



# Flow-e Anesthesia Machine System version 4.7

Datasheet

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# Flow-e Anesthesia Machine

## Technical specifications

Gas volumes, flows and leakages associated with the breathing system are stated in the technical specifications and adhere to BTPS reference conditions. (Body Temperature, Ambient Pressure, Saturated).

All gas concentration readings are normally referenced to dry gas conditions, ambient room temperature and atmospheric pressure (ATPD).

The condition for measured inlet gas pressures and flows is STPD (Standard Temperature and Pressure Dry); 20°C, standard pressure at 101.3 kPa and 0% relative humidity (dry).

### Weight and dimensions

Base system weight (out of the box weight)	324 lbs. (147 kg)
System nominal weight*	361 lbs. (164 kg)
* Equipped with control panel, patient cassette, one full vaporizer, one CO <sub>2</sub> absorber.	
System max weight including maximum load	694 lbs. (315 kg)
Dimensions of base plate	27.4" x 42.6" (697 x 1083 mm)
Drawers	4
Vertical rail	5
Wheels	Four wheels (diameter 4.9"/125 mm)
Working surface/writing table	15.0" x 18.9" (380 x 480 mm)
Reading lamp	Adjustable LED light integrated into the shelf tower

### Display

Type	LED touch screen, complete with 11 membrane switches and one rotary knob
Size	17.0" x 11.6" (432 x 295 mm)
Placement	Attached to display arm
Viewing area	15"
Waveforms	Up to 6 waveforms, user configurable
Trends	<ul style="list-style-type: none"><li>• Graphic display, 1 to 24 hour resolution</li><li>• Numeric display, 1 to 60 minute resolution</li></ul>

## Essential performance (term defined in IEC 60601-1)

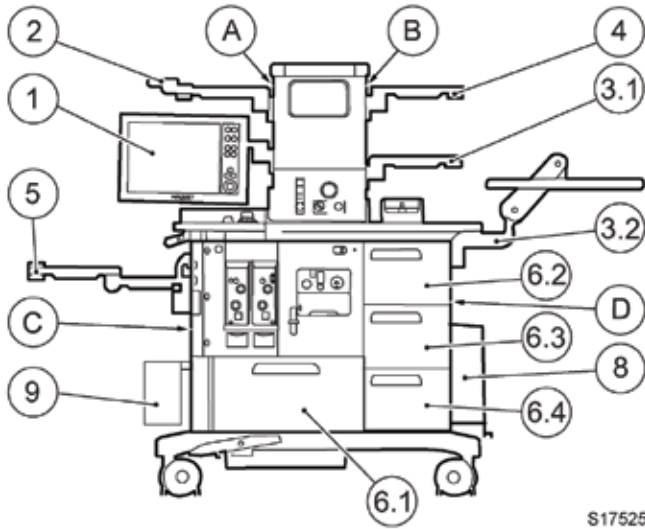
- Oxygen flow under all conditions except the failure of the oxygen supply or generation of a clinical and/or technical alarm.
- Delivery of a non-hypoxic gas mixture to the patient or generation of a clinical and/or technical alarm.
- Non-delivery of excessive concentrations of a volatile anesthetic agent or generation of a clinical alarm.
- Airway pressure monitoring and associated clinical alarms (Ppeak, PEEP).
- Gas measurement accuracy (for Isoflurane, Desflurane, Sevoflurane, CO<sub>2</sub>, N<sub>2</sub>O, O<sub>2</sub>) and generation of gas measurement associated clinical alarms or generation of a technical alarm.
- Delivery of ventilation at the patient connection port within the alarm limits set by the operator or generation of a clinical or technical alarm.

## Environment

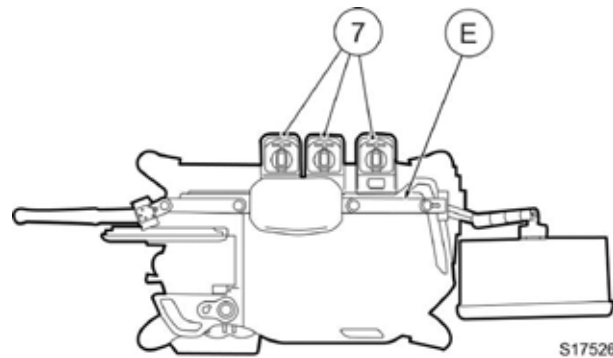
Environment	Operating conditions	Non-operating conditions
Ambient temperature	+60°F to +95°F (+15°C to +35°C) (Desflurane: +60°F to +85°F, +15°C to +30°C)	-15°F to +140°F (-25°C to +60°C)
CO <sub>2</sub> absorber	60°F to 95°F (15°C to 35°C)	32°F to 95°F (0°C to 35°C)
Storage at higher temperatures can result in reduced efficiency and service life due to moisture loss. When correctly stored, canisters will maintain absorption capacity for a period of two years.		
Battery	+60°F to +95°F (+15°C to +35°C)	+40°F to +104°F (+5°C to +40°C)
When the system is disconnected from a mains power supply, a fully charged battery can be stored in the anesthesia system for up to six weeks at temperatures between +40°F and +105°F (+5°C and +40°C). At temperatures between +125 °F and +140 °F (+50°C and +60°C) storage time is one week. If these limits are exceeded, battery performance can no longer be guaranteed.		
Relative humidity (non-condensing)	15% to 95%	<95%
Atmospheric pressure	700 hPa–1060 hPa	470 hPa–1060 hPa

## Maximum weight, number, and position of accessories

- Accessories must be installed according to any installation and safety guidelines given in the accessories installation instruction. Additional local, regional, and/or national guidelines related to occupational safety may apply.
- The following illustrations show a typical configuration. The setup given in the table has been verified by the manufacturer. The manufacturer assumes no responsibility for other configurations.
- The functionality of the system is extended by installing accessory carriers with appropriate accessories using the vertical rails.



