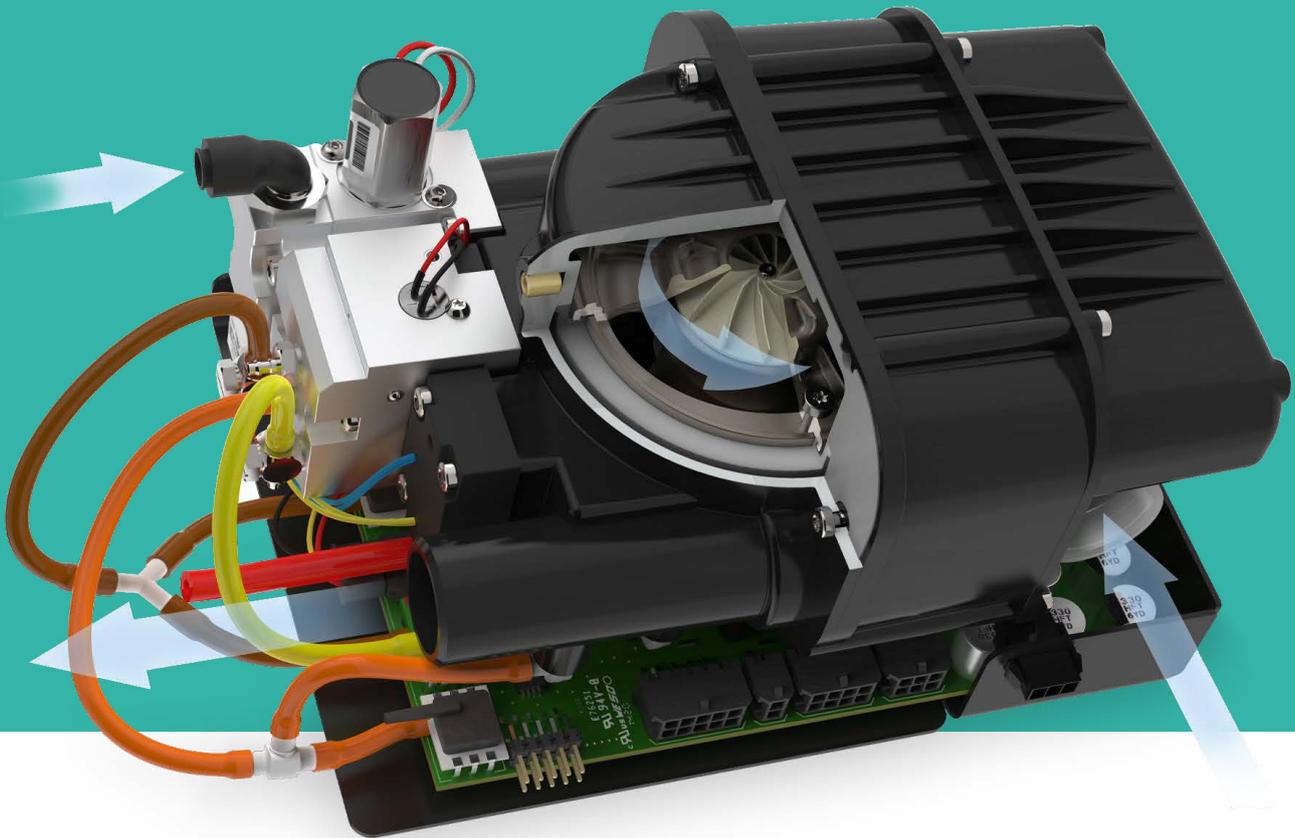


Macawi Respiratory Module specifications.



TURBINE BLOWER BASED FULL FUNCTIONAL MACAWI RESPIRATORY MODULE FOR VENTILATION

The Demcon Macawi Respiratory Module offers an easy-to-integrate and highly flexible solution for ventilation. It supports all invasive and non-invasive ventilation modes for neonatal, pediatric, and adult patients, including oxygen mixing.

