

A9

Anesthesia system

Physical Specifications

Dimensions and Weight

Height	1490 mm
Width	910 mm
Depth	705 mm
Weight	160 kg (with AG module and 3 yokes, without vaporizers and gas cylinders)

Work Surface

Height	850 mm
Width	590 mm
Depth	325 mm
Weight limit	30 kg

Drawer (3 drawers, Internal Dimension)

Height	140 mm
Width	420 mm
Depth	315 mm
Weight limit	5 kg

Bag Arm

Height	1130 mm
Length	312 mm
Swiveling angle	120 degrees

Casters

Diameter	12.5 cm
Brake	Centre brake system with Lock / Unlock icons
Cable pusher	cable pusher wish each caster

Side mounting GCX Rails

Upper left length	130 mm
Upper right length	180 mm
Lower right length	485 mm
Supporting weight	27 kg at a maximum distance of 0.41 m

Work Light

Settings	OFF, Low, High
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Main Screen

Display size	18.5 inch
Display type	Color LCD with capacitive touch screen
Resolution	1920 x 1080
Rotated	360 degrees
Tilted	60 degrees
Display parameters	All setting and alarm parameters (including Breath rate, I/E ratio, Tidal volume, Minute volume, PEEP, MEAN, PEAK, PLAT, and O ₂ concentration, EtCO ₂ , N ₂ O, Aesthesia gas concentration, BIS)
Graphic waveforms	Pressure, Flow, Volume, CO ₂ , O ₂ , Anesthetic gas, N ₂ O, BIS, Pes, Ptp Up to 5 waveforms display simultaneously
Spirometry loops	Pressure-Volume, Flow-Volume and Pressure-Flow
Timer	Display on screen timer

System status display

Display size	8.4 inch
Display type	Color LCD
Resolution	800 x 600
Display content	Volume exchanger indicator, gas supply pressure, vaporizer status, AGSS status

Ventilator Specifications

Modes of Ventilation

Manual/Spontaneous ventilation/Bypass
Volume Control Ventilation (VCV) with PLV function



Pressure Control Ventilation (PCV)
Pressure Control Ventilation with volume guarantee (PCV-VG)
Continuous Positive Airway Pressure/Pressure Support Ventilation with apnea backup (CPAP/PS)
Pressure Support Ventilation (PS) with apnea backup
Synchronized Intermittent Mandatory Ventilation (SIMV-Volume Controlled and SIMV-Pressure Controlled)
Synchronized Intermittent Mandatory Ventilation Volume Guarantee (SIMV-VG)
Airway Pressure Release Ventilation (APRV)
Adaptive Minute Ventilation (AMV)

Compensation

Circuit gas leakage compensation and automatic compliance compensation

Ventilation Parameters Range

Patient type	Adult, Pediatric, Neonate
Tidal volume	10 to 1500 mL (VCV, SIMV-VC) 5 to 1500 mL (PCV-VG, SIMV-VG) With TV/IBW indicator
Pinsp	5 to 90 cmH ₂ O
Plimit	5 to 100 cmH ₂ O
ΔPsupp	0, 3 to 60 cmH ₂ O (CPAP/PS)
Respiration rate	4 to 100 bpm
I:E	4:1 to 1:8
Tpause	OFF, 5% to 60%
Tinsp	0.2 to 10.0 s
Trigger window	5% to 90%
Flow trigger	0.2 to 15 L/min
Pressure trigger	-20 to -1 cmH ₂ O
Exp%	5% to 80%
Min rate	2 to 60 bpm
Tslope	0.0 to 2.0 s
Apnea I: E	4:1 to 1:8
ΔPapnea	3 to 60 cmH ₂ O
Phigh	3 to 90 cmH ₂ O
Plow	3 to 50 cmH ₂ O
Thigh	0.2 to 10.0 s
Tlow	0.2 to 10.0 s
MV%	25% to 350%

Positive End Expiratory Pressure (PEEP)

