HAMILTON-T1

Technical specifications

As one of the best in its class, the HAMILTON-T1 ensures the optimal ventilation therapy in transport situations for all patient groups from adult to neonate. The HAMILTON-T1 complies with RTCA/DO-160G, EN 13718-1, and EN 1789, and offers:

- Performance of a fully featured ICU ventilator
- Approved for ambulances, helicopters, airplanes, and ships
- Independent air supply
- More than 9 hours of battery operating time
- Noninvasive ventilation and high flow oxygen therapy[1)]
- Advanced ventilation modes, including ASV®
- Adult, pediatric, and neonatal ventilation

For more information, visit our website: **www.hamilton-medical.com/T1**

[1)] Optional - not available in all markets

Swiss Quality

HAMILTON MEDICAL
Intelligent Ventilation since 1983

Technical specifications

Ventilation Cockpit

Dynamic Lung	Real-time visualization of the lungs with representations of tidal volume, lung compliance, resistance, and patient activity
Vent Status	Visual representation of ventilator dependence, grouped into oxygenation, CO2 elimination, and patient activity
ASV target graphics	Graphic display of target and current parameters for tidal volume, frequency, pressure, patient activity, and minute ventilation
Monitoring	Display of more than 50 monitoring parameters
Real-time waveforms	Paw, Flow, Volume, Plethysmogram[1)], and Capnograph[1)]
Others [1)]	SpO2, volumetric CO2, sidestream CO2, Loops: P-V, V-Flow, P-Flow, V-CO2, Trends: 1, 6, 12, 24, and 72 hours

Alarms

Operator adjustable	Low/high minute volume, low/high pressure, low/high tidal volume, low/high rate, apnea time, low/high oxygen, low/high PetCO2[1)], low/high SpO2[1)], low/high pulse[1)], low/high perfusion index[1)], flow[1)], low/high PVI[1)], low/high SpCO[1)], low/high SpMet[1)], low/high SpHb[1)]
Special alarms	O2 cell, disconnection, exhalation obstructed, loss of PEEP, pressure not released, flow sensor, expiratory valve, pressure limitation, performance limited, CO2[1)] and SpO2[1)], battery, power supply, gas supply, oxygen concentration, check patient interface (HiFlowO2, SpeakValve)
Loudness	Adjustable (1 – 10), configurable minimum loudness

Ventilation Modes

Type	Mode	Description	Adult/Ped.	Neonatal[1)]
Closed-loop control	ASV	Adaptive Support Ventilation. Guaranteed minute volume based on user settings and application of lung-protective rules.	✓	
Pressure	PCV+	Pressure-controlled ventilation. Biphasic breathing	✓	✓
	PSIMV+	Pressure-controlled synchronized intermittent mandatory ventilation	✓	✓
	SPONT	Pressure support ventilation	✓	✓
	APRV[1)]	Airway pressure release ventilation	✓	✓
	DuoPAP[1)]	Duo positive airway pressure	✓	✓
Volume	(S)CMV+/APVcmv	(Synchronized) controlled mandatory ventilation	✓	✓
	SIMV+/APVsimv	Synchronized intermittent mandatory ventilation	✓	✓
Noninvasive	NIV[1)]	Noninvasive ventilation	✓	✓
	NIV-ST[1)]	Spontaneous / timed noninvasive ventilation	✓	✓
	nCPAP[1)]	Nasal continuous positive airway pressure		✓
	nCPAP-PC[1)]	Nasal continuous positive airway pressure - pressure control		✓
	HiFlowO2[1)]	High flow oxygen therapy	✓	✓

Maintenance

Blower lifetime	Dynamic lifetime surveillance, typically 8 years. 5-year warranty.

