

# Avance\* CS2

Precise care.  
With a personal touch.



## Features

- Movable 15" touch screen with CARESCAPE\* user interface for the unified CARESTATION\* user experience with GE CARESCAPE monitors
- ecoFLOW provides information that may help clinicians mitigate the risk of hypoxic mixtures during low and minimum flow
- ecoFLOW for visualizing agent consumption and help in mitigating wasteful over delivery of fresh gas flow
- User configurable 'Quick Picks' for rapid selection of FiO<sub>2</sub> and total flow combinations

## Ventilation Options

- With 'Flow Power Inside' our ventilator engine can ventilate all patient types from neonates to large adults
- Sophisticated mechanical ventilation and assisted ventilation options including synchronised PCV-VG with pressure support (SIMV PCV-VG) and minimum rate ventilation (CPAP+PSV)
- Vital capacity and Cycling lung ventilation procedures

## Advanced Breathing System (ABS\*)

- Compact breathing system specifically designed for low flow to help provide fast gas kinetics for rapid wash-in and wash-out
- Continual fresh gas flow with fresh gas flow compensation during mechanical ventilation

## Exceptional Design

- Central brake
- Top shelf mounting rails
- Metal work surface
- Movable display arm for inbound and outboard positioning
- Two or three vaporiser positions
- Bi-level work surface illumination



## Physical Specifications

### Dimensions

Height:	139 cm
Width:	77 cm
Depth:	76 cm
Weight:	147 kg <sup>1</sup>

### Top shelf

Weight limit:	34 kg/75 lb
Width:	69.7 cm
Depth:	44 cm

### Work surface

Height:	81.7 cm/32.2 in
Size:	2640 cm <sup>2</sup> /409 in <sup>2</sup>

### Upper left GCX/DO dovetail

GCX length:	13.2 cm
DO dovetail length:	23.2 cm

### Upper right DO dovetail

Length:	34 cm
---------	-------

### Lower right GCX rail

Length :	41 cm
----------	-------

### Drawers (internal dimensions)

Height:	17.5 cm/6.9 in
Width:	33 cm/13 in
Depth:	26.5 cm/10.4 in

### Absorber bag arm (optional)

Arm length:	39.8 cm/15.7 in
Bag arm height (adjustable):	87 cm/34.3 in 113 cm/44.4 in

### Casters

Diameter:	13 cm
Brakes:	Central Brake



## Ventilator Operating Specifications

### Modes of ventilation – standard

VCV (Volume Control) Mode with tidal volume compensation

### Modes of ventilation – optional

Pressure Control

Pressure Controlled Ventilation-Volume Guaranteed (PCV-VG)

SIMV (Synchronized Intermittent Mandatory Ventilation) (volume and pressure)

PSVPro\* (Pressure Support with Apnea backup)

CPAP+PSV (Pressure support mode)

SIMV PCV-VG

### Ventilator parameter ranges

Tidal volume range:	5 to 1500ml ( Volume Control, PCV-VG and SIMV volume 20 to 1500ml) (PCV modes 5 to 1500ml)
Incremental settings:	20 to 50 mL (increments of 1 mL) 50 to 100 mL (increments of 5 mL) 100 to 300 mL (increments of 10 mL) 300 to 1000 mL (increments of 25 mL) 1000 to 1500 mL (increments of 50 mL)
Minute volume range:	Less than 0.1 to 99.9 L/min
Pressure (P <sub>inspired</sub> ) range:	5 to 60 cmH <sub>2</sub> O (increments of 1 cmH <sub>2</sub> O) 5 to 1500 mL volume delivery
Pressure (P <sub>max</sub> ) range:	12 to 100 cmH <sub>2</sub> O (increments of 1 cmH <sub>2</sub> O)
Pressure (P <sub>support</sub> ) range:	Off, 2 to 40 cmH <sub>2</sub> O (increments of 1 cmH <sub>2</sub> O)

<sup>1</sup> Excludes vaporisers, airway gas module and patient monitor.

