

WATO EX-65

Anesthesia Machine Quick Guide



Shenzhen Mindray Bio-Medical Electronics Co., Ltd.

This guide contains the basics necessary to operate the product safely and quickly. For details, refer to the Operator's Manual.

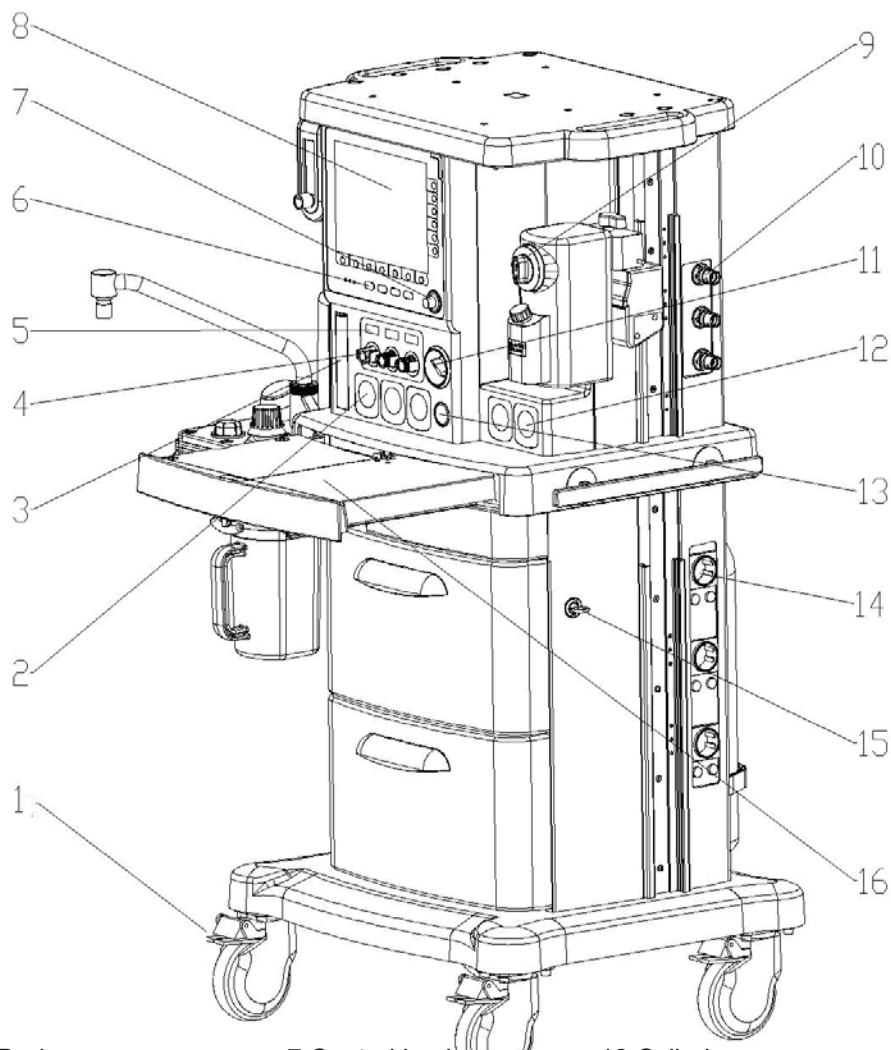
Notes:

- ☐ Observance of this guide is a prerequisite for proper product performance and correct operation and ensures patient and operator safety.
- ☐ This guide is based on the maximum configuration and therefore some contents may not apply to your product. If you have any question, please contact us.



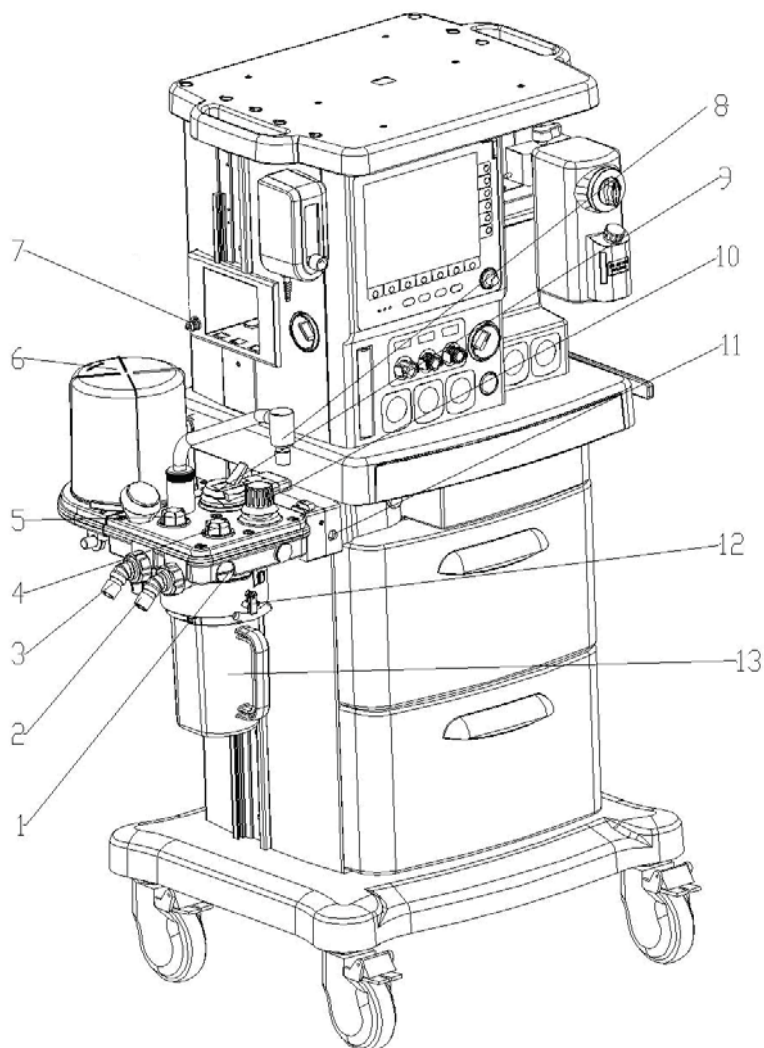
The product bears CE mark indicating its conformity with the provisions of the Council Directive 93/42/EEC concerning medical devices.

