ResMed

VPAP™ ST-A with iVAPS

NONINVASIVE VENTILATOR

H5i™

HEATED HUMIDIFIER

Clinical Guide

English

Respiratory Care Solutions

Making quality of care easy

Respiratory Care Solutions

Making quality of care easy

Contents

Welcome

Thank you for choosing the VPAP ST-A with iVAPS (hereafter 'VPAP ST-A') or H5i.
Before operating these devices, please read the entire Clinical and Information Guides.

VPAP ST-A indications for use

The VPAP ST-A is indicated to provide noninvasive ventilation for patients weighing more than 13 kg or more than 30 kg in iVAPS mode with respiratory insufficiency or obstructive sleep apnoea (OSA). The VPAP ST-A is intended for home and hospital use.

VPAP ST-A contraindications

Positive airway pressure therapy may be contraindicated in some patients with the following pre-existing conditions:

- severe bullous lung disease
- pneumothorax or pneumomediastinum
- pathologically low blood pressure, particularly if associated with intravascular volume depletion
- dehydration
- cerebrospinal fluid leak, recent cranial surgery, or trauma.

VPAP ST-A adverse effects

Patients should report unusual chest pain, severe headache, or increased breathlessness to their prescribing physician. An acute upper respiratory tract infection may require temporary discontinuation of treatment.

The following side effects may arise during the course of therapy with these devices:

- drying of the nose, mouth, or throat
- nosebleed
- bloating
- ear or sinus discomfort
- eye irritation
- skin rashes.

H5i indications for use

The H5i is indicated for the humidification of the air delivered from a CPAP or bilevel device. The H5i is for use only as recommended by a physician. The H5i is intended for single patient re-use in the home environment and re-use in a hospital/institutional environment.

H5i contraindications

The H5i is contraindicated for use with patients whose upper (supraglottic) airway has been bypassed.

VPAP ST-A at a glance

The VPAP ST-A system comprises the following elements:

- VPAP ST-A device
- Air tubing
- 90W power supply unit
- S9 travel bag
- SD card
- S9 SD card protective folder.

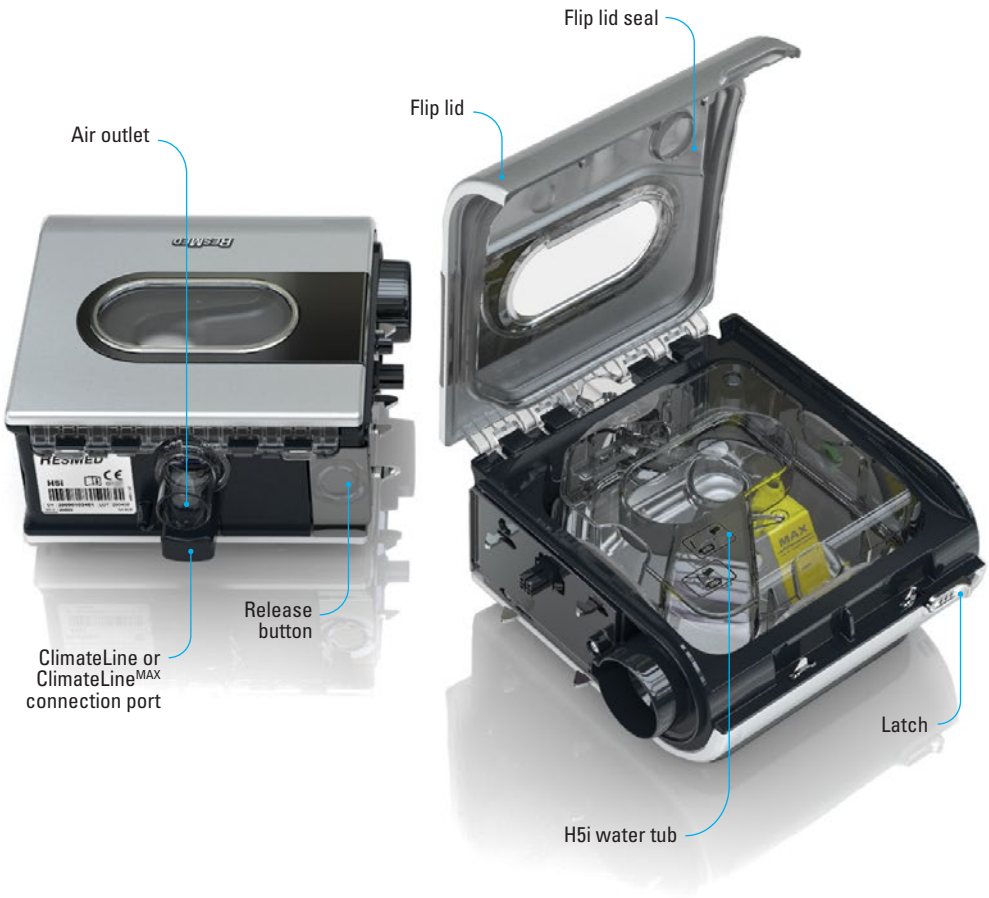
Optional components include:

- H5i heated humidifier
- Standard air tubing
- SlimLine™ air tubing
- 3 m air tubing
- ClimateLine™ heated air tubing
- ClimateLine^{MAX} ™ heated air tubing
- 30W power supply unit (does not support H5i)
- Power Station II battery pack
- DC/DC Converter 24V/90W
- S9 Oximeter Adapter.

Travelling with the VPAP ST-A

When the patient travels with the VPAP ST-A only:

- Advise the patient to pack the SlimLine or Standard air tubing as the ClimateLine or ClimateLine^{MAX} heated air tubing is not designed to connect directly to the device.
- Advise the patient to purchase and travel with the approved power cord for the region where they will be using the device.
- ResMed confirms that the VPAP ST-A meets the Federal Aviation Administration (FAA) requirements (RTCA/DO-160, section 21, category M) for all phases of air travel.



H5i at a glance

The H5i system comprises the following elements:

- H5i heated humidifier
- H5i cleanable water tub
- ClimateLine heated air tubing (if sold as a Climate Control Kit).

Optional components include:

- H5i standard water tub
- ClimateLine^MAX heated air tubing

Travelling with the H5i

When moving or travelling with the H5i:

- Ensure that the water tub is empty.
- Disconnect the H5i from the VPAP ST-A by pressing the release button.

Operating information

The device uses internal pressure and flow sensors in the air path to respond reliably to patient flow rates even in the presence of most normal leaks in the patient circuit.

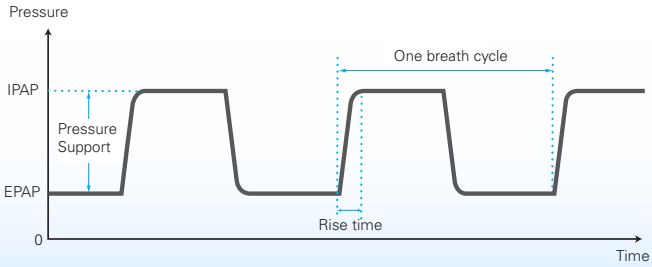
Bilevel pressures

The device assists spontaneous breathing by cycling between two pressures in response to the patient flow or a preset fixed time.

The inspiratory positive airway pressure (IPAP, or the sum of EPAP and the pressure support level) assists inspiration.

The lower expiratory positive airway pressure (EPAP) eliminates exhaled air through the mask exhaust vent. This facilitates exhalation comfort while providing a splint to maintain an open upper airway.

The difference of the two pressures—pressure support (PS) level—contributes to improved patient ventilation.

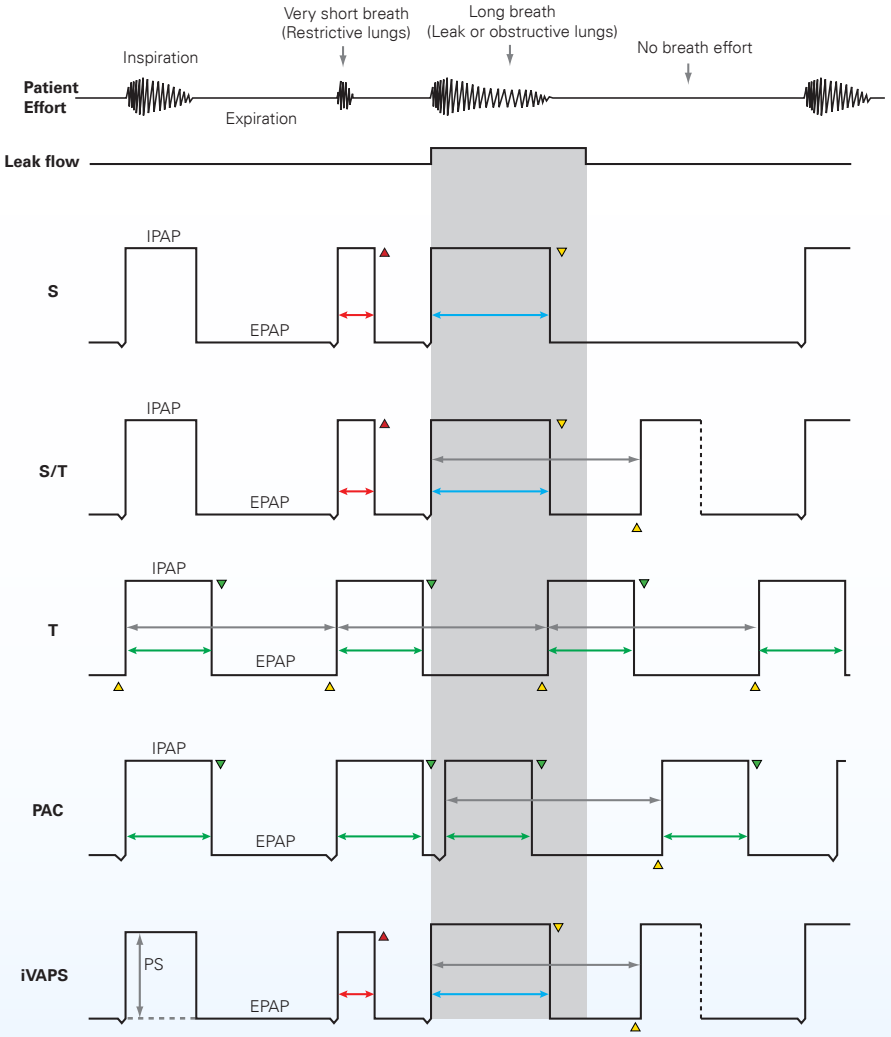


Modes of operation

The following table describes the operating modes available on the VPAP ST-A.

Modes
CPAP A fixed pressure is delivered.
S (Spontaneous) You may set two treatment pressures—one for inspiration (IPAP) and one for expiration (EPAP). The device senses when the patient is inhaling and exhaling and supplies the appropriate pressures accordingly. The difference between IPAP and EPAP levels helps determine the tidal volume.
ST (Spontaneous/Timed) The device augments any breath initiated by the patient, but will also supply additional breaths should the patient breath rate fall below the clinician's set "backup" breath rate.
T (Timed) The fixed breath rate and the fixed inspiration/expiration time set by the clinician is supplied regardless of patient effort.
PAC (Pressure Assist Control) The inspiration time is preset in the PAC mode. There is no spontaneous/flow cycling. The inspiration can be triggered by the patient when respiratory rate is above a preset value, or time triggered breath will be delivered at the backup breath rate.
iVAPS (intelligent Volume Assured Pressure Support) iVAPS is designed to maintain a preset target alveolar minute ventilation by monitoring delivered ventilation, adjusting the pressure support and providing an intelligent backup breath automatically. The iVAPS therapy mode is indicated for patients weighing 66 lbs (30 kg) and above.

