

APUS x3

ANESTHESIA WORKSTATION

INSTRUCTIONS FOR USE

[Version 1.2]



Product Information

Thanks for purchasing APUS x3 Anesthesia machine.

Before using the product, please read the user manual carefully to use the product properly.

Keep the user manual to check it in anytime.

Product Name:	Anesthesia Machine
Product type:	APUS x3
Manufacturer:	aXcent medical GmbH Josef-Görres-Platz 2, 56068 Koblenz, Germany

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Dated:	June 03, 2019

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Words before the operation manual

Statement

This User's Manual describes the performance, operating procedures and other safety messages of anesthesia machines manufactured by the Company. The manual offers the best starting point for a new user to begin operating the anesthesia machines.

The applicable person

This user manual is suitable for clinical medical professionals or experienced personnel in the use of monitoring equipment of reading, the reader should have necessary to care patients medical procedures, practices, and terminology knowledge and working experience.

Figure

All figures in this User's Manual are given for reference only. The menus, setup and parameters given in the figures may be not completely consistent with those that you see on the anesthesia machine.

Customs and Usages

- [Characters]: Used to indicate the character strings of software.
- →: The symbol is used to indicate the operational procedures.

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Chapter 1 Abbreviations and symbols

Abbreviations

Abbreviations	Meaning	Abbreviations	Meaning
Ppeak	The maximum working pressure	Pmean	Average pressure
Pplat	Inspiration platform pressure	PEEP	Positive end expiration pressure
awRR	Airway respiratory rate	FiO ₂	Inspired oxygen concentration
Freq	Respiratory frequency	Vt	Tidal volume
I:E	Inspiration: expiration ratio	Tip:Ti	Inspiration pause:inspiration
Plimit	Pressure limiting level	Psupp	Pressure support level
Pinsp	Pressure control level	Tinsp	Inspiration time
Trigger	Trigger level	Trig Window	Trigger window
Volume	Volume	Flow	Flow speed
Vte	Expired volume	Vti	Inspiration tidal volume
MVe	Exhaled minute ventilation	MVi	Inhalation of minute ventilation
EtCO ₂	End tidal CO ₂	FiCO ₂	Inhalation of CO ₂
Et	End tidal	Fi	Inhalation of
ISO	Isoflurane	SEV	Sevoflurane
DES	Desflurane	HAL	Halothane
ENF	Enflurane	MAC	Minimum alveolar concentration
Manual	Manual ventilation	V-CMV	Volume control ventilation
V-SIMV	Synchronized intermittent mandatory ventilation - volume controlled ventilation	P-CMV	Pressure control ventilation
P-SIMV	Synchronized intermittent mandatory ventilation - pressure control ventilation	SIMV	Synchronized intermittent mandatory ventilation
PSV	Pressure support ventilation	PCV-VG	Pressure regulated volume control ventilation
Raw	Airway resistance	Cydn	Dynamic compliance
Tlope	The pressure rise time	APL	Adjustable pressure limit
AA	anesthetic	AGSS	The exhaust system
O ₂	Oxygen	N ₂ O	Nitrous oxide
Air	Air	ACGO	Auxiliary common gas outlet
Paw	Airway pressure	DEMO	Demo mode
Man/Spont	Manual ventilation/ autonomous	FreqMin	Mandatory

	respiration		minimum frequency under the mode of pressure support
Adu	Adult	Ped	Pediatric

Symbols

Symbol	Meaning	Symbol	Meaning
	Caution! Check the documentation		Refer to user manual
	Power on key		Application of electric shock type (type BF)
	AC		battery
	Manual ventilation		Machine controlled ventilation
	N2O gas source interface		Air gas source interface
	O2 gas source interface		O2 battery interface
	APL Valve		Knob adjustment
	Fast O2 button		Approximate
	Lock		Unlock
	Spare cylinder		Piped medical gas
	ACGO on		ACGO off
	USB port		Network port
	Nurse calling port		Calibration port
	AG/CO2 Module port		BIS module port

	lamp		Equipotential column
	Maximum capacity scale line		Minimum capacity scale line
	Manufacturing date		Manufacturer
	Maximum load 2kg		Maximum load 30kg
	Series No.		Prohibition of high-temperature sterilization
	High temperature steam sterilizing		Upwards (POP-off Valve)
	The arrow indicates the inlet direction		According to the direction of the arrow to unlock or lock
	Alarm pause key		Fuse
	Break off		Connect
	Evaporator		Protective earthing
	Please enter 6 digital password		Temperature limitation
	AGSS exhaust port		Waterproof and dustproof grade
	Lock Soda Lime tank device		Open Soda Lime tank device
	Pressure limitation		Humidity limitation
	Only monitoring CO2		Can monitor multiple gas
	Multiple gas Technology		Shall not be repeated use
	period of validity		production batch number
	Waste electrical and electronic equipment individual Handle		Reference number

Chapter 2 Security

2.1 Terms

 **Danger**

- Prompt you possibly have the serious results, adverse events or endanger the safety situation. Do not follow the warning will lead to serious staff or patient injury or death.

 **Warning**

- Prompt potentially dangerous or unsafe operation, if not avoided, may lead to minor personal injury, product failure and damage or property loss . Also may cause even more serious damage in the future.

 **Be careful**

- In order to secure the device of continuous use, must comply with the guidelines outlined. The instructions listed in the user manual can not be listed instead of have been in executed medical procedures.

Caution

- Is the important emphasis of matter needs to be paid attention to, provides a description or explanation in order to better use this product.
- In order to secure the device of continuous use, must comply with the guidelines outlined. The instructions listed in the user manual can not be listed instead of have been in executed medical procedures.

2.2 Danger

The equipment is not involving dangerous grade information.

2.3 Warning



Warning

- The anesthesia machine is used for inhalation anesthesia, the user should be full-time anesthetist, and received training in the use of anesthesia machine.
- Before use, the user must check the equipment, cable and its accessories whether normal, safe work.
- The patient should be according to the actual situation to set the alarm, alarm volume and low limit, can't just rely on the voice alarm system monitoring in patients, the alarm volume set too small or close completely may cause alarm failure, endanger patient safety. The patient actual clinical situation should be paid close attention .
- This device can only be connected with the protection power supply socket earthing, if the power supply socket is not connected to ground wire, please do not use the socket, but should use rechargeable batteries to power the device.
- Do not open the shell of equipment, to avoid the possibility of electric shock risk. Any of the monitor repair and upgrade must by the trained and authorized service staff by aXcent.
- Handling of packaging materials, should abide the local laws or waste treatment regulations to deal with. Packaging materials must be placed in the place that children can not get in touch with.
- In order to avoid the risk of explosion, ether and cyclopropane or flammable anesthetic can not be used in the equipment. Only use the symbol IEC 60601-2-13 standards of non flammable anesthetics.
- Install the power line and various accessories cable carefully, to avoid the patient was entanglement or strangulation, cable entangled together or by electrical interference.
- when use of the equipment and other equipment together, if with the device that the specification is not listed connected together when in use, the connection must consult the relevant manufacturers or expert.
- Connection between all the medical electrical equipment rooms and at least one medical electrical equipment with one or more non medical electrical equipment, shall comply with the provisions of GB9706.15-2008.
- Even in the individual equipment components without functional connectivity, when they are connected to an auxiliary power supply socket, which formed the medical electrical systems. The operator must pay attention when the device is connected to the auxiliary power supply socket, may cause the leakage current is increased to exceed the limited value.

2.4 Be careful



Be careful

- In order to avoid the equipment damage and ensure the safety of patients, please use the user manual specified accessories.
- Please properly installing or carrying instrument, prevent instrument fall, collision, damaged by strong oscillation or other mechanical force.
- Electromagnetic fields can affect the performance of this instrument, therefore the use of other devices in the vicinity of the equipment must comply with the corresponding requirements of EMC. For example: mobile phone, X ray or MRI devices are may be the source of interference, because the electromagnetic radiation they emit high intensity.
- Before the device is switched on, make sure the power used by the equipment standard power supply voltage and frequency specified stuck or user manual requirements.
- When the instrument and accessories to be used beyond the time limit, shall be handled in accordance with the relevant local laws and regulations or the rules and regulations of the hospital.
- Shall not exceed 10 ° tilt in the normal use of equipment, casters should brake, prevent equipment dumping, fall.

2.5 Caution

Caution

- Please put the equipment installed in a convenient observation, operation and maintenance place.
- Please put the user manual close to the instrument, so when needed, can be convenient, timely.
- Instrument limit using only one patient at the same time.

Chapter 3 Summary

3.1 Introduction

3.1.1 Product use

- The anesthesia machine is intended for use in medical departments using inhalation anesthesia with ventilation with adult (applicable tidal volume 300-1500 ml) and pediatric (applicable tidal volume 20-400 ml) patients.
- The anesthesia machine users should be full-time anesthetist, and received training in the use of anesthesia machine.



Warning:

- The equipment is not suitable for magnetic resonance imaging (MRI) environment.
- The equipment shall be full-time anesthetist, or used in a full-time anesthetist guidance. The user of the equipment shall acceptfully training before use. Any unauthorized person, or no trained person shall not carry out any operation.
- The anesthesia system cannot be used in the flammable and explosive anesthesia gas and other combustible gas existing environment.

3.1.2 Contraindications

- Pneumothorax, pulmonary dysfunction are banned.

3.1.3 Product performance constructions

The anesthesia machine consists of anesthetic gas delivery system, anesthetic gas delivery device, anesthesia ventilator, electronic flowmeter assembly, anesthesia and ventilation systems, anesthesiagas purification system transmission and collection system, module monitoring (optional AG module, CO2 module, BIS module and multi parameter patient monitor).

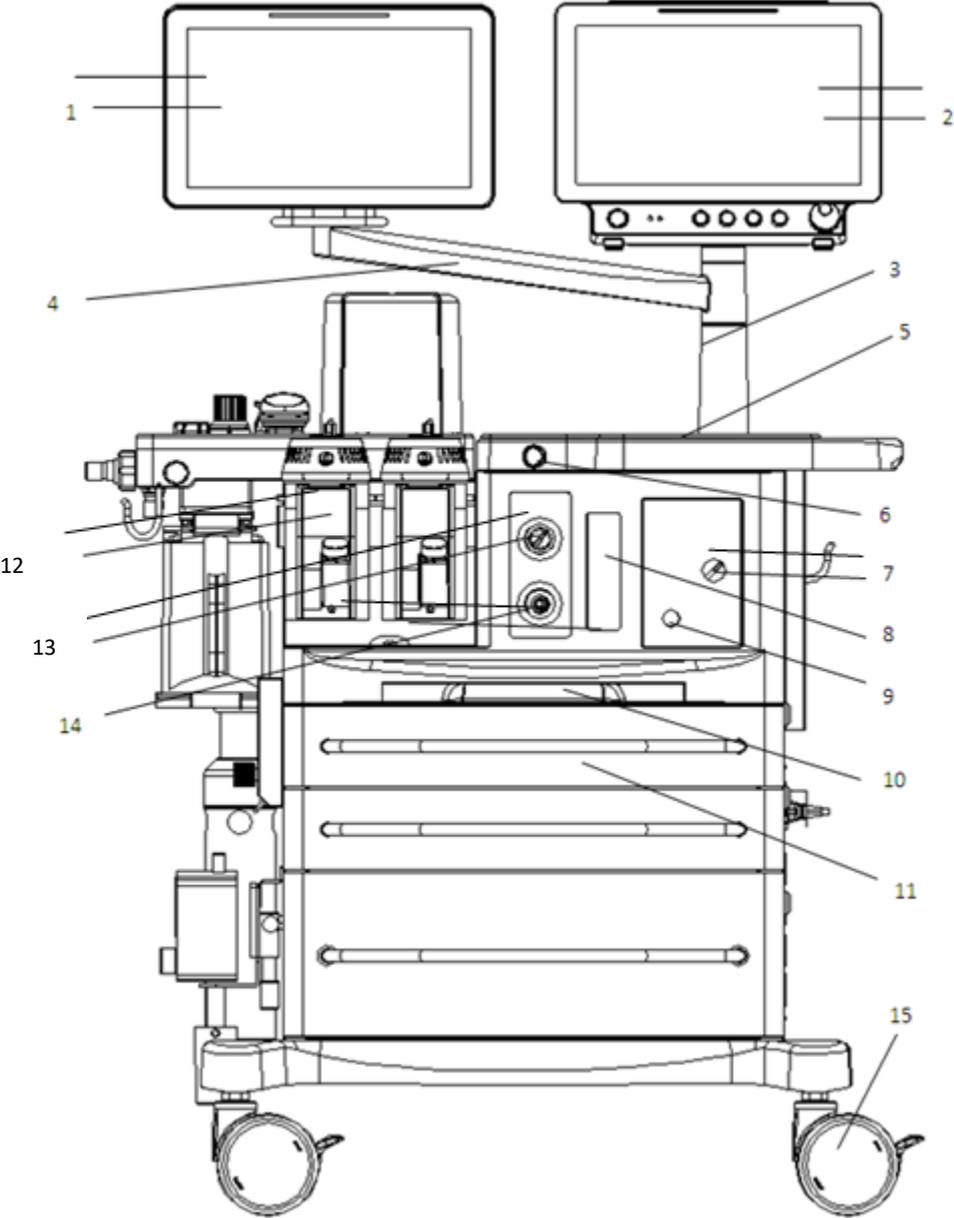
The anesthesia machine has the following functions and features:

- In full electronic control, monitoring, no knob, full touch operation.
- With automatic leakage detection, detection and diagnosis for system boot and other functions.

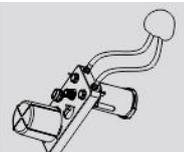
- With loop gas leakage compensation and automatic compliance compensation function.
- Provide spare cylinders and central gas supply two kinds of interface for gas input.
- With electronic flowmeter, safety oxygen flow and electronic adjustable PEEP.
- With respiratory mechanical parameters (airway resistance and compliance) monitoring display, with pulmonary function ring display function.
- Has the network function, can be configured to anesthesia information system (CIS).
- Has the large font display function.
- Equipped with overhead illumination.
- Can upgrade the software by USB.
- With nurse call function.
- Has the function which can adjust waveform display interface according to the user demand .
- Has the function with alarm events save and review, fault status and maintenance of information recording .
- Possess the following modes of ventilation function: capacity (V-CMV) controlled ventilation, synchronized intermittent mandatory - volume controlled ventilation (V-SIMV) mode, the pressure control ventilation (P-CMV), synchronized intermittent mandatory pressure control ventilation (P-SIMV), pressure support ventilation (PSV) and pressure volume control (PCV-VG) mode.
- Configure supplemental oxygen, ACGO, active AGSS (exhaust gas discharge system, Anesthesia Gas ScavengingSystem).
- Optional anesthetic gas module, CO2 module, BIS module, multi parameter monitor and negative pressure sputum device.
- Has extracorporeal circulation operation mode.

3.2 Construction introduction

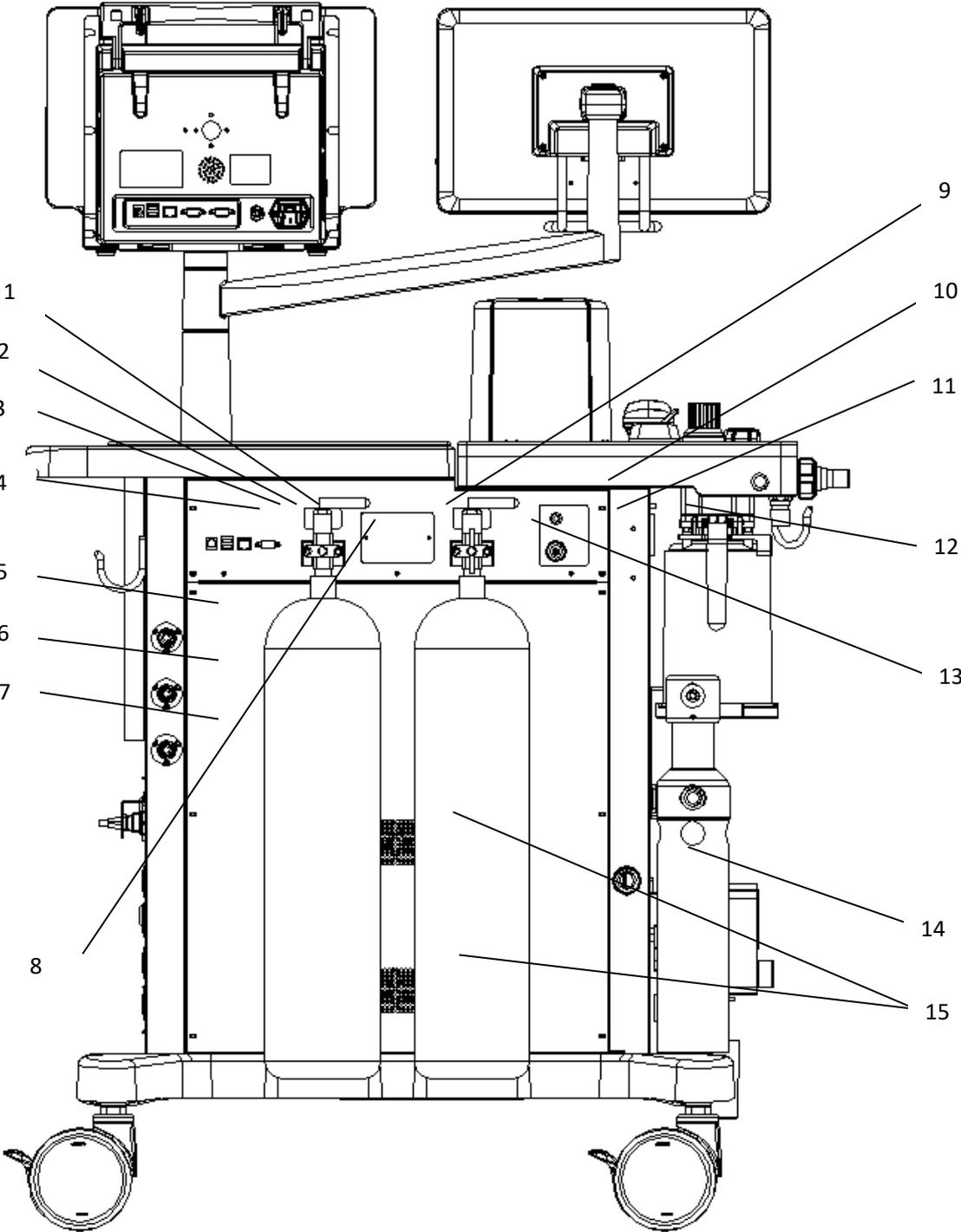
3.2.1 Front view



APUS X3 front view

No.	Name	Meaning
1	Control Panel	Consist of the LCD display screen, touch screen, LED indicator and keys. Used for operation and information display of the anesthesia system
2	Multi parameter Monitor	Optional Aries Series or Taurus Series series multi parameter monitor, the specific use. See Aries Series or TaurusSeries series multi parameter monitor instructions.
3	Control lighting switch	System startup, switch "I" top light lights; switch "O" top light lights off
4	Lamp	lamp
5	Working table	Working table
6	Fast-O2 button	Fast oxygen button O ₂ +, Press start gas supply, release stop gas supply
7	Safety oxygen flow meter switch	In the open position, starting safety oxygen flowmeter, shielding of electronic flowmeter; in the Close position,shielding safety oxygen flowmeter, start electronic flowmeter
8	General flow meter	Display the total flow of fresh gas flow
9	Safety oxygen flowmeter knob	When rotatingclockwise, flowmeter decreases; when rotating counterclockwise,flowmeter increases
10	Working table	Working table
11	Drawer	Provide three draws
12	Evaporator	Double tank evaporator base, can hold up to 1 or 2 evaporator.
13	ACGO switch	 : System stopped mechanical ventilation , through the external artificial respiration loop of the ACGO export externalconveying new controller fresh gas, and prompt [ACGO open]; system stop capacity monitoring function, but canmonitor the airway pressure and oxygen concentration  : Can through the breathing circuit to do the mechanical ventilation or manual ventilation for the patients.
14	ACGO outlet connector	Auxiliary common gas outlet (Auxiliary Common Gas Outlet), the ACGO switch is open, fresh gas out from the port.
15	Casters	With brake device. For moving and fixing the anesthesia machine .

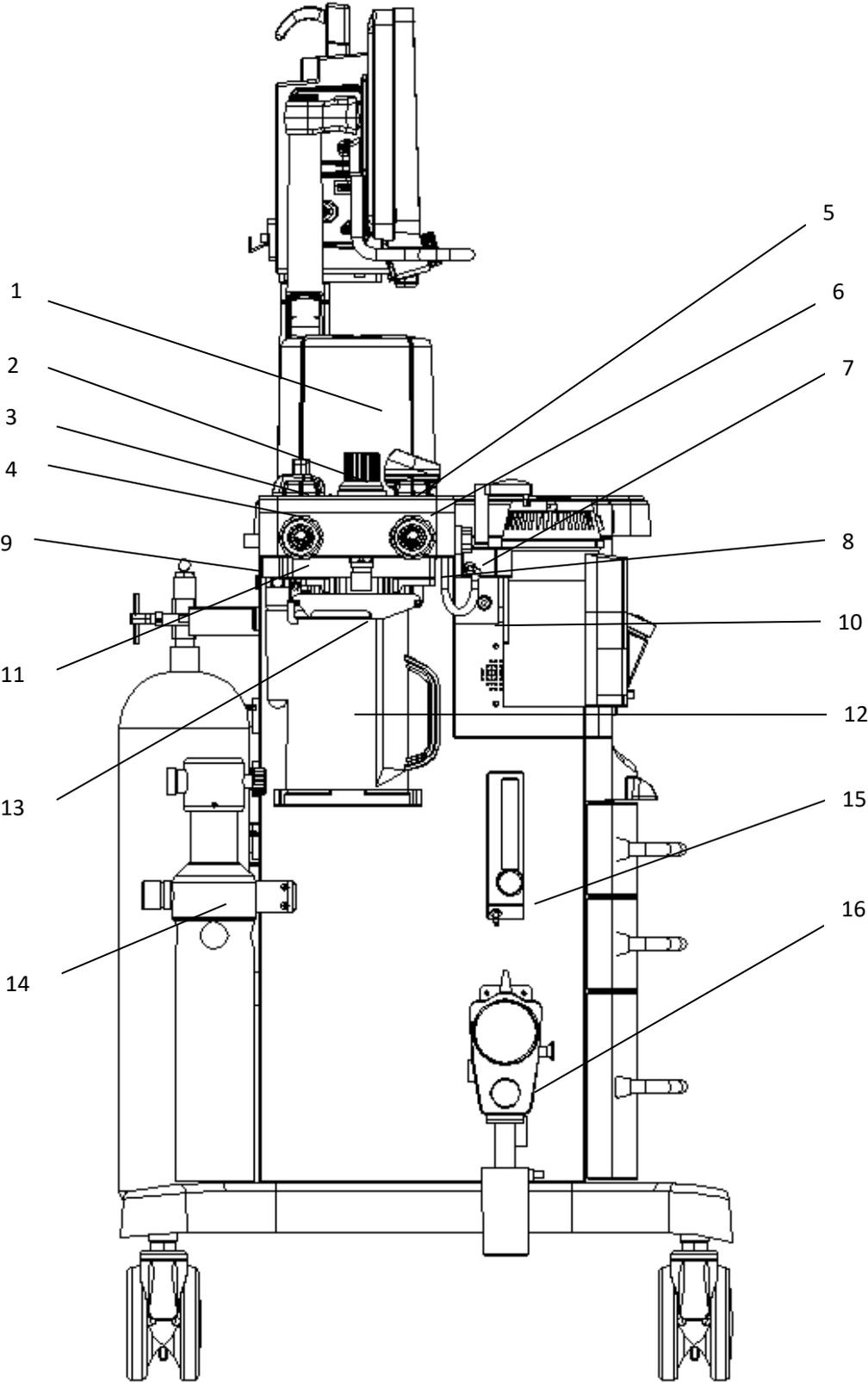
3.2.2 Back view



APUS X3 back view

NO.	Name	Meaning
1	RS-232-interface	Through the port to realize the flow, pressure calibration
2	Network interface	The network interface is multifunctional multiplexing port, providing 100 BASE-TX Ethernet communication channel. Only connected with the RJ45 connector that meet the requirements
3	USB interface	Provide 2 USB sockets, to realize data export, software upgrades and other functions
4	Nurse calling interface	Use to connect with the hospital call system
5	Oxygen pipeline entrance	Provide oxygen gas resource input pipeline
6	N2O pipeline entrance	Provide N2O pipeline gas resource input pipeline
7	Air pipeline entrance	Provide air pipeline gas resource input pipeline
8	Gas bottle O2 entrance	Provide gas bottle O2 gas resource input pipeline
9	Battery interface	Use to install battery device
10	AG/CO ₂ module interface	Use to connect AG/CO ₂ module
11	BIS module interface	Use to connect BIS module
12	Sidestream module fixing groove	Use to install fixed sidestream module device
13	Gas bottle N2O entrance	Provide gas bottle N2O gas resource input pipeline
14	AGSS interface	Waste gas exhaust port, connect with the AGSS delivery system inlet
15	Fan	Provide 2 fans

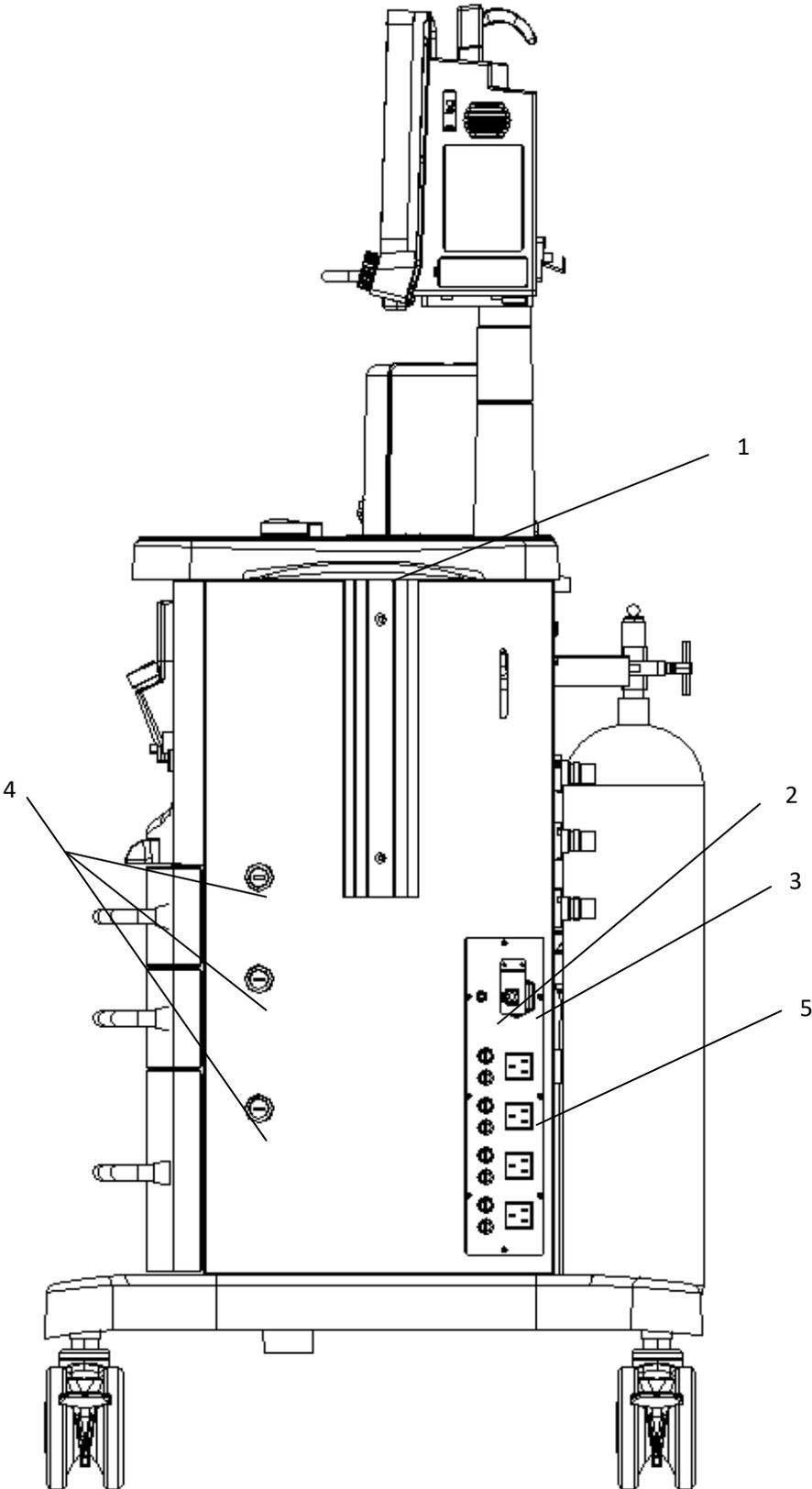
3.2.3 Left view



APUS X3 left view

NO.	Name	Meaning
1	Bellows cover	Bellows cover
2	APL valve	In manual ventilation period, which is used to adjust the respiration pressure limit. The scale display similar pressure value. Clockwise rotation of the valve can be adjusted high pressure limit, when more than 30 cmH ₂ O and continues to rotate, will be a "clicking" sound .
3	Manual / machine control switch	 : can use bag for manual ventilation  : can use anesthesia ventilator to do mechanical ventilation
4	Expiration branch one-way valve	When expiration , expiration branch one-way valve move
5	Airway pressure gauge	Display airway peak pressure of breathing system
6	Inspiration branch one-way valve	When inspiration, inspiration branch one-way valve move
7	Oxygen battery interface	Install oxygen battery, oxygen concentration monitoring
8	Inspiration pipeline interface	Use to connect the inspiration pipeline
9	Test plug	When anesthesia and ventilation system leakage test, block the Y tube port
10	Hook	Use for hanging Y tube
11	Expiration pipeline interface	Use to connect the expiration pipeline
12	Soda Lime tank	Put on CO ₂ absorber, for absorption of exhaled CO ₂
13	The manual air bag interface	Use to connect the air bag
14	AGSS	For exhaust gas transfer and collection of anesthesia system for hospital wastegas treatment device collecting and processing
15	Supplemental oxygen	Continue to provide adjustable flow 100% O ₂
16	Negative pressure sputum	For pumping, pumping flow is adjustable device by the user

