



HAMILTON-C3 Quick Guide



HAMILTON
MEDICAL
Intelligent Ventilation since 1983

This Quick Guide is intended as a useful reference for ventilation of adult and pediatric patients. It does not replace the clinical judgment of a physician or the content of the *HAMILTON-C3 Operator's Manual*, which should always be available when using the HAMILTON-C3 ventilator. Some functions are optional and not available in all markets.

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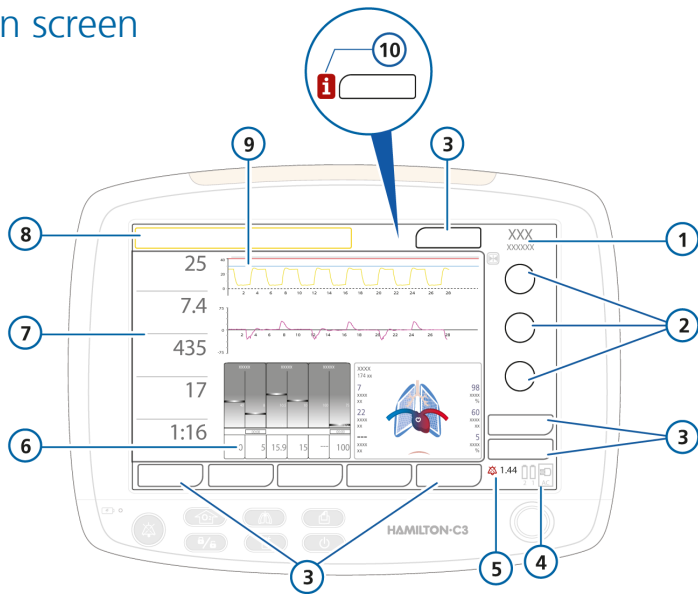







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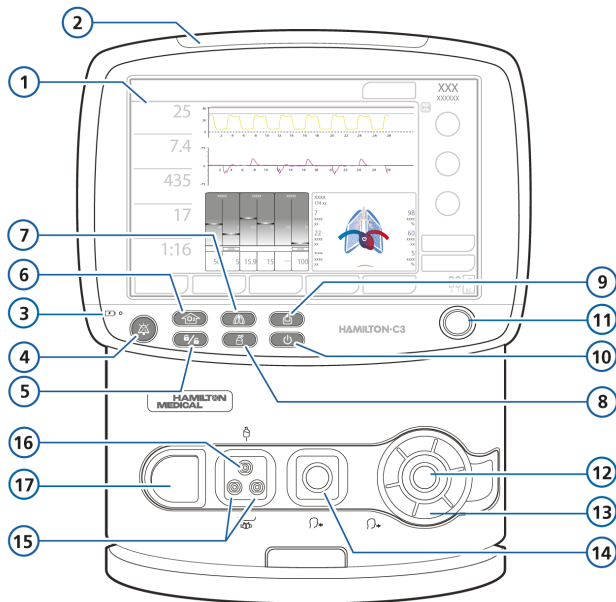
1. HAMILTON-C3 basics

1.1 Main screen



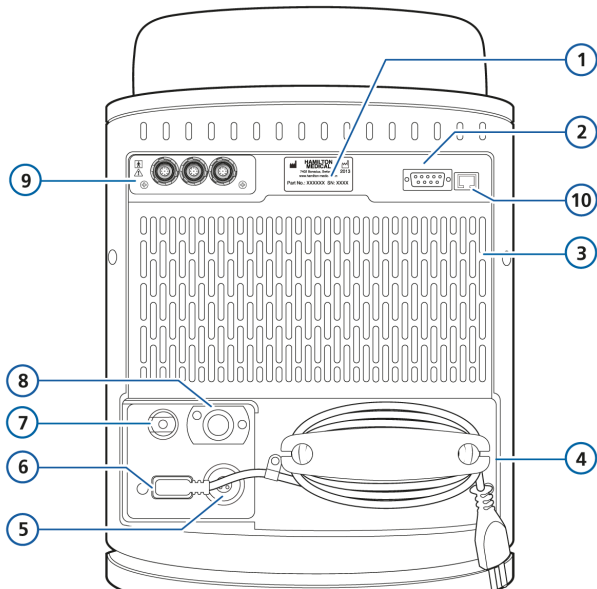
- 1 Active mode & patient group.**
- 2 Main controls.** Touch the **Controls** button to display all controls for the selected mode.
- 3 Window tabs.** Open the associated windows.
- 4 Input power.** Shows available power sources.
- 5 Alarm silence indicator and countdown.** Shows whether alarm silence has been activated, and displays the remaining silence time.
- 6 Graphic display.** Shows a user-selectable waveform or an Intelligent Panel graphic (Dynamic Lung, ASV graph, Vent Status).
- 7 Main monitoring parameters (MMP) and alarm limits.** View other numeric parameters from the monitoring window.
- 8 Message bar.** Displays color-coded alarm messages. If an alarm is active, touch the message bar to view the alarm buffer.
- 9 Pressure/time waveform.** Shown by default.
 - The waveform shows the patient's breath cycles.
 -  The red line is the Pmax high pressure alarm setting.
 -  The blue line is the pressure limit, automatically 10 cmH2O below the Pmax alarm setting.
 -   The pink (flow triggered) or yellow (pressure triggered) triangles indicate the patient is triggering a breath.
 -  The **Freeze** button freezes the graphic.
- 10 Alarm indicator (i-icon).** Touch the icon to view alarm history.

