Medcaptain

Anes V60/Anes V60T

Veterinary Anesthesia Machine

User Manual

MEDCAPTAIN MEDICAL TECHNOLOGY CO., LTD.

About This Manual

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Product Model: Anes V60, Anes V60T

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Statement

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This manual describes all configurations supported by all models of the product, and therefore some descriptions may not apply to your model. Illustrations in this user manual are provided for your reference only and may differ from what is actually displayed on the screen or device.

MEDCAPTAIN is responsible for the safety, reliability, and performance of this product only if:

- The product is used in accordance with this manual.
- All installations, replacements, tests, modifications, and repairs are conducted by technicians authorized by MEDCAPTAIN.
- All spare parts for repair and replacement, accessories, and consumables used with this product are provided by MEDCAPTAIN.
- All maintenance and servicing records are kept.

Documentation

Understand the meanings of the following items clearly before reading this manual.

Item	Meaning
	Indicates a potentially hazardous situation that, if not avoided, may result in death or serious injury.
	Indicates a potentially hazardous situation that, if not avoided, may result in device malfunction or damage or performance impairment.
	Indicates a potentially biological hazardous situation that, if not avoided, may result in disease transmission.

Item	Meaning
NOTE	Indicates precautions or recommendations that should be used in operating the device.
Boldfaced Word	Indicates physical buttons and silk-screen words on the device, or on-screen objects such as menu items or buttons.

Customer Service

Thanks for purchasing the MEDCAPTAIN product.

- MEDCAPTAIN provides a limited warranty on the product. Within the warranty period, after-sales services for the product are provided free of charge. The length of the warranty period is stipulated in the sales contract. For details, contact your local distributor. However, a product damage or failure is not covered by the warranty if it is caused by:
  - Operation error;
  - Improper use;
  - Out-of-range grid voltage;
  - Force majeure such as natural disasters;
  - Replacement with or use of any component, accessory, or consumable other than authorized by MEDCAPTAIN; or
  - Other causes not related to the product itself.
- After the warranty expires, MEDCAPTAIN shall continue to provide paid maintenance service within the service life of the product.
- Feel free to contact us or your local distributor if you have any problem in using the product.

Contact our after-sales service department:

After-sales service provider: MEDCAPTAIN MEDICAL TECHNOLOGY CO., LTD.

After-sales service address: 12th Floor, Baiwang Research Building, No.5158 Shahe West Road, Xili, Nanshan, 518055 Shenzhen, Guangdong, PEOPLE'S REPUBLIC OF CHINA

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Contents

1 Overview

1.1 Intended Purpose

The product is intended to provide inhalation anesthesia and ventilatory support for animals.

1.2 Contraindications

The device has no defined contraindications.

1.3 Product Features

This product is intended for clinical anesthesia for animals in the following scenarios: medical treatment, animal laboratories, school teaching medical use, school training bases, and school teaching and laboratory use.

The product offers the following features:

- An 8.4-inch color touchscreen.
- A breathing circuit that is equipped with a heating module (only for Anes V60T) to prevent condensation and supports high-temperature steam disinfection at 134℃.
- Multiple breathing modes, including basic ventilation modes (volume/pressure control ventilation modes) and auxiliary ventilation modes (SIMV/PSV/SMMV).
- Wide setting range of 5 to 1,600 ml for tidal volume.
- Tidal volume setting recommendations and adaptive ventilation parameters based on weight.
- A quick-detach CO_2 absorbent canister to ensure safe absorbent replacement during surgeries.

2 Safety

This chapter describes important precautions for operating this device. To ensure the safety of both the operator and the animal, read this chapter carefully before using the device. You should be fully aware of the precautions provided in this manual. Otherwise, the manufacturer is not responsible for the safety, reliability, and performance of the device.

2.1 Warnings and Cautions

- The device shall be installed and set up by personnel authorized or trained by the manufacturer. Unauthorized personnel cannot install, disassemble, or modify the device.
- Place the device near the power socket and ensure that it is easy to disconnect the device and the power plug.
- Do not service or maintain the device when it is in use.
- The device shall be operated and managed by trained professional personnel. The operator must receive a training in the use of the device.
- To avoid risk of electric shock, the device must only be connected to mains power with protective earth. If a protective earth conductor is not provided, operate it on battery power, if possible.
- The device is intended for clinical and scientific use in animal anesthesia only and is prohibited for human use.
- It is recommended to prepare an alternative means of anesthesia when the anesthesia machine is in use.
- Use of unsuitable gas sources and anesthetics can result in injury to the animal and the operator as well as damage to the device.
- Unauthorized reconstruction of the device can result in injury to the animal and the operator as well as damage to the device.
- Use of an overpressurized gas source can result in injury to the animal and the operator as well as damage to the device.
- Keep away from sources of ignition and flammable and explosive materials when in use.
- Ensure that the oxygen gas supply tube is properly connected to the anesthesia machine before use.
- Ensure that the flowmeter is turned off before use, and make sure to turn off the flowmeter after use.
- When turning the flowmeter knob, turn it slowly. Do not turn the knob too fast in case the flowmeter is damaged by the impact.
- Make sure to turn off the vaporizer after use.

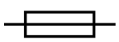
- Ensure that the exhaust gas generated during use of the device is vented to the outdoors or that an exhaust gas filter canister is properly connected to the device.
- During anesthesia, the vitals of the animal should be monitored to ensure that the depth of anesthesia is appropriate.
- The vaporizer of the veterinary anesthesia machine can be filled only with an applicable anesthetic agent. Do not fill the vaporizer with water or any other liquid. Read the label on the vaporizer before use.
- Waste and hazardous materials generated during use of the veterinary anesthesia machine shall be disposed of in accordance with local laws and regulations.
- Before moving the device, remove the items on its top to avoid the risk of the device tipping over.
- If there is a leak in the ventilation system, do not use the device.
- Fresh gas must not be turned off before the vaporizer is turned off and the vaporizer must not be turned on before fresh gas is turned on. Otherwise, highly concentrated anesthetic vapors may enter the piping of the device or diffuse in the air and cause injury to the animal or humans.

- Do not use the device in a strong electric or magnetic field or near mobile radio-frequency communication equipment as this may compromise the performance of the device or cause the device to malfunction.
- Use only the power cable and accessories provided by the manufacturer. Otherwise, the performance and safety of the device may be compromised and the device may be damaged.
- To avoid damage, do not touch the screen with a sharp object.
- Do not use the device in an MRI environment.
- Do not expose the device to treatment-level ionizing radiation or ultrasound.
- Before using accessories or consumables, ensure they are not expired.
- Ensure that the gas supply from the gas source is stable.
- When using the veterinary anesthesia machine indoors, ensure that the room is well-ventilated.
- The anesthetic gas overflowing due to overpressure shall be collected and disposed of in time.
- Prevent the anesthetic agent from contacting the anesthesia mask and other parts of the anesthesia system. If the anesthetic agent spills, let the spill evaporate instead of wiping it.
- When using the anesthesia machine on the trolley provided by the manufacturer, be sure to lock the wheels of the trolley so that the machine remains stationary in use.
- Keep the veterinary anesthesia machine out of the reach of animals and irrelevant persons.
- Keep the veterinary anesthesia machine away from direct sunlight and high-temperature and high-humidity environments.
- If the veterinary anesthesia machine cannot function properly as described in this manual for some unknown reason, terminate the operation of the machine immediately and report the operating conditions to your local distributor or the after-sales service department of the manufacturer.
- The veterinary anesthesia machine and its parts shall be inspected on a regular basis.

- Before using the veterinary anesthesia machine for the first time after a long time, check whether the machine can operate in a proper and safe manner.
- Maintenance of the veterinary anesthesia machine must be conducted by personnel authorized by the manufacturer. The authorized personnel can ask the manufacturer for materials such as the circuit diagram and component list.
- Certain settings of the device requires entering a password. To obtain the initial password, contact the after-sales service department of the manufacturer.

2.2 Symbol Description

The following table describes the symbols in this manual and on the labels of the device.

Symbol	Meaning	Symbol	Meaning
	Model number		Serial number
	Caution		Refer to instruction manual/ booklet (Background: blue; symbol: white)
	"OFF" (power)		"ON" (power)
	Mass		Stacking limit by number
	Importer		Temperature limit
	Manufacturer		Date of manufacture
	Batch code		Humidity limitation
	Comply with the requirements of Directive 2012/19/ EU Waste Electrical & Electronic Equipment		Keep away from sunlight
	Audio Paused		Atmospheric pressure limitation
	Menu		Fragile, handle with care
	Fuse		This way up

Symbol	Meaning	Symbol	Meaning
	The device is operating on mains power and the battery is being charged.		General warning sign (Background: yellow; Symbol & outline: black)
	The device is operating on battery power and the battery level is 100%.		The device is powered by a mains supply.
	Breathing bag		The device is operating on battery power and the battery level is low.
	Manual ventilation via breathing bag		The device is operating on battery power and the battery is nearly depleted.
	Automatic ventilation		CO_2 absorbent canister release lever
	Bag/Vent switch (between manual and automatic modes)		Adjustable pressure limiting (APL) valve
	Inspiratory port		Expiratory port
	Flowmeter knob (air)		Flowmeter knob (oxygen)
	Type B applied part		Keep dry

3 Product Specifications

■ **Basic Information**

Product name	Veterinary anesthesia machine
Product models	Anes V60, Anes V60T
Dimensions (W×H×D)	410 mm×620 mm×360 mm
Weight	Net weight: approx. 30 kg (excluding the trolley and accessories) Maximum weight: 73 kg
Display	8.4-inch touchscreen
Date of manufacture	See the product label
Service life	10 years (excluding the battery and oxygen sensor)