Rate:	4 to 100 breaths per minute for Volume Control and Pressure Control; 2 to 60 breaths per minute for SIMV, PSVPro and SIMV PCV-VG; 4 to 60 bpm for CPAP+PSV (increments of 1 breath per minute)
Inspiratory/ expiratory ratio:	2:1 to 1:8 (increments of 0.5)
Inspiratory time:	0.2 to 5.0 seconds (increments of 0.1 seconds) (SIMV, PSVPro and CPAP PSV)
Trigger window:	0 to 80% (increments of 5%)
Flow trigger:	1 to 10 L/min (increments of 0.5 L/min) 0.2 to 1 L/min (increments of 0.2 L/min)
Inspiration termination level:	5 to 75% (increments of 5%)
Inspiratory Pause range:	0-60%

### Positive End Expiratory Pressure (PEEP)

Type:	Integrated, electronically controlled
Range:	OFF, 4 to 30 cmH <sub>2</sub> O (increments of 1 cmH <sub>2</sub> O)

### Ventilator performance

Pressure range at inlet:	240 kPa to 700 kPa (35 psig to 100 psig)
Peak gas flow:	120 L/min + fresh gas flow
Flow valve range:	1 to 120 L/min
Flow compensation range:	150 mL/min to 15 L/min

### Ventilator Accuracy

#### Delivery/monitoring accuracy

Volume delivery:	> 210 mL = better than 7% ≤ 210 mL = better than 15 mL < 60 mL = better than 10 mL
Pressure delivery:	±10% or ±3 cmH <sub>2</sub> O
PEEP delivery:	±1.5 cmH <sub>2</sub> O
Volume monitoring:	> 210 mL = better than 9% ≤ 210 mL = better than 18 mL < 60 mL = better than 10 mL
Pressure monitoring:	±5% or ±2 cmH <sub>2</sub> O

### Alarm settings

Tidal volume (V <sub>TE</sub> ):	Low: OFF, 1 to 1500 mL High: 20 to 1600 mL, OFF
Minute volume (V <sub>E</sub> ):	Low: OFF, 0.1 to 10 L/min High: 0.5 to 30 L/min, OFF
Inspired oxygen (FiO <sub>2</sub> ):	Low: 18 to 99% High: 19 to 100%, OFF
Apnea alarm:	<i>Mechanical ventilation ON:</i> < 5 mL breath measured in 30 seconds  <i>Mechanical ventilation OFF:</i> < 5 mL breath measured in 30 seconds
Low airway pressure:	4 cmH <sub>2</sub> O above PEEP
High pressure:	12 to 100 cmH <sub>2</sub> O (increments of 1 cmH <sub>2</sub> O)
Sustained airway pressure:	<i>Mechanical ventilation ON:</i> P <sub>max</sub> < 30 cmH <sub>2</sub> O, the sustained limit is 6 cmH <sub>2</sub> O P <sub>max</sub> 30 to 60 cmH <sub>2</sub> O, the sustained limit is 20% of P <sub>max</sub> P <sub>max</sub> > 60 cmH <sub>2</sub> O, the sustained limit is 12 cmH <sub>2</sub> O <i>PEEP and mechanical ventilation ON</i> Sustained limit increases by PEEP minus 2 cmH <sub>2</sub> O <i>Mechanical ventilation OFF:</i> P <sub>max</sub> ≤ 60 cmH <sub>2</sub> O, the sustained limit is 50% of P <sub>max</sub> P <sub>max</sub> > 60 cmH <sub>2</sub> O, the sustained limit is 30 cmH <sub>2</sub> O
Subatmospheric pressure:	Paw < -10 cmH <sub>2</sub> O
Audio pause countdown clock:	120 to 0 seconds

### Ventilator Components

#### Flow transducer

Type:	Variable orifice flow sensor
Dimensions:	22 mm OD and 15 mm ID
Location:	Inspiratory outlet and expiratory inlet

(Optional autoclavable sensor available)

#### Oxygen sensor

Type:	Optional galvanic fuel cell or paramagnetic with Airway Module option
-------	---

