ResMed

Lumis™ series

Noninvasive ventilators

# NIV Technologies: Lumis™ handbook

ResMed.com/Lumis

# Table of contents


**Lumis Technologies at a glance ..... 3**

**Accessing the Lumis clinical menu ..... 4**

**Lumis ventilation modes ..... 5**

**Advanced setting to optimise comfort ..... 6**
- Rise Time ..... 6
- Trigger and Cycle Sensitivities ..... 7
- Ti Control ..... 8
- Setting Ti Min and Max ..... 9

**Lumis comfort features ..... 10**
- Ramp and Ramp Down ..... 10
- Smart Start ..... 10
- Vsync ..... 11
- Climate Control ..... 12

**Lumis 150 ST-A alarm modules ..... 13**

**NIV Titration and troubleshooting ..... 14**

**Intelligent Volume Assured Pressure Support (iVAPS) ..... 16**
- iBR ..... 17
- AutoEPAP ..... 18

**iVAPS titration protocol for Lumis ..... 19**
- Manual titration using Target Va Calculator ..... 19
- Automated titration using Learn Targets ..... 20
- Full titration using EasyCare Tx ..... 21

**Lumis series accessories ..... 23**

**Lumis Oximetry set-up procedure ..... 25**
- Connecting the Lumis Oximetry Module ..... 25

**Lumis RPS II set-up procedure ..... 26**

**Lumis reprocessing guidelines ..... 27**
- Reprocessing the air tubing ..... 27
- Reprocessing the humidifier and air outlet ..... 29
- Reassembling ..... 31



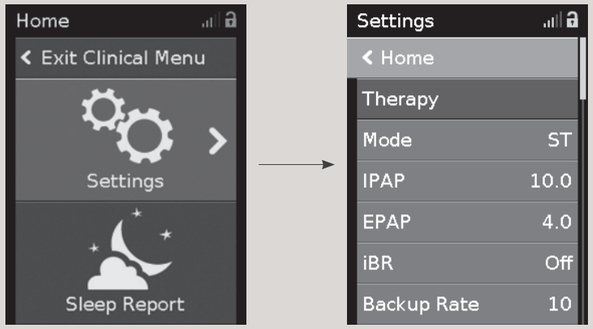

# Lumis technologies at a glance

| Therapy modes | Lumis 100 VPAP S (28012) | Lumis 150 VPAP ST (28124) | Lumis 150 VPAP ST-A (28223) |
|---|---|---|---|
| CPAP (Continuous Positive Airway Pressure) | • | • | • |
| S (Spontaneous) | • | • | • |
| T (Timed) | | • | • |
| ST (Spontaneous-Timed) with optional iBR | | • | • |
| PAC (Pressure Assist-Control) | | • | • |
| iVAPS (with iBR) and optional AutoEPAP | | • | • |
| **Features** | | | |
| Alarms | | | • |
| Vsync | • | • | • |
| TiControl | • | • | • |
| Trigger and cycle | • | • | • |
| EPR™ | | | |
| Ramp | • | • | • |
| Ramp Down | • | • | • |
| Climate Control Auto | • | • | • |
| Essentials mode | • | • | • |
| **Data management** | | | |
| Built-in wireless connectivity* | • | • | • |
| AirView | • | • | • |
| AirView's remote assist | • | • | • |
| ResScan | • | • | • |

*Wireless communication depends on network availability.

# Accessing the Lumis clinical menu


Hold down the home button and dial together for three second to unlock the Clinical Menu




# Lumis ventilation modes

## CPAP

CPAP (continuous positive airway pressure) mode delivers one fixed level of pressure during both the patient's inspiratory and expiratory phase.

## S

S (spontaneous) mode senses both the patient's inspiratory and expiratory phase, and delivers a preset level of pressure during each to support the patient's spontaneous breathing.

## ST

ST (spontaneous timed) mode delivers a preset level of pressure to support the patient's spontaneous breathing while providing additional breaths should the patient's respiratory rate fall below the backup rate.

## T

T (timed) mode delivers pressure at a fixed breath rate, and a fixed inspiration and expiration time set by the clinician, regardless of the patient's effort.

## P(A)C*

P(A)C (pressure assist control) is a mandatory pressure mode where the inspiration time is preset, with inspiration initiated spontaneously or time triggered should the patient's respiratory rate fall below the backup rate.

## iVAPS

iVAPS (intelligent volume-assured pressure support) mode automatically adjusts the pressure delivered to meet a patient's target alveolar ventilation.

**The common adjustable parameters for different modes in the Lumis device are shown below.**

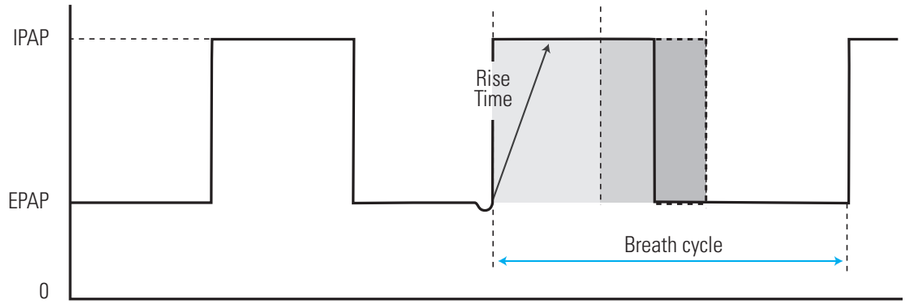
| Parameter | S | ST | T | PAC | iVAPS | CPAP |
|---|---|---|---|---|---|---|
| Set Pressure | | | | | | • |
| IPAP | • | • | • | • | | |
| EPAP | • | • | • | • | • | |
| Min PS | | | | | • | |
| Max PS | | | | | • | |
| Mini EPAP* | | | | | • | |
| Max EPAP* | | | | | • | |
| Resp. Rate | | | • | | | |
| Backup Rate | | • | | • | | |
| Target Pt Rate** | | • | | | • | |
| Target Va | | | | | • | |
| Ti | | | • | • | | |
| Ti Max | • | • | | | • | |
| Ti Min | • | • | | | • | |
| Rise Time | • | • | • | • | • | |
| Trigger | • | • | | • | • | |
| Cycle | • | • | | | • | |
| Height | | | | | • | |

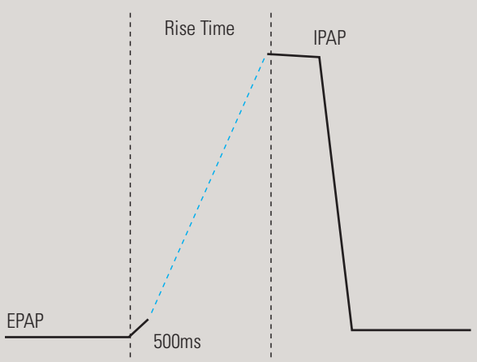
* Only available when AutoEPAP is enabled ** Only available when iBR is enabled in ST mode

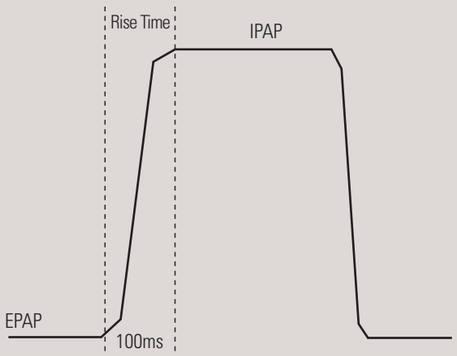
# Advanced settings to optimise comfort

## Rise Time

Rise Time is the time it takes for inspiratory pressure to rise to the prescribed level.
A controllable Rise Time enhances your patient's breathing effort, comfort and synchrony.
Set in milliseconds with a settable range of MIN/150 -900ms. Reports of the air delivery being 'too hard', 'too fast', 'too strong' or 'intolerable' may indicate that the Rise Time may need to be lengthened. Reports of the air delivery being 'too slow' or 'not enough air' may indicate a need for a shorter Rise Time.