The following diagram illustrates these operating modes (excluding CPAP mode where a single level of continuous pressure is delivered).



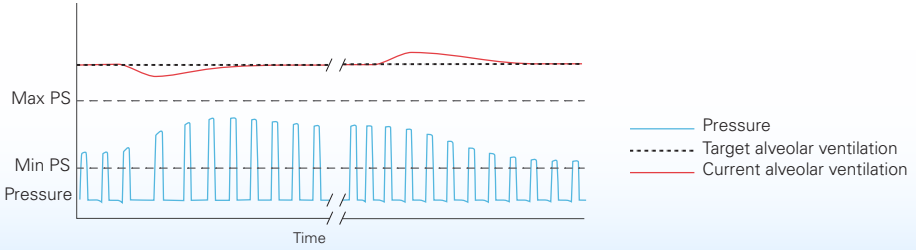
The common adjustable settings for different modes in the VPAP ST-A are shown below.

Settings	S	ST	T	PAC	iVAPS	CPAP
Set pressure						✓
IPAP	✓	✓	✓	✓		
EPAP	✓	✓	✓	✓	✓	
Respiratory rate		✓	✓	✓		
Ti			✓	✓		
Target Va					✓	
Target Patient Rate					✓	
Ti Max	✓	✓			✓	
Ti Min	✓	✓			✓	
Rise time	✓	✓	✓	✓	✓	
Trigger sensitivity	✓	✓		✓	✓	
Cycle sensitivity	✓	✓			✓	
Min PS					✓	
Max PS					✓	
Height					✓	

More about iVAPS

You may prefer some assurance that the patient's ventilatory needs will be defended if their condition varies. A variety of 'dual mode' schemes exist, that aim to combine the benefits of pressure target and volume target, most of which can be categorised generically as volume-assured pressure support, or VAPS modes.

With VAPS devices in general, the ventilatory assistance (pressure support) aims to automatically adjust to changes in patient condition over time, typically to maintain a target tidal volume.



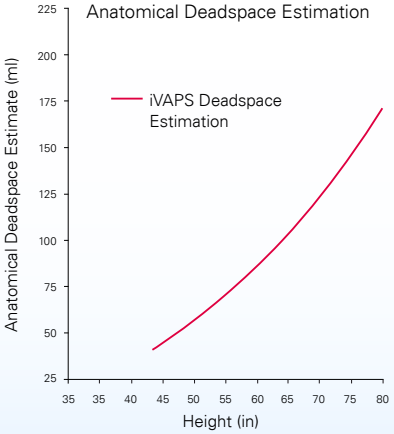
iVAPS offers the comfort and synchrony of pressure support, but with the assurance offered by a volume target. iVAPS has the following advantages over traditional VAPS schemes:

- iVAPS is a unique combination for a servo-controlled ventilator, in that iVAPS has the goal of regulating alveolar ventilation to a prescribed target, and iVAPS has a swift but gentle servocontrol response. iVAPS is tuned to be fast enough to avoid blood-gas derangement associated with most breathing challenges, including during sleep, but is gentle enough to avoid disruption.
- iVAPS has an intelligent Backup Rate (iBR) which aims to keep 'out of the way' while the patient is breathing, yet during sustained apnoea will mimic the patient's own breath rate. This contributes to iVAPS' ability to maintain its ventilation target and so stabilise blood gases even during sleep.
- iVAPS has ResMed's robust leak compensation scheme (Vsync). This promotes synchrony and comfort even during significant leak.

Target alveolar ventilation

iVAPS targets alveolar ventilation. Alveolar ventilation was chosen because it is at the level of the alveoli that gas exchange occurs. Total ventilation includes the ventilation devoted to the conducting airways, whereas alveolar ventilation best represents the useful portion of ventilation that reaches the alveoli.

Alveolar ventilation cannot be measured directly, so iVAPS estimates it using a height approximated value of anatomical deadspace as shown in the graph below. Anatomic deadspace is the amount of breath that remains in the conducting airways, which does not reach alveoli and does not contribute to gas exchange. Its contribution is proportional to breath rate. By using alveolar ventilation as a servoventilation target, as opposed to tidal volume or minute ventilation, the effect of respiratory rate change on effective ventilation is negated.

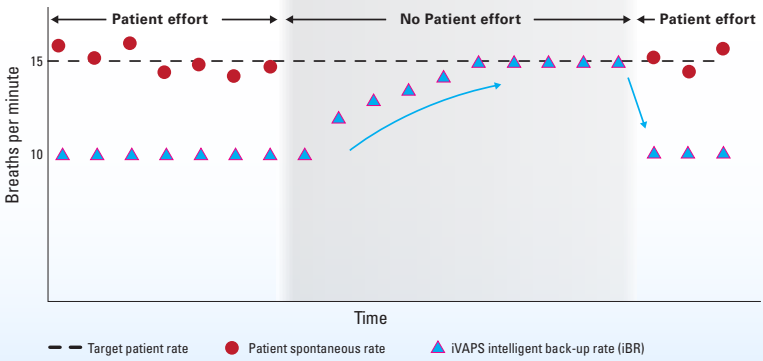


Adapted from Hart MC et al. Journal Applied Physiology.18(3), p519-522. 1963

Target Patient Rate

iVAPS has a novel approach to providing a backup rate. Instead of mandating a fixed backup rate, iVAPS' intelligent Backup Rate (iBR) will shift automatically between two limits, according to the context. The benefit of this approach is improved synchrony, while maximising iVAPS' ability to maintain the target ventilation, at *minimal pressure support*.

- During sustained apnoea, the iBR will adopt a pre-configured Target Patient Rate. This Target Patient Rate defines the upper boundary for iBR. You set the Target Patient Rate to match the patient's average spontaneous rate (unlike a traditional backup rate).
- During spontaneous ventilation, the iBR adjusts to remain well in the background, at two-thirds of the Target Patient Rate. This 'background' backup rate is lower than a traditional S/T rate, so gives the patient maximum opportunity to spontaneously trigger.
- When spontaneous triggering ceases (eg, at the onset of an apnoea/hypopnoea), the iBR adjusts from its background frequency to its Target Patient Rate. It will adjust quickest (within 4–5 breaths) when ventilation is below the target ventilation.
- A single spontaneous triggered breath resets the iBR to its background rate (two-thirds of Target Patient Rate).



Min/Max PS

The default settings for maximum and minimum pressure support are normally adequate, but you may wish to alter them in some patients.

Min PS and Max PS define the range of pressure support adjustment available to the iVAPS algorithm as it regulates alveolar ventilation.

It is recommended that Max PS be set high enough to allow the alveolar ventilation target to be met, while exercising clinical judgement over considerations such as patient comfort and tolerance, lung mechanics, age, mask seal, etc.

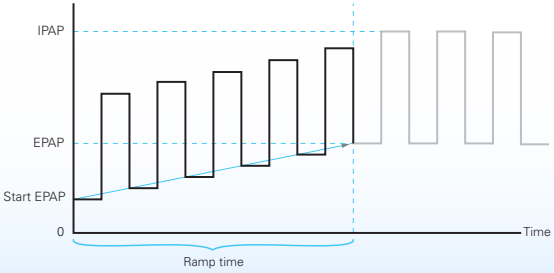
It is recommended that Min PS is left at the level set when learning the patient's ventilation target (default 4 cm H_2O) unless the patient finds this too little for comfort.

Ramp

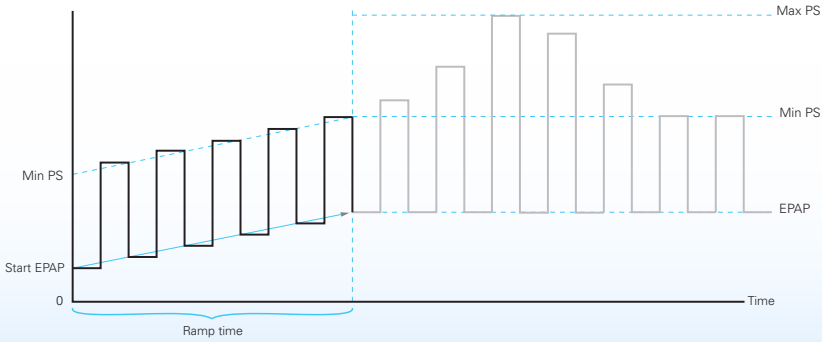
Ramp is designed to make the beginning of treatment more comfortable.

In CPAP mode during ramp time, the pressure increases from a low pressure to the prescribed treatment pressure.

In S, ST and T modes, ramp time defines the period during which the EPAP gradually increases from the Start EPAP to the prescribed treatment pressure. Pressure support remains at set PS during ramp.



In iVAPS mode, ramp time defines the period during which the EPAP gradually increases from the Start EPAP to the Min EPAP. Pressure support remains at Min PS during ramp.



Alarms

The VPAP ST-A is fitted with an alarm module that continuosly monitors both therapy and device conditions.

When an alarm condition occurs:

- an alarm message appears on the LCD screen
- the yellow alarm LED indicator flashes
- an audible alarm sounds.

For further information, see Working with alarms.

Noninvasive ventilation and leak management

Two critical factors for the success of non-invasive ventilation therapy are:

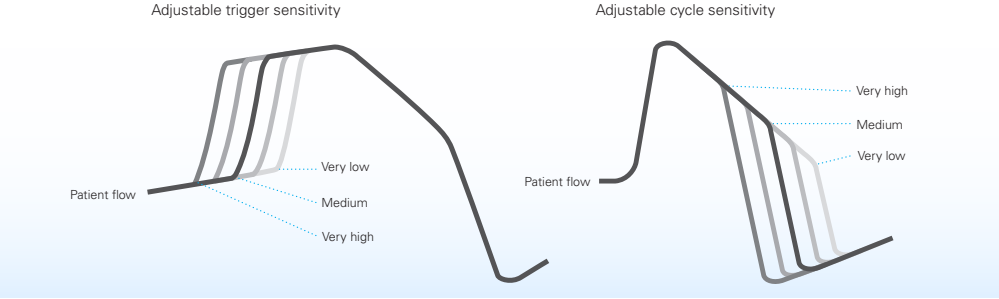
- ventilator triggering—sensing inspiratory effort and determining the end of inspiration
- time taken to reach and maintain the set pressure, espcially in the presence of leak.

The device has a unique leak management algorithm, Vsync, that monitors and compensates for leak by continuously and automatically adjusting the baseline flow. This enables reliable triggering and cycling while maintaining the set pressures.

Triggering and cycling

Under normal conditions, the device triggers (initiates IPAP) and cycles (terminates IPAP and changes to EPAP) as it senses the change in patient flow.