## Ventilator screen

---

Display size:	15 inch
Pixel format:	1024 x 768

## Battery backup

---

Backup power:	Demonstrated battery time is up to 90 minutes when fully charged. Battery time under extreme conditions is 30 minutes.
Battery type:	Internal rechargeable sealed lead acid

## Communication ports

---

RS-232C compatible serial interface
Ethernet
Datex-Ohmeda device interface solutions port
USB port
VGA Output

## Anesthetic Agent Delivery

### Delivery

---

Vaporizers:	Tec* 6 Plus, Tec 7
Number of positions:	2 (3 as an option)
Mounting:	Tool-free installation Selectatec* manifold interlocks and isolates vaporizers

## Airway Modules

### General

---

M-CAiO, M-CAiOV, M-CAiOVX module software version 3.2 or higher; E-CAiO, ECAiOV, E-CAiOVX	
Size (WxDxH):	75 x 228 x 112 mm/ 3.0 x 9.0 x 4.4 in
Weight:	1.6 kg/3.5 lb
Sampling rate:	200 mL/min $\pm$ 20 mL
E-sCAiO, E-sCAiOV	
Size (WxDxH):	38 x 205 x 113 mm/ 1.5 x 8.1 x 4.4 in
Weight:	0.7 kg/1.5 lb
Sampling rate:	120 mL/min $\pm$ 20 mL
Automatic compensation for atmospheric pressure variation (500 to 800 mmHg for E-, M-series modules; 495 to 795 mmHg for CARESCAPE modules) temperature and CO <sub>2</sub> /N <sub>2</sub> O and CO <sub>2</sub> /O <sub>2</sub> collision broadening effect. Parameter display update interval typically breath-by-breath. Functional alarms for blocked sample line, D-fend check and D-fend replacement.	

## Non-disturbing gases:

---

Ethanol, acetone, methane, nitrogen, nitric oxide, carbon monoxide, water vapor:	
Maximum effect on readings:	CO <sub>2</sub> < 0.2 vol %; O <sub>2</sub> , N <sub>2</sub> O < 2 vol %

## Carbon dioxide (CO<sub>2</sub>)

---

EtCO <sub>2</sub> :	End-tidal CO <sub>2</sub> concentration
FiCO <sub>2</sub> :	Inspired CO <sub>2</sub> concentration

## CO<sub>2</sub> waveform

---

Measurement range:	0 to 15% (0 to 15 kPa, 0 to 113 mmHg)
Accuracy:	$\pm$ 0.2 vol % + 2 % of reading
Datex-Ohmeda infrared sensor	
Adjustable low and high alarm limits for EtCO <sub>2</sub> and FiCO <sub>2</sub>	

## Respiration rate (RR)

---

Measurement range:	4 to 60 breaths/min for E-, M-series modules 4 to 100 breaths/min for CARESCAPE modules
Detection criteria:	1% variation in CO <sub>2</sub>
Adjustable low and high alarm limits for respiration rate; alarm for apnea	

## Patient Oxygen (O<sub>2</sub>)

---

FiO <sub>2</sub> :	Inspired O <sub>2</sub> concentration
EtO <sub>2</sub> :	End-tidal O <sub>2</sub> concentration
FiO <sub>2</sub> -EtO <sub>2</sub> :	Inspired-expired difference

## O<sub>2</sub> Measurement

---

Measurement range:	0 to 100%
Accuracy:	$\pm$ 1 vol % +2 % of reading
Datex-Ohmeda differential paramagnetic sensor	
Adjustable low and high alarm limits for FiO <sub>2</sub> and EtO <sub>2</sub> ; alarm for FiO <sub>2</sub> < 18%	

## Nitrous Oxide (N<sub>2</sub>O)

---

Measurement range:	0 to 100%
Accuracy:	$\pm$ 2 vol % +2 % of reading

## Anesthetic Agent (AA)

---

<i>Halothane, Isoflurane, Enflurane</i>	
Measurement range:	0 to 6%
Accuracy:	$\pm$ (0.15 vol % +5% of reading)

