HAMILTON-G5/S1

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 nor the content of the ventilator *Operator's Manual*, which should always be available when using the ventilator.

Some functions are optional and are not available in all markets.
The HAMILTON-S1 is not available in all markets.
Some features are optional on the HAMILTON-G5.

The graphics shown in this guide may not exactly match what you see in your environment.

HAMILTON-G5/S1 v2.8x
2018-07-20

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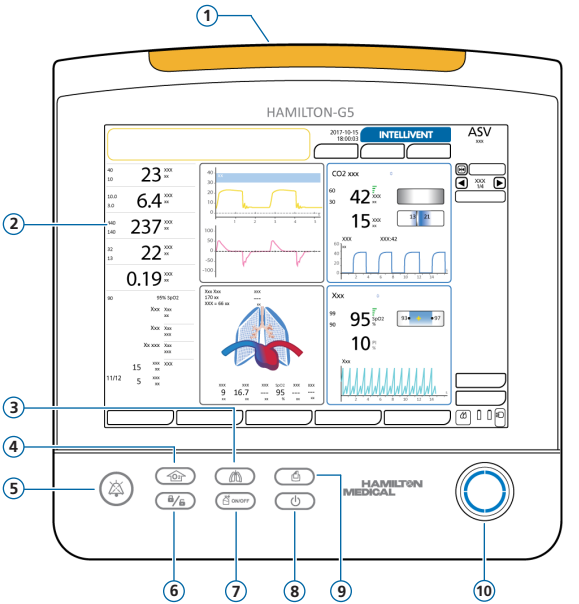
1. HAMILTON-G5/S1 basics

1.1 Monitor



1 **Lamp.** Lights when an alarm is active.*
Red = high priority. Yellow = medium or low priority

2 **Touch screen**

3 **Manual breath key.** Delivers a mandatory breath.

4 **O2 enrichment key.** Delivers a specified amount above the current oxygen setting for a set time. Also used for suctioning.

5 **Audio Pause key.** Pauses (silences) the audible alarm for 2 minutes.** Press the key again to cancel the Audio Pause.

6 **Screen lock/unlock key.** Disables/enables the touch screen (for example, for cleaning).

7 **Nebulizer on/off key.** Activates nebulization during the specified breath phase(s) for a configured duration.

8 **Standby key.** Press to enter or exit Standby.

9 **Print screen key.** Saves a JPG of the current display to a connected storage device.

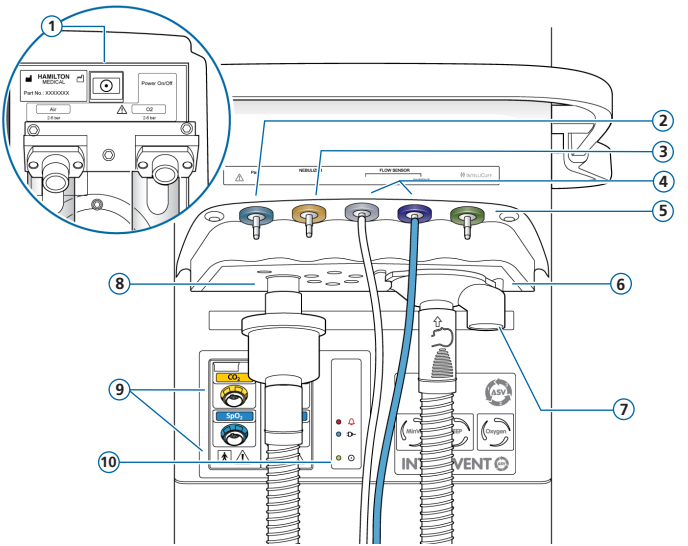
10 **Press-and-turn (P&T) knob.** Selects and adjusts settings.

* When heliox is selected, the alarm lamp is always lit blue. If an alarm is generated, the alarm lamp alternates between blue and red/yellow, depending on the alarm priority.

** When global AUDIO OFF is activated, use the Audio Pause key to enable/disable silencing alarms at the ventilator. For details, see the ventilator *Operator's Manual*.

1. HAMILTON-G5/S1 basics

1.2 Ventilator connections



1 **Power button** (back of ventilator)

2 **Paux (Pes) port.** Allows you to use pressure readings other than airway pressure (Paw), for example, from an esophageal balloon catheter, for monitoring purposes. Transpulmonary pressure is also calculated using a combination of the Paw and Pes pressures.

3 **Pneumatic nebulizer port**

4 **Flow sensor connection ports.** Always attach the blue tube to the blue connector and the clear tube to the silver connector.

5 **IntelliCuff port.** (Optional) Dedicated connection port for IntelliCuff.

6 ***From patient* expiratory port.** Connect the expiratory valve set and expiratory limb of the breathing circuit.

7 **Expiratory valve set**

8 ***To patient* inspiratory port.** Connect the inspiratory limb of the breathing circuit and an inspiratory (bacteria) filter.

9 **CO2, SpO2, Aerogen, HAMILTON-H900 modules** (Optional)

10 **Status indicators.** Ventilator status, as follows:

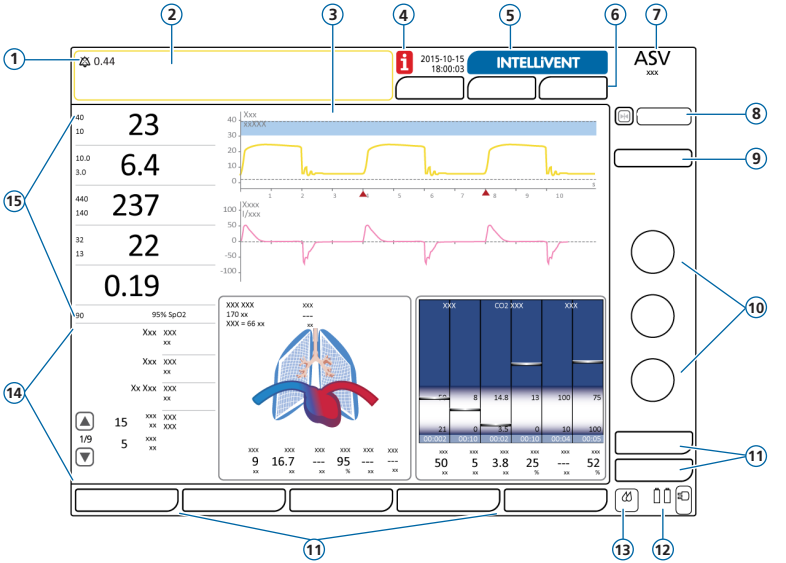
Alarm indicator. Red when an alarm is active.