S17525



S1752E

Ref.no.	Accessory carrier	Accessory	Remark	Rail	Max load
1	Control panel arm	Control panel		A, B	
2, 4	<ul style="list-style-type: none"> <li>• Monitor arm VESA</li> <li>• Monitor arm slide-in plate</li> <li>• Monitor arm 2 pin</li> </ul>	<ul style="list-style-type: none"> <li>• Patient monitor</li> <li>• Display</li> </ul>	If both arms are used: one arm with max 27.5 lbs. (12.5 kg) and second arm with max 22.0 lbs. (10 kg)	A, B	27.5 lbs. (12.5 kg)
3.1	<ul style="list-style-type: none"> <li>• Monitor arm VESA</li> <li>• Monitor arm slide-in plate</li> <li>• Monitor arm 2 pin</li> </ul>	<ul style="list-style-type: none"> <li>• PDMS Display</li> <li>• Patient monitor</li> </ul>	Requires extra mains power outlet option	A, B	22.0 lbs. (10 kg)
3.2	Height adjustable keyboard arm	PDMS keyboard	Requires extra mains power outlets option	D	3.3 lbs. (1.5 kg)
5	Equipment arm including downward pole, short	<ul style="list-style-type: none"> <li>• Upward pole short</li> <li>• Quad hook for cable management</li> <li>• Parameter box</li> <li>• Syringe pump</li> <li>• IV pole</li> </ul>		C	Total load max 16.5 lbs. (7.5 kg), of which max 8.8 lbs. (4 kg) is placed on IV hooks
6.1	Drawer large	Drawer with load		N/A	22.0 lbs. (10 kg)
6.2	Drawer small	Drawer with load		N/A	11.0 lbs. (5 kg)/ drawer
6.3					
6.4					

## Maximum weight, number, and position of accessories (continued)

Ref. no.	Accessory carrier	Accessory	Remark	Rail	Max load
7	<ul style="list-style-type: none"> <li>Backup gas rack O<sub>2</sub></li> <li>Backup gas rack Air</li> <li>Backup gas rack N<sub>2</sub>O</li> </ul>	Backup gas cylinders		N/A	15.4 lbs. (7 kg)/ cylinder
8	<ul style="list-style-type: none"> <li>CPU mounting small</li> <li>CPU mounting large</li> </ul>	<ul style="list-style-type: none"> <li>CPU</li> <li>CPU</li> </ul>	CPU width/max height/ max depth: <ul style="list-style-type: none"> <li>3.0-4.9/14.0/14.0" (76-114/356/356 mm)</li> <li>4.9-7.0/18.0/18.0" (114-178/457/457 mm)</li> </ul>	<ul style="list-style-type: none"> <li>D</li> <li>D</li> </ul>	24.9 lbs. (11.3 kg) 40.1 lbs. (18.2 kg)
9	Horizontal short rail DIN Horizontal short rail Duoflex	Suction container	Only used in front direction.	C, D	6.6 lbs. (3 kg)
Not shown	Additional table	N/A	May only be used if replacing one of ref no 2, 3.1, 4 or 5	D	11.0 lbs. (5 kg)
Not shown	Other equipment	N/A	Only if no third backup gas cylinder is used	E	11.0 lbs. (5 kg)

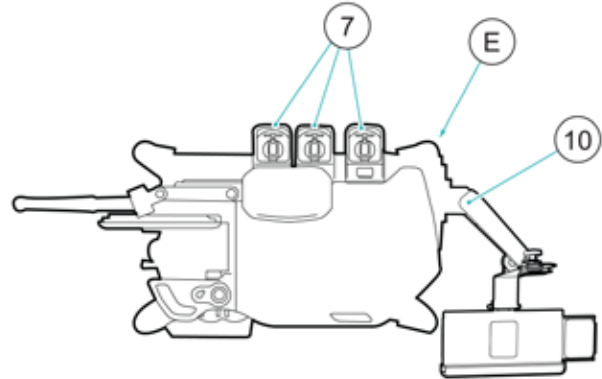
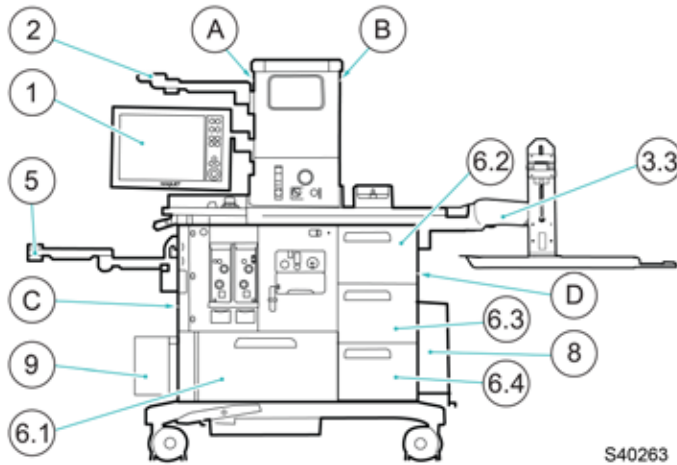
### Accessory

### Equipment weight

Additional writing table	9.9 lbs. (4.5 kg)
GCX arm with VESA interface Monitor arm slide-in plate Monitor arm 2 pin	4.4 lbs. (2 kg)
Equipment arm	6.6 lbs. (3 kg)
CPU mounting small	5.1 lbs. (2.3 kg)
CPU mounting large	16.1 lbs. (7.3 kg)
Height-adjustable keyboard arm	13.2 lbs. (6 kg)

## Alternative configuration for height-adjustable arm with VESA interface

- The Height adjustable arm with VESA interface must only be mounted on rail D. Do not use rail B when using the alternative configuration.



