FLIGHT MEDICAL INNOVATIONS LTD.

FLIGHT 50 Ventilator

Operator's Manual

LIT-0002 Rev. A00

Flight Medical®

CE 0483

Legal Notice

Disclaimer

FLIGHT MEDICAL INNOVATIONS LTD. (FLIGHT MEDICAL) provides this Operator's Manual in its commitment to help reduce patient risk and injury. However, this manual is not intended to in any way replace or substitute duty of care to a patient, professional responsibility, or professional judgment, nor is it intended to provide any warranty, promise, guarantee, assumption of risk or duty, release, or indemnity. Physicians shall at all times maintain responsibility for patient treatment and outcomes, and FLIGHT MEDICAL further assumes no liability for patient treatment or outcome or for physician's negligence, breach of duty of care, or malpractice.

The FLIGHT 50 Ventilator operator is solely responsible for selecting the appropriate level and method of patient monitoring. Product modification or misuse can be dangerous. FLIGHT MEDICAL disclaims all liability for the consequences of product alterations or modifications, as well as for the consequences which might result from the combination of this ventilator with other products, whether supplied by FLIGHT MEDICAL or by other manufacturers, unless such a combination has been specifically endorsed by FLIGHT MEDICAL.

The design of FLIGHT 50 Ventilator, the Operator's 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 FLIGHT 50 Ventilator.

Federal law (US) restricts this device to sale by or on the order of a physician.

This Operator's Manual excludes references to various hazards which are obvious to medical professionals and operators of this equipment, to the consequences of product misuse, and to potential adverse effects in patients with abnormal conditions.

When the FLIGHT 50 Ventilator is used in homecare and subacute environments, only properly trained personnel should operate the ventilator. FLIGHT 50 Ventilator is a restricted medical device designed for use by respiratory therapists or other properly trained and qualified personnel under the direction of a physician and in accordance with applicable state laws and regulations.

Transport of patients with the FLIGHT 50 Ventilator requires that medical staff have a good working knowledge of the ventilator's use and problem resolution. Proper emergency backup equipment must be immediately available during transport.

FLIGHT 50 Ventilator operators must recognize their responsibility for implementing safety monitoring mechanisms which supply appropriate

information on equipment performance and patient condition. Patient safety may be achieved through a wide variety of means, such as electronic surveillance of equipment performance and patient condition. However, equipment surveillance should not replace direct observation of clinical signs.

The liability of FLIGHT MEDICAL is subject to and limited to the exclusive terms and conditions as set forth herein. Said liability is limited whether arising out of, or related to, the manufacture and sale of goods, their installation, demonstration, sales representation, use, performance, or otherwise. Any liability based upon product warranty is limited regardless of any fault attributable to FLIGHT MEDICAL and the nature of the action (including breach of warranty, negligence, and strict liability).

The written warranties are in lieu of all other warranties, expressed or implied, including, without limitation, warranties of merchantability, fitness for any purpose, or non-infringement.

FLIGHT MEDICAL shall not be liable for any special incidental or consequential damages incurred by the buyer to a third party. The buyer shall not be entitled to make liability recoveries from FLIGHT MEDICAL due to such situations.

Warranty

FLIGHT 50 Ventilator warranty does not apply for/ in case of:

- Defects caused by misuse, mishandling, tampering, or by modifications not authorized by FLIGHT MEDICAL or its representatives.
- Rubber and plastic components and materials, which are guaranteed to be free of defects at time of delivery.

Any product which proves during the warranty period to be defective in workmanship or material, will be replaced, credited, or repaired. FLIGHT MEDICAL retains the discretion to select the most suitable of these options. FLIGHT MEDICAL is not responsible for deterioration, wear, or abuse. In all cases, FLIGHT MEDICAL will not be liable beyond the original selling price.

Application of this warranty is subject to the following conditions:

- FLIGHT MEDICAL or its authorized representatives must be promptly notified upon detection of the defective material or equipment.
- Defective material or equipment must be returned to FLIGHT MEDICAL or its authorized representative.
- Examination by FLIGHT MEDICAL or its authorized representatives must confirm that the defect is covered by the terms of this warranty.

The above is the sole warranty provided by FLIGHT MEDICAL. No other warranty, expressed or implied, is intended. Representatives of FLIGHT MEDICAL are not authorized to modify the terms of this warranty.

In no way does this or any of FLIGHT MEDICAL's policies, training materials, guidelines, or instructions create an obligation for FLIGHT MEDICAL to perform any services.

Table of Contents

1 Safety Instructions

At all times, strictly follow this manual. The safe use of the FLIGHT 50 Ventilator requires full understanding of its operation, and adherence to the manual's instructions. The equipment is only to be used for the purpose specified in section 1.1. Observe all of the WARNINGS and CAUTIONS posted in this manual, and on buttons found on the FLIGHT 50 Ventilator and associated accessories.

1.1 General Warnings

External power connection: To maintain grounding integrity when using AC power, only connect to hospital grade receptacles. Always disconnect the external power supply prior to servicing. There is a risk of explosion if used in the presence of flammable anesthetics.

All settings and adjustments in the different ventilation modes must be made in accordance with a physician's prescribed therapy.

Do not use electrically conductive patient circuits.

Always use a clean, disinfected patient circuit.

Always use an outlet filter or equivalent at the Airway Pressure Connector, to protect the internal transducers from moisture and other contaminants.

The ventilator is ready for operation only when:

- It is completely assembled.
- The OVP has been successfully completed.

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

Ensure that the oxygen source is not empty before and during the use of the optional Air/Oxygen Entrainment Mixer or Oxygen Blending Bag Kit.

As Li-Ion batteries are charged and discharged over time, their ability to hold a charge is decreased with use. This can shorten the amount of time the ventilator can function while on battery power.

The batteries should be replaced when they no longer meet the needs of the user. This depends on a number of factors including settings and usage patterns.

Charge the batteries for a minimum of three hours before powering the ventilator from the batteries. This ensures that the batteries will be fully charged.

During storage, charge the batteries for a minimum of three hours every 30 days. This improves the chances of always having charged batteries.

Always ensure that the green Ext. Power LED is illuminated after connecting the FLIGHT 50 Ventilator to an external AC or DC power source. If the LED is not illuminated, check all power connections and resolve any problems.

Always plug the FLIGHT 50 Ventilator into an AC power supply source when not in use. This will ensure the best battery performance.

The flow resistance of the air inlet filter, located on the right side of the ventilator, will likely increase with repeated use. Ensure that the filter is changed regularly.

Only a FLIGHT MEDICAL approved patient circuit can be used with the FLIGHT 50 Ventilator.

Only a FLIGHT MEDICAL approved exhalation valve can be used with the FLIGHT 50 Ventilator.

Perform an exhalation valve calibration each time a clean circuit/exhalation valve is installed.

The FLIGHT 50 Ventilator has been tested and found to comply with the EMC limits according to the EN60601-1-1-2 standard class B. These limits are designed to provide reasonable protection against harmful interference in a typical medical installation. The equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with these instructions, may cause harmful interference to other devices in the vicinity. However, there is no guarantee that interference will not occur in a particular installation. If it is found that this equipment causes harmful 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 distance between the equipment.
- Connect the equipment into an outlet on a circuit different from that to which the device (s) is connected.
- Consult the manufacturer for help.

1.2 **Cautions**

Only use medical grade oxygen with the Air/Oxygen Entrainment Mixer or Oxygen Blending Bag Kit.

Do not place liquid containers in the immediate vicinity or on top of the FLIGHT 50 Ventilator. Liquids that get into the ventilator can cause equipment malfunction and damage.

After the FLIGHT 5050 Ventilator is serviced, it must completely pass an Operational Verification Procedure (OVP) before being returned to patient use.

An authorized FLIGHT MEDICAL factory-trained technician must do all service or repairs performed on the FLIGHT 5050 Ventilator.

Do not open the ventilator or perform service on an open unit while connected to external power.

Use standard antistatic techniques while working inside the ventilator or handling any electronic parts.

Clean all external accessories of the ventilator prior to servicing.

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

Batteries contain Li-Ion. Do not discard them in an incinerator or force them open. Batteries should not be disposed of with normal waste.

Use the tools and equipment specified in this manual to perform specific procedures.

1.3 Contact Information

Address further questions or problems to one of the FLIGHT MEDICAL offices.

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2 Specifications

2.1 INTENDED USE

FLIGHT 50 Ventilator is intended to provide continuous or intermittent mechanical ventilation support for the care of individuals who require mechanical ventilation. Specifically, the FLIGHT 50 is applicable for adult and pediatric (i.e., infant, child and adolescent) patients, greater than or equal to 10kg (22 lbs).

FLIGHT 50 Ventilator is a restricted medical device intended for use by qualified, trained personnel under the direction of a physician; it is suitable for use in hospital, sub-acute, emergency room, and home care environments, as well as for transport and emergency response applications. Front panel controls allow trained operators to select between a number of operational modes, pressure support and volume or pressure control. Flight 50 Ventilator has a comprehensive built-in alarm system to alert the user to violations of set safety limits. When new and fully charged, the internal battery system provides up to 10 hours of power. With its patented, self-contained gas supply source, FLIGHT 50 Ventilator requires no external air compressor.

2.2 SYMBOLS and SPECIFICATIONS

Main Power On

Alarm Setting

Main Power Standby

Audible Alarm Silence/Reset

Equipotentiality

High Alarm

Set High Alarm

Refer to Operating Manual

Low Alarm

Set Low Alarm

Applied Parts Type BF

Controls/Alarms/Monitors	Range/Selection
MODE (Pressure or Volume Control)	A/CMV SIMV SPONT
Volume Control (Tidal Volume)	100 to 2,200 mL, ATPS, ± 10%
Pressure Control (Target Pressure)	PEEP +5 to 60 cmH_2O / mbar
$\dot{V}$ **(Flow)**	6 to 100 L/min
t_i **(Inspiratory Time)**	0.1 to 3.0 sec
f **(Frequency)**	1 to 99 b/min
Ptrig (Sensitivity)	–9.9 to 0 cmH2O / mbar, pressure triggering (Patient Effort Indicator LED blinks once each time the airway pressure reaches the Ptrig setting.)
PEEP/CPAP	0 to 30 cmH_2O / mbar
P support (Pressure Support)	0 to 60 cmH_2O / mbar above baseline pressure, limited to PEEP + Psupport ≤ 60 cmH_2O / mbar
I:E Ratio	1:99 to 3:1
Maximum Limited Airway Pressure (Safety Valve)	100 cmH_2O (98 mbar)
Manual Inflation	3 sec maximum (While button is pushed, the ventilator closes the exhalation valve and delivers an operator controlled breath to the patient.)
Humidifier (Optional)	19ºC to 39ºC
Airway Pressure Meter	-10 to 100 cmH_2O/-10 to 98 mbar
Alarm Silence/Reset Button & Indicator	Pressing the button silences an audible alarm violation for 60 seconds and resets a latched alarm indicator. LED lights to indicate that Silence is active.
ALARMS Indicators	Indicators for violated alarms blink red. When the alarm is no longer violated, the indicator latches (stays lit). Cancel a latched indicator by pressing the Silence/Reset button.
Int. Battery Button and Indicator	Pressing the button displays the internal battery charge level in the airway pressure meter (Paw) window. Use only when operating on the internal battery system for accurate reading. LED lights to indicate internal battery system operation and alarms.

Controls/Alarms/Monitors	Range/Selection

F_IO_2 (with optional accessories)	0.21 to 1.00
On / Standby Button	Press once to put in Setting condition. (On-Setting/LED off) Press again to begin ventilating (On-Ventilating/LED on). When the FLIGHT 50 Ventilator is ventilating, press two times to put ventilator into Standby/Off condition (LED off).
Push To Unlock Buttons & Indicator	Pressing the button unlocks the front panel buttons, if they were locked by automatic panel lock feature. Auto lock is enabled/ disabled in User Set Up. LED lights to indicate panel is locked.
Alarms	
▲Paw (High Pressure)	4 to 99 cmH_2O / 4 to 99 mbar, must be 1< Low Paw
▼Paw (Low Pressure)	3 to 98 cmH_2O / 3 to 98 mbar, limited by ≥ PEEP + 3 and High Paw -1
Low Baseline Pressure	Paw ≤ PEEP - 3 cmH_2O/mbar for 3 sec during exhalation
High Baseline Pressure	Paw ≥ PEEP + 8 cmH_2O/mbar at onset of a breath or 3 sec after the start of exhalation
Occlusion	Paw ≥ PEEP + 15 cmH_2O/mbar at onset of a breath or 3 sec after start of expiration
Apnea	30 sec ± 3 sec
PCV Not Reached	Paw P < 50% of PCV setting
▲ $\dot{V}_I$ Insp. Min. Volume	1.1 to 50.0 L/min
▼ $\dot{V}_I$ Insp. Min. Volume	0.1 to 49.0 L/min
Check Prox Line	Prox Paw does not match machine Paw during inspiration
Humidifier (5 messages)	Humidifier malfunction/disconnection
Power Switchover	External power to internal battery switchover alert
Battery Low	Minimum of 30 minutes battery time remains until shutdown
Battery Empty	Minimum of 15 minutes battery time remains until shutdown

The time between the Battery Low Alarm violation and the Battery Empty Alarm violation will vary depending on the ventilator load. At high volumes and pressures, the Battery Empty Alarm will occur much sooner after the Battery Low Alarm, than it will at lower volumes and pressures. In all cases, the stated minimum times for each alarm will be met, even if the two alarms occur almost simultaneously.

Device Alert (5 messages)	Ventilator malfunction: FAULT BAT SYS, OCCLUSION, 10V SHUTDOWN, SYSTEM ERROR or MOTOR FAULT
Shut Down Alert	On to Standby/Off Shut Down Alert

Message Display Window	
Up to 16 characters, LED alpha numeric display. Displayed monitored parameters:	V_T (Actual delivered tidal volume) V_I (Inspiratory minute volume) f (Total breath frequency) Paw P (Peak airway pressure) Paw M (Mean airway pressure) Paw B (Baseline airway pressure) H (Hours of operation) S (Software version) L (or Q) (Buzzer volume (Loud or Quiet) for audible alarm)
Other displayed parameters (In USER SET UP):	Power Save (On / Off) Airway Pressure Units (cmH_2O / mbar) Set Up (User / Default) Auto Panel Lock (Enabled / Disabled) Tech. Setup (Technical set up, refer to Service Manual)
Front Panel Indicators	
Modes:	
A/CMV	Green LED indicates that A/CMV mode is active.
SIMV	Green LED indicates that SIMV mode is active.
SPONT	Green LED indicates that SPONT mode is active.
Controls:	
Volume Control	Green LED indicates Volume Control ventilation.
Pressure Control	Green LED indicates Pressure Control ventilation.
Alarms:	
▲Paw (High Pressure)	Red LED indicates high peak airway pressure, high baseline pressure, or occlusion alarm violation.
▼Paw (Low Pressure) / Apnea	Red LED indicates low peak airway pressure, low baseline pressure, apnea, or PCV (50% of PCV setting not achieved) alarm violation.
Device Alert	Red LED indicates ventilator malfunction alert.
▲ $\dot{V}_I$ (High Insp. Min. Volume)	Red LED indicates high inspiratory minute volume alarm limit is violated.
▼ $\dot{V}_I$ (Low Insp. Min. Volume) (Back-Up Vent)	Red LED indicates low inspiratory minute volume alarm limit is violated.
Miscellaneous Indicators	
Silence / Reset	Yellow LED indicates that the audible alarm is silenced for 60 seconds.
Auto Lock On	Green LED indicates that the panel is currently locked.
On / Standby	Green LED indicates that the FLIGHT 50 is ventilating.
Ptrig	Green LED blinks on to indicate patient breathing effort.

$\dot{V}$ (Flow)	Green LED indicates that Flow is displayed in the $\dot{V}$/ I:E Ratio numeric window display.
I:E	Green LED indicates that the I:E Ratio is displayed in the $\dot{V}$/ I:E Ratio numeric window display. Blinking LED indicates a breath with an inverse I:E Ratio.
Ext. Power / Charging Int. Battery	Green LED indicates external power is on and the internal battery is being charged. Red LED indicates power switchover to internal battery.
Int. Battery (Push to Test)	Yellow LED indicates internal battery is in use. LED blinks yellow to indicate Battery Low alarm condition or blinks red to indicate Battery Empty alarm condition.
Humidifier On	Green LED indicates humidifier is active. LED blinks yellow to indicate humidifier alarm condition.

Hardware	**Requirements**
Electrical	Applied parts type BF
External A.C. /D.C. (Battery Input)	100-240 VAC, max. 2 A 50 / 60 / 400 Hz 12-30 VDC, max. 12 A
Dual Internal Battery	Primary battery: lead acid, 12 VDC, 5 AH Secondary back up battery: nickel metal hydride,12 VDC, 2.1 AH When new and fully charged, the Dual internal battery supplies power for up to 10 hours of operation at these settings: A/CMV mode, f=15, Volume Control=500 mL, t_I =1.0 sec, PEEP=Ø, max. airway pressure 30 cmH_2O/mbar, Power Save mode ON.
RS-232C Interface /Remote Alarm Output	8 pin SEMCONN connector. Operates at 19,200 baud. Allows put for interfacing with central alarms systems
Pneumatics	Gas delivery system requires no external air compressor.

The dual internal battery charges whenever the FLIGHT 50 Ventilator is connected to an external power source. Battery charge level is best maintained by keeping the FLIGHT 50 Ventilator continuously connected to external power.

The primary internal battery capacity diminishes with age. As the battery ages the Battery Low alarm will occur sooner. If this begins to infringe on the needed battery time, prior to scheduled replacement, the primary internal battery should be replaced.

Miscellaneous	Description
Operating Temperature	–18ºC to 50ºC

For proper operation at low range temperatures (-18°C), the FLIGHT 50 Ventilator must be started in a normal room temperature environment and allowed to run for 30 minutes prior to transfer to colder environment.

