

Ventilation modes – invasive ventilation

Controlled ventilation	<ul style="list-style-type: none"> • PC (Pressure Control) • VC (Volume Control) • PRVC (Pressure Regulated Volume Control), option
Supported ventilation:	<ul style="list-style-type: none"> • PS/CPAP (Pressure Support / Continuous Positive Airway Pressure) • VS (Volume Support), option
AUTOMODE (option)	<ul style="list-style-type: none"> • Control mode: VC <-> Support mode: VS • Control mode: PC <-> Support mode: PS • Control mode: PRVC <-> Support mode: VS
Combined ventilation	<ul style="list-style-type: none"> • SIMV (VC) + PS (Synchronized Intermittent Mandatory Ventilation) • SIMV (PC) + PS • SIMV (PRVC) + PS (option) • Bi-Vent/APRV (Airway Pressure Release Ventilation), option

Ventilation modes – non invasive ventilation

Controlled ventilation	<ul style="list-style-type: none"> • NIV PC (option)
Supported ventilation:	<ul style="list-style-type: none"> • NIV PS (option) • Nasal CPAP (option)

Non invasive ventilation

Max. leakage compensation level	<ul style="list-style-type: none"> • Adult: <ul style="list-style-type: none"> - Inspiratory leakage: up to 200 l/min - Expiratory leakage: up to 65 l/min • Pediatric and neonatal: <ul style="list-style-type: none"> - Inspiratory leakage: up to 33 l/min - Expiratory leakage: up to 25 l/min - Nasal CPAP leakage: up to 20 l/min
Disconnection flow (configurable)	<ul style="list-style-type: none"> • Low: 7.5 l/min • High: 40 l/min • Disabled: Deactivates disconnection detection
Connection detection	Manual or automatic via bias flow

High Flow therapy (option)

Flow setting range	<ul style="list-style-type: none"> • Pediatric: 0.5 – 50 l/min • Adult: 5 – 60 l/min
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Stress Index 3.3.8

Patient category	Adult
Modes	VC, SIMV (VC)+PS, Automode VC <->VS
Values	0.5 – 1.5 (A Stress Index above 1.05 suggest that the lungs are over-distended)

Open Lung Tool trends (option)

OLT trends (option)

Graphical trend areas	1: <ul style="list-style-type: none"> - P_{ei} (end-inspiratory pressure) - P_{drive} * - PEEP 2: <ul style="list-style-type: none"> - V_{TCO₂} (when applicable) - SI * (Stress Index, adult patient category only) 3.3.8 - C_{dyn} 3: <ul style="list-style-type: none"> - V_{Ti} - V_{Te}
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* P_{drive} and SI only shown as values – not graphical trends

Modes	All invasive modes
Trend time	5, 10, 15, 30, or 60 minutes
Recruitment recording	Recording of recruitments for retrospective review of recruitments



Important: If one or several settings in the mode settings window are highlighted in yellow, this indicates that it/they should be considered for adjustment, as the values entered there may have been carried over from the previous mode.

- If *No* is tapped, the mode settings window will open with default settings, which may then be adjusted.

6.18 Apnea management

6.18.1 Apnea time

Apnea time is the time without a patient breathing effort that the ventilator system will allow to elapse in supported ventilation before the *No patient effort* alarm is activated and the ventilator system switches to the backup mode.

The relevant backup mode is highlighted in white in the heading on the screen and the alarm *No patient effort* is displayed.

If the patient triggers a breath, the ventilator system automatically switches back to supported ventilation and the *No patient effort* alarm disappears.

Apnea time is available in all supported modes and in all SIMV modes. Set the apnea time that is appropriate for each patient in the mode settings window.

Important: In SIMV modes, there is no backup ventilation and the apnea time only controls the *No patient effort* alarm. The apnea time is therefore set in the *Alarm limits* window.

Refer to chapter Alarm handling on page 115 and to section Alarm limits on page 153.

3.4

6.18.2 Backup ventilation 3.4.1

For invasive modes, backup ventilation entails a switch in case of apnea:

- from VS to PRVC
- from PS/CPAP to PC.
- from VC to VS

For non invasive modes, the switch is from NIV PS to NIV PC.

When the relevant backup mode is activated while ventilating in a supported mode, the name of the mode is highlighted in white in the mode heading and the backup parameters in the direct access bar are shown as active.

The following parameters are set under the backup mode heading in the mode settings window:

- PC above PEEP (cmH₂O) for PS backup. The minimum backup pressure level is 5 cmH₂O.
- Tidal volume (ml) for VS backup.
- Respiratory rate (b/min)
- I:E or Ti (s) (depending on configuration)

Refer to section Settings on page 41.



7.1 Introduction

7.1.1 General

The ventilator system is equipped with an alarm system to help ensure patient safety. It is active as long as the ventilator system is switched on

Visual and audible alarms warn about:

- patient breathing problems e.g. apnea
- power problems e.g. loss of mains power
- problems with gases e.g. low supply pressure
- technical problems e.g. hardware failure

7.1.2 Safety guidelines

WARNING! A potential hazard can arise if different default alarm settings are used on ventilator systems or similar equipment which are located within the same intensive care unit.

CAUTION: Always make sure relevant values are set. Extreme settings may render the alarm system unusable.

Important: Those responding to alarms must be healthcare professionals who have experience in ventilation treatment and who have been trained in the use of this ventilator system.

Refer to section Set alarm limits on page 42.

7.1.3 Conditions leading to default alarm settings

Alarm limits are set to their default values when:

- powering on the ventilator system
- changing ventilation type (invasive/non invasive)
- changing patient category in *Standby*

7.2 Handling alarms

7.2.1 Alarm indication 3.4.2

The alarms are divided into three priorities:

- high priority — all alarm indications are red
- medium priority — all alarm indications are yellow
- low priority — all alarm indications are blue

Technical error messages indicating a technical problem are presented together with a numeric code, TE: x.

When the alarm log is full, the oldest data is discarded when new alarms are added.

The alarm log is not affected by system shutdown or a temporary loss of power (supply mains and/or battery power).

An alarm message explaining the cause of the alarm is displayed in the alarm list in the status bar.

The numerical value for the parameter causing the alarm highlighted with the color of the alarm priority and its exceeded alarm limit is marked.



