DATA SHEET

VENTILATION SERVO-s®

MAQUET
GETINGE GROUP

CRITICAL CARE

HIGHLIGHTS

- SERVO-s® offers unique SERVO ventilation capabilities for adult and pediatric patients
- Features a range of standard and optional ventilation modes
- Simple to learn, operate and maintain
- Monitors lung mechanics
- Supports invasive as well as Non invasive ventilation (NIV)

KEY FEATURES
SERVO-s ®

- For adult and pediatric patients
- A ventilator system designed to operate in a variety of hospital ventilatory care settings
- Standard ventilation modes:

Controlled ventilation:	- PC - VC
Supported ventilation:	- PS/CPAP
Combined ventilation:	- SIMV (PC) + PS - SIMV (VC) + PS

- Optional ventilation modes:

Controlled ventilation:	- PRVC
Combined ventilation:	- SIMV (PRVC) + PS (included in PRVC) - Bi-Vent

- Optional functions:
  - Lung mechanics parameters
  - Alarm output connector for external alarm
- Supports invasive ventilation and the option Non invasive ventilation (NIV) with leakage compensation
- High level of sensitivity to your patient´s efforts
  - Precise gas delivery system
  - Extreme speed in sensing and regulation
- Diagnostic trend tools ensure accurate time and detail recording for up to 24 hours after an event
- Volume/Pressure and Flow/Volume loops
- Simple to operate and learn
  - Large color display with clear graphic presentation
  - Intuitive user interface
  - Select between touch screen, direct access knobs or dial
  - Fast and simple start up procedure e.g. automated pre-use check with user configurable default ventilator settings
  - Suction Support
  - Previous Mode functionality
  - High-resolution pressure, flow and volume waveforms
- Simple to maintain and clean
  - One-piece interchangeable part for cleaning
  - Extended maintenance interval (5000 hours)
  - Maintenance information given via graphical user interface
- Reliable
  - Battery backup (60 minutes)
  - Apnea backup
  - Direct access knobs for vital settings
  - Enhanced alarm system
- Uninterrupted bedside quality ventilatory treatment during intra-hospital transportation with Mobile Cart
- Can be mounted on both ceiling pendant and shelf
- Non-consumable and maintenance-free ultrasonic O_2 sensor, alternative to consumable O_2 cell

KEY TO ABBREVIATIONS

NIV	Non invasive ventilation
PRVC	Pressure Regulated Volume Control
SIMV	Synchronized Intermittent Mandatory Ventilation
VC	Volume Control
PC	Pressure Control
PS	Pressure Support
CPAP	Continuous Positive Airway Pressure

TECHNICAL SPECIFICATIONS
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The system - General	
CE 0413	The device complies with requirements of Medical Device Directive 93/42/EEC.
Classification:	Class I equipment. According to IEC/EN 60 601-1.
Standards:	IEC/EN 60 601-1 (Type B). IEC/EN 60 601-2-12. EN 794-1.
Noise level:	<50 dBA, measured at 0.3 m distance.
IP classification	IP 20
Electromagnetic compatibility (EMC):	
■ Emission:	According to IEC/EN 60601-1-2 (Edition 2:2001).
■ Immunity- Extended test to 30 v/m:	According to IEC/EN 60601-1-2.
The '*EMC Declaration, Information to the Responsible Organization*' is available from MAQUET.	
Patient range:	Patient weight 10 – 250 kg

Operating conditions	
Operating temperature:	+10 to +40ºC
Relative humidity:	15 to 95% non-condensing
Atmospheric pressure:	660 to 1060 hPa
Lowest pressure in breathing system:	–400 cmH_2O

Non-operating conditions	
Impact:	Peak acceleration: 15 g. Pulse duration: 6 ms. Number of impacts: 1000.
Storage temperature:	–25 to +60° C (–13 to 140° F)
Storage Relative Humidity:	< 95%
Storage Atmospheric Pressure:	470 to 1060 hPa

Power supply	
Power supply, automatic range selection:	100 – 120 V AC ±10%, 50 – 60 Hz, or 220 – 240 V AC ±10%, 50 – 60 Hz.
External 12 V DC:	12.0 V – 15.0 V DC, 10 A
Battery capacity:	Rechargeable, 12 V, 7 Ah
Battery backup time:	At least 1 h
Battery recharge time:	Approximately 6 h
Max power consumption:	At 100 – 120 V: 2 A, 190 VA, 140 W. At 220 – 240 V: 1 A, 190 VA, 140 W.