Type	Integrated, electronic controlled
Range	0 to 50 cmH ₂ O

Monitoring Parameters

Tidal volume	0 to 3000 ml
Minute volume	0 to 100 L/min
Minute volume leakage	0 to 10.0 L/min
Peak pressure	-20 to 120 cmH ₂ O
Mean pressure	-20 to 120 cmH ₂ O
Plateau pressure	-20 to 120 cmH ₂ O
I:E	4:1 to 1:10

Rate	0 to 150 bpm
PEEP	0 to 70 cmH ₂ O
Resistance (R)	0 to 600 cmH ₂ O/(L/s)
Compliance (C)	0 to 300 ml/cmH ₂ O
Inspired oxygen (FiO ₂)	18% to 100%

Control Accuracy

Volume delivery	≤60 ml: ± 10 ml >60 ml and ≤ 210 ml: ±15 ml >210 ml: ±7 % of the set value
Pressure delivery	± 2.0 cmH ₂ O or ± 7% of the set value, whichever is greater
PEEP	± 2.0 cmH ₂ O or ± 7% of the set value, whichever is greater
MV%	± 10% or ± 10% of the set value, whichever is greater

Monitoring Accuracy

Volume monitoring	≤60 mL: ± 10 mL >60 and ≤210 mL: ± 15 mL >210 mL: ± 7% of the reading
Pressure monitoring	± 2.0 cmH ₂ O or ± 4% of the reading, whichever is greater
Rate	± 1bpm or ± 5% of the reading, whichever is smaller
MV	± 0.1L/min or ± 8% of the reading, whichever is greater

Alarm Setting

Paw High	2 to 100 cmH ₂ O
Paw Low	0 to (Paw High – 2) cmH ₂ O
TV High	5 to 1600 mL
TV Low	OFF, 0 to (TV High – 5) mL
MV High	0.2 to 100 L/min
MV Low	0 to 15 L/min: 0 to (MV High-0.2) L/min 15 to 100 L/min: 15 to (MV High – 1) L/min
FiO ₂ High	20% to 100%, OFF
FiO ₂ Low	18 to (FiO ₂ High – 2) %
Apnea alarm	No breath has been detected within the apnea time.
Apnea delay time	5 to 60 s (by volume or pressure) 10 to 40 s (by CO ₂ waveform)

Lung Recruitment Tool

Multi-step recruitment (Increasing PEEP progressively)	
Control parameters	a maximum of 7 steps Δpsupp, PEEP, Breaths, I:E, Rate PEEP on exit
Preset procedure	up to 5
One-step recruitment (sustain inflation)	
Control parameters	Pressure Hold, Hold Time, PEEP on exit
Cycle Interval	OFF, 1 - 180 min

Auxiliary Pressure Monitoring

Monitor waveform	Ptp, Pes
Monitor parameter	PtpI, PtpE, ΔPtp, PesI, PesE, ΔPes

Data Storage and Recording

Configuration storage	up to 10 customized profiles
Log storage	10000 entries of alarm and activity logs
History trend	48 hours of continuous trend data
Screenshot	up to 50

Pre-use system check

Fully automatic performed by system, including hardware, flowmeter, gas supply, power supply, module, breathing circuit leakage and compliance, vaporizer and AGSS

Pneumatic Specifications

Pipeline Supply

Gas type	O ₂ , N ₂ O and Air
Pipeline input range	280 to 600 kPa (40 to 87 psi)

Pipeline connections	DISS or NIST
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Pipeline Supply Pressure Monitoring

Display type	Electronic
Ranges	0 to 1000kPa (0 to 140 psi)
Accuracy	± (4% of the full scale reading + 8% of the actual reading)

Cylinder Supply

Cylinder supply	E Cylinder (American style or UK style)
O ₂ input range	6.9 to 20 MPa (1000 to 2900 psi)
N ₂ O input range	4.2 to 6 MPa (600 to 870 psi)
Air input range	6.9 to 20 MPa (1000 to 2900 psi)
Cylinder connections	Pin-Index Safety System (PISS)
Yoke configuration	O ₂ , N ₂ O, Air

