

PHILIPS

sense **and** simplicity



Trilogy™

Provide Efficient & Versatile ventilation

- ✓ Ventilation modes
- ✓ Alarms and settings
- ✓ Circuit types
- ✓ RI technology, Auto-TRAK™ & AVAPS™

Trilogy combines Respironics well known Technology with all the features of a fully flexible Life Support Ventilator

- Auto-TRAK™ algorithm for optimal trigger sensitivity
- AVAPS™ Hybrid Ventilation in all pressure modes
- Advanced Leak Compensation in Pressure and Volume Modes
- Passive exhalation port Circuit & active exhalation valve Circuit configuration

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Ventilation modes
Alarms & Settings
Circuit type

Ventilation Modes

Pressure modes

- ✓ CPAP
- ✓ S*
- ✓ S/T*
- ✓ PC*
- ✓ T*
- ✓ PC- SIMV

Volume modes

- ✓ AC
- ✓ VC
- ✓ SIMV

Passive exhalation port circuit

AVAPS* & Auto-TRAK

Auto-TRAK

Active exhalation valve circuit

For Adult and children / For invasive and Non-invasive

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Pressure modes settings

CPAP, S modes

CPAP : 4 – 20 cmH₂O
IPAP : 0 – 50 cmH₂O
EPAP : 4/0 – 25 cmH₂O

Flex : Off, 1, 2, 3*

Ramp : off, 5 – 45 min

Starting pressure : 4 - EPAP

* Only when Auto-Trak is ON

S/T, PC, T modes

IPAP : 0 – 50 cmH₂O
EPAP : 4/0 – 25 cmH₂O
RR : 0 – 60 BPM
Ti : 0,3 – 3 sec

Ramp : off, 5 – 45 min

Starting pressure : 4 – EPAP

PC-SIMV

Mandatory or assisted breaths:

Pressure : 0 – 50 cmH₂O
PEEP: 4/0 – 25 cmH₂O
RR : 0 – 60 BPM
Ti : 0,3 – 3 sec

Spontaneous breaths:

Pressure support : 0 – 30
cmH₂O

Volume modes settings

VC, AC modes

Vt : 50 - 2 000 ml
Flow pattern : square - ramp
EPAP : 4/0 - 25 cmH₂O
RR : 0 - 60 BPM
Ti : 0,3 – 3 sec

SIMV

Mandatory or assisted breaths:

Vt : 50 - 2 000 ml
Flow pattern : square - ramp
PEEP: 4/0 - 25 cmH₂O
RR : 0 - 60 BPM
Ti : 0,3 – 3 sec

Spontaneous breaths:

Pressure support : 0 – 30 cmH₂O

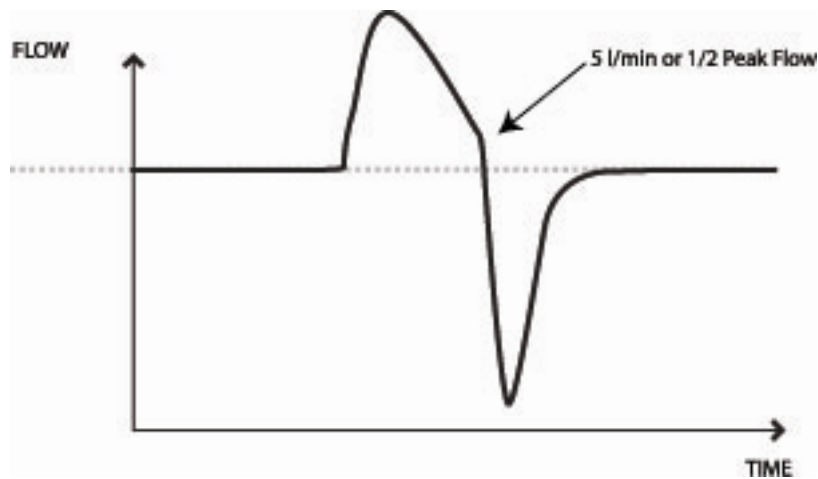
Sighs:

