Veta 5

Anesthesia Machine

Operator's Manual

CE

 For this Operator's Manual, the issue date is March, 2021.

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- the product is used in accordance with the instructions for use.

WARNING: **It is important for the hospital or organization that employs this equipment to carry out a reasonable service/maintenance plan. Neglect of this may result in machine breakdown or personal injury.**

NOTE: **This equipment must be operated by skilled/trained clinical professionals.**

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Preface

Manual Purpose

This manual contains the instructions necessary to operate the product safely and in accordance with its function and intended use. Observance of this manual is a prerequisite for proper product performance and correct operation and ensures animal and operator safety.

This manual is based on the maximum configuration and therefore some contents may not apply to your product. If you have any question, please contact us.

This manual is an integral part of the product. It should always be kept close to the equipment so that it can be obtained conveniently when needed.

Intended Audience

This manual is geared for clinical professionals who are expected to have a working knowledge of medical procedures, practices and terminology as required for monitoring of critically ill animals.

Illustrations

All illustrations in this manual serve as examples only. They may not necessarily reflect the setup or data displayed on your anesthesia machine.

Conventions

- *Italic* text is used in this manual to quote the referenced chapters or sections.
- [ ] is used to enclose screen texts.
- → is used to indicate operational procedures.

Password

A password is required to access different menus within the anesthesia machine.

- System menu: 1234

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1.0 *Safety*

1.1 Safety Information

WARNING — Indicates a potential hazard or unsafe practice that, if not prevented, could result in death, serious injury or property damage.

CAUTION — Indicates a potential hazard or unsafe practice that, if not prevented, could result in minor personal injury, product fault, damage or property loss.

NOTE — Highlights important precautions and provides descriptions or explanations for better use of this product.

1.1.1 WARNING

WARNING: Do not operate the anesthesia machine before reading this manual.

WARNING: Before operation, ensure that the machine, connecting cables, and accessories are in correct working order and operating condition.

WARNING: The equipment must be connected to a properly installed power outlet with protective earth contacts only. If the installation does not provide for a protective earth conductor, disconnect it from the power cord or operate with the equipment's internal battery supply.

WARNING: Connect the anesthesia machine to an AC power source before the internal battery power source is depleted.

WARNING: Do not use the machine in the presence of flammable or explosive materials to prevent fire or explosion.

WARNING: Do not open the case of the machine, as you may suffer an electric shock. All servicing and upgrading operations of the machine must be carried out only by the trained and authorized Mindray personnel.

WARNING: Fresh gas flow must never be switched off before the vaporizer is switched off. The vaporizer must never be left switched on without a fresh-gas flow. Otherwise, anesthetic agent vapor at a high concentration can get into the machine lines and ambient air, causing harm to people and materials.

WARNING: Before moving the anesthesia machine, remove the objects from the top shelf and bracket to prevent the system from tilting.

WARNING: Disconnect the power supply before repairing the machine.

WARNING: Do not use the anesthesia machine when there is leakage in the breathing system.

WARNING: Check the specifications of the Anesthetic Gas Scavenging System (AGSS) processing system and the specifications of the anesthesia machine to ensure compatibility and to prevent a mismatched processing system.

WARNING: A hazard may exist due to the use of improper connectors. Ensure all assemblies use the proper connectors.

WARNING: **Single use breathing tubes, soda lime, watertraps, sampling tubes and other single use items may be considered potential biologically hazardous items and should not be reused. Dispose of these items in accordance with hospital policy and local regulations for contaminated and biologically hazardous items.**

WARNING: **The top shelf should not be used to push or lift the machine.**

WARNING: **Do not use antistatic masks or breathing tubes.**

WARNING: **Cross infection may be caused if the anesthesia machine is used without timely disinfection.**

WARNING: **Do not clean or repair the machine during operation.**

WARNING: **The mains plug is used to isolate the anesthesia vaporizer electrically from the supply mains. Do not place the anesthesia machine to a place where it is difficult to operate the plug.**

WARNING: **All analog or digital equipment connected to this system must be certified passing the specified IEC standards (such as IEC 60950 for data processing equipment and IEC 60601-1 for medical electrical equipment). All configurations shall comply with the valid version of IEC 60601-1. The personnel who are responsible for connecting the optional equipment to the I/O signal port shall be responsible for medical system configuration and system compliance with IEC 60601-1.**

WARNING: **Do not touch the animal when connecting external devices via the I/O signal ports to prevent animal leakage current from exceeding the requirements specified by the standard.**

1.1.2 CAUTION

CAUTION: **Use only the accessories specified in this manual to ensure animal safety.**

CAUTION: **Dispose of the machine and its accessories that approach the end of service life in compliance with applicable local laws and regulations or hospital regulations.**

CAUTION: **Electromagnetic field may affect the equipment performance. Therefore, other devices used in the vicinity of the machine must meet corresponding EMC requirements. Mobile phones and X-ray or MRI Machine are possible sources of interference as they emit higher levels of electromagnetic radiation.**

CAUTION: **This system is capable of operating properly at the interference levels indicated in this manual. Higher levels of interference may trigger alarms and even stop automatic ventilation. Please keep the equipment away from high-intensity electric fields which may cause the system to issue false alarms.**

CAUTION: **Ensure that the voltage and frequency of the power supply fall into the specified ranges on the equipment's label or in this manual before connecting the equipment to a power supply.**

CAUTION: **Always install or transfer the machine carefully to prevent the machine from fall, collision, violent vibration or other damage from external mechanical force.**

CAUTION: **In standard configuration, the anesthesia machine can maintain stable when it is tilted at 10 degrees. Do not hang objects on two sides of the machine in case of tipping.**

CAUTION: **Fix the equipment on the top shelf securely to prevent unexpected sliding.**

CAUTION: **Prevent or avoid using and storing the gas supply hose assembly in an environment exposed to ultraviolet light or oxidizing agents, or in a high-temperature or moist environment to avoid damage to people and materials because of the release of pressure from aged hoses in the assembly.**

CAUTION: **The machine is not suitable for use in a magnetic resonance imaging (MRI) environment.**

CAUTION: **Use the power cord provided with the product.**

CAUTION: **Unintended movement may occur if the casters are not locked. Casters should be locked during operating the machine.**

1.1.3 NOTE

NOTE: **Put the machine in a location that facilitates observation, operation and maintenance. During operation, stay right in front of the machine within four meters away from the display to facilitate observation of the displayed information on the machine.**

NOTE: **Keep this manual somewhere near the machine for convenient and prompt access.**

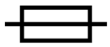
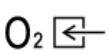
NOTE: **This manual describes the product for the purpose of fully covering its functions and configuration options, and the product you have purchased may not support part of these functions or configuration options.**

NOTE: **The battery supply of this machine is not a user serviceable component. Only an authorized service representative can replace the battery supply. If the system is not used for a long time, contact Mindray Technical Support to have the battery supply disconnected. At the end of the battery life, dispose of the battery in accordance with local regulations.**

NOTE: **Some alarm settings on this machine are not configurable by users.**

NOTE: **When the Compliance Compensation is Off, the tidal volume may not reach the set value.**

1.2 Device Symbols

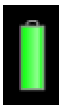
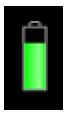
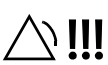
SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	Refer to the operator's manual		Warning
	Fuse		Input/output connector
	Alternative current		Protective earth (ground)
	Power switch		Battery LED
	Not autoclavable	IPX1	Degree of protection against harmful ingress of water
	Unlock		Lock
	Oxygen supply connector		Air supply connector
	Manual ventilation		Auto ventilation
	Minimum value		Maximum value
	Gas outlet		Flow or pressure control knob
	Temperature limitation		Humidity limitation
	Atmospheric pressure limitation		Keep dry
	This way up		Fragile, handle with care
	Recyclable		Stacking limit by number
	Manufacturer		Date of manufacture

SN	Serial number		Defibrillation-proof type BF applied part
	No push	O_2+	O_2 flush button
MR	MR Unsafe - do not subject to magnetic resonance imaging (MRI)		Gas Inlet
	Manual bag connector	OFF ◄ ACGO ► ON	ACGO switch

The following definition of the WEEE label applies to EU member states only. This symbol indicates that this product should not be treated as household waste. By ensuring that this product is disposed of correctly, you will help prevent bringing potential negative consequences to the environment and human health. For more detailed information with regard to returning and recycling this product, please consult the distributor from whom you purchased it.
* For system products, this label may be attached to the main unit only.

CE

The product complies with the Low Voltage Directive 2014/35/EU and the EMC Directive 2014/30/EU.

	Battery is fully charged. AC power is connected and it is powering the system.		Battery is not installed
	Battery is partially charged. AC power is connected. It is charging the battery and powering the system.		Alarm Audio Pause icon
	Battery is fully charged and it is powering the system. AC power is not connected.		Low priority message
	Battery is partially charged and it is powering the system. AC power is not connected.		Medium priority message
	Battery level is low and it is powering the system. Recharging recommended. AC power is not connected.		High priority message

2.0 *Overview*

2.1 Introduction

2.1.1 Intended Use

The anesthesia machine supplies anesthetic agents to the animals and provides respiratory support.

WARNING: The anesthesia machine cannot be used in an MRI environment.

WARNING: The anesthesia machine should be operated by professional and trained anesthetists.

2.1.2 Contraindications

Not identified yet.

2.1.3 Product Description

The anesthesia machine consists of a main unit, anesthetic ventilator, anestheetic gas delivery system, anesthetic vaporizer, anesthetic breathing system (including the airway pressure gauge, bellow, CO_2 absorbent canister, inspiratory and expiratory check valves, APL valve and Auto/Manual switch), Anesthetic Gas Scavenging System (AGSS), CO_2 gas monitoring module and accessories. The anesthetic machine is applicable to the patient environment. The applied parts of the anesthesia machine are masks and breathing tubes.

The anesthesia system provides the following ventilation modes:

- Volume Support Ventilation (VS)
- Volume Control Ventilation (VCV)
- Pressure Control Ventilation (PCV)
- Synchronized Intermittent Mandatory Ventilation (SIMV)
- Manual Ventilation
- Non-rebreathing ventilation

2.2 Equipment Views

Refer to the accompanied Installation Guide to install this anesthesia machine.

2.2.1 Main Unit (Front View)

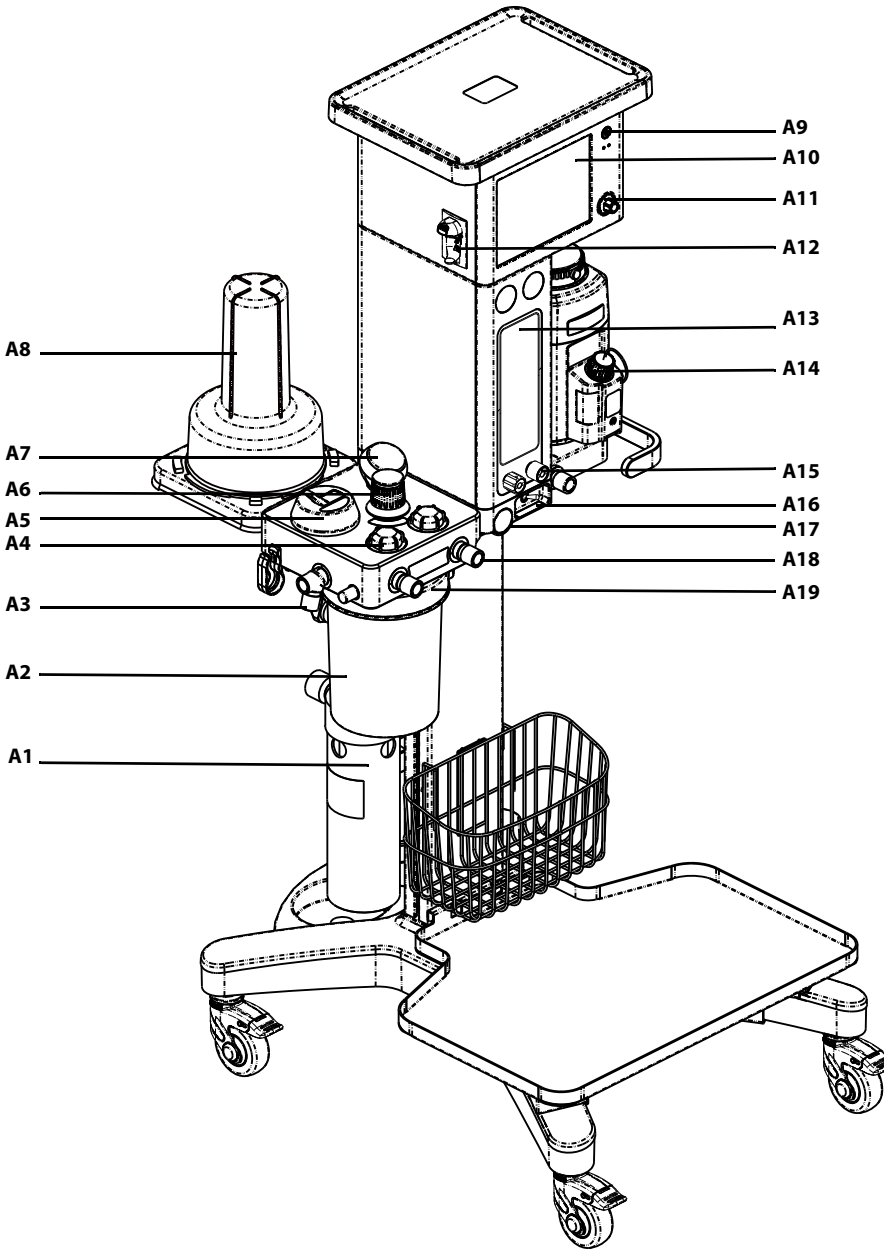


Figure 2-1 Main Unit (Front View)

COMPONENT		DESCRIPTION
A1	**AGSS System**	Used to discharge waste gas.
A2	**CO_2 absorbent canister**	The container for holding the CO_2 absorbent.
A3	**Manual bag connector**	Used to connect the manual bag for manual ventilation.
A4	**Observation window of expiratory/inspiratory check valve**	Used to observe the status of expiratory and inspiratory check valves from outside the equipment.
A5	**Auto/Manual switch**	Used to switch between the automatic ventilation and manual ventilation modes.
A6	**APL valve**	A rotary regulator for setting the pressure limit of the breathing system during manual ventilation. The scales on the APL valve indicate approximate pressure. Rotating the APL valve clockwise will increase the pressure limit and rotating it counterclockwise will decrease the pressure limit. The pressure limit will increase by 30 cmH_2O after pressing the APL valve and return to the original pressure after releasing.
A7	**Airway pressure gauge**	Used to indicate the airway pressure.
A8	**Bellows**	Used to separate the air of breathing system and drive gas. The bellows housing is a transparent cover with scale lines. These scale lines are only for information. It is recommended to read the tidal volume from the system screen. The tidal volume delivered is the sum of the bellow output and the fresh gas flow.
A9	**System switch**	Used to switch on or off the system.
A10	**Display**	Shows the software interface of the ventilator system. Selecting and changing settings is allowed by clicking the screen.
A11	**Master control knob**	Press the control knob to select menu items or confirm settings. Rotate clockwise or counterclockwise to scroll through menu items or change settings.
A12	**CO_2 module watertrap connector**	Used to install the watertrap.
A13	**Flowmeter**	Shows the flow of O_2 or air.
A14	**Vaporizer**	The vaporizer can accurately feed the anesthetic agent into anesthesia breathing system at certain concentration. Each vaporizer is calibrated for a specified anesthetic agent and is only suitable for that anesthetic agent. The specific agent that the vaporizer must be used is marked in text and by specific color on the vaporizer.
A15	**Flowmeter control knob**	Rotate the knob to adjust the flow.
A16	**ACGO (Auxiliary Common Gas Outlet) switch**	Used to enable/disable the ACGO function and output fresh gas through ACGO connector.
A17	**O_2 flush button**	Used to provide fixed O_2 flow for the inspiratory branch of the breathing system. Please note that the animal should be disconnected with the machine when pressing the O_2 flush button.
A18	**Inspiratory branch**	Inspiration connector.
A19	**Expiratory branch**	Expiration connector.