■ **Environmental Specifications**

Operating conditions	Ambient temperature: 15 ℃ - 30 ℃ Ambient humidity: 10% - 85%, non-condensing Atmospheric pressure: 70 kPa - 106 kPa
Storage and shipping conditions	Ambient temperature: -5 ℃ - 40 ℃ Ambient humidity: 10% - 85%, non-condensing Atmospheric pressure: 50 kPa - 106 kPa

■ **Safety Information**

Classification	● Class I / Internally powered equipment ● IPX0 ● Disinfected and sterilized as recommended by the manufacturer ● Not suitable for use in the presence of flammable gases or oxygen-enriched environments ● Operating mode: continuous operation ● Mobile equipment

■ **Power Specifications**

Power	● AC power input: 200-240V, 0.6A; 50/60 Hz ● Battery: − Specification: D.C.. 12V; 2.8 Ah − Run time: ≥60 min (Testing condition: Fully charged new battery, VC ventilation mode, bpm= 10, I:E ratio= 1:2, TV= 500 mL), PEEP OFF, Pressure limit= 40 cmH_2O, Inspiration pause= 0%, Gas supply = 0.4±0.1MPa) − Charging time: ≥14h (when powered off)
Maximum power of heater	● Heater for breathing circuit: 45W ● Heater for spirobox flowsensor: 3W
Power indicator	● Yellow: the equipment is connected to mains power and the battery is being charged. ● Green: the equipment is switched on.

■ **Pneumatic System**

Source gas type	Air, oxygen
Source gas pressure	280 - 600 kPa
Interface type	NIST
Oxygen flush	10 L/min - 15 L/min
Flow range	0 - 10 L/min. Accuracy: full range of ±2.5%

■ **Breathing Circuit**

Inspiratory port	22mm outer cone and 15mm inner cone
Expiratory port	22mm outer cone and 15mm inner cone
Bag port	22mm outer cone and 15mm inner cone
Exhaust outlet	30mm outer cone
System leak rate	<50 ml/min@3 kPa
Expiratory bypass air resistance	<6 cmH_2O@6 L/min
Inspiratory bypass air resistance	<6 cmH_2O@6 L/min
Pressure range of APL valve	1 - 60 cmH_2O

■ **Ventilator Parameters**

Monitoring parameters	
Airway pressure	Monitor range: -20 cmH_2O to 99 cmH_2O Accuracy: ±(2% of full range + 4% of the actual reading)
Tidal volume	Monitor range: 0 mL to 2000 mL Accuracy: ● 300mL - 2000mL, ±10% of the actual reading ● 100mL - 300mL, ±20% of the actual reading ● <100mL, ±50% of the actual reading or ±10 mL (whichever is greater)
Minute volume	Monitor range: 0 L to 50 L Accuracy: ±1 L or ±8% of the actual reading (whichever is greater)
O_2 concentration	Monitor range: 0 vol.% to 100 vol.% Accuracy: ±3 vol.% Display resolution: 1 vol.% Response time: reach 90% of the target value within 15 seconds
Respiration Rate	Monitor range: 4 bpm - 120 bpm Accuracy: ±1 bpm or ±10% of the actual reading (whichever is greater)
I:E ratio	Monitor range: 1:0.2 - 1:8.0 Accuracy: ● ±10% of the actual reading (range of 1:0.5 to 1:8.0) ● ±25% of the actual reading (other)
Control parameters	
Tidal volume (VT)	Range: 5mL - 1600mL ● 5mL≤VT≤20mL, step: 1mL ● 20mL<VT≤70mL, step: 5mL ● VT>70mL, step: 10mL Accuracy: ● >300mL , ±10% of the set value ● 100mL - 300mL , ±20% of the set value ● <100mL, ±50% of the set value or ±10mL (whichever is greater)
Respiration Rate	Range: 4bpm - 100bpm Step: 1bpm Accuracy: ±1bpm or ±5% of the set value (whichever is greater)

I:E ratio	Range: 1:0.2 - 1:8.0 Step: 1:0.1 Accuracy: ● ±10% of the set value (range of 1:0.5 to 1: 4.0) ● ±25% of the set value (other)
Pressure Limit	Range: 10 cmH_2O - 80 cmH_2O Step: 1 cmH_2O Accuracy: ±2.5 cmH_2O or ±7% of the set value (whichever is greater)
Pinsp	Range: 5 cmH_2O - 70 cmH_2O Step: 1 cmH_2O Accuracy: ±3.0 cmH_2O or ±8% of the set value (whichever is greater)
Tinsp	Range: 0.3 s - 5 s Step: 0.1 s Accuracy: ±0.2 s
PEEP	Range: OFF, 4 cmH_2O - 30 cmH_2O Step: 1 cmH_2O Accuracy: ±2.0 cmH_2O or ±10% of the set value (whichever is greater)
Trigger	Range: 0.7 L/min - 4.0 L/min Step: 0.1 L/min Accuracy: ±1 L/min
Pressure support level	Range: 4 cmH_2O - 70 cmH_2O Step: 1 cmH_2O Accuracy: ±2.5 cmH_2O or ±10% of the set value (whichever is greater)

■ **Alarms**

Ventilator inoperative, Outlet blocked, Low supply pressure, Low airway pressure, High continuous pressure, High airway pressure, Negative airway pressure, Check pressure sensing, Low tidal volume (V_T), Low minute volume (V_M), Apnoea, High tidal volume (V_T), High minute volume (V_M), High O_2 concentration %, Low O_2 concentration %, Oxygen sensor fault, Rate or ratio error, AC power failure, Battery power fail, Low battery, Power about to fail, Sensor cable, High VC pressure

4 Product Introduction

Before using this device, please be familiarized with the components, features, buttons, and interface operations related to the device.

4.1 Structural Composition

The anesthesia machine is composed of a main unit, anesthesia ventilator, anesthesia vaporizer, anesthesia breathing circuit, anesthesia exhaust gas absorbent system and accessories.

This device provides the following ventilation modes:

- Standby
- Spontaneous Mode (Spont)
- Non-circulating Ventilation (ACGO)
- Volume Control Ventilation (VC)
- Pressure Control Ventilation (PC)
- Pressure Supported Ventilation (PSV)
- Synchronized Intermittent Mandatory Ventilation (SIMV)
- Synchronised Mandatory Minute Ventilation (SMMV)

NOTE:

SIMV and SMMV modes are available only for Anes V60T.

4.2 Schematic Description

4.2.1 Front View

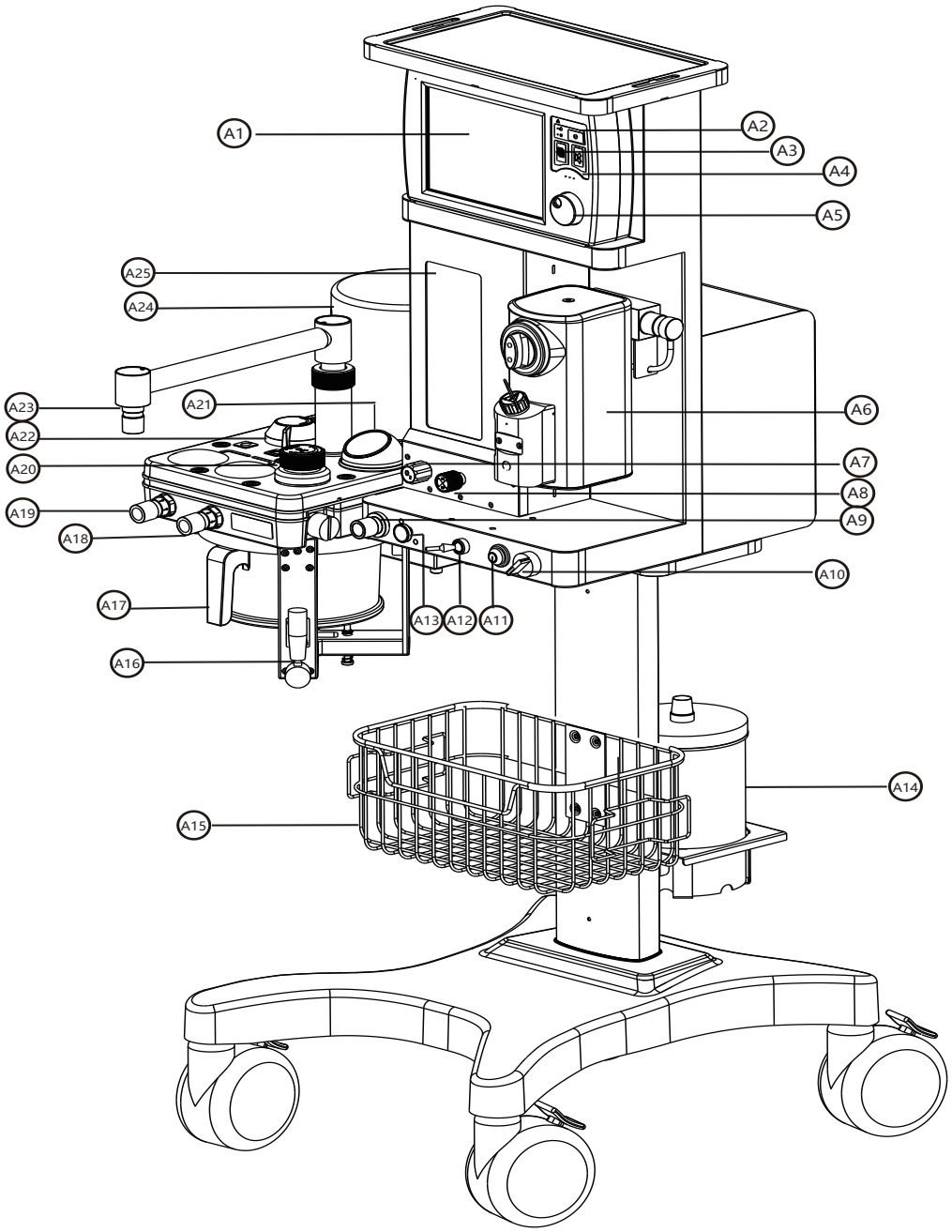


Figure 4-1 Front View

No.	Name	Description
A1	Touchscreen	Display software interface and support touch operations.
A2	AV-S ventilator switch	Turn on or off the AV-S ventilator.
A3	AV-S ventilator menu switch	Press to access the main menu. All available menus can be accessed through the main menu system when the ventilator is in Standby mode.