1.2 Front view



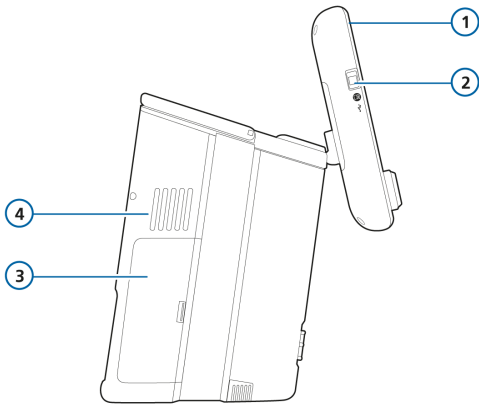
- 1 **Display.** Touch screen provides access to measurements, controls, and other options.
- 2 **Alarm lamp.** Red = high-priority alarm, yellow = medium- or low-priority alarm.
- 3 **Battery charge indicator.** Lit when the ventilator is connected to AC power.
- 4 **Alarm silence key.** Silences the main ventilator audible alarm for 2 min. Press the key a second time to cancel the alarm silence.
- 5 **Screen lock/unlock key.** Prevents inadvertent change of settings.
- 6 **O2 enrichment key.** Delivers 100% oxygen for 2 min. Press the key a second time to cancel. Press O2 enrichment key and disconnect patient to start a suctioning maneuver.
- 7 **Manual breath key.** Triggers a mandatory breath when pressed and released.
- 8 **Nebulizer on/off key.** Activates the pneumatic nebulizer during the inspiration phase for 30 minutes or until pressed again (only if high-pressure oxygen (HPO) is connected).
- 9 **Print screen key.** Saves a JPG file of the current ventilator screen to a USB memory drive.
- 10 **Power/Standby key.** Turns the ventilator on and off and accesses standby.
- 11 **Press-and-turn (P&T) knob.** Use to select and adjust ventilator settings.
- 12 **From patient port.** To connect the breathing circuit expiratory limb and the expiratory valve.
- 13 **Expiratory valve cover and membrane.**
- 14 **To patient port.** To connect the inspiratory filter and inspiratory limb of the breathing circuit.
- 15 **Hamilton Medical flow sensor connectors.** The blue tube goes to the blue connector. The clear tube goes to the white connector.
- 16 **Pneumatic nebulizer output connector.**
- 17 **O2 cell with cover.**

1.3 Rear view



- 1 Serial number label
- 2 RS-232 connector, for external monitoring
- 3 Fresh air intake and cooling fan vents, HEPA and dust filters. (behind the cover)
- 4 AC power cord with retaining clip
- 5 DC power connector
- 6 AC power receptacle
- 7 Low-pressure oxygen connector
- 8 High-pressure oxygen. DISS or NIST inlet fitting
- 9 Communications board. (optional) Offers one or more of the following options:
CO2 monitoring, SpO2 monitoring, Nurse call port
- 10 RJ-45 Ethernet connector. For internal use only

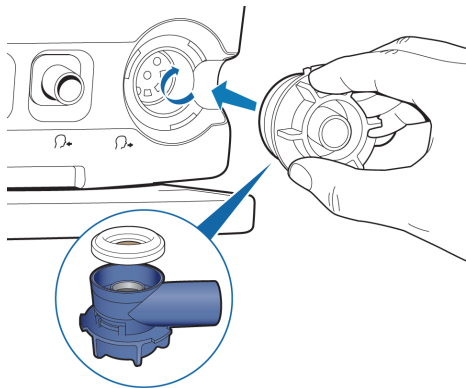
1.4 Side view, with battery door



- 1 Adjustable tilt monitor
- 2 USB connector
- 3 Battery door. The batteries are located inside the door.
- 4 Cooling air vent. *Do not obstruct.*

