

# HAMILTON-C6

## Technical specifications for SW version 1.1.x

### Ventilation modes

Mode form	Mode name	Mode	Adult/Ped	Neonatal
Volume-controlled, flow-controlled	(S)CMV	Breaths are volume controlled and mandatory, including patient triggered breaths.	✓	--
	SIMV	Volume controlled mandatory breaths can be alternated with pressure-supported spontaneous breaths.	✓	--
Volume-targeted, adaptive pressure- controlled	APVcmv / (S)CMV+	Breaths are volume targeted and mandatory.	✓	✓
	APVsimv / SIMV+	Volume-targeted mandatory breaths can be alternated with pressure-supported spontaneous breaths.	✓	✓
Pressure-controlled	PCV+	All breaths, whether triggered by the patient or the ventilator, are pressure controlled and mandatory.	✓	✓
	P-SIMV+	Mandatory breaths are pressure controlled. Mandatory breaths can be alternated with pressure-supported spontaneous breaths.	✓	✓
	DuoPAP	Mandatory breaths are pressure controlled. Spontaneous breaths can be triggered at both pressure levels.	✓	✓
	APRV	Spontaneous breaths can be continuously triggered. The pressure release between the levels contributes to ventilation.	✓	✓
	SPONT	Every breath is spontaneous, with or without pressure-supported spontaneous breaths.	✓	✓
Intelligent ventilation	ASV®	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. The underlying mode is ASV.	○	--
Noninvasive ventilation	NIV	Every breath is spontaneous.	✓	✓
	NIV-ST	Every breath is spontaneous as long as the patient is breathing above the set rate. A backup rate can be set for mandatory breaths.	✓	✓
	nCPAP-PS	Every breath is spontaneous as long as the patient is breathing above the set rate. A backup rate can be set for mandatory breaths.	--	○
Oxygen therapy	HiFlowO2	High flow oxygen therapy. No supported breaths.	○	○

Standard: ✓ Option: ○ Not applicable: --

## Standard configuration and options (in alphabetical order)

Functions	Adult / Ped	Neonatal
Capnography, mainstream (volumetric) and sidestream	O	O
Communication ports: Three COM ports, two USB ports, DVI, Nurse call	✓	✓
Communication protocols: for details see Connectivity brochure	✓	✓
Dynamic Lung (real-time visualization of the lungs)	✓	--
Event log (up to 10,000 events with date and time stamp)	✓	✓
HAMILTON-H900 humidifier control via ventilator	O	O
Inspiratory and expiratory hold maneuver	✓	✓
IntelliCuff® cuff pressure controller control via ventilator	O	O
IntelliSync+ (inspiratory and expiratory trigger synchronization)	O	--
IntelliTrig (leak compensation)	✓	✓
Languages (English, US English, Chinese, Croatian, Czech, Danish, Dutch, Finnish, French, German, Greek, Hungarian, Indonesian, Italian, Japanese, Korean, Norwegian, Polish, Portuguese, Romanian, Russian, Serbian, Slovak, Spanish, Swedish, Turkish)	✓	✓
Manual breath / prolonged inspiration	✓	✓
Nebulization (Aerogen®)	O	O
Nebulization (pneumatic)	✓	--
O2 enrichment	✓	✓
On-screen help	✓	✓
P/V Tool® Pro	O	O
Paramagnetic O2 sensor	O	O
Patient group	✓	O
Print screen	✓	✓
Screen lock	✓	✓
Second battery	O	O
SpO2 monitoring	O	O
Standby with timer	✓	✓
Suctioning tool	✓	✓
Transpulmonary pressure monitoring	✓	✓
TRC (tube resistance compensation)	✓	✓
Trends/Loops	✓	✓
Trigger, flow and pressure selectable	✓	✓
Vent Status (Visual representation of ventilator dependence)	✓	✓