No.	Name	Description
A4	Alarm mute switch	Used to mute the alarm sound. Note that some alarms are not mutable.
A5	Navigator wheel and press button	Turn the wheel. Select a function or parameter, alter the value of an active parameter. Press to confirm the setting.
A6	Vaporizer	The anesthetic agent is evaporated and mixed into the anesthesia ventilation system in a proportional concentration.
A7	Oxygen flowmeter knob	The flow rate can be adjusted by turning the knob.
A8	Air flowmeter knob	The flow rate can be adjusted by turning the knob.
A9	ACGO outlet	Output fresh gas in ACGO mode.
A10	System switch	Turn on or off the anesthesia system. This switch controls all gas supply and electrical supply for AV-S ventilator.
A11	Oxygen supply indicator	The indicator shows GREEN when the supply is at working pressure, and RED if the pressure falls.
A12	ACGO switch	Switch to enable or disable the ACGO function. When the ACGO function is enabled, fresh gas is output through the ACGO outlet.
A13	Oxygen flush switch	Press for certain flow rate of oxygen into the breathing circuit.
A14	Exhaust gas absorbent canister	To absorb residual anesthetic gas in exhaust gas
A15	Basket	Maximum weight 3KG
A16	Canister release lever	To release the CO_2 absorbent canister
A17	CO_2 absorbent canister	For placing carbon dioxide absorbers
A18	Inspiratory port	Taper connector for inspiratory
A19	Expiratory port	Taper connector for expiratory
A20	Adjustable Pressure Limit valve (APL valve)	Rotate to adjust the airway pressure limit for manual ventilation mode
A21	Airway pressure gauge	Indicates airway pressure
A22	Bag/Vent switch	Turn to switch between automatic ventilation and manual ventilation
A23	Bag arm	Connect the breathing bag, for manual ventilation

No.	Name	Description
A24	Bellows	The drive mechanism for supplying gas to the ventilation system
A25	Flowmeter	Display flow rate for air and oxygen

4.2.2 Rear View

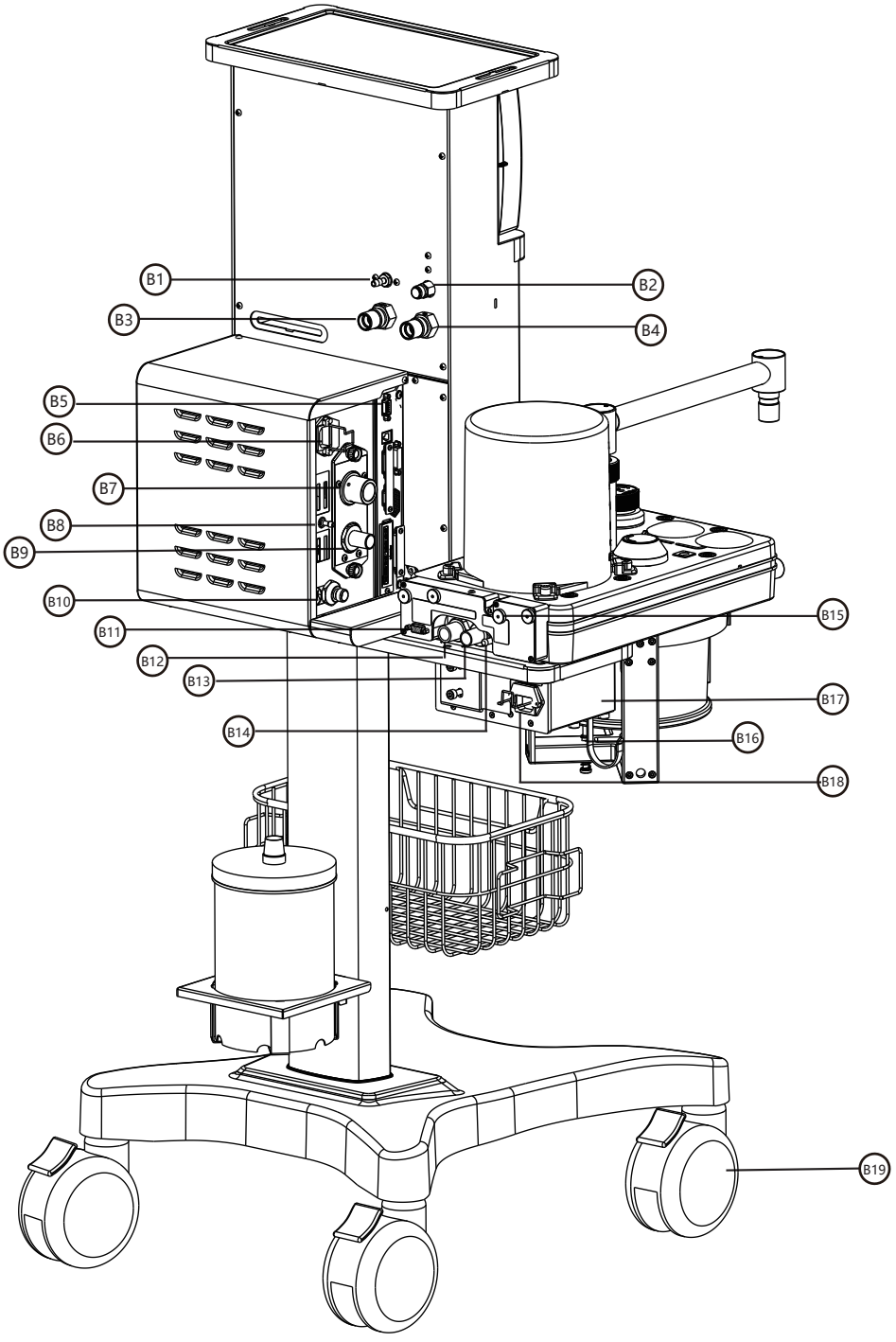


Figure 4-2 Rear View

No.	Name	Description
B1	Fresh gas output	Set oxygen percentage of fresh gas supply
B2	Auxiliary high pressure oxygen output	High pressure oxygen supply (280 - 600 kPa)
B3	Oxygen supply inlet	Oxygen supply hose connector
B4	Air supply inlet	Air supply hose connector
B5	AV-S spirometer connector	AV-S spirometer connection
B6	Electrical mains input	AC power cable connection
B7	AV-S outlet - exhaust valve	Connect to the exhaust gas absorbent canister
B8	AV-S pressure monitor port	Connect to the breathing circuit pressure sampling tube, for monitoring the breathing circuit pressure
B9	Bellows drive gas output	Output the drive gas for ventilator and control the bellows
B10	Ventilator drive gas inlet	Inlet for drive gas to the ventilator
B11	Circuit spirometer connector	Connect to the spirobox of breathing circuit
B12	Circuit exhaust port	Connect to the exhaust gas absorbent canister or gas scavenging system to discharge the overflow gas from the circuit
B13	Bellows drive gas input	Input drive gas into the bellows
B14	Circuit fresh gas input	Input fresh gas to the breathing circuit
B15	Circuit pressure monitor port	Connect the pressure sampling tube for monitoring circuit pressure
B16	Cable hook	For cable and hose management
B17	Breathing circuit heater module (Optional)	For heating up the breathing circuit
B18	Electrical input of heater module	For power supply of heater module
B19	Casters	To move equipment or secure equipment through caster locks

CAUTION

- Additional equipment connected to medical electrical equipment through the network/data coupling must comply with the respective IEC or ISO standards (e.g. IEC 60950-1 or IEC 62368-1 for data processing equipment). Furthermore, all configurations shall comply with the requirements for medical electrical systems (see clause 16 of the 3Ed. of IEC 60601-1, 60601-1-2, respectively). Anybody connecting additional equipment to medical electrical equipment configures a medical system and is therefore responsible that the system complies with the requirements for medical electrical systems. Attention is drawn to the fact that local laws take priority over the above mentioned requirements. If in doubt, consult your local representative or the technical service department.
- The device must be used by or under the directions of professional medical care personnel, and all connections must comply with requirements.