Power status indicator. Blue when plugged into primary power.

Power indicator. Green when ventilator is turned on.

1. HAMILTON-G5/S1 basics

1.3 Main display



1 **Audio indicator.** Shows that Audio Pause is enabled and how much time remains before the audible alarm sounds. (When global AUDIO OFF is activated, the message bar shows other messages; see *Operator's Manual*.)

2 **Message bar.** Displays alarms and other messages. Touch the message to open the Alarms > Buffer window.

3 **Graphic panels.** Real-time waveforms, loops, trends, Intelligent panels. Touch graphic to change display.

4 **i-icon.** Displayed when there are unreviewed alarms. Touch the icon to display alarm information.

5 **INTELLiVENT-ASV button.** (Optional) Access INTELLiVENT®-ASV® settings and controls.

6 **Patient, Additions, Modes buttons.** Access to patient settings, ventilation timer, TRC/Sigh, and modes.

7 **Active mode and selected patient group**

8 **Freeze (left) and Trend (right) buttons.** Briefly freeze graphic/trend displays to review measurements.

9 **IntelliCuff button.** (Optional) Access IntelliCuff settings.

10 Frequently used **Controls** for the active mode (a subset of those in the Controls window).

11 **Window buttons.** Access ventilator settings windows (Monitoring, Graphics, Tools, Events, System, Alarms, Controls).

12 **Power source.** Shows the active and available power sources.

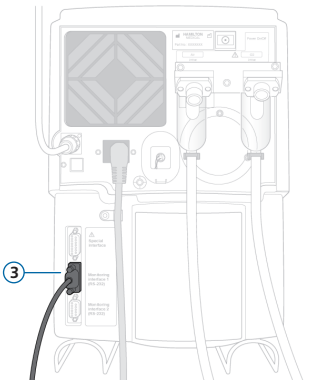
13 **Humidifier quick access icon.** (Optional) Access the System > Humidifier window.

14 **Secondary monitoring parameters (SMPs).** Touch the arrows to scroll through SMP data.

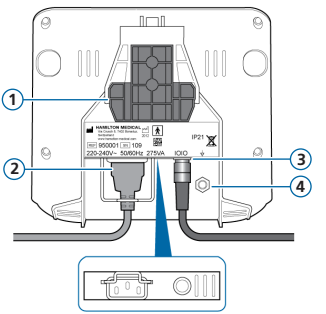
15 **Main monitoring parameters (MMPs).** Configurable monitoring data, shown with upper and lower alarm limits, when applicable.

2. Setting up the ventilator

2.1 Connecting a humidifier (optional)



Back/bottom of HAMILTON-H900 humidifier



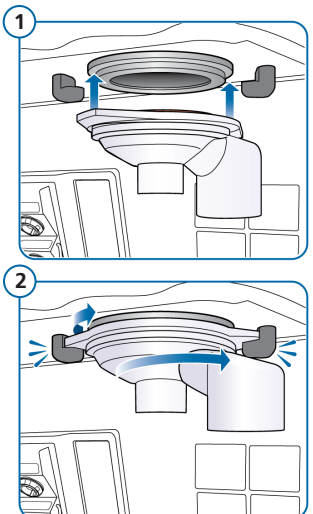
1. Mounting bracket
2. HAMILTON-H900 power cord
3. COM port and communication cable
4. Potential equalization conductor

If using a HAMILTON-H900 humidifier, operation of the humidifier is integrated with the ventilator.*

* Not available in all markets.

2. Setting up the ventilator

2.2 Assembly/installation of expiratory valve set

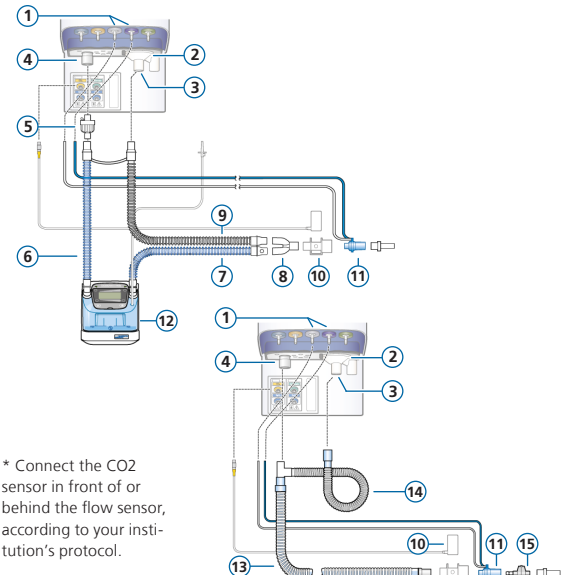


To install the expiratory valve set

1. Position the housing into the expiratory port (**1**).
2. Twist clockwise until it locks into place (**2**).

2. Setting up the ventilator

2.3 Connecting a breathing circuit (humidification/HMEF)

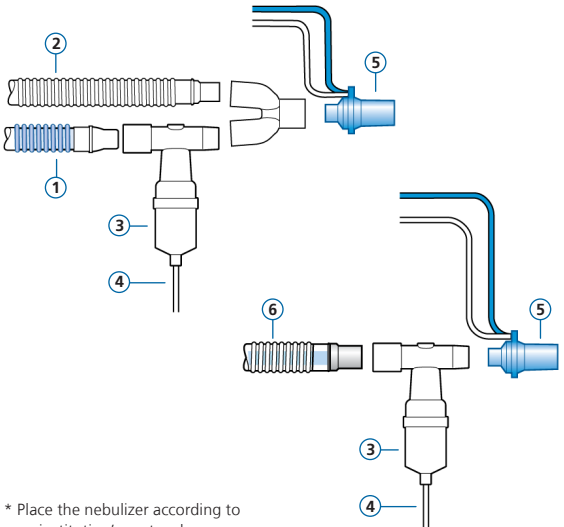


* Connect the CO2 sensor in front of or behind the flow sensor, according to your institution's protocol.