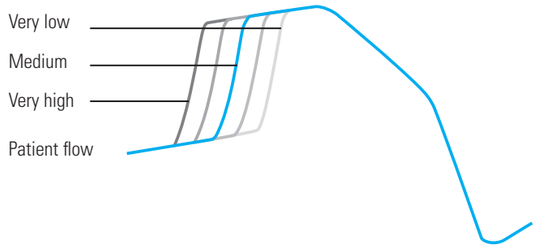


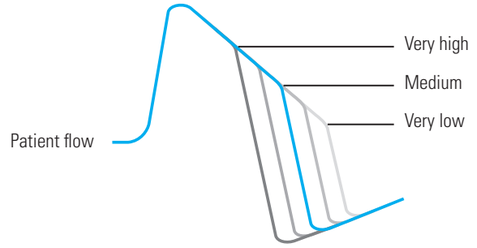




## Trigger and Cycle Sensitivities

Trigger and Cycle customises the beginning and end of each breath to reflect your patient's condition and is designed to maintain patient-ventilator synchrony, and reduce the effort required to breathe.




### What does Trigger and Cycle do?

ResMed ventilators employ flow triggering and cycling.

- Under normal conditions, the device triggers (initiates IPAP) and cycles (changes to EPAP) as it detects changes in patient flow.
- Trigger settings can be used to adjust the amount of flow required to trigger inspiration.
- Cycle settings can be used to adjust the percentage of peak inspiratory flow required to cycle to expiration.

### What makes Trigger and Cycle special?

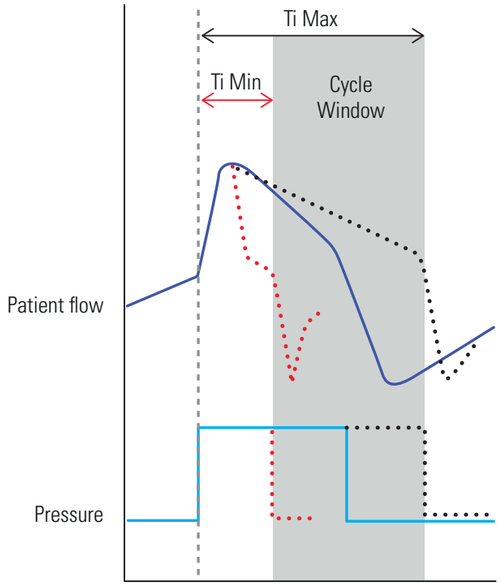
- **Fine-tuning and customisation:** five adjustable breath detection sensitivity settings are available and can be used to optimise the detection of the beginning and end of the breath and customise the technology to meet your patient's unique needs.
- **Flexibility:** a wide range of settings enables you to personalise therapy, comfort and synchrony across a wide range of pathologies, from paediatric to adult and from restrictive to obstructive.
- **Synchronisation:** functions in parallel with ResMed's Vsync automatic leak management technology and is designed to enhance breath detection and optimise patient-device synchronisation.

### Trigger and cycle sensitivity table

| | Very Low | Low | Medium | High | Very High |
|---|---|---|---|---|---|
| Trigger settings | Less sensitive/Harder to Trigger | | Default | | More sensitive/Easier to Trigger |
| Cycle settings | Less sensitive/Harder to Cycle | | Default | | More sensitive/Easier to Cycle |

# TiControl™

TiControl maintains the ideal inspiratory cycle for your patient's needs. Minimum and maximum inspiratory time limits can be set above and below a patient's spontaneous inspiration time, for enhanced patient–ventilator synchrony.




## What does TiControl do?

TiControl tailors your patient's breathing to suit their condition by:

- enabling you to set upper and lower limits on inspiratory time
- enabling you to manage spontaneous flow and set ideal levels that match your patient's unique needs
- reacting swiftly and effectively to correct unstable breathing.

## What makes TiControl special?

- **Reassuring responsiveness:** provides timely intervention if your patient's breathing cycle becomes spontaneous and shifts away from its registered inspiration phase.
- **Personalised fine-tuning:** allows you to limit minimum and maximum inspiratory periods to suit your patient's unique situation. For example, you can deliver a shortened Ti Max phase if your COPD patient has a restricted respiratory flow and difficulties exhaling.

This could help to prevent late cycling to expiratory pressure and provide a better match with their ideal inspiratory time.

- **Patient-device synchronisation:** works in combination with Vsync technology and is designed to offer extra assurance, control over your patient's inspiratory time and maintain outstanding patient-device synchronisation.



## TiControl titration table

Note: This table is meant to be used as a guide. The clinician shall exercise due caution and judgement, while ensuring the patient is comfortable.

### Setting Ti Min and Max

1. Instruct the patient to breathe normally while either lying down or sitting in an upright position.
2. Observe and record the number of breaths the patient takes per minute (BPM).
3. Consider the patient's respiratory condition and refer to the appropriate table for that condition i.e. Restrictive, Obstructive or Normal.
4. Match the patient's spontaneous BPM to the BPM on the left hand side of the table.
5. Input the corresponding Ti Min and Max setting.

| Restrictive States | | |
|---|---|---|
| BPM | Ti Min: (ratio 1:3) | Ti Max: (ratio 1:1) |
| 30 | 0.5 | 1.0 |
| 29 | 0.5 | 1.0 |
| 28 | 0.5 | 1.1 |
| 27 | 0.6 | 1.1 |
| 26 | 0.6 | 1.2 |
| 25 | 0.6 | 1.2 |
| 24 | 0.6 | 1.3 |
| 23 | 0.7 | 1.3 |
| 22 | 0.7 | 1.4 |
| 21 | 0.7 | 1.4 |
| 20 | 0.8 | 1.5 |
| 19 | 0.8 | 1.6 |
| 18 | 0.8 | 1.7 |
| 17 | 0.9 | 1.8 |
| 16 | 0.9 | 1.9 |
| 15 | 1.0 | 2.0 |
| 14 | 1.1 | 2.1 |
| 13 | 1.2 | 2.3 |
| 12 | 1.3 | 2.5 |

Examples of Restrictive states are; Neuro-Muscular Disease and Duchenne Muscular Dystrophy

| Obstructive States | | |
|---|---|---|
| BPM | Ti Min: (leave on default setting - 0.3 sec) | Ti Max: (ratio 1:2) |
| 30 | 0.3 | 0.7 |
| 29 | 0.3 | 0.7 |
| 28 | 0.3 | 0.7 |
| 27 | 0.3 | 0.7 |
| 26 | 0.3 | 0.8 |
| 25 | 0.3 | 0.8 |
| 24 | 0.3 | 0.8 |
| 23 | 0.3 | 0.9 |
| 22 | 0.3 | 0.9 |
| 21 | 0.3 | 0.9 |
| 20 | 0.3 | 1.0 |
| 19 | 0.3 | 1.0 |
| 18 | 0.3 | 1.1 |
| 17 | 0.3 | 1.2 |
| 16 | 0.3 | 1.2 |
| 15 | 0.3 | 1.3 |
| 14 | 0.3 | 1.4 |
| 13 | 0.3 | 1.5 |
| 12 | 0.3 | 1.7 |

Examples of Obstructive states are; Chronic Obstructive Pulmonary Disease (COPD)

| Normal States | | |
|---|---|---|
| BPM | Ti Min: (leave on default - 0.3 sec or use a 1:2 ratio as below) | Ti Max: (ratio 1:1) |
| 30 | 0.7 | 1.0 |
| 29 | 0.7 | 1.0 |
| 28 | 0.7 | 1.1 |
| 27 | 0.7 | 1.1 |
| 26 | 0.8 | 1.2 |
| 25 | 0.8 | 1.2 |
| 24 | 0.8 | 1.3 |
| 23 | 0.9 | 1.3 |
| 22 | 0.9 | 1.4 |
| 21 | 0.9 | 1.4 |
| 20 | 1.0 | 1.5 |
| 19 | 1.0 | 1.6 |
| 18 | 1.1 | 1.7 |
| 17 | 1.2 | 1.8 |
| 16 | 1.2 | 1.9 |
| 15 | 1.3 | 2.0 |
| 14 | 1.4 | 2.1 |
| 13 | 1.5 | 2.3 |
| 12 | 1.7 | 2.5 |

Examples of Normal states are; Obesity HypoventilationSyndrome (OHS) & Post-Operative Applications

# Lumis comfort features

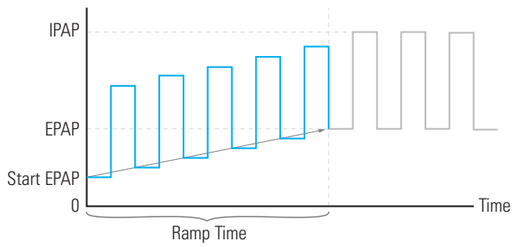
## Ramp and Ramp Down

Ramp gradually and comfortably increases the pressure until the prescribed therapy level is reached.