4.3 Screen

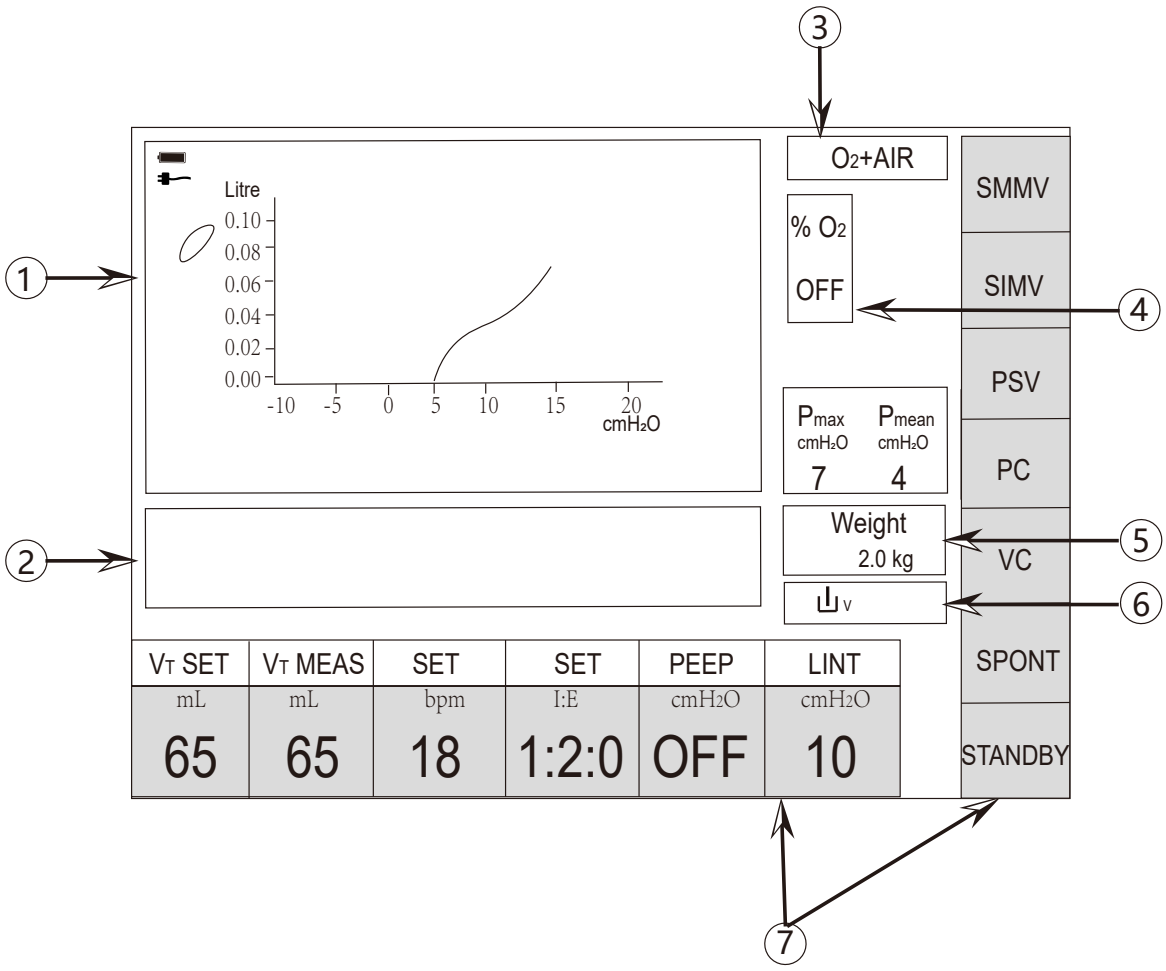


Figure 4-3 AV-S Ventilator Screen

No.	Description
1	Waveform display, pause and print symbols
2	Alarm values window, display ongoing alarm information
3	Gas mixture selection window

No.	Description
4	Oxygen monitor values window
5	Weight parameter setup window
6	Ventilation mode symbol
7	Ventilation modes and parameter setup window

Table 4-1 Breathing Mode Symbols

Symbol	Description	Symbol	Description
	Automatic Ventilation Mode		Sigh
	Manual Ventilation Mode		Inspiration Pause

4.4 Accessories

Oxygen gas hose	1	Circle Breathing System (ID 15mm)	1
Exhaust gas absorbent bracket	1	Single Breathing System (With APL valve)	1
1L Latex-free Reservoir Bag	1	0.5L Latex-free Reservoir Bag	1
Disposable tracheal intubation	1	2L Latex-free Reservoir Bag	1
Retractable twin-band Y-fitting (2m)	1	500g Soda lime (bag)	2
Anesthetic scavenging canister	1	User manual	1
AC power cable	1	Quick operation guide	1
Packing list	1		

4.5 Optional Accessories

Oxygen gas hose	GS Oxygen connector
GS air connector	Circle Breathing System (ID 22mm)
Coaxial Breathing System	Retractable single tube (2m)
Anesthetic breathing masks	Drip stand arm
Drip stand	Cylinder Pressure Reducing Valve
Oxygen sensor	0-300ml Bellows kit

Vaporizer (Sevoflurane)	

WARNING Use only the accessories provided by the manufacturer, otherwise, the performance and safety of the equipment may be affected and the equipment may be damaged.

5 Preoperative Preparations

Basic preoperative checks:

- Each day before administering anesthesia, the following should be done:
  - With the anesthesia machine connected to AC power, turn the mains switch to ON and verify that the unit is operating on AC.
  - Check that the vaporizers are properly installed and sufficiently filled and that filler ports are tightly closed.
- Prior to each animal, before administering anesthesia, the following should be done:
  - Inspect the machine for damage or hazardous conditions; ensure all necessary equipment and supplies are present, e.g., drugs, CO_2 absorbent (not exhausted), and absorbent canister.
  - When a central gas supply or a gas tank is used, check whether O_2 pressure and air pressure are within the specified ranges.
  - With a breathing system and reservoir bag attached, check whether the unidirectional valves operate normally by visual inspection.
  - Check ventilation capability in Standby, Manual, VC and PC ventilator modes.
  - Verify ability of required monitors and check alarms.
- The following step is recommended to be performed when the CO_2 absorbent, the bellows, or the breathing tube is replaced:
  - Perform a leak test.

WARNING

- The equipment must be installed and set up by personnel authorized or trained by the manufacturer.
- Before using the machine, follow the procedures to check the machine to ensure proper operation of the machine and protect the safety of both the operator and the animal.
- If you have any doubt during checks, do not use the equipment. Contact the after-sales service department of the manufacturer.

5.1 Inspect the System

1. Check whether the device and its accessories are intact.
2. Inspect the system for:
   - Damage to flowmeters, vaporizers, gauges, supply hoses
   - Complete breathing system with adequate CO_2 absorbent Pre-Pak or loose fill
   - APL valves are closed
   - Vaporizers are off and filled
3. The breathing system is correctly connected and the breathing tubes are undamaged.

4. The gas supplies are connected and the pressures are correct.
5. Prepare an alternative means of anesthesia in case of emergencies.
6. Inspect the color of the sodalime in the canister. Replace the sodalime immediately if obvious color change is detected.
7. Applicable anesthetic and emergency drugs are available.
8. The casters are not damaged or loose, and the brake is set and prevents movement.
9. The O_2 flush button and other buttons are functioning.

5.2 Power Check

WARNING

- Do not touch the power plug with wet hands. If any liquid or liquid residue exists on or around the power plug or power port, remove the liquid or liquid residue before plugging in the device. Otherwise, a safety accident may occur.
- Use only the power adapter provided by the manufacturer.
- Ensure that the specifications of the power supply meet the requirements.

1. Insert one end of the power adapter provided by the manufacturer into the power port of the pump and the other end into a wall AC outlet.
2. Press the ON/OFF button of the pump. Check that the power indicator is steady green.

NOTE:

- The power cable must be firmly and fully inserted.
- Do not pull the power cable by force.
- Before moving the device, be sure to plug out the power cable.

5.3 Leak Test

1. Power on the system and start the anesthesia machine system.
2. Connect a breathing system to the inspiratory and expiratory ports. Close the breathing system at the animal connection by connecting the Y-piece on the breathing system to the leak test port.
3. Set the ventilation switch to the automatic position. Press the O_2 flush button until the bellows inflates to the maximum.
4. Turn the ACGO switch to the dual-circuit status.
5. In standby mode, tap the button and select Leak Test from the menu.
6. Select the Start Leak Test button.

After the leak test is completed, the test result is displayed on the screen.

5.4 AC Power Failure Alarm Test

1. In standby mode, set the system switch to the On position.
2. Disconnect the AC mains.
3. Ensure that the AC mains indicator is extinguished. The prompt message "AC power failure" should be displayed on the screen.

4. Reconnect the AC mains and set the system switch to the On position. The prompt message "AC power failure" should not be displayed on the screen.

5.5 Basic Ventilation Testing

1. Attach a breathing system and breathing bag.
2. Attach a test lung or breathing bag to the animal end of the Y-fitting of the breathing system.
3. Set the O_2 flow to 1 L/min.
4. Set the ventilation controls to:
   - V_TSET: 50 ml
   - bpm: 18
   - I:E: 1:2
   - PEEP: OFF
   - LIMIT: 10 cmH_2O
5. Double-click **VC** in the ventilation mode area and begin ventilation.
6. Verify that the breathing bag at the animal end of the Y-fitting of the breathing system inflates and deflates and that the PLAT on the display and the airway pressure gauge are consistent with the Ptarget testing.

5.6 Spirometer Calibration

NOTE:

The Spirometry system must be calibrated with zero flow going through.

Perform zero calibration according to the following steps:

1. Set the system switch to the Off position, turn the flowmeter counterclockwise to the full, and stop all gas flows.
2. Turn the ventilator on at the ventilator switch.
3. Remove the breathing circuit hoses from the inspiratory and expiratory connectors.
4. Disconnect the hose that connects the APL valve outlet to the AGSS receiver.
5. Remove the bag and set the Auto/Manual switch to Manual.
6. Turn the APL valve clockwise to the full.
7. Select O2 MONITOR > SPIRO CALIBRATION and press the navigation wheel to confirm.

5.7 O_2 Sensor Calibration

Calibrate a new unit before clinical use. Thereafter, as a safety precaution, we recommend calibration of the unit every time the system is switched on.