Non



Non

Alarms

Alarm	Pediatric range	Adult range
Airway pressure (upper alarm limit)	16 – 90 cmH ₂ O	16 – 120 cmH ₂ O
Airway pressure NIV (upper alarm limit)	16 – 70 cmH ₂ O	16 – 70 cmH ₂ O
Respiratory rate (upper alarm limit)	1 – 160 breaths/min	1 – 160 breaths/min
Respiratory rate (upper and lower alarm limit)	1 – 159 breaths/min	1 – 159 breaths/min
Expired minute volume (upper alarm limit)	0.02 – 30 l/min	1 – 60 l/min
Expired minute volume (lower alarm limit)	0.01 – 20 l/min	0.5 – 40 l/min
Expiratory tidal volume high	6 – 400 ml	60 – 4 000 ml
Expiratory tidal volume low	5 – 390 ml	50 – 3 900 ml
End expiratory pressure (upper alarm limit)	1 – 55 cmH ₂ O	1 – 55 cmH ₂ O
End expiratory pressure (lower alarm limit)	0 – 47 cmH ₂ O	0 – 47 cmH ₂ O
No patient effort (Apnea) alarm	2 – 45 s	15 – 45 s
	Automatic return to support mode on patient triggering	
No consistent patient effort	Yes, described in User's manual	
High continuous pressure	Yes, described in User's manual	
O ₂ concentration	Set value ±5 vol% or ≤18 vol% ** ** When the set O ₂ concentration is higher than 90%, the O ₂ concentration low alarm is set to 85%.	
Gas supply	Below 200 kPa (2.0 bar/29 PSI), above 600 kPa (6.0 bar/87 PSI)	
Battery	<ul style="list-style-type: none"> Limited battery capacity: 10 min No battery capacity: less than 3 min Low battery voltage 	
End tidal CO ₂ (upper and lower limit)	0.5–20 %, 4–100 mmHg, 0.5–14 kPa	
Leakage too high	Yes, described in User's manual	
Technical	Yes, described in User's manual	

Autoset (alarm limits) specification

Autoset (alarm limits) specification	Invasive ventilation, controlled modes only
3.4.2 High airway pressure:	Mean peak pressure +10 cmH ₂ O or at least 35 cmH ₂ O
3.4.2 Expiratory minute volume (upper alarm limit)	Mean expiratory minute volume +50 %
3.4.2 Expiratory minute volume (lower alarm limit)	Mean expiratory minute volume -50 %
Expiratory tidal volume (upper alarm limit)	Mean tidal volume +50 %
Expiratory tidal volume (lower alarm limit)	Mean tidal volume -50 %
Respiratory rate (upper alarm limit)	Mean respiratory rate +40 %
Respiratory rate (lower alarm limit)	Mean respiratory rate -40 %
End expiratory pressure (upper alarm limit)	Mean end expiratory pressure +5 cmH ₂ O
End expiratory pressure (lower alarm limit)	Mean end expiratory pressure -3 cmH ₂ O
End tidal CO ₂ concentration (upper alarm limit)	Mean end tidal CO ₂ concentration +25 %
End tidal CO ₂ concentration (lower alarm limit)	Mean end tidal CO ₂ concentration -25 %

Aerogen nebulizers

Aerogen nebulizers	Pro	Solo
Size	W 50 x L 50 x H 45 mm (W 2.0" x L 2.0" x H 1.8")	W 48 x L 25 x H 67 mm (W 1.9" x L 1.0" x H 2.6")
Weight	Approx. 25 g (0.88 oz)	Approx. 14 g (0.49 oz)
Particle size	1 – 5 µm mass median aerodynamic diameter (MMAD)	
Flow rate	>0.2 (average: ~0.4) ml/min	
Max. volume	10 ml	6 ml
Residual volume	<0.1 ml for 3 ml dose	
Control cable	1.8 m (5.9 ft)	



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per text here



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Alarm message	Possible causes	Alarm management checklist
Expiratory minute volume low	Preset or default alarm limit exceeded. Low spontaneous patient breathing activity. Leakage around the cuff. Leakage in the patient circuit. Improper alarm setting. Note: This alarm also works as a patient disconnect alarm.	Check patient. Check patient circuit. Check ventilator settings. Check support level.
Low battery voltage	Battery voltage too low. Cannot guarantee continued ventilator system operation.	Connect to mains power. Replace all batteries.
Airway pressure continuously high	Obstruction leading to constant high airway pressure (>PEEP +15 cmH ₂ O) during: <ul style="list-style-type: none"> • within 2 breaths or 5 s, whichever is greater, • 15 ±1.5 s if less than 2 breaths are triggered) 	Check patient circuit. Check ventilator settings. Check alarm limits. Contact service technician.
O ₂ concentration low	Measured O ₂ concentration is below the set value by more than 5 vol.% or concentration is below 18 vol.% which is independent of settings. Gas delivered in O ₂ supply line is not O ₂ . O ₂ sensor faulty or exhausted. O ₂ cell uncalibrated. Gas module for O ₂ faulty.	Check O ₂ supply. If using an O ₂ cell, perform O ₂ cell adjustment. Perform a pre-use check. Contact service technician.
3.4.2 page 3		
Patient disconnected > 1 min	Patient circuit disconnected.	Reconnect patient. Check patient circuit.
Alarm limits invalid	Alarm limits lost.	Replace the ventilator immediately.
No battery capacity (with two batteries)	Less than 4 minutes left of battery operation.	Connect to mains power to charge battery. Replace the battery in slot 1.
No battery capacity (with one battery)	Less than 3 minutes left of battery operation.	Connect to mains power to charge battery. Insert an additional battery in the empty slot.
High inspiratory pressure	Kinked or blocked tubing. Blockage in patient interface. High-flow nasal cannula is displaced. Size of high-flow nasal cannula is too small for the set flow.	Check patient. Check patient interface. Check patient circuit. Check size of high-flow nasal cannula.