2. Setting up the ventilator

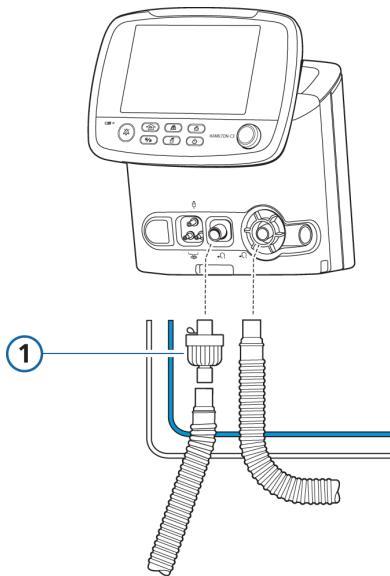
2.1 Installing the expiratory valve



To install the expiratory valve

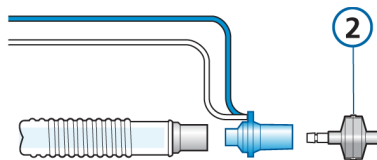
- 1 Holding the expiratory valve housing, seat the silicone membrane onto the housing. The metal plate must face up and be visible.
- 2 Position the housing and twist clockwise until it locks into place.

2.2 Installing the bacterial filter or HMEF/HME

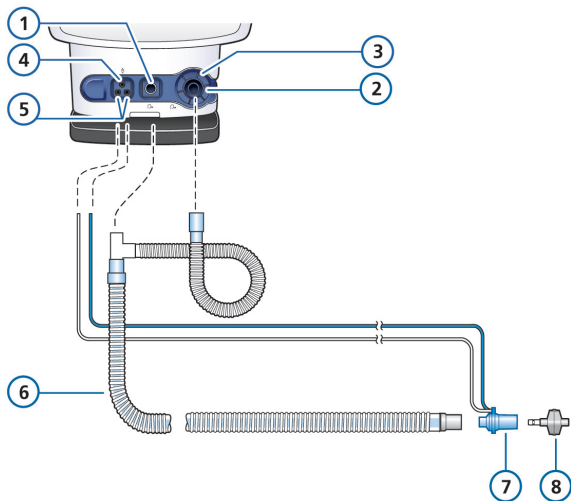


Installing the bacterial filter or HMEF/HME

To prevent patient or ventilator contamination, be sure to install a bacteria (inspiratory) filter **(1)** or HMEF/HME **(2)** between the patient and the inspiratory port.



2.3 Connecting a coaxial breathing circuit

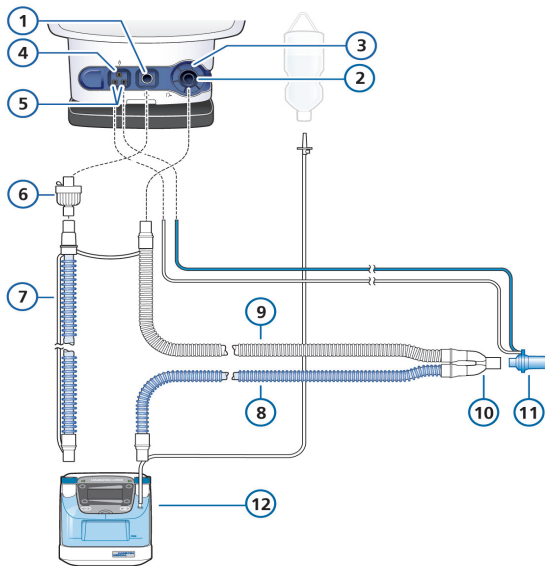


- 1 To patient
- 2 From patient
- 3 Expiratory valve
- 4 Nebulizer outlet
- 5 Flow sensor connectors
- 6 Coaxial inspiratory/expiratory limb
- 7 Flow sensor
- 8 HMEF/HME

Connect the breathing circuit to the inspiratory and expiratory ports **(1, 2)** and the flow sensor tubes to the flow sensor connectors **(5)**.

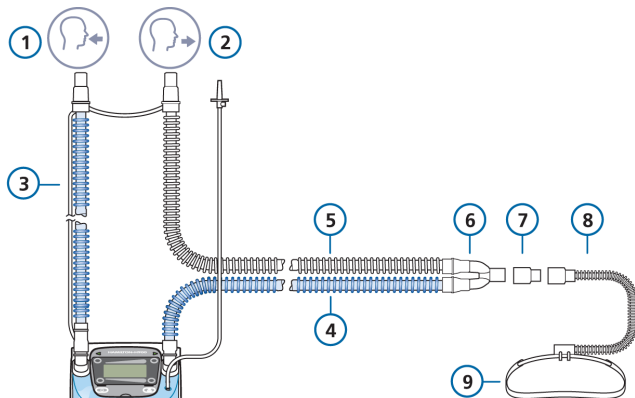
Use either a bacteria filter or a combined heat-moisture exchanger and filter (HMEF).