Ref.no	Accessory carrier	Accessory	Remark	Rail	Max load
1	Control panel arm	Control panel		A	
2	<ul style="list-style-type: none"> <li>• Monitor arm VESA</li> <li>• Monitor arm slide-in plate</li> <li>• Monitor arm 2 pin</li> </ul>	<ul style="list-style-type: none"> <li>• Patient monitor</li> <li>• Display</li> </ul>		A	27.5 lbs. (12.5 kg)
3.3	Height adjustable arm VESA	PDMS system	Requires Extra mains power outlets option.	D	29.9 lbs. (13.6 kg)
5	Equipment arm including downward pole, short	<ul style="list-style-type: none"> <li>• Upward pole short</li> <li>• Quad hook for cable management</li> <li>• Parameter box</li> <li>• Syringe pump</li> <li>• IV pole</li> </ul>		C	Total load max 16.5 lbs. (7.5 kg), of which max 8.8 lbs. (4 kg) is placed on IV hooks
6.1	Drawer large	Drawer with load		N/A	22.0 lbs. (10 kg)
6.2	Drawer small	Drawer with load		N/A	11.0 lbs. (5 kg)/ drawer
6.3					
6.4					

## Alternative configuration for height-adjustable arm with VESA interface *(continued)*

Ref.no	Accessory carrier	Accessory	Remark	Rail	Max load
7	<ul style="list-style-type: none"> <li>Backup gas rack O<sub>2</sub></li> <li>Backup gas rack Air</li> <li>Backup gas rack N<sub>2</sub>O</li> </ul>	Backup gas cylinders		N/A	15.4 lbs. (7 kg)/cylinder
8	<ul style="list-style-type: none"> <li>CPU mounting small</li> <li>CPU mounting large</li> </ul>	<ul style="list-style-type: none"> <li>CPU</li> <li>CPU</li> </ul>	CPU width/max height/ max depth: <ul style="list-style-type: none"> <li>3.0"-4.9"/14.0"/14.0" (76-114/356/356 mm)</li> <li>4.9"-7.0"/18.0"/18.0" (114-178/457/457 mm)</li> </ul>	<ul style="list-style-type: none"> <li>D</li> <li>D</li> </ul>	24.9 lbs. (11.3 kg) 40.1 lbs. (18.2 kg)
9	Horizontal short rail DIN Horizontal short rail Duoflex	Suction container	Only used in front direction	C, D	6.6 lbs. (3 kg)
Not shown	Other equipment	N/A	Only if no third backup gas cylinder is used.	E	11.0 lbs. (5 kg)

Accessory	Equipment weight
Equipment arm	6.6 lbs. (3 kg)
CPU mounting, small	5.1 lbs. (2.3 kg)
CPU mounting, large	16.1 lbs. (7.3 kg)
GCX arm with VESA interface Monitor arm slide-in plate Monitor arm 2 pin	4.4 lbs. (2 kg)
Height-adjustable arm VESA	22.0 lbs. (10 kg)



## Standards — safety and functionality

Safety	IEC 60601-1:2005 + A1:2012 IEC 60601-1-2:2014 IEC 60601-1-8:2006 + A1:2012 ISO 80601-2-13:2011 + A1:2015 IEC 62304:2006 + Cor1:2008 + A1:2015 ISO 5360:2016
Electromagnetic compatibility	IEC 60601-1-2:2014 Refer to <b>Electromagnetic Compatibility, Flow-e Anesthesia System</b>
Respiratory gas monitoring	ISO 80601-2-55:2011
Anesthetic gas delivery	ISO 80601-2-13:2011 + A1:2015
Usability	IEC 62366-1:2015
Cleaning	IEC 60601-1:2005 + A1:2012 ISO 80601-2-13:2011 + A1:2015
<b>Classification according to IEC 60601-1:</b>	
Class I equipment	According to the type of protection against electrical shock
Type B equipment	According to the degree of protection against electrical shock
Continuous operation	According to the mode of operation
<b>Classification according to EU Medical Directive 93/42/EEC:</b>	
The anesthesia system is classified as IIb	
<b>Classification according to IEC 60529:</b>	
Ingress Protection	IP21 Valid when the patient cassette is in place and the patient cassette lid is closed. Make sure any fluid has been wiped from the connections in the vaporizer slots before connecting a vaporizer.
IP number	First digit — Solids                      Second digit — Liquids
IP21	Protected against solid foreign objects of 12.5 mm diameter and greater                      Protected against vertically falling water drops

# Power supply

## Mains power

Mains power	100–240 V, AC 50–60 Hz (without auxiliary power outlets) 100–120 V, 220–240 V, AC 50–60 Hz (with auxiliary power outlets)
Power consumption	300 VA (auxiliary power outlets not included) 1500 VA (maximum auxiliary configuration)

## Battery

Type	Sealed acid-lead rechargeable
Capacity	18 Ah
Operating time	Approx. 90 minutes
Charging time	Approx. 6 hours

## Auxiliary power outlets

All auxiliary power outlets are connected to an isolation transformer.  
Voltage depends on mains power supply.

Voltage	Type of electrical outlet	Max load total	Max load from each outlet
<b>220–240 V</b>	4 x IEC	• 5 A	• 5 A
	• 4 x CEE 7/3 (EU)	• 5 A	• 2 A
	• 4 x BS 1363 (UK)	• 5 A	• 2 A
<b>100–120 V</b>	• 4 x IEC	• 10 A	• 10 A
	• 4 x CEE 7/3 (EU)	• 10 A	• 4 A
	• 4 x BS 1363 (UK)	• 10 A	• 4 A
	• 4 x NEMA 5-15R (US)	• 10 A	• 4 A

# Gas supply

All gases and anesthetic agents must conform to the European and American Pharmacopeia.

## Central gas

Supply pressure:	
• O <sub>2</sub>	• 250–600 kPa (2.5–6.0 bar, 36–87 psi)*
• Air	• 250–600 kPa (2.5–6.0 bar, 36–87 psi)†
• N <sub>2</sub> O	• 250–600 kPa (2.5–6.0 bar, 36–87 psi)

Hospital central gas supply must be able to deliver a flow of at least 60 l/min at a supply pressure of 280 kPa (2.8 bar, 41 psi).

Connection standards	AGA DISS NIST French standard British standard
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Maximum levels	Air	O <sub>2</sub>
	• H <sub>2</sub> O <7 g/m <sup>3</sup>	• H <sub>2</sub> O <20 mg/m <sup>3</sup>
	• Oil <0.5 mg/m <sup>3</sup>	
	• Chlorine must not be detectable	

If the compressed air is generated by a liquid ring compressor there is a potential risk of chlorine in the supplied air.