Cylinder Supply Pressure Gauges

Display type	Mechanical or Electronic
Air range	0 to 25 MPa (0 to 3500 psi)
O ₂ range	0 to 25 MPa (0 to 3500 psi)
N ₂ O range	0 to 10 MPa (0 to 1400 psi)
Accuracy	± (4% of the full scale reading+8% of the actual reading)

Ventilator Performance

Peak gas flow	180 L/min + Fresh Gas Flow
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ACGO (Auxiliary Common Gas Outlet)

Control type	Mechanical
Safety pressure	A relief valve limits fresh gas pressure at ACGO outlet port to not more than 12.5 kPa

O₂ Flush

Flow rate	35 to 50 L/min
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Auxiliary O₂ & Air Flowmeter

Flow range	0 to 15 L/min
Oxygen concentration	21 % to 100 %
Indicator	Glass tube and LED display

High Flow Nasal Cannula

Flow range	2 to 100 L/min
Oxygen concentration	21 % to 100 %
Indicator	Glass tube and LED display

Auxiliary High Pressure O₂ Outlet

Pressure range	280 to 600 kPa
Maximum flow	≥ 90 L/min

O₂ Controls

Supply failure alarm	≤ 220 kPa
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Anesthetic Gas Scavenging System (AGSS)

Type of disposal system	Passive Active: High-flow or low-flow
Pump rate	75 to 105 L/min (High-flow) 25 to 50 L/min (Low-flow)
Management	Scavenging flow rate monitoring and alarm Automatically switch off when standby

Venturi Suction Regulator

Supply	Air, from system gas source
Maximum vacuum	≥72 kPa at supply gas pressure of 280 kPa ≥73 kPa at supply gas pressure of 600 kPa
Maximum flow	≥25 L/min with pipeline gas at 280 kPa ≥32 L/min with pipeline drive gas at 600 kPa

Continuous Suction Regulator

Supply	External vacuum
Maximum vacuum	517.5 mmHg to 540 mmHg (69 kPa to 72 kPa) with external vacuum applied of 540 mmHg and 40 L/min free flow
Maximum flow	39 L/min to 40 L/min with external vacuum applied of 540mmHg and 40 L/min free flow

Electronic Flow control system (Electronic Mixer)

Direct Flow Control Mode

O ₂ flow range	0, 0.2 to 15 L/min
Air flow range	0 to 15 L/min

N ₂ O flow range	0 to 12 L/min
O ₂ flow accuracy	± 50 ml/min or ± 5% of setting value, whichever is greater
Balance gas (Air/N ₂ O) flow accuracy	± 50 ml/min or ± 5% of setting value, whichever is greater

Total Flow Control Mode

Total flow range	0, 0.2 to 20 L/min
Total flow accuracy	± 100 ml/min or ± 5% of setting value, whichever is greater

O₂ concentration

Range	21% to 100% (The balance gas is Air) 26% to 100% (The balance gas is N ₂ O)
Accuracy	± 5% V/V for flows < 1 L/min ± 5% of setting for flows ≥ 1 L/min

Optimizer

Available when AG module is loaded

Flow Pause

The fresh gas flow and ventilation will be paused for 1 minute at default. (Maximum 2 minutes)

Backup Flow Control System

Control Type

Mechanical (Control needle valve and knob)

Flow Range

Control range (O ₂)	1 to 15 L/min
Control range (Air)	0 to 15 L/min

Total flow meter

Range	0 to 15 L/min
Indicator	Flow tube
Indicator accuracy	± 10% of the indicated value for flows (between 10% and 100% of full scale with oxygen)

Breathing System Specification

Breathing system volume

Automatic ventilation	1800 ml
Manual ventilation	1950 ml

CO₂ Absorber Assembly

Absorber capacity	1500 ml
Absorber type	1 Pre-Pak canister or Loose Fill absorbent

Inspiratory Airway Pressure Gauge

Range	-20 to 100 cmH ₂ O
Accuracy	± (2% of the full scale reading + 4% of the actual reading)

Flow Sensor

Type	Variable orifice flow sensor
Location	Inspiratory and expiratory port

Oxygen Sensor

Type	Galvanic fuel cell
FiO ₂ displayed	18% to 100%
Accuracy	± (volume fraction of 2.5 % + 2.5 % gas level)
Response time	≤ 20 seconds