### Sevoflurane

Measurement range: 0 to 8%  
 Accuracy:  $\pm(0.15 \text{ vol\%} + 5\% \text{ of reading})$

### Desflurane

Measurement range: 0 to 20%  
 Accuracy:  $\pm(0.15 \text{ vol\%} + 5\% \text{ of reading})$

Waveform displayed  
 MAC value displayed  
 Identification threshold: 0.15 vol %<sup>1</sup>  
 Agent mixture detection  
 Adjustable high and low alarm limits for EtAA, FiAA

### Patient Spirometry\*

Pressure-volume loop  
 Pressure-flow loop  
 Flow-volume loop  
 Airway pressure and flow waveforms  
 Adjustable low and high alarm limits for  $P_{\text{peak}}$ ,  $PEEP_{\text{tot}}$  and  $MV_{\text{exp}}$   
 Alarms for  $MV_{\text{exp}} \ll MV_{\text{insp}}$  and for  $MV_{\text{exp}}$  low. Detection through D-lite\* or Pedi-lite\* flow sensor and gas sampler with following specifications:

### Compact Airway Modules

	<b>D-lite</b>	<b>Pedi-lite</b>
Respiration rate:	4 to 35 breaths/min	4 to 50 breaths/min
<i>Tidal volume</i>		
Measurement range:	150 to 2000 mL	15 to 300 mL
Accuracy <sup>1</sup> :	$\pm 6\%$ or 30 mL	$\pm 6\%$ or 4 mL
<i>Minute volume</i>		
Measurement range:	2 to 20 L/min	0.5 to 5 L/min
Accuracy <sup>1</sup> :	$\pm 6\%$	$\pm 6\%$
<i>Airway pressure</i>		
Measurement range:	-20 to +100 cmH <sub>2</sub> O	
Accuracy <sup>1</sup> :	$\pm 1 \text{ cmH}_2\text{O}$	
Display units:	cmH <sub>2</sub> O, mmHg, kPa, mbar, hPa	
<i>Flow</i>		
Measurement range:	1.5 to 100 L/min	0.25 to 25 L/min

### I:E

Measurement range: 1:4.5 to 2:1

### Compliance

Measurement range: 4 to 100 mL/cmH<sub>2</sub>O      1 to 100 mL/cmH<sub>2</sub>O

### Airway resistance

Measurement range: 0 to 40 cmH<sub>2</sub>O/L/s

### CARESCAPE Airway Modules

	<b>D-lite(+)</b>	<b>Pedi-lite(-)</b>
Respiration rate:	4 to 35 breaths/min	4 to 70 breaths/min
<i>Tidal volume</i>		
Measurement range:	150 to 2000 mL	5 to 300 mL
Accuracy <sup>1</sup> :	$\pm 6\%$ or 30 mL	$\pm 6\%$ or 4 mL
<i>Minute volume</i>		
Measurement range:	2 to 20 L/min	0.1 to 5 L/min
Accuracy <sup>1</sup> :	$\pm 6\%$	$\pm 6\%$
<i>Airway pressure</i>		
Measurement range:	-20 to +100 cmH <sub>2</sub> O	
Accuracy <sup>1</sup> :	$\pm 1 \text{ cmH}_2\text{O}$	
Display units:	cmH <sub>2</sub> O, mmHg, kPa, mbar, hPa	
<i>Flow</i>		
Measurement range:	-100 to 100 L/min	-25 to 25 L/min
<i>I:E</i>		
Measurement range:	1:4.5 to 2:1	
<i>Compliance</i>		
Measurement range:	4 to 100 mL/cmH <sub>2</sub> O	1 to 100 mL/cmH <sub>2</sub> O
<i>Airway resistance</i>		
Measurement range:	0 to 200 cmH <sub>2</sub> O/L/s	

### Sensor specifications

	<b>D-lite/ D-lite(+)</b>	<b>Pedi-lite/ Pedi-lite(+)</b>
Dead space:	9.5 mL	2.5 mL
<i>Resistance</i>		
at 30 L/min:	0.5 cmH <sub>2</sub> O	
at 10 L/min:		1.0 cmH <sub>2</sub> O

