A8

Anesthesia System

Operator's Manual

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CE 0123

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- the electrical installation of the relevant room complies with the applicable national and local requirements; and
- 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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Foreword

The Operator's Manual for the A8 Anesthesia System (hereinafter referred to as Anesthesia System, Equipment, A8) 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 patient 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 patients.

Illustrations

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

Responsibilities of Operators

The proper function of the Anesthesia System can only be guaranteed if it is operated and serviced in accordance with the information provided in this manual and by an authorized Mindray service representative. Non-compliance with this information voids all guarantee claims.

The Anesthesia System must be operated by qualified and trained personnel only. All operators must fully observe this operator's manual and relevant additional documentation. They must also comply with the WARNINGS, CAUTIONS, and NOTES detailed in this manual.

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1.0 Safety

1.1 Safety Information

WARNING — Indicates a potential hazard or unsafe practice that, if not avoided, could result in death, serious injury or property damage to the patient or user.

CAUTION — Indicates a potential hazard or unsafe practice that, if not avoided, could result in minor personal injury, product malfunction, damage or property loss to the patient or user.

NOTE — Provides application tips or other useful information to ensure that you get the most from your product.

1.1.1 Warnings

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

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: This equipment must only be operated by trained, skilled medical staff.

WARNING: Before putting the system into operation, the operator must verify that the equipment, 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 line or operate from the equipment's internal battery supply.

WARNING: Multiple AC power outlets are provided on the rear of the equipment. These outlets are intended to supply power to additional equipment that form a part of the anesthesia system (i.e. vaporizers, etc.). Do not connect other equipment to these outlets, as patient leakage current may be affected. Each outlet is rated 3 A. The total current that may be drawn through all outlets is 5 A on the system. Do not attempt to exceed these load ratings. Do not connect the additional MPSOs (Multiple Portable Socket Outlets, i.e. multiple outlet extension cords) or extension cords to these outlets.

WARNING: Do not place MPSOs on the floor.

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

WARNING: Do not open the equipment housings. All servicing and future upgrades must be carried out only by trained and authorized Mindray personnel.

WARNING: Do not rely exclusively on the audible alarm system for patient monitoring.

WARNING: Adjustment of alarm volume to a low level may result in a hazard to the patient.

WARNING: Alarm settings should be customized according to different patient situations. Constantly keeping the patient under close surveillance is the most reliable way for safe patient monitoring.

WARNING: **The physiological parameters and alarm messages displayed on the screen of the equipment are for the caregiver's reference only and cannot be directly used as the basis for clinical treatment.**

WARNING: **Dispose the packaging material, observing the applicable waste control regulations and keeping it out of children's reach.**

WARNING: **To avoid the possibility of explosion, do not use the equipment in the presence of flammable anesthetic agents, vapors or liquids. Do not use flammable anesthetic agents such as ether and cyclopropane for this equipment. Use only non-flammable anesthetic agents that meet the requirements specified in ISO 80601-2-13. The anesthesia system can be used with Halothane, Isoflurane, Sevoflurane and Desflurane. Only one anesthetic agent can be used at a time.**

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 equipment lines and ambient air, causing harm to people and materials.**

WARNING: **To avoid the risk of electric shock, this equipment must only be connected to a supply mains with protective earth.**

WARNING: **The use of anti-static or electrically conductive breathing tubes, when utilizing high frequency electric surgery equipment, may cause burns, and is therefore not recommended in any application of this equipment.**

WARNING: **Possible electric shock hazard. The equipment may only be opened by authorized service personnel.**

WARNING: **The patient should be visually monitored by qualified personnel. In certain situations, life-threatening circumstances may occur that may not necessarily trigger an alarm.**

WARNING: **Set the alarm limits properly based on the patient conditions so that the alarm is triggered before a hazardous situation occurs. Incorrectly set alarm limits may result in operating personnel not being aware of drastic changes in the patient's condition.**

WARNING: **Connection of both medical and non-medical equipment to the auxiliary mains socket outlet(s) may increase the leakage currents to values exceeding the allowable limits.**

WARNING: **Electric shock and fire hazard. Do not clean the equipment while it is powered on and/or plugged into an outlet.**

WARNING: **Disconnect the power plug from the mains supply before removing the rear panels or servicing the equipment.**

WARNING: **Malfunction of the central gas supply system may cause more than one or even all devices connected to it to stop their operation simultaneously.**

WARNING: **The anesthesia system will cease to deliver gas when the gas supply pressure is smaller than 200 kPa.**

WARNING: **Standard gas terminal connectors tailored to the attributes of gases should be used on the gas supply hose assembly to avoid damage to people and materials from improper connectors used.**

WARNING: **Use a cleaning and disinfection schedule that conforms to your institution's disinfection and risk-management policies.**

- **Refer to the material safety data sheet as applicable.**
- **Refer to the operation and maintenance manuals of all disinfection equipment.**
- **Do not inhale fumes produced during any disinfection process.**

WARNING: Use extreme care while handling the CO_2 absorbent as it belongs to caustic irritant.

WARNING: Use care in lifting and manipulating vaporizers during the installing process as their weight may be greater than expected, based on their size and shape.

WARNING: Do not use talc, calcium stearate, corn starch or similar materials, as these materials may enter the patient's lungs or airway, causing irritation or injury.

WARNING: All gas supplies should be of medical grade.

WARNING: Single use breathing tubes, face masks, sensors, soda lime, water traps, sampling lines, airway adapters, 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: To avoid endangering the patient, do not perform test or maintenance when the equipment is in use.

WARNING: Review the performance specifications of the disposal system that the transferring and receiving systems are intended to be used with, to ensure compatibility.

WARNING: The equipment should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, the equipment should be observed to verify normal operation in the configuration in which it will be used.

WARNING: Ensure that the current alarm presets are appropriate before use on each patient.

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

WARNING: Due to the size and weight of the equipment, it should only be moved by qualified personnel.

WARNING: Overloading machine may cause tipping. Equipment attached to the side of the equipment should be within the rated weights to prevent dumping of the machine.

WARNING: Excess load may cause a tip hazard while moving the equipment. Before moving, remove all equipment from the top shelf and all monitoring equipment installed to the side of the equipment. Use care when moving the equipment up or down a slope, around a corner, and across threshold. Do not attempt to roll the equipment over hoses, cords, or other obstacles.

WARNING: Leaks or internal venting of sampled gas may affect accuracy. Perform proper preoperative tests to ensure that the equipment is operating properly. Leaky circuits can not be used.

WARNING: Connecting the equipment's exhaust port to the hospital's waste gas scavenging system is strongly recommended to prevent exposure of hospital personnel to the waste gas.

WARNING: **Pins of connectors identified with the ESD warning symbol should not be touched. Connections should not be made to these connectors unless ESD precautionary procedures are used.**

WARNING: **Operation of the equipment below the minimum flow values may cause inaccurate results.**

WARNING: **This equipment/system is intended for use by healthcare professionals only. This equipment/system may cause radio interference or may disrupt the operation of nearby equipment. It may be necessary to take mitigation measures, such as reorienting or relocating the equipment, or shielding the location it was placed.**

WARNING: **Ensure that an independent means of ventilation (e.g. a self-inflating manual resuscitator with mask) is available whenever the equipment is in use.**

WARNING: **The use of accessories with damaged packaging may cause biocontamination or failure. The operator should check the integrity of accessory packaging before use.**

WARNING: **Before using the anesthesia system after cleaning or disinfecting, power on the system and follow the on-screen prompts to perform leak test and compliance test. See (Pages 5-7) 5.4.2"Leak & Compliance Test".**

WARNING: **If the equipment is damaged in any way that compromises the safety of the patient or user, discontinue use and attach a visible label indicating that the equipment is unusable. Please contact Mindray Technical Support.**

WARNING: **Oxygen, when present in high concentrations, can significantly increase the chance of fire or explosion. Oil and grease may be ignited at the same time. Therefore, oil and grease should not be used where oxygen enrichment may occur.**

WARNING: **Use of lubricants not recommended by Mindray may increase the danger of fire or explosion. Please use lubricants as approved by Mindray.**

WARNING: **Low-pressure regulators and flow-meters are susceptible to high pressure, and may burst if improperly maintained or disassembled while under pressure. Changing or disassembling connectors should be performed only by qualified personnel.**

WARNING: **Do not disassemble the low-pressure regulator, flow-metering device, or connector while under pressure. Sudden release of pressure may cause injury.**

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

WARNING: **Avoid connecting two or more hose assemblies in series as this may cause a loss of pressure and flow.**

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

WARNING: **Avoid replacing a high-pressure flexible connection with one of lower nominal inlet pressure.**

WARNING: **Reusing breathing circuits or reusable accessories that are not disinfected may cause cross-contamination. Disinfect the breathing circuits and reusable accessories before use.**

WARNING: **Inspect all breathing system components carefully before each use. Ensure all components contain no obstructions or debris that can cause a potential hazard to the patient.**

WARNING: **Use breathing circuits and manual bags in accordance with ASTM F1208 and compatible with standard 22mm male conical fittings per ASTM specifications F1054.**

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

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

WARNING: **If the Drive Gas Pressure Low alarm occurs when the gas supply pressure is greater than 200 kPa, contact your service personnel or Mindray.**

WARNING: **Make sure that CO_2 can be fully absorbed by the absorbent after the CO_2 absorbent is replaced or a CO_2 absorbent canister is installed.**

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

WARNING: **AGSS is not recommended to be used when the breathing tubes between the waste gas disposal system and AGSS get clogged, the extracted flow of the waste gas disposal system is deficient or the waste gas disposal system fails to work properly, as the waste gas in the AGSS may flow out to the atmosphere at a rate higher than 100 mL/min.**

WARNING: **When anesthetic gas delivery equipment needs to be configured for the anesthesia system, make sure to configure a monitor that is compliant with the ISO 80601-2-55 standard for monitoring the anesthetic gas concentration monitoring, and make sure that the anesthetic gas concentration monitoring range of the monitor can fully cover the adjustable range of values of the anesthetic gas delivery equipment.**

WARNING: **When the Isoflurane anesthetic vaporizer is used, confirm whether the set concentration of the vaporizer exceeds the monitorable range of the AG module. If it is the case, the anesthesia system won't be able to guarantee the monitoring precision of the AG module. For the monitorable range of the AG module configured in this anesthesia system, See (Pages 12-14) 12.11.1"AG Module".**

WARNING: **According to international laws and regulations, the equipment is required to monitor the O_2 concentration when applied to patients. If the equipment you are using is not configured with this feature, please use a monitor compliant with the corresponding international standards for O_2 concentration monitoring. The gas sampling tube of the monitor should be connected to the Y-shaped three-way valve of the breathing system of the equipment.**

WARNING: **CO_2 concentration monitoring is recommended when the equipment is applied to patients. If the equipment you are using is not configured with this feature, please use a monitor compliant with the corresponding international standards for CO_2 concentration monitoring. The gas sampling tube of the monitor should be connected to the Y-shaped three-way valve of the breathing system of the equipment.**

WARNING: **The anesthesia system may lose its balance if it is tilted more than 10 degrees. Use extreme caution when moving or resting the equipment on slopes of over 10 degrees. Before moving, remove all equipment from the top shelf, all monitoring equipment mounted to the side of this machine, all brackets, cylinders, objects on the top self and worktable and in the drawers.**

WARNING: **Do not move the anesthesia system after unpacking it.**

WARNING: **No modification of this equipment is allowed.**

WARNING: **The service personnel must be properly qualified and thoroughly familiar with the operation of the equipment.**

WARNING: **External exhaust outlets of Anesthesia System shall not be located to place which has any electrical component.**

1.1.2 Cautions

CAUTION: **To ensure patient safety, use only parts and accessories specified in this manual.**

CAUTION: **At the end of its service life, the equipment, as well as its accessories, must 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.**

CAUTION: **Magnetic and electrical fields are capable of interfering with the proper performance of the equipment. Ensure that all external devices operating in the vicinity of the equipment comply with the relevant EMC requirements. Mobile phones, x-ray equipment, and MRI equipment are possible sources of interference as they may emit higher levels of electromagnetic radiation.**

CAUTION: **This system operates correctly at the electrical interference levels identified in this manual. Higher levels can cause nuisance alarms that may stop automatic ventilation. Be aware of false alarms caused by high-intensity electrical fields.**

CAUTION: **Perform the daily checks specified on the checklist. In case of a system fault, do not operate the system until the fault has been corrected.**

CAUTION: **Before starting the equipment, users must be familiar with the information contained in this Operator's Manual and must have been trained by an authorized representative.**

CAUTION: **If the equipment does not function as described, it must be examined and repaired as necessary by qualified service personnel before being put back to use.**

CAUTION: **Handle the equipment with care to prevent damage or functional faults.**

CAUTION: **Ensure that the gas supply of the equipment always complies with the technical specifications.**

CAUTION: **Before clinical use, the equipment must be correctly calibrated and/or the respective tests must be performed, as described in this Operator's Manual.**

CAUTION: **If system faults occur during the initial calibration or testing, the equipment should not be operated until those faults have been corrected by a qualified service personnel.**

CAUTION: **After servicing, functional, sensor, and system tests must be performed before clinical use.**

CAUTION: **Only vaporizers with Selectatec Interlock-Systems may be used with this equipment.**

CAUTION: **Each time you replace the vaporizer, please carry out leak test for the breathing circuit.**

CAUTION: **Use cleaning agent sparingly. Excess fluid could enter the equipment and cause damage.**

CAUTION: **Do not autoclave any parts of the equipment unless specifically identified as autoclavable in this manual. Clean the equipment only as specified in this manual.**

CAUTION: **To prevent system damage:**

- **Refer to the documentations provided by the manufacturer of the cleaning agent.**
- **Never use organic, halogenated or petroleum-based solvents, anesthetic agents, glass cleaning agents, acetone or other irritant agents.**
- **Never use abrasive agents (i.e. steel wool or silver polish) to clean components.**
- **Keep all liquids away from electronic components.**
- **Prevent liquid from entering the equipment.**
- **All cleaning solutions used must have a pH value between 7.0 and 10.5.**

CAUTION: **Never immerse the oxygen sensor or its connector into any type of liquid. Dispose the O_2 sensor according to the manufacturer's specifications.**

CAUTION: **Do not fumigate using peracetic acid or formaldehyde.**

CAUTION: **The valve disc in each of the inhalation and exhalation valve assemblies on the breathing system is fragile and must be handled with care while disassembling the valve cage from the valve assembly.**

CAUTION: **Only connect Mindray approved devices to the equipment's communication ports. Devices connected to the ethernet ports must comply with IEC 60950.**

CAUTION: **Do not connect any non-isolated devices to the DB9/RS232C interface of the equipment.**

CAUTION: **Do not connect any devices to the SB ports other than Mindray approved USB storage devices and a supported USB mouse.**

CAUTION: **Do not wash the inner surface of the oxygen sensor.**

CAUTION: **Do not perform soaking or high-temperature processing on the O_2 sensor.**

CAUTION: **Users should monitor oxygen percentage (FiO_2%) when using the Auxiliary O_2/Air Flow Meters. Without oxygen monitoring, it would be impossible to know the concentration of oxygen delivered to the patient.**

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

CAUTION: **To ensure measurement accuracy and to avoid possible damage to the equipment, use only Mindray-approved cables and accessories.**

CAUTION: **Use the power cord provided with the product. If a substitute is necessary, use power cord in compliance with the specification.**

CAUTION: **Do not use a damaged device or accessory. Periodically check all cables (e.g., AC line cord and patient connection cables) for damage that may occur through normal use. Replace cables if damaged in any way.**

CAUTION: **Use of other oxygen sensors may cause improper oximeter performance.**

CAUTION: **Unintended movement may occur if the casters are not locked. The operator should lock casters during use of the equipment.**

CAUTION: **Unsecured devices may slide off the top shelf. Devices should be securely attached to the top shelf.**

CAUTION: **The voltage on the auxiliary outlets should be the same voltage as the outlet into which the equipment is plugged. Ensure that devices plugged into the auxiliary outlets are rated for the same supply voltage as the equipment.**

CAUTION: **During the transport and storage of the vaporizer, block the gas inlet and outlet of the vaporizer with plugs to prevent foreign substances from entering the vaporizer.**

CAUTION: **Do not use any flow outlets as handles when moving the equipment. The flow outlets may become damaged. Use the metal side bars on the main body when moving the equipment.**

CAUTION: **Do not push down on the bag arm forcefully or hang heavy objects onto it. Excessive weight may bend and damage the bag arm.**

CAUTION: **Use caution when disconnecting [quick connectors], as the sudden release of pressure may cause injury.**

CAUTION: **Avoid factors that can contribute to deterioration of the hose assemblies. Factors include excessive bending, crushing, abrasion, system pressures and temperatures that exceed hose ratings, and improper installation.**

CAUTION: **Be careful in lifting and manipulating the breathing system during disassembly of the system.**

CAUTION: **When the electronic flow control system is disabled, the backup flow control system will be enabled. The initial flow of backup flow control system is 1 L/min of O_2. The backup flow control system display only has a total flowmeter which can display a maximum flow of 15 L/min.**

CAUTION: **Turn the flow control knob of the backup flow control system slowly. To avoid damaging the control valves, do not turn further when the flowmeter reading is out of range. When turning a flow control knob clockwise to decrease flow, the flowmeter should reach 1 L/min before the knob reaches its most clockwise mechanical stop (off) position. Do not turn any further when the knob has reached the off position. Turning a flow control knob counter clockwise increases flow.**

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.**

1.1.3 Notes

NOTE: **Figures in this manual are provided for reference purposes only. Screens may differ based on the system configuration and selected parameters.**

NOTE: **Put the equipment in a location where you can easily see the screen and access the operating controls.**

NOTE: **Keep this manual close to the equipment so that it can be obtained conveniently when needed.**

NOTE: **The software was developed in compliance with IEC 60601-1.The possibility of hazards arising from software errors is minimized.**

NOTE: **This manual describes all features and options. Your equipment may not have all of them.**

NOTE: **The equipment is intended to be operated with its integral Breathing Pressure monitoring in use.**

NOTE: **The equipment is intended to be operated with its integral Breathing Pressure limiting devices in use.**

NOTE: **The equipment is intended to be operated with its integral Expiratory Volume monitoring in use.**

NOTE: **The equipment is intended to be operated with its integral Breathing System integrity Alarm System in use.**

NOTE: **The equipment is intended to be operated with its integral Continuous Pressure Alarm in use.**

NOTE: **The equipment is intended to be operated with its integral O_2 monitoring in use.**

NOTE: **An Anesthesia Vapor Delivery Device is to be used with an Anesthetic Agent Monitor complying with ISO 80601-2-55. The connection of Patient Circuit and Agent monitor should be made by a sample line.**

NOTE: **Continuously monitor the anesthetic agent concentration when using the anesthesia system to ensure accurate output of the anesthetic agent.**

NOTE: **Check the liquid level of the anesthetic agent before and during all operations. When the liquid level is below the warning line, more anesthetic agent needs to be added. Refer to the vaporizer Instructions For Use for filling the vaporizer and other information.**

NOTE: **The system is designed to be equipped with an anesthetic vapor delivery device that complies with ISO 80601-2-13.**

NOTE: **The battery supply of this equipment 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 a service representative to have the battery supply disconnected. The disposal of battery should comply with local regulations. At the end of the battery life, dispose of the battery supply in accordance with local regulations.**

NOTE: **Areas designated for the servicing of oxygen equipment shall be clean, free of oil and grease, and not be used for the repair of other equipment.**

NOTE: **Opening the cylinder valve quickly may cause unexpected pressure difference and lead to potential fire or explosion hazard due to the oxygen pressure shock. Open and close the cylinder valve slowly.**

NOTE: **Changes in inlet pressure, outlet resistance, or ambient temperature may affect the accuracy of flow values.**

NOTE: **The power supplies, terminal units and pipeline systems can be supplied by one or several different manufacturers.**

NOTE: **Regional or national regulations that apply to manufacturers of medical equipment can exist.**

NOTE: **The product does not contain latex parts.**

NOTE: **The operator should stay right in front of the equipment within four meters away from the display to facilitate observation of the displayed information on the equipment.**

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

NOTE: **The tidal volume and minute ventilation displayed on this equipment are measured in BTPS conditions. The fresh gas flow is measured in STPD conditions.**

NOTE: **For the method of connecting this equipment to an external monitor or other devices, please see Anesthesia System Bracket Installation Instructions.**

NOTE: **All the materials of this equipment exposed to gases are compatible with O_2, air and N_2O.**

NOTE: **To avoid abnormal gas supply, the anesthesia system has a 758 kPa pressure relief valve installed at the gas supply inlet. When the gas supply pressure is abnormally elevated, the pressure relief valve is turned on to ensure the proper operation of the anesthesia system. When the pressure relief valve is on, the anesthesia system and the O_2 flush are both operating properly, and their P-F (pressure/flow) characteristics are consistent with those under rated conditions. The pressure at the high-pressure O_2 outlet will be elevated to 758 kPa, and the maximum flow rate meets requirements in the specifications.**

NOTE: **The defibrillation restoration time is 15 seconds unless otherwise stipulated.**

NOTE: **According to the conclusion of clinical evaluation and residual risk evaluation, for the intended patients, there is no known side effects that can occur during or after the use of the medical device. And there is no need for the operator to make extra preparations. Thus, no residual risk associated with using the medical device should be disclosed.**

1.2 Symbols

The following table provides descriptions of symbols that are used on the equipment and/or within this manual.

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	Caution!		Warnings


Temperature limitation


Humidity limitation


Keep dry


Atmospheric pressure limitation


This way up


Fragile, handle with care


Recyclable


Stacking limit by number


Ambient: temperature range

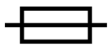

Ambient: humidity range


Electrical: alternating current (AC)


Electrical: internal battery


Electrical: equipotentiality


Electrical: protective earth (ground)


Electrical: fuse or circuit breaker

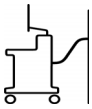

Video signal port


Electrical: powered-on

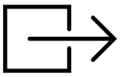

Electrical: powered-off

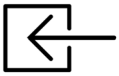

Electrical: input/output


Gas flow: flow control knob


Pipelined gas supply


Gas cylinder


Gas Outlet

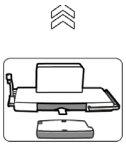

Gas Inlet

MAX
Maximum value

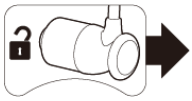
MIN
Minimum value

>PPSU<
Material: polyethylene sulfone (PPSU)

>PSU<
Material: polysulfone

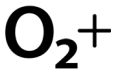


Assemble volume exchanger



Disassemble O_2 sensor

O_2 Sensor Connector

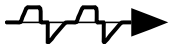


Gas: O_2 flush button

Lock/Unlock: locked

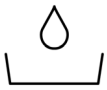
Lock/Unlock: unlocked

Manual ventilation



Automatic ventilation

Water Drain



Watertrap

No heavy objects:
Do Not Crush

Do Not Oil

134°C

Autoclavable

Not Autoclavable

Caution: Hot

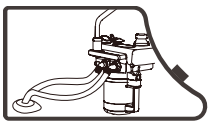
Direction

Electrical: light

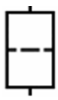
5 kg MAX
11 lbs MAX

Weight limit

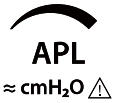
ACGO mode



Automatic ventilation mode



Filter Access

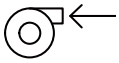


APL valve

Canister opened

Canister closed

Negative pressure suction device



Negative pressure gas supply

IPX1

Protection level of anesthesia system against splashing water

IPX4

Protection level of BIS module against splashing water

REF	Identifier: manufacturer's reference/catalog number	SN	Identifier: serial number
	Applied parts of defibrillator proof type CF equipment		Applied parts of defibrillator proof type BF equipment
	Identifier: Manufacturer		Refer to instruction manual/booklet
MD	Medical Device	UDI	Unique Device Identifier

CE 0123 The product complies with the Council Directive Concerning Medical Devices (93/42/EEC) and meets the basic requirements in the Appendix I of the directive, hence the CE mark.

Electrical:
WEEE (Waste of Electrical and Electronic Equipment) Marking. Separate treatment from general waste at end of life.

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

The general meaning assigned to geometric shapes, safety colors and contrast colors for safety signs are as follows:

GEOMETRIC SHAPE	MEANING	SAFETY COLOR	CONTRAST COLOR	GRAPHICAL SYMBOL COLOR
	Prohibition	Red	White	Black
	Mandatory action	Blue	White	White
	Warning	Yellow	Black	Black

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2.0 Product Description

2.1 Introduction

2.1.1 Intended Use

2.1.1.1 Intended Purpose Statement

The Anesthesia System is intended for administering to a patient, continuously or intermittently, a general inhalation anesthetic and to maintain a patient's ventilation.

2.1.1.2 Indication for use

The Anesthesia System is intended for administering to a patient, continuously or intermittently, a general inhalation anesthetic and to maintain a patient's ventilation.

2.1.1.3 Intended users

The Anesthesia System is intended for use by licensed clinicians in the administration of general anesthesia.

2.1.1.4 Intended patient population

Suaugusiems, vaikams ir naujagimiams.

2.1.1. The Anesthesia System can be used in adult, pediatric and neonate populations.

2.1.1.5 Intended medical conditions

The Anesthesia System is used within a health care facility by licensed clinicians in the administration of general anesthesia.

2.1.1.6 Contra-indications

Not identified yet.

2.1.1.7 Side-effects

According to the conclusion of clinical evaluation and residual risk evaluation, for the intended patients, there is no known side effects that can occur during or after the use of the medical device. And there is no need for the operator to make extra preparations. Thus, no residual risk associated with using the medical device should be disclosed.

WARNING: **This anesthesia system is intended for use by qualified anesthesia personnel only or under their guidance. Personnel for using the equipment should receive complete pre-use training. Unauthorized personnel, or personnel who have received no training, must not perform any operations on the equipment.**

WARNING: **The equipment is not suitable for use in an MRI environment.**

2.1.2 Structure and Composition

The Anesthesia System consists of main unit, anesthetic ventilator, anesthetic gas delivery system, anesthetic vaporizer (V60 model, applicable anesthetic agents: Isoflurane, Sevoflurane and Halothane; Sigma Delta model, applicable anesthetic agents: Isoflurane, Sevoflurane and Halothane; D-Vapor model, applicable anesthetic agents: Desflurane), anesthetic breathing system (including the airway pressure gauge, volume exchanger, CO_2 absorbent canister, inspiratory and expiratory check valves, inspiratory and expiratory flow sensors, exhaust valve, Auto/Manual switch, manual bag port, inspiratory and expiratory ports and connectors), Anesthetic Gas Scavenging System (AGSS), negative pressure suction device, anesthetic gas monitoring module, bispectral index (BIS) module, neuromuscular monitoring (NMT) module, O_2 cell and accessories.

2.1.3 Functions and Features

The anesthesia system is intended to provide continuous or intermittent general inhalation anesthesia and maintain ventilation for patients. This equipment also provides ventilation monitoring for patients. The anesthesia system is applicable to patient environments.

Applied parts of the anesthesia system are the breathing tubes, masks, BIS electrodes, NMT electrodes and cables. Connect the patient to the Anesthesia System via the breathing circuit. The anesthesia system provides the following ventilation modes:

- Manual ventilation
- Volume Control Ventilation (VCV)
- Pressure Controlled Ventilation
  - Pressure Controlled Ventilation (PCV)
  - Pressure Controlled Ventilation-Volume Guarantee (PCV-VG)
- Synchronized Intermittent Mandatory Ventilation (SIMV)
  - Synchronized Intermittent Mandatory Ventilation – Volume Control (SIMV-VC)
  - Synchronized Intermittent Mandatory Ventilation – Pressure Control (SIMV-PC)
  - Synchronized Intermittent Mandatory Ventilation – Volume Guarantee (SIMV-VG)
- Continuous Positive Airway Pressure/Pressure Support Ventilation (CPAP/PS)
- Airway Pressure Release Ventilation (APRV)
- Adaptive Minute Ventilation (AMV)

The anesthesia system provides the following frequently-used features or configurations:

- Cardiopulmonary bypass
- Monitor mode
- Recruitment
- High-flow Nasal Cannula Oxygen (HFNC)
- Flow pause
- Anesthetic breathing system purge
- Agent usage calculation
- Prediction of anesthesia
- Anesthetic gas monitoring (paramagnetic O_2 sensor optional)
- Oxygen concentration monitoring
- Bispectral Index (BIS) monitoring
- Neuromuscular monitoring (NMT) monitoring
- Auxiliary Pressure Monitoring
- Screen saver
- AGSS visualization
- Auxiliary Common Gas Outlet (ACGO)
- Sample gas return to the anesthesia breathing system
- Negative pressure suction
- Foldable worktable
- Vaporizer Parking Spot

2.2 Equipment Views

2.2.1 Main Unit (Front View)

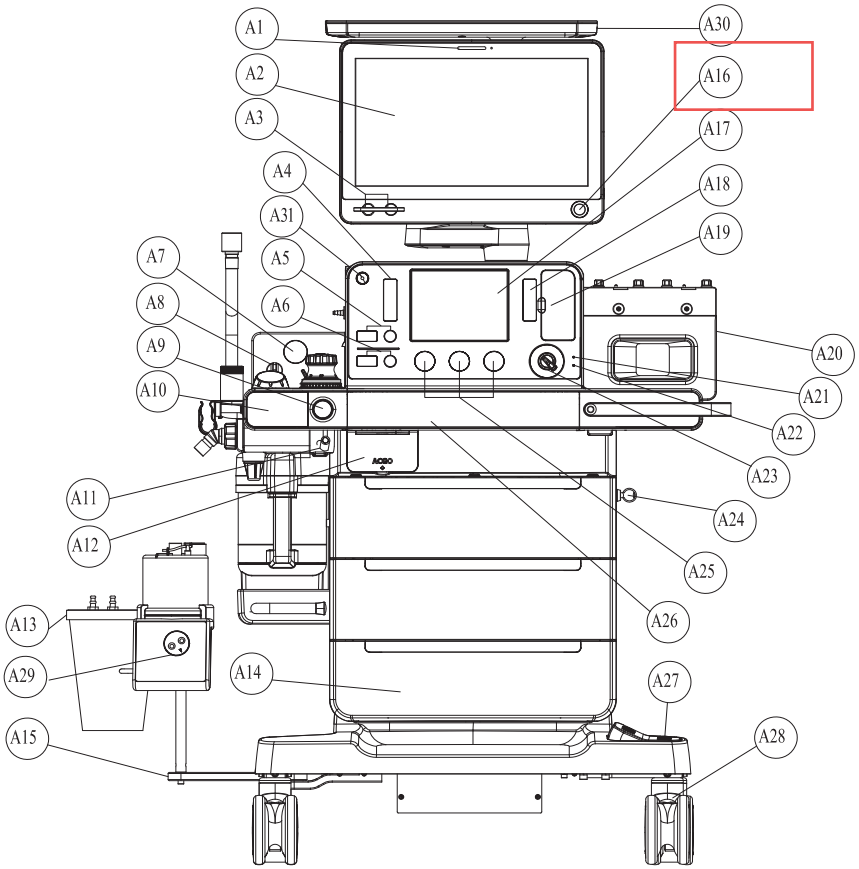

Figure 2-1 Main Unit (Front View)

PARTS		DESCRIPTION
A1	**Alarm LED**	The alarm LED may turn red, yellow or cyan, indicating different priorities. Red = high priority, yellow = medium priority, cyan = low priority, off = no alarms.
A2	**Main Screen**	See "System Interface" on Pages 4-1.
A3	**The flow or O_2 concentration control knob of the electronic flow control system.**	Rotate the knob to adjust the flow or O_2 concentration.
A4	**Auxiliary flowmeter (O_2/air) or High-flow Nasal Cannula Oxygen (HFNC)**	There is a float in the flow tube, and the scale line that the middle of the float is aligned to indicates the current gas flow. There is a flow control knob on the flowmeter to control the flow. Rotate the knob counter clockwise to increase the gas flow and rotate the knob clockwise to reduce the gas flow.

PARTS		DESCRIPTION
A5	**Total flow control knob for auxiliary flow or HFNC**	Rotate the knob to adjust the total flow of the auxiliary flowmeter or HFNC.
A6	**Oxygen concentration control knob for auxiliary flow or HFNC**	Rotate the knob to adjust the O_2 concentration of the auxiliary flowmeter or HFNC.
A7	**Negative pressure gauge**	Used to indicate the negative pressure.
A8	**Negative pressure suction switch**	Used to switch the work mode of the negative pressure suction device. FULL, OFF and REG modes are available. FULL mode indicates that the negative pressure suction device works with the maximum pressure continuously and the control knob is inoperative. OFF mode indicates that the negative pressure is turned off and the negative pressure suction device is inactive. REG mode indicates that the pressure of the negative pressure suction device can be adjusted with the negative pressure control knob. Rotate the knob counter clockwise to increase the negative pressure. Rotate the knob clockwise to reduce the negative pressure.
A9	**O_2 Flush button**	Used to provide high-flow O_2 for the inspiratory branch of the breathing system.
A10	**Oxygen sensor cover**	Open the cover to install the O_2 sensor.
A11	**Negative pressure suction tube clamp**	Used to retain the tubes of the negative pressure suction device.
A12	**ACGO (independent outlet and switch)**	ACGO switch is used to enable/disable the ACGO feature. ACGO independent outlet is used to output fresh gas.
A13	**Negative pressure suction liquid collection bottle**	Used to collect the hydrops, hematocele, pus and other contaminants from the patient's pharynx.
A14	**Storage drawers**	Three (3) storage drawers (lockable) are available.
A15	**Liquid collection bottle and humidifier bracket**	Used to support the negative pressure suction liquid collection bottle and humidifier.
A16	**Main control knob of display**	Press the main control knob to select an item on the menu or confirm the settings. Rotate the knob clockwise or counter clockwise to scroll the items on the menu or change the settings.
A17	**Status display**	Used to display the status of gas supply pressure, volume exchanger, AGSS and heating module of the breathing system.
A18	**Total flowmeter of Backup Flow Control System**	Display the total flow of Backup Flow Control System.
A19	**Backup Flow Control System (BFCS) Cover**	Pull the BFCS cover switch outward to start the BFCS. Rotate the flow control knob to control the air and O_2 flows. Rotate the knob counter clockwise to increase the gas flow and rotate the knob clockwise to reduce the gas flow.
A20	**Vaporizer Mount Spot**	Used to install two Selectatec vaporizers. One installing stem can support two vaporizers. The vaporizer is equipped with an internal interlocking mechanism, limiting the use of only one vaporizer and the delivery of one anesthetic agent in one operation.
A21	**Battery charging indicator**	The indicator is on when the battery is being charged.
A22	**AC status indicator**	The indicator is on when the system is connected to an AC power source.
A23	**System switch**	Used to switch on or off the system.
A24	**Key lock**	The key and lock to lock a drawer.

2.1.28.1.

PARTS		DESCRIPTION
A25	**Gas supply pressure gauge**	Used to indicate the inlet pressure of the O_2, air and N_2O pipelines for the anesthesia system not configured with backup gas cylinders. Used to indicate the pressure of the O_2, air and N_2O backup gas cylinders for the anesthesia system configured with backup gas cylinders.
A26	**Volume exchanger cover**	Pull the unlocking button in the bottom right corner outward as per instructions on the equipment to open the volume exchanger cover.
A27	**Caster lock**	Lock/release the brakes for front two casters when depressed.
A28	**Caster**	The system moves with the help of casters. Caster lock of the equipment is controlled by the central brake and caster brake.
A29	**Humidifier**	The humidifier should be connected to the tube when the High-flow Nasal Cannula Oxygen (HFNC) feature is enabled.
A30	**Top Shelf**	Top shelf surface.
A31	**Auxiliary flowmeter (O_2/air) or High-flow Nasal Cannula Oxygen (HFNC) switch**	Used to switch on or off the auxiliary flowmeter or high-flow nasal cannula oxygen function.