[1)] Optional - not available in all markets

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Standards	IEC 60601-1, IEC 60601-1-2, ISO 80601-2-12, CAN/CSA-C22.2 No. 60601-1, ES60601-1, EN 794-3, EN 1789 for ambulances, EN 13718-1, RTCA/DO-160G for air transport, MIL-STD-461G control of electromagnetic interference

Configurations	
Trolley accessories	Humidifier support, cylinder holder, tubing support arm
Options[1]	Volumetric mainstream capnography, sidestream capnography, DuoPAP/APRV, NIV/NIV-ST, Trends/Loops, Neonatal application, nCPAP/nCPAP-PC, NVG, SpO2, Masimo rainbow SET, PVI, 2nd battery, HiFlowO2, SpeakValve
Accessories	Multiple handles for various options (jet, ambulance, or bed rail mount) HAMILTON-T1 carrying unit for bedside transport with O2 cylinder

Electrical and pneumatic specifications	
Input voltage	100 to 240 V AC -15%/+10%, 50/60 Hz or 12 to 28 V DC (total range 10.2 to 30.3 VDC)
Power consumption	50 VA typical, 150 VA maximum
Backup battery time	Typical 8 h, maximum 9 h 25 min[2] with one internal battery and one hot-swappable battery
Oxygen supply	280 to 600 kPa (41 to 87 psi), V´max 200 l/min (HPO 93% compatible)
Low pressure oxygen	≤15 l/min, max. 600 kPa (87 psi) for low pressure
Air supply	Integrated turbine
Peak flow	260 l/min (adult / pediatric), 40 l/min (neonatal)[1]

Environment	
Temperature	Operating: -15°C to 50°C (adult / pediatric) / -15°C to 40°C (neonatal)[1] Storage: -20°C to 60°C
Humidity	5% to 95% noncondensing (operating), 10% to 95% noncondensing (storage)
Altitude	Adult[3]: Up to approx. 7,620 m (25,000 ft), 1,100 to 376 hPa Neonatal[1]: Up to approx. 4,000 m (13,120 ft), 1,100 to 600 hPa
Degree of protection	IP24

Interface connectors	USB, COM1 (RS-232)[1], nurse call[1], CO2[1], SpO2[1]
Event log	Storage and display of up to 1,000 events with date and time stamp
IntelliTrig	Automatic response to varying leaks and configurable trigger sensitivity in all modes Inspiratory leakage up to 85 l/min, expiratory leakage up to 40 l/min
PSync	Guaranteed rate ventilation
SpeakValve	SpeakValve function makes the pressure-controlled ventilation modes (PCV+, SPONT, PSIMV+) compatible with speaking valves[1]

[1] Optional - not available in all markets, [2] Reduced display brightness,

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Controls

Type	Adult / Pediatric	Neonatal [1]
Special functions	Manual breath, O2 enrichment, standby, sigh, screen lock, apnea backup ventilation, inspiratory hold, print screen, suctioning tool, dimmable screen, configurable quick-start settings, startup settings based on patient height and gender, integrated pneumatic nebulizer, O2 consumption display	Manual breath, O2 enrichment, standby, screen lock, apnea backup ventilation, inspiratory hold, print screen, suctioning tool, dimmable screen, configurable quick-start settings, startup settings based on body weight, O2 consumption display
Ventilation modes	See page 2, Ventilation modes	See page 2, Ventilation modes
Patient groups	adult / pediatric	neonatal
Patient height	30 to 250 cm	-
Patient gender	male / female	-
Patient weight	-	0.2 to 30 kg
(S)CMV+/ APVcmv	4 to 80 b/min	15 to 80 b/min
SIMV+/APVsimv+	1 to 80 b/min	1 to 80 b/min
PCV+	4 to 80 b/min	15 to 80 b/min
NIV-ST[1]	5 to 80 b/min	15 to 80 b/min
PSIMV+	5 to 80 b/min	15 to 80 b/min (without PSync 5 to 80 b/min)
DuoPAP[1]	1 to 80 b/min	1 to 80 b/min
APRV[1]	1 to 80 b/min	1 to 80 b/min
nCPAP-PC[1]	-	10 to 80 b/min
Tidal volume	20 to 2,000 ml	2 to 300 ml
PEEP/CPAP	0 to 35 cmH2O	3 to 25 cmH2O
Oxygen	21% to 100%	21% to 100%
I:E ratio	1:9 to 4:1 (DuoPAP 1:599 to 149:1)	1:9 to 4:1 (DuoPAP 1:599 to 149:1)
%MinVol (ASV)	25% to 350%	-
Inspiratory time (TI)	0.1 to 12 s	0.1 to 12 s
Flow trigger	off, 1 to 20 l/min	off, 0.1 to 5 l/min
Pressure control	5 to 60 cmH2O, added to PEEP/CPAP	0 to 45 cmH2O, added to PEEP/CPAP
Pressure support	0 to 60 cmH2O, added to PEEP/CPAP	0 to 45 cmH2O, added to PEEP/CPAP
Pressure ramp	0 to 2,000 ms	0 to 600 ms
P high (APRV/DuoPAP)[1]	0 to 60 cmH2O	0 to 45 cmH2O
P low (APRV)[1]	0 to 35 cmH2O	0 to 25 cmH2O
T high (APRV/DuoPAP)[1]	0.1 to 40 s	0.1 to 40 s
T low (APRV)[1]	0.2 to 40 s	0.2 to 40 s
Expiratory trigger sensitivity (ETS)	5% to 80% of peak inspiratory flow	5% to 80% of peak inspiratory flow
Flow (HiFlowO2)[1]	2 to 80 l/min	2 to 12 l/min
PSync	on/off	on/off
SpeakValve[1]	on/off	-