Product Introduction



- | | | |
|----------------------------|-------------------------|--------------------------------|
| 1.Brake | 7.Control knob | 12.Cylinder pressure gauge |
| 2.Pipeline pressure gauge | 8. Display | 13.O2 flush button |
| 3.Total flowmeter | 9.Vaporizer | 14.Auxiliary electrical outlet |
| 4.Flow control | 10.Gas supply connector | 15.Drawer lock |
| 5.Electronic flowmeter | 11.System switch | 16.Worktable (with drawer) |
| 6.Ventilator control panel | | |

Product Introduction

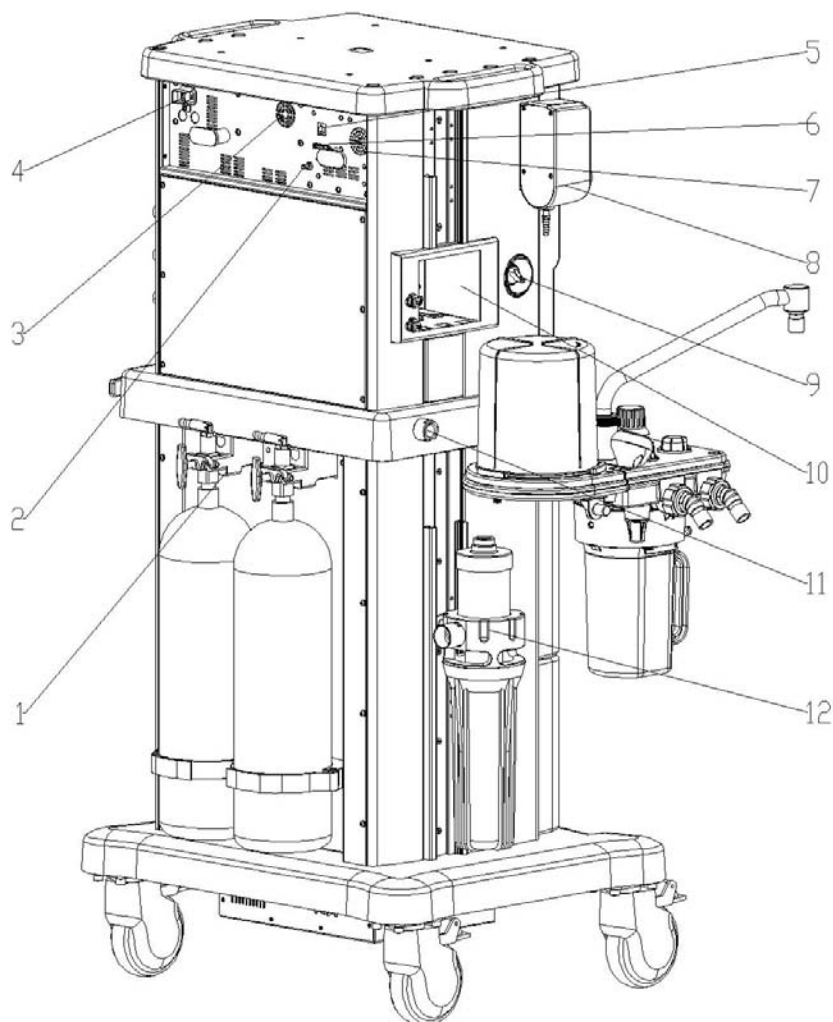


1.O₂ sensor connector
2.Inspiration connector
3.Expiration connector
4.Inspiratory check valve
5.Expiratory check valve

6.Bellows housing
7.Sample gas return port
8.Manual bag port
9.Bag/mechanical ventilation switch

10.APL (Airway Pressure Limit) valve
11.O₂ sensor connector
12.Rotary handle
13.Sodalime canister

Product Introduction



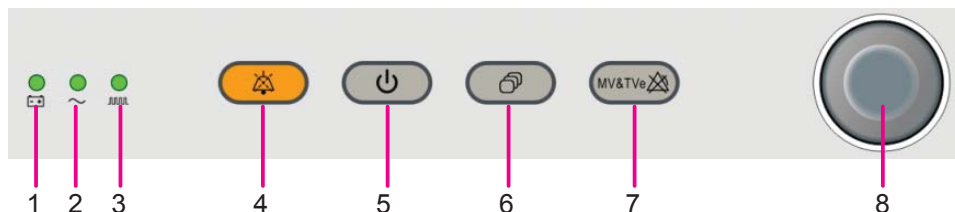
- 1.Cylinder connector
- 2.Equipotential stud
- 3.Fan
- 4.Mains inlet
- 5.Network connector

- 6.CIS 12 V power supply connector
- 7.Speaker
- 8.Auxiliary O2 supply

- 9.ACGO (Auxiliary Common Gas Outlet) switch
- 10.Module slot
- 11.AGSS outlet
- 12.AGSS Transfer and Receiving System

Control Panel

The control panel is located beneath the ventilator display, as shown below:




1. Battery LED

2. AC power LED

3. Operating state LED

4. Alarm silence key

To set alarm silence state, push this key to enter 120 s alarm silenced status. The alarm silence symbol  and 120 s countdown time appear in the upper right corner of the screen.

To clear alarm silence, push this key again.

5. Standby key

Push to enter or exit standby mode.

6. Normal screen key

Push to clear all menus popping up on the screen and return to the normal screen.

7. MV&Tve alarm key

In case of manual ventilation mode: Push the key to switch off MV and Tve overrange alarms and apnea alarm. Push the key again to switch on MV and Tve overrange alarms and apnea alarm.

In case of mechanical ventilation mode: Push the key to switch off MV and Tve overrange alarms. Push the key again to switch on MV and Tve overrange alarms.