2.2.2 Main Unit (Rear View)

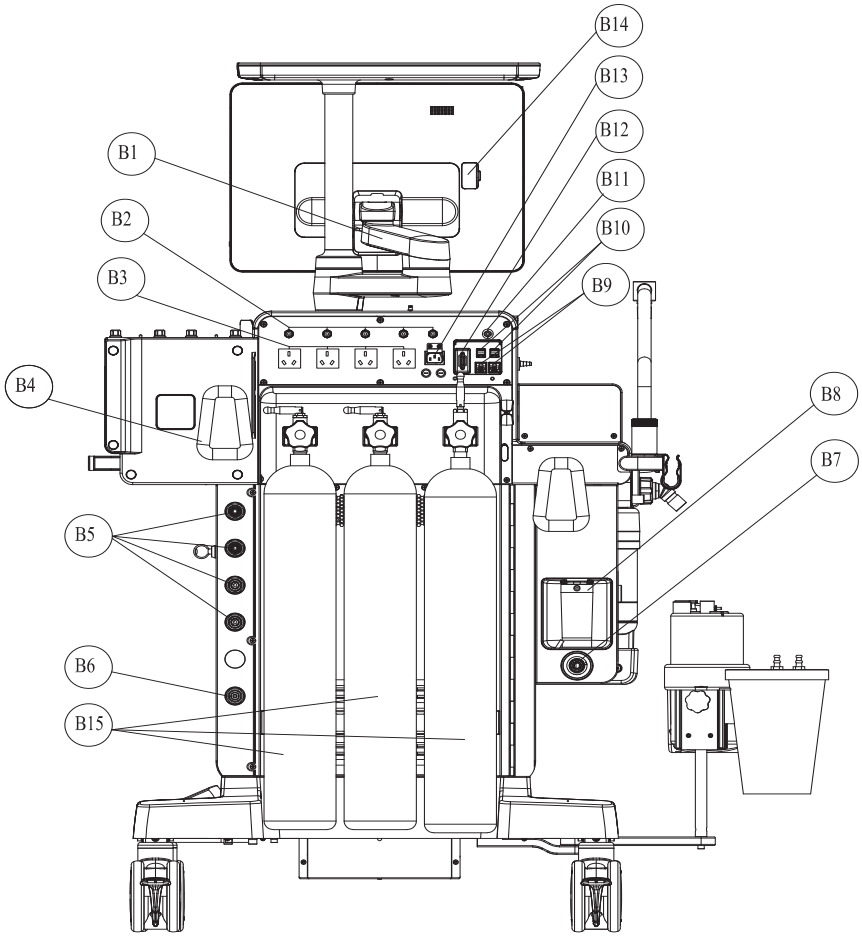

Figure 2-2 Main Unit (Rear View of Standard Cylinder)

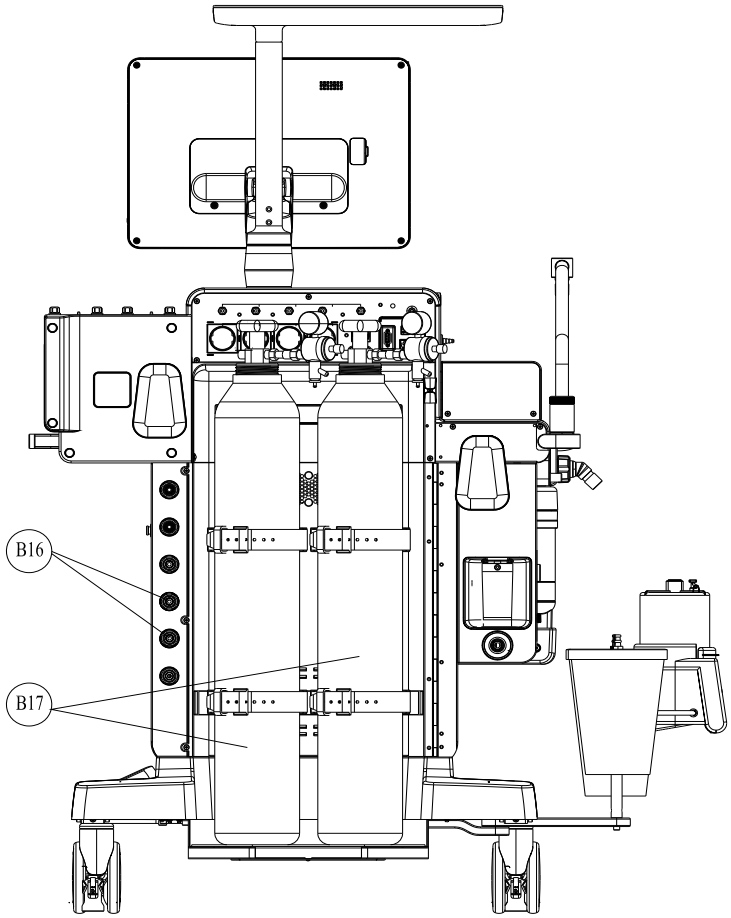

Figure 2-3 Main Unit (Rear View of Large Cylinder)

PARTS		DESCRIPTION
B1	**Display arm**	Used to install the display.
B2	**Breaker**	The breaker for each auxiliary output power outlet.
B3	**Auxiliary AC power outlet**	Three or four auxiliary AC power outlets are available.
B4	**Hanger**	Used to hang cables and gas supply hoses.
B5	**Pipelined gas supply ports**	The connecting ports for pipelined gas supply of O_2, air and N_2O.
B6	**Negative pressure source port**	Used to connect to the wall-mounted negative pressure source of the hospital.
B7	**Waste Gas Scavenging outlet**	Used to connect to the waste gas disposal system. **NOTE: Please use a waste gas disposal system that complies with the ISO 80601-2-13 standard.**

PARTS		DESCRIPTION
B8	**Overfill protection**	The overfill protection of the negative pressure suction device, used to prevent backflow of effluent after the bottle is full to ensure pipeline and tube safety.
B9	**Network interfaces (CS1, CS2)**	RJ-45 network interface. It can connect with a PC to perform software upgrading. It can synchronize time with PC through SNTP protocol. It supports wired network 10 M/100 M, and comply with technical standard IEEE 802.3. It complies with Mindray internal protocol, HL7 protocol and SNTP protocol. The intended information flow is between the PC and the anesthesia system. The interface must be used by the specified service personnel.
B10	**SB interfaces (SB1, SB2, SB3, SB4)**	Type A interface, complied with USB 2.0 standard and Mindray internal protocol. It can connect to a USB device or the mouse; export configuration information and historical data; transfer configuration data between machines of the same type. The intended information flow is between the anesthesia system and the U disk. The interface must be used by the specified service personnel. **CAUTION: Do not connect any devices to the SB ports other than Mindray approved USB storage devices and a supported USB mouse.**
B11	**Equipotentiality**	Used to provide a grounding point. Used to eliminate the electric potential difference between the ground wires of different devices to ensure safety.
B12	**Communication interface (SP1)**	One DB9 male port, with TTL serial port. It can connect to the external calibration device. An external medical device can be connected via this connector to communicate with the anesthesia system. It complies with serial protocol, HL7 protocol, OpenInterface protocol and Mindray internal protocol. The intended information flow is from the anesthesia system to the external medical device or calibration device. The interface must be used by the specified service personnel.
B13	**Power input socket**	Used to connect to the power cord.
B14	**Video signal port**	D-sub connector, complied with RS343 electrical standards. It can connect to an external display and output the video signal of the main display.
B15	**Standard cylinders**	Supply tanks (E-size) containing high pressure O_2, Air, and N_2O to act as backup supply if the pipeline pressure is removed. **NOTE: Tanks not supplied by Mindray.**
B16	**Large cylinder supply connections**	Interface connectors to high pressure supply tanks (O_2 and N_2O). Connects to large cylinder via a hose.
B17	**Large cylinders**	Supply tanks containing high pressure O_2, and N_2O to act as backup supply if the pipeline pressure is removed. **NOTE: Tanks not supplied by Mindray.**

2.2.3 Main Unit (Left View)

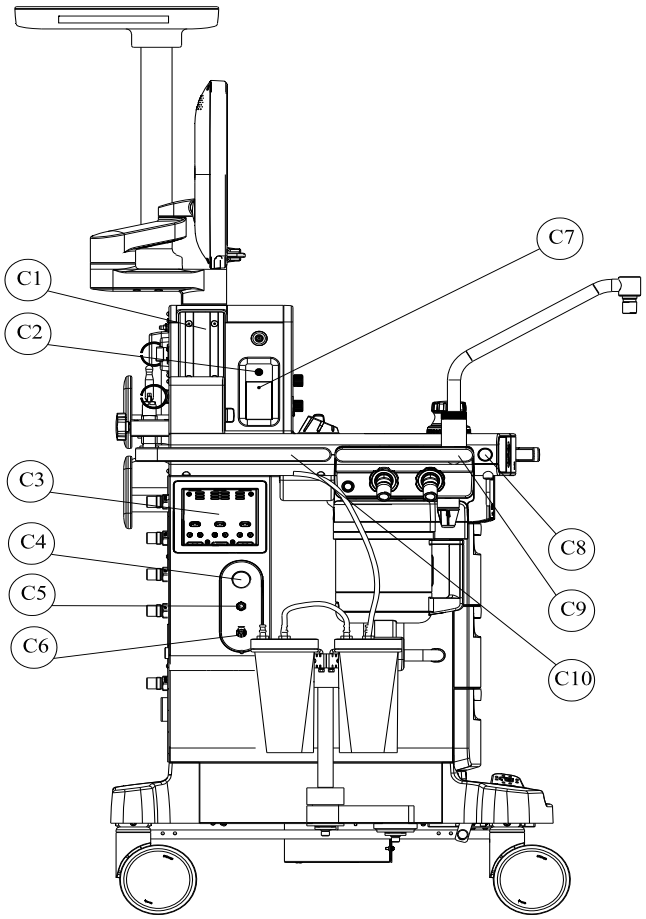

Figure 2-4 Main Unit (Left View)

PARTS		DESCRIPTION
C1	**Installing rail**	Used to install the standard attachment arms of the monitor and other equipment. Installing rails are available on both sides of the equipment.
C2	**Auxiliary O_2/air outlet or High-flow Nasal Cannula Oxygen (HFNC) outlet**	Used to output the auxiliary O_2/air when the auxiliary O_2/air feature is enabled. Used to output O_2 when the HFNC feature is configured for the anesthesia system.
C3	**Module slot**	Used to be inserted with and recognize the NMT, AG, BIS mentioned in this manual.
C4	**AGSS flow control knob**	Rotate the knob clockwise or counter clockwise to adjust the flow in the AGSS until the float in the Status Screen is located between Min and Max scale lines.
C5	**Sample gas return port**	The sample gas return port of the Gas module.
C6	**Auxiliary high-pressure O_2 outlet**	Used to connect to an external device (such as an air-jet ventilator) for hyperbaric O_2 venting.
C7	**Auxiliary pressure port**	Used to monitor the auxiliary pressure.
C8	**Oxygen sensor cover switch**	Used to open the O_2 sensor cover.
C9	**Handle**	The maximum force capacity of the handle is 10 kgf. **WARNING: The handle in intended to be used for installing and dissembling the breathing system only and shall not be used for pushing/pulling/lifting the anesthesia system.**
C10	**Handle**	The handle is intended to be used for pushing/pulling/rotating the anesthesia system, with a maximum force capacity of 80 kgf.

2.2.4 Main Unit (Right View)

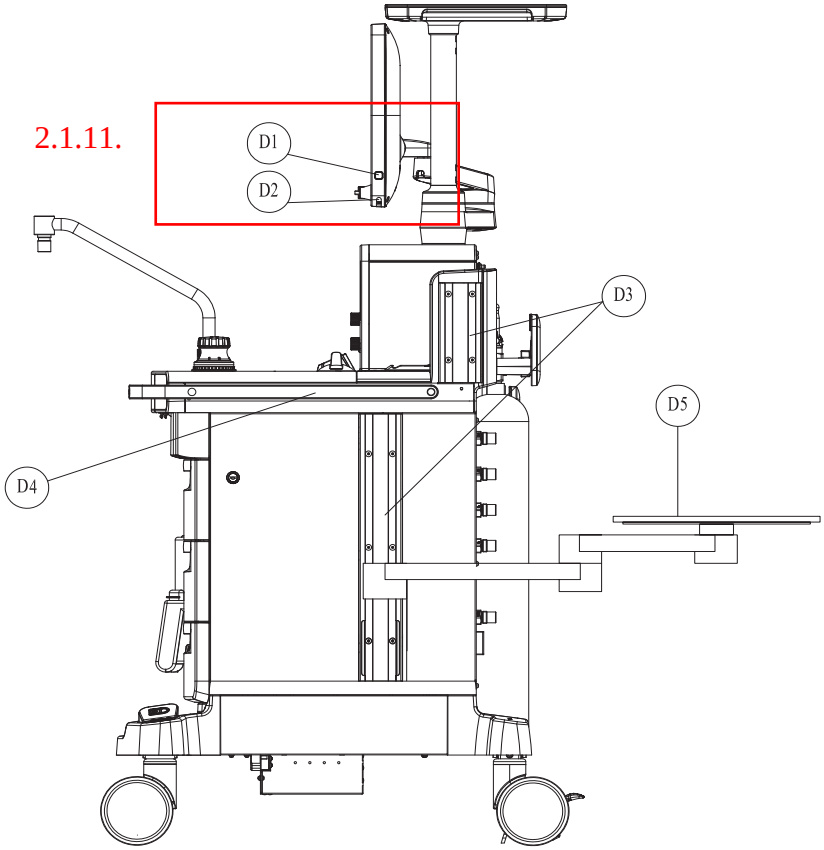

Figure 2-5 Main Unit (Right View)

PARTS		DESCRIPTION
D1	**Work lamp switch**	Used to turn on/off the work lamp. Three settings are available: off, low-light and high-light. Users can only turn on the work lamp when the system is switched on.
	Darbo vietos apšvietimas	
2.1.11. **D2**	**Work lamp**	Located beneath the display to illuminate the worktable.
D3	**Installing rail**	Used to install the standard attachment arms of the monitor and other equipment.
D4	**Handle**	The handle is intended to be used for pushing/pulling/ rotating the anesthesia system, with a maximum force capacity 80 kgf.
D5	**Foldable worktable**	Foldable worktable, 180-degree rotatable horizontally. Maximum supporting weight: 15kg.

2.2.5 Main Unit (Top View)

Perjungimas tarp rankinės/auto vent. vienu jungikliu

2.1.10.

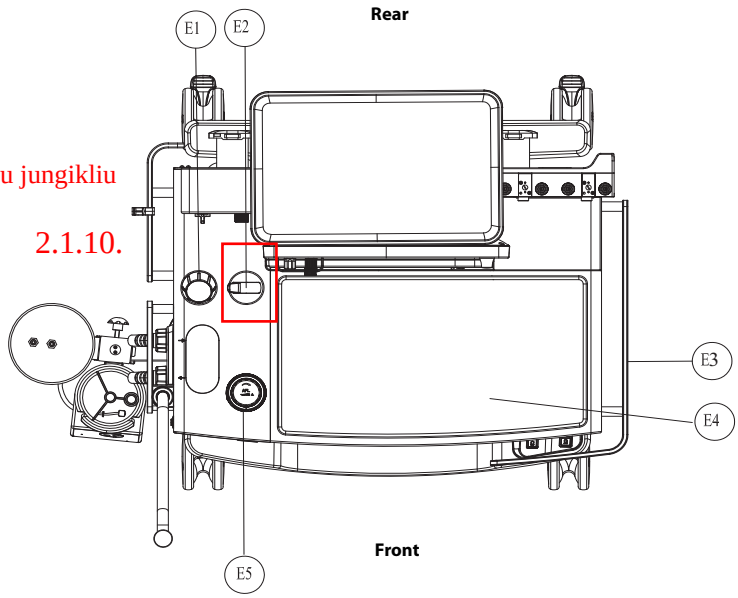

Figure 2-6 Main Unit (Top View)

PARTS		DESCRIPTION
E1	**Airway pressure gauge**[1]	Used to indicate the airway pressure of patients. **NOTE: It is normal to have a minor difference between the airway pressure gauge reading and the electronically monitored value. When the difference is greater than 15%, please contact your service personnel or Mindray.**

Perjungimas tarp rankinės/auto vent. vienu jungikliu

2.1.10.

E2	**Manual/Auto switch**	Used to switch between the automatic ventilation and manual ventilation modes.
E3	**Handle**	The handle is intended to be used for pushing/pulling/ rotating the anesthesia system, with a maximum force capacity 80 kgf.
E4	**Workbench**	Workbench surface (stainless steel), with a maximum force capacity of 30 kgf.

PARTS		DESCRIPTION
E5	**APL valve**[1]	Used to set the rotary pressure regulating valve of the breathing system during manual ventilation. Its scales represent the approximate pressure values. Set the APL valve to the SP position during spontaneous respiration. Elevate the APL valve upward as needed to release the pressure quickly. At a flow of 3L/min, the pressure of the APL valve should be between 1cmH_2O and 3cmH_2O (exclusive) either in dry or humid conditions. At a flow of 30L/min, the pressure of the APL valve should be between 1cmH_2O and 5cmH_2O (exclusive) either in dry or humid conditions.

[1] *The APL valve and PAW gauge numerics are for reference only. Calibrated patient airway pressure is displayed on the user screen.*

2.2.6 Breathing System

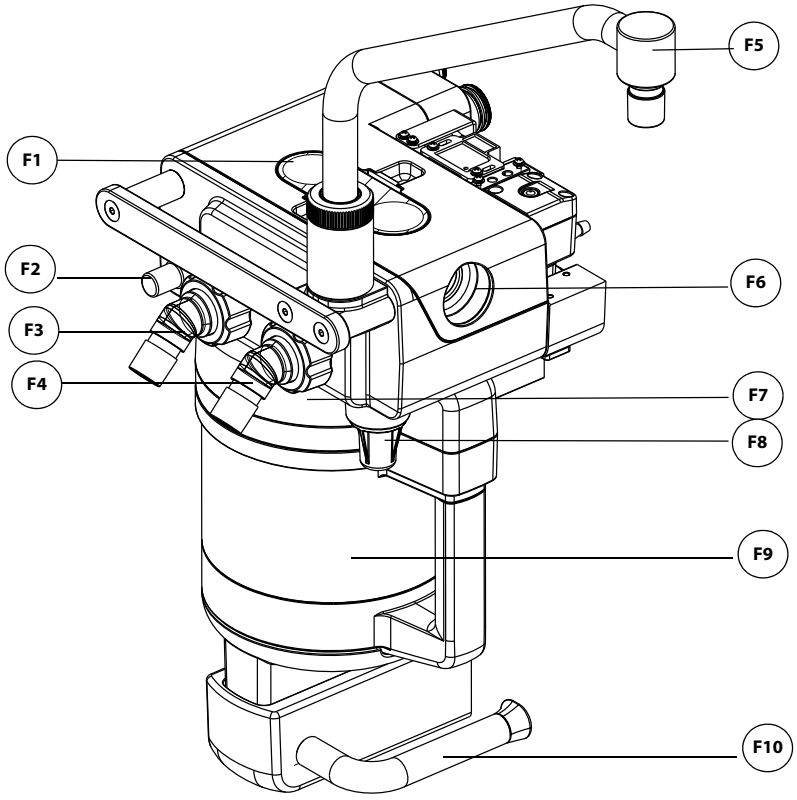

Figure 2-7 Breathing System

PARTS		DESCRIPTION
F1	**Observation window of expiratory/inspiratory check valve**	Used to observe the status of expiratory and inspiratory check valves from outside the equipment.
F2	**Leak test plug**	Used to connect to a breathing tube for leak tests.

PARTS		DESCRIPTION
F3	**Expiration connector**	The expiration connector of the breathing circuit.
F4	**Inspiration connector**	The inspiration connector of the breathing circuit.
F5	**Bag arm**	Used to connect to a manual ventilation bag.
F6	**O_2 sensor port**	Used to install the O_2 sensor and monitor the O_2 concentration.
F7	**Canister bypass assembly**	Used to maintain the pressure in the breathing circuit when the soda lime in the CO_2 absorbent canister is being replaced.
F8	**Watertrap**	Used to collect the condensate water in the breathing system. The watertrap must be emptied on a regular basis.
F9	**CO_2 absorbent canister**	The container for holding the CO_2 absorbent (bulk CO_2 absorbent or Pre-pak CO_2 absorbent).
F10	**Canister lock**	A latch to lock (horizontal)/unlock (vertical) the canister.

2.2.7 Negative pressure suction device

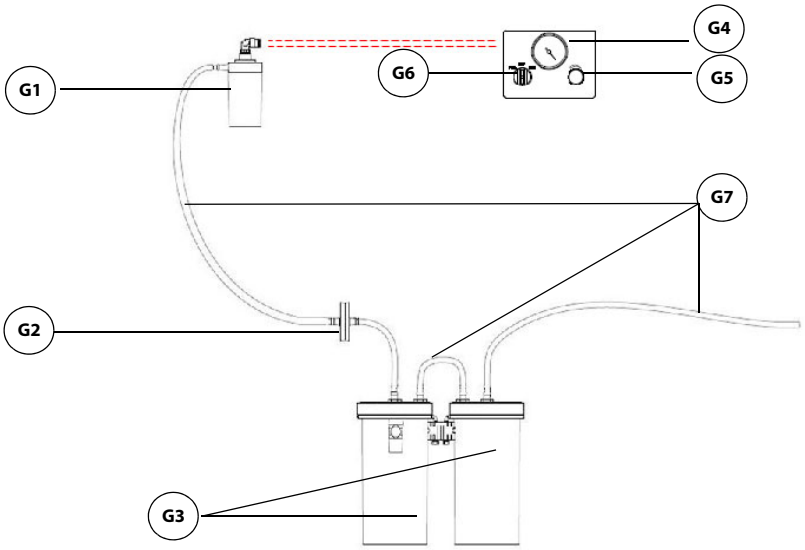

Figure 2-8 Negative pressure suction device

PARTS		DESCRIPTION
G1	**Overfill protection**	Used to prevent backflow of effluent after the bottle is full to ensure pipeline and tube safety.
G2	**Filter**	Used to filter moisture and impurities.
G3	**Liquid collection bottle**	Used to collect the hydrops, hematocele, pus and other contaminants from the patient's pharynx.
G4	**Negative pressure gauge**	Used to indicate the negative pressure.
G5	**Negative pressure control knob**	Used to control the pressure of the negative pressure suction device.

PARTS		DESCRIPTION
G6	**Selection switch**	Used to switch the work mode of the negative pressure suction device. FULL, OFF and REG modes are available. FULL mode indicates that the negative pressure suction device works with the maximum pressure continuously and the control knob is inoperative. OFF mode indicates that the negative pressure is turned off and the negative pressure suction device is inactive. REG mode indicates that the pressure of the negative pressure suction device can be adjusted with the negative pressure control knob. Rotate the knob counter clockwise to increase the negative pressure. Rotate the knob clockwise to reduce the negative pressure.
G7	**Suction tube**	Used to transmit the hydrops, hematocele, pus and other contaminants from the patient's pharynx. The tube's inner diameter is Φ8. The tube is directly inserted to the interface.

3.0 Installation and Disassembly

WARNING: **Before installation, check the adequacy of the surface of the structure to which the equipment is to be attached.**

WARNING: **This equipment must be installed by a factory authorized representative.**

WARNING: **Continuous use of desiccated soda lime may endanger patient safety. Adequate precautions should be taken to ensure that the soda lime in the CO_2 absorbent canister does not become desiccated. Turn off all gases when finished using the system.**

WARNING: **When electrosurgical equipment is used, keep the electrosurgical leads away from the breathing system, the O_2 sensor, and other parts of the anesthesia system. Keep available backup manual ventilation and a respirator with mask in case the electrosurgical equipment prevents safe use of the ventilator. Ensure the correct operations of all life support and monitoring equipment.**

WARNING: **Do not use masks or breathing tubes that are antistatic or conductive. They can cause burns if they are used near high frequency electrosurgical equipment.**

WARNING: **This anesthesia system has waste gas exhaust ports. The operator of the machine should pay attention to the disposal of the residual breathing gas scavenged.**

CAUTION: **The operational environment and the power source of the equipment must comply with the requirements as specified in the "Product Specifications" on Pages 12-1.**

3.1 Unpacking

When the anesthesia system is delivered, IMMEDIATELY inspect the box for any damage.

a. If there is NO damage and ALL tip indicators on the box exterior are intact, then sign and date the bill of lading or airway bill to indicate safe receipt of the equipment.

b. If there is DAMAGE or ANY of the tip indicators on the box exterior have been activated, then conditionally accept the delivery and clearly describe the damages on the bill of lading or airway bill. BOTH the carrier and recipient must sign and date the bill of lading or airway bill. Save all damaged factory packaging until further instructed by Mindray. The receiver should immediately contact Mindray Customer Service.

3.2 Initial Setup

The initial setup of the anesthesia system must be performed by an authorized Mindray service representative. Please contact Mindray Technical Support for any additional assistance.

3.3 Breathing System

Please install the breathing system, refer to 11.7.3.4 "Reassembly".

3.4 Vaporizer

The equipment contains a 2-position vaporizer installing system to enable anesthetic agents to be introduced into the fresh gas flow. Two vaporizers are supported, but only one vaporizer can be opened at a time. Halothane, Isoflurane, Desflurane and Sevoflurane vaporizers can be used.

CAUTION: Only vaporizers with Selectatec® Interlock-Systems may be used with this equipment.

WARNING: Use vaporizers compliant with ISO 80601-2-13. Refer to the vaporizer manufacturer's Instructions For Use for installing, filling or draining the vaporizer and other information.

WARNING: Use care in lifting and manipulating vaporizers during the installing process as their weight may be greater than expected.

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.

1. To replace or disassemble a vaporizer, lift each vaporizer straight up off the manifold. Do not pull the vaporizer forward. Do not rotate the vaporizer on the manifold.
2. Align the new vaporizer over the valve cartridges of the installing bar, slightly tilting back the vaporizer. Hang the vaporizer on the installing bar as shown in Figure 3-1. Ensure that the locking mechanism handle is in the unlocked position.

Figure 3-1 Vaporizer, unlocked

3. Rotate the locking mechanism handle clockwise into the locked position as shown in Figure 3-2.

NOTE: **If installing a Desflurane vaporizer, refer to the manufacturer's Instructions For Use on installation and use of the vaporizer.**

Figure 3-2 Vaporizer, locked

4. Finally, check the following items:

a. Ensure that the top of the vaporizer is horizontal. If not, disassemble and reinstall the vaporizer.

b. If a vaporizer lifts off the manifold, repeat steps 1 through 3 to reinstall the vaporizer. If the vaporizer lifts off a second time, do not use the system.

WARNING: **For the anesthesia system, using or turning on more than onevaporizer simultaneously is prohibited and prevented by a mechanical interlock. Do not ignore the safety mechanism.**

3.4.1 Filling and Draining the Vaporizer

Install the vaporizers with a Selectatec® interlock system that are compliant with ISO 80601-2-13 on the unit. Refer to the vaporizer manufacturer's Instructions For Use for filling or draining the vaporizer and other information.

WARNING: **Ensure that the correct anesthetic agent is used. The vaporizer is designed with the specific anesthetic agent named on it and further indicated by color coded labeling. The actual output concentration of the anesthetic agent will vary if the vaporizer is filled with the wrong agent.**

WARNING: **The anesthetic liquid discharged from the vaporizer must not be used again. Please regard it as a dangerous chemical and dispose of it properly in accordance with local regulations.**

3.5 Negative Pressure Suction Device

The negative pressure suction device comprises the negative pressure regulator, the liquid collection bottle, the suction tube and the filter. It is primarily used to collect the hydrops, hematocele, pus and other contaminants from the patient's pharynx. The unit supports overfill protection to prevent backflow of effluent after the bottle is full to ensure pipeline and tube safety.

1. Place the liquid collection bottle to the bracket. Connect the suction tube, the liquid collection bottle and the filter following the screen printed instructions.
2. Insert the suction tube to the overfill protection connector. The negative pressure suction device is now fully installed.

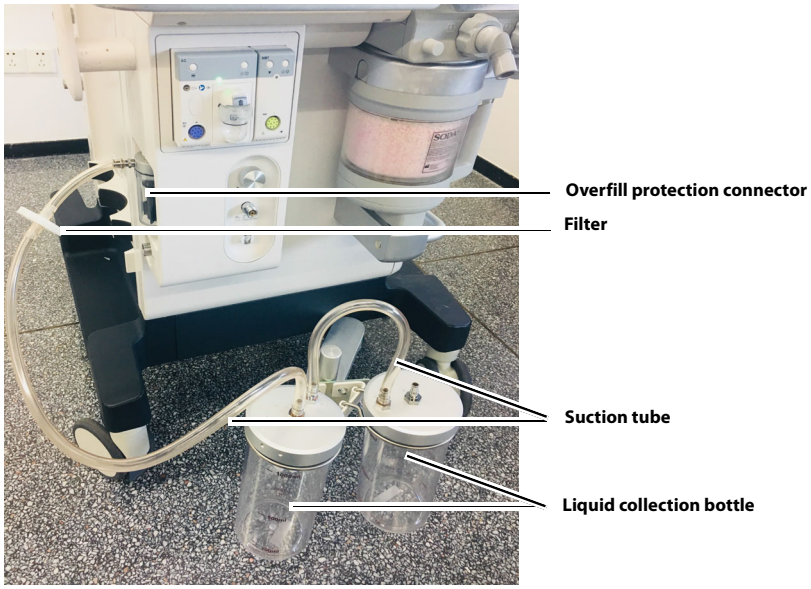

Figure 3-3 Install the negative pressure suction device

NOTE: **When installing the filter to the suction tube, pay attention to keeping the side printed with IN facing the liquid collection bottle.**

NOTE: **Avoid twisting or bending suction tubes during use.**

3. To disassemble the negative pressure suction device, pull out the suction tube, take out the liquid collection bottle and discard the filter. To replace the filter, please follow local regulations to dispose of discarded filters.

3.5.1 Turn on Negative Pressure Suction Device

1. Assemble the negative pressure suction device.

2. Occlude the suction tube inlet at the patient end.

3. Turn on the negative pressure pipeline supply.

4. Set the selector switch to **REG**.

5. Adjust the negative pressure regulating knob to keep the pressure gauge reading smaller than -40kPa.

3.5.2 Turn off Negative Pressure Suction Device

Set the selector switch to **OFF** to turn off the negative pressure suction device.

WARNING: **Keep the negative pressure suction switch in the OFF state when the negative pressure suction device is not in use.**

3.6 High-flow Nasal Cannula Oxygen (HFNC) Tube

1. Hang the humidifier on the bracket on the side of the anesthesia system.

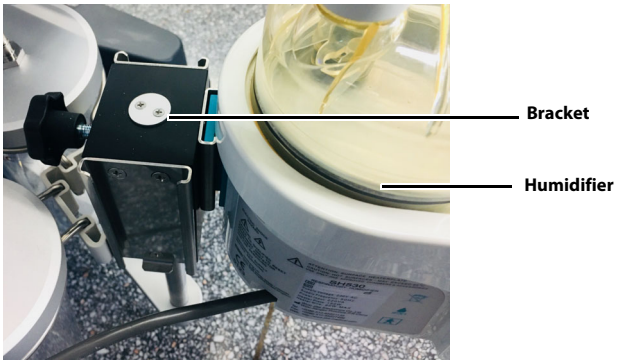

Figure 3-4 Install the humidifier

2. Connect the gas inlet of the humidifier and the HFNC outlet of the anesthesia system with a breathing tube. Connect the gas outlet of the humidifier and the patient with a breathing tube.

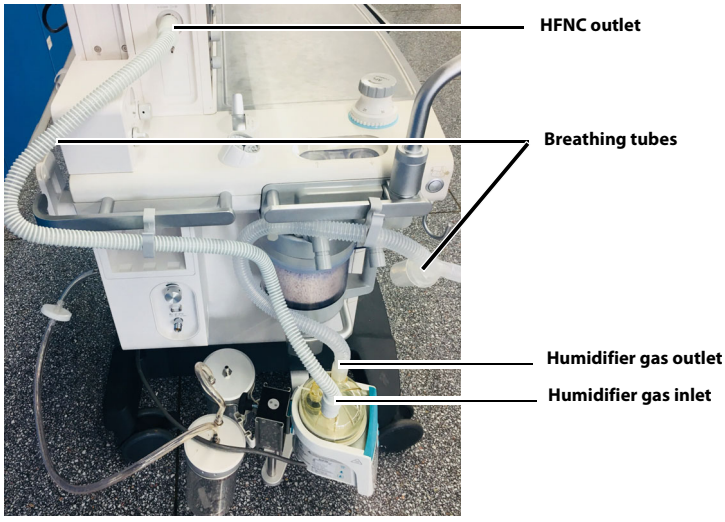

Figure 3-5 Connection hoses

3. To disassemble the humidifier, draw out the breathing tube and lift the humidifier upward.

3.7 Connect Anesthesia System with Information System

3.7.1 Connect Anesthesia System with Information System Through Serial Interface

The anesthesia system can be connected to the information system through a serial interface and sends its ventilation modes, status, parameters, alarms, alarm limits and patient information to the information system in the HL7 protocol.

1. The communication cable is connected to the communication interface of the anesthesia system on one end and connected to the matched interface of the information system on the other end.
2. Select the  icon to open the [**Setup**] menu.
3. Select the [**System**] soft key, enter the system password and confirm the password.
4. Select the [**Network**] tab in the system menu.
5. Select the [**Serial**] tab.
6. Set [**Protocol**] to [**HL7**].
7. Configure related settings. See 4.7.10.4 (Pages 4-44) "Network".

3.7.2 Connect Anesthesia System with Information System Through Ethernet

The anesthesia system can be connected to the information system through ethernet and sends its ventilation modes, status, parameters, alarms, alarm limits, patient information and waveforms to the information system in the HL7 protocol.

1. The network cable is connected to the ethernet interface of the anesthesia system on one end and connected to the matched interface of the information system on the other end.
2. Select the  icon to open the [**Setup**] menu.
3. Select the [**System**] soft key, enter the system password and confirm the password.
4. Select the [**Network**] tab in the system menu.
5. Select the [**HL7**] tab.
6. Configure related settings. See 4.7.10.4 (Pages 4-44) "Network".

NOTE: The IP addresses of the anesthesia system and the information system must be in the same segment.

3.8 Connect Anesthesia System with Monitor

3.8.1 Connect Anesthesia System with Monitor Through Serial Interface

The anesthesia system can be connected to our company's monitor through a serial interface and the BeneLink module and sends the ventilation modes, parameters, alarms, alarm limits, waveforms and patient information to the monitor in our company's MR-WATO protocol.

The anesthesia system can be connected to the Philips monitor through a serial interface and the IntelliBridge module and sends the partial ventilation modes, parameters, alarms, alarm limits and waveforms of the anesthesia system to the monitor in the Philips IntelliBridge protocol.

1. The communication cable is connected to the communication interface of the anesthesia system on one end and connected to the matched interface of the monitor on the other end.
2. Select the  icon to open the [**Setup**] menu.
3. Select the [**System**] soft key, enter the system password and confirm the password.
4. Select the [**Network**] tab in the system menu.
5. Select the [**Serial**] tab.
6. Set [**Protocol**] to [**MR-WATO**] or [**Philips**].
7. Configure related settings. See 4.7.10.4 (Pages 4-44) "Network".

3.9 Connect Anesthesia System with eGateway

The anesthesia system can be connected to the ADT server through eGateway to download patient information from the ADT server. See 4.2.1.2 (Pages 4-5) "Retrieve Patient Information from ADT Server".

With the anesthesia system connected to the eGateway, when key words are entered in the anesthesia system and eGateway recognizes the patient information related to the key words, it will update the patient information to the anesthesia system synchronously. If the patient information in the eGateway is updated, eGateway will also update the information to the anesthesia system synchronously. See 4.2.1.3 (Pages 4-5) "Synchronize Patient Information".

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4.0 System Interface

4.1 Main Screen

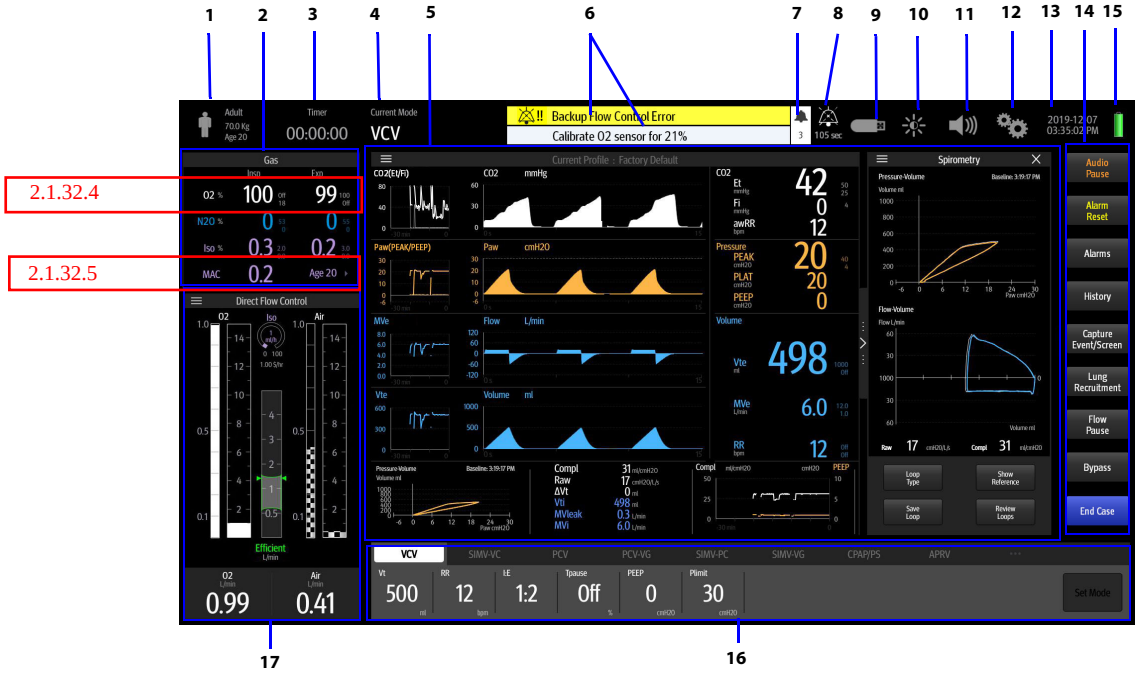


Figure 4-1 Main Screen

2.1.28.3. Vartotojo meniu esančios greitai pasiekiamos funkcijų mygtukų piktogramos

SERIAL NO.	MAIN SCREEN	DESCRIPTION
1	Patient information	Shows the information of the current patient, including the patient type, weight and age. You can click on the section to view more personal information of the patient. See (Pages 4-3) 4.2.1 "Patient Information".
2	Gas Area	The section displays parameter information in real time when the Gas or O_2 Sensor module is configured.
3	Elapsed / Countdown Timer	Displays elapsed time. Select to start,stop, or reset the timer.
4	Current ventilation mode	Displays the current ventilation mode.
5	Waveform/parameter/ spirometry/trend/prediction display zone	Displays the waveforms, monitoring parameters, spirometry, trends and predictions.

Table 4-1 Main Screen

2.1.28.3

SERIAL NO.	MAIN SCREEN	DESCRIPTION
6	Alarm/prompt message zone	Displays physiological alarms, technical alarms and prompt messages. The most recent and top-priority alarm is displayed in the topmost section. Other alarms are displayed in the lower section, grouped by priority for scrolled display. Select the zone to display a list of all active alarms. See the table in Section "Alarms and Prompt Messages" on Pages 10-12 for a list of prompt messages and related priorities. Alarms with a high priority are displayed in red. Alarms with a medium priority are displayed in yellow. Alarms with a low priority are displayed in cyan. Prompt messages are displayed in white.
7	Number of active alarms	Displays the current numbers of active alarms and prompts.
8	Audio Pause/Alarm Reset icon	When the [**Audio Pause**] or [**Alarm Reset**] soft key is selected, the Audio Pause or Alarm Reset icon is displayed along with a 120-second countdown timer.
9	U disk icon	The U disk icon is displayed when the anesthesia system recognizes that U disk is connected to the anesthesia system.
10	Screen brightness adjustment icon	Select the icon to adjust the brightness of both the Main Screen or Status Screen.
11	Volume adjustment icon	Select the icon to adjust the alarm volume, the system alert volume, the key click volume or the NMT beep volume.
12	Setup icon	Select the icon to open the [**Setup**] menu.
13	System date and time	Displays the current system date and time. To adjust the date and time, see "Date and Time" on Pages 4-8.
14	Soft key field	Displays the [**History**] soft key, the [**Lung Recruitment**] soft key, the [**Flow Pause**] soft key, the [**Capture Event/ Screens**] soft key, the [**Alarms**] soft key, the [**Alarm Reset**] soft key, the [**Audio Pause**] soft key, the [**Bypass**] soft key or the [**Start Case**] soft key. See (Pages 4-25) 4.6 "System Soft Key".
15	Main power supply and battery status icon	Displays the main power supply and battery status, See Pages 4-9 "Battery Status"
16	Ventilation mode and setting parameter zone	Displays tabs for all ventilation modes. Each tab displays the ventilation mode and its parameters. Select a tab and the [**Set Mode**] soft key to change the ventilation mode. Select the parameter key to change the parameter settings. See "Set Ventilation" on Pages 6-5.
17	Display zone of fresh gas control/anesthetic agent consumption speed	Displays the real-time flow and optimizer information of O_2 or balance gas. Select the zone to set the fresh gas flow in the pop-up menu. Displays the anesthetic agent consumption speed and cost.

Table 4-1 Main Screen

4.2 System Information Title

4.2.1 Patient Information

An icon displaying the information of the current patient. Select the icon to open the **Patient Information** menu. You can set the data for patients and hospitals in the Patient Information menu.

Figure 4-2 Patient information icon

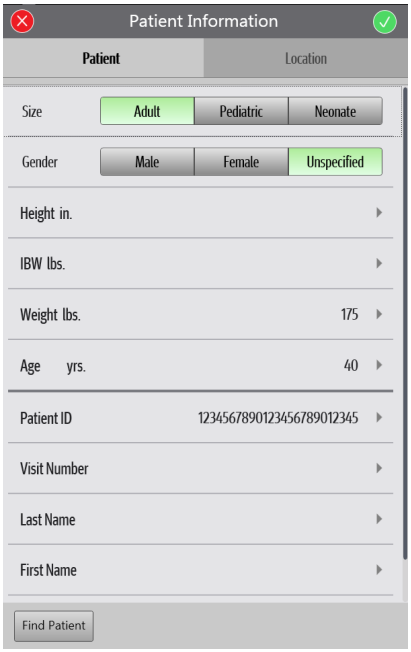


Figure 4-3 Patient Information menu

NOTE: **The equipment saves the latest patient parameter settings for each patient type: Adult, Pediatric, and Neonate. Changing to another patient size does not clear the parameter settings for the previous patient size. For example, changing from Adult to Pediatric and back to Adult will result in the Adult patient parameter settings still being saved.**

EDITABLE FIELD	DESCRIPTION
Patient ID	Enter up to 30 digits for each field. The fields will be cleared when the equipment powers off or enters the standby mode.
Visit Number	
First Name	
Last Name	
Size	Radio option.
Gender	Radio option.
Height	Enter information using the virtual keyboard. The system will display prompt messages if the entered information exceeds the allowed range. The system will display <1 if the entered age is younger than 1.
Age	
Weight	
IBW	

Table 4-2 Patient information

EDITABLE FIELD	DESCRIPTION
Bed	Enter up to 30 digits for each field.
Room	
Department	
Facility	

Table 4-2 Patient information

4.2.1.1 Set Patient Information in Anesthesia System

NOTE: The patient type can be changed only when the equipment is in the standby or manual mode.