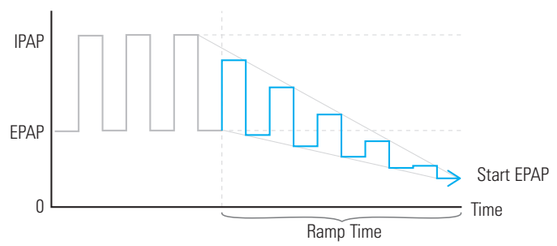
Ramp Down eases your patient into spontaneous breathing by gradually reducing the pressure.

Ramp Down gradually decreases the therapeutic pressure until Start EPAP is reached. Lumis decreases the pressure over a fixed 15-minute period then continues in CPAP mode.

**Ramp - Lumis**




**Ramp Down - Lumis**

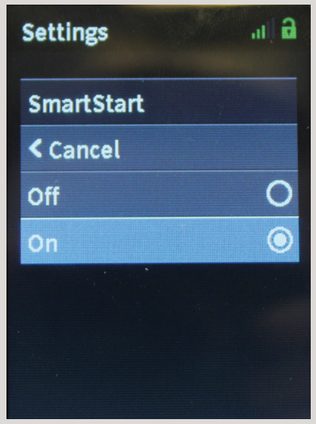



## SmartStart

With the SmartStart feature enabled, the device will start automatically when the patient breathes into the mask and then stop automatically when the patient removes the mask.

With SmartStart enabled, the start/stop button will still function if pressed.

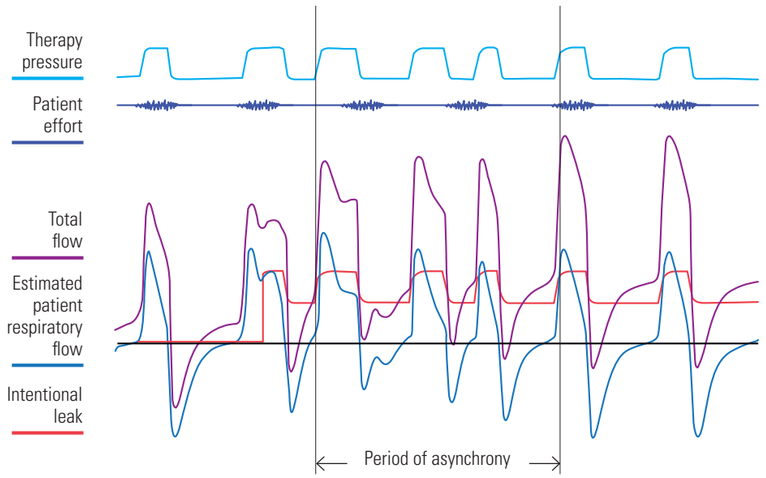
With the High Leak alarm enabled (in Lumis ST-A device only), the SmartStart function will be automatically disabled.




## Vsync

Vsync is designed to ensure reliable, patient-device synchrony and rapidly, accurately and automatically detect and compensate for leaks. This essential technology underpins excellence in NIV ventilation.

**Vsync leak management algorithm**




### What does Vsync do?

Vsync supports successful ventilation by:

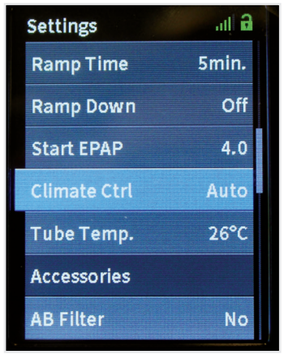
- rapidly detecting and responding to leaks
- accurately compensating for dynamic, fast-changing and unstable leaks
- effectively restoring patient-device synchrony, usually within 2-3 breaths.

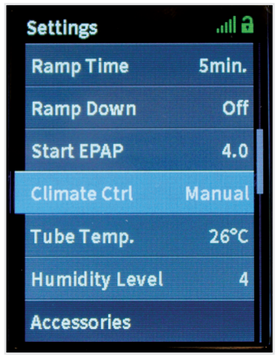
### What makes Vsync special?

- **Rapid response:** shifts to a 2-second detection and re-synchronisation phase as soon as a leak is detected. As soon as patient-device synchrony is restored, it reverts to the default 10-second mode.
- **Smart algorithm:** recognises the difference between patient inhalation and leak. This reduces the risk that the ventilator will cycle your patient's breath ineffectively or mis-trigger from EPAP to IPAP, out of sync with actual effort.
- **Reassuring insight:** reliably measures essential patient information including tidal volume, minute ventilation and respiratory rate.
- **Patient-device synchronisation:** complements TiControl technology and is designed to maintain outstanding patient-device synchronisation, even in cases of significant leak.

# Climate Control

Advanced humidification that adapts to changing ambient conditions.




## What does Climate Control do?

Climate Control is a comfort feature designed to automatically adjust to:

- changes in ambient room temperature and humidity,
- changes in flow caused by pressure changes,
- changes in flow due to mask or mouth leak.

## What makes Climate Control special?

- **Comfort:** feedback from five sensors intelligently adjusts the humidity to deal with changes in ambient conditions.
- **Flexibility:** in Manual mode, the tube temperature and humidity level can be set independently, so your patient can control the comfort of their therapeutic experience.
- **Simplicity:** in Auto mode, temperature and humidity are pre-set at levels designed to deliver increased comfort, providing your patient with immediate access to comfortable humidification at the touch of a button.



# Lumis 150 ST-A alarm modules

## Alarm types

All the alarms on the device are classified as medium priority.

**Fixed alarms**
The alarms pre-set for the device are:

- Power fail
- Blocked tube*
- Tube disconnected
- System fault (system error).

*Only triggered reliably for pressures above 10 cm $H_20$.

**Adjustable alarms**
Alarms that can be set are:

- High leak
- Non-vented mask
- Low minute ventilation
- Apnoea
- Low $SpO_2$ (when oximeter connected).

The alarms listed above can also be catergorised as:

- Clinical alarms—Low minute ventilation, Apnoea, Low $SpO_2$
- Patient circuit alarms—Blocked tube, Tube disconnected, High leak, Non-vented mask
- System alarms—Power fail, System fault.

| Alarm | Description | Range |
|---|---|---|
| High Leak* | Enable / disable the High Leak alarm.<br>Activates when a leak >40 L/min (0.7 L/sec) occurs for >10–30 seconds. | On / Off |
| Non-Vented Mask | Enable / disable the Non-Vented Mask alarm.<br>Activates within 20–40 seconds when a non-vented mask is attached during therapy.<br>Note: Use of supplemental oxygen with a vented | On / Off |
| Low MV* | Sets the Low Minute Ventilation alarm.<br>Activates within 20–40 seconds after the measured level remains below the set limit.<br>Note: Alarm may not trigger reliably when using a P10 mask. | Off / 1–10 L/min,<br>1 L/min increments |
| Low $SpO_2$ | Sets the Low $SpO_2$ alarm.<br>Activates when the $SpO_2$ value is below the set value for 20–40 seconds.<br>Only functional when an oximeter is connected.<br>When the Low $SpO_2$ alarm is set, the Oximeter sensor disconnected alarm and Oximeter sensor failure alarm are also enabled. | Off / 70–95%,<br>1 % increments |
| Apnoea | Sets the Apnoea alarm.<br>Activates when there is no inspiratory trigger (either patient or machine) detected from the previous inspiration for the set interval. Two consecutive inspirations (either patient or machine triggered) reset the Apnoea alarm. | Off / 10–60 sec,<br>1 sec increments |
| Alarm Volume | Sets the alarm volume. | Low / Medium / High |

*When enabled, SmartStart is automatically disabled.

# NIV Titration and troubleshooting

## NIV Initiation Protocol for Chronic Respiratory Insufficiency or Failure

Choose S mode, or ST or PAC mode if back-up rate[1] is needed.

Reset default settings for optimal out-of-box performance and fine-tune as required or as per Troubleshooting Guide.[2]

Start with pressure settings:
- IPAP 8–10 cm $H_2O$
- EPAP 4–5 cm $H_2O$

In S or ST mode, set Ti Min and Ti Max.[3]
In PAC mode, set Ti as per protocol.[3]

Set rise time < 30% of Ti or a short rise time for COPD patients.

### INCREASE IPAP

Increase IPAP to:

- achieve a tidal volume of 6–10 mL/kg of ideal body weight
- decrease WOB (less use of accessory muscles)
- decrease RR to below 25 bpm
- reduce $PaCO_2$

### SET/ADJUST BACK-UP RATE[1]

- Set the back-up rate, usually at 2–6 bpm below the patient's resting respiratory rate.
- Adjust the back-up rate[1] to ensure an adequate respiratory frequency and minute ventilation.