The ventilator - General	
Dimensions:	(See dimensional drawings page 10)
User Interface and Patient Unit:	W 380 x D 300 x H 520 mm
■ User Interface:	W 355 x D 53 x H 295 mm
■ Patient Unit:	W 380 x D 300 x H 210 mm
Weight:	Approximately 18 kg
Method of triggering:	Flow and pressure
Max. operating pressure:	Approximately 115 cmH_2O
Bias flow:	2 l/min

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Gas supply	
Inlet gas pressure:	200 – 650 kPa / 2.0 – 6.5 bar / 29 – 94 PSI
Connection standards available:	AGA, DISS, NIST, or French standard.
Unavailable gas/loss of gas pressure:	The flow from an unavailable gas (air or O_2) is automatically compensated for so that the patient gets the preset volume and pressure.

Patient system gas connectors	
Conical fittings:	Male 22 mm / female 15 mm. In accordance with ISO 5356-1.
Gas exhaust port:	Male 30 mm cone

Screen	
Type:	TFT-LCD module
Size:	31 cm (12.1”) diagonal
Viewing area:	246.0 x 184.5 mm

Inspiratory channel	
Pressure drop:	Max. 6 cmH_2O at a flow of 1 l/s
Internal compressible factor:	Max. 0.1 ml/cmH_2O
Gas delivery system:	Microprocessor controlled valve
Inspiratory flow range:	0 to 3.3 l/s

Expiratory channel	
Pressure drop:	Max. 3 cmH_2O at a flow of 1 l/s
Internal compressible factor:	Max. 0.1 ml/cmH_2O
PEEP regulation:	Microprocessor controlled valve
Rise time, expiratory flow measurement:	<12 ms for 10 – 90 % response at flow of 0.05 – 3.2 l/s
Expiratory flow range:	0 to 3.2 l/s

Ventilation Modes – Invasive ventilation	
Controlled ventilation:	
■ PC	
■ VC	Can be configured with alternative flow patterns - VC with flow adaptation, - VC without flow adaptation, - VC with decelerating flow
■ PRVC	Optional
Supported ventilation:	
■ PS/CPAP	
Combined ventilation:	
■ SIMV (PC) + PS	
■ SIMV (VC) + PS	
■ SIMV (PRVC) + PS	Optional, comes with the corresponding controlled ventilation mode.
■ Bi-Vent	Optional, pressure controlled ventilation on two independently adjustable levels, allowing unrestricted spontaneous breathing on both levels.

Ventilation modes – Non invasive ventilation (optional)
NIV PC
NIV PS

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Alarms	
Airway pressure (upper):	
■ Invasive ventilation:	16 – 120 cmH_2O
■ Non-invasive ventilation	16 - 40 cmH_2O
Expired minute volume (Upper alarm limit):	0.5 - 60 l/min
Expired Minute Volume (Lower alarm limit):	0.5 – 40 l/min
No patient effort (Apnea) alarm	15 – 45 s
Automatic return to support mode on patient triggering	
No consistent patient effort	Yes, described in User's manual
Respiratory frequency:	1 – 160 breaths/min
High end expiratory pressure:	0 – 55 cmH_2O
Low end expiratory pressure:	0 – 47 cmH_2O. Note. Setting the alarm to 0 (zero) is equal to alarm off.
High continuous pressure:	Set PEEP level +15 cmH_2O exceeded for more than 15 seconds.
O_2 concentration:	Set value ±5 vol% or ≤18 vol%
Gas supply:	Below 200 kPa / 2.0 bar / 29 PSI and above 650 kPa / 6.5 bar / 94 PSI
Battery:	Limited battery capacity: 10 min. No battery capacity: less than 3 min. Low battery voltage.
Leakage out of range in NIV:	Yes. Described in the User's manual.
Technical:	Yes. Described in the User's manual.

Alarms	
Autoset alarm limits specifications:	Invasive ventilation, controlled modes only
■ High airway pressure:	Mean peak pressure +10 cmH_2O or at least 35 cmH_2O.
■ Upper minute volume:	Expiratory minute volume + 50%.
■ Lower minute volume:	Expiratory minute volume – 50%.
■ Upper respiratory frequency:	Breathing frequency + 40%.
■ Lower respiratory frequency:	Breathing frequency – 40%.
■ High end expiratory pressure:	Mean end expiratory pressure + 5 cmH_2O.
■ Low end expiratory pressure:	Mean end expiratory pressure – 3 cmH_2O.