- On, OFF
- 150% of the preset Vt 1 breaths / 100

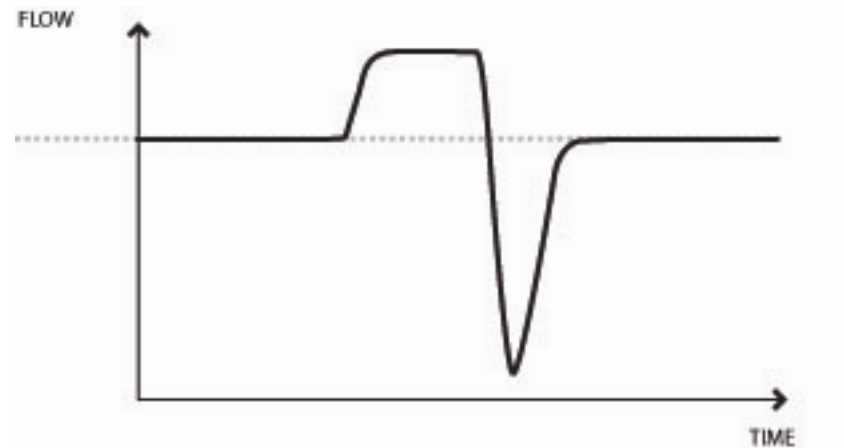
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Waveform Patterns

- Ramp



- Square



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Patient Alarms

	Pressure Modes						Volume Modes		
	CPAP	S	S/T	PC	T	PC-SIMV	CV	AC	SIMV
Circuit Disconnect: off, 0-60sec									
Apnea*: off, 0-60sec									
Apnea Rate*: RR - 60 BPM									
High/Low Tidal Volume									
High/Low Minute Ventilation									
High/Low Respiratory Rate									
High/Low Peak Insp Pressure									

* Apnea Ventilation:

- Set apnea alarm and apnea rate
- Goes off after Xsec and will generate mandatory breaths with fixed respiratory rate (= apnea rate)

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System Alarms and Messages

- ✓ High/Low Pressure Alarms (Volume modes only)
- ✓ Circuit Occlusion
- ✓ Low Leak (passive circuit configuration)
- ✓ Power/battery Alarms
- ✓ Check Circuit
- ✓ Ventilator Inoperative
- ✓ Service required / Service recommended
- ✓ 'Limit Reached' message

High Priority – Red

Medium Priority – Yellow

Informational – No Indication

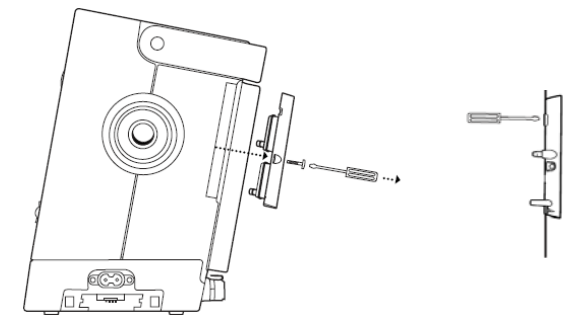
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Circuit Types

- Passive exhalation port circuit
 - Auto-TRAK™
 - AVAPS™
- Active exhalation valve circuit

⇒ Both provide invasive and non-invasive ventilation

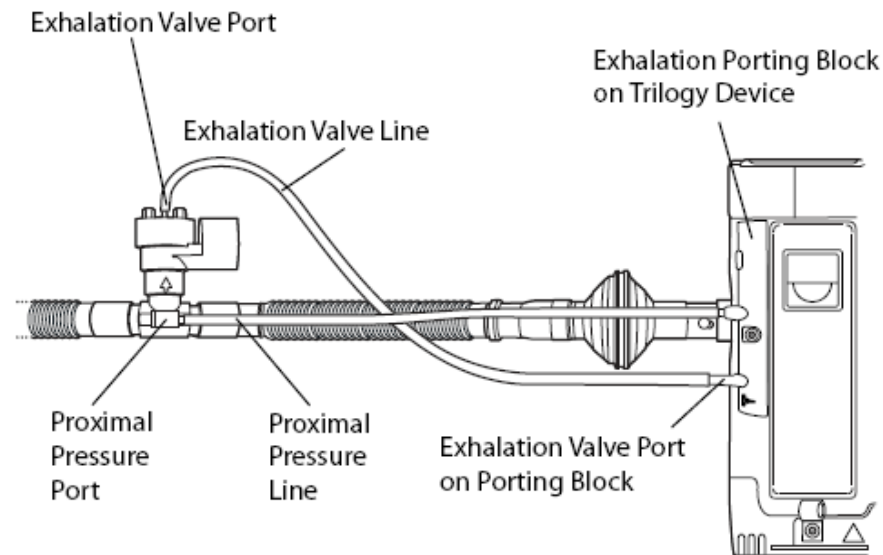
⇒ Both provide volume and pressure modes