1. Flow sensor connection ports
2. *From patient* expiratory port
3. Expiratory valve set
4. *To patient* inspiratory port
5. Inspiratory bacteria filter
6. Inspiratory limb to humidifier
7. Heated inspiratory limb with temperature sensor, to patient
8. Y-piece
9. Heated expiratory limb
10. CO2 sensor/adapter*
11. Flow sensor
12. Humidifier
13. Coaxial inspiratory/expiratory limb
14. Expiratory limb extension
15. HMEF

2. Setting up the ventilator

2.4 Connecting an internal pneumatic nebulizer (optional)



* Place the nebulizer according to your institution's protocol.

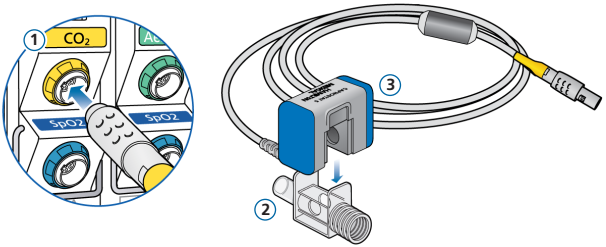
1. Inspiratory limb
2. Expiratory limb
3. Nebulizer (example)*
4. Connection tube to ventilator
5. Flow sensor
6. Coaxial breathing circuit

Inspiratory bacteria filter not shown.

For details about using an Aerogen nebulizer, see the *Aerogen Solo/Aerogen Pro Instructions for Use*.

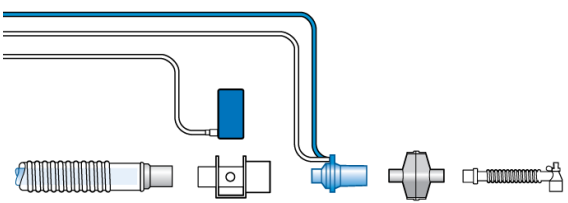
2. Setting up the ventilator

2.5 Connecting a mainstream CO2 sensor



Attaching the CO2 sensor to the airway adapter

1. Connect to CO2 module port on the ventilator
2. Airway adapter
3. CO2 sensor

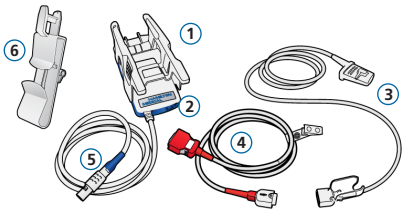


Connecting the CO2 sensor/ adapter* to the breathing circuit

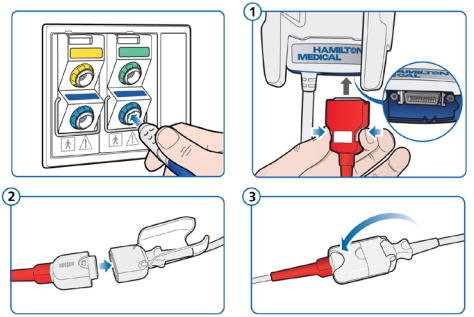
* Connect the CO2 sensor in front of or behind the flow sensor, according to your institution's protocol.

2. Setting up the ventilator

2.6 Connecting an SpO2 pulse oximeter (Masimo SET)



* Your cables may look different from those shown.



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 the SpO2 module port on the ventilator)
6. Sensor cable holder

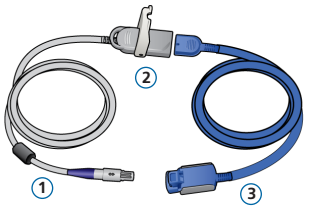
To connect the cables

▶ Connect the ventilator, patient, and sensor cables as shown.

Your cables may look different.

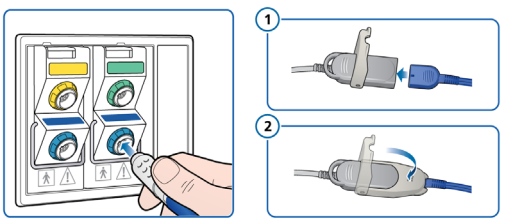
2. Setting up the ventilator

2.7 Connecting an SpO2 pulse oximeter (Nihon Kohden)



Nihon Kohden pulse oximeter components

1. Adapter cable (connects the adapter (**2**) to the SpO2 module port on the ventilator)
2. Adapter
3. Sensor and sensor cable

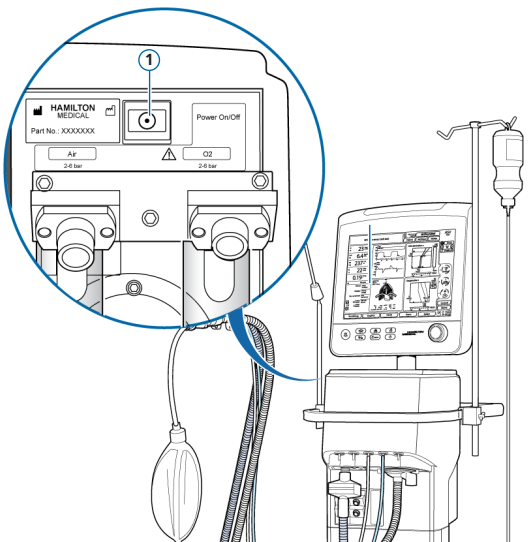


To connect the cables

- ▶ Connect the patient and sensor cables to the ventilator as shown.

