.3 Troubleshooting Guide

Ventilation and alarm settings are determined by the physician’s prescription. Consult with the physician regarding ventilation and alarm settings.



Note:

Clear alarm messages with the *Audio Paused/Reset* button.



Note:

Review the entire operator’s manual for full user instructions.



Note:

Note that the minute volume alarms are expiratory minute volume alarms when the on-airway flow sensor is in use and they are inspiratory minute volume alarms when the on-airway flow sensor is not in use.



Note:

Backup Ventilation increases the respiratory rate in A/CMV and SIMV and provides pressure-controlled breaths in SPONT mode. It may be caused by the violation of a Low Minute Volume alarm or Apnea alarm. Resolve the alarm to resolve the Backup Ventilation.

Table 5-2. Troubleshooting

Problem/area of concern	Probable cause	Resolution
Touch screen does not respond to touch	Screen is locked by Autolock function (set on Utility screen).	Touch the lock icon in the lower right corner of the screen for 3 seconds to unlock the screen.
	Using basic domain and the parameters are changed to displays rather than buttons.	Touch the <i>Basic Domain</i> button in the lower right corner of the screen to toggle the domain to hospital (Hosp), and then press <i>Accept</i> .
Touch screen is dark/blank	Power Save is on (Utility screen) and the screen has “gone to sleep” to save power.	Touch the screen or push any button to “wake up” the screen.

Table 5-2. Troubleshooting (Continued)

Problem/area of concern	Probable cause	Resolution
Need to view all monitored values	N/A	Touch any monitored value at lower edge of the screen.
Alarm indicator not blinking but alarm message in the message window	Alarm condition is resolved.	Push <i>Audio Paused/Reset</i> to clear the messages one at a time. Hold for 3 seconds to clear all messages at once.
Water accumulating in the breathing circuit	Gas is cooling as it travels through the circuit tubing.	Keep tubing as short and warm as possible between the humidifier and the airway so that water remains in the vapor state. Keep tubing away from cold surfaces. Do not aim a cooling fan at the tubing. If appropriate, use a heated wire circuit.
	Water trap needs to be emptied.	Empty the water trap frequently.
Audible alarm is too quiet	Alarm loudness is set too low.	Touch <i>Alarms</i> , and then touch <i>Alarm Loudness</i> . Adjust setting to a higher number, and press <i>Accept</i> .
Power Pac battery does not last long enough	Not fully recharged.	Connect the Power Pac to external AC or DC power for at least 3 hours between uses.
	Ventilator settings/patient condition (a large leak during pressure ventilation, a high level of bias flow setting, or an aggressively breathing patient) demand more gas delivery than the standard settings.	The Power Pac battery is functioning normally. Carry at least one extra fully charged Power Pac battery (part number BAT3271A) for ventilator dependent patients and for patients whose ventilation pattern requires higher battery power consumption.
	Power Pac needs to be replaced.	Contact Covidien Technical Services for assistance. Reference Contact Information on page 1-9.
Check Circuit or Prox Line alarm	Circuit disconnect.	Reconnect the circuit.
	Humidity in proximal line.	Change where proximal line is connected to the circuit. Move it from the connection at the patient wye (wet environment) to an adapter placed directly on the inlet of the humidifier chamber (dry environment).
	No proximal inline filter in place.	Insert approved proximal inline filter (part number HT6004701).
	Inspiratory flow is too low, circuit pressure does not rise fast enough when the breath starts.	As appropriate, increase flow or change flow pattern in Volume Control or speed up slope rise in Pressure Control/Pressure Support.

Table 5-2. Troubleshooting (Continued)

Problem/area of concern	Probable cause	Resolution
Circuit check fails	Leak in breathing circuit.	Tighten all circuit and water trap connections. Trim ends of the proximal and exhalation valve tubings to enable a tighter fit. Check the integrity of/replace the exhalation valve diaphragm.
	Connecting test lung instead of occluding patient connection of the circuit in step 1.	Remove test lung and occlude the patient connection of the circuit during step 1.
	Incorrect assembly of circuit/exhalation valve.	See <i>Attaching a Patient Circuit</i> on page 3-6 for proper assembly.
	Incompatible circuit/exhalation valve.	Contact Covidien to verify if circuit is compatible. Reference <i>Contact Information</i> on page 1-9.
	Oxygen connected directly to the circuit.	Use the low flow oxygen reservoir or 50 psi air oxygen mixer. Connect oxygen devices to the fresh gas intake port after, not before, the circuit check is complete.
	Ventilator needs service.	Contact Covidien Technical Services for assistance. Reference <i>Contact Information</i> on page 1-9.
Green external power indicator on panel does not light when ventilator is plugged into external AC (wall) or DC (external battery or auto lighter outlet) power	No external power is reaching the ventilator. The ventilator is running from the internal battery system.	Check power cord connections. (L-shaped pinch fit connector on rear of ventilator should angle toward the midline of the ventilator, not away. See diagram on sticker.) Check that power outlet is active. External battery is depleted. Plug into another external battery, auto lighter, or AC power. Check/replace the fuse in the external battery system or auto DC cable. Contact Covidien Technical Services for assistance. Reference <i>Contact Information</i> on page 1-9.
Auto-triggering (at a typical trigger setting) (green trigger light illuminates when there is no patient effort)	Circuit leak, airway leak, or both.	Check for and resolve leaks if unintentional. If airway leak is intentional, turn on NIV and adjust bias flow/trigger settings so that the patient can trigger effectively without auto-triggering. Consider using the flow sensor and flow trigger.
In SIMV or SPONT modes, some or all breaths seem to last extra long	Leak is causing flow to remain high during Pressure Support breath delivery, so the PS exp. threshold (flow cycling off threshold) is never met.	Eliminate circuit leaks. Set the PS max i-time control to limit the breath delivery to a reasonable inspiratory time.

Table 5-2. Troubleshooting (Continued)

Problem/area of concern	Probable cause	Resolution
Occlusion alarm/Sustained Occlusion alarm The patient will not be ventilated. Manually ventilate the patient until this is resolved.	The patient’s expiratory gas pathway is occluded or partially occluded.	Evaluate everything in the patient’s pathway of exhalation to determine what is causing resistance and resolve the issue. Change HME, expiratory filter, or both, if used. Change the exhalation valve. Unkink expiratory drive line. Replace flow sensor.
Apnea alarm	No mandatory breaths or spontaneous efforts detected within the set time period of 5–70 seconds.	Determine if patient is breathing. Make sure Ptrig/Flow trig setting is set sensitive (low) enough. Use A/CMV or SIMV (not SPONT), and make sure respiratory rate setting is adequate.
High (Peak) Pressure alarm This alarm violation stops breath delivery until pressure drops.	Coughing/need for airway care or bronchodilator treatment.	Perform suctioning/airway care, or if due and prescribed, give prescribed bronchodilator treatment.
	Secretions too dry due to inadequate humidity.	Use heated humidifier with the appropriate temperature setting and keep tubing warm.
	Pneumatic nebulizer inline.	Contact Covidien Technical Services for assistance. Reference Contact Information on page 1-9.
	Supplemental oxygen flowing directly into breathing circuit.	Use the low flow oxygen reservoir or 50 psi air oxygen mixer.
	Kinked tubing.	Unkink the tubing.
	Sticky exhalation valve or on-airway flow sensor from medication treatments or secretions.	Install a clean exhalation valve, an on-airway flow sensor, or both.
	Ventilation settings mismatch the patient condition, such as an actively spontaneously breathing patient under controlled ventilation mode, ventilator’s inspiratory time (i-time) setting too long, flow setting too high, VT setting too high.	Evaluate patient and change settings (ventilation mode, flow, VT, i-time, flow waveform) as appropriate.
	Alarm setting too low.	Resolve appropriately.

Table 5-2. Troubleshooting (Continued)

Problem/area of concern	Probable cause	Resolution
<p>Low (Peak) Pressure alarm</p> <p>Note: Situations that violate the Low Pressure alarm in Volume Control may violate the High Inspiratory Minute Volume alarm or Low Expiratory Minute Volume alarm in Pressure Control. Seek similar remedies.</p>	Circuit leak (especially while using Volume Control).	Check for and resolve leaks in circuit or exhalation valve (similar to resolving failed exhalation valve calibration).
	Flow setting is too low (i-time setting is too high) in Volume Control.	Evaluate patient and change settings (flow, VT, flow waveform) as appropriate.
	Big airway leak while using Volume Control.	Evaluate cuff inflation/trach tube size. Reposition mask. Make sure mask is not vented. Use Pressure Control instead of Volume Control if clinically appropriate.
	Trigger setting too insensitive.	Use P _{trig} setting that is closer to zero.
<p>High (Expiratory) Minute Volume alarm</p> <p>This alarm is only active when the on-airway flow sensor is in place.</p>	Patient is breathing faster than usual.	Check patient for anxiety, pain, discomfort, or change in illness.
	A change in ventilator settings or patient condition has caused delivery of a higher patient tidal volume.	Check the patient. If appropriate, lower the Pressure Control/Pressure Support setting until the exhaled volume is suitable for the patient.
	High Min Vol alarm has not been set properly for use with on-airway flow sensor.	Set alarm appropriately.
	Pneumatic nebulizer inline.	Contact Covidien Technical Services for assistance. Reference Contact Information on page 1-9.
	Supplemental oxygen flowing directly into breathing circuit.	Use the low flow oxygen reservoir or 50 psi air oxygen mixer.
	On-airway flow sensor is not clean.	Replace sensor.
<p>Low (Expiratory) Minute Volume alarm</p> <p>This alarm is only active when the on-airway flow sensor is in place.</p>	Circuit or airway leak (not intentional).	Check for and resolve circuit leaks (similar to resolving failed exhalation valve calibration). Evaluate cuff inflation/trach tube size, increase as needed. If problem occurs only at night, make sure alarm settings are appropriate for day and night conditions. Reposition mask. Make sure mask is not vented.
	Intentional leak for speech.	If a speaking valve is in use, this alarm will need to be disabled. Make sure appropriate monitoring is in place to maintain patient safety.
	Patient is breathing slower than usual.	Check patient and resolve problems.
	Low Min Vol alarm has not been set properly for use with on-airway flow sensor.	Set alarm appropriately.
	Connected to a test lung with a resistor.	The resistor may be causing flow eddies that make the flow sensor measurement inaccurate. Try a test lung with less resistance.

Table 5-2. Troubleshooting (Continued)

Problem/area of concern	Probable cause	Resolution
High (Inspiratory) Minute Volume alarm On-airway flow sensor is not in place Note: Situations that violate the Low Pressure alarm in Volume Control may violate the High Inspiratory Minute Volume alarm or Low Expiratory Minute Volume alarm in Pressure Control. Seek similar remedies.	Large airway or circuit leak (Pressure Control or Pressure Support).	Check for and resolve leaks (similar to resolving failed exhalation valve calibration). Reposition mask. Make sure mask is not vented. Evaluate cuff inflation/trach tube size. If problem occurs only at night, make sure alarm settings are compatible with day and night conditions.
	Patient is breathing faster than usual.	Check patient for anxiety, pain, discomfort, or change in illness.
	Circuit just reconnected after disconnect.	Press <i>Audio Paused/Reset</i> ; the alarm will resolve by itself.
	Auto-triggering due to airway leak.	Turn on NIV and increase Bias Flow setting. Balance Trigger and Bias Flow settings to provide the most effective triggering and comfort.
	High Min Vol alarm has not been set properly for use without on-airway flow sensor.	Set alarm appropriately or reconnect on-airway flow sensor.
Low (Inspiratory) Minute Volume On-airway flow sensor is not in place This will trigger Backup Ventilation if the Backup ventilation link is set to LMV or Both.	Need suctioning/airway care when using Pressure Control or Pressure Support.	Suction/perform airway care.
	Upper airway occlusion during mask ventilation.	Reposition head/neck.
	Supplemental oxygen flowing directly into breathing circuit.	Use the low flow reservoir or 50 psi air oxygen mixer instead of adding oxygen directly into the circuit.
	Ventilator is not triggering with each breathing effort.	Use P <trig> setting that is closer to zero or add flow sensor and use flow trigger. </trig>
	Patient is breathing slower than usual.	Replace HME if one is in use. Assess the patient and ventilator settings.
	Low Min Vol alarm has not been set properly for use without on-airway flow sensor.	Set alarm appropriately or reconnect on-airway flow sensor.
High VTE alarm High Expiratory Tidal Volume alarm This alarm is only active when the on-airway flow sensor is in place.	A change in ventilator settings or patient condition has caused delivery of a higher patient tidal volume.	Check the patient. If appropriate, lower the Pressure Control/Pressure Support setting until the exhaled volume is suitable for the patient.
	High VTE alarm has not been set properly for use with the on-airway flow sensor.	Set alarm appropriately.
	On-airway flow sensor is not clean.	Replace sensor.