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Monitoring	Displayed value	Trended value*
Breathing frequency:	Yes	Yes
Spontaneous breaths per minute (RRsp):	No	Yes
Peak Airway Pressure:	Yes	Yes
Mean Airway Pressure:	Yes	Yes
Pause Airway Pressure:	Yes	Yes
End Expiratory Pressure:	Yes	Yes
Inspired Tidal Volume:	Yes	Yes
Expired Tidal Volume:	Yes	Yes
Inspired Minute Volume:	Yes	Yes
Expired Minute Volume:	Yes	Yes
Leakage fraction in NIV (%):	Yes	Yes
Ti/Ttot:	Yes	No
I:E ratio:	Yes	No
Total PEEP**:	Yes	No
O_2 Concentration (measured):	Yes	Yes
MV_e sp / MV_e:	Yes	No
Spontaneous Exp. Minute Volume (MV_e sp):	Yes	Yes
End Expiratory Flow:	Yes	Yes
Static Compliance**:	Yes	Yes
Dynamic Compliance**:	Yes	Yes
Inspiratory Resistance**:	Yes	Yes
Expiratory Resistance**:	Yes	Yes
Elastance**:	Yes	Yes
Time Constant**:	Yes	No
P0.1 measurement**:	Yes	Yes
Work of Breathing patient**:	Yes	Yes
Work of Breathing ventilator**:	Yes	Yes
Shallow Breathing Index (SBI)**:	Yes	Yes
Supply pressure (O_2 and air):	Yes	No
Battery remaining time:	Yes	No
Barometric pressure:	Yes	No
* Stored trend values for up to 24 hours		
** Optional		

Waveform and loop presentations

Real time waveforms - up to 3 waveforms can be displayed simultaneously:

- Pressure
- Flow
- Volume

Loops:

- Volume / Pressure
- Flow / Volume

Log function

Event log:	Alarms. Ventilator settings. Apnea periods. Immediate functions.
Service log:	Technical alarms. Test results. Preventive maintenance. Service history. Configuration log.

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Parameter:	Setting range:
Inspiratory tidal volume (ml):	100 – 2000
Inspiratory minute volume (l/min):	0.5 – 60
Apnea, time to alarm (s):	15 – 45
PC/PS above PEEP (cmH_2O)	0 – (120 - PEEP)
PC/PS above PEEP in NIV (cmH_2O)	0 – (32 - PEEP)
PEEP (cmH_2O):	0 – 50
PEEP in NIV (cmH_2O):	2 – 20
CMV frequency (breaths/min):	4 – 100
SIMV frequency (breaths/min):	1 – 60
Breath cycle time, SIMV (s):	1 – 15
P_{High} (cmH_2O):	(PEEP+1) – 50
T_{High} (s):	0.2 – 10
T_{PEEP} (s):	0.2 – 10
O_2 concentration (%):	21 – 100
I:E ratio:	1:10 – 4:1
T_{Insp} (s):	0.1 – 5
T_{Pause} (% of breath cycle time)	0 – 30
Flow trigger sensitivity level (fraction of bias flow):	0 – 100%
Press. trigg sensitivity (cmH_2O):	-20 – 0
Insp. rise time (% of breath cycle time):	0 – 20
Insp. rise time (s):	0 – 0.4
Insp. cycle off (% of peak flow):	1 – 70
Insp. cycle off in NIV (% of peak flow):	10 – 70

Parameter:	Setting range:
Oxygen breaths:	100% for 1 minute
Start breath:	Initiation of 1 breath (In SIMV mode initiation of 1 mandatory breath)
Pause hold:	Insp. or exp (0 – 30 seconds)
Alarm silence/reset:	2 minute silence and reset of latched alarms
Compliance compensation:	On/Off
Backup ventilation	On/Off

Backup settings Parameter:	Setting range:
Inspiratory tidal volume (ml):	100 - 2000
PC above PEEP (cmH_2O)	5 – (120 - PEEP)
PC above PEEP in NIV	5 – (32 - PEEP)
CMV frequency (breaths/min):	4 – 100
I:E ratio:	1:10 – 4:1
T_{Insp} (s):	0.1 – 5

Suction Support	
Pre oxygenation time:	Max. 2 min
Post oxygenation time:	Max. 1 min
Suction phase time:	No maximum level
Adjustable oxygen level:	21 – 100 %