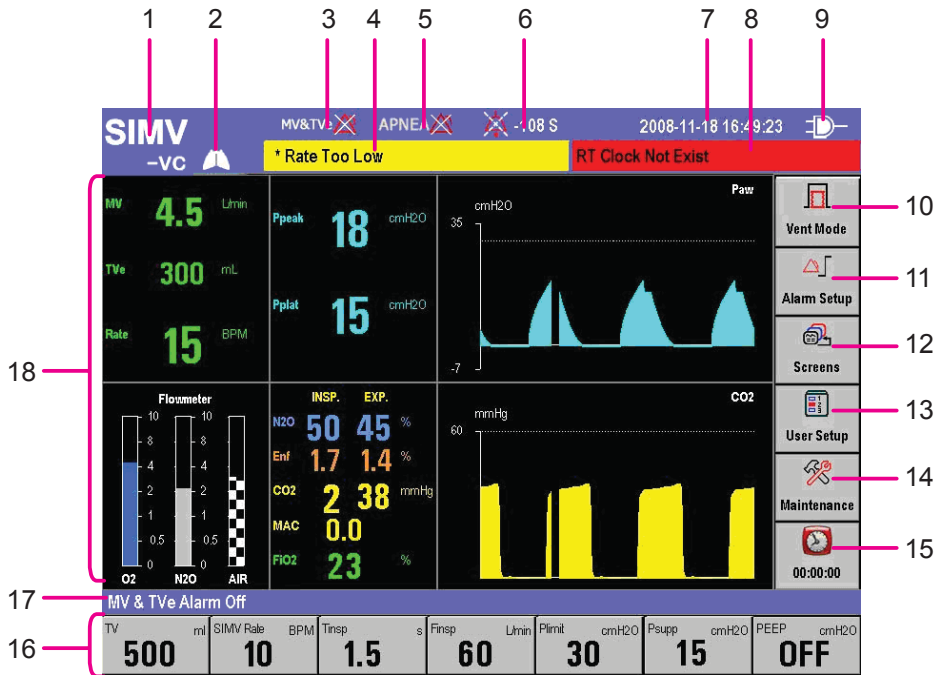
8. Control knob

Push the control knob to select a menu option or confirm your setting. Turn the control knob clockwise or counterclockwise to scroll through the menu options or change your settings.

Display Screen

This anesthesia machine adopts a high-resolution color TFT LCD to display various parameters, spirometry loops and waveforms (airway pressure, flow, volume, EtCO₂, etc).

The following is a standard display screen. For descriptions of other screens, refer to Operator's Manual.



1. Ventilation mode prompt area


Displays the current ventilation mode. If manual ventilation is selected for the bag/mechanical ventilation switch, is displayed in this area. Otherwise, the currently selected mechanical ventilation mode is displayed.

2. Lung icon

The icon is displayed when SIMV-VC or SIMV-PC mode is selected and inspiration triggering action is done currently.

Display Screen


3. MV&TVe alarm off icon
4. Physiological alarm area
5. Apnea alarm off icon
6. Alarm silence icon area
7. System time
8. Technical alarm area
9. Power supply state icon area

Displays power source or battery icon. The icon  is displayed when the anesthesia machine is powered by AC power source. The battery icon is displayed when the anesthesia machine is battery powered to indicate battery capacity.

- 10.[Vent Mode] shortcut key
Used to select mechanical ventilation mode.
- 11.[Alarm Setup] shortcut key
Used to change the alarm settings for the anesthetic ventilator, gas module or BIS module.
- 12.[Screens] shortcut key
Used to set user screen.
- 13.[User Setup] shortcut key
Used to change the settings for TV compensation, O2 monitoring source, gas module, BIS module, screen, sound etc.
- 14.[Maintenance] shortcut key
Used to perform leak test, calibrate O2 sensor and flow sensor, view trend graph, trend table and alarm logbook, and set language, system time, pressure unit, IP address etc.
15. Timer Setup shortcut key
16. Parameter Setup shortcut keys area
Used to set the parameters related to mechanical ventilation mode. Shortcut keys arrangement is subject to specific mechanical ventilation mode.
17. System prompt message area
18. Parameter & graph area
Displays the parameters, waveforms, spirometry loops, or electronic flowmeter graphs which the anesthetic ventilator, gas module, or BIS module monitors. Different types of screens are displayed based on the actual system configuration or screen layout settings.

Inspect the System

Make sure that:

1. The anesthesia machine is undamaged.
2. All components are correctly attached.
3. The breathing system is correctly connected, and the breathing tubes are undamaged.
4. The vaporizers are locked in position and contain sufficient agent.
5. The gas supplies are connected and the pressures are correct.
6. Cylinder valves are closed on models with cylinder supplies.
7. The necessary emergency equipment is available and in good condition.
8. Equipment for airway maintenance and tracheal intubation is available and in good condition.
9. Applicable anesthetic and emergency drugs are available.
10. The casters are not damaged or loose and the brake is set and prevents movement.
11. The breathing system is locked (in the  position).
12. The AC mains indicator and the battery indicator come on when the power cord is connected to the AC power source. If the indicators are not on, the system does not have electrical power.
13. The anesthesia machine is switched on or off normally.



NOTE:

- ☐ Make sure that the breathing system is correctly connected and not damaged.
- ☐ The top shelf weight limit is 30 kg.

Preoperative Test

Test Intervals

Perform the preoperative tests listed below at these events:

1. Before each patient.
2. When required after a maintenance or service procedure.

The following table indicates when a test must be done.

Test Item	Test Intervals
Pipeline tests	Every day before the first patient
Cylinder tests	
Flow control system tests	
Inspect the system	Before each patient
Alarm tests	
Power failure alarm test	
Breathing system tests	
O2 Flush Test	
Preoperative preparations	



NOTE:

- ☐ Read and understand the operation and maintenance of each component before using the anesthesia machine.
- ☐ Do not use the anesthesia machine if a test failure occurs. Contact us immediately.
- ☐ Within the warranty period, check the sealing condition only. When a great deviation occurs to the pressure value or the flow value that is measured, contact the authorized engineer for calibration service.

Turn on the System

1. Connect the power cord to the AC power source. Make sure that the AC power LED is illuminated.
2. Set the system switch to ON. Make sure that both the operating state LED and battery LED are illuminated (the battery is being charged or fully charged).
3. The alarm lamp flashes yellow and red once in turn and then a beep is given.
4. The display shows the start-up screen and then enters the standby screen after half a minute.



WARNING:

- ☐ Do not use the anesthesia machine if it generates alarms when turned on, or can not operate normally. Contact your service personnel or us.

Input Fresh Gas

1. Connect the gas supplies correctly and ensure adequate gas pressure.
2. You can control the O₂, N₂O and AIR flows in the fresh gas through the O₂, N₂O and AIR flow controls. Readings of the gas flows can be seen on the respective flowmeters.
3. If inspiratory anesthetic agent is used, ensure that the vaporizer is correctly mounted onto the anesthesia machine and the vaporizer conforms to the the anesthetic agent to be used. Fill the vaporizer with the anesthetic agent properly.
4. Push and turn the concentration control on the vaporizer to set the appropriate concentration of anesthetic agent.