At temperatures over 40ºC the charging circuit is disabled and the internal battery does not charge.

Operating Humidity	15 to 95% non-condensing
Operating Altitude	Sea level to 15,000 ft (0 to 4,572 m) There is no altitude limitation when FLIGHT 50 Ventilator is operated in a pressurized environment.
Operating Pressure	600 to 1,100 mbar
Regulatory and Agency Standards/Requirements	Complies with the following international standards and requirements: **IEC 60601-1:1988** (+A1:1991 +A2:1995; EN 60601-1:1990 +A1:1993 +A2:1995 +A3:1996) Medical Electrical Equipment – Part 1: General Requirements for Safety **CEI/IEC 60529:2001** Degrees of Protection Provided by Enclosures (IP Code) **IEC 60601-1-2:2001** (+A1:2006) Medical Electrical Equipment, Collateral Standard: Electromagnetic Compatibility – Requirements and Tests IEC 68-2-6 Test Fc Environmental Tests: Vibration (sinusoidal) **IEC 68-2-29** Test Eb Environmental Tests: Bump **IEC 68-2-32** Test Ed Environmental Tests: Free Fall **IEC 68-2-36** Test Fdb Environmental Tests: Random Vibration
Storage Temperature	–40ºC to 65ºC
Storage Humidity	0 to 95% non-condensing
Height (includes handle)	10 inches (26 cm)
Width	11 inches (27 cm)
Depth	8 inches (20 cm)
Weight	16.7 lbs. (7.6 kg) without humidifier 18.0 lbs. (8.2 kg) with humidifier

Patient Range	Adult - Pediatric (i.e. infant, child & adolescent) with body weight ≥10 kg
Factory Default Parameters	
Patient Settings	
MODE	A/CMV
Volume Control	500 mL
t_I	1.0 sec
f	15 b/min
Ptrig	-1.0 cmH_2O
Paw Alarms	5 cmH_2O ▼ Paw 40 cmH_2O ▲ Paw
$\dot{V}_I$ Alarms	3 L/min ▼ $\dot{V}_I$ 20 L/min ▲ $\dot{V}_I$
PEEP/CPAP	0 cmH_2O
Psupport	0 cmH_2O
Humidifier	Off
Buzzer Volume	Loud
User Set Up	
Power Save	On
Pressure Units	cmH_2O
Auto Panel Lock	Disabled
Set Up	User
Patient Circuit	Reusable 22 mm I.D. adult/pediatric circuit with 3/16 inch (4.8 mm) I.D. proximal pressure sensing line, 1/8 inch (3.2 mm) I.D. exhalation valve control drive line, and exhalation valve.
Exhalation Valve	FLIGHT MEDICAL'S FLIGHT 50 exhalation valve (P/N V54-00000-67) is manufactured and designed specifically for the FLIGHT 50 Ventilator. FLIGHT MEDICAL does not approve of the use of any type or brand of exhalation valve that has not been tested and approved by FLIGHT MEDICAL for use with the FLIGHT 50.

FLIGHT 50 HUMIDIFIER
(operates on A.C. power only)

Set Target Temperature Range	19ºC to 39ºC
Operating Water Volume	300 mL
Usable Volume of Water Bottle	265 mL
Compliance at Minimum Water Level	0.5 mL/cmH_2O / mbar @ 23ºC

(Refill Line)	
Compliance at Maximum Water Level (Full Line)	0.33 mL/cmH_2O / mbar @ 23ºC
Intended Use	Adult and pediatric patients whose supraglottic airway is or is not bypassed.
Warm-Up Time	30 minutes
Gas Leakage	2 mL/min at airway pressure of 80 cmH_2O / mbar
Humidifier Output	33.8 mg/L at a continuous flow of 10 L/min @ 39ºC
Maximum Operating Airway Pressure	100 cmH_2O / 98 mbar
Maximum Temperature at the Patient Wye That Triggers an Alarm	41ºC

Air / Oxygen Entrainment Mixer Specifications
(optional)

Pneumatic Requirements:	
Oxygen	35 to 90 psig (2.4 to 6.2 Bar) full operating range 40 to 70 psig (2.7 to 4.8 Bar) accuracy ± .08
Air	Atmospheric pressure
F_IO_2 Control	Adjusted continuously from 0.21 to 1.00

Continuous oxygen monitoring is required for patient safety. FLIGHT 50 does not have a built-in alarm system to notify user of a failure or disconnect of the oxygen source.

Oxygen Blending Bag Kit Specifications
(optional)

Pneumatic Requirements:	
Oxygen	0-10 L/min (calibrated)
Air	Atmospheric pressure
F_IO_2 Control:	F_IO_2, indirectly adjusted from 0.21 up to 1.00 via oxygen flow (L/min)

Continuous oxygen monitoring is required for patient safety. FLIGHT 50 does not have a built-in alarm system to notify user of a failure or disconnect of the oxygen source.

3 Ventilator Description

3.1 Front Panel Overview

The following is an overview of the FLIGHT 50 Ventilator front panel button functions. For an in-depth description, please review Front Panel Controls and Indicators.

3.1.1 Turning the FLIGHT 50 Ventilator On/Off

The On/Standby button toggles between the following conditions:

Standby -►Setting -► On -► -► Standby

➔ **To turn the FLIGHT 50 Ventilator On/Off:**

1. Press **On/Standby** button once to go from Standby to Setting.
2. Press again to turn On.
3. Press twice to go from On to Standby.
   - Standby: FLIGHT 50 Ventilator dormant.
   - Setting: Enables setting of control parameters and exhalation valve calibration.
   - On: Enables ventilation

There is approximately a two second delay in going from Off to Setting condition. During this time, the FLIGHT 50 Ventilator performs a self-test and will light all displays on the front panel.

3.1.2 Changing the MODE Control

The MODE control buttons (A/CMV / SIMV / SPONT) function differently in Setting and On conditions.

3.1.2.1 Setting Condition

Press the **A/CMV, SIMV or SPONT** button.

The LED on the selected Mode will light green to confirm the selection.

3.1.2.2 On Condition

Press the **A/CMV, SIMV or SPONT** button.

The LED on the selected Mode will blink green and the Message Display Window will read "**PRESS AGAIN**." Press the button again within 5 seconds to confirm the mode change, or the previously selected mode will continue.

3.1.3 Changing between Pressure Control and Volume Control

The Pressure Control and Volume Control buttons function differently when in A/CMV or SIMV in On condition compared to when in SPONT mode in On condition or Settings condition.

3.1.3.1 On Condition: A/CMV or SIMV

1. Select—Adjust (▲Up / ▼Down)—Accept
2. Select the Pressure Control or Volume Control button.

   The LED indicator and the target value blink.
3. Adjust the blinking target value for the selected control with the ▲Up / ▼Down buttons.
4. Press the desired control button (Volume or Pressure) a second time to accept the new control and target value.

3.1.3.2 On Condition: SPONT or Setting Condition: A/CMV, SIMV, or SPONT

1. Select—Adjust (▲Up / ▼Down)—Accept
2. Select the Pressure Control or Volume Control button.

   The LED indicator and the target value blink.
3. Adjust the blinking target value for the selected control with the ▲Up / ▼Down buttons.
4. To accept the new control and target value, either:
   - Press the selected button again.
   - Press another button to select a new parameter for adjustment.
   - Wait 5 seconds without making a change.

The transition to a new pressure or volume target may require several breaths.

3.1.4 Changing a Parameter (or Multiple Parameters)

1. Select—Adjust (▲Up / ▼Down)—Accept.
2. Select the parameter by pressing the labeled button (i.e. f, P trig, etc).

   The parameter's numeric display blinks.
3. Adjust the numeric value with the ▲Up / ▼Down buttons.
4. To accept the value, either:
   - Press the selected button again.
   - Press another button to select a new parameter for adjustment.
   - Wait 5 seconds without making a change.

3.1.5 Enabling/Disabling Auto Panel Lock

Auto Panel Lock can be enabled or disabled via User Set Up (see page 3-32). When the Auto Panel Lock is enabled, the Panel will lock 30 seconds after the last button is pushed and the LED lights green. All touch buttons (except Silence/Reset and Internal Battery Test) are locked, preventing accidental parameter changes.

Auto Panel Lock is factory preset to "**Disabled**" (off).

To temporarily unlock parameters when Auto Panel Lock is active, press the **Push To Unlock** button for at least one second. The Panel will relock 30 seconds after the last button is pushed.

Figure 1 – FLIGHT 50 Ventilator Front Panel

3.2 Front Panel Controls and Indicators

Front panel controls that have corresponding LED indicators are included with the description of the control.

The FLIGHT 50 Ventilator front panel is shown in Figure 1.

On / Standby

Figure 2 – On/Standby Button

This button toggles between the following conditions:

- Standby: (if attached to external power, the battery is being charged) -► Setting (allows setting of control parameters) -►On (enables ventilation) -► -► Standby.
- Standby: The FLIGHT 50 Ventilator is dormant and ventilation is not enabled. If attached to external power, the Ext. Power/ Charging Int. Battery LED is lit green, indicating that the internal battery is being charged. The On/Standby indicator is not lit.
- Setting: Pressing the **On/Standby** button once changes the ventilator from Standby to Setting condition.

There is approximately a two second delay in going from Standby to Setting condition. During this time, the FLIGHT 50 Ventilator performs a self-test and will light all displays on the front panel.

During Setting condition, all adjustable LEDs are lit. This allows the operator to preset and adjust controls prior to ventilation. The On/Standby indicator is not lit. The Message Display Window shows **Press On to Vent**, suggesting to the operator that the **On/Standby** button needs to be pressed if the FLIGHT 50 Ventilator should start ventilation.

On: Pressing the **On/Standby** button once more changes the ventilator from Setting to On. In the On condition, the FLIGHT 50 Ventilator is ventilating and the On/Standby indicator is lit green.

Pressing the **On/Standby** button twice while in On condition turns the ventilator from On to Standby.

3.2.1 MODE Control

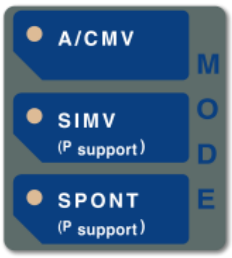

Figure 3 – Mode Control Button

The MODE control buttons enable the user to switch between the following operational modes:

- A/CMV
- SIMV
- SPONT

In A/CMV and SIMV, mandatory breaths can be pressure controlled or volume controlled. A green LED indicates which mode is active.

- If the FLIGHT 50 Ventilator is in Setting condition, changes are made by pressing the requested **MODE** button once.
- If in ON condition, changes are made by pressing the requested **MODE** button twice.

After the first press, the Message Display Window displays **"PRESS AGAIN"** and the requested MODE's indicator starts to blink.

If the requested MODE button is not tapped within 5 seconds, the change is cancelled.

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

Figure 4 – A/CMV Mode Button

In A/CMV, the user may choose to volume or pressure control mandatory breaths. In either case, all breaths delivered to the patient, whether time (ventilator initiated) or patient activated, are the same.

The *f* (frequency) setting determines the minimum number of time activated (mandatory) breaths delivered each minute. The Ptrig setting determines the airway pressure threshold that patient effort must reach to trigger additional mandatory breaths. If patient effort doesn't cause airway pressure to drop enough to meet the Ptrig threshold, or if the patient doesn't breathe, the FLIGHT 50 Ventilator will deliver the set *f* (frequency) of mandatory breaths.

If the Ptrig setting is not adjusted to a level that allows the patient's inspiratory effort to be detected, A/CMV mode performs as CMV (control) mode.

3.2.3 SIMV Mode (Synchronized Intermittent Mandatory Ventilation)

Figure 5 – SIMV Mode Button

In SIMV, the user may choose to volume or pressure control mandatory breaths. In either case, all mandatory breaths delivered to the patient, whether time (ventilator initiated) or patient-activated, are the same. In addition, the user may choose to pressure support the spontaneous breaths in between mandatory breaths.

Unlike A/CMV, the *ƒ* (frequency) setting in this mode determines the total rather than the minimum number of time (ventilator) or patient activated mandatory breaths delivered each minute.

The *ƒ* (frequency) setting also establishes a timing window which determines whether a patient activation results in a mandatory breath or a spontaneous breath.

The Ptrig setting determines the airway pressure threshold that patient effort must reach to activate mandatory breaths and also to activate spontaneous breaths in between mandatory breaths.

If patient effort doesn't cause airway pressure to drop enough to meet the Ptrig threshold or if the patient doesn't breathe, the FLIGHT 50 Ventilator will deliver the set *ƒ* (frequency) of mandatory breaths each minute.

3.2.4 SPONT Mode (Spontaneous Ventilation)

Figure 6 – SPONT Mode

In this mode, all breaths are patient activated by spontaneous efforts. Psupport (Pressure Support Ventilation) may be used to support spontaneous efforts. When PEEP/CPAP is set above 0, the ventilator mode is CPAP (without Psupport) or Bi-level Positive Airway Pressure (with PSV).

3.2.5 ▲ Up and ▼ Down Control

The **▲Up/▼Down** control buttons have multiple uses on the FLIGHT 50 Ventilator.

3.2.5.1 Parameter Adjustment

Use the **▲Up/▼Down** buttons to adjust ventilation control parameter values (including Pressure Control and Volume Control values), alarms, and humidifier setting (if available). Select the desired parameter by pressing its touch button once. The corresponding value (numerical display) will blink. Press the **▲Up** control to increase or the **▼Down** to decrease the affected parameter value. The value continuously changes when the **▲Up/▼Down** controls are tapped and held. The value adjustment is accepted if:

- The user presses the selected parameter button again.
- The user selects a different parameter.
- Five seconds elapse.

Pressing a parameter button without pressing either the **▲Up** or **▼Down** control button within 5 seconds causes the parameter to preserve its current value.

If in the On condition and switching between Volume Control and Pressure Control, the value adjustment for the new breath type selected (Volume or Pressure) will be accepted as noted above, but the breath type (VC or PC) will only change if the user taps the new breath type control button again.

3.2.5.2 **Monitored Information:**

The **▲Up/▼Down** controls are used to access and display monitoring messages in the Message Display Window. Monitored information includes volume, frequency, pressure values and operation information. See page 3-37 for more information on the Front Panel Message Display Window.

When the FLIGHT 50 Ventilator is ventilating and there are no alarm messages displayed on the Message Display Window, press the **▲Up** control to access the monitoring information. Press the **▲Up** button again to scroll through the messages.

3.2.5.3 Changing Default Settings

The **▲Up/▼Down** controls are also used in User Set Up to change a set up value. See User Set Up on page 3-32 for more details.

3.2.6 Frequency of Breaths (*f*)

Figure 7 – Frequency of Breaths Button

Range: 1 to 99 b/min

In the ACMV mode, the *f* (frequency) setting determines the minimum number of time-triggered mandatory breaths; in the SIMV mode, it

determines the total number of mandatory breaths. The frequency or rate value is displayed in the window adjacent to the selector button.

The user is alerted to frequency settings which result in an inverse I:E Ratio by an audible beep and an "**Inverse I:E**" message in the Message Display Window. Attempts to continue increasing the value after this alert are permitted up to an I:E Ratio of 3:1.

3.2.7 t_I (Inspiratory Time)

Figure 8 – t_I (Inspiratory Time) Button

Range: 0.1 to 3.0 sec

The t_I setting determines the inspiratory time for mandatory breaths (volume or pressure control). The selected time value is displayed in the window adjacent to the selector button. If the t_I settings results in an inverse I:E Ratio, the user is alerted by an audible beep and an **Inverse I:E** message in the Message Display Window. Attempts to continue increasing the value after this alert are permitted up to an I:E Ratio of 3:1.

If the inspiratory time setting causes the flow rate to reach the maximum or minimum level of the flow specification, adjustment of t_I ceases, a beep sounds, and a setting limitation message appears in the Message Display Window.

In SPONT mode, the t_I setting is not utilized but the value can be preset.

See page 3-28 for a list of setting limitation messages. (Setting Limitation Messages)

3.2.8 Volume Control (tidal volume)

Figure 9 – Volume Control Button

Range: 100 to 2,200 mL, ATPS

When Volume Control is first initiated, or when a large change is made to the volume setting, it may take 5 or 6 breaths to reach the volume setting.

Pressing the **Volume Control** button followed by the **▲Up/▼Down** controls enables the user to adjust the tidal volume setting. When the green Volume Control LED illuminates, the adjacent window displays the set tidal volume. See Theory of Operation, page 4-1, for more details. If the Volume Control setting causes the flow rate to reach the maximum or minimum level of the flow specification, adjustment of Volume Control ceases, a beep sounds, and a setting limitation message appears in the Message Display Window.

See page 3-28 for a list of setting limitation messages.

In SPONT mode, the Volume Control is not utilized but the value can be preset.

3.2.8.1 Switching from Pressure Control to Volume Control:

Press the **Volume Control** button. The set tidal volume is displayed in the adjacent window if the FLIGHT 50 Ventilator is ventilating. A "**PRESS AGAIN**" message appears in the Message Display Window.

Adjust the tidal volume level by pressing the **▲Up/▼Down** controls while the LED and numerical display are blinking. If the FLIGHT 50 Ventilator is ventilating, you will need to press the **Volume Control** button again within 5 seconds following adjustment.

3.2.9 Pressure Control (target pressure)

Figure 10 – Pressure Control Button

Range: 5 to 60 cmH_2O / mbar

When Pressure Control is first initiated or the setting is changed, the first few breaths may cycle off early until slope/rise is optimized. If early cycling off continues, reevaluate the breathing circuit configuration and lengthen the tubing as necessary.

Press the **Pressure Control** button followed by the **▲Up/▼Down** controls to adjust the target airway pressure setting. Target pressure references ambient (atmospheric pressure). When the green Pressure Control LED illuminates, the adjacent window displays the set airway pressure. See Theory of Operation page 4-1 for more details.

In SPONT mode, the Pressure Control is not utilized but the value can be preset.

