HAMILTON-C3

Technical specifications for SW version 2.0.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	A fixed rate is set for volume-controlled mandatory breaths. Additional patient triggered breaths between mandatory breaths are spontaneous breaths (with or without pressure support).		--
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 either the patient or the ventilator, are pressure controlled and mandatory.		
	PSIMV+	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 support.		
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.	O	--
Noninvasive ventilation	NIV	Every breath is spontaneous, with or without pressure support.		
	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. PS can be set to 0 (= nCPAP).	--	O
Oxygen therapy	HiFlowO2	High flow oxygen therapy. No supported breaths.	O	O

Standard: Option: O   Not applicable: --

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HAMILTON MEDICAL
Intelligent Ventilation since 1983

Standard configuration and options (in alphabetical order)

Functions	Adult / Ped	Neonatal
Capnography, mainstream (volumetric) and sidestream	O	O
Communication ports:		
COM port		
Nurse call	O	O
Communication protocols: for details see Connectivity brochure		
Dynamic Lung (real-time visualization of the lungs)		--
Event log (up to 1000 events with date and time stamp)		
Inspiratory and expiratory hold maneuver		
IntelliTrig (leak compensation)		
Manual breath / prolonged inspiration		
Nebulization (pneumatic)		--
O2 enrichment		
On-screen help		
P/V Tool® Pro	O	O
Patient group		O
Print screen		
Screen lock		
Second battery	O	O
SpO2 monitoring	O	O
Standby with timer		
Suctioning tool		
TRC (tube resistance compensation)		
Trends/Loops		
Trigger, flow, and pressure selectable		
Vent Status (Visual representation of ventilator dependancy)		

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 60 cmH2O
Maximum inspiratory flow	240 l/min (150 l/min with 100% O2)
Means of inspiratory triggering	Flow trigger or pressure trigger control
Means of expiratory triggering	Flow cycle (ETS)
Minimum expiratory time	20% of cycle time; 0.2 to 0.8 s
O2 input flow	80 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/O2 sensor/CO2 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	IEC 60601-1:2005/A1:2012, 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-C3 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 II, Type B applied part (ventilator breathing system, VBS), type BF applied parts CO2 sensor including CO2 module connector, humidifier, nebulizer, and SpO2 sensor including SpO2 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 ultra-quiet turbine
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, 50/60 Hz or 12 to 24 VDC	
Power consumption	50 VA typical, 150 VA maximum	
Battery	Electrical specifications:	14.4 V DC, 6.8 Ah, 98 Wh, 35 W typical, 115 W maximum
	Type:	Lithium-ion
	Normal operating time:	3.5 h with one battery / 7 h with two batteries

Graphical patient data

Graphic type/Tab name	Options
Waveforms	Pressure, Flow, Volume, PCO2[1], FCO2[1], Plethysmogram[1], Ptrachea
Intelligent panels	Dynamic Lung[2], Vent Status, ASV Graph[3]
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/PCO2[1], Volume/FCO2[1]

Alarms[4]

Priority	Alarm
High priority	Apnea time (s), ExpMinVol high/low (l/min), Oxygen high/low (%), Pressure high/low (cmH2O), Flow sensor calibration needed, Exhalation obstructed, Disconnection, Oxygen supply failed
Medium priority	fTotal high/low (b/min), PetCO2 high/low (mmHg), Pressure limitation (cmH2O), Vt high/low (ml), SpO2 high/low, High PEEP, Loss of PEEP, Pulse high/low
Low priority	High SpO2, Loss of external power

1 CO2 + SpO2 option required | 2 For adult/pediatric patients only | 3 Only available in ASV mode | 4 For complete list of alarms see the operator's manual

Control settings and ranges[5]

Parameter (units)	Range Adult/Ped	Range Neonatal
Apnea backup	On, Off	On, Off
Expiratory trigger sensitivity ETS (%)	5 to 80	5 to 80
Flow for HiFlowO2 therapy (l/min)	2 to 80	2 to 12
Flow pattern	Square, 50% decelerating, Sine, 100% decelerating	--
Flow trigger (l/min)	1 to 20, Off	0.1 to 5.0, Off
Gender	Male, Female	--
I:E	1:9 to 4:1	1:9 to 4:1
%MinVol (%)	25 to 350	--
Oxygen (%)	21 to 100	21 to 100
P high (cmH2O) (only in DuoPAP and APRV)	0 to 60	0 to 60
P low (cmH2O) (only in APRV)	0 to 35	0 to 25
Pasvlimit (cmH2O)	5 to 60	--
Pat. height (cm) (in)	30 to 250 / 12 to 98	--
Pause (%)	0 to 70	--
Pcontrol (cmH2O)	5 to 60	3 to 60
Peak flow (l/min)	1 to 195	--
PEEP/CPAP (cmH2O)	0 to 35	0 to 25
Pinsp (cmH2O)	3 to 60	0 to 60 nCPAP-PS. 3 to 60 all other modes
P-ramp (ms)	0 to 2000	0 to 600
Pressure trigger (cmH2O)	-0.1 to -15.0, Off	-0.1 to -15.0, Off
Psupport (cmH2O)	0 to 60	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)	1 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

5 Parameter settings and ranges can change depending on the mode

Monitoring parameter

Parameter (units)		Description
Pressure	AutoPEEP (cmH2O)	Unintended positive end-expiratory pressure
	Paw (cmH2O)	Airway pressure
	PEEP/CPAP (cmH2O)	PEEP (positive end-expiratory pressure) and CPAP (continuous positive airway pressure)
	Pinsp (cmH2O)	Inspiratory pressure
	Pmean (cmH2O)	Mean airway pressure
	Ppeak (cmH2O)	Peak airway pressure
	Pplateau (cmH2O)	Plateau or end-inspiratory pressure
Flow	Control Flow (l/min)	The set flow of gas to the patient. HiFlowO2 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)	Inpiratory tidal volume
	Vt/IBW Vt/Weight (ml/kg)	Tidal volume according to ideal body weight (IBW) for adult/ pediatric patients and 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 (%)	Oxygen saturation
	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)[2] (%)[2]	Carboxyhaemoglobin saturation
	SpMet (%)	Methaemoglobin saturation
	SpHb (g/dl) (mmol/l)	Total haemoglobin
	SpOC (ml/dl)	Oxygen content
Oxygen	Oxygen (%)	Oxygen concentration of the delivered gas
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	Ventilation unit: 9.5 kg (21 lb)
	37 kg (81.6 lb) with trolley and 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: 1280 x 800 pixels, 12.1 in (307.3 mm) diagonal
Trolley accessories	O2 bottle holding system, HAMILTON-H900 mounting system

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HAMILTON-C3