Standard: ✓ Option: O Not applicable: --

## Technical performance data (in alphabetical order)

Description	Specification
Automatic expiratory base flow	Fixed at 6 l/min
Inspiratory pressure	0 to 100 cmH <sub>2</sub> O
Maximum inspiratory flow	260 l/min
Means of inspiratory triggering	Flow trigger control, pressure trigger control, or optional IntelliSync+ control
Means of expiratory triggering	Flow cycle (ETS), or optional IntelliSync+ control
Minimum expiratory time	20% of cycle time; 0.2 to 0.8 s
O <sub>2</sub> input flow	80-150 l/min (at 2.8 bar/ 280 kPa / 41 psi input pressure)
Oxygen mixer accuracy	± (Volume fraction of 2.5% + 2.5% of actual reading)
Preoperational checks	Tightness test, flow sensor/O <sub>2</sub> sensor/CO <sub>2</sub> sensor calibration
Tidal volume	Adult/Ped: 20 to 2000 ml Neonatal: 2 to 300 ml

## Standards and approvals

Classification	Class IIb, continuously operating according to EC directive 93/42/EEC
Certification	EN 60601-1:2006/A1:2013, IEC 60601-1-2:2014, ANSI/AAMI ES60601-1:2005/(R)2012, ISO 80601-2-12:2011, CAN/CSA-C22.2 NO. 60601-1:14, EN ISO 5356-1:2015, ISO 80601-2-55:2011
Declaration	The HAMILTON-C6 was developed in accordance with pertinent international standards and FDA guidelines. The ventilator is manufactured within an EN ISO 13485 and EN ISO 9001, Council Directive 93/42/EEC, Annex II, Article 3 certified quality management system. The ventilator meets the Essential Requirements of Council Directive 93/42/EEC, Annex I.
Electromagnetic compatibility	According to IEC 60601-1-2:2014
Safety Class	Class I, Type B applied part (ventilator breathing system, VBS), type BF applied parts CO <sub>2</sub> sensor including CO <sub>2</sub> module connector, humidifier, Aerogen <sup>s</sup> system, nebulizer, and SpO <sub>2</sub> sensor including SpO <sub>2</sub> adapter, continuous operation according to IEC 60601-1

## Pneumatic specifications

O2	Input pressure	2.8 to 6 bar / 41 to 87 psi
	Connector	DISS (CGA 1240) or NIST
Air supply		Integrated turbine with lifetime warranty
Inspiratory outlet (To patient port)	Connector	ISO 15 mm ID/22 mm OD conical
Expiratory outlet (From patient port)	Connector (on expiratory valve)	ISO 15 mm ID/22 mm OD conical

## Electrical specifications

Input power	100 to 240 VAC $\pm$ 10%, 50/60 Hz	
Power consumption	60 VA typical, 210 VA (485 VA with humidifier) maximum	
Battery	Electrical specifications:	14.4 V, 5.0 Ah, 72 Wh, 48 W typical, 288 W maximum
	Type:	Lithium-ion
	Normal operating time:	$\geq$ 90 min with one battery / $\geq$ 180 min with two batteries

## Graphical patient data

Graphic type/Tab name	Options
Waveforms	Pressure, Flow, Volume, Off, PCO <sub>2</sub> <sup>1</sup> , FCO <sub>2</sub> <sup>1</sup> , Plethysmogram <sup>1</sup> , Ptrachea, Pes, Ptranspulm
Intelligent panels	Dynamic Lung <sup>2</sup> , Vent Status, ASV Graph <sup>3</sup> , SMPs (Secondary monitoring parameter)
Trends	1-, 6-, 12-, 24-, or 72-h trend data for a selected parameter or combination of parameters
Loops	Pressure/Volume, Pressure/Flow, Volume/Flow, Volume/PCO <sub>2</sub> <sup>1</sup> , Volume/FCO <sub>2</sub> <sup>1</sup> , Pes/Volume, Ptranspulm/Volume

## Alarms<sup>4</sup>

Priority	Alarm
High priority	Apnea time (s), ExpMinVol high/low (l/min), Oxygen high/low (%), Pressure high/low (cmH <sub>2</sub> O), Flow sensor calibration needed, Exhalation obstructed, Disconnection, Oxygen supply failed
Medium priority	fTotal high/low (b/min), PetCO <sub>2</sub> high/low (mmHg), Pressure limitation (cmH <sub>2</sub> O), Vt high/low (ml), SpO <sub>2</sub> high/low, SpOC high/low, %leak, High PEEP, Loss of PEEP, Pulse high/low
Low priority	High SpO <sub>2</sub> , Loss of external power, Cuff leak