2.4 Connecting a dual limb circuit with humidifier



- 1 To patient
- 2 From patient
- 3 Expiratory valve
- 4 Nebulizer outlet
- 5 Flow sensor connectors
- 6 Bacteria filter
- 7 Inspiratory limb to humidifier
- 8 Heated inspiratory limb with temperature sensor to patient
- 9 Expiratory limb
- 10 Y-piece
- 11 Flow sensor
- 12 Humidifier

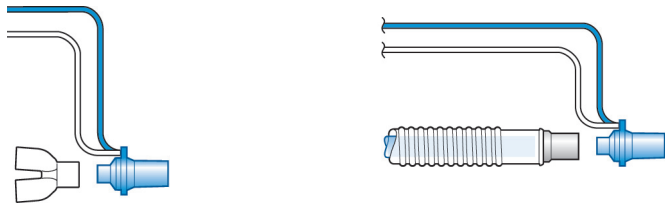
2.5 High flow oxygen therapy breathing circuit



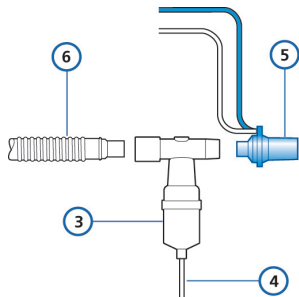
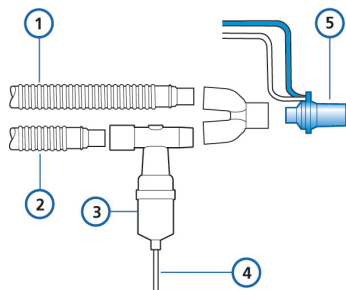
- 1 To patient
- 2 From patient
- 3 Inspiratory limb to humidifier
- 4 Heated inspiratory limb with temperature sensor to patient
- 5 Expiratory limb
- 6 Y-piece
- 7 Adapter
- 8 Nasal cannula
- 9 Attachment strap

Always use a nonocclusive interface and active humidification for high flow oxygen therapy.

2.6 Connecting an adult/pediatric flow sensor

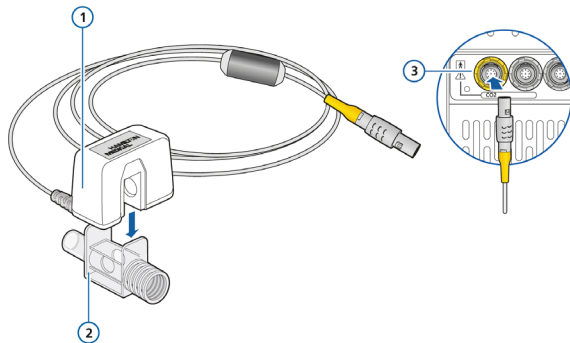


2.7 Connecting the internal pneumatic nebulizer



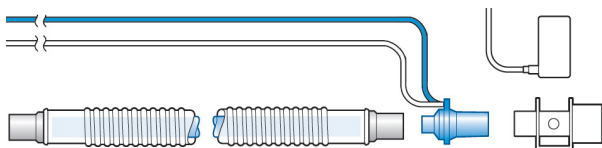
- 1 Expiratory limb
- 2 Inspiratory limb
- 3 Nebulizer
- 4 Nebulizer tube
- 5 Flow sensor
- 6 Coaxial breathing circuit

2.8 Connecting a CO2 mainstream sensor



Attaching the CO2 sensor to the airway adapter

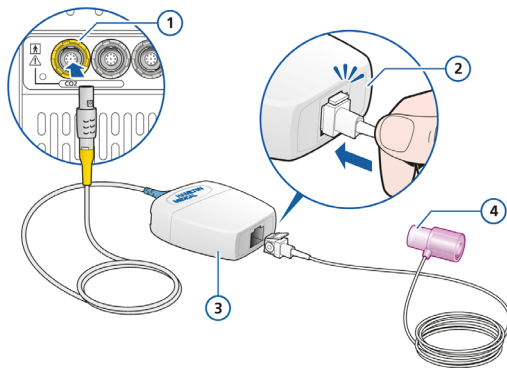
- 1 CO2 sensor
- 2 Airway adapter
- 3 Connect to CO2 port on ventilator



Connecting the CO2 sensor/airway adapter to the patient circuit

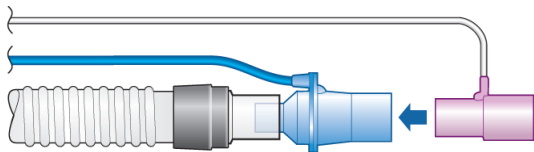
You can connect the CO2 sensor before or after the flow sensor according to your institution's protocol.