Signature



Signature

7.5 Alarms 3.4.3

7.5.1 High priority alarms

Alarm message	Possible causes	Alarm management checklist
Airway pressure high 3.4.3.2	Airway pressure exceeds preset upper pressure limit. Kinked or blocked tubing. Mucus or secretion plug in endotracheal tube or in airways. Patient coughing or fighting ventilator. Inspiratory flow rate too high. Improper alarm setting. Blocked expiratory filter.	Check patient circuit. Check expiratory filter. Check ventilator settings. Check alarm limits.
Apnea 3.4.3.1	Time between two consecutive inspiratory efforts exceeds the set alarm limit.	Check patient. Check ventilator settings.
Check tubing	Patient circuit disconnected Problems with patient circuit or expiratory pressure transducer. Disconnected pressure transducer (expiratory or inspiratory). Blocked pressure transducer (expiratory or inspiratory). Water in expiratory limb of ventilator. Wet or clogged expiratory filter. Excessive leakage.	Check patient circuit. Perform a pre-use check Contact service technician.
Patient circuit disconnected	Problems with patient circuit. Excessive leakage. Note: This alarm does not detect decannulation or extubation.	Check patient circuit.
Time in waiting position > 2 min	Time in waiting position is exceeded. Patient is not connected to the ventilator or leakage is excessive.	Connect patient. Check patient circuit.
Leakage too high	Leakage too high. The mask/prongs may not be adjusted properly for the patient or may be the wrong size.	Check patient interface. Check patient circuit.
Gas supply pressures low	Air and O ₂ supply is below 2.0 kPa x 100 (29 psi). Air and O ₂ gas supply disconnected.	Check gas supply.



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Alarm message	Possible causes	Alarm management checklist
Expiratory minute volume low 3.4.3.3	<p>Preset or default alarm limit exceeded.</p> <p>Low spontaneous patient breathing activity.</p> <p>Leakage around the cuff.</p> <p>Leakage in the patient circuit.</p> <p>Improper alarm setting.</p> <p>Note: This alarm also works as a patient disconnect alarm.</p>	<p>Check patient.</p> <p>Check patient circuit.</p> <p>Check ventilator settings.</p> <p>Check support level.</p>
Low battery voltage	Battery voltage too low. Cannot guarantee continued ventilator system operation.	<p>Connect to mains power.</p> <p>Replace all batteries.</p>
Airway pressure continuously high	<p>Obstruction leading to constant high airway pressure (>PEEP +15 cmH₂O) during:</p> <ul style="list-style-type: none"> • within 2 breaths or 5 s, whichever is greater, • 15 ±1.5 s if less than 2 breaths are triggered) 	<p>Check patient circuit.</p> <p>Check ventilator settings.</p> <p>Check alarm limits.</p> <p>Contact service technician.</p>
O ₂ concentration low 3.4.2 page 3	<p>Measured O₂ concentration is below the set value by more than 5 vol.% or concentration is below 18 vol.% which is independent of settings.</p> <p>Gas delivered in O₂ supply line is not O₂.</p> <p>O₂ sensor faulty or exhausted.</p> <p>O₂ cell uncalibrated.</p> <p>Gas module for O₂ faulty.</p>	<p>Check O₂ supply.</p> <p>If using an O₂ cell, perform O₂ cell adjustment.</p> <p>Perform a pre-use check.</p> <p>Contact service technician.</p>
Patient disconnected > 1 min	Patient circuit disconnected.	<p>Reconnect patient.</p> <p>Check patient circuit.</p>
Alarm limits invalid	Alarm limits lost.	Replace the ventilator immediately.
No battery capacity (with two batteries)	Less than 4 minutes left of battery operation.	<p>Connect to mains power to charge battery.</p> <p>Replace the battery in slot 1.</p>
No battery capacity (with one battery)	Less than 3 minutes left of battery operation.	<p>Connect to mains power to charge battery.</p> <p>Insert an additional battery in the empty slot.</p>
High inspiratory pressure	<p>Kinked or blocked tubing.</p> <p>Blockage in patient interface.</p> <p>High-flow nasal cannula is displaced.</p> <p>Size of high-flow nasal cannula is too small for the set flow.</p>	<p>Check patient.</p> <p>Check patient interface.</p> <p>Check patient circuit.</p> <p>Check size of high-flow nasal cannula.</p>



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Alarms

Alarm	Pediatric range	Adult range
Airway pressure (upper alarm limit)	16 – 90 cmH ₂ O	16 – 120 cmH ₂ O
Airway pressure NIV (upper alarm limit)	16 – 70 cmH ₂ O	16 – 70 cmH ₂ O
Respiratory rate (upper alarm limit)	1 – 160 breaths/min	1 – 160 breaths/min
Respiratory rate (upper and lower alarm limit)	1 – 159 breaths/min	1 – 159 breaths/min
Expired minute volume (upper alarm limit)	0.02 – 30 l/min	1 – 60 l/min
Expired minute volume (lower alarm limit)	0.01 – 20 l/min	0.5 – 40 l/min
Expiratory tidal volume high	6 – 400 ml	60 – 4 000 ml
Expiratory tidal volume low	5 – 390 ml	50 – 3 900 ml
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End expiratory pressure (lower alarm limit)	0 – 47 cmH ₂ O	0 – 47 cmH ₂ O
No patient effort (Apnea) alarm	2 – 45 s	15 – 45 s
	Automatic return to support mode on patient triggering	
No consistent patient effort	Yes, described in User's manual	
High continuous pressure	Yes, described in User's manual	
O ₂ concentration	Set value ±5 vol% or ≤18 vol% ** ** When the set O ₂ concentration is higher than 90%, the O ₂ concentration low alarm is set to 85%.	
Gas supply	Below 200 kPa (2.0 bar/29 PSI), above 600 kPa (6.0 bar/87 PSI)	
Battery	<ul style="list-style-type: none"> Limited battery capacity: 10 min No battery capacity: less than 3 min Low battery voltage 	
End tidal CO ₂ (upper and lower limit)	0.5–20 %, 4–100 mmHg, 0.5–14 kPa	
Leakage too high	Yes, described in User's manual	
Technical	Yes, described in User's manual	



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Autoset (alarm limits) specification

