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Technical Guide for Ventilator Set-Up

Does not replace clinical judgment or patient assessment

For more detail on each ventilator circuit and set-up refer to individual ventilator guide in this booklet.

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Adult Critical Care, St George's University Hospitals NHS Foundation Trust 2020

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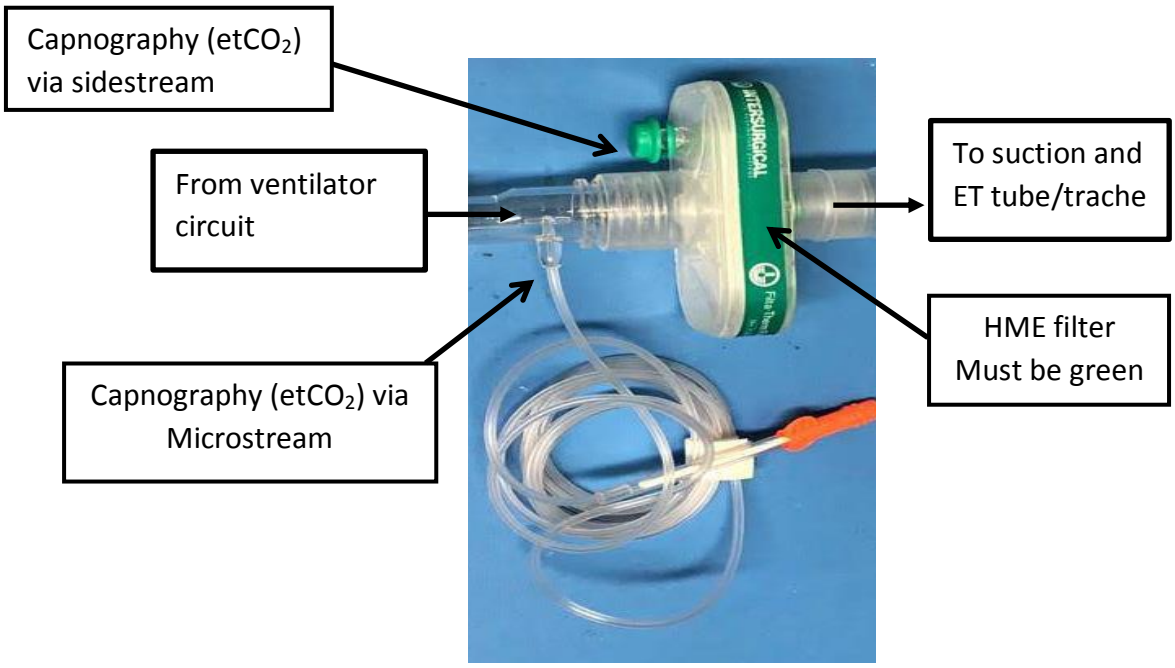
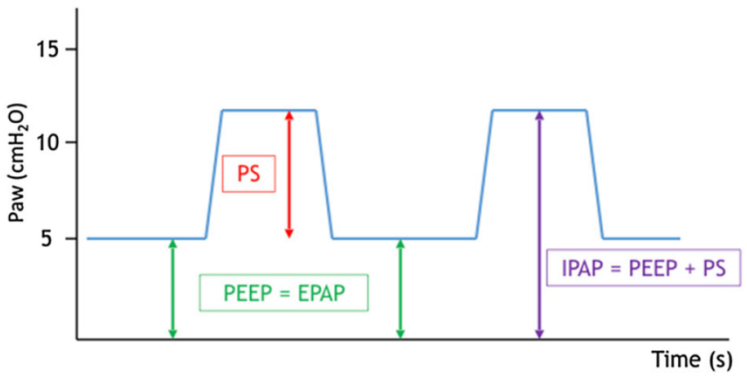
Set Up for Invasive Ventilation



Suggested Modes for Different Models

	Dräger Evita V300, V500	Getinge Servo i/u	Hamilton C1, T1, MR1	Philips Trilogy 202	Breas Vivo	Löwenstein PrismaVENT 50-c
Pressure SIMV	PC-SIMV	SIMV-PC/PS PRVC	PSIMV+	PC-SIMV	PCV - A PSV	aPCV PSV
Spontaneous Pressure / CPAP	SPN-CPAP/PS	PS/CPAP	Pressure Support	S/T	S/T	X
NIV/CPAP	PC-BIPAP NIV	NIV PS	NIV-ST	CPAP	CPAP	PSV (no CPAP)
Specialist modes	APRV	BIVENT/APRV	APRV	X	X	X



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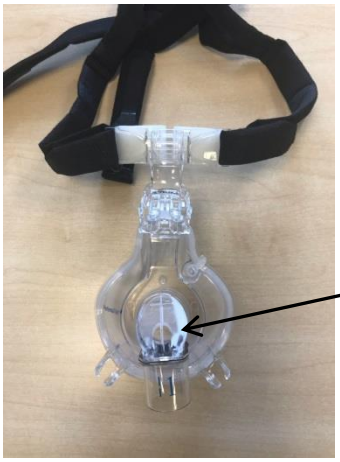
Set Up for Non-Invasive Ventilation