NOTE:

- ☐ This anesthesia machine can be mounted with vaporizers corresponding with halothane, enflurane, isoflurane, sevoflurane and desflurane. Only one of the five vaporizers can be opened at a time because the vaporizers are featured with interlock.

Mechanical Ventilation Mode

Ventilation Mode

1. Make sure that the system is Standby.
2. Set the appropriate Plimit value in the parameter setup shortcut keys area.
3. Check the ACGO switch to make sure that it is OFF .
4. Set the bag/mechanical ventilation switch to the  position.
5. Push the O₂ flush button **O₂+** to inflate the bag if it collapses.
6. Select the [Vent Mode] shortcut key to open the [Vent Mode Setup] menu.
Select ventilation mode.


Set Ventilator Parameters

Select the parameter setup shortcut key to set the parameters related to mechanical ventilation mode.

Set Alarm Limits

1. Select the [Alarm Setup] shortcut key and then [Ventilator >>].
2. Set [High Limit] and [Low Limit] respectively for each parameter.
3. Select the [Alarm Setup] shortcut key and then [Gas Module >>].
4. Set [High Limit] and [Low Limit] respectively for each parameter.

Start Mechanical Ventilation

After settings of the related parameters are already made, you can enter mechanical ventilation mode by pushing the Standby key  and then selecting [Ok] from the pop-up menu to exit the standby status. The system will work in the selected mechanical ventilation mode.




NOTE:

- ☐ Before starting a new mechanical ventilation mode, make sure that all related parameters are set to the appropriate values.

Mechanical Ventilation Mode

Stop Mechanical Ventilation

1. Make sure that the APL valve is set properly before stopping mechanical ventilation. The APL valve adjusts the breathing system pressure limit during manual ventilation. Its scale shows approximate pressure.
2. Set the bag/mechanical ventilation switch to the  position. This selects manual ventilation and stops mechanical ventilation (ventilator).





NOTE:

- ☐ Before applying mechanical ventilation, check the soda lime in the canister. If soda lime color changes significantly, replace the soda lime promptly.

Manual Ventilation Mode

Start Manual Ventilation

1. Turn the APL valve control to adjust the pressure in the breathing system within the appropriate range.
2. Set the bag/mechanical ventilation switch to the  position. The ventilation mode prompt area displays the icon for manual ventilation mode. Besides, the system prompt message area displays [Manual Vent.].
3. Press the O₂ flush button  to inflate the bag if necessary.

Set Alarm Limits

1. Select the [Alarm Setup] shortcut key and then [Ventilator >>].
2. Set [High Limit] and [Low Limit] respectively for each parameter.
3. Select the [Alarm Setup] shortcut key and then [Gas Module >>].
4. Set [High Limit] and [Low Limit] respectively for each parameter.

Turn off the System

To turn off the system, do as follows:

1. Confirm that system use is finished.
2. Set the system switch to OFF.

Cleaning and Disinfection

WARNING:

- ☐ Obey applicable safety precautions.
- ☐ Read the material safety data sheet for each cleaning agent.
- ☐ Read the operation and service manual for all disinfection equipment.
- ☐ Wear gloves and safety glasses. A damaged O2 sensor can leak and cause burns (contains potassium hydroxide).
- ☐ Reuse of undisinfected breathing system or reusable accessories may cause cross-contamination.
- ☐ Preoperative tests must be performed before patient use every time the anesthesia machine has been disassembled for cleaning and disinfection, or has been reassembled.
- ☐ To prevent leaks, avoid damaging any component in case of disassembling and reassembling the breathing system. Ensure the correct installation of the system, especially of the seal. Make sure of the applicability and correctness of the cleaning and disinfection methods.
- ☐ Disassemble and reassemble the breathing system as described in this guide. For further disassembly and reassembly, contact us. Improper disassembling and reassembling may cause breathing system leak and compromise normal system use.

NOTE:

- ☐ To help prevent damage, refer to the manufacturer's data if you have questions about a cleaning agent.
- ☐ Do not use organic, halogenated, or petroleum based solvents, anesthetic agents, glass cleaners, acetone, or other harsh cleaning agents.
- ☐ Do not use abrasive cleaning agents (such as steel wool, silver polish or cleaner).
- ☐ Keep all liquids away from electronic parts.
- ☐ Do not permit liquid to go into the equipment housings.
- ☐ Do not soak synthetic rubber parts for more than 15 minutes. Otherwise swelling or faster aging may occur.
- ☐ Only autoclave parts marked 134°C.
- ☐ Cleaning solutions must have a pH of 7.0 to 10.5.

Cleaning and Disinfection

All parts of the breathing system can be cleaned and disinfected. The cleaning and disinfection methods are different for different parts. You need to select the appropriate method to clean and disinfect the parts based on the actual situations to avoid cross-contamination.

This table is our recommended cleaning and disinfection methods for all parts of the breathing system.

Parts	Intermediate level disinfection		High level disinfection
	A*	B*	C*
Breathing tubes and Y piece		★	★
Breathing mask		★	★
Flow sensor		★	
Bellows assembly		★	★
Inspiratory and expiratory check valves assembly		★	★
O2 sensor	★		
Canister assembly		★	★
Canister connection block assembly		★	★
Water collection cup		★	★
Bag arm		★	★
BYPASS assembly		★	★
Breathing System		★	★
Manual bag		★	★
AGSS assembly	★		

★ Indicates that this disinfection method is applicable.

A* Clean with a damp cloth soaked in mild detergent and then wipe off the remaining detergent with a dry lint free cloth.

B* Flush with water first; then soak in water and cleaning solution (water temperature 40°C recommended) for approximately three minutes and wipe with 70% ethanol.

C* Steam autoclave at maximum 134°C.

Cleaning and Disinfection

Clean and Disinfect the Anesthesia Machine Housing

1. Clean the surface of the anesthesia machine housing with a damp cloth soaked in mild detergent (such as 70% ethanol).
2. After cleaning the housing, remove the remaining detergent by wiping with a dry lint free cloth.

WARNING:

- ☐ Seeping liquid into the control assembly can damage the equipment or cause personal injury. When cleaning the housing, make sure that no liquid flows into the control assembly and always disconnect the equipment from the AC mains. Reconnect the AC mains after the cleaned parts are fully dry.

NOTE:

- ☐ Use only soft dry and lint free cloth to clean the display. Do not use any liquid for display cleaning.