VENTILATION MODES		MRM	MRM-100D	MRM-60D
Ventilation mode	Commercial name - description			
PC-CMV	PC (Pressure Control)	●	●	●
VC-CMV	VC (Volume Control)	●	●	●
PC-SIMV	SIMV (PC)	●	●	●
VC-SIMV	SIMV (VC)	●	●	●
PC-SIMV+	Bi-Level Ventilation, PC-BIPAP	●	●	●
PC-ACV	ACV (PC)	●	●	●
VC-ACV	ACV (VC)	●	●	●
VC-ACV+	Volume controlled - ACV with expiration trigger	●	●	●
Spn-CPAP	CPAP	●	●	●
CFLOW	Continuous Flow at pre-set O2 concentration	●	●	●
PC-AMV	Assisted Manual Ventilation, Neonatal T-piece resuscitation	●	●	-
PC-APRV	Pressure controlled – Airway Pressure Release Ventilation	●	●	●
PC-MMV	Pressure controlled – Mandatory Minute Ventilation	●	●	●

VENTILATION MODE OPTIONS		MRM	MRM-100D	MRM-60D
Ventilation mode option	Commercial name - description			
NIV	Non Invasive Ventilation	●	●	●
Inspiratory flow pattern VC	Constant, accelerating, decelerating	●	●	●
PS Low	PSV (Pressure Support Ventilation on expiratory level)	●	●	●
PS High	PSV (Pressure Support Ventilation on inspiratory level)	●	●	●
PPS	Proportional Pressure Support	●	●	●
PCVR (Pressure Controlled Volume Regulation)	PRVC, AutoFlow, Volume Guarantee	●	●	●
VS	Volume Support	●	●	●
HPO & LPO	High Pressure Oxygen & Low Pressure Oxygen	●	●	●
Tube Compensation	On inspiratory and/or expiratory level	●	●	●
Leakage compensation	Up to 80 L/min adult, 50L/min pediatric and 20L/min neonatal	●	●	no neonatal
HFO compatible	High Frequency Oscillation	●	●	-

VENTILATION MANEUVERS		MRM	MRM100D	MRM60D
Name	Commercial name - description			
Inspiratory Pause	Manual generation of prolonged inspiration time	●	●	●
Expiratory Pause	Manual generation of prolonged expiration time	●	●	●
Expiratory Hold	Intrinsic PEEP, AutoPEEP	●	●	●
Recruitment	Generate a fixed number of elevated pressure strokes	●	●	●
P0.1	Measurement figure for weaning purposes	●	●	●
Sigh	Generate sigh maneuver at set time interval	●	●	●

VENTILATION RELATED FUNCTIONALITIES		MRM	MRM-100D	MRM-60D
Functionality	Remark			
Patient pressure, flow and volume monitoring	Pneumatic measurement (including purge system)	●	-	-
	Digital measurement (no purge system)	-	●	●
Inspiratory and expiratory triggering	All modes, pressure and flow	●	●	●
Nebulizer control output	Driver for pneumatic valve	●	●	●
Oxygen sensor interface	Galvanic analog sensor	●	●	●
	Paramagnetic digital sensor	●	-	-
System tests	Sensor zeroing, self-test and test modes	●	●	●
System and patient circuit calibrations	Hose compliance, incl. leakage test, hose resistance, patient flow sensor and oxygen sensor calibrations	●	●	●
Expiration valve control	For external pneumatic valve	●	●	●
	For external voice coil valve	●	●	●
External Pneumatic Safety valve	Pneumatic interface provided	●	-	-
	Electrical interface for control valve hardware provided	-	●	●
Apnea detection	Time dependent detection	●	●	●

VENTILATION SETTINGS RANGE		MRM	MRM-100D	MRM-60D
Setting	Range			
V_T	30 – 3000 mL in VC, 2 – 3000 mL in PCVR	●	●	–
	30 – 3000mL in VC and PCVR	–	–	●
Inspiratory flow (results in VC pressure plateau phase)	5 – 200 L/min	●	●	●
RR	3 – 200 breaths/min	●	●	●
T_i , T_e and T_{ramp}	150 – 30000 ms (T_i & T_e) 60 – 30000 ms (T_{ramp})	●	●	●
BAP (PEEP setting)	0 – 50 mbar	●	●	●
P_{insp}	1 – 90 mbar	●	●	max 60 mbar
Pressure Support	1 – 90 mbar	●	●	max 60 mbar
FiO_2	21 – 100 Vol%	●	●	●

MEASUREMENTS (REAL TIME)		MRM	MRM-100D	MRM-60D
Name	Remark			
Airway Pressure	T_s : 2ms	●	●	●
Patient Flow	T_s : 2ms	●	●	●
Patient Volume	T_s : 2ms	●	●	●