Communication/Interface	
Serial port:	RS-232C - isolated. For data communication via the Communication Interface Emulator (CIE).
Alarm output connector (optional)	
Connector:	4-pole Modular connector
Ratings:	Max 40 V DC, Max 500 mA, Max 20 W

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Non invasive ventilation (optional)	
Max. leakage compensation level:	65 l/min
Leakage overrange detection:	Automatic
Disconnect detection:	Automatic
Disconnect flow:	Configurable
■ Low:	7.5 l/min
■ High:	40 l/min
■ Disabled	Deactivates disconnect detection
Connect detection:	Manual, or automatic via bias flow

Service	
Regular maintenance:	Once every 12 months or at least after 5000 operating hours.

Note: For inaccuracies and more detailed technical specifications please refer to the User's manual.

SERVO-s Mobile Cart (optional)	
Weight:	25 kg
Dimensions:	H 826 mm (with handles 1.051 mm) x L 644 mm x W 538 mm (see dimensional drawing)

Gas cylinder restrainer (optional)	
Max load:	2 x 5-liter bottles

Compressor Mini (optional)
See separate data sheet.

SERVO-s Shelf Base (optional)	
Weight:	0.1 kg
Dimensions:	H 8 mm x L 160 mm x W 60 mm (see dimensional drawing)

Aeroneb Nebulizer Systems (optional)
See separate data sheets.

ORDERING INFORMATION

SERVO-s, Ventilator and accessories: See separate information: "SERVO-, System Version 6.1 — System Flow Chart" (Order no: 66 70 112).

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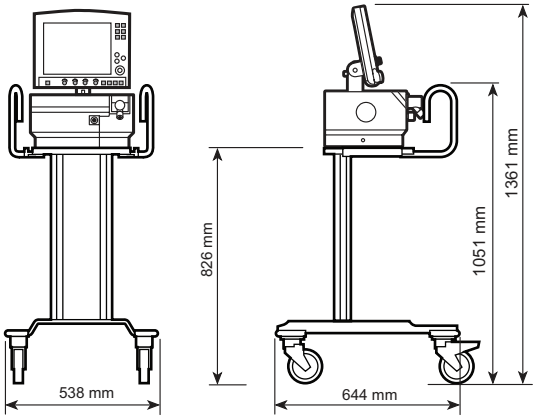
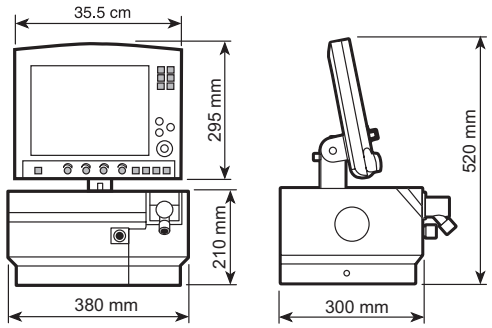
Dimensional drawings

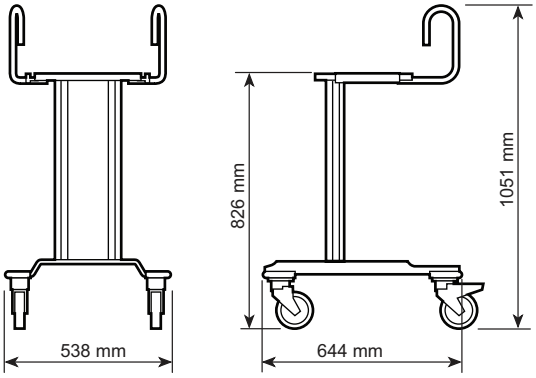
SERVO-s on Mobile Cart



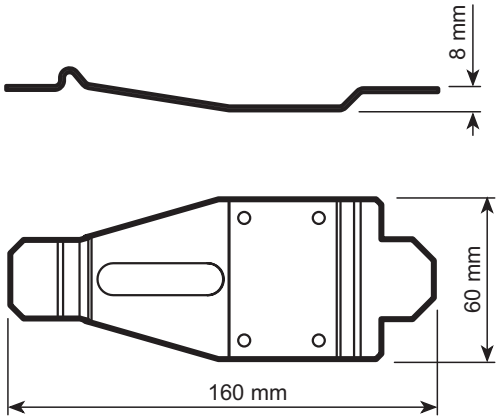
SERVO-s on Shelf base



Mobile Cart SERVO-s



Shelf Base SERVO-s



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