### INCREASE EPAP

Increase EPAP to:

- eliminate upper airway obstruction
- reduce intrinsic PEEP
- improve oxygenation

Note: To keep the same PS, increase IPAP when EPAP is increased.

Add oxygen if $SpO_2$ remains < 90% after optimising ventilation.
Consider assisted cough techniques to clear secretions if patient's $SpO_2$ < 90.

Verify settings, refer to Troubleshooting Guide.

These are recommendations for NIV settings, but existing protocols within your facility should always take precedence.

1 Back-up rate is only available in ST and PAC modes.
2 The Troubleshooting Guide is available on the other side of this document.
3 Please ask your local ResMed representative for the Ti Chart, a useful reference tool for Ti adjustments.

NIV: Noninvasive ventilation; S: Spontaneous; ST: Spontaneous–Timed; PAC: Pressure Assisted Control; IPAP: Inspiratory positive airway pressure; EPAP: Expiratory positive airway pressure; PEEP: Positive end expiratory pressure; PS: Pressure support; WOB: Work of breathing; OSA: Obstructive sleep apnea; RR: Respiratory Rate; bpm: breaths per minute; Vt: Tidal volume; Lpm: Litres per minute



# NIV troubleshooing guide

Problem  Action/solution

**HIGH UNINTENTIONAL LEAK PRESENT**

- **Median Leak > 12 L/m (0.2 L/s)** — YES → **Suspected mask leak— Check mask fitting**
- NO
- **95th Percentile > 24 L/m (0.4 L/s)** — YES → **Suspected mouth leak— Change to vented full face mask; use a chin strap or add heated humidification**

**POOR VENTILATION**

- **Low tidal volume (Vt) < 6–8 mL/kg in obstructive and < 8–10 mL/kg in restrictive**
- **High $PaCO_2$**
- **Signs of increased WOB (eg accessory muscle use or increased respiratory rate)**

YES → **Evaluate and assess nocturnal ventilation using ResScan™ with or without $SpO_2$. The following can help improve ventilation:**
- **Increase IPAP/PS**
- **Increase back-up rate**
- **Increase hours of daytime ventilation**
- **Decrease Rise Time**
- **Increase Ti or Ti Min[1]**
- **Consider assisted cough techniques to clear secretions**

**POOR OXYGENATION**

**Low $SpO_2$ with good ventilation** — YES →
- **Increase EPAP/PEEP***
- **Provide supplemental oxygen**
- **Consider assisted cough techniques to clear secretions**

**COMPLAINTS ABOUT SPEED OF AIR FLOW**

- **Air arrives too quickly** — YES → **Increase Rise Time**
- NO
- **Air arrives too slowly or RR > 25–30** — YES → **Decrease Rise Time**

**TRIGGERING ASYNCHRONIES**

- **Missed Triggers** — YES → **Presence of OSA or intrinsic PEEP** — YES → **Increase EPAP/PEEP*[2]**
- **Presence of OSA or intrinsic PEEP** — NO → **Increase Trigger Sensitivity to High or V. High**
- **Missed Triggers** — NO
- **Auto Trigger** — YES → **Decrease Trigger Sensitivity to Low or V. Low**

**CYCLING ASYNCHRONIES**

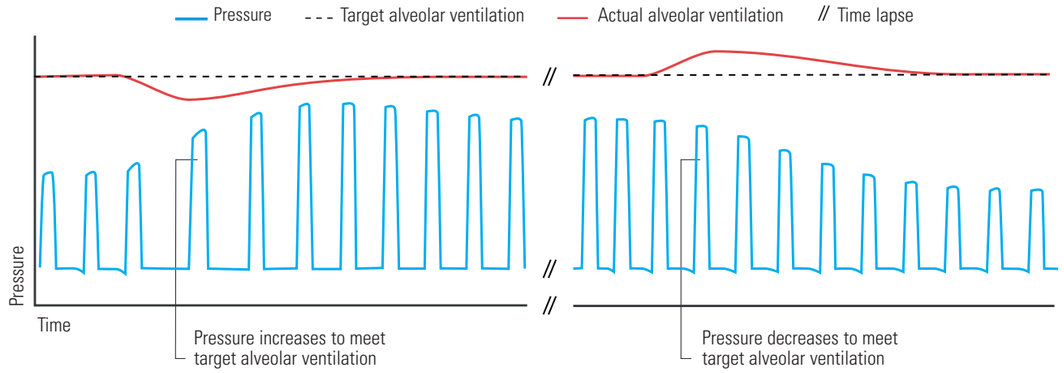
- **Inspiration is too short** — YES → **Increase Ti Min or use PAC mode[1] Check Ti Max is set as per protocol Change Cycle to Low or V. Low[1]**
- NO
- **Inspiration is too long** — YES → **Check Ti Min is set as per protocol Check Ti Max is set as per protocol Change Cycle to High or V. High[2] Minimise mask leak/adjust mask**

**USE OF SUPPLEMENTAL OXYGEN AND/OR COMPLAINTS OF DRYNESS AND/OR NASAL CONGESTION** — YES → **Add or increase heated humidification such as Climate Control**

* To maintain PS, increase IPAP when EPAP is increased.
1 These strategies apply particularly to patients with Restrictive Lung Mechanics.
2 For COPD patients who miss triggers due to PEEPi, consider moving cycle sensitivity to HIGH or V. HIGH to shorten Ti and allow more time for exhalation.

# Intelligent Volume Assured Pressure Support (iVAPS)

iVAPS is ResMed's unique volume-assurance mode designed for adults with chronic respiratory failure whose condition is likely to change during therapy. It is designed to maintain a preset target alveolar ventilation by monitoring delivered ventilation, adjusting the pressure support and providing an intelligent backup breath automatically.




## What does iVAPS do?

iVAPS automatically:

- monitors the presence and volume of air flow
- delivers the volume of air your patient needs for their next breath.

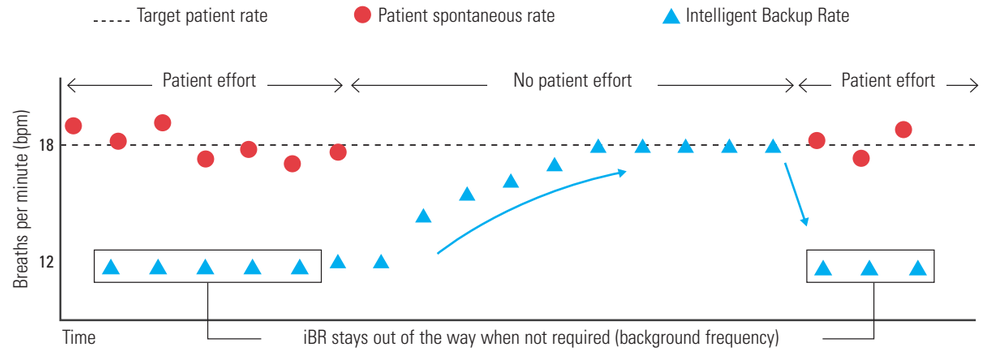
## What makes iVAPS special?

- **Targets alveolar ventilation:** iVAPS enables improved control of ventilation by taking account of tidal volumes, respiratory rates and the anatomical dead space in your patient's airways.
- **Responds to change:** reacts rapidly but gently to maintain your patient's unique alveolar ventilation target and stabilise blood gases, even when their respiratory rate changes during the night.
- **Learns and adapts:** the Learn Targets feature uses information about your patient's alveolar ventilation and respiratory rate to automatically set targets and streamline titration. Targets can also be entered manually.
- **Improves adherence:** compared to standard pressure support ventilation, iVAPS helps patients adhere to therapy for 60 minutes longer per session.



# iBR

iBR (intelligent Backup Rate) is designed to enhance the conventional approach to backup breaths. It maximises your patient's opportunities for spontaneous breathing by delivering support only when it's needed and tailoring that support to meet their real needs.




## What does iBR do?

iBR supports spontaneous breathing by:

- providing backup breaths within two boundaries: target patient rate and background frequency which is two-thirds of the target rate
- responding only when the patient needs support
- gradually adjusting the backup breath from the lower limit (background frequency) to the patient's own rate when an apnoea or lack of effort is detected.

.

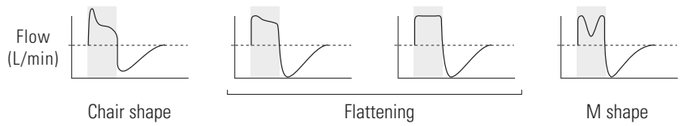
## What makes iBR special?