Table 5-2. Troubleshooting (Continued)

Problem/area of concern	Probable cause	Resolution
<p>BUV (Backup Ventilation) Backup Ventilation is delivered in response to Low Min Vol alarm or Apnea alarm (set in More> Utility>Custom Settings> BUV screen).</p>	<p>Same causes as Low Min Vol or Apnea alarm. Resolved when inspiratory minute volume rises to 10% above the Low Min Vol alarm setting or Apnea alarm is resolved.</p>	<p>Resolve Low Min Vol alarm or Apnea alarm. Note: Backup Ventilation is suspended for 1 minute when turning on the ventilator and after any ventilation setting is adjusted or screens changed.</p>
<p>High Baseline Pressure alarm</p>	<p>Circuit check was not done when circuit was installed.</p>	<p>Do a circuit check every time a fresh circuit/exhalation valve is installed.</p>
	<p>Increased resistance to exhalation.</p>	<p>Evaluate everything in the patient’s pathway of exhalation to determine what is causing resistance and resolve the issue. Change HME, expiratory filter, or both, if used. Change the exhalation valve. Unkink expiratory drive line. Replace flow sensor with a clean one.</p>
	<p>Exhalation drive tubing is kinked.</p>	<p>Unkink the tubing.</p>
	<p>Auto-triggering due to leaks (if PEEP is set >0).</p>	<p>Check for and resolve leaks. Activate NIV and adjust bias flow on the More screen.</p>
	<p>Auto-triggering due to flow or pressure trigger settings being too low.</p>	<p>Readjust trigger settings to eliminate auto-triggering (higher number is less sensitive).</p>
	<p>Pressure Support breaths are not ending when patient exhales.</p>	<p>Increase expiratory threshold, decrease PS max i-time (More screen), or do both.</p>
	<p>Too little time allowed for exhalation.</p>	<p>As appropriate, shorten i-time, change flow waveform, decrease respiratory rate.</p>
<p>Pressure Control Setting Not Reached alarm</p>	<p>Big leak/disconnect.</p>	<p>Check for and resolve leaks or disconnect.</p>
<p>No external power Power Switchover alarm Ventilator will use its internal battery system. Unless external power was disconnected on purpose, ALL resolutions MUST include making sure that the green external power LED lights up.</p>	<p>Ventilator does not detect external power.</p>	<p>If intentionally unplugged, press <i>Audio Paused/Reset</i> to clear the message. If unintentional, plug the ventilator into external power.</p>
	<p>Power source is switched off.</p>	<p>Switch power source on.</p>
	<p>Power cord is not fully inserted/ inserted backwards.</p>	<p>Fully insert power cord in the proper orientation (angled to the right). Refer to illustrated label on Power Pac.</p>
	<p>Power source is depleted.</p>	<p>Connect to another power source. If power was not purposely disconnected and none of these actions resolves the issue, call for service immediately.</p>
<p>Running on Backup Battery alarm Power Pac is nearing depletion and ventilator has switched to the emergency backup battery.</p>	<p>Minimum of 30 minutes internal battery system use time left.</p>	<p>Connect to external AC or DC power, and make sure that the green external power LED lights up. Do not leave the ventilator until you see the green light.</p>

Table 5-2. Troubleshooting (Continued)

Problem/area of concern	Probable cause	Resolution
Backup Battery Shutdown Imminent alarm Internal battery system is depleted. Connect to external power immediately.	Minimum of 15 minutes internal battery system use time left.	Connect to external AC or DC power, and make sure that the green external power LED lights up. Do not leave the ventilator until you see the green light. If no external power is available, prepare an alternate method of mechanical ventilation immediately.
High Respiratory Rate alarm The delivered breath rate is higher than the alarm setting.	Patient is breathing fast.	Check the patient and resolve.
	Auto-triggering of ventilator caused by leak.	Resolve leak in circuit by tightening all connections. If airway leak, turn on NIV and increase bias flow setting.
	The sensitivity setting for flow, pressure trigger, or both is too sensitive.	Optimize trigger setting(s).
	Double triggering caused by too short of an inspiratory time setting.	As appropriate, increase i-time, or PS max i-time, or both. Decrease expiratory threshold.
High O ₂ alarm The delivered oxygen concentration is higher than set high limit.	Oxygen was increased prior to an intervention (for example, suctioning) and was not reduced back to prescribed value.	Adjust oxygen setting back to prescribed value.
	Low flow reservoir is in use and: <ul style="list-style-type: none"> • Patient's minute volume has decreased • Airway or circuit leak has decreased during pressure control and so delivered minute volume is lower • NIV is on and bias flow was decreased • Oxygen concentrator is putting out a higher FiO₂ than expected 	Evaluate patient and readjust settings or alarm as appropriate.
	High O ₂ alarm is set inappropriately.	Set the High O ₂ alarm appropriately.
	Oxygen sensor calibration was not done appropriately.	Calibrate oxygen sensor appropriately.

Table 5-2. Troubleshooting (Continued)

Problem/area of concern	Probable cause	Resolution
Low O ₂ alarm Delivered oxygen concentration is lower than set high limit.	Oxygen supply loss or disconnect or cylinder empty.	Restore oxygen supply.
	Low flow reservoir is in use and: <ul style="list-style-type: none"> • Patient's minute volume has increased • Airway or circuit leak has increased during Pressure Control and so delivered minute volume is higher • NIV is on and bias flow was increased • Oxygen concentrator is putting out a lower FiO₂ than expected 	Resolve leak, evaluate patient, and readjust settings or alarm as appropriate.
	Low O ₂ alarm is set inappropriately.	Set the Low O ₂ alarm appropriately.
	Oxygen sensor calibration was not done appropriately.	Calibrate oxygen sensor appropriately.
	Patient inhales room air through emergency intake valve.	Make sure the ventilator settings (such as flow, tidal volume, i-time, and trigger) match the patient needs.
O ₂ Sensor Failure alarm	O ₂ sensor needs calibration, is depleted, or is past recommended replacement time.	Perform 0.21 and 1.00 FiO ₂ calibrations. If either calibration fails when performed properly, replace the sensor.
The system date time has reset to 2006/01/01 or the message "Date has reset. Please replace coin battery" is shown.	The internal coin battery needs to be replaced.	Revise the date and contact Covidien Technical Services for assistance. Reference Contact Information on page 1-9.

For further assistance, contact Covidien Technical Services. Reference [Contact Information](#) on page 1-9.

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6 Ventilator Alarms

6.1 Setting Alarms

Reference *Alarms* on page 9-5 for alarm priority level, ranges, and descriptions for the Newport™ HT70 ventilator.

The alarm controls are changed just like the parameter controls—with a simple touch/adjust/accept method:

1. Touch the *Alarms* button to enter the Alarms screen.
2. Touch the desired alarm control (it will appear highlighted).
3. Use the up and down arrow buttons to make the desired adjustment.
4. Press the *Accept* button to confirm the change.

Several adjustments can be made before accepting the changes. When satisfied with the changes, accept them all by pressing the *Accept* button once.

If the *Accept* button has not already been pressed, press *Cancel* to go back to the previous settings.

The minute volume alarms are expiratory minute volume alarms when the on-airway flow sensor is in use, and they are inspiratory minute volume alarms when the on-airway flow sensor is not in use.



WARNING:

Setting any alarm limits to zero or off, or to extreme high or low values, can cause the associated alarm not to activate during ventilation, which reduces its efficacy for monitoring the patient and alerting the clinician to situations that may require intervention.



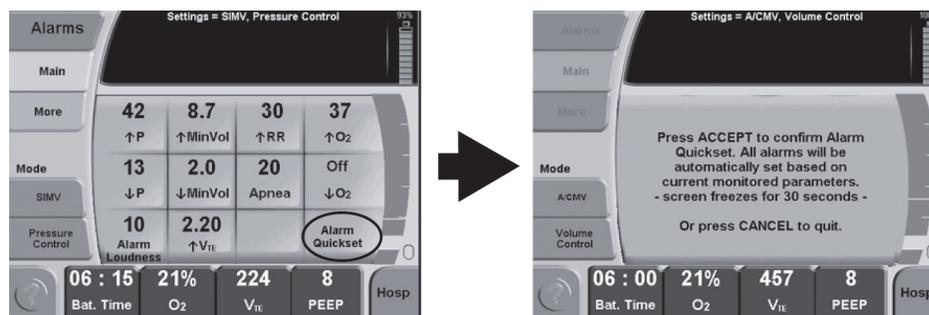
Note:

All configurable alarm settings are stored in the ventilator's non-volatile internal memory, ensuring that they are retained during power loss conditions or when the ventilator is powered off.

6.1.1 Alarm Quickset

When no alarms are being violated, the ventilator can automatically set the alarm limits. From the Alarms screen, touch *Alarm Quickset*, and confirm the selection by pressing the *Accept* button.

Figure 6-1. Alarm Quickset



The ventilator will monitor ventilation for 30 seconds and then set the alarm limits. During the 30-second period, the touch screen will not respond unless an alarm occurs or the *Cancel* button is pressed.

If an alarm occurs during the monitoring period, Alarm Quickset is canceled. If this occurs, check the ventilator settings and confirm that they meet the physician's prescription and are meeting the patient's needs. Adjust alarms manually if needed to clear any alarm condition. Then activate Alarm Quickset again.

Alarm Quickset will not activate in standby condition; the ventilator must be in ventilation condition.

6.2 Alarm Indicators



Note:

The alarm indicator LEDs in the handle of the Newport™ HT70 ventilator are designed to be visible to the operator at any position when the ventilator is visible to the operator. Specific alarm detail (shown in the message area of the touch screen) is designed to be readable from up to 4 meters from the touch screen, at a viewing angle of up to 30°. The ventilator is constructed to meet the compliance requirements of the IEC 60601-1-8 alarm standard.

When an alarm limit is violated, the following events occur:

1. The message area changes color according to alarm priority, and an alarm message is shown.
2. The alarm LEDs in the handle of the ventilator flash.
3. The alarm parameter button on the Alarms screen (if it is an adjustable alarm) is highlighted.
4. An audible alarm sounds.

When the violation is no longer in effect, the alarm message latches (remains steadily visible) until it is reset by pressing the *Audio Paused/Reset* button.

6.2.1 Audio Paused/Reset Button

Press the *Audio Paused/Reset* button to mute the audible alarm for 1 minute (60 sec). Once an alarm condition is corrected, press this button to clear (reset) the alarm message. Press repeatedly to clear multiple messages. Press and hold for 3 seconds to clear all alarm messages at once.



WARNING:

Failure to identify and correct alarm violations may result in patient injury.

6.2.2 Audio Paused LED

Located next to the *Audio Paused/Reset* button, the audio paused LED remains lit during the 1 minute audio paused period.

6.3 User-Adjustable Alarms

Table 6-1. User-Adjustable Alarms

↑P (High Pressure)	↑Min Vol (High Inspiratory or Expiratory* Minute Volume)
↓P (Low Pressure)	↓Min Vol (Low Inspiratory or Expiratory* Minute Volume)
↑RR (High Respiratory Rate)	↑O ₂ (High O ₂)
Apnea (time adjustment)	↓O ₂ (Low O ₂)
↑VTE (High Tidal Volume)*	

*only available on the HT70PM when the on-airway flow sensor is in use

The HT70M model ventilator monitors the volume of gas output from the ventilator; therefore, the High and Low Inspiratory Minute Volume alarms respond to changes in delivered, not exhaled, volumes. For this model, use the High Inspiratory Minute Volume Alarm (↑Min Vol) to detect leaks or disconnects while using pressure-controlled ventilation, and use the Low Pressure Alarm (↓P) to detect circuit leaks or disconnect while using volume-controlled ventilation.

For the HT70PM model, if the on-airway flow sensor is in use, the sensor measures exhaled volumes. So in this case, the ventilator will automatically show exhaled tidal volume and exhaled minute volume, and the alarms will respond accordingly. That is, when the on-airway flow sensor is in use, the Low Minute Volume alarm will respond to leaks and disconnects when minute volume leaving the patient drops to the alarm setting. If exhaled volumes are important to the care of the patient, Covidien recommends the HT70PM model with the on-airway flow sensor. To verify exhaled volumes when not using the flow sensor, use a separate exhaled volume monitor.

6.3.1 Low Pressure Alarm

The Low Pressure alarm determines the minimum pressure that must be attained in the breathing circuit during mandatory breaths. It should be set as close to the patient's normal peak pressure as possible.

The Low Pressure alarm limit does not apply to any breaths in the SPONT mode or to spontaneous breaths in SIMV mode.

**Note:**

The Low Pressure alarm and PEEP/CPAP settings are linked; the Low Pressure alarm limit must be greater than the PEEP/CPAP setting. When NIV is on, increasing the PEEP/CPAP setting will automatically increase the Low Pressure alarm setting to maintain a minimum interval of 1 cmH₂O greater than the PEEP/CPAP setting. When NIV is off, increasing the PEEP/CPAP setting will automatically increase the Low Pressure alarm setting to maintain a minimum interval of 3 cmH₂O greater than the PEEP/CPAP setting.