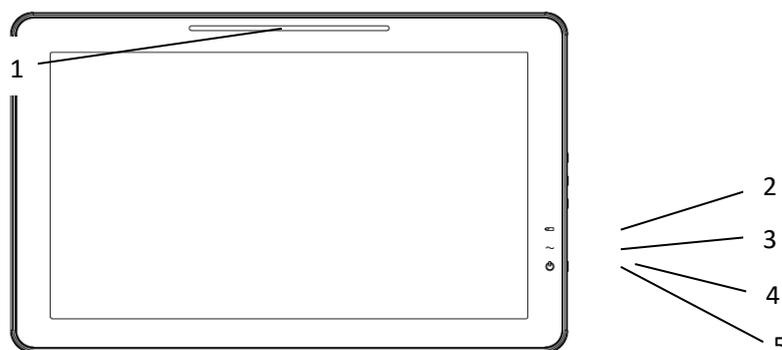
3.2.4 Right view



APUS X3 right view

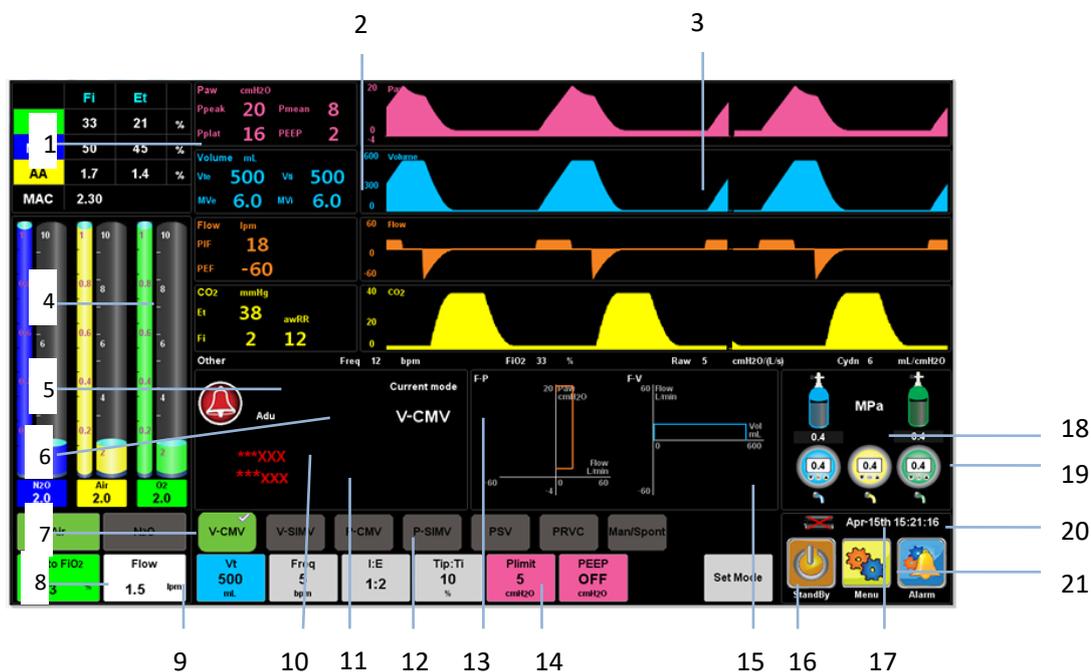
No.	Name	Meaning
1	Handrail	Provide anesthesia machine arm, used to push the machine
2	Equipotential terminal	Provide equipotential connection
3	General power input interface	Provide anesthesia machine AC input
4	Drawer lock	Altogether 3 drawers, and each drawer has a corresponding lock
5	The auxiliary output power socket	Provide 4 auxiliary output power socket

3.3 Control panel



No.	Name	Meaning
1	Alarm indicator	A group of red / yellow color, and includes a translucent lens LED. Provide visual alarm information through different color and different flicker frequency.
2	The battery indicator	1) bright: battery is charged or fully charged. 2) extinct: the battery is not installed or the anesthesia machine is not connecting AC . 3) flash: the anesthesia machine is use battery power supply .
3	AC indicator	1) bright: anesthesia machine connected alternating current. 2) extinct: anesthesia machine is not connecting AC.
4	System on / off key	Press this button to start system, long press this button again, pop-up box then select [OK] button, enter the 5S countdown display interface , After countdown system automatically shutdown ; if you choose [Cancel] button, exit interface, return the current state, the system shutdown is not successful.
5	Running indicator	1) bright: start system. 2) extinct: system shutdown

3.4 User interface



No.	Name	Meaning
1	Gas monitoring parameter zone	Display gas concentration monitoring information
2	Physiological parameter monitoring zone	Display physiological parameters monitoring information
3	Wave zone	Display Wave, including the pressure, volume, velocity and CO2
4	The gas supply block diagram	The gas supply block diagram (virtual flow tube, metering device, optional)
5	Voice Pause Icon	If the alarm is triggered, press the icon, the icon turn to mute icon, and below will display 120s countdown
6	Patient type display zone	Display patient type information , click on the icon, pop-up patient information interface, the operator can input patient information
7	Selection of carrier gas (nitrous oxide or air) softkey	The carrier gas can choose N2O or air, selection display pale green, no selection display grey
8	Set the oxygen concentration softkey	Click on the button, the pop-up window, can increase or decrease through the fingers right or to left sliding
9	Set the fresh air softkey	Click on the button, the pop-up window, can increase or decrease through the fingers right or left sliding
10	Physiological alarm zone	Display physiological alarm information, including the background color, character and alarm level
11	Technical alarm zone	Display technical alarm information, including the background color, character and alarm level
12	Select the mode of ventilation softkey zone	After selecting ventilation mode, click the [Set Mode] soft key, mode confirmation success
13	Prompt zone	Display the current ventilation pattern name, prompt information

14	Set the ventilation parameter softkey zone	The corresponding click, pop-up window, can increase or decrease through the fingers right or left sliding
15	Pulmonary function graph zone	Display Pulmonary function graph
16	Ventilation mode confirm softkey	Ventilation mode selection, click on the [Set Mode] soft key, mode confirmation success
17	The battery icon	Display battery status, please see 3.5 battery
18	Spare cylinder pressure monitoring zone	Display the backup cylinder pressure monitoring, respectively O2 and N2O
19	Pressure monitoring zone of pipeline gas	Display pipeline gas pressure monitoring, respectively O2, N2O, Air
20	Show the system time zone	Display the system time
21	Function softkey zone	Display function key

3.5 Battery



Caution:

- Battery life depends on the frequency and time of use. If the battery maintenance and storage is appropriate, lithiumbattery life is about 3 years. If used improperly, can shorten the life. Our recommendation on the lithium battery is replaced in every 3 years.
- To extend battery life, should be at least monthly use battery once, and when the battery is willing to run out of time,charging the battery.
- The battery failure, please contact the manufacturer, replaced by the designated repair staff, users do not replace by themselves.

The anesthesia machine configuration can recharge batteries, to to ensure the power failure of anesthesia machine can also be used normally. When the anesthesia machine connected to AC power, regardless of whether it is boot, it can charge the rechargeable battery. In the case of the sudden power failure, the system will automatically switch tobattery power supply, and will not lead to disconnect the AC power stop working after. When the AC power supply in a specified period of time for the restoration, the system stops the battery power supply, automatic transfer to AC power supply, ensure the continuous operation of the anesthesia machine.

On the screen of the battery icon indicates the state of the battery:



The battery work normal, the battery is full of electricity .



The battery work normal, The green part indicates the electricity of battery.

 The battery power is low, need to be charged immediately, otherwise the device will automatically shut down.

 Battery is not installed

 The battery is normal, in a state of charge.

Battery power can only be maintained for a period of time. Low voltage battery will trigger the [Battery Low] semi-technical alarm, at this time should let the anesthesia machine connect to AC power, charge the battery.

 **Warning:**

Do not remove the battery, or throw into the fire, or short circuit. Battery combustion, explosion, leakage may lead to personal injury, do not directly touch the leakage battery.

Chapter 4 Installation

4.1 Gas resource connection

4.1.1 Summary

The anesthesia machine provides pipeline gas source (O₂, N₂O and Air) and a cylinder (O₂ and N₂O) source of two kinds of ports.

Pipeline gas source, provides three kinds of configuration:

- oxygen (O₂) and nitrous oxide (N₂O)
- oxygen (O₂) and air (AIR)
- oxygen (O₂)

Gas source, provides two kinds of configuration:

- oxygen (O₂) and nitrous oxide (N₂O)
- oxygen (O₂)

Please refer to the specific structure of the 3.2

**Warning:**

- to ensure gas source cleaning can be used, please be sure to use medical gas source.
- when anesthesia system stopping the gas, medical gas pipeline still has certain pressure, before the pull off air hose please release the pressure inside the pipeline.
- Fault pipeline gas supply system may lead to anesthesia respirator, anesthesia gas delivery system, anesthesia and ventilation system stop working, so should at least have a full bottle of oxygen, and pre-installed to the anesthiemachine, so that the cylinder gas in fault can use gas supply pipeline system, maintenance of anesthesia system work normal.
- Pipeline gas supply and the backup cylinders gas supply runs out, switched to independent simple breathing patterns, for ventilation of patients.

4.1.2 Pipeline gas resource connection

Pipeline gas source connection please according to the following steps:

- 1) to ensure that the oxygen gas output pressure of central gas supply system should be in the (280 ~ 600) kPa range;

- 2) use corresponding oxygen gas hose connected with the oxygen central gas supply port, the other end is connected to the interface of oxygen pipeline gas of the anesthesia machine behind the corresponding, and tighten union nut;
- 3) refer to the above step 1) and step 2), the N_2O source pipeline connect to the nitrous oxide interface;
- 4) refer to the above step 1) and step 2), the air source pipeline connect to the air interface ;
- 5) collated all air hose, prevent stumble.



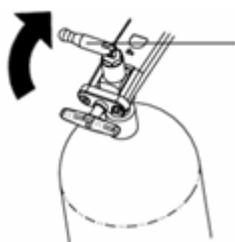
Warning:

If medical gas pipeline supply pressure greater than 200KPa, [Gas Pressure Low] appearance technology alarm, please contact equipment repair staff or the customer service .

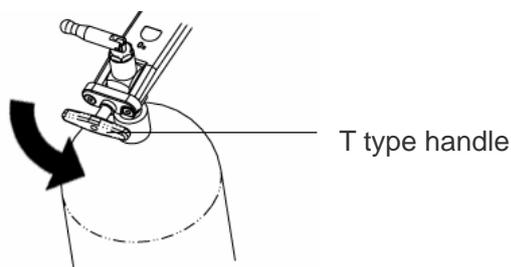
4.1.3 Gas cylinder installation and replacement

The process of installing / replace the cylinder as shown below:

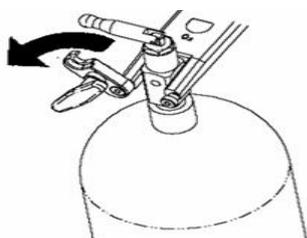
- 1) clockwise rotating cylinder valve, close the cylinder valve to be replaced.



- 2) counterclockwise unscrew T type handle



Security release T handle, breaking off a rap.



1) remove the bottle, and remove the old washer.



2) in front of the new bottle exit , do not place any article may due to the high pressure gas release and easily damaged.

3) quickly open and close the cylinder valve, dust removing of cylinder outlet.

4) install new gasket.

5) the cylinder position and the indexing pin alignment.

6) closed card knock and tighten T type handle.

7) Doing cylinder test, the specific steps can see 5.4 spare test.



Warning:

- during the anesthesia machine in the use of pipeline gas supply , do not let the spare cylinder valve is in the open state. Otherwise, when the pipeline gas supply failure, may cylinders gas supply will be depleted, resulting in insufficient supply of reserves.
- Installing or replacing the cylinder need to check whether the deformation of O shaped gasket, oxidation and other phenomena, proposed to replace O washer

4.2 Power connection

Power connection, see **5.5 power fault test**

4.3 Install respiratory circuit



Caution:

- The anesthesia machine's anesthesia ventilation system accords with the standard ISO 8835.22007 regulations.

- The anesthesia machine 's patient pressure limit comply with 51.101.1 pressure limit device of IEC 60601-2-13 2006.

4.3.1 Install circuit

Put the whole circuit on the fixed seat, screwing 3 nuts tightly. (1 nuts on the box cover side, the other 2 under the loop fixed seat)



4.3.2 Install bellows



Warning:

- Before installing the bellows cover check whether the seal of bellows seat is normal, if prolapse or tilted, please ringup and then install the bellows cover.
- 1) 1) ensure that the circuit integral blocks have been fixed, installed bellows holder, align with the corresponding hole touse a slightly downward pressure, and tight the 4 nut.



- 2) Put the folding pocket bottom last lap in the loop bellows holder, ensure the folding bag and bellows seat is connected closely.



3) put the bellows cover card edge alignment card slot of loop, cover the bellows , to ensure that the bellows cover uniform pressure on the seal.



4) Both hands gripping the external side of the cover, along the clockwise, make sure that the side with scale mark towards the operator.



4.3.3 Install flow sensor

1) the direction of the arrow consistent with the direction arrow above the circuit flow sensor , and one side of the silk-screen towards upside ;



2) Flow sensor needs to be will be horizontal inserted in



3) Put the respiratory connector and its locking nut together towards the inspiration flow sensor connector.



- 4) Clockwise twist tightly the respiratory locking nut.



Warning:

- Please be careful of remove the equipment, to avoid the impact of respiratory flow sensor port caused damage.
- when installation of flow sensor, installed in place and connector screw cap lock nut, otherwise gas leaks, the monitoring failure.
- Y tube connected with connector should be kept down, otherwise may cause condensation of water vapor into the loop, affect the flow sensor to measure the tidal volume, lead to inaccurate.



Caution:

- Before installing the flow sensor, make sure that the sealing ring is intact, and inspection sampling joint non clogging.

4.3.4 Installing breathing tube and Y type connector



Caution:

- Pls hold two ends of breathing tube when install it.
- Pls refer to instruction manual before installing breathing tube.

- 1) Connect breathing tube to breathing circuit input&output connector



- 2) Connect filter to Y-tye connector



4.3.5 Installing oxygen sensor



Warning:

- Before installing the oxygen sensor, please check if the oxygen sensor seal is damaged, or if there are no damaged, replacement then installation, otherwise circuit leakage.
- Oxygen sensor installation must be installed in place, otherwise it will cause circuit leakage.



- 1) Put the thread of oxygen cell towards oxygen battery interface of loop O2% position , tighten the screw clockwise;
- 2) Put side of the oxygen sensor cable into the jack of oxygen sensor.



4.3.6 Installing Soda lime tank



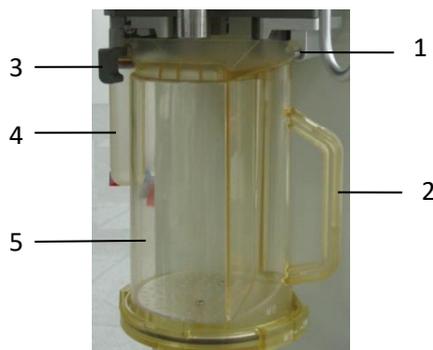
Warning:

- The anesthesia machine absorption tank only use for air, oxygen, nitrous oxide, enflurane, isoflurane, sevoflurane, desflurane and sevoflurane, the absorption tank cannot be used in chloroform or trichloroethylene environment.
- The anesthesia machine absorbent tank is only filled by Soda Lime.
- In accordance with the description of the color change of Soda lime on Soda

Lime packaging , check the absorption tank Soda Lime color in the process of using anesthesia machine and after use, to take corresponding measures to deal with.

- Switch off all gas timely after using the anesthesia machine, prevent Soda Lime dry, after Soda Lime dry completely ,if contact anesthesia gas, reacts and the release of carbon monoxide, endanger patient safety, then replace the Soda Lime timely.
- Do not let any part of the body directly contact the absorption tank material, such as the bottom water absorbent, filter, if contact with eyes or skin, immediately rinse with water on affected area, and medical treatment.
- Install the absorption tank, shall ensure that the , the absorption tank bottom sealing ring and a support member without adhesion Soda Lime particles etc. foreign body, if yes, clear after the installation, otherwise it may cause circuit leakage.
- If the anesthesia machine is not configured BYPASS function, do not change the absorption tank during ventilation.
 - Ensure the regular replacement of absorbent, often clean the absorption tank, in order to maintain anesthesia and ventilation system cleaning environment.

1. Support Pin
2. Handle
3. Release Pin
4. Water cup
5. Absorption tank



Installing Absorption Tank



Caution:

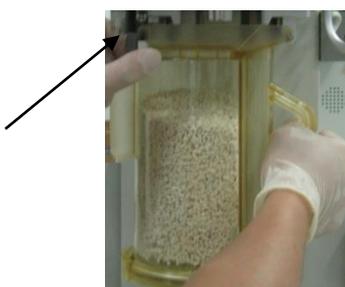
Before installation, check the water cup joint is in the open state, if not, will be converted to open.

Catch water cup joint push upwards and counterclockwise rotation, joint is in a closed state; a clockwise rotation, the joint is open.

- 1) Hold the handle of the absorption tank, and put the absorption tank on the two support pin.



2) Press the release pin, the port Soda Lime tank are respectively aligned to push upward the absorption tank, installation in place, will release the pin lock the absorption tank.



⚠ Caution:

- Re install the Soda Lime tank, do loop leak test, please see Chapter fifth related content.

Replace Soda Lime

⚠ Caution:

1. Absorption Soda Lime tank in the absorption of carbon dioxide, the color will change, to decide whether to replace the Soda Lime.
 2. Soda Lime color for reference only, please use carbon dioxide to monitor data as the basis, to decide whether to replace the Soda Lime.
 3. Absorbent color change, if place a few hours, it reverts to the original color, may be misleading and was again misuse. Should be in accordance with the provisions of the local medical wastes treatment timely disposal.
 4. Please use the company recommended that you use Medisorb™ Soda Lime.
- Before using the product, the complete specification can watch it again.

1) please see 12.4.7 removing Soda Lime tank.

2) a new sponge filter placed in the bottom of the absorption tank, the Soda Lime into absorption tank, put a newsponge filter in Soda Lime, then cover the lid and lock. Wipe the absorber dust.

3) align the cover groove towards the locking tabs of absorption tank , press cover down, installed. Clockwise rotation of the cover lock ring, locking lid. Ensure that the lid seal, preventing leakage and overflow. The arrow markpositioning instruct you on how to correct assembly.

**Warning:**

- After Soda Lime loaded, before installation, clean Soda Lime tank inlet and outlet, to prevent dust and particles into the breathing circuit.

**Caution:**

- Install bottom of sodium lime tank, please check the seal is intact.
- Soda Lime tank sponge can not be reused, must replacing the sponge filter while replacing Soda Lime each time.
- Soda Lime cannot pour over Soda Lime tank on the MAX logo.

4.3.7 Installing manual controlled respiratory bag

- 1) ensure the installation manual breathing bag appearance without damage, wrinkles without adhesion;
- 2) hold the reservoir bag interface aligning the reservoir bag connection port and use the appropriate force upwards, to put the air bag sleeve in port.

**Caution:**

- When installing manual breathing bag, suggest to add silica gel corrugated pipe to connect, the purpose is convenient operation.

4.4 Installing Evaporator

⚠ Warning:

- When the equipment does not match and the evaporator, the evaporator the performance will decrease. Please use the evaporator is matched with the equipment.

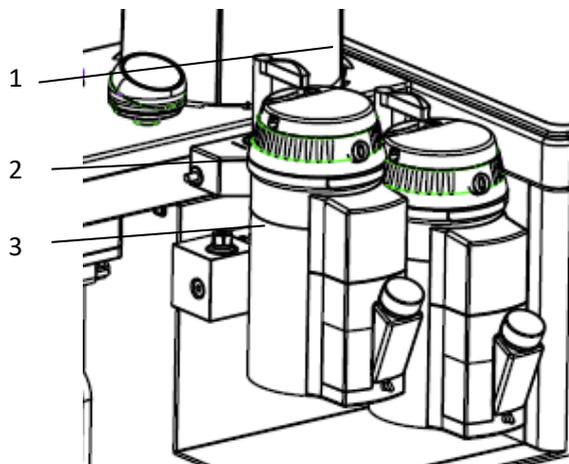
⚠ Caution:

- On the installation and use of evaporator, please see the detailed instructions of corresponding evaporator.

4.4.1 Installing Evaporator

⚠ Caution:

- before installing check the evaporator base O type sealing ring is deformed, aging and other phenomena, if yes, after changing install again, otherwise the installation is not in place, resulting in leakage or not working properly.



1.The lock rod, 2 interlocking screws, 3 evaporator base

- 1) evaporator will be linked to the evaporator base on the anesthesia machine;
- 2) press and clockwise rotation lock rod 1, make the evaporator fix on the mounting seat;
- 3) ensure that the evaporator top at the horizontal level, otherwise should remove the evaporator, and restart the installation.
- 4) when re installing, should as far as possible carry each evaporator along upwards from the mount, and not Pull forward, be careful not to let the evaporator rotation on the mounting seat.

5) when the evaporator is carried far way from installed base, evaporator and execute first 1~ 3 step again. Still can't put evaporator away

Flat on the installation seat, which should give up the use of the system.

4.4.2 Add anesthetics



Warning:

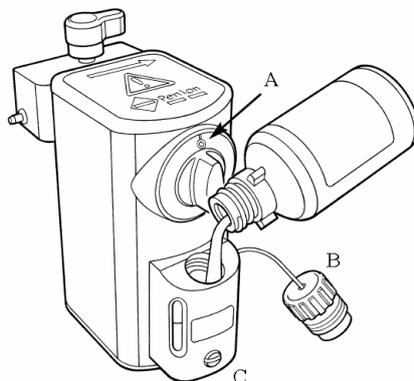
- Before adding the anesthetic, confirm the name and logo of anesthetic compare with the drugs on the evaporator is consistent. If the wrong anesthetic, anesthetic concentration changes in real output.



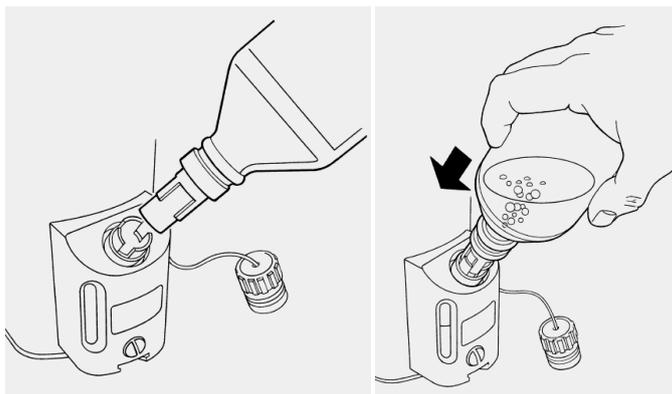
Caution:

In the highest level of anesthesia evaporator capacity is 250L; the lowest level capacity is 35mL.

Pour Fill evaporator in dosing mode



- 1) check the knob A which control concentration and the zero its position; examination and drain screw C tightening.
- 2) Unscrew the screw cap B .
- 3) the anesthetic liquid slowly pour into evaporator. In the pouring process, pay attention to check the tank liquid levelheight, when the liquid level reaches the highest scale line, stop pouring liquid.
- 4) hand tighten the screw cap B. Do not over tighten.

Quik-Fill evaporator in dosing mode

- 1) check the knob A which control concentration and put it in the zero position.
- 2) taken off the protection cover of anesthetic bottle , to ensure that the bottle and the doser without damage.
- 3) taken off the seal cover of evaporator feeding port, put a bottle mouth insert into the evaporator dosing opening. Spin the bottle, the bottle wedge bolt align evaporator mouse dosing tank.
- 4) the anesthetic bottle tightly pressed into the feeding port of evaporator , and pay attention to the liquid level of the evaporator observation hole. let liquid flow into the evaporator, until reach the level of scale biggest, continue to observe the liquid level scale of observation holes and back bubble of air flow into the bottle .
- 5) when evaporator filled with liquid medicine , loosen bottle, if continued rising bubble then stopped.
- 6) put the bottle out of the evaporator feeding port, re installed evaporator dosing opening seal cover and the bottle protection cover.

4.4.3 Discharge anesthetics

Warning:

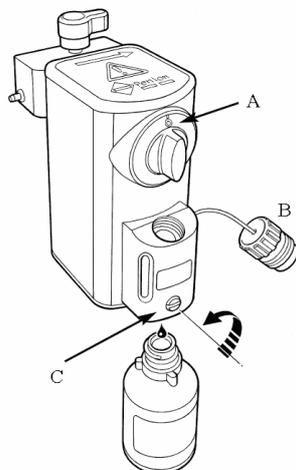
- Anesthetic discharged from the evaporator can not be added again to the evaporator used repeatedly, must according to the provisions of the disposal of dangerous chemical treatment.



Caution:

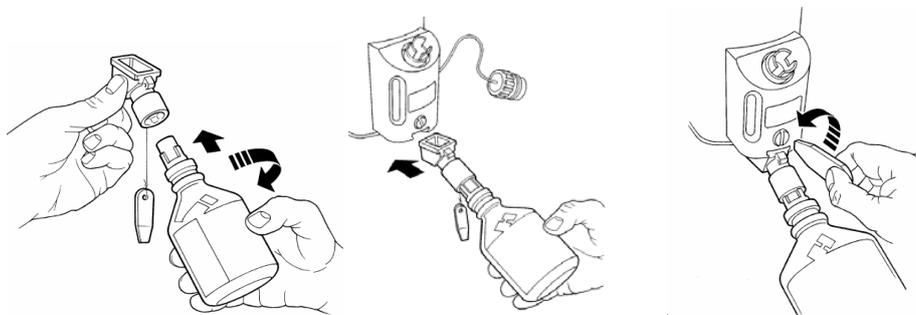
In order to avoid the anesthetic liquid overflow, please ensure that the used bottles have sufficient capacity for liquid discharged.

Pour Fill evaporator in medicine mode



- 1) check the concentration control knob A, and put it in the zero position.
- 2) Unscrew the screw cap B .
- 3) put a corresponding name of anesthetics bottle placed in the downwards of evaporator , its port align with the funnel of liquid discharge tube , loosen the screw C, ensure that the anesthetic flow into the bottle.

Quik-Fill evaporator in medicine mode



- 1) take off a bottle cap of empty anesthetic bottle. let the bottle mouth insert into the medicine funnel. Spin the bottle, the bottle mouth wedge bolt aligned to evaporator dosing tank. And then put the medicine funnel tightening in empty bottle.
- 2) remove the evaporator dosing sealing cover.
- 3) put the medicine funnel completely into the wedge shaped groove of medicine outlet on evaporator, unscrew the drain screw C. The liquid in the evaporator flows into the bottle, till discharge all the liquid inside the evaporator. Tighten the drain screw C, remove the release drug funnel.
- 4) screw down the medicine funnel from the anesthetic bottle, replace the cap and evaporator dosing opening sealing cover.

4.5 Installing module



Caution:

- In order to ensure patient safety, in the use of the anesthesia machine needs matching proper gas monitor module. If the use of the anesthesia machine is not configured gas monitor module, please meet with ISO 21647 2004 standard gas monitoring device in the use of the anesthesia machine.

4.5.1 Installing AG modul

- 1) the mainstream type of anesthetic gas monitor installation, in accordance with the ninth chapter "install 9.4.1" instructions.
- 2) the sidestream type of anesthetic gas monitor installation, in accordance with the ninth chapter "install 9.5.1" instructions.

4.5.2 Installing CO2 Module

- 1) the mainstream type CO2 monitor installation, in accordance with the ninth chapter "install 9.4.1" instructions.
- 2) the sidestream type CO2 monitor installation, in accordance with the ninth chapter "install 9.5.1" instructions..

4.6 Exhaust gas discharge port

- 1) the anesthesia machine exhaust port is located in the back of the anesthesia machine, anesthesia machine produced exhaust gas, including anesthesia ventilator exhaust gas side stream gas monitor output gas and respiratory output gas, were expelled by the exhaust interface.
- 2) AGSS joint diameter is 30mm, its special joint is taper 1:20, conforming to ISO 5356-1 2004 regulations. Through this connector to connect anesthetic gas purification device and exhaust gas treatment system.

The interface position, please see the 3.2.2 **rear view**



Warning:

Please do not jam AGSS emissions interface, otherwise anesthesia respirator will not work.

- Before the equipment working, should be equipped with ISO 8835.32004 anesthetic gas purification system transmission and collection system, in order to purify the operation room.

4.7 AGSS transmission and collection system

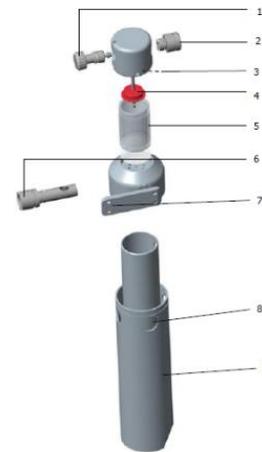


Caution:

- The anesthetic gas purification system transmission and collection together use with the anesthesia machine need to in accordance with the requirements of ISO 8835.32004.

4.7.1 AGSS constructions

- 1 flow limiting valve
2. AGSS outlet (connect to hospital sewage pipe)
3. The filter
4. float
5. observation window
- 6..AGSS intake port (30mm endocone connector)
7. The fixed plate
8. pressure compensating port
9. gas volume



4.7.2 Installing AGSS

- 1) the AGSS system is fixed on the equipment left by nut, see **3.2.3 left view**.
- 2) transmission system hose 30mm endocone connect to equipment AGSS emissions interface.
- 3) transmission system hose 30mm external cone connect to AGSS collection interface .
- 4) AGSS collection system endocone connect to the hospital exhaust gas treatment system .

4.7.3 Exhaust dealing system test

- 1) AGSS transmission and collection system is processing system for low flow type, suitable for pumping speed range is 25 ~ 50L/min.
- 2) After AGSS system has been connected, confirm the match of pumping velocity and AGSS system, doing the actual pumping test.



Caution:

- Do not block pressure compensation port in the AGSS collection system when testing .



Warning:

The AGSS transmission and collection system is not suitable for combustible anesthesia gas.

Chapter 5 Test before operation



Caution:

- Before operating the anesthesia system, must carefully read each component description;
- Make sure you understand all the "dangerous", "warning" and "attention" and other information;
- Use disinfection components;
- Connection, using and testing method of each system component must to be understood.
- Before operating the anesthesia system, must accomplish this chapter all testing and inspection, and testing of other system components.

If the test fails, do not use the equipment, and contact the customer service and maintainer to repair this equipment.

5.1 Test interval

Before the use of anesthesia machine for each patient , the anesthesia machine needs to do basic operation test or maintenance to ensure equipment safety and effective.

Test item	Testing time
Check system	◎
Pipe gas supply test	○
Spare gas cylinder test	○
AGSS system test	◎
Anesthesia and ventilation system test	◎
Power failure test	◎
Fast O ₂ test, include electronic and push button	◎
Evaporator pressure test	○
Flow control device test, include electronic and mechanical	○
Alarm test	◎
○ : before first patient use in the first day	
◎ : before each patient use	

5.2 Check system

The initial examination of the anesthesia machine, ensure that comply with the following requirements before use :

- 1) equipment in good condition;

- 2) casters has been locked, and no loosening, can prevent the anesthesia machine movement;
- 3) system components is connected properly;
- 4) supply system is connected properly, the screen showed a normal pressure monitoring;
- 5) cylinders gas supply, gas is enough, to ensure that cylinder valve is closed;
- 6) safety oxygen control switch is intact and function of flowmeter is normal;
- 7) the function of electronic flowmeter is normal;
- 8) ACGO switch is intact;
- 9) breathing circuit is connected properly, respiratory tube is intact, Soda Lime enough;
- 10) anesthesia ventilation system has been fixed on the seat, and the nut is screwed up;
- 11) adjustable pressure limiting valve, its calibration points to the minimum (MIN);
- 12) the evaporator is installed and have adequate locking, anesthetics is enough, evaporator have been closed;
- 13) 13) for airway maintenance and equipment for tracheal incubation was ready, in good condition;
- 14) required emergency equipment and medicines have been ready, in good condition;
- 15) power line is connected to the AC power supply, AC power indicator light;
- 16) spare battery installed nondestructive;
- 17) to ensure that all switch of anesthesia system work normally;
- 18) to ensure that the anesthesia ventilator associated parameter and alarm limit set for the clinical level;
- 19) to ensure that the system is in standby state.