In addition, the device has adjustable trigger/cycle sensitivity to optimise the sensing level according to patient conditions.



Rise time adjustment

Rise Time sets the time taken for the device to reach the set inspiratory pressure after triggering. The greater the Rise Time value, the longer it takes for pressure to increase from EPAP to IPAP.

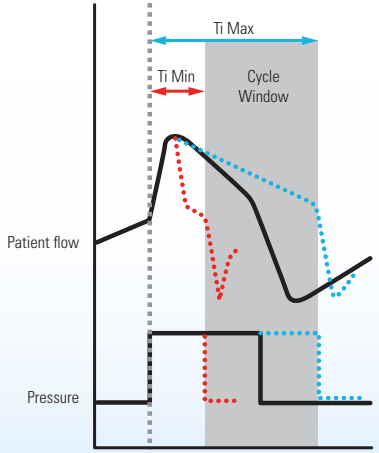
Patients with a high ventilatory demand may prefer a shorter Rise Time, while patients who are slow breathers may prefer a longer Rise Time.

TiControl™ – Inspiratory Time Control

Unique to ResMed bilevel devices, TiControl allows the clinician to set minimum and maximum limits on the time the device spends in IPAP. The minimum and maximum time limits are set at either side of the patient's ideal spontaneous inspiratory time, providing a 'window of opportunity' for the patient to spontaneously cycle to EPAP.

The minimum time limit is set via the Ti Min parameter and the maximum time limit is set via the Ti Max parameter.

TiControl's Ti Max and Ti Min parameters play a significant role in maximising synchronisation by effectively intervening to limit or prolong the inspiratory time when required. This ensures synchronisation even in the presence of significant mouth and/or mask leak.



The following table is a guide to selecting the Ti Max and Ti Min values that best correspond to the patient's respiratory rate and inspiration and expiration ratio, depending on the respiratory conditions.

Notes:

- *I:E = 1:1 – Ti Min prevents the premature cycling to EPAP for patients whose inspiratory effort is extremely weak.*
- *I:E = 1:3 – Ti Max limits the inspiration time for patients who require a longer* expiration time.

Patient breath (BPM)	Ttot = 60/BPM (sec)	I:E = 1:2 (Reference)	Sufficient inhalation time I:E = 1:1		Secure exhalation time I:E = 1:3
			Ti Min	Ti Max	Ti Max
10	6	2	1.0	2.0	1.5
15	4	1.3	1.0	2.0	1.3
20	3	1.0	0.8	1.5	1.0
25	2.4	0.8	0.7	1.2	0.8
30	2	0.7	0.6	1.0	0.7
35	1.7	0.6	0.5	0.8	0.7
40	1.5	0.5	0.5	0.7	0.7

Climate Control

The VPAP ST-A when used in conjunction with the H5i and ClimateLine or ClimateLine^{MAX} heated air tubing, offers a feature called Climate Control.

Climate Control enables the automatic delivery of a constant value of absolute humidity to the patient's upper airway while protecting against rainout and allowing patients to select the air temperature that offers the most comfort for them.

Rainout protection

Rainout refers to the water or condensation that collects in the patient's tubing or mask. Rainout is a common side effect of using a humidifier due to the humidified air cooling as it travels down the tubing and into the mask. Rainout occurs when relative humidity, which is a measure of the air's capacity to hold water vapour, exceeds 100%.

Climate Control protects the patient from rainout by maintaining a target relative humidity of 80% as well as maintaining the temperature of the air delivered to the patient without compromising the amount of absolute humidity delivered.

Automatic constant humidity delivery

For each temperature setting, the Climate Control system delivers a constant amount of water vapour, or absolute humidity, to the patient's upper airway. The following table shows the target absolute humidity value that will be delivered to the mask for a selection of temperature settings.

Temperature delivered to the mask	Target absolute humidity at the mask, Body Temperature Pressure Saturated (BTPS)
16°C	10 mg/L
20°C	12 mg/L
24°C	16 mg/L
27°C	19 mg/L
30°C	22 mg/L

Automatic constant temperature delivery

The temperature sensor located at the mask end of the ClimateLine or ClimateLine^{MAX} heated air tube enables the system to automatically control the temperature of the air delivered to the patient. This ensures the temperature of the air delivered to the patient does not fall below the set minimum temperature, therefore maximising breathing comfort for the patient.

Automatic adjustment

The H5i and ClimateLine or ClimateLine^{MAX} heated tubing are controlled by the Climate Control algorithm to deliver constant humidity and temperature outputs. The system adjusts automatically to changes in:

- ambient room temperature and humidity values
- flow due to pressure changes
- flow due to mask or mouth leak.

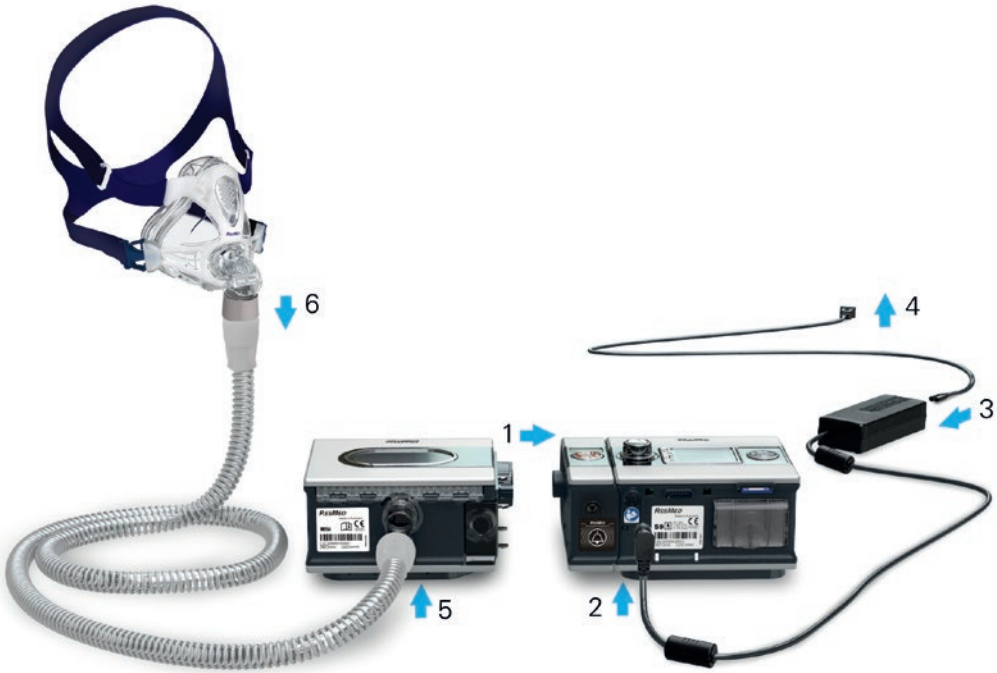
S9 Essentials

S9 Essentials is designed to make device interaction and menu navigation easier for patients. If enabled, S9 Essentials disables the Info and Setup functionality so that patients can simply start and stop therapy and adjust ramp, humidification and Climate Control. S9 Essentials can be enabled via Clinical Setup > Options > Access.

Sleep Quality

Designed to promote compliance, the Sleep Quality indicator allows the patient to actively engage in their own therapy by identifying leak, usage and AHI information. This information can be set to:

- Usage—where only usage hours are displayed
- On—where usage, mask fit and AHI information are displayed.



Setting up

1. Align the H5i with the VPAP ST-A and push them together until they click into place.
2. Connect the DC plug of the power supply unit to the rear of the device.
3. Connect the power cord to the power supply unit.
4. Plug the other end of the power cord into the power outlet.
5. Connect one end of the air tubing firmly onto the air outlet.
6. Connect the assembled mask system to the free end of air tubing.

Notes:

- *Always ensure that the VPAP ST-A and H5i are placed on a stable, level surface for proper operation.*
- *Always ensure that the VPAP ST-A is placed in an area where the alarm LED indicators are clearly visible.*
- *Place the power supply unit away from the H5i to allow for adequate ventilation.*

Mask and air tubing settings

Use the following settings below for each mask type:

Mask type	Settings
Full Face	Full Face
Pillows	Pillows
Nasal	Nasal (for Ultra Mirage mask, use 'Nasal Ultra')
Pediatric	Pediatric

Notes:

- *For more information on assembling the mask see the mask user guide.*
- *For a complete list of recommended masks and their settings go to www.resmed.com on the* ***Products*** *page under* ***Service & Support****. If you do not have internet access, please contact your ResMed representative.*

The VPAP ST-A is compatible with the following air tubing:

Air tubing	Specifications	Settings
ClimateLine	Heated Length: 2 m Inner diameter: 15 mm	Automatically detected
ClimateLine^{MAX}	Heated Length: 1.9 m Inner diameter: 19 mm	Automatically detected
SlimLine:	Length: 1.8 m Inner diameter: 15 mm	If using the SlimLine, Standard or 3 m air tubing, adjust the tube setting in the Patient Setup or Clinical Setup menus.
Standard	Length: 2 m Inner diameter: 19 mm	
3 m	Length: 3 m Inner diameter: 19 mm	

Notes:

- *When using the SlimLine or ClimateLine above 20 cm H_2O, the device optimum performance may not be reached if used with an antibacterial filter. The device performance must be checked prior to prescribing the SlimLine for use with an antibacterial filter.*
- *The ClimateLine/ClimateLine^{MAX} are designed only for use with the H5i.*

Filling the water tub

1. Slide the latch and lift open the flip lid.
2. Remove the water tub.
3. Fill the water tub (through the centre hole) with water up to the maximum water level mark (380 mL).
4. Return the water tub to the H5i.
5. Close the flip lid ensuring that it clicks into place.

VPAP ST-A basics

Key	Function
Start/Stop button	Starts or stops treatment. Power Save mode—hold for three seconds
Info menu button*	Allows you to view your sleep statistics or to exit from the menu.
Setup menu button*	Allows you to make changes to settings or to exit from the menu.
Push dial	Turning the dial allows you to scroll through the menu and change settings. Pushing the dial allows you to enter into a menu and confirm your choice.
Alarm mute button	Press once to mute alarms. Press a second time to un-mute. If the problem is still present, the alarm will sound again after two minutes.
Advanced Info menu	Allows you to access the Advanced Info menu by pressing and holding the Info menu and Setup menu buttons for three seconds.
Clinical Setup menu	Allows you to access the Clinical Setup menu by pressing and holding the Setup button and push dial for three seconds.
LCD screen	Displays the menus, treatment screens and reminders. Backlight—when treatment is being delivered, the backlight (including the Start/Stop button) automatically turns off after 30 seconds, otherwise it turns off after 3 minutes.
Alarm LED	Yellow LED—flashes during an alarm.
Therapy LED	Blue LED—always on during therapy (if enabled in the Options menu).

*The Info and Setup menus are disabled if S9 Essentials is enabled.

Navigating the menus

In general, to navigate the menus:

1. Turn until the parameter you require is displayed in blue.

2. Press . The selection is highlighted in orange.

3. Turn until you see the setting that you require.

4. Press to confirm your choice. The screen returns to blue.

About the menus

There are three menus that are designed to help you choose your options. These are:

1. **Home** menu—for day to day adjustments.
2. **Info** menu—provides sleep quality information.
3. **Setup** menu—where settings can be adjusted.