Breathing System Connectors

Exhalation	22 mm OD / 15 mm ID conical
Inhalation	22 mm OD / 15 mm ID conical
Manual bag port	22 mm OD / 15 mm ID conical

Bag-to-Ventilator Switch

Type	Bi-stable
Control	Switch between manual and mechanical ventilation

Adjustable Pressure Limiting (APL) Valve

Type	Manually control with quick relief function and illumination
Range	Approximately (SP), 5 to 70 cmH ₂ O

Tactile knob indication ≥ 30 cmH₂O

Breathing Circuit Parameters

System compliance	≤ 2 mL/cmH ₂ O
Volume of gas lost due to internal compliance	
Impedance in manual mode	≤ 6 cmH ₂ O
Impedance in automatic ventilation mode	≤ 6 cmH ₂ O
Leakage	≤ 50 mL @ 3 kPa
System safety pressure on patient circuit	110 ± 10 cmH ₂ O

Breathing System Temperature Controller

Breathing system temperature maintained at least 31°C typical at 20°C ambient temperature in normal condition

Materials

All materials in contact with exhaled patient gases are autoclavable up to a maximum temperature of 134°C, except O₂ sensor and mechanical pressure gauge.

All materials in contact with patient gas are latex free.

Vaporizers

Anesthetic Agent Delivery

Vaporizer	V90 Electronic injection anesthetic vaporizer
Support agents	Isoflurane, Sevoflurane, Desflurane
Position	2 positions
Filling system	Safety filling adaptor (Iso, Sev) Saf-T-Fill (Des)
Isoflurane range	0% to 5%
Sevoflurane range	0% to 8%
Desflurane range	0% to 18%
Control accuracy	± 15% of the setting or ± 5% of full scale, which is greater

Dimension

Height	215 mm
Width	75 mm
Depth	185 mm
Weight	3.5 kg (empty)
Agent capacity	320 mL
Liquid level	Optical and electronic monitoring

Monitor Modules

Anesthesia Gas (AG) Module

Conformity with standard	ISO 80601-2-55
Measurement mode	Infrared absorption, sidestream
Monitor gases	CO ₂ , O ₂ (Paramagnetic O ₂ module), N ₂ O, and any of the five anesthetic agents: DES, ISO, ENF, SEV and HAL
Warm-up time	< 45 s (ISO accuracy mode) < 10 min (full accuracy mode)
Sample rate	Adu/Ped: 150, 180, 200 ml/min Neo: 100, 110, 120 ml/min
Monitoring range	CO ₂ : 0% to 30% (0.0 to 30 kPa, 0.0 to 226 mmHg) O ₂ /N ₂ O: 0% to 100% HAL, ISO, ENF: 0% to 30.0% SEV: 0% to 30.0% DES: 0% to 30.0%

BIS/BISx4 Module

Conformity with standard	IEC 60601-2-26
BIS, BIS L/ BIS R	0 to 100
Sweep speed	6.25 mm/s, 12.5 mm/s, 25 mm/s or 50 mm/s
Alarm limit	BIS high: 2 to 100 BIS low: 0 to (BIS high - 2)
Calculated parameters	SQI/SQI L, SQI R; EMG/EMG L, EMG R; SR/SR L, SR R; SEF/SEF L, SEF R; TP/TP L, TP R; BC/BC L, BC R; sBIS L, sBIS R; sEMG L, sEMG R; ASYM

NMT Module

Conformity with standard

IEC 60601-2-10

Stimulation output

Pulse width: 100, 200, or 300 μ s; monophasic rectangle pulse; Accuracy: $\pm 10\%$

Stimulation current range: 0 to 60 mA in increments of 5 mA
Accuracy: $\pm 5\%$ or ± 2 mA, whichever is greater

Maximum skin resistance: 3 k Ω @ 60 mA, 5 k Ω @ 40 mA

Block recovery OFF, 1, 2, 3, 4, 5 %, 10 %, 20 %, 30 %, 40 %, 50 %, 60 %, 70 %, 80 %, 90 %, 100 %