3.2.9.1 Switching from Volume Control to Pressure Control:

➔ **To switch from volume control to pressure control:**

1. Press **Pressure Control**.

   The set target airway pressure value is displayed in the adjacent window if the FLIGHT 50 Ventilator is ventilating.

   A "**PRESS AGAIN**" message appears in the Message Display Window.

2. Adjust the set target airway pressure by pressing the **▲Up/▼Down** controls while the LED and numerical display are blinking.
3. If the FLIGHT 50 Ventilator is ventilating, you will need to press the **Pressure Control** button again within 5 seconds following adjustment.

The minimum target airway pressure is 5 cmH_2O / mbar above set baseline pressure.

3.2.10 Ptrig (sensitivity)

Figure 11 – Ptrig Button

Range: 0.0 to –9.9 cmH_2O/mbar

The Ptrig setting determines trigger sensitivity in terms of how far airway pressure must drop below the set baseline pressure for a patient's spontaneous efforts to be detected. The Ptrig LED indicator illuminates each time the airway pressure reaches the set Ptrig level, and turns off once the airway pressure has returned to baseline pressure. The blinking Ptrig LED is referred to as the Patient Effort Indicator. The Ptrig value is displayed in the adjacent window.

Set Ptrig as close to 0.0 cmH_2O as possible without auto triggering to maximize triggering synchrony.

3.2.11 PEEP/CPAP

Figure 12 – PEEP/CPAP Button

Range: 0 to 30 cmH_2O/mbar

The PEEP/CPAP setting establishes airway pressure in the patient circuit during the exhalation phase. It is also referred to as base or baseline pressure. The set PEEP/CPAP value is displayed in the adjacent window.

In Pressure Control ventilation, PEEP/CPAP cannot be set higher than 5 cmH_2O/mbar below the set Pressure Control setting.

The value of PEEP/CPAP plus Psupport cannot exceed 60 cmH_2O/mbar.

3.2.12 PSupport

Figure 13 – Psupport Button

Range: 0 to 60 cmH_2O/mbar

The Psupport functions during patient activated spontaneous breaths in SIMV and SPONT modes only. During each spontaneous breath, the ventilator supports the patient by elevating the airway pressure to the Psupport + PEEP level.

Any time the active Psupport control is pressed, Psupport flow delivery slows to a lower level then it gradually increases to the appropriate level as pressure rise is re-assessed.

The value of PEEP/CPAP plus P support cannot exceed 60cmH_2O/mbar.

3.2.13 Manual Inflation

Figure 14 – Manual Inflation Button

Range: 0 to 3.0 sec

Pressing this button delivers an operator initiated Manual Inflation. Pressing the **Manual Inflation** button will not initiate an inflation if the patient is currently in the inspiratory phase of a breath or if airway pressure is > 5 cmH_2O (mbar) above the set PEEP/CPAP level. Manual Inflation delivers the set flow rate (in Volume Control) or the set target pressure (in Pressure Control), but inspiratory time is controlled by the user.

During Manual Inflation, the breath is terminated if:

- The Manual Inflation button is released

- The ▲Paw (High Pressure) alarm is violated
- Three seconds have elapsed.

	Manual Inflation is only available in A/CMV and SIMV modes.

	Manual Inflation may be prematurely cycled off in the first several breaths in Pressure Control when the initial flow has not yet been optimized.

3.2.14 Humidifier On Button

Figure 15 – Humidifier On Button

Range: 19ºC to 39ºC

This touch button activates the built-in humidifier. Pressing this button displays the set target temperature in the adjacent window. While the display is blinking, use the **▲Up/▼Down** controls to adjust the target temperature.

When temperature adjustment is complete and the following occurs:

- Five seconds have elapsed without touching the control
- The Humidifier On button is tapped again
- Another parameter is selected for adjustment

The display stops blinking and the measured temperature is displayed.

While the humidifier is On, the target temperature can be readjusted by pressing the **Humidifier On** button and using the **▲Up/▼Down** controls.

	Preheating the humidifier for 30 minutes prior to beginning ventilation will improve the heating performance of the humidifier.

During ventilation (On condition) the displayed temperature is the measured temperature at the patient connector. In the Setting condition, the displayed temperature is the measured temperature at the humidifier bottle outlet.

To turn the humidifier Off, press and hold the **Humidifier On** button for three seconds. See

Humidifier On Button page 3-12 for more details.

The measured proximal temperature may be different from the set target temperature due to the patient temperature, environmental temperature, minute volume , etc.

The humidifier is operational only when the FLIGHT 50 Ventilator is powered by external A.C. power.

If the humidifier and/or the temperature probe is removed or malfunctions or if the humidifier bottle is removed prior to turning the humidifier off, the Humidifier On LED changes from green to blinking yellow, an audible alarm sounds and the heater shuts down automatically. To restart the humidifier, correct the alarm condition and press the **Humidifier On** button.

3.2.15 $\dot{V}$ (mandatory flow)

Figure 16 – $\dot{V}$ (mandatory flow) Button

Range: 6 to 100 L/min

$\dot{V}$ shares a numeric display window with I:E Ratio.

$\dot{V}$ LED is illuminated green when flow is displayed.

Displays the calculated flow delivered from the ventilator during volume controlled mandatory breaths. $\dot{V}$ display is not available during Pressure Controlled breaths or SPONT mode.

Flow can be adjusted indirectly by changing the tidal volume (Volume Control) or t_I settings.

3.2.16 I:E Ratio (inspiratory time to expiratory time)

Figure 17 – I:E Ratio Button

Range: 1:99 to 3:1

I:E Ratio shares a numeric display window with $\dot{V}$.

I:E LED is illuminated green when I:E Ratio is displayed.

I:E Ratio is determined by the / and t_I settings. If expiratory time is longer than inspiratory time, the display format is 1:X.X. If expiratory time is shorter than t_I, the display format is X.X:1. When the I:E Ratio is inverse, the I:E Ratio indicator illuminates once every breath. I:E Ratio does not function during SPONT mode.

3.2.17 Internal Battery Test Button and Indicator

Figure 18 – Internal battery Test Button

When the FLIGHT 50 Ventilator is powered by the dual internal battery, the LED on this button illuminates as follows:

- A yellow LED indicates the internal battery system is in use.
- A blinking yellow LED indicates low power.

A blinking red LED light indicates when the battery system is completely discharged. Pressing this button allows the Int. Battery Charge Level to be read in the lower half of the Paw meter window. The battery charge level should only be tested when the FLIGHT 50 Ventilator is operating on the dual internal battery. Testing while plugged into any external power source will give inaccurate readings.

Test the FLIGHT 50 Ventilator dual internal battery periodically to verify that the charge level is in the blue area. The numbers on the Paw meter do not reflect the percent of charge.

3.2.18 Internal Battery Charge Level Meter

Figure 19 – Internal Battery Charge Level Meter

The Int. Battery Charge Level meter is located beneath the Paw meter. If the needle is in the red when the test button is pressed the battery charge is low. You should use an external power source. The blue area indicates medium to full battery charge. Each battery use time is different based on your conditions. The numbers on the Paw meter do not reflect the percent of charge.

The battery charge level is best maintained by keeping the FLIGHT 50 Ventilator continuously plugged into an external power source.

3.2.19 Push to Unlock Button and Auto Lock Indicator

Figure 20 – Push to Unlock Button and Auto Lock Indicator

Auto Panel Lock can be enabled or disabled via User Set Up (see page 3-32). When Auto Lock is set to "**Enabled**" in User Set Up and the ventilator is in **On** condition and thirty (30) seconds have elapsed without pressing any buttons, the Auto Lock function is automatically activated and the (Auto Lock On) LED illuminates green. When Auto Lock is active, all touch buttons (except Int. Battery Test and Silence/Reset) are locked, preventing accidental changes.

➔ **To unlock the panel and enable the activation of all touch buttons for adjustment:**

1. Press and hold **Push to Unlock** for at least one second.

   An audible beep sounds and the LED is extinguished.

2. After thirty (30) seconds have elapsed without pressing any buttons, the Auto Lock is automatically activated again.

Auto Panel Lock is factory preset to "**Disabled**" (off).

3.2.20 Silence / Reset

Figure 21– Silence Reset Button

The Silence/Reset button has three functions:

- Silencing alarms: press the **Silence/Reset** button to silence all alarms for 60 seconds. When the Silence/Reset indicator is illuminated, all alarms are silenced except Device Alert alarm. Press the **Silence/ Reset** button again to cancel the silence period.
- Clearing alarm messages: press the **Silence/Reset** button to clear all alarm messages in the Message Display Window and to release latched LED indicators when the cause for the alarm is no longer present.
- Toggle Buzzer Volume (alarm loudness) between Loud and Quiet: press and hold the **Silence/Reset** button when there are no alarm messages displayed to toggle the alarm audible volume between loud and quiet. The alarm will sound at the new setting.

The Battery Empty Alarm and the Device Alert Alarm cannot be silenced permanently. These alarms indicate that an alternate source of ventilation must be utilized. See pages 3-23 and 3-25 for more details.

3.2.21 Paw Meter (airway pressure meter)

Figure 22 – Paw Meter

Range: –10 to 100 cmH_2O / 98 mbar

The Paw meter displays airway pressure. It also indicates the internal battery charge level when the Int. Battery button is tapped.

3.3 Front Panel Alarms

The front panel alarm LED indicators blink when an alarm limit setting is violated. Once the violation is no longer in effect, the indicators latch (remain steadily lit) until they are reset by pressing the **Silence/Reset** button.

3.3.1 High ▲ Paw and Low ▼ Paw Alarm Control and Display (Airway Pressure)

Figure 23 – High ▲ Paw and Low ▼ Paw Alarm Control and Display

Range:

Paw –10 to 100 cmH_2O / 98 mbar

High ▲ Paw Alarm 4 to 99 cmH_2O / 97 mbar

Low ▼ Paw Alarm 3 to 98 cmH_2O / 96 mbar

The ▲ Paw button allows the selection of the high (peak) airway pressure alarm setting.

The ▼ Paw button allows the selection of the low peak airway pressure alarm setting.

To adjust either alarm:

1. Press the desired button once.

The value in the adjacent display window blinks.

2. Use the ▲**Up**/▼**Down** controls to adjust the displayed alarm setting value.
3. The new setting can be retained by:
   - Pressing the selected button again to accept the alarm setting
   - Selecting another parameter for adjustment
   - Allowing five seconds to elapse without adjustment.

In SPONT mode the ▼ Paw alarm is inactive but the value can be preset.

The ▼ Paw alarm setting cannot be a value below PEEP/CPAP + 3. The ▲ Paw alarm setting must be a value at least 1 above the ▼ Paw alarm setting.

3.3.2 ▲ Paw (High Pressure) Alarm (user adjustable)

Figure 24 – ▲ Paw (High Pressure) Alarm

Audible Alarm: Intermittent beep

Visual Alarm: ▲Paw indicator blinks red

Message Window: HIGH PRESSURE

The High ▲Paw Alarm is activated when airway pressure (Paw) reaches the ▲ Paw alarm limit setting. Any breath in progress immediately cycles to exhalation.

The alarm violation is cancelled when Paw falls below the Paw alarm limit setting and at least one second has elapsed since the alarm was activated.

3.3.3 ▼ Paw (Low Pressure) Alarm (user adjustable)

Figure 25 – ▼ Paw (Low Pressure) Alarm

Audible Alarm: Intermittent beep

Visual Alarm: ▼Paw indicator blinks red

Message Window: LOW PRESSURE

The Low ▼Paw Alarm is activated when airway pressure remains below the ▼Paw alarm limit setting for two consecutive mandatory breaths.

The alarm violation is cancelled when one mandatory breath is delivered without a ▼Paw alarm violation.

> The Low ▼Paw Alarm does not function in SPONT mode. The ▼Paw alarm limit does not apply to spontaneous breaths in SIMV mode.

3.3.4 High ▲ $\dot{V}_I$ and Low ▼ $\dot{V}_I$ Alarm Control and Display (inspiratory minute volume)

Figure 26 – High ▲$\dot{V}_I$ and Low ▼$\dot{V}_I$ Alarm Control and Display

Range:

$\dot{V}_I$	0 to 99.0 L/min
High ▲ $\dot{V}_I$ Alarm	1.1 to 50.0 L/min
Low ▼ $\dot{V}_I$ Alarm	0.1 to 49.0 L/min

This window displays the inspiratory minute volume (in liters) and is automatically updated every 10 seconds. The $\dot{V}_I$ window always displays the delivered minute volume, except when the user is in the process of setting either the High or Low $\dot{V}_I$ alarm limit.

➔ **To adjust the High or Low $\dot{V}_I$ alarm limit:**

1. Press ▲ or ▼.

   The value in the adjacent display window blinks.
2. Use the **▲Up/▼Down** controls to adjust the displayed alarm limit value.
3. The new limit can be retained by:
   - Pressing the selected button again to accept the alarm setting.
   - Selecting another parameter for adjustment.
   - Allowing five seconds to elapse without adjustment.

> The high inspiratory minute volume alarm limit is limited to 1 > the low alarm limit setting. The low alarm limit is limited to 1 < the high alarm limit setting.

3.3.5 ▲ $\dot{V}_I$ (High Insp. Minute Volume) Alarm (user adjustable)

Figure 27 – ▲ $\dot{V}_I$ (High Insp. Minute Volume) Alarm

Audible Alarm: Intermittent beep

Visual Alarm: ▲$\dot{V}_I$ indicator blinks red

Message Window: HIGH $\dot{V}_I$

The High Insp. Minute Volume Alarm is activated when the delivered inspiratory minute volume exceeds the High ▲$\dot{V}_I$ alarm setting. The alarm is cancelled after delivered inspiratory minute volume falls below the ▲$\dot{V}_I$ alarm setting.

WARNING

The Insp. Minute Volume Alarms are based on the delivered volume from the ventilator. The actual minute volume in the patient lungs may be significantly different in cases such as circuit leak, pneumothorax, and disconnection.

To verify the exhaled minute volume, use a separate exhaled volume monitor.

3.3.6 ▼ $\dot{V}_I$ (Low Insp. Minute Volume) Alarm Back-up Ventilation (user adjustable)

Figure 28 – ▼ $\dot{V}_I$ (Low Insp. Minute Volume) Alarm Back-up Ventilation

Audible Alarm: Intermittent beep

Visual Alarm: ▼$\dot{V}_I$ indicator blinks red

Message Window: LOW $\dot{V}_I$

LOW $\dot{V}_I$ (BUV) (if back-up ventilation is active

The Low Insp. Minute Volume Alarm is activated when delivered inspiratory minute volume falls below the Low ▼$\dot{V}_I$ alarm limit setting.

WARNING

The Insp. Minute Volume Alarms are based on the delivered volume from the ventilator. The actual minute volume in the patient lungs may be significantly different in cases such as circuit leak, disconnection, and pneumothorax.

To verify the exhaled minute volume, use a separate exhaled volume monitor.

3.3.6.1 Back-up Ventilation

Back-up Ventilation is an alarmed function that activates when the delivered inspiratory minute volume ($\dot{V}$) falls below the Low ▾V_I setting. During Back-up Ventilation, the Low ▼$\dot{V}_I$ (Back-up Vent) alarm indicator blinks, an audible alarm sounds, and "**LOW $\dot{V}_I$ (BUV)**" is displayed in the Message Display Window. The ventilation settings employed by Back-up Ventilation

are then displayed on the front panel. Back-up Ventilation ceases when $\dot{V}_I = \underline{\blacktriangledown}\dot{V}_I + 10\%$, at which time ventilation and front panel displays return to user-set values.

Back-up Ventilation is functional in all modes. See page 4-5 for a complete description of Back-up Ventilation.

3.3.7 High Baseline Pressure Alarm (automatic)

Figure 29 – High Baseline Pressure Alarm

Audible Alarm: Intermittent beep

Visual Alarm: ▲Paw indicator blinks red

Message Window: HIGH Pbase

The High Baseline Pressure (High Pbase) alarm is activated when airway pressure is above the Low $\underline{\blacktriangledown}$ Paw alarm limit setting at the beginning of a time activated mandatory breath. The alarm resets when Paw drops to within 5 cmH_2O/mbar of the set PEEP/CPAP level.

3.3.8 Occlusion Alarm, Circuit (automatic)

Figure 30 – Occlusion Alarm, Circuit (automatic)

Audible Alarm: Intermittent beep

Visual Alarm: ▲Paw indicator blinks red at the high priority rate

Message Window: OCCLUSION

An Occlusion alarm is activated when airway pressure is above the set PEEP + 15 cmH_2O/mbar at 3 seconds after the beginning of expiration, or at the end of expiration, whichever comes first. When a breathing circuit occlusion occurs, the ventilator will be unable to release the pressure. Therefore, additional breaths will not be delivered until the condition is corrected. The alarm resets when airway pressure falls to within 15 cmH_2O/mbar of baseline, at which point breath delivery is resumed.

3.3.9 Occlusion Alarm, Device (automatic)

Audible Alarm: Intermittent beep

Visual Alarm: ▲Paw indicator blinks red at the high priority rate and Device Alert indicator blinks

Message Window: OCCLUSION

An Occlusion alarm is activated when airway pressure is above the set PEEP + 15 cmH_2O/mbar at 3 seconds after the beginning of expiration, or at the end of expiration, whichever comes first. When the Occlusion alarm is caused by a malfunction inside the ventilator, the FLIGHT 50 Ventilator will

attempt to relieve circuit pressure through its redundant safety system. If successful, ventilation will continue, but in an alarmed state.

It is possible that the condition causing the alarm will self-correct, in which case the alarm is reset. Otherwise, the ventilator will continue to alarm until the necessary service is performed. If the FLIGHT 50 Ventilator is unsuccessful in relieving circuit pressure, additional breaths will not be delivered unless airway pressure falls to within 15 cmH_2O/mbar of baseline.