1. Select the Patient Information icon to open the Patient Information settings menu.
2. Set the patient information.
3. Select to confirm the change and close the menu.

4.2.1.2 Retrieve Patient Information from ADT Server

The anesthesia system can be connected to the ADT server through eGateway to download patient information from the ADT server.

1. Connect the network cable.
2. Set the network and ensure that the network access is normal.
   a. Enter Standby mode.
   b. Select the icon to open the [**Setup**] menu.
   c. Select the [**System**] soft key, enter the system password and confirm the password.
   d. Select the [**Network**] tab in the system menu.
   e. Select [**ADT**] and set the [**ADT**] to (on) on the pop-up screen.
   f. Set [**Destination IP**] and [**Port**].
   g. Select the [**Test**] soft key.
   h. Confirm that the test result is [**Connected**].
3. Select the [**Find Patient**] soft key in the Patient Information menu.
4. Enter the key information on the pop-up screen.
5. Select the [**Search**] soft key and a list of conforming patient information will be displayed on the screen.
6. Select the desired patient information in the list and select the [**Import**] soft key. The imported data includes patient ID, visit number, first name, last name, bed, room, department and facility.

4.2.1.3 Synchronize Patient Information

With the anesthesia system connected to the eGateway, when key words are entered in the anesthesia system and eGateway recognizes the patient information related to the key words, it will update the patient information to the anesthesia system synchronously. If the patient information in the eGateway is updated, eGateway will also update the information to the anesthesia system synchronously. Synchronizable patient information include: patient ID, visit number, last name, first name, date of birth, age, weight, height and gender.

1. Connect the network cable.

2. Set the network and ensure that the network access is normal.
   a. Enter Standby mode.
   b. Select the icon to open the [**Setup**] menu.
   c. Select the [**System**] soft key, enter the system password and confirm the password.
   d. Select the [**Network**] tab in the system menu.
   e. Select [**MD2**] and set the [**MD2**] to (on) in the pop-up screen.
   f. Set [**Destination IP**] and [**Port**].
   g. Select the [**Test**] soft key.
   h. Confirm that the test result is [**Connected**].

NOTE: **Key information is defined by the eGateway. For specific operations, see the eGateway Integrated Management and Installation Guide.**

4.2.2 Timer (Elapsed Timer/Countdown Timer)

Displays the elapsed timer, the countdown timer or both of the two timers. The timer is located in the top left corner of the Main Screen. You can select the Timer icon to open the timer menu. (Figure 4-4)

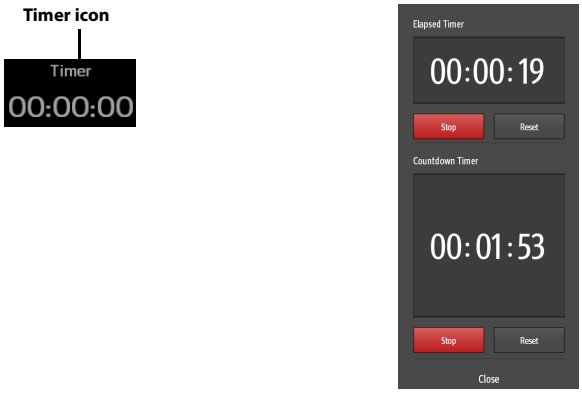


Figure 4-4 Timer

Elapsed timer

Select the [**Start**] soft key to start the elapsed timer. Select the [**Stop**] soft key to stop the elapsed timer. Select the [**Reset**] soft key to reset the timer.

Countdown timer

Set the remaining time for countdown and select the [**Start**] soft key to start the countdown. Select the [**Stop**] soft key to stop the countdown timer. Select the [**Reset**] soft key to reset the timer. The system will pop up a dialog box and beep when the countdown is over. In the dialog box, select to turn off the system beep.

4.2.3 Alarm and Prompt Message

Displays physiological alarms, technical alarms and prompt messages. The most recent and top-priority alarm is displayed in the topmost section. Other alarms are displayed in the lower section, grouped by priority. In each group, the most recent alarm is displayed on the top of the list. Select the zone to display a list of all active alarms. See the table in Section "Alarms and Prompt Messages" on Pages 10-12 for a list of prompt messages and related priorities. Alarms with a high priority are displayed in red. Alarms with a medium priority are displayed in yellow. Alarms with a low priority are displayed in cyan. Prompt messages are displayed in white (Figure 4-5).

Figure 4-5 Alarms and Prompt Messages

4.2.4 Audio Pause/Alarm Reset icon

Select the [**Audio Pause**] soft key to display the Audio Pause icon and a 120-second countdown timer, indicating that all the audio alarms will be paused for 120 seconds.

When there is a medium priority or high priority alarm in the active alarms, select the [**Alarm Reset**] soft key to display the Alarm Reset icon and a 120-second countdown timer, indicating that all the current audio alarms will be paused for 120 seconds.

Figure 4-6 Audio Pause icon

Figure 4-7 Alarm Reset icon

4.2.5 Screen Brightness

Select the screen brightness adjustment icon to adjust the brightness of the Main Screen or Status Screen on the pop-up screen.

 indicates the lowest brightness and  indicates the highest brightness.

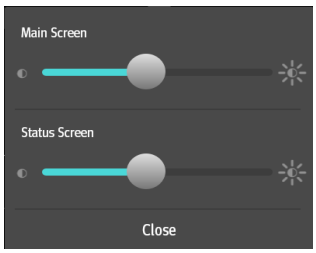


Figure 4-8 Screen brightness adjustment icon

4.2.6 Volume

Select the volume adjustment icon to adjust the alarm volume, the system alert volume, the key click volume or the NMT beep volume on the pop-up screen.

 indicates the lowest volume.  indicates the highest volume.  indicates that the volume is turned off.

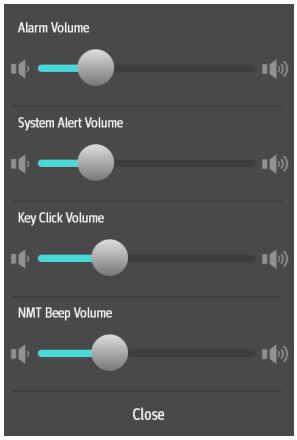


Figure 4-9 Volume adjustment icon

4.2.7 Date and Time

Displays the current system date and time (Figure 4-10).

Figure 4-10 Date and time icon

To adjust the date and time:

1. Enter Standby mode.
2. Select the  icon to open the [**Setup**] menu.

3. Select the [**System**] soft key, enter the system password and confirm the password.
4. Select the [**Setup**] tab in the system menu.
5. Select the [**Time/Date**] tab.
6. Adjust [**24 Hour Time**], [**Time Zone**], [**Date**], [**Time**], [**Date Format**] and [**Daylight Savings Time**] in the pop-up menu. See (Pages 4-39) 4.7.10.2 "Setup".

NOTE: Select [Daylight Savings Time], if applicable, before performing other settings.

7. Select to confirm the changes.

4.2.8 Battery Status

Displays the main power supply and battery status(Figure 4-11).

Figure 4-11 Battery status icon

The power management system of the equipment supplies AC power to primary system features and charges the internal battery of the system. When the AC power supply suffers a fault, the equipment will be powered by the battery. See "Electrical Specifications" on Pages 12-5.

The equipment provides four (4) auxiliary AC power outlets. When the equipment is powered by its internal battery, the auxiliary AC power outlet is not live.

NOTE: To extend the service life of the battery, please use the battery at least once a month. Charge the battery before the battery runs out.

NOTE: Check and replace the battery regularly. The service life of the battery depends on the frequency and duration of use. Improper use of the battery may shorten its service life. It is recommended that the lead acid battery be replaced once every three (3) years.

NOTE: The battery's power supply time depends on the equipment configuration and operation.

NOTE: In the event of a fault with the battery, contact our company's maintenance personnel for replacement.

The anesthesia system is equipped with an internal chargeable battery to ensure normal operation of the system in a power failure. When the equipment is connected to an AC power supply, the battery is charged regardless of whether the equipment is on or off. In the event of a sudden power failure, the system will automatically switch to the battery power supply mode without interrupting the operation of the system. When the AC power supply resumes within a specified period of time, the battery will start to be charged and the system will automatically switch from the battery to the AC power supply to ensure continuous operation.

When the power failure lasts shorter than 60 seconds (inclusive), the alarming settings before the power failure will be automatically restored.

The battery icon on the screen indicates the status of the battery.

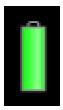
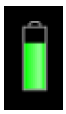
PARTS	DESCRIPTION
	Battery is fully charged. AC power supply is connected. Equipment is powered by the AC power supply. The solid part of the battery icon represents the remaining battery level.
	Battery is partially charged. AC power supply is connected and charging the battery. Equipment is powered by the AC power supply.
	Battery is fully charged. AC power is not connected. Equipment is powered by the internal battery.
	Battery is partially charged. AC power is not connected. Equipment is powered by the internal battery.
	Battery is low. The battery should be charged immediately to work as a safe backup power supply. AC power is not connected. Equipment is powered by the internal battery.
	Battery is not installed.

Table 4-3 Battery status

Low battery may cause power supply faults. The equipment will trigger a high priority alarm and display [**Low Battery Voltage!**] in the Technical Alarm area. In this case, use the AC power supply to power the anesthesia system to resume its normal operation and charge the battery.

4.3 Fresh Gas Flow Display

4.3.1 Electronic Flow Control System

Displays the real-time flow of O_2 or balance gas. The balance gas can be set to air or N_2O.

The flow meter numerics display a precision to two decimal digits for flows < 1 L/min and one decimal digit for flows ≥ 1 L/min.

In this equipment, the electronically-controlled flow meter is called the Electronic Flow Control System (hereinafter referred to as the EFCS). EFCS has two control modes available: Total Flow and Direct Flow.

4.3.1.1 Total Flow Control Mode

The total flow control mode of the EFCS is shown in the figure below:

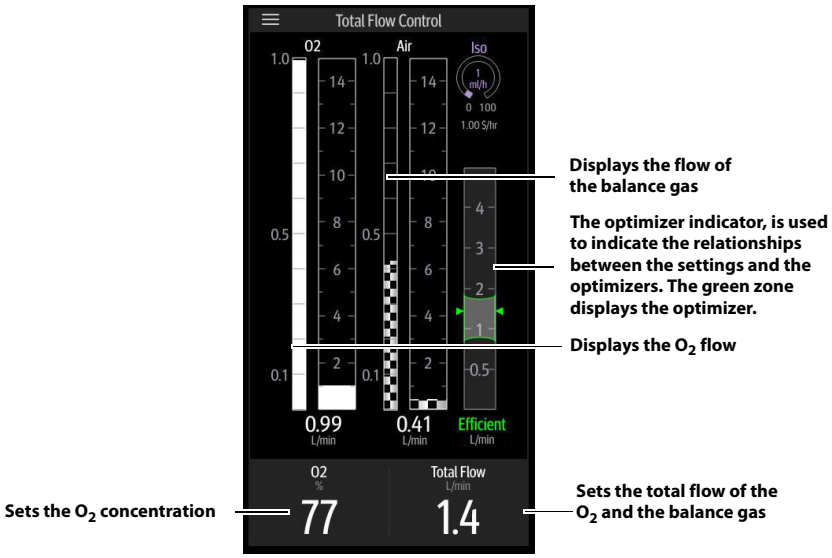


Figure 4-12 Total Flow Control Mode

Select the fresh gas flow display zone and open the following total flow control menu.

Figure 4-13 Total Flow Control menu

You can perform the following settings in the Total Flow Control menu:

- Set 100% O_2 flow rate using quick keys.
- Set the [**Control Mode**] to [**Total Flow**] or [**Direct Flow**].
- Set the [**Balance Gas**] to [**Air**], [**N_2O**] or [**None**].
- Set the total flow.

- Set the O_2 concentration value.

4.3.1.2 Direct Flow Control mode

The direct flow control mode of the EFCS is shown in the figure below:

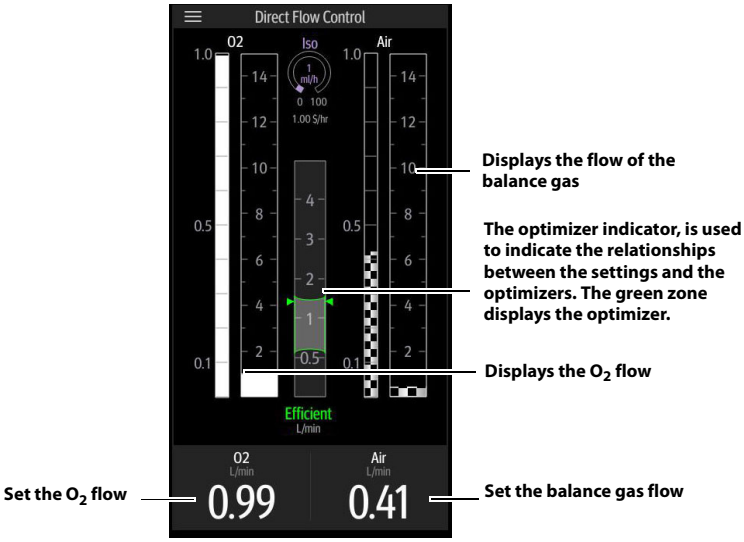


Figure 4-14 Direct Flow Control mode

Select the fresh gas flow display zone and open the following direct flow control menu.

Figure 4-15 Direct Flow Control menu

You can perform the following settings in the Direct Flow Control menu:

- Set 100% O_2 flow rate using quick keys.
- Set the [**Control Mode**] to [**Total Flow**] or [**Direct Flow**].

- Set the [**Balance Gas**] to [**Air**], [**N_2O**] or [**None**].
- Set the balance gas flow.
- Set the O_2 flow.

4.3.1.3 Optimizer

WARNING: **The fresh gas optimizer indicator must not be used when high-flow fresh gas is needed.**

NOTE: **The optimizer is effective only when the anesthesia system is configured with the AG, and the anesthesia system is in the automatic ventilation mode.**

NOTE: **The optimizer feature will become ineffective and unavailable when the data for optimizer calculation is not valid.**

The optimizer indicator, is used to indicate the relationships between the settings and the optimizers.

The green zone displays the optimizer in a 1L/min range. The triangle pointers indicate the measured value of the total flow. If the triangle pointers are higher than the green zone, the triangle pointers and the indication text of [**High**] are in yellow. If the triangle pointers are in the green zone, the triangle pointers and the indication text of [**Efficient**] are in green. If the triangle pointers are lower than the green zone, the triangle pointers and the indication text of [**Low**] are in red (Figure 4-16).

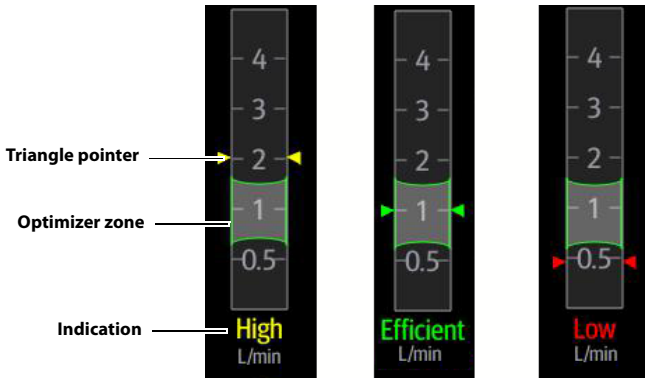


Figure 4-16 Optimizer

To enable or disable the optimizer indicator, do the following:

1. Enter Standby mode.
2. Select the icon to open the [**Setup**] menu.
3. Select the [**System**] soft key, enter the system password and confirm the password.
4. Select the [**Setup**] tab in the system menu.
5. Select the [**Optimizer**] tab.
6. Set [**Optimizer**] to (off) or (on).

The optimizer indicator is invalid in the following circumstances:

- The automatic circuit leak test is not executed or fails.
- The Vt, MV, $EtCO_2$ or $FiCO_2$ parameter values are invalid.
- The alarms listed in the following table are triggered.

ALARM MESSAGES	THE OPTIMIZER INDICATOR BECOMES INVALID WHEN AN ALARM IS TRIGGERED
Apnea	Yes
Apnea>2 min	Yes
Apnea CO_2	Yes
Flow Sensor Failure	Yes
Check Flow Sensors	Yes
Pinsp Not Achieved	Yes
Vt Not Achieved	Yes
Patient Circuit Leak	Yes
CO_2 Absorber Canister Not Locked	Yes
Ventilator Control Board Communication Stopped	Yes
Drive Gas Pressure Low	Yes
AG Module Error	Yes
AG Self Test Error	Yes
AG No Watertrap	Yes
AG Change Watertrap	Yes
AG Airway Occluded	Yes
AG Zero Failed	Yes
$EtCO_2$ Over Range	Yes
$FiCO_2$ Over Range	Yes

4.3.2 Backup Flow Control System

When the EFCS fails, the system automatically opens the Backup Flow Control System (hereinafter referred to as the BFCS) cover, and adjusts the gas flow with the needle valve of flowmeter. Before the EFCS is restored, you cannot disable the BFCS.

The BFCS screen is shown in the figure below:

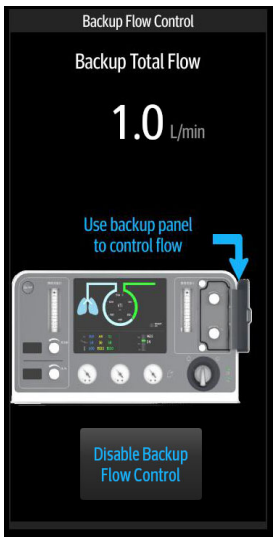


Figure 4-17 Backup Flow Control System

After the BFCS is enabled, the system will automatically provide O_2 flow at 1L/min. Rotate the needle valve to adjust the flow, and the flow will increase the flow from 1L/min. The total flowmeter is used to display the total flow. With the O_2 concentration displayed on the screen, you can calculate the O_2 flow and balance gas flow. By pressing the [**Audio Pause**] or [**Alarm Reset**] button, you can disable the audio alarm of [**Backup Flow Control System is enabled**].

When the EFCS is still on, you can pull the BFCS cover outward to start the BFCS. To disable the BFCS, close all the needle valves and press the [**Disable Backup Flow Control System**] button on the screen. Then select [**Yes**] in the pop-up dialog box and close the BFCS cover to disable the BFCS.

When the [**Low Battery Voltage!**] alarm shows, the system will prompt to use the BFCS to control the flow. Please connect the system to an AC power supply as soon as possible.

4.4 Waveform/Parameter/Spirometry/Trend/ Prediction Display Zone

Displays the pressure, flow rate, volume, CO_2, O_2, N_2O, and AA waveforms; displays the monitoring parameters; displays the waveforms and monitoring parameters of the NMT module, the BIS module; displays spirometry; displays the mini trends and dual trends; displays the prediction waveforms (Figure 4-18).

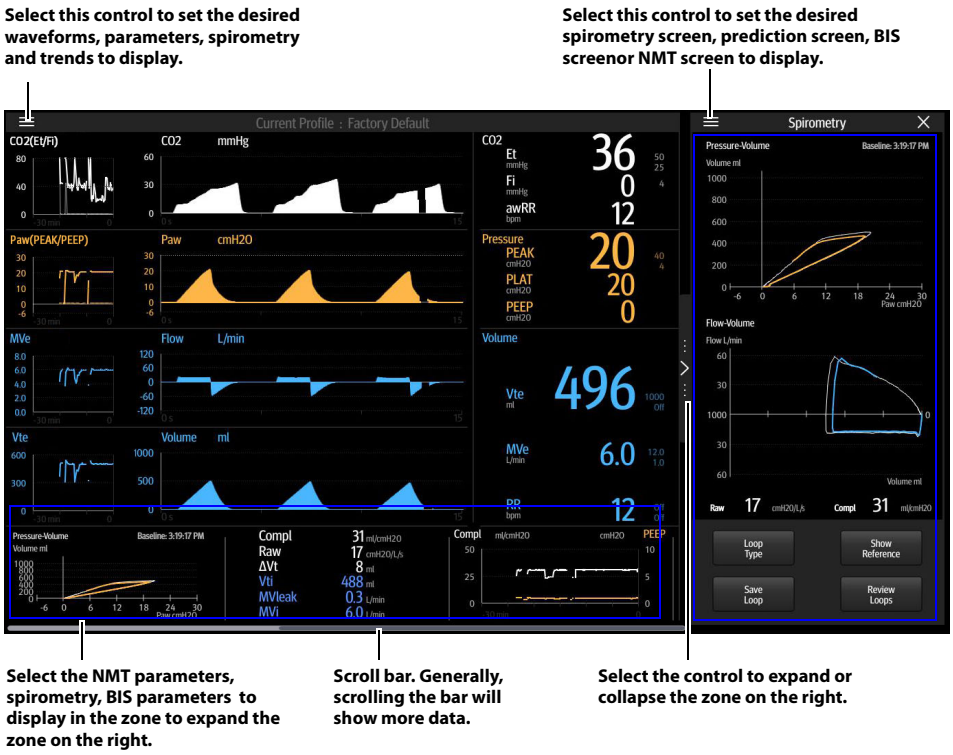


Figure 4-18 Waveform/parameter/spiometry/trend display zone

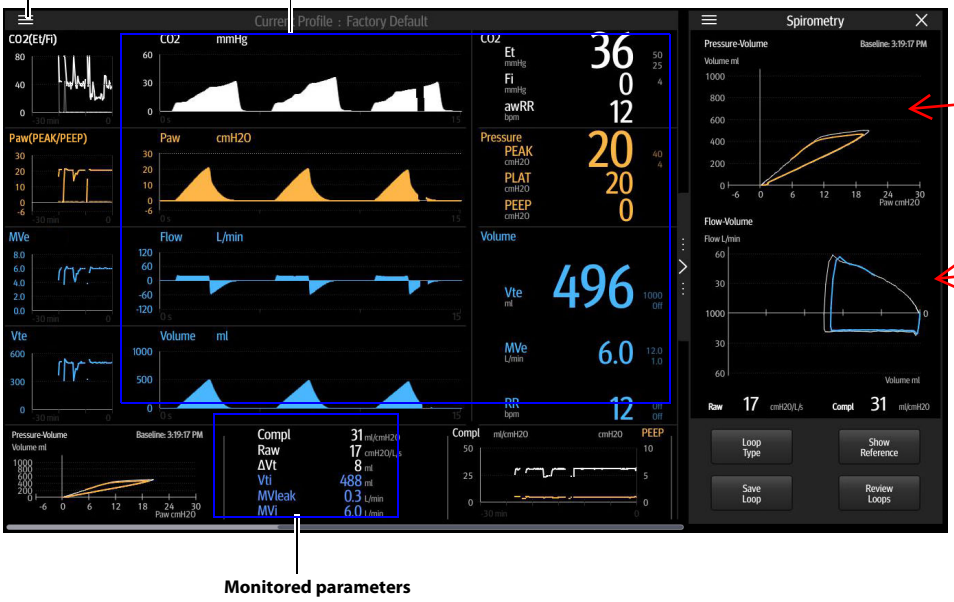
Rodomas kvėpavimo takų slėgis, srauto, tūrio....grafinės kreivės ir monitoruojami parametrai

4.4.1 Waveform/Parameter Screen

2.1.32.2

Displays the pressure, flow rate, volume, CO_2, O_2, N_2O, and AA waveforms and monitoring parameters.

2.1.32.3



2.1.30 Kilpiniai grafikai

Figure 4-19 Waveform/parameter screen

4.4.2 Spirometry Screen

Spirometry loops reflect patient lung function and ventilation. They also indicate other related parameters such as compliance, over-inflation, breathing system leak, and airway blockage.

The system provides three types of spirometry loops: pressure - volume loop, flow - volume loop and pressure - flow loop. Loops data comes from pressure and flow data. A maximum of two loops are displayed at a time.

Sistemoje yra trijų tipų spirometrijos kilpos: slėgis - tūrio kilpa, srautas - tūrio kilpa ir slėgis - srauto kilpa

Four soft keys are displayed on the Spirometry screen: Loop Type, Show Reference, Save Loop and Review Loops.

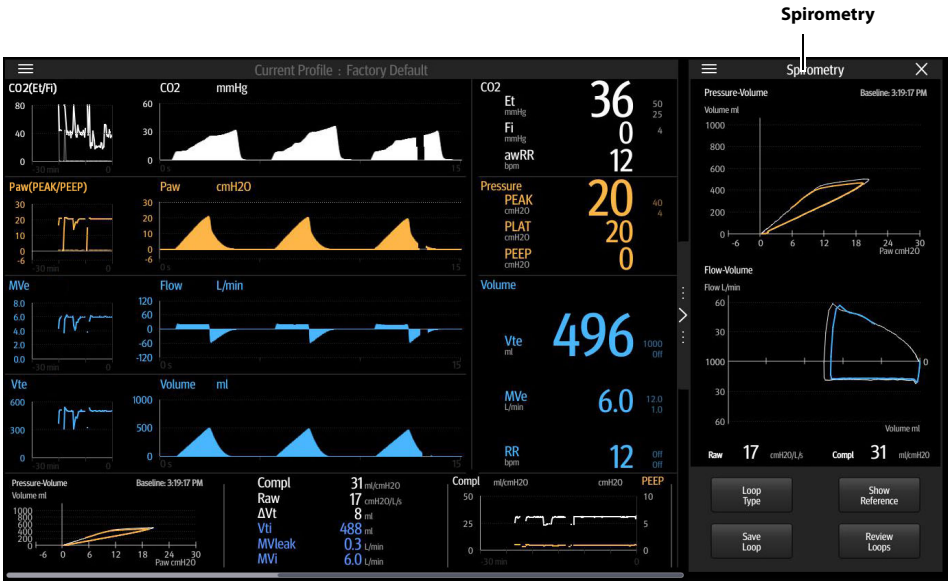


Figure 4-20 Spirometry (standard loop screen, two loops are displayed)

4.4.2.1 Loop Type

The [**Loop Type**] option is used to display the P-V, the F-V, or the P-F loop on the spirometry screen.

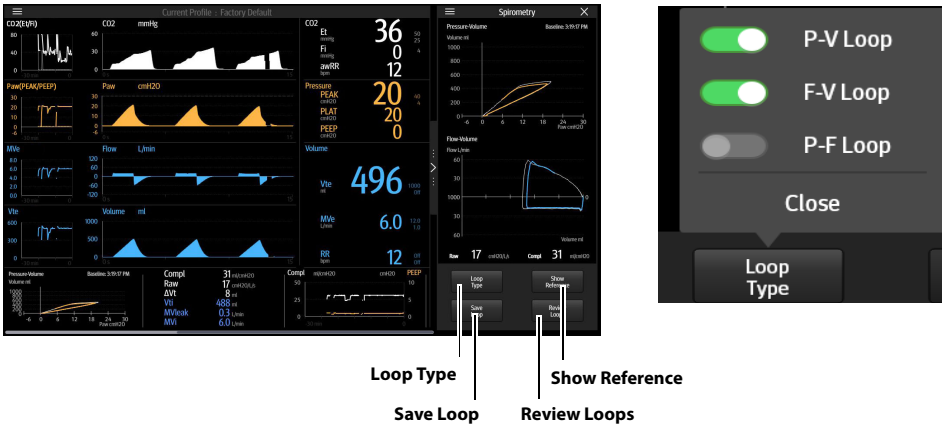


Figure 4-21 Soft keys of loops: Loop Type, Show Reference, Save Loop and Review Loops

4.4.2.2 Show Reference

Select [**Show Reference**] softkey only after saving a baseline via the [**Save Loop**] softkey.

[**Show Reference**] soft key is used to select and display the saved baseline loop and reference loop, or hide the loops (disable) in the loop window. The selected baseline loop or reference loop will be shown overlapped with the current loop. Only the most recent four reference loops saved will be displayed in the chronological order.

After the reference loop or baseline loop to display in the loop window are selected, the timestamp will also be displayed.

4.4.2.3 Save Loop

Select the [**Save Loop**] soft key to save the current loop (including its monitoring parameter data) as a baseline loop or reference loop. You can save a maximum of one baseline loop and four reference loops. Other loops can be saved to replace the baseline loop or reference loops. Only the most recent four reference loops are saved.

Review the saved baseline or reference loop with its numeric data (via [**Review Loops**] softkey) or displayed with the currently plotting loop on the same graph for comparison (via [**Show Reference**] softkey).

NOTE: **A reference loop cannot be saved without first saving a baseline loop. The System always makes the first saved loop as the baseline loop if no previous loops have been saved. Afterward, additional loops can be saved either as a baseline replacement or as a new reference loop.**

To save a baseline loop:

1. On the Spirometry Screen, select the [**Save Loop**] soft key. If no baseline loop has been saved, the current loop will be automatically saved as a baseline loop.
2. If a baseline loop has been saved, a dialog box will pop up, offering the [**baseline loop**] and [**reference loop**] options. After saving a loop as a [**baseline loop**], a confirmation box will pop up with a prompt message saying [**Selecting 'Yes' will overwrite the current baseline loop saved. Confirm to continue?**]. If [**Yes**] is selected, the currently saved baseline loop will be replaced. If [**No**] is selected, the save will be canceled.

To save a reference loop:

1. On the Spirometry Screen, select the [**Save Loop**] soft key. If a baseline loop has been saved, a dialog box will pop up, offering the [**baseline loop**] and [**reference loop**] options. Select [**reference loop**].

You can save a maximum of four (4) reference loops and one (1) baseline loop along with their monitoring parameter data.

When the maximum of four (4) loops is reached, and the user attempts another save, a confirmation dialog will be displayed with the following text, [**Selecting 'Yes' will overwrite the earliest saved reference loop. Confirm to continue?**]. If [**Yes**] is selected, the oldest data will be removed as the new data is added. If [**No**] is selected, the save will be canceled.

4.4.2.4 Review Loops

Select the [**Review Loops**] soft key to display the [**Review Loops**] screen, with the following zones and options available:

Small Loop Window: These small loop windows display the baseline loop and the reference loops. The baseline loop (only one) is always displayed on the top. The reference loops (four at most) are displayed under the baseline loop. The reference loops are sorted in the chronological order from the earliest (up) to the latest (bottom).

The baseline loop information is displayed on the right side of the small baseline loop window.

Large Loop Window: The loop window displays the enlarged view of the selected reference loop and is shown overlapped with the baseline loop.

Loops Type: Used to select the type of the loop to be reviewed. P-V loop, F-V loop and P-F loop options are available. P-V loop is the default option.

Delete Loops: The [**Delete**] option is used to delete a selected reference loop. After a reference loop is deleted, the new reference loop will move to the top. If no reference loops have been saved, the [**Delete**] key will be disabled (turning gray). The baseline loop cannot be deleted. It can only be replaced by a new baseline loop.

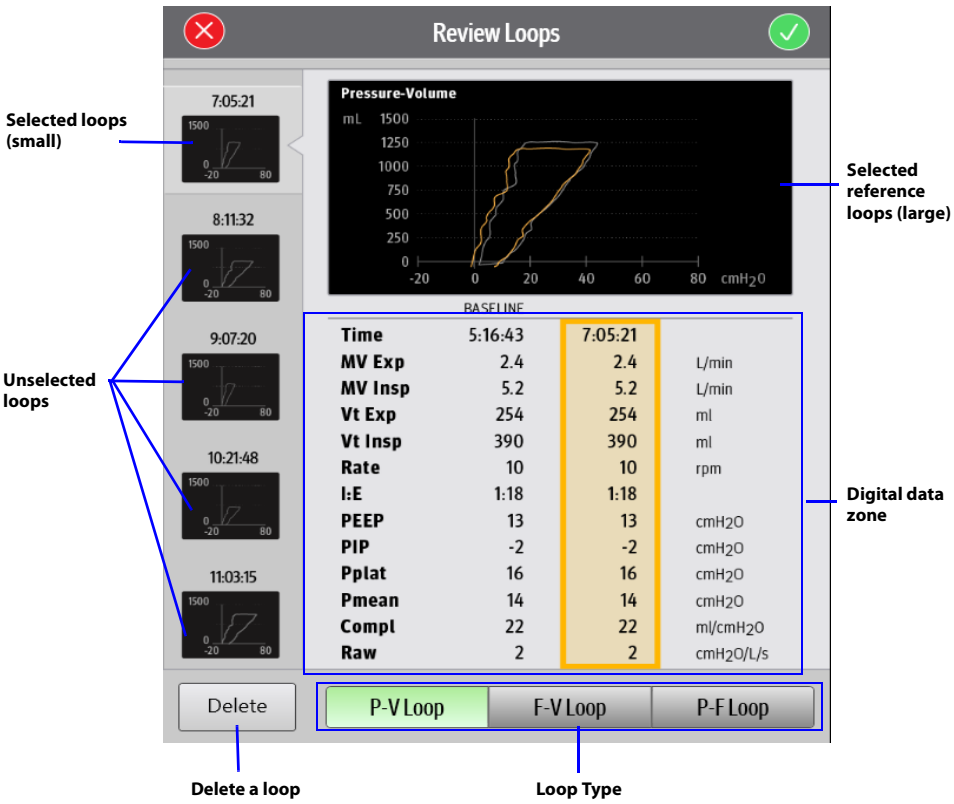


Figure 4-22 Review Loops window

Parameter data zone: Displays the monitoring parameter data related to the saved baseline loop and reference loops. Listed parameters include: **time, minute expiratory volume (MV Exp), minute inspiratory volume (MV Insp), expired tidal volume (Vt Exp), inspiratory tidal volume (Vt Insp), inspiration/expiration ratio (I:E), positive end-expiratory pressure (PEEP), respiratory rate (RR), peak inspiratory pressure (PEAK), inspiratory plateau pressure (Pplat), mean pressure (Pmean), dynamic airway compliance (Compl) and airway resistance (Raw).**

4.4.2.5 Freeze loop

t the key to expand the large Spirometry loop screen, which contains the Freeze softkey. When the Freeze softkey is selected, the system enters the Freeze status. The system pauses real-time refreshes of Spirometry on the screen to facilitate a brief review of the patient's data for more in-detail examination of the patient's conditions within the period of time. Tap the screen or rotate the main control knob to move the cursor to view the value at any point on the spirometry loop. Select the Freeze softkey again to exit the Freeze status. In Freeze status, if no operation is performed on the system for more than three minutes, the system exits Freeze status automatically.

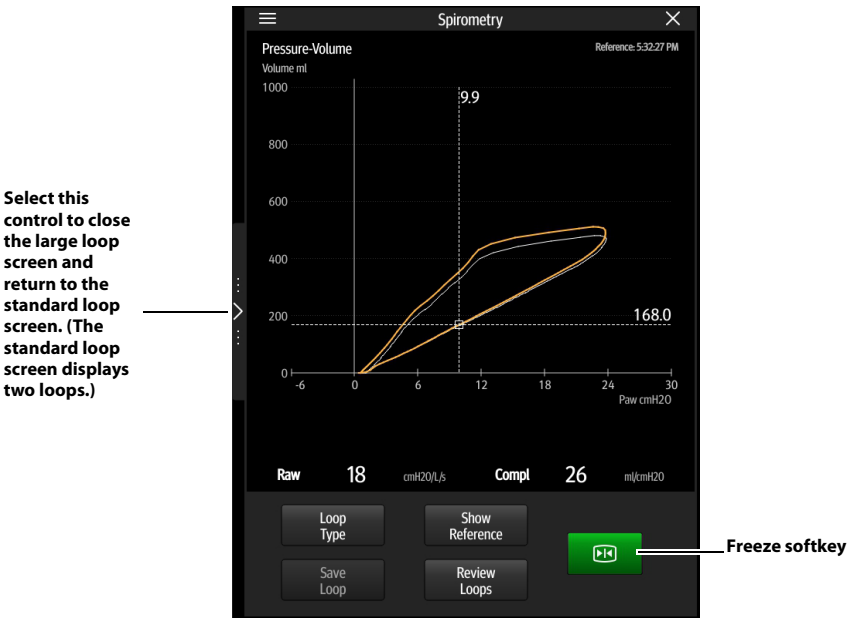


Figure 4-23 Freeze loop (large loop screen, only one loop is displayed)

4.4.3 Mini Trends Screen

Mini trends screen displays trend waveforms that correspond to the waveforms. Select a trend waveform to set the trend duration on the pop-up screen.

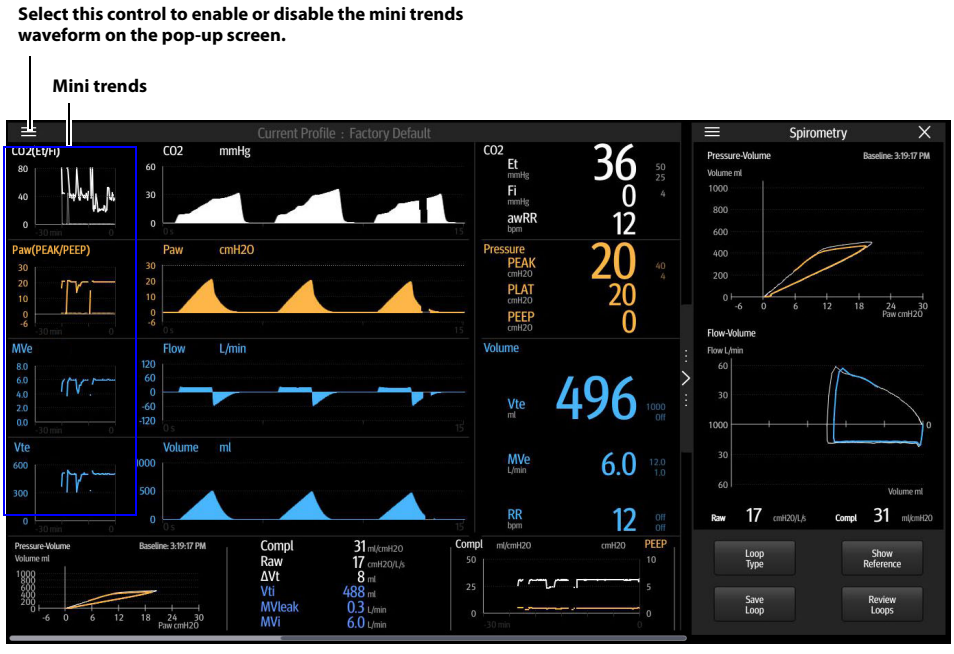


Figure 4-24 Mini trends

4.4.4 Dual-trend Screen

Compl and PEEP trend waveforms are displayed at the same time on the dual trends screen.