Home menu

The Home menu shows you and your patient what features are currently activated, and the accessories that are connected to the device.

Ramp—displayed when the Max Ramp function is activated in the Clinical Setup menu.

Humidity Level—displayed when the H5i is connected.

Climate Control—displayed when both the H5i and the ClimateLine or ClimateLine^{MAX} heated air tubing are connected and when Climate Control is activated in the Clinical Setup menu.

Humidity Level and **Heated Tube**—displayed when both the H5i and the ClimateLine or ClimateLine^{MAX} heated air tubing are connected and when Climate Control is set to Manual in the Clinical Setup menu.

Changing settings via the Home menu

From the Home menu, you can adjust or check the following features:

Ramp

Designed to make the beginning of treatment more comfortable for the patient, ramp time is the period during which the pressure increases from an initial pressure to the prescribed treatment pressure or minimum treatment pressure.

Humidity level

The patient can adjust their humidity level at any time to find the setting that is most comfortable for them.

Climate Control

When the ClimateLine or ClimateLine^{MAX} heated air tubing is connected and Climate Control is enabled, the patient can adjust the air temperature to find the setting that is most comfortable for them.

When set to Auto, Climate Control prevents rainout by maintaining 80% relative humidity in the delivered air. If Climate Control is set to Manual, Humidity Level and Heated Tube temperature can be set independently.

Mask Fit

Mask Fit is designed to help patients fit the mask properly.

The Mask Fit feature delivers CPAP pressure for a three-minute period, prior to starting treatment. During this time, the mask can be adjusted to minimise leaks.

To use Mask Fit:

1. Fit the mask as described in the mask user guide.
2. Press  for at least three seconds.
   One of the MASK FIT screens is displayed (as shown on the left).
3. If necessary, adjust the mask, mask cushion and headgear until there is a secure and comfortable fit. After three minutes, the pressure reverts to the set pressure and treatment will begin. You can end Mask Fit at any time by pressing  .

S9 Essentials

When S9 Essentials is enabled, the patient can simply start and stop therapy, access Mask Fit and adjust ramp, humidification and Climate Control.

Viewing the treatment screens

Depending on how the system has been configured and what mode has been selected, you will see one of the following example screens (shown in ST mode below) when the device is running:

- ✓ H5i humidifier

- ✓ H5i humidifier
- ✓ ClimateLine/ClimateLine^{MAX}
- ✓ Climate Control – Auto

- ✓ H5i humidifier
- ✓ ClimateLine/ClimateLine^{MAX}
- ✓ Climate Control – Manual

- ✓ Therapy data—without optional accessories

- ✓ Oximetry data—via the oximeter adapter

To toggle between the treatment screens, press  from your HOME screen.

- ✓ Treatment with device trigger (Timed) and cycle (Timed, Ti Max or Ti Min) breath indicators

- ✓ Treatment with spontaneous trigger and cycled breaths

- ✓ Treatment with alarm functionality

Pressure bar: In bilevel modes, the pressure bar is marked with fixed vertical lines indicating the expiratory and inspiratory pressures. While the treatment is ramping (indicated by an orange ramp icon) or variable, the pressure values appear in orange. When a set pressure is reached these values are displayed in white. In CPAP mode, only a set pressure is shown.

Treatment screen parameters

Parameter	Modes						Description
	CPAP	S	ST	T	PAC	iVAPS	
Leak	✓	✓	✓	✓	✓	✓	Estimate of the total rate of air escaping due to mouth and unintentional mask leaks, expressed in L/min (5-breath moving average).
Minute Ventilation (MV)	✓	✓	✓	✓	✓	✓	Volume of air breathed in, or out within any 60-second period, expressed in L/min (5-breath moving average).
Respiratory rate (RR)	✓	✓	✓	✓	✓	✓	Frequency of breathing, expressed as the number of breaths per minute (5-breath moving average).
Tidal volume (Vt)	✓	✓	✓	✓	✓	✓	Volume of air inspired or expired in one respiratory cycle (breath), expressed in mL (5-breath moving average).
Pressure support (PS)		✓	✓	✓	✓	✓	Difference between IPAP and EPAP.
Alveolar minute ventilation (Va)						✓	Minute volume without dead space, expressed in L/min.
Target alveolar ventilation (TgVa)						✓	Target alveolar minute ventilation that determines the amount of pressure support required, expressed in L/min.
Oxygen saturation (SpO_2)*	✓	✓	✓	✓	✓	✓	Measure of the saturation of blood haemoglobin with oxygen, expressed as a percentage (sampled every second).
Pulse*	✓	✓	✓	✓	✓	✓	Number of heart beats in a 60-second time frame (sampled every second).
Ti	✓	✓	✓	✓	✓	✓	Duration of inspiration (ie, the respiratory flow into the lungs), expressed in seconds (5-breath moving average).
I:E	✓	✓	✓	✓	✓	✓	Inspiration to expiration ratio measured by the device (5-breath moving average).
Ti Max		✓	✓			✓	Maximum inspiration time in seconds
Ti Min		✓	✓			✓	Minimum inspiration time in seconds.
% Spontaneous Triggering or Cycling (%Spont Trig or %Spont Cyc)		✓	✓		✓	✓	Percentage of breaths that are spontaneously triggered or cycled (average of the last 20 breaths). In PAC mode, there is no spontaneous cycling.
Trigger/Cycle indicators (Timed, Ti Max or Ti Min)		✓	✓	✓	✓	✓	Indicates a patient or device triggered/cycled breath. In ST mode, Timed indicator is left blank if it is a spontaneous breath.

* Only available via the oximeter adapter.

Setup menu

The Setup menu consists of:

- **Patient Setup menu**—allows the patient to optimise comfort settings as well as make changes to the mask or tube type.
- **Clinical Setup menu**—allows you to set all parameters pertaining to the patient's therapy.

Patient Setup menu

Only settings relevant to the patient are displayed in the Patient Setup menu. Depending on how the device has been customised via the Clinical Setup menu, the following screens can be viewed:

Tube—only displayed if ClimateLine or ClimateLine^{MAX} is not connected. If ClimateLine or ClimateLine^{MAX} is attached, no setting is required.

Climate Ctrl—only displayed if ClimateLine or ClimateLine^{MAX} is connected and also set to PATIENT in the Clinical Setup menu.

Mask—always available.

Mask Fit—always available.

SmartStart—only displayed if set to PATIENT in the Clinical Setup menu.

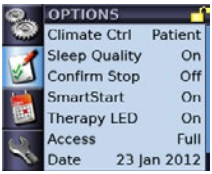
+ Clinical Setup menu

To access the Clinical Setup menu, press and hold the Setup button and push dial for three seconds. There are four screens available from the Clinical Setup menu as shown in ST mode below:

Settings

Displays parameters directly affecting the patient's therapy.

Note: Clinical menus are identified by the yellow open lock shown in the top right corner. Where further options exist on a screen, the blue scroll bar down the right of the screen indicates your position within these options.



Options

Displays parameters affecting the patient's comfort, therapy feedback and compliance reporting.

Reminders

Displays parameters for accessories requiring replacement.

Configuration

Displays general device setting and resetting options.

Clinical setup menu parameters[1]

Parameter	Modes						Default	Range	Description
	CPAP	S	ST	T	PAC	iVAPS			
Settings									
Mode	✓	✓	✓	✓	✓	✓	ST	CPAP / S / ST / T / PAC / iVAPS	Sets the therapy mode available on the device.
Set pressure	✓						8 cm H_2O	4–20 cm H_2O	Sets the fixed treatment pressure.
Height						✓	175 cm	110–250 cm	Body height needed for the dead space determination.
Target Pt Rate						✓	15 BPM	8–30 BPM	The rate input to the iVAPS algorithm. This should be set at the patient's actual respiratory rate.
Target Va						✓	5.2 L/min	1–30 L/min	Used to determine the amount of pressure support required by the iVAPS algorithm.
IPAP		✓	✓	✓	✓		10 cm H_2O	4–30 cm H_2O	Sets the pressure which will be delivered to the patient when the device is triggered into inspiration.
EPAP		✓	✓	✓	✓	✓	4 cm H_2O	2–25 cm H_2O	Sets the pressure which will be delivered to the patient when the device is cycled into expiration. Dependent on IPAP.
Min PS						✓	4 cm H_2O	0–20 cm H_2O	Minimum pressure support in iVAPS mode. Dependent on EPAP.
Max PS						✓	20 cm H_2O	0–28 cm H_2O	Maximum pressure support in iVAPS mode. Dependent on EPAP and Min PS.
Respiratory Rate			✓	✓	✓		10 BPM	5–50 BPM	Sets the breaths per minute (BPM) or 'backup' rate.
Ti Max		✓	✓			✓	2 sec	0.3–4.0 sec	Sets the maximum limit on the time the device spends in IPAP. Dependent on Respiratory Rate.
Ti Min		✓	✓			✓	0.3 sec	0.1–4.0 sec	Sets the minimum limit on the time the device spends in IPAP. Dependent on Ti Max.

1 Default settings may differ in other countries

Parameter	Modes						Default	Range	Description
	CPAP	S	ST	T	PAC	iVAPS			
Ti				✓	✓		2 sec	0.3–4.0 sec	Sets the duration of inspiration in timed breath. Dependent on Respiratory Rate.
Rise Time		✓	✓	✓	✓	✓	150 ms	Min / 100–900 ms	Sets the time taken for the device to reach to IPAP. Dependent on Ti Max and Ti.
Trigger		✓	✓		✓	✓	Med	Very Low / Low / Med / High / Very High	Sets the level of inspiratory flow above which the device changes from EPAP to IPAP.
Cycle		✓	✓			✓	Med	Very Low / Low / Med / High / Very High	Sets the level of inspiratory flow below which the device changes from IPAP to EPAP.
Max Ramp	✓	✓	✓	✓	✓	✓	Off	Off–45 min	Limits the ramp time the patient may select.
Start pressure	✓						4 cm H_2O	4–Set pressure	Sets the pressure at the start of ramp, up to fixed treatment pressure
Start EPAP		✓	✓	✓	✓	✓	4 cm H_2O	2–EPAP	Sets the pressure at the start of ramp, up to minimum treatment pressure.
Learn Targets									
Only in iVAPS mode. A sub-menu is displayed when Learn Targets is selected where you can adjust the height, EPAP and PS parameters. See Configuring iVAPS.									
Circuit									
Mask type	✓	✓	✓	✓	✓	✓	Full Face	Full Face / Nasal / Pillows / Nasal Ultra / Pediatric	Selects the type of mask used by the patient.
Tube type	✓	✓	✓	✓	✓	✓	Standard	SlimLine / Standard / 3 m	Shows the type of air tubing used by the patient.
AB filter	✓	✓	✓	✓	✓	✓	No	No / Yes	Enables or disables antibacterial filter.
Ext. humidifier	✓	✓	✓	✓	✓	✓	No	No / Yes	Enables or disables an external humidifier.
Alarms									
See Working with alarms.									
Options									
Climate Control	✓	✓	✓	✓	✓	✓	Auto	Auto / Manual / Patient	Sets the type of Climate Control.
Sleep quality	✓	✓	✓	✓	✓	✓	Usage	On / Usage	Sets Sleep Quality to Usage or On.