6.3.2 High Pressure Alarm

The High Pressure alarm setting determines the maximum pressure allowed in the breathing circuit. In general, it should be set 10–15 cmH₂O above the patient's normal peak pressure, but always at or below a safe ventilating pressure.

6.3.3 Low Inspiratory Minute Volume Alarm

The Low Inspiratory Minute Volume alarm alerts the caregiver when delivered minute volume decreases to the set alarm level. Delivered minute volume may decrease due to slowed or absent patient breathing effort in any mode/breath type. It may also decrease due to worsening lung conditions or secretion buildup in Pressure Control or Pressure Support.

This alarm may be linked with Backup Ventilation.

When the NIV feature is turned on, the Low Inspiratory Minute Volume alarm can be set to off.

6.3.4 Low Expiratory Minute Volume Alarm

The on-airway flow sensor must be in use to enable the Low Expiratory Minute Volume alarm.

The Low Expiratory Minute Volume alarm alerts the caregiver when exhaled minute volume decreases to the set alarm level. Exhaled minute volume may decrease due to slowed or absent patient breathing effort in any mode/breath type. It may also decrease due to worsening lung conditions or secretion buildup in Pressure Control or Pressure Support. It may also decrease due to leaks at the airway (such as deflated cuff) or in the breathing circuit.

This alarm is not compatible with use of a speaking valve. The speaking valve diverts the patient's exhaled gas around the trach tube so that it can pass through the vocal cords, and therefore the gas does not exit the patient through the flow sensor. When using a speaking valve, turn NIV on

and then disable the Low Expiratory Minute Volume alarm. Make sure to provide appropriate monitoring and alarms from other sources to ensure patient safety.

This alarm may be linked with Backup Ventilation.

When the NIV feature is turned on, the Low Expiratory Minute Volume alarm can be set to off.

6.3.5 High Inspiratory Minute Volume Alarm

The High Inspiratory Minute Volume alarm alerts the caregiver when delivered minute volume increases to the set alarm level. This alarm helps alert the caregiver to increases in breath rate, auto-triggering, and during Pressure Control or Pressure Support, to large leaks or tubing disconnects.

6.3.6 High Expiratory Minute Volume Alarm

The on-airway flow sensor must be in use to enable the High Expiratory Minute Volume alarm.

The High Expiratory Minute Volume alarm alerts the caregiver when exhaled minute volume increases to the set alarm level. This alarm helps alert the caregiver to increases in breath rate, auto-triggering, or improvements in lung compliance.

6.3.7 High Respiratory Rate Alarm

The High Respiratory Rate alarm alerts the caregiver if the total respiratory rate rises above the alarm setting.

6.3.8 High O₂ Alarm

The O₂ sensor must be installed and enabled to enable the High O₂ alarm.

This alarm alerts the caregiver if the delivered oxygen concentration increases to the ↑O₂ alarm setting.

6.3.9 Low O₂ Alarm

The O₂ sensor must be installed and enabled to enable the Low O₂ alarm.

This alarm alerts the caregiver if the delivered oxygen concentration decreases to the ↓O₂ alarm setting.

6.3.10 High Tidal Volume Alarm

The on-airway flow sensor must be in use to enable the High Tidal Volume alarm.

This alarm alerts the caregiver if the measured exhaled tidal volume increases to the \uparrow VTE alarm setting. This alarm will help alert the caregiver to changes in patient condition during pressure support/pressure control ventilation.



Note:

The High Tidal Volume alarm and Tidal Volume settings are linked; the High Tidal Volume alarm limit must be at least 10 mL greater than the tidal volume setting. Increasing the tidal volume setting will automatically increase the High Tidal Volume alarm setting to maintain this minimum interval.

6.3.11 Apnea Alarm

The Apnea alarm is violated when no mandatory breaths or detected spontaneous efforts occur within the set time period.

This alarm may be linked with Backup Ventilation.

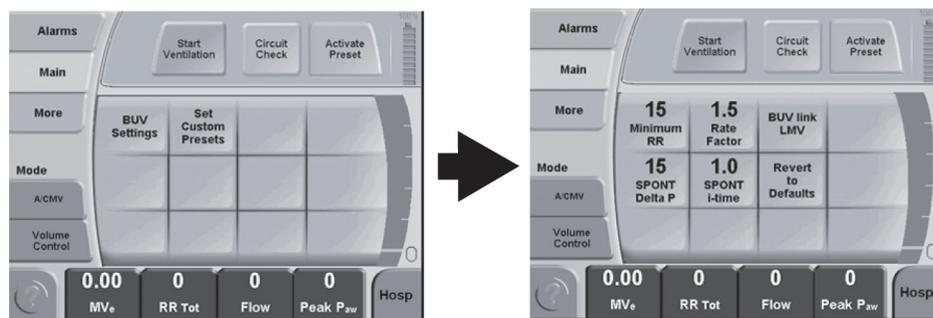
6.4 Backup Ventilation

Backup Ventilation can be set to be activated by either the Low Inspiratory/Expiratory* Minute Volume alarm, or the Apnea alarm, or both. See the More>Utility>Custom Setting screen parameters for selecting BUW criteria.

When Backup Ventilation is activated, the following events occur:

- The alarm indicator blinks
- An audible alarm sounds
- A Backup Ventilation alert is shown in the message window

Figure 6-2. Backup Ventilation



*only available on the HT70PM



Note:

Backup Ventilation is functional in all modes/breath types.

6.5 Automatic Alarms

The following alarms are automatically set by the ventilator based on patient settings or device condition. Violated alarms are indicated by an audible alarm, an alarm message shown on the touch screen, and the LEDs in the handle flashing.

Table 6-2. Automatic Alarms

High Baseline Pressure	O ₂ Cylinder Low/Empty
Low Baseline Pressure	Pressure Control Setting Not Reached
Occlusion	Backup Battery Low Charge
Sustained Occlusion	No External Power
Check Circuit or Prox Line	Shut Down Alert
Device Alert	Backup Battery Low
Power Pac Battery Pack Low	Backup Battery Shutdown Imminent
Integrated Power Pac Failure	Internal Temperature
Switching to Backup Battery	Backup Battery Temperature
Running on Backup Battery	Power Pac Temperature
Motor Fault	Backup Battery Failure
Flow Sensor Disconnect/Failure*	

*only available on the HT70PM when the on-airway flow sensor is in use

6.5.1 High Baseline Pressure Alarm

The High Baseline Pressure alarm is activated by obstruction or high resistance to exhalation. Check for obstructions to patient exhalation or for improper exhalation valve function. This could be caused by aerosol medication buildup on the exhalation valve, an occluded filter, or incomplete exhalation due to auto-triggering.

6.5.2 Low Baseline Pressure Alarm

The Low Baseline Pressure alarm is activated by an unstable baseline (for example, leak in the breathing circuit or at the patient interface). Check for leaks and for improper exhalation valve operation. If the leak is purposeful (that is, deflated tube cuff), turn NIV on and adjust bias flow to stabilize PEEP (baseline).

6.5.3 Occlusion Alarm

An Occlusion alarm is activated by an obstruction in the breathing circuit. The ventilator will attempt to relieve the pressure that has built up in the circuit and will not deliver additional breaths until the situation is resolved. The alarm resets when the occlusion is resolved and breath delivery will resume at that point.

6.5.4 Sustained Occlusion Alarm

A Sustained Occlusion alarm is activated if the Occlusion alarm is not cleared within 10 seconds or two breath periods, whichever is shorter. The ventilator will attempt to relieve the pressure and will not deliver additional breaths until the situation is resolved. The alarm resets when the occlusion is resolved and breath delivery will resume at that point.

6.5.5 Check Circuit or Prox Line Alarm

The Circuit Check or Prox Line alarm indicates that the circuit has become disconnected or the proximal pressure tubing is disconnected, kinked, or has water in it. Check the circuit for disconnects or problems with the prox line pressure tubing/prox line filter.

**Note:**

Be sure to keep the prox inline filter clean and dry at all times.

6.5.6 Flow Sensor Disconnect/Failure Alarms

The Flow Sensor Disconnect and Failure alarms indicate that the on-airway flow sensor has become disconnected, the tubing has been partially blocked with water, or the flow sensor is no longer working.*

*only available on the HT70PM when the on-airway flow sensor is in use

6.5.7 Pressure Control Setting Not Reached Alarm

The Pressure Control Setting Not Reached alarm is activated by inadequate pressure rise during pressure-controlled breaths. Check for leaks and that the slope/rise is set to a fast enough level.

6.5.8 No External Power Alarm

The No External Power alarm is activated by disconnection from the power cord or a power interruption. The ventilator will automatically switch to the Power Pac battery pack or backup battery. Pressing the *Audio Paused/Reset* button will clear the alarm.

6.5.9 Device Alert Alarm—System Error

The Device Alert alarm is activated when the microprocessor detects a functional problem with the ventilator. When this occurs, an alternate means of ventilation should be used. The ventilator must be powered down by pressing the on/off button on the back of the unit.

If the cause of the device alert does not allow the ventilator to show the alarm message and the device alert indicator to light, the ventilator will shut down, and the Shut Down Alert alarm will activate.



WARNING:

If a device alert alarm occurs, immediately disconnect the patient from the ventilator and provide an alternate method of ventilation until the cause of the alert has been determined and corrected.

6.5.10 Motor Fault Alarm

The Motor Fault alarm is activated when the microprocessor detects a functional problem with the motor or motor control systems. When this occurs, the ventilator should be replaced and sent in for service.

6.5.11 Shut Down Alert Alarm

The Shut Down Alert alarm occurs when the ventilator is turned off. A continuous audible alert indicates the ventilator is no longer operating. The alert beeps will continue for at least 15 minutes or until muted by pressing the *Audio Paused/Reset* button.

6.5.12 Internal Temperature Alarm

The Internal Temperature alarm indicates that the internal temperature has exceeded specifications. Environmental temperature during operation should not exceed 60°C (140°F). Connect the ventilator to an external power source as soon as possible and take steps to make the environment cooler. Also check that the fan filter is clean.

6.5.13 O₂ Cylinder Low/Empty Alarms

This alarm indicates that the oxygen cylinder that was set up in the O₂ calculator data screen has reached a low or empty level. The O₂ Cylinder Low alarm will sound when the time reaches 10 minutes. The O₂ Cylinder Empty alarm will sound when the estimated time reaches 5 minutes.

6.6 Battery Alarms

6.6.1 Power Pac Battery Pack Low Alarm

The Power Pac Battery Pack Low alarm indicates that the Power Pac battery pack should be replaced with a fully charged battery pack or the ventilator should be plugged into an external power supply. Pressing the *Audio Paused/Reset* button will clear this alarm.

6.6.2 Integrated Power Pac Failure Alarm

The Integrated Power Pac Failure alarm message indicates there was a loss of communication with the Power Pac battery. The charge level indicator will not be correctly updated. Replace the Power Pac battery.

6.6.3 Switching to Backup Battery Alarm

The Switching to Backup Battery alarm occurs when the Power Pac battery pack can no longer power the ventilator and the unit switches to the backup battery. Connect the ventilator to an alternate power source immediately or install a fully charged battery pack. Pressing the *Audio Paused/Reset* button will clear this alarm.

6.6.4 Running on Backup Battery Alarm

An audible alarm sounds if the ventilator has been running on the backup battery for more than 15 minutes. This alarm can be muted, but a reminder alarm will occur every 5 minutes until a fully charged Power Pac battery pack is inserted or an external power source is connected.

6.6.5 Backup Battery Low Alarm

The Backup Battery Low alarm indicates that there is a minimum of 15 minutes left on the backup battery. Connect the ventilator to an alternate power source immediately. This alarm can be muted, but a reminder alarm will sound every minute until a fully charged Power Pac battery pack is inserted or an external power source is connected.

6.6.6 Backup Battery Shutdown Imminent Alarm

The Backup Battery Shutdown Imminent alarm indicates that the backup battery is empty and about to shut down. It cannot be muted until the ventilator is turned off, a fully charged Power Pac battery pack is inserted, or an external power source is connected.

**WARNING:**

Immediately secure an external power source or insert a fully charged Power Pac battery pack when the Backup Battery Shutdown Imminent alarm occurs.

**Note:**

It is highly recommended to carry at least one extra, fully charged Power Pac during transport or outdoor applications.

6.6.7 Backup Battery Failure Alarm

The Backup Battery Failure alarm indicates that the backup battery is faulty and will not safely operate the ventilator. Do not use the ventilator on battery power until it has been serviced.

6.6.8 Backup Battery Low Charge Alarm

The Backup Battery Low Charge alarm indicates that the backup battery has insufficient charge to maintain ventilation if the Power Pac battery runs low or is removed. Attach to external power to charge both batteries. If the backup battery does not charge within 3 hours, do not use the ventilator on battery power until it has been serviced.