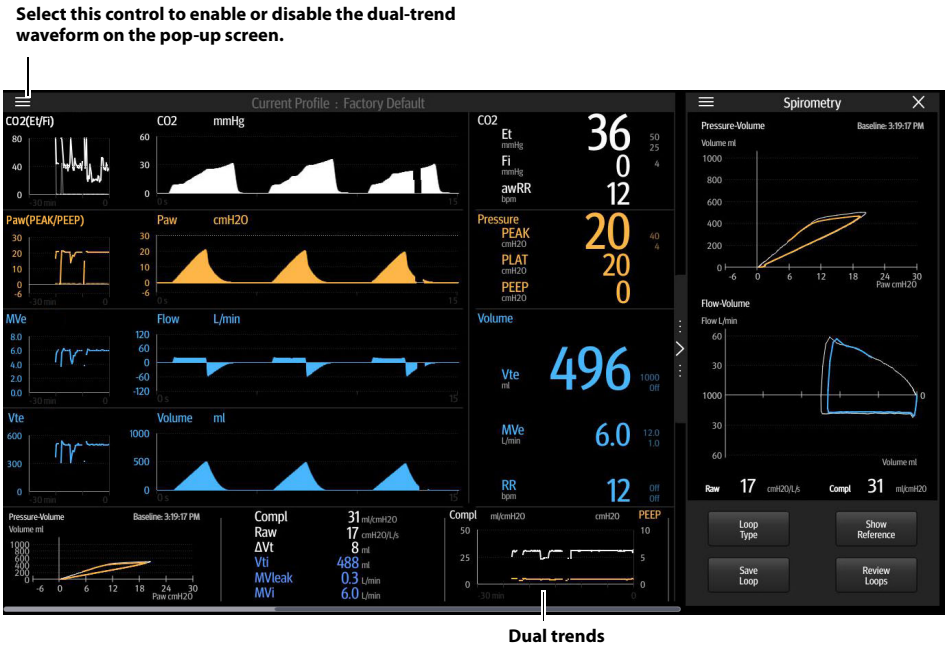


Figure 4-25 Dual trends

4.4.5 Prediction Screen

WARNING: **The pharmacokinetic models used for anesthesia prediction are constructed based on population sampling statistics. Do not make anesthetic delivery decisions solely relying on the displayed predicted curve.**

NOTE: **The predicted gas concentrations in the Prediction interface are calculated based on public models, and do not represent the actual inhaled or exhaled concentrations of patients.**

Displays the historical curves and prediction curves of anesthetic agent concentration and O_2 concentration. The anesthesia prediction feature utilizes public pharmacokinetic models to calculate the trends of inhaled and exhaled gas concentrations of patients within a period of time based on preset anesthesia machine parameters, including fresh gas settings, vaporizer settings, and ventilation settings. The model used by the anesthesia prediction feature was proposed by Lerou. For details, see Reference [1] .

1. Lerou JGC, et al. Model-based administration of inhalation anaesthesia 1. Developing a system model. B J Anaesth, 2001, 86(1): 12-28.

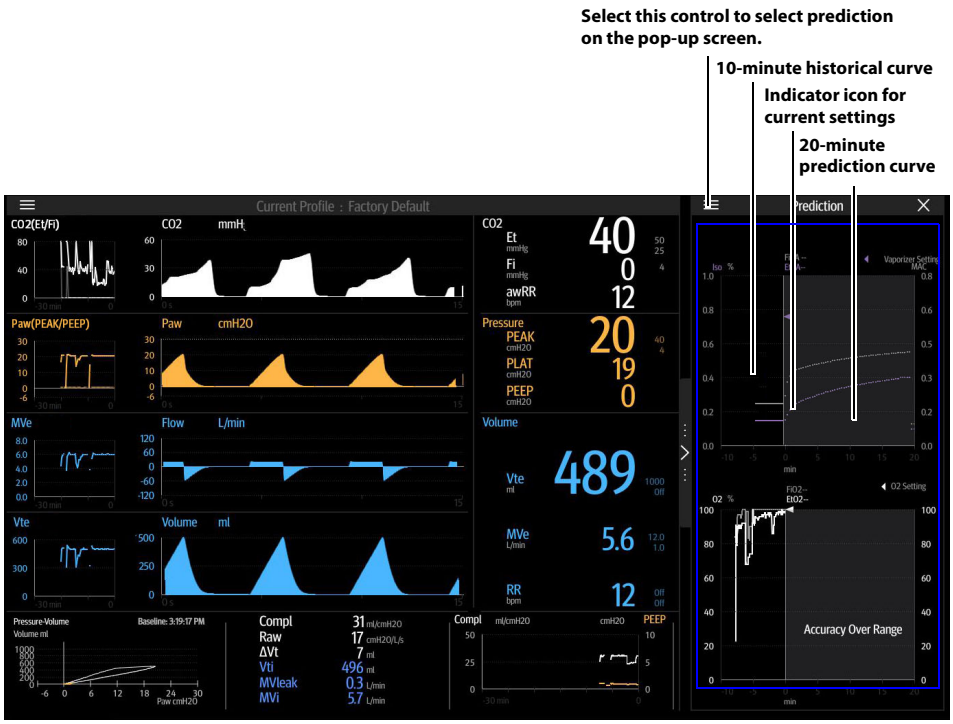


Figure 4-26 Prediction

About prediction:

- Displays the FiAA, EtAA, FiO_2 and EtO_2 concentration curves. AA stands for any of the following anesthetic agents: Des (Desflurane), Iso (Isoflurane), Sev (Sevoflurane), or Hal (Halothane).
- Displays the 10-minute historical curve with a black background.
- Displays the 20-minute prediction curve with a gray background.
- The indicator icon for current settings indicates the current vaporizer setting or O_2% setting.
- Prediction only functions while the system is in automatic ventilation mode.
- Prediction only functions when the AG module is configured in the anesthesia system.
- Prediction is unavailable when age, weight or height is not configured, or the setting exceeds the allowable range. The allowable ranges of age, weight and height settings supported by the anesthesia prediction models are:

Age	18 to 90
Weight	40 kg to140 kg
Height	150 cm to 200 cm

- No prediction curve will be displayed when the deviation between the predicted concentration and the actual concentration exceeds the values indicated in the following table.

EtAA=0	0.05 vol.%
EtAA≠0	-20% to 30% of the actual EtAA value measured, or -5% to 7.5% of the maximum concentration set for the evaporator, whichever is greater.
EtO_2	-10% to 15% of the actual EtO_2 value measured, or -5 vol.% to 7.5 vol.%, whichever is greater.

- Prediction is unavailable when the BFCS is in use.
- Prediction issues can be solved as per the prompts on the Main Screen. Please contact Mindray Technical Support if the problem persists.

4.5 Ventilation Mode Tabs

Displays tabs for ventilation modes. Each tab displays the ventilation mode and its parameters.

The ventilation modes on the screen can be customized. Select ventilation mode custom soft key to open [**Vent Mode Setup**] menu. In the opened menu, set the ventilation modes to be displayed in ventilation mode zone. The system will add one ventilation mode at a time according to the order of selection.

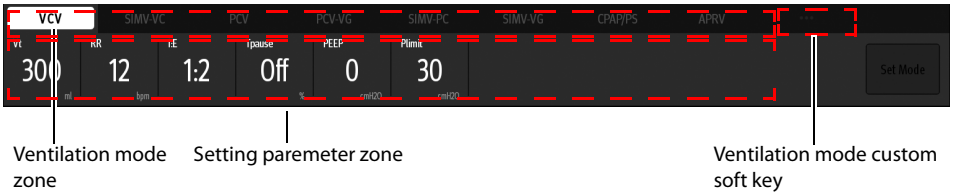


Figure 4-27 Ventilation Mode Tabs

To change the ventilation mode:

1. Select the desired ventilation mode tab, the [**Set Mode**] soft key will turn green and start to flash.
2. Optionally, select one or more parameter buttons to change the parameter settings of the desired ventilation mode. Select "✓" in the pop-up dialog box of parameter settings to confirm the changes to the parameter.
3. Select the [**Set Mode**] soft key to finalize the ventilation mode.

NOTE: **If the [Set Mode] soft key is not selected after several seconds, the system will give audio alerts and then the desired ventilation mode will be canceled.**

4.6 System Soft Key

System soft keys are provided on the right side of the Main Screen.

Figure 4-28 System soft keys

4.6.1 History

Select the [**History**] soft key on the Main Screen to open the [**History**] menu. The menu contains the List Trends, the Graphic Trends, the Event Log, Screen and Export tabs. The List Trends, Graphic Trends and Event Log tabs on the History screen are associated. When you switch among the tabs, the cursor is automatically positioned to the record that is related to the previous page.

4.6.1.1 List Trends

On the [**List Trends**] screen, you can view the parameter data and events of a patient. If no display interval is set, the trends will be displayed based on the data with an interval of one minute by default.

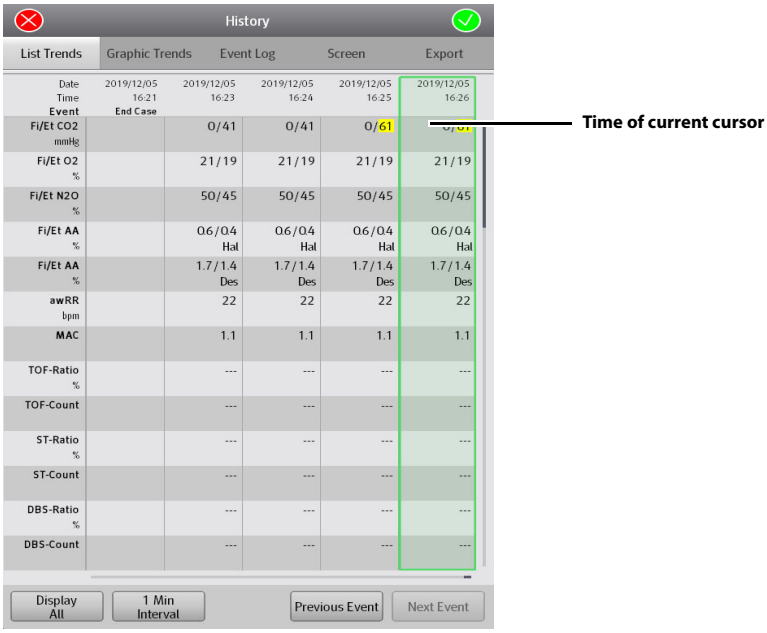


Figure 4-29 List Trends

4.6.1.1.1 About List Trends

- The horizontal coordinates of a list trend show the time and date.
- List Trends displays the parameter name on the vertical axis and it is always visible.
- List Trends displays the trend records in descending order beginning with the most recent on the right side of the grid.
- Graphic Trends are not stored when the system is in standby.
- List Trends can display the trend data of 48 consecutive hours.
- List Trends highlights the parameter data in the corresponding alarm color if an alarm condition existed for the parameter at the time of trend record storage.

4.6.1.1.2 List Trend Events Buttons

Drag the horizontal or vertical progress bar to view the updated trend data.

BUTTON	FUNCTION
Previous Event	The cursor moves from the current event to the previous event.

BUTTON	FUNCTION
Next Event	The cursor moves from the current event to the next event.

Table 4-4 List Trend Events Buttons

4.6.1.1.3 Display Interval

In the List Trends menu, you can set the display interval to [**1 Min**], [**5 Min**], [**10 Min**], [**15 Min**], [**30 Min**], [**1 Hour**] and [**2 Hour**].

4.6.1.1.4 Display Group

In the List Trends menu, you can set the display group to [**NMT**], [**BIS**], [**Gas**], [**Gas Flow**], [**Ventilator**] and [**All**].

4.6.1.2 Graphic Trends

Graphic trends display allows the user to observe the trend of the physiological parameters. The trend is reflected through a curve. Every point on the curve corresponds to the parameter value at a specific time point. Graphic trends can also record standby and parameter alarm events Graphic trend data automatically displays in one minute intervals unless the zoom is selected.

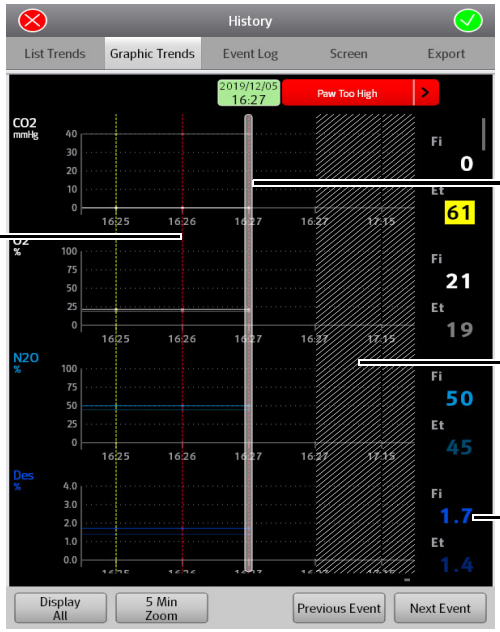


Figure 4-30 Graphic Trends

4.6.1.2.1 About Graphic Trends

- Graphic Trends store the data with the interval in 1 minute.
- Graphic Trends displays the trend records in descending order beginning with the most recent.
- Graphic Trends are not stored when the system is in standby.
- The display period of data is a rolling 48 hours of continuous data.
- Graphic Trends highlights the parameter data in the corresponding alarm color if an alarm condition existed for the parameter at the time of trend record storage.

4.6.1.2.2 Graphic Trend Events Buttons

Drag the horizontal or vertical progress bar to view the updated trend data.

BUTTON	FUNCTION
Previous Event	The cursor moves from the current event to the previous event.
Next Event	The cursor moves from the current event to the next event.

Table 4-5 Graphic Trend Events Buttons

4.6.1.2.3 Zooming

In the Graphic Trends menu, you can set the zooming to [**1 Min**], [**5 Min**], [**10 Min**], [**15 Min**], [**30 Min**], [**1 Hour**] and [**2 Hour**].

4.6.1.2.4 Display Group

In the Graphic Trends menu, you can set the display group to [**NMT**], [**BIS**], [**Gas**], [**Gas Flow**], [**Ventilator**] and [**All**].

4.6.1.3 Event Log

The [**Event Log**] tab can record the technical alarms, physiological alarms, capture events, power-off delays, standbys, canceled power-off delays, system time changes, lung recruitments, system self-tests and leak tests.

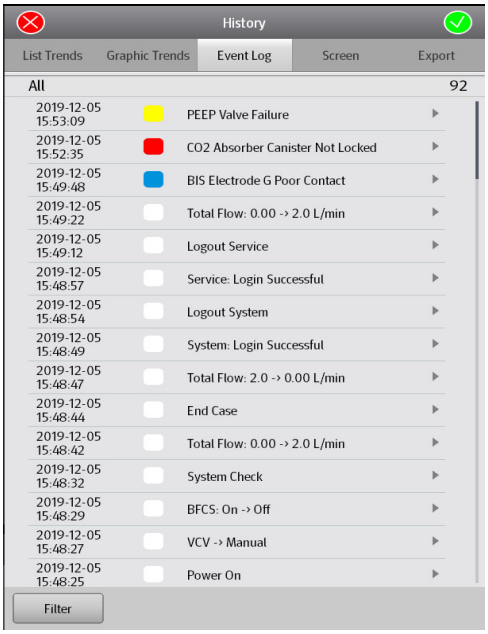


Figure 4-31 Event Log

NOTE: **Event logs will not be cleared after the anesthesia system powers off.**

NOTE: **The system can store up to 10,000 events. After the number of events exceeds 10,000, the earliest event will be overwritten by the latest event.**

4.6.1.3.1 Filter

In the Event Log menu, you can set [**Filter**] to [**High**], [**Medium**], [**Low**], [**Informational**], [**Activity**] and [**All On**].

4.6.1.4 Screen

You can select and delete captured screens. Select the [**Capture Event/Screens**] soft key on the Main Screen to capture the current screen and save it as an image. You can save up to 50 captured screens.

4.6.1.5 Export

Insert a U disk to the USB interface of the equipment as per the prompts on the screen. Select the [**Export**] soft key to export list trends, graphic trends, event logs and captured screens to the U disk. The exported data is in the format of .html. Files in the format can be opened in Internet Explorer 8.0, 9.0, 10.0 and 11.0.

4.6.2 Lung Recruitment

See (Pages 6-15) 6.6.11 "Lung Recruitment Ventilation".

4.6.3 Flow Pause

Use [**Flow Pause**] to temporarily suspend fresh gas flow during the ventilation. Using [**Flow Pause**] while the breathing system is disconnected from patient prevents the flow of gas into the room. [**Flow Pause**] is available during both mechanical ventilation and manual ventilation.

To enter the [**Flow Pause**] state:

1. On the Main Screen, select the [**Flow Pause**] soft key.
2. Select [**Yes**] on the pop-up screen to confirm the change. The system will enter the [**Flow Pause**] state.

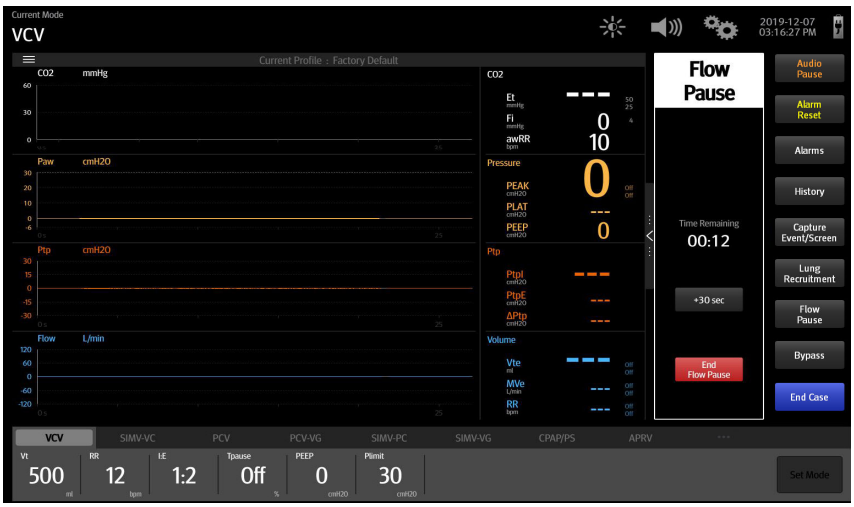


Figure 4-32 Flow pause

When the system is in the [**Flow Pause**] state:

- The fresh gas flow is turned off.
- The mechanical ventilation is suspended.
- Physiological alarms related to ventilation and gas are disabled.
- The countdown timer is enabled. The default countdown time is 60 seconds. You can select [**+30 sec**] button to add 30 seconds to the current countdown time. The maximum countdown time is 2 minutes.

To exit the [**Flow Pause**] state:

- The system exits the [**Flow Pause**] state automatically when the countdown time is 00:00.
- Select [**End Flow Pause**] button to exit the [**Flow Pause**] state.
- The system exits the [**Flow Pause**] state automatically when the system enters Standby mode or the BFCS is enabled.

After the system exits from the [**Flow Pause**] state:

- The fresh gas flow resumes at the settings from before entering the [**Flow Pause**] state.
- Ventilation resumes in the same ventilation mode and with the same parameter settings as before entering the [**Flow Pause**] state.
- Physiological alarms related to ventilation and gas are enabled.

4.6.4 Cardiac Bypass Mode

See (Pages 6-20) 6.7.3 "Cardiac Bypass Mode".

4.6.5 Screens

Select the [**Capture Event/Screens**] soft key, and the system will save the current screen as an image in the [**png**] format and log the current monitoring and event to the Event Log (See Pages 4-28 "Event Log"). The anesthesia system can store up to 50 images.

4.6.6 Alarms

Select the [**Alarms**] soft key on the Main Screen to open the [**Alarms**] menu where you can set the alarm limits and view active alarms (See (Pages 10-1) 10.0 "Alarms and Messages").

4.6.7 Alarm Reset

See (Pages 10-8) 10.6 "Setting Alarm Limits".

4.6.8 Audio Pause

See (Pages 10-7) 10.4 "Pause Alarm Audio".

4.7 Setup Menu

Select the  icon to open the [**Setup**] menu (Figure 4-33).

NOTE: The [System] soft key is only available in the standby mode.

NOTE: The [Service] tab is for use only by Mindray Technical Service. Please contact Mindray Technical Support for details.

4.7.1 Ventilation

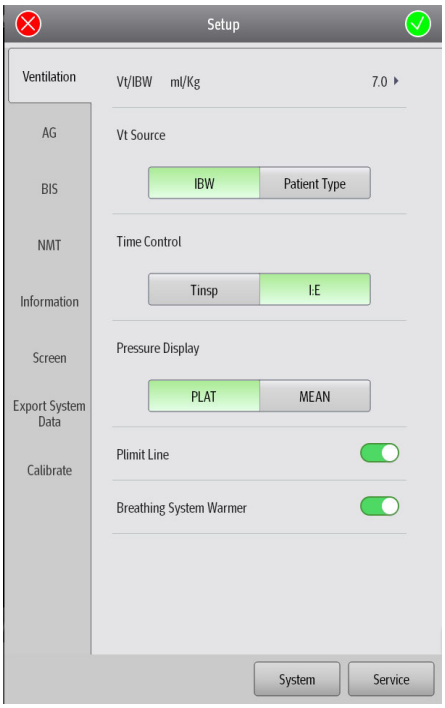


Figure 4-33 Ventilation (taking AG, BIS and NMT module configuration for example)

Vt/IBW

The system calculates the default tidal volume in the ventilation mode based on the [**Vt/IBW**] value.

Vt Source

Set the [**Vt Source**] to [**IBW**] or [**Patient Type**]. When the [**Vt Source**] is set to [**Patient Type**], changes to [**IBW**] won't impact [**Vt**] setting. When the [**Vt Source**] is set to [**IBW**], changes to [**IBW**] will impact [**Vt**] and [**RR**] settings based on the aforementioned Vt/IBW result.

Time Control

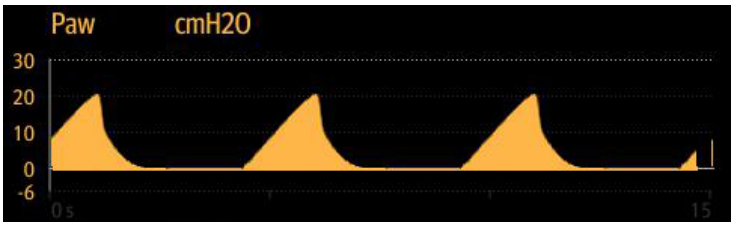
When [**Time Control**] is set to [**I:E**], the time control parameter in the VCV, PCV and PCV-VG ventilation modes is [**I:E**], and that in the PS and CPAP/PS ventilation modes is [**Apnea I:E**]. When [**Time Control**] is set to [**Tinsp**], the time control parameter in the VCV, PCV and PCV-VG ventilation modes is [**Tinsp**], and that in the PS and CPAP/PS ventilation modes is [**Apnea Ti**].

Pressure Display

Set the pressure monitoring to display on the Main Screen to [**Plat**] or [**Mean**].

Plimit Line

Set the [**Plimit Line**] to (off) or (on). The Plimit line function displays a dashed line in the Pressure waveform area to indicate the Plimit position. The Plimit line can be displayed in VCV, SIMV-VC, SIMV-VG and PCV-VG modes.



NOTE: **The Plimit line does not affect the auto-scaling algorithm. If the Plimit line is turned on but not visible, it may be because the line is positioned off the waveform scale.**

Breathing System Warmer

The [**Breathing System Warmer**] can be set to (off) or (on). If the [**Breathing System Warmer**] is (off), or if AC power is not connected, the system displays an icon to indicate that the warmer is not active.

After cycling power, the Breathing System Warmer will return to the default state.

NOTE: **The Breathing System Warmer is inactive when the equipment is powered by battery.**

4.7.2 Oxygen

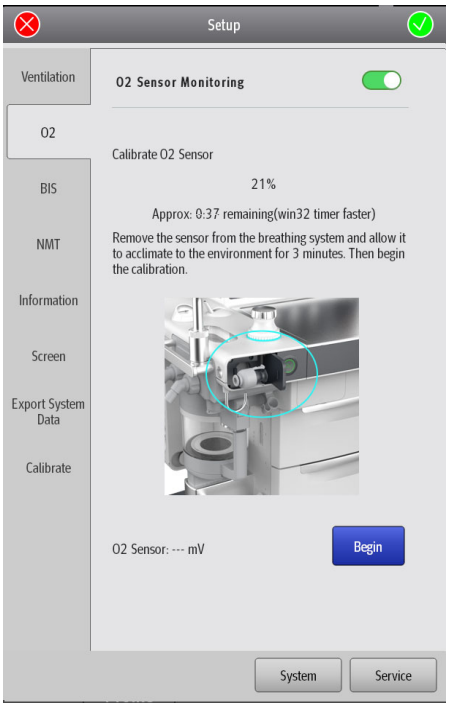


Figure 4-34 O_2

O_2 Sensor Monitoring

The [**O_2 Sensor Monitoring**] can be set to (off) or (on). If the [**O_2 Sensor Monitoring**] is set to (on), it indicates that the system can monitor the inhaled O_2 concentration of the patient. If the feature is not needed, you can set the [**O_2 Sensor Monitoring**] to (off). After the O_2 Sensor Monitoring is off, the system will block the alarms and prompt messages related to the O_2 sensor.

CAUTION: **The O_2 Sensor Monitoring feature is allowed to be turned off. But to prevent potential hazards to the patient after the monitoring and alarming features are disabled, it is not recommended that you disable the O_2 Sensor Monitoring feature continuously.**

Calibrate O_2 Sensor

You can select the [**Calibrate O_2 Sensor**] button to calibrate the O_2 sensor. Follow the prompts on the screen to perform the operation: See "21% Oxygen Calibration" on Pages 11-4 for more information.

4.7.3 AG Settings (AG module configured)

See (Pages 7-1) 7.0 "Anesthetic Gases and O_2 Concentration Monitoring" for more information.

4.7.4 BIS Settings (BIS module configured)

See (Pages 8-1) 8.0 "BIS Monitoring" for more information.

4.7.5 NMT Settings (NMT module configured)

See "NMT Monitoring" on Pages 9-1 for more information.

4.7.6 Information

Displays the software version, network setup information and other related information of the equipment. The information is for view purpose only and does not support modifications.

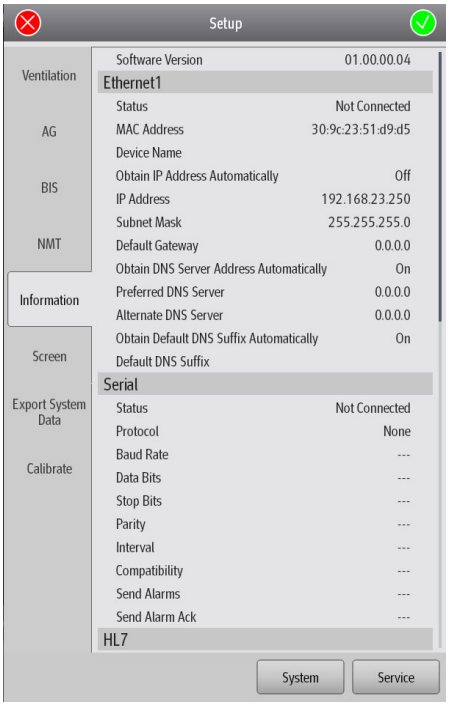


Figure 4-35 Information

4.7.7 Screen

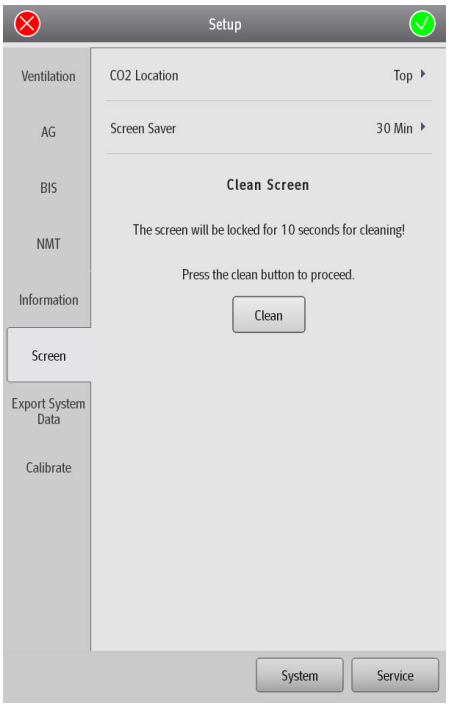


Figure 4-36 Screen

CO_2 Location

When the AG module is configured, the system will display the CO_2 waveform on the Main Screen. The [**CO_2 Location**] can be set to [**Top**] or [**Bottom**]. Based on the [**CO_2 Location**] setting, the system displays the CO_2 waveform at the corresponding location on the Main Screen.

Screen Saver

Set the delay time for entering the screen saver or disable the screen saver feature by setting it OFF. When the system enters the screen saver status, the status screen is displayed as blank, and the Main Screen displays Mindray at random locations as the screen saver. The system will exit from the screen saver when it detects the following operations:

- A touch on the Main Screen
- An operation on the main control knob
- An operation on either Flow Control Knob
- The BFCS cover is opened/closed
- The ACGO is enabled
- The auxiliary O_2/air supply is enabled
- The Auto/Manual switch is flipped
- A module is inserted/withdrawn (AG module, BIS module, or NMT module)
- An alarm is issued

Clean Screen

When the [**Clean**] soft key is selected, the system will lock the screen for 10 seconds so that the display can be cleaned.

4.7.8 Export System Data

Figure 4-37 Export System Data

The anesthesia system can export system data. The system data includes the equipment information, logs, monitoring data, system information, historical data, captured screens and network information.

To export data from the system, follow the steps below:

1. As per the instructions on the screen, insert a U disk to the SB interface of the anesthesia system. The icon is displayed on the Main Screen.
2. Select the [**Export**] soft key, and the system will check the remaining space of the U disk. If the remaining space is enough, the system will export the system data. Exported file is encrypted in the format of blg except the captured screens.
3. After the export is complete, select the icon.
4. Select [**Yes**] in the pop-up dialog box, and remove the U disk.

4.7.9 Calibrate

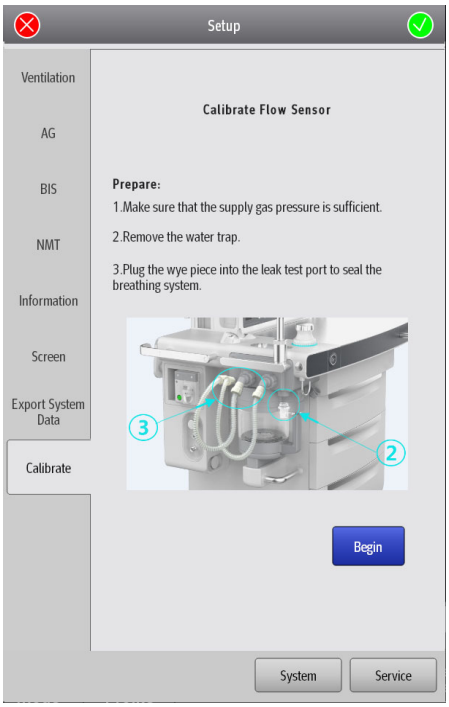


Figure 4-38 Calibrate

Follow the prompts on the screen to calibrate the flow sensor. See (Pages 11-4) 11.3 "Flow Sensor Calibration" for more information.

4.7.10 System

The [**System**] menu is accessible only by authorized administrative service personnel with password access. The [**System**] menu can only be accessed in Standby mode. (Figure 4-39).

NOTE: **The default password for accessing the System menu is [1234]. The authorized administrator should change the default password immediately after the system is installed to prevent unauthorized access to the System menu. The password may contain up to 30 digits including numbers, letters (case sensitive) and special characters.**

4.7.10.1 Calibrate

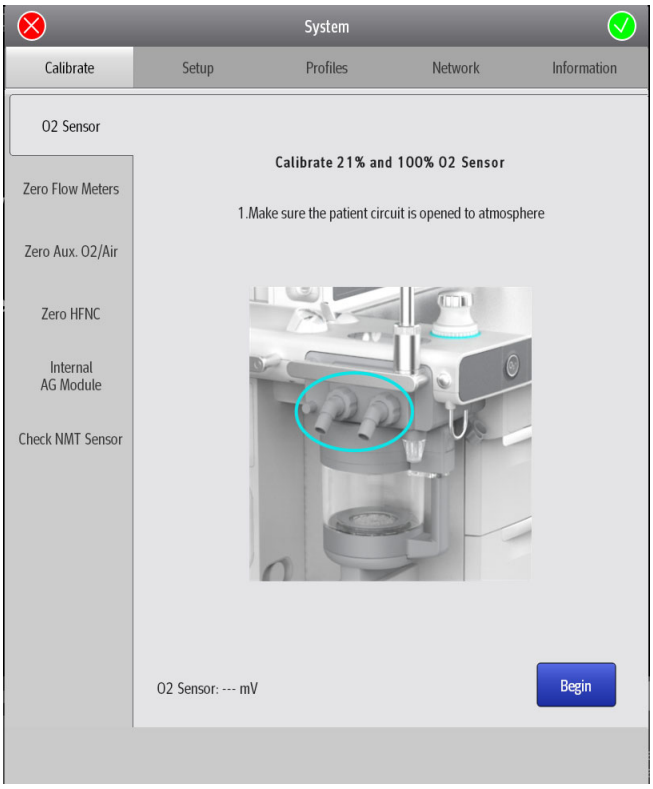


Figure 4-39 Setup > System > Calibrate menu

MENU	DESCRIPTION
O_2 sensor	Select [**Begin**] to calibrate the O_2 sensor and follow the prompts on the screen. See (Pages 11-4) 11.4 "O_2 Sensor Calibration".
Zero Flow Meters	Select [**Begin**] to zero the flowmeter and follow the prompts on the screen. **NOTE: Before zeroing the flowmeter, make sure that the gas supply (O_2, N_2O and air) is disconnected.**
Zero Aux. O_2/Air	This menu shows when you configure the auxiliary O_2/air function. Select [**Begin**] to zero the auxiliary O_2/air supply and follow the prompts on the screen.
Zero HFNC	This menu shows when you configure the HFNC function. Select [**Begin**] to zero the HFNC module and follow the prompts on the screen.
AG module	This menu shows when you configure the AG module. See (Pages 7-11) 7.11 "Calibrate the AG Module".
Internal AG module	This menu shows when you configure the internal AG module. See (Pages 7-11) 7.11 "Calibrate the AG Module".
Check NMT sensor	This menu shows when you configure the NMT module. You can check the sensor when the sensor measurement is not accurate.

Table 4-6 Calibrate menu

4.7.10.2 Setup

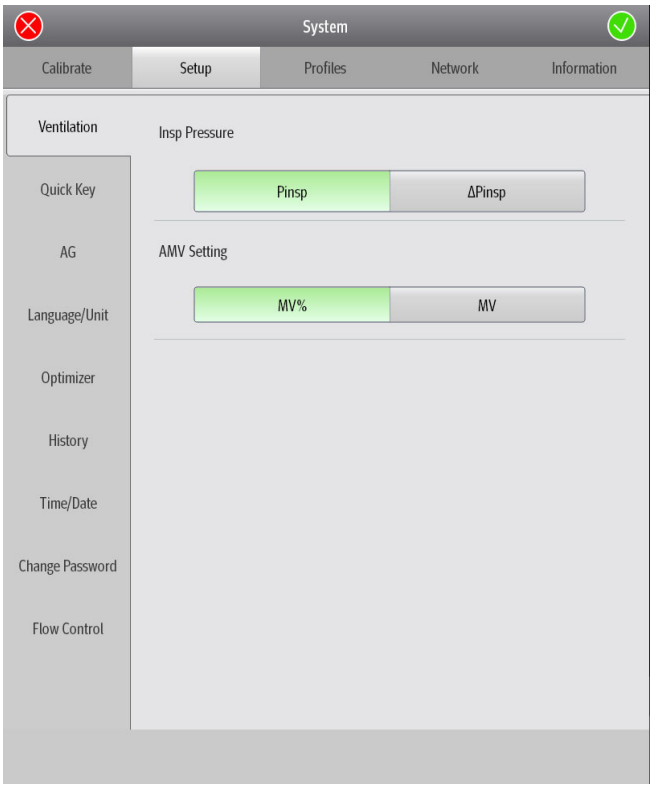


Figure 4-40 Setup > System > Setup menu

MENU	OPTION	DESCRIPTION
Ventilation	**Insp Pressure**	When [**Insp Pressure**] is set to [**Pinsp**], the inspiration pressure parameter in the PCV and SIMV-PCV ventilation modes is [**Pinsp**]. When [**Insp Pressure**] is set to [**ΔPinsp**], the inspiration pressure parameter in the PCV and SIMV-PCV ventilation modes is [**ΔPinsp**].
	AMV Setting	When [**AMV Setting**] is set to [**MV%**], the setting parameter in the AMV ventilation mode is [**MV%**]. When [**AMV Setting**] is set to [**MV**], the setting parameter in the AMV ventilation mode is [**MV**].

Table 4-7 Setup menu

MENU	OPTION	DESCRIPTION
Quick Key	**Alarm Reset**	When the [**Alarm Reset**] is enabled, the Main Screen will display the **[Alarm Reset]** soft key. When the [**Alarm Reset**] is disabled, the Main Screen will not display the **[Alarm Reset]** soft key.
	Capture Event/Screen	When the [**Capture Event/Screen**] is enabled, the Main Screen will display the **[Capture Event/Screen]** soft key. When the [**Capture Event/Screen**] is disabled, the Main Screen will not display the **[Capture Event/Screen]** soft key.
	Lung Recruitment	When the [**Lung Recruitment**] is enabled, the Main Screen will display the **[Lung Recruitment]** soft key. When the [**Lung Recruitment**] is disabled, the Main Screen will not display the **[Lung Recruitment]** soft key.
	Flow Pause	When the [**Flow Pause**] is enabled, the Main Screen will display the **[Flow Pause]** soft key. When the [**Flow Pause**] is disabled, the Main Screen will not display the **[Flow Pause]** soft key.
	Bypass in Auto mode	When the feature is enabled, the [**Bypass**] soft key on the Main Screen is available in both the Auto Ventilation mode and Manual Ventilation mode. When the feature is disabled, the [**Bypass**] soft key is only available in the Manual Ventilation mode.
2.1.32.1 **AG (AG module configured)**	**Null for 30s from zeroing** Agento tipai - Nustatykite reikalingų anestetikų tipus, kuriems reikia automatinio atpažinimo	When the feature is enabled, related parameters of AG module will be invalid within 30s of starting zeroing AG module. When the feature is disabled, related parameters of AG module will be normal within 30s of starting zeroing AG module.
	Types of Agent	Set the types of anesthetic agent which need automatic recognition.
Language/ Unit	**Language**	Sets the user interface text language.
	Pressure Unit	Sets the unit for pressure.
	CO_2 Unit	Sets the unit for CO_2.
	Gas Supply Pressure	Sets the unit for the gas supply pressure.
	Agent Cost Unit	Sets the agent cost unit.
	Patient Height	Sets the unit for patient height.
	Patient Weight	Sets the unit for patient weight.
Optimizer	**Optimizer**	Enables or disables the optimizer feature.
	Agent Usage	Enables or disables the agent usage calculation feature.
	Cost/ml of Liquid Agent	Sets the cost of anesthetic agent per ml.
History	**Clear History**	Configure the Clear History setting at the end of the case. When this feature is enabled, the standby screen displays the [**Clear History will delete all List Trends and Event Logs at the start of case!**].