<sup>1</sup> CO<sub>2</sub> + SpO<sub>2</sub> option required | <sup>2</sup> For adult/pediatric patients only | <sup>3</sup> Only available in ASV mode | <sup>4</sup> For complete list of alarms see operation manual

## Control settings and ranges<sup>5</sup>

Parameter (units)	Range Adult/Ped	Range Neonatal
Apnea backup	On, Off	On, Off
Cuff pressure (cmH <sub>2</sub> O)	0 to 50	0 to 50
Expiratory trigger sensitivity ETS (%)	5 to 80	5 to 80
Flow for HiFlowO <sub>2</sub> therapy (l/min)	2 to 80	2 to 12
Flow pattern	Square, 50% decelerating, Sine, 100% decelerating	--
Flow trigger (l/min)	0.5 to 20, off	0.1 to 5.0, off
Gender (sex)	Male, Female	--
I:E	1:9 to 4:1	1:9 to 4:1
%MinVol (%)	25 to 350	--
Nebulizer Duration (min)	5 to 40, continuous	5 to 40, continuous
Nebulizer Synchronisation	Inspiration, Exhalation, Insp. and Exh.	Inspiration, Exhalation, Insp. and Exh.
Oxygen (%)	21 to 100	21 to 100
P high (cmH <sub>2</sub> O) (only in DuoPAP and APRV)	0 to 100	0 to 60
P low (cmH <sub>2</sub> O) (only in APRV)	0 to 50	0 to 25
Pasvlimit (cmH <sub>2</sub> O)	5 to 100	--
Pat. height (cm) (in)	30 to 250 / 12 to 98	--
Pause (%)	0 to 70	--
Pcontrol (cmH <sub>2</sub> O)	5 to 100	3 to 60
Peak flow (l/min)	1 to 195	--
PEEP/CPAP (cmH <sub>2</sub> O)	0 to 50	0 to 25
Pinsp (cmH <sub>2</sub> O)	3 to 100	0 to 60
P-ramp (ms)	0 to 2000	0 to 600
Pressure trigger (cmH <sub>2</sub> O)	-0.1 to -15.0, off	-0.1 to -15.0, off
Psupport (cmH <sub>2</sub> O)	0 to 100	0 to 60
Rate (b/min)	1 to 80	1 to 150
Sigh	On, Off	--
T high (s) (only in DuoPAP und APRV)	0.1 to 40	0.1 to 40
T low (s) (only in APRV)	0.2 to 40	0.2 to 40
TI (s)	0.1 to 12	0.1 to 12
TI max (s)	0.5 to 3	0.25 to 3.0
Tip (s)	0 to 8	--
Tpause (s)	0 to 30	0 to 30
TRC compensation (%)	0 to 100	0 to 100
Vt (ml)	20 to 2000	2 to 300
Weight (kg)	--	0.2 to 30.0

<sup>5</sup> Parameter settings and ranges can change depending on the mode

## Monitoring parameter

Parameter (units)		Description
Pressure	AutoPEEP (cmH <sub>2</sub> O)	Unintended positive end-expiratory pressure
	Paw (cmH <sub>2</sub> O)	Airway pressure
	ΔP (cmH <sub>2</sub> O)	Driving pressure
	PTP (cmH <sub>2</sub> O*s)	Inspiratory pressure time product
	Pcuff (cmH <sub>2</sub> O)	Cuff pressure
	Ptrans I (cmH <sub>2</sub> O)	The arithmetic mean value of Ptranspulm over the last 100 ms of the last inspiration.
	Ptrans E (cmH <sub>2</sub> O)	The arithmetic mean value of Ptranspulm over the last 100 ms of the last expiration.
	PEEP/CPAP (cmH <sub>2</sub> O)	PEEP (positive end-expiratory pressure) and CPAP (continuous positive airway pressure)
	Pinsp (cmH <sub>2</sub> O)	Inspiratory pressure
	Pmean (cmH <sub>2</sub> O)	Mean airway pressure
	Ppeak (cmH <sub>2</sub> O)	Peak airway pressure
	Pplateau (cmH <sub>2</sub> O)	Plateau or end-inspiratory pressure
	Pes min (cmH <sub>2</sub> O)	See PEEP. The pressure is measured through the Pes port instead of using airway pressure.
	Pes max (cmH <sub>2</sub> O)	See Ppeak. The pressure is measured through the Pes port instead of using airway pressure.
	Pes plateau (cmH <sub>2</sub> O)	See Pplateau. The pressure is measured through the Pes port instead of using airway pressure.
	Pes PTP (cmH <sub>2</sub> O)	See PTP. The pressure is measured through the Pes port instead of using airway pressure.
Pes P0.1 (cmH <sub>2</sub> O)	See P0.1. The pressure is measured through the Pes port instead of using airway pressure.	
Flow	Control Flow (l/min)	The set flow of gas to the patient. HiFlowO <sub>2</sub> mode only.
	Insp Flow (l/min)	Peak inspiratory flow, spontaneous or mandatory
	Exp Flow (l/min)	Peak expiratory flow
Volume	ExpMinVol or MinVol NIV (l/min)	Expiratory minute volume
	MVSpont or MVSpont NIV (l/min)	Spontaneous expiratory minute volume
	VTE or VTE NIV (ml)	Expiratory tidal volume
	VTESpont (ml)	Spontaneous expiratory tidal volume
	VTI or VTI NIV (ml)	Inspiratory tidal volume
	Vt/IBW	Tidal volume according to ideal body weight (IBW) for adult/ pediatric patients and
	Vt/Weight (ml/kg)	according to the actual body weight for neonatal patients.
	VLeak (%) or MVLeak (l/min)	Leakage percent or total minute volume leakage