Do not use vented NIV mask (small multiple holes on bridge of nose) on suspected COVID-19 patients



Anti-asphyxiation valve

Anti-asphyxiation valve NIV mask to be used with single limbed circuits (Trilogy 202, Breas, PrismaVENT)

(N.B. Can be used on double limb circuit, but will alarm)

No anti-asphyxiation valve

Non-valved NIV mask to be used with double-limbed circuits (Draeger Evita, Servo, Hamilton, anaesthetic machine)

(N.B. Can be used on single-limb circuits, but ideally should be saved for double limb)

Circuit setup

Attach yellow bacterial/viral filter to mask. HME not required for NIV.

Attach the circuit to the filter. **The circuit must have an expiratory port (leak) at the patient end.**

$etCO_2$ is not routinely required for NIV patients.

If used, both the waveform and the $etCO_2$ value may be unreliable.

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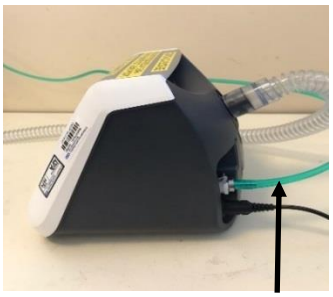
Breas Vivo 2 and Vivo 3

Vivo 3: battery life approximately 2 hours

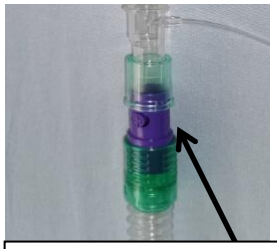
Vivo 2: no battery. Unsuitable for invasive ventilation.



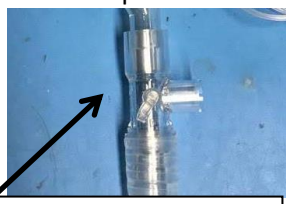
Do not remove or discard green tubing

Two types of single limb circuit work with the Vivo:

Intersurgical **5804000**



Respironics **1065836**
Discard long thin tube and close port on circuit



Expiratory Valve – DO NOT OCCLUDE

1. Ensure length of green oxygen tubing is attached from the wall oxygen flowmeter to the metal connector on the rear of the vent (see photo above).
2. Connect the circuit directly to the rear of the ventilator (see photo above).

3. Plug in and turn on using **ON/OFF** button.

4. Arrow buttons used to navigate – up/down to scroll, left/right to change values

5. Press button under **Setup** – set desired mode (choose **PCV+A, PSV, S/T, CPAP**) and appropriate settings. Maximum PEEP = 20 cmH_2O. May be less effective at inspiratory pressures > 25 cmH_2O due to the leak design.

Note: For pressure control, turn off Target Volume. If changing mode, use **NEXT** button to scroll through screens then **CONFIRM**.

6. Set **alarms** either under **Setup** if mode changed or press button under **Alarm** – **ENSURE** alarms for **Low MV**, **Rebreathing** and **Disconnection** are **ON**.
7. Press **ON/OFF** button and button under **Start** to start ventilation.
8. At the wall, set O_2 flow to 15 litres and titrate down to achieve target SpO_2.
9. Press the button under **Monitor** for monitoring page.
10. To stop ventilation press + hold **ON/OFF** button and then press alarm **Silence** to confirm. To turn vent off press **ON/Off** briefly and then button under **OFF** on display.

Litres	Approx. FiO_2
0	21%
1	27%
5	43%
10	65%
15	87%

Troubleshooting:

The trigger is very sensitive. If you suspect auto-triggering or the patient seems tachypnoeic, try changing **Exp. Trigger** and **Insp. Trigger** from **Auto** to a higher number (range 1-9).

If oxygen flow was turned on before ventilation was started, you may later encounter “flow sensor failure”. To fix: turn ventilator OFF, oxygen OFF, turn ventilator ON, start therapy and then turn oxygen back ON.