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Active Exhalation Valve circuit

- 1 single limb circuit
- Dedicated Respironics exhalation valve
- Monitoring: Vi/Vti measurements
- Provides Volume and Pressure modes (EPAP = 0-25 cmH₂O)
- Provides invasive and non-invasive ventilation

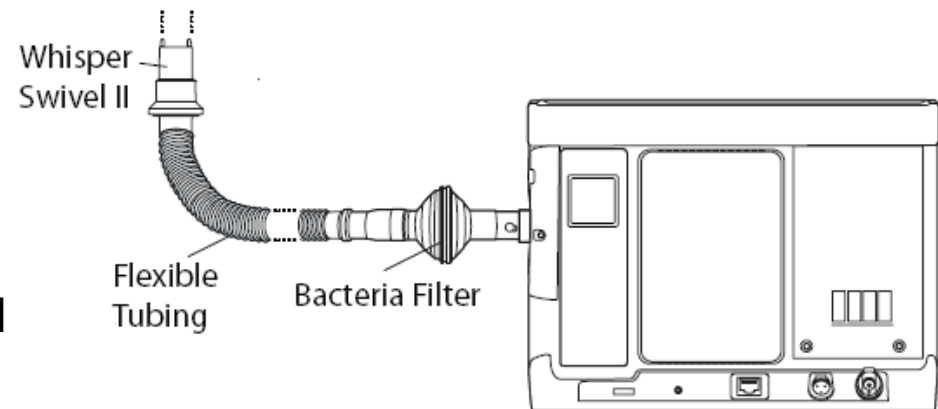


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Passive Exhalation Port circuit



- 1 single limb circuit to connect to a mask with integrated leak or to a trach with a whisper swivel
- Provide Respirationics well known technology for both invasive and non-invasive ventilation:
 - Leak compensation in pressure and volume modes
 - Automatic triggers with Auto-Trak in pressure and volume modes
 - Monitoring: V_e/V_{te} estimation
 - AVAPS ventilation in all pressure modes (except CPAP and PC-SIMV)
- Only one tube
 - Easy to clean for the patient
 - No risk of wrong connection
 - No noise from the valve
- Minimum EPAP of $4\text{cmH}_2\text{O}$ is required



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Respironics Technology

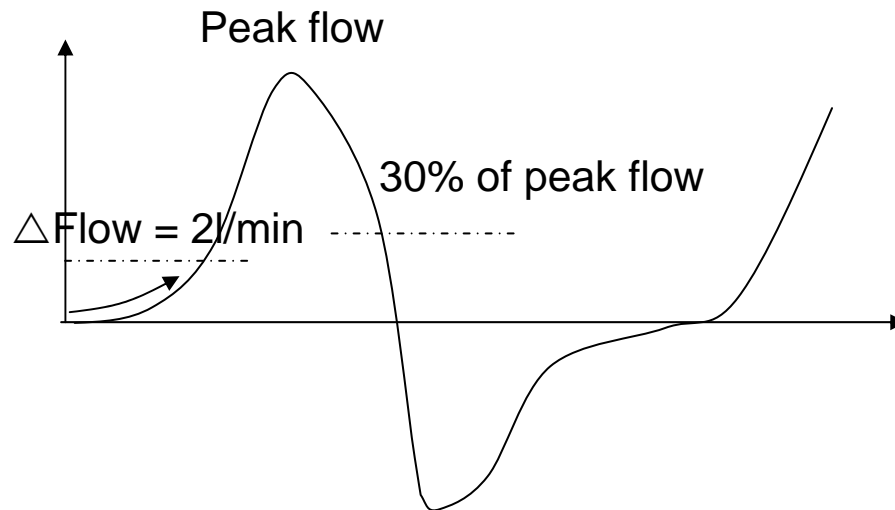
- ✓ Auto-TRAK™ Algorithm
- ✓ AVAPS™ Hybrid Ventilation
- ✓ Volume mode with passive circuit