6.6.9 Power Pac Battery Pack Temperature Alarm

The Power Pac Battery Pack Temperature alarm indicates that the Power Pac battery pack temperature has exceeded specifications for the battery. Replace the Power Pac battery pack with a fully charged one. Contact Covidien Technical Services for repair or replacement of the battery.

6.6.10 Backup Battery Temperature Alarm

The Backup Battery Temperature alarm message indicates that the backup battery temperature has exceeded specifications for the battery. Connect the ventilator to external power; do not use on battery power until the ventilator has been serviced. Use an alternate means of ventilation and have the ventilator serviced.

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7 Battery Operation

7.1 Internal Dual Battery System

The Newport™ HT70 ventilator's internal dual battery system consists of two internal independent but coordinated lithium ion batteries: the Power Pac, located on the back of the ventilator, and the secondary backup battery inside the ventilator. The internal dual battery system can provide up to 10 hours of operation at standard settings* when new and fully charged. This system assures continued support during transport, daily activities or power outages.

Proper care and maintenance of the internal dual battery system will ensure the longest life.



Note:

Always plug the Newport™ HT70 ventilator into an external power source when available. Plug the ventilator into an external power source even when not in use to insure best battery performance. Check the battery capacity on the front panel before removing from external power.



Note:

For long-term storage the batteries should be recharged every 6 months. If the storage temperature is above 80°F (27°C), then the batteries should be charged every 3 months.

7.1.1 Power Pac Battery Pack

The integrated Power Pac battery pack (BAT3271A) is a detachable, "hot-swappable" battery. It easily slides out and can be replaced with a fully charged battery pack without interrupting ventilation.

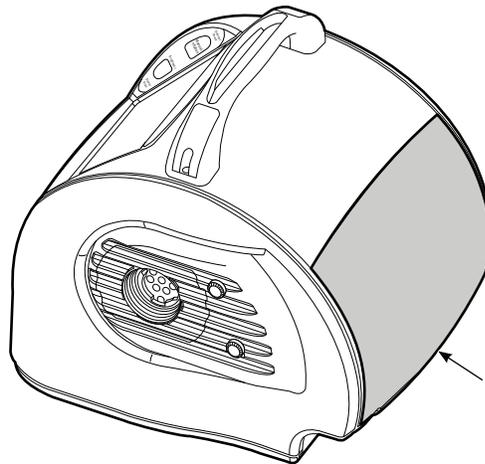
Charge the Power Pac for a minimum of 3 hours for 100% recharge. If the battery charge is not fully depleted, the charge time may be less.



Note:

Covidien recommends keeping an extra Power Pac with the Newport™ HT70 ventilator.

Figure 7-1. Power Pac



When the ventilator is used for transport applications, ensure that the Power Pac battery pack is fully charged prior to use. It is highly recommended to carry an extra, fully charged Power Pac during transport or outdoor applications.

The Power Pac can be charged independently from the ventilator and has an LED on the bottom edge to show charge condition. To view the charge condition, push the button on the bottom edge of the Power Pac (green = approximately 90% or higher charge level, amber = charge not completed, red = battery depleted). Always attach the Power Pac to the ventilator and turn it on to verify the actual charge level percentage (shown in the message display).

***Standard Settings:** Fully charged, new battery in good condition. Power Save on. Peak pressures below 30 cmH₂O with these settings:

- Mode = A/CMV
- Respiratory rate = 15
- Tidal volume = 500 mL
- Inspiratory time = 1.0 seconds
- PEEP = 0

7.1.2 Backup Battery

The secondary backup battery will provide a minimum of 30 minutes of operation. The ventilator will automatically switch to the backup battery whenever the Power Pac battery pack is removed or when the Power Pac power is low and the Switching to Backup Battery alarm occurs.

7.2 Conditions that Affect Battery Use Time

Each of the items listed below will affect the amount of time that the internal dual battery system will last:

- Power save
- Pressure
- Respiratory rate
- PEEP on or off
- Time/usage

The most significant setting that affects battery use time is Power Save. If Power Save is off, battery use time is decreased by about 30%. When Power Save is on, the screen will go to sleep (go blank) to save energy. An active alarm will temporarily end Power Save, and the screen will become active. Power Save will resume 2 minutes after the alarm condition is resolved.

Peak pressures and respiratory rate also affect battery use time. If the peak pressure rises above 30 cmH₂O consistently and the respiratory rate is above 20, expect to lose another 15% to 25% of the battery use time.

Using PEEP means that the bias flow will be in use. As this means that the twin pistons will run during both inspiration and exhalation, battery time will be shorter with PEEP on.

As the batteries age with use, the time that the ventilator will operate on battery power from a fully charged state will decrease. Replace the Power Pac battery pack every 24 months or sooner if battery operation time is insufficient for usage.

If the ventilator will be powered from the Power Pac battery pack for an extended period, ensure that the battery pack is fully charged prior to use.



Note:

Covidien recommends carrying at least one extra, fully charged Power Pac during transport or outdoor applications.

7.3 Check Battery Charge Level/Battery Time Estimator

Before using the Newport™ HT70 ventilator for transport or when planning to use the internal dual battery system as the primary power source, always check the Power Pac and backup battery charge condition. The charge level indicator on the touch screen shows the percent of charge available. A blue battery icon indicates the status for the Power Pac battery pack, and a red battery icon indicates the status for the backup battery. A gray battery icon with a red question mark indicates there was a loss of communication between the ventilator and the Power Pac battery. To view the backup battery condition, temporarily remove the Power Pac.

Also check the battery time estimator shown on the monitoring screen. When the ventilator is disconnected from external power, this indicator shows the estimated time remaining based on the current ventilation settings.

**Note:**

The battery use time that is shown on the monitor is an estimate only. It can be affected by many factors, such as the environmental temperature, age of battery, etc. Also, battery use time will change as ventilation conditions change. Do not rely solely on this estimate. Check the battery charge level indicator frequently to confirm actual battery consumption.

When installing a replacement Power Pac during battery operation, always ensure that the charge level LED (located on the bottom of the Power Pac) is green, indicating that the charge level is approximately 90% or higher. Attach the Power Pac to the ventilator and power it on to verify the actual charge level percentage (shown in the message display area).

7.4 Best Use Tips

When the battery use time begins to encroach on the user's lifestyle or impede transport times, it is time to replace the Power Pac battery pack (BAT3271A). Use these tips to help prolong the life of the batteries.

- Always keep the Power Save function on.
- Use an external power source when possible. For example, when traveling, use the optional DC auto lighter power adapter accessory to power the ventilator from an automobile lighter outlet.
- Always have a backup power source nearby, such as an extra Power Pac battery pack. When the Switching to Backup Battery alarm is activated, install the fresh Power Pac or plug into external power. This alarm means a minimum of 30 minutes of the emergency backup battery time is left.
- Keep both the Power Pac and backup battery fully charged. Partially discharged batteries will age faster.

**Note:**

Remember, the internal dual battery system is charging anytime the ventilator is connected to external AC or DC power.

7.5 Battery System Maintenance

Reference *Routine Maintenance* on page 8-5 for more information on integrated battery system maintenance.

Proper care of the battery system, including performing the following items, will preserve battery use time.

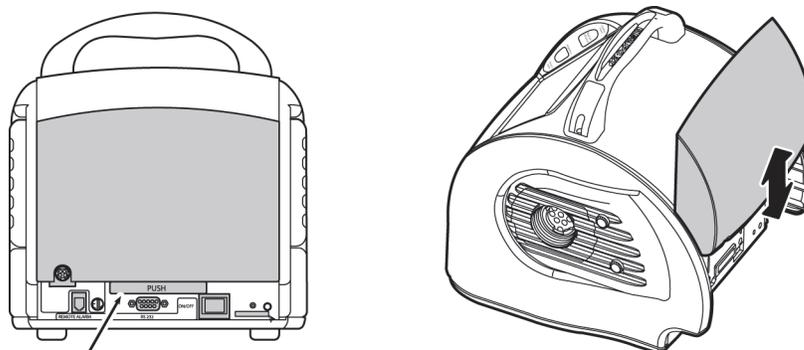
- Keep the ventilator plugged into an external power source whenever available.

- Keep an extra fully charged Power Pac battery pack as a backup.

7.6 Power Pac Battery Pack Removal

To remove the Power Pac battery pack, press the release latch labeled “PUSH” while lifting the Power Pac up at its base and sliding it upward.

Figure 7-2. Power Pac Battery Pack Removal



The Newport™ HT70 ventilator should always have a Power Pac battery pack installed. The AC power connection for the ventilator is located on the back of the Power Pac battery pack.

When inserting the power supply into the AC connection on the Power Pac, ensure that the cord is to the right of the plug and that it locks in place securely. Plug one end of the power cord into the adapter and the other end into a properly grounded outlet. Ensure that the green external power LED lights whenever the ventilator is connected to external power.

To remove the AC power supply from the Power Pac, gently pinch the connector to release the locking pin and then pull the plug out.



WARNING:

Batteries contain environmentally unfriendly materials. Do not discard them in an incinerator or force them open. Batteries cannot be discarded with normal waste. Discard in accordance with your institution's or local jurisdiction's policy.

7.7 Battery Alarms Overview

Reference Chapter 6 for descriptions of each alarm and *Alarms* on page 9-5 for alarm priority level and description.

The ventilator automatically monitors the Power Pac battery pack and the secondary backup battery to alert users of their condition. An icon in the upper right corner of the touch screen shows the charge level condition of the battery that is in use.

Battery condition alarm violations are indicated by an audible alarm, an alarm message shown on the touch screen, and the LEDs in the handle of the ventilator flashing. The battery alarms will occur in the following order:

1. Power Pac Battery Pack Low
2. Switching to Backup Battery
3. Running on Backup Battery
4. Backup Battery Low
5. Backup Battery Shutdown Imminent

In addition, the following are functional alarms for the battery system:

- Power Pac Battery Temperature Alarm
- Backup Battery Temperature Alarm
- Backup Battery Failure Alarm
- Backup Battery Low Charge Alarm



WARNING:

Immediately secure an external power source or insert a fully charged Power Pac battery pack when a Backup Battery Shutdown Imminent alarm occurs.

Charge the Power Pac battery pack for a minimum of 3 hours for 100% recharge. If the battery charge is not fully depleted, the charge time may be less.

7.8 Power Accessories

7.8.1 Power Pac Battery Pack (BAT3271A)

It is recommended to have extra Power Pac battery packs on hand at all times. The Power Pac is hot swappable—one can be removed and another inserted without interrupting ventilation.

7.8.2 AC Power Supply (SP-PWR3204P)

It is recommended to have an extra AC power supply available to charge the extra Power Pac battery when not attached to the ventilator.

7.8.3 Country-Specific Power Cord

AC power supply cords with a region-appropriate outlet plug are available for order. Choose from NA-North American style (PWR3207P), UK-British style (PWR3210P), or EU-European style (PWR3211P).

7.8.4 External Battery System (BAT3300A)

The external battery comes in a sturdy case for easy handling. Use the battery charger (CHG3313P) every night to recharge the external battery. Use the DC auto lighter power adapter (SP-ADP3203P) to connect to the ventilator.

7.8.5 DC Auto Lighter Power Adapter (SP-ADP3203P)

The DC auto lighter power adapter allows the user to plug the ventilator into a vehicle's auto lighter power outlet (12 V DC to 16 V DC) or external battery. To save internal battery power for when it is needed, use this adapter to plug the ventilator into the auto lighter port any time the ventilator is used while in a vehicle. While plugged in, the ventilator will be powered and both of the internal batteries will be recharged.

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8 Cleaning and Maintenance

8.1 Cleaning and Disinfecting

Use the information in this chapter in conjunction with hospital policy, physician prescription, and homecare dealer or accessory manufacturer instructions when cleaning and disinfecting the Newport™ HT70 ventilator.

8.1.1 Definitions

Cleaning: A process that uses a medical detergent or alcohol-based cleaning solution to remove blood, tissue and other residue. Rinse thoroughly with sterile, distilled water and allow to air dry.

Disinfection: A liquid chemical process that kills microbial organisms.

Sterilization: A process that uses steam autoclave or ethylene oxide (EtO), which is designed to render a product free of viable microorganisms.



WARNING:

Ethylene oxide (EtO) is toxic. All accessories MUST be completely dry prior to packaging for ethylene oxide sterilizing. After sterilizing, they must be properly aerated to dissipate residual gas absorbed by the material. Follow the EtO manufacturer's recommendations for the specific aeration periods required.



Caution:

When using liquid chemical agents, closely follow the manufacturer's recommendations. Prior to use, verify that the agent is compatible with plastics.



Caution:

Ethylene oxide (EtO) may cause superficial crazing of plastic components and will accelerate the aging of rubber components.



Caution:

Always inspect breathing circuits and accessories after cleaning, disinfecting or sterilizing to check for deterioration. If any part is damaged or shows excessive wear, replace with a new part. Do not use cracked or damaged parts.