Maximum inlet gas temperature	<95°F (<35°C)
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External vacuum source pressure -0.9 to -0.6 bar (-90 to -60 kPa)

## Backup gas

Cylinder connection standards	• Pin Index Safety System (PISS) • DIN
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DIN connections 6, 9, 12, 13

Backup gas rack, excluding valves	
Size	25.8" x 5.5" (655 x 140 mm) (H x Ø)
Weight	Max 15.4 lbs. (7 kg) per cylinder, including gas

Cylinder configuration Max three cylinders and only one of each

- O<sub>2</sub>
- Air
- N<sub>2</sub>O

Cylinder pressure	
• O <sub>2</sub>	Max 20,000 kPa (200 bar, 2900 psi)
• Air	Max 20,000 kPa (200 bar, 2900 psi)
• N <sub>2</sub> O	Max 8,000 kPa (80 bar, 1160 psi)

Pressure measurement Electronically measured cylinder pressure

Cylinder safety valve opening pressure	
• O <sub>2</sub>	650 kPa (6.5 bar, 94 psi)
• Air	650 kPa (6.5 bar, 94 psi)
• N <sub>2</sub> O	650 kPa (6.5 bar, 94 psi)

\* The auxiliary O<sub>2</sub> device will not meet specified performance if the supply pressure is less than 300 kPa (3 bar, 44 psi).

† The Venturi vacuum ejector pump will not meet specified performance if the supply pressure is less than 300 kPa (3 bar, 44 psi).

## Suction unit

Type	High vacuum/high flow rate
<b>Vacuum ejector pump — Venturi</b>	
Compressed air consumption (Suction unit)	50–90 NI/min* at a supply pressure equivalent to patient suction supply pressure (Air)
Max free flow (suction flow)	28 NI/min
Max vacuum (suction) <sup>†</sup>	-0.9 to -0.6 bar (-90 to -60 kPa), at a supply pressure equivalent to patient suction supply pressure (Air)

### External vacuum source — Medical vacuum system

External vacuum source pressure	-0.9 to -0.6 bar (-90 to -60 kPa)
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\* Normal liter (NI) — volume of gas given ambient conditions, for example current atmospheric pressure.

† Max vacuum varies as a function of atmospheric pressure and supply pressure. Highest performance is obtained at sea level when the supply pressure is approx. 4 bar. Performance decreases with increased altitude.

## Recruitment maneuvers (option)

### Monitoring and trends

End Inspiratory Pressure (EIP)	Breath-by-breath
Positive End Expiratory Pressure (PEEP)	Breath-by-breath
Dynamic compliance (C <sub>dyn</sub> )	Breath-by-breath
RM trends timescale	5 or 20 minutes
Set Ppeak alarm limit	The level is plotted with the pressure curves
Breath count	The number of breaths is counted at a certain level of PEEP or PC above PEEP until a further change of these parameters is made

### Recruitment maneuvers parameters

Ppeak target	30 to 45 cmH <sub>2</sub> O
PEEP target	15 to 40 cmH <sub>2</sub> O
PEEP after RM	5 to 20 cmH <sub>2</sub> O
Ppeak increase per step	2 to 10 cmH <sub>2</sub> O
Breaths per step	1 to 10
Breaths at target	3 to 30
I:E during RM	1:3.0 to 3.0:1

## Anesthetic Gas Scavenging System (AGSS)

Type	Passive system (including a flow indicator) integrated into the system
Scavenging flow	Minimum 25 l/min (STPD), or 10 l/min (STPD) over the set minute volume, whichever is greater
Outlet connections	<ul style="list-style-type: none"> <li>• 30 mm ISO taper</li> <li>• DISS EVAC</li> <li>• 0.5"/12.7 mm in-hose barb</li> <li>• 1"/25 mm barb</li> <li>• AGA EVAC</li> <li>• WAGD-to-vacuum connector</li> <li>• 22 mm out. diam. connector and 22 mm int. diam. connection tube</li> </ul>

## Fresh gas flow

Gas mix	Air/O <sub>2</sub> O <sub>2</sub> /N <sub>2</sub> O	Electronic Servo controlled Electronic Servo controlled
Fresh gas flow range	<ul style="list-style-type: none"> <li>• MAN = 0.1–20 l/min</li> <li>• AUTO = 0.1–20 l/min (FGF delivery depending on set MV)</li> <li>• AFGO = 1.0–20 l/min</li> </ul>	
Fresh gas O <sub>2</sub> /Air Flow (numerical/bar graph)	Selectable	
Fresh gas O <sub>2</sub> /N <sub>2</sub> O Flow (numerical/bar graph)	Selectable	
O <sub>2</sub> concentration accuracy in the fresh gas:		
• Air/O <sub>2</sub> (21–100%)	• Fresh gas flow 0.3–20 l/min: ±5%	• Fresh gas flow <0.3 l/min: ±20%*
• O <sub>2</sub> /N <sub>2</sub> O (28–100%)	• Fresh gas flow 0.3–20 l/min: ±5%	• Fresh gas flow <0.3 l/min: ±20%†
Setting resolution, O <sub>2</sub>	1%	
Setting resolution, flow	0.1 l/min	
O <sub>2</sub> Flush	<ul style="list-style-type: none"> <li>• Approximately 56 l/min</li> <li>• 2 cmH<sub>2</sub>O expiratory resistance when APL is set to SP</li> </ul>	

### Auxiliary O<sub>2</sub>

Auxiliary O <sub>2</sub> flow range	0–15 l/min‡
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\* Specification valid in typical clinical range for minimal flow anesthesia: Respiratory Rate 5–35 breaths/min, Tidal Volume 100–700 ml, Minute Volume <10 l/min, Pressure 5–40 cmH<sub>2</sub>O, Set O<sub>2</sub> 50–100%.

† Specification valid in typical clinical range for minimal flow anesthesia: Respiratory Rate 5–35 breaths/min, Tidal Volume 100–700 ml, Minute Volume <10 l/min, Pressure 5–40 cmH<sub>2</sub>O, Set O<sub>2</sub> 50–100%.

‡ The apparent gas flow will increase if the ambient pressure decreases.