Any time a Device Alert violation occurs along with the message "**OCCLUSION**" an alternate method of ventilation should be provided for the patient as soon as possible so that the cause of the violation can be adequately and safely investigated.

3.3.10 Low Baseline Pressure Alarm (automatic)

Figure 31 – Low Baseline Pressure Alarm (automatic)

Audible Alarm: Intermittent beep

Visual Alarm: ▼Paw/Apnea indicator blinks red

Message Window: LOW Pbase

The Low Baseline Pressure (Low Pbase) Alarm is activated by an unstable baseline (leak in the breathing circuit) or by a baseline decrease since the last PEEP/CPAP control change. A Low Pbase violation occurs in all modes when airway pressure remains ≥ 3 cmH_2O/mbar below baseline for 3 seconds. The same LED that blinks during Low ▼Paw violations blinks when this alarm is activated. The alarm resets when airway pressure is <3 cmH_2O/mbar below baseline.

3.3.11 Check Prox Line Alarm (automatic)

Figure 32 – Check Prox Line Alarm (automatic)

Audible Alarm: Intermittent beep

Visual Alarm: ▼Paw/Apnea indicator blinks red

Message Window: CHECK PROX LINE

The Check Prox Line Alarm is activated when, during inspiration, the pressure measurement of the proximal pressure sensing line is significantly different from the internal back up pressure sensing line located inside the ventilator.

This may be caused by a disconnected, kinked, water-filled proximal sensing line, or a blocked proximal line filter. Ventilation is continued during the alarm condition, using the pressure measurement of the internal sensing line.

3.3.12 Apnea Alarm (automatic)

Figure 33 – Apnea Alarm (automatic)

Audible Alarm: Intermittent beep

Visual Alarm: ▼Paw/Apnea indicator blinks red

Message Window: APNEA

The Apnea Alarm is activated when no mandatory breaths or detected spontaneous efforts occur for 30 seconds. The alarm is reset by a time or patient trigger.

The Apnea Alarm does not activate Back-up Ventilation.

3.3.13 PCV Not Reached Alarm (automatic)

Figure 34 – PCV Not Reached Alarm (automatic)

Audible Alarm: Intermittent beep

Visual Alarm: ▼Paw/Apnea indicator blinks red

Message Window: PCV NOT REACHED

The PCV Not Reached Alarm is activated in pressure control ventilation when the maximum inspiratory pressure (Paw P) is less than 50% of the target pressure for two consecutive mandatory breaths.

The alarm is reset when maximum inspiratory pressure (Paw P) is ≥ 50% of the target pressure.

3.3.14 Humidifier Alarm (automatic)

Figure 35 – Humidifier Alarm (automatic)

Audible Alarm: Intermittent 3-pulse caution beep

Visual Alarm: Humidifier indicator blinks yellow

The Humidifier Alarm is activated when any of the following conditions occur in the FLIGHT 50 Ventilator built-in humidifier. When an alarm condition is detected the humidifier heater shuts down.

There are five humidifier alarms:

Message Display Window	Cause of Alarm
Check Humidifier	Bottle removed or not clamped properly when trying to activate the humidifier. Temp Probe not connected or missing when trying to activate the humidifier.
Humidifier Fail	Bottle removed while humidifier is On. Failure of the primary humidifier control.
Check Temp Probe	Temp Probe damaged or missing while humidifier is On.
High Prox Temp	Proximal temperature exceeds set target temperature by 4°C when set at ≥ 34ºC or 6ºC when set at < 34ºC.
High Temp Core	Excessive temperature in the humidifier heating element.

The Humidifier Alarm is automatically set when using the FLIGHT 50 Ventilator humidifier. Humidifier Alarms (and the built-in humidifier) do not function when the FLIGHT 50 Ventilator is powered on internal battery.

3.3.15 Battery Low Alarm

Figure 36 – Battery Low Alarm

Audible Alarm: Intermittent 3-pulse caution beeps

Visual Alarm: Int. Battery indicator blinks yellow

Message Window: Battery Low

Indicates that a minimum of 15 minutes of operating power remains in the dual internal battery. Pressing the **Silence/Reset** button will cancel the audible 3-pulse caution beeps but the visual alarm will continue to blink and the alarm will beep once every three minutes as long as the alarm condition continues. The alarm is reset when A.C. or external D.C. power is connected to the FLIGHT 50 Ventilator.

The battery condition and ventilator settings used will affect remaining time, but it will be at least 30 minutes.

3.3.16 Battery Empty Alarm (automatic)

Figure 37 – Battery Empty Alarm (automatic)

Audible Alarm: Intermittent beep

Visual Alarm: Int. Battery indicator blinks red

Message Window: BATTERY EMPTY

Indicates that a minimum of 15 minutes of operating power remains in the dual internal battery. An alternate power source must be located immediately. This alarm can only be temporarily silenced as long as the alarm condition continues. The alarm is reset when A.C. or external D.C. power is connected to the FLIGHT 50 Ventilator.

The actual time remaining depends on the battery condition and the ventilator settings used.

Frequent deep discharge of the dual internal battery will decrease the amount of time the FLIGHT 50 Ventilator will operate on battery power from a full charge state. Replace the battery when battery operation time is insufficient for application.

Immediately secure an external power source when the Battery Empty alarm is violated. Charge the battery for a minimum of 5 hours (~80% recharged) before powering the ventilator again from the internal battery. If the battery is completely depleted, it takes approximately 7 to 8 hours to fully recharge.

If the FLIGHT 50 Ventilator is to be powered from the dual internal battery for an extended period, ensure that the dual internal battery is fully charged prior to use.

3.3.17 Fault, Battery System Alarm, Device Alert (automatic)

Audible Alarm: Intermittent beep

Visual Alarm: Device Alert indicator blinks red

Message Window: FAULT BAT SYS

The status of the internal battery system and the charging system is continuously monitored and any deficiency will result in a Battery Fault Alarm. The FLIGHT 50 Ventilator will continue to operate properly from an external power source but it cannot be powered by the internal battery system.

If the "**Fault Bat Sys**" device alert alarm occurs, keep the FLIGHT 50 Ventilator plugged into an external power source. Contact FLIGHT MEDICAL Technical Service Dept.

3.3.18 Power Switchover Alarm (automatic)

Figure 38 – Power Switchover Alarm (automatic)

Audible Alarm: Intermittent 3-pulse caution beeps

Visual Alarm: Ext. Power indicator illuminates red Int. Battery indicator blinks yellow

Message Window: No ext power

The Power Switchover Alarm is activated by switching from external power to the dual internal battery due to disconnection from the power cord or a power interruption.

Press the **Silence/Reset** button to cancel:

- The audible alarm
- The "**No ext power**" message
- The Ext. Power LED
- The Int. Battery LED to change to non-blinking yellow indicator

If external power is connected within 60 seconds following internal battery operation, the FLIGHT 50 Ventilator will immediately switch back to external power.

If internal battery operation has lasted longer than 60 seconds, there will be a delay of up to an additional 60 seconds before the FLIGHT 50 Ventilator will switch back to external power. If "**No ext power**" message is still displayed following the re-connection to external power, press **Silence/Reset** button to cancel the message.

3.3.19 Device Alert Alarm (automatic)

Figure 39 – Device Alert Alarm (automatic)

Audible Alarm: Intermittent beep

Visual Alarm: Device Alert indicator blinks red

Message Window: OCCLUSION or 10V SHUTDOWN or FAULT BAT SYS or SYSTEM ERROR or MOTOR FAULT

The Device Alert Alarm is activated when the microprocessor detects a functional problem with the ventilator. With the exception of OCCLUSION & FAULT BAT SYS, all other Device Alert alarms are non-recoverable and will result in the FLIGHT 50 Ventilator discontinuing ventilation. When this occurs, the ventilator must be powered down by pressing the **On/Standby** button.

DO NOT use the ventilator until the cause of the alert has been determined and corrected.

See page 3-20, Occlusion Alarm, Device (automatic), and page 3-24, Fault, Battery System Alarm, Device Alert (automatic), for a detailed description of these recoverable Device Alert Alarms.

There are three possible messages that will be displayed when a non-recoverable Device Alert Alarm occurs:

- MOTOR FAULT
- 10V SHUTDOWN
- SYSTEM ERROR.

For MOTOR FAULT and 10V SHUTDOWN the full text message will be displayed for 5 seconds, followed by an abbreviated form of the message, eg. MTR Fail, or 10V Fail. A timing message will also appear, documenting how long the condition has been present. The format for the time is "**H:MM:SS**." The SYSTEM ERROR message will always be displayed with full text.

If the cause of the SYSTEM ERROR does not allow the FLIGHT 50 Ventilator to display the alarm message and the Device Alert indicator to light, the ventilator will shut down and the Shut Down Alert Alarm will activate.

Upon the next power up of the unit, the SYSTEM ERROR message will be displayed. If the cause of the alarm has been corrected, the message can be cancelled by pressing the **Silence/Reset** button.

If a non-recoverable Device Alert alarm occurs, immediately disconnect the patient from the ventilator and provide an alternate method of ventilation.

A non-recoverable Device Alert Alarm cannot be silenced without first turning the ventilator Off (Standby).

3.3.20 Shut Down Alert Alarm (automatic)

Audible Alarm: Intermittent beeps

The Shut Down Alert Alarm occurs when the ventilator is powered Off. An intermittent audible alert indicates the ventilator is no longer operating. The intermittent beeps will continue for at least 10 minutes or until it is silenced by pressing the **Silence/Reset** button

3.4 Front Panel Message Display Window

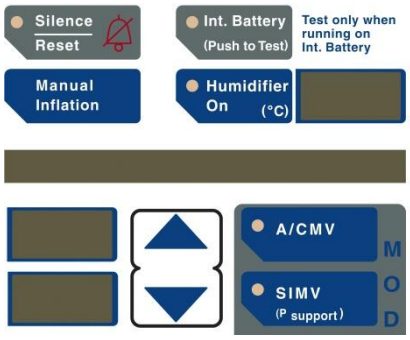

Figure 40 – Front Panel Message Display Window

All messages and alarms are displayed in a 16 character, alpha numeric window located above the MODE controls.

3.4.1 Message Monitoring

When the Message Display Window is blank, with no messages displayed, press the ▲**Up** control to scroll through the available monitoring messages. Monitored information includes:

- Volume
- Frequency
- Pressure values
- Operation information

Tidal volume, baseline pressure, and peak pressure are updated breath by breath. Frequency and mean pressure are also updated breath by breath, using a 6 second rolling average for frequency and a 60 sec. rolling average for mean pressure. Minute volume is updated every ten (10) seconds using a sixty (60) second rolling average.

Monitoring Messages cannot be accessed during alarm violations.

There are 3 selections available:

- VT / $\dot{V}$i / f
- Paw / P / M / B
- H/S/L (or Q)

Press ▲ **Up** to scroll through the lines. Three seconds after selecting a line, the relevant operating parameters are displayed. The following table details the parameters for each line:

Line 1	"VT xxx $\dot{V}$i xx f xx"
	VT – Tidal volume (in mL)

	$\dot{V}$i – Insp. Minute Volume (in L/min) rounded to nearest whole number f – Total number of patient or time activated breaths detected for the last 60 seconds (in b/min)
Line 2:	"Paw Pxx Mxx Bxx" P – Peak airway pressure of last breath M – Mean airway pressure B – Baseline airway pressure at the end of expiration
Line 3	"H xxxxx Sxxxxx L (or Q)" H – Hour meter reading S – Software Version L/Q – Audible Level of Alarm (Loud or Quiet)

After 4 seconds this line will go blank. Access this information any time by pressing the ▲ **Up** button.

3.4.2 Alarm and Caution Messages

All alarms have corresponding messages in the Message Display Window. See page 2-1 for list of alarms. If more than one alarm is violated, they are displayed in order of medical priority. Alarm messages override the display of monitored parameters.

3.4.3 Setting Limitation Messages

The following "**Setting Limitation**" messages are displayed to notify the user that adjustments have caused parameters to reach software defined limitations.

Reached Max $\dot{V}$	maximum $\dot{V}$ (flow) setting has been reached
Reached Min $\dot{V}$	minimum $\dot{V}$ (flow) setting has been reached
Inverse I:E	inverse I:E ratio has been reached
Reached Max I:E	inverse I:E ratio has reached 3:1
$\dot{V}$ Unavailable	$\dot{V}$ display is not available in Pressure Control
Peep + PS Too High	set PEEP + Psupport is higher than 60
PC - Peep Too Low	Pressure Control value minus PEEP is less than 5 cmH_2O/mbar
↑ - PEEP Too Low	High Pressure alarm limit minus PEEP is less than 5 cmH2O/mbar

The following messages are provided as "prompts" or reminders.

Panel Locked:	Notifies user that the front panel buttons are now locked
PRESS AGAIN:	Notifies user that a second press on the same button is required in order to confirm change requested.

3.5 Left Side Connectors

The round heater for the optional humidifier is located near the left side connectors. This heater becomes extremely hot when the humidifier is on. **DO NOT TOUCH!**

3.5.1 Airway Pressure Connector

Measures airway pressure. Connect the proximal pressure sensing line of the patient breathing circuit to this fitting.

Always use an inline filter at the Airway Pressure Connector to protect the internal pressure transducers from moisture or other contaminants.

3.5.2 Gas Output Connector

Supplies gas flow to the patient. Connect the patient breathing circuit to this outlet.

3.5.3 Exhalation Valve Connector

Controls the exhalation valve. Connect the exhalation valve control drive line to this outlet.

3.5.4 Temperature Probe Connector

The electrical connector for dual-channel temperature probes which connectors are used to measure the temperature in the humidifier water bottle and the patient breathing circuit.

3.5.5 RS-232C Connector

An 8 pin SEMCONN connector operating at 19,200 baud which allows the ventilator system to interface with central alarm systems and remote alarms.

Contact your FLIGHT MEDICAL representative for more information regarding compatibility with specific remote monitoring systems.

3.5.6 Emergency Air Intake

This enables the patient to pull ambient air into the breathing circuit in the event of a complete system failure. Air intake opening pressure is approximately –3 cmH_2O (–3 mbar).

WARNING

Do not obstruct the Emergency Air Intake! Any impediment could result in patient suffocation.

WARNING

If a complete failure of the ventilator occurs, the Emergency Air Intake allows the patient to breath from room air through the intake valve. Blockage of the valve could result in suffocation. Check periodically to ensure that the valve functions correctly.

3.6 Right Side Connectors

3.6.1 Fresh Gas Intake and Filter Cover

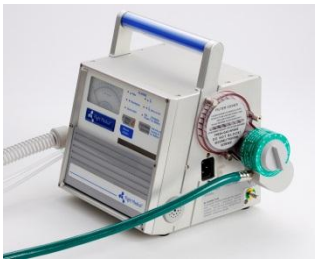

Figure 41 – Fresh Gas Intake and Filter Cover

Environmental air enters through this 30 mm ID Fresh Gas Intake. The air inlet particle filter is placed behind the Filter Cover. This protects the patient as well as the ventilator's piston system from dirt and particles. The Fresh Gas Intake is the attachment socket for the optional FLIGHT 50 Ventilator Air/Oxygen Entrainment Mixer or an Oxygen Blending Bag.

WARNING

Do not block the Fresh Gas Intake.

3.6.2 External Power Connector

- 100-240 VAC, max. 2A
- 12-30 VDC, max. 12A
- 50/60/400 Hz

The FLIGHT 50 Ventilator uses a single inlet for both A.C. and D.C. power sources. The inlet power connector automatically recognizes A.C. voltage ranges from 100 to 240 and D.C. ranges from 12 to 30. A FLIGHT MEDICAL approved external battery can be attached to this connector.

WARNING

To ensure proper grounding and prevent possible shock hazards, this device should only be connected to "Hospital Grade" power receptacles.

WARNING

HOME CAREGIVERS: External power in the home environment must support min. 100 to max. 240 VAC and must have a grounded receptacle.

3.6.3 Equipotential Connector

Figure 42 – Equipotential Connector

Used for electric potential equalization.

3.6.4 Power Cord Ferrite

Figure 43 – Power Cord Ferrite

Use of the Power Cord Ferrite ensures that the FLIGHT 50 Ventilator meets EMC requirements. Anytime the FLIGHT 50 Ventilator is operating on A.C. power, the ferrite should be attached to the power cord. Operating from D.C. power does not require the use of the ferrite.

Always use the A.C. power cord supplied with the FLIGHT 50 Ventilator

3.7 Optional Accessories

3.7.1 Air/Oxygen Entrainment Mixer

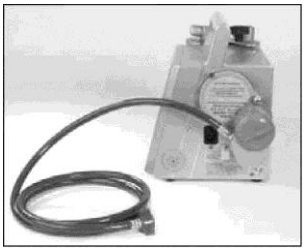

Figure 44 – Air/Oxygen Entrainment Mixer

The Air/Oxygen Entrainment Mixer is used to blend atmospheric air with medical grade oxygen at a precise ratio. A control knob allows for incremental adjustment from 21% to 100% FIO2. The high pressure oxygen hose has a standard female DISS 1240 connection. The Mixer attaches to the Fresh Gas Intake of the FLIGHT 50 Ventilator on the Filter Cover, located on the right side of the ventilator.

Pneumatic Requirements: Oxygen 35-90 psig (2.4 to 6.2 Bar)

3.7.2 Oxygen Blending Bag Kit

The Oxygen Blending Bag Kit is used to blend atmospheric air with a low flow (0 to 10 L/min) medical grade oxygen source. The Oxygen Blending Bag Kit attaches to the Fresh Gas Intake on the Filter Cover, located on the right side of the ventilator. This system allows the user to ventilate patients with oxygen enriched gas from 21% to 100% FiO2.

Pneumatic Requirements: Oxygen 0-10 L/min

3.7.3 Auto Lighter Cable

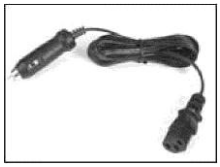

Figure 45 – Auto Lighter Cable

The Auto Lighter Cable (p/n A01-00040-29) allows the FLIGHT 50 Ventilator to be powered through the D.C. lighter plug in an automobile. The internal battery charges whenever the FLIGHT 50 Ventilator is connected to an external power source, equal to or greater than 12 VDC, including the D.C. lighter plug.