2.9 Connecting a CO2 sidestream sensor



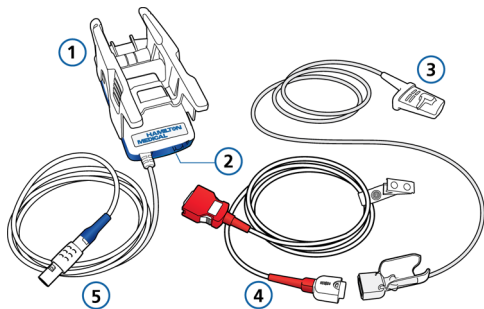
Inserting the sample cell into the CO2 module

- 1 Connect to CO2 port on ventilator
- 2 Sample cell clicks into place
- 3 LoFlow sidestream CO2 module
- 4 Airway adapter



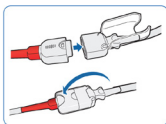
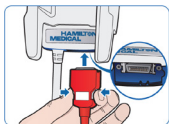
Connecting the CO2 airway adapter to the patient circuit

2.10 Connecting a Masimo SET SpO2 monitor



Masimo SET pulse oximeter components

- 1 Adapter, which contains the oximeter hardware
- 2 Cable connection ports
- 3 Sensor and cable
- 4 Patient cable (connects to adapter and sensor)
- 5 Adapter cable (connects the adapter to SpO2 connector on ventilator)

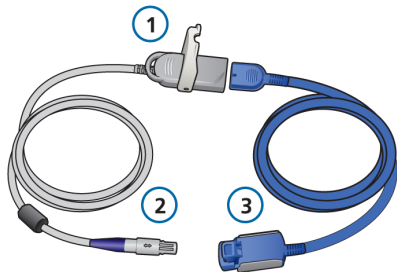


To connect the cables

- ▶ Connect the cables as shown.

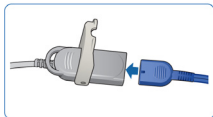
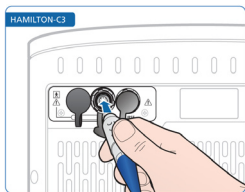
Not all options are available in all markets.

2.11 Connecting a Nihon Kohden SpO2 monitor



Nihon Kohden SET pulse oximeter components

- 1 Adapter, which contains the oximeter hardware
- 2 Adapter cable (connects the adapter to SpO2 connector on ventilator)
- 3 Sensor and sensor cable

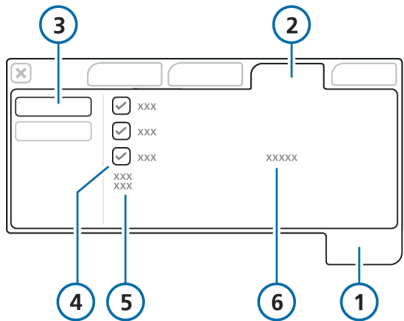


To connect the cables

- ▶ Connect the cables as shown.

Not all options are available in all markets.

2.12 Enabling O2, CO2, and SpO2 monitoring



- 1 System
- 2 Sensors
- 3 Sensors on/off
- 4 Sensor options (O2, CO2 and SpO2)
- 5 Sensor status
- 6 Sensor type

To enable CO2 / SpO2 monitoring

- 1 Open the System > Sensors > On/off window.
- 2 Select the O2, CO2, and/or SpO2 checkboxes to enable/disable the monitoring functions.

The ventilator always enables O2 monitoring upon restart.

3. Tests and calibrations

3.1 Running the preoperational check

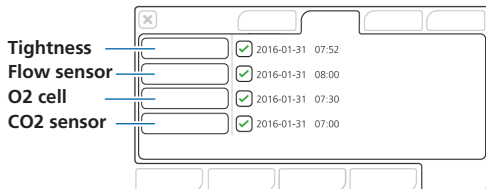
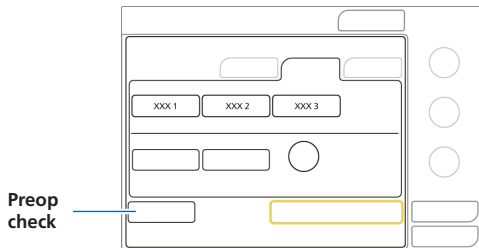
To perform the preoperational check

- 1 Connect ventilator to AC or DC power and an oxygen supply.
- 2 Assemble the patient breathing circuit.
- 3 Turn on power.

During start up, the ventilator runs a self-test and displays the Standby window. The preoperational check consists of four tests/calibrations. Only use the ventilator once it passes the preoperational check.

To perform the tightness test

- 1 Touch **Preop check** in the Standby window. The System > Tests & calib window opens.
- 2 Touch the **Tightness** button to perform the tightness test.



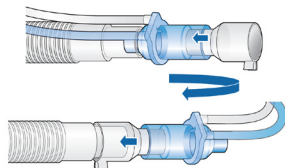
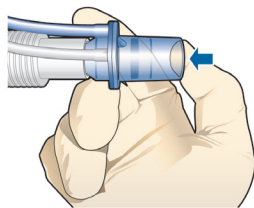
- 3 When prompted, block the patient end of the breathing circuit. Hold until prompted.

Pass ✓ or fail ✗ and date/time of completed test are displayed.

To calibrate the flow sensor

- 1 Touch the **Flow Sensor** button to calibrate the flow sensor.
- 2 When prompted, turn the flow sensor and connect to Y-piece using the calibration adapter. Calibration starts automatically.
- 3 When prompted, turn the flow sensor again and remove the calibration adapter. Calibration continues automatically.