5.3 Pipe gas supply test

- 1) the center gas source pressure hose of O₂ is screwed to oxygen port on the back of the machine , if the cylinders gas supply, shall ensure that all cylinder valve is closed;
- 2) the other end of pipeline connected to the wall type air connection;
- 3) to ensure that the central gas supply pressure in the range of 0.28 ~ 0.6KPa;
- 4) press system switch key, start the system, the main interface displayed normal O₂ pipeline pressure;
- 5) disconnect oxygen pipeline gas source;
- 6) should be observed in the main interface of monitoring O₂ pipeline pressure 0.0MPa, system send out [No O₂Pressure] alarm prompt;
- 7) if the current O₂ is selected as the system drive gas, O₂ gas pressure is lower than 0.2MPa, [Low Drive GasPress] trigger alarm;

8) to access the N₂O pipeline gas source, and refer to steps 1) - step 7), test N₂O gas pressure gauge display and pressure gauge zero function;



Caution:

- must access the oxygen first, then access nitrous oxide, can be set to nitrous oxide as cut gas.
- different with O₂ pipeline, cut off the gas pipeline gas source, the pressure reducing process, system does not emit pressure alarm correlation.

Not connected to the O₂ source, interface [Auto FiO₂] softkey to gray is not operable.

1) access the Air pipeline gas source, and refer to steps 1) - step 7), test Air gas pressure gauge and pressure gauge zero function;

2) if the current machine driven gas Air is selected as the driving gas, disconnect the Air pipeline gas is lower than 0.2MPa, [Low Drive Gas Press] trigger alarm.

5.4 Spare gas cylinder test



Caution:

- if the anesthesia machine is connected to the central gas supply, gas cylinders should be retained on the machine in emergency.
- not filling the oil on cylinder gas valve or decompression table or forgivable lubricant. Not available greasy hands open cylinder. There is a danger of explosion!
- the cylinder valve only can use hands slowly open / close, do not use other tools.
- If a cylinder valve leakage serious, or difficult operation, shall be sent to the professional department to repair.

Cylinders will be sufficient gas, and hung on spare cylinder bracket on the back surface of machine;;

1) only open the oxygen cylinder valve;

2) press the system on / off key, starting system, the main interface displayed normal O₂ cylinder pressure;

3) closure of the oxygen cylinder valve;

4) after about a minute, record the current gas cylinder pressure monitoring value;

5) if after record value than the previous record value (i.e., pressure drop) over 500kPa, it shows the leakage phenomenon; see Chapter Fourth "4.1.3 cylinder installation and replacement," to replace the new bottle washer, then refer to the above step 1) - step 5), re-test, if still leakage phenomenon, do not use the cylinders gas supply system;

6) only open N₂O gas cylinder valve, and refer to the step 5) - step 6) operating N₂O gas cylinder valve, doing the N₂O gas cylinders test;

7) if the N₂O gas cylinder pressure decreases below 500kPa, the N₂O gas cylinder test qualified.

5.5 Power failure test



Caution:

- voltage must be consistent with the calibration of machine backside plate specifications, voltage range: V ~ 100V-120AC (single).
- check whether installation of fuse and ground connection is good.
- Power failure, please switch to the safety of oxygen flowmeter, manual ventilation.

Insert the plug into the socket on the wall;

- 1) press the system on / off key , starting system, unplug the power line;
- 2) should be observed in AC indicator lights off of AC power, battery powered lights flashing, alarm information display area prompt [AC Disconnect] alarm;
- 3) put the power line connect to the AC power supply socket;
- 4) should be observed in AC indicator lights on of AC power, the battery power indicator light, from the original [ACDisconnect] prompt alarm automatically canceled;
- 5) long press again system On / off key, pop-up box to select [OK] button, enter the 5S countdown, after countdown shutdown system automatically; if you choose [Cancel] button, quit interface, return to the current state, the shutdowncancel.

5.6 Flow control device test



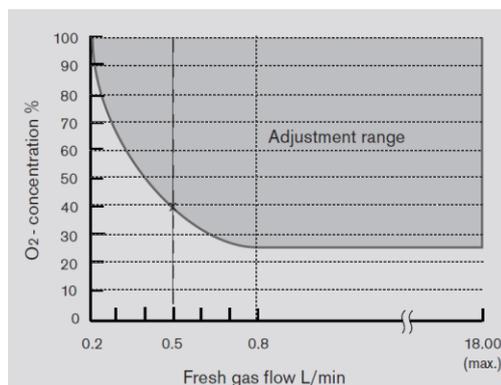
Warning:

- to avoid harm to the patients, if oxygen & N₂O electronic sensing device can not provide the correct ratio of oxygen and nitrous oxide, please switch to the safety of oxygen flowmeter, which provide fresh air ventilation.
- If no oxygen, if there is N₂O gas flow through the system, must use method which has been confirmed and secured to emission and collection .

Equipped with a electron lowest oxygen transport system to avoid hypoxia mixed gas, can be detected according to the following function:

- 1) when nitrous oxide as the carrier gas, the lowest oxygen transfer capacity for the 200mL/min. Fresh gas flow rate is greater than 0.8 L/min, the lowest oxygen concentration limit was 25%. Fresh gas flow settings below 0.8 L/min, the oxygen concentration automatically elevated to oxygen flow is equivalent value to 200 mL/min.
- 2) when choosing the air as carrier gas, do not start SORC function, and range of 100% air can be detected in the entire flow regulation.

3) if prompt "NO Fresh Gas" alarm, increase the fresh gas flow.



5.7 Evaporator pressure test



Warning:

- in order to avoid damage the evaporator, before use, should set the fresh gas flow to the 100mL/min;
- Evaporator can only use method of Selectac series, when test needs to ensure that before the test has the evaporator is locked;
- In the testing process, anesthetic by fresh gas exports (suction port) output, connections and emissions of these anesthetics must use method has been confirmed and secured .

The following test of anesthesia system evaporator, to ensure its normal function:

- 1) to ensure that the evaporator has been in accordance with the fourth chapter "install 4.4.1" installed;
- 2) press the system on / off key , starting system;
- 3) access pipeline gas supply or cylinders gas supply;
- 4) set the oxygen concentration is 100%, set the fresh gas flow rate of 6L/min, and keep the stability of flow;
- 5) conditioning evaporator concentration from 0 ~ 1%;
- 6) should be observed, in the whole process flow of oxygen reduction shall not exceed 1L/min;
- 7) if the observed flow decreased more than 1L/min should be replaced with an evaporator, and then refer to the step 1) to step 5), re-testing, if the flow reduction is still more than 1L/min, it means the system failure, do not use theanesthesia system.



Caution:

- The evaporator in the "OFF" ("off") and higher than the very low output volume between the first scale range of "0" ,not in this range test.

5.8 Fast O₂ test

- 1) Connect to O₂ pipeline gas resource or gas cylinder ;
- 2) in the standby state or condition, press the fast oxygen button O₂+ or long press the [O₂+] soft key , will show [rapid oxygenation] at the system prompt information area; keep pressing time exceeds 15 s, trigger alarm [rapidoxygenation failure];
- 3) during rapid oxygenation, release fast oxygen button O₂+ or loosen [O₂+] soft key, prompting information and alarm information will disappear.

5.9 Respiratory circuit test



Warning:

Check whether there is any stuff in the breathing circuit, if yes please clean, otherwise it will block the gas flowing to the patient, which may cause casualty accident. Please ensure that no stuff.

Ensure that the breathing circuit is properly connected and undamaged.

Ensure that the single direction valve on breathing circuit work on normal:

when Inspiration , inspiration direction valve open, the expiration direction valve closed instantly, indicates that the inspiration direction valve work on normal.

when expiration , expiration direction valve open, the inspiration direction valve closed instantly, indicates that the expiration direction valve work on normal.

5.9.1 Bellows test

- 1) press system on / off key, boot device, and keep the device is in the standby state.
- 2) manual / machine control switch is arranged in the machine control position.
- 3) set the fresh gas flow to a minimum.
- 4) blocked the patient end export, closed respiratory loop.
- 5) press the fast O₂+ button , fill in bellows, make the bellows folding bag rises to the top.
- 6) ensure that the pressure of airway pressure table can not rise to more than 15 cmH₂O.
- 7) the bellows folding bag shall not fall, if falling means the bellows leak. Please re-install the bellows.

5.9.2 Mechanical ventilation respiratory loop leakage test



Caution:

- Before breathing circuit leakage detection needs to ensure circuit is connected properly , and pipeline is intact.
- Before breathing circuit leakage detection needs to ensure the system is on standby state .

According to the follow method to do the leak test:

- 1 Make sure that the supply gas pressure is normal;
- 2 Set the bag/vent switch to vent position;
- 3 Plug the Y piece into the leak test plug to close the breathing system;
- 4 Turn off fresh gas inputs;
- 5 Push the O2 flush button to fill the bellows, folding bag rising to the top.
- 6 Press **【Selftest Result】** -> **【Auto Ventilation check】**.
- 7 Press**【Start】**, System starts respiring system leak detection, meanwhile display fill loading. If the check passed, will display information **【Check Passed】** . Otherwise display information **【Check Failure】**, at this time need to check whether the respire loop connection is right, pipe whether the pipe is intact, ensure if there are no problem, re-check the leak.



Caution:

- In the leak testing process, select **【Stop】**, will stop the testing process, This check is fail.
- Select **【skip】**, jump the testing.
- If the leak test failure, display **【Check Failure】**, please check each possible leak source: bellows, breathing loop pipeline, Soda Lime tank and its connectors, make sure it is intact or connection is right. In the examination of Soda Lime tank, please note that check the Soda Lime tank seal is pasted with Soda Lime particles, if any, please clear.
- If the breathing circuit leakage, do not use the equipment, please contact maintain officer or the customer service department.

5.9.3 Manual ventilation respiratory circuit leakage test

According to the follow method to do the leak test:

- 1) Make sure that the supply gas pressure is normal.
- 2) Set the bag/vent switch to bag.
- 3) Plug the Y piece into the leak test plug to close the breathing system.
- 4) Connect the manual bag to the manual bag port.
- 5) Set the APL valve 75cmH₂O.
- 6) Turn off all fresh gas inputs.
- 7) Push the o₂ flush button to let the pressure increase to approximately 30 cmH₂O on

the airway pressure gauge.

- 8) Press **【Self-test Result】** -> **【Menu Ventilation check】**.
- 9) Press **【Start】**, System starts respiring system leak detection, meanwhile display fill loading. If the check passed, will display information **【Check Passed】**. Otherwise display information **【Check Failure】**, at this time need to check whether the respire loop connection is right, pipe whether the pipe is intact, ensure if there are no problem, re-check the leak.

5.9.4 APL Valve Test

- 1) Manual / machine control switch to manual position;
- 2) Ensure system on STANDBY mode, if not, press **【Standby】** button, select **【ok】** to enter STANDBY mode;
- 3) Connect the manual breathing bladder to the manual gas-save bag connector of breathing circuit;
- 4) Put “Y” shape of bellows into leakage test plug of circuit to block the gas outlet of “Y” shape.
- 5) Adjust the APL valve, keep the valve in the fully closed (70 cmH₂O) position;
- 6) Set oxygen concentration as 100%, set fresh gas flow as 3 L/min;
- 7) Press quick O₂+ or press **【O₂+】** on the screen, keep the manual ventilation bag full;
- 8) Ensure the AP gauge no more than 85 cmH₂O. Pressure fluctuation is permitted;
- 9) Adjust APL Valve control the rotation, make APL valve pressure to 30 cmH₂O;
- 10) Ensure the AP gauge as 30 cmH₂O;
- 11) Adjust APL Valve control the rotation, make APL valve pressure to minimum (MIN position);
- 12) Ensure the AP gauge less than 5 cmH₂O;
- 13) set fresh gas flow as MIN;
- 14) Press quick O₂+ or press **【O₂+】** on the screen, Ensure the AP gauge as 0 and no less than 0 cmH₂O, APL Valve Exhaust no abnormal.

5.10 Anesthesia and ventilator machine test

According to the following steps and methods to do the anesthesia machine and ventilator test:

- 1) Press the start button, start the system;
- 2) Put manual / machine control switch to control position;
- 3) Put the test lung connected to the Y tube connector;
- 4) Set fresh gas flow as 100 mL/min, ensure the minimum flow or close;
- 5) Set the system to the standby mode;
- 6) Through the operation interface, in accordance with the following parameters set options:
 - Mechanical ventilation mode: select [V-CMV] -> [Set module]

- Tidal volume TVe:500mL
- Respiratory frequency Rate:12bpm
- Breath Ratio I:E:1:2
- Pressure limit level Plimit:30cmH2O
- Positive end expiratory pressure PEEP:OFF

7) Oxygen meter on the screen, touch control in 0.5 ~ 1L/min;

8) Press the rapid oxygenation button, the bellows folding bag completely supports;

9) Click on the [Start Ventilation] screen hotkey, into the ventilation condition;

10) Observably, has launched the mechanical ventilation, bellows folding bag regular rising and The basic function of anesthesia ventilator after test, according to the following steps and methods of anesthesia respirator leakage test:

11) The system is set to the standby mode;

12) Set the fresh gas flow about 0.3L/min

The bellows on the Y shape is inserted into the test plug leakage circuit, blocking the outlet Y shape ;

13) Press the rapid oxygenation button, the bellows folding was propped up, loosen the rapid oxygen filling button;

14) Should be observed, folding bag doesn't fall down, otherwise the system has a leak, should investigate the cause and find solution then test again according to the above method.



Caution:

- When anesthesia ventilation system leakage, remove as much as possible leakage, such as folding, box cover, box of Y tube is installed in place, the hose with such phenomena.
- The anesthesia machine volume monitoring comply exhaled gas monitor with 51.101.4 of IEC 60601-2-13 2006 .

5.11 Check AGSS Transporting and absorbing system

Invent the AGSS , check float can freely move up and down. If the float motion any blocking adhesion phenomenon or appears damaged, it must be reset or replace the float before use.



Caution:

- Do not Block the pressure compensation entrance of AGSS when checking.

If the float does not float, there may be several reasons:

1) float adhesion. Please check the free movement of the float on the above way.

- 2) float slowly rising. The filter may be blocked, please press 14.5 removing filter in the manner described check if the filter in the upper cap is blocked.
- 3) exhaust gas treatment system does not work or pumping gas flow rate is lower than the normal work of AGSS flow 50L/min. Please check the 4.7.3 waste gas treatment system test are described by way of waste gas treatment system.

5.12 Preparation before system operation

- 1) ensure that relevant parameters of ventilator and alarm limits set for clinical application, the specific settings can refer to the relevant sections of the eighth chapter of operation and parameter setting.
- 2) to ensure that the system is in standby state.
- 3) requires the following equipment: airway maintenance, manual ventilation and tracheal incubation device, and the application of anesthesia and emergency medicine.
- 4) manual / machine control switch is set to manual position.
- 5) manual breathing bag port connects to manual breathing bag.
- 6) close all evaporator.
- 7) regulating the rotation control APL valve, the valve in the fully open state of APL (MIN).
- 8) fresh gas flow is set to minimum.
- 9) to ensure that the breathing circuit is properly connected and undamaged.

5.13 Alarm Test

5.13.1 Setting before alarm test

Setting before alarm test please refer to chapter "5.10 Anesthesia and ventilator machine test" step 1 to 10.

5.13.2 O₂ Concentration Monitoring and alarm test

The test is for the anesthesia machine with aerobic cells on the configuration only, if no does not need the test.

- 1) manual / machine control switch is arranged on the manual position.
- 2) remove oxygen cell from the circuit, placing 2 ~ 3 minutes, screen [FiO₂] parameter monitoring value around 21%.
- 3) click on the [Alarm] - > [Alarm Setup] into the interface, select [Alarm Limit] options, select [FiO₂ Low Limit] set to 50%.
- 4) observe the screen physiological alarm, alarm trigger [FiO₂ Too Low].

- 5) [FiO₂] inside [FiO₂ Low Limit] is set lower than the current value of the [FiO₂] monitoring , the screenprompt [FiO₂ Too Low] alarm disappeared
- 6) the oxygen battery re-installed back into loop, please see 4.3.6 installation oxygen battery.
- 7) click on the [Alarm] -> [Alarm Setup] interface, select [Alarm Limit] options, select [FiO₂ High Limit]: set to 50%.
- 8) the manual breathing bladder connected to manual breath air interface of breathing circuit, press the fast oxygenfilling button, filling in manual ventilation bag, 2 ~ 3 minutes later, the screen [FiO₂] parameter monitoring value is about 100%.
- 9) observe the screen physiological alarm, alarm trigger [FiO₂ Too High].
- 10) [FiO₂] inside the [FiO₂ High Limit] is set to 100%, the screen physiological alarm prompt [FiO₂ Too High] alarm disappeared.

5.13.3 Ventilation/min MV low alarm test

- 1) click onthe [Alarm] -> [Alarm Setup] interface, select [Alarm Limit] options, select [MV Low Limit]: set to 8.0L/min.
- 2) observe the screen physiological alarm, alarm trigger [MV Too Low].
Click the [Alarm] -> [Alarm Setup] interface, select [Alarm Limit] options, select [MV Low Limit]: set to the default value. Tips [MV Low Limit] alarm disappeared.

5.13.4 Continuous positive airway pressure high alarm test

- 1) Manual / machine control switch is arranged on the manual position, the manual breathing bladder connected to manual breath air interface of breathing circuit.
- 2) Adjust the APL valve, the scale at 30cmH₂O.
- 3) Continued keep pressing the rapid oxygenation button , filling manual breathing bag. About 15 seconds, you should observe the physiological alarm, alarm trigger [Sustained Airway Pressure].
- 4) Let the patient port through the atmosphere, prompt [Sustained Airway Pressure] alarm disappeared.

5.13.5 Respiratory apnea alarm test

- 1) manual / machine controlled switch
to manually position, and manual breathing bladder connected to manual air bag interface of breathing circuit;
- 2) adjust the APL valve, adjusted to the scale 30cmH₂O;
- 3) press the rapid oxygenation button, fill the breathing bag;
- 4) extrusion breathing bag, observe the bellows folding bag regular rising and falling 2 times;
- 5) stop squeezing the bag, wait for about 20s (asphyxia time limit setting);
- 6) should be observed, screen physiological alarm, alarm trigger [Apnea], if continued apnea time more than 2min,[Apnea] alarm switch to alarm for [Apnea>2 min];
- 7) repeatedly pressing the breathing bag, observe the bellows folding bag regular rising and falling several times;
- 8) should be observed, prompt [Apnea] alarm or [Apnea>2 min] alarm disappeared .

5.13.6 Airway pressure Ppeak high alarm test

- 1) manual / machine control switch is arranged in the machine control position.
- 2) click on
the [Alarm] - > [Alarm Setup] interface, select [Alarm Limit] options, select [Ppeak Low Limit]: set to 0cmH₂O; [Ppeak High Limit]: set to 5cmH₂O.
- 3) should be observed, screen physiological alarm, alarm trigger [Ppeak Too High].
- 4) click on
the [Alarm] - > [Alarm Setup] interface, select [Alarm Limit] options, select [Ppeak High Limit]: set to 40cmH₂O.
- 5) should be observed, prompt [Paw Too High] alarm disappeared.

5.13.7 Airway pressure Ppeak low alarm test

- 1) manual / machine control switch is arranged in the machine control position.
- 2) click on
the [Alarm] - > [Alarm Setup] interface, select [Alarm Limit] options, select [Ppeak Low Limit]: set to 0cmH₂O; [Ppeak High Limit]: set to 5cmH₂O.
- 3) should be observed, screen physiological alarm, alarm trigger [Ppeak Too High].
- 4) click on
the [Alarm] - > [Alarm Setup] interface , select [Alarm Limit] options, select [Ppeak High Limit]: set to 40cmH₂O.

5) should be observed, prompt [Paw Too High] alarm disappeared.

5.13.8 Expired Volume alarm test

- 1) manual / machine control switch is arranged in the machine control position.
- 2) click on the [Alarm] -> [Alarm Setup] interface, select [Alarm Limit] options, select [Vt Low Limit]: set to 200mL; [VtHigh Limit]: set to 400mL.
- 3) should observe the screen physiological alarm, alarm trigger [Vt Too High].
- 4) click on the [Alarm] -> [Alarm Setup] interface, select [Alarm Limit] options, select [Vt High Limit]: set to 1000mL.
- 5) should observe the screen alarm physiological District, prompting [Vt Too High] alarm.
- 6) click on the [Alarm] -> [Alarm Setup] interface, select [Alarm Limit] options, select [Vt Low Limit]: set to 600mL; [VtHigh Limit]: set to 1000mL.
- 7) should observe the screen alarm physiological District, alarm trigger [Vt Too Low].
- 8) click on the [Alarm] -> [Alarm Setup] interface , select [Alarm Limit] options, select [Vt Low Limit]: set to 200mL; [VtHigh Limit]: set to 1000mL.
- 9) should observe the screen physiological alarm area, prompt [Vt Too Low] alarm disappeared.

5.13.9 Respiratory Frequency Alarm Test

- 1) manual / machine control switch is arranged in the machine control position.
- 2) click on the [Alarm] -> [Alarm Setup] interface, select [Alarm Limit] options, select [Rate Low Limit]: set to 4bpm; [Rate High Limit]: set to 10bpm.
- 3) should observe the screen physiological alarm, alarm trigger [Rate Too High].
- 4) click on the [Alarm] -> [Alarm Setup] interface, select [Alarm Limit] options, select [Rate High Limit]: set to 40bpm.
- 5) should observe the screen physiological alarm area, suggesting that [Rate Too High] alarm.
- 6) click on the [Alarm] -> [Alarm Setup] interface, select [Alarm Limit] options, select [Rate Low Limit]: set to 20bpm.
- 7) should observe the screen alarm physiological District, alarm trigger [Rate Too Low].

- 8) click on the [Alarm] - > [Alarm Setup] interface, select [Alarm Limit] options, select [Rate Low Limit]: set to 4bpm.
- 9) should observe the screen alarm area, prompt [Rate Too Low] alarm disappeared.

Chapter 6 Basic Setting

6.1 Boot system

- 1) the power line is inserted into the AC outlet, should observe the display AC power indicator light and the battery indicator light.
- 2) press system on / off key, should observe the screen  indicator light, into the self checking system.
- 3) alarm indicator light self test, is yellow and red flashes once one by one, also issued a "tick" sound tone.
- 4) system self check ending, into the LOGO picture, the interface automatically pop-up detection results, click on the [Exit] button to exit, and to enter the standby mode.



Caution:

- if self test appeared abnormal alarm, exit the self-test end interface, view alarm data, refer to the chapter "12.6 alarm information table" relevant content processing.
- If you can't start, please do not use, contact equipment repair staff or the customer service department immediately.

6.2 Standby

- 1) system boot, boot normally into standby;
- 2) non standby interface, click on the [StandBy] soft key, in the confirmation popup window select [OK], enter the standby state.

On the standby screen, click on the [StandBy] soft key, in the confirmation popup window select [OK], you can exit the standby state.

Standby mode, can do the ventilation mode setting, ventilation parameter modification, alarm settings and system settings .

6.3 Shutdown system

- 1) long press system switch key, pop-up box to select [OK] button, enter the 5S interface countdown, countdown to the end, the system automatically shut down.
- 2) long press system switch key, pop-up box to select [Cancel] button, exit the interface, return the current state, the system cancel the shutdown.

6.4 Patient information setting

- 1) boot machine, patient type [Previous Patient] , the default display as a previous patient information.
- 2) patient type setting: click on the [New Patient] - > patient selection: [Adu] or [Ped], Adu weight default is 75kg, the maximum is 200Kg, the weight of Ped default to 7.5kg, the maximum is set to 200kg.
- 3) patient information input: patient selection: [Adu] or [Ped], next to screen alarm silence logo click on the [Adu] or [Ped], [Patient Info] window, enter information, click on the [OK] set successfully, click on the [Cancel] is not successful.

6.5 Set fresh air

- 1) select N2O as carrier gas, press [N2O], selected for shallow green indicator.
- 2) select Air as carrier gas, press [Air], selected for shallow green indicator.
- 3) oxygen concentration set: click on [O2%] soft key, the pop-up window according to the arrow to do the left or rightsliding, or press towards the arrow, numerical increase or decrease, after settings, click on the  button to confirm, or click on the  button to exit
- 4) fresh gas flow setting: click on [Flow] soft key, the pop-up window according to the arrow to do the left or rightsliding, or press towards the arrow, numerical increase or decrease, after settings, click on the  button to confirm, or click on the  button to exit.

6.6 Set anesthetics

- 1) installation, please see the 4.4 evaporator installation.
- 2) use the hands keep holding the 'O' key on the evaporator scale adjustment knob and counterclockwise rotation control knob, anesthetic concentration parameters needed until the knob on the value orientation scale position.

6.7 System setting

6.7.1 Set page

Large font selection

- 1) click on the [Menu] - > [System Setup] soft key, enter "System Setup" interface, select "Setting" option;
- 2) Select the [big Font] : on and off. Select the on as large font, off as the default font .

O2 sensor monitor selection

- 1) click on the [Menu] - > [System Setup] soft key, enter "System Setup" interface, select "Setting" option;
- 2) Select [O2 Sensor Monitor] : on and off. Select on to start the oxygen sensor monitoring; off for shielding the oxygen sensor monitoring, the system default is on.

Pressure Unit display selection

- 1) click on the [Menu] - > [System Setup] soft key, enter "System Setup" interface, select "Setting" option;
- 2) Select the [Paw Unit] : cmH2O, KPa and mbar. Select cmH2O as the unit of pressure is cmH2O; KPa is the unit of pressure is KPa; mbar is the unit of pressure is mbar, the system default is cm2HO.

Volume of tidal selection

- 1) click on the [Menu] - > [System Setup] soft key, enter "System Setup" interface, select "Setting" option;
- 2) Select the [Vti Display] : on and off. Select on as the inspiration tidal volume parameter display; off inspiration tidal volume parameters of shield, the system default is on.

Heat selection

- 1) click on the [Menu] - > [System Setup] soft key, enter "System Setup" interface, select "Setting" option;

2) choose [Heat]: on and off. Select on as start heating module; off as shielding heating module, the system default is on.

Demo selection

1) click on the [Menu] -> [System Setup] soft key, enter "System Setup" interface, select "Setting" option;

2) choose [Demo]: on and off. Select the on Demo mode; off is not Demo mode, the system default is off.

Language selection

1) click on the [Menu] -> [System Setup] soft key, enter "System Setup" interface, select "Setting" option;

2) select [Language]: English, Spanish and Russian. Select the English system for the English language; Spanish system for the Spanish language; Russian language for Russian. After the system language settings, reboot the system, the choice of language to take effect.

6.7.2 Module

Module work selection

1) click on the [Menu] -> [System Setup] hotkey, enter "System Setup" interface, select "Gas Module" option;

2) Select the [Operating Mode] : Measure and Standby. Select Measure in working mode for module; Standby module is in standby or hibernation mode, the system default is Measure.

CO2 Unit selection

1) click on the [Menu] -> [System Setup] hotkey, enter "System Setup" interface, select "Gas Module" option;

2) Select the [CO2 Unit] : mmHg, KPa and%. Select the mmHg CO2 unit is mmHg; KPa for CO2 is a unit of KPa, CO2 units is %, the system default is mmHg.

O2 compensation selection

- 1) click on the [Menu] -> [System Setup] soft key, enter "System Setup" interface, select "Gas Module" option;
- 2) Select the [O2 Compen] : Low, Mid and High. Such as oxygen concentration range: 0 ~ 30Vol% select Low; oxygenconcentration range: 30 ~ 70vol% select Mid; oxygen concentration range: 70 ~ 100Vol% High.



Caution:

- If the equipment installing AG matching module, set the oxygen compensation, to ensure accurate enough CO2concentration monitoring. N2O compensation select OFF

N2O compensation selection

- 1) click on the [Menu] -> [System Setup] soft key, enter "System Setup" interface, select "Gas Module" option;
- 2) Select the [N2O Compen] : on and off. Select on\off.



Caution:

- If the equipment installing CO2 matching module, should respectively set oxygen and nitrous oxide compensation, to ensure accurate enough CO2 concentration monitoring.

Apnea alarm limit time selection

- 1) click on the [Menu] -> [System Setup] soft key, enter "System Setup" interface, select "Gas Module" option;
- 2) Select the [Apnea Delay] : 20s, 25s, 30s, 35S and 40s. Select 20s, 25s, 30s, 35S and 40s.

6.7.3 Wave

Pressure wave selection

- 1) click on the [Menu] -> [System Setup] soft key, enter "System Setup" interface, select "Gas Module" option;
- 2) Select the [Pressure Wave] : on and off. Select on as the pressure wave display; off shielding pressurewave display, the system default is on.

Volume wave selection

- 1) click on the [Menu] -> [System Setup] soft key, enter "System Setup" interface, select "Gas Module" option;
- 2) Select the [Volume Wave] : on and off. Select on as the capacity of wavedisplay; off shielding capacitywave display, the system default is on.

Flow speed wave selection

- 1) click on the [Menu] -> [System Setup] soft key, enter "System Setup" interface, select "Gas Module" option;
- 2) Select the [Flow Wave] : on and off. Select on as the flow velocity wave display; off shielding flow velocity wave display, the system default is on.

CO2 wave selection

- 1) click on the [Menu] -> [System Setup] soft key, enter "System Setup" interface, select "Gas Module" option;
- 2) Select the [CO2 Wave] : on and off. Select the on CO2 wave display; off for shielding CO2 wave display, the system default is on.

6.7.3 Set system time

- 1) click on the [Menu] -> [System Setup] soft key, enter "System Setup" interface, select "Time" option;
- 2) Set [Date] and Time ;
- 3) the date format: YYYY-MM-DD, MM-DD-YYYY and DD-MM-YYYY, the system default is YYYY-MM-DD;
- 4) Time Format: the system default is 24h;
- 5) after setting, click on the [Confirm], time settings take effect.

Chapter 7 Operation interface

7.1 Summary

According to the gas module and system function configuration, user interface display will be different, mainly reflected in the parameters and waveform display area.

The user interface can be roughly divided into the following:

- 1) self test interface
- 2) standby interface
- 3) standard interface
- 4) large font interface

7.2 Self test interface

Press system on/off key, self test step will display on the screen. After finishing self-testing, jump out self test result interface automatically. As below:



Testing result will be displayed in “✗” and “✓”:

- ◆ “✗”: probably section components function does not connect, or re-self test after error check, district running.
- ◆ “✓”: self test accomplished successfully.
- ◆ 【 Auto Ventilation check 】 :Machine controlled ventilation leakage detection , operation see section 5.9.2.
- ◆ 【 Menu Ventilation check 】 :Manual controlled ventilation leakage detection , operation see section 5.9.3
- ◆ 【Exit】: exit self test interface, enter into the standby interface.