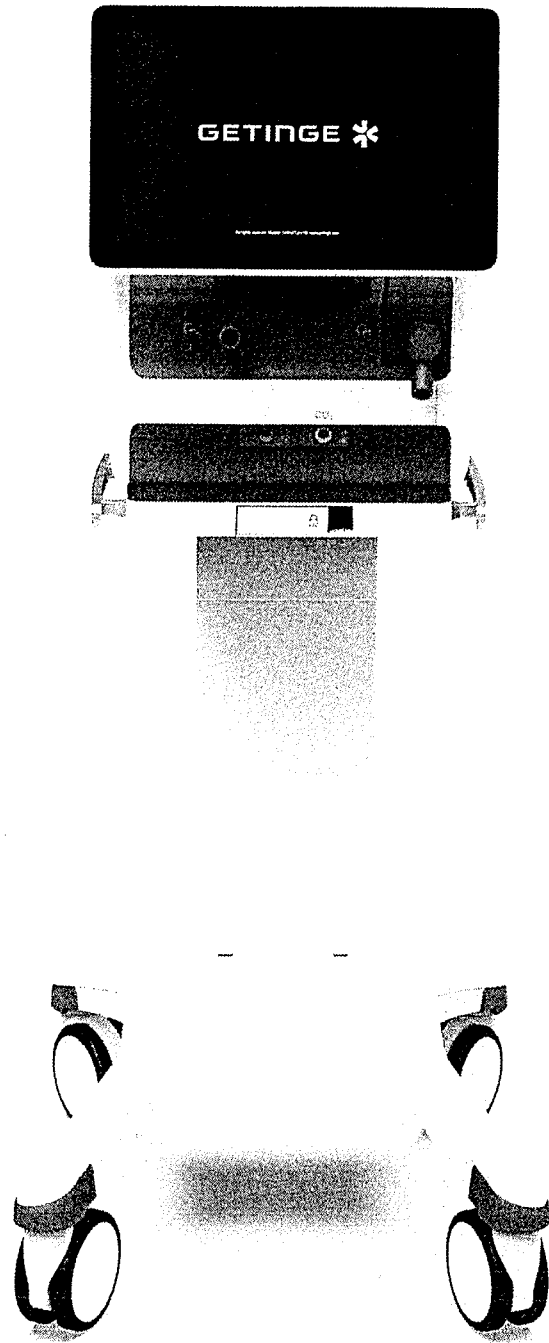
Autoset (alarm limits) specification	Invasive ventilation, controlled modes only
High airway pressure:	Mean peak pressure +10 cmH ₂ O or at least 35 cmH ₂ O
Expiratory minute volume (upper alarm limit)	Mean expiratory minute volume +50 %
Expiratory minute volume (lower alarm limit)	Mean expiratory minute volume -50 %
Expiratory tidal volume (upper alarm limit)	Mean tidal volume +50 %
Expiratory tidal volume (lower alarm limit)	Mean tidal volume -50 %
Respiratory rate (upper alarm limit)	Mean respiratory rate +40 %
Respiratory rate (lower alarm limit)	Mean respiratory rate -40 %
End expiratory pressure (upper alarm limit)	Mean end expiratory pressure +5 cmH ₂ O
End expiratory pressure (lower alarm limit)	Mean end expiratory pressure -3 cmH ₂ O
End tidal CO ₂ concentration (upper alarm limit)	Mean end tidal CO ₂ concentration +25 %
End tidal CO ₂ concentration (lower alarm limit)	Mean end tidal CO ₂ concentration -25 %

Aerogen nebulizers

Aerogen nebulizers	Pro	Safe
Size	W 50 x L 50 x H 45 mm (W 2.0" x L 2.0" x H 1.8")	W 48 x L 25 x H 67 mm (W 1.9" x L 1.0" x H 2.6")
Weight	Approx. 25 g (0.88 oz)	Approx. 14 g (0.49 oz)
Particle size	1 – 5 µm mass median aerodynamic diameter (MMAD)	
Flow rate	>0.2 (average: ~0.4) ml/min	
Max. volume	10 ml	6 ml
Residual volume	<0.1 ml for 3 ml dose	
Control cable	1.8 m (5.9 ft)	



Don



Datasheet
Servo-c
System version 4.4



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Non



Non

Servo-c

Technical specifications

General

Intended use	<p>The Servo-c ventilator system is:</p> <ul style="list-style-type: none"> • intended for respiratory support, monitoring and treatment of pediatric and adult patients • to be used only by healthcare providers • to be used only in professional healthcare facilities and for transport within these facilities
Instructions for use	Please carefully read the user's manual
Legal manufacturer	Maquet Critical Care AB
Other products	See separate data sheets. Contact your local Getinge supplier for more information.

The ventilator – general

	Servo-c	Servo-c on mobile cart
Base system weight	Approx. 18 kg (40 lbs)	Approx. 35 kg (77 lbs) • Base system approx. 18 kg (33 lbs) • Mobile cart approx. 17 kg (40 lbs)
Dimensions of base (W x D), see dimensional drawings	375 x 350 mm (14.8"x13.8")	647 x 547 mm (25.5"x21.5") incl. wheels
Height (incl. user interface)	489 mm (19.3")	1335 mm (52.6")
Wheels	N/A	Four wheels with separate brakes
A-weighted sound pressure level (L_{pA})	<50 dB, measured at a distance of 1 m (3.3 ft)	
A-weighted sound power level (L_{WA})	<58 dB	



Non



Non

Ventilation – general

Patient range	Tidal volume: <ul style="list-style-type: none"> • Pediatric: 10 – 350 ml • Adult: 100 – 4000 ml
Bias flow	<ul style="list-style-type: none"> • Pediatric: 0,5 l/min • Adult: 2 l/min
Internal compressible factor	Max. 0.1 ml/cmH ₂ O
Gas delivery system	Microprocessor controlled valves
Maximum airway pressure	125 cmH ₂ O
Method of triggering	Flow and pressure
Inspiratory flow range	<ul style="list-style-type: none"> • Pediatric: 0 – 33 l/min • Adult: 0 – 200 l/min
Pressure drop	Max. 6 cmH ₂ O at a flow of 60 l/s (exp. channel)
PEEP regulation	Microprocessor controlled valve
Rise time, expiratory flow measurement	<12 ms for 10 – 90 % response at flow of 3 – 192 l/min
Expiratory flow range	0 – 192 l/min

User interface

Type	TFT-LCD touchscreen
Size	344x194 mm (13,5"x7,6")
Viewing area	15,6" Full HD, 24 bit color extra wide angle
Touch glass coating	Anti reflective, Anti finger print