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Löwenstein PrismaVENT 50-C

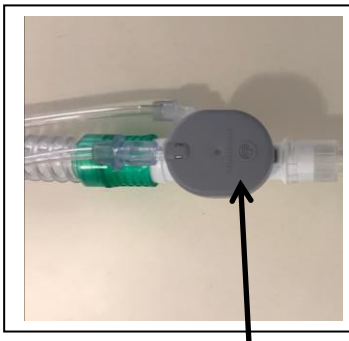
Battery life approx 6 hours

Single limb circuit

Intersurgical 518300/5191000

A

DO NOT DISCARD GREEN TUBING



Expiratory Valve – DO NOT OCCLUDE

B

1. Ensure length of green oxygen tubing is attached from the wall oxygen flowmeter to the white nipple on the rear of the vent (photo **A**).
2. Connect the circuit to front port of the ventilator. Connect line from top of expiratory valve to port labelled **VALVE CONTROL** (right) and the pressure line to port labelled **PRESSURE LINE** (left) (photo **B**).
3. Plug in and turn on using **ON/OFF** button.
4. Enable **EXPERT** mode by pressing and holding home button .
5. Press the soft button under **Ventilation**. Using the scroll, select desired mode (**aPCV/PSV**). NB Scroll used to navigate and confirm by clicking. Set appropriate settings using scroll. Max PEEP = 25 cmH_2O. Leave **LIAM turned OFF**. Continue scrolling to set **alarms** (must be **ON** to access) – ensure alarms for **MV low** are **ON**.
6. Press **ON/OFF** button once more to start ventilation.
7. At the wall, set O_2 flow to 15 litres and titrate down to achieve target SpO_2.
8. Press the **GRAPH** button ( )again to view other charts.
9. To stop ventilation, press and hold the **ON/OFF** button and then press **Alarm Silence** to confirm. To turn vent off, hold **ON/OFF** again for 3 seconds.

ON/OFF

SCROLL

Litres	Approx. FiO_2
0	21%
1	30%
5	63%
10	75%
15	85%

Troubleshooting:

If ventilation is inadequate, or circuit leaks continuously, ensure pressure line and valve control line are connected correctly, and ventilator is set to **Valve** circuit.

To check this, go into **EXPERT** mode, press **System**, go to **Tube systems**, and check it is set to **Valve** and not **Leakage**. This can only be changed when not ventilating.

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Philips Respironics Trilogy 202

Battery life approx. 3 hours

Two types of single limb circuit work with the Trilogy:

Intersurgical **5804000**

Respironics **1065836**
Discard long thin tube and close port on circuit

Expiratory Valve – DO NOT OCCLUDE

1. Connect the circuit at side of the ventilator (see photo above). Connect O2 hose to port. Plug in.

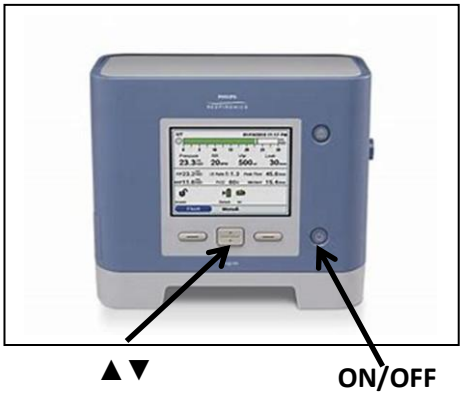
2. Press and hold the ▼ and alarm silence buttons simultaneously for at least 5 seconds to enter **Setup** menu.

3. Use ▼ to scroll to **Settings and Alarms**. Press button under **Select**.

4. Set desired mode (**PC-SIMV, ST, CPAP**) and appropriate settings.

▲▼to scroll to parameter or adjust, button under **Modify** to confirm to change, and button under **Ok** to confirm each setting.

Ensure **AUTO-TRAK** trigger (monitors and compensates for leaks) is **ON**. Note Circuit type = **passive** and dual prescription = **OFF**.



5. Set alarms (included in Settings and Alarms menu). **ENSURE** alarms for **Low MV** and **Circuit Disconnect** are **ON**.

6. Press button under **Finish**. **If mode changed** check details correct on screen, press button under **Yes** button then **Exit**. Mode not changed just press **Exit**. Ventilator turns off after **Exit** selected.

7. Turn on using **ON/OFF** button. Device performs a self-test and **VENTILATION WILL COMMENCE** with the previous settings.

NOTE device connects directly to oxygen outlet. Value displayed is set O_2. Can deliver 100% O_2 for 2 mins via button under **100% O_2** on monitoring page.

<u>Troubleshooting:</u>

Circuit type **must be passive** – Setup Menu (step 2) -> Settings and alarms -> Circuit type **Passive**

Keypad locked – press and hold the right button for 5s to unlock. Turn function on/off in **Options**

Unable to view full details on display – change to detailed view under **Options**

If limited menu access – press ▼ and mute button together to re-access the menu and change to full under **Options.**

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Dreamstation BIPAP (white with black front panel)

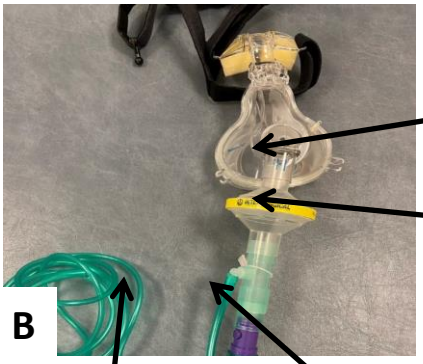
No internal battery – mask use only

REMEMBER: machine on, mask on, machine off, mask

A

Single limb circuit

Pre-made by respiratory team – can use tubing as per Trilogy/ Vivo



B

Mask

Filter

Expiratory Valve – DO NOT OCCLUDE **O2 Entrainment**

1. Connect the circuit at rear of the ventilator (see photo above photo **A**). Place O2 entrainment connector at end of tubing after expiratory valve and prior to bacterial filter. Attach length of green oxygen tubing from connector to the wall oxygen flowmeter (photo **B**).