## Monitoring parameter (continued)

Parameter (units)	Description	
CO2	FetCO2 (%)	Fractional end-tidal CO2 concentration
	PetCO2 (mmHg)	End-tidal CO2 pressure
	slopeCO2 (%CO2 / l)	Slope of the alveolar plateau in the PetCO2 curve, indicating the volume/flow status of the lungs
	Vtalv (ml)	Alveolar tidal ventilation
	V'alv (l/min)	Alveolar minute ventilation
	V'CO2 (ml/min)	CO2 elimination
	VDaw (ml)	Airway dead space
	VDaw/VTE (%)	Airway dead space fraction at the airway opening
	VeCO2 (ml)	Exhaled CO2 volume
	ViCO2 (ml)	Inspired CO2 volume
	SpO2	SpO2 (%)
Pulse (1/min)		Pulse
Plethysmogram		The waveform that visualizes the pulsating blood volume; it is delivered by the pulse oximeter.
SpO2/FiO2 (%)		The SpO2/FiO2 ratio (%) is an approximation of the PaO2/FiO2 ratio, which, in contrast to PaO2/FiO2, can be calculated noninvasively and continuously.
PI (%)		Perfusion index
PVI (%)		Pleth variability index
SpCO (ml/dl) <sup>2</sup> (%)		Carboxyhaemoglobin saturation
SpMet (%)		Methaemoglobin saturation
SpHb (g/dl) (mmol/l)		Total haemoglobin
SpOC (ml/dl)		Oxygen content
Oxygen		Oxygen (%)
Time	I:E	Inspiratory:expiratory ratio
	fControl (b/min)	Mandatory breath frequency
	fSpont (b/min)	Spontaneous breathing frequency
	fTotal (b/min)	Total breathing frequency
	TI (s)	Inspiratory time
	TE (s)	Expiratory time
	Pause (s)	Inspiratory pause or plateau
Lung mechanics	Cstat (ml/cmH2O)	Static compliance
	P0.1 (cmH2O)	Airway occlusion pressure
	PTP (cmH2O*s)	Pressure time product
	RCexp (s)	Expiratory time constant
	Rinsp (cmH2O/(l/s))	Inspiratory flow resistance
	RSB (1/(l*min))	Rapid shallow breathing



## Physical characteristics

Weight	Monitor (interaction panel) 7.8 kg (17.2 lb), with shelf mount: 10.0 kg (22.0 lb)
	Ventilation unit, shelf mount: 10.5 kg (23.15 lb)
	46 kg (101 lb) with trolley, monitor, ventilation unit
	The trolley can accommodate a maximum safe working load of 80 kg (176 lb)
Dimensions	See graphic above
Monitor	Type: Color TFT, Size: 1920 x 1200 pixels, 17 in (431.8 mm) diagonal
Monitor mounting options	VESA, pole mount, rail mount, handle mount
Trolley accessories	Basket, O2 cylinder holder (two bottles), HAMILTON-H900 mounting system, additional standard rail