Power supply

Power supply, automatic range selection	100 – 240 V AC ±10%, 50 – 60 Hz
Plug-in battery module:	
<ul style="list-style-type: none"> • Battery backup (Li-ion) • Battery capacity • Battery backup time • Recharge time 	<ul style="list-style-type: none"> • Two battery module slots. One battery is delivered with the ventilator • Rechargeable, 14.4 V, 6.6 Ah each • Approximately 1.5 h (factory new battery) • Approximately 4 h/battery

Gas supply

Inlet gas pressure air/ O ₂	200 – 600 kPa / 2.0 – 6.0 bar / 29 – 87 PSI (O ₂ : 99 – 100%)
Connection standards available	AGA, DISS, NIST, or French standard
Unavailable gas/loss of gas pressure	The flow from an unavailable gas (O ₂) is automatically compensated for so that the patient gets the preset volume and pressure.
Patient system gas connectors	Male 22 mm / female 15 mm. In accordance with ISO 5356-1.
Gas exhaust port	Male 30 mm cone

Operating conditions

Operating temperature	+10 to +40°C (+50 to +104°F)
Relative humidity	15 to 95% non-condensing
Atmospheric pressure	700 to 1060 hPa
Lowest pressure in patient circuit	-400 cmH ₂ O

Non-operating conditions

Storage temperature	+5 to +40°C (41 to +104°F)
Storage relative humidity	5 to 85% non-condensing
Storage atmospheric pressure	660 to 1060 hPa
Transport temperature	-25 to +60°C (-13 to +140°F)
Transport relative humidity	<95% non-condensing
Transport atmospheric pressure	470 to 1060 hPa



Standards – safety and functionality



The device complies with requirements and classification IIb of Medical Devices Regulation (EU) 2017/745.

CE Mark Notified Body number: 0123.

Classification

IEC 60601-1: 2005 + A1:2012 + A2:2020, Class I, continuous operation.

Applied parts:

- Equipment making physical contact with the patient and the gas path ways. Type B
- Nebulizer patient unit and cable. Type BF
- CO₂. Type BF

Standards

- ISO 80601-2-12:2020
- EN 13544-1:2007 + A1:2009

Ingress protection

IP 21

Electromagnetic compatibility (EMC)

According to limits specified in IEC 60601-1-2:2014 + A1:2020

Display

Views

- Basic view
- Advanced view
- Loops view
- Distance view
- Family view
- Each of the screen layout views offers a specific combination of displayed waveforms, loops and presented values.

Real time waveforms

- Pressure
- Flow
- Volume
- CO₂ (option)

Loops

- Pressure – Volume
- Volume – Flow
- Pressure – Flow loop

A reference loop and two overlaying loops can be displayed.

Servo Compass

Visualizes volume (VT/PBW) and pressure (total or driving) in relation to set targets in invasive modes.

Short trends

- During ventilation in all ventilation modes, short trends of the numerical values in the first column can be displayed.
- Trend time 15 minutes to 72 hours.

Trends

Trending of measured and calculated values:

- Trend time 1 to 72 hours.
- Order of trended values can be set by the user.



Ventilation modes – invasive ventilation

- | | |
|------------------------|---|
| Controlled ventilation | <ul style="list-style-type: none"> • PC (Pressure Control) • VC (Volume Control) • PRVC (Pressure Regulated Volume Control), option |
| Supported ventilation: | <ul style="list-style-type: none"> • PS/CPAP (Pressure Support / Continuous Positive Airway Pressure) • VS (Volume Support), option |
| AUTOMODE (option) | <ul style="list-style-type: none"> • Control mode: VC <--> Support mode: VS • Control mode: PC <--> Support mode: PS • Control mode: PRVC <--> Support mode: VS |
| Combined ventilation | <ul style="list-style-type: none"> • SIMV (VC) + PS (Synchronized Intermittent Mandatory Ventilation) • SIMV (PC) + PS • SIMV (PRVC) + PS (option) • Bi-Vent/APRV (Airway Pressure Release Ventilation), option |

Ventilation modes – non invasive ventilation

- | | |
|------------------------|--|
| Controlled ventilation | <ul style="list-style-type: none"> • NIV PC (option) |
| Supported ventilation: | <ul style="list-style-type: none"> • NIV PS (option) • Nasal CPAP (option) |

Non invasive ventilation

- | | |
|-----------------------------------|--|
| Max. leakage compensation level | <ul style="list-style-type: none"> • Adult: <ul style="list-style-type: none"> - Inspiratory leakage: up to 200 l/min - Expiratory leakage: up to 65 l/min • Pediatric and neonatal: <ul style="list-style-type: none"> - Inspiratory leakage: up to 33 l/min - Expiratory leakage: up to 20 l/min • Nasal CPAP leakage: up to 20 l/min |
| Disconnection flow (configurable) | <ul style="list-style-type: none"> • Low: 7.5 l/min • High: 40 l/min • Disabled: Deactivates disconnection detection |
| Connection detection | Manual or automatic via bias flow |

High Flow therapy (option)

- | | |
|--------------------|--|
| Flow setting range | <ul style="list-style-type: none"> • Pediatric: 0.5 – 50 l/min • Adult: 5 – 60 l/min |
|--------------------|--|

Stress Index

- | | |
|------------------|---|
| Patient category | Adult |
| Modes | VC, SIMV (VC)+PS, Automode VC <-->VS |
| Values | 0.5 – 1.5 (A Stress Index above 1.05 suggest that the lungs are over-distended) |

Open Lung Tool trends (option)

OLT trends (option)

- | | |
|-----------------------|---|
| Graphical trend areas | 1: |
| | <ul style="list-style-type: none"> - Pei (end-inspiratory pressure) - Pdrive* - PEEP |
| | 2: |
| | <ul style="list-style-type: none"> - VTCO₂ (when applicable) - SI* (Stress Index, adult patient category only) - Cdyn |
| | 3: |
| | <ul style="list-style-type: none"> - VTi - VTe |

* Pdrive and SI only shown as values – not graphical trends

- | | |
|-----------------------|--|
| Modes | All invasive modes |
| Trend time | 5, 10, 15, 30, or 60 minutes |
| Recruitment recording | Recording of recruitments for retrospective review of recruitments |

Non



Non

CO₂ analyzer (option)