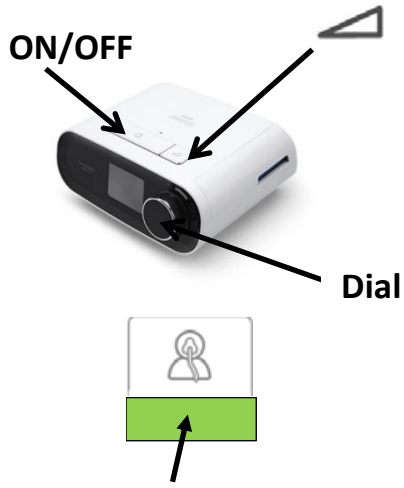
2. Plug into mains via transformer. Device turns on.

3. Scroll using dial until **Therapy** icon appears on display. **NOTE: Device should be unlocked** but If unable to access device is locked.

To unlock: *Press and hold the dial on front of the device and the* ◿ *button on top for at least 5-8 s.* ***Therapy*** *displayed – scroll using dial to* ***Device****. Click dial to confirm.*

Scroll using dial to ***Padlock****. Click dial to confirm and use dial to set to* ***On****. Click dial to confirm.*

Scroll to arrow and click to return to main menu and access ***Therapy*** *icon.*



Therapy screen

6. Select mode (**ST, CPAP, S**) and set appropriate parameters – e.g. IPAP, EPAP, Ti, BPM – mode dependent. Scroll dial to access each parameter – click dial to confirm selection, turn dial to adjust.

8. Select **arrow up** to return to main menu. Click dial to confirm.

9. Set to O2 flow 15 litres and titrate down to achieve target SpO2.

10. To start therapy press the **on/off** button once.

11. Press the **on/off** button once to display Parameter view on screen (pressure, tidal volume, minute vent, rate, leak). To change mode, settings and alarms whilst in use dial to scroll to setting screen, Scroll dial to access each parameter – click dial to confirm selection, turn dial to adjust.

12. To stop therapy press and hold the **on/off** button. To turn device off turn off at mains.

O2 Litres	Approx. FiO_2
0	21%
1	24%
3	32%
5	36%
7	41%
10	54%
15	62%

Troubleshooting:

Screen dim – automatic screen saver – press dial to return to display
Need help contact respiratory team on call
Switch off alarm by pressing centre of dial

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Dreamstation CPAP (all white)

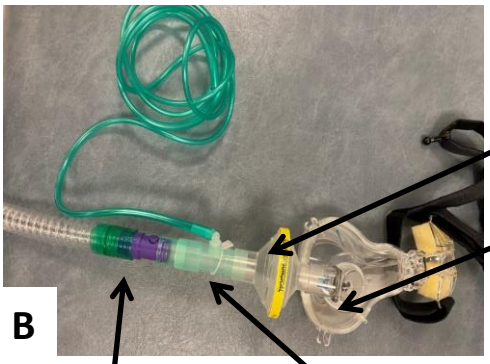
No internal battery – mask use only

REMEMBER: machine on, mask on, machine off, mask

A

Single limb circuit

Pre-made by respiratory team – can use tubing as per Trilogy/ Vivo



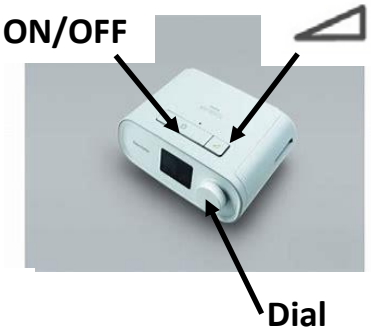
B

Filter

Mask

Expiratory Valve – DO NOT OCCLUDE **O2 Entrainment**

1. Connect the circuit at rear of the ventilator (see photo above photo **A**). Place O2 entrainment connector at end of tubing after expiratory valve and prior to bacterial filter. Attach length of green oxygen tubing from connector to the wall oxygen flowmeter (photo **B**).



2. Plug into mains via transformer. Device turns on.

3. Press and hold the dial on front of the device and the ◿ button on top for at least 5-8 s.

4. **Therapy** icon appears on display. Press button centre of dial to select.

5. Options include – **Mode**, **A-trial (off)**, **EZ start (off)**, **pressure**.

6. Click dial to select **Mode**. Scroll using dial to select **CPAP** and press centre of dial to confirm.

7. Using dial scroll to **pressure**. Scroll using dial to set pressure in cmH2O – **currently recommended 10 cmH2O**. Press centre of the dial to confirm selection.