Flow Trigger

- Available in both circuit configurations
- For both Volume and Pressure modes
- For both non-invasive and invasive
- Trigger sensitivity: 1 – 9 l/min
- Cycle sensitivity: 10 – 45% of peak flow

Auto-TRAK Trigger

- Available in passive exhalation port circuit configuration
- For both Volume and Pressure modes
- For both non-invasive and invasive
- No trigger adjustments required



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Auto-Trak™ Sensitivity

« Unlike manually controlled triggers,
Auto-TRAK does the work for you »

Characteristics

- **Automatic** triggers
- **Advanced Leak compensation** over 60LPM
- **Vte Ve estimation** at max (15lpm,15%) accuracy

Advantages

- **Efficient Ventilation:** Leaks are all compensated for.
Trigger thresholds automatically adjust according to the changes in leaks and patient respiratory mechanics
- **Easy Ventilation:** No trigger adjustments are required
- **Advanced monitoring:** Alarms & monitoring on Vte & MinVent



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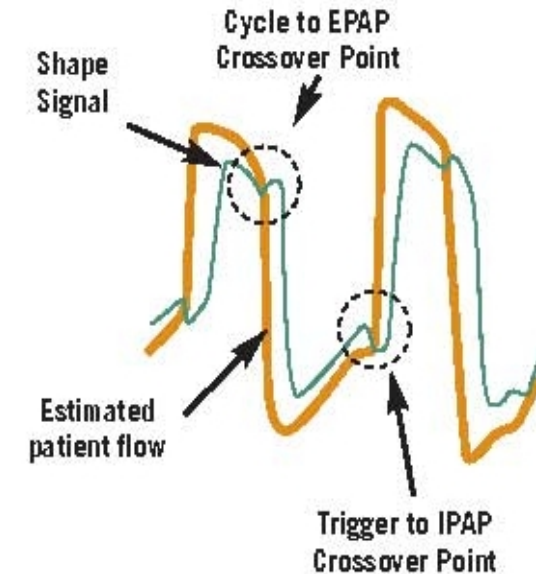
Version 1 – April 2009

Digital Auto-TRAK Algorithm

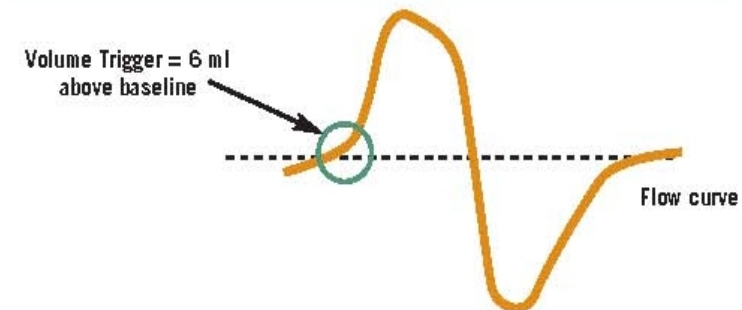
- **Inspiration:** when the patient makes an effort to inspire, the flow naturally increases
- **Expiration:** when the patient makes an effort to expire, the flow naturally decreases

Flow Shape signal:

Delayed waveform crossing patient flow in case of flow direction changes



Detects an accumulated 6ml volume above the base line



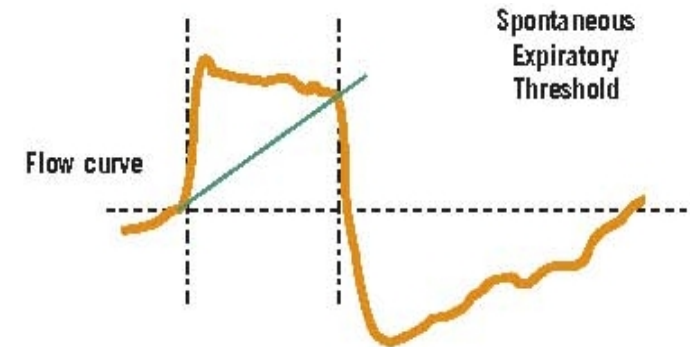
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Digital Auto-TRAK Algorithm