CO ₂ analyzer (option)	Size	Weight
Sensor (Capnostat 5)	32.0 x 47.0 x 21.6 mm (1.3" x 1.9" x 0.8")	20 g (0.70 oz)
Airway adapter		10 g (0.35 oz)
Operating temperature	10 to 33 °C (50 to 91 °F)	
Power source	Powered by the ventilator	
Connectors and cables	Sensor	2.8 m (9.2 ft) cable
Measuring method	Mainstream, dual-wavelength, non-dispersive infrared	
Measured parameters	<ul style="list-style-type: none"> • CO₂ end tidal concentration (etCO₂) • CO₂ minute elimination (VCO₂) • CO₂ tidal elimination (VTCO₂) 	
Measuring range	<ul style="list-style-type: none"> • 0 to 100 mmHg CO₂ partial pressure • 0 to 13.3 kPa CO₂ partial pressure • 0 to 13.2 % CO₂ volume (at a barometric pressure of 1013 hPa) 	
System response time CO ₂	The total system response time of the CO ₂ monitor when exposed first to air and then to a gas mix with 5.0 % CO ₂ is <250 ms	
Warm-up time	15 s to initial CO ₂ indication maximum 2 minutes to full specification	
Oxygen concentration compensation	Automatic. Values supplied from the ventilator system	
Barometric pressure compensation	Automatic. Values supplied from the ventilator system	
Digitizing rate	100 Hz	
Airway adapter dead space	<ul style="list-style-type: none"> • Pediatric: <1 cm³ • Adult: <6 cm³ 	

Parameter settings

Parameter	Pediatric range	Adult range
Tidal volume (ml)	10 – 350	100 – 4000
Minute volume (l/min)	0.3 – 20	0.5 – 60
Apnea, time to alarm (s)	2 – 45	15 – 45
Max. apnea time in Automode (s)	3 – 15	7 – 12
Pressure level above PEEP (cmH ₂ O)	0 – 80	0 – 120
Pressure level above PEEP in NIV (cmH ₂ O)	0 – 60	0 – 60
PEEP (cmH ₂ O)	0 – 50	0 – 50
PEEP in NIV (cmH ₂ O)	2 – 20	2 – 20
Respiratory rate (breaths/min)	4 – 150	4 – 100
SIMV rate (breaths/min)	1 – 60	1 – 60
Breath cycle time, SIMV (s)	0.5 – 15	1 – 15
P _{High} (cmH ₂ O)	2 – 50	2 – 50
T _{High} (s)	0.2 – 30	0.2 – 30
T _{PEEP} (s)	0.1 – 10	0.1 – 10
PS above P _{High} in Bi-Vent/APRV (cmH ₂ O)	0 – 78	0 – 118
O ₂ concentration (%)	21 – 100	21 – 100
I:E ratio	1:10 – 4:1	1:10 – 4:1
Ti (s)	0.1 – 5	0.1 – 5
T _{Pause} (s)	0 – 1.5	0 – 1.5
T _{Pause} (% of breath cycle time)	0 – 30	0 – 30
Flow trigger (l/min)	0 – 0.5	0 – 2
Pressure trigger (cmH ₂ O)	-1 to -20	-1 to -20
Insp. rise time (% of breath cycle time)	0 – 20	0 – 20
Insp. rise time (s)	0 – 0.2	0 – 0.4
End inspiration (% of peak flow)	1 – 70	1 – 70
End inspiration (% of peak flow) in NIV	10 – 70	10 – 70
Decelerating flow pattern in VC (%)	0 – 100	0 – 100
Flow adaptation in VC	on/off	on/off



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Backup parameter settings

Parameter	Pediatric range	Adult range
Inspiratory tidal volume (ml)	10 – 350	100 – 4 000
Pressure level above PEEP in backup (cmH ₂ O)	5 – 80	5 – 120
Pressure level above PEEP in NIV backup (cmH ₂ O)	5 – 60	5 – 60
Respiratory rate in backup (breaths/min)	4 – 150	4 – 100
I:E ratio	1:10 – 4:1	1:10 – 4:1
Ti (s)	0.1 – 5	0.1 – 5

Special functions

Special function	Setting range
Manual breath	Initiation of 1 breath (In SIMV mode initiation of 1 mandatory breath)
Static measurements	Insp. or exp. hold (0 – 30 seconds)
Nebulization	5 – 30 min/Continuous/Off
O ₂ boost level	Off, 1 – 79 %
O ₂ boost function	Activate O ₂ boost up to 1 minute
Leakage compensation	Automatic in all non invasive modes
Circuit compensation (not available in NIV)	On/Off
Previous mode	Activates previously used mode
Backup ventilation	Backup On/Off
Apnea management	Several parameters

Disconnection / Suction

Pre-oxygenation time	Max. 2 min
Post-oxygenation time	Max. 1 min
Patient disconnected	High priority alarm activated after 1 min
Adjustable oxygen level	21 – 100 %



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Monitoring and trends

Peak airway pressure	Ppeak
Pause airway pressure	Pplat
Mean airway pressure	Pmean
Driving pressure	Pdrive
Positive end expiratory pressure	PEEP
Spontaneous breaths per minute	RR sp
Respiratory rate	RR
Spontaneous expiratory minute volume	MVe sp
Inspired minute volume	MVi
Expired minute volume	MVe
Leakage fraction (%)	Leakage
Inspired tidal volume	VTi
Expired tidal volume	VTe
End expiratory flow	Flowee
Measured oxygen concentration	O ₂ conc.
CO ₂ end tidal concentration	etCO ₂
CO ₂ minute elimination	VCO ₂
CO ₂ tidal elimination	VTCO ₂
Dynamic compliance	Cdyn
Static compliance	Cstatic
Inspiratory resistance	Ri
Expiratory resistance	Re
Work of breathing, ventilator	WOBvent
Work of breathing, patient	WOBpat
Elastance	E
P 0.1	P 0.1
Shallow Breathing Index	SBI
Ratio of expired tidal volume to predicted body weight	VT/PBW
Ratio of expired tidal volume to body weight	VT/BW
Switch to backup (/minute)	Trended value only
Backup (%/min)	Trended value only