3.8 User Set Up

The User Set Up allows the operator to select a variety of functional parameters. User Set Up parameters must be established before the FLIGHT 50 Ventilator is used for ventilation.

HOME CAREGIVERS: The User Set Up parameters should be defined in conjunction with your physician or Homecare Dealer. Once established, these parameters are kept in memory and will be in affect each time the ventilator is powered on until the operator enters User Set Up and makes changes.

To enter User Set Up the FLIGHT 50 Ventilator must be in the Standby condition.

➔ **To access User Set Up, when connected to A.C. power:**

1. Press and hold the **Silence/Reset** button down.
2. When operating on internal battery, you must press the **On/Standby** button while pressing and holding the **Silence/Reset** button.
3. When the Message Display Window briefly displays the message **"USER SETUP"**, release the button.

The Message Display Window will next display the first parameter. See Table 31 – User Set Up Parameters.

4. The user may scroll through the rest of the set up parameters by pressing the **Int. Battery** button. Use the **▲Up/▼Down** control buttons to change the parameter setting.

To exit User Set Up, press the **Silence/Reset** button once. The FLIGHT 50 Ventilator is now ready for use.

Table 31 – User Set Up Parameters

Parameter	**Display**	**▲ Up/ ▼ Down** (allows selection)
Headline	USER SETUP	None
Power Save	Power Save ON*	Toggles On/Off
Pressure Units	Pressure cmH O* 2	Toggles cmH O/mbar 2
Set up	Set up USER*	Toggles User/Default
Auto Panel Lock	Lock DISABLED*	Toggles Enabled/Disabled
Technical Set Up	Tech. Setup	Refer to Service Manual Section 5

* Factory default setting. May be different if another setting was selected during the previous User Set Up.

Only the ▲Up/▼Down, Silence/Reset, and Int. Battery buttons are active during User Set Up.

3.8.1 User Set Up Parameter

3.8.1.1 Power Save

Use the **▲Up/▼Down** controls to toggle the Power Save function On or Off. To conserve battery power consumption during internal battery operation, the Power Save function automatically blanks the FLIGHT 50 Ventilator's numeric displays if the ventilator has operated for 2 minutes with no buttons pressed or alarms violated. MODE, On/Standby, Int. Battery indicators and message display window remain active at all times.

If an alarm condition occurs, or any button is tapped, the Power Save function is suspended for 2 minutes. The Power Save feature can extend battery operating time by as much as 30%.

3.8.1.2 Pressure Units

Selects between cmH_2O and mbar as the unit used on the pressure meter and the various front panel controls. The FLIGHT 50 Ventilator is factory set to cmH_2O. Use the **▲Up/▼Down** controls to toggle to the mbar setting.

For consistency, particularly in medical record keeping, it is recommended that each institution standardize to either "cmH_2O" or "mbar" operation.

HOME CAREGIVERS: The unit of measure, along with other parameter settings, should be established by the patient's physician or Homecare Dealer.

3.8.1.3 **Set Up**

The Set Up parameter allows the operator to set the ventilator's start up settings. There are two selections, DEFAULT or USER. Use the **▲Up/▼Down** button to toggle between selections.

When USER is selected, all of the ventilation parameters in effect at shutdown will be saved. The saved parameters will appear next time the ventilator is powered on.

When DEFAULT is selected, factory set default parameters will appear next time the ventilator is powered on. Default parameters are listed on page 2-1.

HOME CAREGIVERS: This parameter should always be set to USER for home use to ensure that when the FLIGHT 50 Ventilator is powered off and on the physician directed ventilation settings remain in place.

3.8.1.4 **Auto Panel Lock**

This setting allows the user to enable (turn on) or disable (turn off) the Auto Panel Lock feature. For a complete description of Auto Panel Lock see page 3-34. The Auto Panel Lock feature is factory set at Disabled or off. Use the **▲Up/▼Down** buttons to toggle between Enabled and Disabled.

HOME CAREGIVERS: FLIGHT MEDICAL recommends that the Auto Panel Lock feature be enabled in homecare environments as an added safety feature to prevent accidental changes to panel controls.

3.8.1.5 **Exiting User Set Up**

Exit by pressing the **Silence/Reset** button at any time.

4 Theory of Operation

4.1 General System Overview

The FLIGHT MEDICAL FLIGHT 50 Ventilator is a compact, lightweight, power-conservative, ventilator that is designed to provide ventilation for adult and pediatric (infants, children & adolescents) patients with body weight ≥10 kg.

The FLIGHT 50 Ventilator Ventilator's unique, patented dual-micro-piston gas compressing technology allows the FLIGHT 50 Ventilator to operate without an external compressed gas source, making it convenient to use in a variety of environments such as hospitals, emergency response, sub-acute facilities, homes and transport operations. The dual micro pistons' ability to deliver a variable flow enables the FLIGHT 50 Ventilator to provide a full range of operating modes and breath types, including Assist Control, SIMV and SPONT modes with Volume Control and Pressure Control mandatory breaths, Pressure Support of spontaneous breathing and servo-controlled leak-compensated PEEP. Leak compensation helps to improve triggering and avoid auto-triggering when a leak is present. The FLIGHT 50 Ventilator may be used with an endotracheal tube, tracheal tube, mask or mouthpiece.

The FLIGHT 50 Ventilator 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 displayed at all times on the airway pressure gauge on the face panel.

The user sets variable alarm settings for High Pressure, Low Pressure, High Inspiratory Minute Volume and Low Inspiratory Minute Volume, with Back Up Ventilation provided in all modes in response to a Low Minute Volume Alarm. There are also built in alarms for High Baseline, Low Baseline, (Circuit) Occlusion, Apnea, PCV Not Reached, Check Prox Line, Power Switchover (from external to internal), Low Battery and Empty Battery and Device Alerts. The FLIGHT 50 also provides humidifier related alarms.

Gas delivery to the patient may be enriched with oxygen (0.21-1.00) using either the Air Oxygen Entrainment (50 psi) Mixer (V13-00010-60) or the Low Flow Oxygen Blending Bag Kit (V17-00001-67).

There is an Auto-Lock feature that may be enabled or disabled. The alarm loudness may be set to two different levels.

The FLIGHT 50 Ventilator may be operated from a variety of AC (100-240 VAC @ 50/60/400 Hz) or DC (12-30 VDC) external power sources or from the Dual Internal Battery System. The Auto lighter Cable (A01-00040-29) accessory enables connection to an automobile-type DC outlet.

Any time external power is connected to the ventilator, the Dual Internal Battery system is charging. And when external power is lost, the (new and fully charged) Dual Internal Battery system takes over and powers the FLIGHT 50 Ventilator for up to 10 hours, at standard ventilator settings. A

Battery Low Alarm alerts the user when a minimum of 30 minutes operating time remains.

The FLIGHT 50 Ventilator is available with a built-in humidifier or without.

The FLIGHT 50 Ventilator is very easy to set up and use with clear indications of all ventilation and alarm settings and alarm violations.

When the FLIGHT 50 Ventilator is used in a home care environment it is important that the primary caregiver has received training and has demonstrated competency in all equipment functions. A specific written care plan must be established by the attending physician.

Transport of patients with the FLIGHT 50 Ventilator requires that medical staff have a good working knowledge of the ventilator's use and problem resolution. Proper emergency back-up equipment must be immediately available during transport.

4.2 Setting the Main Parameters

The ventilator can be switched between the following operational modes:

- **A/CMV** (Assist/Control Mandatory Ventilation)
- **SIMV** (Synchronized Intermittent Mandatory Ventilation)
- **SPONT** (Spontaneous Ventilation)

4.3 A/CMV Mode

In A/CMV mode, time activated (mandatory) breaths are delivered in accordance with the *f* setting. Patients can trigger mandatory breaths in addition to, or in place of, time activated (mandatory) breaths, if the effort that they generate causes airway pressure to meet the Ptrig setting. Each such patient effort results in a mandatory breath. The breath can be volume or pressure controlled. PEEP may be added. Tidal volume is determined by the target pressure, Ti, patient respiratory mechanics in Pressure Control, and by the tidal volume setting in Volume Control.

As with all FLIGHT 50 Ventilator operating modes, Backup Ventilation is activated if the Apnea alarm limit is violated.

4.4 SIMV MODE (Synchronized Intermittent Mandatory Ventilation)

In SIMV mode, patients receive a fixed number of volume or pressure controlled mandatory breaths (time or patient activated) and may breathe spontaneously between mandatory breaths, with or without pressure support

(Psupport). See Figure 46 for a schematic illustration. PEEP/CPAP may be added.

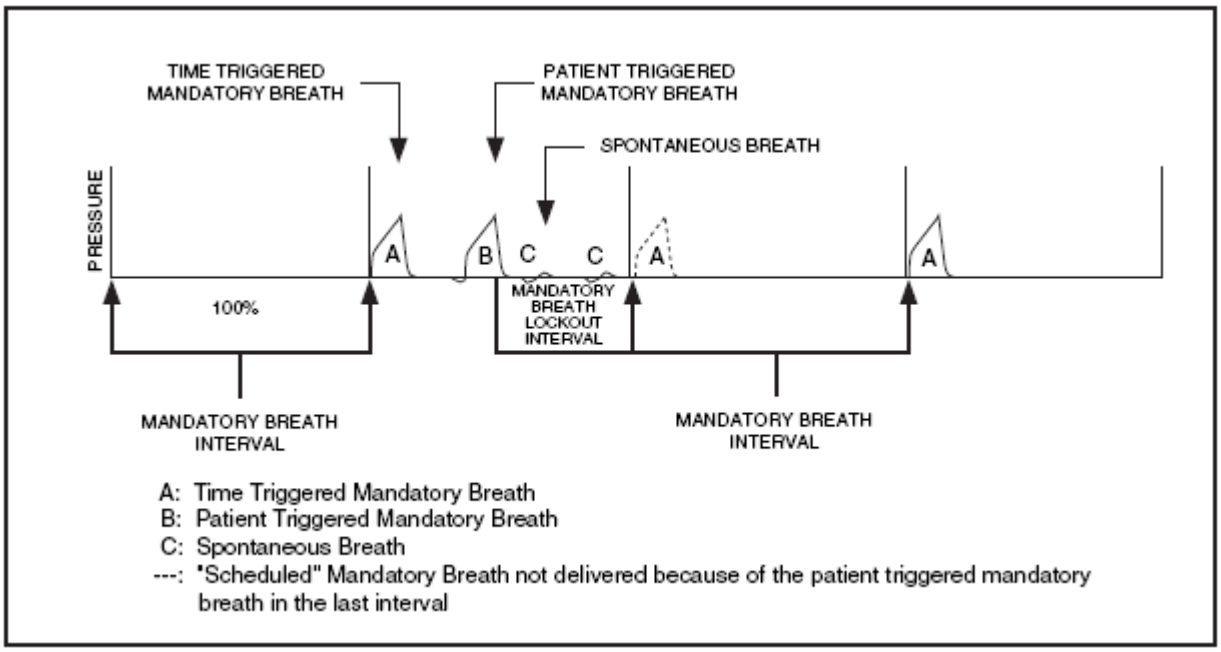

Figure 46 – Synchronized Intermittent Mandatory Ventilation (SIMV)

The first patient activated breath in any mandatory breath interval will be a patient triggered mandatory breath. The patient has the rest of the interval to breathe spontaneously. If the patient does not trigger the ventilator, and one complete mandatory breath interval has elapsed, a time triggered mandatory breath is delivered.

A mandatory breath lockout interval is activated whenever the patient triggers a mandatory breath. This limits the number of mandatory breaths (time activated or patient activated) the patient receives in 60 seconds to the f (b/min) setting.

As with all FLIGHT 50 Ventilator operating modes, Back-up Ventilation is activated if the Low $\underline{\blacktriangledown}\dot{V}_I$ alarm limit is violated.

4.5 SPONT MODE (Spontaneous Ventilation)

In SPONT mode, mandatory breaths are not delivered but the user can adjust both PEEP/CPAP and pressure support (Psupport) levels. The patient has control over each breath.

When PEEP/CPAP is set above 0, the ventilator mode is CPAP (without Psupport) or Bi-level Positive Airway Pressure (with Psupport). Ensure that Ptrig is set so the FLIGHT 50 Ventilator detects all spontaneous patient efforts.

Entries for tidal volume, pressure control, f, t_I and Low Paw alarm limit are all inactive in SPONT mode. However, users can preset these parameters for future A/CMV or SIMV operation.

As with all FLIGHT 50 Ventilator operating modes, Back-up Ventilation is activated if the Low $\underline{\blacktriangledown}\dot{V}_I$ alarm limit is violated.

4.6 Psupport (Pressure Support)

Psupport only functions during patient activated spontaneous breaths in SIMV and SPONT modes. During each spontaneous breath, the ventilator supports the patient by elevating the airway pressure to the Psupport + PEEP level.

Breaths are terminated when:

- Flow to the patient drops to 25% of that breath's peak flow rate
- The target airway pressure is exceeded by 3 cmH_2O (mbar)
- After 3 seconds of inspiration

4.7 Pressure Control (Pressure Control Ventilation)

The FLIGHT 50 Ventilator targets and maintains patient airway pressure at the set pressure control level throughout inspiration.

Breath termination occurs when:

- The set t elapses
- Paw exceeds the Pressure Control setting by 8 cmH_2O (mbar).

The target airway pressure for pressure controlled mandatory breaths in A/CMV and SIMV is the display setting above ambient pressure, not above PEEP.

Both time and patient activated mandatory breaths can be delivered in A/CMV and SIMV Pressure Control operation. During SIMV Pressure Control operation, patients can breathe spontaneously between mandatory breaths with or without pressure support.

When disconnecting the patient circuit during PCV/Psupport ventilation, i.e. 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.

4.8 Volume Control (Volume Control Ventilation)

During Volume Control ventilation, tidal volume can be set for mandatory breaths. If a 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 $\dot{V}$ (mandatory flow) changes.

If an attempted tidal volume setting results in a flow rate in excess of 100 L/min or less than 6 L/min, adjustment ceases and the user is alerted by an audible beep and the message "**Reached Max $\dot{V}$**" or "**Reached Min $\dot{V}$**" will appear in the Message Display Window.

Make sure that the mandatory flow ($\dot{V}_I$) setting is adequate to meet patient flow demands. The flow setting is displayed by pressing the front panel button labeled $\dot{V}$. Mandatory flow is changed by adjusting t_I.

4.9 Back-up Ventilation

Back-up Ventilation is an alarmed function that activates when the delivered inspiratory minute volume ($\dot{V}_I$) falls below the Low $\blacktriangledown\dot{V}_I$ alarm limit setting. During Back-up Ventilation, the Low $\blacktriangledown\dot{V}_I$ (Back-up Vent) alarm indicator blinks, an audible alarm sounds, and "**Low $\dot{V}_I$ (BUV)**" is displayed in the Message Display Window. The ventilation settings employed by Back-up Ventilation are displayed on the front panel.

Back-up Ventilation is functional in all modes.

Back-up Ventilation is not active for 60 seconds after the user adjusts any ventilator controls, changes modes or turns the ventilator On from the Setting condition.

During Back-up Ventilation, the **Silence/Reset** button can be tapped to silence the audible alarm. This will not cancel Back-up Ventilation.

Back-up Ventilation in the FLIGHT 50 Ventilator is based on the delivered inspiratory 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 patient airway leak.

4.9.1 Back-up Ventilation in A/CMV and SIMV Modes:

(Back-up Ventilation parameters are indicated on the front panel displays.)

In A/CMV or SIMV modes, mandatory breath frequency increases by 1.5 times the frequency (f) setting, up to a maximum of 99 b/min. The minimum breath frequency delivered is 15 b/min.

The frequency (f) will only increase up to a rate that produces a 1:1 I:E ratio even if the calculated Back-up Ventilation rate is higher.

4.9.2 Back-up Ventilation in SPONT Mode:

(Back-up Ventilation parameters are indicated on the front panel displays.)

In SPONT mode, the mode automatically changes from SPONT to SIMV, Pressure Controlled Ventilation (PCV), mandatory breath frequency (*f*) = 15 b/min, peak inspiratory pressure = 15 cmH2O/mbar above set PEEP, and inspiratory time (Ti) = 1.0 sec.

4.9.3 Cancellation of Back-up Ventilation

4.9.3.1 User Cancelled

If during Back-up Ventilation, the user adjusts any ventilation parameter, Back-up Ventilation is suspended for one minute and all user selected ventilation parameters are employed. Another 60 seconds must pass after parameter adjustments before a $\underline{\blacktriangledown}\dot{V}_I$ alarm violation will result in Back-up Ventilation.

4.9.3.2 Patient Cancelled

If delivered inspiratory minute volume exceeds the Low $\underline{\blacktriangledown}\dot{V}_I$ alarm setting by 10%, Back-up Ventilation is cancelled, the audible alarm stops, the Low $\blacktriangledown\dot{V}_I$ (Back-up Vent) alarm indicator latches and the FLIGHT 50 Ventilator resumes ventilation at the user-selected parameters.

Press the **Silence/Reset** button to cancel the latched alarm indicator and alarm message in the Message Display Window.

5 Ventilator Setup and Use

5.1 Introduction

Familiarize yourself with the instructions in this section prior to ventilating patients with the HT FLIGHT 50 Ventilator. Following all of the listed steps is essential to ensuring the safest possible operation of the ventilator. Use the information in this section in conjunction with established hospital protocols and homecare dealer instructions.

Non-medical home caregivers must have complete training and demonstrate competency in proper set up, use, troubleshooting and maintenance of the FLIGHT 50 Ventilator prior to use. They must have a planned response to emergencies and must comply with appropriate infection control procedures.