<sup>1</sup> Typical value

## Electrical Specifications

### Current leakage

---

100/120 V:	< 300 $\mu$ A
220/240 V:	< 500 $\mu$ A

### Power

---

Power input:	100-120 Vac, 50/60 Hz 220-240 Vac, 50/60 Hz
Power cord:	Length: 5 m/16.4 ft Rating: 10A @ 250 Vac or 15A @ 125 Vac

### Inlet/outlet modules

---

#### 100 -120 V

System circuit breakers:	15A
Outlets:	4 outlets on back, 3-2A, 1-3A individual breakers, isolation transformer

#### 220-240 V

System circuit breakers:	8A
Outlets (optional):	4 outlets on back, 3-1A, 1-2A individual breakers, isolation transformer

## Pneumatic Specifications

### Auxiliary common gas outlet (optional)

---

Connector:	ISO 22 mm OD and 15 mm ID
------------	---------------------------

### Gas supply

---

Pipeline input range:	280 kPa to 600 kPa (41 psig to 87 psig)
Pipeline connections:	DISS-male, DISS-female, AS4059, BSPP 3/8, S90-116, or NIST All fittings available for O <sub>2</sub> , N <sub>2</sub> O, and Air, and contain pipeline filter and check valve
Cylinder input:	Pin indexed in accordance with CGA-V-1 or DIN (nut and gland); contains input filter and check valve.

**Note:** Maximum 3 cylinders

Primary regulator diaphragm minimum burst pressure:	2758 kPa/400 psig
Primary regulator nominal output:	$\leq$ 345 kPa/50 psig Pin indexed cylinder connections $\leq$ 414 kPa/60 psig DIN cylinder connections

### O<sub>2</sub> controls

---

Method:	N <sub>2</sub> O shut off with loss of O <sub>2</sub> pressure
Supply failure alarm:	< 252 kPa (36.55 psig)
O <sub>2</sub> flush:	Range: > 25 L/min

### Alternate O<sub>2</sub> (safety flow)

---

Range:	500 mL/min minimum to 10 L/min
Indicator:	Flow tube
Indicator accuracy:	$\pm$ 5% full scale

### Fresh gas

---

Flow range:	0 and 150 mL/min to 15 L/min (minimal flow capable)
Total flow accuracy:	$\pm$ 10% or $\pm$ 40 mL/min of setting (larger of)
O <sub>2</sub> flow accuracy:	$\pm$ 5% or $\pm$ 20 mL/min of setting (larger of)
Balance gas flow accuracy:	$\pm$ 5% or $\pm$ 20 mL/min of setting (larger of) Air/N <sub>2</sub> O
O <sub>2</sub> concentration range:	21% to 100% when Air is available
O <sub>2</sub> concentration accuracy:	2.5% (Total Flow $\leq$ 15 L/min) 5% (Total Flow < 1 L/min) 6.5% (Total Flow < 0.4 L/min)
Electronic mixer response time:	500mS (10% to 90% flow step)
Compensation:	Temperature and atmospheric pressure compensated to standard conditions of 20°C and 101.3 kPa
Hypoxic guard:	Electronic

### Materials

---

All materials in contact with patient breathing gases are not made from natural rubber latex.

## Environmental Specifications

### System operation

Temperature:	10° to 40°C (50° to 104°F)
Humidity:	15 to 95% relative humidity (non-condensing)
Altitude:	-440 to 3000 m (537 to 800 mmHg)

### System storage

Temperature:	-25° to 60°C (-13° to 140°F)
Humidity:	15 to 95% relative humidity (non-condensing)
Altitude:	-440 to 4880 m (425 to 800 mmHg)
Oxygen cell storage:	-15° to 50°C (5° to 122°F) 10 to 95% relative humidity 500 to 800 mmHg

### Electromagnetic compatibility

Immunity:	Complies with all requirements of EN 60601-1-2
Emissions:	CISPR 11 group 1 class A
Approvals:	AAMI ES60601-1, CSA C22.2 #601.1, EN/IEC 60601-1, CE 0197, ISO 80601-2-13