8.2 Ventilator

Wipe clean between patients and as needed while in use. The exterior of the ventilator should be wiped clean with a cloth dampened with a medical detergent, disinfectant, or alcohol-based cleaning solution.



Caution:

Do not use agents that contain acetone, toluene, halogenated hydrocarbons, or strong alkalines on the face panel or ventilator housing.



Caution:

Never autoclave or EtO sterilize the Newport™ HT70 ventilator. These processes will damage the unit, rendering it unusable.

8.3 Accessories

8.3.1 Low Flow Oxygen Reservoir

Clean and disinfect between patients and as needed while in use. Refer to the instructions provided with the oxygen reservoir.

To disassemble and clean the low flow oxygen reservoir:

1. Remove the oxygen reservoir from the fresh gas intake port.
2. Disconnect the oxygen tubing.
3. Grasp the low flow oxygen reservoir in both hands and twist the top counterclockwise to disassemble.
4. Separate all the parts, and clean with soap and water. Rinse thoroughly and allow to air dry.



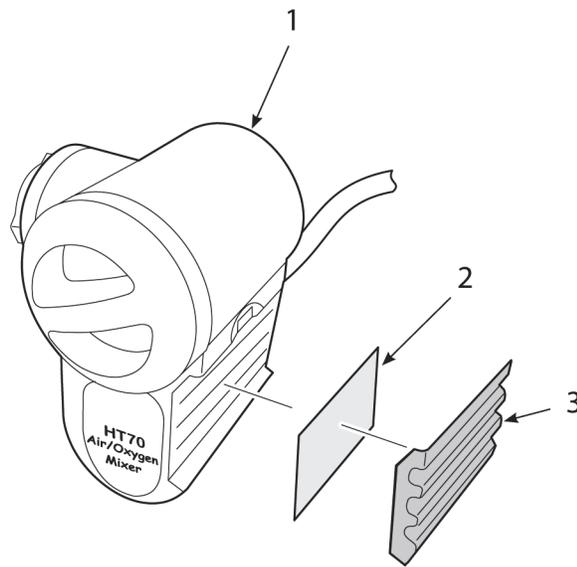
Caution:

Never mount the low flow oxygen reservoir onto the ventilator when wet.

8.3.2 Air/Oxygen Entrainment Mixer

Between patients and as needed while in use, the exterior of the mixer and attached hose should be wiped clean with a cloth dampened with a medical detergent, disinfectant, or alcohol-based cleaning solution.

Figure 8-1. Air/Oxygen Entrainment Mixer



- | | | | |
|---|--------------|---|-------|
| 1 | Oxygen mixer | 3 | Cover |
| 2 | Filter | | |

Check the mixer intake filter at setup and at least weekly. Replace when dirty.



WARNING:

Always use a mixer intake filter in the mixer to protect the internal mechanisms from contaminants and preserve the lifespan of your mixer.



WARNING:

Never reverse the mixer filter.



Caution:

Do not wash or sterilize the mixer filter.

8.4 Reusable Breathing Circuits and Exhalation Valves

The Newport™ HT70 ventilator may be used with a standard single-limb or “J” style breathing circuit with a quality exhalation valve. Reusable breathing circuits and exhalation valves are generally provided in clean, but not sterile, condition. Follow the manufacturer’s instructions to clean and disinfect prior to use.



WARNING:

Do not use electrically conductive breathing circuits. Always use clean and dry breathing circuits.

Reusable circuits should be cleaned and disinfected between patients and as needed while in use. Always use a clean, disinfected exhalation valve (and humidifier/probe assembly if appropriate) when a breathing circuit is reassembled for patient use. Clean and disinfect in accordance with the instructions provided by the manufacturer.

**Caution:**

To avoid damage to a reusable circuit, attach and detach the circuit by grasping the cuffs at the end of the circuit tubing. Do not pull or twist the circuit tubing.

To clean the reusable breathing circuit and exhalation valve:

1. Use a low flow of running water or low flow of air to clear tubings and passages of organic matter.
2. Wash all components of the breathing circuit and exhalation valve with a soft brush in a mild medical detergent and rinse thoroughly with sterile, distilled water.
3. Shake off excess water and place all parts on a clean towel to air dry. (Do not heat or blow dry.)

Always follow the cleaning instructions provided by the manufacturer.

To disinfect and sterilize the circuit and exhalation valve, refer to the instructions provided by the breathing circuit and exhalation valve manufacturer.

8.5 Air Intake Filter

The air intake filter, located on the right side of the ventilator behind the filter cover, keeps dirt and particles out of the ventilator's piston system and patient gas pathway. As the filter becomes dirty, it can reduce the volume of air drawn into the ventilator and add stress to the pump. Check the intake filter weekly and replace it with a new filter when the majority of the filter surface area is no longer white. Intake filters are not reusable.

**WARNING:**

NEVER operate the Newport™ HT70 ventilator without a clean air intake filter in place. NEVER reverse the air intake filter when dirty.

8.6 Proximal Inline Filter

Check the proximal (prox) inline filter weekly and replace it at least every 3 months. Discard the filter and replace with a new one if it appears to have gotten wet or come in contact with a contaminant. Proximal inline filters are not reusable. If the filter becomes occluded, replace the filter. The primary indication for this would be a Check Circuit or Prox Line alarm.

Covidien strongly recommends that extra prox inline filters be available at all times when using the Newport™ HT70 ventilator.

**WARNING:**

Always use a proximal inline filter (P/N HT6004701 or equivalent) at the prox line connector to protect the internal pressure transducers from moisture or other contaminants.

**WARNING:**

Never reverse the proximal inline filter.

**Caution:**

Do not wash or sterilize the prox inline filter.

8.7 Maintenance Guidelines

**Note:**

Refer to the manufacturer's instructions for more information about the use and maintenance of bacteria filters.

8.7.1 Routine Maintenance

- Perform the circuit check each time a fresh circuit/exhalation valve is installed.
- Check the air intake filter (located behind the filter cover) at setup and at least weekly while in use. In some environments, it may need to be checked more often. Replace when the majority of the filter surface area is no longer white. Air intake filters are not reusable.

**WARNING:**

NEVER reverse the air intake filter when dirty.

- Check the prox inline filter weekly. Replace with a new filter if it appears to have gotten wet or come in contact with a contaminant. Inline filters are not reusable.
- Check the mixer intake filter (located behind the mixer cover) at setup and at least weekly while in use. In some environments, it may need to be checked more often. Replace when the majority of the filter surface area is no longer white. Mixer intake filters are not reusable.
- Inspect the AC power adapter on a regular basis for signs of broken or frayed cord or connectors.
- Inspect the exhalation valve after each cleaning to verify that there are no cracks or damaged surfaces.
- Wipe down the surface of the ventilator housing regularly to remove any dust that might accumulate.
- Inspect and when necessary, replace accessories.
- If service is required, contact Covidien or a local Covidien representative.

- To preserve the internal dual battery system life:
 - Whenever possible, plug into external power source to charge the batteries.
 - Use the optional DC auto lighter cable accessory to power the ventilator when traveling by automobile or to connect to an external battery.

Reference Chapter 7 for more information on the proper operation of the internal dual battery system.

8.7.2 6-Month Maintenance

- Routine maintenance as described in [Routine Maintenance](#) on page 8-5
- Perform the quick check procedure (reference [Quick Check Procedure](#) on page 5-1)

8.7.3 12-Month Maintenance

- Routine maintenance as described in [Routine Maintenance](#) on page 8-5
- Perform the quick check procedure (reference [Quick Check Procedure](#) on page 5-1)

8.7.4 24-Month Maintenance

- Replace air intake and prox inline filter
- Replace the primary integrated battery (Power Pac)
- Replace the secondary internal backup battery
- Replace the coin battery
- Replace the oxygen sensor (if installed)
- Replace the cooling fan filter
- Perform calibration and OVP (to be done by authorized service provider only)

8.7.5 15 000-Hour Maintenance (or Every 4 Years)

A comprehensive maintenance should be performed after 15000 hours of operation or every 4 years, whichever comes first. Refer to the service manual, or contact Covidien Technical Services for detailed information on the 15 000-hour maintenance.

Do not attempt to open or perform any service procedures on the ventilator. Only Covidien-trained service personnel are authorized to service the ventilator. Reference [Contact Information](#) on page 1-9.

8.8 General Warnings

**WARNING:**

Preventive maintenance work, repairs, and service may only be performed by Covidien-trained or factory-authorized personnel.

**WARNING:**

Always follow accepted hospital procedures or physician instructions for handling equipment contaminated with body fluids.

**WARNING:**

The ventilator and its accessories must be thoroughly cleaned and disinfected after each patient use. Perform all cleaning and sterilization of external parts and accessories in accordance with established hospital procedures and manufacturer's instructions.

**WARNING:**

Certain components of the ventilator, such as the exhalation valve and the front panel, consist of materials that are sensitive to some organic solvents used for cleaning and disinfection (e.g., phenols, halogen-releasing compounds, oxygen-releasing compounds, and strong organic acids). Exposure to such substances may cause damage that is not immediately recognizable.

**WARNING:**

The reusable exhalation valve, reusable breathing circuit, and other parts that come in direct contact with the patient should be disinfected or sterilized between uses according to hospital policy.

8.9 Factory Maintenance or Repair

Authorized Covidien-trained service personnel must do all service or repairs performed on the Newport™ HT70 ventilator.

**Caution:**

Always disconnect the external power supply prior to servicing.

Scheduled maintenance or repair services are available from Covidien. To send your ventilator in for service, see [Repacking/Return Information](#) on page 8-8.

To obtain current pricing for scheduled maintenance and labor rates, please contact Covidien or your local Covidien representative.

8.10 Repacking/Return Information

Use the original packing carton and material to ship the ventilator back to Covidien. If needed, contact Covidien or a local Covidien representative to order replacement packing material.

Prior to returning your ventilator for service or repair, obtain a returned goods authorization number from Covidien Technical Services. Refer to the service manual or contact Covidien Technical Services for complete instructions.

Reference *Contact Information* on page 1-9 for address, phone, and website details.

9 Specifications

9.1 Front Panel Buttons—Symbols Version

Table 9-1. Front Panel Buttons—Symbols Version

Symbol	Definition
	Accept
	Cancel
	Audio Paused/Reset button and LED
	Breath delivery indicator
	Brightness
	Device alert LED
	External power LED
	Manual Inflation
	Up/down arrow

9.2 Miscellaneous Reference Symbols

Table 9-2. Miscellaneous Reference Symbols

Symbol	Definition
	Manufacturer name and address
○	Main power off/on (momentary switch)
	Low (Paw or Min Vol) alarm
	High (Paw, Min Vol, or RR) alarm
	Caution
	Consult instructions for use
	Equipotentiality
	Applied parts type BF
	Brightness control
	Audio paused
	Up/down arrow
	Federal law (US) restricts sale by or on the order of a physician
	Meets FAA requirements in RTCA standard, DO160, sec 21 category M for use in all stages of air travel, including takeoff and landing
	Canadian and U.S. certification mark Note: Products bearing this mark have been tested and certified in accordance with applicable U.S. and Canadian electrical safety and performance standards.