Disassemble the Breathing System Cleanable Parts

You need to disassemble the breathing system cleanable parts first before cleaning the system.

O₂ Sensor

1. Remove one end of the O₂ sensor cable from the **O₂%** connector on the anesthesia machine. Unplug the other end of the cable from the O₂ sensor.
2. Turn the O₂ sensor counterclockwise to take it out.



Cleaning and Disinfection

Breathing Tubes and Y Piece

Remove the filter from the Y piece. Disconnect the breathing tubes from the inspiration/expiration connectors on the breathing system.



WARNING:

- ☐ When installing the breathing tube, hold the tube connector at both ends of the tube to prevent damage of the tube.
- ☐ Do not reuse the filter to prevent cross-contamination. Follow local regulations regarding disposal of hospital waste when the filter is discarded.
- ☐ Install the filter as described in this guide to prevent dust and particles from entering the patient's lungs and prevent cross-contamination.

Flow Sensor

1. Turn the locking nuts counterclockwise.
2. Pull out the inspiration/expiration connectors and their locking nuts.



WARNING:

- ☐ Tighten the locking nuts when installing the flow sensor. Failure to do so may result in invalid measurement.
- ☐ The end of inspiration/expiration connectors which connect the breathing tube shall be kept downward to prevent condensed water from entering the breathing system.

Cleaning and Disinfection

3. Pull out the flow sensors horizontally.



Check Valve Assembly

1. Turn the check valve cover counterclockwise to remove it.



2. Pull out the check valve.



⚠ WARNING:

- ❑ Do not separate the check valve diaphragm from the valve cover.
- ❑ When installing the check valve, depress the valve forcibly to make sure that it is installed in position.

Water Collection Cup

1. Hold the water collection cup and turn it clockwise.



2. Remove the water collection cup.



Cleaning and Disinfection

Sodalime Canister

1. Hold and pull up the rotary handle for 90 degrees.



2. Turn the rotary handle for 90 degrees counterclockwise.



3. Pull out the sodalime canister from the slot.



WARNING:

- ☐ Sodalime is a caustic substance and is a strong irritant to eyes, skin and respiratory system. Affected parts should be flushed with water. If irritation continues after flushed by water, seek medical assistance immediately.
- ☐ Before installing the sodalime canister, inspect the canister mouth, canister support and seal for sodalime particles. If there is, clear it to prevent breathing system leakage.
- ☐ Clean the sodalime canister and change the sodalime canister sponge regularly. Otherwise, the sodalime powder built up inside the canister will go into the breathing system.
- ☐ The sodalime canister sponge must be in place to prevent dust and particles from entering the breathing system.
- ☐ Do not reuse the sodalime canister sponge, which must be replaced every time the sodalime canister is replaced.



Canister seal
Canister support
Canister mouth

Cleaning and Disinfection

Airway Pressure Gauge

Pull off the airway pressure gauge as shown below.



Manual Bag

Remove the manual bag from the manual bag port on the breathing system as shown below.

The anesthesia machine is configured with bag arm:



The anesthesia machine is not configured with bag arm:



Bag Arm

1. Loosen the locking nut counterclockwise.



2. Remove the bag arm from the breathing system.



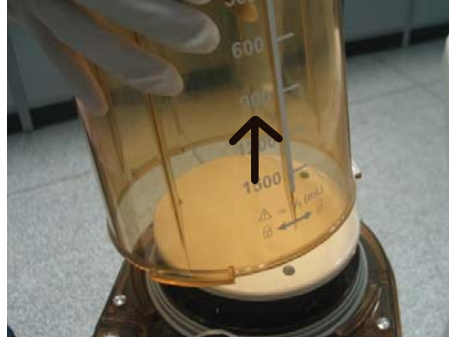
Cleaning and Disinfection

Bellows Assembly

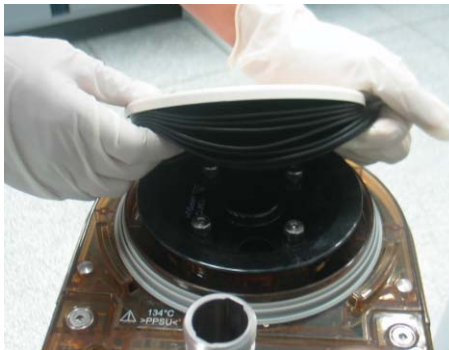
1. Turn the bellows housing counterclockwise.



2. Remove the housing.



3. Remove the folding bag from the bellows base.

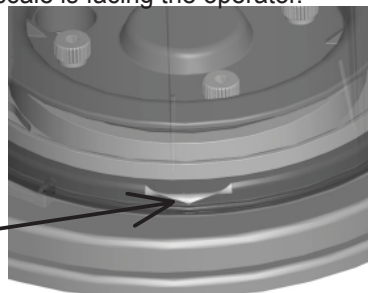


❑ Incorrect installation causes the folding as shown in the figure, which leads to the breathing system leakage. Reinstall the bellows housing.



NOTE:

- ❑ Before installing the bellows housing, check that the sealing component on the breathing system is in position. If not, you must install the sealing component properly before installing the bellows housing.
- ❑ When installing the bellows housing, align the bellows housing bayonet tabs with the slots on the breathing system and then lower the bellows housing. Make sure that the housing is depressing the seal evenly. Hold the bellows housing tightly and turn it clockwise until it stops. Make sure that the side of the housing marked with scale is facing the operator.



Cleaning and Disinfection

Breathing system

1. Remove the breathing system assembly according to the aforementioned procedures. Hold the breathing system with one hand. Pull up the locking catches on the breathing system adapter with the other hand to unlock it.
2. Remove the breathing system from the breathing system adapter with both hands.



3. Ensure that the breathing system assembly has been removed correctly. Disinfect the breathing system assembly.



WARNING:

- ☐ Disassemble and reassemble the breathing system as described in this guide. For further disassembly and reassembly, contact us. Improper disassembling and reassembling may cause breathing system leak and compromise normal system use.
- ☐ After the breathing system assembly is cleaned and disinfected, reinstall the assembly when it is fully dry.

Maintenance

Do not use malfunctioning anesthesia machine. Have all repairs and service done by an authorized service representative. Replacement and maintenance of tube parts listed in this manual may be undertaken by a competent, trained individual having experience in the repair of devices of this nature.

After repair, test the anesthesia machine to ensure that it is functioning properly, in accordance with the specifications.