Calibration must also be performed:

- When the sensor is replaced
- When point-of-use elevation changes by more than 160 m (500 ft).

Note that altitude compensation is automatically applied during calibration. The calibration process requires calibration at the primary point of 100% oxygen.

To provide enhanced accuracy there is an optional secondary point at 21% oxygen, using medical air (or room air), which can be carried out after the primary calibration in 100% oxygen.

- **Calibration - Using 100% Oxygen**

  Calibrate with the sensor in position within the absorber.

  1. Detach the absorbent canister and remove the breathing circuit hoses from the inspiratory and expiratory connectors. This will give a free flow of oxygen through the sensor.
  2. Set the breathing circuit to VENT, allow the bellows to deflate.
  3. Turn the system switch to the On position and switch on the ventilator. Select O2 MONITOR 'on' in the O2 MONITOR AND SPIROMETRY sub-menu.
  4. Ensure that all vaporizers are OFF.
  5. Apply 100% oxygen at 5 L/min, from the anaesthetic machine flowmeter. Allow the oxygen sensor to stabilise for 15 minutes (check that the reading remains constant for a 30 seconds period).
  6. Press the menu button and select the O2 monitor sub-menu.
  7. Scroll to CALIBRATION and press the navigation wheel to switch to 100%.
  8. Exit the menu system, turn off the gas flow, and refit the absorbent canister.

- **Secondary Point Calibration - Using Room Air**

  NOTE:

  A primary calibration in 100% oxygen must be performed before this procedure.

  1. Detach the sensor from the breathing circuit, and gently move it through the air to allow room air to circulate for 20 seconds.
  2. Allow the oxygen sensor to stabilise for 15 minutes (check that the reading remains constant for a 30 seconds period).
  3. Press the menu button and select the O2 monitor sub-menu.
  4. Scroll to CALIBRATION and press the navigation wheel to switch to 21%.
  5. Exit the menu system and refit the oxygen sensor.

5.8 Preoperative Preparations

1. Ensure that the ventilator parameters and alarm limits are set to applicable clinical levels.
2. Ensure that the system is in Standby.
3. Ensure that applicable emergency equipment, anesthetic, and emergency drugs are available.
4. Set the ventilation switch to the manual position.
5. Connect the manual bag to the bag port.
6. Turn off all vaporizers.
7. Turn the APL valve to the MIN position.
8. Ensure that the breathing system is correctly connected and not damaged.

6 Operating Instructions

6.1 Setting Gas Supply

1. Turn the system switch to the | position and power on the system.
2. Connect the gas supply and make sure that the airbag has enough pressure.
3. Use the O_2 and AIR knob to control the flow rate of O_2 and AIR in the fresh gas. The flow meter displays the value of each gas in the fresh gas.

6.2 Filling And Draining the Vaporizer

WARNING
- The vaporizer must be filled only by skilled and trained personnel.
- The vaporizer must be either secured to the anaesthetic machine or free standing on a level table so that in either case it is upright during the filling process. Overfilling may occur if the vaporizer is tipped during the filling process.
- The concentration control must be in the 0 (zero) position during the filling process.
- Before filling, ensure that the system switch is turned off and the flowmeter valve is completely closed (ensuring that no fresh gas flows into the vaporizer). Otherwise, drug liquid may flow from the filler port.

6.2.1 Installing the Vaporizer

1. Connect the inlet of the vaporizer to the fresh gas inlet connector on the main unit of the anesthesia machine (the fresh gas inlet connector is located on the right of the flowmeter).
2. Ensure that the vaporizer mounting base fits closely with the main unit of the anesthesia machine.
3. Tighten three screws onto the rear cover plate of the main unit to secure the vaporizer.
4. Properly connect the outlet connector on the main unit to the vaporizer outlet.

6.2.2 Filling the Vaporizer

WARNING
- Check that the drug name on the vaporizer and the supply bottle are the same before commencing the filling process, and ensure that the bottle is fitted with a keyed collar.
- Do not use the vaporizer if the agent level is not visible or the level is above the maximum mark or below the minimum mark.

CAUTION Ensure the materials compatibility of the drug and the vaporizer before commencing the filling process.

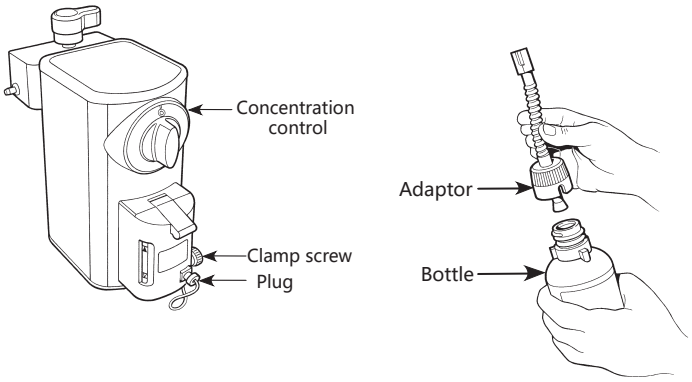
■ **Key Filler System**

WARNING

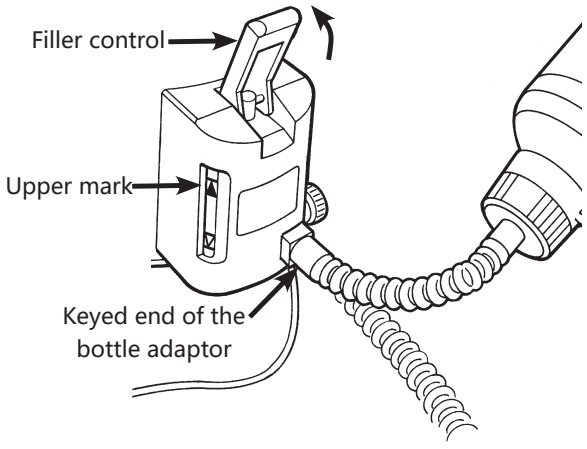
- Do not overfill. A vaporizer that has been overfilled must be withdrawn from use. If the vaporizer has been inadvertently overfilled, excess liquid agent will spill from the drain hole in the keyed slot in the filler block. Do not reuse this agent. Allow all the excess liquid to drain from the vaporizer before inserting the plug.
- For the vaporizer to function correctly it is important to insert the sealing plug fully before clamping it into position with the clamp screw after filling is completed. If this is not done, the possibility exists that agent may leak from the vaporizer or the vaporizer may not pressurise properly, giving reduced concentration output and gas flow to the animal.

The filling steps are as follows:

1. Check that the vaporizer concentration control is in the 0 (zero) position as illustrated. Attach the keyed filler adaptor to the bottle.



2. Tighten the adaptor to ensure an airtight joint, which must be maintained throughout the filling operation to avoid overfilling.
3. Rotate counter clockwise to loosen the clamp screw. Remove the sealing plug.
4. Insert the keyed end of the bottle adaptor fully into the vaporizer receiver. Rotate clockwise to tighten the clamp screw to secure the adaptor.



5. Raise the bottle above the filler.
6. Open the filler control and lift upwards. Allow the liquid to flow into the vaporizer. The liquid level should not exceed the upper mark on the filler block.

7. Close the filler control.
8. Lower the bottle below the level of the filler and allow the liquid in the bottle adaptor to flow back into the bottle. Loosen the clamp screw, remove the bottle adaptor from the receiver.

   NOTE:

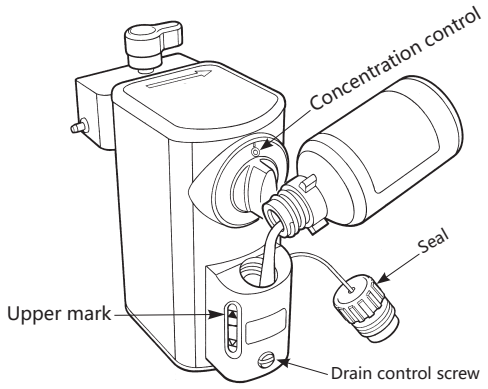
   A small amount of liquid is likely to spill when the bottle adaptor is removed from the receiver.
9. Insert the plug and tighten the clamp screw.

■ **Pour Fill System**

WARNING
- Do not overfill. A vaporizer that has been overfilled must be withdrawn from use.
- Do not operate the vaporizer if the filler cap is not secured in position. Incorrect concentration may be delivered to the animal and pollution may result.

The filling steps are as follows:

1. If the vaporizer is empty, check that the drain control screw is fully tightened before filling.
2. Check that the concentration control is in the 0 (zero) position, Unscrew the filler cap.
3. Remove the bottle cap. Fill the vaporizer slowly and carefully, stopping to check the liquid level occasionally. Stop filling when the upper mark is reached on the filler block.



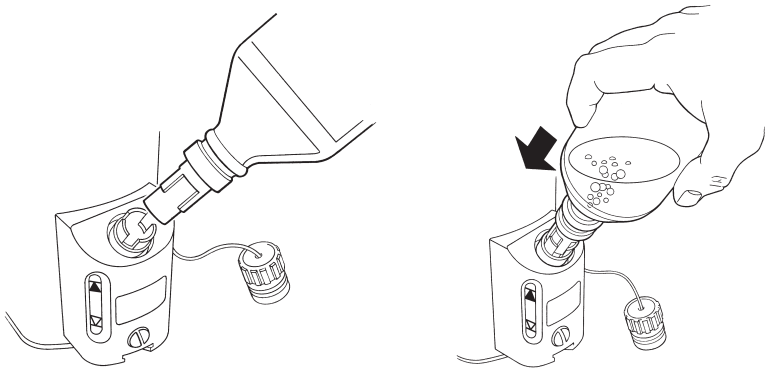
4. Check that the seal in the filler cap is clean, and positioned correctly. Replace the filler cap. Tighten finger tight only. Do not use a wrench.