2. Setting up the ventilator

2.8 Turning on the ventilator



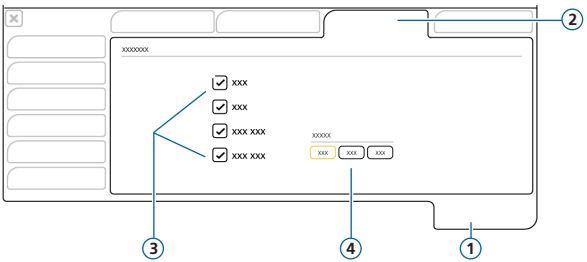
1. Connect ventilator to AC power and gas supply.
2. Assemble and connect the patient breathing circuit.
3. Press the **Power** button (**1**) on the rear of the ventilator.

The ventilator runs a self-test and, when complete, displays the Standby window.

Use the ventilator only if it passes all tests.

2. Setting up the ventilator

2.9 Enabling O2, CO2, and/or SpO2 monitoring



1. System
2. Sensors on/off
3. Sensor options (O2, CO2, SpO2)
4. Master sensor options* (when two SpO2 sensors connected)

To enable O2 / CO2 / SpO2 monitoring

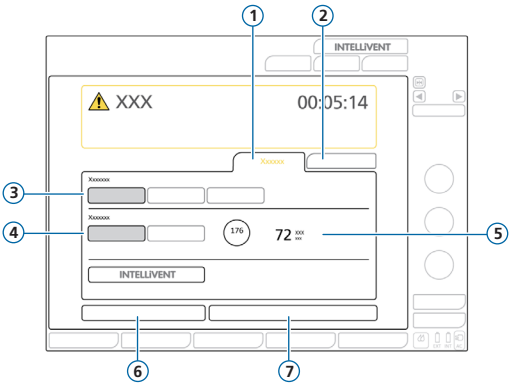
1. Touch **System > Sensors on/off**.
2. Select the **O2 sensor****, **CO2 sensor**, and/or **SpO2 sensor** checkboxes as required, and close the window.

   With Heliox, O2 monitoring cannot be disabled.

Note that these settings are generally set once; they do not need to be regularly reconfigured.

* Not available in all markets. ** By default, the O2 sensor is enabled.

3. Configuring settings for the patient



1. New patient
2. Last patient
3. Patient group: Adult, pediatric, neonatal
4. Gender
5. Patient height, calculated IBW for adult and pediatric patients
6. Preop check
7. Start ventilation

To select the patient group and specify patient data

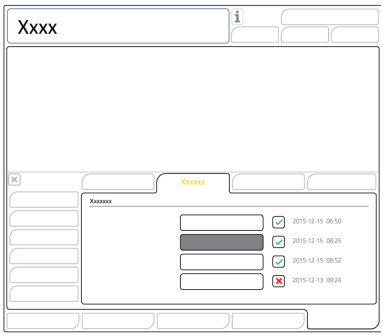
1. Touch **New patient** or **Last patient** (uses the last-specified settings).
2. Touch the desired patient group: **Adult**, **Pediatric**, or **Neonatal**.
3. If Adult or Pediatric, touch the patient gender and set the patient height. The device calculates the ideal body weight (IBW). If Neonatal, set the body weight.
4. Touch **Preop check** to perform the preoperational check.

4. Performing the preoperational check

4.1 Tightness test

Perform these steps disconnected from the patient.

Prompts are provided in the message bar.



Step one

1. Touch **Preop check** in the Standby window, or open the System > Tests & calib window.
2. Touch the **Tightness** button to perform the tightness test.
3. When prompted, block the patient end of the breathing circuit.
4. Hold until instructed to stop.

Pass ✔ or fail ✖ and date/time of completed test are displayed.

4. Performing the preoperational check

4.2 Calibrating the flow sensor

Step two

1. Touch the **Flow sensor** button to calibrate the flow sensor.

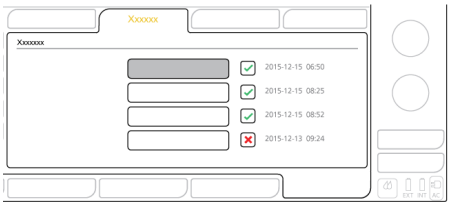
   Calibration starts automatically.

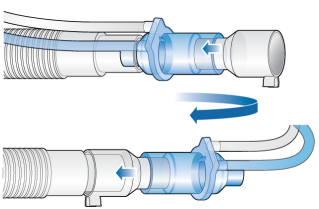
2. When prompted, attach the calibration adapter to the flow sensor and flip them 180° so the adapter is directly connected to the limb (as shown to the right).

   Calibration continues automatically.

3. When prompted, flip the flow sensor/adapter 180° again, so the flow sensor is directly connected to the limb, and remove the calibration adapter.

Pass ✔ or fail ✖ and date/time of completed test are displayed.





4. Performing the preoperational check

4.3 O2 sensor calibration, alarm tests

Step three

The paramagnetic O2 sensor does not require calibration.

1 If an ✖ is displayed next to O2 sensor, touch the **O2 sensor** button to calibrate the O2 sensor.

2 If the **O2 sensor calibration needed** alarm is generated, repeat the calibration.

Step four

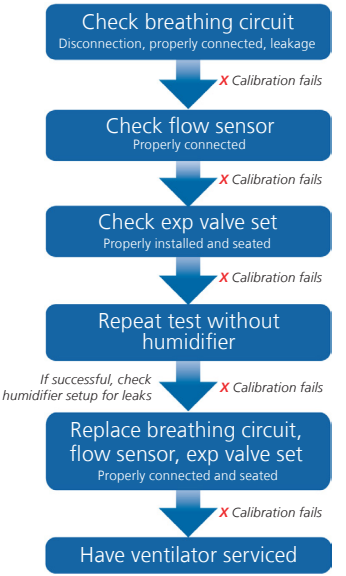
▶ Test the alarms to ensure proper operation. See the ventilator *Operator's Manual*.

If using a distributed alarm system (DAS), ensure the alarms are audible on the DAS monitoring device.

When calibration and tests are complete, the ventilator is ready for use.