Table 2-1 Main Unit (Front View) Components List

2.2.2 Main Unit (Back View)

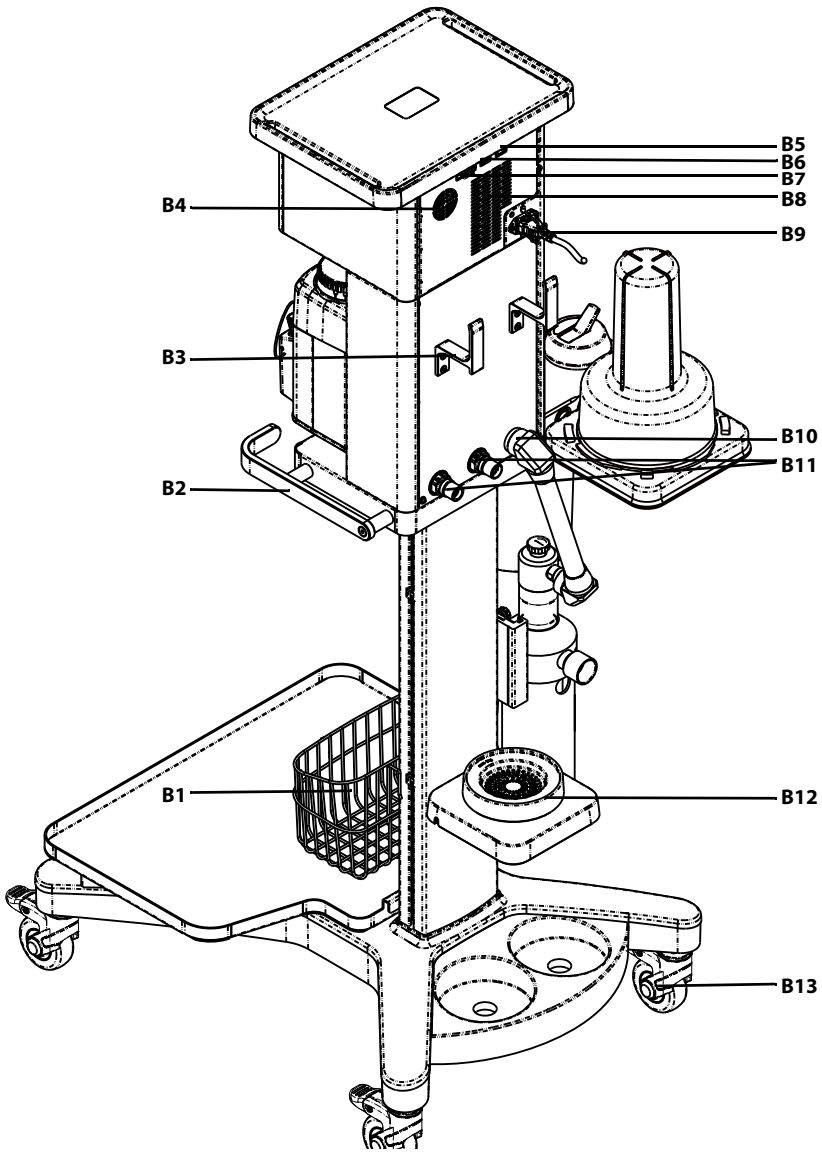


Figure 2-2 Main Unit (Back View)

COMPONENT		DESCRIPTION
B1	**Basket**	Used to store various medical equipments.
B2	**Handrail**	Used to move the machine. Its maximum bearable force is 100 N. **WARNING: The handrail should not be used to lift the machine.**
B3	**Hanger**	Used to hang gas supply hoses and power cords. **NOTE: Hang the cables on the hanger when moving the machine so as to prevent unexpected tilting.**
B4	**Ventilating fan**	Used to cool the electronic devices and prevent the accumulation oxygen concentrations. Do not block the ventilating fan.
B5	**Network interface (CS)**	Supports connection to a PC for software upgrading.
B6	**USB interface (SB)**	Used to connect to a USB device so as to export data and upgrade software.
B7	**Communication interface (SP)**	Multi-functional communication port which supports data transmission with the weigher.
B8	**Blower gas inlet**	Blower gas Inlet.
B9	**Power socket**	Used to connect the power cord.
B10	**Waste gas scavenging outlet**	Used to connect AGSS or the anesthesia gas filter canister.
B11	**Gas supply connector**	Oxygen and air supply connector.
B12	**Weigher**	Monitors the anesthesia gas filter canister in real time. When the weight increased surpasses the setting value of reminding, replace the gas filter canister. The cable of weigher should be connected to the multifunctional communication port (SP) to transfer data to the system.
B13	**Caster**	The casters are used to move the machine, and the brakes to fix it.

Table 2-2 Main Unit (Back View) Components List

3.0 System Interface and Basic Settings

3.1 System Interface

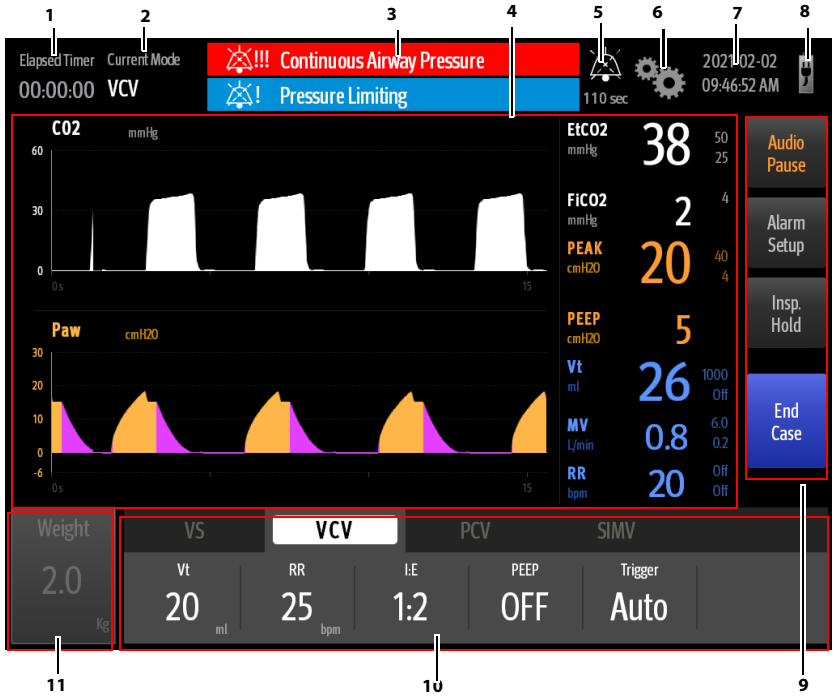


Figure 3-1 System Interface

NO.	SYSTEM INTERFACE	DESCRIPTION
1	Elapsed timer	Displays the timekeeping information. Select to start, stop or reset the timer.
2	Current ventilation mode	Displays the current ventilation mode.
3	Alarm message field	Displays current alarm messages, including physiological alarms, technical alarms and prompt messages.
4	Waveforms/parameter display field	Displays waveforms and monitoring parameters.
5	Alarm Audio pause field	When the 120s alarm audio pause countdown icon is displayed, it indicates that an alarm is generated and the alarm sound has been paused.
6	Setup	Select to open the **[Main]** menu.
7	System time	Displays the current system time.
8	Power status icon	Displays the current power supply status of the system.
9	Soft key field	Displays the soft keys such as audio pause, alarm setup, inspiration hold, and end /start case.

Table 3-1 System Interface

NO.	SYSTEM INTERFACE	DESCRIPTION
10	Ventilation mode and parameter setup field	Displays the keys for ventilation mode setup and corresponding parameters.
11	Weight	The weight of the animal can be set in standby status and displayed in non-standby status.

Table 3-1 System Interface

3.2 Basic Settings

Select button to enter the **[Main]** menu.

3.2.1 General

In this menu, it is allowed to set the Vt/Weight of the animal, CO_2 scale, screen brightness, key click volume and history. Detailed descriptions are shown as follows.

SETTING ITEMS	DESCRIPTION
Vt/Weight	Set the tidal volume and weight of the animal.
CO_2 Scale	Select 0-40 mmHg, 0-60 mmHg, or 0-80 mmHg.
Screen Brightness	Adjust the screen brightness from 0 to 10.
Key Click Volume	Adjust the key click volume from 0 to 10.
History	View the list of trends and the event log. The system can display 48 hours of data of trends continuously. Event logs will not be cleared after the anesthesia system powers off. The system can store up to 1,000 events. After the number of events exceeds 1,000, the earliest event will be overwritten by the latest event.

3.2.2 Weigher

The main function of the weigher is monitoring the weight of the anesthesia gas filter canister in real time. When the weight increased surpasses the setting value of reminding, replace the gas filter canister. Place a new anesthesia gas filter canister and connect the waste gas scavenging pipeline as per the prompts on the screen. Then, zero the weigher and enter the **[Weigher]** menu to set weight increase value for replacement remind.

3.2.3 Export Data

Insert a U disk to the USB interface of the equipment as per the prompts on the screen. In standby status, select botton → **[Export Data]** → **[Export]** to export system data to the USB flash disk. The system data includes machine ID, monitoring data, system information, historical data and network information.

3.3 System Settings

3.3.1 Setup

In standby status, select button, click **[System]** and input the default password "1234" to enter the system setting screen. The **[System]** interface is accessible only by authorized administrative service personnel with password access. Detailed introduction are as follows.

SETTING ITEMS	DESCRIPTION
Language/Unit	Set language, pressure unit, CO_2 unit and weight unit.
Altitude	Set the altitude based on the local altitude. The ventilator will be adjusted according to the setting altitude to ensure the accuracy of output tidal volume.
Time/Date	Set the date, date format, time and time zone, etc.
Profiles	Save the current profiles as the user configurations. When the anesthesia system restarts within 60 seconds after an abnormal power outage, the system can automatically restore the recent profile. If the power outage lasts longer than 120 seconds, the anesthesia system will automatically load the user profile before the shutdown. If the power outrage lasts between 60 to 120 seconds, the anesthesia system may automatically restore the recent profile or automatically load the user profile before the shutdown.
Weigher	Switch the weigher on or off. When the weigher is off, the weigher will not be displayed on the **[Main]** screen, and its related alarms and prompt information will be closed.
Change Password	Change the system password as needed. After the system is installed, the authorized administrator should change the default password immediately to prevent unauthorized access to the **[System]** menu. The password may contain up to 30 digits including numbers, letters (case sensitive) and characters.

3.3.2 Calibration

When there is a measurement deviation caused by an offset, select **[Calibrate]** → **[Zero Sensors]** → **[Begin]** to perform pressure and flow zeroing. Before zeroing, turn off all the flowmeters, and disconnect the machine with breathing tubes of the animal end. After zeroing, the screen will show up "Zeroing Successful".

When the CO_2 module works in full accuracy mode, select **[Calibrate]** → **[CO_2 Module]** to calibrate the CO_2 module. First, connect the calibration cylinder to the sampling tube and then open the cylinder pressure relief valve. Then, enter the concentration of the supplied gas. Finally, click **[Begin]** to start calibration.

3.3.3 Information

In this menu, the system displays machine ID, MAC address and function status. This information can only be viewed, not changed.

3.4 Service settings

Only authorized maintenance personnel by Mindray have access to the **[Service]** interface. Please contact Mindray Technical Support for assistance for help.

4.0 *Preoperative Tests*

4.1 Requirements of Preoperative Tests

Preoperative tests on the anesthesia machine should be performed according to the test intervals listed below. Refer to special procedures or precautions in this manual.

Perform the preoperative tests listed below at these events:

- **Before using the anesthesia machine on each animal:**
  - System Check
  - Startup Selftest
  - Leak Tests
  - Power Failure Alarm Tests
  - Pipeline Tests
  - Basic Ventilation Tests
  - Breathing System Tests
  - Alarm Tests
  - Inspect the AGSS
  - Inspect the Anesthesia Gas Filter Canister
  - Pre-operation Preparations
- **After the service or maintenance of the anesthesia machine:**
  - System Check
  - Startup Selftest
  - Pipeline Tests
  - Breathing System Tests
  - Inspect the AGSS
  - Pre-operation Preparations

NOTE: **Do not use the machine if a failure occurs. Please contact Mindray Technical Support.**

4.2 Preoperative Checklist

WARNING: **To ensure the normal operation of the machine and the safety of both the user and the animal, please follow all check procedures established by the hospital before administering anesthesia to the animal.**

- **Each day before administering anesthesia machine, the following should be done:**

1. Connect the anesthesia system to an AC power supply, turn on the power switch and verify that the system is powered by the AC power supply. Perform the System Check and Leak Test by following the instructions on the screen.
2. Check that the vaporizers are properly installed and sufficiently filled and that filler ports are tightly closed.