- **Interprets information:** iBR will provide backup breaths if there's an apnoea or lack of effort, but won't provide unnecessary support for pauses caused by a cough or a sigh.
- **Reacts swiftly:** designed to safely and quickly return your patient to their target rate, typically within 4-5 breaths. A single spontaneous breath resets the iBR and re-establishes the background frequency until backup support is next required.
- **Time-saving personalisation:** automatically determines the most suitable iBR for your patient based on their spontaneous stable awake rate, giving you peace of mind and ensuring your patient receives personalised ventilation.

# AutoEPAP

AutoEPAP automatically adjusts expiratory positive airway pressure (EPAP) to maintain an open upper airway. It aims to prevent full and partial obstructions from occurring and automatically adjusts expiratory pressure settings to address any obstructions that do occur.

The following inspiratory flow shapes are indicative of partial upper airway obstruction.




Severe to complete reduction of airflow is indicative of a complete upper airway obstruction.

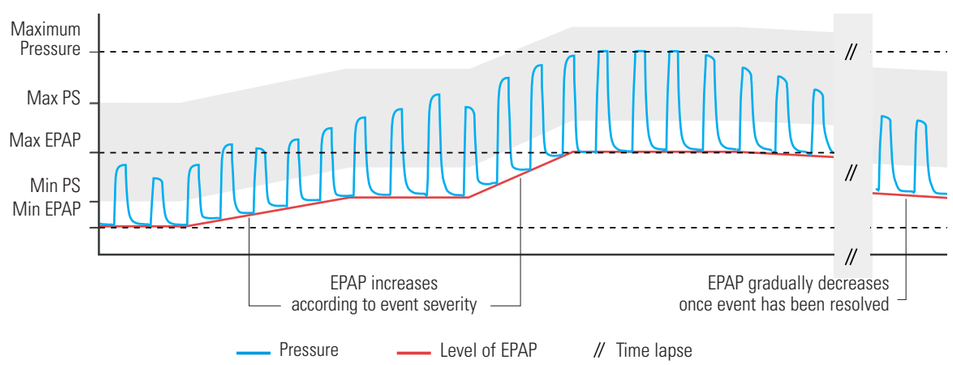

## What does AutoEPAP do?

AutoEPAP maintains an open upper airway by:

- identifying full and partial obstructions
- calculating the severity of the event
- providing the minimum level of EPAP required to meet your patient's needs,
- gradually decreasing the pressure once the obstructive event has been addressed.

## What makes AutoEPAP special?

- **Manages complexity:** finely balances the multiple parameters required to ventilate adults with chronic respiratory failure. AutoEPAP maintains upper airway patency even if target expiratory pressure fluctuates due to variations in your patient's primary condition, body position, weight or medication.
- **Swift, automatic response:** automatically adjusts expiratory pressure within Min EPAP and Max EPAP settings to address full and partial obstructions, then re-establishes the right balance between upper airway patency and breathing comfort.

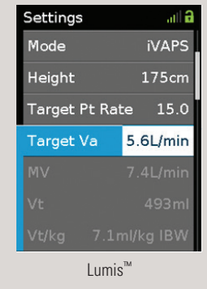





# iVAPS titration protocol for Lumis

## Manual titration using target Va Calculator

1. Set up the circuit configuration and default settings
2. Select iVAPS mode
3. Enter the patient's height



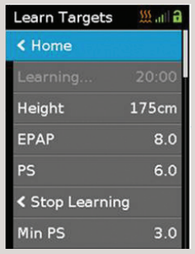

Lumis™

4. Set the target patient rate (Target Pt Rate)
5. Determine the target alveolar ventilation (Target Va) with the help of the relevant tidal volume (Vt) or minute ventilation (MV)
6. Check the calculated values
7. Start ventilation
8. Re-evaluate the settings

- Target Pt Rate should be equivalent to the patient's spontaneous respiratory rate (RR) during ventilation.
- The patient's typical values (RR, MV and Vt) can be viewed on the monitoring screens, or in ResScan™ – ResMed's data management software. These values should be adopted from the stable breathing phase: spontaneous triggering with no desaturation.

# Automated titration using Learn Targets

1. Set up the circuit configuration and default settings
2. Select iVAPS mode
3. Enter the patient's height
4. Select Learn Targets




Lumis

5. Enter preliminary PEEP/EPAP (e.g., 4–6 cm $H_2O$). If AutoEPAP is on, the EPAP setting for Learn Targets is Min EPAP
6. Adjust pressure support (PS) (e.g., 3–4 cm $H_2O$)
7. Wait until the patient's breathing appears stable (a minimum of 20 minutes)
8. Accept stable Target Va and RR. Ventilation will start automatically
9. Re-evaluate the settings

- During Learn Targets, the patient should be awake, seated and show stable breathing.
- There is no backup rate during Learn Targets.
- Pressure support should be set to a clinically relevant level depending on the patient's condition. For patients who maintain adequate daytime ventilation, i.e., patients with obesity hyperventilation syndrome (OHS), the goal is to capture the resting daytime ventilation with minimal pressure support. Patients with significant daytime hypercapnia may require greater levels of pressure support (i.e., 6–10 cm $H_2O$).



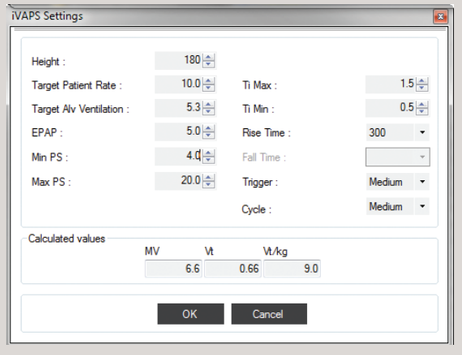
# Full titration using EasyCare Tx

## A iVAPS titration by entering the target values directly

1. Set up the circuit configuration and default settings
2. Select iVAPS mode

**Set**

3. Height (e.g., 180 cm)
   Target Pt Rate (e.g., 15 bpm)
   Target Va (e.g., 6 mL/kg IBW)
   EPAP (e.g., 5 cm $H_2O$)
   Min PS (e.g., 4 cm $H_2O$)
   Max PS (e.g., 20 cm $H_2O$)

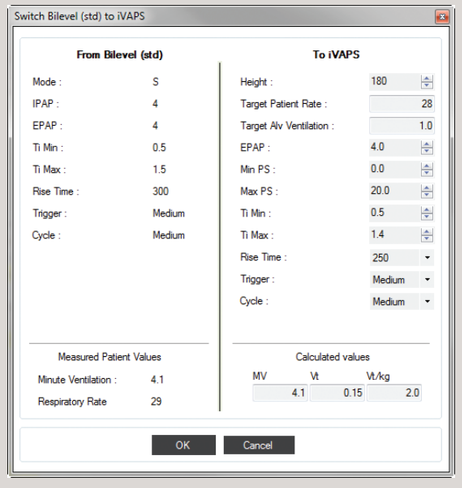



## B Titration with transition from bilevel mode to iVAPS mode

1. Titrate in bilevel mode and check if MV, Vt and RR are stable
2. Select iVAPS mode

**Set**

3. Height (e.g., 180 cm)
   Min PS (e.g., 4 cm $H_2O$)
   Max PS (e.g., 20 cm $H_2O$)




4. Start ventilation
5. Check flow, $SpO_2$ and $CO_2$. Adjust settings if necessary

- In response to obstructive apnoeas, hypopnoeas, snoring and flow limitation, increase EPAP incrementally, e.g., by ≥1 cm $H_2O$ every five minutes. Alternatively, select AutoEPAP: a setting designed to automatically maintain upper airway patency. The AutoEPAP algorithm does not address any other titration target, such as lung recruitment, to improve oxygenation or offset intrinsic PEEP. Min EPAP should be set to treat lower airway conditions.
- To address desaturation in the absence of upper airway obstruction, increase Target Va incrementally, e.g., by 0.3 L/min every five minutes.
- The Target Pt Rate should be equivalent to the patient's spontaneous respiratory rate.

# Frequently asked questions

## Who can benefit from iVAPS and AutoEPAP?

Patients (weighing 30 kg or more) with chronic respiratory failure or insufficiency, e.g., neuromuscular disease (NMD), obesity hypoventilation syndrome (OHS) and chronic obstructive pulmonary disease (COPD).