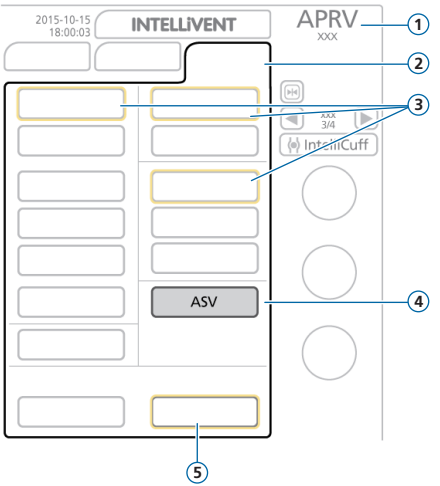
4. Performing the preoperational check

4.4 If the preoperational check fails



5. Configuring ventilation settings

5.1 Selecting a mode



1 Active mode and patient group
2 Mode button
3 Backup modes for active mode
4 New mode to apply
5 Confirm/Cancel buttons

To change the mode

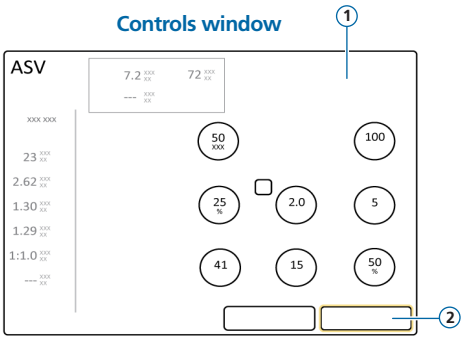
1 In the Modes window, touch the desired ventilation mode.
2 Touch **Confirm**.

The Controls window opens.

*The **Confirm/Cancel** buttons are only displayed when selecting a new mode.*

5. Configuring ventilation settings

5.2 Reviewing and adjusting mode controls



Adjust controls at any time during ventilation by touching **Controls**.

For details about control settings, see the ventilator *Operator's Manual*.

To adjust settings

1. Adjust control settings as needed.
2. Touch **Confirm**, if displayed.

The new mode becomes active.

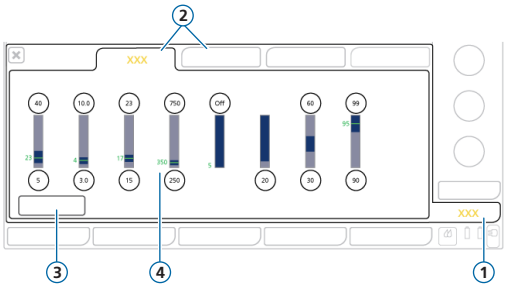
*The **Confirm/Cancel** buttons are only displayed when selecting a new mode.*

To start ventilating the patient

- Touch **Start ventilation** or the Standby key to start ventilating the patient.

5. Configuring ventilation settings

5.3 Reviewing and adjusting alarm limits



1 Alarms
2 Limits 1, 2
3 **Auto** button
4 Current monitored value

To review alarms

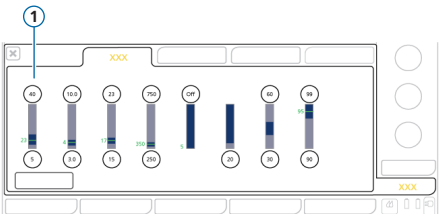
1 Touch **Alarms** (**1**).
The Alarms > Limits 1 window opens.
2 Set alarm limits as appropriate.

Changing the high Pressure alarm setting may affect ventilation. See next page.

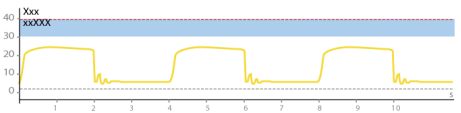
High pressure alarm

In APV, VS, and ASV modes, the ventilator uses the high **Pressure** alarm setting minus 10 cmH2O as a safety boundary for its inspiratory pressure adjustment, and does not exceed this value.

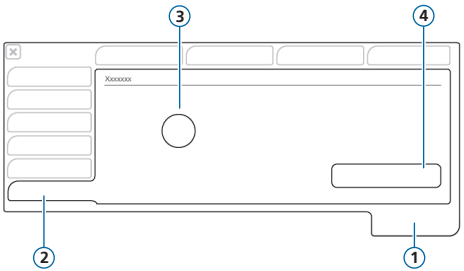
High Pressure alarm setting (**1**)

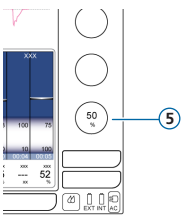


High Pressure alarm limit (**1**) (APV, VS, ASV modes)



6. Adjusting the oxygenation level for O2 enrichment





When using oxygen enrichment, you set the oxygen concentration to be delivered *in addition* to the current **Oxygen** setting.*

1. System
2. O2 enrichment tab
3. **Additional O2 for enrichment** control
4. **Restore** button
5. Current **Oxygen** setting

* Note that the maximum delivered oxygen concentration will not exceed 100%. If the sum of the two settings is greater than 100%, the device delivers 100%.

To change the O2 enrichment level

1. Before proceeding:
   - Decide on the total oxygen to deliver during enrichment.
   - Note the current **Oxygen** setting.
2. Open the System > O2 enrichment window.
3. Touch the **Additional O2 for enrichment** control and set it to the difference between your current **Oxygen** setting and the desired enrichment level.

   Note that you cannot change this setting while O2 enrichment is in progress.

During O2 enrichment, the sum of this control setting and the current **Oxygen** setting is delivered.

To revert to the default setting

▶ In the System > O2 enrichment window, touch **Restore**.

The **Additional O2 for enrichment** setting is reset to the configured default**.