3. For the anesthesia gas filter canister, check if its gaining weight surpasses the claimed range. For an anesthesia machine equipped with an AGSS, check if the AGSS float position is between the Min and Max scale lines.

- **Prior to administering anesthesia machine to each animal, the following should be done:**

1. Check for any damage to or dangerous conditions in the equipment; ensure all necessary equipment and supplies are present, e.g., anesthetic drugs, CO_2 absorbent (not exhausted) and anesthesia gas filter canister (not overweighted).
2. Check that the central supply O_2 and Air pressure is within the specified range for pipelined gas supply (i.e., 280-600 kPa/40-87psi). Or, check the oxygen generator works well when using the oxygen generator and ensure that its maximum output pressure does not surpass 600 kPa.
3. With a breathing circuit and manual bag attached, check the operation of unidirectional valves by visual inspection.
4. Check the ventilation capability in Standby, Manual, VCV and VS modes.
5. Verify the monitoring functionality and check alarms.

- **Prior to administering anesthesia machine to each animal, the following should be done:**
  - Leak Test.

4.3 System Inspect

Check the system to meet the following requirements:

1. The equipment is correctly connected and in good condition.
2. Inspect the system for:

   a. Damage to flowmeters, vaporizers, gauges, supply hoses.

   b. Complete breathing system with adequate CO_2 absorbent.

3. Inspect other items:

   a. Flow control valve is closed.

   b. Vaporizer is closed.

   c. Vaporizer is dosed.

4. All components are correctly attached.
5. The breathing system is correctly connected and the breathing tubes are undamaged.
6. The gas supply system has been connected and the pressures are correct.
7. The necessary emergency equipment is available and in good condition.
8. Inspect the color of the soda lime in the canister. Replace the soda lime immediately if obvious color change is detected.
9. Applicable anesthetic and emergency drugs are available.
10. The casters are not damaged or loose, the brake(s) is set and prevents movement.
11. Ensure the breathing system is in proper position.
12. The AC mains indicator is displayed when the power cord is connected to the AC power source. If the indicator is not displayed, the system does not have electrical power.
13. The anesthesia system can be switched on or off normally.
14. Check if the O_2 flush button is normal.

4.4 Startup Selftest

1. When the system is turned on, it performs a self-test to ensure its alarm system (speaker) and hardware boards are properly functioning.
2. After the startup, the machine automatically enters the **[System Check]** screen. If failed, the failed items will show up on the screen.
3. Continue to operate or troubleshoot the equipment based on the selftest results.

4.5 Leak Tests

4.5.1 Auto Circuit Leak Test

NOTE: **The [Event Log] of the system records the result of the last automatic circuit leak test, including the passed, failed, or skipped recordings. If needed, select button to enter the [Main] screen and click [History] → [Event log].**

NOTE: **During the test, please replace the HEPA if the [Replace HEPA Filter] alarm prompts.**

NOTE: **The system will perform the compliance test while doing the auto circuit leak test. The compliance means the overall compliance of the breathing system (including bellows, CO_2 absorbent canister and breathing tubes).**

1. Start the test.
   - From system being turned on: when the system is turned on, it will initiate selftest and enter the **[Manual Circuit Leak Test]** screen.
   - From the standby screen: select **[Leak Test]** and enter **[Auto Circuit Leak Test]** screen.
2. Perform operations according to the instructions on the screen.

4.5.2 Manual Circuit Leak Test

1. Start the test.
   - From system being turned on: when the system is turned on, it will initiate self-test and enter the **[Manual Circuit Leak Test]** screen.
   - From the standby screen: select **[Leak Test]** and enter **[Auto Circuit Leak Test]** screen.
2. Perform operations according to the instructions on the screen.

4.6 Power Failure Alarm Tests

1. Press ⏻ to turn on the system.
2. Cut off the AC power.
3. Ensure that the AC power indicator is off and the system prompts **[Battery in use]**.
4. Reconnect the AC power.
5. Ensure that the AC power indicator is on and **[Battery in use]** disappears.
6. Press ⏻ to turn off the system.

4.7 Pipeline Tests

1. Connect the Air/O_2 pipeline or oxygen generator with the gas supply connector of the anesthesia machine. Then, turn on the system.
2. Adjust the flow to a medium level of the measurement range.
3. Ensure that the readings of each pipeline pressure gauge are within the range of 280 to 600 kPa. Please note that the readings of the pressure gauge should be in line with the output pressure of the oxygen generator.
4. Cut off the gas supply of the pipeline.
5. Ensure that the gauge of related gas supply pressure decreases to zero.

4.8 Basic Ventilation Tests

1. Install the breathing circuit and manual bag.
2. Connect the test lung or manual bag to the animal end of the Y-piece of the breathing circuit.
3. Set the O_2 flow to 1 L/min.
4. Set the anesthesia machine controls according to the following table:
5. Select **[VS]** and begin ventilation.

CONTROLS	SETTING
Ventilation Modes	VS
Vt	20 ml
Min RR	20 bpm
PEEP	OFF
Trigger	Auto

6. Verify that the manual bag at the animal end of the Y-piece of the breathing circuit inflates and deflates and that the monitoring value of Vt on the display is consistent with the setting value of Vt.

4.9 Breathing System Tests

WARNING: Objects in system can stop gas flow to the animal. This can cause injury or death. Ensure that there are no test plugs or other objects in the breathing system.

WARNING: Do not use a test plug that is small enough to fall into the breathing system.

1. Ensure that the breathing system is correctly connected and not damaged.
2. Ensure that the check valves in the breathing system are operating normally.
   a. If the inspiratory check valve opens during inspiration and closes at the start of expiration, then the inspiratory check valve is operating normally.
   b. If the expiratory check valve opens during expiration and closes at the start of inspiration, then the expiratory check valve is operating normally.

4.9.1 Bellows Tests

1. Set the system to Standby status.

2. Move the Manual/Auto switch to the Auto position.
3. Set all gas flows to a minimum volume.
4. Insert the Y-piece tube to the leak test plug so as to block the outlet of the Y-piece tube.
5. Press the O_2 flush button to raise the bellows to its top.
6. Ensure that the airway pressure cannot rise over 15 cmH_2O.
7. The large bellow should not drop more than 300 ml in a minute, or the small bellow should not drop more than 100 ml in a minute. Otherwise, it means the bellow is leaky. Please reinstall it.

4.9.2 APL Valve Tests

1. Ensure that the system is in Standby status. If not, select the **[Standby]** button on the main screen and follow the on-screen prompts to enter Standby mode.
2. Set the Manual/Auto switch to the Manual position.
3. Connect the manual bag connector.
4. Connect the Y-piece on the breathing circuit to the leak test port.
5. Turn the APL valve control knob to adjust the APL valve to 30 cmH_2O.
6. Set the O_2 flow to 3 L/min.
7. Ensure that value displayed on the airway pressure gauge ranges from 20 to 40 cmH_2O.
8. Pull the APL valve and observe the reading on the airway pressure gauge to verify that the pressure can reach to 50-70 cmH_2O.
9. Adjust the APL valve to the MIN position.
10. Ensure that the value displayed on the airway pressure gauge does not exceed 10 cmH_2O.
11. Set the O_2 flow to a minimum value. Ensure that the value displayed on the airway pressure gauge does not decrease below 0.

4.10 Alarm Tests

The system will perform selftest after startup. The startup interface will be displayed after a beep. The system will enter the leak test screen in half a minute. It indicates that the audible alarm indicator starts working.

Preparations before the Alarm Tests

1. Connect the test lung or manual bag to the animal end of the Y-piece of the breathing circuit.
2. Move the Auto/Manual Switch to the Auto position.
3. Power on the system. Set the system to Standby status.
4. Set the anesthesia machine controls as follows:
   - Ventilation mode: [VCV].
   - Vt: 50 ml.
   - RR: 20 bpm.
   - I:E: 1:2.
   - PEEP: OFF.
   - Trigger: Auto.
5. Press the O_2 flush button to lift the bellow to its top.
6. Rotate the O_2 flow knob to set the flow to 0.5-1 L/min.

7. Press **[Start Case]** button to start working status.
8. Ensure that:
   - Monitoring parameters of ventilator is normal.
   - The bellows can drop or rise regularly during mechanical ventilation.

4.10.1 Continuous Airway Pressure Too High Alarm Test

1. Connect the manual bag connector to its connector.
2. Set the O_2 flow to its minimum position.
3. Turn the APL valve control knob to adjust the APL valve to 30 cmH_2O.
4. Set the Auto/Manual switch to Manual position.
5. Push the O_2 flush button for about 15 seconds, and ensure that the screen prompts **[Continuous Airway Pressure]** alarm.
6. Open the gas outlet of the animal end and ensure that the **[Continuous Airway Pressure]** alarm disappears.

4.10.2 Paw Too High/Too Low Alarm Test

1. Set the Auto/Manual switch to Auto position.
2. Select **[Alarm Setup]** to enter the **[Alarm Limit]** screen.
3. Set Paw low limit to 10 cmH_2O and Paw high limit to 20 cmH_2O.
4. Set the Paw to 25 cmH_2O in a ventilation mode, and ensure that the **[Paw Too High]** alarm appears.
5. Set the Paw to 5 cmH_2O in a ventilation mode, and ensure that the **[Paw Too High]** alarm disappears and **[Paw Too Low]** alarm appears.
6. Set the Paw to 15 cmH_2O in a ventilation mode, and ensure that the **[Paw Too Low]** alarm disappears.

4.10.3 Vt Too High/Too Low Alarm Test

1. Set the Auto/Manual switch to Auto position.
2. Select **[Alarm Setup]** to enter the **[Alarm Limit]** screen.
3. Set Vt high limit to 40 cmH_2O and Vt low limit to 20 cmH_2O.
4. Connect the test lung with the Y-piece. Set Vt to 50 ml in VCV mode and ensure that the **[Vt Too High]** alarm appears.
5. Set Vt to 5 ml and ensure that the **[Vt Too High]** alarm disappears and **[Vt Too Low]** alarm appears.
6. Set Vt to 30 ml and ensure that the **[Vt Too Low]** alarm disappears.

4.11 Inspect the AGSS

Open the waste gas disposal system and check if the float can surpass the MIN line. Please read the figures according to the float center. If the float is tacky or damaged, please reinstall or replace it based on the following possible conditions.

NOTE: Do not block the AGSS pressure compensation openings during the inspection.

If the float fails to move up to above the MIN scale line, possible reasons include as follows:

1. The float surface is tacky. Turn over the AGSS and check if the float moves up and down freely.
2. The float is rising slowly. The filter may be blocked. Disconnect the EVAC port with the AGSS. Dismount the AGSS and its hose, together with its upper cover. Check the AGSS filter, and shake it above the waste container. Clean it if necessary. If it is a must to replace the filter, please follow local regulations to dispose of discarded filters.
3. The waste gas disposal system is not working, or the pump rate is less than the flow required for proper operating of the AGSS.

4.12 Pre-operation Preparations

1. Ensure that the anesthesia machine parameters and alarm limits are set to applicable clinical levels.
2. Ensure that the system is in Standby status.
3. Ensure that the equipment for airway pressure maintenance, manual ventilation and tracheal intubation, and applicable anesthetic and emergency drugs are available.
4. Set the ventilation switch to the Manual position.
5. Connect the manual bag to its connector.
6. Turn off the vaporizer.
7. Turn the APL valve control to the MIN position to fully open the APL valve.
8. Ensure that the breathing system is correctly connected and not damaged.

5.0 *Operation*

5.1 Turn on the System

1. Insert the power cord into the power socket. Ensure that the external power indicator is on.
2. Press ⏻ button and ⏻ is lit up.
3. The screen displays the start-up screen and then the system conducts a self check of the speaker once.
4. The screen displays the selftest progress bar, and then the system check screen is displayed.
5. Completes the leak test.

NOTE: **The system checks whether alarm tones function properly during the start-up. If normal, the speaker can produce self-test sound. Otherwise, do not use the equipment and contact Mindray Technical Support immediately.**

5.2 Set O_2 and Air Inputs

1. Connect the gas supply and ensure there is enough pressure for gas supply.
2. Adjust the flows of O_2 and Air by rotating the knob and their values are displayed on the flowmeter.

5.3 Set the Vaporizer

Press the control dial of the vaporizer to set the concentration of anesthetic agent to a proper value.

NOTE: **The barometric pressure may differ from the calibration pressure of the anesthetic vaporizer. This may cause an inaccurate output of the anesthetic agent. The operator should continuously monitor the concentration of anesthetic agent during system use to determine if the output concentration is accurate.**

NOTE: **Jerky movements or tilting at an angle of more than 30° can cause incorrect output concentration.**

NOTE: **If the vaporizer is not going to be used for up to six months, then the anesthetic agent inside the vaporizer should be drained.**

NOTE: **Check the liquid level of the vaporizer. If the liquid level is below the min warning line, it needs to add anesthetic agent.**

5.3.1 Fill the Anesthetic Agent

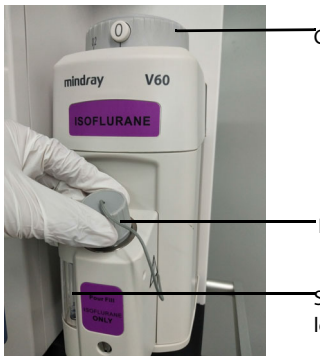
Check the following items before filling the anesthetic agent:

1. Check the vaporizer for damage.
2. Set the control dial to "0" (off) position.
3. Observe expiry date of the anesthetic agent.
4. After filling for the first time, wait 15 minutes for the dry wicks inside to become saturated.