WARNING :

- ☐ Only use lubricants approved for anesthesia or O2 equipment.
- ☐ Do not use lubricants that contain oil or grease. They burn or explode in high O2 concentrations.
- ☐ Obey infection control and safety procedures. Used equipment may contain blood and body fluids.
- ☐ Movable parts and removable components may present a pinch or a crush hazard. Use care when moving or replacing system parts and components.



NOTE :

- ☐ No repair should ever be attempted by anyone not having experience in the repair of devices of this nature.
- ☐ Replace damaged parts with components manufactured or sold by us. Then test the unit to make sure that it complies with the manufacturer's published specifications.
- ☐ Contact us for service assistance.

Maintenance



NOTE:

- ❑ These schedules are the minimum frequency based on typical usage of 2000 hours per year. You should service the equipment more frequently if you use it more than the typical yearly usage.

Maintenance Schedule:

Minimum frequency	Maintenance
Daily	Clean the external surfaces. 21% O ₂ calibration (O ₂ sensor in breathing system).
Biweekly	Drain the vaporizers and discard the agent.
Monthly	100% O ₂ calibration (breathing system O ₂ sensor). Clear water built up inside the waterstraps of CO ₂ module and AG module.
During cleaning and setup	Inspect the parts and O-rings for damage. Replace or repair as necessary.
Annually	Replace the seal on the vaporizer manifold and that on the breathing system port. Contact us for details. CO ₂ module calibration. AG module calibration.
Every three years	Replace the built-in lithium-ion batteries. Contact us for details.
As necessary	Before installing the cylinder, use a new cylinder gasket on cylinder yoke. Empty the water collection cup If there is water built up in it. Replace the sodalime in the sodalime canister if sodalime color changes. Replace the breathing system O ₂ sensor if it is damaged (Under typical use the sensor meets specifications for one year.). Replace the flow sensor if it is damaged. Calibrate the flow sensor when any of the following occurs: 1) the flow sensor is changed; 2) the tidal volume set is not consistent with that displayed when no leakage occurs; 3) there is a great difference between the tidal volume measured and that displayed by the bellows scale when fresh gas is very small.


Flow Sensor Calibration



NOTE:

- ❑ Do not perform calibration while the unit is connected to a patient.
- ❑ During calibration, do not operate the pneumatic parts. Do not move or press the breathing tubes especially.
- ❑ During calibration, the drive gas pressure must be kept above 0.3 MPa. Otherwise calibration failure may result.


To calibrate the flow sensor, do as follows:

1. Before calibration, ensure that the supply gas pressure is normal.
2. Turn all flowmeter controls to 0. Turn off all fresh gas inputs.
3. Make sure that the bag/mechanical ventilation switch is set to the  position.
4. Remove the folding bag from the bellows and reinstall the bellows housing.



5. Plug the Y piece into the leak test plug to close the breathing system.



7. Make sure that the system is Standby. If not, press the  key and then select [Ok] from the pop-up menu to enter standby status.
8. Select the [Maintenance] shortcut key and then select [Flow Sensor Cal. >>] to open the [Flow Sensor Cal.] menu. Select [Start] from the menu to start to calibrate the flow sensor. The screen prompts [Calibrating].
9. During calibration, if you select [Stop], calibration is stopped. Then the message [Calibration Stopped! Calibration is unfinished.] is displayed. This indicates invalid calibration instead of calibration failure.
10. After a successful calibration, the screen shows [Calibration Completed!]. Otherwise, the message [Calibration Failure! Please try again.] is displayed. In this case, you need to do the calibration again.

Flow Sensor Calibration

In case of flow sensor calibration failure, refer to the following table for troubleshooting.

Failure description	Possible cause	Recommended action
After the calibration is started, the message of calibration failure is displayed before ventilation sound is heard.	<ol style="list-style-type: none"> 1. The pipeline supply pressure is too low. 2. The bag/mechanical ventilation switch is not set to the mechanical position. 3. The supply pressure switch malfunctions. 4. The bag/mechanical ventilation switch malfunctions. 	<ol style="list-style-type: none"> 1. Check the supply pressure and ensure that it is not lower than 0.2 MPa. 2. Check the bag/mechanical ventilation switch and ensure that it is set to the mechanical position. 3. In case that the supply pressure is normal but the alarm [Drive Gas Pressure Low] is still on, contact us. 4. Switch over the bag/mechanical ventilation switch but the ventilation status displayed in the screen upper left corner keeps unchanged. In this case, contact us.
After the calibration is started, the message of calibration failure is displayed shortly after ventilation sound is heard.	<ol style="list-style-type: none"> 1. The flow sensor in the breathing system is not installed properly. 2. The check valve assembly in the breathing system is not installed properly. 3. The flow sensor malfunctions. 	<ol style="list-style-type: none"> 1. Check the flow sensor and the related sealing components for improper installation. 2. Check the check valve assembly and the related sealing components for improper installation. 3. Replace the flow sensor and calibrate again. 4. If the problem persists after taking all the mentioned measures, contact us.
After the calibration is started, the ventilation sound is heard. After the calibration lasts about 3 minutes, the system prompts calibration failure.	During calibration, the gas supply or the breathing tubes are interfered so that the calibration data are not correct.	<ol style="list-style-type: none"> 1. Remove the problem that the tubes are pressed. Calibrate the flow sensor again by following calibration procedures. 2. If the problem persists after multiple calibrations, contact us.

Commonly-encountered Problems

Failure description	Possible cause	Recommended action
The alarm [Check Flow Sensors] is displayed.	<ol style="list-style-type: none"> 1. The expiratory/inspiratory check valve and its seal are not installed properly. 2. The flow sensor is installed improperly or damaged. 3. Other part of the anesthesia machine malfunctions. 	<p>In case of this problem, judge the actual gas delivery volume to the patient by observing the graduation on the bellows housing. If it is abnormal, apply manual ventilation. After the operation, take the measures below to remove the problem.</p> <ol style="list-style-type: none"> 1. Clear water or other liquids built up inside the flow sensor in the breathing system. 2. Check if the flow sensor is installed properly and if its sealing components are in good condition. 3. Recalibrate the flow sensor. 4. Check the membrane inside the flow sensor for distortion. If there is, replace the flow sensor and calibrate again. 5. Check if the expiratory/inspiratory check valve and its seal are installed properly. If necessary, use a new one and reinstall it. 6. If the problem persists after taking all the mentioned measures, apply manual ventilation and contact us promptly.
The alarm [Volume Monitoring Disabled] occurs.	<ol style="list-style-type: none"> 1. ACGO is switched on. 2. The flow sensor malfunctions. 	<ol style="list-style-type: none"> 1. Switch off ACGO. 2. If the sensor malfunction related alarm is detected, apply manual ventilation and contact us promptly.