This section provides instructions for both Pressure Control and Volume Control ventilation. Follow the sections specific to the type of ventilation required for your patient(s).

5.2 Assembling the Ventilator

Before assembling the ventilator, review the assembly set up shown in Figure 49 and familiarize yourself with the various components. Remove all of the items from the shipping box and inspect each part and component for completeness and to verify that there is no shipping damage. Complete the Order Review Form and Warranty Card, and process as per the instructions.

The complete assembly consists of the following parts:

- FLIGHT 50 Ventilator — Select one:
  - FLIGHT 50 Ventilator (home care/hospital use) with built-in humidifier
  - FLIGHT 50 Ventilator (home care/hospital/transport use) without built-in humidifier
- Includes:
  - 1 ea. FLIGHT 50 Operator’s Manual
  - 1 ea. V24-00900-90 F50 US Power Cord
  - 1 ea. V64-50040-60 F50 Single Use Patient Circuit
  - 1 ea. V11-35300-60 Air Intake Filter Disposable (pk. of 5 filters)

- With built-in humidifier includes (all items listed above plus):
  - 1 ea. V12-32000-18 Humidifier Bottle – Upper
  - 1 ea. V12-31001-67 Humidifier Bottle – Lower
  - 1 ea. V12-33001-03 Heat Sink
  - 1 ea. V12-60000-69 Dual Airway Temperature Probe
  - 1 ea. V12-70000-27 Flex Hose – Humidifier Connection
  - 1 ea. V12-34001-62 Absorbent Paper (pk. of 10 papers)

The built-in humidifier on the FLIGHT 50 Ventilator only functions when used on A.C. power. It provides temperature monitoring and alarm functions. When using the FLIGHT 50 Ventilator on battery, for transport or in home care environments for example, alternate humidification devices may be necessary.

For a complete list of FLIGHT 50 Ventilator accessories, see Appendix B.

5.3 **Ventilator Set Up Procedure**

Figure 47 – Power Cord Restraint

➔ **To set up the ventilator:**

1. Mount the ventilator on a stable surface (e.g., bedside table or the Compact Stand Assembly).
2. For Compact Stand Assembly, follow the instructions provided with stand to position the ventilator on pedestal mount and secure using the screws provided.
3. Remove the white plastic cord restraint next to the power entry module.
4. Slip the power cord into the restraint.
5. Plug the power cord into the power entry module and re-attach the restraint with cord onto the side of the FLIGHT 50 Ventilator.

CAUTION

Be careful to position the cord so that it won't interfere with the Air/Oxygen Entrainment Mixer attachment.

Figure 48 – Power Cord Ferrite

6. Verify that the A.C. power cord supplied with the FLIGHT 50 Ventilator has the Power Cord Ferrite attached between the adapter box and the ventilator.
7. If utilizing external power, plug the ventilator's electric cord into a properly grounded outlet.
8. If using internal battery, ensure that battery is fully charged.

WARNING

Always use the A.C. power cord supplied with the FLIGHT 50 Ventilator that has the Power Cord Ferrite attached between the adapter box and the ventilator to ensure that the FLIGHT 50 Ventilator meets EMC requirements.

9. Attach a patient circuit as follows:
   - For use without a humidifier, attach one end of the 22 mm ID breathing circuit to the Gas Output on the FLIGHT 50 Ventilator.
   - When using a humidifier, connect one end of the short humidifier tubing to the Gas Output on the FLIGHT 50 Ventilator and the other end to the inlet port of the humidifier. Then attach one end of the 22 mm ID breathing circuit limb to the outlet port of the humidifier.
   - Attach the Proximal Inline Filter with tubing to the Airway Pressure connection located below the Gas Output port.
   - Attach one end of the Proximal Pressure sensing line to the Proximal Inline Filter as shown in Figure 49, Detail A.
   - For use without a humidifier or HME, attach the other end of the Proximal Pressure line to the pressure port on the exhalation valve. See Detail B, Figure 5–1.
     - For use with an HME, attach the Proximal Pressure line to a pressure tee adapter (p/n NP130-22) on the patient side of the HME. Use the cap that comes with the tee adapter to seal the pressure port on the exhalation valve.
     - For use with a humidifier, attach the Proximal Pressure line to a pressure tee adapter (p/n NP130-22) before the inlet port on the

humidifier. Use the cap that comes with the tee adapter to seal the pressure port on the exhalation valve.

- Attach the reusable exhalation valve to the patient end of the breathing circuit.
- Attach one end of the exhalation valve drive line to the exhalation valve and the other end to the Exh. Valve. connection located below the Gas Output on the FLIGHT 50 Ventilator.
  See Figure 49.
- When using the FLIGHT 50 Ventilator built-in humidifier, plug the temperature probe electrical connector into the Temp Probe connection on the left side of the FLIGHT 50 Ventilator. Attach the short wire plug into the elbow outlet on top of the humidifier. Attach the long wire plug into the exhalation valve port.

5.3.1 Exhalation Valve Calibration

The exhalation valve needs to be calibrated before use.

➔ **To calibrate the exhalation valve prior to use:**

Each time an exhalation valve is replaced or maintained it must be calibrated.

1. Connect the FLIGHT 50 Ventilator patient breathing circuit to the ventilator as instructed above.
2. Connect an adult (500 mL) test lung or occlude the patient connection of the breathing circuit.
3. Press the **On/Standby** button once to enter Settings condition.
4. Press the **Manual Inflation** button once, then again within three seconds.
5. The FLIGHT 50 Ventilator will start the EZ Cal and the ventilator will automatically test the exhalation valve. If it passes the test, the messages "**Cal Completed**", then "**Press ON to Vent**" will be displayed.
6. If the test fails, the message "**Cal Failed**" will be displayed.
   - Press the **Silence/Reset** button.
   - If using a test lung during the EZ Cal, remove the test lung and occlude the patient connection instead.
   - Check the integrity of the circuit and connections, then press the **Manual Inflation** button twice to initiate calibration again.
7. When calibration is finished, adjust patient setting appropriately, then press **On/Standby** to begin ventilation.

Inadequate ventilation may result if the exhalation valve is not calibrated properly. If the circuit/exhalation valve fails the calibration procedure, try another circuit/exhalation valve or use an alternate method of ventilation.

WARNING

Some disposable breathing circuit/exhalation valve assemblies are not compatible with the FLIGHT 50 Ventilator due to the requirements of the ventilator's sophisticated servo-controlled, pressure management system. If your disposable circuit fails consistently, switch to a FLIGHT MEDICAL approved, reusable FLIGHT 50 Ventilator breathing circuit/exhalation valve assembly to ensure that the FLIGHT 50 Ventilator performs to specification.

HOME CAREGIVERS: It is common practice to have two patient breathing circuits available in homecare environments to ensure that a clean circuit is always available for regularly scheduled circuit changes. The exhalation valve in each circuit must be calibrated before being put into use.

Exhalation Valve

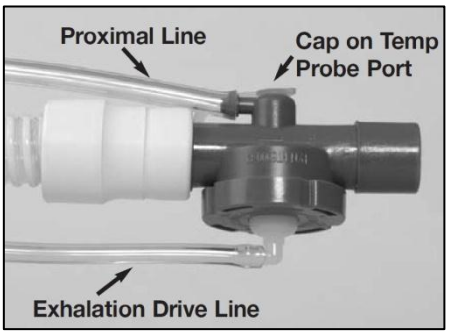

Figure 49 – Set Up Assembly

5.4 **Patient Set Up Procedure**

A "Quick Reference Guide" is located on the front panel cover door to assist the user in setting controls and alarms.

HOME CAREGIVERS: The front panel cover door should be left up as an added safety feature to prevent accidental parameter changes. There is also an optional Auto Panel Lock feature that locks in parameter settings once they have been made. See page 3-13 for more details.

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

1. Ensure the ventilator is assembled correctly and the exhalation valve calibration is performed as described in the previous sections.
2. Verify proper ventilator operation by performing the Quick Check Procedure (see page 7-6) upon initial set up for use. The Quick Check should be repeated or an Abbreviated Check Procedure (see page 7-6) performed each time the ventilator is placed on a new patient and when the breathing circuit/exhalation valve is changed.

HOME CAREGIVERS: Initial set up and verification of the ventilator operation should be done by the caregiver in conjunction with the Homecare Dealer or hospital-provided clinician.

3. Press the **On/Standby** button located on the lower right side of the ventilator's front panel.

   The ventilator performs a brief self-test to ensure proper microprocessor function. During the self-test, verify that all indicators illuminate; the numeric LEDs, Message Display Window and airway pressure meter activate and alarm buzzer makes a single beep.
4. Following the self-test, the FLIGHT 50 Ventilator enters Settings condition in which the ventilation parameters may be adjusted but the FLIGHT 50 Ventilator does not ventilate. The On indicator does not illuminate when the FLIGHT 50 Ventilator is in the Settings condition.
5. Push the appropriate MODE of operation button (A/CMV, SIMV or SPONT) to select.
6. Set the patient parameters for f (frequency), Ti (inspiratory time) and Volume Control (mandatory tidal volume) or Pressure Control (target pressure). Use the dual display $\dot{V}$/I:E: to verify the mandatory flow or the I:E ratio.

The $\dot{V}$ (flow) display is unavailable during SPONT and Pressure Control operation. The I:E Ratio display is also unavailable during SPONT mode.

Always ensure adequate monitoring is in place when ventilating patients. HOME CAREGIVERS: Follow physician prescribed monitoring checks. These may include regularly scheduled pulse, frequency of breathing and airway pressure checks.

7. Set Ptrig.
8. Set PEEP/CPAP, as needed.
9. Set the Psupport level, as needed.
10. Set the ▲ High and ▼ Low Paw alarm settings.
11. Set the ▲ High and ▼ Low $\dot{V}_I$ alarm limit settings.
12. Check all alarm limit and control settings to ensure they are appropriate for the patient to be ventilated.
13. If the FLIGHT 50 humidifier is being used, set the target temperature level.
14. Press the **On/Standby** button again to initiate ventilation. The On indicator illuminates.
15. Connect the ventilator breathing circuit to the patient interface.
16. Reassess ▲ High and ▼ Low Paw alarm settings and adjust to appropriate levels.
17. Verify that the Ptrig indicator blinks each time the patient initiates a spontaneous inspiratory effort. Readjust Ptrig as necessary.
18. Reassess ▲ High and ▼ Low $\dot{V}_I$ alarm settings and adjust to appropriate levels.

FLIGHT MEDICAL strongly recommends that you set the High $\dot{V}_I$ alarm no more than 1 L above and the Low $\dot{V}_I$ alarm no more than 1 L below the patient's average $\dot{V}_I$ in order to ensure the quickest response to changes in patient and/or breathing circuit conditions.

19. Closely monitor the patient and ventilator for at least 10 minutes to ensure adequate ventilation.

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 physician or health care provider immediately.

20. To power down the FLIGHT 50 Ventilator after it is removed from the patient, press the **On/Standby** button twice. An audible beep sounds and the FLIGHT 50 Ventilator automatically shuts down. Press the Silence/Reset button to mute the audible alarm.

5.5 Built-In Humidifier

You will need to use an alternate source of humidification with FLIGHT 50 Ventilator.

HOME CAREGIVERS: The patient's physician or your Homecare Dealer will determine the appropriate type of humidification device to be used. Proper training is required prior to setting up and using the FLIGHT 50 built-in humidifier.

The FLIGHT 50 humidifier operates only on A.C. power. It turns off automatically when A.C. power is disconnected, when the humidifier bottle is opened to refill the water and after sixty (60) minutes in the Setting condition.

The FLIGHT 50 Ventilator built-in humidifier can only be powered on by the user. It never powers on automatically.

When the FLIGHT 50 Ventilator is powered by internal battery, appropriate actions, such as using an HME, should be taken to prevent significant humidity deficit in the patient.

When a humidifier malfunction is detected, or a humidifier alarm exists, the humidifier turns OFF. The user is alerted by both an audible alarm and a change in the LED from green to blinking yellow. The nature of the alarm is displayed in the message window. Pressing the **Silence/Reset** button silences the audible alarm and cancels the latched alarm indicator. Press the Humidifier On button to restart the humidifier after the alarm condition is corrected.

The humidifier's round heating mechanism gets hot when the humidifier is on. Do not touch!

5.5.1 General Description

The FLIGHT 50 Ventilator humidifier is a precision, temperature-regulation device that employs microprocessor control to target the user-defined temperature at the patient breathing circuit connection by regulating the temperature of the sterile, distilled water in the humidification bottle.

The Humidifier On button toggles the humidifier On (indicator lit) and Off (indicator unlit). Turning the humidifier on causes the display to flash, indicating that target humidification temperature is now adjustable. Use the **▲Up/▼Down** controls to adjust the set target temperature.

The set target temperature (blinking) is displayed only during the adjustment period. The monitored temperature is displayed whenever the value is not blinking. During ventilation, temperature at the patient connector is monitored. During Setting condition, humidifier bottle temperature is monitored. Pressing the button while the humidifier is operating shows the set target temperature (blinking) and allows for re-adjustment.

To turn the humidifier off, press and hold the **Humidifier On** button for one second, after which an audible beep is heard and both the indicator and the display go dark.

The FLIGHT 50 humidifier is powered on independently from the ventilator. But when the ventilator is switched from On to Standby, the humidifier is also turned off.

Refer to Humidifier Alarm (automatic), page 3-22, for a summary of humidifier alarms.

5.5.2 Preparation for Use

The humidifier's round heating mechanism gets hot when the humidifier is on. **DO NOT TOUCH!**

Use sterile, distilled water only.

Electric temperature probes must be placed firmly in the patient circuit opening for proper humidifier operation.

It is unsafe to configure the FLIGHT 50 Ventilator humidifier with accessories that are not specified for use with the humidifier.

Remove the plastic packaging from the humidifier bottle and heat sink before use.

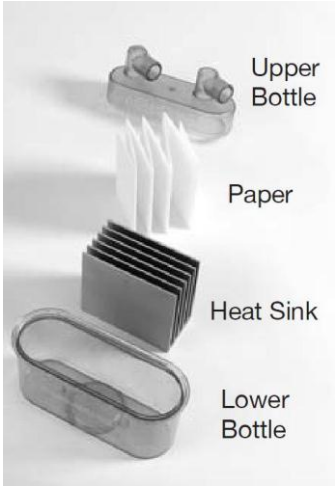

Figure 50 – Humidifier Bottle and Heat Sink

1. Ensure that the patient circuit and humidifier are assembled correctly.
2. Open the humidifier clamp knob located on the upper case of the ventilator.
3. Remove the humidifier bottle from the ventilator.
4. Open the humidifier bottle, remove the heat sink and place absorbent paper between the heat sink ribs.
5. Position the heat sink inside the lower half of the bottle.
6. Fill the lower half with sterile, distilled water, up to the FULL line. Attach the upper half of the bottle to the lower half.
7. Re-attach the humidifier bottle to the ventilator. Secure the clamp knob.
8. Connect the short side of the Humidifier Temperature Probe cable to the port on the top of the humidifier bottle.
9. Plug the electrical connector into the side of the FLIGHT 50 Ventilator and then connect the other end of the cable to the temperature probe port on the exhalation valve.

5.5.3 Set Up and Operation

1. From the Off/Standby condition, switch the ventilator to the Setting condition by pressing **On/Standby** once.
2. Turn the humidifier on by pressing the **Humidifier On** button.
3. Adjust humidification temperature.

4. After a minimum of 30 minutes (for temperature to stabilize), maximum of 55 minutes, start ventilation by pressing **On/Standby** again.

WARNING

Failure to change from the Setting condition to the On condition within 60 minutes will cause the humidifier to turn off. After restarting, ensure that temperature is appropriate before starting ventilation.

5. When the humidifier water level reaches the "REFILL" line, refill with sterile distilled water. The humidifier must be restarted afterward by pressing the **Humidifier On** button.
6. The absorbent paper in the humidifier should be replaced with each cleaning, weekly during use, or sooner if it becomes torn.

Humidifier specifications may be found on page 2-7.

For cleaning, disinfection and sterilization of the humidifier please see page 6-12.

5.6 Oxygen Accessories

WARNING

Continuous oxygen monitoring is required for patient safety. The FLIGHT 50 Ventilator does not have a built-in alarm system to notify user of a failure or disconnection of the oxygen source.

WARNING

Ensure that the oxygen source is not empty before and during the use of Air/Oxygen Entrainment Mixer or Oxygen Blending Bag Kit.

5.6.1 Air / Oxygen Entrainment Mixer (Optional Accessory)

Figure 51 – Air / Oxygen Entrainment Mixer

An optional Air/Oxygen Entrainment Mixer (p/n V13-00010-60) is designed for exclusive use with the FLIGHT 50 Ventilator. It is used to blend atmospheric air with pressurized medical grade oxygen at a precise ratio. The standard oxygen inlet connection is DISS 1240.

Flow Range: Up to 100 L/min

F I O 2: 0.21 to 1.00

Accuracy: ±8% (at flows: 10-100 L/min)

Input Pressure – Oxygen: 35-90 psig / 240-620 kPa

The oxygen concentration to the patient should be monitored with a device that will sound an alert if the concentration deviates from the set value.

The Air/Oxygen Entrainment Mixer is designed to operate with hospital grade O_2 supply.

No oxygen is delivered through the Air/Oxygen Entrainment Mixer while the FLIGHT 50 Ventilator is in User Setup or Settings Condition.

5.6.1.1 Installation Instructions

Make sure to monitor and when necessary replace the air inlet filter to ensure that it is clean when using the Mixer.

The Air/Oxygen Entrainment Mixer attaches into the inlet port on the Filter Cover, located on the right side of the ventilator.

Before attaching the Air/Oxygen Entrainment Mixer, make sure that the three hold-down screws on the Filter Cover are tight. If the screws are not tight, ambient air may enter the FLIGHT 50 Ventilator from around the inlet cover. This may change the oxygen enrichment level delivered to the patient when the Mixer is in use.

gvhnkkkjOpen the supply pressure valve slowly and listen to verify that there is no hiss, indicative of a leak. Do not use the oxygen mixer with a leak in the system.

