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HAMILTON-MR1

Technical specification for SW 2.2.3

Ventilation modes

Mode form	Mode name	Mode	Adult/Ped	Neonatal
Volume-targeted modes, 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 modes	PCV+	All breaths, whether triggered by 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.	O	O
	APRV	Spontaneous breaths can be continuously triggered. The pressure release between the levels contributes to ventilation.	O	O
	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.	✓	--
Noninvasive modes	NIV	Every breath is spontaneous.	O	O
	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.	O	O
	nCPAP	Demand flow Nasal Continuous Positive Airway Pressure.	--	O
	nCPAP-PC	Breaths are pressure controlled and mandatory.	--	O
High flow oxygen therapy	HiFlowO2	High flow oxygen therapy. No supported breaths.	O	O

Standard: ✓ Option: O Not applicable: - -

Swiss Quality

HAMILTON MEDICAL
Intelligent Ventilation since 1983

Standard configuration and options (in alphabetical order)

Functions	Adult/Ped	Neonatal
Communication ports: USB port	✓	✓
Dynamic Lung	✓	--
Event log (up to 1000 events with data and time stamp)	✓	✓
IntelliTrig (leak compensation)	✓	✓
Languages (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	✓	✓
MR conditional up to 50 mT	✓	✓
Nebulization, pneumatic	✓	--
O2 enrichment	✓	✓
Patient group	✓	o
Print screen	✓	✓
Screen lock	✓	✓
Speaking valve	o	--
Standby with timer	✓	✓
Suctioning tool	✓	--
TeslaSpy: Integrated magnetic field navigator	✓	✓
Trends/Loops	o	o
Flow trigger	✓	✓
Vent Status (Visual representation of ventilator dependence)	✓	✓

Standard: ✓ Option: o Not available: --

Technical performance

Description	Specification
Automatic expiratory base flow	Adult/Ped.: Fixed at 3 l/min Neonatal: Fixed at 4 l/min
Inspiratory pressure	0 to 60 cmH2O
Maximum inspiratory flow	260 l/min (120 l/min with 100% O2)
Means of inspiratory triggering	Flow trigger control
Minimum expiratory time	20% of cycle time; 0.2 to 0.8 seconds
Oxygen mixer accuracy	± (volume fraction of 2.5% + 2.5% of actual reading)
Preoperational checks	Tightness test, Flow Sensor/O2 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-MR1 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 1 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)

Pneumatic performance

O2	Pressure:	2.8 to 6 bar / 41 to 87 psi
	Connector:	DISS (CGA 1240) or NIST
Air supply	Integrated turbine	
Inspiratory outlet (To patient port)	Connector:	ISO ID15/OD22 conical
Expiratory outlet (From patient port)	Connector (on expiratory valve):	ISO ID15/OD22 conical

Electrical specifications

Input power	100 to 240 VAC ±10%, 50/60 Hz	
Power consumption	50 VA typical, 120 VA maximum	
Battery	Electrical specifications:	10.8 V DC, 6.7 Ah, 72 Wh, 50 W typical, 150 W maximum
	Type:	Lithium-ion, supplied by Hamilton Medical only
	Operating time:	Display brightness = 80%: 8 h Display brightness = 20%: 9.2 h

MR clearance

MR Conditional	1.5 and 3.0 T static magnetic field
Maximum proximity to MRI scanner	50 mT
Gaussmeter	TeslaSpy

Graphical patient data

Graphic type/tab name	Options
Waveforms	Pressure, Volume, Flow
Intelligent panels	Dynamic Lung [1], Vent Status, ASV Graph [2]
Trends	1-, 6-, 12-, 24-, or 72-h[3] trend data for a selected parameter or combination of parameters
Loops	Pressure/Volume, Pressure/Flow, Volume/Flow

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), Pressure limitation (cmH2O), Vt high/low (ml), High PEEP, Loss of PEEP, Pulse high/low
Low priority	Loss of external power