■ **Quik-Fil System**

WARNING
- Do not use the anaesthetic agent bottle to fill the vaporizer if the bottle is cracked or the filler connector is loose or broken. This may result in overfilling or contaminated agent entering the vaporizer.
- Ensure that the drain plug screw, located on the lower front of the vaporizer, is correctly tightened to prevent loss of liquid agent.
- After filling, remove the bottle and refit the filler block cap before using the vaporizer. Check that the seal in the cap is clean. Do not overtighten the cap.

The filling steps are as follows:

1. Check that the vaporizer concentration control is in the 0 (zero) position.
2. Remove the yellow protective cap from the anaesthetic agent bottle filler, checking that the bottle and filler mechanism are not damaged.
3. Remove the vaporizer filler block cap and insert the bottle nozzle into the filler block, Rotate the bottle to align the bottle filler keys with the slots in the filler block.
4. Note the liquid level in the vaporizer and press the agent bottle firmly into the vaporizer filler against the spring valve assembly. Allow the liquid to flow into the vaporizer until the upper mark is reached, paying continuous attention to the level in the sight glass and the air return bubbles flowing into the bottle.
5. Release the bottle when the vaporizer is full and the continuous stream of bubbles ceases.
6. Withdraw the bottle from the vaporizer filler and replace the yellow cap on the agent bottle.
7. Check that the seal in the vaporizer filler block cap is clean. Refit the cap - do not overtighten.



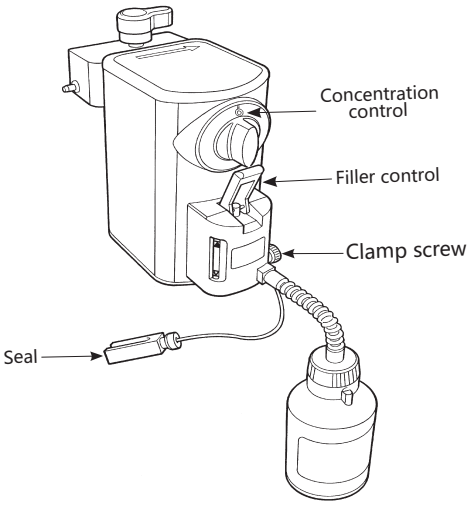
6.2.3 Draining the Vaporizer

WARNING

- Anaesthetic drugs must be treated as a pharmaceutical product. Liquid should never be drained from a vaporizer into an open container and reused. Always dispose of such drained liquid as a hazardous chemical.
- To avoid spillage, check that the bottle to be used for draining has sufficient capacity for the volume of liquid to be drained.

■ **Key Filler**

1. Check that the vaporizer concentration control is in the 0 (zero) position. Attach the keyed filler adaptor to the bottle.
2. Tighten the adaptor to ensure an airtight joint, which must be maintained throughout the filling operation to avoid overfilling.
3. Rotate counter clockwise to loosen the clamp screw. Remove the plug.
4. Insert the keyed end of the bottle adaptor fully into the vaporizer receiver. Rotate clockwise to tighten the clamp screw to secure the adaptor. Raise the filler control and allow the liquid to run into the bottle until the flow ceases.
5. Close the filler control, loosen the clamp screw, and reinsert the sealing plug. Tighten the clamp screw.

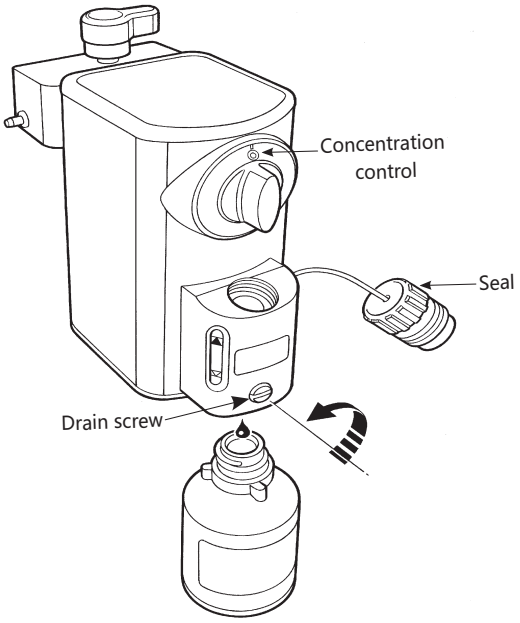


■ **Pour Fill**

1. Check that the vaporizer concentration control is in the 0 (zero) position, as illustrated.
2. Unscrew the filler cap.
3. Place a bottle marked with the drug name on the vaporizer under the drain tube in the base of the filler block and undo the drain screw at least three full turns.
4. Allow the liquid to run into the bottle until the flow ceases. Close the drain screw.

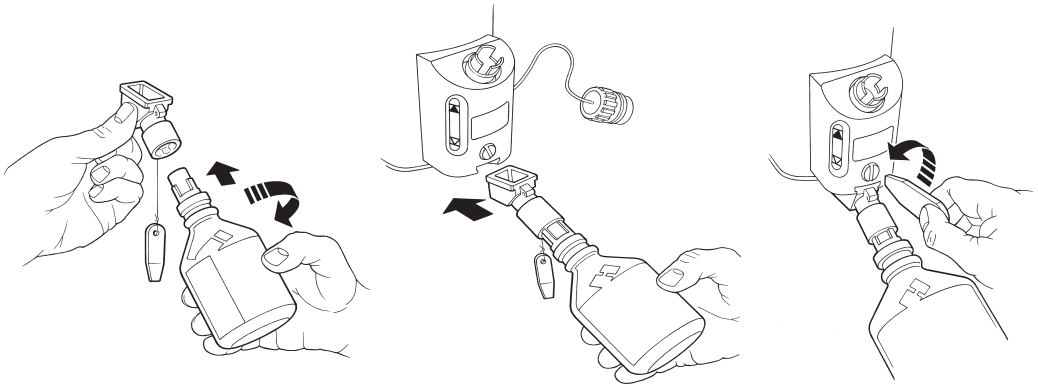
   NOTE:

   Always close the drain screw firmly before replacing the filler cap on the vaporizer.
5. Check that the seal in the filler block cap is clean and positioned correctly. Refit the cap - do not overtighten.



■ **Quik-Fil**

1. Remove the yellow protective cap from an empty sevoflurane bottle. Insert the bottle nozzle into the drain funnel. Rotate the bottle to align the bottle filler keys with the index slots in the drain funnel, and screw the drain funnel onto the empty bottle.
2. Remove the vaporizer filler block cap.
3. Fully insert the drain funnel into the keyed drain slot, and unscrew the drain plug. Continue to drain the vaporizer until empty. Close the drain plug and tighten, and withdraw the drain funnel.
4. Unscrew the drain funnel from the bottle and refit the bottle cap.
5. Check that the seal in the vaporizer filler block cap is clean. Refit the cap - do not overtighten.



6.3 Ventilation Modes

Steps for setting ventilation mode:

1. In the ventilation mode and parameter setting area, select the required modes by using the touchscreen or the navigator wheel.
2. Rotate the wheel to select the required value and modify the value.
3. Press wheel to confirm.

6.3.1 Standby Mode

In Standby mode, the mode underlined indicates the last used ventilation mode. In this mode, after you tap the weight area to set the weight of the animal, the system automatically recommends a tidal volume, respiratory rate, and I:E ratio.

- Standby mode at ventilator start-up: The last used Volume mode settings will be displayed
- Standby mode selected while the ventilator is in use: The screen will display the previous ventilation mode, highlighted in yellow. The last used parameters will also be displayed.

6.3.2 Volume Mode（VC）

The ventilator delivers a mandatory set volume of gas at preset, fixed breath intervals. The animal is making no respiratory effort.

■ **Setting VC Mode**

1. Press VC in the ventilation mode area on the screen.

2. The screen shows the previous setting, or default setting. A new Volume value can be set if required.
3. Press the navigator wheel to confirm change of mode and new setting, and the ventilator will switch to Volume Mode.

Volume mode parameters

Tidal volume	5 - 1600 mL
Rate	4 - 100 bpm
I:E ratio	1:0.2 - 1:8
PEEP **Off** or adjustable	4 - 30 cmH_2O
Pressure limit	10 - 80 cmH_2O To set Pressure limit, touch the **LIMIT** tab area on screen , turn the navigator wheel to select the required value, and press to confirm.
Inspiratory pause	0 - 60% of inspiratory (does not affect I:E ratio) time
Sigh	Approximately 1.5 x set V_T is delivered every 10 to 100 breaths (sigh to breath ratio is user selectable)

NOTE:

- Pressure limit will default to the previous Pressure Target value + 5 cmH_2O
- Volume mode will commence at the beginning of an exhalation phase.

■ **Volume Type Selection**

Touch the screen tab to switch between Tidal Volume and Minute Volume.

NOTE：

Minute Volume is derived from a rolling average during a 30 second period.

■ **Inspiratory Pause function**

1. Press the menu switch, turn the navigator wheel to scroll through the menus.
2. Select **Modes**, and select **Percentage Time Value (0 - 60%)**
3. Exit menus and the symbol for inspiratory pause will appear on the display.

NOTE:

The inspiratory pause function is canceled when **Standby** is selected.

■ **Sigh function:**

1. Press the menu switch, turn the navigator wheel to scroll through the menus.
2. Select **Modes** and select Sigh Enable on/off
3. Select **Sigh-to-Breath Ratio**
4. Rotate the wheel to select the required value。
5. Press wheel to confirm, and exit menus. The symbol for Sigh will appear on the display.