MEASUREMENTS (BREATH BY BREATH)		MRM	MRM-100D	MRM-60D
Measurement	Explanation			
VT	Tidal Volume (insp & exp) [mand & spon]	●	●	●
MV	Mandatory Volume (insp & exp & tot) [mand & spon]	●	●	●
RR	Respiratory Rate [mand & spon]	●	●	●
P_{peak}	Peak Pressure (PIP)	●	●	●
P_{plat}	Plateau Pressure	●	●	●
PEEP	Positive End-Expiratory Pressure	●	●	●
MAP	Mean Airway Pressure	●	●	●
FiO_2	Fraction of Inspired Oxygen	●	●	●
V_{leak}	Leakage volume per breath	●	●	●
MV_{leak}	Leakage volume per minute	●	●	●
$Flow_{peak_insp}$	Inspiratory Peak Flow	●	●	●
$Flow_{peak_exp}$	Expiratory Peak Flow	●	●	●
P_{min}	Minimum Pressure	●	●	●
PO.1	Negative pressure after 100 ms no inspiratory support	●	●	●
RSBI	Rapid Shallow Breathing Index	●	●	●
PTP	Pressure Time Product	●	●	●
C_{stat}	Static Compliance	●	●	●
R_{lung}	Lung Resistance	●	●	●
AutoPEEP	Intrinsic PEEP	●	●	●
Tracheal Pressure	Derived Tracheal Pressure	●	●	●

VENTILATION PERFORMANCE		MRM	MRM-100D	MRM-60D
Name	Range - Accuracy			
Maximum Pressure	100 mbar at sea level (> 80 mbar at 3000m altitude)	●	●	–
	60 mbar at sea level (> 60 mbar at 3000m altitude)	–	–	●
Maximum Flow	> 220 L/min	●	●	●
Volume delivery	Adult & Ped: $\pm(10ml + 10\%)$ in VC	●	●	●
	Neo: $\pm(2ml + 12\%)$ in PCVR	●	●	–
Volume monitoring	Adult: $\pm(4ml + 12\%)$	●	●	●
	Ped: $\pm(4ml + 12\%)$	●	●	●
	Neo: $\pm(2ml + 12\%)$	●	●	–
Pressure delivery	All types: $\pm(2mbar + 5\%)$	●	●	●
Pressure monitoring	All types: $\pm(2mbar + 4\%)$	●	●	●
Oxygen delivery	$\pm(2.5vol\% + 2.5\%)$	●	●	●

OPERATING CONDITIONS			MRM	MRM-100D	MRM-60D
Quantity	Range	Remark			
Operating temperature	-20 – +60 degrees C	Environmental temperature	●	●	●
Relative air humidity	0 – 95% RH	Environmental RH	●	●	●
Ambient Pressure	500 – 1100 hPa	Environmental pressure	●	●	●
Blower lifetime expectancy	> 45.000 hours	L10 @ moderate Ventilation level ¹	●	●	●
Noise generation	< 45 dB	@ a pressure of 40 mbar, ISO 3744	●	●	●
¹ Pinsp = 35 mbar, PEEP = 12 mbar, Tslope = 200ms, RR = 12 /min @ Rp5C20					

ELECTRICAL OPERATING CONDITIONS			MRM	MRM-100D	MRM-60D
Quantity	Range	Remark			
Power Supply Voltage	24V DC		●	●	●
Peak current	≤ 6A	Max. 250ms during maximum pressure ramp-up	●	●	●
Continuous current	≤ 3A	@ 100 mbar	●	●	@60 mbar
Nominal Power consumption	5 – 30 W	Depending on ventilation conditions	●	●	●

DIMENSIONS AND WEIGHT		MRM	MRM-100D	MRM-60D
Property	Value			
Dimensions	≈ 130 x 90 x 185 mm	●	●	●
Volume	≈ 2L	●	●	●
Module Weight		≈ 850g	≈ 800g	≈ 800g

PRECOMPLIANCE TO STANDARDS				MRM	MRM-100D	MRM-60D
Software class C	(IEC 62304)	Oxygen monitoring	(IEC 80601-2-55)	●	●	●
Biocompatibility	(ISO 18562)	ICU ventilators	(IEC 80601-2-12)	●	●	●
Gas mixers	(ISO 11195)	EMC	(IEC 60601-1-2)	●	●	●
Oxygen compatibility	(ISO 15001)	Electrical Safety	(ISO 60601-1)	●	●	●
Transport Ventilators	(ISO 10651-3)	Emergency Care Ventilators	(EN 1789, IEC 60601-1-12)	●	●	●
QMS	(ISO 13485)	Shock & Vibration	(up to RTCA)	●	●	●



- 1: RS232 communication
- 2: Power supply
- 3: USB communication
- 4: Nebulizer
- 5: O₂ monitoring / Digital Patient flow sensing
- m: Mounting points

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