[1] Only for adult/pediatric patients.
[2] Only in ASV mode.
[3] 72-hour trend not available in all markets.
[4] For a 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
ATS (%)	5 to 80	5 to 80
Flow (l/min)	2 to 80	2 to 12
Flow trigger (l/min)	1 to 20	0.1 to 5
Height (cm)	30 to 250	--
Height (in)	12 to 98	--
IE	1:9 to 4:1	1:9 to 4:1
%MinVol (%)	25 to 350	--
Oxygen (%)	21 to 100	21 to 100
PEEP (cmH2O)	0 to 35	3 to 25
Pasvlimit (cmH2O)	5 to 60	--
Pcontrol (cmH2O)	5 to 60	3 to 45
Phigh APRV (cmH2O)	0 to 60	0 to 45
Phigh DuoPAP (cmH2O)	0 to 60	3 to 45
Pinsp (cmH2O)	3 to 60	3 to 45
Plow APRV (cmH2O)	0 to 35	0 to 25
Pramp (ms)	0 to 2000	0 to 600
Psupport (cmH2O)	0 to 60	0 to 45
Rate (b/min)	1 to 80	1 to 80
Sex	Male, Female	--
Sigh	On, Off	--
SpeakValve	On, Off	--
Tfall (s)	0.1 to 12	0.1 to 12
Tfall max (s)	1 to 3	0.25 to 3
Thigh APRV (s)	0.1 to 40	0.1 to 40
Thigh DuoPAP (s)	0.1 to 40	0.1 to 40
Tlow APRV (s)	0.2 to 40	0.2 to 40
Vt (ml)	20 to 2000	2 to 300
Vt/Weight (ml/kg)	--	5 to 12
Weight (kg)	--	0.2 to 30

Parameter settings and ranges can change depending on the mode

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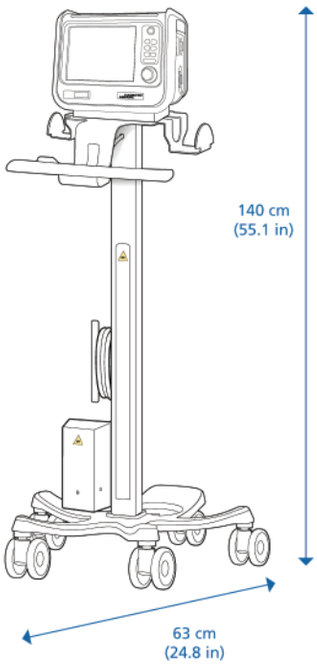
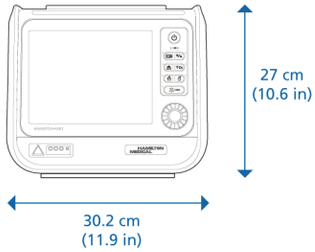
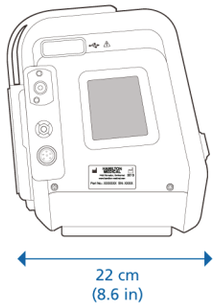
Monitoring parameters

Parameter (units)		Description
Pressure	AutoPEEP (cmH2O)	Unintended positive end-expiratory 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	Flow (l/min)	In nCPAP mode, the average flow, updated every second. In nCPAP-PC mode, the average flow during expiration, updated every breath.
	Insp Flow (peak) (l/min)	Peak inspiratory flow, spontaneous or mandatory
	Exp Flow (peak) (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
	VTI (ml)	Inpiratory tidal volume
	VLeak (%)	Leakage percent or total minute volume leakage
	MVLeak (l/min)	Leakage percent or total minute volume leakage
Oxygen	Oxygen (%)	Oxygen concentration of the delivered gas
	Oxygen consumption (l/min)	The current oxygen consumption rate
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
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 index

Physical characteristics







Weight	6.8 kg (15 lb) 21 kg (46.2 lb) with trolley The trolley can accommodate a maximum safe working load of 44 kg (97 lb)
Dimensions	See graphic above
Monitor	Type: TFT color Size: 640 x 480 pixels, 8.4 in (214 mm) diagonal
Trolley accessories	Auto-lock brake, optional O2 bottle holding system
Optional transport kit	Quick-lock mounting plate and universal handle