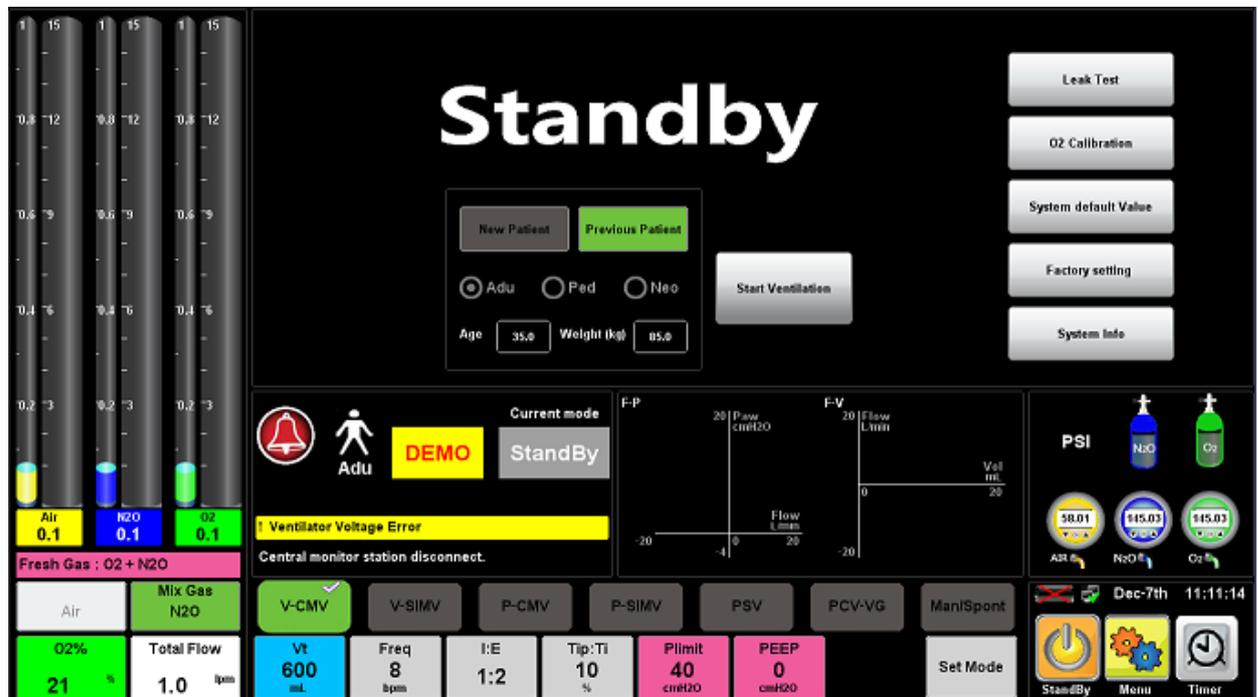


Caution:

- **When display “✘”, exit this interface, enter into standby interface to check the technical alarm information, then correct the mistake and back to self test, use the device after self test passed.**

7.3 Standby interface

Press the key of the system switch, the system starts to enter the self-test screen, pop-up test results after finish the self-test , then click the [Exit] button to enter standby interface, or the work running state, click [StandBy] soft key ,pop-up prompt window to select [OK] to enter the standby interface, the standby interface as shown:



1) Patient type setting:

Patient type setting: Default [Previous Patient] as the latest patient who used the anesthesia machine, re-set the patient type, click [New Patient] button, operable button background color is light green, inoperable Button background color is gray.

- 1) Click this button to switch the standby mode to ventilation mode; or click [StandBy] button, pop-up prompt window and select [OK] to enter the ventilation mode.
- 2) function soft keys: at the top right of the screen:
 - Press [Selftest Result] soft key to enter the self-test results interface.
 - Press [Leak Test] soft key, enter the leak detection interface.
 - Press [O2 Calibration] soft key to enter the oxygen concentration calibration interface, operation ways see Chapter 16.
 - Press [System default Value] soft key, the system setting turn into factory defaults.
 - Press [Maintain] soft key, enter the user maintenance interface, operation ways see Chapter 16.
- 3) Press [System Info] soft key to enter the system software version information.
- 4) Air pressure monitoring: Including the pressure of pipes and spare cylinders monitoring.
 - Menu soft key: various soft keys located below the right side of the screen:
 - **【StandBy】** standby soft key.
 - **【Menu】** Main Menu soft key.
 - **【Alarm】** Alarm settings soft key.

In standby mode, the system will have the following changes:

- ◆ Ventilator stop delivering fresh gas.
- ◆ Can set the fresh gas flow rate, ventilation mode, ventilation parameters, alarm limit and system basic information. When you exit the standby state, the system will work according to the last setting in the standby state.
- ◆ physiological parameter alarm will be automatically closed. If technical alarm occurs, the alarm function will be shown normally.
- ◆ Turn off the monitoring parameters and waveform display, the system enter standby state.
- ◆ gas module access will be on standby.

Exit standby mode: In standby mode, you can press [StandBy] soft key and in the pop-up prompt window select [OK] to make anesthesia machine out of standby modo.

7.4 Standard interface

Interface gas module, fresh gas flow, parameters, waveforms, ring chart and ventilation parameters softkeys and other display areas, generally are divided into area A1, area A2, area B1, area B2, area B3, area B4, area B5, area C , area D, area E, area F, area G, area Kand area K.

Area A1	Area B1	Area C		
Area A2	Area B2			
	Area B3			
	Area B4			
	Area B5			
	Area D	Area E	Area F	
	Area G		Area H	Area K

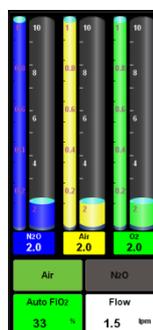
- 1) Area A1
Module gas monitoring parameters:

	Fi	Et	
O ₂	33	21	%
N ₂ O	50	45	%
AA	1.7	1.4	%
MAC	2.30		

- ◆ FiO₂: Inhaled oxygen concentration
- ◆ EtO₂: Exhaled oxygen concentration
- ◆ FiN₂O: Inhaled nitrous oxide concentration
- ◆ EtN₂O: Exhaled nitrous oxide concentration
- ◆ FiAA: Inhaled anesthetic gas concentration (AA represents anesthetic)
- ◆ EtAA: Exhaled anesthetic gas concentration (AA represents anesthetic)
- ◆ MAC: Minimum alveolar effective concentration

2) Area A2

Fresh gas flow and oxygen concentration set:



- ◆ **【Air】**, **【N2O】** soft key, is used to select which kind of gas to mixed with oxygen to get a fresh mixture.
- ◆ **【Auto FiO₂】** soft key, is used to set oxygen concentration. Click it, popup settings window, slide in the direction of the indication arrow, to the right is increase, to the left is reduce; or long press “**➡**” value also increased, long press “**⬅**” value reduced. After confirmed the settings, press **【✔】** confirm successfully, otherwise **【✖】** setting unsuccessfully, and quit.
- ◆ **【Flow】** soft key, for setting the fresh gas flow rate. Click it, popup settings window, slide in the direction of the indication arrow, to the right is increase, to the left is reduce; or long press “**➡**” value also increased, long press “**⬅**” value reduced. After confirmed the settings, press **【✔】** confirm successfully, otherwise **【✖】** setting unsuccessfully, and quit.
- ◆ Bar graph (the virtual flow tube) are nitrous oxide, air and oxygen.

3) Area B1

Pressure parameters:

Paw	cmH ₂ O		
Ppeak	20	Pmean	8
Pplat	16	PEEP	2

- ◆ Ppeak: Peak airway pressure
- ◆ Pplat: Plateau pressure
- ◆ Pmean: The average pressure
- ◆ PEEP: positive end-expiratory pressure

4) Area B2

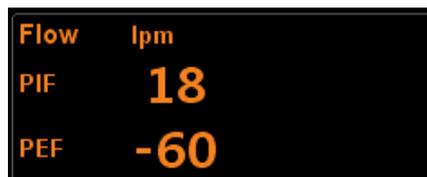
Volume parameters:



- ◆ Vte: Exhaled tidal volume
- ◆ Vti: Inhaled tidal volume
- ◆ MVe: Exhaled minute ventilation
- ◆ MVi: Inhaled minute ventilation

5) Area B3

Velocity parameters:



- ◆ PIF: Inspiratory phase velocity
- ◆ PEF: Expiratory phase velocity

6) Area B4

module CO₂ gas monitoring parameters:

- ◆ EtCO₂: Exhaled CO₂ gas concentration
- ◆ FiCO₂: Inhaled CO₂ gas concentration
- ◆ awRR: Frequency of respiratory airway

7) Area B5

Other parameters:



- ◆ Freq: Respiration frequency
- ◆ FiO₂: Inhaled oxygen concentration
- ◆ Raw: Air resistance
- ◆ Cydn: Dynamic compliance

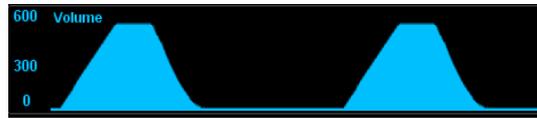
8) Area C

- 9) Area C is the waveform area. According to different user configuration, the combination of display is different. Area C may display the waveforms as follow:

◆ Pressure waveform



◆ Volume waveform



◆ Velocity waveform

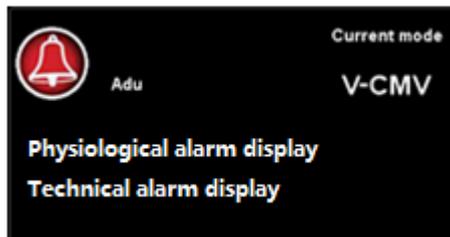


◆ CO2 waveform



10) Area D

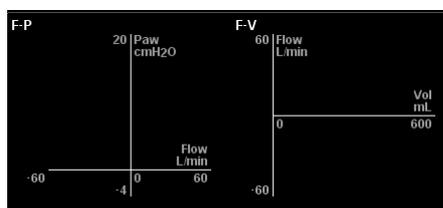
Area D are the patient type setting, the alarm sounds pause, physiological alarm display, technical alarm display and the current status display.



- ◆ Alarm sound suspended soft key: trigger alarm, click this button, the icon turn into , and in the physiological alarm area display mute countdown. If the countdown ends or not ends click or occur new alarm, the alarm sound pause cancel, and the icon from , turn into .
- ◆ **【Adu】**: Display patient types, if click it, popup prompt window, set the patient's basic information.
- ◆ **【Current mode】**: Display the current ventilation mode type and prompt information.
- ◆ **【Physiological alarm display】**: Display Physiological alarm information
- ◆ **【Technical alarm display】**: Display technical alarm information

11) Area E

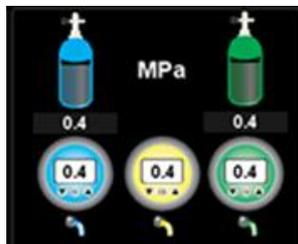
Area E is Lung function ring graph:



- ◆ Lung function ring graph is divided into **【F-P】** (Flow rate - pressure ring)、**【F-V】** (Flow rate - volume loop) and **【P-V】** (Pressure- volume loop)。Click in the acyclic graph area, expand the prompt menu, select the desired observation acyclic graph, click [Save Loop] button。

12) Area F

Area F is the display area of gas source pressure monitoring, divided into pipe, spare cylinders of gas source pressure monitoring.



- ◆ spare cylinders of gas source pressure monitoring: Nitrous oxide and oxygen, Pressure unit MPa。
- ◆ pipe gas source pressure monitoring: Nitrous oxide, air and oxygen, Pressure unit MPa。

13) Area G

Area G is ventilation mode and parameter setting softkeys, according to different machinery ventilation modes, the soft key and it's arrangement in the parameter setting softkey area will be different. Specific parameter settings softkey operation, see Chapter 8.3 the content related machinery ventilation modes.

Parameter setting, For example "PEEP" parameter setting.

- ◆ **【PEEP】** Soft key: Click it, popup settings window, slide in the direction of the indication arrow, to the right is increase, to the left is reduce; or long press“”value also increased, long press“”value reduced。After confirmed the settings, press **【】** confirm successfully, otherwise **【】** setting unsuccessfully, and quit.

 **caution:**

- other parameters' setting operation is consistent with the PEEP parameter operation setting。
- There are interdependencies between parameters, when one parameter changes,the same parameter adjustment range will vary in other parameters.

14) Area H

Area H is display the battery status and system time. Battery status, see Chapter 11 describes.

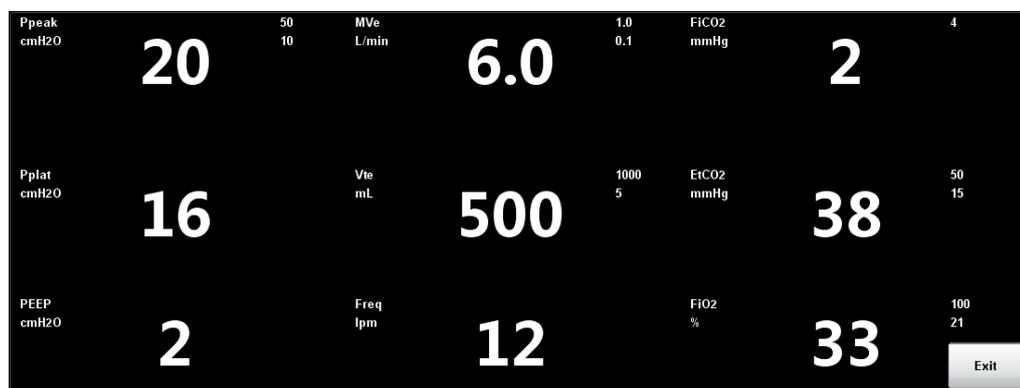
15) Area K

Area K is menu display area, respectively  **【StandBy】**、 **【Menu】**、 **【Alarm】**。

- ◆ **【StandBy】** soft key: operating status, press  **【StandBy】** button, popup the prompt window and select **【OK】**, switching to standby status; standby status, press  **【StandBy】** button, popup the prompt window and select **【OK】**, exit standby mode.
【Menu】 soft key: press  **【Menu】** button, expand the sub-menu, then press sub-menu key to enter the sub-menu pages. Operations, see chapter 6.7 relevant content. **【Alarm】** soft key: click this button, enter the alarm setting interface, operations, see Chapter 12 of the relevant content description.

7.5 Large font interface

large font interface, parameters display as below:

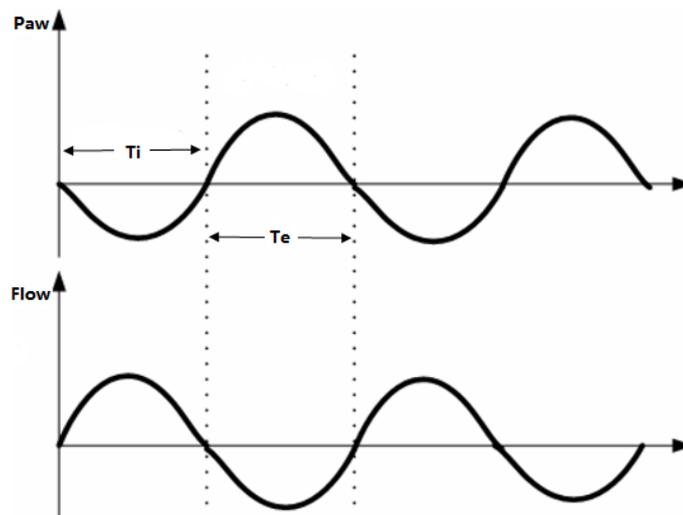


- ◆ parameters on the interface are: Ppeak, Pplat, PEEP, MVe, Vte, FiCO₂, EtCO₂, FiO₂;
- ◆ click **【Exit】** button, exit large font interface.

Chapter 8 Ventilation and parameter settings

8.1 Spontaneous breathing mode

- 1) centered at the bottom of the screen, press **【Man/Spont】** soft key.
- 2) Turn manual / machine control switch to the manual position and adjust APL valve to the MIN position (APL in the fully open state).
- 3) spontaneous breathing mode, pressure and flow waveforms schematic as below:



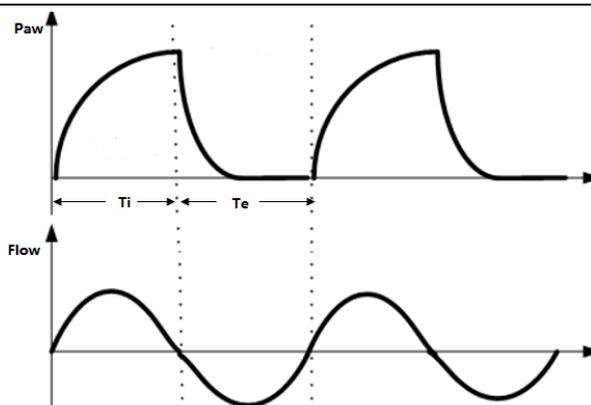
⚠ caution:

- The waveform only as a schematic, is not the same with the display on the device screen.

8.2 Manual ventilation mode

- 1) Turn manual / machine control switch to the manual position, and press **【Man/Spont】** soft key, in the ventilation prompt area the system display **【Manual】**.
- 2) Set the pressure limit of APL valve, generally set between 20 ~ 30cmH₂O.
- 3) Connect the manual breathing bladder to the port of gas pocket.
- 4) Use hand to pinch the breathing bladder to ventilate with the patient .

Manual ventilation mode, pressure and flow waveforms schematic as below:



8.3 Machinery ventilation mode

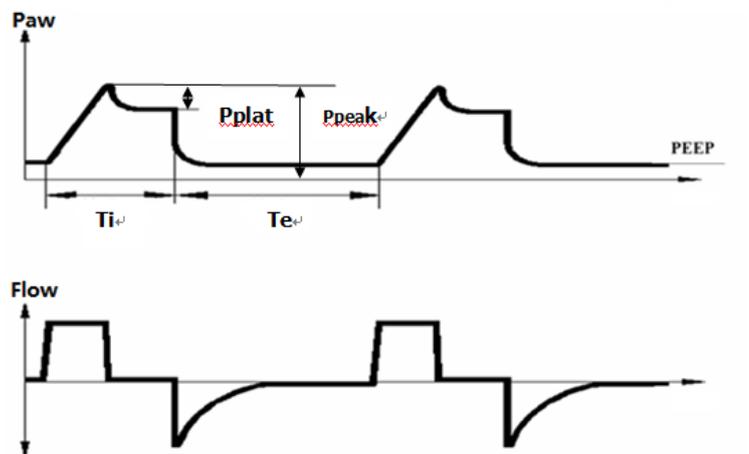
8.3.1 Settings before start the Machinery ventilation mode

- 1) Set the machine in standby mode.
- 2) In the ventilation parameter settings soft key area, set the applicable **【Plimit】** value.
- 3) Check the status of ACGOswitch, make sure ACGO is in off status.
- 4) Check the spare oxygen flow meter control, if it is working properly.
- 5) Manual / machine control switch setting is on the machine control position.
- 6) If necessary, press the fast oxygenation button **O₂+**, inflate the folding bags of bellows.

8.3.2 V-CMV mode

- 1) Select **【V-CMV】** mode:
 - ✧ centered at the bottom of the screen, select **【V-CMV】** -> **【Set Mode】**, the system in the ventilation mode prompt area display **【V-CMV】**.
- 2) **【V-CMV】** mode, the parameters need to set are below:
 - ✧ **【Vt】**: Tidal volume
 - ✧ **【Freq】**: Breathing rate
 - ✧ **【I:E】**: Breathing ratio
 - ✧ **【Tip:Ti】**: Percentage of inspiratory pause (to improve the gas distribution in the patient's lungs)
 - ✧ **【Plimit】**: Pressure limit level (to avoid high airway pressure harm the patient)
 - ✧ **【PEEP】**: positive end-expiratory pressure (can increase oxygenation in the breathing process, improve end-tidal carbon dioxide emissions)
- 3) Introduction of the principle:
 - ✧ V-CMV (volume control) mode is a basic full machinery ventilation mode.
 - ✧ In patient breathing phase, anesthesia machine in accordance with pre-set **【Vt】**, **【Freq】** 和 **【I:E】** parameter values to use a constant aspirated speed to delivery the fresh gas into the patient's lungs, so that the **【Vt】** can reach the pre-set value during the patient breathing time; then the patient begins to exhale, after the expiration time, turn into inhale, cycle like this.

- 4) Under V-CMV mode, Tidal volume compensation function is based on actual monitoring of exhaled tidal volume to adjust aspirated flow ,in order to compensate the tidal volume loss that circuit compliance bring.Turn on tidal volume compensation function, in order to ensure accurate tidal volume delivery
- 5) **【V-CMV】** mode, pressure and flow waveforms schematic as below:

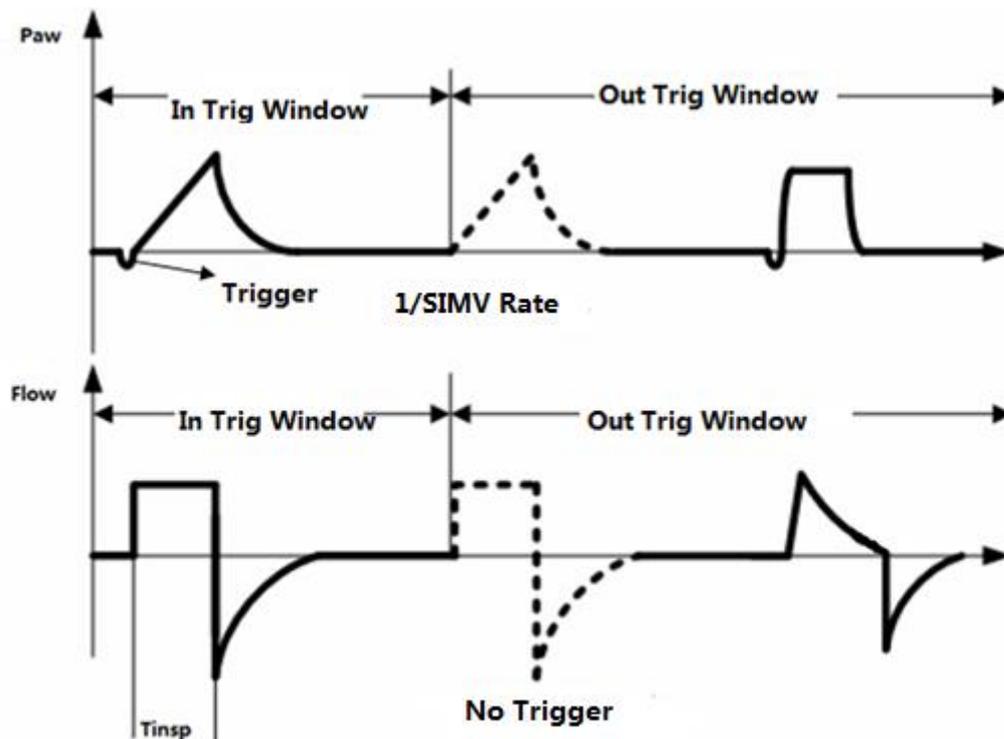


8.3.3 V-SIMV mode

- 1) Select **【V-SIMV】** mode:
 - ✧ centered at the bottom of the screen, select **【V-SIMV】** -> **【Set Mode】**, in the ventilation mode prompt area the system display **【V-SIMV】** .
- 2) **【V-SIMV】** mode, the parameters need to set are below:
 - ✧ **【Vt】**: Tidal volume
 - ✧ **【Freq】**: Breathing rate
 - ✧ **【Tinsp】**: Breathing ratio
 - ✧ **【Tip:Ti】**: Percentage of inspiratory pause (to improve the gas distribution in the patient's lungs)
 - ✧ **【Trigger】**: Touch off
 - ✧ **【Tslope】**: Pressure rise time
 - ✧ **【Plimit】**: Pressure limit level (to avoid high airway pressure harm the patient)
 - ✧ **【PEEP】**: positive end-expiratory pressure (can increase oxygenation in the breathing process, improve end-tidal carbon dioxide emissions)
 - ✧ **【Trig Window】**: Touch off window
 - If need to combine with **【PSV】** ventilation mode to use, also need to set:
 - ✧ **【Psupp】**: Pressure support
- 3) Introduction of the principle:
- 4) V - SIMV mode is a kind of synchronizing intermittent mandatory ventilation mode for forced ventilation through using the V-CMV.V-SIMV mode divided into inside the trigger window and outside the trigger window. As long as the system monitoring achieved the pre setted inspiratory trigger level (pressure trigger or flow trigger) in the trigger window, it triggers a machinery ventilation;if monitoring does not achieved the pre setted inspiratory trigger level in the trigger window, at the end of the synchronization trigger window , the system will conduct a mandatory V-CMV machinery ventilation automatically. If the setting allow to to use with PSV mode,outside

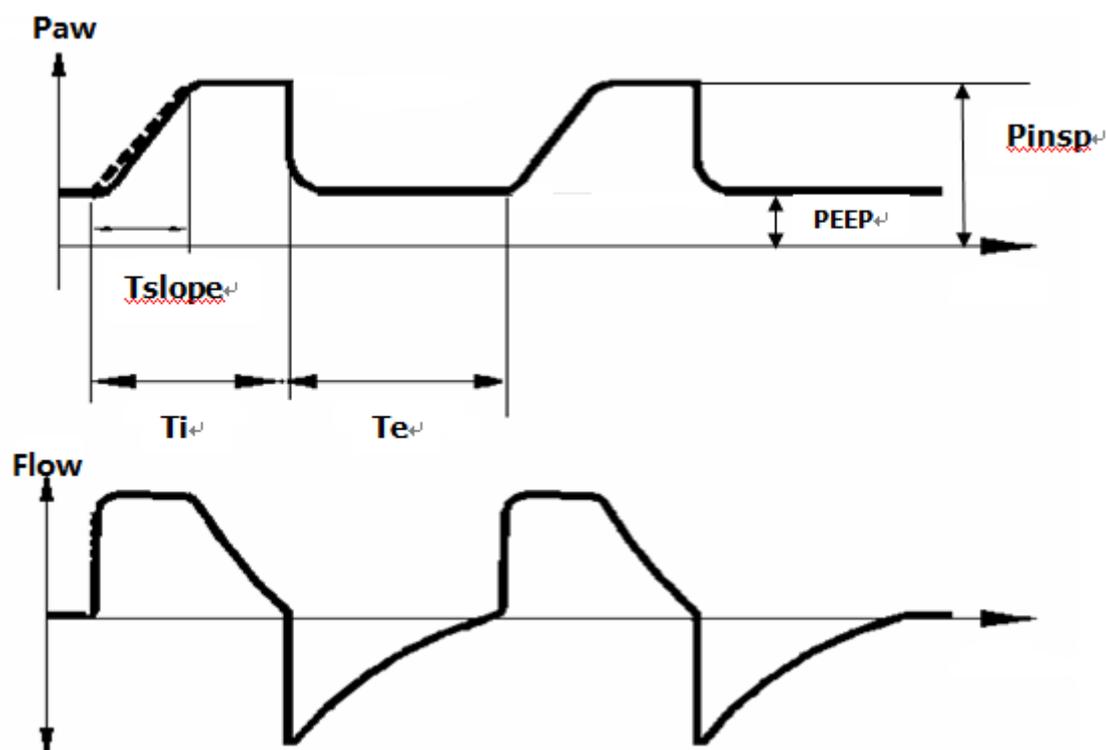
triggerwindow monitored the airway pressure achieved the pre settedinspiratory trigger level , you can start PSV mode ventilation.

- 5) **【V-SIMV】** mode, pressure and flow waveforms schematic as below:



8.3.4 P-CMV mode

- 1) Select P-CMV mode:
 - ✧ centered at the bottom of the screen, select **【P-CMV】** -> **【Set Mode】**, in the ventilation mode prompt area the system display **【P-CMV】**.
- 6) **【P-CMV】** mode, the parameters need to set are below:
 - ✧ **【Pinsp】**: pressure control level
 - ✧ **【Freq】**: Breathing rate
 - ✧ **【I:E】**: Breathing ratio
 - ✧ **【Tslope】**: Pressure rise time
 - ✧ **【Plimit】**: Pressure limit level (to avoid high airway pressure harm the patient)
 - ✧ **【PEEP】**: positive end-expiratory pressure (can increase oxygenation in the breathing process, improve end-tidal carbon dioxide emissions)
- 2) Introduction of the principle:
 - ✧ P-CMV (Pressure control) mode is a basic fully machinery ventilation mode.
 - ✧ During the patient inhale phase,the anesthesia machine according to the pre setted **【Pinsp】** , **【Freq】** and **【I:E】** parameter values, in a fast speed to delivery the fresh gas the the lungs of the patient; When reached the**【Pinsp】**pre setted value, the anesthesia machine reduce the speed, keep the **【Pinsp】** pre setted value, until the patient inhale phase finished, then start the patient exhale phase.
- 3) **【P-CMV】** mode, pressure and flow waveforms schematic as below:

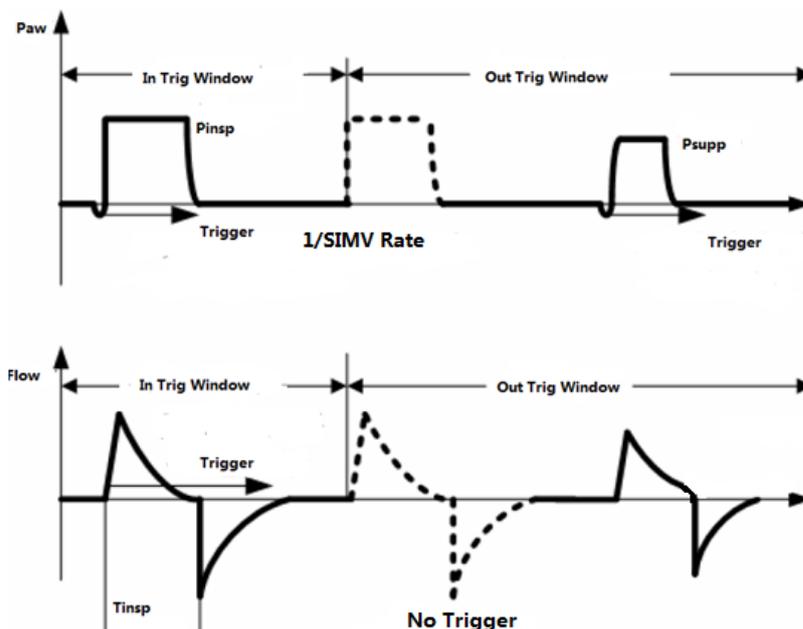


8.3.5 P-SIMV mode

- 1) Select **【P-SIMV】** mode:
 - ✧ centered at the bottom of the screen, select **【P-SIMV】** -> **【Set Mode】**, in the ventilation mode prompt area the system display **【P-SIMV】**.
- 7) **【P-SIMV】** mode, the parameters need to set are below:
 - ✧ **【Pinsp】**: pressure control level
 - ✧ **【Freq】**: Breathing rate
 - ✧ **【Tinsp】**: Inspiratory time
 - ✧ **【Trigger】**: Touch off
 - ✧ **【Tslope】**: Pressure rise time
 - ✧ **【Plimit】**: Pressure limit level (to avoid high airway pressure harm the patient)
 - ✧ **【PEEP】**: positive end-expiratory pressure (can increase oxygenation in the breathing process, improve end-tidal carbon dioxide emissions)
 - ✧ **【Trig Window】**: Touch off window
 - If need to combine with **【PSV】** ventilation mode to use, also need to set:
 - ✧ **【Psupp】**: Pressure support level
- 2) Introduction of the principle:
- 3) P-SIMV mode is a kind of synchronizing intermittent mandatory ventilation mode for forced ventilation through using the P-CMV.P-SIMV mode divided into inside the trigger window and outside the trigger window. As long as the system monitoring achieved the pre setted inspiratory trigger level (pressure trigger or flow trigger) in the trigger window, it triggers a machinery ventilation;if monitoring does not achieved the pre setted inspiratory trigger level in the trigger window, at the end of the synchronization trigger window , the system will conduct a mandatory P-CMV machinery ventilation automatically. If the setting allow to to use with PSV mode,outside

trigger window monitored the airway pressure achieved the pre setted inspiratory trigger level , you can start PSV mode ventilation.