Table 4-7 Setup menu

MENU	OPTION		DESCRIPTION
Time/Date	**24 Hour Time**		Enables or disables the 24 Hour Time.
	Time Zone		Selects to set the UTC time zone.
	Time		Sets the current time.
	Date Format		Sets the date format.
	Date		Sets the current date.
	Daylight Savings	**Daylight Savings**	The [**Daylight Savings**] can be set to [**Auto**], [**On**] or [**Off**]. When the [**Daylight Savings**] is set to [**Auto**], the start time and end time of the daylight savings should be set. When the [**Daylight Savings**] is set to [**On**], the system time is automatically adjusted. If the region or country where the equipment is installed does not observe the daylight savings, set the [**Daylight Savings**] to [**Off**].
		Start	Sets the start time of [**Daylight Savings**]. If the [**Daylight Savings**] is set to [**On**] or [**Off**], this setting cannot be selected.
		End	Sets the end time of [**Daylight Savings**]. If the [**Daylight Savings**] is set to [**On**] or [**Off**], this setting cannot be selected.
Change Password	**Current Password**		Changes the system password. The authorized administrator should change the default password immediately after the system is installed to prevent unauthorized access to the System menu. The password may contain up to 30 digits including numbers, letters (case sensitive) and special characters.
	New Password		
	Confirm Password		
Flow Control	**Quick Key 1**		The quick key for the [**Fresh Gas Control**] menu can be set here. The option can also be used to set the flow rate and O_2 concentration.
	Quick Key 2		
	Quick Key 3		
	Quick Key 4		
	Total Flow		Select to set the default fresh gas total flow when coming out of standby.

Table 4-7 Setup menu

4.7.10.3 Profiles

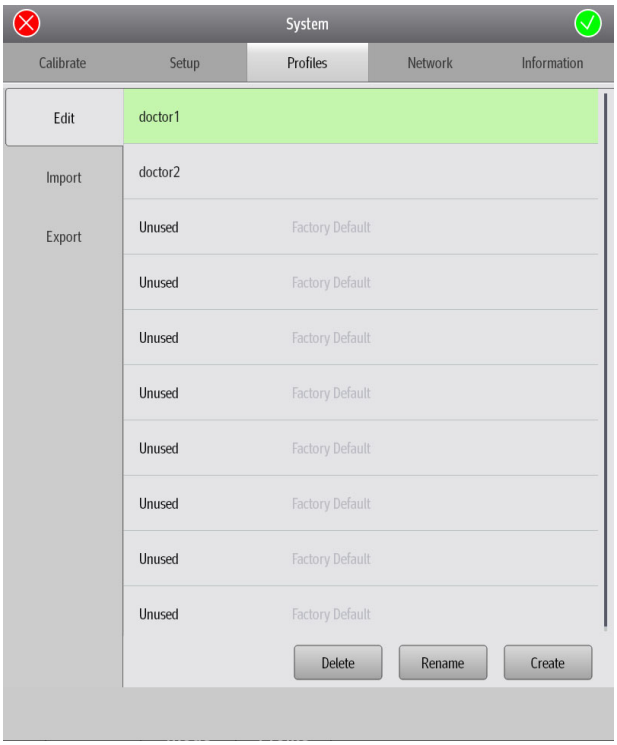


Figure 4-41 Setup > System > Profiles menu

MENU	OPTION	DESCRIPTION
Edit	**Delete** **Rename** **Create**	10 factory profiles are displayed by default. In practical application, the operator may make some changes to some settings and these changes can be saved as user profiles. The anesthesia system saves the profiles in real time and the saved profiles are called recent profiles. Save User Profile: Select the [**Create**] soft key to set the profile name on the pop-up screen. After the profile is confirmed, the system will save the current profile as a user profile. Restore Factory Profile: Select a user profile, and select the [**Delete**] soft key. The system will delete the user profile and restore the factory profile. Load Profile Manually: • In the standby mode, select the [**Current Profile: xxxx**] soft key and select the desired profile on the pop-up screen. • Select the [**Manual**] ventilation mode, and select the [**Load Profile**] soft key on the pop-up screen, and then select the desired profile on the pop-up screen. When the anesthesia system restarts within 60 seconds after an 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.
Import	/	Insert a USB storage device into the SB interface of the anesthesia system and import the profile duplicate from the USB storage device as per the prompts on the screen.
Export	/	Insert a USB storage device into the SB interface of the anesthesia system and export the profile duplicate to the USB storage device as per the prompts on the screen.

Table 4-8 Profiles menu

4.7.10.4 Network

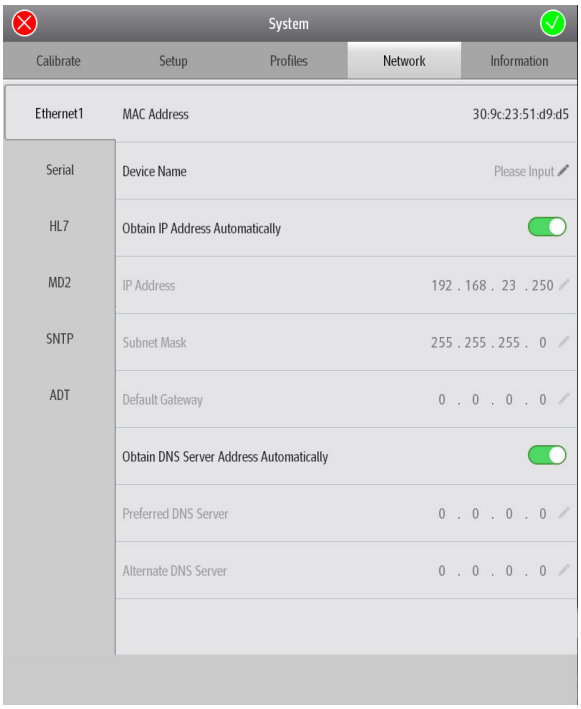


Figure 4-42 Setup > System > Network menu

MENU	OPTION	DESCRIPTION
Ethernet	**MAC Address**	Displays the MAC address of the anesthesia system.
	Device Name	Sets the device name.
	Obtain IP Address Automatically	Enables or disables the Obtain IP Address Automatically feature. When the feature is enabled, the [**IP Address**], [**Subnet**] and [**Default Gateway**] cannot be manually changed. When the feature is disabled, the [**IP Address**], [**Subnet**] and [**Default Gateway**] need to be manually changed. In this case, the Obtain DNS Server Address Automatically and Obtain Default DNS Suffix Automatically features, and the Obtain IP Address Automatically feature in the SNTP menu are disabled.
	IP Address	Sets the IP address.
	Subnet Mask	Sets the subnet mask.
	Default Gateway	Sets the default gateway.
	Obtain DNS Server Address Automatically	Enables or disables the Obtain DNS Server Address Automatically feature. When the feature is enabled, the [**Preferred DNS Server**] and [**Alternate DNS Server**] cannot be manually changed. When the feature is disabled, the [**Preferred DNS Server**] and [**Alternate DNS Server**] need to be manually changed.
	Preferred DNS Server	Sets the preferred DNS server.
	Alternate DNS Server	Sets the alternate DNS server.
Serial	**Protocol**	Sets the serial communication protocol. **NOTE: If the protocol is set to MR-WATO, the anesthesia system supports communications with a Mindray monitor with the Mindray Benelink module.**
	Baud Rate	Sets the Baud rate.
	Data Bits	Sets the data bits.
	Stop Bits	Sets the stop bits.
	Parity	Sets the parity.
	Data Interval	Sets the data intervals.
	Compatibility	Sets the serial communication protocol version.
	Send Alarms	Enables or disables the Send Alarms feature.
	Send Alarm Ack	Enables or disables the Send Alarm Ack feature.

Table 4-9 Network menu

MENU		OPTION	DESCRIPTION
HL7	Data+ Waveforms	Destination IP	Sets the destination IP address.
		Port	Sets the port.
		Test Results	Select the [**Test**] soft key, and the system will start the network test and display the test results.
		Data Internal	Sets the data intervals.
		Compatibility	Sets the serial communication protocol version.
		Send Waveforms	Enables or disables the Send Waveforms feature.
	Alarm	Destination IP	Sets the destination IP address.
		Port	Sets the port.
		Test Results	Select the [**Test**] soft key, and the system will start the network test and display the test results.
		Compatibility	Sets the serial communication protocol version.
		Send Alarms	Enables or disables the Send Alarms feature.
		Send Alarm Ack	Enables or disables the Send Alarm Ack feature.
	Receiving Setting	Receiving Application	Input the receiving application.
		Receiving Facility	Input the receiving facility.
MD2		EUI	Displays the EUI mark.
		MD2	Enables or disables the MD2 protocol channel. When MD2 protocol channel is enabled, the [**Destination IP**] cannot be manually changed. When MD2 protocol channel is disabled, the [**Destination IP**] needs to be manually changed.
		Destination IP	Sets the destination IP address.
		Test Results	Select the [**Test**] soft key, and the system will start the network test and display the test results.
SNTP		Interval	Sets the time interval.
		Primary Server IP Address	Sets the primary Server IP address.
		Secondary Service IP Address	Sets the secondary server IP address.
		Test Results	Select the [**Test**] soft key, and the system will start the network test and display the test results.
ADT		ADT	Enables or disables the ADT feature.
		Destination IP	Sets the destination IP address.
		Port	Sets the port.
		Test Results	Select the [**Test**] soft key, and the system will start the network test and display the test results.

Table 4-9 Network menu

4.7.10.5 Information

Displays the equipment ID, MAC address and system features status.

Figure 4-43 Setup > System> Information menu

4.7.11 Service Tab

Only authorized maintenance personnel by our company have access to the [**Service**] tab. Please contact Mindray Technical Support for any additional assistance.

4.8 Status Screen

4.8.1 Volume Exchanger

The Status Screen does not display the volume exchanger when in standby, ACGO and Monitor modes.

4.8.1.1 Automatic Ventilation, Flow Pause or Bypass

The system provides a VTi loop and dynamic lung to indicate the operation status of the volume exchanger during ventilation.

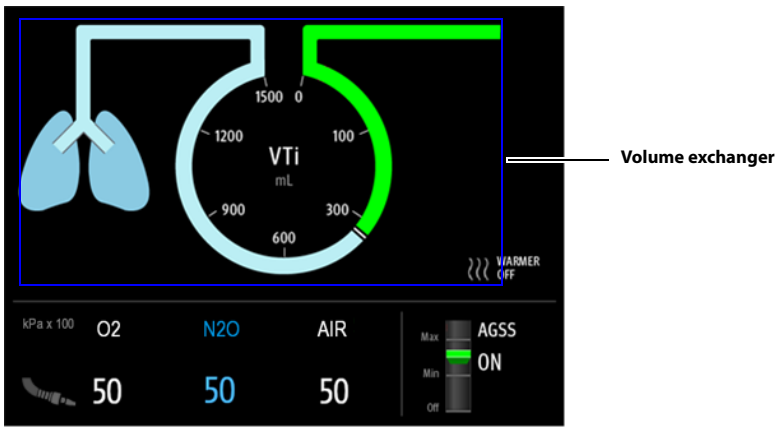


Figure 4-44 Volume exchanger (in automatic ventilation, flow pause or Bypass mode)

4.8.1.2 Manual Ventilation

The system provides a dynamic bag and dynamic lung to indicate the ventilation status.

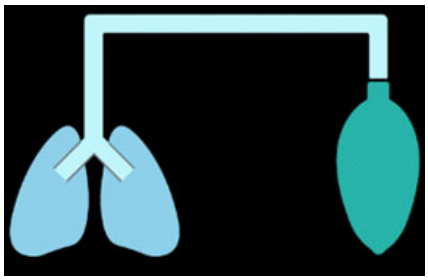


Figure 4-45 Manual Ventilation Mode

4.8.2 Gas Supply Pressure Monitoring

The anesthesia system monitors the gas supply pressure electronically. When the gas supply pressure suffers an exception and triggers an alarm, the pressure value on the screen is highlighted in the color matching the alarm priority and flashes.

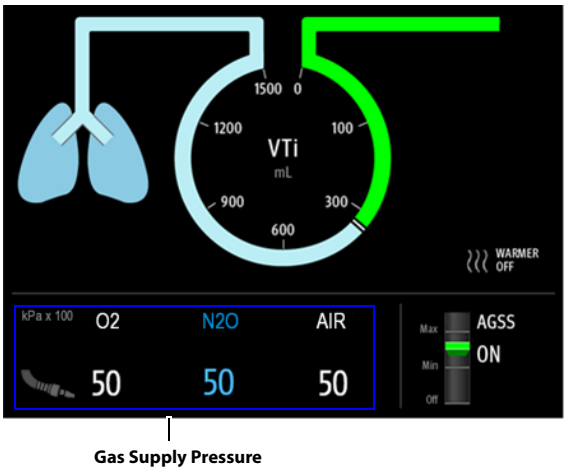


Figure 4-46 Gas Supply Pressure Monitoring

To change the gas supply pressure unit, perform the following settings:

1. Select the  soft key > [**System**] soft key (system password required) > [**Setup**] > [**Language/Unit**] tab.
2. Set [**Gas Supply Pressure**] to [**kPa**], [**psi**] or [**bar**].

4.8.3 AGSS

The AGSS status is displayed when the system is configured with AGSS. The float is used to indicate the AGSS flow rate. Rotate the knob clockwise or anticlockwise the AGSS flow control knob until the float in the Status Screen is located between Min and Max scale lines. When the system enters the standby status, the AGSS is off and the float is in the [**Off**] status.

NOTE: **Read the AGSS flow rate based on the position of the upper surface of the float.**

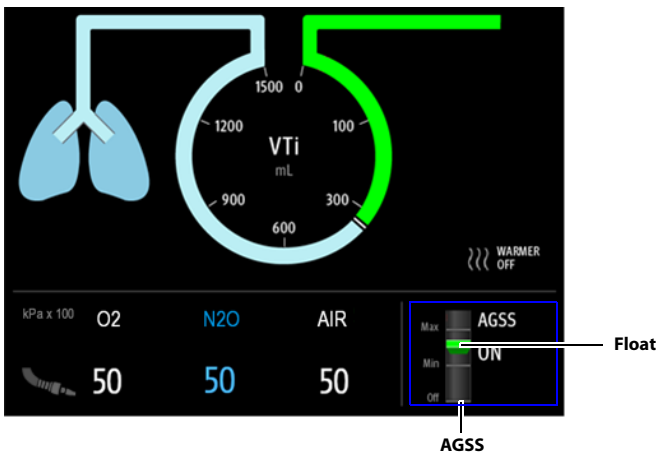


Figure 4-47 AGSS

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5.0 Preoperative Tests

5.1 Requirements of Preoperative Tests

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

NOTE: This is a guideline which can be modified to accommodate variations in local clinical practice. Such local modifications should have appropriate peer review.

NOTE: Ensure that the N_2O cutoff and O_2/N_2O ratio are normal before use. Use an O_2 concentration tester to monitor the O_2 concentration in the gas output.

Perform the preoperative tests listed below at these events:

- **After the equipment is repaired or maintained, all test items should be tested.**
- **Every day before the equipment is used on the first patient:**
  - Inspect the System (Section 5.3)
  - System Check (Section 5.4)
  - Power Failure Alarm Test (Section 5.5)
  - Pipeline Test (Section 5.6)
  - Basic Ventilation Test (Section 5.7)
  - Backup Gas Cylinder Test (Section 5.8)
  - Flow Control System Test (Section 5.9)
  - Vaporizer Test (Section 5.10)
  - Breathing System Test (Section 5.11)
  - Alarm Test (Section 5.12)
  - Inspect the AGSS (Section 5.13)
  - Inspect the Negative Pressure Suction Device (Section 5.15)
  - Pre-operation Preparations (Section 5.16)
- **Before using the equipment on each patient:**
  - Inspect the System (Section 5.3)
  - System Check (Section 5.4)
  - Pipeline Test (Section 5.6)
  - Vaporizer Test (Section 5.10)
  - Breathing System Test (Section 5.11)
  - Inspect the AGSS (Section 5.13)
  - Inspect the Negative Pressure Suction Device (Section 5.15)
  - Pre-operation Preparations (Section 5.16)

NOTE: Read and understand the operation and maintenance of each component before using the anesthesia system.

NOTE: Do not use the anesthesia system if a test failure occurs. Please contact Mindray Technical Support for any additional assistance.

NOTE: Provide a checklist of the anesthetic system, including anesthetic gas delivery system, monitoring device, alarm system, and protective device, which are intended to be used for the anesthetic system, whether they are used alone or assembled together.

5.2 Preoperative Checklist

5.2.1 Introduction

The purpose of preoperative check is to detect potential system problems before use.

An effective method for detecting pneumatic circuit occlusions, leaks, and other system problems can be found in the procedures of preoperative checks. In addition, it is recommended that the breathing circuit be tested for the ability to effectively deliver positive pressure ventilation before each ventilation begins. Test to see if the test lung can be properly ventilated and quickly identify an occluded circuit limb and other breathing circuit problems.

5.2.2 Suggested Preoperative Checklist

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

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

1. With the anesthesia system connected to an AC power supply, turn on the power switch and verify that the system is powered by the AC power supply. Follow the on-screen prompts to perform and complete the start-up test.
2. a. Check the O_2 Supply Failure safety messages and alarms.
   (See "O_2 Pipeline Test" on Pages 5-8)
   b. Test low O_2 concentration alarms.
   (See "O_2 Concentration Monitoring and Alarm Test" on Pages 5-15)
   c. Test high and low airway pressure alarms.
   (See "Airway Pressure (Paw) Too High Alarm Test" on Pages 5-17)
   (See "Airway Pressure (Paw) Too Low Alarm Test" on Pages 5-17)
   d. Test low minute ventilation and apnea alarms.
   (See "Minute Volume (MV) Too Low Alarm Test" on Pages 5-16)
   (See "Apnea Alarm Test" on Pages 5-16)
3. Verify that the O_2 sensor displays approximately 21% in room air and above 94% after exposure to 100% O_2 (See "O_2 Concentration Monitoring and Alarm Test" on Pages 5-15).
4. Check that the vaporizers are properly installed and sufficiently filled and that filler ports are tightly closed. Verify that only one vaporizer can be turned ON at a time("Vaporizer" on Pages 3-3.).
5. Perform a vaporizer leak test for each vaporizer installed on the equipment(See "Vaporizer Leak Test" on Pages 5-13).
6. For an anesthesia system equipped with an AGSS, check whether the AGSS float position is between the Min and Max scale lines ("Inspect the AGSS" on Pages 5-18).
7. Check the watertrap of the breathing system to ensure that there is no water collected.

Prior to administering anesthesia to each patient, 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., drugs, CO_2 absorbent (not exhausted), breathing circuits and backup O_2 supply.
2. Check that the central O_2, N_2O and air supply pressure is within the specified range for pipelined gas supply (i.e., 280 -600 kPa (40 to 87 psi)).
3. Perform the flow control system test (See "Flow Control System Test" on Pages 5-11).
4. Perform a vaporizer leak test for each vaporizer installed on the equipment(See "Vaporizer Leak Test" on Pages 5-13).
5. Verify that auxiliary O_2 and air supplies are available and functioning.
6. Verify that the Self-inflating Manual Ventilation device is available and functioning.
7. Check whether the backup O_2, N_2O and air cylinders (if applicable) have been installed onto the equipment and whether they have sufficient pressure without leakage under high pressure. (See "Test Backup Gas Cylinders" on Page 4-12)
8. Check whether the valves of the backup O_2, N_2O and air cylinders (if applicable) have been closed and not opened until needed to prevent unexpected use.
9. Connect the breathing circuit and manual bag and check the operation of unidirectional valves by visual inspection.
10. Check the ventilation capability in Standby, Manual, VCV and PCV modes.
11. Check that patient suction is adequate to clear the airway.
12. Verify the monitoring functionality and check alarms.

The following step is recommended to be performed when prompted by the equipment:

- Complete the 21% of O_2 calibration (See "O_2 Sensor Calibration" on Pages 11-4).

The following step is recommended when replacing an O_2 sensor:

- Complete the 21% and 100% of O_2 calibration (See "O_2 Sensor Calibration" on Pages 11-4).

The following steps are recommended for each installing of new vaporizers or each replacement of CO_2 absorbent:

- Perform a vaporizer leak test (See "Vaporizer Leak Test" on Pages 5-13).

5.3 Inspect the System

NOTE: Ensure that the breathing system is correctly connected and not damaged.

Perform the following inspections before operating the equipment:

1. The equipment is correctly connected and it is in good condition.
2. Inspect the system for:
   a. Damage to flowmeters, vaporizers, gauges, supply hoses.
   b. Complete breathing system with adequate CO_2 Pre-Pak absorbent or loose fill CO_2 absorbent.
   c. Backup gas cylinders are properly installed onto the yokes.
   d. Wrenches of backup gas cylinders are in place.
   e. Auxiliary O_2 supply is available and functioning.
3. All components are correctly attached.
4. The breathing system is correctly connected, the breathing tubes are undamaged. The self-inflating manual ventilation device is available and functioning.
5. The gas supply system has been connected and the pressure is correct.
6. The necessary emergency equipment is available and in good condition.
7. Equipment for airway maintenance and tracheal intubation 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.

WARNING: Check if the gasket is properly installed in place while installing the canister. If the gasket is not properly installed (for example, gasket is not centered), it may cause breathing system leakage.

WARNING: Before locking the canister, make sure that the gasket on the bypass assembly and the canister edge have no residual absorbent particles or powder. Otherwise it may cause breathing system leaks.

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 that the breathing system is in proper position.
12. The AC mains indicator turns on when the power cord is connected to the AC power source. If the indicators are not displayed, the system does not have electrical power.
13. The anesthesia system can be switched on or off normally.
14. The O_2 Flush button is functioning properly.

5.4 System Check

1. *From system being turned on:*
   When the system is turned on, it automatically initiates the Power On Self Test (POST). After the POST is over, the system check screen is displayed.

   Alternatively, on the *Main Screen:*
   Enter the standby screen, select the  soft key > [**System Check**] soft key, and enter the system check screen.
2. Follow the instructions on the Main Screen for operations.
3. Select the [**Continue**] soft key and the system starts the check.
4. Select [**Test Details**] to view the test results of each test item.
5. You can then proceed to standby or troubleshoot the equipment based on the test results.
6. After the system check is over, the Preoperative Checklist screen is displayed. Perform desired preoperative checks as per the prompts on the screen.

SYSTEM CHECK ITEMS		DESCRIPTION	REMARK
1.	Startup	When the system is turned on, it performs a check to ensure its alarm system (alarm LED and speaker) and hardware (flowmeter board, ventilator board, auxiliary ventilator board, power board, and CPU board) are functioning properly.	Confirm that the buzzer plays the check sound when the power on self test is started. Otherwise, stop using the anesthesia system and contact your service personnel or Mindray.
2	System Check	Performs leak and compliance tests and AGSS tests. Checks the hardware, valves, sensors, flowmeters, gas supplies, power supplies and modules.	
3	Preoperative Check List	Displays the checks to be performed before operating the system.	

Table 5-1 System Check

NOTE: **Select the [Alarms] soft key > [Limits] tab on the Main Screen. Set the [AGSS Alarms] to  (off) or  (on) in the pop-up menu. When the [AGSS Alarms] is set to  (on) , the System Check items include the AGSS tests. When the [AGSS Alarms] is set to  (off), the System Check items do not include the AGSS tests.**

5.4.1 Auto System Check

Set the time for the next automatic system check.

1. Enter the standby screen, and select the  soft key > [**Auto System Check**] soft key.
2. Set the time for automatic system checks.
3. Select the [**Start**] soft key and the system enters the standby screen. The time for the next automatic system check is displayed on the standby screen.

5.4.2 Leak & Compliance Test

NOTE: **The system records the result of the last Automatic Circuit Leak Test on its standby screen, indicating whether the test was passed, failed, or skipped.**

1. *From system being turned on:*
   When the system is turned on, it automatically initiates the Power On Self Test (POST). After the POST is over, the system automatically enters the System Check screen. System Check includes leak and compliance tests.

   Alternatively, on the *Main Screen:*
   Enter the standby screen, and select the  soft key > [**Leak Test**] soft key.
2. Follow the instructions on the screen:
3. Perform corresponding operation according to the test result and help information.

5.5 Power Failure Alarm Test

1. Set the System switch to the On position.
2. Disconnect the AC mains.
3. Make sure that the AC mains indicator is off. An audible alarm should sound and the alarm [**Battery in Use**] should be displayed on the Main Screen.
4. Reconnect the AC mains.
5. Make sure the audible alarm sound disappears and the AC mains indicator and battery charge indicator are illuminated. The alarm [**Battery in Use**] should not be displayed on the Main Screen.
6. Set the System switch to the OFF position.

5.6 Pipeline Test

5.6.1 O_2 Pipeline Test

1. Connect the O_2 pipeline supply.
2. If the anesthesia system has been configured with backup gas cylinders, turn off the valves of all the backup gas cylinders.
3. Set the System switch to the On position.
4. Set the O_2 flow to 6 L/min.
5. Ensure that the readings of O_2 pipeline pressure gauges are within the range of 280 to 600 kPa (40 to 87 psi).
6. Disconnect the O_2 pipeline supply.
7. As O_2 pressure decreases, the alarms of [**O_2 Supply Failure**] and [**Drive Gas Pressure Low**] should occur.
8. Ensure that the O_2 gauge reading decreases to zero.

5.6.2 N_2O Pipeline Test

NOTE: **To perform a N_2O pipeline test, connect the O_2 supply first to enable N_2O flow control.**

NOTE: **Different from O_2 pipeline supply, when N_2O supply is disconnected, the anesthesia system with no pressure sensor configured will issue no alarms related to N_2O pressure as N_2O pressure decreases.**

1. Connect O_2 and N_2O pipeline supplies.
2. If the anesthesia system has been configured with backup gas cylinders, turn off the valves of all the backup gas cylinders.
3. Set the System switch to the On position.
4. Select the Fresh Gas Flow display zone, and set the [**Control Mode**] on the pop-up screen to [**Direct Flow**].
5. Set [**Balance Gas**] to [**N_2O**].
6. Set the N_2O flow to 6 L/min.
7. Check whether the readings of the N_2O pipeline pressure gauges are within the range of 280 to 600 kPa (40 to 87 psi).

8. Disconnect the N_2O pipeline supply.
9. With the N_2O pressure decreases, the O_2 flow remains unchanged and the N_2O flow becomes zero. Meanwhile, the anesthesia system with a pressure sensor configured will issue the alarm of [**N_2O Supply Failure**].
10. Ensure that the N_2O gauge reading decreases to zero.

5.6.3 Air Pipeline Test

NOTE: **Different from O_2 pipeline supply, when air supply is disconnected, the anesthesia system with no pressure sensor configured will issue no alarms related to air pressure as air pressure decreases.**

1. Connect the pipelined Air supply.
2. If the anesthesia system has been configured with backup gas cylinders, turn off the valves of all the backup gas cylinders.
3. Set the System switch to the On position.
4. Select the Fresh Gas Flow display zone, and set the [**Control Mode**] on the pop-up screen to [**Direct Flow**].
5. Set the Balance Gas to AIR.
6. Set the Air flow to 6 L/min.
7. Check that the Air pipeline pressure gauges show 280 to 600 kPa (40 to 87 psi).
8. Disconnect the pipelined Air supply.
9. With the air pressure decreases, the anesthesia system with a pressure sensor configured will issue the alarm of [**Air Supply Failure**].
10. Ensure that the Air gauge decreases to zero.

5.7 Basic Ventilation Test

1. Attach a breathing circuit and breathing bag.
2. Attach an adult test lung or breathing bag to the patient end of the Y-fitting of the breathing circuit.
3. Set the O_2 flow to 3 L/min and set the N_2O and air flows to zero.
4. Set the ventilator controls according to the following table:

VENTILATOR CONTROLS	VENTILATOR SETTINGS
Patient Size	Adult
Ventilation Modes	PCV
Target Pressure - **Pinsp**	20
Respiratory Rate - **RR**	8
I:E Ratio - **I:E**	1:2
PEEP - **PEEP**	0
Inspiratory Rise Time - **Tslope**	0.5

5. Select **PCV** and begin ventilation.
6. Verify that the breathing bag at the patient end of the Y-fitting of the breathing circuit inflates and deflates and that the PLAT monitoring on the display and the PAW gauge reading are consistent with the Pinsp setting.

5.8 Backup Gas Cylinder Test

NOTE: No backup gas cylinder test is required for an anesthesia system not configured with backup gas cylinders.

5.8.1 Check Cylinder Pressure

1. Set the system switch to the Off position and connect the gas cylinder to check.
2. Open the valve of each gas cylinder using the attached wrench.
3. Make sure that each gas cylinder has adequate pressure. In case of inadequate pressure discovered in any gas cylinder, close the valve for the specific cylinder and replace the cylinder with a fully-inflated one.

- Input range of O_2 cylinder: 6.9 to 20 MPa (1000 - 2900 psi)
- Input range of N_2O cylinder: 4.2 to 6 MPa (600 - 870 psi)
- Input range of air cylinder: 6.9 to 20 MPa (1000 - 2900 psi)

4. Close the valves of all cylinders.

5.8.2 High Pressure Leak Test of O_2 Cylinders

1. Set the system switch to the Off position and disconnect the O_2 pipeline supply.
2. Open the valve of the O_2 cylinder.
3. Record the current pressure of the cylinder.
4. Close the valve of the O_2 cylinder.
5. Record the cylinder pressure after one minute.

   If the pressure reduction of the backup gas cylinder exceeds 1.25 MPa, install a new cylinder gasket. Repeat Steps 1 to 5. If the leak persists, stop using the backup gas cylinder supply system.

5.8.3 High Pressure Leak Test of N_2O Cylinders

1. Set the system switch to the Off position and disconnect the N_2O pipeline supply.
2. Open the valve of the N_2O cylinder.
3. Record the current pressure of the cylinder.
4. Close the valve of the N_2O cylinder.
5. Record the cylinder pressure after one minute.

   If the pressure reduction of the backup gas cylinder exceeds 0.5 MPa, install a new cylinder gasket. Repeat Steps 1 to 5. If the leak persists, stop using the backup gas cylinder supply system.

5.8.4 High Pressure Leak Test of Air Cylinders

1. Set the system switch to the Off position and disconnect the air pipeline supply.
2. Open the valve of the air cylinder.
3. Record the current pressure of the cylinder.
4. Close the valve of the air cylinder.
5. Record the cylinder pressure after one minute.

   If the pressure reduction of the backup gas cylinder exceeds 1.25 MPa, install a new cylinder gasket. Repeat Steps 1 to 5. If the leak persists, stop using the backup gas cylinder supply system.

5.9 Flow Control System Test

WARNING: If N_2O is available and flows through the system during this test, use a safe and approved procedure to collect and remove N_2O gas.

WARNING: Incorrect gas mixtures can cause patient injury. If the O_2:N_2O ratio system does not supply O_2 and N_2O in the correct proportions, do not use the system.

CAUTION: Open the gas cylinder valve slowly to avoid damage to it. Do not rotate the flow control knob hard. If a backup gas cylinder is not used after a backup gas cylinder test, close its valve.

CAUTION: When the electronic flow control system is disabled, the backup flow control system will be enabled. The initial flow of backup flow control system is 1 L/min of O_2. The BFCS display only has a total flowmeter.

CAUTION: Turn the flow control knob of the backup flow control system slowly. To avoid damaging the control valves, do not turn further when the flowmeter reading is out of range. When turning a flow control knob clockwise to decrease flow, the flowmeter should reach 1 L/min before the knob reaches its most clockwise mechanical stop (off) position. Do not turn any further when the knob has reached the off position. Turning a flow control knob counter clockwise increases flow.

The flow control system includes Electronic Flow Control System (hereinafter referred to as EFCS) and Backup Flow Control System (hereinafter referred to as BFCS). Normally, EFCS is used. Perform EFCS and BFCS tests before any case:

1. Connect the pipeline supplies or slowly open the cylinder valves.
2. Set the System switch to the ON position.
3. Select the Fresh Gas Flow display zone, and set the [**Control Mode**] on the pop-up screen to [**Direct Flow**].
4. Set the Balance Gas to AIR.
5. Adjust the Air flow. Make sure that the displayed reading of electronic flowmeter is consistent with the setting.
6. Set [**Balance Gas**] to [**N_2O**].
7. Adjust the N_2O flow gradually. Make sure that the O_2 flow increases with the increase of N_2O flow and that the O_2 and N_2O flows are in the proportion of 1 to 3.
8. Set both O_2 flow and N_2O flow to 5 L/min.
9. Turn off the O_2 pipeline supply.
10. Push the [**O_2 Flush**] button to release the pressure inside the system.

11. Make sure that the technical alarm of [**O_2 Supply Failure**] appears, and the N_2O flow is zero.
12. Make sure that a N_2O flow value is read and finally stabilized at 5 L/min after the O_2 pipeline supply is turned on.
13. Open the BFCS cover, start the BFCS and make sure that a prompt message of [**BFCS in Use**] appears.
14. Make a visual check to ensure that the total flowmeter shows a basal flow of approximately 1 L/min.
15. Adjust the Air needle valve. Increase Air flow gradually and make sure that the total flow can rise to more than 10 L/min. Close the Air needle valve.
16. Adjust the O_2 needle valve to increase the O_2 flow gradually and make sure that the total flow can rise to more than 10 L/min. Adjust the flow to 10 L/min.
17. Close the O_2 needle valve.
18. Rotate the O_2 needle valve for half a circle.
19. Close the BFCS cover, and the Main Screen will prompt a menu to confirm disabling the flow control system. Select [**Yes**] and ensure that the [**Manual valves must be closed!**] prompt message appears.
20. Close the O_2 needle valve and close the BFCS cover again. The Main Screen prompts a menu to confirm disabling the flow control system. Select [**Yes**], and the prompt message disappears.
21. Open the BFCS cover and turn the Air needle valve for half a circle.
22. Close the BFCS cover, the system automatically opens the BFCS cover and the Main Screen will prompt a menu to confirm disabling the flow control system. Select [**Yes**] and ensure that the [**Manual valves must be closed!**] prompt message appears.
23. Close the air needle valve and close the BFCS cover again. The Main Screen prompts a menu to confirm disabling the flow control system. Select [**Yes**], and the prompt message disappears.

NOTE: **In the event that the BFCS needle valve fails to be closed when you have closed the BFCS cover, the system will prompt [Manual valves must be closed!] if you proceed with other operations. In this case, check if all the needle valves are fully closed.**

NOTE: **When checking the readings on the total flowmeter, keep your visual angle at the same level of the float. The reading of the scale may vary when viewed at a different angle.**

24. Disconnect the pipelined gas supply or close the cylinder valve.
25. Set the System switch to the OFF position.

5.10 Vaporizer Test

WARNING: During the vaporizer test, the anesthetic agent comes from the fresh gas outlet. Use a safe and approved procedure to remove and collect the agent.

Before the test, ensure that the vaporizers are correctly installed. For detailed steps, see "Vaporizer" on Pages 3-12.

5.10.1 Vaporizer Back Pressure Test

1. Connect the O_2 pipeline supply or open the O_2 cylinder valve.
2. Set the O_2 flow to 6 L/min.
3. Ensure that the O_2 flow stays constant.
4. Adjust the vaporizer concentration from 0 to 1%. Ensure that the O_2 flow does not decrease by more than 1 L/min throughout the process. Otherwise, install a different vaporizer and repeat this step. If the problem persists, the malfunction is in the anesthesia system. Do not use this system.
5. Test each vaporizer as per the steps above.

NOTE: Do not perform this test on the vaporizer when the concentration control is between [OFF] and the first graduation above [0] (zero) as the amount of anesthetic drug outputted is very small within this range.

5.10.2 Vaporizer Leak Test

1. Set the Auto/Manual switch to the Manual position.
2. Set the APL valve to the SP position.
3. Connect the Y-piece on the breathing circuit to the leak test port, and one end of the breathing circuit to the bag arm, one end to the inspiratory port.

4. Install and lock the vaporizer onto the mount spot. (Certain vaporizers need to be set to at least 1% for correct testing. See the vaporizer manufacturer's manual for details.)
5. Set the fresh gas flow to 0.2 L/min.

6. Set the APL valve to the 70 cmH_2O position and verify that the pressure on the airway pressure gauge increases above 30 cmH_2O within 2 minutes.
7. Turn off the vaporizer. Set the APL valve to the SP position.
8. Repeat Steps 4 to 7 for another vaporizer.

5.11 Breathing System Test

WARNING: Objects in the breathing system can stop gas flow to the patient. 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.

5.11.1 Inspiratory and Expiratory Check Valve Tests

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.

5.11.2 APL Valve Test

1. Enter Standby mode.
2. Set the Auto/Manual switch to the Manual position.
3. Connect the manual bag to the bag arm port.
4. Connect the Y-piece on the breathing circuit to the leak test port.
5. Turn the APL valve control to the 30 cmH_2O position.
6. Press the [**O_2 Flush**] button to inflate the manual bag.
7. Ensure that the reading on the airway pressure gauge is within the range of 25 cmH_2O to 40 cmH_2O.
8. Turn the APL valve control to the fully open position.
9. Set the O_2 flow to 3 L/min. Turn any other gases off.
10. Ensure that the reading on the airway pressure gauge is less than 5 cmH_2O.
11. Push and hold the [**O_2 Flush**] button. Ensure that the reading on the airway pressure gauge does not exceed 10 cmH_2O.
12. Set the O_2 flow to zero. Ensure that the reading on the airway pressure gauge does not fall below 0 cmH_2O.

5.12 Alarm Test

Alarms also can be verified by creating an alarm condition on the equipment and verifying the corresponding alarm indicators are present on the anesthesia system.

5.12.1 Prepare for Alarm Tests

1. Connect the test lung or manual bag to the Y-piece of the breathing circuit.
2. Set the Auto/Manual switch to the Auto position.
3. Set the System switch to the ON position.
4. Set the system to Standby mode.
5. Set Patient Size to Adult.
6. Set the ventilator controls as follows:
   - Ventilation mode: VCV
   - Vt: 500 mL
   - RR: 12 bpm
   - I:E: 1:2
   - Tpause: 10%
   - PEEP: 0 cmH_2O
   - Plimit: 30 cmH_2O
7. Set the Auto/Manual switch to the Manual position.
8. Set the O_2 flow to within the range of 0.5 to 1 L/min.
9. Set the Auto/Manual switch to the Auto position.
10. Ensure that:
    - The Main Screen displays the correctly set data. The measured values should be within the tolerances specified in the specifications. (See "Ventilator Specifications", Table 12.12 on Pages 12-21.

5.12.2 O_2 Concentration Monitoring and Alarm Test

NOTE: **For the anesthesia system with the Gas module installed, disconnect the sample line from the Y-piece and breathe into it until you see a CO_2 reading on the screen. Then reconnect the sample line to the Y-piece. This will activate the gas module alarms.**

1. Set the Auto/Manual switch to the Manual position and exit Standby mode.
2. If the system has an AG module configured with O_2 monitoring functionality available, make sure that the pre-heating of the module has been complete. Keep the sampling port on the watertrap of the AG module facing the air and check the FiO_2 value on the Main Screen to make sure that approximately 21% O_2 is measured in room air. If the system has no AG module configured with O_2 monitoring functionality available or has no AG module configured, make sure that the system is using the O_2 sensor and the O_2 sensor has been calibrated. Remove the O_2 sensor from the breathing circuit, but do not disconnect the cable of the O_2 sensor. After three minutes, check the FiO_2 value on the Main Screen to make sure that the approximately 21% O_2 is measured in room air.
3. On the Main Screen, select the [**Alarms**] soft key > [**Limits**] tab. Set the FiO_2 low alarm limit to 50%.
4. Ensure that a [**FiO_2 Too Low**] alarm occurs.