Example

Current **Oxygen** setting: **50%**

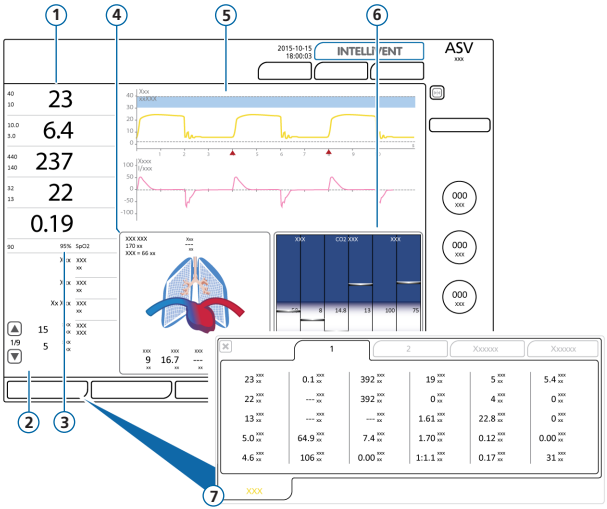
Additional O2 for enrichment setting: **40%**

When you perform O2 enrichment by pressing the **O2 enrichment** key, the ventilator increases the delivered oxygen to **90%** for two minutes.

* Setting configured at your site, or if not changed, the factory default setting: Adult/Pediatric: 79%, Neonatal: 10%

7. Monitoring the patient

7.1 Reviewing patient data

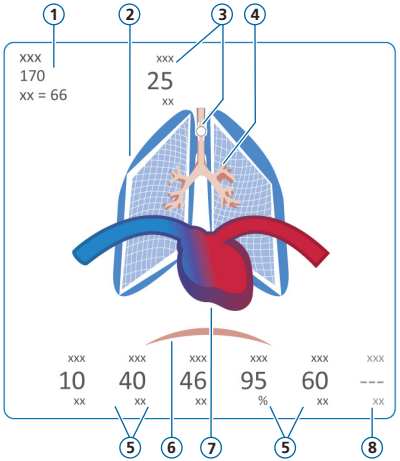


1. Main monitoring parameters (MMP), configurable
2. Secondary monitoring parameters (SMPs), multiple panels
3. SpO2 (when enabled)
4. Dynamic Lung panel
5. Waveforms, configurable
6. Vent Status panel
7. Monitoring window, shows all available monitoring data

The main display provides an at-a-glance overview of the patient's data.

7. Monitoring the patient

7.2 The Dynamic Lung



1 Sex, height, IBW
2 Real-time representation of lung compliance
3 Cuff indicator (shows ETT cuff pressure)*
4 Real-time representation of airway resistance
5 Parameter values
6 Patient trigger (diaphragm)
7 Heart and pulse display**
8 PVI (Masimo only) or HLI (Nihon Kohden only, if enabled)

Visualizes in real-time:

Tidal volume, lung compliance, resistance, patient triggering, heart rate, cuff pressure

The lungs expand and contract in synchrony with patient breaths.

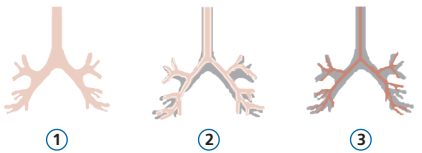
When all values are within the specified ranges, the panel is framed in green.

* *When IntelliCuff connected*

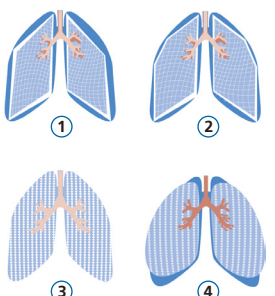
** *When SpO2 activated and sensor connected*

7. Monitoring the patient

7.3 Dynamic Lung: resistance, compliance display



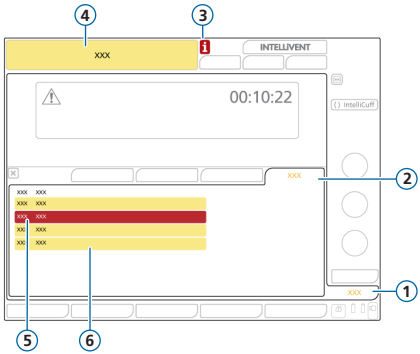
1. Normal resistance
2. Moderately high resistance
3. High resistance



1. Very low compliance
2. Low compliance
3. Normal compliance
4. High compliance

7. Monitoring the patient

7.4 Reviewing alarms



1. Alarms
2. Buffer
3. i-icon (not displayed when alarms have been reviewed)
4. Message bar with alarm
5. High-priority alarm (red)
6. Medium- or low-priority alarm (yellow)

The *alarm buffer* displays *active* alarms. Active alarm messages also alternate in the message bar.

To review active alarms

Do one of the following:

- Touch the message bar
- Touch **Alarms > Buffer**

The Events > Alarms window displays all previous (now inactive) alarms.

To review previous (inactive) alarms

Do one of the following:

- Touch the i-icon
- Touch **Events > Alarms**

8. Ventilation modes

Mode	Description
(S)CMV	*Synchronized controlled mandatory ventilation.* Breaths are mandatory and volume controlled, including patient-triggered breaths.
SIMV	*Synchronized intermittent mandatory ventilation.* Breaths are mandatory, volume controlled, with constant flow and rate, which can be alternated with pressure-supported spontaneous breaths.
VS	Volume Support. Breaths are volume targeted, pressure regulated, variable flow, and flow cycled, and deliver a set tidal volume to support patient-initiated breaths.
APVcmv	*Adaptive pressure ventilation with controlled mandatory ventilation.* Breaths are mandatory, volume targeted, pressure regulated, variable flow, and time cycled.
APVsimv	*Adaptive pressure ventilation with synchronized intermittent mandatory ventilation.* Volume-targeted mandatory breaths can be alternated with pressure-supported spontaneous breaths.
P-CMV	*Pressure-controlled ventilation.* Breaths are pressure controlled and mandatory.
P-SIMV	*Pressure-controlled synchronized intermittent mandatory ventilation.* Mandatory breaths are pressure controlled. Mandatory breaths can be alternated with pressure-supported spontaneous breaths.
DuoPAP	*Duo positive airway pressure.* Mandatory breaths are pressure controlled. Spontaneous breaths can be triggered at both pressure levels. Rate and inspiratory time is set.
APRV	*Airway pressure release ventilation.* Spontaneous breaths can be continuously triggered. The pressure release between the levels contributes to ventilation. **T high** and **T low** settings determine the rate.
SPONT	*Spontaneous mode.* Every breath is spontaneous, with or without pressure-supported spontaneous breaths.