- 4) **【P-SIMV】** mode, pressure and flow waveforms schematic as below:



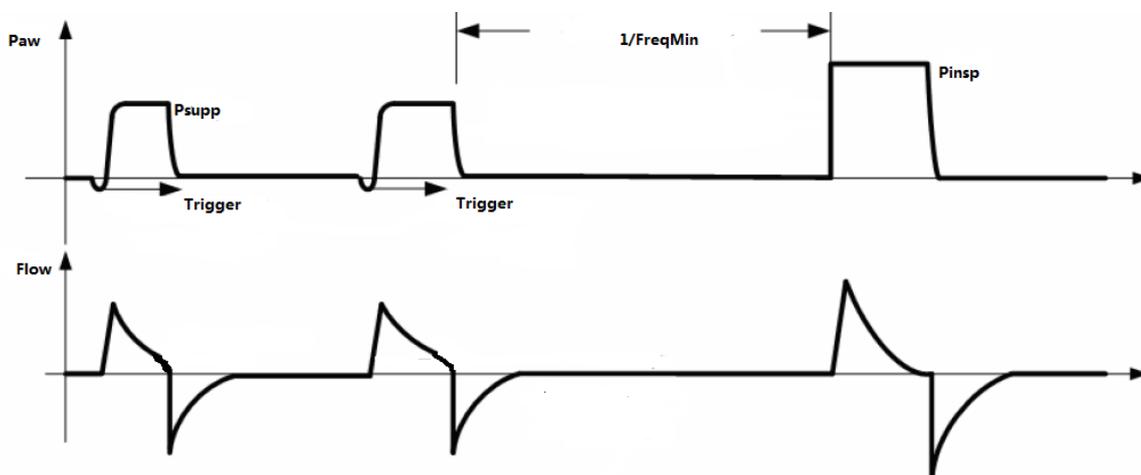
8.3.6 PSV mode

- 1) Select **【PSV】** mode:
 - ✧ centered at the bottom of the screen, select **【PSV】** -> **【Set Mode】**, in the ventilation mode prompt area the system display **【PSV】**.
- 8) **【PSV】** mode, the parameters need to set are below:
 - ✧ **【Psupp】**: Pressure support level
 - ✧ **【FreqMin】** : Spare minimum breathing rate
 - ✧ **【Tslope】**: Pressure rise time
 - ✧ **【Trigger】**: Touch off level
 - ✧ **【Plimit】**: Pressure limit level (to avoid high airway pressure harm the patient)
 - ✧ **【PEEP】**: positive end-expiratory pressure (can increase oxygenation in the breathing process, improve end-tidal carbon dioxide emissions)
- 2) The principle description:
 - ✧ PSV (Pressure support) mode is a ventilation mode that auxiliary respiration mode, it is based on the patient's autonomous respiration, then combine the ventilator to achieve scheduled inhale positive airway pressure.
 - ✧ **【PSV】** ventilation mode must be triggered by patients with autonomous respiration, so when you start this mode you should set well spare PCV mandatory ventilation mode. When the patient autonomous respiration can not achieve **【Trigger】**, or without autonomous respiration, as long as achieved **【FreqMin】**, then can start PCV mandatory ventilation mode to ventilate to the patient automatically. Under **【PSV】** mode, a breath process in accordance with the time switch into inspiratory and expiratory phase. During the patient's inspiratory phase, it's autonomous inspiratory achieved the expectant inhale trigger level, will trigger the ventilator to delivery gas with inspiratory flow speed: First promote the air way pressure to the

expectant **Psupp** (Pressure support) level, then under the system control reduce the speed and to keep the **Psupp** (Pressure support) level, until the patient inhale phase finished, then start the patient exhale phase.

◇ **Vt** (Tidal volume) under PSV mode changing constantly, so there is no need to set.

3) **【PSV】** mode, pressure and flow waveforms schematic as below:



8.3.7 PCV-VG mode

1) Select **【PCV-VG】** mode:

◇ centered at the bottom of the screen, select **【PCV-VG】** -> **【Set Mode】**, in the ventilation mode prompt area the system display **【PCV-VG】**.

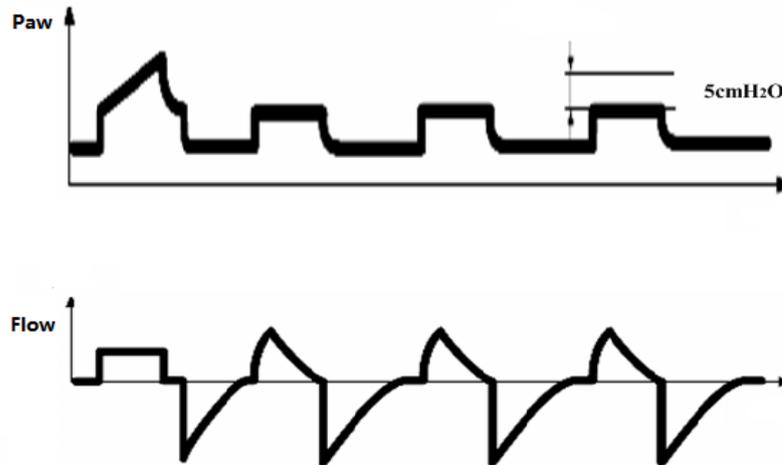
9) **【PCV-VG】** mode, the parameters need to set are below:

- ◇ **【Vt】**: Tidal volume
- ◇ **【Freq】**: Breathing rate
- ◇ **【I:E】**: Breathing ratio
- ◇ **【Tslope】**: Pressure rise time
- ◇ **【Plimit】**: Pressure limit level (to avoid high airway pressure harm the patient)
- ◇ **【PEEP】**: positive end-expiratory pressure (can increase oxygenation in the breathing process, improve end-tidal carbon dioxide emissions)

2) Introduction of the principle:

- ◇ **【PCV-VG】** mode is a kind of pressure regulating volume control ventilation mode.
- ◇ **【PCV-VG】** as a tidal volume to guarantee control ventilation, this ventilation is done by the regulation of pressure control level. Every time enter PCV-VG mode, the first period all conduct a tentative ventilation (V-CMV mode). P_{plat} measured in the tentative ventilation period as the goal pressure of the next ventilation, each period according to the difference monitored between tidal volume and setted tidal volume to calculate the target pressure in next ventilation period.

3) **【PCV-VG】** mode, pressure and flow waveforms schematic as below:



8.4 Ventilator parameters setting



caution:

- If you need to adjust some parameter you must confirm it first. If you want to regain the previous setted value, you need to reset it.
- If some parameter adjusted exceed the reasonable range, the system will show a prompt message.

8.4.1 Set the Tidal volume

- 1) Select **【V-CMV】**, **【V-SIMV】** or **【PCV-VG】** -> **【Vt】** soft key.
- 2) Pop up the prompt setting window, use your finger press the frame and slide to the right, the value gradually increase; slide to the left, the value gradually reduce; or long press **【➡】** and no release, the value gradually increase; long press **【⬅】** and no release, the value gradually reduce; also you can press **【➡】** or **【⬅】** release, the value increase or reduce one step length. Set **【Vt】** to the appropriate value.
- 3) Press **【✔】** to confirm your setting take effect; press **【✘】** cancel setting and not take effect.

8.4.2 Set Breathing rate

- 1) Select **【V-CMV】**, **【V-SIMV】**, **【P-CMV】**, **【P-SIMV】** or **【PCV-VG】** -> **【Freq】** soft key.
- 4) Pop up the prompt setting window, use your finger press the frame and slide to the right, the value gradually increase; slide to the left, the value gradually reduce; or long press **【➡】** and no release, the value gradually increase; long press **【⬅】** and no release, the value gradually reduce; also you can press **【➡】** or **【⬅】** release, the value increase or reduce one step length. Set **【Freq】** to the appropriate value.
- 2) Press **【✔】** to confirm your setting take effect; press **【✘】** cancel setting and not take effect.

8.4.3 Set Inspiratory time

- 1) Select **【V-SIMV】** or **【P-SIMV】** -> **【Tinsp】** soft key.
- 5) Pop up the prompt setting window, use your finger press the frame and slide to the right, the value gradually increase; slide to the left, the value gradually reduce; or long press **【➡】** and no release, the value gradually increase; long press **【⬅】** and no release, the value gradually reduce; also you can press **【➡】** or **【⬅】** release, the value increase or reduce one step length. Set **【Tinsp】** to the appropriate value.
- 2) Press **【✔】** to confirm your setting take effect; press **【✖】** cancel setting and not take effect.

8.4.4 Set the pressure rise time

- 1) Select **【V-SIMV】**, **【P-CMV】**, **【P-SIMV】** or **【PCV-VG】** -> **【Tslope】** soft key.
- 6) Pop up the prompt setting window, use your finger press the frame and slide to the right, the value gradually increase; slide to the left, the value gradually reduce; or long press **【➡】** and no release, the value gradually increase; long press **【⬅】** and no release, the value gradually reduce; also you can press **【➡】** or **【⬅】** release, the value increase or reduce one step length. Set **【Tslope】** to the appropriate value.
- 2) Press **【✔】** to confirm your setting take effect; press **【✖】** cancel setting and not take effect.

8.4.5 Set Breathing ratio

- 3) Select **【V-CMV】**, **【P-CMV】** or **【PCV-VG】** -> **【I:E】** soft key.
- 7) Pop up the prompt setting window, use your finger press the frame and slide to the right, the value gradually increase; slide to the left, the value gradually reduce; or long press **【➡】** and no release, the value gradually increase; long press **【⬅】** and no release, the value gradually reduce; also you can press **【➡】** or **【⬅】** release, the value increase or reduce one step length. Set **【I:E】** to the appropriate value.
- 1) Press **【✔】** to confirm your setting take effect; press **【✖】** cancel setting and not take effect.

8.4.6 Set Pressure limit level

- 1) Select **【V-CMV】**, **【V-SIMV】**, **【P-CMV】**, **【P-SIMV】**, **【PSV】** or **【PCV-VG】** -> **【Plimit】** soft key.
- 8) Pop up the prompt setting window, use your finger press the frame and slide to the right, the value gradually increase; slide to the left, the value gradually reduce; or long press **【➡】** and no release, the value gradually increase; long press **【⬅】** and no release, the value gradually reduce; also you can press **【➡】** or **【⬅】** release, the value increase or reduce one step length. Set **【Plimit】** to the appropriate value.
- 2) Press **【✔】** to confirm your setting take effect; press **【✖】** cancel setting and not take effect.

8.4.7 Set Inspiratory pause

- 4) Select **【V-SIMV】** or **【V-CMV】** -> **【Tip:Ti】** soft key.
- 9) Pop up the prompt setting window, use your finger press the frame and slide to the right, the value gradually increase; slide to the left, the value gradually reduce; or long press **【➡】** and no release, the value gradually increase; long press **【⬅】** and no release, the value gradually reduce; also you can press **【➡】** or **【⬅】** release, the value increase or reduce one step length. Set **【Tip:Ti】** to the appropriate value.
- 1) Press **【✔】** to confirm your setting take effect; press **【✘】** cancel setting and not take effect.

8.4.8 Set PEEP

- 5) Select **【V-CMV】**, **【V-SIMV】**, **【P-CMV】**, **【P-SIMV】**, **【PSV】** or **【PCV-VG】** -> **【PEEP】** soft key.
- 10) Pop up the prompt setting window, use your finger press the frame and slide to the right, the value gradually increase; slide to the left, the value gradually reduce; or long press **【➡】** and no release, the value gradually increase; long press **【⬅】** and no release, the value gradually reduce; also you can press **【➡】** or **【⬅】** release, the value increase or reduce one step length. Set **【PEEP】** to the appropriate value.
- 6) Press **【✔】** to confirm your setting take effect; press **【✘】** cancel setting and not take effect.

8.4.9 Set Pressure control level

- 7) Select **【P-SMC】** or **【P-SIMV】** -> **【Pinsp】** soft key.
- 11) Pop up the prompt setting window, use your finger press the frame and slide to the right, the value gradually increase; slide to the left, the value gradually reduce; or long press **【➡】** and no release, the value gradually increase; long press **【⬅】** and no release, the value gradually reduce; also you can press **【➡】** or **【⬅】** release, the value increase or reduce one step length. Set **【Pinsp】** to the appropriate value.
- 1) Press **【✔】** to confirm your setting take effect; press **【✘】** cancel setting and not take effect.

8.4.10 Set Psupp

- 8) Select **【V-SIMV】**, **【P-SIMV】** or **【PSV】** -> **【Psupp】** soft key.
- 12) Pop up the prompt setting window, use your finger press the frame and slide to the right, the value gradually increase; slide to the left, the value gradually reduce; or long press **【➡】** and no release, the value gradually increase; long press **【⬅】** and no release, the value gradually reduce; also you can press **【➡】** or **【⬅】** release, the value increase or reduce one step length. Set **【Psupp】** to the appropriate value.
- 1) Press **【✔】** to confirm your setting take effect; press **【✘】** cancel setting and not take effect.

8.4.11 Set Inspiratory touch off level

- 1) Inspiratory touch off type, can select **【Pressure】** or **【Flow】** touch off.
- 2) Select **【V-SIMV】**, **【P-SIMV】** or **【PSV】** -> **【Trigger】** soft key.
- 13) Pop up the prompt setting window, use your finger press the frame and slide to the right, the value gradually increase; slide to the left, the value gradually reduce; or long press **【➡】** and no release, the value gradually increase; long press **【⬅】** and no release, the value gradually reduce; also you can press **【➡】** or **【⬅】** release, the value increase or reduce one step length. Set **【Trigger】** to the appropriate value.
- 9) Press **【✔】** to confirm your setting take effect; press **【✖】** cancel setting and not take effect.

8.4.12 Set touch off window

- 1) Select **【V-SIMV】** or **【P-SIMV】** -> **【Trig Window】** soft key.
- 14) Pop up the prompt setting window, use your finger press the frame and slide to the right, the value gradually increase; slide to the left, the value gradually reduce; or long press **【➡】** and no release, the value gradually increase; long press **【⬅】** and no release, the value gradually reduce; also you can press **【➡】** or **【⬅】** release, the value increase or reduce one step length. Set **【Trig Window】** to the appropriate value.
- 2) Press **【✔】** to confirm your setting take effect; press **【✖】** cancel setting and not take effect.

8.4.13 Set Spare mode start time

- 1) Select **【PSV】** -> **【FrerqMin】** soft key.
- 15) Pop up the prompt setting window, use your finger press the frame and slide to the right, the value gradually increase; slide to the left, the value gradually reduce; or long press **【➡】** and no release, the value gradually increase; long press **【⬅】** and no release, the value gradually reduce; also you can press **【➡】** or **【⬅】** release, the value increase or reduce one step length. Set **【FrerqMin】** to the appropriate value.
- 2) Press **【✔】** to confirm your setting take effect; press **【✖】** cancel setting and not take effect.

8.5 Start Machinery ventilation



caution:

- Before start a new ventilation mode, please ensure all related parameters have been adjusted to appropriate value and check if the system configuration is correct.

After setted all the related parameter values,click **【Start Ventilation】** in the standby interface to quit the standby state and work as the setted the machinery ventilation mode.

8.6 Stop Machinery ventilation

When you confirm to stop machinery ventilation,you can operate as following ways:

- 1) Before stop machinery ventilation, adjust evaporator control valve to 0 position ,make sure the APL valve has setted to the appropriate position and the reathing bag installed to the port of manual storage airbag .
- 2) Switch the Manual/ Mechanical control switch to the manual position,switch to manual ventilation then stop the machinery ventilation; or turn on ACGO, stop the machinery ventilation directly.



caution:

- **After stop machinery ventilation,do not stop ventilate to the patient immediately,please select manual ventilation.Can move away the anesthesia machine when the patient can breath autonomously.**

Chapter 9 Anesthetic gas and CO₂ module

9.1 Summary

Anesthetic gas and Co₂ module using the principle of gas having absorption characteristics with infrared to measure the gas concentration. All the gases that can be measured by the module can absorb the infrared and each gas has its own absorption characteristics. The gas sent to a sampling room, infrared filter select a particular band infrared through the gas. If measure with several gases, then it will have a number of infrared filter. In a given volume, the higher the gas concentration, the more infrared absorbed, the less the transmission volume of infrared that through the gas. Through measuring the transmission volume of infrared can calculate the gas concentration.

Anesthetic gas module can monitor Enflurane, Isoflurane, Sevoflurane, Desflurane and Fluothane five kinds of anesthetic, Nitrous oxide and Co₂. Also divided into Main stream (IRMA AX+) and Side stream (ISA AX+).

Co₂ module only monitor the gas concentration of CO₂. Also divided into Main stream (IRMACO₂) and Side stream (ISA CO₂).

Caution:

- For guarantee the safety of the patient, when operate this Anesthesia machine you need to monitor the anesthetic and Co₂. If the anesthetic system doesn't configure anesthetic gas module or (and) Co₂ module, please use the module that having anesthetic gas or (and) Co₂ monitor function which comply with relevant standard requirements to ensure the anesthetic system can realize the monitoring of anesthetic gas and Co₂ in the meantime.
- Rise to 10kPa periodic pressure doesn't affect the performance of gas monitor.

9.2 Minimum alveolar concentration

MAC (minimum alveolar concentration), mean minimum alveolar concentration, it's the basic indicator that reflect inhalation anesthetic concentration. Standard ISO 21647 for the definition of MAC: When there is no exist other anesthetic and achieve a balance, some alveolar concentration of anesthetic inhaled, the concentration can prevent 50% of patients' limb movements in a standard surgical stimulation.

Using Tidal anesthetic gas concentration calculate and MAC display, calculated as follows:

$$\text{MAC} = \text{Et}(\text{AG1})\% / \text{X}(\text{AG1}) + \text{Et}(\text{AG2})\% / \text{X}(\text{AG2}) + \text{Et}(\text{N}_2\text{O})\% / 100$$

Formula Et (AG1)% and Et (AG2)%, respectively, on behalf of an inhaled anesthetic end-tidal concentration, Et (N₂O)% on behalf of the end-tidal concentration of N₂O. X (AG1) and X (AG2) respectively on behalf of a corresponding MAC concentration values of the inhaled anesthetics: enflurane

(ENF) = 1.7%, isoflurane (ISO) = 1.15%, sevoflurane (SEV) = 2.05 % desflurane (DES) = 7.3%, halothane (HAL) = 0.77%.

For example, Anesthetic gas module monitored the end-expiratory gas of the patient contains 2.6% ISO、4%ENF、42%N₂O, then the MAC value is:

$$\text{MAC}=(2.6\%/1.15\%)+(4\%/1.7\%)+(42\%/100)=5.0$$

 **caution:**

- **Above formula does not consider the patient's age, personal factors and altitude.**

9.3 Monitoring ways

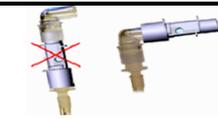
9.3.1 Main stream

IRMA main stream Anesthetic gas module、Co₂ module is install it's probe to the airway adapter, then insert the airway adapter to the connection port between endotracheal tube and breathing circuit Y-shaped tube,the module through the two sides window of the IRMA airway adapter to read the respiratory gas measurement value.The two sides windows of airway adapter use the special design and material, can prevent performance degradation due to water vapor.

 **caution:**

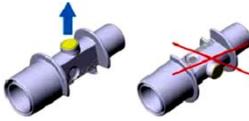
- **Main stream IRMA module can only be used by trained or authorized medical staff.**
- **IRMA module can not be used in flammable anesthetic gas environment.**
- **IRMA module banned for MRI environment.**
- **To avoid cross-infection,do not reuse disposable IRMA airway adapter.**
- **The used disposable airway adapter should be disposed according to local medical waste disposal regulations.**
- **If IRMA airway adapter occurs water droplets / condensation, replace the adapter.**
- **Use only with IRMA monitor supporting PHASEIN airway adapter.**
- **After IRMA adult / pediatric model airway adapter access to circuit will increase 6mL of dead space, and therefore prohibited for infants.**
- **Do not use IRMA infant airway adapter for adults, otherwise it will lead to excessive flow resistance.**
- **To avoid the patient's secretions clogging the adapter window caused operational errors, do not put IRMA airway adapter between the endotracheal tube and elbows.**

- Ensure IRMA module is



placed in the vertical direction and the status

LED upward.



- To avoid effect the light propagation of airway adapter windows, do not use airway adapter and quantitative spray or spray together.
- Ensure IRMA module used in electromagnetic environment that this specification defined, in case of to be affected by mobile or portable communication devices.
- IRMA module is only designed as an auxiliary method to patient assessment. Always with other vital signs and symptoms assessed with the use of equipment. Please use it together with other vital signs and symptoms assessed equipment.

 **Caution:**

- Do not stretch IRMA module probe cable.

9.3.2 Side stream

ISA side stream anesthetic gas module, Co2 module is through the sampling tube to collect a small quantity of mixed gas from the endotracheal tube of breathing circuit, which is transferred to the sampling gas input port of the monitors, the module will measure and analysis the sample gas. Nonline sampling tube has a special impermeable area regardless of the direction, the impermeable area with a hydrophobic bacterial filter and made of special polymer. Impermeable area can remove the condensate that produced by sampling gas or removal inhaled water, serve to prevent cross-contamination caused by moisture intruded into the monitor. The design of sampling tube ensures sampling air flow continuous unimpeded, and therefore the response time of measure the gas is very short.

 **Caution:**

- Side stream ISA module can only be used by trained or authorized medical staff.
- ISA module can not be used in flammable anesthetic gas environment.
- Use only with ISA module supporting PHASEIN sampling tube.
- To reduce the risk of bridling or entangling the patient, be sure to carefully straighten out the sampling tube.
- To avoid cross-infection, do not reuse disposable sampling tube.

- The used disposable sampling tube should be disposed according to local medical waste disposal regulations.
- Do not through Nomoline sampling tube apply negative pressure (such as using a syringe) to remove condensate.
- Do not grab sampling tube to lift the ISA module or system components, or it may make off with the ISA module or system components, resulting in ISA module or system components fall on the patient.
- To avoid the ISA module fall on the patient, please ensure it has been fixed when using.
- After ISA adult / pediatric model sampling tube access to circuit will increase the patient's dead space, and therefore prohibited for infants.
- Do not use ISA infant sampling tube for adults, otherwise it will lead to excessive flow resistance.
- If the collection of gas sample need to provide gas for breathing, always use bacteria filter in the exhaust side.
- Ensure ISA module used in electromagnetic environment that this specification defined, in case of to be affected by mobile or portable communication devices.
- ISA monitor or system uses high-frequency electro-surgical devices in the vicinity may cause interference, and led to incorrect measurements.
- ISA monitor banned for MRI environment.
- To avoid bacterial filter clogging, do not use ISA monitor and quantitative spray or spray together.
- Check if the sample gas flow rate for given patient type is too high.
- If the screen prompts Nomoline blockage information or the input port of ISA sampling tube is beginning to show red flash, replace the sampling tube.
- Do not make any changes to the ISA module, If it has been changed, please do appropriate tests and inspections to ensure long-term safe operation.
- Do not use ISA module external natural cooling function.
- If the patient circuit's positive or negative pressure is too large, which may affect the sample flow.
- If the discharge suction pressure is too large, it may affect the sample flow.

**Caution:**

- Exhaust gases should be discharged into the drainage system.
- ISA module is only designed as an auxiliary method to patient assessment. Please use it together with other vital signs and symptoms assessed equipment.

 **Caution:**

- Do not stretch ISA monitor probe cable.
- To avoid the damage to ISA monitor, should be ensure it has been fixed installed.

9.3.3 Set AG

- 1) In standby state, select **【Maintain】** soft key, popup password box, input the correct password, select **【Enter】** button, enter the setting option.
- 2) Select **【confi】** -> **【Gas Module Setting】** -> **【AG Module】**.

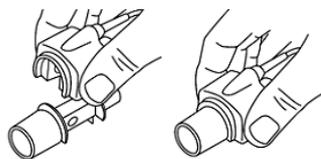
9.3.4 Set CO2

- 3) In standby state, select **【Maintain】** soft key, popup password box, input the correct password, select **【Enter】** button, enter the setting option.
- 1) Select **【confi】** -> **【Gas Module Setting】** -> **【CO₂ Module】**.

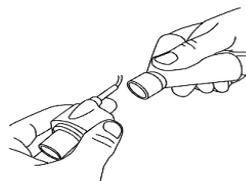
9.4 Mainstream Anesthetic gas module and Co2 module

9.4.1 Installation

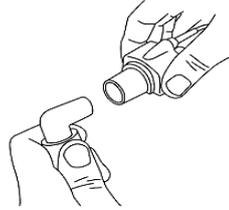
- 1) Make sure the anesthesia machine is turned off, connect the communication port of IRMA monitor with the module interface cable on the backboard of the anesthesia machine, see chapter "3.2.2 Rear View";
- 2) Install IRMA probe to the airway adapter, the probe buttoned means installed correctly;



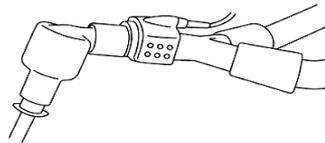
- 3) Connect the 15mm male adapter of the airway adapter to the connection port of the patient Y-shaped tube of breathing circuit;



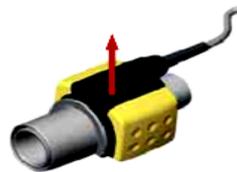
- 4) Connect the 15mm female adapter of the airway adapter to the patient's endotracheal tube;



Also can connect HME(heat and Moisture Exchanger) between the patient's endotracheal tube and IRMA probe. Can protect the airway adapter from affected by secreta and water vapor through put the HME in front of the probe, so there is no need to replace the adapter. In addition, by installing the exchanger, can place IRMA probe at will.



- 5) Unless use HME to protect IRMA probe, ensure when place the IRMA probe , the status LED is always upward.



- 6) Press the start key to start the system, in the beginning the LED on probe flashes, probably about 10 seconds later turn to normally green.



- 7) AG module defaults to standby mode, when connected AG module, the screen will display **【AG is sleeping】** .
- 8) Click **【Menu】** hot key->**【System Setup】**, enter "System Setup" interface, select "Gas Module" option; **【Operating Mode】** -> **【Measure】** , the screen display **【AG is starting】** .
- 9) After finish the preheat the module into full precision measurement state.

⚠ Caution:

- **IRMA probe is not designed to be used in contact with the patient;**
- **When connected the IRMA probe to the patient circuit, IRMA probe must avoid direct contact with the patient's body;**
- **No matter for any reason need to use the IRMA probe to contact with the patient's body directly, must use an insulating material between the IRMA probe and body.**

9.4.2 Checking before using

Before connecting the breathing circuit of IRMA Airway adapter to the patient, be sure to perform the following operations:

- 1) Ensure that you have finished all related operations in Chapter "9.4.1 Installation" ;
- 2) Connect the airway adapter to patient circuit, should observe the gas readings and waveforms display on anesthesia machine interface;
- 3) After installed the IRMA probe on the IRMA airway adapter, do tightness check for the patient circuit .

9.4.3 Affecting factors of monitoring

Factors affecting the monitoring accuracy of mainstream gas monitor to, including:

- Quantitative effects of humidity or condensation;
- Quantitative effects of atmospheric pressure (see Chapter "9.5.3 Monitoring Factors" described the effects of atmospheric pressure);
- Interfering gases or water vapor;
- Other interference sources.

9.4.4 Monitor calibration

In the following situations Main stream Anesthetic gas module (IRMA AX+)、Main stream Co2 module (IRMA CO₂) should be calibrated to zero:

- Everytime after start IRMA probe or change IRMA airway adapter;
- Display the gas concentration appear an offset or accuracy error.

IRMA zero calibration operation as follows:

- 1) IRMA monitor to atmospheric, see step 1)~step 2) in Chapter "9.4.1 installation";
- 2) Press the system switch button to start the system. The LED on IRMA probe from flash to normally green, need wait about 30s in order to wait the probe pre-heat;
- 3) Select  -> **【Sensor Parameter】** -> **【CO₂】**, press **【Start】** button, the screen will display **【AG is zeroing】**, in the meantime IRMA probe LED flash display, lasts about 5s, and **【Start】** button turn to **【Stop】** button; after finish checking, **【Start】** button turn to the original one, in the meantime prompt the test result, if the test passed, prompt: **【PASS】**; if failed, prompt: **【Failure】**.
- 4) If zero calibration failed, please try again after change airway adapter.

⚠ Caution:

- **Incorrect IRMA probe zero calibration will cause false gas reading;**
- **After finish IRMA probe ZERO calibration should always check before using.**

⚠ Caution:

- **When do IRMA probe zero calibration should ensure it doesn't connect with the patient;**
- **Before or during do IRMA probe zero calibration, should pay special attention to avoid airway adapter close to airway adapter, exist air in the IRMA airway adapter is very important for zero calibrating successfully;**
- **When standard zero calibration failed, if prompt calibration failed after re-calibration, please contact with our after-sales service department.**

9.4.5 Module LED status information

LED on mainstream gas module offers a variety of instructions in order to reflect the current state in time:

Display mode	Statements
Green light no twinkle	System OK
Green light twinkle	Calibrating
Blue light no twinkle	Exist anesthetic gas
Red light no twinkle	Sensor error
Red light twinkle	Check the adapter
Note1: Only apply to IRMA AX+ main stream anesthetic gas module.	

9.4.6 Module cleanliness

Allow to clean the probe. Before cleaning should take down the airway adapter, then use the damp cloth that soaked in the highest concentration of 70% of medical alcohol to clean the probe, at last, with a dry lint-free cloth to dry it.

⚠ Caution:

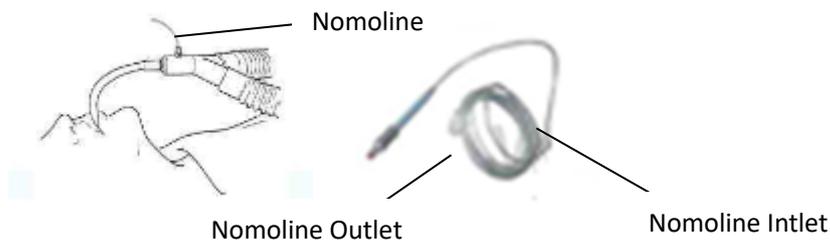
- **When do IRMA probe zero calibration should ensure it doesn't connect with the patient;**

- Before or during do IRMA probe zero calibration, should pay special attention to avoid airway adapter close to airway adapter, exist air in the IRMA airway adapter is very important for zero calibrating successfully;
- When standard zero calibration failed, if prompt calibration failed after re-calibration, please contact with our after-sales service department.