## What are the recommended default values?

| | Min PS | Max PS | EPAP | Min EPAP | Max EPAP |
|---|---|---|---|---|---|
| Obstructive | 4 cm $H_2O$ | 20 cm $H_2O$ | 5 cm $H_2O$ | 5 cm $H_2O$ | 15 cm $H_2O$ |
| Restrictive | 4 cm $H_2O$ | 20 cm $H_2O$ | 5 cm $H_2O$ | 5 cm $H_2O$ | 15 cm $H_2O$ |
| OHS | 4 cm $H_2O$ | 18 cm $H_2O$ | 8 cm $H_2O$ | 8 cm $H_2O$ | 15 cm $H_2O$ |
| Normal | 2 cm $H_2O$ | 20 cm $H_2O$ | 5 cm $H_2O$ | 5 cm $H_2O$ | 15 cm $H_2O$ |

Some clinicians may choose to increase Min PS for patients who have been established in bilevel modes.

**Example:**

| Treated in ST mode | Transition to iVAPS mode |
|---|---|
| IPAP: 20 cm $H_2O$ | Min PS: 12 cm $H_2O$ |
| EPAP: 5 cm $H_2O$ | |
| PS: 15 cm $H_2O$ | Max PS: 20 cm $H_2O$ |

## What is the typical Target Va value?

The default value for the Target Va is 5.2 L/min.

| | Target Va |
|---|---|
| COPD | <11 L/min |
| Non-COPD | <7 L/min |

## Does the Target Va need to be adjusted during follow-up?

The Target Va needs to be assessed and adjusted just like IPAP and EPAP in bilevel mode.

## How can $PaCO_2$ be reduced further?

To decrease $PaCO_2$ by 10%, increase Target Va by 10%.

$PaCO_2$: **55** mm Hg → **50** mm Hg

Target Va: **6** L/min → **6.6** L/min

## What should be considered when setting PEEP/AutoEPAP?

PEEP (or EPAP) should be set to a level according to each of your patients' needs. Examples of its use include:

- Recruiting/maintaining lung volume, aiding gas exchange, improving lung compliance or minimising lung injury.
- In obstructive lung disease – to offset intrinsic PEEP, to reduce work of breathing and/or to maximise effective triggering.
- To splint open or stabilise the upper airway during sleep. For nocturnal ventilation, a starting pressure of 5 cm $H_2O$ is recommended. An additional 1–3 cm $H_2O$ may be helpful if there is any indication of symptoms such as daytime sleepiness, obesity, an anatomically narrow airway (including NMD), or pressure support frequently reaching the maximum level.

It is important to note that AutoEPAP is designed only to maintain upper airway patency by automatically adjusting pressure in response to flow limitation or obstruction of the upper airway. To treat lower airway conditions, the Min EPAP can be set to help improve lung recruitment or offset intrinsic PEEP.

## What should be assessed at follow-up?

**Consider the following:**

- Does the patient sleep well?
- Is leak present?
- What is the level of $SpO_2$?

**Review the change of pressure via ResScan**

If the pressure support remains high:

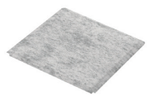
- Is Target Va too high?
- Is Max PS too high?
- Is EPAP or Min EPAP (when AutoEPAP is on) too low?

**Check in ResScan for upper airway obstruction**

- Are there episodes of desaturation?
- Does the flow graph show small flattened breaths?
- Is there high pressure support without associated respiratory flow?
- If yes, adjust EPAP or Min EPAP (when AutoEPAP is on).



# Lumis™ series accessories

| Product image | Description | Order code | MRRP |
|---|---|---|---|
|  | ClimateLine™ Heated Tube | 37296 | $99.00 |
|  | Standard Tubing | 14994 | $18.00 |
|  | HumidAir™ Humidifier Tub (re-usable) | 37300 | $129.95 |
|  | Air Outlet | 37310 | $9.95 |
|  | 90W PSU | 37347 | $49.95 |
|  | USB Module | 37301 | $69.95 |
|  | SD Card (1 pk)<br>SD Card (12 pk) | 37334<br>37332 | $19.95<br>$179.95 |
|  | Standard Filter (2 pk)<br>Standard Filter (12 pk)<br>Hypoallergenic (2 pk)<br>Hypoallergenic (12 pk) | 36852<br>36852<br>36856<br>36857 | $5.90<br>$29.90<br>$7.50<br>$34.90 |
|  | Oximeter Module | 37302 | $120.00 |
|  | XPOD LP Oximeter | 22374 | $750.00 |
|  | XPOD LP Oximeter Clip | 22371 | $6.00 |

# Lumis™ series accessories

| Product image | Description | Order code | MRRP |
|---|---|---|---|
|  | NONIN Oximeter Reusable Soft Sensor (8000SS) - Small (1m) | 70567 | $300.00 |
|  | NONIN Oximeter Reusable Soft Sensor (8000SM) - Medium (1m) | 70568 | $300.00 |
|  | NONIN Oximeter Reusable Soft Sensor (8000SL) - Large (1m) | 70413 | $300.00 |
|  | NONIN Oximeter Reusable Finger Clip Sensor - 8000AA (1m) | 631803 | $300.00 |
|  | Homecare Stand without Interface Top Plate | 27963 | $700.00 |
| IMAGE NOT AVAILABLE | Air10/Lumis Series Top Plate | 27964 | $100.00 |
|  | Homecare Stand IV Pole Kit | 27948 | $80.00 |
|  | RPS II External Battery Pack (includes Battery, Power Supply Unit adapter and Carry Bag)Note: S9 Power Supply Unit 90W & DC Cable is not included and must be ordered separtely. | 24921 | $549.00 |
|  | ResMed Power Station II (Battery only) | 24926 | $520.00 |
|  | RPS II - DC Cable Lumis Note: RPS II Lumis PSU Adapter is also required | 37343 | $43.00 |
|  | RPS II - Lumis PSU Adapter Note: RPS II Lumis DC Cable is also required | 37342 | $41.00 |



# Lumis oximetry set-up procedure


**Items required:**

**37302** – Lumis/Air10 Oximetry Module/ Adapter

**22374** – NONIN XPOD 3012 LP Oximeter

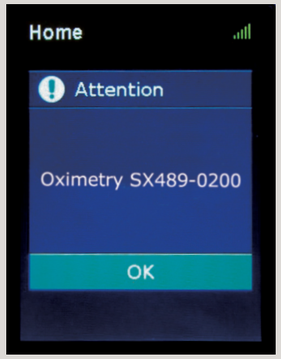
**22371** – XPOD LP Oximeter Clip (optional)

**70568** – NONIN 8000SM Soft Sensor – Reusable (Medium)

Or alternatively, the below kit is available.

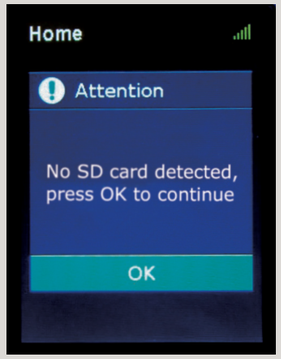
**22370** - Oximetry Set with Reusable Sensor - includes 1 x XPOD LP Oximeter, 1 x XPOD LP Oximeter Clip, 1 x NONIN Oximeter Reusable Soft Sensor (8000SM)

## Connecting the Lumis Oximetry Module



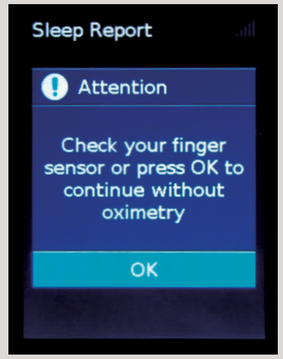

### Step 1

Prepare the Lumis with the Oximeter module attached and with the XPOD and finger sensor onnected. Attach the finger sensor to the patient. Connect power to the Lumis. There should be a brief message displayed on the Lumis LCD as shown above – Oximetry SX489-0200.




### Step 2

Make sure the Lumis machine has the SD card installed or you will see this message. If the card has been removed then power down the Lumis, insert the SD card and then reapply the power.




### Step 3

If there is a problem with the finger sensor then you will see this message.

# Lumis™ RPS II set-up procedure


RPS II Battery Pack

RPS II Lumis/ Air 10 PSU Adapter

RPS II Lumis/ Air 10 DC Cable

**Items required:**

**24921** – RPS II Battery Pack (includes battery, PSU adapter, and carry bag)

OR

**24926** – RPS II Battery only

AND

**37343** – RPS II Lumis/Air10 DC Cable

**37342** – RPS II Lumis/Air10 PSU Adapter



# Lumis reprocessing guidelines

This guide is intended for multipatient use of the Lumis™ devices.