WARNING: **Only fill the vaporizer with the anesthetic agent specified on it. Before use, check the name of anesthetic agent and color mark on the vaporizer and the anesthetic agent bottle. Sevoflurane is yellow while Isoflurane is purple.**

WARNING: **Stop using the vaporizer immediately which has been filled or partly filled with the wrong anesthetic agent or other substance to prevent danger to health. If this occurs, mark the vaporizer for incorrect filling and call the distributor for servicing.**

5.3.1.1 Pour Fill System



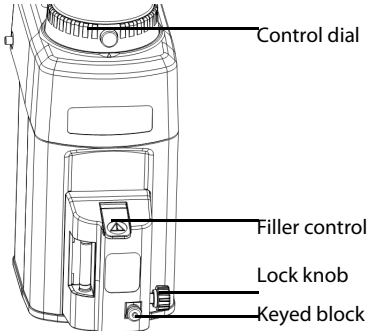
1. Set the control dial to "0" (off) position.
2. Rotate the filler cap slowly anticlockwise to discharge the pressure in the vaporizer.
3. Remove the cap of the anesthetic bottle, and pour the anesthesia agent into the vaporizer slowly.
4. Check the filling level on the sight glass during filling. The filling level must not exceed the maximum mark, or there is a risk of incorrect output concentration. If the maximum mark has been exceeded, the agent will flow out. Please drain the excess liquid (see "Drain the Anesthetic Agent" on Page 5-4)until the level drops below the maximum mark.
5. Tighten the filler cap clockwise. If this is not done properly, fresh gas and anesthetic agent may escape when the vaporizer is switched on next time.

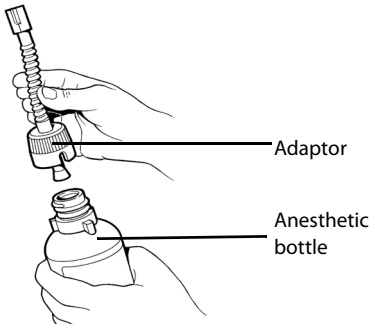
WARNING: **Significant quantities of anesthetic agent vapor may escape if the control dial does not return to "0" position.**

CAUTION: **It is necessary to wait at least 5 seconds after setting the control dial to "0" position before opening the vaporizer. This allows the pressure to balance and prevents fresh gas and anesthetic agent vapor escaping from the vaporizer.**

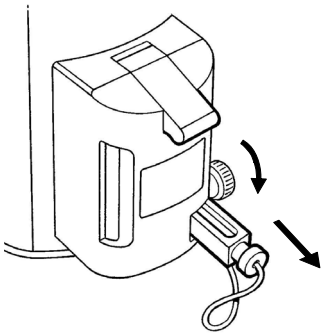
5.3.1.2 Key Filler System

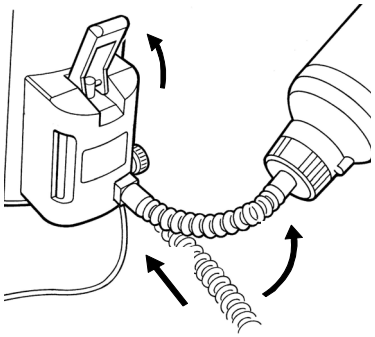
1. Set the control dial to "0" (off) position.
2. Attach the Keyed Filler adaptor to the bottle.
3. Tighten the adaptor to ensure an airtight joint, which must be maintained throughout the filling operation.



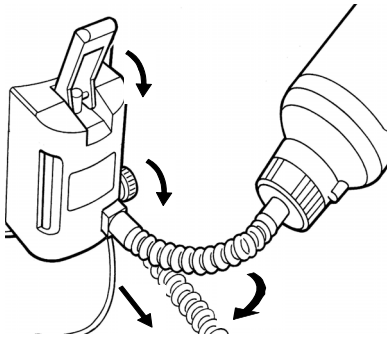


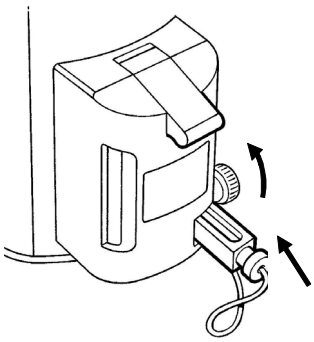
4. Loosen the knob and pull the keyed block out.
5. Insert the keyed end of the bottle adaptor fully into the vaporizer receiver. Tighten the lock knob to secure the adaptor.
6. Raise the bottle above the filler.
7. Open the filler control and allow the liquid to flow into the vaporizer until the upper mark is reached on the filler block window.





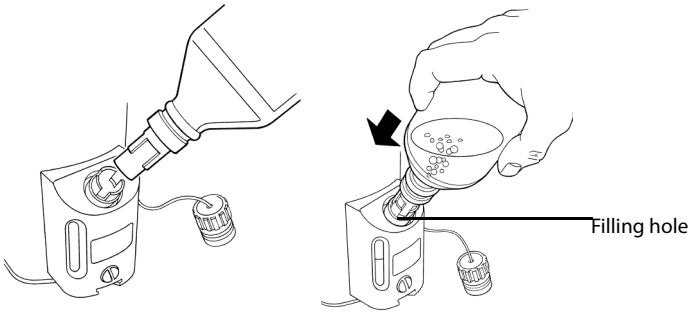
8. Close the filler control.
9. Lower the bottle below the level of the filler and allow the liquid in the bottle adaptor to flow back into the bottle. Loosen the lock knob, remove the bottle adaptor from the receiver.
10. Reinstall the keyed block and tighten the knob.





CAUTION: If the connection between the filling adaptor and the anesthetic agent bottle is not tight, the anesthetic agent may escape.

5.3.1.3 Quik-Fil System



1. Set the control dial to "0" (off) position.
2. Remove the protective cap from the anesthetic agent bottle filler, checking that the bottle and filler mechanism are not damaged.
3. Remove the vaporizer filler block cap and insert the bottle nozzle into the filler block. Rotate the bottle to align the bottle filler keys with the slots in the filler block.
4. Note the liquid level in the vaporizer window and press the agent bottle firmly into the vaporizer filler against the spring valve assembly. Allow the liquid to flow into the vaporizer until the maximum level mark is reached, paying continuous attention to the level in the window and the air return bubbles flowing into the bottle.
5. Release the bottle when the vaporizer is full and the continuous stream of bubbles ceases.
6. Pull out the bottle from the vaporizer filler and replace the vaporizer filler block cap, and the protective cap on the agent bottle.

NOTE: **The highest liquid level of the anesthesia agent is 250ml and the lowest of it is 35 ml.**

5.3.2 Drain the Anesthetic Agent

WARNING: **Handle, Storage, or dispose of the drained anesthetic as drug. Otherwise, anesthetic agent may be misused.**

WARNING: **When the drainage is completed, please tighten the filler cap and drainage knob; otherwise, the anesthetic agent may escape when the vaporizer is turned on next time.**

NOTE: **Do not reuse anesthetic agent drained from the vaporizer.**

NOTE: **During drainage, do not make an anesthetic bottle full; otherwise, anesthetic overflow may occur.**

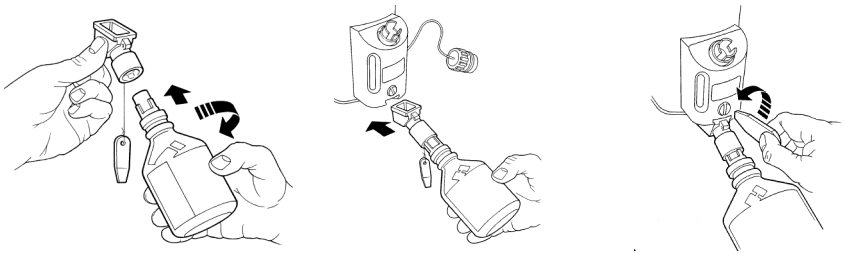
5.3.2.1 Pour Fill System

1. Set the control dial to “0” (off) position.
2. Select the correct bottle and place it under the drainage outlet.
3. Slowly rotate the filler cap counterclockwise.
4. Drain the anesthetic agent until no anesthetic agent is visible in the window and no anesthetic agent flows into the bottle. If necessary, turn off the drainage knob and drain the anesthetic agent into another anesthetic bottle.
5. When the vaporizer has been completely drained, close the drainage knob clockwise. Tighten the cap of the anesthetic agent bottle even if it is completely empty. Additionally, tighten the filler cap.

5.3.2.2 Key Filler System

1. Set the control dial to”0”(off) position.
2. Repeat Step 2-5 of Filling the anesthetic agent: Key Filler System (see "Key Filler System" on Page 5-2). Put the bottle under the vaporizer.
3. Open the filler control and allow the liquid of the adapter flow back to the bottle.
4. Close the filler control. Loosen the knob and pull the keyed block out. Reinstall the keyed block and tighten the knob.

5.3.2.3 Quik-Fil System



1. Remove the protective cap from an empty bottle. Insert the bottle nozzle into the drain funnel. Rotate the bottle to align the bottle filler keys with the index slots in the drain funnel, and screw the drain funnel onto the empty bottle.
2. Remove the vaporizer filler block cap.
3. Fully insert the drain funnel into the keyed drain slot, and unscrew the drain plug. Continue to drain the vaporizer until empty. Tighten the drain plug, and pull out the drain funnel.
4. Unscrew the drain funnel from the bottle and refit the bottle cap and the vaporizer filler block cap.

5.4 Set the Ventilation Mode

5.4.1 Set the Ventilation Mode and Parameters

Figure 5-1 Ventilation Mode

To set the ventilation mode:

1. In the ventilation mode field, rotate the control knob or click the screen to select ventilation modes.
2. Press the control knob and select  to confirm the settings.

A quick setting method of ventilation parameters is as follows:

1. In the parameter setting field, select the desired ventilation parameter to set.
2. Rotate the control knob to set the parameter to an appropriate value.
3. Press the control knob to confirm the settings.

5.4.2 Volume Support Ventilation (VS)

VS mode means that the system will start volume support ventilation upon detection of animal's inspiration effort that reaches the preset inspiratory trigger level. In VS mode, the ΔPsupp is adjusted based on the respiratory efforts of the animal in order to provide preset tidal volume to the animal.

In this mode, the duration of inspiratory and expiratory phase are controlled by the animal itself. The system starts automatic ventilation when it detects that the period of time in which the animal does not perform continuous effective inspiratory trigger exceeds the preset minimum respiratory rate.

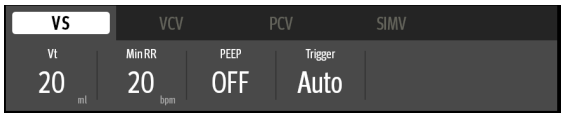
The first VS delivered is an experimental ventilation mode that delivers a breath according to the default pressure level. Then, this pressure level will be used as a regulating object for tidal volume control in the following ventilation cycles.

Set VS mode:

1. Select **[VS]** on the main screen.
2. Check that all the VS parameters are set appropriately. Rotate the control knob to set parameters.
3. Press the control knob to confirm the settings.

NOTE: **Before activating a new automatic ventilation mode, ensure that all related parameters are set appropriately. Other parameters can only be set after the setting one is confirmed.**

VS Parameters: Vt, Min RR, PEEP and Trigger.



5.4.3 Volume Control Ventilation (VCV)

VCV is a pressure control ventilation mode with the volume as its target.

In the VCV mode, each time automatic ventilation starts, gas is delivered to the animal at a constant flow. It implements volume control ventilation in a pressure-controlled manner. In VCV, a relatively low pressure level is held as much as possible during the inspiratory phase, and the gas volume delivered is guaranteed to be equal to the preset tidal volume. Pressure control level will vary according to the tidal volume setting, resistance and compliance of the animal's lungs. The adjustment of pressure increase of the machine is limited, and the maximum pressure cannot exceed the pressure alarm high limit -5 cmH_2O.

In the VCV mode, you can set PEEP to improve expiration of end-tidal carbon dioxide and to increase oxygenation of breathing process. The first VCV delivered is an experimental ventilation mode that delivers a breath according to the default pressure level. Then, this pressure level will be used as a regulating object for tidal volume control in the following ventilation cycles.

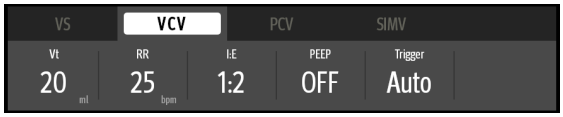
In this mode, the system will deliver a breath when detecting the spontaneous breathing of the animal.

To ensure the set tidal volume gas delivery, the ventilator adjusts gas flow based on the measured inspiratory volume, dynamically compensates for the loss of tidal volume arising from breathing system compliance and system leakage, and compensates for the effect of fresh gas as well. This is called tidal volume compensation..

Set VCV Mode:

1. Select the **[VCV]** on the main screen.
2. Check that all the VCV parameters are set appropriately. Rotate the control knob to set parameters.
3. Press the control knob to confirm the settings.

VCV Parameters: Vt, Min RR, PEEP and Trigger.



5.4.4 Pressure Control Ventilation (PCV)

In the PCV mode, each time automatic ventilation starts, airway pressure rises rapidly to the preset pressure control level. Then, the closed-loop feedback system adjusts the gas supply rate to an appropriate range based on the setting value of pressure control level and the compliance and resistance of the animal. Then gas flow slows down through the feedback system to keep Paw constant until expiration starts at the end of inspiration. The tidal volume delivered in the PCV mode changes based on the pulmonary compliance and airway resistance of different animals.

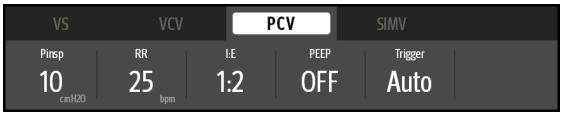
In this mode, the system will deliver a breath when detecting the spontaneous breathing of the animal.

In this mode, you can set PEEP to improve expiration of end-tidal carbon dioxide and to increase oxygenation of breathing process, etc.

Set PCV Mode:

1. Select the **[PCV]** on the main screen.
2. Check that all the PCV parameters are set appropriately. Rotate the control knob to set parameters.
3. Press the control knob to confirm the settings.