Pass ✓ or fail ✗ and date/time of completed test are displayed.



To calibrate the O2 sensor

Perform the O2 sensor calibration if you insert a new oxygen cell, if prompted by **✗** next to the **O2 test** button, or after an O2 measurement alarm. If possible, calibrate the O2 cell using 100% oxygen.

- ▶ Touch the **O2 test** button to run the O2 sensor calibration.
If O2 cell calibration needed alarm is active, repeat O2 calibration once device has warmed up (after 30 minutes).

Pass **✓** or fail **✗** and date/time of completed test are displayed.

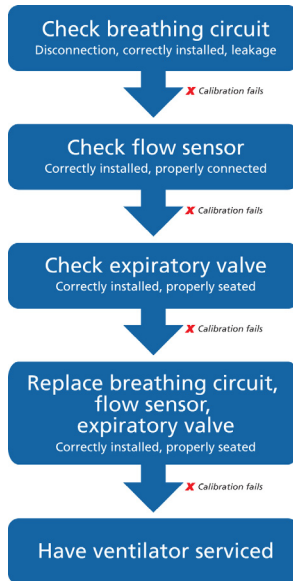
To perform the Loss of external power alarm test

Generate an alarm to check that the ventilator's alarms are working correctly.

- 1 Ensure the ventilator is connected to AC power.
- 2 Disconnect the power cord.
- 3 Verify that the Loss of external power alarm is generated and that the ventilator is powered by its backup battery.
- 4 Reconnect the ventilator to AC power.
- 5 Verify that the alarm resets and that the ventilator is again powered by AC.

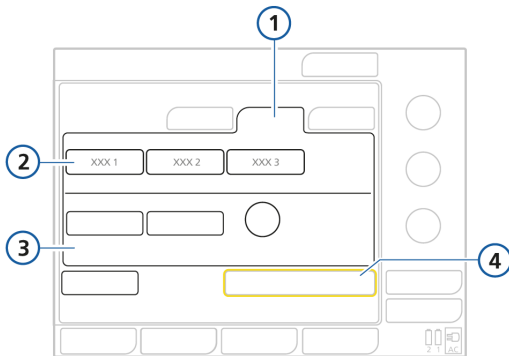
The HAMILTON-C3 is ready to ventilate **✓**.

3.2 If the preoperational check fails



4. Ventilating a patient

4.1 Using Quick Setup



- 1 Patient group
- 2 Quick Setup buttons
- 3 Gender and patient height
- 4 Start ventilation

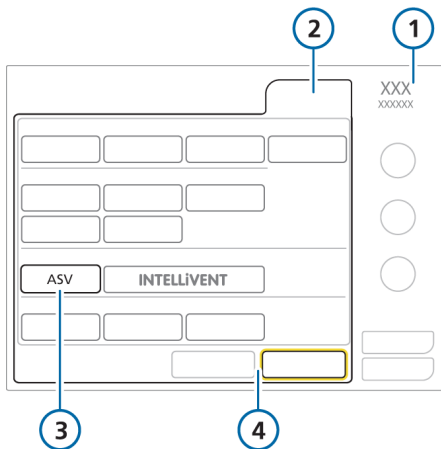
The HAMILTON-C3 has three different Quick setup buttons per patient group. Mode, mode control settings, graphic selections, alarm settings, Vent Status panel settings, and Vt/IBW are automatically applied when a Quick setup is selected in the Standby window.

Settings can be configured in advance according to your institution's standard protocols. Once configured, you can start ventilation in six easy steps.

To start ventilation using Quick Setup buttons

- 1** Touch one of the three Quick Setup buttons.
- 2** Touch **Male** or **Female**.
- 3** Touch **Pat. Height** and adjust patient height.
The ventilator uses patient height and gender to calculate the ideal body weight (IBW). IBW is used to determine several startup settings, safety settings, and backup ventilation. (see page 29).
- 4** If required, touch the **Modes** tab to change ventilation mode.
- 5** Review control and alarm settings.
- 6** Touch **Start ventilation**.

4.2 Selecting modes

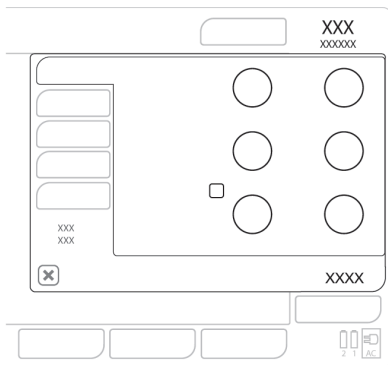


- 1 Active mode
- 2 Modes
- 3 New mode to apply
- 4 Cancel and Confirm buttons

To change the mode

- 1 Select the desired ventilation mode.
- 2 Touch **Confirm** to select the mode and display the control settings for the selected mode.
- 3 Adjust controls as required, and touch **Confirm**.