TOF (Train Of Four) mode

TOF-Ratio (response percentage) : 5 % to 160 %

TOF-Count (number of responses) : 0 to 4

TOF-T1% (response to the first stimulus as percentage of the reference value) : 0 % to 200 %

ST (Single Twitch) mode

ST-Ratio (response percentage) : 0 % to 200 %

DBS (Double-Burst Stimulation) 3.2/3.3 mode

DBS-Ratio (response percentage) : 5 % to 160 %

DBS-Count (number of responses): 0 to 2

PTC (Post-Tetanic Count) mode

PTC-Count (number of responses) : 0 to 20

Anesthesia Function

Automatic controlled anesthesia (ACA)

Control range

EtISO: 0% to 5%

EtSEV: 0% to 8%

EtDES: 0% to 18%

FiO₂: 25% to 100%

Flow: Min, 0.3 to 6.0 L/min

Control accuracy

EtAA: ± 0.2 Vol.% or $\pm 5\%$ of the setting, whichever is larger

FiO₂: ± 3 Vol.% or $\pm 5\%$ of the setting, whichever is larger

Response time

EtAA: <100s

FiO₂: <130s (increase);

< 230s (decrease)

Stable time

EtAA: <200s

FiO₂: <140s (increase);

< 260s (decrease)

Anesthetic Prediction

Patient type

Height: 150 to 200 cm

Weight: 40 to 140 kg

Age: 18 to 90 years old

Anesthetic agents

Desflurane, Isoflurane, Sevoflurane

Prediction trend and waveform

Dynamic short trend waveforms of FiAA, EtAA, FiO₂ and EtO₂ in the last 10 min and prediction trend waveforms of FiAA, EtAA, FiO₂ and EtO₂ in the next 20 min.

Prediction deviation

EtAA=0: less than volume fraction of 0.05 %
EtAA \neq 0: - 20 % to 30 % of the measured EtAA, or - 5 % to 7.5 % of the vaporizer maximum setting, whichever is greater

EtO₂ : - 10 % to 15 % of the measured EtO₂, or volume fraction of - 5 % to 7.5 %, whichever is greater

Agent Consumption Calculation

Usage speed range

ISO: 0 mL/h to 250 mL/h

SEV: 0 mL/h to 450 mL/h

DES: 0 mL/h to 900 mL/h

Accuracy

± 2 mL/h, or $\pm 15\%$ of the reading, whichever is larger

Total usage range

0 to 3000 ml

Accuracy

± 2 mL, or $\pm 15\%$ of the reading, whichever is larger

Electrical Specifications

Main Electrical Power

Power input

220-240 Vac, 50/60 Hz, 10A max

100-240 Vac, 50/60 Hz, 10A max

100-120 Vac, 50/60 Hz, 10A max

Power cord

5 m (length)

Battery Power

Battery type

Lead-acid, 12 VDC, 32 Ah (2 batteries)

Run-time

New battery: minimum 90 minutes under typical operating conditions

Time to shut down from the first Lower Battery Alarm

5 minutes minimum

(new fully-charged battery)

Battery charge time

<12 hours

Auxiliary Electrical Outlets

Number of outlets

4

Output current

3 A for each outlet, 5 A for total

Communication Port

Communication port

RS-232 compatible serial interface (DB9)

Network port

Two RJ-45 network ports

USB port

Four USB ports

Video signal port

One VGA port for inputting the VGA video signal of the main to external display

Environmental Specifications

Operating

Temperature

10 to 40°C

Relative humidity

15% to 95% (noncondensing)

Barometric (Kpa)

70 to 106.7 kPa

Storage

Temperature

-20 to 60°C for main unit,

-20 to 50°C for O₂ sensor

Relative humidity

10% to 95% (noncondensing)

Barometric

50 to 106.7 kPa

Resistance to Ingress of Fluids

Complies with the requirements of clause 11.6.3 in IEC 60601-1 and also the requirements in IEC 60529 for protection against vertically falling water drops equipment (IPX1)

Please contact your local Mindray sales representative for the most current information.

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P/N:ENG-A9 Datasheet -210285X4P-20200102

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