Parameter	Modes						Default	Range	Description
	CPAP	S	ST	T	PAC	iVAPS			
Confirm Stop		✓	✓	✓	✓	✓	Off	On / Off	Sets a confirmation message when therapy is stopped. If enabled, SmartStart is disabled.
SmartStart	✓	✓	✓	✓	✓	✓	Off	On / Off / Patient	Enables or disables the SmartStart feature.
Therapy LED	✓	✓	✓	✓	✓	✓	Off	On / Off	Enables or disables the blue LED
Access	✓	✓	✓	✓	✓	✓	Full	Full / Limited	Enables or disables S9 Essentials—If set to Limited, the Info and Setup menu buttons are disabled. This means that the patient can simply start or stop therapy and adjust ramp, humidification or Climate Control. Combined button presses remain enabled.
Date	✓	✓	✓	✓	✓	✓		DD Mmm YYYY	Sets the current date or time. If you set a new date or time that occurs in the past then an 'Invalid date/time, data exists for this period' message is displayed. Before this change can be made, erase the compliance data – available under the Configuration menu.
Time	✓	✓	✓	✓	✓	✓		00:00 (24 hr)	
Reminders									
Mask	✓	✓	✓	✓	✓	✓	12	Seven-day increments (starting from the current set date) with a recurrence period of one to 24 months.	A timed reminder to remind a patient when they need to replace their mask.
Water tub	✓	✓	✓	✓	✓	✓	Off		A timed reminder to remind a patient when they need to replace their water tub.
Tube	✓	✓	✓	✓	✓	✓	Off		A timed reminder to remind a patient when they need to replace their tubing.
Filter	✓	✓	✓	✓	✓	✓	6		A timed reminder to remind a patient when to replace the air filter.
SD card	✓	✓	✓	✓	✓	✓	Off		A timed reminder to remind a patient that they need to remove their SD card and return it to you, enabling you to establish compliance.
Service	✓	✓	✓	✓	✓	✓	24		A timed reminder to remind a patient when to return the device for service.

Parameter	Modes						Default	Range	Description
	CPAP	S	ST	T	PAC	iVAPS			
Customised messages (Custom 1, Custom 2)	✓	✓	✓	✓	✓	✓	Off		Customised reminders, eg, to return equipment or to phone a particular person or number. Custom reminder text can be up to 32 characters long, via a PC application. See your PC application manual for more information.
Configuration									
Language	✓	✓	✓	✓	✓	✓	English	English / Français / Español / Português / Deutsch / Italiano / Nederlands / Svenska / Norsk / Dansk / Suomi / Polski / Türkçe / Русский / 简体中文 / 繁體中文	Sets the display language. ***Note:*** *Not all languages are available in all regions.*
Restore factory defaults	✓	✓	✓	✓	✓	✓		Yes / No	Resets machine default settings (except for language, date and time).
Erase data	✓	✓	✓	✓	✓	✓		Yes / No	Allows you to erase all data stored in the unit and SD card (except for device run hours). Settings, date and time are not affected.
Pressure units	✓	✓	✓	✓	✓	✓	cm H_2O	cm H_2O / hPa	Sets pressure unit.
Temperature units	✓	✓	✓	✓	✓	✓	°C	°F / °C	Sets temperature unit.
Height units	✓	✓	✓	✓	✓	✓	cm	cm / inches	Sets height unit.

Reminder menu

You can access reminders from the Clinical Setup Menu > Reminders. Select the required reminder and change the settings as necessary.

You can use the Reminder menu to alert a patient to specific events, such as when to replace the filter (shown below) or when to insert an SD card.

When a reminder is due, a message is displayed on the LCD and remains while the device is not delivering therapy. The backlight on the LCD flashes when a message is displayed.

If more than one reminder for a patient is scheduled for the same date, all scheduled reminders will be displayed.

Patients can clear each message by pressing any key (except the Start/Stop button).

Configuring iVAPS

There are two ways in which you can configure iVAPS mode:

- using Learn Targets—learns the patient's breathing pattern and calculates the target values automatically, or
- directly entering the target values.

Using Learn Targets

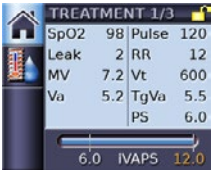
Learn Targets monitors the patient's resting ventilation, with the goal of learning the patient's Target Alveolar Ventilation and Target Patient Rate in preparation for iVAPS mode.

After the final circuit configuration (includes patient's height, EPAP, appropriate mask or tube settings and any supplemental oxygen added) is achieved, follow the procedure below. The device must be in standby to start the Learn Targets cycle.

1. Select Learn Targets from the Settings screen in iVAPS mode.

2. Press to start the 20-minute Learn Targets cycle.

3. Tidal Volume and Respiratory Rate are recorded for each breath. Target Va and Target Pt Rate are then calculated from these two recorded paramaters.

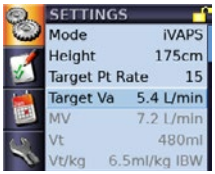


4. If the target values are acceptable, select Accept and therapy will commence in iVAPS mode. If not acceptable, select Cancel and therapy terminates.

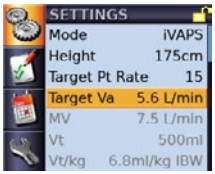
During the Learn Targets cycle, the device delivers two pressures: EPAP and Pressure Support without backup breath (like S mode). Ensure the patient remains comfortable, breathing is stable and leak is minimised, particularly in the final five minutes.

Entering the target values

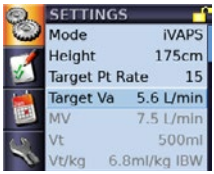
The Target Va can also be determined to adopt a Target Patient Rate using a settable Target Va parameter and patient height.



1. Select Target Va from the Settings screen in iVAPS mode.



2. Press and turn to set the Target Va as required. The equivalent MV, Vt and Vt/kg are automatically calculated and displayed.



3. Press to confirm. The selected Target Va will then be applied to iVAPS therapy settings.

Info menu

The Info menu consists of:

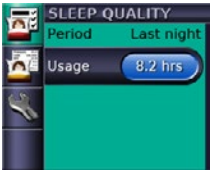
- **Standard Info menu**—provides patients with information about compliance, therapy and settings.
- **Advanced Info menu**—provides you with additional therapy settings and compliance information.

Standard Info menu

From the Standard Info menu, patients can check their sleep quality, sleep report and service information.

Sleep Quality—On

When Sleep Quality is set to On (via Setup > Clinical Setup > Options), data on previous usage (up to 365 days of data), Mask Fit and AHI can be viewed.

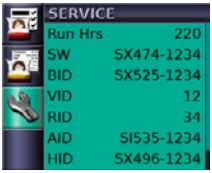


Sleep Quality—Usage

When Sleep Quality is set to Usage, only the data on previous usage is displayed.

Sleep Report

For Sleep Report, only the period can be changed—other values are for display only.

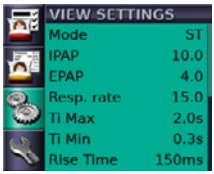


Service

For Service information, the device run hours and software identifications are displayed

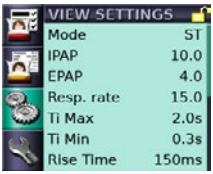
+ Advanced Info menu

To access the Advanced Info menu, press and hold the Info and Setup buttons for three seconds. This menu provides additional settings and sleep report information. Usage, Mask Fit and AHI are always displayed even when Sleep Quality is set to Usage.



Clinical Info menu

Accessed from the Clinical Setup menu, the Clinical Info menu provides the same screens as shown on the Advanced Info menu on the previous page but with lighter green background and with the unlock symbol.



Info menu parameters

Parameter	Description
Sleep Quality	Displays the following information on last night's usage, mask fit and AHI data.
Period	Time period displayed as Last night (last session).
Usage	Number of hours the device has been used during the last session.
Mask Fit	Indicates 'Good' if the 70th percentile leak is less than 24 L/min.
AHI	Apnoeas and hypopnoeas measured per hour for one day. An apnoea is when the respiratory flow decreases by more than 75% for at least 10 sec. A hypopnoea is when the respiratory flow decreases to 50% for at least 10 sec. The Apnoea Index (AI) and Apnoea Hypopnoea Index (AHI) are calculated by dividing the total number of events that occurred by the total mask-on therapy period in hours.
Sleep Report	Displays additional therapy settings and compliance information
Period	Sets time periods to a day, week, month (1, 3 or 6) and year to display available data. This period is the only parameter you can change in the Sleep Report—other parameters are for display only.
Days Used	Number of days the device has been used during the selected period or since the last compliance data was reset.
Days>4hrs	Number of days the device has been used for more than 4 hours during the selected period or since the last compliance data was reset.
Avg. usage	Average number of hours per day the device has been used during the selected period.
Used Hrs	Number of hours the device has been used during the selected period or since the last compliance data reset.
Insp. pressure	Average inspiratory pressure during the selected period (95th percentile for each day; average of the 95th percentile values for periods >1 day).
Exp. pressure	Average expiratory pressure during the selected period (95th percentile for each day; average of the 95th percentile values for periods >1 day).
Leak	Average of the 95th percentile values of leak during the selected period for days with usage only.
Vt	Average of the 50th percentile values of tidal volume during the selected period for days with usage only.

Parameter	Description
RR	Average of the 50th percentile values of respiratory rate during the selected period for days with usage only.
MV	Average of the 50th percentile values of minute ventilation during the selected period for days with usage only.
%Spont T or %Spont C	Percentage of breaths that are spontaneously triggered or cycled, measured during the selected period for days with usage only.
AHI	Apnoea-Hypopnoea Index—average AHI during the selected period. AHI and AI are calculated for times of low leak only.
Total AI	Apnoea Index—average total AI during the selected period.
View settings	Displays parameter settings depending on therapy mode.
	Note: The screens display the same parameters as shown on the Settings screens in the Setup menu.
Service	Displays the device run hours, software version and other component versions.
Run hours	Displays the total number of hours the device has been used including warm-up and cool-down times for the humidifier. It is not affected by the Period selected. This is the only data item that is not reset when data is erased.
SW	Displays the current software version.
BID	Displays the boot loader ID.
VID	Displays the variant ID.
RID	Displays the regional variant ID.
AID	Displays the alarm software ID
HID	Displays the humidifier software ID.

Managing Climate Control

Designed to be ideal for most patients, Climate Control – Auto enables the automatic delivery of a constant value of absolute humidity while protecting against rainout.

To allow for increased flexibility, Climate Control can be turned to Manual in either the Patient Setup (when enabled) or the Clinical Setup menus. Setting Climate Control to Manual disables the automatic control of humidity and allows the patient to set humidity and temperature levels independently. However, rainout protection is not provided when Climate Control is set to Manual.