4.3 Adjusting controls



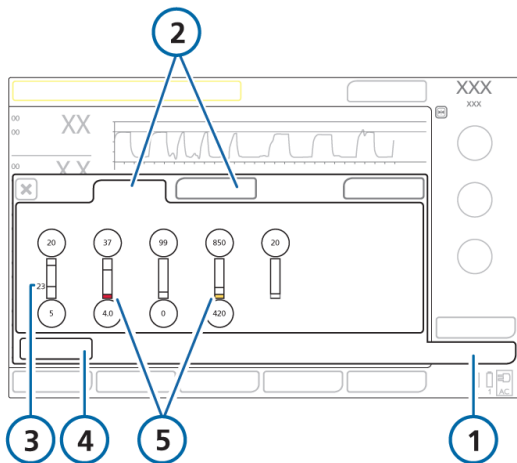
To adjust controls

- 1 Touch the control to adjust.
The control button turns orange.
- 2 Use the P&T knob to change to the desired setting.
- 3 Confirm changes to the setting by touching the control again or by pressing the P&T knob.
The control button turns blue.
Confirm changes before modifying another control.

The following parameters are set based on ideal body weight (IBW): Vt, Rate, Thigh, Tlow, TI, ExpMinVol, and Vt alarm limits. The ventilator uses the Vt/IBW setting to set the initial delivered Vt in volume-controlled modes.

See the glossary of control parameters on page 36.

4.4 Adjusting alarm limits



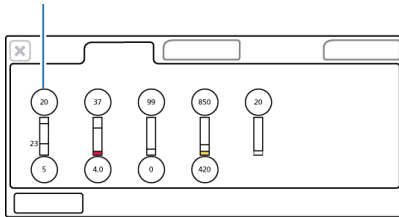
- 1 Alarms
- 2 Limits 1, 2
- 3 Current monitored value
- 4 **Auto** button
- 5 Red or yellow bar (depending on alarm priority) indicates the monitored value is out of range

Changing the High pressure and VT high alarm settings may affect ventilation. See next page.

High pressure alarm

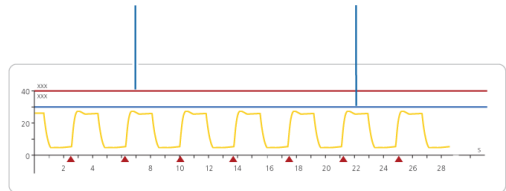
The High pressure alarm automatically sets the pressure limit 10 cmH₂O below the P_{max} alarm setting. Changing the P_{max} pressure alarm limit also changes the maximum pressure applied by the ventilator.

High pressure alarm limit



P_{max} high pressure alarm setting

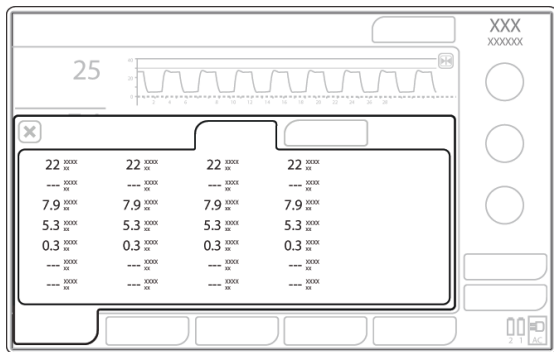
Pressure limit



VT high alarm

Inspiratory volume is limited to 1.5 times the set VT high alarm limit. Changing the VT high alarm may limit the inspiratory volume. Volume limitation is disabled in noninvasive modes.

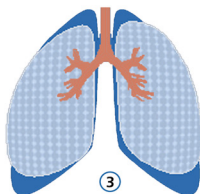
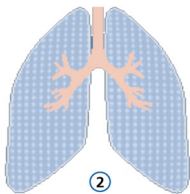
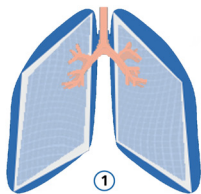
5. Monitoring patient data



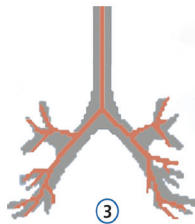
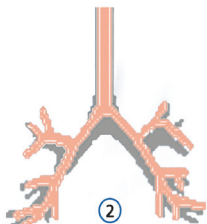
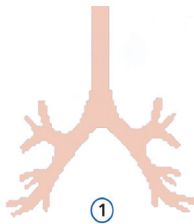
- ▶ Touch the **Monitoring** button to access patient data.

5.1 Monitoring patient data using the dynamic lung

The dynamic lung shows compliance (C_{stat}) and resistance (R_{insp}) breath-by-breath relative to "normal" values for the patient's height.