When the device is used for multiple patients, for example, in a sleep lab, clinic, hospital or at a health care provider, the cleanable humidifier, air outlet and air tubing should be reprocessed between each patient use.

If the cleanable humidifier or the air tubing are being used for a single user in the home, refer to the cleaning instructions in the User Guide.

Described here are ResMed's recommended and validated procedures for cleaning and disinfecting the cleanable humidifier, air outlet and air tubing. However, the steps for disinfection vary regionally and each healthcare facility should consult its own procedures before carrying out those within this guide.

**WARNING**

- **ResMed cannot give any assurance that deviations from the procedures listed in this guide, and their effect on the performance of the product, will be acceptable.**
- **When using detergents, disinfectants or sterilisation agents, always follow the manufacturer's instructions.**
- **Beware of electrocution. Do not immerse the device, power supply or power cord in water. If liquids are spilled into or onto the device, unplug the device and let the parts dry. Always unplug the device before cleaning and make sure that all parts are dry before plugging it back in.**

## Surface disinfection

1. Wipe the exterior of the device including display, externally accessible ports, side cover, power supply unit and accessories with a disposable cloth and mild detergent or alcohol disinfectant (see list below).
2. Remove any excess disinfectant with a disposable dry cloth.

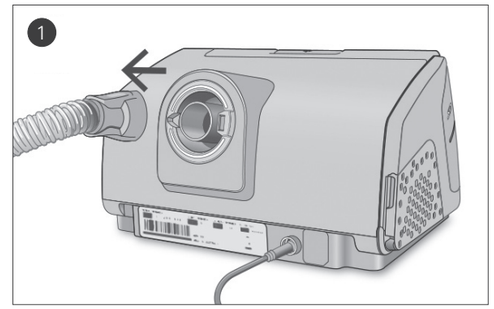
Agents recommended for surface disinfection and cleaning:

- Warm water and mild detergent eg, Teepol™ multipurpose detergent
- Window cleaner or other premixed surface detergent
- Methyl alcohol solution
- 70% Ethyl alcohol solution
- 70-90% Isopropanol solution
- 10% Bleach solution
- Isopropyl wipes
- CaviCide™
- Mikrozid®
- Actichlor™ Plus
- Terralin®.

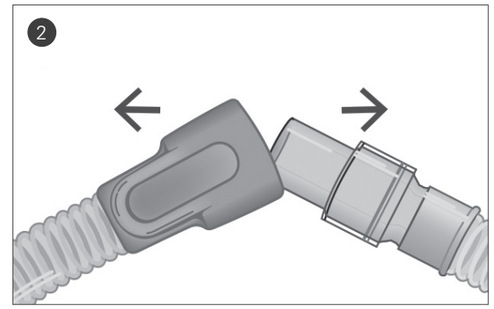
Note: Agents may not be available in all regions.

# Reprocessing the air tubing

## Disconnecting




Hold the cuff of the air tubing and gently pull it away from the device




Hold both the cuff of the air tubing and the swivel of the mask, then gently pull apart.

## Decontaminating

Before the disinfection process, each component must be cleaned and rinsed so no visible contamination is present.

1. Clean all components with a soft bristled brush for one minute while soaking in detergent solution (see table below). Pay particular attention to all crevices and cavities.
2. Run the detergent solution through the air tubing repeatedly until no contamination is visible.
3. Thoroughly rinse each component according to the detergent manufacturer's instructions

ResMed has tested the following detergents according to the manufacturer's instructions:

| Detergent | Water temperature | SlimLine/ Standard | ClimateLine Air | ClimateLine Air Oxy |
|---|---|---|---|---|
| Alconox™ (diluted at 1%) | Hot water (approx 60°C) Warm water (approx 45 to 60°C) Room temperature water (approx 21°C) | • | • | • |
| Neodisher MediZym™ (diluted at 2.0%) | Warm water (approx 45 to 60°C) | • | | |
| Gigazyme® (diluted at 1.0%) | Room temperature water (approx 21°C) | | • | |

## Disinfecting

In the procedures below, only one disinfection process needs to be performed.

**High level thermal**

| Part | Validated number of cycles Hot water: 75°C for 30 minutes OR 70°C for 100 minutes. |
|---|---|
| SlimLine | 20 |
| ClimateLineAir | 26 |
| ClimateLineAir Oxy | 20 |
| Standard | 100 |

1. Soak the air tubing in a commercially available solution of a chemical sterilant. Take care that no air bubbles are trapped inside the air tubing.
2. Thoroughly rinse the air tubing in drinking quality water (five litres per assembly) by immersing it completely for a minimum of one minute in duration.
3. Repeat the rinse procedure two additional times using fresh water for a total of three rinses.

**High level chemical**

| Part | Validated number of cycles CIDEX® OPA Ortho-phthalaldehyde 0.55% for 12 mins | Sterrad NX Sterrad 100S | Gigasept FF® 5% for 15 mins |
|---|---|---|---|
| SlimLine | 100 | - | - |
| ClimateLineAir | 26 | 26 | 26 |
| ClimateLineAir Oxy | 20 | 20 | - |
| Standard | 100 | - | - |

1. Soak the air tubing in a commercially available solution of a chemical sterilant. Take care that no air bubbles are trapped inside the air tubing.
2. Thoroughly rinse the air tubing in drinking quality water (five litres per assembly) by immersing it completely for a minimum of one minute in duration.
3. Repeat the rinse procedure two additional times using fresh water for a total of three rinses.
4. Air dry out of direct sunlight and/or heat.

## Inspecting

Perform a visual inspection of the air tubing. If any visible deterioration is apparent (holes, tears or cracks etc), the air tubing should be discarded and replaced. Slight discoloration may occur and is acceptable.

## Reconnecting the air tubing

When the air tubing is dry, you can reconnect it to the device.

1. Connect the air tubing firmly to the air outlet located on the rear of the device.
2. Connect the free end of the air tubing firmly onto the assembled mask.

## Packaging and storage

Store in a dry, dust-free environment away from direct sunlight.

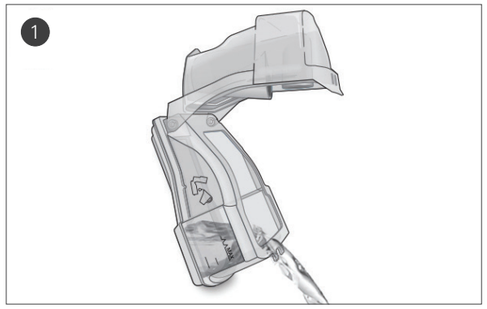
Storage temperature: -20°C to 60°C.



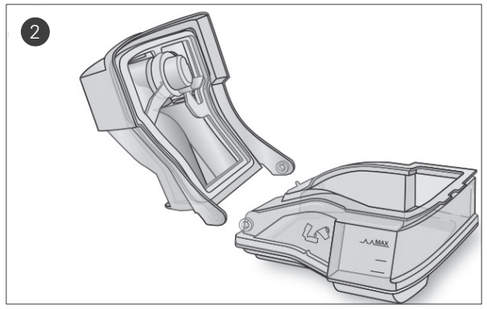
# Reprocessing the humidifier and air outlet

## Disassembling

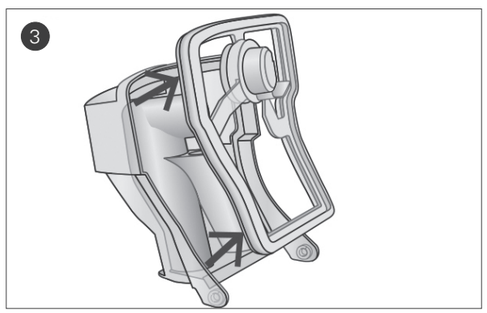
The following instructions provide guidance on how to correctly disassemble the cleanable humidifier and the air outlet.



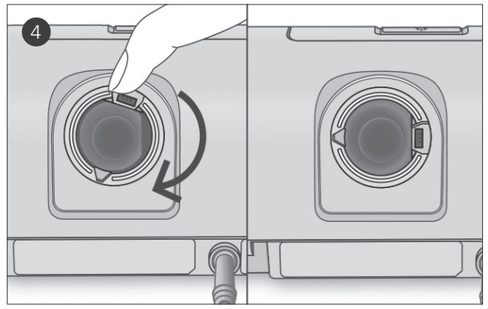

Remove the humidifier from the device, open it and discard any remaining water.