8. Scroll using the dial to the **return arrow**, press the centre of the dial to confirm.

9. Set to O2 flow 15 litres and titrate down to achieve target SpO2.

10. To start and stop treatment, press the **on/off** button once.

11. To turn device off turn off at mains.

O2 Litres	Approx. FiO_2
0	21%
1	24%
3	32%
5	36%
7	41%
10	54%
15	62%

CPAP display

<u>Troubleshooting:</u>

Screen dim – automatic screen saver – press dial to return to display
Need help contact respiratory team on call
The machine automatically locks and to change CPAP pressure user needs to unlock device as per step 3 to change however the device needs to be turned off first.

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Draeger V300/V500

Internal battery – approx. 20 minutes unless external battery fitted then approx. 4 hours

Note if ventilator tubed and capped at end the device has been set up by a technician and there is no requirement to exchange the expiratory valve and membrane or perform the pre-use checks. Skip steps 1-3 and step 12-14.

1. Remove the expiratory valve and membrane from the expiratory part of the device.
   - Lift the blue flap (if present).
   - Slide the flowsensor to the left.
   - Twist the outer rim of the valve to the unlock position and pull the valve out of the device.
   - Place valve and membrane in appropriate container for collection by technician – will be sent to CSSD.

2. Collect clean expiratory valve and membrane.

3. Replace the expiratory valve and membrane.
   - Push the valve into the device and twist the outer rim of valve to the right to click into position.
   - Slide the flowsensor to the right into connector.

4. Plug into mains and connect oxygen/ air hoses to the appropriate ports.

5. Turn device on using **Power/standby** button.

NOTE – if green LED not lit on **Power/ standby** button the ventilator may have been turned off completely – turn on using hard power switch at side – under door to the left.

6. Device self-tests and enters **Standby**.

7. Connect a standard adult basic breathing circuit.

8. Set ventilator up for use and perform pre-use checks.

To select parameter/option highlight parameter/ option on screen and use trim knob to confirm – trim knob will light to indicate confirmation required.

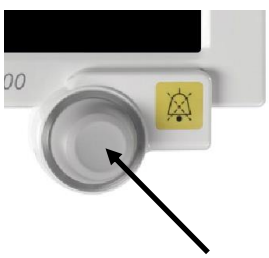
1

Flowsensor

2

3

Power/standby



Trim control

Hard on/off power switch

9. From standby screen select **New Adult** - tab 1 Start/ Standby.

NOTE – if device turned on using hard power switch need to select **New Adult** before device moves into standby screen.

10. From tab 2 ensure **Tube** selected.

11. From tab 3 ensure **breathing circuit basic** selected. If not use arrow to highlight choices and trim knob to scroll through options until **breathing circuit basic** highlighted and then confirm.

12. From tab 4 perform **System check** – when selected tabs appear on right of screen

13. Select **Device check** tab and then select **Start** on the screen.

Follow prompts on screen confirming as and when necessary. As part of the device check the user will require a test lung.

Successful completion of each individual test will be marked with a green circle.

14. Once device check complete device will state on screen **Device check is finished. To proceed to breathing circuit check touch yes**. Select **Yes** and follow prompts. Once breathing circuit complete marked with green circle.

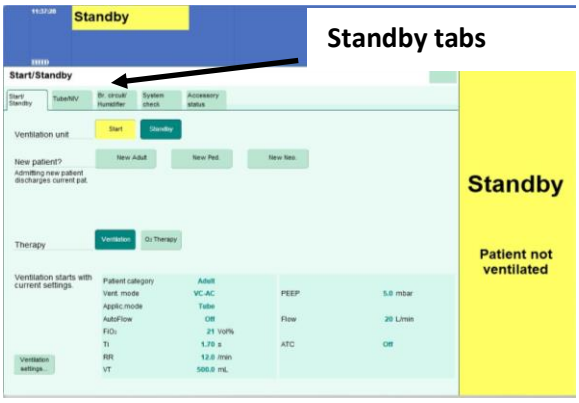
15. Select **Ventilation settings**.

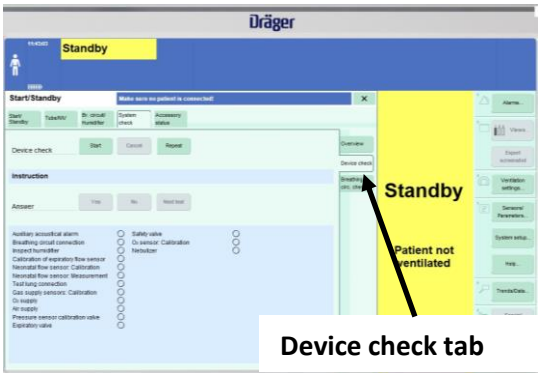
16. Select desired mode (**PC-SIMV, SPN-CPAP/PS, APRV, NIV PS**) and appropriate settings.