## Breathing system

Type	Circle system with Volume Reflector						
System volume (incl. absorber, without patient tubings and manual breathing bag)	Approx. 2.8 l						
Maximum volume allowed for patient tubings and optional equipment forming part of the circle system	3000 ml						
The patient circuit configurations are intended to provide the following range of inspired tidal volumes	<ul style="list-style-type: none"> <li>• Adult: 22 mm tubing, Tidal Volumes 100–2000 ml</li> <li>• Infant: 15 mm tubing, Tidal Volumes 25–350 ml</li> <li>• Infant: 10–12 mm tubing, Tidal Volumes 5–100 ml*</li> </ul> <p>* VC: 20–100 ml, PC: 5–100 ml</p>						
Drive gas	O <sub>2</sub>						
CO <sub>2</sub> absorber	<table border="0"> <tr> <td>Volume disposable</td> <td>Approx. 0.8 l</td> </tr> <tr> <td>Volume reusable</td> <td>Approx. 0.7 l</td> </tr> <tr> <td>Absorbent material</td> <td>Sofnolime®</td> </tr> </table>	Volume disposable	Approx. 0.8 l	Volume reusable	Approx. 0.7 l	Absorbent material	Sofnolime®
Volume disposable	Approx. 0.8 l						
Volume reusable	Approx. 0.7 l						
Absorbent material	Sofnolime®						
Patient tube connections	22/15 mm ISO cone						
Type of material (breathing circuit system)	<ul style="list-style-type: none"> <li>• PPSU (Polyphenylsulphone)</li> <li>• SBC (Styrene-butadiene copolymer)</li> <li>• PP (Polypropylene)</li> </ul>						
System compliance (volume of gas lost due to internal compliance — manual mode only)	Approx. 3 ml/cmH <sub>2</sub> O, i.e. 90 ml at a pressure of 30 cmH <sub>2</sub> O						
Inspiratory/expiratory flow resistance of the system (the figures here apply to the breathing tubes recommended by the manufacturer)	<ul style="list-style-type: none"> <li>• 10 mm breathing circuits (including Y-piece): <ul style="list-style-type: none"> <li>– &lt;2.8 cmH<sub>2</sub>O at a flow of 2.5 l/min</li> <li>– &lt;5.5 cmH<sub>2</sub>O at a flow of 15 l/min</li> </ul> </li> <li>• 15 mm breathing circuits (including Y-piece): <ul style="list-style-type: none"> <li>– &lt;1.3 cmH<sub>2</sub>O at a flow of 2.5 l/min</li> <li>– &lt;2.1 cmH<sub>2</sub>O at a flow of 15 l/min</li> <li>– &lt;4.4 cmH<sub>2</sub>O at a flow of 30 l/min</li> </ul> </li> <li>• 22 mm breathing circuits (including Y-piece): <ul style="list-style-type: none"> <li>– &lt;1.1 cmH<sub>2</sub>O at a flow of 2.5 l/min</li> <li>– &lt;2.0 cmH<sub>2</sub>O at a flow of 15 l/min</li> <li>– &lt;3.7 cmH<sub>2</sub>O at a flow of 30 l/min</li> <li>– &lt;6.0 cmH<sub>2</sub>O at a flow of 60 l/min</li> </ul> </li> </ul>						
<b>Manual ventilation</b>							
Electronic APL valve	Spontaneous breathing (SP) and adjustable pressure up to 80 cmH <sub>2</sub> O						
<b>AFGO — Additional Fresh Gas Outlet (option)</b>							
Type	<ul style="list-style-type: none"> <li>• 22 mm coaxial/15 mm conical outlet connections</li> <li>• Pneumatic powered SW controlled (from control panel)</li> </ul>						
<b>Emergency backup ventilation</b>							
Emergency APL valve	SP–80 cmH <sub>2</sub> O, SP = 2 cmH <sub>2</sub> O						
O <sub>2</sub> emergency flow	0–10 l/min						

## Breathing circuits and accessories

Note that the table applies to the breathing circuits recommended by the manufacturer.

Compliance	<ul style="list-style-type: none"> <li>• 10 mm breathing circuits: &lt;0.4 ml/cmH<sub>2</sub>O</li> <li>• 15 mm breathing circuits: &lt;0.7 ml/cmH<sub>2</sub>O</li> <li>• 22 mm breathing circuits: &lt;1.8 ml/cmH<sub>2</sub>O</li> </ul>
Internal volume	<ul style="list-style-type: none"> <li>• 10 mm breathing circuits: 0.4 l</li> <li>• 15 mm breathing circuits: 0.7 l</li> <li>• 22 mm breathing circuits: 1.8 l</li> </ul>
Flow resistance in each limb including Y-piece	<ul style="list-style-type: none"> <li>• 10 mm breathing circuits:               <ul style="list-style-type: none"> <li>– At 2.5 l/min: &lt;3.0 cmH<sub>2</sub>O/(l/s)</li> <li>– At 15 l/min: &lt;6.0 cmH<sub>2</sub>O/(l/s)</li> <li>– At 30 l/min: &lt;10 cmH<sub>2</sub>O/(l/s) (30 l/min not applicable for intended patient tidal volume range)</li> </ul> </li> <li>• 15 mm breathing circuits:               <ul style="list-style-type: none"> <li>– At 2.5 l/min: &lt;1.5 cmH<sub>2</sub>O/(l/s)</li> <li>– At 15 l/min: &lt;1.5 cmH<sub>2</sub>O/(l/s)</li> <li>– At 30 l/min: &lt;2 cmH<sub>2</sub>O/(l/s)</li> </ul> </li> <li>• 22 mm breathing circuits:               <ul style="list-style-type: none"> <li>– At 2.5 l/min: &lt;0.5 cmH<sub>2</sub>O/(l/s)</li> <li>– At 15 l/min: &lt;0.7 cmH<sub>2</sub>O/(l/s)</li> <li>– At 30 l/min: &lt;1.0 cmH<sub>2</sub>O/(l/s)</li> </ul> </li> </ul>
Flow resistance for angled adapter	<ul style="list-style-type: none"> <li>• At 2.5 l/min: &lt;0.2 cmH<sub>2</sub>O/(l/s)</li> <li>• At 15 l/min: &lt;0.6 cmH<sub>2</sub>O/(l/s)</li> <li>• At 30 l/min: &lt;1.0 cmH<sub>2</sub>O/(l/s)</li> </ul>
• Flow resistance for 22 mm joint adapter	<ul style="list-style-type: none"> <li>• At 2.5 l/min: &lt;0.2 cmH<sub>2</sub>O/(l/s)</li> <li>• At 15 l/min: &lt;0.2 cmH<sub>2</sub>O/(l/s)</li> <li>• At 30 l/min: &lt;0.2 cmH<sub>2</sub>O/(l/s)</li> </ul>