[1] Optional - not available in all markets

Technical specifications

Monitoring parameters

Type	Parameter	Unit	Description	Numeric monitoring	Wave-forms	Vent Status	Dynamic Lung
Pressure	Paw	cmH2O;mbar;hPa	Real-time airway pressure		✓		
	Ppeak	cmH2O;mbar;hPa	Peak airway pressure	✓			
	Pmean	cmH2O;mbar;hPa	Mean airway pressure	✓			
	Pinsp	cmH2O;mbar;hPa	Inspiratory pressure			✓	
	PEEP/CPAP	cmH2O;mbar;hPa	Positive end expiratory pressure/ continuous positive airway pressure	✓		✓	
	Pplateau	cmH2O;mbar;hPa	Plateau or end inspiratory pressure	✓			
Flow	Flow	l/min	Real-time inspiratory flow		✓		
	Insp Flow	l/min	Peak inspiratory flow	✓			
	Exp Flow	l/min	Peak expiratory flow	✓			
Volume	Volume	ml	Real-time tidal volume		✓		✓
	VTE/VTE NIV	ml	Expiratory tidal volume	✓			
	VTI/VTI NIV	ml	Inspiratory tidal volume	✓			
	ExpMinVol/MinVol NIV	l/min	Expiratory minute volume	✓		✓	
	MVSpont/MVSpont NIV	l/min	Spontaneous expiratory minute volume	✓			
	Leak/MV Leak	%;l/min	Leakage minute volume Leakage percentage at the airway	✓			
	Vt/IBW (adult/ped)	ml/kg	Tidal volume/IBW ratio	✓			
	Vt/Weight (neonatal only)	ml/kg	Tidal volume/weight ratio	✓			
Time	I:E		Inspiratory-expiratory ratio	✓			✓
	fTotal	b/min	Total breathing frequency	✓			✓
	fSpont	b/min	Spontaneous breathing frequency	✓			
	TI	s	Inspiratory time	✓			✓
	TE	s	Expiratory time	✓			✓
	%fSpont	%	Percentage of spontaneous breathing rate	✓		✓	
Lung mechanics	Cstat	ml/cmH2O	Static compliance	✓			✓
	AutoPEEP	cmH2O;mbar;hPa	AutoPEEP or intrinsic PEEP	✓			
	RCexp	s	Expiratory time constant	✓			
	Rinsp	cmH2O*s/l	Inspiratory flow resistance	✓			✓
	RSB	1/l*min	Rapid shallow breathing index	✓		✓	
	PTP	cmH2O*s;mbar*s	Pressure-time product	✓			
	P0.1	cmH2O;mbar;hPa	Airway occlusion pressure	✓			
Oxygen	O2	%	Airway oxygen concentration (FiO2)	✓		✓	
Carbon dioxide[1)]	CO2	mmHg;%;kPa	Real-time CO2 measurement		✓		
	FetCO2	%	Fractional end-tidal CO2 concentration	✓	✓		
	PetCO2	mmHg;Torr;kPa	End-tidal CO2 partial pressure	✓	✓		✓
	SlopeCO2	%CO2/l	V/Q status of the lung	✓			
	VTalv	ml	Alveolar tidal ventilation	✓			
	VTalv/min	ml	Alveolar minute ventilation	✓			
	V'CO2/min	ml/min	CO2 elimination	✓			
	VDaw	ml	Airway dead space	✓			
	VDaw/VTE	%	Dead space fraction measured at the airway opening	✓			
	VeCO2	ml	Exhaled volume of CO2	✓			
	ViCO2	ml	Inspired volume of CO2	✓			