9.5 Sidestream Anesthetic gas module and Co2 module

9.5.1 Installation

- 1) Make sure the anesthesia machine is turned off, connect the communication port of IRMA monitor with the module interface cable on the backboard of the anesthesia machine, see chapter “3.2.2 Rear View”;
- 2) Connect Nomoline sampling tube output port to the air inlet port of ISA monitor ;
- 3) ISA monitor air outlet port , use soft tube connect to AGSS system, discharge the exhaust gas together with AGSS;
- 4) Connect Nomoline gas inlet port of sampling tube to the sampling port of the patient's breathing circuit;



- 5) Press the system switch button, start the system;
- 6) After LED flash on ISA monitor flashed several seconds turn to normally on means measuring state.
- 7) Sidestream module defaults to standby mode, when connected sidestream module, the screen will display **【AG is sleeping】** .
- 8) Click **【Menu】** hot key -> **【System Setup】**, enter “System Setup” interface, select “Gas Module” option; **【Operating Mode】** -> **【Measure】**. The screen display **【AG is starting】**.

9.5.2 Checking before using

Before connecting Nomoline sampling tube to the mask of the patient, please do the following checking:

- 1) Ensure that you have finished all related operations in Chapter "9.5.1 Installation";
- 2) Exhale to the sampling tube to check if the monitoring interface of the anesthesia machine has display valid Co2 waveform and value;
- 3) Use your fingertip to block off the sampling tube, last 10 seconds, should be observed on the anesthetic operation interface display “* Please check the sampling tube”, in the meantime the red LED light on the

monitor flash;

- 4) In appropriate situation, to check the patient breathing circuit and sealing of the connection of the sampling tube;
- 5) After finish above steps, can connect the Nomoline sampling tube to the patients' mask or Y shaped connector.



caution:

- **To prevent contaminate operating room, make sure the sidestream gas outlet through the soft tube connected to the AGSS system. Discharge the exhaust together with AGSS.**
- **The leak of sample gas will cause the measurement accuracy beyond specification; internal exhaust is not smooth, it may cause the monitor can not working properly. Therefore, we must ensure the correct connection.**

9.5.3 Affecting factors of monitoring

Effects of atmospheric pressure

Use the percentage of the volume as the unit to report the gas concentration, at this time the measurement results are not affected by atmospheric pressure. Concentration is defined as follows:

$$\% \text{gas} = \text{Partial pressure of gas component} / \text{Total pressure of gas mixture} * 100$$

The total pressure of the mixed gas using the cup pressure sensor of ISA gas analyzer to measure.

When the test result using partial pressure indicated that it is related with the current atmospheric pressure, need to be calculated based on the actual atmospheric that the analyzer sent, the following formula:

$$\text{Co}_2 \text{ (mmHg)} = \text{Co}_2 \text{ concentration} \times \text{pressure from the ISA (kPa)} \times (750/100).$$

For example: 5.0Vol% Co₂(101.3kPa), according to the above method transfer: $0.05 \times 101.3 \times 750/100 = 38$ mmHg.

Effects of moisture

The partial pressure and the volume percentage of Co₂, Nitrous oxide, O₂ and Anesthetic depend on water vapor content. Calibrate the O₂ measurement will display 20.8Vol% at the actual ambient temperature and humidity level, but not the actual partial pressure. 20.8Vol% O₂ corresponding to the actual O₂ concentration in the room (water concentration 0.7Vol%) (e.g., at 101.3kPa, corresponding to 25 °C and 23% RH). When measuring Co₂, Nitrous oxide and O₂(for example, all gas measured by the infrared pool) will always show the actual partial pressure in current humidity level.

In patient's alveolar, water vapor in respiratory gas at body temperature achieved saturated (BTPS).

After collected and put the breathing gas to the sampling tube, before the gas enter ISA sidestream monitor, its temperature turn to close to ambient temperature. When Nomoline sampling tube remove all condensed water, the moisture will not enter ISA sidestream monitor. The relative humidity of the collected gas is about 95%.

If you need Co2 value under BTPS, the formula as follow:

$$EtCO_2(BTPS) = EtCO_2 * (1 - (3.8 / pamb))$$

Of which: $EtCO_2$ = from ISA delivered $EtCO_2$ value [Vol%]

$pamb$ = from ISA delivered atmospheric pressure [kPa]

3.8 = typical partial pressure between the patient circuit and the water vapor of condensed water of ISA [kPa]

$$EtCO_2(BTPS) = EtCO_2 \text{ value [Vol%] under BTPS}$$

Assumed to have been calibrated the O2 using the room air in 0.7Vol% H2O humidity level.

9.5.4 Module calibration

ISA marginalia gas analyzer with automatic zero calibration function, no need the user to operate. Switch the gas sampling from the breathing circuit to ambient air will calibrate to zero automatically. Every 24 hours to perform an automatic zero calibrate, ISA CO2 module calibration takes less than 3s, ISA AX + monitor calibration time less than 10s.

Caution:

- Exist air in the ISA module is very important for zero calibrating successfully, so need to ensure it's ventilated environment is good; before and after zero calibration, avoid breathing in it's vicinity.
- ISA modules adopt stable design, and has been done a permanent calibration when leave factory, so no need for routine calibration. When appear a large measurement bias or need the annual calibration, please contact our after-sales service department for professional calibration.

9.5.5 Module LED status information

LED on sidestream gas module offers a variety of instructions in order to reflect the current state in time:

Display mode	Statements
Green light no twinkle	System OK
Green light twinkle	Calibrating
Blue light no twinkle	Exist anesthetic gas
Red light no twinkle	Sensor error
Red light twinkle	Check the sampling pipe

9.5.6 Module cleanliness

Allow do regularly cleaning for the monitor. To avoid dust or cleaning liquid through LEGI interface enter the monitor, during the cleaning process should always make sure Nomoline sampling tube is connected with the monitor. When cleaning the monitor, first use the damp cloth that soaked in the highest concentration of 70% of medical alcohol to wipe clean the probe, at last, with a dry lint-free cloth to dry it.

Caution:

- **Do not soak the ISA module in liquid or disinfect it;**
- **Nomoline sampling tube it's not a sterile component;**
- **Please do not do high-temperature high-pressure sterilization to the ISA module(including the sampling tube), otherwise it will damage the components.**

9.6 Compensation

- 1) If this Anesthesia machine need to configure mainstream CO₂ module (IRMA CO₂), or sidestream Co₂ module (ISA CO₂), need to do N₂O and O₂ compensation set to ensure the accuracy of CO₂ monitoring. Operation see "6.7.3 O₂ Compen " and "6.7.4 N₂O Compen " instructions.
- 2) If this Anesthesia machine need to configure mainstream AG module (IRMA AX+), or sidestream AG module (ISA AX+), need to do O₂ compensation set to ensure the accuracy of CO₂ monitoring. Operation see "6.7.3 O₂ Compen" instructions.

Caution:

- **If equipped IRMA CO₂ or ISA CO₂ module, in the monitored gas exist nitrous oxide or O₂, must do compensation settings for nitrous oxide and O₂, otherwise it will cause the CO₂ monitoring result is not accurate.**
- **If equipped IRMA AX+ or ISA AX+ module, in the monitored gas exist O₂, must do compensation settings for O₂, otherwise it will cause the CO₂ monitoring result is not accurate.**

9.7 About phasein

PHAESIN AB have the following patent related products that this User operation introduced:

SE519766; SE519779; SE523461; SE524086. Other patents are under applying;

PHAESIN AB have the following licensed trademark;

PHAESIN IRMA™、PHAESIN ISA™、Nomoline™、LEGI™.

Chapter 10 Alarm

10.1 Summary



Caution:

- **This anesthesia machine alarm device respectively in accordance with the requirements 51.101.5 in IEC 60601-2-13, 2006 and alarm in the general regulations for IEC 60601-1-8, 2006.**

10.1.1 Alarm type

According to the nature of the alarm, the alarm in anesthesia machine can be divided into physiological alarm, technical alarm and prompt information.

■ Physiological alarm

Physiological alarm is usually due to some physiological parameters of patients exceeds the seted high and low limit range alarm or the patient occurs physiological abnormalities. The physiological alarm information display on the top of the screen of the physiological alarm area.

■ Technical alarm

Technical alarm also known as the system error message, it is to point to some system function can not work normally or the monitoring results in distortion then trigger the alarm which caused by improper operation or system failure normal operation. Technical alarm information display on the top of the screen of the technical alarm area.

■ prompt information

Strictly speaking, prompt information does not belong to the alarm, it is to point to except the Physiological alarm and Technical alarm, the monitor will display some information related to the system state, the information is generally not involved in the patient's vital signs. Generally Prompt information display in the system technology alarm area and parameters area.

10.1.2 Alarm level

According to the severity of the alarm, the physiological alarm of the anesthesia machine can be divided

into advanced alarm, secondary alarm and low level alarm.

- **Senior alarm**

The patient is in critical condition, and may have life risk, should be an immediate rescue;

- **Secondary alarm**

Physical signs of patients with abnormal, should take the corresponding measures and treatment;

- **Low level alarm**

Physical signs of patients with abnormal, maybe need to take the corresponding measures and treatment;

All technical alarm and some physiological alarm level has been set in anesthesia machine factory, the user can't change it. Some physiological alarm level can be modified.

10.2 Alarm mode

when the alarm occurs, the anesthesia machine use the following auditory or visual alarm prompt the user:

- Light alarm
- Audible alarm
- Alarm information
- Parameter twinkle

Among them, the light alarm, audible alarm and alarm information respectively in different ways to distinguish alarm level.

10.2.1 Light alarm

when the alarm occurs, alarm indicator lights use different colors and twinkle frequency suggest different levels of the alarm.

- Senior alarm: Red、twinkle frequency fast
- Secondary alarm: Yellow、twinkle frequency slow
- Low level alarm: Yellow、Normally on not twinkle

10.2.2 Audible alarm

Audible alarm refers to when the alarm occurs, anesthesia machine adopts different voice characteristics to indicate different levels of the alarm.

- Senior alarm: DO-DO-DO--DO-DO----DO-DO-DO--DO-DO
- Secondary alarm: DO-DO-DO
- Low level alarm: DO

When alarms occur, the anesthesia machine prompts the user by the type of audible alarm and visual alarm below:

- Visual alarm
- Audible alarm
- Alarm information

Scintillation of parameters

Herein, Visual alarm, audible alarm and alarm information could distinguish the alarm levels by the different means.

10.2.3 Alarm information

Alarm information is when an alarm occurs, the physiological alarm zone or the technical alarm zone of the anesthesia machine displays the corresponding alarm information. The system distinguishes the levels of the alarm information by the different ground colors

- High-level alarm: red
- Secondary alarm: yellow
- Low-level alarm: yellow

Distinguish the levels of alarm information by these symbols in front of the alarm information:

- High-levels alarm: ***
- Secondary alarm: **
- Low-level alarm: *

10.2.4 Parameters scintillation

When the alarm of parameters which are for monitoring the patients such as monitoring EtCO₂, FiCO₂ and awRR occur, the parameter value will blink once per second frequency, high limit or lower limit of the parameter will also be the same frequency flashing, indicating that the parameter exceeds the upper limit or a low limit.

10.2.5 Alarm status icon

In addition to the above alarm mode, the following alarm status icons will appear on the screen to indicate different states of the alarm.

■  , indicate alarm pause.

10.3 Set the alarm volume

- 1) Click [Menu] -> [Alarm] - [Alarm Volume];
- 2) Alarm Volume: 1 ~ 10.1 is the lowest volume; 10 is the maximum;
- 3) Min Alarm Volume: lowest volume.

10.4 Set the parameter alarms

Set the ventilator's alarm limit

- 1) Click [Menu] -> [Alarm] -> [Alarm Limit].
- 2) Set the parameters one by one [Low Limit] and [High Limit] key, after setting the appropriate value, aligned digital frame click OK again.
- 3) Click on the top right corner [X] to exit.
- 4) Click [Default], converted to factory default settings.

10.4.1 CO₂ alarm limit settings

- 1) Click [Menu] -> [Alarm] -> [Alarm Limit] -> [Other Setup >>] -> [CO₂].
- 2) Set the parameters one by one [Low Limit] and [High Limit] key, after setting the appropriate value, aligned digital frame click OK again.
- 3) alarm switch selection: [on] and [off]. [On] is enabled, [off] for shielding.
- 4) adjustable alarm levels, [Mid] and [High].
- 5) Click [Default] converted to factory default settings.

10.4.2 Set alarm limits N2O

- 1) Click [Menu] -> [Alarm] -> [Alarm Limit] -> [Other Setup >>] -> [N2O].
- 2) Set the parameters one by one [Low Limit] and [High Limit] key after setting the appropriate value, aligned digital frame click OK again.
- 3) alarm switch selection: [on] and [off]. [On] is enabled, [off] is for shielding.
- 4) adjustable alarm levels, [Mid] and [High].
- 5) Click [Default] converted to factory default settings.

10.4.3 Set N2O alarm limits

- 1) Click [Menu] -> [Alarm] -> [Alarm Limit] -> [Other Setup >>] -> [N2O].
- 2) Set the parameters one by one [Low Limit] and [High Limit] key, after setting the appropriate value, aligned digital box click OK again.
- 3) alarm switch selection: [on] and [off]. [On] is enabled, [off] for shielding.
- 4) adjustable alarm levels, [Mid] and [High].
- 5) Click [Default] converted to factory default settings.

10.4.4 Set AA alarm limits

- 1) Click [Menu] -> [Alarm] -> [Alarm Limit] -> [Other Setup >>] -> [AA] -> [HAL Alarm Setup >>] or [DES Alarm Setup >>], [ENF Alarm Setup >>], [SEV Alarm Setup >>], [ISO Alarm Setup >>].
- 2) enter [HAL] interface, you can click on the appropriate options such as [ENF], [ISO], [SEV], [DES] setting.
- 3) set the parameters [Low Limit] and [High Limit] key one by one. after setting the appropriate value, alignment frame click OK again.
- 4) alarm switch selection: [on] and [off]. [On] is enabled, [off] is for shielding.
- 5) adjustable alarm levels, [Mid] and [High].
- 6) Click [Default] converted to factory default settings.

10.4.5 Set suffocation alarm

- 1) Click [Menu] -> [System Setup] -> [Gas Module].
- 2) Apnea Delay: [20s], [25s], [30s], [35s], [40s].

10.5 Alarm response measures

When the anesthesia machine alarm occurs , see the following steps and take the appropriate measures:

- 1) Check the alarm parameter or alarm type.
- 2) Check the patient's condition.
- 3) Identify the Cause of the alarm and the reasons for troubleshooting.

4) After remove the alarm , check the alarm is eliminated or not.

System alarm information and processing methods refer to the chapter "10.6 alarm information table" related content.

10.6 Alarm information table

1) Alarm information includes physical and technical alarm information, but some alarm information is not necessarily listed.

2) with a "●" indicates the level of user-adjustable.

3) AA represents one of the five anesthetic gases DES (desflurane), ISO (isoflurane), ENF (enflurane), SEV (sevoflurane) and HAL(halothane).

4) For each alarm message, list all the corresponding countermeasures. Follow the operations of the countermeasures if the problem persists, contact your service personnel.

10.6.1 Physiological alarm

Physiological alarm information

Alarm information	Level	Reason	Reponse measures
Paw Too High	HIG H	Ppeak Greater than Paw alarm high limit setting	Reduce tidal volume setting or increase Paw alarm high limit setting
Paw Too Low	HIG H	Ppeak less than Paw alarm low limit setting	increase tidal volume setting or reduce Paw alarm low limit setting
MV Too High	MID	MV Greater than alarm high limit setting	Reduce the set tidal volume,reduce the respiratory frequency or increase the alarm high limit setting
MV Too Low	MID	MV less than alarm low limit setting	Increase set tidal volume,increase respiratory frequency or reduce the alarm low limit setting
Vte Too High	MID	Vte Greater than alarm high limit setting	Adjust the respiratory frequency setting,reduce the fresh gas flow,or reduce the set tidal volume or increase the alarm high limit
Vte Too Low	MID	Vte less than alarm low limit setting	Adjust the respiratory frequency setting,increase the fresh gas flow,or increase the set tidal volume or reduce the alarm high limit
FiO ₂ Too High	MID	FiO ₂ greater than alarm high limit setting	reduce the oxygen flow of fresh gas ,or increase the alarm high limit
FiO ₂ Too Low	HIG H	FiO ₂ less than alarm low limit setting	increase the oxygen flow of fresh gas ,or reduce the alarm low limit
Apnea	MID	resp/ventilation	

		stop(pression 、 volume 、 CO2 monitoring)	Check spontaneous breathing, the ventilator settings, fresh gas settings, each connection and piping; immediately manual ventilation.
Apnea>2min	HIG H	Apnoea in 2 mins	Check the connections of pipes, the patient's condition, and switch to manual ventilation mode to ventilate the patient.
Apnea Ventilation	HIG H	Apnoea in the pressure mode	Check the patient's ability to trigger. Correctly set the trigger
Pressure Limiting	LOW	Ppeak greater than the set value of Plimit	Reduce the tidal volume setting or increase the Plimit setting
Continuous Pressure	HIG H	Continuous airway pressure alarm limit is higher than over 15s	Check whether the pipe is bend, blocked or disconnected
Negative Pressure	HIG H	Below atmospheric pressure 10 cmH ₂ O	Check whether the patient breathing spontaneously. Increase Fresh gas flow. Observe whether there is high-speed gas flow through the residual gas removal system. If so, check the negative pressure release valve on the receiver
Rate Too Low	HIG H	Rate less than alarm low limit setting	increase the set value of rate or reduce alarm low limit setting
FiCO ₂ Too High	●	monitoring values greater or less than alarm high limit or alarm low limit setting	If the alarm high limit and low limit are set patient's physiological status appropriate, make adjustments as needed
EtCO ₂ Too High	●		
EtCO ₂ Too Low	●		
awRR Too High	●		
awRR Too Low	●		
FiN ₂ O Too High	●		
FiN ₂ O Too Low	●		
EtN ₂ O Too High	●		
EtN ₂ O Too Low	●		
FiAA Too High	●		
FiAA Too Low	●		
EtAA Too High	●		
EtAA Too Low	●		

10.6.2 Technical alarm

technical alarm information

Alarm information	level	reason	Reponse measures
Battery Low	High	Battery power is less than 20%	Connected to AC power, ready to manual ventilation with 100% oxygen
The system will shut down		Battery power is less than 10%	Connected to AC power, ready to manual ventilation with 100% oxygen
Battery Disconnect	low	Battery is not installed	Check whether the battery is installed or after replacing the battery and installate it.
AC Disconnect	low	AC power is not connected	Check whether the AC is connected or the fuse is burning
Monitor Board Comm.Error	High	Monitoring board communication error	Check the monitoring board and the control board communications and the power supply is normal
Self Check Error	High	Self-test error	Enter the alarm log to check alarm information, please switch to the manually ventilation
Power Failure	High	Power failure	Check the board output voltage is normal, please use the manual ventilation
Expiration Valve Failure	Mid	Exhalation valve failure	Check exhalation valve voltage is normal, please use the manual ventilation
Flow Valve Failure	Mid	Inspiratory valve failure	Check the Inspiratory valve voltage is normal, please use the manual ventilation
Safe Valve Failure	Mid	Proportional valve failure	Check proportional voltage is normal, please use the manual ventilation
Flow Sensor Failure	low	Flow sensor monitoring failure	Check if the flow sensor is deformed, water and so on. Please re-calibration
Calibrate flow Sensor	low	Flow sensor calibration failure	Check whether the front air supply pressure is between 0.4 ~ 0.5MPa and the communication cable for the calibration of the instrument is good
Calibrate pressure Sensor	low	Pressure sensor calibration failure	Check whether the front air supply pressure is between 0.4 ~ 0.5MPa and the communication cable for the calibration of the instrument is good
Safe valve control failure	Mid	Proportional valve control failure	Check whether the operating voltage of proportional valve is normal
Pressure Sensor Failure	Mid	Pressure sensor	Patients end pressure monitoring malfunction,

		failure	use manual ventilation
Calibrate O2 Sensor	low	Oxygen sensor failure	Check the oxygen sensor is expired or failure, replace the oxygen sensor
Low Drive Gas Press	High	Driving gas supply pressure is low	Please use the spare gas cylinders, or using manual ventilation.
No O2 Pressure	High	Insufficient oxygen supply pressure	Using a new oxygen cylinder or open the cylinder valve. Use Central oxygen supply
Zero Valve Failure	low	Valve zero failure	Reboot the machine after a power interruption. Please use the manual ventilation
Check Flow Sensor	High	Abnormal flow sensor readings	calibrate the flow sensor after the reinstallation
Pinsp Not Achieved	low	Unrealized inspiratory pressure	Check the breathing circuit connections and settings
Vt Not Achieved	low	Unrealized tidal volume	Check the breathing circuit connections and settings.
Patient Circuit Leak	Mid	Breathing circuit leak	Check the breathing circuit leaks, see
Absorber Panel Open	High	Soda lime canister is not installed in place	Reinstall soda lime canister
O2 Sensor not connect	low	Oxygen battery cables are not installed in place.	Please check if the oxygen battery cables are installed in place
Replace O2 Sensor	Mid	Oxygen sensor expired or failure	Replace the oxygen sensor
Flowmeter Comm.Error	High	Flowmeter communication error	Check if the flow meter panel's output data communications voltage is normal
O2 Sensor Fail	low	Oxygen flowmeter sensor fails	Check if the oxygen flowmeter sensor communication is normal
N2O Sensor Fail	low	Nitrous oxide flow meter sensor fails	Check the laughing gas flowmeter sensor communication is normal
Air Sensor Fail	low	The air flow	Check the air flowmeter sensor communication

		meter sensor fails	is normal
NO Fresh Gas	Mid	No fresh air	Check if the fresh gas settings are correct
O2-N2O Ratio Error	High	Abnormal ratio of oxygen to laugh	Oxygen laughing gas ratio is not accurate, please use the manual ventilation
O2 Flow Too High	low	Oxygen flow is opened too much	Oxygen flow exceeds 10L / min, maintaining the flow at 10L / min or less
N2O Flow Too High	low	Laughing gas flow is opened too much	Nitrous oxide flow exceeds 10L / min, maintaining the flow at 10L / min or less
Air Flow Too High	low	air flow is opened too much	Air flow exceeds 10L / min, maintaining the flow at 10L / min or less
AG Comm.Stop	High	AG communication stop	Check the AG module failure or communication failure
AG Comm.Error	High	AG communication error	Check the AG module cable is connected correctly or communication failure
AG Sensor Off	High	AG sensor Stop monitoring	Put the AG module into standby mode, stop the measurement. Please disconnect AG module, stop using the contact maintenance personnel.
Sensor Err(AG)	Mid	AG sensor error	
Software Error(AG)	Mid	AG software error	
Hardware Error(AG)	Mid	AG hardware error	
Motor out of accuracy(AG)	Mid	AG monitoring accuracy error	
Factory Calibration lost(AG)	Mid	AG initialization error	
Temp out of accuracy(AG)	Mid	Ambient temperature	Check the gas line connection status, make sure the environment in line with the specifications of the anesthesia machine, if there are special reasons influence environmental pressures. Try to re-boot.
Pressure out of accuracy(AG)	Mid	Atmospheric pressure is too low or too high	
Zero required(AG)	Mid	AG zero failure	Check if the AG module voltage meets AG specifications.
AG ID&Conc unreliable	Mid	Failure to read the module ID	If detection is successful,when Re-connect after power shutdown. Or replace the AG module
Span Calibrating(AG)	Mid	AG calibration	Please contact maintenance personnel
Span Cal Error(AG)	Mid	AG calibration error	Please contact maintenance personnel
Mixed Agents	low	Mixed agents	Replace anesthetic and wait end of conversion
Check Adapter	Mid	Adapter abnormal	Check whether the adapter probe is dirty, replace the adapter

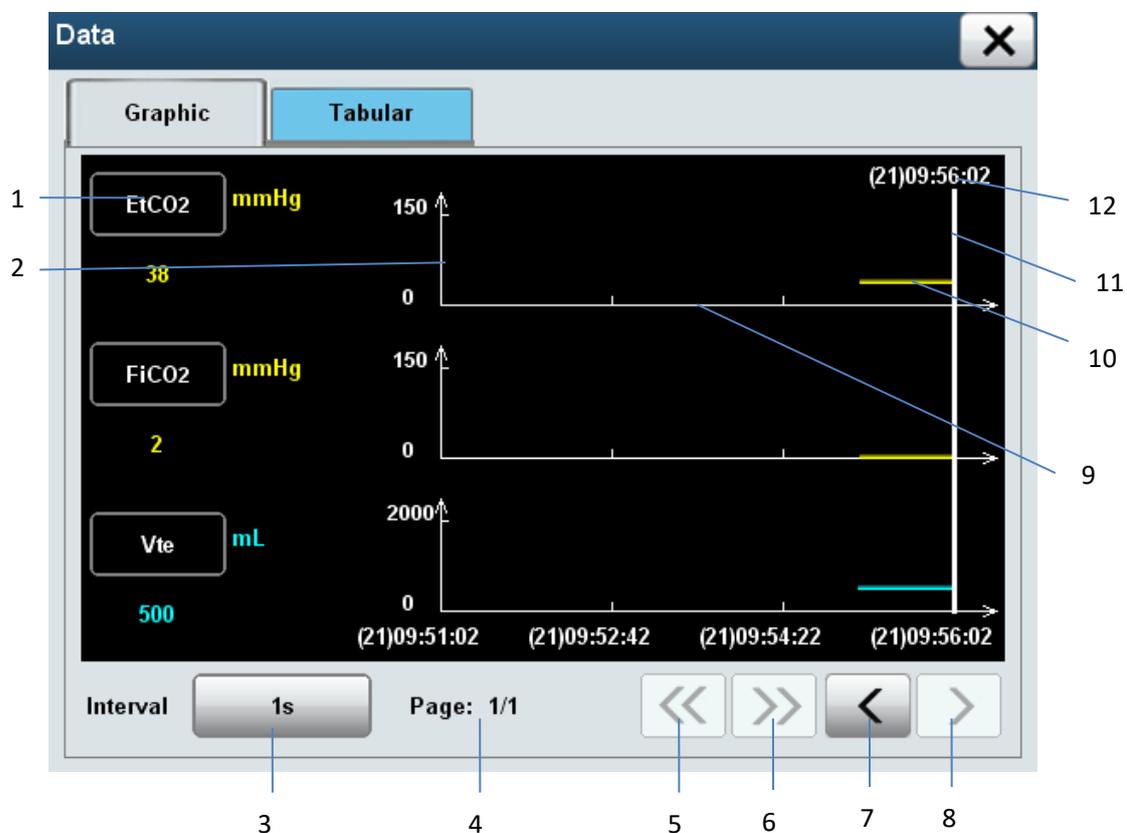
Check Sampling Line	Mid	Sampling tube abnormalities	Check if the sampling tube is blocked, water, replace the sampling tube
one param accuracy err	Mid	The first parameter accuracy error	Please contact maintenance personnel
O ₂ calib required	Mid	O ₂ calibration fails	Please contact maintenance personnel
Air calib required	Mid	Air calibration fails	Please contact maintenance personnel
O ₂ Sensor Error	Mid	O ₂ sensor error	Please contact maintenance personnel
Replace Adpter	Mid	Adapter abnormal	Check module LED red light does not blink, replace the adapter
Sampling line clogged	Mid	Sampling line clogged	replace the sampling tube
No Sampling line	Mid	Do not detect the sampling tube	Check if the sampling tube was installed in place, or replace the sampling tube
No Adpter	Mid	Do not detect the adapter	Check if the adapter is installed in place, or replace the adapter
O ₂ Port Error	Mid	O ₂ port error	Check if the board oxygen sensor cable is wrong connected
CO ₂ out of accuracy	Mid	CO ₂ accuracy error	Check if the AG / CO ₂ monitoring module is abnormal, replace AG / CO ₂ module
N ₂ O out of accuracy	Mid	N ₂ O accuracy error	Check if the AG monitoring module is abnormal, replace AG module
AA/AA2 out of accuracy	Mid	AA/AA2 accuracy error	Check if the AG monitoring module is abnormal, replace AG module
O ₂ out of accuracy	Mid	O ₂ accuracy error	Check if the O ₂ sensor is expired or failure, replace the O ₂ sensor

Chapter 11 Trends and log

11.1 Trends

Trend chart is used for reviewing of the parameter values changing trend in corresponding time, which is described the changes of the parameter's measurement results, the value of each point in the line corresponds to the time for each of the physiological parameters. Trends provide parameters: Vte, Vti, MVe, Mvi, Rate, Ppeak, Pplat, Pmean, PEEP, Raw, Cydn, FiO2, EtCO2, FiCO2, FIF, FEF. Trends will be re-recorded after re-starting the machine.

Click the bottom at the right corner of the screen [Menu] -> [Data] -> [Graphic], you can enter the trend interface, as shown below:



- 1 Parameter selection frame
- 2 Ordinate
- 3 Resolution (1s, 5s, 1min, 10min, 30min, 60min)
- 4 Displays the current pages / total pages
- 5 Turned Previous
- 6 Next turn
- 7 Left
- 8 Right
- 9 Abscissa
- 10 Trend curve
- 11 Cursor

11.2 Trends table

trend table is used for reviewing the parameter data of corresponding time point, which will be described in the form of table of changes of the parameter's measurement results. Trends table provides a record of parameters: EtCO₂, FiCO₂, awRR, Vte, Vti, Mve, Mvi, Rate, Ppeak, Pplat, Pmean, PEEP, Raw, Cydn, FIF, FEF, FiO₂, I: E. Trend tables will be re-recorded after re-starting the machine.