5. Set the FiO_2 low alarm limit back to a value lower than the measured O_2 value and make sure that the alarm cancels.
6. Install the O_2 sensor back to the breathing system.
7. Select the Alarms soft key and then the Limits tab. Set the FiO_2 high alarm limit to 50%.
8. Connect the manual bag to the manual bag port. Press the [**O_2 Flush**] button to inflate the manual bag. Ensure that the sensor measures 90% O_2 at least.
9. Ensure that a [**FiO_2 Too High**] alarm occurs.
10. Set the FiO_2 high alarm limit to 100% and make sure that the alarm cancels.

5.12.3 Minute Volume (MV) Too Low Alarm Test

1. Connect the test lung or manual bag to the Y-piece of the breathing circuit.
2. Set the ventilation switch to the Auto position.
3. Set the ventilator controls as follows:
   - Ventilation mode: VCV
   - Vt: 500 mL
   - RR: 12 bpm
   - I:E: 1:2
   - Tpause: 10%
   - PEEP: 0 cmH_2O
   - Plimit: 30 cmH_2O
4. On the Main Screen, select the [**Alarms**] soft key > [**Limits**] tab. Set the MV low alarm limit to 15.0 L/min.
5. Ensure that a [**MV Too Low**] alarm occurs after approximately 60 seconds.
6. Select the [**Alarms**] soft key > [**Limits**] tab. Set the MV low alarm limit back to a value lower than the measured MV value and ensure that the alarm cancels.

5.12.4 Apnea Alarm Test

1. Connect the manual bag to the manual bag port.
2. Set the ventilation switch to the Manual position.
3. Turn the APL valve control to set the APL valve to 10 cmH_2O position.
4. Push the [**O_2 Flush**] button to inflate the bag. Squeeze the manual bag to make sure that a complete breathing cycle is displayed on the screen.
5. Stop squeezing the manual bag and wait for more than 30 seconds to ensure that the [**Apnea**] alarm occurs.
6. Inflate and squeeze the manual bag to ensure that the apnea alarm cancels.

5.12.5 Continuous Airway Pressure Too High Alarm Test

1. Connect the manual bag to the manual bag port.
2. Set the O_2 flow to the minimum value.
3. Turn the APL valve control to set the APL valve to 30 cmH_2O position.
4. Set the ventilation switch to the Manual position.
5. Connect the Y piece on the breathing circuit to the leak test port to occlude the patient end of the breathing system.
6. Push and hold the [**O_2 Flush**] button for approximately 15 seconds. Ensure that the [**Continuous Airway Pressure**] alarm occurs.
7. Disconnect the breathing circuit and ensure that the alarm cancels.
8. Reconnect the breathing circuit.

5.12.6 Airway Pressure (Paw) Too High Alarm Test

1. Connect the test lung or manual bag to the Y-piece of the breathing circuit.
2. Set Patient Type to Adult, and start the automatic ventilation.
3. On the Main Screen, select the [**Alarms**] soft key > [**Limits**] tab.
4. Set the lower limit of PEAK alarm to 0 cmH_2O and the upper limit of PEAK alarm to 5 cmH_2O lower than the monitoring of the anesthesia system.
5. Ensure that the [**Paw Too High**] alarm occurs.
6. Set the PEAK high alarm limit to 40 cmH_2O.
7. Ensure that the alarm cancels.

5.12.7 Airway Pressure (Paw) Too Low Alarm Test

1. Connect the test lung or manual bag to the Y-piece of the breathing circuit.
2. Set Patient Type to Adult, and start the automatic ventilation.
3. On the Main Screen, select the [**Alarms**] soft key > [**Limits**] tab.
4. Set the PEAK low alarm limit to 10 cmH_2O.
5. Disconnect the test lung or manual bag from the Y-piece of the breathing circuit.
6. Wait for 20 seconds. Check the alarm area and ensure that the [**Paw Too Low**] alarm occurs.
7. Connect the test lung or manual bag to the Y-piece of the breathing circuit.
8. Ensure that the alarm cancels.

5.12.8 AG Module Alarm Test

1. Install the AG module and see See "AG Measurement Preparation" on Pages 7-6.
2. Remove the gas sampling tube from the anesthesia system and connect the standard gas bag filled with anesthetic gas AA. AA stands for one of the following anesthetic agents: Des (Desflurane), Iso (Isoflurane), Sev (Sevoflurane), or Hal (Halothane).
3. On the Main Screen, select the [**Alarms**] soft key > [**Limits**] tab.
4. Set the EtAA upper limit to be lower than the standard gas concentration.
5. Ensure that the [**EtAA Too High**] alarm appears on the screen.
6. Set the EtAA lower limit to be higher than the standard gas concentration.

7. Ensure that the [**EtAA Too Low**] alarm appears on the screen.

5.13 Inspect the AGSS

1. Connect to the O_2 supply.
2. Connect the waste gas outlet of the anesthesia system to the EVAC port or the vacuum port of the medical institution and enable the waste gas disposal system.
3. Put the anesthesia machine out of standby status. Check whether the float is located between the MIN and MAX scale lines.

NOTE: **If the float is located below the MIN line, rotate the flow control knob (rotate the knob counter clockwise to increase the flow, and rotate it clockwise to decrease the flow) to adjust the float position to between the MIN and MAX scale lines.**

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 the following:**
1. The waste gas disposal system is not working or the pump rate is less than the minimum flow value of the active AGSS specification.
2. The drive gas supply pressure is too low to enable the AGSS normally.

5.14 Check Passive AGSS

1. Connect the waste gas outlet of the anesthesia system to the passive AGSS.
2. Seal the Y-piece and install the manual bag. Set the Auto/Manual switch to the Manual position and rotate the APL valve to the SP position.
3. Set the fresh gas flow to 2 L/min and then exit to the standby mode. Observe the changes in airway pressure for one minute and confirm that the airway pressure does not exceed 5 cmH_2O.

5.15 Inspect the Negative Pressure Suction Device

2.1.36. Integruota atsiurbimo sistema su neigiamo slėgio reguliavimu

1. Assemble the negative pressure suction device.
2. Occlude the suction tube at the patient end.
3. Turn on the negative pressure pipeline supply.
4. Set the selector switch to REG.
5. Turn the negative pressure adjustment knob to the maximum position and check if the reading on the pressure gauge increases gradually.

5.16 Pre-operation Preparations

1. Ensure that the ventilator parameters and alarm limits are set to applicable clinical levels.
2. Ensure that the system is in Standby mode.
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 the manual bag port.
6. Turn off all vaporizers.
7. Turn the APL valve control to the SP position to fully open the APL valve.
8. Set all gas flows to zero.

9. Ensure that the breathing system is correctly connected and not damaged.

WARNING: Before connecting the equipment to the patient, flush the device with O_2 at a flow of 8 L/min for at least two minutes. This removes unwanted mixtures and by-products from the system.

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6.0 Operations

WARNING: Before using the anesthesia system on the patient, ensure that the system is correctly assembled and in good condition, and that all the tests described in the Preoperative Tests are already completed. In case of test failure, do not use the system. Contact a qualified Mindray service representative to repair the system.

6.1 Powering On the Anesthesia System

1. Connect the pipelined gas supply and backup gas cylinders of the equipment.
2. Connect the power cord to the AC power source. Check that the AC power LED is illuminated.
3. Set the System switch to ON.
4. The Main Screen shows the start-up screen.
5. The alarm LED flashes red, yellow, and cyan once in turn and then a beep is given. This verifies that audible and visual alarms are operational.
6. After several seconds, the system self-test screen is displayed and the equipment runs its system self-test.

6.2 Powering Off the Anesthesia System

The system provides a powering off function with the following features:

- A prompt sound is given when user turns off the system. If the system switch is turned off in Standby mode, the system waits 3 seconds to power off completely.
- If the power switch is turned off in Manual mode or in any of the Automatic ventilation modes, the system will wait 12 seconds until it is completely powered off. In the 12-second power off delay period, the screen will display a 10-second countdown timer. If the equipment is performing Automatic ventilation, the ventilator will continue ventilating the patient in the current ventilation mode.
- The system beeps once every second during the countdown from 10 seconds to 1 second. When the timer turns to zero, a two-second power-off sound is played.
- When the user turns on the equipment during the power off delay period, the countdown timer will disappear, and the anesthesia system will resume its previous state.

NOTE: The delayed power-off feature is not available when the equipment is in the standby mode. The power-off feature is only available when the equipment is in an active ventilation mode.

6.3 Patient Setup

6.3.1 Standby Mode

Some system functionalities do not work when the system is in the standby mode.

Figure 6-1 Standby Mode

NOTE: **Whether to display the [Standby] or [Start Case] key on the soft key field of the Main Screen shall be set by authorized service personnel. Please contact Mindray Technical Support if necessary.**

6.3.1.1 Enter Standby mode

When the [**Standby**] key is displayed on Soft key field of the Main Screen:

1. Select the [**Standby**] key on the Main Screen.
2. Follow the on-screen prompts to enter Standby mode.

When the [**Standby**] key is not displayed on Soft key field of the Main Screen:

1. Set the Auto/Manual switch to the Manual position.
2. When using the EFCS, skip to Step 3.
   When using the BFCS, turn the flow control knob of the BFCS clockwise to the mechanical stop position.
3. Select the [**Standby**] key in the Manual mode.
4. Follow the on-screen prompts to enter Standby mode.

NOTE: **After selecting the [Standby] key, you can set whether to [Restore current prrofile settings] in the pop-up dialog box.**

NOTE: **When the system is in Standby mode and the Auto/Manual Switch is in Manual position, the [Bypass] button in the Manual tab is disabled. However, the [Alarms] button remains enabled and can be toggled to On or Off.**

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

6.3.1.2 Exit Standby mode

When the [**Start Case**] key is displayed on Soft key field of the Main Screen:

Touch the standby zone or select the [**Start Case**] soft key on the screen, and follow the on-screen prompts to exit the standby mode.

When the [**Start Case**] key is not displayed on Soft key field of the Main Screen:

1. Set the Auto/Manual switch to the Manual position.
2. Touch the waveform zone on the screen or turn on Fresh Gas, or select the [**Start Case**] key, and follow the on-screen prompts to exit standby mode.

6.3.2 Set Patient Information

See 4.2.1 (Pages 4-3) "Patient Information".

6.4 O_2 Sensor Calibration

If O_2 sensor calibration is needed, please see "O_2 Sensor Calibration" on Pages 11-4.

6.5 Set Fresh Gas

6.5.1 Set O_2, N_2O and Air Inputs

You can set the O_2 and balance gas through EFCS, or set the O_2 and air flows through BFCS.

The Security System in the equipment is intended to prevent delivering low-O_2 gas mixtures to patients. N_2O cannot be delivered without O_2.

The equipment maintains a safe O_2 to N_2O ratio by keeping the N_2O flow in a proper ratio to the pre-conditioned O_2 flow. N_2O flow is subject to the limitation of O_2 flow to make sure that O_2 remains in a safe ratio of not lower than 25%.

Auto cut-off of N_2O:
When the O_2 flow rate is lower than 200 mL/min, N_2O is automatically cut off to zero the N_2O flow rate.

O_2 pressure loss alarm:
When the O_2 pressure is lower than 220 kPa (32 psi), the O_2 supply failure alarm is triggered.

O_2 ratio controller:
The O_2 ratio controller ensures that the O_2 concentration in the fresh gas is always not lower than 25% when the N_2O valve is fully opened.

WARNING: If BFCS is used, make sure that both O_2 and air flow controllers are fully closed at the beginning and the end of each case.

NOTE: The float flowmeter is calibrated based on 100% O_2. For other gas, the accuracy of the flowmeter may degrade.

NOTE: When checking the readings on the float flowmeter, keep your visual angle at the same level of the float. The reading of the scale may vary when viewed at a different angle.

6.5.2 Set Anesthetic Agent

NOTE: You do not need to perform this operation if inspiratory anesthetic agent is not used.

NOTE: **The anesthesia system can be installed with vaporizers of Halothane, Isoflurane, Sevoflurane and Desflurane. Only one vaporizer can be opened at a time.**

6.5.2.1 Select the Desired Anesthetic Agent

1. Determine the anesthetic agent to be used and then fill the vaporizer.

NOTE: **Only vaporizers compliant with ISO 80601-2-13 and with Selectatec Interlock-Systems may be Installed to this equipment. Refer to the vaporizer manufacturer's instructions for filling, draining and other information of the vaporizer.**

WARNING: **Ensure that the correct anesthetic agent is used. The vaporizer is designed with the specific anesthetic agent named on it and further indicated by color coded labeling. The actual output concentration of the anesthetic agent will vary if the vaporizer is filled with the wrong agent.**

2. Install the vaporizer filled with anesthetic agent onto the anesthesia system.

6.5.2.2 Adjust the Concentration of Anesthetic Agent

Push and turn the concentration control on the vaporizer to set the appropriate concentration of anesthetic agent. For details about how to use the anesthetic agent, refer to the Vaporizer Instructions for Use.

6.6 Set Ventilation

NOTE: **In all ventilation modes, when inspiration pressure reaches the upper limit of PAW alarms, the system switches to expiration immediately and airway pressure is released.**

NOTE: **In case of a fault with the drive gas supply, the Auto ventilation mode won't function normally.**

6.6.1 Change Ventilation Mode

To change ventilation mode to Manual:

Use the Auto/Manual switch on the breathing system to enter and exit Manual ventilation mode.

To change ventilation mode to VCV, SIMV-VC, PCV, PCV-VG, SIMV-PC, SIMV-VG, CPAP/PS, APRV or AMV:

1. Select the tab of the desired ventilation mode. The [**Set Mode**] button (or [**Preset Mode**] button in manual mode) will flash (Figure 6-2).
2. Select the [**Set Mode**] button (or [**Preset Mode**] button in manual mode) to confirm the change. If the [**Set Mode**] button is not selected after several seconds, an audio reminder will sound for several seconds and then the system will return to the previous ventilation mode.
3. Optionally, select each available ventilation parameter to edit the parameter setting.
4. Move the Auto/Manual Switch to the Auto position.

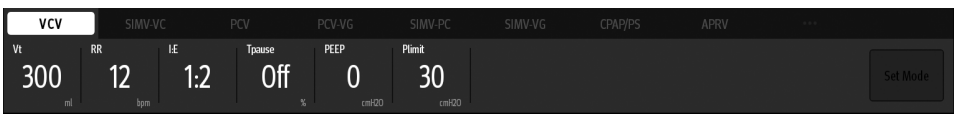

Figure 6-2 Ventilation Mode Tabs

6.6.2 Set Manual Ventilation Mode

Manual ventilation mode is the operating mode used to manually ventilate the patients or allow patients to breathe spontaneously. To use the manual mode, the user must first set the APL valve to the desired pressure value and then use the Auto/Manual switch on the breathing module to enter and exit Manual mode. Push the [**O_2 Flush**] button to inflate the bag if necessary.

Set the APL Valve for Manual Ventilation

Rotate the APL valve adjustment knob to the desired pressure. The number on the knob that lines up with the index mark on the bottom section of the valve indicates the approximate pressure setting.

NOTE: Clockwise rotation increases the pressure, and counter clockwise rotation decreases the pressure.

The patient can be ventilated manually using the breathing bag. The pressure will be limited to the value set on the APL valve.

Set the APL Valve for Spontaneous Breathing

Rotate the APL valve adjustment knob fully counter clockwise until the SP marking on the knob lines up with the index mark on the bottom section of the valve. The valve will then be open for the patient to breathe spontaneously.

NOTE: In the manual ventilation mode, you can use the APL valve to adjust the pressure limit of breathing system and gas volume in the manual bag. When the pressure in the breathing system reaches the pressure limit set for the APL valve, the valve opens to release excess gas.

NOTE: The APL valve adjusts the breathing system pressure limit during manual ventilation. Its scale shows approximate pressure.

Set Alarms

In the manual ventilation mode, when the [**Alarms**] soft key is set to [**Off**], the pressure, volume and apnea alarms are disabled, and the related alarm limits will be displayed as [**Off**]. Pressure, volume and apnea alarms can be turned on by setting the [**Alarms**] soft key to [**On**]. The related alarm limits will be restored to their original settings.

Set CO_2 Alarms

In the Manual ventilation mode, the CO_2 and the CO_2 apnea alarms can be turned off by setting the [**CO_2 Alarms**] soft key to [**Off**], and the related alarm limits will be displayed as [**Off**]. The [**CO_2 and CO_2 Apnea Alarms are OFF**] prompt will be displayed in the alarm area. The CO_2 and the CO_2 apnea alarms can be turned on by setting the [**CO_2 Alarms**] soft key to [**On**] or by turning the Auto/Manual switch to the Auto position. The related alarm limits will be restored to their original settings.

NOTE: In the Auto ventilation mode, the system's CO_2 alarms are turned on by default and cannot be turned off.

When the system exits the standby mode and enters the Manual ventilation mode, if the [**CO_2 Alarms**] soft key is [**On**], the system will not enable the CO_2 and the CO_2 apnea alarms until three continuous respiratory waves are monitored.

In the following two cases, the system will disable the CO_2 alarms or CO_2 apnea alarms for 30 seconds. After 30 seconds, the CO_2 and the CO_2 apnea alarms will be enabled even if no respiratory wave has been monitored.

- If the [**CO_2 Alarms**] soft key is set to [**On**] from the [**Off**] status
- Set the Auto/Manual switch from the Manual position to the Auto position

WARNING: Risk of inadequate monitoring. National standards require a minimum monitoring with some basic alarm functions. The standard may not be met if the CO_2 parameter alarms feature is disabled. Please disable the CO_2 parameter alarms feature only after you check the standard.

6.6.3 Settings Before Starting the Automatic Ventilation Mode

1. Enter Standby mode.
2. Select the desired ventilation mode tab.
3. Set the desired ventilation parameters.
4. Select the [**Set Mode**] key (flashing green) on the right of the ventilation tab to confirm the ventilation mode.
5. If in Standby, exit Standby by touching the Main Screen.
6. To begin automatic ventilation, set the Auto/Manual switch to the Auto position.

6.6.4 Volume Control Ventilation (VCV)

Volume Control Ventilation (VCV) mode is a fully automatic ventilation mode. In the VCV mode, each time automatic ventilation starts, gas is delivered to the patient at a constant flow, which reaches the preset Vt within the gas delivery time. To ensure a certain amount of Vt, the resulted airway pressure (Paw) changes based on patient pulmonary compliance and airway resistance.

In the VCV mode, you need to set the Plimit to prevent harm to patients that may be caused by excess airway pressure. Set Tpause to improve patient pulmonary gas distribution and PEEP to prevent end-expiratory alveolar collapse and improve hypoxemia.

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

In the VCV mode, if tidal volume compensation fails, the system can continue to deliver gas in a stable manner but cannot compensate for the effects of fresh gas flow and breathing system compliance losses.

In VCV and SIMV-VC modes, when inspiration pressure reaches Plimit, respectively, the inspiration pressure is held.

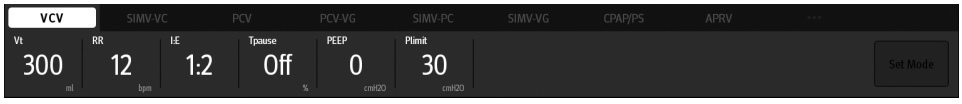

Figure 6-3 Volume Control Ventilation (VCV) Tab

Set VCV Mode:

1. Select the VCV tab on the Main Screen.
2. Select the parameter soft key and assign an appropriate value on the pop-up screen.

3. Check that all VCV parameters are set appropriately.
4. Select the [**Set Mode**] soft key to confirm the settings.

VCV parameters:

- Vt: tidal volume
- RR: respiratory rate
- I:E or Tinsp: ratio of inspiratory time to expiratory time or time of inspiration
- Tpause: percentage of inspiratory pause time in inspiratory time
- PEEP: positive end-expiratory pressure
- Plimit: pressure limit level

NOTE: **Before activating a new automatic ventilation mode, ensure that all related parameters are set appropriately.**

6.6.5 Set Pressure Control Ventilation (PCV)

Pressure control ventilation (PCV) mode is a basic fully-automatic ventilation mode. In the PCV mode, each time automatic ventilation starts, airway pressure rises rapidly to the preset Pinsp, then the feedback system will slow down the output flow and maintain a constant airway pressure until the end of the inspiration time. The tidal volume delivered in the PCV mode changes based on patient pulmonary compliance and airway resistance.

In the PCV mode, you can set PEEP to improve expiration of carbon dioxide and to increase oxygenation of breathing process.

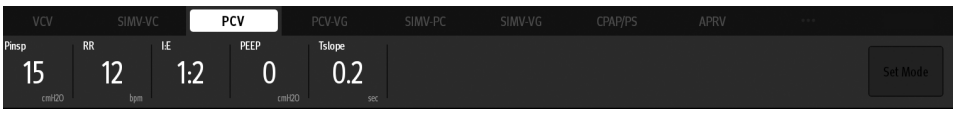

Figure 6-4 Pressure Control Ventilation (PCV) Tab

Set PCV Mode:

1. Select the PCV tab on the Main Screen.
2. Select the parameter soft key and assign an appropriate value on the pop-up screen.
3. Check that all PCV parameters are set appropriately.
4. Select the [**Set Mode**] soft key to confirm the settings.

PCV parameters:

- Pinsp or ΔPinsp: peak inspiratory airway pressure or relative inspiratory pressure.
- RR: respiratory rate
- I:E or Tinsp: ratio of inspiratory time to expiratory time or time of inspiration
- PEEP: positive end-expiratory pressure
- Tslope: rise time

NOTE: **Before activating a new automatic ventilation mode, ensure that all related parameters are set appropriately.**

6.6.6 Set Pressure Control Ventilation - Volume Guarantee (PCV-VG)

Pressure Control Ventilation - Volume Guarantee (PCV-VG) mode implements volume-guaranteed ventilation in a pressure-controlled manner. In this mode, the pressure level should be kept as low as possible during the inspiratory phase, meanwhile the gas supply volume should be equal to the preset tidal volume. The Pressure control level will vary according to the tidal volume setting, resistance and compliance of the patient's lungs.

Figure 6-5 Pressure Control Ventilation - Volume Guarantee (PCV-VG) Tab

Set PCV-VG Mode:

1. Select the PCV-VG tab on the Main Screen.
2. Select the parameter soft key and assign an appropriate value on the pop-up screen.
3. Check that all PCV-VG parameters are set appropriately.
4. Select the [**Set Mode**] soft key to confirm the settings.

PCV -VG parameters:

- Vt: tidal volume
- Plimit: pressure limit level with volume guarantee
- RR: respiratory rate
- I:E or Tinsp: ratio of inspiratory time to expiratory time or time of inspiration
- PEEP: positive end-expiratory pressure
- Tslope: rise time

NOTE: **Before activating a new automatic ventilation mode, ensure that all related parameters are set appropriately.**

6.6.7 Synchronized Intermittent Mandatory Ventilation (SIMV)

The equipment supports three modes of SIMV: SIMV-volume control (SIMV-VC), SIMV–pressure control (SIMV-PC) and SIMV–volume guarantee (SIMV-VG).

6.6.7.1 Synchronized Intermittent Mandatory Ventilation–Volume Control (SIMV-VC)

Figure 6-6 Synchronized Intermittent Mandatory Ventilation–Volume Control (SIMV-VC) Tab

SIMV-VC means to deliver synchronized intermittent mandatory volume controlled ventilation to the patient. In the SIMV-VC mode, the ventilator waits for patient's next inspiration based on the specified time interval. The sensitivity depends on Trigger. If Trigger is reached within the trigger waiting time (called synchronous trigger window), the ventilator delivers volume controlled ventilation synchronously with the preset tidal volume and inspiratory time. If the patient does not inspire within the trigger window, the ventilator delivers volume controlled ventilation to the patient at the end of trigger window. Spontaneous breathing outside trigger window can acquire pressure support.

2.1.13.5 In VCV and SIMV-VC modes, when inspiration pressure reaches Plimit, the inspiration pressure is held.

6.6.7.2 Synchronized Intermittent Mandatory Ventilation–Pressure Control (SIMV-PC)

SIMV-PC reiškia tiekti sinchronizuotą intervalinę privalomą slėgio valdymo ventiliaciją pacientui. SIMV-PC režime ventiliatorius laukia paciento kito įkvėpimo, remdamasis nurodytu laiko intervalu. Jautrumas priklauso nuo išprovokuojančio veiksnio (Trigger). Jei išprovokuojančio veiksnio pasiekiama per išprovokuojančio laukimo laikotarpį (vadinamąjį sinchroninio išprovokuojančio langelį), ventiliatorius tiekia sinchroniška privalomą slėgio valdymo ventiliaciją su iš anksto nustatytu tidaliniu tūriu ir įkvėpimo laiku. Jei pacientas nekvėpuoja per trigerio langelį, ventiliatorius tiekia privalomą slėgio valdymo ventiliaciją pacientui iki trigerio langelio pabaigos. Spontaniškas kvėpavimas už išprovokuojančio langelio ribų gali būti vykdomas naudojant slėgio palaikymą.

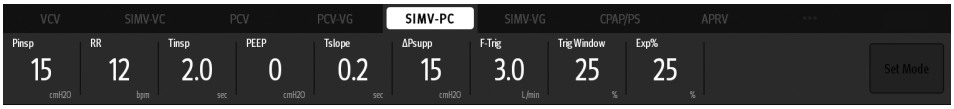

Figure 6-7 Synchronized Intermittent Mandatory Ventilation–Pressure Control (SIMV-PC) Tab

SIMV-PC means to deliver synchronized intermittent mandatory pressure controlled ventilation to the patient. In the SIMV-PC mode, the ventilator waits for patient's next inspiration based on the specified time interval. The sensitivity depends on 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 patient does not inspire within the trigger window, the ventilator delivers pressure controlled ventilation to the patient at the end of trigger window. Spontaneous breathing outside trigger window can acquire pressure support.

6.6.7.3 Synchronized Intermittent Mandatory Ventilation–Volume Guarantee (SIMV-VG)

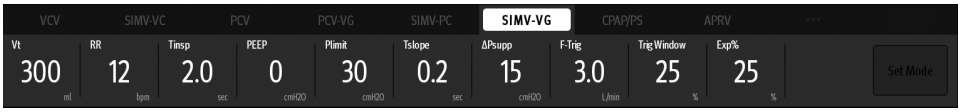

Figure 6-8 Synchronized Intermittent Mandatory Ventilation–Volume Guarantee (SIMV-VG) Tab

SIMV-VG means to deliver synchronized intermittent mandatory pressure control volume guarantee ventilation to the patient. In the SIMV-VG mode, the ventilator waits for patient's next inspiration based on the specified time interval. The sensitivity depends on F-Trig (or P-Trig). If F-Trig (or P-Trig) is reached within the trigger waiting time (called synchronous trigger window), the ventilator delivers pressure controlled volume guarantee ventilation synchronously with the preset tidal volume and inspiratory time. If the patient does not inspire within the trigger window, the ventilator delivers pressure controlled volume guarantee ventilation to the patient at the end of trigger window. Spontaneous breathing outside trigger window can acquire pressure support.

Set SIMV-VC, SIMV-PC or SIMV-VG Mode:

1. Select the SIMV-VC tab, SIMV-PC tab or SIMV-VG tab on the Main Screen.
2. Select the parameter soft key and assign an appropriate value on the pop-up screen.
3. Check that all SIMV-VC, SIMV-PC or SIMV-VG parameters are set appropriately.
4. Select the [**Set Mode**] soft key to confirm the settings.

SIMV-VC parameters:

- Vt: tidal volume
- RR: respiratory rate
- Tinsp: time of inspiration
- F-Trig/P-Trig: flow rate trigger level/pressure trigger level
- ΔPsupp: support pressure
- PEEP: positive end-expiratory pressure
- Plimit: pressure limit level
- Tpause: inspiratory pause
- Trig Window: trigger window (supports buffer time of synchronous inspiration of patients, in the later expiratory stage in the Auto ventilation mode, with its duration being a percent of the set breathing cycle)
- Tslope: rise time
- Exp%: expiration trigger level (change to the expiratory stage when the expiration trigger level (peak flow * expiration trigger level) is reached.)

SIMV-PC parameters:

- Pinsp or ΔPinsp: peak inspiratory airway pressure or relative inspiratory pressure
- RR: respiratory rate
- Tinsp: time of inspiration
- F-Trig/P-Trig: flow rate trigger level/pressure trigger level
- Tslope: rise time
- ΔPsupp: support pressure
- PEEP: positive end-expiratory pressure
- Trig Window: trigger window
- Exp%: expiration trigger level

SIMV-VG parameters:

- Vt: tidal volume
- RR: respiratory rate
- Tinsp: time of inspiration
- F-Trig/P-Trig: flow rate trigger level/pressure trigger level
- ΔPsupp: support pressure
- PEEP: positive end-expiratory pressure
- Plimit: pressure limit level
- Trig Window: trigger window
- Tslope: rise time
- Exp%: expiration trigger level

NOTE: Before activating a new automatic ventilation mode, ensure that all related parameters are set appropriately.

6.6.8 Set Continuous Positive Airway Pressure/Pressure Support Ventilation (CPAP/PS)

In the Pressure Support (PS) mode (when ΔPsupp is not 0 cmH_2O, PS is displayed in the current ventilation mode area), the equipment provides support to the patient's effort at a preset inspiratory pressure level. Inspiration is triggered and cycled by patient's effort.

In the Continuous Positive Airway Pressure (CPAP) mode (when ΔPsupp is 0 cmH_2O, CPAP is displayed in the current ventilation mode area), the system maintains the airway pressure at the user-defined positive pressure level throughout the ventilation cycle. The patient breathes spontaneously and determines his own breathing frequency, timing and tidal volume.

The user can set the F-Trig (or P-Trig), ΔPapnea, PEEP, Allowed Min RR, and Tslope. If the Min RR (minimum respiratory rate) is exceeded, and there's no spontaneous breathing or spontaneous breathing is too weak to reach F-Trig (or P-Trig), the equipment will give an Apnea Ventilation breath to assure ventilation is occurring.

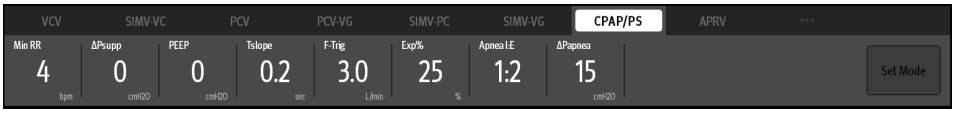

Figure 6-9 Continuous positive airway pressure tab

Figure 6-10 Pressure support tab

Set CPAP/PS Mode:

1. Select the CPAP/PS tab on the Main Screen.
2. Select the parameter soft key and assign an appropriate value on the pop-up screen.
3. Check that all CPAP/PS parameters are set appropriately.
4. Select the [**Set Mode**] soft key to confirm the settings.

CPAP/PS parameters:

- ΔPsupp: support pressure (the ventilation mode is CPAP when ΔPsupp=0cmH_2O)
- Tslope: rise time
- PEEP: positive end-expiratory pressure Reguliuojamas tėkmės trigerio jautrumas
- F-Trig/P-Trig: flow trigger level/pressure trigger level 2.1.23.
- Exp%: expiration trigger level
- Min RR: minimum respiratory rate, applies to apnea backup breaths only
- ΔPapnea: apnea pressure
- Apnea Ti: apnea inspiration time

NOTE: **Before activating a new automatic ventilation mode, ensure that all related parameters are set appropriately.**

6.6.9 Set Airway Pressure Release Ventilation (APRV)

The APRV mode refers to the Airway Pressure Release Ventilation mode, which can be regarded as the CPAP mode with periodical and transient airway pressure release.

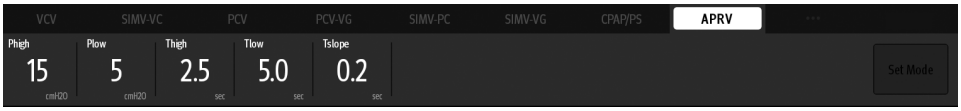

Figure 6-11 Airway Pressure Release Ventilation tab

Set APRV Mode:

1. Select the APRV tab on the Main Screen.
2. Select the parameter soft key and assign an appropriate value on the pop-up screen.
3. Check that all APRV parameters are set appropriately.
4. Select the [**Set Mode**] soft key to confirm the settings.

APRV parameters:

- Phigh: high pressure level
- Plow: low pressure level
- Thigh: high pressure time
- Tlow: low pressure time
- Tslope: rise time

NOTE: **Before activating a new automatic ventilation mode, ensure that all related parameters are set appropriately.**

6.6.10 Set Adaptive Minute Ventilation (AMV)

The AMV refers to the Adaptive Minute Ventilation mode which aims to minimize the patient's work of breathing. This mode adaptively adjusts the patient's ventilation parameters. Users can adjust the target minute ventilation by setting the patient's ideal body weight and minute ventilation percentage. Based on the Otis formula, the Ventilator will calculate the respiratory rate and tidal volume that minimize the work of breath under the minute ventilation, and adjust the inspiration/ expiration ratio based on the measured lung time constant.

Otis formula:

$$f = \frac{\sqrt{1 + 2a \cdot RC_{exp} \cdot \frac{MV - f \cdot V_d}{V_d}} - 1}{a \cdot RC_{exp}}$$

Where f indicates the minimum respiratory rate that minimizes the work of breath, MV indicates the target minute ventilation, V_d indicates the patient's physiological dead space volume and RC_{exp} indicates the time constant of lung. a is a coefficient related to the respiratory waveform. For a sine wave, a=2π2/60.

The target minute ventilation is calculated using the following formula:

Target minute ventilation MV=Minute ventilation %×$f_{default}$×Vt/IBW×IBW/1000

Where Vt/IBW is the tidal volume for the ideal body weight and IBW is the ideal body weight. $f_{default}$ is a group of default values related to the IBW. Its values are shown in the table below:

IBW (kg)	$f_{default}$ (/min)
[1.8, 3)	40
[3, 9)	35
[9, 13)	30
[13, 17)	25
[17, 23)	20
[23, 29)	15
[29, 36)	14
[36, 200)	12

The first three cycles of the AMV are trial PCV to calculate the patient's lung resistance and compliance. The initial ventilation parameters are set as shown in the table below:

IBW (kg)	Pinsp(cmH_2O)	Tinsp(s)	$f_{default}$ (/min)
[1.8, 3)	15	0.4	40
[3, 6)	15	0.4	30
[6, 9)	15	0.6	25
[9, 12)	15	0.6	20
[12, 15)	18	0.7	20
[15, 21)	15	0.8	20
[21, 24)	15	0.9	15
[24, 30)	15	1	15

[30, 40)	15	1	14
[40, 60)	15	1	12
[60, 90)	15	1	10
[90, 100)	18	1.5	10
⩾ 100	20	1.5	10

Table 6-1 Trial ventilation cycle parameters

After three trial ventilations, the ventilation enters automatic adjustment stage. With minimizing the work of breath as the principle, the actual minute ventilation is ensured to stay close to the minute ventilation setting. If the patient has no spontaneous respiration, enable automatic ventilation. If the patient restores spontaneous respiration, enable support ventilation.

Figure 6-12 Adaptive minute ventilation tab

Set AMV Mode:

1. Select the AMV tab on the Main Screen.
2. Select the parameter soft key and assign an appropriate value on the pop-up screen.
3. Check that all AMV parameters are set appropriately.
4. Select the [**Set Mode**] soft key to confirm the settings.

AMV parameters:

- MV%: percentage of minute ventilation
- PEEP: positive end-expiratory pressure
- Tslope: rise time
- F-Trig/P-Trig: flow trigger level/pressure trigger level
- Exp%: expiration trigger level

NOTE: **Before activating a new automatic ventilation mode, ensure that all related parameters are set appropriately.**

6.6.11 Lung Recruitment Ventilation

Lung recruitment is a lung-protective ventilation strategy. The ventilator intermittently supplies gases of a pressure higher than the mean airway pressure, and sustains the pressure for a period of time during the automatic ventilation. In this way, the lung recruitment maneuvers open more collapsed pulmonary alveoli and prevent the secondary pulmonary atelectasis caused by the low tidal volumes ventilation.

For the safety of the ventilation and observing the effect of the lung recruitment ventilation, the anesthesia system needs to perform real-time monitoring over PEAK, PEEP, C, and Vte during the lung recruitment ventilation.

NOTE: **Recruitment can only be used in automatic ventilation modes.**

NOTE: **Generally, 100% O_2 or high-concentration O_2 is used for ventilation during lung recruitment.**

NOTE: **It is not recommended to use lung recruitment where patients may spontaneously breath.**

NOTE: **Terminate the lung recruitment ventilation when the physiological state of the patient is abnormal.**

6.6.11.1 One-Step Recruitment

NOTE: **Before activating the lung recruitment ventilation, ensure that all related parameters are set appropriately.**

1. On the Main Screen, select the [**Lung Recruitment**] soft key > [**One-Step Recruitment**].
2. Set the lung recruitment parameters in the pop-up menu.
3. Select the Start soft key to start the lung recruitment ventilation. [**Lung Recruitment**] is displayed in the current ventilation mode area.

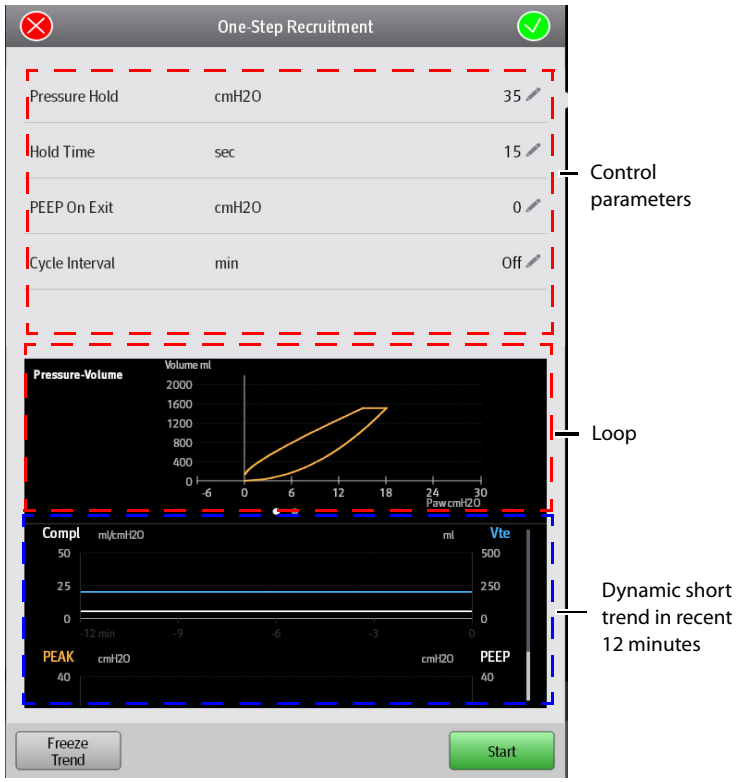

Figure 6-13 One-Step Recruitment

Recruitment parameters:

- Pressure Hold: the lung recruitment ventilation pressure.
- Duration: the lung recruitment ventilation duration.
- PEEP On Exit or Plow On Exit: the positive end-expiratory pressure or low pressure level upon exit from the lung recruitment ventilation mode.
- Cycle Interval: reminds users of the interval of starting lung recruitment ventilation.