Commonly-encountered Problems

Failure description	Possible cause	Recommended action
The alarm [Paw Too High] or [Pressure Limiting] occurs.	<p>1 The breathing tubes are occluded.</p> <p>2 Patient airway is occluded.</p> <p>3 Paw high alarm setting is too low or Plimit setting is too low.</p> <p>4 Ventilation parameters are changed.</p> <p>5 The value measured by the airway pressure sensor is a bit high.</p> <p>Any of the above reasons may cause Paw to be higher than Paw high alarm limit so that the alarm [Paw Too High] is triggered, or cause Paw to exceed the Plimit setting so that the alarm [Pressure Limiting] is triggered.</p>	<p>1 Check if the breathing tubes are pressed or bent. Check if the filter connected to the Y-piece is filled with patient secretions and replace it if necessary.</p> <p>2 Check if the patient tracheal intubation is in good condition. If necessary, clear excessive patient secretions in the airway.</p> <p>3 Increase Paw high alarm setting or Plimit setting.</p> <p>4 Re-set the ventilation parameters.</p> <p>5 Compare the Ppeak displayed on the screen with the reading on the airway pressure gauge. If the Ppeak is significantly different from the maximum reading on the airway pressure gauge, apply manual ventilation and contact us promptly.</p>
The alarm [Paw Too Low] occurs.	<p>1 The breathing tubes leak.</p> <p>2 Paw low alarm limit is set too high.</p> <p>3 The breathing system is not installed properly.</p> <p>4 The value measured by the pressure sensor is a bit low.</p> <p>Any of the above reasons may cause the Paw to be lower than the Paw low alarm limit for consecutive 20 seconds.</p>	<p>1 Check for tube leakage, especially when the disposable breathing tubes are used. Replace them promptly in case of leakage.</p> <p>2 Set Paw low alarm limit to a lower value.</p> <p>3 Check if the breathing system is installed properly. If necessary, reinstall it.</p> <p>4 Compare the Ppeak displayed on the screen with the reading on the airway pressure gauge. If the Ppeak is significantly different from the maximum reading on the airway pressure gauge, apply manual ventilation and contact us promptly.</p>

Commonly-encountered Problems

Failure description	Possible cause	Recommended action
The alarm [Sustained Airway Pressure] occurs.	<ol style="list-style-type: none"> 1. TV is set too high. Rate or I:E setting is too high, which disables complete expiration and results in sustained airway pressure. 2. The airway resistance inside the patient expiratory pipeline in the breathing system is too high. 3. The airway resistance inside the AGSS is so high that the expiratory pressure cannot be released timely. 	<ol style="list-style-type: none"> 1 Decrease TV or the respective settings for Rate and I:E to lengthen expiratory duration. 2. Check if the expiratory pipeline is pressed or distorted. Check if the filter connected to the Y-piece is filled with patient secretions and replace it if necessary. 3. Check if the AGSS is blocked. 4. If the problem persists after taking all the mentioned measures, apply manual ventilation and contact us promptly.
The alarm [Pinsp Not Achieved] occurs.	<ol style="list-style-type: none"> 1. In the PCV mode, Pinsp is set too high or RR is too high. 2. Patient compliance is too high. 3. The folding bag collapses or does not reach the top of the bellows housing. 4. The breathing system or patient tracheal intubation leaks. 	<ol style="list-style-type: none"> 1. Adjust pressure control parameters. 2. If the actual gas delivery volume detected is too high, switch to VCV. 3. Push the O2 flush button to fill the folding bag. Increase the fresh gas flow appropriately to ensure the folding bag reaches the top of the bellows housing each time. 4. Check the breathing system and patient tracheal intubation for leakage. 5. If the problem persists after taking all the mentioned measures, apply manual ventilation and contact us promptly.

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Failure description	Possible cause	Recommended action
The alarm [Paw < -10cmH ₂ O] occurs	<p>1 Patient spontaneous breathing is so strong that Paw is less than -10 cmH₂O.</p> <p>2 The value measured by the pressure sensor is not correct.</p>	<p>1. Check if the patient is in good condition. According to patient physiological status, increase TV delivery or fresh gas flow, or check if patient tracheal intubation is in good condition.</p> <p>2. Compare the value measured by the pressure sensor with the reading on the airway pressure gauge. If the difference is significant, apply manual ventilation and contact us promptly.</p>
The alarm [TV Not Achieved] occurs.	<p>1 TV is set too high, RR too high or PEEP too high.</p> <p>2. Paw is higher than Plimit so that gas delivery stops in advance.</p> <p>3. The folding bag collapses or does not reach the top of the bellows housing.</p> <p>4. The breathing system or patient tracheal intubation leaks.</p>	<p>1. Adjust the breathing parameter settings.</p> <p>2. Change the Plimit setting and check if the breathing tubes are blocked.</p> <p>3. Push the O₂ flush button to fill the folding bag. Increase the fresh gas flow appropriately to ensure the folding bag reaches the top of the bellows housing each time.</p> <p>4. Check the breathing system and patient tracheal intubation for leakage.</p> <p>5. If the problem persists after taking all the mentioned measures, apply manual ventilation and contact us promptly.</p>

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Failure description	Possible cause	Recommended action
The alarm [TV Comp Disabled] occurs.	<ol style="list-style-type: none"> 1. TV compensation is switched off. 2. The flow of fresh air is too high. 3. There is significant leakage in the breathing system. 4. The measured value by the flow sensor in the breathing system is inaccurate. 	<ol style="list-style-type: none"> 1. Switch on TV compensation. 2. Decrease the fresh gas flow appropriately. 3. Check the breathing system and patient tracheal intubation for leakage. 4. During ventilation, observe the graduation on the bellows housing and the fresh gas volume. If necessary, change the parameter setting to ensure that the gas delivery volume meets the patient requirements or apply manual ventilation. After the operation, check the sensor measurement and perform calibration at the user-end. If necessary, replace the flow sensor and calibrate again. 5. If the problem persists after taking all the mentioned measures, apply manual ventilation and contact us promptly.
The alarm [Pressure Monitoring Channel Failure] occurs.	<ol style="list-style-type: none"> 1. The measured value by the pressure sensor exceeds the range. 2. The pressure sensor malfunctions. 	<ol style="list-style-type: none"> 1. Observe if the anesthesia machine operates normally. If yes, switch it to VCV. If not, apply manual ventilation and restart the machine. 2. If the measured value is significantly different from the reading on the airway pressure gauge, contact us promptly.