Click the bottom at the right corner of the screen [Menu] -> [Data] -> [Tabular], you can enter the trend table interface, as shown below:

Time	EtCO ₂	FiCO ₂	awRR	Vte	Vti
(21)09:56:02	38	2	12	500	500
(21)09:56:01	38	2	12	500	500
(21)09:56:00	38	2	12	500	500
(21)09:55:59	38	2	12	500	500
(21)09:55:58	38	2	12	500	500
(21)09:55:57	38	2	12	500	500
(21)09:55:56	38	2	12	500	500
(21)09:55:55	38	2	12	500	500

Interval: 1s

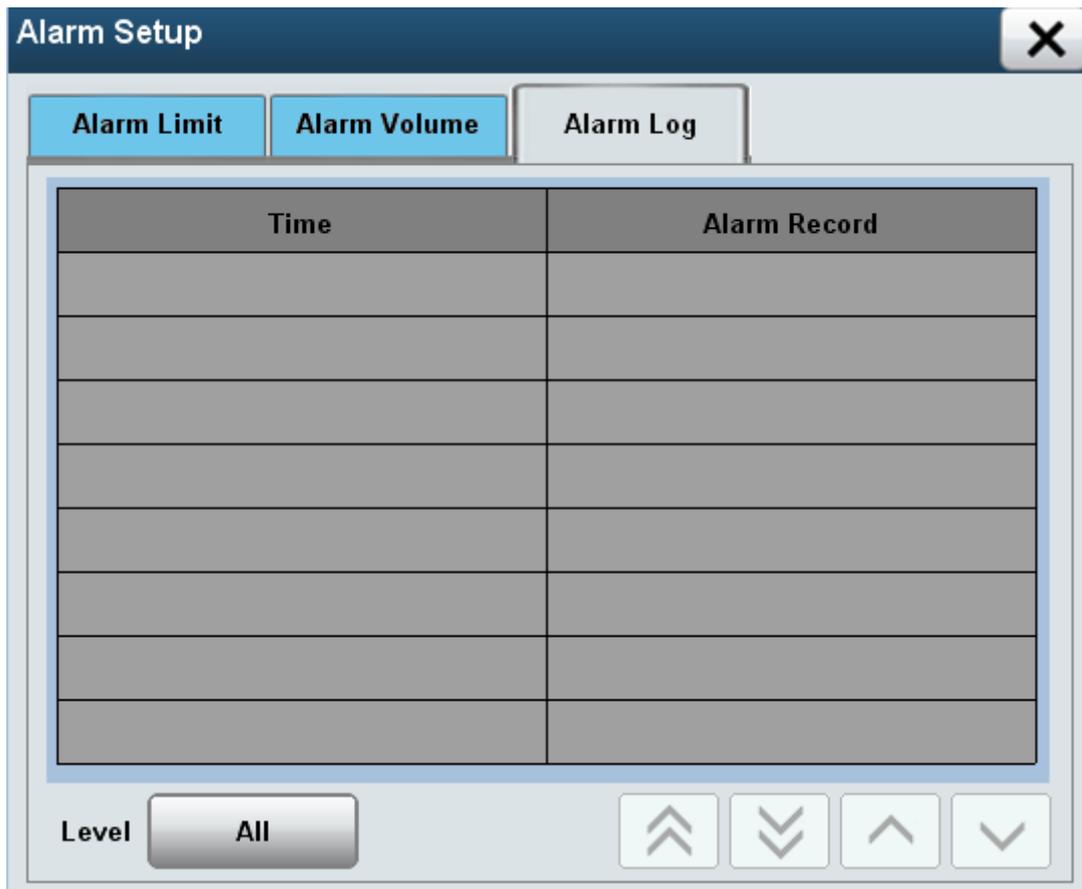
1 2 3 4 5 6 7

- 1 Resolution (1s, 5s, 1min, 10min, 30min, 60min)
- 2 Left
- 3 Right
- 4 1st page
- 5 last page
- 6 previous line
- 7 next line

11.3 Alarm Log

Alarm log record the trigger alarm event, including time, alarm levels and events. Logging in chronological order of the alarm to store, the latest incident occurred in front of a record, the log can record 500 messages, if it exceeds 500 messages ,the earliest messages will be covered. And it could be paged display.

Click the at the right corner of the screen [Alarm] -> [Alarm Setup] -> [Alarm Log], you can enter the alarm log screen, as shown below:



Interface options, as follows:

1) Click []: Expand options are: [All], [Low], [High], [Mid]. If you selecte[All] displays all-level alarm messages; [Low] show only low-level alarm messages; [High] show only high-level alarm messages; [Mid] show only secondary level alarm messages

2) Click on [], turn to the first page

3) Click on [], turn to the last page

4) Click on [], move the cursor to the previous line

5) Click on [], move the cursor to the next line

Chapter 12 Cleaning and disinfection

Caveat:

Please comply with applicable security regulations.



The company provides the clean machine and accessories in the factory , but without disinfection and sterilization. If it offers the products and their components with disinfection and sterilization , in the prominent position on its packaging will indicate "sterile" and other information.

Before first time to use it, follow the recommended method in this chapter, take the necessary cleaning, disinfection and sterilization for the machine and accessories . Prohibition of the cleaning, disinfection and sterilization to the disposable use accessories.

Reusable Accessories of anesthesia machine or anesthesia ventilation system, it should be cleaned and disinfected before re-use as necessary in accordance with the method recommended in this chapter, without disinfection will result in the risk of cross infection.

Carefully read all operating and maintenance instructions of the disinfection equipment.

Read the material safety data description of each detergent.

wear protective gloves and safety glasses.

The components can only be removed and installed by the instructions of this chapter , if the components are removed and installed improperly, it will lead to the leak risk of the anesthesia ventilation systems.

The components can only be cleaned and disinfected by the instructions of this chapter , if the components are cleaned and disinfected improperly, it will lead to the damage risk of the anesthesia ventilation systems.

Do not use calcium carbonate, calcium stearate, maize starch, talc or similar material to prevent adhesions. These materials may enter the patient's airway or lungs, causing irritation or damage.

Checking if the parts are damaged during operation, the damaged parts should be replaced.

After the cleaning and the disinfection are completed and re-installed, be sure to pass the test examination of the instructions of Chapter 5, "preoperative test" , the anesthesia system will be allowed to use ; otherwise, you should discontinue use it and contact our after-service personnel.

Do not inhale the smoke dust during operation; If the oxygen sensor is damaged, it could lead to leak and cause burns.

After cleaning or disinfecting The machine, the accessories, ensure the related components are completely dry, after that, install and connect the AC power.

Note:

High temperature steam sterilize only the components which are marked with parts 134 °C .

To prevent the abrasion of device, do not use abrasive cleaning agents (such as the silver polish or cleaning agents, the steel wool).

Do not use halogenated organic or petroleum-based solvents, acetone, glass cleaner or other harsh cleaning agents.

If there is any doubt about the cleaning agent, please check the reference data and instructions which are provided by the manufacturer.

Cleaning solution pH must be within the range of 7.0 to 10.5.

Do not soak the synthetic rubber parts over than 15min, otherwise it will lead to accelerated aging or swelling.

Do not allow the liquid to flow into the anesthesia system housing case.

□

Ensure that all liquids away from the electronic components.

12.1 Cleaning methods

There are two manual cleaning methods: general cleaning and rinsing soak.

1) General cleaning is that using the damp cloth which are soaked in the flexible detergent solution (as 70% of medical alcohol) to wipe the shell surface, then wipe it dry with a dry cloth.

2) refers to the rinsing soak, rinsing with water, then add warm water with weakly alkaline detergent solution soak for 3 ~ 5min, then use the water to rinse, and finally wipe it clean with the solution of 70% medical alcohol .

12.2 Disinfection methods

1) The autoclavable Disinfection is achieved by the steam with 134 °C at most . Before disinfecting the components, they should be cleaned, and then at 121 °C temperature and under the 1.05kg / cm² steam pressure, sterilizing during 15 ~ 20min. All the components have 134 °C's. High temperature sterilization mark

which are applicable with this disinfection methods .

2) Take the combined action of hydrogen peroxide and ozone disinfection manner. The disinfection is according to the disinfection procedures (atomization 15min, disinfection 60min, 10min drying procedures) .

12.3 Cleaning and disinfecting for the machine housing

1) Make sure the AC input plug has been pulled out, and the device is turned off ;

2) in accordance with the first methods of this chapter "14.1 Cleaning Methods" , cleaning the whole housing case.

 **Caveat:**

Ensure that no liquids penetrate inside the control module in the cleaning process , in order to avoid causing personal injury or damage of internal components.

 **Note:**

The disinfection method by spreading or spraying the disinfectant to the housing case , due to the short reaction time, it can only reduce the number of bacteria in the surface of the machine, so do not adopt it!

Display screen can not touch the liquid, it can only be cleaned by the dry lint-free soft cloth.

12.4 Disassemble and install the components of the anesthesia ventilation system which could be rinsed and disinfected

If you want to make the cleaning and the disinfection to the system of anesthesia ventilation, you should firstly disassemble all the components of respiratory system which could be rinsed and disinfected

12.4.1 Disassemble the bellows components

Disassembly:

1) Holding the shell of the bellows cover with two hands, counterclockwise unscrewing;



2) Lifting the bellows cover;



3) Remove the folding bag from the base seat of the bellows.



Cleaning and disinfection:

According to the second article of chapter "14.2 cleaning methods" , and also the first article and second article of "14.3 Disinfection Methods", Clean the bellows components by the method of completely rinsing soak cleaning and disinfect by autoclaving or disinfect the components by the method of hydrogen peroxide and ozone combined action .

□

Installation:

According to the reversed operational process,install the bellows components.

 Note:

If you need disinfect the bellows components by autoclav, firstly you should assemble the bellows components well before effecting the autoclavable disinfection. On being disinfected by autoclav , make the bellows components towards up.

On cleaning, please disassemble the bellows assembly apart to clean, otherwise it will take a long time to dry them.

After drying folding bag, it should be suspended and fully developed. Otherwise, it may make the folding bag adhesive.

12.4.2 Disassembling the breathing air check valve components

Disassembling :

- 1) Holding the cover of the check valve,unscrew it counterclockwise,take the cover of the check valve out.



- 2) Pull out the inspiratory check valve from the loop



Cleaning and disinfection:

According to the second article of chapter "14.2 cleaning methods" , and also the first article and second article of "14.3 Disinfection Methods", Clean the components of the expiratory and inspiratory check valve by the method of completely rinsing soak cleaning and disinfect them by autoclaving or disinfect the components by the method of hydrogen peroxide and ozone combined action .

Installation:

According to the reversed operational process,install the expiratory and inspiratory air check valve components.

12.4.3 Disassembling the inspiratory hose and connectors of type Y

Disassembling:

- 1) Take down the inspiratory hose and expiratory hose from the inspiratory port and expiratory port.



- 2) Take down the filter from the patient connecting port of the Y-shaped tube.



Cleaning and disinfection:

According to the second article of chapter "14.2 cleaning methods" , and also the first article and second article of "14.3 Disinfection Methods", Clean the silica gel hoses and the Silica gel masks by the method of completely rinsing soak cleaning and disinfect them by autoclaving or disinfect the components by the method of hydrogen peroxide and ozone combined action .

 **Note:**

Do not reuse disposable filters, expiratory and inspiratory hoses and masks ,thet should be disposed of in accordance with local medical waste disposal regulations.

To prevent damage to the expiratory and inspiratory tubes, please hold on joints of both ends of the expiratory and inspiratory tube for disassembling

Installation:

According to the reversed operational process, install the expiratory and inspiratory tube and the Y-type connector.

12.4.4 Disassembling the manual expiratory and inspiratory bladder

Disassembling:

Removing the manual breathing bladder demolition:

Hold the port parts of the bladder, push down with the appropriate force, take down the bladder from the connecting port.



Cleaning and disinfection:

According to the second article of chapter "14.2 cleaning methods" , and also the first article and second article of "14.3 Disinfection Methods", Clean the silica gel bladder by the method of completely rinsing soak cleaning and disinfect it by autoclaving or disinfect the bladder by the method of hydrogen peroxide and ozone combined action .



Note:

Do not reuse the disposable bladder, it should be disposed of in accordance with local medical waste disposal regulations.

Installation:

According to the reversed operational process, install the manual expiratory and inspiratory bladder.

12.4.5 Disassembling the flow sensor

Disassembling:

- 1) Unscrew counterclockwise the lock nut which is on the inspiratory port.



- 2) Pull out both the lock nut and the inspiratory port



- 3) Pull out the inspiratory flow sensor.



Cleaning and disinfection:

According to the second article of chapter "14.2 cleaning methods" , Clean the inspiratory flow sensor and the expiratory flow sensor by the method of rinsing soak cleaning. That is, first rinse with water, then added weakly alkaline detergent solution of warm water and soak for 3 ~ 5min, then use the water to rinsin, and finally wipe clean the surface of the inspiratory flow sensor with 70% of medical alcohol.

Caveat:

- Do not disinfect the flow sensors by the autoclave;
- Do not clean the flow sensors with a brush or by the high pressure gas ;
- Do not use unapproved cleaning agents containing polycarbonate.
- Do not clean the inner surface of the flow sensor, you can only wipe the outer surface with a damp cloth.

Installation:

According to the reverse operation Process, install the expiratory flow sensor and the inspiratory flow sensor separatetly.

12.4.6 Airway Pressure Gauge

Notice:

- This anesthesia machine airway pressure gauge pressure measuring in accordance with 8.1 of ISO 8835-2.

Disassembling:

Hold the airway pressure gauge and press buckle spring, remove the airway pressure gauge from the loop.



Cleaning and disinfection:

According to the second article of chapter "14.2 cleaning methods", Wipe clean the outer surface of the airway pressure gauge.

Caveat:

- **Do not rinse soak the airway pressure gauge, or disinfect it by autoclave;**

Installation:

Press the buckle spring does not move, Loosen it after installed the upper airway pressure gauge, and install the airway pressure gauge with a appropriate force.

Disassembling the soda lime canister

◇ Disassembly:

- 1) Grab the handle of the absorption canister, press the release pin to unlock the absorption canister



- 2) Slope upward the absorption canister, and disengage it with the two supporting pins, remove the canister;



- 3) Reverse the absorption canister upside down, make the lid lock ring counterclockwise rotation with the thumb, to unlock the absorption canister.



- 4) Lift the lid, and remove the lid.
5) Remove the sponge filter, soda lime and the water of water cup, discard them by proper methods .



Cleaning and disinfection:

According to the second article of chapter "14.2 cleaning methods" , Clean the absorption canister by the method of rinsing soak cleaning,disinfect it by autoclave or by the method of hydrogen peroxide and ozone combined action.

Caveat:

- Soda lime has a strong corrosive, such as a strong irritant to the eyes, respiratory system and skin,. If you accidentally stick to soda lime, wash immediately with water, if there is still discomfort after washing, please seek for medical help immediately.

Installation:

Please See the chapter 4.3.8 the process of the installation of soda lime canister.

Disassembling the oxygen sensor

Disassembly:

- 1) Pull out the electric cable plug of the oxygen sensor



- 1) Counterclockwise unscrew the oxygen sensor, remove the oxygen sensor.



Cleaning and disinfection:

According to the first article of chapter "14.2 cleaning methods", Clean the the oxygen sensor by the method of the general cleaning, General cleaning is that using the damp cloth which are soaked in the flexible detergent solution to wipe clean the oxygen sensor , then wipe it dry with a dry cloth.

Caveat:

- Do not put the oxygen sensor soaked in the liquid alone or with anesthesia ventilation system;
- Do not disinfect the oxygen sensors by autoclave;
- The condensation water vapor that on the oxygen sensor surface would cause inaccurate measurement of the oxygen concentration, the moisture on the surface should be promptly removed.

Installation:

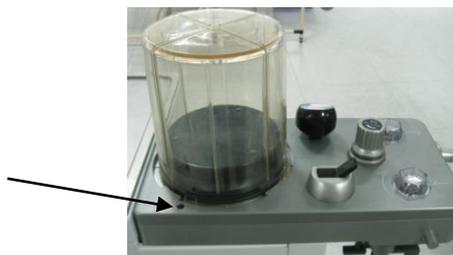
- According to the reverse operation process, install the oxygen sensor.

Disassembling the loop

Disassembling:

- 1) Ensure that the components had been disassembled, on holding the circuit by one hand,

unscrew the screw of the circuit, including the three screws total which are in the top and the bottom of the circuit .



- 2) Take down the circuit on the base seat of the circuit.



Cleaning and disinfection:

According to the first article of chapter "14.1cleaning methods" , and also the second article of "14.2 Disinfection Methods",disinfect the cricuit case by the method of hydrogen peroxide and ozone combined action .

Note:

- Do not put the whole circuit case soaking in liquid or disinfect it by autoclave.
- Be careful, make sure that the circuit electrical connections must be correct.

12.5 AGSS delivery and collection system



Disassembling:

- 1) Counterclockwise unscrew the nut which is for fixing the AGSS,remove the waste gas treatment system which is connected with the cover of the AGSS;
- 2) Counterclockwise unscrew the cover till it is released from the observation window.

- 3) Remove the filter which is installed on the inside of the cover;
- 4) Remove the observation window;
- 5) Remove the float;

Cleaning and disinfection:

- 1) Blow away the dust which is attached to the filter of the AGSS components with the compressed air.
- 2) In accordance with the instruction of this chapter "14.2 cleaning method", clean the float of the AGSS components by the method of the general cleaning. That is, wipe clean the choke plate and the float with a damp cloth which are soaked in the flexible detergent solution ,then wipe it dry with a dry cloth.

Installation:

After completed drying the AGSS components, reference to the above Step 1) to Step 6), according to the inverse operation of the process,finish the installation of the AGSS system components .

12.6 Cleaning the Anesthetic gases and the carbon dioxide module

Cleaning methods for the anesthetic gases and carbon dioxide modules see the relevant description in the Chapter 9, "The anesthetic gases and the carbon dioxide module" .

12.7 Cleaning the BIS Module

Cleaning methods for the BIS modules see the relevant description in the Chapter 10, "BIS module".

Chapter 13 Maintenance

Warning:

- Before maintenance the system should be cut off the power and the gas supply refers to the manual of the system. The system shall be dried after cleaning and do not cover the system with wet plastic bag. Prevent any water leaking into the machine.
- Do not use lubricants that contain oil or grease. They can burn or explode in the presence of high O₂ concentrations.
- Only use lubricants approved for anesthesia or O₂ equipment.
- Use care when moving or replacing system parts and components. Movable parts and removable components may present a pinch or a crush hazard.
- Refer to the disinfection control and safety regulation; the used system may be contaminated by blood or body fluid.

Note:

- Before maintenance, the machine and all parts shall be cleaned and disinfected especially before returning for repair.

13.1 Principle of maintenance

- Prior to operate or clean the system, check the modules and parts accordingly including the Y tube, filter, mask, breathing circuit parts and seal ring. Repair or replace the damaged parts.
- Maintenance should be performed by a trained technician. The maintenance schedule should be every 1000 hours usage or six months, or the system is being powered off for six months. The maintenance record should be kept by specially-assigned person.
- A service agreement between the user and the company is recommended to authorize the company proceed the regular check and maintenance.

13.2 Maintenance schedule

The following maintenance schedule is based on the 2000 hours annual usage. More maintenance work should be conducted if the usage time is more than that.

Minimum frequency	maintenance
daily	Clean the external surfaces.
	perform 21% O ₂ calibration (O ₂ sensor in breathing system).□

Minimum frequency	maintenance
	Check the anesthetic gas module or CO2 module before operation.
	Make sure the airway pressure meter hand is at zero under the atmospheric pressure.
Every tow weeks	Evacuate the remained anesthetic gas in the vaporiszer
Every month	100%O ₂ calibration (O ₂ sensor in breathing system).□
As necessary	Replace the defective sodalime in the canister
	Replace the O ₂ sensor if it can not be calibrated(the working life should be at least one year)
	Replace the damaged flow sensor
	Replace the damaged APL valve
	Replace the damaged gasket on the gas cylinder connector
	Replace the disabled fuse
	Main stream anesthetic gas or CO ₂ module zeroing
	Flow sensor, pressure sensor and three way valve zeroing
	Empty the water trap
	Clean the AGSS strainer
	Clean the hardware case air inlet filter net
Annually	Replace the o type ring at the connector of the vaporizer
	Replace the filter of the gas supply inlet
Every three years	Replace the built-in Li battery

13.3 Breathing system maintenance

When cleaning the breathing system, replace any parts that are visibly cracked, chipped, distorted or worn. For details, refer to Chapter 4 “Installation” and Chapter 14” clean and disinfection”.

13.4 Replace the fuse

To replace the fuse:

- 1) Pull out the AC power plug;
- 2) Open the fuse box with the screwdriver;
- 3) Install the fuse, the fuse shall be the same as the original one;
- 4) Installation procedure is adverse to the above steps.

13.5 O₂ calibration



warning:

- **Do not perform calibration while the unit is connected to a patient**
- **To calibrate the O₂ sensor, the environment pressure should be the same as the oxygen deliver pressure in the circuit. Otherwise the monitoring value may be inaccurate.**
- **Follow the biohazard regulation when dispose the O₂ sensor. To discard the sensor should follow the local medical waste disposable regulations.**

13.5.1 21%O₂ calibration



warning:

- **The O₂ needs calibration when the Oxygen concentration value is of big error or replace the sensor.**
- **No need to calibrate the O₂ sensor when do not operate the O₂ sensor.**
- **To calibrate the O₂ concentration, the system should be at standby.**

Calibration procedure:

- 1) Make sure the system status is standby, otherwise press the button  **【StandBy】**, select **【OK】** in the prompt window to make the system enter standby status.
- 2) Remove the O₂ sensor from the O₂ sensor port on the breathing system. Allow 2-3 minutes for the sensor to acclimate to the environment
- 3) Select the **【O₂ Calibration】** -> **【21% O₂ Calibration】**, the press the **【Start】** button, the system will start the “21% O₂ calibration” and display the progress bar.
- 4) During calibration, press the **【Stop】** button, the system will stop the calibration. The calibration is failed.
- 5) If the calibration is passed, the system will display the time and O₂ sensor model and the information of : **【PASS】** , otherwise will show : **【Failure】** and require a recalibration.
- 6) Press **【Exit】** button to exit the calibration.

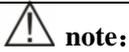


note:

- **In case of calinration failure, please check related technical alarms. Repeat the calibration then.**

- In case of repeated calibration failures, replace the O₂ sensor and repeat the calibration. If calibration still fails, contact our company technical support.

13.5.2 100%O₂ calibration



note:

- **Before 100%O₂ calibration, make sure 21%O₂ calibration finished.**

Calibration procedure:

- 1) Install the O₂ sensor back into the circuit, refer to the 4.3.6 O₂ sensor installation.
- 2) Make sure the system status is standby, otherwise press the button  **【StandBy】**, select **【OK】** in the prompt window to make the system enter standby status.
- 3) Patient connector faces the atmosphere.
- 4) O₂ inlet connect with the pure oxygen supply, other gas supply inlet closed or no connection. The fresh gas flow is set to 8L/min for about 5 minutes.
- 5) Select **【O₂ Calibration】** -> **【100% O₂ Calibration】** then press the **【Start】** button, the system will start the “100% O₂ concentration calibration” and display the progress bar - 131 - simultaneously.
- 6) During calibration, press the **【Stop】** button, the system will stop the calibration. The calibration is failed.
- 7) If the calibration is passed, the system will display the time and O₂ sensor model and the information of : **【PASS】** , otherwise will show : **【Failure】** and require a recalibration.
- 8) Press **【Exit】** button to exit the calibration.
- 9)



note:

- **In case of calibration failure, please check related technical alarms. Repeat the calibration then.**
- **In case of repeated calibration failures, replace the O₂ sensor and repeat the calibration 21% O₂ calibration then for 100% O₂ calibration. If 100% O₂ calibration still fails, contact our company technical support.**

13.6 Sensor zeroing



warning:

- **Do not perform calibration while the unit is connected to a patient**
- **To zero the sensors when the unit is standby.**

13.6.1 Flow sensor zeroing



note:

- **If the flow sensor reading is of significant error, to zero the flow sensor. If the repeated errors occur, please contact our company technical support.**

The system is on StandBy, to zero the flow sensor. Detail procedure as follows:

- 1) Make sure the system is on Standby, or press the softkey **【StandBy】**, then select **【OK】**, to make the system on Standby status.
- 2) Select the **【Menu】** -> **【Sensor Parameter】** -> **【Flow】**, then press the **【Start】** key, the system will start the zeroing of the flow sensor and the **【Start】** key color will change to gray which can not be operated. The **【Start】** key will change back when the zeroing finished and display the diagnosis result. The displayed message is **【PASS】** or **【Failure】**.

13.6.2 O2 sensor zeroing



Note:

- **If the O2 sensor's reading error is more than 2%, to zero the O2 sensor. If repeated error occurs after zeroing, to replace the O2 sensor and then calibrate the sensor of 21%O₂ and 100%O₂.**

The system is on StandBy, to zero the O2 sensor. Detail procedure as follows:

- 1) Make sure the system is on Standby, or press the softkey **【StandBy】**, then select **【OK】**, to make the system on Standby status.
- 2) Select the **【Menu】** -> **【Sensor Parameter】** -> **【O2】**, then press the **【Start】** key, the system will start the zeroing of the flow sensor and the **【Start】** key color will change to gray which can not be operated. The **【Start】** key will change back when the zeroing finished and display the diagnosis result. The displayed message is **【PASS】** or **【Failure】**.

13.6.3 Electronic flowmeter zeroing



Note:

- **If the electronics flowmeter's reading is of significant error, to zero the flowmeter. If the repeated errors occur, please contact our company technical support**

The system is on StandBy, to zero the electronic flowmeter sensor. Detail procedure as follows:

- 1) Make sure the system is on Standby, or press the softkey **【StandBy】**, then select **【OK】**, to make the system on Standby status.

- 2) Select the  **【Menu】**->**【Sensor Parameter】**->**【Flowmeter】**, then press the **【Start】**key, the system will start the zeroing of the flow sensor and the **【Start】** key color will change to gray which can not be operated. The **【Start】** key will change back when the zeroing finished and display the diagnosis result. The displayed message is **【PASS】** or **【Failure】** .

13.7 Airway pressure meter zeroing

If the airway pressure meter does not return to zero, the pressure indicator will be not correct. Bystop the manual or mechanical ventilation to make the airway pressure close to zero, and then observe the indicator postion at zero or not. To zero the airway pressure meter if the indicator does not return to zero. The procesure is as follows:

- 1) Stop the manual or mechanical ventilation, and make sure the ventilation pipe is connected to the anethesia breathing system. The patient connector of the respiratory pipeline is open to the atmosphere and the folding bag is fully falled in the below.
- 2) Use a small screw driver or the finger to open the lens cover of the airway pressure meter and remove the lens.
- 3) Use the small slotted screw driver to adjust the zeroing screw until the pressure meter indicator needel to zero postion.
- 4) To turn the “manual/mechanical switch” to mechanical ventilation, and start the mechanical ventilation.
- 5) Seal the patient connector of the Y-tube to close the breathing circuit.
- 6) Press the “O2 flush” button repeatedly to make the pressure meter indicator needle swing back and forth.
- 7) Reopen the patient connector of the Y-tube and loose the “o2 flush” button, then check the indicator return to zero or not. If the pressure indicator has returned to zero, assemble the pressure meter lens.
- 8) Please contact our company after-sales service department if the pressure indicator still unable to return to zero.

**Note:**

- **When clean or disinfect the parts, the part shall be replaced if it is cracked, broken, deformed or abraded.**

Chapter 14 Replace the Accessory

Warning:

- This anesthesia machine parts are of latex free.
- The parts which contact with human body are all comply with the biological compatibility of ISO 10993-1, and will not create adverse reaction.
- Only use the accessories specified in this manual otherwise may lead to danger or incorrect measurements.
- Read the packing instruction before use the accessories. The disposable accessories can only be used once, otherwise may lead to cross infection or incorrect performance. The reusable accessories must be cleaned and disinfected before usage to avoid the cross infection.
- To dispose the accessories according to the local laws, regulations or the hospital's waste disposal regulations to avoid the environment pollution.

Replaced accessories list:

Accessory description	Notes
corrugated pipe	
Silicon corrugated pipe (adult, 100 cm)	
Silicon corrugated pipe (pediatric, 100 cm)	
Adult corrugated pipe sets(including corrugated pipe、Y-connector,L-connector,filter, manual breathing bag)	
Pediatric corrugated pipe set(including corrugated pipe,Y-connector, L-connector, filter, manual breathing bag)	
Manual breathing bag	
Silicon bag (1L)	
silicon bag (2L)	
silicon bag (3L)	
rubber bag (latex free, 1L)	
rubber bag (latex free, 2L)	
rubber bag (latex free, 3L)	
mask	

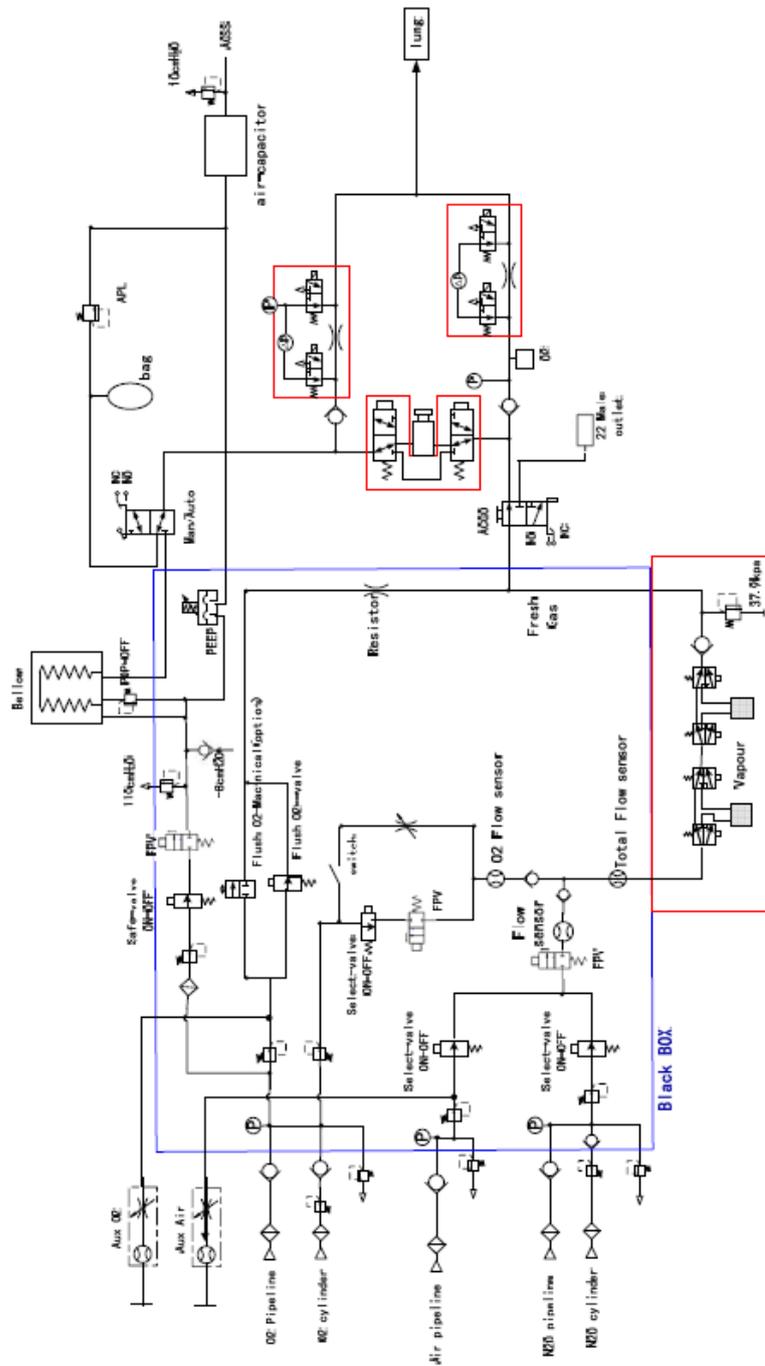
soft siliconmask (pediatric, 2#)	
siliconmask (pediatric big size, 3#)	
siliconmask (adult, 4#)	
siliconmask (adult big size, 5#)	
inflatable anaestheticmask (pediatric, 3#, disposable)	
inflatable anaestheticmask (pediatric big size, 4#, disposable)	
inflatable anaestheticmask (adult, 5#, disposable)	
soft siliconmask (pediatric, 2#)	
siliconmask (pediatric big size, 3#)	
siliconmask (adult, 4#)	
siliconmask (adult big size, 5#)	
inflatable anaestheticmask (pediatric, 3#, disposable)	
inflatable anaestheticmask (pediatric big size, 4#, disposable)	
inflatable anaestheticmask (adult, 5#, disposable)	
inflatable anaestheticmask (adult big size, 6#, disposable)	
connector	
High temperature resistance L-connector	
High temperature resistance Y-connector	
Fow sensor	
Breathing flow sensor set inspiratory	
Breathing flow sensor set expiratory	
Oxygen sensor	
Oxygen sensor	
Oxygen sensor cable	
soda lime canister	
soda lime canister	
soda lime canister sponge	
Side stream CO₂ and AG module accessories	
PhaseinNomolinesampling pipe (disposable)	
Main stream CO₂ and AG module accessories	
Airway adapter (adult, disposable)	
Airway adapter (pediatric, disposable)	
BIS accessories	
BIS patient cable (adult/pediatric)	
BIS sensor (adult)	

BIS sensor (pediatric)	
Module	
Main stream CO ₂ module (IRMA CO ₂)	
Side stream CO ₂ module (ISA CO ₂)	
Main stream AG module (IRMA AX+)	
Side stream AG module (ISA AX+)	
Power cable	
Power cable (0A, 125V/5m)	
battery	
Li-ion battery, 4800mAh 11.1V)	

Chapter 15 System Principle

15.1 Airway system

15.1.1 Airway schematic diagram



15.1.2 Principle description

This device is a pneumatic electric controlled anesthesia machine. The gas supply includes the pipe gas supply and the spare cylinders. The pipe gas supply includes the O₂, N₂O and the AIR with the working pressure 2000~15000 KPa. Each connector is equipped with filter, check valve, pressure relief valve, pressure regulating valve and pressure monitoring device, by adjusting the pressure regulating valve on 200~300 kPa to keep the stable gas supply. Pressure relief valve is used to prevent the over high pressure of the input gas. The check valve is used to prevent the counter current and the filter to prevent the impurities into the pipe. Each connector has a clear label and with the fool-proof design to avoid the operator connecting to the wrong gas supply.

