Trilogy100 Ventilation Workshop

Ron Hosp, MS, RRT
Congratulations for 30 years of Education 😊
1986 Memorable Moments

• “Say You, Say Me,” Lionel Richie
Features

- Display screen
- Audio pause
- Up/Down
- Start/Stop
- AC power light
- Left/Right
SD Card Slot
On the back

- Detachable battery
- Cord retainer
- Serial connector
- Remote alarm
- Ethernet connector
- External battery connector
- Oxygen valve connector
- Removable air path
- Filter
Trilogy100 Circuit Options – Passive

• Utilizes an Exhalation Port
  – Integrated into a mask
  – Whisper Swivel II

• Passive Porting Block

• Choose Passive in Set up Menu
User Interface

Viewing and Changing Settings
Simple Screen
Detailed Screen

Low pressure alarm

High pressure alarm
Control keys
Accessing prescription setting screens

Two levels of Menu access
  • Full
  • Limited

To change prescription setting from limited access
  • Hold Audio Pause and Down Arrow Keys
Accessing prescription setting screens

- Set-up Screen
- When airflow is off
- Hold Audio Pause and Down Arrow Keys
- Setting circuit type
Menu screen
Menu screen

Safely Remove SD Card
Menu screen

Settings and Alarms

- Dual prescriptions
- Modes
- Settings for mode chosen
- Alarms
Menu screen

Options

– Menu Access
– Detailed View
– Language
– Pressure Units
– Alarm Volume
– Keypad Backlighting
– LCD Brightness
– Screen Saver
– Date Format
– IP Address Mode
– Operational Hours
Menu screen

Alarm Log

- Lists last 20 alarms
  - High priority appear in red
  - Medium priority appear in yellow
  - In Full and Limited Access
  - Alarm log can only be cleared in full access
Menu screen

Event Log

- Event Log – 12,000 events
  - Can only be viewed and cleared in full access
Menu screen

Information

- Summary of current
  - Prescription settings
  - Device settings
  - System settings
  - Can be viewed in full and limited access
Screen saver option

• Reduce power consumption
• Dim in a darkened room
• Pressing any key, the occurrence of an alarm or informational message will exit screen

Breath

Black

Off and Dim Screen Savers are also available
On-screen waveforms allow clinicians to visually identify ...

- Triggering
- Cycling
- Synchrony
Additional features

In-line nebulizer treatment feature
  – Alarm sensitivity is adjusted for a 20-minute period in order to reduce nuisance alarms

Battery count/discharge on screen
  – Allows clinicians to easily determine life of battery

Circuit type on screen
Alarms
Types of alarms

System Alarms
- High/Low Pressure Alarms (BiPAP only)
- Circuit Occlusion
- Low Leak
- Power Alarms
- Ventilator Inoperative
- Check circuit

Patient Alarms
- High/Low Pressure Alarm (Volume only)
- High/Low RR
- High/Low Minute Ventilation
- Patient Disconnect
- Apnea
Alarms

- Alarm LED indicator on the audio pause button lights
- Audible alarm sounds
- Message appears on the screen describing the alarm

- High Priority – Red
- Medium Priority – Yellow
- Informational – No Indication
Power Options
Power options

1. Internal AC/DC Power Supply
2. External 12V/24V battery
   - Not recharged through vent
   - Automotive adapter
3. Detachable Lithium Ion Battery
   - 3 hours
   - Easily hot swapped
   - Recharges as long as it is plugged in
4. Internal Lithium Ion Battery
   - 3 hours
   - Recharges as long as it is plugged in
Battery charge indicator

<table>
<thead>
<tr>
<th>Battery</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal Battery</td>
<td>![Internal Battery Symbol]</td>
</tr>
<tr>
<td>Detachable Battery</td>
<td>![Detachable Battery Symbol]</td>
</tr>
<tr>
<td>External Battery</td>
<td>![External Battery Symbol]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LED Status</th>
<th>Battery Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 LEDs are lit</td>
<td>80-100% capacity</td>
</tr>
<tr>
<td>4 LEDs are lit</td>
<td>60-79% capacity</td>
</tr>
<tr>
<td>3 LEDs are lit</td>
<td>40-59% capacity</td>
</tr>
<tr>
<td>2 LEDs are lit</td>
<td>20-39% capacity</td>
</tr>
<tr>
<td>1 LED is lit</td>
<td>11-19% capacity</td>
</tr>
<tr>
<td>1 LED flashes</td>
<td>≤ 10% capacity</td>
</tr>
<tr>
<td>0 LEDs lit</td>
<td>0% capacity</td>
</tr>
</tbody>
</table>

- Battery Count/Discharge is now on the screen
Battery cycle times

Trilogy 100 counts cycles

- Detachable battery ≥ 500 cycles
  "Replace Detachable Battery" Low priority Alarm - Alarm repeats in 1 hour if Reset key is pressed

- Internal battery ≥ 500 cycles
  "Ventilator Service Required" Urgent Service Alarm - Alarm repeats in 1 hour if Reset key is pressed
Maintenance and Support
Maintenance