17. Set appropriate alarms via **Alarms** on screen.

18. Press the **Start/Standby**. Select **Start ventilation** on screen and confirm with trim knob. To stop ventilation – press **Standby** on screen and confirm with trim knob. To turn off press and hold **Power/standby** button for 3 seconds.

Nebulisation, oxygen enrichment, day/night mode available





Test lung

<u>Troubleshooting:</u>

Leaks – check expiratory valve, flowsensor positioning.
Errors with flowsensor or expiratory valve – check indicated component

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Hamilton C1/T1

C1 battery approx. 4 hours T1 battery approx. 9 hours

Note if ventilator tubed and capped at end (photo A) the device has been set up by a technician and there is no requirement to exchange the expiratory valve and membrane or perform the pre-use checks. Skip steps 1-4 and step 8.

A

1. Remove the expiratory valve and membrane from the expiratory part of the device.
   Twist the valve to the left to release.
   Place valve and membrane in appropriate container for collection by technician – will be sent to CSSD.

2. Collect clean expiratory valve and membrane.

3. Twist the valve to the right to click into position.

4. Connect the circuit and flowsensor (blue to blue, white to white) at side of ventilator (picture **4**).

5. Plug into mains and connect oxygen hose to port.

6. Turn device on using **Power/standby** button.

7. Device self-tests and enters **Standby**.

8. Select **Preop check**.

Perform flowsensor calibration – select **Flow sensor** tab – follow prompts and use flowsensor adapter provided in packet when required.

Perform tightness check – select **Tightness** tab - follow prompts

Perform oxygen cell calibration – select **O2 cell** tab – follow prompts

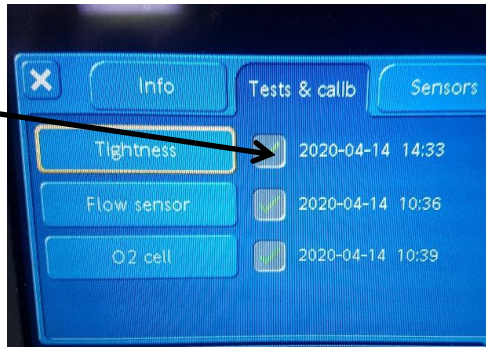
1

2

3

4

Flowsensor adapter



Preop checks performed – screen indicates pass with green tick, time/date.

NOTE O2 calibration can be performed during ventilation via **System tab, Tests & Calib** & then **O2 Cell**

9. Select **Modes** – select desired mode (**Pressure-SIMV, Spont, NIV-ST, APRV**). Select **Confirm** tab.

10. Set desired settings – additional tabs if required. Select **Confirm** tab.

NOTE controls can also be accessed by **Controls** tab on screen.

11. Set appropriate alarms via the **Alarms** tab on screen.

User can use touch screen or control knob to highlight parameter and control knob to confirm by pushing. X to close

12. Select **Start Ventilation** to commence ventilation.

13. To stop ventilation – press **Power/standby** button and press **Activate Standby** on screen. To turn off press and hold **Power/standby** button for 3 seconds.

For full monitoring parameters select Monitoring tab on screen.

Hard keys on right include – inspiratory hold, O2 100%, nebulizer, day/night.

Top waveform preset = pressure/time, press middle of screen to access trends, loops, waveforms.

Battery status can be checked under **System** tab on the info page.

Troubleshooting:

Leaks – check expiratory valve, flowsensor connection ventilator and patient end.

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Servo U

Battery – individual battery in slots – approx. 45 mins each if charged

Note if ventilator tubed and capped at end the device has been set up by a technician and there is no requirement to exchange the expiratory valve and membrane or perform the pre-use checks. Skip steps 1-3 and steps 6-11.

1. Remove the expiratory cassette from the expiratory part of the device.
   - Press the button on top of the cassette to release.
   - Lift the cassette up and out.
   - Place cassette in appropriate container for collection by technician – will be sent to CSSD.

2. Collect clean expiratory cassette.

3. Replace the expiratory cassette.
   - Slide cassette into grove with the port at the front.
   - Click down into place.

4. Plug into mains and connect oxygen/ air hoses to the appropriate ports.

5. Device generally in **Standby**.

6. Perform pre-use checks. User will require test tube for the test.

7. Select **pre-use check** on screen. Screen will display **Do you want to start Pre-Use Check**. Select **Yes** on screen.

8. Pre-use check will proceed. Follow prompts on screen confirming as and when necessary.

Successful completion of each individual test will be marked with a green tick.

9. Remove test tube and connect basic adult breathing circuit when prompted and continue check.

10. Once check completed and all tests passed – green tick – select **Ok** on screen to confirm and return to **Standby** screen.