Alarms

Alarm	Pediatric range	Adult range
Airway pressure (upper alarm limit)	16 – 90 cmH ₂ O	16 – 120 cmH ₂ O
Airway pressure NIV (upper alarm limit)	16 – 70 cmH ₂ O	16 – 70 cmH ₂ O
Respiratory rate (upper alarm limit)	1 – 160 breaths/min	1 – 160 breaths/min
Respiratory rate (upper and lower alarm limit)	1 – 159 breaths/min	1 – 159 breaths/min
Expired minute volume (upper alarm limit)	0.02 – 30 l/min	1 – 60 l/min
Expired minute volume (lower alarm limit)	0.01 – 20 l/min	0.5 – 40 l/min
Expiratory tidal volume high	6 – 400 ml	60 – 4 000 ml
Expiratory tidal volume low	5 – 390 ml	50 – 3 900 ml
End expiratory pressure (upper alarm limit)	1 – 55 cmH ₂ O	1 – 55 cmH ₂ O
End expiratory pressure (lower alarm limit)	0 – 47 cmH ₂ O	0 – 47 cmH ₂ O
No patient effort (Apnea) alarm	2 – 45 s	15 – 45 s
	Automatic return to support mode on patient triggering	
No consistent patient effort	Yes, described in User's manual	
High continuous pressure	Yes, described in User's manual	
O ₂ concentration	Set value ±5 vol% or ≤18 vol% **	
	** When the set O ₂ concentration is higher than 90 %, the O ₂ concentration low alarm is set to 85%.	
Gas supply	Below 200 kPa (2.0 bar/29 PSI), above 600 kPa (6.0 bar/87 PSI)	
Battery	<ul style="list-style-type: none"> Limited battery capacity: 10 min No battery capacity: less than 3 min Low battery voltage 	
End tidal CO ₂ (upper and lower limit)	0.5–20 %, 4–100 mmHg, 0.5–14 kPa	
Leakage too high	Yes, described in User's manual	
Technical	Yes, described in User's manual	

Autoset (alarm limits) specification

Autoset (alarm limits) specification	Invasive ventilation, controlled modes only
High airway pressure:	Mean peak pressure +10 cmH ₂ O or at least 35 cmH ₂ O
Expiratory minute volume (upper alarm limit)	Mean expiratory minute volume +50 %
Expiratory minute volume (lower alarm limit)	Mean expiratory minute volume -50 %
Expiratory tidal volume (upper alarm limit)	Mean tidal volume +50 %
Expiratory tidal volume (lower alarm limit)	Mean tidal volume -50 %
Respiratory rate (upper alarm limit)	Mean respiratory rate +40 %
Respiratory rate (lower alarm limit)	Mean respiratory rate -40 %
End expiratory pressure (upper alarm limit)	Mean end expiratory pressure +5 cmH ₂ O
End expiratory pressure (lower alarm limit)	Mean end expiratory pressure -3 cmH ₂ O
End tidal CO ₂ concentration (upper alarm limit)	Mean end tidal CO ₂ concentration +25 %
End tidal CO ₂ concentration (lower alarm limit)	Mean end tidal CO ₂ concentration -25 %

Aerogen nebulizers

Aerogen nebulizers	Pro	Solo
Size	W 50 x L 50 x H 45 mm (W 2.0" x L 2.0" x H 1.8")	W 48 x L 25 x H 67 mm (W 1.9" x L 1.0" x H 2.6")
Weight	Approx. 25 g (0.88 oz)	Approx. 14 g (0.49 oz)
Particle size	1 – 5 µm mass median aerodynamic diameter (MMAD)	
Flow rate	>0.2 (average: ~0.4) ml/min	
Max. volume	10 ml	6 ml
Residual volume	<0.1 ml for 3 ml dose	
Control cable	1.8 m (5.9 ft)	



Communication / Interface

Serial ports	Two RS-232C ports. For data communication via the Servo Communication Interface (SCI).
Servo Communication Interface (SCI)	A protocol for data communication with external devices
Alarm output connection (option)	<ul style="list-style-type: none"> • 4-pin modular connector for communication of all active alarms • Switching capability: Max. 40 V DC, max. 500 mA, max. 20 W
Data transfer via USB port	For transfer of trends, logs, screenshots and recordings to a USB memory stick
Ethernet port	The network connection (LAN) port is for service use

Saving of data

Recording of current waveform and parameter values	30 seconds of data will be recorded (15 seconds before and 15 seconds after activation). Up to 40 recordings can be stored.
Saving screenshots	Up to 40 screenshots can be stored.
Saving recruitments	Up to 12 manual recruitment recordings can be stored (option).
Export files	Recordings, screenshots, recruitments, trends and event log can be saved and exported to a USB memory stick.

Log function

Event log	<ul style="list-style-type: none"> • Alarms • Ventilator settings • Apnea periods • Immediate functions
Service log	<ul style="list-style-type: none"> • Technical alarms • Test results • Service records • Software installation • Configuration information



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Optional equipment

Optional equipment	Weight	Dimensions	Maximum load
Mobile cart	15.0 kg (33.0 lbs)	W 647 x L 547 x H 860 mm (W 25.5" x L 21.5" x H 33.9")	-
Shelf base	3.0 kg (6.6 lbs)	W 340 x L 270 x H 43 mm (W 13.4" x L 10.6" x H 1.7")	-
Humidifier holder	0.5 kg (1.1 lbs)	W 84 x L 124 x H 135 mm (W 3.3" x L 4.9" x H 5.3")	5 kg (11 lbs)
Waterbag/IV pole	0.4 kg (0.9 lbs)	W 148 x L 26 x H 1007 mm (W 5.8" x L 1.0" x H 39.6")	1.5 kg (3.3 lbs)
Support arm 179	1.9 kg (4.2 lbs)	Length 900 mm (35.4")	<ul style="list-style-type: none"> • 1 kg (2.2 lbs) at 180° • 1.5 kg (3.3 lbs) at 90° • 3 kg (6.6 lbs) at 45°
Support Arm 177	2.4 kg (5.3 lbs)	L 1000 mm (39.3")	0.5 kg (1.1 lbs) *
* At all angles (2nd joint). Note: The first rod must be in vertical position.			
Cable holder for handle	0.1 kg (0.2 lbs)	W 138 x L 92 x H 155 mm (W 5.4" x L 3.6" x H 6.1")	2.5 kg (5.5 lbs)
Gas cylinder restrainer kit	1.0 kg (2.2 lbs)	Upper: W 104 x L 65 x H 48 mm (W 4.1" x L 2.5" x H 1.9") Lower: W 106 x L 162 x H 76 mm (W 4.1" x L 6.4" x H 3.0")	Two 8 kg bottles
Y piece holder	-	W 26 x L 52 x H 46 mm (W 1.0" x L 2.0" x H 1.8")	-