7. Set the entrainment mixer dial to the desired concentration.

WARNING

Ensure that the oxygen supply is enabled prior to powering on the FLIGHT 50 Ventilator and after the Air/Oxygen Entrainment Mixer is secured in place. Otherwise, stress to the internal pump will occur and gas delivery to the patient will be compromised.

5.6.2 Oxygen Blending Bag Kit (Optional Accessory)

The Oxygen Blending Bag Kit is designed for use with the FLIGHT 50 Ventilator. The Oxygen Blending Bag Kit (p/n V17-00001-67) allows the operator to ventilate patients with oxygen enriched gas of up to 100% oxygen.

WARNING

The Oxygen Blending Bag Kit is designed to operate with a hospital grade O_2 supply. The flow rate of the supply to the oxygen blending bag should not exceed 10 L/min flow.

Before attaching the Oxygen Blending Bag, make sure that the three hold-down screws on the Filter Cover are tight. If the screws are not tight, ambient air may enter the FLIGHT 50 Ventilator from around the inlet cover. This may change the oxygen enrichment level delivered to the patient when the Oxygen Blending Bag is in use.

WARNING

Keep the oxygen supply tubing (and cylinder) away from traffic areas.

WARNING

Using an oxygen concentrator as the oxygen supply source may affect the level of oxygen enrichment, as in most cases oxygen concentrators do not supply 100% oxygen. Use the FLIGHT 50 Ventilator oxygen monitor to verify F_IO_2 delivery.

WARNING

Any change in settings or any change in patient assisted breathing patterns that alters the delivered minute volume, will alter the level of oxygen enrichment.

5.6.2.1 Installing the Oxygen Blending Bag Kit

The Oxygen Blending Bag Kit attaches into the Fresh Gas Intake port on the Filter Cover, located on the right side of the FLIGHT 50 Ventilator.

The following materials are required for Installation:

- Hospital grade oxygen source
- Oxygen 50 psig regulator/flow meter (0-10 L/min) assembly with small-bore connector
- A suitable length of oxygen supply tubing

➔ **To install the Oxygen Blending Bag Kit:**

1. Remove the three thumb screws from the Filter Cover.
2. Remove the Filter Cover and inspect the filter. Replace the filter, if it is dirty.
3. Reattach the Filter Cover, ensuring that the three thumb screws are tight.

Before attaching the Oxygen Blending Bag, make sure that the three hold-down screws on the Filter Cover are tight. If the screws are not tight, ambient air may enter the FLIGHT 50 Ventilator from around the inlet cover. This may change the oxygen enrichment level delivered to the patient when the Oxygen Blending Bag is in use.

4. Press the 30 mm OD outlet of the Oxygen Blending Bag Kit into the Fresh Gas Intake port of the FLIGHT 50 Ventilator Filter Cover.
5. Attach the oxygen supply tubing to the oxygen flow meter and to the small-bore connector of the Oxygen Blending Bag Kit.

WARNING

Keep the oxygen supply tubing (and cylinder) away from traffic areas.

6. Tug lightly on both ends of the tubing to verify that it is secure.

7. Adjust the oxygen flow meter to the appropriate liter-flow to obtain the desired level of oxygen enrichment.
8. Monitor regularly the patient's inspiratory minute volume and delivered F_IO_2, and adjust the oxygen liter flow as necessary to maintain the prescribed level of oxygen enrichment.

5.6.2.2 Disassembling and Cleaning the Oxygen Blending Bag Kit

For information on disassembly and cleaning, see the instructions included with the Blending Bag Kit or see Cleaning and Maintenance.

5.6.2.3 Monitoring the Oxygen Supply Flow in the Oxygen Blending Bag

The following graphs can be used to determine the required oxygen supply flow for the patient. There are two graphs – the first one is for when there is no PEEP; the second is for when PEEP is added.

The oxygen supply flow of the Oxygen Blending Bag Kit is determined according to the desired percent of oxygen enrichment as well as the minute volume of the patient.

The oxygen blending bag is not a calibrated oxygen mixing device. It requires the use of oxygen monitoring, to verify the level of oxygen enrichment. The information in these graphs should be used as a reference only.

➔ **To use the graphs:**

1. Choose the appropriate graph, based on whether you are ventilating with or without PEEP.
2. Choose the Desired % of Oxygen Enrichment listed at the bottom of the graph.
3. Follow your selection up vertically until it meets with the line that is equal to the minute volume of the patient (i.e. flow 10 L/min).

The delivered minute volume of the patient can be read from the alarm setting display window, when it is not blinking.

4. Move horizontally to the left and identify the estimated oxygen supply flow (L/min) needed.
5. Set the flow meter to the oxygen supply flow indicated.

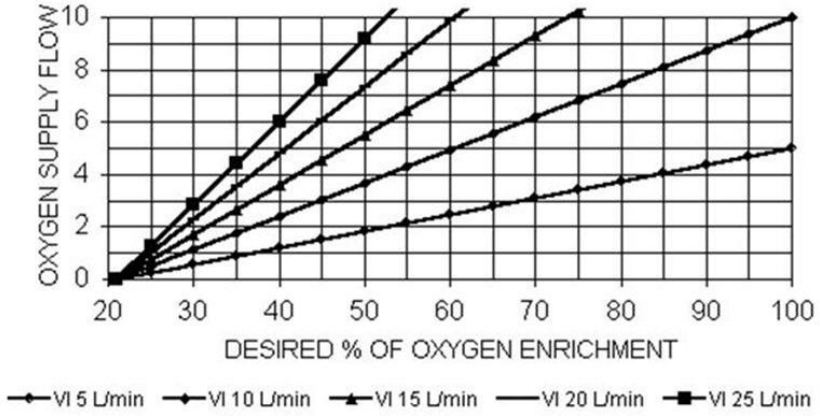

Figure 52 – Oxygen Supply Flow for Desired % of Oxygen Enrichment without PEEP

When PEEP is added, it changes the mixing of oxygen with air. Use the chart in Figure 52when the patient is ventilated without PEEP; use the chart in Figure 53 in the presence of PEEP. Data in the chart in Figure 53 are taken at an I:E ratio of 1:2. Different I:E ratios may slightly affect the Desired % of Oxygen Enrichment when PEEP is in use.

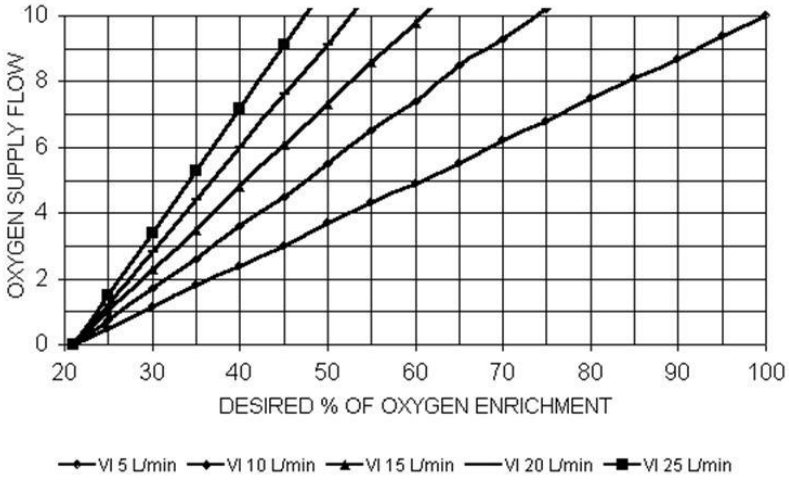

Figure 53 – Oxygen Supply Flow for Desired % of Oxygen Enrichment with PEEP

6 Cleaning and Maintenance

6.1 Cleaning and Disinfecting

The FLIGHT 50 Ventilator and associated patient circuits are shipped in clean but not sterile condition. Reusable (single patient) patient circuits should be disinfected before reapplying to the patient.

Use the information in this section in conjunction with hospital policy, physician prescription, or Homecare Dealer instructions.

Term	Definition
Clean	Indicates that a medical detergent or alcohol based cleaning solution should be used.
Disinfect	Indicates that a liquid chemical disinfectant should be used.
Sterilize	Indicates that liquid chemicals, pasteurization, steam autoclave or Ethylene Oxide (EtO) should be used.

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

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.

Ethylene Oxide may cause superficial crazing of plastic components and will accelerate the aging of rubber components.

6.1.1 FLIGHT 50 Ventilator

Wipe clean the FLIGHT 50 Ventilator between patients, and once a week while in use.

➔ **To clean the ventilator:**

1. Wipe clean the exterior (besides the screen) of the ventilator and all parts not in direct contact with patients, using a cloth that has been dampened with a medical detergent or alcohol-based cleaning solution.
2. Clean the front panel display (the screen) using a lint free damp cloth dampened with LCD cleaner solution.
3. Air dry.

CAUTION	Do not apply the cleaning solution directly on the screen.
CAUTION	On the front panel display or ventilator housing, do not use agents that contain acetone, toluene, halogenated hydrocarbons, or strong alkaline.
CAUTION	Never autoclave or EtO sterilize the FLIGHT 50 Ventilator and its accessories. These processes will damage the FLIGHT 50 Ventilator and accessories, rendering them unusable.

6.1.2 FLIGHT 50 Ventilator Accessories

All accessories should be thoroughly cleaned, rinsed, and air dried prior to disinfecting. Examine all accessories for excessive wear or damage. Discard and replace if necessary.

6.1.3 Humidifier Assembly (V51-00000-60 only)

Wipe clean and disinfect the Humidifier once a week while in use and clean and sterilize between patients.

	The following instructions are for the V51-00000-60 integrated humidifier. If a third party humidifier is used see humidifier manufacturer's instructions for cleaning. See Figure 54 for humidifier assembly.

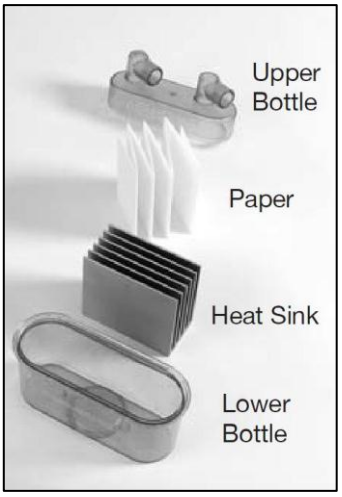

Figure 54 – Humidifier Assembly

➔ **To disassemble the Humidifier:**

1. Remove the humidifier bottle from the FLIGHT 50 Ventilator.
2. Open the humidifier bottle and remove the heat sink.
3. Remove the absorbent paper from the heat sink and discard.
4. Wash off any residual paper that remains on the heat sink with running water.

➔ **To clean the Humidifier:**

1. Wash both halves of the bottle and the heat sink in a warm detergent solution using a soft brush. Rinse thoroughly with sterile water.

CAUTION	Do not use harsh abrasives on humidifier bottle or heat sink.

2. Shake off excess water and place all parts on a clean towel to air dry. (Do not heat or blow dry.)

To disinfect the Humidifier:

1. Soak in one part white vinegar to three parts of water.
2. Rinse thoroughly with sterile, distilled water.
3. Air dry.

Alternatively:

1. Soak in an approved chemical disinfectant such as a glutaraldehyde solution (2%) following the manufacturer's instructions.
2. Rinse thoroughly with sterile, distilled water
3. Air dry.

To sterilize the Humidifier:

The following sterilizing methods are suitable for the bottle and heat sink.

1. Soak in an approved chemical sterilant following the manufacturer's instructions.
2. Rinse thoroughly with sterile, distilled water.
3. Air dry.

Autoclave 121ºC / 250ºF for 20 min.

FLIGHT MEDICAL recommends that only sterile, distilled water be used in the humidifier to prevent build-up of mineral deposits.

Always use new absorbent paper when reassembling the humidifier.

Visually inspect all parts for cracks or damage. Do not use cracked or damaged parts. Contact FLIGHT MEDICAL for replacements.

6.1.4 Humidifier Temperature Probe

Wipe clean and disinfect the Humidifier Temperature Probe twice a week while in use and clean and sterilize between patients.

➔ **To disassemble the Humidifier Temperature Probe:**

1. Remove the temperature probes from the patient breathing circuit (humidifier outlet and exhalation valve).
2. Unplug the electrical connector from the side of the ventilator by pressing the release tab and pulling gently.

The electrical connector that plugs into the ventilator must stay dry at all times.

To clean the Humidifier Temperature Probe:

1. Wipe down the probe cable with a soft cloth dampened in a mild detergent.
2. Wash the probe tips in a mild detergent with a brush.
3. Rinse thoroughly with sterile, distilled water.

Shake off excess water and place all parts on a clean towel to air dry. (Do not heat or blow dry.)

To disinfect the Humidifier Temperature Probe:

1. Soak the probe tips in one part white vinegar to one part of water for 2 hours.
2. Rinse thoroughly with sterile, distilled water.
3. Air dry.

Alternatively:

1. Place the probe tips in a glutaraldehyde solution such as Cidex (2%) for 2 hours.
2. Rinse thoroughly with sterile, distilled water.
3. Air dry.

To sterilize the Humidifier Temperature Probe:

The following method is suitable for sterilizing the entire probe assembly:

The following sterilizing methods are suitable for the bottle and heat sink.

1. Soak in an approved chemical sterilant following the manufacturer's instructions.
2. Rinse thoroughly with sterile, distilled water.
3. Air dry.

Ethylene Oxide 55ºC / 131ºF

Visually inspect all parts for cracks or damage. Do not use cracked or damaged parts. Contact FLIGHT MEDICAL for replacements.

6.1.5 Reusable Patient Circuits

Clean and sterilize patient circuits once weekly while in use. Always use a clean, disinfected exhalation valve when the patient circuit is reassembled for patient use.

The breathing circuit includes the tubing, water trap (if used), proximal pressure line and exhalation valve drive line.

FLIGHT MEDICAL patient circuits are supplied non-sterile.

HOME CAREGIVERS: In the home environment, it is important to always use a clean, disinfected patient circuit. The objective of cleaning circuits is to render the surfaces free of pathogens.

If you are using a FLIGHT MEDICAL reusable breathing circuit refer to cleaning directions below. If you are using another manufacturer's permanent breathing circuit please refer to manufacturer's instructions for cleaning.

➔ **To disassemble the patient circuit:**

1. Remove the entire circuit from the ventilator.
2. Remove the exhalation valve and flow sensing kit.
3. Disassemble the circuit to expose all surfaces for cleaning.

The FLIGHT MEDICAL patient circuit is manufactured from a Polyester Elastomer, high-temperature material and incorporates a silicone rubber cuff. To avoid damage to the circuit, attach and detach the circuit by handling only the silicone cuffs. Do not pull or twist the circuit.

➔ **To clean the patient circuit:**

1. Use a low flow of running water or air to clear tubing and passages of organic matter.
2. Bathe for a minimum of 10 minutes using mild detergent or liquid cleanser.
3. Wash all components of the patient circuit with a soft brush.
4. Rinse thoroughly with sterile, distilled water, removing all traces of the cleanser.
5. Shake off excess water, and place all parts on a clean towel to air dry. (Do not heat or blow dry.)

To sterilize the patient circuit components:

Any of the following sterilizing methods (using standard institutional procedures) are suitable for the FLIGHT MEDICAL breathing circuit components:

1. Soak plastic and metal parts in any of the following solutions:
   - Autoclave - 132ºC / 270ºF for 3-5 min, 126ºC / 259ºF for 10 min, 121ºC / 250ºF for 15 min.
   - Ethyl Oxide - 55ºC / 131ºF
   - Pasteurization - 75ºC / 170ºF
2. Rinse with sterile, distilled water, removing all traces of the cleanser.
3. Air dry.

CAUTION

Patient circuit components should NOT come in contact with the following solutions, because they may cause disintegration of the tubing: Hypochlorite, Phenol (>5%), Inorganic Acids, Formaldehyde, Ketone, Chlorinated Hydrocarbons, and Aromatic Hydrocarbons.

CAUTION

Patient circuits should be inspected after disinfecting to check for deterioration. If the circuit is damaged or shows excessive wear, replace with a new circuit.

6.1.5.1 Reusable Exhalation Valve

Clean and disinfect the Exhalation Valve twice weekly, while in use.

The older revision (prior to February 2003) of the FLIGHT MEDICAL Exhalation Valve does not disassemble. The new revision of the valve can be cleaned as assembled or it can be disassembled for thorough cleaning.

CAUTION

The Exhalation Valve should be inspected after cleaning and/or sterilizing to check for deterioration. If the valve is damaged or shows excessive wear, replace with a new valve. Also perform the exhalation valve calibration whenever the circuit is changed to assure that the circuit will perform correctly.

➔ **To dissasemble the exhalation valve:**

1. Remove the exhalation valve from the patient circuit.
2. Rotate counterclockwise the top cap of the exhalation valve and lift it off.
3. Lift out the valve drive line fitting, and separate it from the diaphragm.

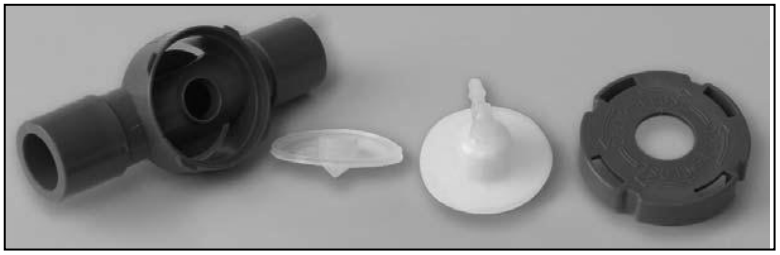

Figure 55 – Exhalation Valve Disassembled Parts

➔ **To clean the exhalation valve:**

1. Use a low flow of running water or air to clear tubing and passages of organic matter.
2. Wash the exhalation valve with a soft brush.