11. Screen will display **New patient – yes or no**. Select **yes**.

Button to release cassette

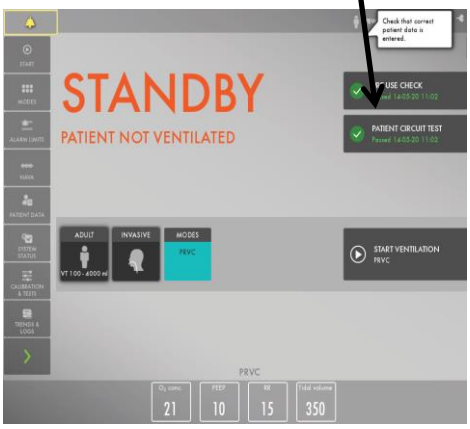
1

2

Cassette

Test tube

Pre-use check button



NOTE – *if device not in **Standby** then the ventilator will have to be turned on by the hard switch at the rear (behind door)*
NB DO NOT FORCE SWITCH – gently pull down to move on/off
*Device will perform self-test and ask user to **Perform pre-use check**, yes or no. Select yes and follow steps 8-11.*

Hard on/off switch

In the event of only a circuit change and device not turned off, carry out patient circuit test only.

12. Set desired mode (**SIMV-PC/PS, PRVC, PS/CPAP, NIV PS, BIVENT/APRV**) and appropriate parameters via **Modes** tab on screen. Press **Accept** to confirm once mode and parameters set.

13. Set appropriate alarms via the **Alarm limits** tab on screen. Select appropriate individual alarm limit, use +/- to adjust and ✓ to confirm. Press **Accept** to confirm once alarms set.

14. Select **START VENTILATION**. To stop ventilation – select **Standby** button and press and hold **STOP VENTILATION** to enter **Standby**.

Start ventilation

Via MANEUVRES - nebulisation, manual breath, static measurements including inspiratory and expiratory hold
Via SYSTEM STATUS – battery life
Oxygen boost, disconnection/ suction on screen buttons

<u>Troubleshooting:</u>
Expiratory cassette issues – membrane inside cassette damaged or wet

Ventilation screen

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Servo I

Battery – individual battery in slots – approx. 45 mins each if charged

Note if ventilator tubed and capped at end the device has been set up by a technician and there is no requirement to exchange the expiratory valve and membrane or perform the pre-use checks. Skip steps 1-3 and steps 6-11.

1. Remove the expiratory cassette from the expiratory part of the device.
   Lift the locking handle and pull out the patient unit
   Press the button on top of the cassette to release.
   Lift the cassette up and out.
   Place cassette in appropriate container for collection by technician – will be sent to CSSD.

Locking handle

2. Collect clean expiratory cassette.

3. Replace the expiratory cassette.
   Slide cassette into grove with the port at the front.
   Click down into place.
   Push the patient unit back into place.

Release button

4. Plug into mains and connect oxygen/ air hoses to the appropriate ports.

5. Device generally in **Standby**.

6. Perform pre-use checks. User will require test tube for the test.

7. Select **Pre-use check** on screen. Screen will display **Do you want to start Pre-Use Check**. Select **Yes** on screen.

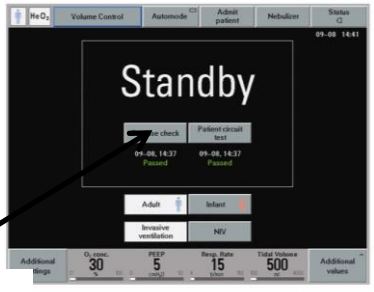
8. Pre-use check will proceed. Follow prompts on screen confirming as and when necessary.

Successful completion of each individual test will be marked with **Passed**.

9. Remove test tube and connect basic adult breathing circuit when prompted and continue check.

Test tube

10. Once check completed screen will display **Do you wish to compensate for compressible volume**. Select **Yes** . Once all tests **Passed** select **Ok** on screen to confirm and return to **Standby** screen.



11. Screen will display **New patient – yes or no**. Select **Yes**. Screen will display **Do you want to delete patient data trends and event log?** Select **Yes**.

Pre-use check button

NOTE – *if device not in **Standby** then the ventilator will have to be turned on by the hard switch at the rear (behind cover).*
*Device will perform self-test and Screen will display **Do you want to start Pre-Use Check**. Select **Yes**. Proceed as step 8.*

In the event of only a circuit change and device not turned off, carry out patient circuit test only.

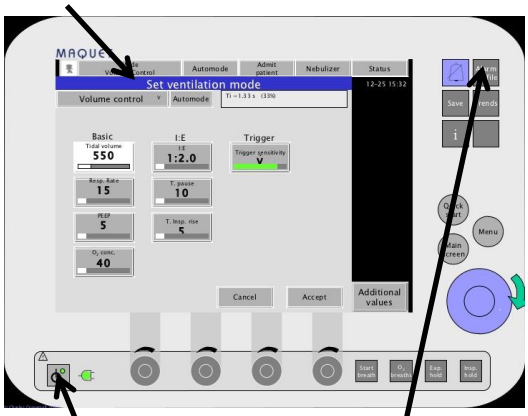
ON/OFF under cover

12.. Set desired mode (**SIMV-PC/PS, PRVC, PS/CPAP, NIV PS – if available**) via **Modes** tab on screen. Select mode on screen. Set appropriate parameters - use control knob to select, adjust and click to confirm. Press **Accept** to confirm. Quick access controls under flap at bottom of screen.