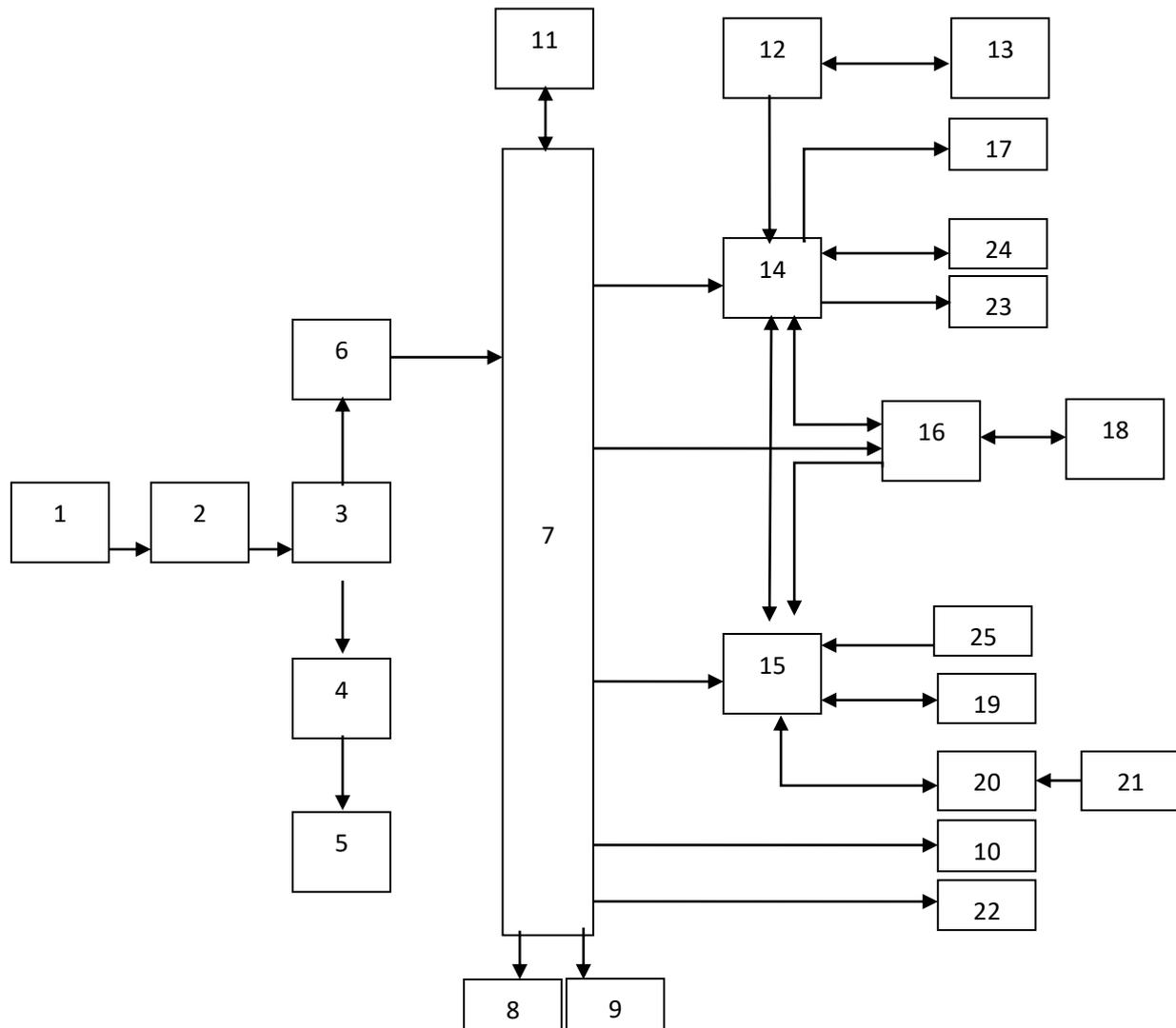
When starts the system, the gas goes through the gas supply connector, the pressure regulating valve and the pressure go down to 200 kPa which enable the stable gas output. The gas goes through the electric switch valve, electric proportion valve and flow sensor, and the system monitors the gas pressure by the pressure sensor on the signal collection board. For example, when the pressure of O₂ is lower than 220 kPa, the ventilator will send the alarm of low gas supply pressure. If the O₂ pressure is lower than 100 kPa, the system will automatically cut off the N₂O supply, but will not affect the air supply. At the same time, the system also controls the concentration of O₂ not less than 25%. O₂, AIR and N₂O are mixed in the flow meter, then go through the vaporizer and carry some anesthetic agent. This forms the fresh air which flows to the ACGO switch from the check valve. When the ACGO switch is open, the system stops the mechanical ventilation and the fresh air flow out from the ACGO outlet. The mechanical pressure relief valve protects the over high pressure under ACGO. When the ACGO switch is closed, the fresh is sent back to the breathing circuit supplying to the patient during the mechanical ventilation. The rapid O₂ button function is that the O₂ output does not through the flow meter and vaporizer, which is directly sent to the breathing circuit. When the electric flow meter does not work properly or without power supply, to start the oxygen mechanical flow meter to supply the fresh gas and put the oxygen meter to open position.

The anesthesia ventilator includes the bellows and control parts. The control parts include the power input, gas supply input, control display, electric switch, pressure sensor, flow sensor, electric proportion valve and the PEEP valve. The bellows parts include the bellow, cover, base (including the connector) and POP-OFF valve. When inspiration, the electric proportion valve set the respiration flow speed, drives the gas into the breathing circuit bellow. The bag in the bellow will move down because of the pressure, to force the gas go into the patient lung through the soda lime canister. When respiration, the electric proportion valve will be closed. The fresh gas and the gas breathed out from the patient are mixed in the bag which makes the bag go up in the bellow. Then the gas outside the bag will be exhausted by the ventilator until the respiration finished.

During the ventilation, the anesthesia machine monitors the patient airway pressure and tidal volume. The visible and audible alarm will be generated if the airway pressure and the tidal volume are not in the limit of the alarm. If the airway pressure is over is over the limit, the ventilator will enter inspiration automatically to avoid the over high pressure for the patient. There is one inside pressure safety valve of 110cmH₂O, when the pressure is over 110 cmH₂O (11 kPa) , the valve opens to prevent the airway pressure continuous rising.

15.2 Electric System

15.2.1 Electric system structure



15.2.2 Structural components list

1	Power cable	14	Main board
2	Power inlet connector	15	Monitoring board
3	Fuse 1	16	Electric flow meter board
4	Fuse 2	17	LCD
5	Auxiliary output	18	Proportianl valve/switchvale
6	Power switch board	19	Proportional valve control module
7	DC/DC board	20	Signal collection board
8	Battery	21	Oxygen sensor
9	fan	22	Head lighting board
10	Heating module	23	speaker
11	Button controller board	24	Connection board
12	Touch screen driver board	25	Circuit switch
13	Touch screen		

Chapter 16 Product Specifications

16.1 Safety Specifications

Type of Protection against electric Shock:	Class I equipment with internal electric power supply. Where the integrity of the external protective earth (ground) in the installation or its conductors is in doubt, the equipment shall be operated from its internal electric power supply (i.e., battery supply).
Degree of Protection against electric Shock:	BF
Mode of Operation:	Continuous
Degree of Protection against hazards of Explosion:	Ordinary equipment, without protection against explosion; not for use with flammable anesthetics.
Degree of Protection against ingress of Liquids:	Ordinary equipment, without protection against ingress of liquids – IPX0 (IEC 60529)
Electrical Connection between Equipment and Patient:	Equipment designed for non-electrical connection to the patient
Degree of Mobility:	Mobile: including the base and casters of the anesthesia system
Disinfection:	Steam autoclavable or disinfectable

16.2 Environment

	Work environment	Storage and transportation
Temperature	5°C~40°C	-40°C~+55°C
Relative humidity	«80 %, non-condensing	10%~93%, non-condensing
Atmosphere pressure	70kPa~106kPa	50kPa~106kPa
Noet: oxygen sensor and vaporizer specifications please refer to the “Oxygen sensor” chapter		

16.3 Power Supply

Electric power	
AC Power supply	Single phase ~100-120V, 50/60 Hz, 10A
Input power fuse	10A
Auxiliary output power	Single phase ~100-120V, 50/60 Hz, 2A

Auxiliary output power fuse	2A
Auxiliary output power socket	
Power cable	5m
length	Three wire cable
Type	
Battery information	Internal Li-battery 11.1 VDC 4800 mAh
Type	2
Cell	1cell for 60minutes and 2 cells for 120 minutes.(new full loaded, with temperature 25°C)。
Working time	Less than 8 hours, working model or standby
Charging time	
System power off	5s

16.4 Physical specifications

Main unit	
dimension	149 X 90 X 65.6 (Height x Width x Depth) (with casters)
weight	136 kg
Work surface	
work surface 1	95.8 X 42.5 X 42.5 (Height x Width x Depth) (with casters)
work surface 1 (max. load)	20kg
work surface 2	60.3 X 35.8 X 17 (Height x Width x Depth) (with casters)
work surface 2 (max. load)	2kg
Drawer	
drawer (2same size)	15.9 x 7.4 x27.5 (Height x Width x Depth)
drawer (3)	15.9 x 52.2 x 27.5 (Height x Width x Depth)
Trundle	
trundle	12.5 cm (5 inch)4 casters
Screen arm	
size	Arm length: 43.4cm; arm height: 121.6cm
handrail	
size	length : 32.5cm
TFT LCD TOUCH SCREEN	
TYPE	TFT LCD touch screen
size	15.6 "
Resolution	1366×768 pixel
LED indicator	
Alarm indicator light	one (red/yellow, when high, middle and low level alarms occurs only the red is on)
AC power indicator light	one (white, when connect with AC power)

Working indicator light	one (white, on when system is working and off when system is power off)
battery indicator light	one (white, when connect with the battery and the AC power, it is on; working with battery it blinks and it is off when no battery or the system is off.)
Audio indicator	
speaker	To make alarm sound, touch warning tone, support multi grade volume. The alarm sound is conformity with the regulation of IEC60601-1-8
buzzer	To make the alarm sound when the system cannot work normally
Communications port	
Auxiliary output interface	Nurse call
USB (2)	External storage device, for software upgrade
Network interface	To connect with PC or other compatible device for data transmission
RS-232 interface	Flow and pressure calibration
Button	
System switch button	Press the button to start the system or keep pressing the button to turn off the system

16.5 Airway specifications

Gas supply			
Pipeline gas	O ₂ , N ₂ O, Air		
Pipeline connector	NIST		
Pipeline input pressure	0.28MPa~0.6MPa		
cylinder gas	O ₂ , N ₂ O		
cylinder connector	PISS		
cylinder connection	Index plunger (all gas) ; large cylinder sets for O ₂ and N ₂ O		
Gas supply pressure display	Displayed on the screen		
Pipeline gas supply pressure	scope: 0~1.0MPa; resolution: 0.1MPa; accuracy: ±0.1MPa or ±4% of the reading, select the max. value		
cylinder	scope: 0~25.0MPa; resolution: 0.4MPa; accuracy: ±0.5MPa or ±4% of the reading, select the max. value		
Auxiliary common gas outlet (ACGO)			
connector	22mm external diameter, 15mm inner diameter, cone coaxial connector		
Fresh gas			
setting	Type	Electric mixer	
	Oxygen concentration	scope	23~100Vol.%
		accuracy	±5% or ±2Vol.%, select the max value
	Fresh gas flow	scope	0.2~20L/min
		accuracy	0.2~0.4L/min: ±0.04L/min >0.4L/min: ±10%
Safety oxygen flow	type	Rotor flow meter	

	scope	0~15L/min
	accuracy	±0.1L/min, or ±10% of the reading , select the max value (20°C and 101.3kPa)
O2 flush		35~75 L/min
Auxiliary O2 supply		
Auxiliary O2 supply	type	Rotor flow meter
	scope	0~15L/min
	accuracy	±0.1L/min, or ±10% of the reading , select the max value (20°C and 101.3kPa)
Negative pressure sputum aspiration		
Negative pressure sputum aspiration	Work pressure	0~0.1MPa (adjustable)
	Flow speed	No less than 30L/min (adjustable)

16.6 Anesthetic gas delivery system

This anesthetic gas delivery system meets the requirements of ISO 8835-2

Bellow capacity	Total capacity is 4600mL including bellow; ventilator capacity 2730mL; gasbag capacity 1215mL								
absorber	950mL absorber								
Water trap	23±2mL								
	installation: integrated								
Pipeline pressure meter	Measurement scope: -20~100cmH ₂ O								
	Measurement accuracy: ±4%								
Manual/Mechanical control switch	pattern: bistable								
Inspiratory connector	22mm external diameter, 15mm inner diameter, cone coaxial connector								
Expiratory connector	22mm external diameter, 15mm inner diameter, cone coaxial connector								
Gasbag connector	22mm external diameter, 15mm inner diameter, cone coaxial connector								
Inspiratory and expiratory valve opening pressure	Pressure in drying condition: 0.023cmH ₂ O; opening pressure in wet condition: 0.026cmH ₂ O								
APL valve	Adjusting scope : 1~70cmH ₂ O								
	Touch indication: over 30cmH ₂ O								
	Pressure flow specifications (APL fully open)								
	flow (L/min)	3	10	20	30	40	50	60	70
	dry (cmH ₂ O)	0.16	0.22	0.25	0.31	0.35	0.34	0.43	0.47
humid (cmH ₂ O)	0.18	0.22	0.26	0.33	0.34	0.39	0.45	0.51	

	Starting pressure when the relative humidity is 100% (37°C)		
	Minimum opening pressure	In dry air	0.32cmH ₂ O
		In humid gas	0.33cmH ₂ O
Inspiration impedance	<p>Impedance loop absorption device of the respiration system, tested in the ByPass off and ByPass on, record the max. value</p>		
Respiration impedance	<p>Impedance loop absorption device of the inspiration system, tested in the ByPass off and ByPass on, record the max. value</p>		
System leakage	Under 3kPa pressure (ByPass off and ByPass on), the leakage of the breathing circuit shall be less than 150mL/min		
System compliance	Under 3kPa pressure (the absorber is full of absorbent), the anesthetic gas delivery system inner compliance shall be 80±10mL.		
Soda lime canister leakage	Under 3kPa pressure, the leakage shall be less than 50mL/min		
APL valve leakage	Less than 50mL/min (APL scale at 70)		

16.7 Ventilator specification

This anesthetic ventilator meets the requirements of ISO 8835-5.

Ventilation model	V-CMV、V-SIMV、P-CMV、P-SIMV、PSV、PCV-VG		
Parameter scope, step length, accuracy			
parameter	range	Step length	accuracy
Tidal volume (V _t)	20~1500 ml Pediatric: 20~400ml Adult: 300~1500ml	1 ml	<100, ±15; 100~1500, ±20, or ±10% of the reading, select the max value; >1500, no specified

Pressure Limit (Plimit)	10~100cmH2O	1cmH2O	±4, or ±8% of the preset value
Inspiratory pressure (P _{insp})	(PEEP+5) ~ 70cmH2O	1cmH2O	±3, or±12% of the preset value
Pressure support (P _{supp})	(PEEP+5) ~ 50cmH2O	1cmH2O	±3, or ±12% of the preset value
Positive end-expiratory pressure (PEEP)	OFF,3~30cmH2O	1cmH2O	±2, or ±10% of the preset value
respiratory frequency (Freq)	4~100bpm	1bpm	±1, or ±4% of the preset value
Inspiratory pause (Tip:Ti)	OFF,5~60%	1%	±0.1
Inspiratory/expiratory time ratio (I: E)	4:1~1:10	0.5	±12% of the preset value
Inspiratory time (T _{insp})	0.4~5s	0.1s	±0.1
Triggering window (Trig Window)	5~95%	1%	/
SIMV respiratory frequency(Freq)	4~60 bpm	1 bpm	/
Inspiratory triggering (Trigger)	Pressure : -1 ~ -20cmH2O	-1cmH2O	/
	Flow: 1~15L/min	1L/min	/
Standby time (FreqMin)	2~60bpm	1bpm	/
Pressure rise time (Tslope)	0~2s	0.1s	/
Parameter monitoring			
parameter	range	resolution	accuracy
Tidal volume (V _t)	0~2500mL	1mL	<100 时, ±15; 100~1500 时, ±20, or ±10% of the reading, select the max. value; >1500, no specified
Minute ventilation (MV)	0.1~99.9L/min	0.L/min	±0.15, or ±10% of the reading, select the max value
Respiratory frequency (Freq)	0~100bpm	1bpm	±1, or ±5% of the reading, select the max value
Fraction of inspired oxygen (FiO ₂)	15~100%(V/V)	1%	± (2.5% percent of the volume+ 2.5% of the concentration)
Air resistance (Raw)	0~250 cmH2O/(L/s)	1 cmH2O/(L/s)	≤200, ±5, or ±30% of the reading, select the max value; >200 , no specified
Dynamic compliance (C _{dyn})	0~250 ml/cmH2O	1 ml/cmH2O	≤100, ±0.5, or ±15% of the reading, select the max value; >100, no specified
Air way peak pressure	0~100cmH2O	0.1cmH2	± (2+4% of the reading)

(Ppeak)		O	
Plat pressure (Pplat)	0~100cmH2O	0.1cmH2 O	± (2+4% of the reading)
Positive end-expiratory pressure (PEEP)	0~30cmH2O	0.1cmH2 O	± (2+4% of the reading); >30, no specified
Airway pressure waveform	-20~100cmH2O	/	/
Volume waveform	0~2L	/	/
Respiration flow velocity waveform	-120~120L/min	/	/
ETCO2 waveform	0~1000mmHg	/	/
Alarm setting			
parameter		range	
FiO2	alarm uppler limit	(lower limit+2) ~100	
	alarm lower limit	18~ (upper limit-2)	
Ppeak	alarm uppler limit	(lower limit +2) ~100	
	alarm lower limit	0~ (upper limit -2)	
Vt	alarm uppler limit	(lower limit +5) ~2000	
	alarm lower limit	0~ (upper limit -5)	
MV	alarm uppler limit	(lower limit +0.1) ~100	
	alarm lower limit	0.0~ (upper limit -0.1)	
Freq	alarm uppler limit	(lower limit +2) ~100	
	alarm lower limit	0~ (upper limit -2)	

16.8 Anesthetic vaporizer specification

This anesthesia machine gas delivery device meets the requirements of ISO 8835-4.

Anesthetic vaporizer (refers to the user manual of vaporizer)	
Vaporizer type	Penlon Sigma Delta (Enflurane, Isoflurane, sevoflurane and hanlothane) or Drager(Vapor 2000 for Enflurane、Vapor 2000 for Isoflurane、Vapor2000 for Sevoflurane、 Vapor2000 for Halothane) (optional)
position	Single or dual (optional)
Installation	Selectatec®, with interlock (Selectatec® is the trademark of Ohmeda)

16.9 AGSSdelivery and collection system

This anesthesia machine AGSS delivery and collection system meets the requirements of ISO 8835-3.

Passive exhaust system	
Negative pressure	0.3cmH ₂ O
Outlet connector	30mm external diameter cone connector
Active anesthetic gas scavenging system	
size	443×145×140mm (L×W×H)
Delivery and absorption system model	Low discharge collection system
Air exhaust speed	25~50L/min
Pressure	<2kPa@25L/min; >1kPa@50L/min
Pressure release device	compensates for barometric pressure
filter	Non-stainless steel net, pore diameter 140~150μm
Delivery and absorption status	The float drops when the system is not working or the air exhaust speed is less than 25L/min
Delivery and absorption system connector	BS6834 connector (standard), other model connectors are optional

16.10 Oxygen sensor specification

This oxygen sensor of the anesthesia machine complies the standard of EN12598-1999。

Oxygen sensor	
Output	9~13mV
Work temperature	0~40°C
Work pressure	75kPa~125kPa
Work humidity	0%~100%, non-condensing
Storage temperature	-20~50°C
Compensation	Automaticly compensation for pressure and temperature (within the regulated work enviroment)
Measurement range	0~100%
Preheating time	<60s
Response time	<15s
linearity	≤2%, 5min in pure oxygen enviroment
stability	<1% monthly measurement accuracy (in the air)
accuracy repeatability	±1%, 5min in pure oxygen enviroment
Normal life	>5×10 ⁵ measurement
<p>Note 1: The oxygen monitor is used for monitoring the oxygen concentration during the inspiration of the patient. The oxygen sensor is a electro-chemical part, self-driven and non-constrained metal-air battery. It includes the positive pole, electrolyte, cathode gas negative pole. The oxygen enters the sensor, oxidizes the metal electrode and generates the current and the current is propotional to the oxygen concentration. The</p>	

oxygen monitor analysis and process the current and signal from the oxygen sensor then change to relative oxygen concentration percentage value.

16.11 CO2 module specification

The CO2 module of the anesthesia machine meets the requirements of ISO 21647.

standard	ISO 21647		
type	Plug and play		
Measurement model	sidestream (Phasein ISA CO ₂) , mainstream (Phasein IRMA CO ₂)		
Preheating time	sidestream: <20s mainstream : <30s		
Total response time	sidestream: <3s(sampling pipe length:2m) mainstream : ≤3s		
Pressure risetime	sidestream (50mL/min flow speed): CO ₂ : ≤200ms mainstream (10L/min flow speed): CO ₂ : ≤90ms		
Sampling flow	sidestream: 50±10mL/min		
Monitoring gas	CO2		
compensation	Sidestream: automatic compensation for pressure and temperature		
Calibration	sidestream: no need to operate calibration. Automatically zero when starts. mainstream : no need to operate calibration, to zeroing when replace the airway adapter.		
Measurement scope and accuracy (standard conditions)	gas	scope	accuracy
	CO2	0~13Vol%	±(0.43Vol%+8% of the reading)
	The above accuracy is applied for the dry gas in 22°C±5°C, 1013±40hPa		
Measurement accuracy (all conditions)	gas	accuracy	
	CO2	±(0.3vol%+4% of the reading)	
	1) accuracyspecification is valid under the specified temperature and humidity. not including the following“interference gas and water vapor affection”		
Accuracy drifting	sidestream: meet the accuracy requirements within 24 hours mainstream : meet the accuracy requirements within 24 hours		
Airway adapter	disposableadult/pediatric: under 6mL is invalid pressure is lower than 0.3cmH2O		
Power input	Only in the 4.5 ~ 5.5VDC, voltage fluctuation. Otherwise may lead to incorrect		

	measurements or monitor damaged.	
Size and weight	sidestream: 33X78X49mm, 130g (with cable) mainstream : 38X37X34mm, <25g (without cable)	
Interference gas and the water vapor		
Gas or water vapour	Gas concentration	CO2
N2O ⁴⁾	60vol%	-2)
Halothane ⁴⁾	4vol%	-1)
Isoflurane, Sevoflurane, Enflurane ⁴⁾	5vol%	+8% of the reading ³⁾
Desflurane ⁴⁾	15vol%	+12% of the reading ³⁾
He ⁴⁾	50vol%	-6% of the reading ³⁾

16.12 Electromagnetic compatibility

This anesthesia machine meets with the MED standard of IEC 60601-1-2:2001+A1:2004

 **Note:**

- The devices on or near this anesthesia machine may interfere this system even if they meet the requirements of CISPR. The system shall be tested before operation.
- According to the above instructions, the EMC of the system installation and operation shall be considered.
- Portable and mobile RF devices may affect the operation of this system.
- Unapproved parts to used on the system may reduce the electromagnetic immunity or increase the electromagnetic emissions of the system.

Guidance and Declaration– Electromagnetic Emission		
Emission type	Compliance	Electromagnetic Environment Guidance
RF emissions (CISPR 11)	Group 1	The system uses RF energy only for its internal function. Its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions (CISPR 11)	Class B	The system is suitable for use in all establishments other than domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions (IEC 61000-3-2)	Class A	
Voltage fluctuations/Flicker emissions (IEC 61000-3-3)	符合	

Guidance and Delcaration- Electromagnetic Immunity			
Immunity test	Test level(IEC 60601)	Compliance level	Electromagnetic Enviroment Guidance
Electrostatic discharge	contact: ±6kV air: ±8kV	contact: ±6kV air: ±8kV	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst	For power supply lines: ±2kV For communications lines: ±1kV	For power supply lines: ±2kV For communications lines: ±1kV	Mains power quality should be that of a typical commercial or hospital environment.
Surge □	differential: ±1kV common: ±2kV	differential: ±1kV common: ±2kV	
magnetic field(50/60Hz)	3A/m	3A/m	magnetic fields should be at levels characteristic of atypical location in a typical commercial/hospital environment
Guidance and Delcaration- Electromagnetic Immunity			
Immunity test	Test level(IEC 60601)	Compliance level	Electromagnetic Enviroment Guidance
Conducted RF(IEC 61000-4-6)	3Vrms (150KHz~80MHz, outside ISM bands)	3Vrms (V1)	Portable and mobile RFcommunications equipment should be used no closer to any part of the system than the separation distance derived from the following calculations: Recommended separation distance $d = \left[\frac{3.5}{V1} \right] \sqrt{P}$ $d = \left[\frac{12}{V2} \right] \sqrt{P}$ $d = \left[\frac{12}{E1} \right] \sqrt{P}$ 80 MHz~800 MHz $d = \left[\frac{23}{E1} \right] \sqrt{P}$ 800 MHz~2.5 GHz where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic sitesurvey, a should be less than the compliance level in each frequency range.
	10Vrms (150KHz ~ 80MHz, ISM bands)	10Vrms (V2)	
Radiated RF (IEC 61000-4-3)	10V/m (80MHz~2.5GHz)	10V/m (E1)	

			Interference may occur in the vicinity of equipment marked with the following symbol:
<ul style="list-style-type: none"> ● The ISM bands within 150KHz~80MHz (industrial, scientific and medical) means the four bands of 6.75MHz~6.795MHz, 13.553MHz~13.567MHz, 26.957MHz~27.283MHz, 40.66MHz~40.70MHz. ● The ISM within the 150KHz~80MHz and the communications devices within 80MHz~2.5GHz, to reduce the interference of such mobile, the 10/3 additional factor is introduced into the formula to calculate the minimum isolation length. ● Over the frequency range of 80MHz and 800MHz, use the high frequency bands formula to calculate the isolation length. ● Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast, and Vt broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the system is used exceeds the applicable RF compliance level above, the system should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the system. ● These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people. 			
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	$< 5\%U_T (> 95\% \text{ dip, in } U_T), 0.5 \text{ cycle}$ $40\%U_T(60\% \text{ dip } U_T), 5 \text{ cycles}$ $70\%U_T(30\% \text{ dip, } U_T), 25 \text{ cycles}$	$< 5\%U_T (> 95\% \text{ dip, } U_T), 0.5 \text{ cycle}$ $40\%U_T(60\% \text{ dip, } U_T), 5 \text{ cycles}$ $70\%U_T(30\% \text{ dip, } U_T), 25 \text{ cycles}$	Mains power quality should be that of a typical commercial or hospital environment. The system requires continued operation during power mains interruptions and is therefore provided with batteries that supply uninterruptible power.

Recommended isolation length between the Communications devices and the anesthesia machine						
This anesthesia system can be operated in the electromagnetic environment of controlled RF interference. Also according to the rated maximum power and frequency of the communications devices, to maintain the recommended isolation length between the devices and the system.						
min. isolation length(m)	Power(W)	0.01	0.1	1	10	100
Frequency						
150KHz~80MHz	Out ISM bands $d = \left[\frac{3.5}{\sqrt{f}} \right] \sqrt{P}$	0.12	0.37	1.2	3.7	12

ISM bands	$d = \left[\frac{12}{V^2} \right] \sqrt{P}$	0.12	0.38	1.2	3.8	12
80MHz~800MHz	$d = \left[\frac{12}{E1} \right] \sqrt{P}$	0.12	0.38	1.2	3.8	12
800MHz~2.5GHz	$d = \left[\frac{23}{E1} \right] \sqrt{P}$	0.23	0.73	2.3	7.3	23
<ul style="list-style-type: none"> ● The ISM within the 150KHz~80MHz and the communications devices within 80MHz~2.5GH, to reduce the interference of such mobile, the 10/3 additional factor is introduced into the formula to calculate the minimum isolation length. ● The ISM bands within 150KHz~80MHz (industrial, scientific and medical) means the four bands of 6.75MHz~6.795MHz, 13.553MHz~13.567MHz, 26.957MHz~27.283MHz, 40.66MHz~40.70MHz. ● Over the frequency range of 80MHz and 800MHz, use the high frequency bands formula to calculate the isolation length. ● If the rated maximum power of the communications device is more than 100W, to find the the formula from the above sheet according to the frequency and then bring the maximum pwer value into the formula to calculate the minimum isolation length. ● These guidelines may not apply in all situations. Electromagneticpropagation is affected by absorption and reflection from structures,objects, and people. 						

Chapter 17 Residual Risks

APUS x3 is an anesthesia machine to monitor and support patient's ventilation during surgery. According to the requirements and regulations of ISO 14971:2016, the risk of this product is analyzed, and the predicted analysis results are risk-free.

The following residual risks for patients, users and third parties have been identified within the risk management process:

- Safety risks due to inadequate service and maintenance tasks and intervals.
- Safety risks due to inadequate transport processes and materials.
- Safety risks by using the device by unqualified staff and misunderstanding the product and documentation.
- Safety risks by electric shock while using the anesthesia machine during maintenance and servicing.

Please be aware of these risks by using the anesthesia machine. In order to minimize these risks, the operator has to take care of checking the device before using and in intervals according manufacturer requirements. Also, that the persons, materials and tools for transport and installation are suitable and approved by the manufacturer.

The staff using this product and make decisions related to patient's health need to be qualified and has to understand the product in function and features.

Risks by electric shock can be minimized by using tested and approved accessories and regular electrical safety testing by authorized staff after installation, before using and during lifetime of the product.



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