Mode	Description
ASV	*Adaptive support ventilation.* Operator sets %MinVol, PEEP, and Oxygen. Frequency, tidal volume, pressure, and I:E ratio are based on physiological input from the patient.
INTELLiVENT-ASV	Fully automated management of ventilation and oxygenation based on physiological input from the patient and operator settings. The underlying mode is ASV.
NIV	*Noninvasive ventilation.* Every breath is spontaneous.
NIV-ST	*Spontaneous/timed noninvasive ventilation.* Every breath is spontaneous as long as the patient is breathing above the set rate. A backup rate can be set for mandatory breaths.
Hi Flow O2	*High flow oxygen therapy.* No supported breaths.*
nCPAP-PS	*Neonatal only mode.* Nasal continuous positive airway pressure. Every breath is spontaneous as long as the patient is breathing above the set rate. A backup rate can be set for mandatory breaths.

Additional information is available in the ventilator *Operator's Manual*.

* Not available in all markets.

9. Monitoring parameters (ventilator)

Parameter	Description
AutoPEEP	The difference between the set PEEP and the calculated total **PEEP** within the lungs. **AutoPEEP** is the abnormal pressure generated by air "trapped" in the alveoli due to inadequate lung emptying. Ideally, it should be zero. AutoPEEP is calculated using the LSF method applied to the entire breath.
Driving pressure	A calculated value showing the ratio of tidal volume to static compliance, which reflects the difference between **Pplateau** and total **PEEP**.
Paux	Auxiliary pressure. Measured at the Paux port, this allows to use pressure readings other than airway pressure, for example, from an esophageal balloon catheter.
PEEP/CPAP	Monitored **PEEP/CPAP**. The airway pressure at the end of exhalation. Measured **PEEP/CPAP** may differ slightly from the set value, especially in spontaneously breathing patients.
Pinsp	Inspiratory pressure, the automatically calculated target pressure (additional to **PEEP**) applied during the inspiratory phase.
Pmean	Mean airway pressure. The absolute pressure, averaged over the breath cycle.
Pminimum	Minimum airway pressure of the previous breath cycle.
Ppeak	Peak airway pressure. The highest pressure during the previous breath cycle. It is influenced by airway resistance and compliance. **Ppeak** may differ noticeably from alveolar pressure if airway resistance is high. This value is always displayed.
Pplateau	Plateau or end-inspiratory pressure. The pressure measured at the end of inspiration when flow is at or close to zero. Used as a rough representation of alveolar pressure. **Pplateau** is displayed for mandatory and time-cycled breaths.
Ptrans E	The arithmetic mean value of **Ptranspulm** over the last 100 ms of the last expiration.
Ptrans I	The arithmetic mean value of **Ptranspulm** over the last 100 ms of the last inspiration.

Parameter	Description
Flow	The set flow of gas to the patient in high flow oxygen therapy mode.
Exp Flow	Peak expiratory flow.
Insp Flow	Peak inspiratory flow, spontaneous or mandatory. Measured every breath.
ExpMinVol/MinVol NIV	Expiratory minute volume. The moving average of the monitored expiratory volume per minute over the last 8 breaths. **ExpMinVol** changes to **MinVol NIV** in noninvasive modes. **MinVol NIV** is an adjusted parameter taking into account the leakage.
MVSpont/MVSpo NIV	Spontaneous expiratory minute volume. The moving average of the monitored expiratory volume per minute for spontaneous breaths, over the last 8 mandatory and spontaneous breaths. In noninvasive ventilation modes, **MVSpont** is replaced by **MVSpo NIV**. **MVSpo NIV** is an adjusted parameter taking into account the leakage.
VLeak/MVLeak	Due to the leakage at the patient interface, displayed exhaled volumes in the noninvasive modes can be substantially smaller than the delivered volumes. The flow sensor measures the delivered volume and the exhaled tidal volume; the ventilator displays the difference as **VLeak** in % or ml, and as **MVLeak** in l/min, averaged over the past 8 breaths.
VTE/VTE NIV	Expiratory tidal volume, the volume exhaled by the patient. If there is a gas leak on the patient side, the displayed **VTE** may be less than the tidal volume the patient actually receives.
VTESpont	Spontaneous expiratory tidal volume, the volume exhaled by the patient. Only displayed for spontaneous breaths.
VTI	Inspiratory tidal volume, the volume delivered to the patient, determined from the flow sensor measurement.
VT/IBW	Tidal volume is calculated according to ideal body weight (IBW) for adult/pediatric patients and according to the actual body weight for neonatal patients.
fSpont	Spontaneous breath frequency.

9. Monitoring parameters (ventilator)

Parameter	Description
fTotal	Total breathing frequency.
I:E	Inspiratory:expiratory ratio. Ratio of the patient's inspiratory time to expiratory time for every breath cycle. This includes both mandatory and spontaneous breaths. **I:E** may differ from the set **I:E** ratio if the patient breathes spontaneously.
TE	Expiratory time. In mandatory breaths, **TE** is measured from the start of exhalation until the set time has elapsed for the switch to inspiration. In spontaneous breaths, **TE** is measured from the start of exhalation, as dictated by the **ETS** setting, until the patient triggers the next inspiration. **TE** may differ from the set expiratory time if the patient breathes spontaneously.
TI	Inspiratory time. In mandatory breaths, **TI** is measured from the start of breath delivery until the set time has elapsed for the switch to exhalation. In spontaneous breaths, **TI** is measured from the patient trigger until the flow falls to the **ETS** setting for the switch to exhalation. **TI** may differ from the set inspiratory time if the patient breathes spontaneously.
Cstat	Static compliance of the respiratory system, including lung and chest wall compliances, calculated using the LSF method. **Cstat** can help diagnose changes in elastic characteristics of the patient's lungs.
IBW	Ideal body weight. A calculated value using height and sex, for adult and pediatric patients.
Oxygen	Oxygen concentration of the delivered gas.
P.01	Airway occlusion pressure. The pressure drop during the first 100 ms when a breath is triggered. **P0.1** indicates the patient's respiratory drive and patient inspiration effort. Applies to patient-triggered breaths.
PTP	Inspiratory pressure time product. **PTP** is valid for patient-initiated breaths only, and indicates work by the patient to trigger the breath.
RCexp	Expiratory time constant. The rate at which the lungs empty.