6.6.11.2 Multi-Step Recruitment

1. On the Main Screen, select the [**Lung Recruitment**] soft key > [**Multi-Step Recruitment**].
2. Select [**Procedures**] in the pop-up menu. If necessary, you can edit the current procedure.
3. Select the Start soft key to start the lung recruitment ventilation. [**Lung Recruitment**] is displayed in the current ventilation mode area.

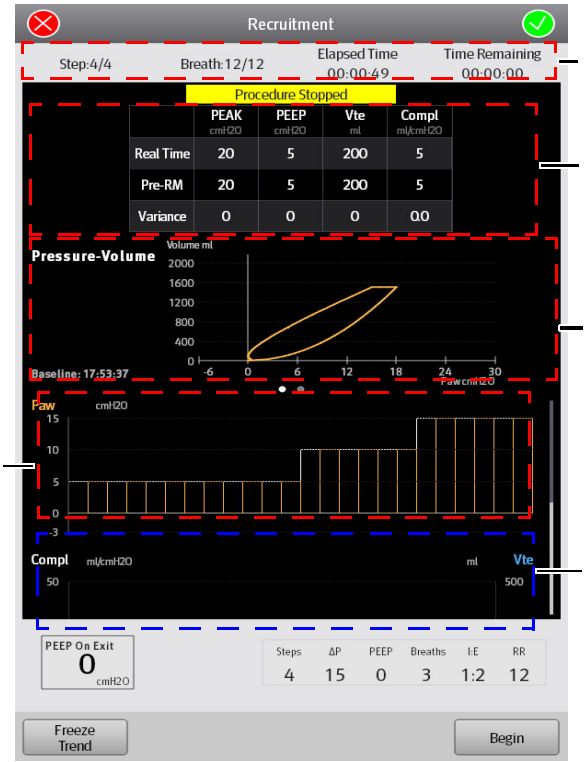

Figure 6-14 Multi-Step Recruitment

Recruitment parameters:

- Step: Step of the lung recruitment ventilation. It sets the step number or sets it to off.
- ΔP: Support pressure in a certain step of lung recruitment ventilation.
- PEEP: Positive end-expiratory pressure in a certain step of lung recruitment ventilation.
- Breaths: Breath cycle numbers in a certain step of the lung recruitment ventilation.
- I:E: Ratio of inspiratory time to expiratory time in a certain step of lung recruitment ventilation.
- RR: Respiratory rate in a certain step of lung recruitment ventilation.
- PEEP On Exit or Plow On Exit: the positive end-expiratory pressure or low pressure level upon exit from the lung recruitment ventilation mode.

6.6.11.3 Parameter Monitoring

During the lung recruitment ventilation, the anesthesia system monitors PEAK, PEEP, Vte and Compl in real time.

6.6.11.4 Freeze Trend

Freeze the trend waveforms by selecting the [**Freeze Trend**] soft key in the Recruitment menu.

When trends are in the frozen status, select the [**Unfreeze Trend**] soft key to exit the frozen status.

6.7 Other Features

6.7.1 Auxiliary Common Gas Outlet (ACGO) Mode

If the equipment is configured with an ACGO switch, the system enters or exits ACGO mode by turning on or off the ACGO switch.

Figure 6-15 ACGO mode

Preset Ventilation Mode after Exit from ACGO

For example, if the current ventilation mode is VCV, enable ACGO and the system will enter the ACGO mode. Under such circumstances:

- If the ventilation mode remains unchanged, the system will enter the VCV mode upon its exit from the ACGO mode.
- If another ventilation mode other than [**VCV**] has been selected, such as [**PCV**], select [**Preset Mode**], and the system will enter the PCV mode upon exit from the ACGO mode.

NOTE: **If the system is currently in Standby or Manual mode, the system enters ACGO mode when ACGO is enabled. Under such circumstances, the [Preset Mode] feature is invalid. At this point, the system will enter the corresponding Standby or Manual mode upon exit from the ACGO mode.**

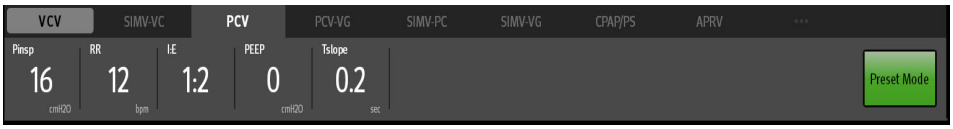

Figure 6-16 Press the [**Preset Mode**] key to set [**PCV**] as the system's ventilation mode upon exit from the ACGO mode

6.7.2 Monitor

When the anesthesia system has an external AG module configured, the system supports the Monitor mode. In the Manual ventilation mode, select the [**Monitor Mode**] soft key to enable the Monitor mode. [**Monitor**] is displayed in the Current Mode area. The mode disables all ventilation-related alarms.

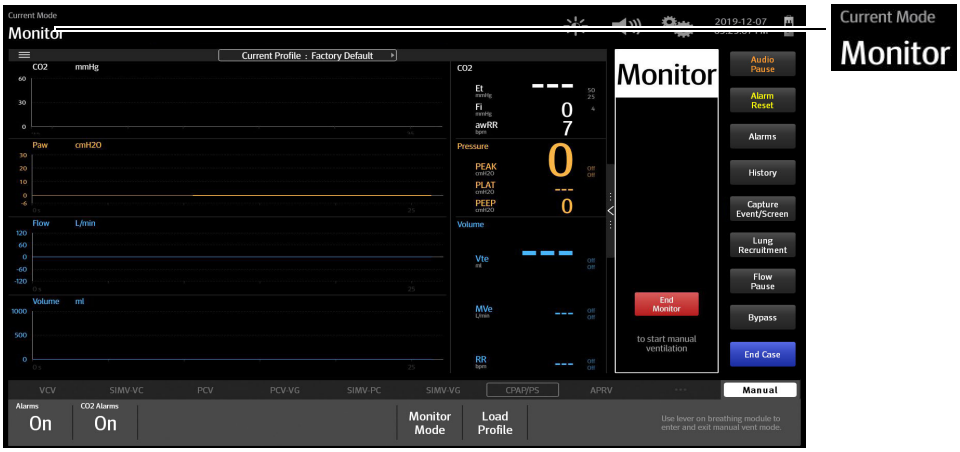

Figure 6-17 Monitor Mode

6.7.3 Cardiac Bypass Mode

The Bypass mode turns off pressure, volume and apnea alarms when they are not appropriate (e.g., during heart/lung bypass).

Set whether to enter the Bypass mode in the automatic ventilation mode:

1. Enter Standby mode.
2. Select the icon > [**System**] soft key > enter the system password and confirm the password > [**Setup**] tab > [**Quick Key**] tab.
3. Set the [**Bypass in Auto mode**] to (off) or (on).
   - When the [**Bypass in Auto mode**] is set to (off), the Bypass mode is only available in the Manual ventilation mode (not available in the Auto ventilation mode). Start the manual ventilation, if you select the [**Bypass**] soft key in the manual mode and select [**Yes**] in the pop-up dialog box, the system will enter the Bypass mode.
   - When the [**Bypass in Auto mode**] is set to (on), the Bypass mode is available in both the Manual and Auto ventilation modes. Start the ventilation, if you select the [**Bypass**] soft key on the Main Screen and select [**Yes**] in the pop-up dialog box, the system will enter the Bypass mode.

NOTE: **When the Bypass mode is enabled, the [Alarms] button is disabled and automatically set to [Off].**

When the system exits the Byapss mode, the [**Alarms**] button returns to its setting before the CPB mode is enabled.

6.7.4 High-flow Nasal Cannula Oxygen (HFNC)

High-flow Nasal Cannula Oxygen (HFNC) refers to a method to increase the O_2 concentration in the airway under atmospheric pressure through simple tubes. HFNC refers a medical measure that increases the alveolar O_2 concentration by increasing the O_2 concentration in the inhaled gas to promote O_2 diffusion, thereby increasing the partial pressure and saturation of blood oxygen in arteries so as to ease or rectify hypoxia. HFNC is a hypoxia prevention or treatment means and the O_2 concentration it provides is higher than that in the air.

WARNING: **HFNC can be applied to open or semi-open ventilations such as nasal cannula or mask ventilation, but it can not be applied to closed or semi-closed ventilations like tracheal intubation or laryngeal mask ventilation.**

WARNING: **Airway pressure and ventilation parameters related to respiration, such as flow rate, minute ventilation, apnea, are not monitored during HFNC.**

WARNING: **An SpO_2 monitoring device should be used to monitor SpO_2 during HFNC.**

WARNING: **Low gas supply pressure may cause inaccurate O_2 concentration control.**

WARNING: **Do not use antistatic or conductive breathing tubes. Using tubes made from such materials will expose the patient to electric shocks and may cause fires in an oxygen-enriched environment.**

WARNING: **The equipment must be used under the supervision of professional medical personnel. If a fault occurs to the equipment or the patient fails to perform enough spontaneous respiration, professional medical personnel can give immediate help.**

NOTE: Stop the automatic ventilation before starting the HFNC. Otherwise it may cause inaccurate accuracy of the automatic ventilation or limited flow adjustment of HFNC.

NOTE: HFNC can be started only when the oxygen supply is connected.

To start the HFNC:

1. Connect the HFNC tube, See "High-flow Nasal Cannula Oxygen (HFNC) Tube" on Pages 3-7.
2. Press the HFNC switch to start the HFNC.
3. Adjust the oxygen concentration and total flow.
4. Press the HFNC switch to close the HFNC after use.

6.8 Start Automatic Ventilation

NOTE: Before starting a new automatic ventilation mode, ensure that all related ventilation parameters are set appropriately.

NOTE: Close the HFNC before starting the automatic ventilation to avoid affecting the accuracy of the automatic ventilation.

To start automatic ventilation from Standby mode:

1. Set the Auto/Manual switch to the Manual position.
2. Exit Standby by touching the Main Screen or by turning on the fresh gas.
3. Set the Auto/Manual Switch to the Auto position.The system will start automatic ventilation.

6.9 Stop Automatic Ventilation

To stop automatic ventilation:

1. Ensure that the breathing system is set up and the APL valve is set properly before stopping automatic ventilation.
2. Set the Auto/Manual switch to the Manual position.This selects manual ventilation and stops automatic ventilation.

6.10 Relationships of Ventilation Parameters

Different ventilation modes may share the same ventilation parameters and values. For example, SIMV-VC and VCV both include Vt, Plimit, RR, Tpause, and PEEP. Therefore, these parameter values that are linked may be passed from the previous ventilation mode to the current mode."Ventilation Linkage Parameters" on Pages B-11 includes a table that lists how the linked parameter values are set when ventilation modes are changed.

Ventilation parameter values that are linked are set according to relationship equations. "Constraints Among Ventilation Parameters" on Pages B-15 includes a table of equations to show how linked parameter values are set when ventilation modes are changed.

7.0 Anesthetic Gases and O_2 Concentration Monitoring

7.1 Introduction

The anesthetic gas (AG) module measures patients' anesthetic and respiratory gases and incorporates the functionalities of the O_2 module as well.

The AG (anesthesia gas) module determines the concentrations of certain gases using the infrared (IR) light absorption measurement. The gases that can be measured by the AG module absorb IR light. Each gas has its own absorption characteristic. The gas is transported into a sample cell, and an optical IR filter selects a specific band of IR light to pass through the gas. For multiple gas measurement, there are multiple IR filters. This means that higher concentration of IR absorbing gas causes a lower transmission of IR light. From the amount of IR light measured, the concentration of gas present can be calculated.

Oxygen does not absorb IR light as other breathing gases and is therefore measured relying on its paramagnetic properties. Inside the sensor of the O_2 module are two nitrogen-filled glass spheres hung on a torsion device in a symmetrical magnetic field. This assembly is suspended in a symmetrical non-uniform magnetic field. In the presence of paramagnetic oxygen, the glass spheres are pushed further away from the strongest part of the magnetic field. The strength of the torque acting on the suspension is proportional to the oxygen concentration. From the strength of the torque, the concentration of oxygen is calculated.

AG measurement provides:

Matuojami parametrai Et (iškvėpimas), Fi (įkvėpimas)

1. Waveform: CO_2, N_2O, O_2 and AA waveforms.

2.1.32.4

2. Measured parameters: $EtCO_2$, $FiCO_2$, EtN_2O, FiN_2O, FiO_2, EtO_2, EtAA, FiAA and MAC.

Specifically, AA stands for any of the following anesthetic agents: Des (Desflurane), Iso (Isoflurane), Sev (Sevoflurane), or Hal (Halothane).

NOTE: **If the AG module does not detect the N_2O, the monitoring value of N_2O will not displayed on the Main Screen.**

The rated respiration rate for the AG module is 2 to 100 bpm. The data sampling rate is 25 Hz.
The peak value of the CO_2 waveform in the corresponding breathing cycle applies as the $EtCO_2$ gas reading. The peak value of the O_2 waveform in the corresponding breathing cycle applies as the O_2 gas reading. The EtN_2O and EtAA values at the time of the recorded CO_2 waveform apply as the EtN_2O and EtAA gas readings.

7.2 MAC Values 2.1.32.5.

Minimali alveolių koncentracija gali būti rodoma ekrane, kai anestezijos sistema sukonfigūruota su išoriniu AG moduliu

The minimum alveolar concentration (hereinafter referred to as MAC) can be displayed on the screen when the anesthesia system is configured with external AG module.

MAC is a basic index indicating the depth of inhaled anesthesia. The ISO 80601-2-55 defines MAC as follows: alveolar concentration of an inhaled anesthetic agent that, in the absence of other anesthetic agents and at equilibrium, prevents 50% of subjects from moving in response to a standard surgical stimulus.

The following table lists 1 MAC of various inhaled anesthetic agents.

anesthetic agent	Des	Iso	Enf	Sev	Hal	N_2O
1 MAC	6.0%	1.15%	1.70%	2.10%	0.77%	105%*

* *1 MAC of nitrous oxide can only be reached in a hyperbaric chamber.*

Table 7-1 1 MAC of various inhaled anesthetic agents

NOTE: **The data shown in this table are from ISO 80601-2-55, which are published by the U.S.Food and Drug Administration for a healthy 40-year-old male patient.**

NOTE: **In actual applications, although the gas module accounts for patient age, the effects of weight and other factors on the inhaled anesthetic agent should be considered.**

When one or more anesthetic agents are used, the formula for calculating MAC is as follow:

$$MAC = \sum_{i=0}^{N-1} \frac{EtAgent_i}{AgentVol_{age}i}$$

Kur N reiškia visų anestetikų (įskaitant N2O), kurį gali išmatuoti AG modulis, skaičių, EtAgenti reiškia kiekvienos inhaliuojamosios anestetikų rūšies galutinę potvynio koncentraciją, o AgentVolagei reiškia 1 MAC vertę, atitinkančią kiekvienai rūšiai. įkvepiamo anestetikų po amžiaus korekcijos.

2.1.32.5. Where, N stands for the number of all anesthetic agents (including N_2O) which the AG module can measure, $EtAgent_i$ stands for the end-tidal concentration of each kind of inhaled anesthetic agent, and $AgentVol_{age}i$ stands for the 1 MAC value corresponding to each kind of inhaled anesthetic agent after age correction.

The formula for calculating age correction of 1MAC is as follow:

$$MAC_{age} = MAC_{40} \times 10^{(-0.00269 \times (age - 40))}$$

NOTE: **The formula above is only available for patients who are older than one year old. If the patient is less than one year old, the system will use one year old to do age correction.**

For example, the AG module measures that a 60-year-old patient's end-tidal concentrations of Iso is 0.9% and that of N_2O is 50%. Based on the above age correction formula, the 1 MAC value of Iso is 1.01% and that of N_2O is 92.7% for the 60-year-old patient, and the MAC value is:

$$MAC = \frac{0.9\%}{1.01\%} + \frac{50\%}{92.7\%} = 1.4$$

2.1.24 2.1.31.

7.3 Agent Usage Calculation

CAUTION: The Agent Usage Calculation feature is intended for management purposes only and shall not be used as a basis for clinical decision-making.

The agent usage is displayed on the standby screen. The agent usage accumulates from 0 when the anesthesia system exits the standby mode. When the anesthesia system enters standby, the agent usage stops accumulating.

Lakaus anestetiko suvartojimas vienos procedūros metu

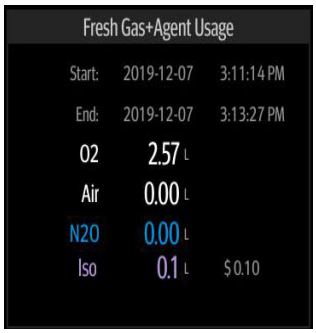

Figure 7-1 Agent Usage Calculation

Enable or disable the Agent Usage Calculation feature following the steps below:

1. Select the soft key > [**System**] soft key (system password required) > [**Setup**] > [**Optimizer**] soft key.
2. Set the [**Agent Usage**] to (off) or (on). If the [**Agent Usage**] is set to (off), no agent usage data is displayed on the Main Screen. If the [**Agent Usage**] is set to (on), the agent usage is displayed on the Main Screen.

agento suvartojimas parodomas pagrindiniame ekrane

7.4 Agent Consumption Speed

CAUTION: The Agent Consumption Speed feature is intended for management purposes only and shall not be used as a basis for clinical decision-making.

The anesthesia system supports calculation of the agent consumption speed and cost.

Figure 7-2 Agent Consumption Speed

Enable or disable the Agent Consumption Speed feature following the steps below:

1. Select the soft key > [**System**] soft key (system password required) > [**Setup**] > [**Optimizer**] soft key.
2. Set the [**Agent Usage**] to (off) or (on). If the [**Agent Usage**] is set to (off), no agent consumption speed is displayed on the Main Screen. If the [**Agent Usage**] is set to (on), the agent consumption speed is displayed on the Main Screen.
3. Set the Cost/ml of Liquid Agent. When the [**Agent Usage**] is set to (on), the cost of used agent is displayed on the Main Screen.

7.5 Identify External AG Module

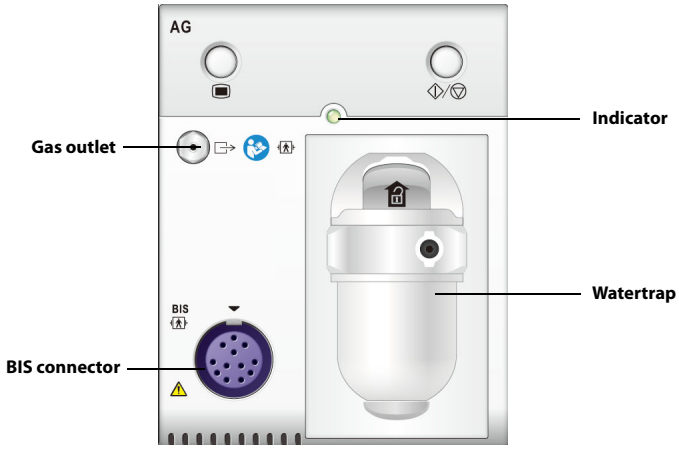

Figure 7-3 External AG module

NOTE: **The AG module is configured with an automatic barometric pressure compensation feature.**

NOTE: **The buttons on the AG module have been disabled.**

NOTE: **The indicator will flash when the module performs a self-test or when the communication between the module and the system is abnormal. The indicator is on when the communication between the module and the system is normal.**

7.6 AG Measurement Preparation

1. Select the appropriate watertrap according to patient type and attach it to the watertrap socket.
2. Connect one end of the gas sampling tube to the watertrap.
3. Connect the other end of the gas sampling tube to the patient via the airway adapter.
4. Connect the exhaust tube to the gas outlet on the module to channel the sample gas back to the patient circuit.

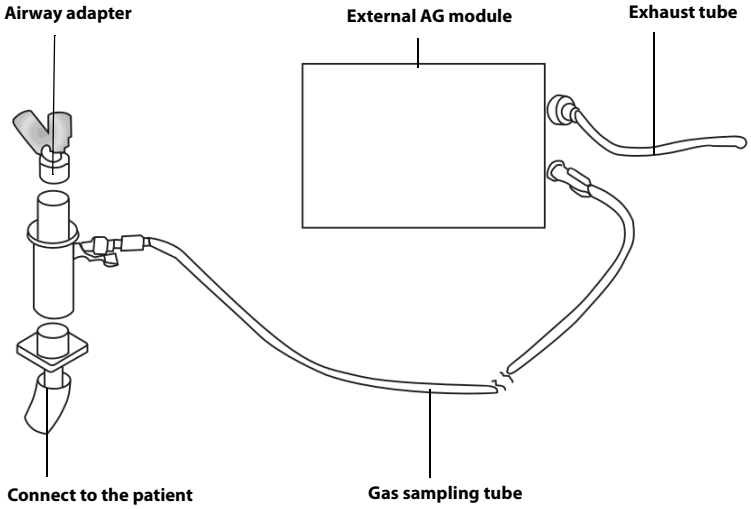

Figure 7-4 AG Measurement Preparation

CAUTION: Position the airway adapter properly so that the part connecting to the gas sampling tube is pointing upwards. This prevents condensed water from entering the gas sampling tube and causing an occlusion as a result.

CAUTION: The watertrap collects water drops condensed in the sampling tube and therefore prevents them from entering the module. If the collected water reaches a certain amount, you should drain it to avoid airway blockage.

CAUTION: The watertrap has a filter preventing bacterium, vapor and patient secretions from entering the module. After a long-term use, dust or other substances may compromise the performance of the filter or even block the airway. In this case, replace the watertrap. Replacing the watertrap once a month is recommended.

WARNING: Do not use the watertraps designed for adults/pediatric patients on infant patients. Otherwise it may cause injuries to the patients.

WARNING: Make sure that all connections are reliable. Any leak in the system can result in erroneous readings due to patient breathing gas mixed with ambient air.

7.7 AG Module Settings

You can do the following settings when the anesthesia system is configured with an external AG module.

7.7.1 Set Operating Mode

When the anesthesia system enters standby mode, then the AG module will also enter its standby mode. When the anesthesia system exits from standby mode, the AG module will also exit from its standby mode and enter measurement mode.

7.7.2 Set AG Flow Rate

To change the AG flow rate:

1. Select the  soft key > [**AG**] soft key.
2. Select the [**Flow Rate**] soft key.
3. Select an appropriate flow rate.
4. Select  to close the dialog box and confirm the changes.

7.7.3 Set CO_2 Unit

To change the CO_2 Unit:

1. Select the  soft key > [**System**] soft key (system password required) > [**Setup**] > [**Language/Unit**] key.
2. Select the [**CO_2 Unit**] key.
3. Choose between mmHg, kPa and %.
4. Select  to close the dialog box and confirm the changes.

7.7.4 Set CO_2 Scale

To change the CO_2 scale:

1. Select the  soft key > [**AG**] soft key.
2. Select the [**CO_2 Scale**] soft key.
3. Choose the appropriate scale.
4. Select  to close the dialog box and confirm the changes.

7.7.5 Set O_2 Scale

To change the O_2 scale:

1. Select the  soft key > [**AG**] soft key.
2. Select the [**O_2 Scale**] soft key.
3. Choose the appropriate scale.
4. Select  to close the dialog box and confirm the changes.

7.7.6 Set N_2O Scale

To change the N_2O scale:

1. Select the  soft key > [**AG**] soft key.

2. Select the [**N_2O Scale**] soft key.
3. Choose the appropriate scale.
4. Select  to close the dialog box and confirm the changes.

7.7.7 Set AA Scale

To change the AA scale:

1. Select the  soft key > [**AG**] soft key.
2. Select the [**AA Scale**] soft key. AA stands for any of the following anesthetic agents: Des (Desflurane), Iso (Isoflurane), Sev (Sevoflurane), or Hal (Halothane).
3. Choose the appropriate scale.
4. Select  to close the dialog box and confirm the changes.

7.7.8 Set Alarm Limits

Users can set the high and low alarm limits of N_2O, CO_2, O_2 and agents to keep alarm conditions consistent with patient needs. The alarm is then triggered when the parameter value is greater than the High Limit or lower than the Low Limit.

NOTE: **When using the anesthesia system, ensure that the alarm limits of each parameter are set to the appropriate values for the patient.**

1. On the Main Screen, select the [**Alarms**] soft key > [**Agents**] tab.
   Or
   select the monitoring area to display the alarm limits settings menu.
2. Select the soft key of the parameter you want to change.

NOTE: **When the monitoring value on the Main Screen flashes due to an alarm, select the flashing area to open the corresponding Alarm Limits setting menu.**

3. Enter the desired parameter value using the keyboard on the screen. For each parameter, the range of values is displayed above the keypad.
4. You can select the [**Load Alarm Defaults**] button to restore the default values. This restores the high and low limits of parameters to the user default values.
5. Select to save the changes (or select to discard the changes).

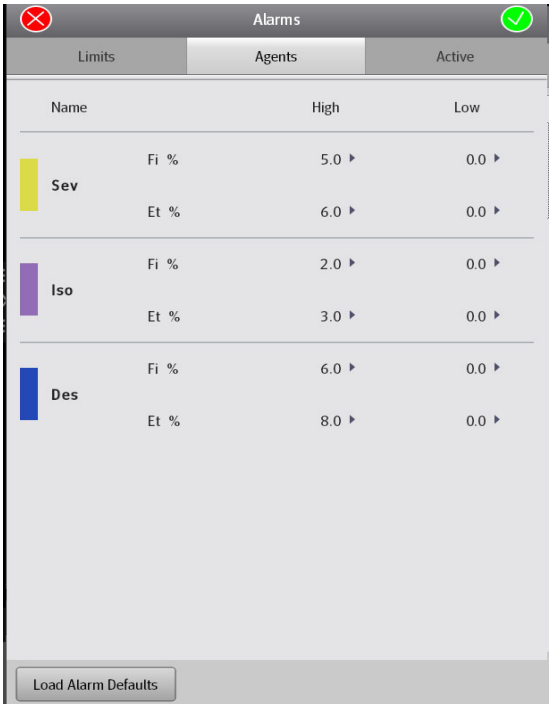

Figure 7-5 [**Agents**] tab

7.8 Measurement Limits

The following factors may reduce measurement accuracy:

- Leakage or internal sample gas leakage
- Mechanical shock
- Humidity or condensate
- Cyclic pressure greater than 10 kPa (100 cmH_2O)
- Other interference source (if present)

NOTE: **The output gas data of the anesthesia module will be zero if the measured concentration is below the defined threshold for more than 3 seconds.**

NOTE: **Inaccuracy is specified at 10-55 °C operating temperature and default compensated for an H_2O partial pressure of 11 mBar (i e 22 °C @40% RH ambient conditions) and using a DRYLINE™ sampling system. Any other ambient H_2O partial pressure will dilute the gas sample to a different extent, causing a measurement error. Under typical operating conditions this effect is negligible. An increase of the ambient H_2O partial pressure to 30 mBar (i e 28 °C @80% RH or 33 °C @60% RH) will cause a general error for all measured gases of -2%$_{REL}$. For automatic compensation of the ambient humidity effect on the gas sample composition, the actual ambient H_2O partial pressure can be input to AION™ from the host via the communication interface.**

7.9 Troubleshooting

If the gas inlet (including watertrap, sampling tube and airway adapter) is occluded by condensed water, airway occlusion will be prompted on the screen.

To remove the occlusion:

- Check the airway adapter for occlusion and replace it if necessary.
- Check the sampling tube for occlusion or kinking and replace it if necessary.
- Check the watertrap for water accumulation. Empty the watertrap. If the problem persists, replace the watertrap.

If the problem persists, internal occlusions may exist. Contact your service personnel.

If the exhaled O_2 concentration is higher than the inhaled O_2 concentration, it may be because of an overly low pump rate. It is recommended to set [**Pump Rate**] to [**High**].

7.10 Sample Gas Recirculation

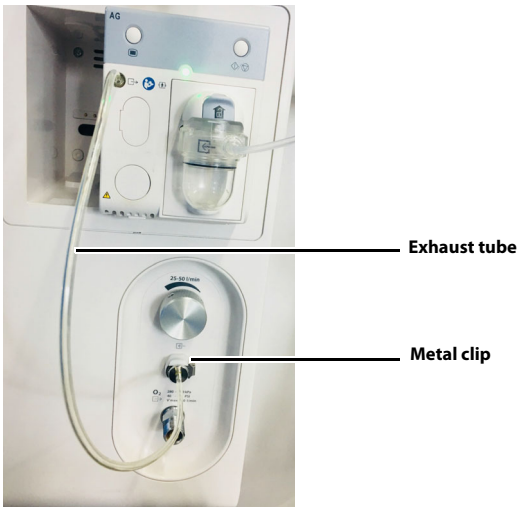

Figure 7-6 Sample gas recirculation

To return the sample gas to the patient circuit, plug the exhaust tube into the sample gas return port marked . A snap indicates that the connector of the exhaust tube is installed in place, as shown above. Depress the metal clip to pull out the exhaust tube.

WARNING: **When using AG module to perform AG measurements on the patient who is receiving or has recently received anesthetic agents, you must connect the gas outlet on the module to the sample gas return port to return the sample gas to the patient circuit, preventing the medical staff from breathing in the anesthetic agent.**

WARNING: **When the Sample Gas Recirculation feature is enabled, please install a breathing system filter compliant with the ISO 23328-1 and ISO 23328-2 standards on the patient end.**

NOTE: **The sample gas recirculation will not impact the measuring precision.**

7.11 Calibrate the AG Module

Prepare the following before doing the calibration:

- Gas cylinder: contains a standard or mixed gas. The gas concentration should meet the following requirements: AA>1.5%, CO_2>1.5%, N_2O >40%, O_2>40%. AA represents an anesthetic gas.
- T-shape connector
- Breathing tubes

Follow the steps below to calibrate the AG module:

1. Use the T-shape connector to connect the gas cylinder, gas bag and sampling tube as follows.

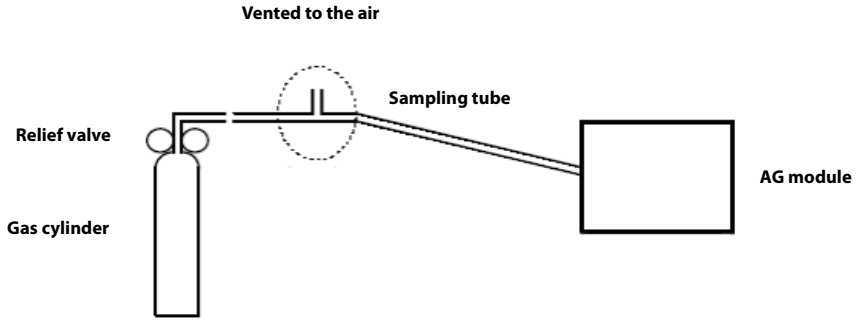

Figure 7-7 Calibrate the AG module

2. Ensure that the system is in Standby mode. Otherwise, select the [**End Case**] soft key on the Main Screen and follow the on-screen prompts to enter the standby mode.
3. Select the  soft key > [**System**] soft key (system password required).
4. Select the [**Calibrate**] soft key.
5. Select the [**AG Module**] or [**Internal AG Module**] soft key.
6. Wait for the AG module to be fully warmed up.
7. Enter the actual concentration of the calibration gas.
8. Turn on the calibration gas canister. The system displays the real-time concentration of calibration gas.
9. Select the [**Begin**] soft key to start calibrating the AG module. The system will display the results of the calibration status when the process is completed.
10. Select the [**Done**] soft key after the calibration is successful. If the calibration failed, select the [**Retry**] soft key to calibrate the module again.
11. Select  to close the window.

8.0 BIS Monitoring

8.1 Introduction

BISx and BISx4 monitors the state of the brain by monitoring the EEG signals. BIS (bispectral index) is used to monitor the effects of certain anesthetic agents, to help reduce the incidence of patient regaining consciousness during general anesthesia or sedation. BISx is used for BIS monitoring of unilateral cerebral hemisphere, BISx4 is used for BIS monitoring of unilateral or bilateral cerebral hemisphere. BISx4 can be used for BIS monitoring of bilateral cerebral hemisphere only when Bilateral sensor is connected. BISx and BISx4 equipment must be used under the guidance of professional medical personnel or professionally trained personnel. The anesthesia system provides protection for the operators and patient during cardiac defibrillation. This protection is achieved via the isolation barrier within the BISx.

8.2 Identify BIS Module

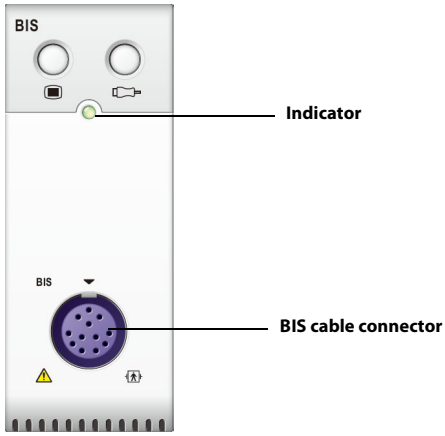

Figure 8-1 BIS Module

8.3 Safety Information

For patients with neurological disorders, patients taking psychoactive medication and children under one year old, BIS values should be interpreted cautiously due to the limited clinical experience.

WARNING: The conductive parts of sensors and connectors should not come into contact with other conductive parts, including earth.

WARNING: To avoid the hazard of burns during the high-frequency surgery, the BIS sensor should not be placed between the surgical site and the electro-surgical unit return electrode.

WARNING: The BIS sensor must not be placed between defibrillator pads when the defibrillator is used on a patient.

WARNING: Aspect is the manufacturer of the BIS module and its accessories. Should you have any clinical questions about the BIS feature, read the documentation provided by Aspect or go to Aspect website (www.aspectmedical.com) to get in touch with the company.

WARNING: BIS serves as an auxiliary feature only for clinical diagnosis and training.

WARNING: The clinical performance, risks/benefits and application of the BIS feature for pediatric patients are not fully verified and assessed.

WARNING: **Using auxiliary equipment that does not conform to the safety requirements of the equipment may compromise the safety level of the system. Considerations for selection should include:**

- **Use of the accessory in the patient vicinity.**
- **Evidence shows that safety of the accessories has been verified in accordance with the national standards equivalent to IEC60601-1 and/or IEC60601-1-1.**

NOTE: **To reduce the risks of burns during using a brain stimulation device (such as Transcranial Electrical Stimulation Motor Evoked Potential, or TES-MEP for short), place the stimulating electrode as far away as possible from the BIS sensor and ensure that the sensor is installed following the documentation in the package.**

NOTE: **If the 1-nA, 128-Hz impedance check signal interferes with another equipment (such as the evoked potential monitoring), you may need to cancel connecting the impedance check.**

NOTE: **If you use the correct BIS sensor electrode and place the electrode following the manufacturer's instructions, the display can resume normal display within 30 seconds after defibrillation.**

8.4 Monitoring Procedure

1. Connect the BISx or BISx4 device to the BIS module.

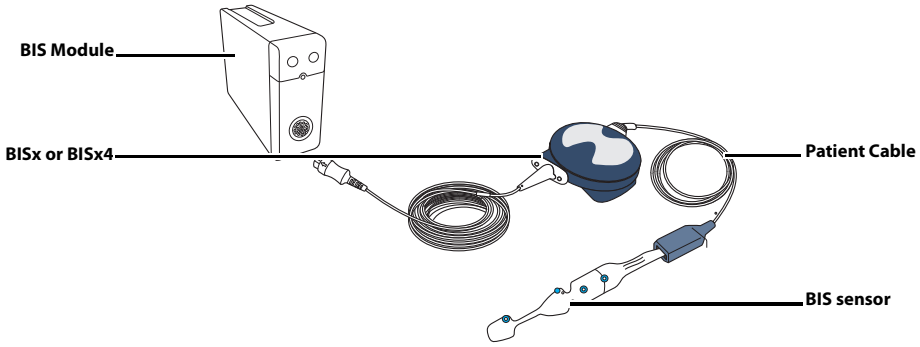

Figure 8-2 Device Connection

2. Use the attachment clip on the back of BISx or BISx4 equipment to keep the equipment fixed at an appropriate position near the patient, but not above the level of the patient's head.
3. Connect the BISx or BISx4 device to the patient cable.
4. Attach the BIS sensor to the patient following the instructions supplied with sensor.

NOTE: **Make sure that the patient's skin is dry. A wet sensor or corrosive substances between electrode flexible conductors (may cause short-circuit) could result in erroneous BIS and impedance values.**

5. Connect the BIS sensor to the patient cable. Once the equipment detects an effective sensor, it automatically measures the impedance values of all electrodes and displays the results on the screen.

CAUTION: **Make sure that the patient's skin is not exposed to BISx or BISx4 for a long time. Otherwise heat may accumulate and lead to discomfort.**

8.5 BIS Parameters

If the anesthesia system is configured with BIS module, there will be an area displaying BIS related monitoring parameters in parameter display area on the screen.

For BIS monitoring of unilateral cerebral hemisphere, the BIS parameter area includes the following parameters:

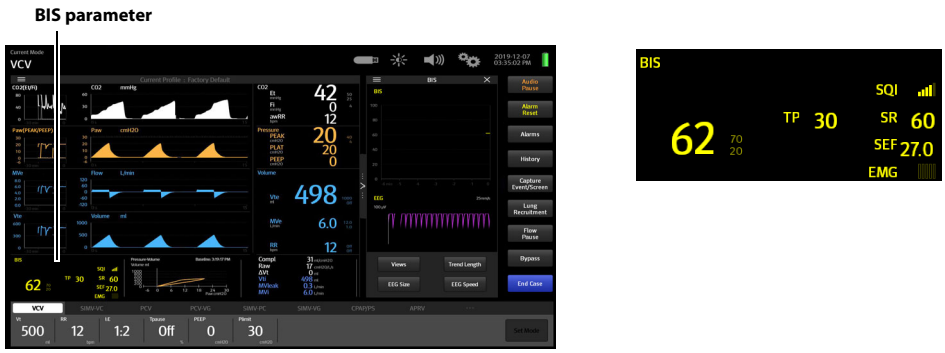

Figure 8-3 BIS monitoring parameter (unilateral cerebral hemisphere)

1. Bispectral Index (BIS)

   The BIS numeric value reflects the patient's level of consciousness. Typically, it ranges from 40 to 60 for a patient under general anesthesia during surgery.

BIS NUMERIC VALUE	DESCRIPTION
100	The patient is totally conscious.
70	The patient is in light hypnotic state but still unlikely to be awakened.
60	The patient is under general anesthesia, loses consciousness and is in moderate hypnotic state.
40	The patient loses consciousness and is in deep hypnotic state.
0	The EEG waveform is displayed as a flat line, and the patient has no electrical brain activity.

Table 8-1 BIS numeric value

2. Signal Quality Index (SQI)

The SQI numeric value reflects signal quality and provides information about the reliability of the BIS, SEF, TP, and SR numeric values during the last minute period. SQI bar chart is filled evenly based on SQI values. It ranges from 0 to 100%.

1 bar represents that SQI is in the range of 1% to 20%.

2 bars represents that SQI is in the range of 21% to 40%.

3 bars represents that SQI is in the range of 41% to 60%.

4 bars represents that SQI is in the range of 61% to 80%.

5 bars represents that SQI is in the range of 81% to 100%.

- 0 to 15%: the numeric values cannot be derived.
- 15 to 50%: the numeric values cannot be reliably derived.
- 50 to 100%: the numeric values are reliable.

3. Electromyograph (EMG)

EMG numeric value reflects the electrical power of muscle activity and high frequency artifacts. The EMG range represented by EMG bar chart is 30 to 55 dB.

1 bar represents that EMG is in the range of 31 to 35.

2 bars represents that EMG is in the range of 36 to 40.

3 bars represents that EMG is in the range of 41 to 45.

4 bars represents that EMG is in the range of 46 to 50.