9.3 Control Data Selections

Table 9-3. Control Data Selections

Control	Range/selection	Resolution	Accuracy
MODE (Pressure or Volume Control)	A/CMV	N/A	N/A
	SIMV		
	SPONT		
Breath type (mandatory)	Pressure Control or Volume Control	N/A	N/A
NIV (Noninvasive Ventilation)	On or off. When on, allows ↓Min Vol alarm to be set to off, ↓P alarm to be set 1 cmH ₂ O / mbar above PEEP, and allows adjustment of bias flow during PEEP	N/A	N/A
VT (tidal volume)	50-2200 mL, ATPS, ±10%	1.0 mL	±10% of setting or ±15 mL, whichever is greater
PC (Pressure Control)	5- 60 cmH ₂ O / mbar	1.0 cmH ₂ O/mbar	±10% or ±2 cmH ₂ O, whichever is greater
Flow	6-100 L/min	1.0 L/min	N/A
i-time (inspiratory time)	0.1-3.0 sec	0.1 sec	±0.05 second
RR (respiratory rate)	1-99 b/min	1.0 b/min	±1 b/min, or 10% of the breath period, whichever is less
P trig (sensitivity)	-9.9 to 0 cmH ₂ O / mbar, pressure triggering	0.1 cmH ₂ O/mbar	±2 cmH ₂ O, or 10%, whichever is greater
Flow trig (sensitivity)	0.1-10 L/min	0.1 L/min	±1 L/min or 10%, whichever is greater
PEEP/CPAP	0-30 cmH ₂ O / mbar	1.0 cmH ₂ O/mbar	±10% or 2 cmH ₂ O, whichever is greater
PS (Pressure Support)	0-60 cmH ₂ O / mbar above baseline pressure, limited to PEEP+PS ≤60 cmH ₂ O / mbar	1.0 cmH ₂ O/mbar	±10% or ±2 cmH ₂ O, whichever is greater
Airway pressure gauge	-10 to 100 cmH ₂ O / -10 to 98 mbar includes indicator bars to show low and high PAW alarm limits	N/A	N/A
O ₂ sensor	Enabled or disabled When enabled, high and low O ₂ alarms are active and O ₂ cylinder time calculator is available	N/A	N/A
PS max i-time	0.1-3.0 sec	0.1 sec	N/A
PS % exp threshold	5-85%	5	N/A
Slope rise	1-10 (1 is slowest)	1	N/A

Table 9-3. Control Data Selections (Continued)

Control	Range/selection	Resolution	Accuracy
Flow wave pattern	Square or descending	N/A	N/A
Bias Flow	0 L/min—PEEP off 7 L/min—PEEP on 3-30 L/min—PEEP + NIV on	1	N/A
Autolock function	Enabled/disabled	N/A	N/A
Autolock icon	Touch for 3 seconds to unlock buttons if Autolock is enabled in Utility screen When lock is on screen, all controls are locked except <i>Audio Paused/Reset</i> , <i>Manual Inflation</i> , and <i>Brightness</i> control	N/A	N/A
O ₂ cylinder data	Size: D, E, H, M, K, 100 L, and 150 L Cylinder pressure: 300-2500 psi or 25-175 ATM or 2000-17 000 kPa Units: psi or ATM or kPa O ₂ cylinder monitor; enabled/disabled	N/A	N/A
Altitude	-1000 to 10 000 feet, -300 to 3000 meters (with flow sensor use)	N/A	N/A
BUV settings	Minimum RR: 8-30 b/min Rate factor: 1.1-1.8 SPONT delta P: 5-20 cmH ₂ O / mbar SPONT i-time: 0.4-2.0 s	N/A	N/A

9.4 Monitor Data Selections

Table 9-4. Monitor Data Selections

Monitor	Range	Resolution
Minute volume	0–99.9 L	0.01 L
Insp./exp. tidal volume	0–9999 mL	1 mL
RR total	0 to 99 b/min	1 b/min
P peak	0 to 99 cmH ₂ O/mbar	1 cmH ₂ O/mbar
P mean	0 to 99 cmH ₂ O/mbar	1 cmH ₂ O/mbar
P base (PEEP)	0 to 99 cmH ₂ O/mbar	1 cmH ₂ O/mbar
(Peak) flow	5-150 L/min	1 L/min
O ₂ cylinder time	0–20 000 hours/min	5 minutes
Battery time	0–12 hours/min	15 minutes

Table 9-4. Monitor Data Selections (Continued)

Monitor	Range	Resolution
O ₂ % (optional)	0 to 100	1%
I:E ratio	1:99.0 to 3.0:1	0.1 (9.9:1 to 1:9.9) 1.0 (99:1 to 1:99)

9.5 Front Panel Membrane Buttons and Indicators

Table 9-5. Front Panel Membrane Buttons and Indicators

Cancel	Press front panel button to cancel any touch screen settings changes that have not been accepted.
Accept	Press to confirm or accept any touch screen setting changes.
Up/down arrows	Arrow buttons allow adjustment of settable parameters. Use up arrow to increase and down arrow to decrease.
Brightness control	Press to select brightness levels, maximum, medium high, medium, and low.
Manual Inflation	Three-second maximum. While button is pressed, the ventilator closes the exhalation valve and delivers an operator-controlled breath to the patient.
Breath indicator LED	Lights to indicate the ventilator is delivering a breath.
External power LED	Lights to indicate the ventilator is powered by external power.
Device alert LED	Lights to indicate a ventilator malfunction. WARNING: Use alternate ventilation source until malfunction is identified and corrected.

9.6 Alarms

Table 9-6. Alarms

Handle LED	Alarm indicators flash red or yellow for violated alarms.
Audio Paused/Reset button	Pauses audible alarm for 1 minute. Once alarm condition has been corrected, press to reset/clear alarm message, or press and hold for 3 seconds to clear all messages.
Audio paused LED	LED remains lit during the audio paused period.
Message display area	Alphanumeric display; turns color during an alarm violation (red is high, amber is medium, yellow is low), and shows alarm message for the active alarm with the highest priority.

Table 9-6. Alarms (Continued)

Alarm loudness (in Alarm screen)	<p>1-10 (10 is loudest)</p> <p>High priority alarm volume range (dBA): 65 (Loudness setting 1) to 95 (Loudness setting 10)</p> <p>Medium priority alarm volume range (dBA): 60 (Loudness setting 1) to 90 (Loudness setting 10)</p> <p>Low priority alarm volume range (dBA): 55 (Loudness setting 1) to 85 (Loudness setting 10)</p> <p>Measurement uncertainty: ±3 dBA</p>
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Table 9-7. User-Adjustable Alarms

Alarm	Alarm priority	Range/description
↑P (High Pressure)	High	5-99 cmH ₂ O / 5-99 mbar
↓P (Low Pressure)	High	NIV off: 3-98 cmH ₂ O / 3-98 mbar (limited by PEEP+3); two-breath delay NIV on: 1-98 cmH ₂ O / 1-98 mbar (limited by PEEP+1); three-breath delay
↑Min Vol (High Insp./Exp. Minute Volume)	High	NIV off: 1.1-50 L/min NIV on: 1.1-80 L/min
↓Min Vol (Low Insp./ Exp. Minute Volume)	High	NIV off: 0.01-49.0 L/min NIV on: Off, 0.01-49.0 L/min
↑RR (High Respiratory Rate)	Med	Off, 30-100 b/min
Apnea	High	5-70 seconds
↑O ₂	Med	Off, 31-100, only available when O ₂ sensor is enabled
↓O ₂	High	Off, 22-91, only available when O ₂ sensor is enabled
↑VTE	High	OFF, 0.06-2.2 Liters
Backup Ventilation (BUV)	Med	Can be set to be activated by either the Low Minute Volume alarm or the Apnea alarm or both via the More>Utilities>Custom Settings>BUV settings. Functional in all modes.

Table 9-8. Automatic Alarms

Alarm	Alarm priority	Description
Low Baseline Pressure	High	Paw <PEEP minus 2 cmH ₂ O/mbar for 3 sec.
High Baseline Pressure	Med	Paw 5 above set PEEP at onset of a time-triggered breath.
Pressure Control Setting Not Reached	High	P Peak <50% of PCV setting for two consecutive breaths.
Check Circuit	High	Circuit may be disconnected or proximal pressure line may be pinched or blocked.

Table 9-8. Automatic Alarms (Continued)

Alarm	Alarm priority	Description
No External Power	Low	Loss of external power, automatic switchover to internal dual battery system.
Occlusion	High	An occlusion or restriction in the circuit that interferes with exhalation.
Occlusion - Sustained	High	Occlusion continues for 10 sec or two breath periods, whichever is shorter.
Device Alert	High	Ventilator malfunction, device alert LED lights red.
Shut Down Alert	High	Mute by pressing <i>Audio Paused/Reset</i> button.
Motor Fault	High	Hardware detected fault in the motor drive circuit has occurred.
Internal Temperature	Low	Internal temperature is >60°C.
Backup Battery Temperature	Low	Backup battery temperature is >60°C.
Power Pac Battery Temperature	Low	Power Pac battery temperature is >60°C.
Power Pac Battery Pack Low	High	Less than 2 Ah of charge is left on Power Pac battery pack.
Integrated Power Pac Failure	Med	Loss of communication with the Power Pac battery. Replace Power Pac battery.
Switching to Backup Battery	Med	Indicates that the Power Pac battery pack is not available or usable. Ventilator is switching battery operation to backup battery.
Running on Backup Battery	Med	The ventilator is operating on backup battery for >15 minutes. Audible alarm will sound every 5 minutes thereafter.
Backup Battery Low	High	Backup battery has insufficient charge (less than 1 Ah).
Backup Battery Shutdown Imminent	High	Backup battery is extremely low and will lose power very soon. Connect to external power or insert new Power Pac battery pack.
Backup Battery Failure	High	Indicates a failure in backup battery due to communication failure with host processor or capacity is below 1 Ah.
Flow Sensor Disconnect	High	Flow sensor is no longer detected or is faulty.

9.7 Hardware Requirements

Table 9-9. Hardware Requirements

Hardware requirements	Description
Patient outlet	22 mm OD
AC power input	100–240 V AC
DC power input	11-16 VDC, nominal 13.5 VDC
Power switch	Momentary switch to power on and off
RS-232C interface	Nine-pin standard RS232 connector

Table 9-9. Hardware Requirements (Continued)

Hardware requirements	Description
Nurse call/remote alarm	RJ435 connector
USB ports	Two USB ports for connecting to central monitoring systems, uploading software upgrades or download data files.
Electrical	Applied parts type BF Class I Protection Against Electric Shock 100-240 V AC, max. 2 A, 50/60 Hz 11-16 V DC, max. 5 A
Internal dual battery system	Power Pac battery pack: 14.4 V DC, 6.5 amp hours Recharge: minimum 3 hours for 100% charge When new and fully charged, the internal dual battery system supplies power for up to 10 hours of operation at these settings: A/CMV mode, RR=15, tidal volume=500 mL, i-time=1.0 sec, PEEP=Ø, max. airway pressure 30 cmH ₂ O /mbar, Power Save on, bias flow off. NOTE: The Power Pac and backup batteries are charged whenever the ventilator is connected to an external power source. Battery charge level is best maintained by keeping the ventilator continuously connected to external power. Backup battery: 14.4 V DC, 2 amp hours The secondary lithium ion backup battery will supply power for a minimum of 30 minutes.
Pneumatics	Dual micro-piston system requires no external air compressor.
Emergency intake	Maximum inspiratory and expiratory pressure drop at single fault conditions: 10 cmH ₂ O/ L/ sec (measured at patient connection port)
Maximum limited pressure (pressure relief)	100 cmH ₂ O/mbar

9.8 Environment

Table 9-10. Environment

Operating temperature	-18°C to 40°C NOTE: For proper operation at low range temperatures (-18°C), the ventilator must be started in a normal room temperature environment and allowed to run for 30 minutes prior to transfer to colder environment.
Water ingress protection	IEC 60529 IPX4
Operating humidity	15-95% noncondensing
Operating altitude	Sea level to 15 000 ft (0-4572 m) There is no altitude limitation when the ventilator is operated in a pressurized environment.
Operating pressure	600-1100 hPa
Storage and shipping temperature	-40°C to 65°C
Storage and shipping humidity	0-95% noncondensing
Storage and shipping pressure	500-1060 hPa

9.9 Size and Weight

Table 9-11. Size and Weight

Height (includes handle)	26.04 cm (10.25 in.)
Width	24.77 cm (9.75 in.)
Depth	27.94 cm (11 in.)
Weight	6.9 kg (15.4 lbs)

9.10 Factory Default Parameters

Table 9-12. Factory Default Parameters (Patient Settings)

Mode	A/CMV
VT (Volume Control)	500 mL
i-time	1.0 sec
RR	12 b/min
Flow	30 L/min
P _{trig}	2 cmH ₂ O
Flow _{trig}	5.0
FiO ₂	FiO ₂ disabled
↓Paw alarm	5 cmH ₂ O
↑Paw alarm	40 cmH ₂ O
↓MV alarm	3 L/min
↑MV alarm	9 L/min
↑RR	30 b/min
↑VTE	Off
PEEP/CPAP	Off
Apnea	20 sec
Alarm loudness	Level 6

Table 9-13. Default Presets (Control Settings)

Control setting	Adult	Pediatric	Infant
Mode	VC A/CMV	PC A/CMV	PC A/CMV

Table 9-13. Default Presets (Control Settings) (Continued)

Control setting	Adult	Pediatric	Infant
VT	500 mL	N/A	N/A
PC	N/A	18 cmH ₂ O	18 cmH ₂ O
RR	12 b/min	20 b/min	20 b/min
Flow	30 lpm	N/A	N/A
i-time	1.0 sec	0.6 sec	0.3 sec
PEEP/CPAP	Off	Off	Off
P _{trig}	2.0 cmH ₂ O	2.0 cmH ₂ O	2.0 cmH ₂ O
FiO ₂	Disabled	Disabled	Disabled
PSV	N/A	N/A	N/A
F _{trig}	5.0 lpm	5.0 lpm	5.0 lpm
Slope/Rise	8	8	8
PS Exp Thresh	25%	30%	35%
PS Max i-time	2 sec	1 sec	0.5 sec
Flow pattern	Square	Square	Square
NIV	OFF	OFF	OFF
Bias flow	N/A	N/A	N/A
Power save	ON	ON	ON

Table 9-14. Default Presets (Alarm Settings)

Alarm setting	Adult	Pediatric	Infant
↑Paw	40 cmH ₂ O	25 cmH ₂ O	25 cmH ₂ O
↓Paw	5 cmH ₂ O	5 cmH ₂ O	5 cmH ₂ O
↑MV	9.0 L/min	8.0 L/min	6.0 L/min
↓MV	3.0 L/min	2.0 L/min	1.0 L/min
↑RR	30 b/min	30 b/min	30 b/min
↑O ₂	N/A	N/A	N/A
↓O ₂	N/A	N/A	N/A
Apnea	20 sec	20 sec	20 sec
Alarm loudness	6	6	6

9.11 Miscellaneous Specifications

9.11.1 Patient Circuit

Reusable or disposable 22 mm I.D. adult or 15 mm I.D. pediatric circuit with 4.8 mm (3/16 in.) I.D. proximal pressure sensing line, 3.2 mm (1/8 in.) I.D. exhalation valve control drive tubing, and exhalation valve.