• Clean grey foam filter at least every 2 weeks
• Replace every 6 months
• Preventative maintenance 10,000 hrs or 2 years whichever come first
• Blowers hours are located in the information menu
Impact of leaks on therapy

The “Critical Balance”

↑WOB
Arousals
Non-compliance
↑Trips to hospital
Calls to provider
Alarms

Leaks

Difficult
triggering/cycling

patient-ventilator synchrony

Most “triggering” problems are really leak estimation problems
Impact of leaks on therapy

The “Critical Balance”

- Leak compensation
- Triggering/cycling

- ↓WOB
- ↑Comfort
- Compliance
- Fewer calls
- ↑Trust

patient-ventilator synchrony
Passive volume and leak compensation

Where Respironics Excels

- The Trilogy100 is the first ventilator to offer volume mode therapy with a passive exhalation device

- Accurate delivery and measurement of patient flow and tidal volume is possible with a passive exhalation device through innovative control algorithms that compensate for circuit leak
In pressure flow terms, the whisper swivel will leak about 16 standard liters per minute at a PEEP of 4 cm H20.
Leak flow through the Whisper Swivel II changes with the pressure. As the pressure increases with the breath delivery, the control algorithms calculate the instantaneous leak.

Mahadevan, A., Truschel, W., A Bench Study Comparison of Volume Delivery in the Presence of Leak Delivered by the Trilogy100 Ventilators with a Passive Exhalation Device versus other Existing Portable Ventilators.
Patient flow is then calculated as the difference between machine flow and leak flow. The total machine flow is *constantly adjusted* to account for the leak to accurately deliver the proper patient flow for each breath.

\[
\text{Machine flow} - \text{Leak flow} = \text{Estimated patient flow}
\]

Trilogy will add the precise amount of flow to compensate for leaks based on the instantaneous pressure reading.
Automatic leak detection and adjustment

• Control algorithms use the patient flow waveform to calculate inspiratory and expiratory tidal volumes

• As unintentional leaks change, the automatic leak algorithms detect it and modify the control algorithms to deliver accurate tidal volumes on the next breath

• No Peak Flow setting—Trilogy *automatically adjusts* to meet demands of the patient
Digital Auto-Trak

• Recognizes and compensates for leak
  – Breath-by-breath sensitivity for optimal comfort

• Automatically adjusts to changing breathing patterns throughout the night
Seven components of Digital Auto-Trak

- Leak detection
- Two triggers (Volume Trigger, Shape Trigger)
- Four cycle determinants (SET, Shape Cycle, Flow Reversal, and Max Inspiratory Time)
Inspiratory trigger

- Leak Detection
- Inspiratory Trigger
- Volume Trigger
- Shape Trigger
- Expiratory Cycle
- SET
- Shape Cycle
- Flow Reversal
- Max Inspiratory

6 cc volume accumulated above base flow

Flow x Time = Volume
Shape trigger

Patient inspiratory flow

DAT shape signal

Trigger

Offset and delay

15 LPM and 200 mcs

Doesn’t look at the value of flow, but at the shape of inspiratory effort

- Rapid change in the breath
- Exertional breathing (anxiety)
The SET rises in proportion to the inspiratory flow rate on each breath. When SET and actual patient flow are equal, expiration begins.

Not used in T, CV, AC, and SIMV
Matching the Right Therapy to the Right Product Just Got Easier

- BiPAP AVAPS
- Restrictive Disorders
- Obese Hypoventilation
- Neuromuscular Disorders
- COPD
- Complex SDB
- Periodic Breathing
- OSA
- CPAP; AUTO-CPAP; BiPAP S; BiPAP AUTO
- BiPAP AVAPS
- BiPAP S; BiPAP AVAPS
- BiPAP autoSV
- BiPAP autoSV
Ventilation types and modes

- **Volume Control Ventilation**
  - Assist Control (AC)
  - Synchronized Intermittent Mandatory Ventilation (SIMV)

- **Pressure Control Ventilation**
  - PC-SIMV
  - Spontaneous Timed (S/T)
  - Pressure Control (PC)
  - AVAPS-AE

True Respironics BiPAP Modes where AVAPS can be added
AVAPS-AE: Auto EPAP proactive analysis

Theory of Operation

Illustration courtesy of Krames Medical Illustration.
AVAPS-AE

Maintaining tidal volume and airway patency
AVAPS-AE

AVAPS-AE is a auto-titration mode of noninvasive ventilation designed to better treat respiratory insufficiency patients (OHS, COPD and NMD) in the hospital and homecare environments.

Achieving a targeted volume is now completely automatic

- Proven performance of AVAPS
- Auto EPAP
- Auto backup rate
Adjustable AVAPS

• Adjustable AVAPS allows you to adjust the maximum rate at which the pressure support automatically changes to achieve the target tidal volume

• It can be set from 1 cm H\textsubscript{2}O per minute to 5 cm H\textsubscript{2}O per minute

• Allows clinicians to customize the setting to the patient’s needs
Mouthpiece ventilation (MPV)

MPV is a form of volume ventilation whereby the patient’s normal state is disconnected from the ventilator and the patient initiates a breath, as needed, through an oral interface.
Demonstration
Questions and Discussion
Contacts

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