Spontaneous Expiratory Threshold:

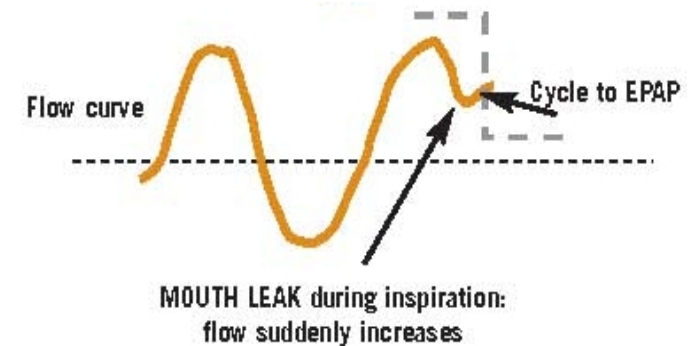
Electronic signal that rises in proportion of the inspiratory flow rate.

SET adapts to flow pattern and therefore to patient respiratory mechanics.



Flow Reversal:

allows detection of excessive mouth leak. If the flow increases by more than 10% of the peak flow in a short period of time then switch to EPAP



Safety Feature:

Inspiratory time cannot exceed 3 sec

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Digital Auto-TRAK™ Sensitivity

« A proven technology »

- **Chest 1997** : “Performance Characteristics of Bilevel Pressure Ventilators” Kacmarek and Co.
- **AJRCCM 2001** : “Noninvasive Ventilator Triggering in Chronic Obstructive Pulmonary Disease” Moxham and Co.
- **Chest 2005** : “Performance Characteristics of 10 Home Mechanical Ventilators in Pressure-Support Mode” Janssens and Co.

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Digital Auto-TRAK™ Sensitivity

“Patient-ventilator synchrony is a key to the success of long-term Home NIV as dyssynchrony causes patient intolerance”

Chest 2005 : “Performance Characteristics of 10 Home Mechanical Ventilators in Pressure-Support Mode”

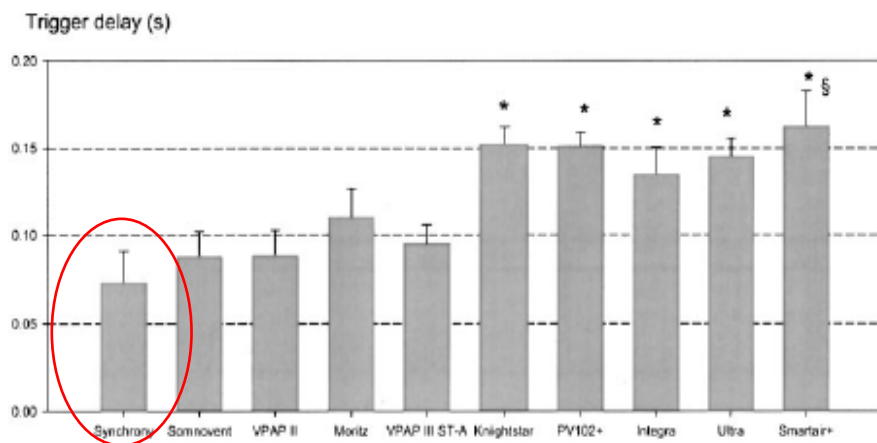


FIGURE 2. Td of the 10 bilevel ventilation devices, tested for an inspiratory effort of 5 cm H₂O. Data pooled for the three levels of pressure support (10, 15 cm H₂O and PSm_{ax}). Histogram bars mean \pm SD. * = $p < 0.05$ vs the Moritz, Synchrony, Somnovent, VPAP II, and VPAP III ST-A devices; § = $p < 0.05$ vs the Integra and Ultra devices.