# Ventilator

Type	Pneumatic powered Servo controlled
Patient range	Neonatal to adult
Ventilation modes	<ul style="list-style-type: none"> <li>• Manual/bag</li> <li>• Additional Fresh Gas Outlet (AFGO, option)</li> <li>• Volume Control (VC)</li> <li>• Pressure Control (PC, option)</li> <li>• Pressure Support (PS, option)</li> <li>• Pressure Regulated Volume Control (PRVC, option)</li> <li>• Synchronized Intermittent Mandatory Ventilation (SIMV, option)</li> <li>• Low VT ventilation (option)</li> <li>• High performance ventilation (option)</li> </ul>
Tidal volume range (volume controlled modes)	<p>20–350 ml, <math>\pm 10\%</math> or 10 ml, whichever is greater*</p> <p>50–1600 ml, <math>\pm 10\%</math> or 10 ml, whichever is greater</p> <p>50–2000 ml, <math>\pm 10\%</math> or 10 ml, whichever is greater†</p> <p>Note that the Flow-e delivers tidal volumes down to 5 ml when using Pressure Control.</p>
Tidal volume setting range	<p>Infant range:</p> <ul style="list-style-type: none"> <li>• 20–350 ml, resolution 1 ml*</li> <li>• 50–350 ml, resolution 1 ml</li> </ul> <p>Adult range:</p> <ul style="list-style-type: none"> <li>• 100–1600 ml, resolution 10 ml</li> <li>• 100–2000 ml, resolution 10 ml†</li> </ul>
Minute volume setting range	<p>Infant range: 0.3–20 l/min</p> <p>Adult range: 0.5–60 l/min</p>
Inspiratory pressure (pressure-controlled modes)	<ul style="list-style-type: none"> <li>• 0–80 cmH<sub>2</sub>O <math>\pm 15\%</math> or <math>\pm 2</math> cmH<sub>2</sub>O, whichever is greater</li> <li>• 0–120 cmH<sub>2</sub>O <math>\pm 15\%</math> or <math>\pm 2</math> cmH<sub>2</sub>O, whichever is greater†</li> </ul>
Inspiratory pressure setting range	<p>Infant range:</p> <ul style="list-style-type: none"> <li>• 0–80 cmH<sub>2</sub>O, resolution 1 cmH<sub>2</sub>O</li> </ul> <p>Adult range:</p> <ul style="list-style-type: none"> <li>• 0–80 cmH<sub>2</sub>O, resolution 1 cmH<sub>2</sub>O</li> <li>• 0–120 cmH<sub>2</sub>O, resolution 1 cmH<sub>2</sub>O†</li> </ul>
Compressible volume compensation	Yes
Inspiratory flow	200 l/min (3.3 l/s)
Breathing frequency	4–100 $\pm 1$ breaths/minute
I:E (VC, PC)	1:8.3–4:1
PEEP	0–50 cmH <sub>2</sub> O
Trigger	Flow/Pressure
Inspiratory pause (VC)	0 to 30% or 0–1.5 s

\* Option low VT ventilation is required.

† Option high performance ventilation is required.



## Respiratory monitoring

Administered breaths	1–100 ±1 breaths/minute
Loops	Flow – Volume Volume – Pressure
Lung characteristics	Airway resistance (R <sub>dyn</sub> ) Compliance (C <sub>dyn</sub> ) Elastance (E <sub>dyn</sub> )
Inspiratory minute volume	0.3–60 l/min
Accuracy insp. minute volume	±15% or ±15 ml multiplied by the breathing frequency, whichever is greater
Expiratory minute volume	0.3–60 l/min
Accuracy exp. minute volume	±15% or ±10 ml multiplied by the breathing frequency, whichever is greater
Inspiratory tidal volume	5–2000 ml
Accuracy insp. tidal volume	±4 ml (5–20 ml range)* ±15% or 15 ml, whichever is greater (20–2000 ml range) <small>* Accuracy valid for O<sub>2</sub>/Air gas mix, O<sub>2</sub> concentration at 60%, RR at 30 and I:E ≥1:2.</small>
Expiratory tidal volume	5–2000 ml
Accuracy exp. tidal volume	+7/-4 ml (5–20 ml range)* ±15% or 10 ml, whichever is greater (20–2000 ml range) <small>* Accuracy valid for O<sub>2</sub>/Air gas mix, O<sub>2</sub> concentration at 60%, RR at 30 and I:E ≥1:2.</small>
Mean airway pressure	0–100 cmH <sub>2</sub> O
Peak airway pressure	0–140 cmH <sub>2</sub> O
End expiratory airway pressure	-40–100 cmH <sub>2</sub> O
Airway pressure	-30–140 cmH <sub>2</sub> O
Airway pressure accuracy (applicable to all pressure measurements)	±5% or ±2 cmH <sub>2</sub> O, whichever is greater