13. Set appropriate alarms via the **Alarm profile** button. Select appropriate individual alarm limit using control knob to adjust and confirm. Press **Accept** to confirm once alarms set.

14. Select ⏻ **START VENTILATION**. To stop ventilation – select ⏻. Screen will display **Do you really want to go into Standby?** Select **Yes** to confirm.

Mode button



Alarm profile button

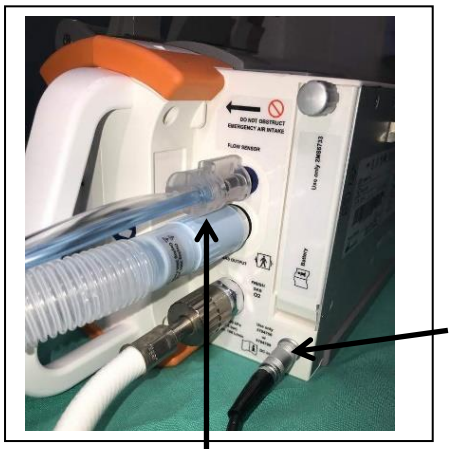
Start/ standby button

O2 breaths, inspiratory and expiratory hold under flap at bottom of screen
Via status button on screen and then Batteries tab – battery life

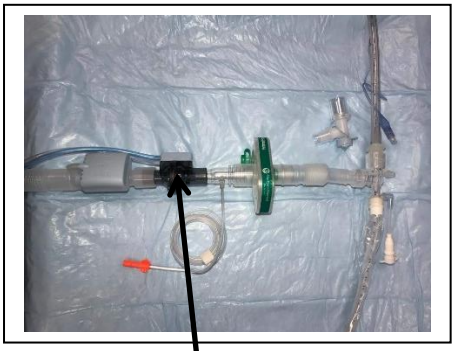
<u>Troubleshooting:</u>
Expiratory cassette issues – membrane inside cassette damaged or wet, incorrectly positioned

Oxylog 3000/3000+

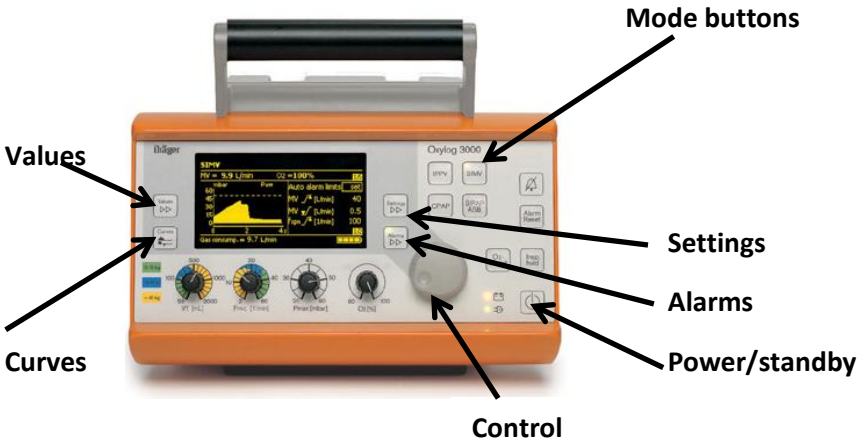
Battery 4-6 hours – battery status indicated on screen - bottom right hand



Single limb circuit
Draeger 5703041



1. Connect the circuit and flowsensor (blue – blue, clear – silver) at side of the ventilator (unless tubed already). Connect O2 hose to ports. Plug in via transformer.
2. Turn device on using **on/off** button. Device performs self-test and enters ventilation.
3. Select ventilation mode using **individual mode** buttons – **CMV/IPPV, SIMV, CPAP, BIPAP ASB**. Amber light flashes on mode button until choice confirmed with control knob.
4. Set appropriate parameters – 3 hard controls under screen can be turned to set Vt, frequency, O2. All other parameters need to be set via the **Settings** button using the control knob to select, adjust and confirm. Press **Settings** button to scroll through additional pages.
5. Set appropriate alarms via the **Alarms** button using the control knob to select, adjust and confirm. Pmax can be set using hard control under screen. Press **Alarms** button to scroll through additional pages.
6. Use **Values** button to display delivered parameters on screen – 2 at any one time, use button to scroll.
7. To stop ventilation and turn off press and hold **on/off** button. Screen displays **!!! Confirm device OFF with rotary knob**. Use control knob to confirm.



Hard keys on right include – inspiratory hold, O2 ↑ 100%

Waveforms can be selected via **Curves** button

<u>Troubleshooting:</u>

Leaks – flowsensor connection ventilator and patient end, flowsensor connectors.