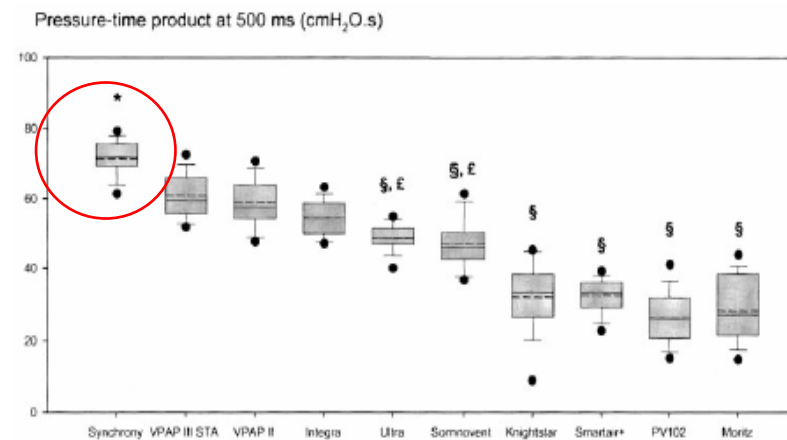
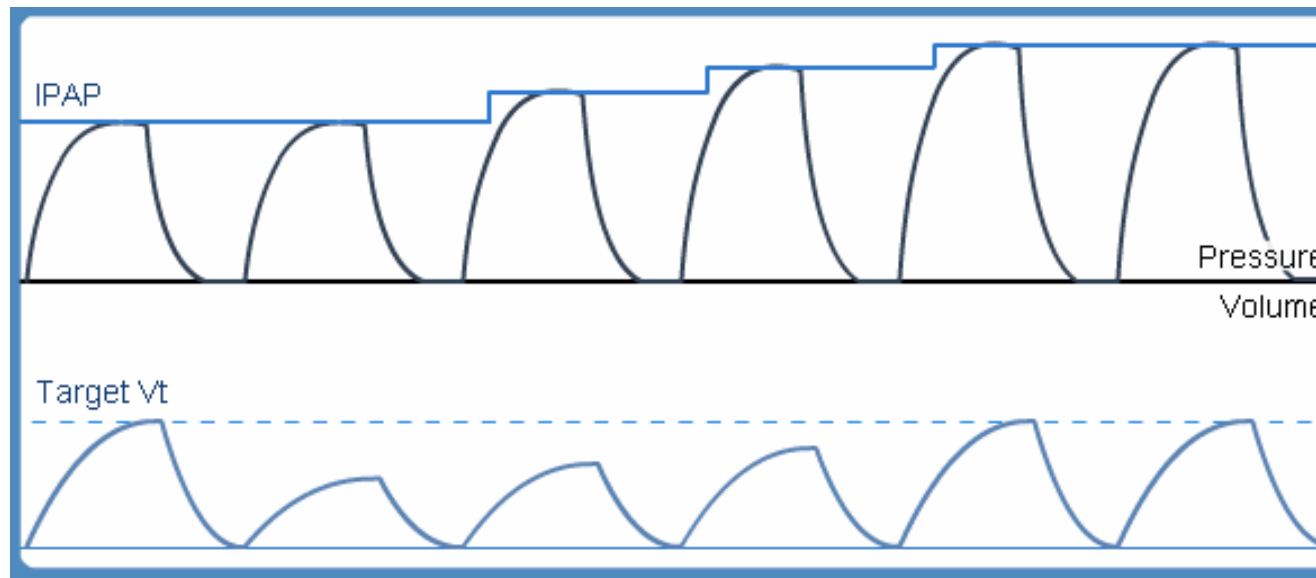


FIGURE 5. PTP₅₀₀ values for the 10 bilevel ventilation devices. The data were pooled for all conditions. Box and whisker plots show the mean values (dashed lines in the boxes), the median values (continuous lines in the boxes), 25th to 75th percentiles (vertical bars), and 5th to 95th percentiles (dots). * = $p < 0.05$ vs all other devices; § = $p < 0.05$ vs the Integra, VPAP II, and VPAP III ST-A devices; £ = $p < 0.05$ vs the Knightstar, Moritz, PV 102, and SmartAir+ devices.

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AVAPS Hybrid Ventilation

AVAPS automatically adapts the pressure support to the patient needs to guarantee an average ventilation



AVAPS is the first technology to combine pressure support and volume ventilation to manage the patient's therapy effectively.