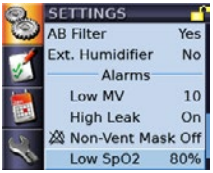
Mode	Humidity		Temperature	
	Setting range	Default settings	Setting range	Default settings
Climate Control – Auto 	**Climate Control**			
	Constant absolute humidity (depending on temperature setting)	–	Off*, 16°C–30°C	27°C
Climate Control – Manual 	**Humidity level**		**Heated tube**	
	Off–6.0 (0.5 increments)	3	Off, 16°C–30°C	27°C

* When the temperature setting is set to Off the tube will not heat the air, nor will the humidifier heat the water to add humidity to the air.

Working with alarms

The VPAP ST-A is fitted with an alarm module that continuously monitors both therapy and device conditions. Alarms are only activated when therapy is running. An alarm condition is indicated by an audible sound, a flashing yellow LED and a message on the screen.

Note: The alarms should be tested on final system configuration to ensure the alarms work as required.



Alarm settings

Alarms are set via the Clinical Settings menu.

✓ Alarm activated

Clearing the alarm message

When an alarm activates, a corresponding alarm message is displayed. If multiple alarms are active, the latest alarm message is displayed and as these are cleared each message can be read.

To clear an alarm message, press . This allows you to return to the previously displayed screen. If the alarm condition remains, the alarm will re-occur.

Note: Power Fail and Alarm Fail alarms are cleared by pressing .

✓ Alarm cleared

Muting the alarm

To mute an alarm for two minutes, press once. If the condition remains, the alarm will sound again after two minutes.

To turn on the alarm again, press a second time. The alarm LED will remain lit for as long as the condition is present.

✓ Single alarm

Viewing the alarms list

To view the list of alarm messages, go to the Treatment screen and press until Treatment screen 3 is displayed.

✓ Multiple alarms

✓ No alarms

Alarms menu

Fixed alarms	Adjustable alarms
The alarms pre-set for the device are: • Power fail • Block tube* • Tube disconnected • Humidifier lid open • System fault (system error).	Alarms that can be set are: • High leak • Non-vented mask • Low minute ventilation • Apnoea • Low SpO_2 (when oximeter connected).

* Blocked tube alarm is only triggered reliably for pressures above 10 cm H_2O.

Note: *The alarms in the above table can also be classified as:*

- *Clinical alarms—low minute ventilation, apnoea and low SpO_2*
- *Patient circuit alarms—blocked tube, tube disconnected, humidifier lid open, high leak and non-vented mask*
- *System alarms—power fail and system fault.*

Adjustable alarm settings

Alarm setting	Default	Range	Description
High Leak	Off	On / Off	Enables or disables the High Leak alarm feature. When enabled, leaks >40 L/min (0.7 L/sec) for >10–30 seconds result in an alarm.*
Non-Vented Mask	Off	On / Off	Sets the Non-Vented Mask alarm. Activates within 20–40 seconds when a non-vented mask is attached during therapy. ***Note:*** *Use of supplemental oxygen with a vented mask may result in false triggering of the Non-Vented Mask alarm.*
Low MV	Off	Off / 1–10 L/min, 1 L/min increments	Sets the Low Minute Ventilation alarm. Activates within 20–40 seconds after the measured level remains below the set limit.
Low SpO_2	Off	Off / 70–95%, 1% increments	Sets the Low SpO_2 alarm. Activates when the SpO_2 value is below the set value for 20–40 seconds. Only available when an oximeter is connected.
Apnoea Alarm	Off	Off / 10–60 sec, 1 sec increments	Sets the Apnoea alarm. Activates when there is no inspiratory trigger (either patient or machine trigger) detected from the previous inspiration for the set interval. Two consecutive inspirations (either patient or machine triggered) reset the Apnoea alarm.
Alarm Volume	Medium	Low / Medium / High	Sets the audio alarm volume.

* When the High Leak or Low MV alarms are set to On, SmartStop is automatically disabled.

Testing the alarms

When the device is turned on, the alarm LED will flash and the alarm will sound to confirm that the alarm is working.

To test the alarm manually or to adjust the alarm volume using the menus, go to the Settings menu (Clinical or Patient), then Alarm Vol/Test. When the setting is entered and confirmed, the alarm will sound and all LEDs will be active.

Initial setup

1. Turn off all adjustable alarms.
2. Set up the device with the air tubing attached, but no mask.
3. Set Ramp to Off.
4. Set SmartStart/Stop to Off.

The alarms should be tested weekly. To test some of the alarm conditions, follow the procedures described below. When completed, stop therapy and return all settings to their original settings appropriate to the patient before delivering therapy.

Power fail

1. Press the Start/Stop key to start therapy.
2. Unplug the DC plug of the power supply unit from the rear of the device. The alarm activates immediately.
3. Plug the DC plug back in. The alarm stops.

Blocked tube

1. Set pressure above 12 cm H_2O in CPAP mode.
   Note: *Blocked Tube alarm only activates above 10 cm H_2O.*
2. Press the Start/Stop key to start therapy.
3. Block the air tubing with your hand. The alarm activates when tubing is blocked for 30–50 seconds.

Tube disconnected

1. Disconnect air tubing at the device air outlet.
2. Press the Start/Stop key to start therapy. The alarm activates after 3–7 seconds.

High leak

1. Set the High Leak alarm to On.
2. Leave the open end of the tube unblocked.
3. Press the Start/Stop key to start therapy. The alarm activates after 10–30 seconds.

Non-vented mask

1. Set the Non-Vented Mask alarm to On.
2. Block the vent holes with your hand.
3. Press the Start/Stop key to start therapy. The alarm activates within 20–40 seconds.

Low minute ventilation

1. Set the Low MV alarm to 10 L/min.
2. Press the Start/Stop key to start therapy.
3. Partially block the open end of the tube with your hand keeping MV below 10 L/min. The alarm activates within 20–40 seconds.

Apnoea alarm
1. Set the device into CPAP mode. 2. Set Apnea Alarm to 10 seconds. 3. Partially block the open end of the tube with your hand. The alarm activates within 10–20 seconds.

Common alarms and solutions

If the system has not been properly assembled, the device will trigger an alarm. Check that the air tubing has been properly attached to the device and mask (and humidifier if used).

Notes:

- *The alarm actions listed below are based on having the appropriate alarm settings for the patient's therapy. When an adjustable alarm is activated, re-confirm the alarm settings.*
- *The alarm log and alarm settings are maintained when the device is powered down and in the event of a power loss.*
- *Alarms will not be logged when the SD card is not present in the device. Ensure that the SD card is properly inserted into the device.*
- *All the alarms on the device are of medium priority.*

If there is an alarm problem, try the following suggestions. If the problem cannot be solved, contact your equiment supplier or ResMed. Do not attempt to open the device enclosure.

Problem/Possible cause	Solution
Alarm is activated and the LCD screen display disappears	
Power failure.	Remove the patient's mask until power is restored.
Power cord is disconnected or mains power switch is turned off during therapy.	Ensure the power cord is connected and the mains power switch (if available) is on.
Displays message: High leak, please check system setup and all connections	
There is excessive leak.	Adjust position of mask and headgear. Connect the air tubing firmly at both ends.
Displays message: No tube, please check your tube is connected	
Flow is high because air tubing is not connected properly. ***Note:*** *The tube disconnection check may not operate when an antibacterial filter is used.*	Connect the air tubing firmly at both ends.
Displays message: Tube blocked, please check your tube	
Air tubing is blocked.	Check the air tubing and remove any blockages. Disconnect the power cord and then reconnect it to restart the device.
Displays message: Please close H5i flip lid, attach tube and press any key.	
H5i flip lid is not closed.	Close the flip lid ensuring that it clicks into place.
Air tubing is not connected properly.	Connect the air tubing firmly at both ends.
Displays message: No SpO2 data, check oxi sensor attachments to module/finger	
Oximeter sensor is not attached properly.	Ensure that the oximeter sensor is attached properly to the module and the patient's finger.

Problem/Possible cause	Solution
Oximeter sensor might be faulty.	If the message appears repeatedly but the oximeter is attached properly to the module and the patient's finger, the oximeter sensor might be faulty. Contact your service provider or exchange the oximeter.
Displays message: Non-vented mask, use vented mask or unblock mask vents	
Non-vented mask is used.	Only use a vented mask.
Mask vents might be blocked.	Check if there is sufficient venting. Unblock mask vents if necessary.
A low EPAP in conjunction with supplemental oxygen may result in false triggering of this alarm on a vented mask.	Increase EPAP.
Displays message: No oximeter, check/connect oximeter adapter	
Oximeter adapter is not attached properly.	Ensure that the oximeter adapter is attached properly.
Oximeter adapter might be faulty.	If the message appears repeatedly but the oximeter adapter is attached properly, the oximeter adapter might be faulty. Contact your service provider.
Displays message: Alarm module fault, please contact service provider	
General failure of the device and/or the alarm module. Therapy cannot be started again.	Contact your service provider immediately.
Displays message: Humidifier fault, replace humidifier	
Device has been left in a hot environment.	Allow to cool before re-use. Disconnect the power cord and then reconnect it to restart the device.
There is a fault in your humidifier.	Discontinue using your humidifier and contact your clinician/service provider.
Refilling the humidifier with cold water while humidifier is still hot after therapy.	Allow to cool before re-use. Ensure the humidifier is filled with water before the start of therapy to avoid running out of water during therapy.
Filling the humidifier with ice cold water on a warm day or with hot water.	Use room temperature water.

Delivering therapy

If you enable SmartStart, the patient's device will start automatically when the patient breathes into the mask and stop automatically when they remove their mask.

Once therapy has started a treatment screen is displayed.

In order to assist the heater plate in cooling, the device will continue to blow air for up to an hour after treatment has stopped. However, you can unplug the device from the power outlet at any time and allow the heater plate to cool without air flow, or press to enable Power Save mode.

Note: *If power is interrupted during treatment, the device automatically restarts therapy when power is restored.*

Adding supplemental oxygen

The device is designed to be compatible with supplemental oxygen of up to 4 L/min in iVAPS mode or 15 L/min in all other modes.

At a fixed rate of supplemental oxygen flow, the inhaled oxygen concentration will vary, depending on the pressure settings, patient breathing pattern, mask selection, and the leak rate.

Notes:

- *Adding oxygen may affect the delivered pressure, and the accuracy of the displayed leak and minute ventilation.*
- *Before adding oxygen, familiarise yourself and your patient with the specific warnings relating to the use of supplemental oxygen. These can be found at the end of this guide.*

Managing data

The SD card may be used to monitor patient usage as well as treatment pressure, mask leak, and incidence of apnoeas and hypopnoeas. To assess the patient's progress, data for the last session may be compared to values for the last week, the last month, the last three months, the last six months, and the last year. The device stores usage and summary data for up to 365 sessions.

SD card

The SD card allows the device to capture data. The device comes with the SD card already inserted and ready to be used.

Compliance data is also stored on the device, so if the card is lost, the data is not. You can also create new treatment settings and transfer them to the patient's device via the SD card.

Device settings are written to the SD card. This allows a ResMed PC application to display actual device settings from the SD card instead of the default values.

Removing the card

Before removing the card, instruct the patient to disconnect the device from the power outlet.