   PCV parameters: Pinsp, RR, I:E, PEEP and Trigger.



5.4.5 Synchronized Intermittent Mandatory Ventilation (SIMV)

SIMV mode delivers pressure regulated volume control ventilation to the animal at preset intervals. In the SIMV mode, the ventilator waits for the animal's next inspiration based on the specified time interval. The inspiratory trigger level can be divided into **[F-trig]**, **[P-Trig]** and **[Auto Trigger]**. If Trigger is reached within the trigger waiting time (called synchronous trigger window), the ventilator delivers pressure controlled ventilation synchronously with the preset tidal volume and inspiratory time. If the animal does not inhale in the trigger window, the ventilator will deliver pressure regulated volume control ventilation to the animal at the end of the trigger window. Spontaneous breathing outside trigger window can acquire pressure support.

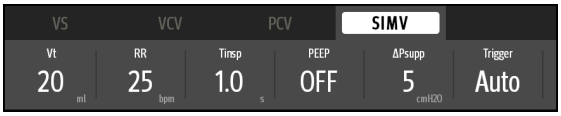
If the inspiratory trigger level is reached outside the trigger window, the ventilator will deliver pressure support ventilation at preset ΔPsupp.

Set SIMV Mode:

1. Select the **[SIMV]** on the main screen.

2. Check that all the SIMV parameters are set appropriately. Rotate the control knob to set parameters.
3. Press the control knob to confirm the settings.

   SIMV Parameters: Vt, RR, Tinsp, ΔPsupp, PEEP and Trigger.



5.4.6 Auxiliary Common Gas Outlet (ACGO) Mode

When ACGO is On, the system is in ACGO mode. If the current ventilation mode is VCV, and ACGO is enabled, the system will enter VCV mode automatically after the ACGO mode is Off without changing the ventilation mode.

5.4.7 Manual Ventilation

Manual ventilation mode is the operating mode used to manually ventilate the animals or allow animals to breathe spontaneously. To use this mode, set the APL valve to the desired pressure value and then adjust the Auto/Manual switch on the breathing system to enter or exit Manual mode. If necessary, push the O_2 flush button to inflate the manual bag.

1. Rotate the APL valve and adjust the pressure of the breathing system to an appropriate range.
2. Set the Auto/Manual switch to the Manual position.
3. Push the O_2 flush button to inflate the manual bag if necessary.

In this mode, APL valve is used to adjust the peak pressure of breathing system and gas volume of the manual bag. When the pressure in the breathing system reaches the preset limit of the APL valve, the valve will be opened to release the excessive gas.

NOTE: **Ensure that the manual ventilation mode can be used normally during operation.**

NOTE: **If the mechanical ventilation is failed, the manual ventilation mode can be set for continuous ventilation.**

5.5 Inspiratory Hold

Inspiration hold means to extend the animal's time of inspiratory phase manually and to prevent the animal from expiration for a certain period of time.

Press and hold the **[Insp. Hold]** on the screen. The anesthesia machine will start the inspiration hold function and the screen displays **[Insp. Hold Active]**. Release the **[Insp. Hold]**, and the machine terminates the inspiration hold function. For animals less than 3 Kg, the inspiration hold function lasts at most 5s; for animals 3 Kg or above, it lasts at most 30s.

NOTE: **The inspiration hold can only be used in mechanical ventilation modes, not in manual ventilation, ACGO and Standby modes.**

5.6 Ventilation Parameters

Setting parameters	Description
Vt	The gas volume that the animal inspires or expires each time during resting breathing.
Pinsp	The inspiratory pressure in the pressure control mode is an absolute value relative to the PEEP.
PEEP	Positive end expiratory pressure.
RR	The number of mechanically controlled breaths in one minute.
Tinsp	Inspiratory time in one breathing cycle.
I:E	Ratio of inspiratory time to expiratory time.
Trigger	Includes auto trigger, flow trigger (F-Trigger) and pressure trigger (P-Trigger). As for pressure trigger and flow trigger, when the trigger level is detected, the ventilator starts to enter the inspiratory phase.
MIN RR	The mechanically controlled breaths will be triggered when the inspiratory time surpasses the breathing cycle time of minimum respiratory rate.
ΔPsupp	A relative value of PEEP.
Monitoring parameters	**Description**
Vt	The expired tidal volume in one cycle.
Pplat	The maximum pressure in one breathing cycle or a fixed period of time.
PEEP	Positive end expiratory pressure.
RR	The respiratory rate monitored in one minute.
MV	The accumulated expired tidal volume in one minute.
$EtCO_2$	The concentration of CO_2 measured at the end of expiration.
$FiCO_2$	The concentration of CO_2 measured at the end of inspiration.

Table 5-2 Ventilation parameters

5.7 Enter Standby Mode

Select the **[Standby]** key and enter the Standby interface after confirmation.

WARNING: Entering Standby mode will stop ventilation and parameter monitoring. Do not select Standby mode if the animal requires continuous ventilation.

5.8 Power off the System

Power off the system by pressing ⏻ button in standby mode.

6.0 *Alarms*

6.1 Overview

Alarms refer to the alerts provided by the anesthesia machine to health care professionals in sounds or other forms when the animal that the machine is used on suffers an exceptional change in vital signs, or when the machine suffers a fault that prevents its proper functioning.

NOTE: **When the equipment is turned on, the system will monitor whether the alarm sound works normally. In normal condition, the equipment will give out a beep. If the sound does not work, do not use this equipment and contact Mindray technical support immediately.**

NOTE: **When multiple alarms of different priorities occur simultaneously, the machine selects the alarm of the highest priority and gives visual and audible alarm indications accordingly.**

NOTE: **If more than one alarm of the same level are triggered simultaneously, the alarm messages will be displayed in the sequence of alarm generation.**

NOTE: **If the equipment is powered off for less than 30 seconds and then powered on, the alarming settings will be restored to the status before the system was powered off.**

6.2 Alarm Types

The equipment provides three categories of alarms in the alarm message field on the screen: physiological alarms, technical alarms and prompt messages.

- **Physiological Alarm:**
  A physiological alarm is usually triggered when a physiological parameter value of the animal exceeds the preset alarm limits, or the animal suffers a physiological abnormality.
- **Technical Alarm:**
  A technical alarm, also called system error message, is triggered when a system function fails or the monitoring result presents distortion because of improper operation or system faults.
- **Prompt messages:**
  Strictly speaking, prompt messages are not alarms. They are the messages about the system statuses apart from physiological and technical alarms, and prompt messages usually do not involve the animal's vital signs.

6.3 Alarm Priority

The anesthesia machine's alarms can be divided into high priority alarms, medium priority alarms and low priority alarms by severity.

6.4 Alarm Signals

When an alarm is triggered, the machine will alert the user through the following visual or audible alarm signals:

- Audible alarm
- Alarm message
- Flashing parameter

6.4.1 Audible Alarm

The machine plays different alarm tones to indicate different alarm priorities.

- High priority alarm: The high priority alarm tone is played.
- Med priority alarm: The medium priority alarm tone is played.
- Low priority alarm: The low priority alarm tone is played.

6.4.2 Alarm Messages

Alarm messages are displayed in the alarm message field of the ventilator when an alarm is triggered. The system uses different background colors to distinguish priorities of alarm messages:

- High priority alarm: red
- Med priority alarm: yellow
- Low priority alarm: cyan

The following symbols are displayed before alarm messages to distinguish priorities of alarm messages:

- High priority alarm: !!!
- Med priority alarm: !!
- Low priority alarm: !

6.4.3 Auditory Messages

- Startup selftest sound: “di”.
- Key click sound: “da” adjustable sound pressure level.

6.5 Set Alarm Volume

1. Select **[Alarm Setup]** → **[Alarm Volume]**.
2. Set **[Alarm Volume]:** indicates the lowest alarm volume, and indicates the highest alarm volume. Adjust the volume by sliding from 0-10. If there are no current alarms, the system will play a low-priority alarm tone once based on the selected alarm volume.

WARNING: **Do not rely exclusively on the audible alarm system when using the equipment. Setting the alarm volume to a low level may result in a hazard to the animal. Always keep an eye on the animal's actual clinical situations.**

NOTE: **A-weighted sound pressure level of audible alarm signals: not less than 45dB and not greater than 85 dB.**

6.6 Set Alarm Limits

NOTE: **An alarm will be triggered when a parameter value is higher than the high alarm limit or lower than the low alarm limit.**

NOTE: **During operation, pay frequent attention to the alarm limits of parameters to ensure that they are appropriately set.**

NOTE: **When the equipment is restarted after the system is powered off for less than 60 seconds, the alarm settings before the loss of power can be restored. When the equipment is restarted after the system is powered off for longer than 120 seconds, the system will automatically load the default settings that the operator saved. If the power outrage lasts between 60 to 120 seconds, the anesthesia system may automatically restore the recent settings or automatically load the user settings.**

NOTE: **When the 120 s countdown time is up, the Audio Pause status terminates and audible alarm tones start again.**

NOTE: **A hazard can exist if different alarm presets are used for the same or similar equipment in any single area.**

Select **[Alarm Setup]** → **[Limits]** or click the flashing module parameters to enter the alarm limit setting menu and set related alarm limit of ventilation parameters and module parameters.

After setting the alarm limit, select → **[System]** → **[Profile]** to save the current profile as default. In the next time of adjusting the alarm limit, click **[Alarm Setup]** → **[Load Alarm Defaults]** to renew the default settings.

6.7 Audio Pause

6.7.1 Set Audio Pause

Press **[Audio Pause]** to enable the Audio Pause state which lasts 120 seconds. The action can mute the current alarm tones.

WARNING: **Pay close attention to the animal and anesthesia machine to ensure that no alarm messages are overlooked during the Audio Pause period. When the alarm triggering condition remains for long without any countermeasures taken, the animal or equipment may be subject to hazards.**

NOTE: **In the Audio Pause state, all the other alarm methods function properly except audible alarms.**

NOTE: **In the Audio Pause state, if a new technical or physiological alarm is triggered, the system will automatically exit the current Audio Pause state and resume audible alarms.**

NOTE: **When the 120-second countdown is over, the system will exit the Audio Pause state and resume audible alarms.**

6.7.2 Cancel Audio Pause

In the Audio Pause state, when **[Audio Pause]** button is pressed, the system will exit the current Audio Pause state and resume audible alarms, and the Audio Pause icon and countdown timer on the screen will also disappear.

6.8 Current Alarms

When the alarm is triggered, select the alarm message zone and the current alarm messages and alarm priority can be viewed. For some alarms, you can select the triangle button on the right side to view related help information.

6.9 Responses to Alarms

Follow the steps below to take appropriate response measures when the anesthesia machine triggers an alarm:

1. Check the animal's condition.
2. Identify the alarming parameter or the alarm type.
3. Identify the cause of the alarm.
4. Eliminate the cause of the alarm.
5. Check whether the alarm has been cleared.

For specific response measures for various alarms, see "Alarm Messages" on Page B-1.

WARNING: **Check whether the animal's ventilation is adequate when an alarm is activated to prevent harm to the animal. Identify and eliminate the cause of the alarm. Re-adjust the alarm limits only when they are inappropriate for the current situation.**

CAUTION: **Contact Mindray Technical Support if the alarm persists without obvious cause.**

7.0 *Maintenance*

7.1 Maintenance Schedule

The schedules listed below are the minimum frequency based on 2,000 hours of usage per year. The equipment should be serviced more frequently if used more than this yearly usage.

NOTE: **During cleaning and installation, inspect the parts and seals for damage. Replace and repair them if necessary.**

MINIMUM MAINTENANCE FREQUENCY	MAINTENANCE
Every day	Check the weight of the anesthesia gas filter canister; check the O_2 flush function; use soft cloths, mild soap and water to clean the surface of the anesthesia machine and CO_2 absorber canister.
Every week	Check whether the inspiratory/expiratory gasket is damaged; check whether the inspiratory/expiratory valve is damaged or coiled; calibrate the pressure sensor.
Every two weeks	Drain the vaporizer.
Every month	Clear the water gathered in the CO_2 module watertrap.
Every year	Calibrate the CO_2 module.
Every three years	Replace the lithium battery and contact Mindray Technical Support for details.
On-demand	• Replace the soda lime in the canister if the soda lime color changes. • Replace the delivery system hose if it is damaged. • Replace the gas supply hose if it is damaged. • Replace the APL valve if its release pressure deviation is too large. • Replace the HEPA filter if it is blocked. • Zero the weigher after replacing the anesthesia gas filter canister.

Table 7-1 Maintenance schedule

7.2 Electrical Safety Inspection

NOTE: **Perform an electrical safety inspection after servicing or routine maintenance. Before performing the electrical safety inspection, ensure that all the covers, panels, and screws are correctly installed.**

NOTE: **It is recommended that a specialized company or the manufacturer be entrusted to conduct electrical safety tests. The electrical safety inspection should be performed once a year.**

1. Perform protective earth resistance test:
   a. Plug the probes of the analyzer into the protective earth terminal of the AC power cord and the screw.
   b. Test the earth resistance with a current of 25A.
   c. Verify the resistance is less than 0.1ohms (100m ohms).
   d. If the resistance is larger than 0.1ohms (100m ohms) but less than 0.2ohms (200m ohms), disconnect the AC power cord and plug the probe, that was previously plugged in the protective earth terminal of the AC power cord, into the protective earth contact of the power outlet. Repeat steps a to c.
2. Perform the following earth leakage current tests:

- Normal polarity
- Reverse polarity
- Normal polarity with open neutral
- Reverse polarity with open neutral

3. Verify the maximum leakage current does not exceed 500 µA (0.5 mA) in the first two tests. While for the last two tests, verify that the maximum leakage current does not exceed 1000 µA (1 mA).

NOTE: Ensure the safety analyzer is authorized by certificate organizations (UL, CSA, AAMI, etc.). Follow the instructions of the analyzer manufacturer.

7.3 Methods for Cleaning and Disinfection

WARNING: During cleaning and disinfection, ensure the applicability and correctness of the cleaning and disinfection methods.

WARNING: Keep all liquids away from electronic components. Prevent liquid from penetrating into the equipment casing.