[1)] Optional - not available in all markets

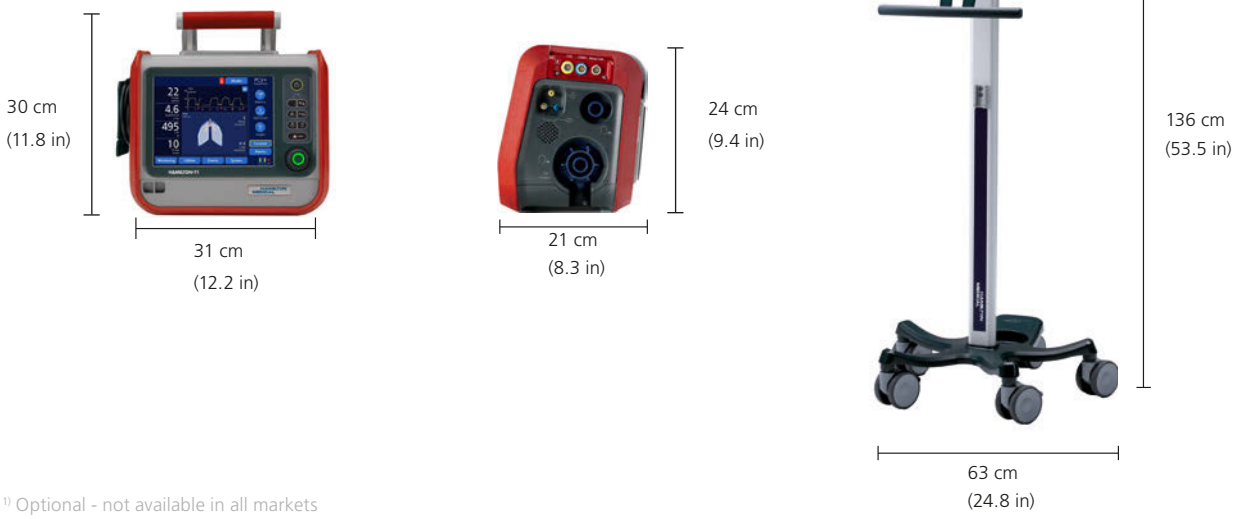
Technical specifications

Monitoring parameters

Type	Parameter	Unit	Description	Numeric monitoring	Wave-forms	Vent Status	Dynamic Lung
SpO2[1)]	Plethysmogram	-	Real-time plethysmogram		✓		
	SpO2	%	Arterial oxygen saturation in blood	✓			✓
	Pulse	1/min	Heart rate	✓			✓
	Perfusion index	ml/dl	Calculation of the oyxgen content	✓			
	SpO2/FiO2	-	Calculated approximation of PaO2/FiO2	✓			
	PVI	%	Pleth variability index	✓			
	SpCO2	%	Carboxyhemoglobin	✓			
	SpMet	%	Methemoglobin	✓			
	SpHb	g/dl	Total hemoglobin	✓			
	SpOC	ml/dl	Oxygen content	✓			

Physical dimensions

Size	See illustrations below
Weight	6.5 kg (14.3 lb) with one battery and handle 5.6 kg (12.3 lb) without battery and handle
Display	8.4 in, TFT color, backlit, touch screen, night-vision compatibility
Main patient outlet	ISO 5356-1; 22OD/15ID
Oxygen inlet	DISS or NIST
Low pressure oxygen inlet	CPC quick coupling, 3.2 mm ID



[1)] Optional - not available in all markets

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