## Breathing Circuit Specifications

### Operational modes

Breathing circuit is circle mode; SCGO option converts to open circuit mode

### Carbon dioxide absorbent canister

Absorbent capacity:	800 g
Integrated expiratory limb water reservoir	

### Ports and connectors

Exhalation:	22 mm OD ISO 15 mm ID taper
Inhalation:	22 mm OD ISO 15 mm ID taper
Bag port:	22 mm OD

### Bag-to-Ventilator switch

Type:	Bi-stable
Control:	Controls ventilator and direction of breathing gas within the circuit

### Integrated Adjustable Pressure Limiting (APL) valve

Range:	0.5 to 70 cmH <sub>2</sub> O
Tactile knob indication at:	30 cmH <sub>2</sub> O and above
Adjustment range of rotation:	0.5 to 30 cmH <sub>2</sub> O (0 to 230°) 30 to 70 cmH <sub>2</sub> O (230 to 330°)

### Materials

All materials in contact with exhaled patient gases are autoclavable, except disposable flow sensors, O<sub>2</sub> cell, and Airway Modules. (Autoclavable flow sensors optional)

All materials in contact with patient gas are not made from natural rubber latex.

### Breathing circuit parameters

Compliance:	Bag mode:	1.82 mL/cmH <sub>2</sub> O
	Mechanical mode:	Automatically compensates for compression losses within the absorber and bellows assembly
Total circuit volume:	2.7 L Vent Mode 1.2 L Bag Mode	

**Note:** Includes Absorber volume

Expiratory resistance:	$P_{exp}$ <b>Bag Mode</b> <b>Pressure drop</b>	$P_{exp}$ <b>Vent Mode</b> <b>Pressure drop</b>
5 L/min	0.46 cmH <sub>2</sub> O	0.46 cmH <sub>2</sub> O
30 L/min	1.47 cmH <sub>2</sub> O	1.55 cmH <sub>2</sub> O
60 L/min	3.80 cmH <sub>2</sub> O	4.09 cmH <sub>2</sub> O

**Note:** Values include patient circuit tubing and wye piece (0.3 cmH<sub>2</sub>O at 60 L/min)

### Anesthetic gas scavenging

AGSS Type	Hospital extract system required	Machine connection
High vacuum, low flow with indicator:	High vacuum 36 L/min @ 12 in Hg (305 mmHg)	DISS evac
High vacuum, variable flow with bag indicator:	High vacuum 30 L/min extract flow @ 12 in Hg (305 mmHg)	DISS evac
Passive:	Passive or external active system with air break	30 mm/1.2 in M ISO taper

© 2013 General Electric Company – All rights reserved.

General Electric Company reserves the right to make changes in specifications and features shown herein, or discontinue the product described at any time without notice or obligation. Contact your GE representative for the most current information.

GE and the GE Monogram are trademarks of the General Electric Company.

\*Avance, ABS, Tec, CARESCAPE, Carestation, D-lite, Pedi-lite, PSVPro, Selectatec and Patient Spirometry are trademarks of General Electric Company.

Not for sale in all markets.

Please check with your sales representative.

Always refer to the complete instructions manuals before use.

GE Healthcare, a division of General Electric Company.

## Healthcare Re-imagined

GE is dedicated to helping you transform healthcare delivery by driving critical breakthroughs in biology and technology. Our expertise in medical imaging and information technologies, medical diagnostics, patient monitoring systems, drug discovery, and biopharmaceutical manufacturing technologies is enabling healthcare professionals around the world discover new ways to predict, diagnose and treat disease earlier. We call this model of care “Early Health.” The goal: to help clinicians detect disease earlier, access more information and intervene earlier with more targeted treatments, so they can help their patients live their lives to the fullest. Re-think, Re-discover, Re-invent, Re-imagine.

GE Healthcare

P.O. Box 900, FIN-00031 GE, Finland

GE Direct United Kingdom: +44 (0)800 0329201

[www.gehealthcare.com](http://www.gehealthcare.com)



GE imagination at work