WARNING: Only all the parts and accessories are dry after cleaning or disinfection can the machine be connected with the AC power.

NOTE: Clean and disinfect the machine as needed before the first use of the equipment. Refer to this chapter for the cleaning and disinfection methods.

NOTE: Do not use abrasive cleaning agents (such as steel wool, silver polish and cleaning agents). The pH value of cleaning solutions must be within the 7.0–10.5 range.

NOTE: During cleaning the bottom of the circuit, do not wipe the cable terminal directly, otherwise the cables will be oxidized or corroded.

CLEANING AND DISINFECTION METHODS	CATEGORY
Clear water	Cleaning agent
Soap solution (PH 7.0–10.5)	Cleaning agent
Alcohol (75%)	Moderately efficient disinfectant
Ultraviolet radiation	/

Table 7-1 Cleaning agents and Disinfectants

7.3.1 Wiping

- When cleaning the exteriors of the anesthesia machine, use wet cloths soaked in alkalescent cleaning agents (such water or soap-suds of pH 7.0 to 10.5) to wipe the surface of the equipment. When disinfecting the exteriors of the anesthesia machine, use wet cloth soaked in moderately efficient disinfectant (ethanol (75%)) to wipe the surface of the equipment.
- When the cleaning or disinfection is completed, use dry and lint-free cloths to remove the residual cleaning or disinfectant agent solution.

CAUTION: Use dry and lint-free cloths to clean the display rather than using liquids.

7.3.2 Ultraviolet radiation

- During the disinfection of the anesthesia machine, place it at a 30 W light in one meter for at least 60 minutes.

CAUTION: Ultraviolet radiation is harmful to the human body. Do not stay in the room during ultraviolet radiation.

8.0 *Accessories*

WARNING: **Please use the accessories specified in this chapter only. Using other accessories may lead to inaccurate measured values or equipment faults.**

WARNING: **Disposable accessories shall be used only once. Repeated use may lead to performance degradation or cross-infection.**

WARNING: **Please do not use an accessory that shows signs of damage in its package or itself.**

WARNING: **The equipment and its accessories, at the end of their service lives, shall be disposed of in compliance with the guidelines regulating the disposal of such products and in accordance with local regulations for contaminated and biologically hazardous items.**

8.1 Accessories List

PART NUMBER	DESCRIPTION OF COMPONENT
0000-10-11215	Power cord 5M (European standard)
009-000093-00	Power cord 250V 10A 5M (British standard)
009-000094-00	Power cord 125V 15A 5M (US standard)
009-000130-00	Power cord 250V 10A 5M NEMA5-15P plug
009-000131-00	Power cord 10A 250V 5M (Indian standard)
009-001050-00	Power cord 250V 10A 5M (Brazil standard)
009-003084-00	Power cord 250V 10A 5M (South African standard)
009-005502-00	Power cord 5M (Australian standard)
040-000065-00	Key filler adapter for filling the vaporizer, Isoflurane
040-000066-00	Key filler adapter for filling the vaporizer, Sevoflurane
040-001187-00	Airway adaptor
040-001827-00	Latex-free breathing bag, disposable, 0.5L
040-001828-00	Latex-free breathing bag, disposable, 1L
040-001829-00	Latex-free breathing bag, disposable, 2L
040-001830-00	Latex-free breathing bag, disposable, 3L
040-001850-00	Breathing Tube, silicon, reusable, adult, 1.5m
040-001851-00	Breathing Tube, silicon, reusable, child/infant, 1.5m
040-001854-00	Breathing Tube, silicon, reusable, adult, 0.45m
040-001856-00	Silicon breathing bag, reusable, 0.5L
040-001857-00	Silicon breathing bag, reusable, 1L
040-001858-00	Silicon breathing bag, reusable, 2L
040-001859-00	Silicon breathing bag, reusable, 3L
040-001866-00	connector, L type (Elbow), reusable, 22M/15F, 22F
040-001867-00	connector, Y-piece, reusable, with sample port, 22M/15F , 15M
040-001868-00	connector, Y-piece, reusable, with sample port, 22M/15F , 22F
040-001869-00	connector, direct-connector, reusable, 22M/22M

040-001870-00	connector, direct-connector, reusable, 22M/15M
040-006307-00	VM-2 masks for animals
040-006382-00	Tube for waste anesthetic gas absorb, EVA
040-006389-00	Tube for waste anesthetic gas absorb, silicon
040-006410-00	Adaptor for AGSS, S type, 30F, 22M
040-006411-00	Adaptor for AGSS, L type, 22F, 22M
045-004360-00	Trolley assembly
0611-20-58778	Nozzle connector
0611-20-58779	Oxygen nozzle nut
0611-30-58802	PCV software function
0611-30-58815	SIMV software function
082-001209-00	O_2 supply hose, British standard, NIST, 5m, 34I-OXY-BS/NS-5
082-001210-00	Air supply hose, British standard, NIST, 5m, 34I-AIR-BS/NS-5
082-001212-00	O_2 supply hose, Germany standard, NIST, 5m, 34I-OXY-GS/NS-5
082-001213-00	Air supply hose, Germany standard, NIST, 5m, 34I-AIR-GS/NS-5
082-001215-00	O_2 supply hose, Australian standard, NIST, 5m, 34I-OXY-SIS/NS-5
082-001216-00	Air supply hose, Australian standard, NIST, 5m, 34I-AIR-SIS/NS-5
082-001218-00	O_2 supply hose, French standard, NIST, 5m, 34I-OXY-FS/NS-5
082-001219-00	Air supply hose, French standard, NIST, 5m, 34I-AIR-FS/NS-5
082-001227-00	O_2 supply hose, US standard, BS, DISS, 5m, 34U-OXY-BS/DS-5
082-001228-00	Air supply hose, US standard, BS, DISS, 5m, 34U-AIR-BS/DS-5
082-001355-00	Air supply hose, US standard, Chemetron, DISS, 5m, 34U-AIR-CH/DS-5
082-001356-00	O_2 supply hose, US standard, Chemetron, DISS, 5m, 34U-OXY-CH/DS-5
082-001374-00	Air supply hose, US standard, Ohmeda, DISS, 5m, 34U-AIR-OH/DS-5
082-001375-00	O_2 supply hose, US standard, P-B, DISS, 5m, 34U-OXY-PB/DS-5
082-001376-00	O_2 supply hose, US standard, Ohmeda, DISS, 5m, 34U-OXY-OH/DS-5
082-001378-00	Air supply hose, US standard, P-B, DISS, 5m, 34U-AIR-PB/DS-5
100-000080-00	DRYLINE II Water Trap, Adult
100-000081-00	DRYLINE II Water Trap, Neonate
115-002342-00	Passive AGSS accessory kit
115-009073-00	AGSS low flow receiving hose, from AGSS assembly to hospital's waste gas disposal system
115-009097-00	AGSS high flow receiving hose, from AGSS assembly to hospital's waste gas disposal system
115-017375-00	AGSS Assembly, high-flow, low vacuum
115-017376-00	AGSS Assembly, low-flow, high vacuum
115-024752-00	Sidestream CO_2 accessory kit, Adult/Pediatric, including: - Dryline airway adapter, straight, Adu/Ped, 2 pcs - DRYLINE II Water Trap, Adu/Ped, 2 pcs - Sampling line, Adu/Ped, 2.5 m, 2pcs - Quick connector for gas return, 1 pcs
115-024753-00	Sidestream CO_2 accessory kit, Neonate, including: - Airway adapter, Neonate, 2 pcs - DRYLINE II Water Trap, Neonate, 2 pcs - Sampling Line, Neonate, 2.5 m, 2 pcs
115-029947-00	Reusable breathing circuit accessory kit, small animal
115-029948-00	Disposable breathing circuit accessory kit with mask, small animal

115-029949-00	Reusable breathing circuit accessory kit, large animal
115-029950-00	Disposable breathing circuit accessory kit with mask, large animal
115-075146-00	AGSS waste gas transfer hose, from main unit to AGSS assembly
115-076000-00	Waste Anesthetic Gas absorb tray, with weighing
115-076013-00	AGSS kit, high flow, low vacuum
115-076014-00	AGSS kit, low flow, high vacuum
115-076053-00	Oxygen concentrator tray kit (NIST)
115-076054-00	Oxygen concentrator tray kit (DISS)
115-076172-00	Sundries Basket kit
9200-10-10533	Gas sampling tube (adult)
9200-10-10555	Sampling tube, DRYLINE, Neonate, 2.5m
M90-000149---	Hose clamps: size 9.5-12mm, galvanized

A.0 *Product Specifications*

A.1 Safety Specifications

Type of protection against electric shock	Class I equipment with internal electrical 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 electrical power supply (batteries).
Degree of protection against electric shock	Type BF, defibrillation-proof
Degree of protection against harmful ingress of	IPX1
Disinfection and sterilization methods.	Recommended by manufactures
Operating mode	Continuous
Degree of protection against hazards of explosion	Ordinary equipment, without protection against explosion; not for use with flammable anesthetics.
Degree of mobility	Mobile (including the base and casters)

Table A-1 Safety Specifications

A.2 Environment Specifications

MAIN UNIT			
Item	Temperature (ºC)	Relative humidity (non-condensing)	Barometric pressure (kPa)
Operation	10 to 40	15% to 95% R.H.	70 to 106.7
Storage	-20 to 60	10% to 95% R.H.	50 to 106.7

Table A-2 Environment Specifications

A.3 Power Supply Specifications

EXTERNAL AC POWER SUPPLY	
Input voltage	100 to 240 V~
Input frequency	50 Hz/60 Hz
INTERNAL BATTERIES	
Number of batteries	1
Battery type	Lithium battery
Rated battery voltage	10.95 V
Battery capacity	5,000 mAh
Minimum battery run time	120 minutes (powered by one new fully-charged battery in standard working condition)

Table A-3 Power Supply Specifications

A.4 Physical Specifications

EQUIPMENT NOISE	
Equipment noise	The A-weighted average sound pressure level at one meter away is below 45 dB (A).
DIMENSIONS	
Dimensions	Overall size (excluding the trolley, anesthesia gas filter canister, oxygen generator; including accessories): (790 mm±25mm)×(515 mm±25mm)×(435 mm±25mm) (height*width*thickness) Overall size (excluding the anesthesia gas filter canister, oxygen generator; including the trolley and accessories): (1375 mm±25mm)×(620 mm±25mm)×(690 mm±25mm) (height*width*thickness)
Standard weight	≤ 30 kg (excluding the trolley, anesthesia gas filter canister, oxygen generator; including accessories) ≤ 43 kg (excluding the anesthesia gas filter canister, oxygen generator; including the trolley and accessories)
Maximum weight	≤ 85 kg (excluding the trolley, anesthesia gas filter canister, oxygen generator, monitor, infusion pumps and accessories) ≤ 100 kg (including the trolley, anesthesia gas filter canister, oxygen generator, monitor, infusion pumps and accessories)
CASTER	
Caster	Four casters with brakes.
DISPLAY	
Size	8"
Resolution	1024*768
Brightness	Adjustable
LED INDICATOR	
AC power LED	One (green. Lit when an AC power supply is connected)
Battery LED	One (green. Lit when an AC power supply is connected; and extinguished when the battery is full or the machine is powered off.)
AUDIO INDICATOR	
Speaker	Produces alarm tones and key tones; and supports multi-level volumes.
CONNECTOR	
Multi-functional communication connector	One DB9 male connector
Wired network connector	One RJ-45 network connector (8PIN 5)
USB connector	One A-type connector

Table A-4 Physical Specifications

A.5 Pneumatic System Specifications

GAS SUPPLY	
Gas type	Air, oxygen
Gas supply pressure range	280kPa to 600kPa (40Psi~87Psi)
Input connector	NIST or DISS
FLOWMETER	

Flow range	0 L/min~100 L/min

Table A-5 Pneumatic System Specifications

A.6 Breathing System Specifications

CONNECTOR	
Manual bag connector	Coaxial 22mm male/15mm female conical connector
Inspiration connector	Coaxial 22mm male/15mm female conical connector
Expiration connector	Coaxial 22mm male/15mm female conical connector
Exhaust connector	30mm male conical connector
AIRWAY PRESSURE GAUGE	
Range	-20 cmH_2O~100 cmH_2O
APL VALVE	
Range	0 cmH_2O~70 cmH_2O

Table A-6 Breathing System Specifications

A.7 Ventilator Specifications

CONTROLLED PARAMETERS			
Parameter name	**Range**	**Parameter name**	**Range**
Vt	5 ml~1500 ml	Min RR	2 bpm~60 bpm
Pinsp	5 cmH_2O~50 cmH_2O	I:E	4:1~1:8
Δ Psupp	3 cmH_2O~50 cmH_2O	Tinsp	0.2s~10.0s
PEEP	OFF, 3~30 cmH_2O	P-Trig	-20 cmH_2O~-0.2 cmH_2O
RR	2 bpm~60 bpm	F-Trig	0.2 L/min~15 L/min
MONITORED PARAMETERS			
Parameter name	**Range**	**Parameter name**	**Range**
Vt	0 ml~3000 ml	PEEP	0 cmH_2O~70 cmH_2O
MV	0 L/min~100 L/min	RR	0 bpm~120 bpm
PEAK	-20 cmH_2O~120 cmH_2O	/	/

Table A-7 Ventilator Specifications

A.8 Ventilator Accuracy

CONTROL ACCURACY	
Vt	<75 ml: ±15 ml ⩾ 75 ml: ±20 ml or ±10% of set value, whichever is greater.
Pinsp	±3.0 cmH_2O or ±8% of set value, whichever is greater.
Δ Psupp	
PEEP	OFF: ⩽ 4.0 cmH_2O 3 cmH_2O~30 cmH_2O: ±3.0 cmH_2O or±10% of set value, whichever is greater.
RR	±1 bpm or ±10% of set value, whichever is greater.
Min RR	

I:E	2:1 to1:4: ±10% of set value Other range: ±25% of set value
Tinsp	±0.2s
MONITORING ACCURACY	
Vt	<75 ml: ±15 ml ⩾ 75 ml: ±20 ml or ±10% of actual reading, whichever is greater.
MV	±1 L/min or ±15% of actual reading, whichever is greater.
PEAK	±3.0 cmH_2O or ±8% of actual reading, whichever is greater.
PEEP	±3.0 cmH_2O or ±10% of actual reading, whichever is greater.
RR	±1 bpm or ±5% of actual reading, whichever is greater.