# Alarms

Expiratory minute volume: high	0.5–60 l/min
Expiratory minute volume: low	0.01–40 l/min
Excessive leakage	The difference between the maximum and minimum pressures during inspiration is too low
Airway pressure: high	10–120 cmH <sub>2</sub> O
Continuous APL pressure (manual mode only)	Activated when the measured airway pressure exceeds predefined values for more than 15 seconds. Predefined values depend on current APL setting.
High continuous pressure (automatic mode only)	Airway pressure is constant above set PEEP level +15 cmH <sub>2</sub> O more than 15 seconds
Negative airway pressure	Measured airway pressure is below -10 cmH <sub>2</sub> O for more than one second
Regulated pressure limited (PRVC mode only)	Permissible pressure limits pre-set tidal volume
PEEP: high	0–55 cmH <sub>2</sub> O
PEEP: low	0–47 cmH <sub>2</sub> O
Respiratory rate: high	1–140 B/min and OFF
Respiratory rate: low	1–140 B/min and OFF
Apnea	5–45 s and OFF
Long apnea (manual mode only)	Infant: No breath detection for up to 60 s Adult: No breath detection for up to 120 s
Check breathing circuit	Activated when inspiratory and expiratory pressures fail to meet preset requirements because of blocked or disconnected tubing
Limited battery capacity	Less than 18 minutes left of battery operation
No battery capacity	Less than 3 minutes left of battery operation
Water trap missing/Replace water trap	The gas analyzer has detected that a water trap replacement is needed
<b>Gas alarms</b>	
FiO <sub>2</sub> : high	23–99% and OFF
FiO <sub>2</sub> : low	18–99%
EtO <sub>2</sub> : high	13–99% and OFF
EtO <sub>2</sub> : low	10–99% and OFF
FiCO <sub>2</sub> : high	0.1–10%
EtCO <sub>2</sub> : high	0.1–10%
EtCO <sub>2</sub> : low	0.1–9.9% and OFF
FiAA: high	<ul style="list-style-type: none"> <li>• 0.1–5.0% and OFF (ISO)</li> <li>• 0.1–8.0% and OFF (SEV)</li> <li>• 0.1–18% and OFF (DES)</li> </ul>
FiAA: low	<ul style="list-style-type: none"> <li>• 0.1–5.0% and OFF (ISO)</li> <li>• 0.1–8.0% and OFF (SEV)</li> <li>• 0.1–18% and OFF (DES)</li> </ul>
EtAA: high	<ul style="list-style-type: none"> <li>• 0.1–5.0% and OFF (ISO)</li> <li>• 0.1–8.0% and OFF (SEV)</li> <li>• 0.1–18% and OFF (DES)</li> </ul>

## Alarms (continued)

EtAA: low	<ul style="list-style-type: none"> <li>• 0.1–4.0% and OFF (ISO)</li> <li>• 0.1–6.0% and OFF (SEV)</li> <li>• 0.1–12% and OFF (DES)</li> </ul>
Agent mixture: MAC >3	The MAC <sub>40</sub> of the secondary agent is ≥0.6 and the total MAC <sub>40</sub> value is ≥3
Agent mixture	The second agent is MAC ≥0.6 and the total MAC value is <3
High continuous MAC	Measured MAC exceeds time limit: <ul style="list-style-type: none"> <li>• MAC &gt;2.2; from starting a new case, until 15 minutes after the first vaporizer activation</li> <li>• MAC &gt;1.8 otherwise</li> </ul>
FiN <sub>2</sub> O: high	Inspiratory N <sub>2</sub> O gas supply >80%
Occlusion in sampling line	Detected occlusion reported from Y-piece gas analyzer

## Vaporizer

Active vaporizers slots	2
Agents	Isoflurane, Sevoflurane and Desflurane
Type	Electronic injector
Weight (full)	Approx. 7.1 lbs. (3.2 kg)
Dimensions	2.8" x 8.5" x 7.0" (70 x 215 x 178 mm)
Agent capacity	300 ml
Residual capacity	30 ml (triggering the low level alarm)
Setting range	Isoflurane                      0, 0.3–5%, OFF Sevoflurane                      0, 0.3–8%, OFF Desflurane                      0, 1.0–18%, OFF
Accuracy	±15% of set value or ±5% of maximum possible user setting (whichever is greater).
Filling system	Isoflurane                      • Maquet filling adapter Sevoflurane                      • Quik Fil, Maquet filling adapter and SAFE-T-SEAL filling adapter attached to anesthetic agent bottle Desflurane                      • SAFE-FIL
Emptying system	Maquet drain adapter for SAFE-T-SEAL vaporizer
Vaporizer filling speed	Approx. 4 ml/s
Tank liquid level	Optical and electronic

# Gas analyzer

Measuring technology	O <sub>2</sub> Agents, CO <sub>2</sub> , N <sub>2</sub> O	Paramagnetic sensor IR sensor
Warm-up time	ISO standard accuracy Full accuracy	Within 60 s Within 10 minutes
Sampling flow and tolerance	225 ml/min ±10% (Return to circuit), BTPS condition	
Sampling line	Length: 2.0 m 2.5 m 3.5 m 4.5 m	Inner diameter: 1.3 mm 1.5 mm 1.5 mm 1.5 mm

## Measured parameters

Resp. rate	2–100 breaths/minute	
Respiration rate measurement accuracy	<60 breaths/minute >60 breaths/minute	±1 breath/minute Unspecified
Inspiratory and End-Tidal O <sub>2</sub> concentration	Yes	
Inspiratory and End-Tidal CO <sub>2</sub> concentration	Yes	
Inspiratory and End-Tidal N <sub>2</sub> O concentration	Yes	
MAC Y (age dependent)	Yes	
MAC Brain (age dependent)	Yes	
Inspiratory and End-Tidal agent concentration	Yes	

## Gas measurement accuracy

	Gas conc.	Accuracy [%ABS]	Interference	[%ABS]
O <sub>2</sub>	0–25%	±1	N <sub>2</sub> O CO <sub>2</sub> Any agent	0.2 0.2 1.0
	25–80%	±2		
	80–100%	±3		
N <sub>2</sub> O	0–20%	±2	CO <sub>2</sub> O <sub>2</sub> Any agent	0.1 0.1 0.1
	0–40%	±3		
	40–80%	±5		
CO <sub>2</sub>	0–1%	±0.3	N <sub>2</sub> O O <sub>2</sub> Any agent	0.1 0.1 0.3
	1–5%	±0.2		
	5–7%	±0.3		
	7–10%	±0.5		
	>10%	Unspecified		
Isoflurane	0–1%	±0.15	CO <sub>2</sub> N <sub>2</sub> O O <sub>2</sub> 2nd agent	0 0.1 0.1 0.2
	1–5%	±0.2		
	>5%	Unspecified		
Sevoflurane	0–1%	±0.15	CO <sub>2</sub> N <sub>2</sub> O O <sub>2</sub> 2nd agent	0 0.1 0.1 0.2
	1–5%	±0.2		
	5–8%	±0.4		
	>8%	Unspecified		
Desflurane	0–1%	±0.15	CO <sub>2</sub> N <sub>2</sub> O O <sub>2</sub> 2nd agent	0 0.1 0.1 0.2
	1–5%	±0.2		
	5–10%	±0.4		
	10–15%	±0.6		
	15–18%	±1.0		
	>18%	Unspecified		