Compressor Mini (option)

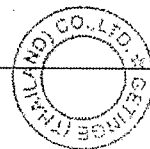
See separate datasheet

Service

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

Ordering information

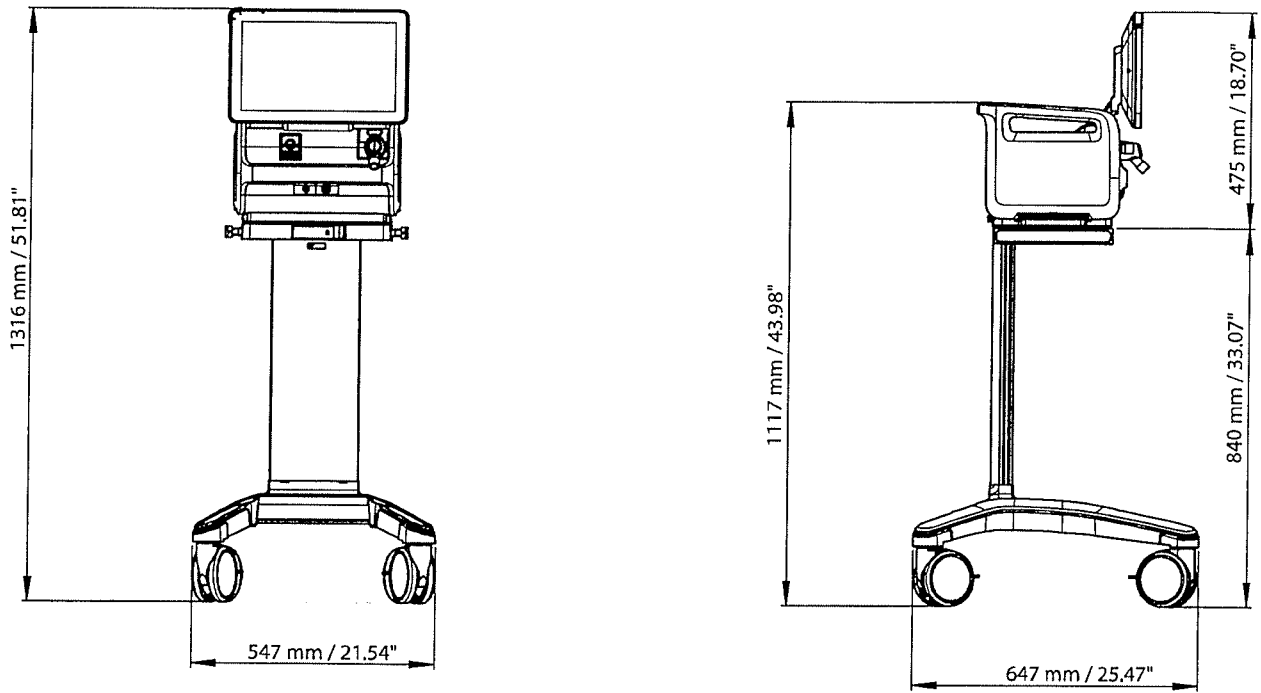
Servo-c, ventilator system and accessories: See separate information:
"System Flow Chart Servo-c" (Order no: 68 92 757).



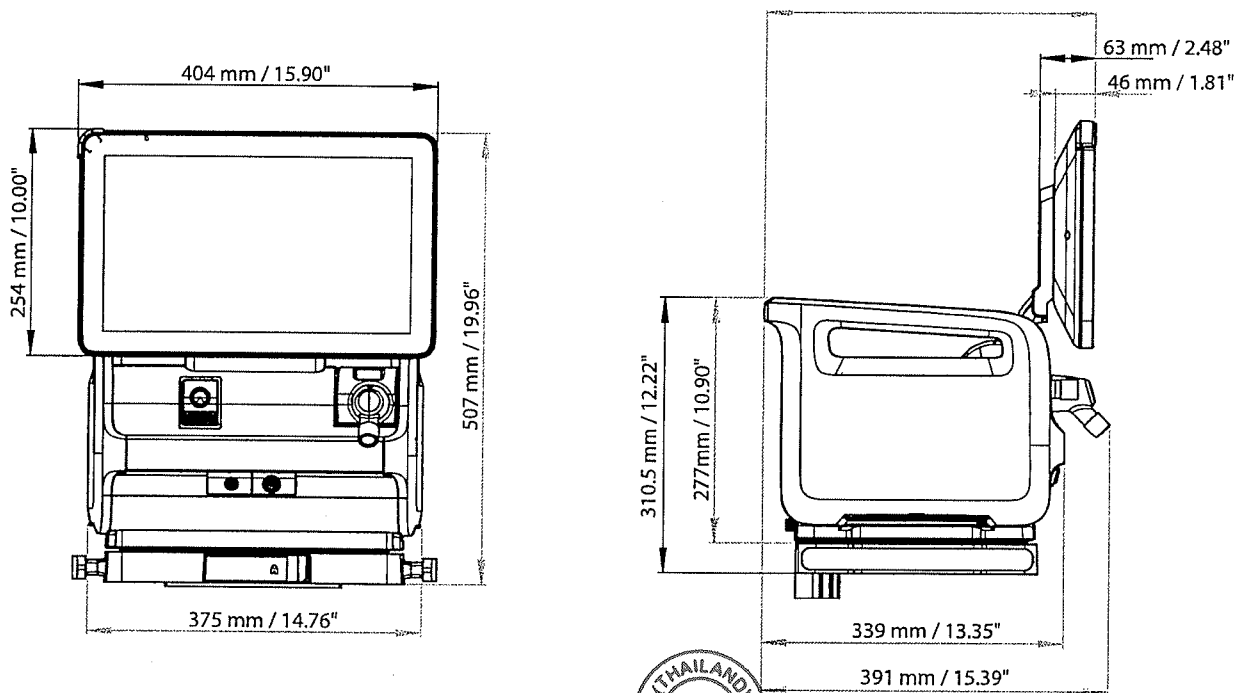
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Dimensional drawings

Servo-c on Mobile cart



Servo-c on shelf base



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