To remove the card, instruct the patient to:

1. Push in the SD card to release it.
2. Remove the card.
3. Insert the card into the protective folder.
4. Send the protective folder back to you as instructed.

Inserting the card

1. Remove the card from the protective folder.
2. Push the card into the device until it clicks.
3. The following message is briefly displayed: **Reading SD card**

Notes:

- *For more information on removing and inserting the card refer to the S9 SD Card Protective Folder provided with the device.*
- *Ask the patient to retain the S9 SD Card Protective Folder for future use.*

Analysing the SD card data

To analyse the data, use a ResMed PC application to transfer data and settings between the device or an SD card and your personal computer. Refer to your PC application guide for more information about analysing the information on returned SD cards.

Data storage

Designed to make data more easily available, the S9 SD card gives clinicians greater insight to patient therapy by making high resolution and detailed data available on the device.

The amount of data stored on the SD card varies compared to the data stored on the device.

Type of data	Device	SD card	Sampling rate
Compliance and therapy summary and statistic data*	365 nights	365 nights	
Detailed data	–	30 nights	
Apnoea or hypopnoea events (sec)			Aperiodic
Flow limitation (flat to round)			1/2 Hz
Leak (L/min)			1/2 Hz
Minute ventilation (L/min)			1/2 Hz
Pressure (cm H_2O)			1/2 Hz
Pulse rate (beats/min)**			1 Hz
Snore (quiet to loud)			1/2 Hz
Oxygen saturation (SpO_2) (%)**			1 Hz
High resolution flow and pressure data	–	7 nights	25 Hz

* The pressure and leak samples used to calculate the statistics data are averages over a one minute period.

** Information only available via the oximeter adapter.

Data transmission adapter

The following data transmission adapter is designed for use with the VPAP ST-A.

Device	Method	Description	Type of data transferred
	Oximeter adapter	Enables collection of oximetry data from an oximeter for storing data on the SD card inserted into the device.	Oximetry data (oxygen saturation and pulse rate)

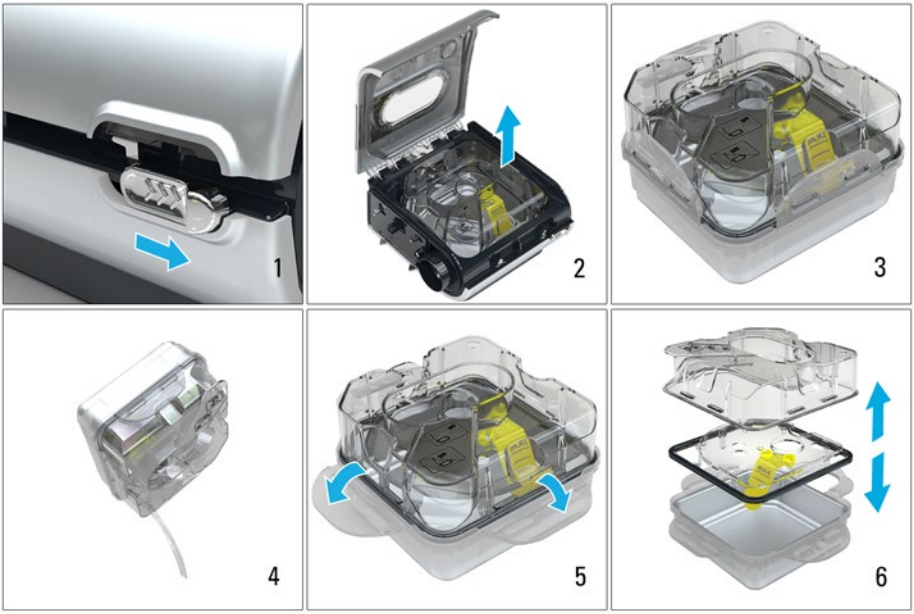
Note: *For more information on setting up your S9 adapter refer to the S9 adapter user guide.*

Cleaning and maintenance

You should regularly clean and maintain the device as described in this section.

Disassembling the H5i

1. Slide the latch.
2. Lift open the flip lid.
3. Remove the water tub.
4. Discard any excess water from the water tub.
5. Unclip all four side latches.
6. Pull apart the tub lid, plate and base.



Daily

1. Remove the air tubing by pulling on the finger grips on the cuff. Hang the air tubing in a clean, dry place until next use.
2. Wash the disassembled tub lid, plate and base in warm water using a mild detergent.
3. Rinse thoroughly in clean water and allow them to dry away from direct sunlight.

Notes:

- *The disassembled tub lid, plate and base may also be washed in a dishwasher on the delicate or glassware cycle (top shelf only).*
- *Do not hang the air tubing in direct sunlight as it may harden over time and eventually crack.*
- *Do not wash the air tubing in a washing machine or dishwasher.*

Monthly

1. Wipe the exterior of the device and H5i with a damp cloth and mild detergent.
2. Check the air filter for holes and blockage by dirt or dust. Replace the air filter if necessary.
3. Peel the flip lid seal from the flip lid and wash it in warm water using a mild detergent.

Reassembling the H5i

1. Place the plate back onto the base ensuring that the maximum water level mark faces up.
2. Place the tub lid back onto the plate/base ensuring that the centre holes are aligned.
3. Clip all four side latches.
4. Fill the water tub and return the water tub to the H5i.
5. Close the flip lid ensuring that it clicks into place.

Maintenance checklist

- ✓ Inspect the H5i water tub and flip lid seal for wear and deterioration.
- ✓ Replace the water tub if any component is leaking or has become cracked, cloudy or pitted.
- ✓ Replace the flip lid seal if cracked or torn.
- ✓ Clean white powder deposits in the water tub by using a solution of one part household vinegar to 10 parts water.
- ✓ Inspect the maximum water level mark. If cleaning is required, remove by pinching and pushing out the locks from the plate. Wash in warm water using a mild detergent.

Reprocessing the H5i between patients

The H5i should be reprocessed when used between patients. Cleaning and disinfection instructions are available from the ResMed website, www.resmed.com under **Products** and **Service & Support**. If you do not have internet access, please contact your ResMed representative.

Replacing the air filter

Replace the air filter every six months (or more often if necessary).

1. Remove the air filter cover from the back of the device.
2. Remove and discard the old filter.
3. Insert a new ResMed air filter ensuring that it is sitting flat in the air filter cover.
4. Replace the air filter cover.

Notes:

- *Ensure the air filter and air filter cover are fitted at all times.*
- *Do not wash the air filter. The air filter is not washable or reusable.*

The following filters are available for use with the device:

Filter	Efficiency
Standard (ASMB 160)	88% at 7 micron
Hypo-allergenic (Air Safety Electret100 – electrostatic filter)	89.8% at 0.5 micron, bacterial efficiency of 99.54%.

Antibacterial filters

Antibacterial filters increase resistance in the air circuit and may affect accuracy of displayed and delivered pressure, particularly at high flows. ResMed recommends using a filter with a low impedance (eg, less than 2 cm H_2O at 60 L/min).

Technical specifications

General technical specifications	
Power supply	90W power supply unit Input range: 100–240V; 50–60Hz; 115V, 400Hz nominal for aircraft use Typical power consumption: 70W (80VA) Maximum power consumption: 110W (120VA)
	30W power supply unit Input range: 100–240V; 50–60Hz; 115V, 400Hz nominal for aircraft use Typical power consumption: 20W (40VA) Maximum power consumption: 36W (75VA)
	90W DC/DC converter Nominal inputs: 12V, 24V Typical power consumption: 70W Maximum power consumption: 110W
Environmental conditions	**Operating temperature:** +5ºC to +35ºC ***Note:*** *The air flow for breathing produced by this therapy device can be higher than the temperature of the room. Under extreme ambient temperature conditions (40°C) the device remains safe.* **Operating humidity:**10 to 95% non-condensing **Operating altitude:** Sea level to 2,591 m; air pressure range 1013 hPa to 738 hPa **Storage and transport temperature:** -20ºC to +60ºC **Storage and transport humidity:** 10 to 95% non-condensing
Electromagnetic compatibility	Product complies with all applicable electromagnetic compatibility requirements (EMC) according to IEC60601-1-2, for residential, commercial, and light industry environments. It is recommended that mobile communication devices are kept at least one meter away from the device. Information regarding the electromagnetic emissions and immunity of these ResMed devices can be found on www.resmed.com, on the Products page under Service and Support. Click on the PDF file for your language.
Aircraft use	ResMed confirms that the VPAP ST-A meets the Federal Aviation Administration (FAA) requirements (RTCA/DO-160, section 21, category M) for all phases of air travel.
IEC 60601-1 classification	Class II (double insulation), Type BF, Ingress Protection IP21
Measuring and display devices	**Pressure sensor:** Internally located at device outlet, analog gauge pressure type, -5 to +45 cm H_2O **Flow sensor:** Internally located at device inlet, digital mass flow type, -70 to +200 L/min

VPAP ST-A technical specifications		
Mode pressure ranges	CPAP mode Set pressure: 4–20 cm H_2O S, ST, T and PAC modes IPAP: 4–30 cm H_2O; EPAP: 2–25 cm H_2O iVAPS mode PS: 0–28 cm H_2O; EPAP: 2–25 cm H_2O	
Maximum single fault pressure	**Maximum single fault steady state pressure:** 30 cm H_2O—if pressure exceeded for > 6 sec; 40 cm H_2O—if pressure exceeded for >1 sec	
Sound: DECLARED DUAL-NUMBER NOISE EMISSION VALUES in accordance with ISO 4871:1996	**Sound pressure level (CPAP mode)**	
	with SlimLine air tubing:	26 dBA with uncertainty of 2 dBA as measured according to EN ISO 17510-1:2009
	with Standard air tubing:	27 dBA with uncertainty of 2 dBA as measured according to EN ISO 17510-1:2009
	with either SlimLine or Standard air tubing and H5i:	28 dBA with uncertainty of 2 dBA as measured according to EN ISO 17510-1:2009
	Sound power level (CPAP mode)	
	with SlimLine air tubing:	34 dBA with uncertainty of 2 dBA as measured according to EN ISO 17510-1:2009
	with Standard air tubing:	35 dBA with uncertainty of 2 dBA as measured according to EN ISO 17510-1:2009
	with either SlimLine or Standard air tubing and H5i:	36 dBA with uncertainty of 2 dBA as measured according to EN ISO 17510-1:2009
Alarm volume settings	Low (nominal 56 dBA), Medium (nominal 68 dBA), High (nominal 80 dBA)	
Physical	**Dimensions (L x W x H):** 153 mm x 172 mm x 86 mm **Weight:** 1.045 kg **Housing construction:** Flame retardant engineering thermoplastic **Air outlet:** 22 mm conical air outlet (complies with ISO 5356-1:2004)	
Air filter	**Standard:** Polyester non-woven fiber **Hypoallergenic:** Acrylic and polypropylene fibers in a polypropylene carrier	
Supplemental oxygen	Recommended maximum supplemental oxygen: 15 L/min (CPAP, S, ST, T, PAC modes), 4 L/min (iVAPS mode)	