Table A-8 Ventilator Accuracy

A.9 Alarms

ALARM SETTINGS			
Parameter		Range	Note
MV	High Limit	0.2 L/min~100.0 L/min	When the MV range is 0.0 L/min~15.0 L/min, the high limit should be 0.2 L/min higher than the low limit; when the MV range is 15.0 L/min~100.0 L/min, the high limit should be 1 L/min higher than the low limit.
	Low Limit	0.0 L/min~99.0 L/min	
PEAK	High Limit	2 cmH_2O~100 cmH_2O	High limit is 2 cmH_2O higher than the low limit.
	Low Limit	0 cmH_2O~98 cmH_2O	
Vt	High Limit	5 ml~1600 ml	High limit is 5 ml higher than the low limit.
	Low Limit	OFF，0 ml~1595 ml	
RR	High Limit	4 bpm~100 bpm，OFF	High limit is 2 bpm higher than the low limit.
	Low Limit	OFF，2 bpm~98 bpm	

Table A-9 Alarms

A.10 CO_2 Module

CO_2 MODULE	
CO_2 range and resolution	0.0% (0 mmHg) ~ 20% (152 mmHg), and the resolution is 0.1%/1 mmHg
CO_2 accuracy	0.0% (0 mmHg) ~ 5.0% (40 mmHg): ±0.2 vol.% (±2 mmHg) 5.0% (41 mmHg)~ 10% (76 mmHg) (excludes 5%): ±5% of actual reading 10% (77 mmHg)~20% (152 mmHg) (excludes 10%): ±10% of actual reading
Sampling rate	Neonate watertrap: 90 ml/min; Adult watertrap: 120 ml/min; Accuracy: ±15% of set value or ±15 ml/min, whichever is greater.

Table A-10CO_2 Module

ALARM SETTINGS				
Parameter		Range	Adjustment step	Note
$EtCO_2$	High Limit	OFF, 2 mmHg~99 mmHg	1 mmHg	The high limit is 2 mmHg higher than the low limit.
	Low Limit	OFF, 0 mmHg~97 mmHg)		
$FiCO_2$	High Limit	OFF, 1 mmHg~99 mmHg		N/A

Table A-11CO_2 Alarm Limit

A.11 Anesthetic Vaporizer

VAPORIZER	
Filling methods	Isoflurane: Pour Fill, Key Filler Sevoflurane: Pour Fill, Key Filler, Quik-Fil
Weight	6.0kg±0.5kg (empty) 6.5kg±0.5kg (full)
Filling volume	360 ml (dry wick) 300 ml (moist wick) 260 ml (between the minimum and maximum marks)
Concentration range	Isoflurane: 0 vol.%~6 vol.% Sevoflurane: 0 vol.%~8 vol.%
Concentration accuracy range	±0.25vol.% or ±20% of set value, whichever is greater.

Table A-12 Anesthetic Vaporizer

A.12 Anesthetic Gas Scavenging System (AGSS)

ACTIVE AGSS		
Type of the applicable disposable system	High flow	Low flow
Extract flow	75L/min~105L/min	25L/min~50L/min
PASSIVE AGSS		
Type of connector	30 mm male conical connector	
WEIGHER		
Support configuration	⩽ 130 mm gas filter canister	
Maximum load	2 kg	

Table A-13 Anesthetic Gas Scavenging System

B.0 *Alarm Messages*

This chapter lists physiological and technical alarm messages:

Note that in this chapter:

- Column L stands for the default alarm level: H for high, M for medium and L for low.
- Corresponding response actions are given for each alarm message. If the problem persists after the response actions have been taken, contact a service personnel.

B.1 Physiological Alarm Messages

ALARM MESSAGE	L	CAUSE AND RESPONSE ACTION
Apnea	M	No breath has been detected within the apnea time.
		1. Check whether patient circuit is leaking or disconnected. 2. Ensure the position of Auto/Manual switch.
Apnea>2 min	H	No breath has been detected within the last 120 seconds.
		1. Check whether ventilation starts. 2. Check whether patient circuit is leaking or disconnected. 3. Ensure the position of Auto/manual switch.
Paw Too High	H	Paw > high alarm limit setting.
		1. Check alarm limit: PEAK High. 2. Check ventilation settings: Pinsp, Vt, PEEP, etc. 3. Check whether patient circuit is kinked or blocked.
Paw Too Low	H	The real time PAW is lower than the Paw low alarm limit setting for 20 seconds.
		1. Check alarm limit: PEAK Low. 2. Check ventilation settings: Pinsp, Vt, PEEP, etc. 3. Check whether patient circuit is leaking or disconnected.
Pressure Limiting	L	Paw $\geqslant$ Max(5cmH_2O, PEAK High Limit-5cmH_2O).
		1. Check alarm limit: PEAK High. 2. Check ventilation settings: Vt.
MV Too High	M	MV > high alarm limit setting.
		1. Check alarm limit: MV Low. 2. Check ventilation settings: Pinsp,Vt, RR, etc.
MV Too Low	H	MV <low alarm limit setting.
		1. Check alarm limit: MV High. 2. Check ventilation settings: Pinsp, Vt, RR, etc.
Continuous Airway Pressure	H	The Paw in the breathing circuit is greater than sustained airway pressure alarm limit for 15 seconds.
		1. Check APL valve setting while in manual mode. 2. Check whether patient circuit or AGSS is blocked.
Negative Pressure	H	Paw< -10 cmH_2O for 1 second.
		1. Check the negative pressure suction. 2. Check whether AGSS works normally.

Table B-1 Physiological alarms

ALARM MESSAGE	L	CAUSE AND RESPONSE ACTION
Vt Too High	M	Vt > high alarm limit setting.
		1. Check alarm limit: Vt High. 2. Check ventilation settings: Pinsp, Vt, etc.
Vt Too Low	M	Vt < the low alarm limit setting.
		1. Check alarm limit: Vt Low. 2. Check ventilation settings: Pinsp, Vt, etc. 3.Check whether patient circuit is leaking or blocked.
RR Too High	L	RR > high alarm limit setting.
		1. Check alarm limit: RR High. 2. Check ventilation settings: RR, F-Trig/P-Trig, etc. 3. Check whether patient circuit is leaking or blocked.
RR Too Low	L	RR < low alarm limit setting.
		1. Check alarm limit: RR Low. 2. Check ventilation settings: RR, F-Trig/P-Trig, etc.
$EtCO_2$ Too High	M	$EtCO_2$ > high alarm limit setting.
		1. Check alarm limit: $EtCO_2$ High. 2. Check whether need to replace soda lime in the CO_2 absorber canister.
$EtCO_2$ Too Low	M	$EtCO_2$ < low alarm limit setting.
		1. Check alarm limit: $EtCO_2$ Low. 2.Check whether the sampleline is disconnected.
$FiCO_2$ Too High	M	FiO_2 > high alarm limit setting.
		1. Check alarm limit: $EtCO_2$ High. 2. Check whether need to replace soda lime in the CO_2 absorber canister.
Apnea CO_2	H	No breath is detected and Apnea time ⩾ Apnea alarm time.
		1. Check whether ventilation starts. 2. Ensure the sampleline is correctly connected to patient circuit. 3. Check patient's breathing ability.

Table B-1 Physiological alarms

B.2 Technical Alarm Messages

ALARM MESSAGE	P	CAUSE AND RESPONSE ACTION
Bundle Version Error	H	Incompatible firmware version is installed.
		Please contact Mindray Technical Support.
Bundle Version: Time out	H	Bundle version selftest result cannot be obtained due to communication error.
		Please contact Mindray Technical Support.
Ventilator Selftest Error	H	1. Board self-test error. 2. After power on, CPU board can't communicate with the ventilator board.
		1. Repeat the test. 2. Please contact Mindray Technical Support if the problem persists.

Table B-2 Technical alarms

ALARM MESSAGE	P	CAUSE AND RESPONSE ACTION
Ventilator Selftest: Time out	H	Ventilator selftest result cannot be obtained due to communication error.
		1. Repeat the test. 2. Please contact Mindray Technical Support if the problem persists.
Ventilator Voltage Error	H	Ventilator voltage error.
		1. Repeat the test. 2. Please contact Mindray Technical Support if the problem persists.
Flow Sensor Failure	L	Ventilator flow is out of range.
		1. Repeat the test. 2. Please contact Mindray Technical Support if the problem persists.
Calibrate Pressure Sensor	L	1. Cal. Table isn't found in EEPROM. 2. Checksum of Calibration table don't match.
		Please contact Mindray Technical Support for pressure calibration.
Ventilator Initialization Error	H	After power on, CPU board can't send the parameter settings to ventilator board.
		1. Repeat the test. 2. Please contact Mindray Technical Support if the problem persists.
Ventilator Initialization: Time out	H	Ventilator Initialization result cannot be obtained due to communication error.
		1. Repeat the test. 2. Please contact Mindray Technical Support if the problem persists.
Power Supply Voltage Error	H	Power supply voltage error.
		1. Repeat the test. 2. Please contact Mindray Technical Support if the problem persists.
Keyboard Self Test Error	H	Keyboard Self Test Error.
		1. Repeat the test. 2. Please contact Mindray Technical Support if the problem persists.
Keyboard Self Test: Time out	H	Keyboard Self Test result cannot be obtained due to communication error.
		1. Repeat the test. 2. Please contact Mindray Technical Support if the problem persists.
Manual Only	M	1.Power on self test failed and the result is “Manual Only”. 2.The alarm “Blower temp too high” is triggered.
		1. Repeat the test. 2. Please contact Mindray Technical Support if the problem persists. 3. When “Blower temp too high” alarm is triggered, wait for the blower temperature drops until the “Blower temp too high” alarm is disappeared.
Auto Ventilation is Non-Functional	H	1. Power on self test failed and system is in the Auto Ventilation Non-functional state. 2. The alarm “Blower temp too high” is triggered and system is in the Auto Ventilation Non-functional state.
		1. Repeat the test. 2. Please contact Mindray Technical Support if the problem persists. 3. When “Blower temp too high” alarm is triggered, wait for the blower temperature drops until the “Blower temp too high” alarm is disappeared.
RT Clock Needs Battery	H	There is no button cell available in the system, or the battery is empty.
		Please contact Mindray Technical Support.

Table B-2 Technical alarms

ALARM MESSAGE	P	CAUSE AND RESPONSE ACTION
RT Clock Failure	H	RT chip malfunction.
		Please contact Mindray Technical Support.
Power System Comm Stop	H	Lost communication with CPU board for 10 seconds.
		Please contact Mindray Technical Support.
Low Battery Voltage!	H	Battery voltage is low.
		1. Check the power supply. 2. Connect AC power immediately.
System shutting down, Battery depleted!	H	Battery voltage is too low.
		1. Check the power supply. 2. Connect AC power immediately.
Battery Undetected	M	Battery Undetected.
		Please contact Mindray Technical Support.
Battery in Use	L	AC power fail.
		Connected to AC power source.
Pinsp Not Achieved	L	Ppeak don't reach the setting Pinsp in pressure mode.
		1. Check ventilation settings: Pinsp, ΔPsupp, PEEP etc. 2. Check whether breathing tube is leaking or Disconnected. 3. Solve the "Paw Too High" alarm.
Vt Not Achieved	L	Vt didn't reach the setting Vt in volume mode.
		1. Check ventilation settings: Vt, PEEP, etc. 2. Check whether patient circuit is leaking or blocked. 3. Solve the "Pressure Limit" alarm and "Paw Too High" alarm.
Pressure Monitoring Channel Failure	M	For auxiliary control module: The monitoring value of the PEEP sensor or pressure sensor is out of range. For ventilator control board: 1. The monitoring value of the PEEP sensor or pressure sensor is out of range. 2. The zero point of the PEEP sensor or pressure sensor is abnormal.
		Please contact Mindray Technical Support.
Circuit Leak	H	1. Circuit leak. 2. The patient is not connected.
		Check whether the patient circuit is leaking or disconnected.
Ventilator Comm Stop	H	Lost communication with CPU board for 10 seconds.
		Please contact Mindray Technical Support.
Calibrate Pressure Sensor	L	1. Cal. Table isn't found in EEPROM. 2. Checksum of Calibration table don't match.
		Please contact Mindray Technical Support for pressure calibration.
Replace HEPA Filter	L	HEPA filter occluded, resistance increased.
		Please contact Mindray Technical Support.
Blower Temperature High	L	Blower Temperature exceeds the threshold.
		1. Check if the operating ambient temperature of the machine exceeds the maximum operating temperature specified by the vendor. 2. Check if the fan inlet and outlet are occluded. If yes, clear the foreign substance and dust. 3. Check the rotation of the fan. If it runs abnormally (such as abnormal sound or rotation speed), replace the fan.

Table B-2 Technical alarms

ALARM MESSAGE	P	CAUSE AND RESPONSE ACTION
Blower Temp Sensor Failure	M	Turbine blower Temp Sensor Failure.
		Please contact Mindray Technical Support.
Blower Failure	H	Blower Failure.
		Please contact Mindray Technical Support.
Blower Temp Too High	H	Blower temperature is too high and auto ventilation is non-functional.
		1. Start manual ventilation in emergency. 2. Stop using auto ventilation until the blower temperature drops and the "Blower temp too high" alarm disappear. 3. Please contact Mindray Technical Support if the problem persists.
Weigher Failure	L	Weigher Failure.
		Please contact Mindray Technical Support.
No Fresh Gas	M	No fresh gas is detected in non-standby mode.
		Adjust the flowmeter to open the fresh gas.
CO_2 Module Error	H	1.CO_2 Comm Stop. 2. CO_2 Hardware Error. 3. CO_2 System Error. 4. CO_2 Init Error.
		Please contact Mindray Technical Support.
CO_2 Module High Temp	L	CO_2 Sensor Temp too high (greater than 63 ℃).
		Please contact Mindray Technical Support.
CO_2 Sampleline Occluded	L	Sampleline Occluded.
		1. Check the sampling tube for occlusion. 2. Replace the sampling line. 3.Please contact Mindray Technical Support if the problem persists.
CO_2 No Watertrap	L	CO_2 No Watertrap or Watertrap disconnected.
		Check the water trap.
EtCO_2 Over Range	L	The monitoring value exceeds the measurable range.
		Please contact Mindray Technical Support.
FiCO_2 Over Range	L	The monitoring value exceeds the measurable range.
		Please contact Mindray Technical Support.
CO_2 Zero Failed	L	CO_2 module Error.
		Please contact Mindray Technical Support.
CO_2 Change Watertrap	L	Need to change the watertrap.
		Check the watertrap. Replace the watertrap.
CO_2 Self Test Error	L	CO_2 Self Test Error.
		Please contact Mindray Technical Support.
CO_2 Self Test: Time out	L	CO_2 Self Test selftest result cannot be obtained due to communication error.
		Please contact Mindray Technical Support.