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Failure description	Possible cause	Recommended action
The alarm [Apnea Alarm] occurs	<p>1 The ventilator fails to detect changes of flow and pressure.</p> <p>2 If the backup ventilation time in PSV mode is set to be longer than 20 s, this alarm occurs when the backup ventilation mode is started.</p>	<p>1. Check if the breathing system is installed properly or leaks significantly. Check if the flow sensor is in good condition or installed properly. In case that parts are damaged or failures cannot be removed, apply manual ventilation and contact us promptly.</p> <p>2. Set the backup ventilation time to be shorter than 20 s in PSV mode if necessary.</p>
The alarm [TV _e >TV _i] occurs.	<p>1. The value measured by the expiratory flow sensor is a bit high or that measured by the inspiratory flow sensor is a bit low.</p> <p>2. The expiratory valve assembly is not installed properly.</p>	<p>In case of this problem, judge the actual gas delivery volume to the patient by observing the graduation on the bellows housing. If it is abnormal, apply manual ventilation. After the operation, take the measures below to remove the problem:</p> <ol style="list-style-type: none"> 1. Clear water or other liquids built up inside the flow sensor in the breathing system. 2. Check if the flow sensor is installed properly and if its sealing components are in good condition. 3. Re-calibrate the flow sensor. 4. Check the membrane inside the flow sensor for distortion. If there is, replace the flow sensor and calibrate again. 5. Check if the expiratory/inspiratory check valve and its seal are installed properly. If necessary, use a new one and reinstall it. 6. If the problem persists after taking all the mentioned measures, apply manual ventilation and contact us promptly.

Commonly-encountered Problems

Failure description	Possible cause	Recommended action
The alarm [O2 sensor Unconnected] occurs.	<ol style="list-style-type: none"> 1. The O2 sensor is not connected. 2. The O2 sensor cable is not connected properly. 	<ol style="list-style-type: none"> 1. Connect the O2 sensor. If it is not configured, select [User Maintenance >>] → [Set O2 Sensor Monitoring >>]. Then select [OFF] from the pop-up menu. 2. Check if the O2 sensor cable is connected properly. If not, reconnect the O2 sensor and its cable. 3. If the problem persists after taking all the mentioned measures, contact us promptly.
The alarm[Low Battery Voltage!] occurs.	The battery voltage is too low.	<ol style="list-style-type: none"> 1. Reconnect the AC mains. In case of power failure, use manual ventilation mode. 2. Reconnect the AC mains and charge the battery. After 30 minutes, disconnect the AC mains. If this alarm is still on, the battery has been damaged. Contact us promptly.
The alarm[XX Comm Error] or [XX Comm Stop] occurs (XX represents Power System, Auxil Ctrl Module, Flowmeter, CO2, AG or BIS).	<ol style="list-style-type: none"> 1. Software occasional error. 2. Ventilator hardware error. 	<ol style="list-style-type: none"> 1. Apply manual ventilation and restart the machine. 2. If the problem persists after taking all the mentioned measures, contact us promptly.
The alarm [Heating module Failure] occurs.	<ol style="list-style-type: none"> 1. The heating voltage of the heating module malfunctions. 2. The temperature test malfunctions. 	Contact us.

Commonly-encountered Problems

Failure description	Possible cause	Recommended action
<p>The breathing system leaks, or the leak test of the breathing system is not passed.</p>	<ol style="list-style-type: none"> 1. Loose connections between the breathing tubes and the connectors occur. Patient tracheal intubation leaks. 2. The POP valve and its seal inside the bellows assembly are installed improperly or damaged. The folding bag is improperly installed, aged or distorted. The bellows housing is improperly installed. 3. The expiratory/inspiratory check valve assembly is not installed properly. 4. The sodalime canister assembly and its sealing components are not installed properly. Soda powder falls into the breathing system. 5. The breathing system is not installed properly. 6. APL valve pressure is insufficient or APL valve malfunctions (in manual ventilation mode). 	<ol style="list-style-type: none"> 1. Check for loose connections between the breathing tubes and the connectors. If the disposable tubes are used, replace them timely. During an operation, check patient tracheal intubation for leakage. 2. Check the POP valve, folding bag, the bellows housing and the sealing components for improper installation. If necessary, use a new seal and install it. If the folding bag aging or distortion is detected, apply manual ventilation and contact us promptly. 3. Check the expiratory/inspiratory check valve cover and its seal for improper installation. If necessary, use a new seal and install it. 4. Check the sodalime canister and its seal for improper installation. If necessary, use a new seal and install it. If soda powder falls into the breathing system, remove it. Follow the procedures specified in the Operator's Manual to change the sodalime. 5 Check if the breathing system is installed properly. If necessary, reinstall it. 6. Increase the APL valve pressure. 7.If the problem persists after taking all the mentioned measures, apply manual ventilation and contact us promptly.

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Failure description	Possible cause	Recommended action
<p>In mechanical ventilation mode, the folding bag of the bellows is basically disabled. The machine seemingly stops operation.</p>	<ol style="list-style-type: none"> 1. Switch on the ACGO. 2. TV or pressure level is set too low, which causes low gas delivery flow. TV setting is not high but the fresh gas is set too high, which causes fresh gas volume to reach the TV setting and the folding bag to remain unmoved. 3. The sensor or the valve malfunctions, or other software/hardware system malfunctions. 	<ol style="list-style-type: none"> 1. Switch off the ACGO. 2. Decrease the fresh gas and increase the TV appropriately to increase Rate. 3. Apply manual ventilation and restart the machine. 4. If the problem persists after taking all the mentioned measures, contact us promptly.
<p>The alarm [O2-N2O Ratio Error] occurs.</p>	<p>The O2-N2O cut-off valve or the O2-N2O chain linkage malfunctions.</p>	<p>Refer to other O2 concentration monitoring when adjusting O2 flow and N2O flow. Ensure that the O2-N2O ratio meets the actual patient requirement. Contact us promptly.</p>

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