Without AVAPS, a change in the patient's condition may increase resistance to flow. As a result, the volume delivered to the patient will be decreased.

AVAPS gradually adjusts the IPAP pressure to maintain the target tidal volume.

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AVAPS Benefits

- To improve sleep quality as V_t varies according to sleep stages
- **Obese hypoventilation patients:** To compensate for changes in body position
- **COPD patients & restrictive patients:**
 - To escape from the compromise “patient comfort” or “ventilation efficacy”; get both benefits by applying “the right pressure at the right time”
 - To improve comfort while guaranteeing the safety of ventilation

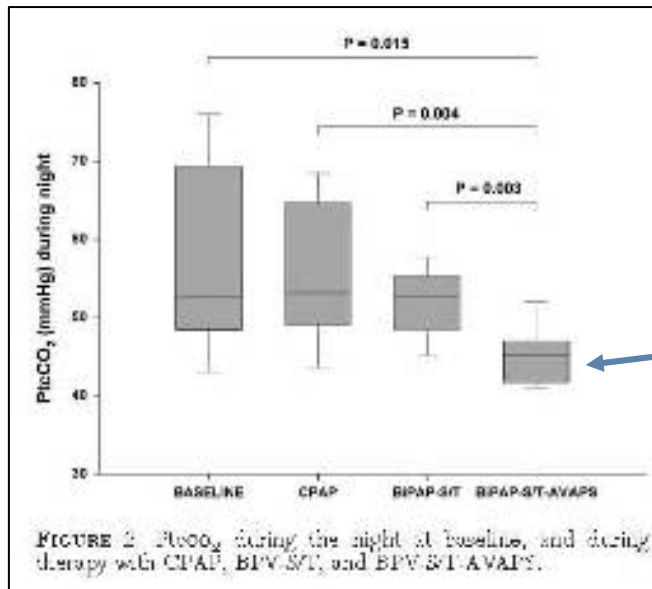
« The right pressure at the right time »

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“Average Volume Assured Pressure Support in Obesity Hypoventilation: a Randomized Cross-Over Trial”

Jan Hendrik Storre, MD; Benjamin Seuthe; René Fiechter, MD; Stavroula Milioglou; Michael Dreher, MD; Stephan Sorichter, MD; and Wolfram Windisch, MD

CHEST, September 2006



“The addition of AVAPS to BPV-S/T provides beneficial physiologic improvements, **resulting in a more efficient decrease of PtcCO₂** compared to BPV-S/T therapy alone”

This study conducted on 10 patients with obesity hypoventilation syndrome (OHS) showed that BiPAP S/T substantially improves sleep quality and specific aspects of the quality of life, the addition of AVAPS further improves the decrease of PtcCO₂.

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PHILIPS AVAPS Settings

Recommendations:

- ✓ EPAP = 4 if no overlap SAS nor intrinsic PEP
- ✓ IPAPmin = EPAP + 0-4 cmH₂O depending on disease
- ✓ IPAPmax = EPAP + 25 (or 30 cmH₂O) depending on disease and ventilation configuration (NIV versus IMV)
- ✓ Vt = 8 ml/kg of ideal body weight