3. Rinse thoroughly with sterile, distilled water.
4. Shake off excess water, and place it on a clean towel to air dry. (Do not heat or blow dry.)

➔ **To disinfect the exhalation valve:**

1. Soak plastic and metal parts in any of the following solutions:
   - One part 5% Acetic Acid (white vinegar) and two parts sterile, distilled water for two hours (for home use only); Then, rinse with sterile distilled water.
   - Glutaraldehyde solution (Cidex [2.4%]) for twelve hours; Then, rinse with sterile, distilled water.
   - Boiling distilled water; boil the water for 15 minutes, making sure that water covers the valve at all times. Allow the water to cool and then drain (for home use only).
2. Air dry.

After the exhalation valve is dry, reassemble it according to the following procedure, to ensure proper ventilator operation.

➔ **To reassemble the exhalation valve:**

1. Carefully seat the diaphragm so that it lies flat on the white plastic drive line fitting and snaps on around the edge completely.
2. Place the fitting/diaphragm assembly in the valve body, with the drive line fitting lined in the opposite direction of the patient and/or the arrow sign.
3. Carefully place the cap over the fitting/diaphragm assembly and turn the cap clockwise until it comes up against the stop.
4. Perform an exhalation valve calibration to ensure proper operation of the ventilator.

Do not try to turn the drive line fitting after securing the cap. This may cause the diaphragm to become wrinkled or unseated and affect ventilator performance.

6.1.5.2 FLIGHT 50 Ventilator Air Inlet Particle Filter

NEVER operate the FLIGHT 50 Ventilator without a clean inlet particle filter in place.

NEVER reverse the inlet particle filter when it is dirty.

The air inlet particle filter, located on the right side of the ventilator behind the Filter Cover, keeps dirt and particles out of the ventilator's piston

system. As the filter becomes dirty, it can reduce the volume of air drawn into the ventilator.

Check the inlet filter weekly. Replace it with a new filter when the majority of the filter surface area has changed from a clean white to dirty brown color. Inlet filters are not reusable.

After replacing the filter, make sure that the three hold down screws on the Filter Cover are secure. If the screws are not tight, ambient air may enter the FLIGHT 50 Ventilator from around the inlet cover.

HOME CAREGIVERS: When the FLIGHT 50 Ventilator is used in a homecare environment, the filter may become dirty more frequently and therefore must be inspected and/or changed more often.

6.1.5.3 **Proximal Inline Filter**

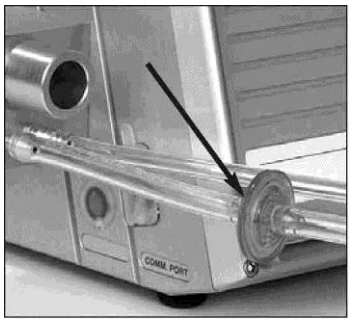

Figure 56 – Proximal Inline Filter

WARNING

Always use a Proximal Inline Filter at the Airway Pressure Connector to protect the internal pressure transducers from moisture or other contaminants.

WARNING

Never reverse the Proximal Inline Filter.

The Proximal Inline Filter has a very important function in the FLIGHT 50 Ventilator. Located at the Airway Pressure Connector, it protects the internal pressure transducers from moisture or other contaminants that may be present in the proximal airway tubing. Since there is no purge flow coming from the FLIGHT 50 Ventilator, it is important to always use a Proximal Inline Filter.

Check the Prox Inline Filter weekly. Discard it and replace with a new filter if it appears to have gotten wet or come in contact with a contaminant. Inline filters are not reusable.

In the event that the filter does become occluded, the primary indication for this would be a Low Pressure Alarm indication with the message "**CHECK PROX LINE.**" Should this happen, replace the filter.

FLIGHT MEDICAL strongly recommends that extra Prox Inline Filters be available at all times when using the FLIGHT 50 Ventilator.

Do not wash or sterilize the Prox Inline Filter.

6.2 Maintenance

6.2.1 Preventive Maintenance

It is recommended to take the following measures to maintain the FLIGHT 50 Ventilator:

- Check the Air Inlet Filter (located behind the Filter Cover) weekly. Replace it when the majority of the filter surface area has changed from a clean white to dirty brown color. Air Inlet Filters are not reusable.

HOME CAREGIVERS: When the FLIGHT 50 Ventilator is used in homecare environments, the filter may become dirty more frequently and therefore, it must be inspected and/or changed more often.

NEVER reverse the inlet particle filter when it is dirty.

- Inspect the FLIGHT 50 Ventilator power cord on a regular basis, for signs of a broken or frayed power cord.
- Inspect the exhalation valve and flow orifice 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.

If service is required, contact your provider.

6.2.2 Dual Internal Battery Maintenance

The primary internal battery should be replaced every 12 months or sooner if the use time no longer meets the needs of the user. This will depend on a number of factors including settings and usage patterns. The secondary internal battery should be replaced every 24 months.

➔ **To preserve Dual internal battery life:**

- Whenever possible, plug the FLIGHT 50 Ventilator into the external power source to charge the batteries. Check that the green "**Ext. Power**" LED is lit.
- Always keep Power Save function ON.
- Always have available a backup power source, AC Power Cord and optional Autolighter Power Cord Accessory (p/n A01-00040-29).
- It is recommended that you keep a Battery Use Time Log so that you know when it is time to have your primary internal battery (LA) replaced. "Use Time" is the time from when you unplug your ventilator from A.C. and power it on internal battery until it indicates a "**Battery Low**" alarm.

6.2.3 15,000 Hour Maintenance

A comprehensive maintenance should be performed after 15,000 hours of operation. The 15,000 hour maintenance includes replacement of the pump assembly.

Contact your provider or FLIGHT MEDICAL for detailed information on the 15,000 hour maintenance.

HOME CAREGIVERS: Do not attempt to open or perform any service procedures on the FLIGHT 50 Ventilator. Only FLIGHT MEDICAL trained technicians are authorized to service the ventilator. Contact your Homecare Dealer or FLIGHT MEDICAL.

If the message "**Service Needed**" appears in the Message Display Window upon power-up, contact FLIGHT MEDICAL or your local dealer for maintenance service.

6.3 General Warnings

- Preventive maintenance work, repairs, and service may only be performed by FLIGHT MEDICAL trained or factory-authorized personnel.
- Always follow accepted hospital procedures or physician instructions for handling equipment contaminated with body fluids.
- The ventilator and its accessories must be thoroughly cleaned and disinfected after each patient use. Perform all cleaning and disinfection of external parts and accessories in accordance with established hospital procedures, physician prescription, or Homecare Dealer instructions.

- 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 (such as phenols, halogen releasing compounds, oxygen releasing compounds, and strong organic acids). Exposure to such substances may cause damage that is not immediately recognizable.

The reusable (single patient) patient circuit including the exhalation valve and flow sensing kit and other parts that come in direct contact with the patient should be periodically disinfected while in use.

7 Ventilator Quick Check Procedure

7.1 Introduction

Upon initial setup of the ventilator, verify proper ventilator operation by performing the Quick Check Procedure.

This procedure is intended to assist qualified operators to establish a routine program for verifying proper FLIGHT 50 Ventilator operation. Perform this procedure each time the ventilator is prepared for clinical use.

Repeat the Quick Check Procedure each time the ventilator is placed on a new patient or the patient circuit/exhalation valve is changed.

Before performing the test, you must perform a pretest inspection, and set up the ventilator for the test.

The Quick Check Procedure includes the following tests:

- Checking the power management
- Checking the alarms
- Checking the monitored parameters

HOME CAREGIVERS: This procedure should be performed by your Homecare equipment provider, prior to delivery of the FLIGHT 50 Ventilator, to verify proper operation. It can also be performed in the homecare environment to ensure proper setup and function of the ventilator.

Do not use the FLIGHT 50 Ventilator if it fails this procedure.

7.1.1 Setting Up the Ventilator for the Test

Before performing the test, do the following:

- Remove the three screws from the Filter Cover. Inspect the filter. Replace the filter if it is dirty. Reinstall the screws.
- Examine the 500 ml test lung and the patient circuit to ensure that there are no holes that will cause leaks.
- Verify that the AC power cord does not have frays or breaks.

➔ **To set up the ventilator for the test:**

1. Connect the detachable and integral batteries.
2. Connect the AC power cord to an AC power source.

3. Connect a patient circuit with 500 ml test lung, to the FLIGHT 60 Ventilator.
4. Calibrate the exhalation valve See Section 7.4.2.
5. Press the **On/Off** button once. The ventilator performs a brief self-test and enters SETTINGS mode. During the self-test, verify that the ventilator purges, an audible alarm sounds and that all indicator LEDS illuminate.
6. Set the ventilator to the following Standard Test Settings *(STS)*:

Control	Setting
MODE	ACMV
Volume Control	500 ml
Ti	1.0 sec
f	15 b/min
Ptrig	0 cmH2O/mbar
Low Pressure alarm limit	3 cmH2O/mbar
High Pressure alarm limit	99 cmH2O
Low MV alarm limit	0.1 L (minimum setting)
High MV alarm limit	50 L (maximum setting)
PEEP	0 cmH2O/mbar
Psupport	0 cmH2O/mbar
Humidifier	Off

7. Press the **On/Off** button to initiate ventilation.

7.2 QUICK CHECK PROCEDURE

7.2.1 Power Switchover Alarm Check

➔ **To check the power switchover alarm:**

1. Disconnect the A.C. power cord.
2. Verify that there is an audible beep (Power Switchover alarm). The **Ext. Power/Charging** indicator turns red and the "**Int. Battery**" indicator blinks to indicate that the ventilator is on battery power. The Message Display Window displays "**No ext. power**"
3. Reconnect the A.C. power cord.
4. Verify that within two minutes the "**Int. Battery**" indicator turns off and the **Ext. Power/Charging** indicator turns green. Press the **Silence/Reset** button to clear the Message Display Window.

7.2.2 Alarms and Indicators Check

1. If the FLIGHT 50 with a humidifier is being used, press **Humidifier On** button and use ▲/▼ control button to set the desired temperature.
2. Press the **On/Standby** button again to exit Settings condition and start ventilation.

7.2.2.1 High ▲Paw Alarm

➔ **To check the High ▲Paw alarm:**

1. Set the High Paw alarm limit to 20 cmH_2O/mbar
2. Verify that an audible and visual High Paw alarm occurs and that inspiration ends when pressure reaches the high limit.
3. Set the High Paw alarm limit back to 99 cmH_2O/97 mbar.
4. Verify that High Pressure alarm is deactivated and the ▲Paw LED latches.
5. Press the **Silence/Reset** button to clear the alarm.

➔ **To check the Low ▼ Paw alarm:**

1. Disconnect the test lung from the breathing circuit and verify that after two breaths an audible and visual Low Paw alarm occurs.
2. Attach the test lung to the breathing circuit.
3. Verify that the audible alarm ceases and the ▼Paw LED latches.
4. Press the **Silence/Reset** button to clear the alarm and the message in the Message Display Window.

➔ **To check the Humidifier alarm (on V51-00000-60 model only):**

1. Read the temperature displayed in the humidifier temperature window.
2. Press the **Humidifier On** button once and use the ▼Down control to lower the set humidifier temperature by 5º.
3. Verify that an audible alarm sounds and the Message Display Window reads "**High Prox Temp**" and the humidifier is powered off.
4. Press the **Silence/Reset** button to clear the alarm.
5. Press the **Humidifier On** button and adjust the set temperature back to the desired temperature.
6. Unclamp the humidifier bottle and remove it from the heating element.
7. Verify that an audible alarm sounds and Message Display Window reads "**Humidifier Fail**" and the humidifier is powered off.
8. Press the **Silence/Reset** button to clear the alarm.
9. Reconnect the humidifier bottle.
10. Press the **Humidifier On** button.
11. Disconnect the temperature probe from the side of the FLIGHT 50.
12. Verify that an audible alarm sounds and the Message Display Window reads "**Check Temp Probe**" and the humidifier is powered off.
13. Press the **Silence/Reset** button to clear the alarm.

7.2.3 Paw Monitor / Pressure Meter Check

The purpose of this check is to compare the pressure reading of the Paw meter to the airway pressure displayed in the Message Display Window.

➔ **To check the Paw Monitor / Pressure Meter:**

1. Press the ▲**Up** control until "**Paw/P/M/B**" is displayed.
2. Wait for two or three breaths for pressures to display.
3. Verify that both the Paw meter and the Message Display Window peak pressure are within 10% or ± 2 cmH_2O/mbar of each other, whichever is greater.
4. Adjust PEEP/CPAP to 5 cmH_2O/mbar.
5. Verify that both the Paw meter and the Message Display Window show the baseline pressure within ± 2 cmH_2O/mbar. Reduce PEEP/CPAP to zero.
6. Select Pressure Control and set pressure at 20 cmH_2O/mbar.
7. Verify that both the Paw meter and the Message Display Window read a peak pressure that is within ± 3 cmH_2O/mbar of each other.
8. Place the ventilator in Volume Control by pressing the **Volume Control** button twice.

7.2.4 Volume/Frequency Monitor Check

➔ **To check the Volume/Frequency Monitor:**

1. Press the ▲**Up** control until "**VT/$\dot{V}_I$/*f***" is displayed.
2. Verify that VT= 450-550, $\dot{V}_I$ = 6-9 and f = 13-17 is displayed.

7.2.5 Internal Battery Check

➔ **To check the Internal Battery:**

1. Unplug the FLIGHT 50 from AC power
2. Clear the alarm with the Alarm/Silence button
3. Press and hold the **Int. Battery** (Push to Test) button while powered on internal battery.
4. Verify that the Int. Battery charge level needle on the Paw (airway pressure) meter is in the blue zone. This indicates the dual internal battery is charged.

7.3 **Check-Off Sheet**

Pass / Fail Check-Off Sheet

Preparation for Use Tests		**Indicate result for each test**
Pre-Test Inspection Check		Pass _____ Fail _____
1.	Power Switchover Alarm Check	Pass _____ Fail _____
2.	Alarm & Indicators Check	Pass _____ Fail _____
	High ▲Paw Alarm	Pass _____ Fail _____
	Low ▼Paw Alarm	Pass _____ Fail _____
	Humidifier Alarm (HT50-H,HT50-HB only)	Pass _____ Fail _____
3.	Paw Monitor / Pressure Meter Check	Pass _____ Fail _____
4.	Volume/Frequency Monitor Check	Pass _____ Fail _____
5.	Internal Battery Check	Pass _____ Fail _____

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

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

Completed by: **Date:**

Facility: **Serial #:** **Unit hours:**

HOME CAREGIVERS: Initial set up and verification of the ventilator operation should be done by the caregiver in conjunction with the Homecare Dealer or hospital provided clinician. The Abbreviated Check Procedure may be performed in the homecare environment to ensure proper set up and function of the ventilator.

7.4 ABBREVIATED CHECK PROCEDURE

7.4.1 Inspection Check

Do this Inspection Check each time you turn on the FLIGHT 50 Ventilator.

1. Remove the three screws from the inlet filter cover.
2. Inspect the filter and replace if dirty.
3. Re-install screws.
4. Examine the test lung and patient breathing circuit to ensure there is no degradation of material which might cause leaks.
5. Examine the Oxygen Blending Bag (if used) to ensure there is no degradation of material which might cause leaks.
6. Verify that the condition of the A.C. power cord is acceptable, i.e. no frays
7. Connect the power cord to A.C. power source.

7.4.2 Exhalation Valve Calibration

Each time an exhalation valve is maintained or replaced by another, such as when the complete circuit is changed, it must be recalibrated. The valve must pass the calibration procedure before it is used.

1. Connect the FLIGHT 50 patient breathing circuit to the ventilator.
2. Connect the patient connection (exhalation valve) of the breathing circuit to an adult (500 mL) test lung with restrictor (LNG500A) or occlude the patient connection of the breathing circuit.
3. Press the **On/Standby** button once to enter Settings condition.
4. Press the **Manual Inflation** button once, then again within three seconds.
5. The FLIGHT 50 will start the EZ Cal and the ventilator will automatically test the exhalation valve. If it passes the test, the messages "**Cal Completed**", then "**Press ON to Vent**" will be displayed.
   - If the test fails, the message "**Cal Failed**" will be displayed.
   - Press the **Silence/Reset** button.
   - If using a test lung during the EZ Cal, remove the test lung and occlude the patient connection instead.
   - Check the integrity of the circuit and connections, then press the **Manual Inflation** button twice to initiate calibration again.
6. When calibration is finished, remove the test lung from the patient connection (if used) and press **Silence/Reset** to exit.

Inadequate ventilation may result if the exhalation valve is not calibrated properly. If the circuit/exhalation valve fails the calibration procedure, try another circuit/exhalation valve or use an alternate method of ventilation.

7.4.3 Battery Function and Charge Level Verification

1. While the FLIGHT 50 is connected to AC power, disconnect the ventilator from A.C. power. An audible alarm should be heard (Power Switchover Alarm). Press the **Silence/Reset** button to cancel alarm.
2. While the FLIGHT 50 is operating on the dual internal battery, push and hold the Int. Battery Test button. Observe the needle indicator on the Paw meter. If the battery charge level is medium to full charge, the needle will read in the blue area. If the battery charge is low, the needle will read in the red area. Reconnect to A.C. power.

The FLIGHT 50 should not be used on internal battery unless the battery is charged to its full level. If the internal battery system charge level is low, connect the FLIGHT 50 to an external power source. The FLIGHT 50 dual internal battery system is charged when the ventilator is connected to external power.

7.4.4 Operation Verification

1. Press **On/Standby** once to place the FLIGHT 50 into the Setting condition.
2. Check settings on the FLIGHT 50 to be sure that they match the physician's prescription.
3. Press **On/Standby** once again to start ventilation.
4. Connect the ventilator to the patient and observe the patient and ventilator for at least 10 minutes to ensure that there is adequate ventilation.

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

8 Index