Table B-2 Technical alarms

B.3 Prompt Messages

ALARM MESSAGE	REMARK
Volume and Apnea Alarms are OFF	This message appears when the "Alarms" is set to "Off" in the Manual mode.
CO_2 and CO_2 Apnea Alarms are OFF	This message appears when "CO_2 Alarms" is set to "Off" in the Manual mode.
Save Profile Failure	This message appears when any fault occurs in the case of save as user defaults.
Demo Mode - Not for Clinical Use	This message appears when the machine is working in demo mode.
Main board Reset	This message appears when the main board is restarted abnormally.
Ventilator Reset	This message appears when the main board is restarted abnormally.
Apnea Ventilation	This message appears when Apnea Ventilation is triggered in the VS mode.
Replace Anesthesia Gas Filter Canister	This message appears when weight increase of Anesthesia Gas Filter Canister exceeds the replacement remind setting.
Weigher Cable Disconnected	This message appears when weigher cable is disconnected.
Fresh Gas is On	This message appears when flowmeter does not adjust to zero in standby mode.
CO_2 Zero Running	CO_2 Zero is running.

Table B-3 Prompt massages

C.0 *Factory Defaults*

C.1 Ventilation Parameters

ITEM	DEFAULTS
Vt	20 ml
Weight	2 Kg
Vt/Weight	10 ml/Kg
Min RR	20 bpm
PEEP	OFF
Trigger	Auto
RR	25 bpm
I:E	1:2
Pinsp	10 cmH_2O
Tinsp	1.0 s
ΔPsupp	5 cmH_2O

Table C-1 Ventilation parameters

C.2 Setup

ITEM	DEFAULTS
Main: General: Vt/Weight	10 ml/Kg
Main: General: CO2 Scale	0-60 mmHg
Main: General: Screen Brightness	50% of maximum brightness
Main: General: Key Click Volume	30% of maximum volume
Main: Weigher: Set replacement remind for filter canister (Weight increase)	Off
Main: System: Setup: Language/Unit: Language	ENGLISH
Main: System: Setup: Language/Unit: Pressure Unit	cmH_2O
Main: System: Setup: Language/Unit: CO2 Unit	mmHg
Main: System: Setup: Language/Unit: Weight Unit	Kg
Main: System: Setup: Altitude: Altitude Unit	m
Main: System: Setup: Altitude: Altitude	300 m
Main: System: Setup: Time/Date: 24 Hour Time	Off
Main: System: Setup: Time/Date: Time Zone	UTC-05:00
Main: System: Setup: Time/Date: Date Format	YYYY-MM-DD
Main: System: Setup: Time/Date: DayLight Savings	Off
Main: System: Setup: Weigher	On

Table C-2 Setup

C.3 Alarms

ITEM	DEFAULTS
Alarm Setup: Limits: MV High Limit	6.0 L/min
Alarm Setup: Limits: MV Low Limit	0.2 L/min
Alarm Setup: Limits: PEAK High Limit	30 cmH_2O
Alarm Setup: Limits: PEAK Low Limit	4 mmHg
Alarm Setup: Limits: Vt High Limit	1,000 ml
Alarm Setup: Limits: Vt Low Limit	Off
Alarm Setup: Limits: RR High Limit	Off
Alarm Setup: Limits: RR Low Limit	Off
Alarm Setup: Limits: FiCO2 High Limit	4 mmHg
Alarm Setup: Limits: EtCO2 High Limit	50 mmHg
Alarm Setup: Limits: EtCO2 Low Limit	25 mmHg
Alarm Setup: Alarm Volume	30% of maximum volume
Volume and Apnea Alarms	On
CO2 Alarms	On

Table C-3 Alarms

D.0 *EMC*

Veta 5 anesthesia machine meets the requirements of IEC 60601-1-2: 2014.

NOTE: **Veta 5 anesthesia machine needs special precautions regarding EMC and needs to be installed and put into service according to the EMC information provided below.**

NOTE: **Use of portable or mobile communications devices will degrade the performance of Veta 5 anesthesia machine.**

NOTE: **Veta 5 anesthesia machine is intended for use in professional healthcare facility environment, If it is used in special environment, such as magnetic resonance imaging environment, Veta 5 anesthesia machine may be disrupted by the operation of nearby equipment.**

NOTE: **If the essential performance is lost or degraded, it may be necessary to take mitigation measures, such as re-orienting or relocating the ME EQUIPMENT or ME SYSTEM or shielding the location or stopping using Veta 5 and contact the service personnel.**

WARNING: **Use of accessories, transducers and cables other than those specified or provided by the manufacturer of Veta 5 anesthesia machine could result in increased electromagnetic emissions or decreased electromagnetic immunity of Veta 5 anesthesia machine and result in improper operation.**

WARNING: **Use of Veta 5 anesthesia machine adjacent to or stacked with other device should be avoided because it could result in improper operation. If such use is necessary, Veta 5 anesthesia machine and the other device should be observed to verify that they are operating normally**

WARNING: **Portable RF communications equipment (including peripherals such as antenna cables and external antennas) should be used no closer than 30 cm (12 inches) to any part of the Veta 5 anesthesia machine, including cables specified by the manufacturer. Otherwise, degradation of the performance of Veta 5 anesthesia machine could result.**

WARNING: **Other devices may interfere with Veta 5 anesthesia machine even though they meet the requirements of CISPR.**

WARNING: **When the input signal is below the minimum amplitude provided in technical specifications, erroneous measurements could result.**

WARNING: **The non-ME EQUIPMENT (e.g. ITE) that is a part of an ME SYSTEM may be disrupted by the electromagnetic interference of nearby equipment. It may be necessary to take mitigationmeasures, such as re-orienting or relocating the non-ME EQUIPMENT or shielding the location.**

Cable information

PORT NO.	NAME	CABLE LENGTH	CABLE SHIELDED (Y/N)
1	Anesthesia System Power input	5m	N
2	Weigher cable	1.2m	Y

GUIDANCE AND DECLARATION - ELECTROMAGNETIC EMISSIONS		
Veta 5 anesthesia machine is intended for use in the specified electromagnetic environment. The customer or the user of Veta 5 anesthesia machine should assure that it is used in such an environment as described below.		
Emissions test	Compliance	Electromagnetic environment - guidance
Radio frequency (RF) emissions CISPR 11	Group 1	Veta 5 anesthesia machine uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
Radio frequency (RF) emissions CISPR 11	Class B	Veta 5 anesthesia machine is suitable for use in all establishments, including 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	Complies	

GUIDANCE AND DECLARATION - ELECTROMAGNETIC IMMUNITY			
Veta 5 anesthesia machine is intended for use in the specified electromagnetic environment. The customer or the user of Veta 5 anesthesia machine should assure that it is used in such an environment as described below.			
IMMUNITY TEST	**IEC 60601 TEST LEVEL**	**COMPLIANCE LEVEL**	**ELECTROMAGNETIC ENVIRONMENT - GUIDANCE**
Electrostatic discharge (ESD) IEC 61000-4-2	±8 kV contact ±15kV air	±8 kV contact ±15kV air	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 IEC 61000-4-4	±2 kV for power supply lines ±1 kV for input/output lines (length greater than 3 m)	±2 kV for power supply lines ±1 kV for input/ output lines (length greater than 3 m)	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV line(s) to line(s) ±2 kV line(s) to earth	±1 kV line(s) to line(s) ±2 kV line(s) to earth	
Voltage dips and Voltage interruptions IEC 61000-4-11	0 % U_T for 0.5 cycle 0 % U_T for 1 cycle and 70 % U_T for 25/30 cycles 0 % U_T for 250/300 cycle	0 % U_T for 0.5 cycle 0 % U_T for 1 cycle and 70 % U_T for 25/30 cycles 0 % U_T for 250/300 cycle	Mains power quality should be that of a typical commercial or hospital environment. If the user of our product requires continued operation during power mains interruptions, it is recommended that our product be powered from an uninterruptible power supply or a battery.
RATED power frequency magnetic fields IEC 61000-4-8	30 A/m 50 Hz / 60 Hz	30 A/m 50 Hz / 60 Hz	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
Note: U_T is the AC mains voltage prior to application of the test level.			

GUIDANCE AND DECLARATION - ELECTROMAGNETIC IMMUNITY			
Veta 5 anesthesia machine is suitable for use in the electromagnetic environment specified below. The customer or the user of Veta 5 anesthesia machine should assure that it is used in such an environment.			
IMMUNITY TEST	**IEC 60601 TEST LEVEL**	**COMPLIANCE LEVEL**	**ELECTROMAGNETIC ENVIRONMENT - GUIDANCE**

<table>
<tr><td>Conduced RF IEC 61000-4-6</td><td>3 Vrms
150k to 80 MHz</td><td>3 Vrms</td><td rowspan="5">Portable and mobile RF communications equipment should be used no closer to any part of Veta 5, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance:
$d = 1.2\sqrt{P}$ 150kHz to 80 MHz
$d = 1.2\sqrt{P}$ 150kHz to 80 MHz
$d = 1.2\sqrt{P}$ 80 MHz to 800 MHz
$d = 1.2\sqrt{P}$ 800 MHz to 2.7 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)[b].
Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey[c], should be less than the compliance level in each frequency range [d].
Interference may occur in the vicinity of equipment marked with the following symbol:  .</td></tr>
<tr><td></td><td>6 Vrms
in ISM bands and amateur radio bands[a] between 0.15 MHz and 80 MHz</td><td>6 Vrms</td></tr>
<tr><td>Radiated RF EM fields IEC 61000-4-3</td><td>3V/m
80 MHz to 2.7 GHz (for RGM function)</td><td>3 V/m</td></tr>
<tr><td></td><td>10V/m
80 MHz to 2.7 GHz</td><td>10 V/m</td></tr>
<tr><td>Proximity fields from RF wireless communications equipment IEC61000-4-3</td><td>27 V/m
380 MHz to 390 MHz</td><td>27 V/m</td></tr>
<tr><td></td><td>28 V/m
430 MHz to 470 MHz,
800 MHz to 960 MHz,
1700 MHz to 1990 MHz,
2400 MHz to 2570 MHz</td><td>28 V/m</td></tr>
<tr><td></td><td>9 V/m
704 MHz to 787 MHz,
5100 MHz to 5800 MHz</td><td>9 V/m</td></tr>
</table>

NOTE:	**At 80 MHz and 800 MHz, the higher frequency range applies.**
NOTE:	**These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.**

a. The ISM (industrial, scientific, and medical) bands between 150 kHz and 80 MHz are 6.765 MHz to 6.795 MHz; 13.553 MHz to 13.567 MHz; 26.957 MHz to 27.283 MHz; and 40.66 MHz to 40.70 MHz. The amateur radio bands between 0.15 MHz and 80 MHz are 1.8 MHz to 2.0 MHz, 3.5 MHz to 4.0 MHz, 5.3 MHz to 5.4 MHz, 7 MHz to 7.3 MHz, 10.1 MHz to 10.15 MHz, 14 MHz to 14.2 MHz, 18.07 MHz to 18.17 MHz, 21.0 MHz to 21.4 MHz, 24.89 MHz to 24.99 MHz, 28.0 MHz to 29.7 MHz and 50.0 MHz to 54.0 MHz.

b. Compliance level in the ISM frequency bands between 150 kHz to 80 MHz and in the frequency range 80 MHz to 2.7 GHz are intended to decrease the likelihood that portable/ mobile communication equipment could cause interference if it is inadvertently brought into patient areas. For this reason, an additional factor of 10/3 is used in calculating the recommended separation distance for transmitters in these frequency ranges.

c. 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 TV 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 Veta 5 is used exceeds the applicable RF compliance level above, Veta 5 should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating Veta 5.

d. Over the frequency ranges 150 kHz to 80 MHz, field strengths should be less than 3V/ m.

RECOMMENDED SEPARATION DISTANCE PORTABLE AND MOBILE RF, COMMUNICATION EQUIPMENT AND Veta 5 ANESTHESIA MACHINE

Veta 5 anesthesia machine is intended for use in an electromagnetic environment in which radiated RF disturbance are controlled. The customer or the user of Veta 5 anesthesia machine can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and Veta 5 anesthesia machine as recommended below, according to the maximum output power of the communication equipment.

RATED MAXIMUM OUTPUT POWER OF TRANSMITTER WATTS (W)	**SEPARATION DISTANCE ACCORDING TO FREQUENCY OF TRANSMITTER (m)**			
	150 kHz to 80 MHz $d = 1.2\sqrt{P}$ (ISM frequency bands)	150 kHz to 80 MHz $d = 1.2\sqrt{P}$ (out of ISM frequency)	80 MHz to 800 MHz $d = 1.2\sqrt{P}$	800 MHz to 2.7 GHz $d = 2.3\sqrt{P}$
0.01	0.12	0.12	0.12	0.23
0.1	0.38	0.38	0.38	0.73
1	1.2	1.2	1.2	2.3
10	3.8	3.8	3.8	7.3

100	12	12	12	23
For transmitters at a maximum output power not listed above, the recommended separation distanced in meters (m) can be determined using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer. **NOTE: At 80 MHz and 800 MHz, the higher frequency range applies.** **NOTE: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.**				

The essential performance verified during the immunity testing comprised of Vdel monitoring accuracy, CO_2 monitoring accuracy, airway pressure monitoring accuracy, PEEP monitoring accuracy.

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