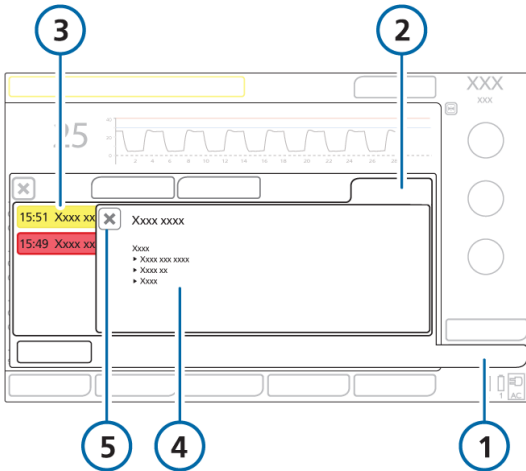


- 1 Low compliance
- 2 Normal compliance
- 3 High compliance



- 1 Normal resistance
- 2 Moderately high resistance
- 3 High resistance

6. On-screen help for alarms



- 1 Alarms
- 2 Buffer
- 3 Selected alarm
- 4 Alarm text and troubleshooting information
- 5 Close the help window

6.1 Accessing on-screen help for alarms

Troubleshooting help is available for the device alarms.

To view the on-screen help for an alarm

- 1** Touch the alarm message in the buffer.
A help window appears in the buffer, providing troubleshooting information for the selected alarm.
- 2** To view help for another alarm, touch the next alarm message.
The contents of the help window refresh with the new information.
The alarm is displayed as long as the window is open even if the alarm is no longer active.
- 3** Touch **X** to close the help window.

7. Glossary of control parameters

Parameter	Definition
Apnea Backup	A function that provides ventilation after the adjustable apnea time passes without breath attempts. If Automatic is enabled, control parameters are calculated based on the patient's IBW.
ETS	Expiratory trigger sensitivity. The percentage of peak inspiratory flow at which the ventilator cycles from inspiration to exhalation.
Flow	In high flow oxygen therapy, Flow is the continuous and constant flow of medical gas to the patient, in liters per minute.
Flow pattern	Flow pattern for gas delivery. Applies to volume-controlled mandatory breaths.
Flow trigger	The patient's inspiratory flow that triggers the ventilator to deliver a breath.
Gender	Sex of patient. Used to compute ideal body weight (IBW) for adults and pediatrics.
I:E	Ratio of inspiratory time to expiratory time. Applies to mandatory breaths, when the device is configured in this way.
%MinVol	Percentage of minute volume to be delivered in ASV mode. The ventilator uses the %MinVol, Pat. height, and Gender settings to calculate the target minute ventilation.
Oxygen	Oxygen concentration to be delivered.
Pasvlimit	The maximum pressure to apply in ASV mode. Changing Pasvlimit or the Pressure alarm limit automatically changes the other: The Pressure alarm limit is always 10 cmH ₂ O greater than Pasvlimit.

Glossary of control parameters

Parameter	Definition
Pat. height	Patient height. It determines the ideal body weight (IBW), which is used in calculations for ASV and startup settings for adult and pediatric patients.
Pause	Inspiratory pause or plateau, as a percentage of total breath cycle time. Applies to volume-controlled mandatory breaths, when the device is configured in this way.
Pcontrol	The pressure additional to PEEP/CPAP.
Peak flow	Peak (maximum) inspiratory flow. Applies to volume-controlled mandatory breaths, when the device is configured in this way.
PEEP/CPAP	Positive end expiratory pressure.
P high	The high pressure setting in APRV and DuoPAP modes. Absolute pressure, including PEEP.
Pinsp	Pressure (additional to PEEP/CPAP) to apply during the inspiratory phase. Applies in PSIMV+, PSync and NIV-ST.
P low	The low pressure setting in APRV.
P-ramp	Pressure ramp. Time required for inspiratory pressure to rise to the set (target) pressure.
Pressure Trigger	The drop in airway pressure when the patient tries to inhale triggers the ventilator to deliver a breath.

Glossary of control parameters

Parameter	Definition
Psupport	Pressure support for spontaneous breaths in SPONT, NIV, and SIMV+ modes.
Rate	Respiratory frequency or number of breaths per minute.
Sigh	Breaths delivered at a regular interval (every 50 breaths) at a pressure up to 10 cmH ₂ O higher than non-sigh breaths, as allowed by the Pressure alarm limit.
T high	Length of time at the higher pressure level, P high, in DuoPAP and APRV modes.
TI	Inspiratory time, the time to deliver the required gas (time to reach the operator-set Vt or Pcontrol value). Used with Rate to set the breath cycle time.
TI max	Maximum inspiratory time for flow-cycled breaths in NIV, NIV-ST, and SPONT.
Tip	Inspiratory pause or plateau time. Applies to volume-controlled mandatory breaths, when the device is configured in this way.
T low	Length of time at the lower pressure level, P low, in APRV mode.
Vt	Tidal volume delivered during inspiration in (S)CMV+ and SIMV+ modes.

PN 624900/00



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