H5i technical specifications	
Temperature	**Maximum heater plate temperature:** 65°C **Temperature cut-out (heater):** 74°C **Maximum gas temperature at mask:** ≤ 41°C
Physical	**Dimensions (L x W x H):** 153 mm x 145 mm x 86 mm **Weight (standard water tub):** Docking station and unfilled water tub 690 g **Weight (cleanable water tub):** Docking station and unfilled water tub 790 g **Water capacity:** To maximum fill line 380 mL
Material	**Docking station:** Flame retardant engineering thermoplastic, aluminium **Standard water tub:** Injection molded plastic, aluminium and elastomer seal **Cleanable water tub:** Injection molded plastic, stainless steel and silicone seal

Air tubing technical specifications			
Air tubing	**Length**	**Inner diameter**	**Material**
ClimateLine	2.0 m	15 mm	Flexible plastic and electrical components
ClimateLine^{MAX}	1.9 m	19 mm	Flexible plastic and electrical components
SlimLine	1.8 m	15 mm	Flexible plastic
Standard	2.0 m	19 mm	Flexible plastic
3 m	3.0 m	19 mm	Flexible plastic
Heated air tubing temperature cut-out: ≤ 41°C			

Notes:

- *The manufacturer reserves the right to change these specifications without notice.*
- *The temperature and relative humidity settings displayed for Climate Control are not measured values.*
- *Check with the service provider before using the SlimLine air tubing with devices other than the S9 or H5i.*
- *The electrical connector end of the heated air tubing is only compatible with the H5i air outlet and should not be fitted to the device or mask.*

Humidifier performance

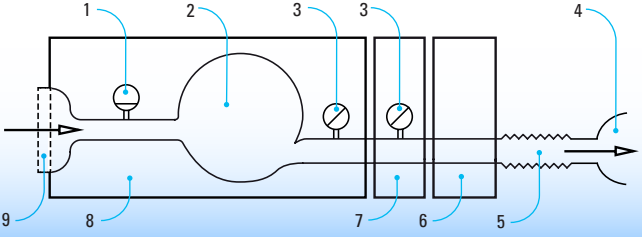
The following settings have been tested at 22°C ambient temperature:

Mask pressure cm H_2O	RH output %		Nominal system output AH[1], BTPS[2]	
	Setting 3	Setting 6	Setting 3	Setting 6
3	90	100	10	18
10	95	100	11.5	21
20	95	100	11	18
25	100	100	12	13.5

[1] AH - Absolute Humidity in mg/L.

[2] BTPS - Body Temperature Pressure Saturated.

Pneumatic flow path



1. Flow sensor
2. Blower
3. Pressure sensor
4. Mask
5. Air tubing
6. H5i
7. Alarm module
8. Device
9. Inlet filter

Flow (maximum) at set pressures

The following are measured at the end of the specified air tubing:

Pressure cm H_2O	VPAP ST-A and standard air tubing, L/min	VPAP ST-A, H5i and standard air tubing, L/min	VPAP ST-A and SlimLine, L/min	VPAP ST-A, H5i and ClimateLine, L/min
4	200	170	195	170
8	200	170	190	170
12	200	170	184	170
16	200	170	175	170
20	190	170	168	161
25	180	161	144	125

Displayed values

Value	Range	Display resolution
Pressure sensor at air outlet		
Mask pressure	2–30 cm H_2O	0.1 cm H_2O
Flow derived values		
Leak	0–200 L/min	1 L/min
Tidal volume	0–4000 mL	1 mL
Respiratory rate	0–50 BPM	1 BPM
Minute ventilation	0–30 L/min	0.1 L/min
Ti	0–4.0 sec	0.1 sec
I:E ratio	1:50–2:1	0.1
Value	**Accuracy[1]**	
Pressure measurement[1]		
Mask pressure	±0.5 cm H_2O (+ 4% of measured value)	
Flow measurements[1]		
Leak[2]	±12 L/min or 20% of reading, whichever is greater, at 0 to 60 L/min	
Tidal volume [2,3]	±20%	
Respiratory rate [2,3]	±1.0 BPM	
Minute ventilation [2,3]	±20%	

[1] Results are expressed at ATPD (Ambient Temperature and Pressure, Dry)

[2] Accuracy may be reduced by the presence of leaks, supplemental oxygen, tidal volumes <100 mL or minute ventilation <3 L/min.

[3] Measurement accuracy verified as per EN ISO 10651-6:2009 for Home Care Ventilatory Support Devices (Figure 101 and Table 101) using nominal ResMed mask vent flows.

Pressure accuracy

Maximum static pressure variation at 10 cm H_2O according to EN ISO 17510-1:2009:		
	Standard air tubing	SlimLine air tubing
Without H5i	9.89 cm H_2O to 9.97 cm H_2O	9.76 cm H_2O to 9.87 cm H_2O
With H5i	9.82 cm H_2O to 9.98 cm H_2O	9.78 cm H_2O to 9.88 cm H_2O

Maximum dynamic pressure variation according to EN ISO 17510-1:2009:			
Pressure (cm H_2O)	10 BPM	15 BPM	20 BPM
	VPAP ST-A and Standard air tubing without H5i / VPAP ST-A and Standard air tubing with H5i		
4	0.18 / 0.18	0.30 / 0.30	0.51 / 0.51
8	0.21 / 0.20	0.26 / 0.24	0.38 / 0.36
12	0.21 / 0.20	0.26 / 0.23	0.34 / 0.31
16	0.22 / 0.21	0.27 / 0.26	0.36 / 0.33
20	0.23 / 0.22	0.26 / 0.28	0.38 / 0.35
25	0.30 / 0.31	0.54 / 0.50	0.74 / 0.71
Pressure (cm H_2O)	10 BPM	15 BPM	20 BPM
	VPAP ST-A and SlimLine air tubing without H5i / VPAP ST-A and SlimLine air tubing with H5i		
4	0.22 / 0.20	0.28 / 0.29	0.47 / 0.53
8	0.23 / 0.19	0.32 / 0.29	0.41 / 0.42
12	0.22 / 0.21	0.35 / 0.29	0.41 / 0.45
16	0.22 / 0.23	0.41 / 0.33	0.44 / 0.50
20	0.24 / 0.27	0.37 / 0.34	0.48 / 0.50
25	0.31 / 0.31	0.50 / 0.54	0.78 / 0.84

Warnings and cautions

⚠ WARNINGS

- Read the entire manual before using the device.
- Use the device only as directed by your physician or healthcare provider.
- Use the device only for the intended use as described in this manual. Advice contained in this manual should not supersede instructions given by the prescribing physician.
- If you notice any unexplained changes in the performance of the device, if it is making unusual or harsh sounds, if the device or the power supply are dropped or mishandled, if water is spilled into the enclosure, or if the enclosure is broken, discontinue use and contact your ResMed Service Center.
- Beware of electrocution. Do not immerse the device, humidifier, power supply or power cord in water. In the event of a spill, disconnect the device from the power supply and let the parts dry. Always unplug the device before cleaning and make sure that all parts are dry before plugging in the device.
- Explosion hazard—do not use in the vicinity of flammable anesthetics.
- Make sure the power cord and plug are in good condition and the equipment is not damaged.
- Keep the power cord away from hot surfaces.
- The device should only be used with masks (and connectors[1]) recommended by ResMed, or by a physician or respiratory therapist. A mask should not be used unless the device is turned on. Once the mask is fitted, ensure that the device is blowing air. The vent hole or holes associated with the mask should never be blocked.
  Explanation: The device is intended to be used with special masks (or connectors) which have vent holes to allow continuous flow of air out of the mask. When the device is turned on and functioning properly, new air from the device flushes the exhaled air out through the mask vent holes. However, when the device is not operating, insufficient fresh air will be provided through the mask, and the exhaled air may be rebreathed. Rebreathing of exhaled air for longer than several minutes can, in some circumstances, lead to suffocation. This applies to most models of CPAP or bilevel devices.
- Oxygen supports combustion. Oxygen must not be used while smoking or in the presence of an open flame.
- Always ensure that the device is turned on and airflow generated before the oxygen supply is turned on. Always turn the oxygen supply off before the device is turned off, so that unused oxygen does not accumulate within the device enclosure and create a risk of fire.
- Do not operate the H5i if it is not working properly or if any part of the device or H5i has been dropped or damaged.
- Do not leave long lengths of air tubing around the top of the patient's bed. It could twist around the patient's head or neck while they are sleeping.
- Do not use electrically conductive or antistatic air tubings.
- Do not use the air tubing if there are any visible signs of damage.
- Only ResMed air tubing and accessories should be used with the device. A different type of air tubing or accessory may alter the pressure you actually receive, reducing the effectiveness of the treatment.
- Only use the ResMed 90W or 30W power supply unit. Use the 90W power supply unit to power the system comprising the device, H5i, air tubing, DC/DC converter and battery pack. The 30W power supply unit is designed to power the device only and recommended for traveling.
- Only ResMed products are designed to be connected to the module connector port. Connecting other devices could damage the device.
- Blocking the air tubing and/or air inlet of the device while in operation could lead to overheating of the device.

⚠ CAUTIONS

- Do not open the device enclosure. There are no user serviceable parts inside. Repairs and servicing should only be performed by an authorised ResMed service agent.
- Do not use bleach, chlorine, alcohol, or aromatic-based solutions, moisturising or antibacterial soaps or scented oils to clean the device, humidifier or air tubing. These solutions may cause damage and reduce the life of these products.
- Incorrect system setup may result in incorrect mask pressure reading. Ensure the system is correctly set up.
- Be careful not to place the device where it can be bumped or where someone is likely to trip over the power cord.

1 Ports may be incorporated into the mask or in connectors that are near the mask.

- Make sure the area around the device is dry and clean and clear of bedding, clothes or other objects that could block the air inlet or cover the power supply unit.
- Ensure that the device is protected against water if used outdoors. Enclose the device in the S9 travel bag for transport.
- The H5i should only be used with tubing or accessories recommended by ResMed. Connection of other delivery tubes or accessories could result in injury, or damage to the device.
- Do not open the H5i enclosure. There are no user serviceable parts inside. Repairs and servicing should only be performed by an authorised ResMed service agent.
- Do not overfill the water tub as water may enter the device and air tubing.
- Do not use any additives (eg, scented oils and perfumes). These may reduce the humidification output of the H5i and/or cause deterioration of the water tub materials.
- Take care when handling the H5i as the water/water tub may be hot. Allow 10 minutes for the heater plate and any excess water to cool.
- The H5i should only be connected or disconnected when the water tub is empty.
- Make sure that the water tub is empty before transporting the H5i.
- Do not operate the H5i on an aircraft as water may enter the device and air tubing during turbulence.
- Always place the H5i on a level surface below the level of the user to prevent the mask and tubing from filling with water.
- If liquids are inadvertently spilled into or on the H5i, unplug the device from the power outlet. Disconnect the H5i from the device and allow it to drain and dry before re-using.

Respiratory Care Solutions

Making quality of care easy

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VPAP ST-A with iVAPS
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Manufacturer: ResMed Pty Ltd 1 Elizabeth Macarthur Drive Bella Vista NSW 2153 Australia. See www.resmed.com for other ResMed locations worldwide.

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