If ideal BMI = 23 kg/m²

Ideal weight = 23 x (patient Height)²

Vt = 8 x ideal weight

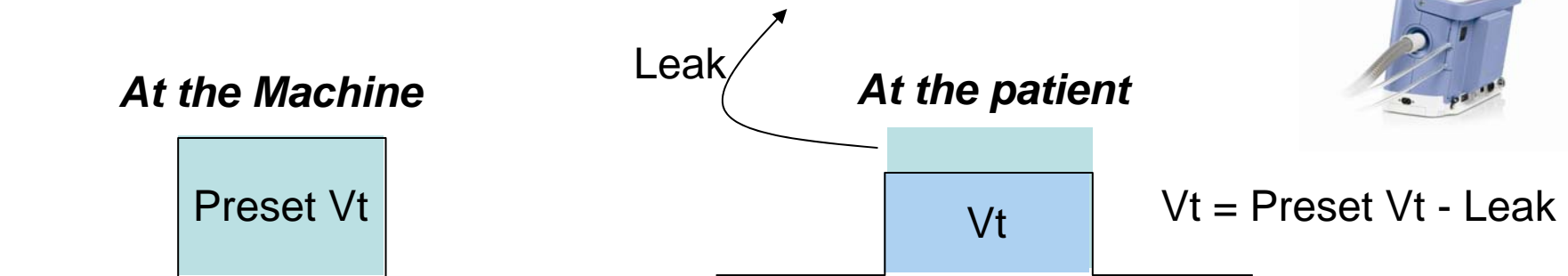
Height	Calculated ideal weight (if BMI = 23)	Target Vte if 8 ml/Kg
1.50 m	52.0 Kg	410 ml
1.55 m	55.0 Kg	440 ml
1.60 m	59.0 Kg	470 ml
1.65 m	62.5 Kg	500 ml
1.70 m	66.5 Kg	530 ml
1.75 m	70.5 Kg	560 ml
1.80 m	74.5 Kg	600 ml
1.85 m	78.5 Kg	630 ml
1.90 m	83.0 Kg	660 ml

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Volume Mode in Passive Circuit

- = Volume mode in Active Circuit but leaks are all compensated for
 - The patient will get what you set
 - Not need to set 30% more V_t to feed the leaks in non invasive ventilation
 - No need to closely monitor exhaled gas
- For non invasive and invasive ventilation
- Minimum PEP of 4 is required
- No active exhalation valve
 - easier to connect, easier to clean
 - no risk of wrong connection, no risk of water/occlusion in the small tubes
 - no noise from the valve, lighter for the patient

Volume Mode in Active Circuit



Volume Mode in Passive Circuit

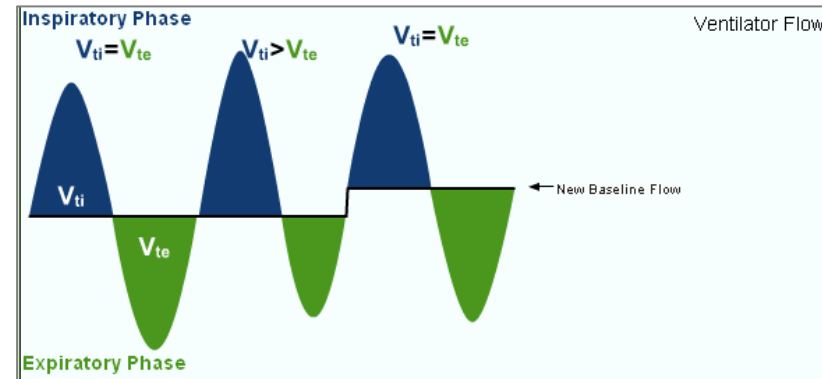
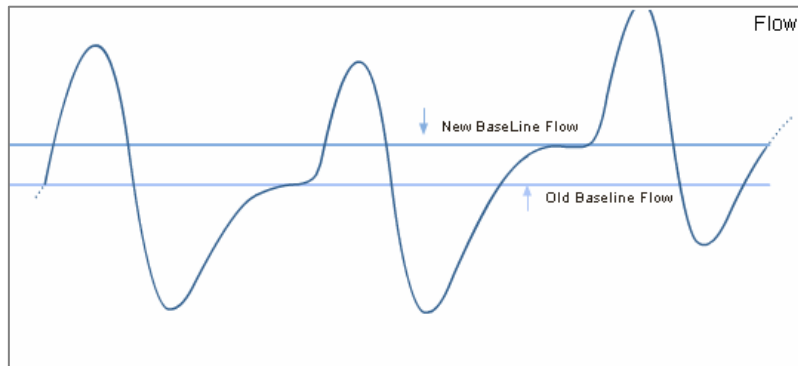


Leaks changes can be generated by different causes:

- Circuit and Interface
- Patient Respiratory mechanics impact pressure that impacts leak flow
- Mouth breathing

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Advanced Leak Estimation



- V_t delivered by the machine is adjusted according to leak estimation

$$\text{Leak} = V_{ti} - V_{te}$$

$$\text{Delivered } V_t = \text{Preset } V_t + \text{Leak}$$

$$\text{Patient } V_t = \text{Preset } V_t$$

- Delivered and Monitored tidal volume is accurate at 15%

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