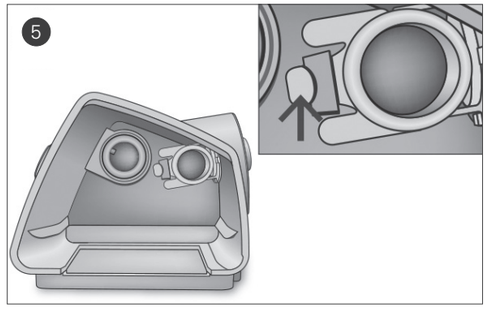

Hold the humidifier base and then fully open the humidifier lid and pull it away so that it easily detaches from the base.



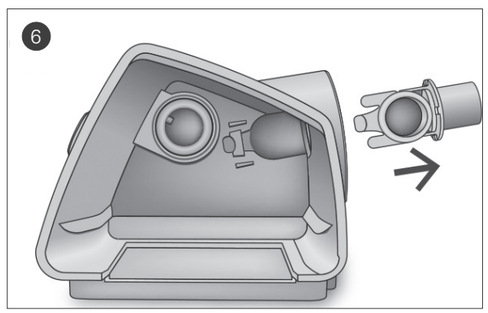

Remove the humidifier seal from the humidifier lid by pulling it away.




Locate the air outlet on the inside of the device.




Release the air outlet by pressing the clip located inside the device.




Remove the air outlet by pulling it out through the air outlet socket at the rear of the device.

## Decontaminating

Before the disinfection process, each component must be cleaned and rinsed so no visible contamination is present.

1. Clean all components with a soft bristled brush for one minute while soaking in detergent solution (see table below). Pay particular attention to all crevices and cavities.
2. Thoroughly rinse each component according to the detergent manufacturer's instructions.

ResMed has tested the following detergents according to the manufacturer's instructions:

| Detergent | Water temperature | Cleanable humidifier | Air outlet |
|---|---|---|---|
| Alconox (diluted at 1%) | Hot water (approx 60°C)<br>Warm water (approx 45 to 60°C)<br>Room temperature water (approx 21°C) | • | • |
| Gigazyme (diluted at 1.0%) | Room temperature water (approx 21°C) | • | • |

## Disinfecting

In the procedures below, only one disinfection process needs to be performed.

**High level thermal**

| Part | Validated number of cycles<br>Hot water: 90°C for 1 minute OR 75°C for 30 minutes OR 70°C for 100 minutes.<br>Due to specific regional requirements, ResMed cleanable humidifiers have been tested for disinfection (100 cycles) at 93°C for 10 minutes |
|---|---|
| Cleanable humidifier | 130 |
| Air outlet | 130 |

1. Soak the disassembled components in a hot water bath at pasteurising temperature. Take care that no air bubbles are trapped against the components.
2. Air dry out of direct sunlight and/or heat.

**High level chemical**

| Part | Validated number of cycles<br>CIDEX OPA Ortho-phthalaldehyde 0.55% for 12 minutes<br>Gigasept FF 5% for 15 minutes<br>Sterrad NX<br>Sterrad 100S |
|---|---|
| Cleanable humidifier | 130 |
| Air outlet | 130 |

1. Soak the disassembled components in a commercially available solution of a chemical sterilant. Take care that no air bubbles are trapped against the components.
2. Thoroughly rinse the cleanable humidifier in drinking quality water (five litres per assembly) by immersing it completely for a minimum of one minute in duration.
3. Repeat the rinse procedure two additional times using fresh water for a total of three rinses.
4. Air dry out of direct sunlight and/or heat.

## Inspecting

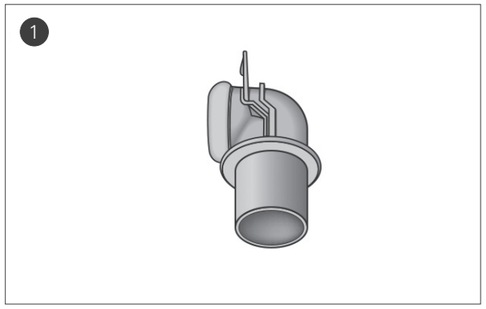
Perform a visual inspection of all components. If any visible deterioration is apparent (cracking, crazing, tears, etc), the humidifier should be discarded and replaced. Slight discoloration of the silicone components may occur and is acceptable.



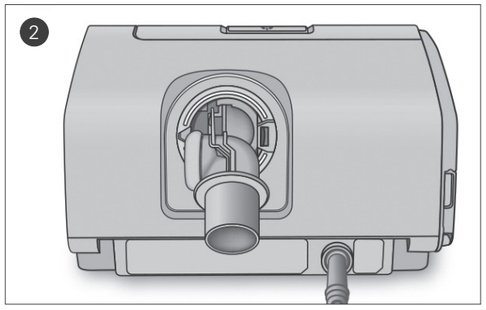
## Reassembling

The following instructions provide guidance on how to correctly reassemble the air outlet and the humidifier.

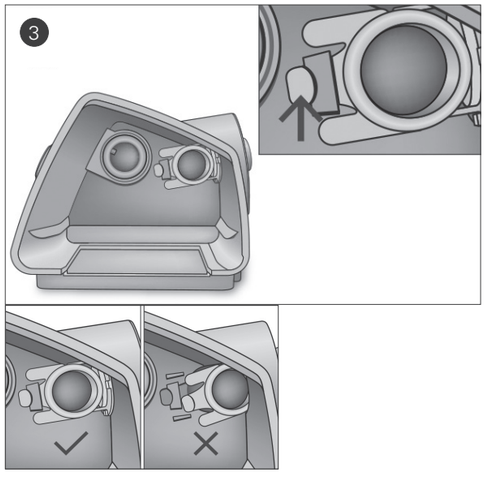
**To reassemble the air outlet**




Hold the air outlet with the seal pointing to the left and the clip pointing forward.




Make sure that the air outlet is correctly aligned and insert the air outlet into the socket. It will click in place.

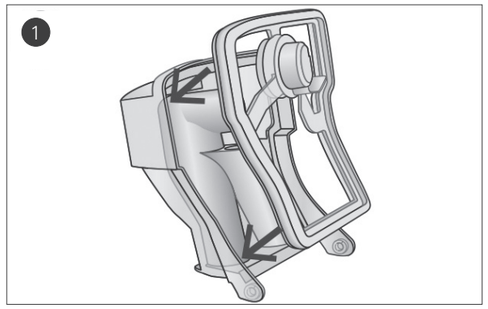



Check if the air outlet is inserted correctly as shown.

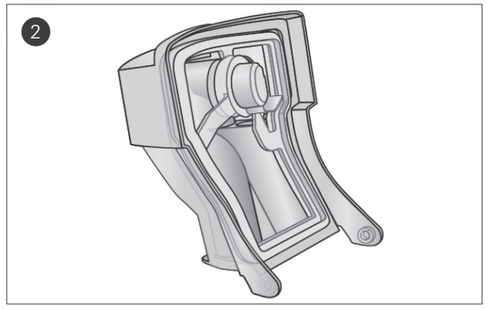
## Packaging and storage

Store in a dry, dust-free environment away from direct sunlight. Storage temperature: -20°C to 60°C.

**To insert the humidifier seal:**

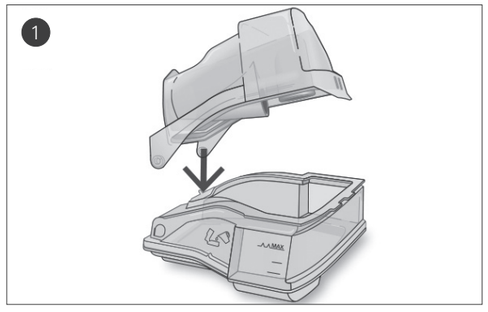



Place the seal into the lid.

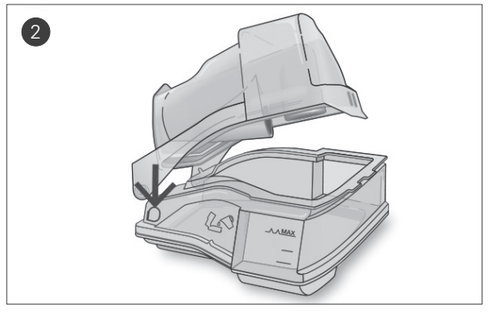



Press down along all edges of the seal until it is firmly in place.

**To reassemble the humidifier lid:**




Insert one side of the lid into the pivot hole of the base.




Slide the other side down the ridge until it clicks into place.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