NOTE:

- The inspiratory pause function and sigh function will be canceled when Tidal volume less than 70ml or minute volume ventilation less than 700ml.

- The sigh function is canceled when standby is selected.
- A sigh to breath ratio of 1:10 indicates 1 breath with sigh, then 10 breaths without sigh
- The extra volume will be approximately 50% above the tidal volume set by the user (1.5 x set V_T).
- The High Volume Alarm is not triggered when **Sigh** is selected.

■ **Volume measurement**

Volumes are measured if the Spirometry function is selected.

Automatic High or Low volume alarms are triggered if the measured volume is 50% above or below the set volume.

If the maximum pressure limit is achieved, the ventilator cycles to the expiratory phase.

6.3.3 Pressure Control Mode

In pressure mode the ventilator delivers a variable flow of gas to achieve a set pressure at fixed breath intervals. The animal is making no respiratory effort.

Pressure range	5 - 70 cmH_2O
Rate	4 - 100 bpm
I:E ratio	1:0.2 - 1:8
PEEP	PEEP **Off** or adjustable: 4 - 30 cmH_2O

■ **Setting PC Mode**

1. Press PC in the ventilation mode area on the screen.
2. The screen shows the previous setting, or default setting. A new Pressure value can be set if required.
3. Press the navigator wheel to confirm change of mode and new setting, and the ventilator will switch to Pressure Mode.

NOTE:

Pressure Mode will commence at the beginning of an exhalation phase.

■ **Pressure Mode Operating Functions**

Pressure mode defaults to a target pressure of 10 cmH_2O at switch on.

- A high inspiratory flow is used to achieve and maintain the target pressure.
- The exhaust valve operates to prevent excess pressure.
- There is no Inspiratory Pause function in pressure mode.

6.3.4 Spontaneous Mode

The ventilator monitors the following animal parameters: Rate, I:E ratio, Pressure and Tidal volume.

■ **Spontaneous Mode Operating Functions**

Move the absorber Bag/vent switch to  - the ventilator will switch from the current ventilation mode to Spontaneous Mode.

NOTE:

- The default trigger level for ventilator support is 1.0 L/min flow.
- In some animals this may be too sensitive and provide inaccurate triggering and also result in a displayed BPM reading that is higher than the actual rate. Should this occur, the user should reduce the level of sensitivity by setting a higher trigger value.

■ **Apnoea Alarm Mute (Spontaneous mode only)**

In spontaneous mode the mute button acts both to silence an existing apnoea alarm and inhibit new apnoea alarms for a given period.

The apnoea alarm will trigger if the animal fails to breathe after 15 seconds. This setting can not be changed.

During the alarm mute period the apnoea alarm message will be displayed if the alarm has been triggered.

The alarm message will be removed if the animal breathes. If re-triggered, the alarm message will be displayed again, but the audible alarm will remain muted if the mute period is still active.

NOTE:

- The alarm mute time period is selectable (choose from 15, 30, 60 or 120 seconds) through the alarm settings menu, or accessed by touching the alarm area of the screen.
- When the alarm mute is selected, the mute period is displayed on the screen, and count-down starts.

■ **Patient Support Modes**

Support modes can be accessed through the display touchscreen.

- SIMV：Synchronised Intermittent Mandatory Ventilation
- SMMV：Synchronised Mandatory Minute Ventilation
- PSV：Pressure Supported Ventilation

6.3.5 Advanced Spontaneous Breathing Modes

■ **SIMV**

Check that SIMV is an enabled option on your ventilator before attempting selection. SIMV allows spontaneous breaths and a set mandatory breath, synchronized with the start of an animal breath.

SIMV Setting

- The trigger window is preset to 60% of the BPM cycle time.
- V_T can be adjusted before SIMV is confirmed.
- The trigger setting is adjustable between 0.7 and 4.0 L/min.

■ **SMMV**

Check that SMMV is an enabled option on your ventilator before attempting selection. SMMV provides a set level of minute volume ventilation. SMMV allows spontaneous breaths, combined with a synchronized mandatory breath, to achieve the set minute volume.

SMMV Setting

- The trigger window is pre-set to 60% of the BPM cycle time.
- V_M can be adjusted before SMMV is confirmed.
- The trigger setting is adjustable between 0.7 and 4.0 L/min.

■ **PSV**

Check that PSV is an enabled option on your ventilator before attempting selection. PSV assists each spontaneous breath to achieve a preset pressure, thus reducing the effort required to breathe. Inspiratory flow (generated by the animal's spontaneous breath) results in synchronized pressure support.

PSV Setting

- The trigger window is preset to 60% of the BPM cycle time.
- Support Pressure can be adjusted before PSV is confirmed.
- The trigger setting is adjustable between 0.7 and 4.0 L/min.

6.3.6 PEEP(Positive End Expiratory Pressure)

The AV-S ventilator includes a microprocessor-controlled, electronically integrated PEEP system, regulated by the secondary pressure on the exhaust diaphragm.

The ventilator controls PEEP by allowing flow from, or delivering flow into the bellows drive circuit, thereby maintaining the set pressure.

PEEP Setting

- PEEP is variable from 4 - 30 cmH_2O, in increments of 1 cmH_2O.
- PEEP maximum limit is 30 cmH_2O
- The display shows **OFF** when PEEP is not in use.
- PEEP is switched off when the ventilator is switched off.
- PEEP is switched off in **Standby** or **Spont** mode to ensure minimal animal breathing effort.

NOTE:

PEEP does not function in Spontaneous Mode or in any Patient Support Mode.

6.3.7 Ventilation Parameters

Setting Parameter	Description
Tidal volume	The volume of air inspired or expired at a time when in rest.
Inspiratory pressure	The inspiratory pressure in pressure control mode, an absolute value relative to the positive end expiratory pressure.
PEEP	Positive end expiratory pressure.
Respiration rate	Breath per minute.

Setting Parameter	Description
Inspiratory time	The inhalation duration in a cycle.
I:E ratio	The ratio of inhalation duration to exhalation duration.
Trigger	Flow rate trigger. If the machine detects this trigger level, it starts the aspiration trigger phase.
Support pressure	The absolute value of PEEP.

Monitoring Parameter	Description
Tidal volume	Tidal volume expired in a cycle.
Peak pressure	The maximum pressure monitored in a cycle or within a fixed period of time.
PEEP	Positive end expiratory pressure.
Respiratory rate	The number of respiratory cycles monitored in a minute.
Minute volume	Total tidal volume expired in a minute.

6.4 Spirometry

Spirometry can be enabled or disabled via the on-screen menu system.

If the spirometry system is turned OFF:

- Fresh gas / fresh gas mixture compensation is disabled.
- Support Modes are disabled.

See section 5.8 for a detailed description of the spirometry system.

6.5 Display Waveforms

The default waveform is always Pressure vs. Time (cmH_2O vs. seconds)

Wave Freeze is available when ventilation is in progress.

- Waveform Pause and Print

Waveform pause icon is located to the left hand side of the waveform displays. Press the pause icon ❚❚ to freeze the waveform and press the pause icon again to unfreeze the waveform.

- Waveform Freeze Loop

The FREEZE LOOP icon is located at the left hand side of the top waveform.

- Second waveform

The second waveform can be displayed by using the menu control or by touching the waveform on screen.

- Display Functions Automatic scale adjustment

Y axis: In Pressure vs. Time mode the scale adjusts as Plimit is changed (-20 to 40, 60, 80 cmH_2O). In Volume vs. Time and Volume vs. Pressure modes the scale adjusts as V_T is changed (0 to 0.5 L, 1.0 L, 2.0 L)

X axis: In Pressure vs. Time and Volume vs. Time modes the scale adjusts as Rate is changed (0 to 15 sec, 5 sec, 3 sec).In Volume vs. Pressure mode the scale adjusts as Plimit is changed (-20 to 40, 60, 80 cmH_2O).

6.6 Power Off

Turn the system switch to the ◯ position, press **OK** on the ventilator screen to turn off the anesthesia system. You can also press **Cancel** and turn the system switch back to the | position to return to the previous interface.

NOTE:

- After turning off the system switch, the anesthesia system will power off automatically if no other operation within 10 seconds.
- Using the AV-S ventilator switch can only turn on or off the AV-S ventilator, and can not cut off the system gas supply.

7 Alarms

7.1 Alarm Overview

The device provides status information about itself and anesthesia processes. In case of an exception such as a fault, an alarm is triggered.

The alarm volume of the device is not lower than 57 dB(A) and cannot be adjusted. Based on fault severity and threat to safety, alarms are classified into three priorities: low, medium, and high. A high-priority alarm is triggered with five tones repeated. A medium-priority alarm is triggered with three tones repeated. A low-priority alarm is triggered with two tones.

When an alarm is triggered, select the alarm area to view the message and level of the current alarm. You can select **Audio Pause** to pause the alarm audio. If the alarm condition is not eliminated within the corresponding period of time, the alarm audio is given again.

7.2 Alarms and Troubleshooting Methods

When an alarm is triggered, perform troubleshooting as instructed in the table below. If the fault persists, contact the after-sales service department of the manufacturer.

Alarm	Priority & Type	Trigger	Mute Time	Set By	Troubleshooting Method
Ventilator inoperative	High, technical	Internal system failure. Check error log for key	Zero	Automatic	Restart the ventilator.
Outlet blocked	High, technical	Positive pressure on PEEP sensor exceeds 122 cmH_2O, due to blocked exhaust valve outlet	/	/	Check whether the exhaust valve outlet is blocked.
Low supply pressure	High, technical	Supplied drive gas pressure on pressure switch is less than 241 kPa	Zero	Automatic	Check whether the gas supply is connected properly.