Parameter	Description
Rinsp	Resistance to inspiratory flow caused by the endotracheal tube and the patient's airways during inspiration.
RSB	Rapid shallow breathing index. The total breathing frequency (fTotal) divided by the exhaled tidal volume (VTE).
VariIndex	Variability index. The coefficient of variation of the Vt/TI index calculated from the last 100 breaths.
WOBimp	Work of breathing imposed by the inspiratory valve, tubing, and humidifier. It is airway pressure integrated over inspiratory volume until pressure exceeds the PEEP/CPAP level. In the dynamic pressure/volume loop, WOBimp is the area below PEEP/CPAP. This is created exclusively by the patient; thus WOBimp is valid for patient-initiated breaths only.
FetCO2	Fractional end-tidal CO2 concentration. Permits assessment of PaCO2 (arterial CO2). Note that it is inaccurate in pulmonary embolism.
PetCO2	End-tidal CO2 pressure. The maximum partial pressure of CO2 exhaled during a tidal breath (just before the start of inspiration). It represents the final portion of air that was involved in the exchange of gases in the alveolar area, thus providing a reliable index of CO2 partial pressure in the arterial blood under certain circumstances.

Additional monitoring parameters and information are available in the ventilator *Operator's Manual*.

10. Control parameters

Parameter	Description
Apnea Backup	A function that provides ventilation after the adjustable apnea time passes without breath attempts.
ETS	Expiratory trigger sensitivity. The percentage of peak inspiratory flow at which the ventilator cycles from inspiration to exhalation.
Flow	With 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.
I:E	Ratio of inspiratory time to expiratory time as determined by the control settings. Applies to mandatory breaths, when the device is configured in this way.
IntelliSync+	Dynamic update of inspiratory or cycling trigger. Optional.
%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.
P ASV limit	The maximum pressure to apply in ASV mode. Changing **P ASV limit** or the high **Pressure** alarm setting automatically changes the other. The upper **Pressure** alarm limit is always 10 cmH2O greater than **P ASV limit**.
Pat. height	Patient height. Used in calculation of 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.

Parameter	Description
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**.
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.
Psupport	Pressure support for spontaneous breaths.
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 cmH2O higher than non-sigh breaths, as allowed by the upper **Pressure** alarm setting.
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	Inspiratory time, the time to deliver gas for inspiration at the **Pcontrol** setting as a percentage of the total breath cycle. Used with **Rate** to set the breath cycle time.
TI max	Maximum inspiratory time for flow-cycled (pressure support) breaths.

10. Control parameters

Parameter	Description
Tip	Inspiratory pause or plateau time. Applies to volume-controlled mandatory breaths when the device is configured in this manner.
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 APVsimv modes.
Vtarget	Target tidal volume to be delivered during inspiration. The device meets **Vtarget** by adjusting the inspiratory pressure by 1 cmH2O per breath. Applies to breaths in APVcmv, APVsimv, and VS modes.

Additional control parameters and information are available in the ventilator *Operator's Manual*.

Notes

11. Ventilation mode comparison

Hamilton Medical	Puritan Bennett	Vyaire Medical	Maquet	GE	Philips	Dräger	
HAMILTON-G5	PB 840 / PB 980	Avea	Servo-I /-U	Carestation R860	Esprit/V200	Evita XL	Evita V500
ASV	--	--	--	--	--	--	--
INTELLiVENT-ASV	--	--	--	--	--	--	--
APVcmv	AC-VC+	PRVC-AC / Volume Guarantee (Neo)	PRVC	A/C PRVC	--	CMV with Auto Flow	VC-CMV with Auto Flow PC-VG
APVsimv	SIMV-VC+	PRVC-SIMV	SIMV (PRVC)	SIMV PRVC	--	SIMV with Auto Flow	VC-SIMV with Auto Flow/ PC SIMV-VG
P-CMV	A/C-PC	Pressure A/C	Pressure control	A/C PC	(PCV) AC	PCV+Assist	PC-AC
P-SIMV	SIMV-PC	Pressure SIMV	SIMV (Pressure control) + Pressure Support	SIMV-PC	(PCV) SIMV	PCV+PSupp	PC-SIMV
SPONT	SPONT, SPONT-PS	CPAP/PSV	PS/CPAP	CPAP/PSV	CPAP/PSV	CPAP/PSupp	SPN-CPAP/PS SPN-CPAP

Hamilton Medical	Puritan Bennett	Vyaire Medical	Maquet	GE	Philips	Dräger	
HAMILTON-G5	PB 840 / PB 980	Avea	Servo-I /-U	Carestation R860	Esprit/V200	Evita XL	Evita V500
APRV	BiLevel	APRV	Bi-vent/APRV	APRV	APRV	APRV	PC-APRV
DuoPAP	BiLevel	BiPhasic	Bi-vent/APRV	BiLevel BiLevel-VG	--	BIPAP	PC-BIPAP
(S)CMV	AC-VC	Volume A/C	Volume Control	AC/VC	(VCV) AC	CMV	VC-AC
SIMV	SIMV-VC	Volume SIMV	SIMV (Volume control) + Pressure Support	SIMV VC	(VCV) SIMV	SIMV	VC-SIMV
VS (Volume support)	Volume Support	--	Volume Support	VS	--	CMV with Auto Flow	SPN-CPAP/VS
NIV / NIV-ST	Spont - CPAP, PS, VS	--	NIV Pressure Support	NIV	NPPV, SPONT, SPONT/T	NIV	NIV, NIV-ST
nCPAP-PS *(Neo only)*	Spont - CPAP, PS, VS	Nasal CPAP/ IMV	Nasal CPAP	nCPAP	--	PSIMV+	SPN-CPAP PC CMV

Notes

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