Note:

Ensure that both the length and the internal volume of the patient circuit are appropriate for the tidal volume.



Note:

Covidien cannot guarantee the safe use of breathing circuits that are not Covidien-recommended.

9.11.2 Ventilator Breathing System (VBS) Resistances

Table 9-15. VBS Resistances

Inspiratory resistance	Expiratory resistance
0.32 kPa at 60 L/min	0.28 kPa at 60 L/min
0.20 kPa at 30 L/min	0.14 kPa at 30 L/min
0.03 kPa at 5 L/min	0.02 kPa at 5 L/min

9.11.3 Pneumatic Requirements (Optional Equipment)



WARNING:

Appropriate oxygen monitoring is required for patient safety.

Table 9-16. Pneumatic Requirements

	Air/oxygen entrainment mixer	Low flow oxygen reservoir
Oxygen	35-65 psig (2.4-4.5 Bar) full operating range, maximum accuracy 40-50 psig (2.8-3.4 Bar) accuracy ± 0.08	0-10 L/min
Air	Atmospheric pressure	Atmospheric pressure
FiO ₂ Control	Adjusted continuously from 0.21 to 1.00	FiO ₂ , indirectly adjusted from 0.21 up to 1.00 via oxygen flow (L/min)



Note:

Oxygen source gas must be medical-grade, 100% oxygen.

9.11.4 Manufacturer’s Declaration

The following tables contain the manufacturer’s declarations for the Newport™ HT70 ventilator’s electromagnetic emissions, electromagnetic immunity, and recommended separation distances between the ventilator and portable and mobile RF communications equipment.



WARNING:

Portable and mobile RF communications equipment can affect the performance of the ventilator system. Install and use this device according to the information contained in this manual.



WARNING:

The ventilator system should not be used adjacent to or stacked with other equipment, except as may be specified elsewhere in this manual. If adjacent or stacked used is necessary, the ventilator system should be observed to verify normal operation in the configurations in which it will be used.

Table 9-17. Electromagnetic Emissions

The ventilator is intended for use in the electromagnetic environment specified below. The customer or the user of the ventilator should assure that it is used in such an environment.		
Emissions test	Compliance	Electromagnetic environment—guidance
RF emissions CISPR 11	Group 1	The ventilator uses RF energy only for its internal functions. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment. The ventilator is suitable for use in all establishments including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
RF emissions CISPR 11	Class B	
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations / flicker emissions IEC / EN 61000-3-3	Complies	

Table 9-18. Electromagnetic Immunity

The ventilator is intended for use in the electromagnetic environment specified below. The customer or the user of the ventilator should assure that it is used in such an environment.			
Immunity test	IEC/EN 60601 test level	Compliance level	Electromagnetic environment— guidance
Electrostatic discharge (ESD) IEC/EN 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/EN 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	AC power ("mains") power quality should be that of a typical commercial or hospital environment.
Surge IEC/EN 61000-4-5	± 1 kV line(s) / line(s) ±2 kV line(s) / earth	±1 kV line(s) / line(s) ±2 kV line(s) / earth	
Voltage dips, short interruptions and voltage variations on power supply input lines IEC/EN 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 s	<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 s	AC power ("mains") power quality should be that of a typical commercial or hospital environment. If the user of the ventilator requires continued operation during power mains interruptions, it is recommended that the ventilator be powered from an uninterruptible power supply or a battery.
Power frequency (50/60 Hz) magnetic field IEC/EN 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.			

Table 9-19. Electromagnetic Immunity—Conducted and Radiated RF

The ventilator is intended for use in the electromagnetic environment specified below. The customer or the operator of the ventilator should assure that it is used in such an environment.			
Immunity test	IEC/EN 60601 test level	Compliance level	Electromagnetic environment—guidance
Conducted RF IEC/EN 61000-4-6	3 Vrms 150 kHz to 80 MHz outside ISM bands ¹	3 Vrms 150 kHz to 80 MHz outside ISM bands ¹	Portable and mobile RF communications equipment should be used no closer to any part of the ventilator system, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance: $d = 0.35 \sqrt{P}$
	10 Vrms inside ISM bands ¹	10 Vrms inside ISM bands ¹	Recommended separation distance: $d = 1.2 \sqrt{P}$
Radiated RF IEC/EN 61000-4-3	10 V/m 80 MHz to 2.5 GHz	10 V/m 80 MHz to 2.5 GHz	Recommended separation distance: $d = 1.2 \sqrt{P}$ 80 MHz to 800 MHz
			$d = 2.3 \sqrt{P}$ 800 MHz to 2.5 GHz
<p>Where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the separation distance in meters (m).²</p> <p>Field strengths from fixed transmitters, as determined by an electromagnetic site survey,³ should be less than the compliance level in each frequency range.⁴</p> <p>Interference may occur in the vicinity of equipment marked with the following symbol:</p> 			
<p>NOTE 1: At 80 MHz and 800 MHz, the higher frequency range applies.</p> <p>NOTE 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.</p>			

1. The ISM (industrial, scientific and medical) bands between 150 kHz and 80 MHz are 6.765 to 6.795 MHz; 13.553 MHz to 13.567 MHz; 26.957 MHz; and 40.66 MHz to 40.70 MHz
2. 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 separation distance for transmitters in these frequency ranges.
3. 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 ventilator is used exceeds the applicable RF compliance level above, the ventilator should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the ventilator.
4. Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 10 V/m.

Table 9-20. Recommended Separation Distances

The ventilator is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the operator of the ventilator can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the ventilator as recommended below, according to the maximum output power of the communications equipment.				
Rated maximum output power of transmitter (W)	150 kHz to 80 MHz (outside ISM bands) $d = 3.5\sqrt{P}$	150 kHz to 80 MHz (inside ISM bands) $d = 12\sqrt{P}$	80MHz to 800 MHz $d = 1.2\sqrt{P}$	800 MHz to 2.5 GHz $d = 2.3\sqrt{P}$
0.01	0.035 m	0.12 m	0.12 m	0.23 m
0.1	0.11 m	0.38 m	0.38 m	0.73 m
1	0.35 m	1.2 m	1.2 m	2.3 m
10	1.1 m	3.8 m	3.8 m	7.3 m
100	3.5 m	12 m	12 m	23 m

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

NOTE 1: At 80 MHz 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.

**WARNING:**

The use of accessories and cables other than those specified, with the exception of parts sold by Covidien as replacements for internal components, may result in increased emissions or decreased immunity of the ventilator system.

9.11.5 Performance

Table 9-21. Performance Parameter Specifications and Tolerances

Setting	Range	Control accuracy
VT (tidal volume)	50-2200 ml	$\pm 10\%$ of setting or $\pm 15\text{mL}$ whichever is greater
Pressure Support	0-60 cmH_2O	$\pm 10\%$ or $\pm 2 \text{ cmH}_2\text{O}$, whichever is greater
Pressure Control	5-60 cmH_2O	$\pm 10\%$ or $\pm 2 \text{ cmH}_2\text{O}$, whichever is greater
Inspiratory time	0.1-3.0 seconds	± 0.05 second
Breath/resp rate	1-99 b/min	± 1 b/min, or 10% of the breath period, whichever is less
P trig (sensitivity)	-9.9 to 0 $\text{cmH}_2\text{O} / \text{mbar}$	$\pm 2 \text{ cmH}_2\text{O}$, or 10%, whichever is greater
Flow trig (sensitivity)	0-10 L/min	$\pm 1 \text{ L/Min}$ or 10% whichever is greater

10 Explanation of Modes and Controls

10.1 Assist/Control Mandatory Ventilation (A/CMV) Mode

In A/CMV mode, all breaths are mandatory Volume Control or Pressure Control breaths, determined by the selection on the touch screen. The RR setting determines the minimum number of mandatory breaths that are delivered each minute. If the patient does not trigger the ventilator, the breaths are time-triggered. If the patient makes a breathing effort that causes airway pressure or flow to meet the Ptrig or Flow trig setting, the patient can trigger mandatory breaths in addition to, or in place of, time-triggered (mandatory) breaths. PEEP may be added.

Reference *Pressure Control (PC)* on page 10-3 and *Volume Control (VC)* on page 10-3 for descriptions of these breath types.

10.2 Synchronized Intermittent Mandatory Ventilation (SIMV) Mode

In SIMV mode, the patient receives mandatory Volume Control or Pressure Control breaths (see A/CMV) that are either time-triggered by the ventilator or flow/pressure-triggered by the patient. They may also receive spontaneous breaths with or without Pressure Support (PS) in between mandatory breaths. PEEP/CPAP may be added.

The RR setting determines the number of mandatory breaths that are delivered each minute (± 1 b/min). If the patient does not trigger the ventilator, these breaths are time-triggered at intervals determined by the RR setting. Patients can trigger mandatory breaths in place of time-triggered (mandatory) breaths if the effort they generate causes airway pressure or flow to meet the Ptrig or Flow trig setting.

The first patient trigger in each mandatory breath interval will result in a mandatory breath. A mandatory breath lockout interval is then activated for the rest of the interval, allowing the patient to breathe spontaneously with or without Pressure Support (PS) until the beginning of the next interval. If the patient does not trigger the ventilator for one complete mandatory breath interval, a time-triggered mandatory breath is delivered at the end of the interval.

Reference *Pressure Support (PS)* on page 10-2, *Pressure Control (PC)* on page 10-3, and *Volume Control (VC)* on page 10-3 for descriptions of these breath types.

10.3 Spontaneous Ventilation (SPONT) Mode

In SPONT mode, all breaths are spontaneous breaths that are flow/pressure-triggered by the patient. The user can adjust both PEEP/CPAP and Pressure Support (PS) levels. Reference [Pressure Support \(PS\)](#) on page 10-2 for a description of how this breath type works.

When PEEP/CPAP is set above 0, the ventilator mode is CPAP (without PS) or Bi-level Positive Airway Pressure (with PS). Ensure that P_{trig} or Flow trig is set so the ventilator detects all spontaneous patient efforts.

The Low Pressure alarm limit is inactive in SPONT mode. However, users can preset this parameter for future A/CMV or SIMV operation.

As with all ventilator operating modes, Backup Ventilation is activated if the BUV linked alarm is violated.

10.4 Noninvasive Ventilation (NIV)

The Newport™ HT70 ventilator can be used for Noninvasive Ventilation in all modes. Go to the More screen, and touch the *NIV* button to toggle on noninvasive.

When NIV is on, the following features are activated to assist with Noninvasive Ventilation:

- Bias flow is increased to 10 L/min and can be adjusted as needed from 3-30 L/min
- The Low Minute Volume alarm can be turned off (Alarms screen)
- The Low Pressure alarm can be set closer to the base pressure (1 cmH₂O /mbar above baseline) (Alarms screen)
- The High Minute Volume alarm range is expanded to 80 L/min

10.5 Pressure Support (PS)

Pressure Support spontaneous breaths are available to support a patient's spontaneous breathing efforts in SIMV and SPONT modes. During each Pressure Support breath, the ventilator elevates and then maintains patient airway pressure at a pressure equal to Pressure Support + PEEP throughout inspiration. Breaths are cycled from inspiration to exhalation when (1) flow to the patient drops to the expiratory threshold setting (a percentage of that breath's peak flow rate), or (2) the target airway pressure is exceeded by 3 cmH₂O (mbar), or (3) after the PS max i-time setting has been reached. Maximum airway pressure never exceeds the High P alarm limit setting.

During Pressure Support, tidal volume is determined by the pressure change during the breath (PS setting), slope rise, expiratory threshold, PS max i-time, patient effort, and patient respiratory mechanics.

10.6 Pressure Control (PC)

Pressure Control mandatory breaths are available during A/CMV and SIMV modes. The ventilator targets and maintains patient airway pressure at the set Pressure Control level above ambient (not above PEEP) throughout inspiration. Breaths are cycled from inspiration to exhalation when (1) the set i-time elapses, or (2) P_{aw} exceeds the Pressure Control setting by 8 cmH₂O (mbar).

Maximum airway pressure will not exceed the user set High P alarm setting.

During Pressure Control breaths, tidal volume is determined by the pressure change during the breath (PC-PEEP settings), slope/rise, i-time, patient effort, and patient respiratory mechanics.