Alarm	Priority & Type	Trigger	Mute Time	Set By	Troubleshooting Method
Low airway pressure	High, physio-logical	Airway and drive gas pressure fails to reach minimum level (volume control)	120 s	Automatic	1. Set a higher tidal volume or set a lower threshold for this alarm. 2. Check whether the breathing circuit has leaks.
High continuous pressure	High, physio-logical	PEEP+10 cmH_2O for 1 cycle, or PEEP+5 cmH_2O for 3 cycles. A PEEP value of 4 cmH_2O is used for PEEP values ≤4. Standby: the alarm triggers after 15 seconds	120 s	Automatic	1. Check whether the breathing circuit is blocked. 2. Check whether the tidal volume, respiratory rate, and I:E ratio are set reasonably.
High airway pressure	High, physio-logical	Airway pressure sensor: Pressure reaches set limit (10 to 80 cmH_2O adjustable)	30 s	User/ Default	1. Set a lower tidal volume or set a higher threshold for this alarm. 2. Check whether the breathing circuit is blocked.
Negative airway pressure	High, physio-logical	Airway pressure sensor: Breathing system pressure exceeds (-)10 cmH_2O	120 s	Automatic	1. Increase the fresh gas flow. 2. Check for large gas flow in AGSS and, if so, check whether the pressure relief valve of the AGSS receiver is functional.
Check pressure sensing	High, technical	Airway pressure sensor: Breathing system pressure exceeds (-)10 cmH_2O	120 s	Automatic	
Low tidal volume (V_T)	High, physio-logical	a) Expiratory spirometer sensor: Measured V_T less than 50% of volume set b) Expiratory spirometer sensor: disconnected	120 s	User/ Default	1. Set a higher tidal volume or set a lower threshold for this alarm. 2. Check whether the breathing circuit has leaks.

Alarm	Priority & Type	Trigger	Mute Time	Set By	Troubleshooting Method
Low minute volume (V_M)	High, physio-logical	Expiratory spirometer sensor: Calculated volume lower than -50% of volume set.	120 s	User/ Default	1. Set a higher tidal volume or set a lower threshold for this alarm. 2. Check whether the breathing circuit has leaks.
Apnoea	High, physio-logical	Breathe not detected within 15 seconds in spontaneous mode	15-120 s	Automatic	1. Check the animal's spontaneous respiratory function. 2. Check whether the breathing circuit is blocked. 3. Check whether the breathing hose has fallen off.
High tidal volume (V_T)	High, physio-logical	Inspiratory spirometer sensor - measured value exceeds 150% of set value	120 s	User/ Default	Set a lower tidal volume or set a higher threshold for this alarm.
High minute volume (V_M)	High, physio-logical	Inspiratory spirometer sensor - calculated value exceeds 150% of set value	120 s	User/ Default	Set a lower tidal volume or respiratory rate, or set a higher threshold for this alarm.
High O_2 concentration %	High, technical	Oxygen monitor: Measured O_2 % exceeds set value	120 s	User/ Default	1. Adjust the alarm threshold to a reasonable value. 2. Check the oxygen monitor settings. 3. Recalibrate the oxygen sensor.

Alarm	Priority & Type	Trigger	Mute Time	Set By	Troubleshooting Method
Low O_2 concentration %	High, technical	Oxygen monitor: Measured O_2 % lower than set value	120 s	User/ Default	1. Adjust the alarm threshold to a reasonable value. 2. Check the oxygen monitor settings. 3. Check whether the breathing circuit has leaks or blockage. 4. Recalibrate the oxygen sensor.
Oxygen sensor fault	High, technical	Oxygen monitor sensor disconnected	120 s	Automatic	Check whether the oxygen sensor is connected properly.
Rate or ratio error	Medium, technical	Ventilator parameter settings unachievable	120 s	Automatic	Adjust the set value of the respiratory rate or I:E ratio.
AC power failure	Low, technical	Mains power fails. Note: A fully charged battery gives 60 minutes use.	Zero	Automatic	Check whether the power cable is connected properly.
Battery power fail	Low, technical	Ventilator is running on mains power, but: (a) Battery is disconnected for not fitted. (b) Battery is discharged below critical level	120 s	Automatic	1. Check whether the battery is installed properly. 2. Recharge the battery. 3. Replace the battery.

Alarm	Priority & Type	Trigger	Mute Time	Set By	Troubleshooting Method
Low battery	Low, technical	Ventilator is running on mains power or battery power, but battery charge is approaching a critical level. Note that if the ventilator is running on battery power, less than 20 minutes battery life remains.	Zero	Automatic	Recharge the battery.
Power about to fail	High, technical	Ventilator is running on battery power and is about to shut down because battery power is depleted to a critical level. Note: (a) Less than 5 minutes battery life remains. (b) When total power failure is imminent, the shutdown procedure starts automatically.	Zero	Automatic	1. Check whether the power cable is connected properly. 2. Replace the battery.
Sensor cable fault	Medium, technical	The sensor is disconnected or malfunctions.	Zero	Automatic	1. Check whether the sensor cable is connected properly. 2. Power off and restart the system.
High VC pressure	Low, physio-logical	The tidal volume is less than 70 ml in VC mode and the pressure is near the target value.	Zero	Automatic	1. Set a lower tidal volume or set a higher threshold for this alarm. 2. Check whether the breathing circuit is blocked.

8 Maintenance

WARNING
- User maintenance is restricted to cleaning the outside surfaces of the device, as detailed in this section.
- Other procedures detailed in this section must be carried out by trained technicians only.
- Service and repair operations must only be carried out by an engineer trained by the manufacturer. The warranty for this product is void if the product is not maintained in accordance with the service schedule detailed below.
- Disconnect the system from the electrical supply before maintenance.
- Exterior panels must not be removed by unauthorized personnel and the apparatus must not be operated with such panels missing. Ensure that all panels are securely fastened after any work has been carried out by authorized personnel.
- Unauthorized personnel must not touch the fuse or other electric components. There is a possible electric shock hazard.

8.1 Regular Maintenance

To ensure safe use and prolong the service life of the system, conduct regular maintenance as described below.

Frequency	Maintenance Operations
Daily	● Check the weight of the absorbent canister. ● Check the oxygen flush function. ● Use a soft cloth dampened with mild soapy water to clean the surfaces of the system and the CO_2 absorbent canister.
Weekly	● Replace the inspiratory and expiratory valves if their sealing rings are worn or their membrane is cracked or distorted. ● Perform a zero calibration on the pressure sensor.
Every 2 weeks	Empty the vaporizer.
Monthly	Empty the CO_2 absorbent canister if there is water buildup.
Every 3 years	Battery replacement. Contact the after-sales service of the manufacturer.
As necessary	● Replace the absorbent in the CO_2 absorbent canister if obvious color change of all the absorbent is detected. ● Replace the breathing tubes if they are damaged. ● Replace the APL valve if a significant pressure deviation is detected.

8.2 Repair

Do not disassemble or try to repair the device. The manufacturer and distributor shall not be responsible for any device that has been disassembled, modified or used for any purpose other than its intended purpose.

If the device falls to the ground or it is affected by an external force, stop using the device even if it appears normal. Contact your local distributor or the manufacturer and have an inspection performed to check whether the device can still operate properly.

Do not use any spare parts not authorized or provided by the manufacturer for repair.

8.3 Cleaning and Disinfection

- **Cleaning and disinfection**

Recommended cleaning agents include clean water and soapy water (pH: 7.0 -10.5).

Recommended disinfectants include 75% ethanol and 70% isopropanol.

Procedure:

1. Use a cloth dampened with clean or soapy water to wipe the surfaces of the system.
2. Use a cloth dampened with a recommended disinfectant to wipe the surfaces of the system.
3. Use a dry, lint-free cloth to wipe off the residual cleaning agent and disinfectant solution.

NOTE:

- Clean and disinfect all surfaces thoroughly, particularly those areas likely to have been touched during clinical procedures.
- Do not use excessive force when cleaning the touchscreen.
- Make sure that all cleaning agent residues are fully removed after cleaning. Always allow the system to dry off thoroughly before reconnection to the mains supply.

- **Sterilization**

The breathing tube and other components of the anesthesia machine can be sterilized with high-pressure steam at 134℃ for a holding time of 3.5 minutes.

NOTE:

- During high-pressure steam sterilization, the breathing circuit and the inner surface of the CO_2 absorbent canister may show slight color change, which is normal and not a sign of aging.
- Do not sterilize the flowmeter or the oxygen sensor with high-pressure steam. Do not immerse the electrical interface and the heating device of the breathing circuit in any type of liquid or sterilize them with high-pressure steam.
- Before sterilizing the APL valve with high-pressure steam, ensure that the valve is in the open position.
- The bellows assembly can be subject to high-pressure steam sterilization for a maximum of 20 times.

8.4 Storage and Transport

■ **Storage**

- Avoid water spills on the system.
- Do not store the system in an environment with a high temperature and humidity.
- Protect the system against vibration, dust, and corrosive gases.
- Keep the system away from direct sunlight and ultraviolet ray.

■ **Transport**

The system can be transported in a common vehicle and must be protected against drastic impact, vibration, and rain and snow splash during transport. In addition, the system must be transported in accordance with the requirements stipulated in the order contract.

8.5 Disposal

Improper disposal of medical waste can lead to environmental pollution and create a public safety hazard. After this system or its accessories have exceeded their useful life, please contact your local distributor for information on disposal, or dispose of the system and its accessories in accordance with local laws and regulations as well as hospital regulations.

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