## Gas analyzer (continued)

Drift of measurement accuracy	The accuracy includes stability and effects of device drift during operation between calibrations.
<ul style="list-style-type: none"><li>• The respiration rate limit for accurately measured end-tidal values is &lt;60 breaths/minute for I:E = 1:1, &lt;40 breaths/minute for I:E = 1:2 and &lt;30 breaths/minute for I:E = 1:3.</li><li>• The accuracy of the gas measurements may be affected if the Ethanol concentration is higher than 0.1%, the Methane concentration is higher than 1% or the Acetone concentration is higher than 1%.</li><li>• The partial pressure and the percentage volume of CO<sub>2</sub>, N<sub>2</sub>O, O<sub>2</sub> and anesthetic agent depend on the amount of water vapor in the breathing gas. A partial H<sub>2</sub>O pressure of 11 cmH<sub>2</sub>O is automatically compensated for by the analyzer. Higher H<sub>2</sub>O partial pressures will further dilute the gas sample; at 30 cmH<sub>2</sub>O the general error of all measured gases is -2%.</li></ul>	

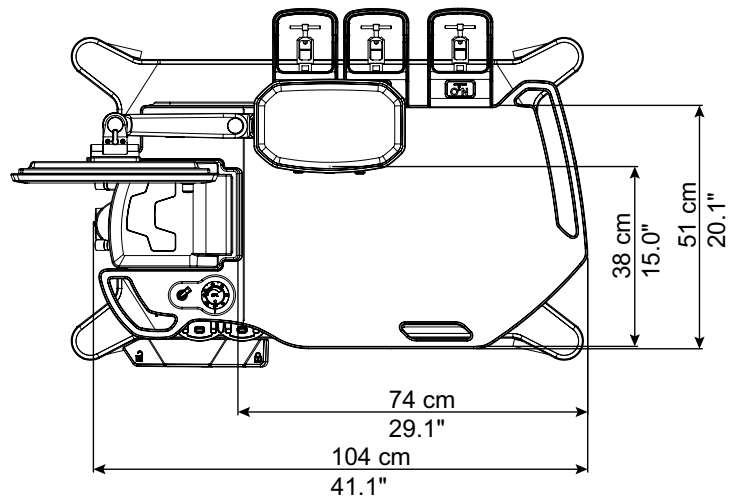
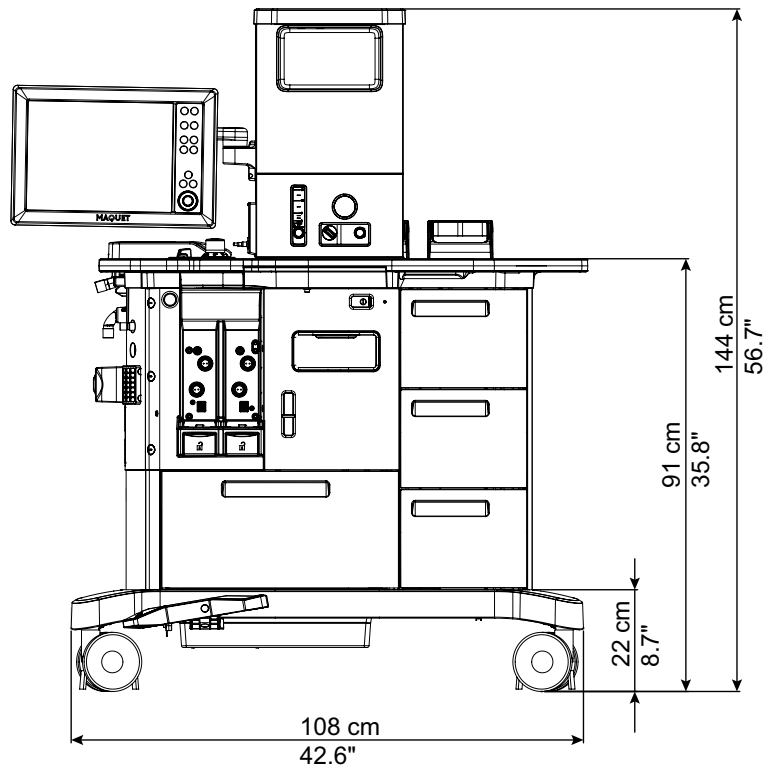
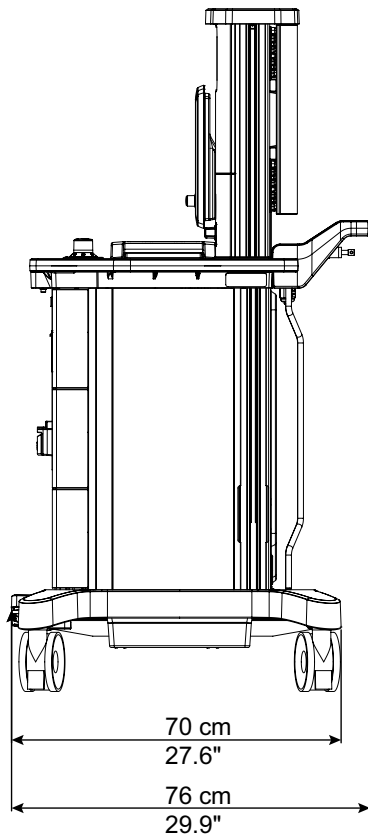
## External communication

	Quantity	Type	Description
Serial ports	2	RS232	FCI (Flow Communication Interface) protocol
USB	2	USB 1.1	<ul style="list-style-type: none"><li>• One port for communication</li><li>• One port for power supply</li></ul>
Video out	1	VGA	Interface for slave monitor
Ethernet	1	RJ45	Network connection for use with remote service

# Ordering information

Flow-e anesthesia machine and accessories:  
See separate information in "System flowchart, Flow-e".

# Dimensional drawings



# Notes



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