When disconnecting the patient circuit during PC or PS ventilation (that is, for suctioning), the flow may increase in order to compensate for the low pressure. After reconnecting the patient circuit, the flow will automatically readjust to meet the patient's demand.

10.7 Volume Control (VC)

Volume Control mandatory breaths are available during A/CMV and SIMV modes. During Volume Control breaths, the ventilator delivers the set tidal volume at the flow and i-time shown on the Main screen and with the flow waveform set on the More screen. If the tidal volume setting is changed while the ventilator is operating, the change takes place in increments over a series of breaths.

When tidal volume is adjusted, inspiratory time remains constant and mandatory flow changes.

During Volume Control breaths, tidal volume is determined by the tidal volume (VT) setting.

If an attempted tidal volume setting results in a flow rate in excess of 100 L/min or less than 6 L/min, flow adjustment ceases and a message appears in the message display window. To allow further volume adjustment, change the i-time to set the flow to meet the patient's need.

10.8 Backup Ventilation

Backup Ventilation activates when the currently linked alarm occurs. This function can be linked with the Low Minute Volume (MVI/MVE) alarm, the Apnea alarm, or both alarms. During Backup Ventilation, the linked alarm(s) will sound and the message window will indicate that Backup Ventilation is in use. There are default Backup Ventilation parameters, but the user may adjust these in the More>Utilities>Custom Setting>BUV screen.

Backup Ventilation is functional in all modes.

Backup Ventilation is not active for 60 seconds after the user adjusts ventilator controls, changes modes, or starts ventilation from the standby condition.

During Backup Ventilation, the *Audio Paused/Reset* button can be pressed to mute the audible alarm. This will not cancel Backup Ventilation.

When linked with the Low Minute Volume alarm, Backup Ventilation is based on the monitored inspiratory (on-airway flow sensor not in use) or expiratory (on-airway flow sensor in use) minute volume. The inspiratory minute volume may be different from the expiratory minute volume in some conditions, such as in the case of a patient breathing circuit or airway leak, a circuit disconnect, and between different breath types. Be sure to check, and if necessary, readjust these alarm settings when installing or disconnecting the on-airway flow sensor.

10.8.1 Backup Ventilation in A/CMV and SIMV Modes

The factory default setting for Backup Ventilation in these two modes will increase the respiratory rate by 1.5 times the set rate, up to a maximum of 99 b/min. The minimum breath rate delivered is 15 b/min.

The respiratory rate (RR) will only increase up to a rate that produces a 1:1 I:E ratio even if the calculated Backup Ventilation rate is higher.

10.8.2 Backup Ventilation in Spont Mode

The factory default setting for Backup Ventilation in the SPONT mode will implement these changes:

- Mode = SIMV mode
- Rate = 15 b/min
- Pressure Control breath type = 15 cmH₂O above set PEEP
- i-time = 1.0 sec

10.8.3 Cancellation of Backup Ventilation

User Canceled

If during Backup Ventilation, the user adjusts a ventilation parameter, Backup Ventilation is suspended for 1 minute and all user-selected ventilation parameters are employed.

Sixty seconds must pass after parameter adjustments before a linked alarm violation will result in Backup Ventilation.

Patient Canceled

If linked to low minute volume, when minute volume exceeds the Low Min Vol alarm setting by 10%, Backup Ventilation is canceled. If linked to Apnea alarm, after 2 minutes of Backup Ventilation, it is canceled. At that time, the audible alarm stops and the ventilator resumes ventilation at the user-selected parameters.

Press the *Audio Paused/Reset* button to cancel the latched alarm message in the message display window.

A Quick Check Procedure Check-Off

Preparation for Use Tests (indicate result for each test)

Item	Pass	Fail
1. Circuit check procedure		
2. No External Power alarm check		
3a. Alarms and indicators check: ↑P alarm		
3b. Alarms and indicators check: ↓P alarm		
4. Pressure gauge/PEEP check		
5. Volume/minute volume/respiratory rate check		
6. Power Pac battery pack and backup battery check		
7. Brightness check		

The Newport™ HT70 ventilator is ready for operation when all tests have been successfully completed.

Note any comments on inspection of unit, corrective action taken, or recommendations for further action.

Completed by	Date	Unit hours

Facility	
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Unit serial number	
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B Foldout Drawings

Use these drawings for reference while reviewing the Newport™ HT70 ventilator manual.

Figure B-1. English Version—Front Panel Overview



- 1 **Breath delivery indicator LED.** Flashes green with every breath delivered by the ventilator.
- 2 **External power LED.** Lights green whenever external power is connected. This also indicates that the internal dual battery system is being charged.
- 3 **Manual Inflation button.** Press and hold this button to deliver flow to the patient. The ventilator will deliver flow at the current settings while the button is pressed. Flow delivery is limited to a maximum of 3 seconds or until the High Pressure alarm setting is reached.
- 4 **Brightness button.** Press this button repeatedly to scroll to one of four screen brightness levels.
- 5 **Device alert LED.** Lights red when there is a device alarm. Take the ventilator out of service and use an alternate means of ventilation until resolved.
- 6 **Patient gas output.** Attach patient breathing circuit tubing here.
- 7 **Proximal pressure line connector.** Attach proximal pressure tubing here.
- 8 **Exhalation valve drive tubing connector.** Attach exhalation valve drive tubing here.
- 9 **Alarm violation LEDs.** LEDs in the handle light to indicate alarm conditions.
- 10 **Audio Paused/Reset button.** Press this button to mute the audible alarm for 1 minute. Once an alarm condition has been corrected, press this button to clear/reset the alarm message. Press this button for 3 seconds to clear all alarm messages.
- 11 **Audio paused LED.** Remains lit during the one-minute audio paused period.
- 12 **Cancel button.** Press this button if you want to cancel changes that have not already been accepted.
- 13 **Accept button.** Press this button to accept/confirm all changes made to control settings.
- 14 **▲ Up/▼ down arrow buttons.** Press to change a highlighted parameter up/down by one unit. Hold down continuously and the parameter will change at an increasingly quicker pace.
- 15 **Touch screen user interface.** Touch screen to access alarms and parameter settings.
- 16 **Flow sensor connector.** Attach on-airway flow sensor here.

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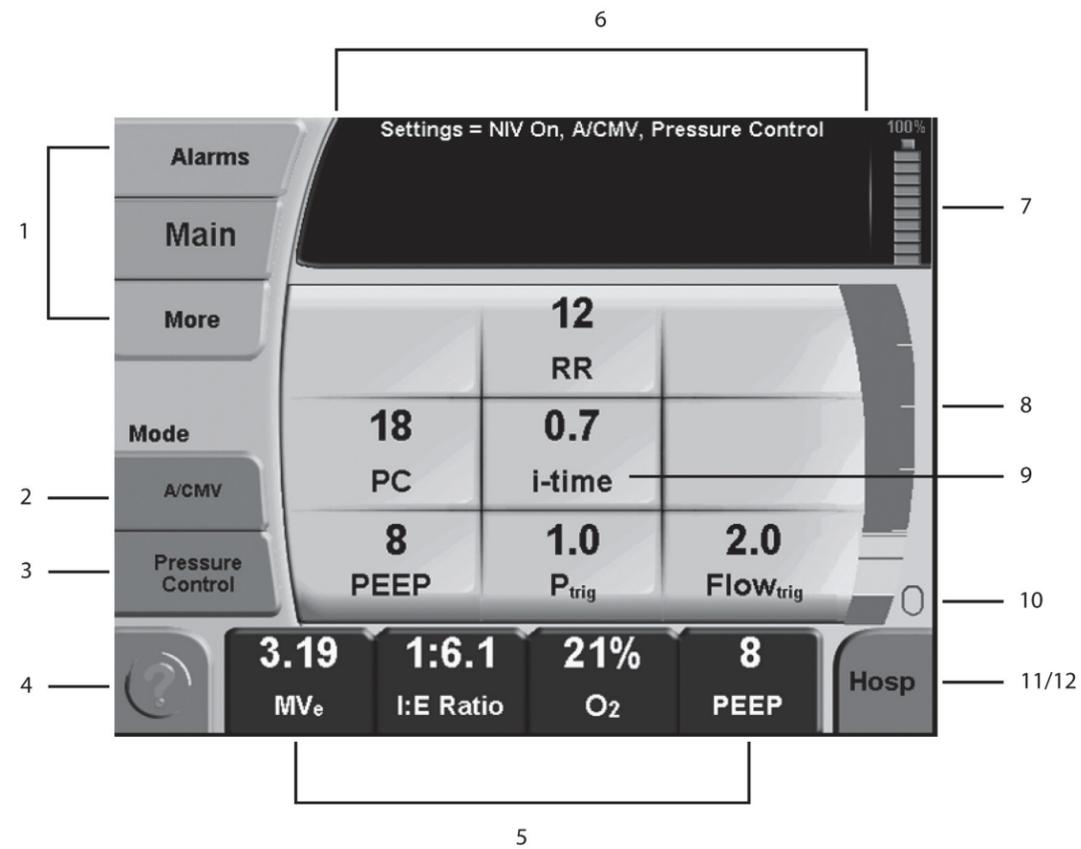
Figure B-2. Symbols Version—Front Panel Overview



- 1 **Breath delivery indicator LED.** Flashes green with every breath delivered by the ventilator.
- 2 **External power LED.** Lights green whenever external power is connected. This also indicates that the internal dual battery system is being charged.
- 3 **Manual Inflation button.** Press and hold this button to deliver flow to the patient. The ventilator will deliver flow at the current settings while the button is pressed. Flow delivery is limited to a maximum of 3 seconds or until the High Pressure alarm setting is reached.
- 4 **Brightness button.** Press this button repeatedly to scroll to one of four screen brightness levels.
- 5 **Device alert LED.** Lights red when there is a device alarm. Take the ventilator out of service and use an alternate means of ventilation until resolved.
- 6 **Patient gas output.** Attach patient breathing circuit tubing here.
- 7 **Proximal pressure line connector.** Attach proximal pressure tubing here.
- 8 **Exhalation valve drive tubing connector.** Attach exhalation valve drive tubing here.
- 9 **Alarm violation LEDs.** LEDs in the handle light to indicate alarm conditions.
- 10 **Audio Paused/Reset button.** Press this button to mute the audible alarm for 1 minute. Once an alarm condition has been corrected, press this button to clear/reset the alarm message. Press this button for 3 seconds to clear all alarm messages.
- 11 **Audio paused LED.** Remains lit during the one-minute audio paused period.
- 12 **Cancel button.** Press this button if you want to cancel changes that have not already been accepted.
- 13 **Accept button.** Press this button to accept/confirm all changes made to control settings.
- 14 **▲ Up/▼ down arrow buttons.** Press to change a highlighted parameter up/down by one unit. Hold down continuously and the parameter will change at an increasingly quicker pace.
- 15 **Touch screen user interface.** Touch screen to access alarms and parameter settings.
- 16 **Flow sensor connector.** Attach on-airway flow sensor here.

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Figure B-3. HT70PM Model Touch Screen (Hospital Domain)



- 1 **Screen selections buttons.** Touching any one of these buttons will take you to the new screen. The More screen includes links to Event, Trends, Wave, and Utility screens.
- 2 **Mode selector.** Touching this button scrolls through the mode choices. The mode will not change until you press the *Accept* button.
- 3 **Breath type selector.** Touching this button toggles the breath type choice. The breath type will not change until you press the *Accept* button.
- 4 **Help button.** Touching this button enables a tutorial for each feature on the screen. Touch the *Help* button then touch any button for an explanation of that feature.
- 5 **Monitored data buttons.** Touching any one of these four buttons opens a screen with a view of monitored parameter choices to display in that button.
- 6 **Message display.** This area shows all informational and alarm messages, and the preset in use, current NIV selection, mode, and breath type selection. During an alarm violation this area will light red for high priority, amber for medium priority, and yellow for low priority alarms and display the alarm message.
- 7 **Battery charge level indicator.** Shows the charge level of the Power Pac battery pack (blue icon) during external power or power pac use or the charge level of the backup battery (red icon) during backup battery use.
- 8 **Pressure bar.** Indicates dynamic pressure in the patient circuit in green, the High and Low Pressure alarm settings in red, and the peak pressure of the last breath in green.
- 9 **Parameter setting buttons.** Touching any one of these buttons will activate the parameter to allow adjustments.
- 10 **Patient effort indicator.** Flashes green to show a spontaneous patient effort.
- 11 **Domain button.** The HT70 can be set up in one of three domains: basic, transport, and hospital. Touch to scroll through the domain choices. Press *Accept* to confirm choice.
- 12 **AutoLock/unlock button.** This button is only visible if Auto Lock is enabled and the panel is locked. Touch and hold for 3 seconds to unlock touch screen buttons.



Note:

While operating on battery power with Power Save enabled and all alarms cleared, the touch screen will go to sleep after 2 minutes. Just touch the screen to bring it back into view.

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