5 bars represents that EMG is greater than 51.

- EMG > 55 dB: EMG bar chart is fully filled, indicating a significant electromyographical interference, and the measured data is not valuable for medical reference.
- EMG < 55 dB: this is an acceptable EMG.
- EMG ≤ 30 dB: EMG bar chart is not filled. This is an optimal EMG.

4. Suppression Ratio (SR)

SR is the percentage of time that EEG is considered to be in a suppressed state during the last 63-second period.

5. Spectral Edge Frequency (SEF)

The SEF is the frequency below which 95% of the total power can be measured.

6. Total Power (TP)

TP numeric number which monitors the state of the brain indicates the power in the frequency band ranging from 0.5 to 30 Hz. The available range is 40 to 100 dB.

7. Burst Count (BC)

A burst means a train of EEG burst pulse and there is no electrical activity of the brain followed and preceded by the period of burst activity (at least 0.5 second). The BC numeric value reflects the number of EEG bursts per minute, helping you quantify the suppression level of EEG. This parameter is only available for the BIS module of the Extend Sensor or Bilateral Sensor. BC numeric value is valid only when SQI ≥15% and SR ≥ 5%.

For BIS monitoring of bilateral cerebral hemisphere, the BIS parameter area includes the following parameters:

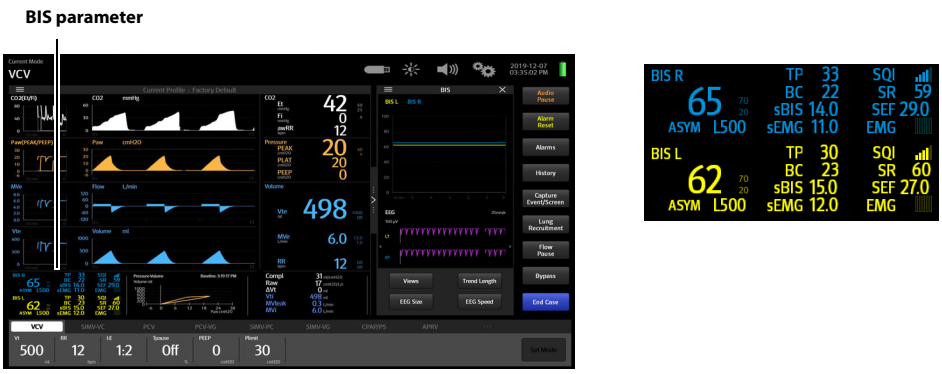

Figure 8-4 BIS monitoring parameter (bilateral cerebral hemisphere)

1. BIS L: bispectral index of left brain
   BIS R: bispectral index of right brain
2. EMG L: electromyograph of left brain (EMG L)
   EMG R: electromyograph of right brain (EMG R)
3. SR L: suppression ratio of left brain
   SR R: suppression ratio of right brain
4. SEF L: spectral edge frequency of left brain
   SEF R: spectral edge frequency of right brain
5. SQI L: signal quality index of left brain
   SQI R: signal quality index of right brain
6. TP L: total power of left brain
   TP R: total power of right brain
7. BC L: burst count of left brain
   BC R: burst count of right brain
8. BIS variability index (sBIS)
   BIS variability index represents the standard deviation of the BIS value in the last three minutes.
   sBIS L: BIS variability index of the left brain
   sBIS R: BIS variability index of the right brain
9. EMG variability index (sEMG)
   EMG variability index represents the standard deviation of the EMG value in the last three minutes.
   sEMG L: EMG variability index of the left brain
   sEMG R: EMG variability index of the right brain
10. Asymmetry (ASYM)
    Asymmetry represents the asymmetry in EEG powers of bilateral cerebral hemispheres and is the difference for percentages of EEG power present in left or right hemisphere with respect to total EEG power present in total brain.
    ASYM value with the prefix of [**L**] indicates the total power of left brain is greater than right brain.
    ASYM value with the suffix of [**R**] indicates the total power of right brain is greater than left brain.

8.6 BIS Screen

The waveforms related to BIS are shown there.

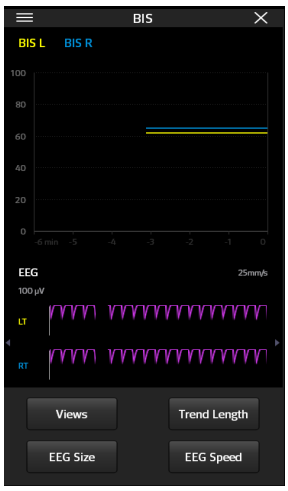

Figure 8-5 BIS screen

8.6.1 View Waveforms

Select [**Views**] softkey, and select the waveform to be viewed as needed.

8.6.2 Set Trend Length

Select [**Trend Length**] softkey, and toggle between 6 min, 12 min, 30 min and 60 min according to your need.

8.6.3 Set EEG Size

If you view EEG waveform, you can set the EEG size of this waveform. Select the [**EEG Size**] soft key, toggle between 50 µV, 100 µV, 200 µV and 500 µV according to your need.

8.6.4 Set EEG Speed

If you view EEG waveform, you can set the EEG speed of this waveform. Select the [**EEG Speed**] soft key, toggle between 6.25 mm/sec, 12.5 mm/sec, 25 mm/sec and 50 mm/sec according to your need. The larger the numeric value is, the faster the scanning speed is.

8.7 Automatic Impedance Check

By default, this check is switched on.

The Impedance Check will continuously check the impedance of the signal electrodes and the reference electrode. This check does not affect the EEG waveform. As long as the impedances are within the valid range, no prompt message or result about this check will be given.

The Impedance Check checks the impedance of ground electrode once every ten minutes and takes approximately four seconds each time. An artifact in the EEG waveform will be caused during this check, and the message [**BIS Ground Checking**] will be prompted. If the ground electrode does not pass this check, another impedance check is initiated. This continues until the ground electrode passes the check.

If the impedance check interferes with other monitors or measurements, it can be switched off.

1. Select the  soft key > [**BIS**] soft key.
2. Set [**Impedance Check**] to Off on the pop-up screen.

CAUTION: After switching off the automatic impedance check, the user will not be notified about the impedance value changes, which may lead to incorrect BIS values. Therefore, Auto Check should only be switched off if the check interferes with other measurements.

8.8 Sensor Impedance Check

Sensor impedance check measures the exact impedance of each individual electrode, and it causes a disturbed EEG waveform. During the check, the message [**Sensor Check In Progress**] will be displayed on the screen.

The check can be started by the following ways:

- The sensor impedance check is automatically initiated when a sensor is connected.
- Select the [**Views**] soft key on the BIS screen, and select [**Sensor**] in the opened options. And then select Check Sensor softkey.

The check can be stopped by the following ways:

- The sensor impedance check stops automatically if the impedances of all electrodes are within the valid range.
- Select the [**Views**] soft key on the BIS screen, and select [**Sensor**] in the opened options. And then select Stop Check Sensor softkey.

Depending on the different sensors used, the sensor check interfaces may slightly be different. This system can automatically identify the type of the used sensor, and show the corresponding electrode on the sensor check interface.

The color of each electrode indicates its status:

ELECTRODE COLOR	STATUS	DESCRIPTION	ACTION THAT SHOULD BE TAKEN
Red	Lead off	Electrode falls off and has no skin contact.	Reconnect electrode, or check the sensor-to-skin contact. If necessary, clean and dry skin.
Grey	Noise	The noise is too loud. Impedance cannot be measured.	Check the sensor-to-skin contact. If necessary, clean and dry skin.
Yellow	High	The impedance is above the high limit.	
Green	Pass	The impedance is within valid range.	No action necessary.
Blue	Unknown	In check or not performed yet	No action necessary.

Table 8-2 Result of sensor check

Although BIS may still be measured when the electrode status is Noise or High, all electrodes should be in Pass status for the best results.

8.9 View DSA

Select the [**Views**] soft key on the BIS screen, and select [**DSA**] in the opened options to call out the DSA screen.

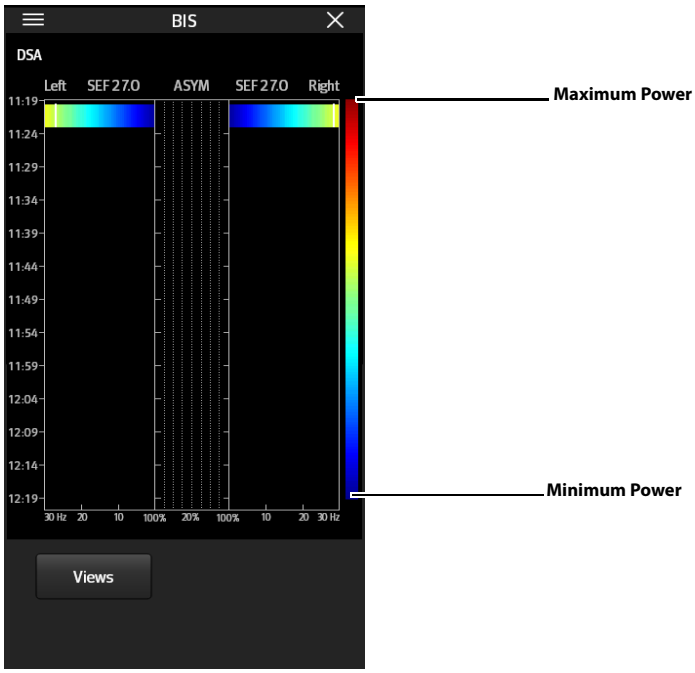

Figure 8-6 DSA

The Density Spectral Array (DSA) can visually show changes in the power spectrum distribution of bilateral cerebral hemispheres over a certain time period. The DSA represents the power spectra ranging from 49 to 94 dB. The horizontal axis of DSA chart represents a range (0 to 30 Hz), the vertical axis represents time, and color represents the amount of power. The rightmost shows the color indicator, red indicating the maximum power, and blue indicating the minimum power. The white curve on the graph represents the changes in Spectral Edge Frequency (SEF): 95% of the total power lies on the side with lower frequency; 5% of total power lies on the side with higher frequency.
The current SEF value is displayed on top of the DSA chart. The asymmetry (ASYM) graph in the center of the expansion interface can reflect the degree of asymmetry in EEG power between the left and right brain. The ASYM scale of 20% is at the center line and runs left or right to 100%. The values of ASYM<20% are not displayed on the graph, but are available in the List Trends.

8.10 BIS Setup

8.10.1 BIS Module Switch

1. Select the  soft key > [**BIS**] soft key.
2. Set [**BIS Module**] to (on) or  (off) to turn on or turn off the BIS module.

8.10.2 Impedance Check

1. Select the  soft key > [**BIS**] soft key.
2. Set [**Impedance Check**] to (on) or  (off) to turn on or turn off the automatic impedance check.

8.10.3 EEG Filter

1. Select the  soft key > [**BIS**] soft key.
2. Set [**EEG Filter**] to (on) or  (off) to turn on or turn off EEG filter function.

8.10.4 Smoothing Rate

1. Select the  soft key > [**BIS**] soft key.
2. Set [**Smoothing Rate**] to 10 Sec, 15 Sec or 30 Sec.

The smoothing rate defines how the anesthesia system calculates the BIS data on average. A smaller smoothing rate indicates increased responsiveness by the anesthesia system to changes in the patient's state. A larger smoothing rate indicates a smoother BIS trend with smaller variation, and decreased sensitivity to artifacts.

8.10.5 Displayed Parameter

1. Select the  soft key > [**BIS**] soft key.
2. Set the parameter you need to (on).

8.10.6 Set Alarm Limits

User can set the high alarm limit and low alarm limit of BIS to make the alarm conditions consistent with patient needs. The alarm is then triggered when the parameter value is greater than the High Limit or lower than the Low Limit.

NOTE: **When using the anesthesia system, ensure that the alarm limits of each parameter are set to the appropriate values for the patient.**

To set alarm limits:

1. On the Main Screen, select the [**Alarms**] soft key > [**Limits**] tab.
   Or
   select the monitoring area to display the alarm limits settings menu.
2. Select a parameter softkey.

NOTE: **When the monitoring value on the Main Screen flashes due to an alarm, select the flashing area to open the corresponding Alarm Limits setting menu.**

3. Enter the desired parameter value using the keyboard on the screen. For each parameter, the range of values is displayed above the keypad.
4. You can select the [**Load Alarm Defaults**] button to restore the default values. This restores the high and low limits of parameters to the user default values.
5. Select  to save the changes (or select  to discard the changes).

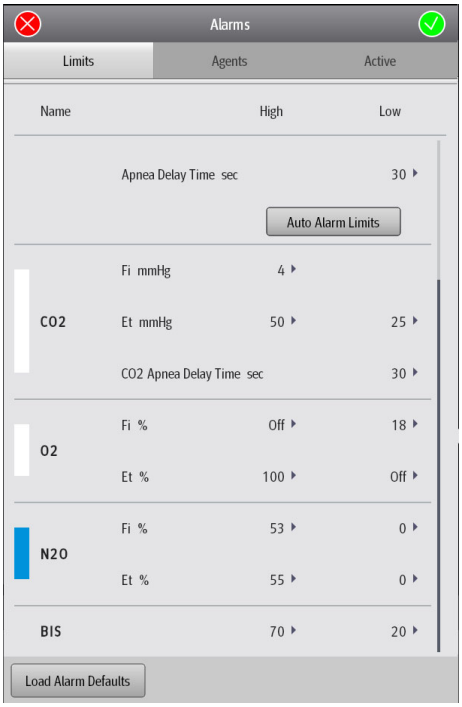

Figure 8-7 BIS Alarm limits

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9.0 NMT Monitoring

9.1 Introduction

NMT (neuromuscular transmission) module quantitatively evaluates the degree of muscle relaxation of patients under neuromuscular blockage by imposing controllable electrical stimulation to a specific motor nerve, using acceleromyography (AMG) to implement motion capture on corresponding muscle responses and extracting the features of the response signals obtained.

9.2 Identify NMT Module

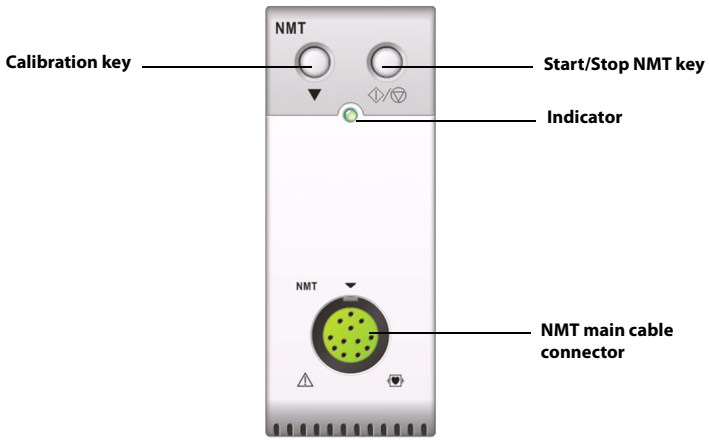

Figure 9-1 NMT module

9.3 Safety Information

WARNING: **The NMT measurement is only available for adult and children, not intended for neonatal patients.**

WARNING: **The NMT stimulation should not be applied directly on the eyes, mouth and the front of the neck (especially the carotid sinus) or the stimulation should not be applied from electrodes placed on the chest and the upper back or placed cross over the heart.**

WARNING: **Application of electrodes near the thorax may increase the risk of cardiac fibrillation.**

WARNING: **Never place the electrodes in body areas where inflammation or injury is evident.**

WARNING: **When you are connecting the electrodes or the patient cable, make sure that the connectors do not touch any other electrically conductive materials or ground.**

WARNING: **Patients with nerve damage or other neuromuscular problems may not respond properly to stimulation. The NMT measurement may show abnormal results when monitoring the status of muscle paralysis in these patients.**

WARNING: **NMT stimulation current pulses may interfere with other sensitive equipment, for example, implanted cardiac pacemakers. Do not use the NMT measurement on patients with implanted medical devices unless directed by a medical specialist.**

WARNING: **Simultaneous use of the NMT measurement with electrosurgical equipment may result in burns at the stimulation site in rare cases and can also adversely affect measurement accuracy. Make sure the negative plate of electrosurgical equipment is properly connected to the patient in order to avoid the burn at the NMT stimulation electrode.**

WARNING: Do not use the NMT measurement in close proximity to shortwave or microwave therapy devices, otherwise, the measurement result may be adversely affected.

WARNING: Never touch the stimulation electrodes during the electrical stimulation unless the stimulation has been stopped.

WARNING: Always check if the insulating barrier of the NMT sensor and the stimulation cable is in good condition and does not show signs of wear and tear before using.

WARNING: When the ambient temperature is 40 degrees Celsius, the temperature on the surface of the NMT sensor may be higher than 41 degrees Celsius, but does not exceed 43 degrees Celsius.

CAUTION: NMT monitoring can only used as an auxiliary method in patient assessment. When using it, the clinical signs and symptoms of the patient must be observed.

CAUTION: NMT stimulation can be painful to a non-sedated patient. It is recommended not to stimulate before the patient is adequately sedated.

CAUTION: Only use applicable electrodes as per doctors' advice.

CAUTION: Pay special attention to current densities exceeding 2 mA r.m.s/cm2 for any electrodes.

9.4 Stimulation Modes

The NMT measurement provides the following four stimulation modes. Some NMT stimulation modes require a little neurophysiological recovery time and during this recovery phase, no new measurement and calibration can be started.

9.4.1 TOF Mode

The TOF (Train-Of-Four) mode is the most common mode for clinical purposes.

In TOF mode, the module generates four stimulation pulses at 0.5 second intervals while measures the patient's reaction, and calculates the ratio of the fourth to the first response of the TOF sequence (TOF-Ratio).

When muscle relaxation continues to deepen, the TOF-Ratio declines until the fourth response disappears and no TOF-Ratio is calculated. At this point, the degree of muscle relaxation of the patient can be estimated from the number of responses detected (TOF-Count). The count of TOF-Count indicates how many times the response is detected in relation to 4 stimulations. The fewer the response count is detected, the deeper is the muscle relaxation.

If the proper reference response value is obtained during the calibration process, the first response amplitude T1 of each TOF measurement as percentage of the reference response value is calculated resulting in T1 %.

In TOF mode, the measurement recovery time is 10 seconds. If the calibration and measurement are initiated during this period, the module will automatically delay the calibration and measurement.

9.4.2 ST Mode

In single twitch stimulation (ST) mode, the module sends a single electrical pulse and measures the response of the patient. If the proper reference response value is obtained during the calibration process, the response value of each TOF measurement as percentage of the reference response value is calculated by the module, resulting in ST-Ratio.

When using depolarizing muscle relaxants, the ST mode is practical if TOF-Ratio does not give any additional information about the patient status. Additionally, when the doctor needs to observe the fast change of patient's muscle relaxation level, ST stimulation at a frequency of 1 Hz can provide more precise measurement and provide the muscle relaxation changes in a more real-time way.

9.4.3 PTC Mode

When muscle relaxation deepens, different parameters are needed to measure the response. When the response to the fourth stimulation disappears or the first stimulation response is very weak, the TOF-Ratio cannot be obtained and only the number of responses TOF-Count can be observed. When stimulation pulses no longer give any stimulation response, the TOF-Count cannot be obtained either. To monitor the muscle relaxation level, you can start the PTC mode.

2.1.58.2.

PTC stimulation mode starts with a sequence of four current pulses delivered at 2 Hz. If a muscle response is detected, the PTC sequence will be stopped and the response will be recorded as TOF result. If there is no muscle response, the tetanic stimulation continues to be delivered for 5 seconds with a frequency of 50 Hz, followed by a pause of 3 seconds, followed by 20 pulses delivered at interval of 1 second. The number of detected responses is counted and expressed as PTC. The fewer responses are detected, the deeper is the muscle relaxation.

After exiting the PTC mode, NMT measurements and calibration will be disabled for 20 seconds, and PTC mode can only be entered again in 2 minutes.

9.4.4 DBS Mode

Double Burst Stimulation (DBS) enables better visual observing for the fading in the responses. DBS consists of two separate trains of impulses, where each train of impulse consists of certain pulses at a frequency of 50 Hz. The response ratio of the second response to the firs response is calculated and expressed as DBS-Ratio, while the number of responses is detected and counted as DBS-Count.

The module supports DBS 3.2 mode and DBS 3.3 mode.

DBS3.2 mode: consists of two consecutive bursts of pulses at an interval of 750ms. The first burst consists of three consecutive pulses, and the second burst consists of two consecutive pulses. The interval between the pulses in the same burst is 20ms.

DBS 3.3 mode: consists of two consecutive bursts of pulses at an interval of 750ms. Each burst consists of three consecutive pulses, and the interval between the pulses in the same burst is 20ms.

In DBS mode, the measurement recovery time is 15 seconds. If the calibration or the measurement is initiated during this period, the module will automatically delay the calibration and measurement.

9.5 NMT Measurement Preparation

Before taking NMT measurement, connect the NMT cable to the NMT module. The following picture shows how NMT cable is connected with patient.

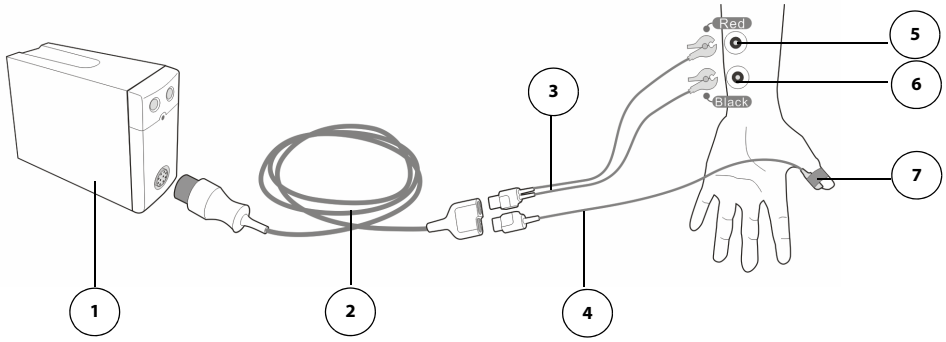

Figure 9-2 Device Connection

1. NMT module
2. NMT main cable
3. NMT stimulation cable
4. NMT sensor cable
5. Proximal electrode
6. Distal electrode
7. NMT sensor

9.5.1 Skin Preparation

Good electrode-to-skin contact is important for good stimulation quality. Before applying the electrodes, clean the application site of oil and dirt and avoid placing the electrodes over the site where there is excessive body hair or lesion. Insufficient cleaning of the skin can cause high skin impedance which could cause the stimulation to stop.

1. Select sites with intact skin and without lesion of any kind to place the electrodes.
2. Clip or shave the body hair of the application sites as necessary.
3. Gently rub the skin surface at the electrode to remove dead skin cells.
4. Thoroughly clean the sites where the electrode will be placed with mild soap and water.
5. Dry the skin thoroughly, leaving no soap residue.

9.5.2 Place Electrodes and Sensor

It is suggested you place the two stimulating electrodes to along the course of the ulnar nerves on the patient's wrist for NMT measuring. ECG electrodes for pediatric patients or neonates are recommended. It is required to use CE-certified electrodes. Make sure that the patient's thumb can move freely before installing the electrodes and sensor.

Follow the steps below to place the electrodes and sensor:

1. Place the distal electrode close to the wrist.
2. Place the proximal electrode 2 to 3 cm away from the distal electrode.
3. Attach the black electrode clamp to the distal electrode.
4. Attach the red electrode clamp to the proximal electrode.
5. Attach the sensor with its large flat side facing towards the palmar side of the thumb with adhesive tape. The cable should be attached in such a way that it does not 'pull' at the sensor and that movement of the thumb is not obstructed.

CAUTION: Pay attention not to make the two electrodes contact each other.

CAUTION: Incorrect placement of electrodes may stimulate the wrong nerves, leading to wrong muscle responses.

CAUTION: When multiple nerves are stimulated, the measured responses may be affected by other muscular activity.

CAUTION: If the stimulating electrodes are placed to near to the palm, the stimulating pulses may directly stimulate the muscle.

CAUTION: A too strong stimulation current may produce a too strong stimulus to the muscle.

CAUTION: Moving or touch the patient during measurement may lead to inaccurate measurement results.

CAUTION: Make sure that the NMT stimulation cable is not in contact with an external pacemaker or vessel lines.

CAUTION: To avoid electrical shocks, do not touch the electrodes before the NMT stimulation is stopped.

CAUTION: Take care to handle the NMT sensor, avoiding forcefully striking the sensor.

CAUTION: After repositioning the patient, check that the NMT sensor is still placed properly and that the thumb can move freely.

NOTE: Correct positioning of the electrodes is important. Even slight displacement may result in considerable changes in stimulation current that the patient receives. Furthermore, the electrodes must be positioned in such a way that avoids direct stimulation to the muscle.

NOTE: It is observed that applying slight pressure on the electrodes may improve the stimulation considerably, so we recommend that fix the electrodes to the skin with tapes.

NOTE: The further the sensor is placed on the thumb, the stronger the acceleration signal is. The signal strength can be adjusted by adjusting the placement of the sensor.

NOTE: **The arm where the electrodes and sensors are attached should be kept immobile during the whole NMT measurement procedure.**

9.6 NMT Calibration

The strength of the sensor signal received varies from patient to patient. The reference response amplitude is determined through NMT calibration. The reference response amplitude is the twitch occurred from the supramaximal stimulation current when the muscle of patient is not paralyzed.

CAUTION: **Start calibration before the administration of a muscle relaxant drug to prevent voluntary muscle contraction and tension from interfering with the reference search.**

The stimulation current for calibration can be defined by the user, or searched by the module. The current searched by the module is the supra current. If the [**Stimulation Current**] is set to [**Supra (60mA)**], the module will automatically search for the supra current to identify the reference response amplitude. If a value between 1 mA and 60 mA is set for the Stimulation Current, the module will use this setting value to determine the reference response amplitude. For adults, the supramaximal current amplitude is usually between 35 mA to 55 mA.

The calibration procedure is as follows:

1. Select the  soft key > [**NMT**] soft key to confirm that [**Stimulation Current**] and [**Pulse Width**] values are correctly set.
2. Open the right view of the NMT, and select the [**Calibrate**] button or press the Calibrate key on the module to start calibration.

If calibration fails, the NMT module will automatically use the default value as the reference amplitude.

NOTE: **Nerve stimulation may cause pain, so it is recommended that perform the calibration after administration of anesthetics.**

NOTE: **Changing the stimulation current or pulse width invalidates the reference response amplitude value, and recalibration is required before the measurement due to the changes in stimulation energy.**

9.7 NMT Measurement

NMT measurement can be started in the following approach:

- Press the Start/Stop key on the NMT module, or
- Select [**Start NMT**] in the right view of the NMT, or
- Select the [**Settings**] button in the right view of the NMT and select the quick key of the desired mode: TOF, ST, DBS or PTC in the pop-up menu.

Press the Start/Stop key on the NMT module again, or select [**Stop NMT**] in the right view of the NMT to stop the NMT measurement immediately.

NOTE: **If you need to change the NMT settings during the measurement, stop the measurements, change the settings, and then restart the measurements.**

NOTE: **Take care when removing the sensor from the patient after measurement is complete. Do not pull on the cable.**

9.8 NMT Setup

9.8.1 Setting Stimulation Mode

The NMT measurement provides four stimulation modes: TOF, ST, DBS, and PTC. Select the [**Settings**] button in the right view of the NMT and set the stimulation mode in the pop-up menu. For the DBS mode, select the  soft key > [**NMT**] soft key to set the [**DBS Mode**] to [**DBS 3.3**] or [**DBS 3.2**].

9.8.2 Setting Measurement Interval

Measurement interval is the time interval between two NMT measurements. This function is not available in the PTC mode. Select the [**Settings**] button in the right view of the NMT and set the intervals in the pop-up menu.

9.8.3 Setting Stimulation Current

Before performing the NMT calibration and measurement, confirm that the desired stimulus current value is selected.

You can use supramaximal current or set a current value between 1 and 60 mA. For adults, the supramaximal current amplitude is usually between 35 mA to 55 mA. Smaller currents may be desirable for children.

Changing stimulation current invalidates the reference response amplitude value obtained during the calibration, and recalibration is required.

Select the  soft key > [**NMT**] soft key and select the [**Stimulation Current**] button to assign an appropriate value.

9.8.4 Setting Pulse Width

You can increase the pulse width to increase the effect of the stimulation to help finding the supramaximal stimulation current.

Changing pulse width invalidates the reference response amplitude value obtained during the calibration, and recalibration is required.

Select the  soft key > [**NMT**] soft key and select the [**Pulse Width**] button to assign an appropriate value.

9.8.5 Enabling Block Recovery Note

Block recovery indicates that the patient is responding more sensitive to the stimulation and the degree of neuromuscular block is decreasing. The block recovery note alerts you when the patient reaches the set block recovery threshold. The note can be used to help maintain a certain muscle relaxation level of the patient.

Select the  soft key > [**NMT**] soft key and set [**Block Recovery**] to  (on) to enable block recovery alerts. If [**Block Recovery**] is set to  (off), the anesthesia system will not give an alert.

9.8.6 Setting Stimulation Beep Volume

You can select the volume adjustment icon on the Main Screen, and adjust the [**NMT Beep Volume**] on the pop-up screen. The anesthesia system gives a beep at the selected volume at each stimulation pulse if [**NMT Beep Volume**] is set to a value other than 0.

9.9 NMT Parameters

The following table provides the NMT measurement parameters in different stimulation modes:

STIMULATION MODE	PARAMETER	PARAMETER UNIT	MAXIMUM BARS
TOF	TOF ratio	%	4
	TOF count	/	4
ST	ST ratio	%	1
	ST count	/	1
PTC	PTC	/	/
DBS	DBS ratio	%	2
	DBS count	/	2

Table 9-1

If the anesthesia system is configured with the NMT module, there will be an area displaying NMT related monitoring parameters in the Waveforms tab.

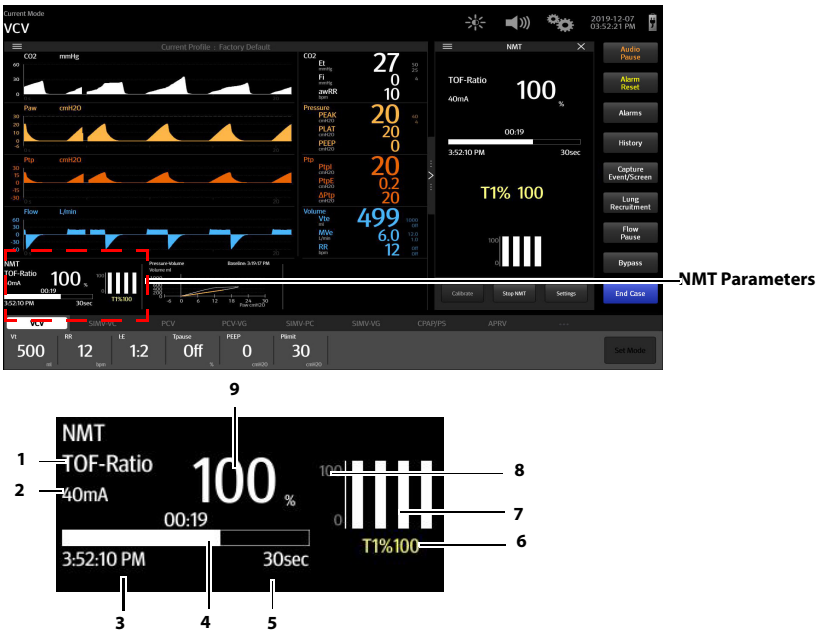

Figure 9-3 NMT Parameter

1. Parameter name
2. Stimulation Current
3. Time of last finished measurement
4. Measurement countdown: time to start the next measurement. The measurement countdown will not be shown if Interval is set to Manual.
5. Intervals: If [**Intervals**] is set to [**Manual**], [**Manual**] is displayed here.
6. T1 %: response to first stimulus as percentage of the reference response amplitude in TOF mode. This value will not be shown if calibration is not completed successfully.
7. Stimulation response bar graph: amplitude of response to the stimulation. The maximum height of the bar graphs is 120 %.
8. Scale: displays the scale of the amplitude of response to stimulation. The scale will not be shown if calibration is not completed successfully.
9. Parameter value

9.10 Recovering NMT Calibration Information

In the event of a brown-out of the NMT module, or when the NMT module is transferred to another equipment together with the patient, you can use the recovery feature if you want to continue with the measurement and use the obtained calibration information including stimulation current, pulse width, and reference response amplitude.

Select the [**Settings**] button in the right view of the NMT and select the [**Reload Value**] button in the pop-up menu to restore the calibration information.

10.0 Alarms and Messages

10.1 Introduction

The system provides alarms and messages that are indicated to the user by visual and audible alerts. Alarms and messages display at the top of the Main Screen and in the Alarms window (See Figure 10-1). Users can adjust alarm properties, which include setting alarm limits to trigger alarm conditions, adjusting alarm volume, and pausing alarm audio(See Figure 10-1).

Figure 10-1 Alarms and messages on the Main Screen

10.1.1 Alarm System Self-Test

The system performs a self-test of its alarm system when powered on. The self-test is described as follows:

- During the self-test, the alarm LED will illuminate in sequence with the colors red, yellow, and cyan for approximately 1 second each color.
- The system speaker produces one tone after the alarm light is in self-test.

10.1.2 Types of Alarms and Messages

The equipment provides the following types of alarms and prompt messages. See (Pages 10-12) 10.8 "Alarms and Prompt Messages" for a list of alarms and prompt messages.

- **Physiological Alarm:**
  Patient-related variables cause physiological alarms. These alarms require a user response. Physiological alarms can have the following priorities: high, medium, and low.
- **Technical Alarm:**
  Machine-related variables cause technical alarms. These alarms require a user response. Technical alarms can have the following priorities: high, medium and low.
- **Prompt Message:**
  This is a message to the user. They do not require an immediate user response. These messages always have the lowest priority, below physiological and technical alarms. It is displayed in white.

10.1.3 Alarm Indicators

The equipment provides the following alarm indicators:

- **Alarm LED located on the top of LCD monitor.** The LED can illuminate in red, yellow, cyan, or OFF, depending on the alarm condition.

  Table 10-1 describes the alarm behavior of various alarm types and various alarm priority levels. If multiple alarms occur simultaneously, the audio and LED behavior will follow the active alarm with the highest priority.

- **Colored alarm messages displayed on the Main Screen.** High priority messages are red. Medium priority messages are yellow. Low priority messages are cyan. Prompt messages are white. Messages display according to priority and time. (See "Display Rules of Alarm Messages" on Pages 10-5.)

- **Alarm audio from the system alarm speaker.** Table 10-1 lists the audio behavior for each type of alarm.

ALARM TYPE	ALARM PRIORITY	AUDIO BEHAVIOR	MESSAGE BEHAVIOR	ALARM LED COLOR
Physiological Alarm	High	Play high priority alarm sounds at an interval of 5 ± 1 seconds.	White text on red background, high priority icon. 	Red
	Medium	Play medium priority alarm sounds at an interval of 5 ± 1 seconds.	Black text on yellow background, medium priority icon. 	Yellow
	Low	Play low priority alarm sounds at an interval of 17 ± 1 seconds.	White text on cyan background, low priority icon. 	Cyan
Technical Alarm	High	Play high priority alarm sounds at an interval of 5 ± 1 seconds.	White text on red background, high priority icon. 	Red
	Medium	Play medium priority alarm sounds at an interval of 5 ± 1 seconds.	Black text on yellow background, medium priority icon. 	Yellow
	Low	Play low priority alarm sounds at an interval of 17 ± 1 seconds.	White text on cyan background, low priority icon. 	Cyan
Prompt Message	None	None	Black text on white background	Off

Table 10-1 Alarm indicators (audio and on-screen messages)

10.2 Alarm Display

On the LCD monitor screen, alarm messages are automatically displayed on the top of the Main Screen when alarm conditions are met (see Figure 10-1).Additionally, a list of all active alarms can be found in the Alarms window (see Figure 10-2).

Each message is displayed with an associated priority symbol as follows:

- High priority !!!
- Medium priority !!
- Low priority !

To display a list of all active alarms:

1. On the Main Screen, select the [**Alarms**] soft key or touch the Alarm Message area on the top of the screen.
   The Alarms window displays.
2. Select the [**Active**] tab.
   A list of all active alarm messages is displayed (Figure 10-2).
   Alarms are displayed in order of priority and time.

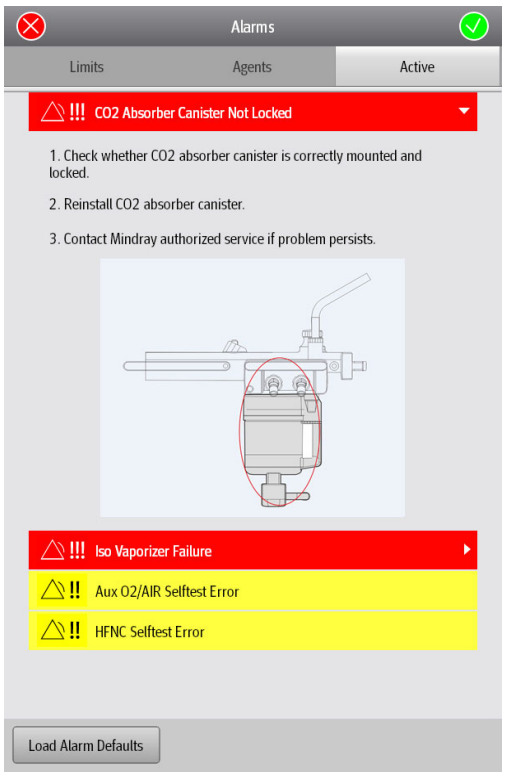

Figure 10-2 Active Alarms list in the Alarms window

10.2.1 Display Rules of Alarm Messages

Alarm messages are displayed in order of priority and time of occurrence.

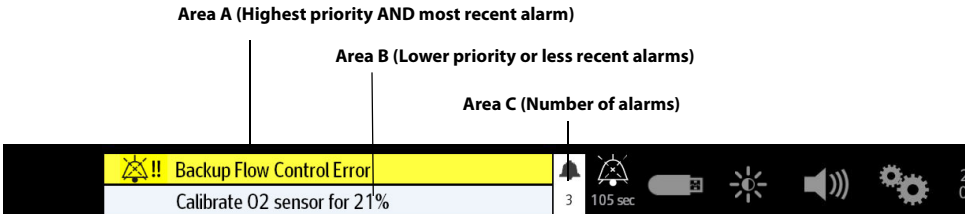

Figure 10-3 Display Rules of Alarm Messages

Alarm messages are displayed in Area A, Area B and Area C, according to the following rules:

- To be in Area A, an alarm must be both the highest priority AND the most recent (Area A does not cycle). The remaining active alarms and prompt messages cycle in Area B.
- New Alarms with lower priority than alarms in Area A are displayed directly in Area B, and the cycle proceeds from that position in the list.
- Alarms cycling in Area B are grouped and displayed in the following order: high, medium, low, and prompt messages. In each group, the most recent alarm displays first.
- If the alarm in Area A is removed, then the most recent alarm with the highest priority from Area B is moved to Area A.
- Area C displays the number of active alarms.

10.3 Setting Alarm Volume

The Alarms Volume settings adjust the audio level of all high, medium, and low priority sounding alarms. The System Alert Volume settings adjust the audio level of all sounding pop-up prompts and non-confirmed ventilation mode alerts.

To set the Alarm Volume:

1. On the Main Screen, select the soft key.
2. Adjust the volume on the pop-up screen.

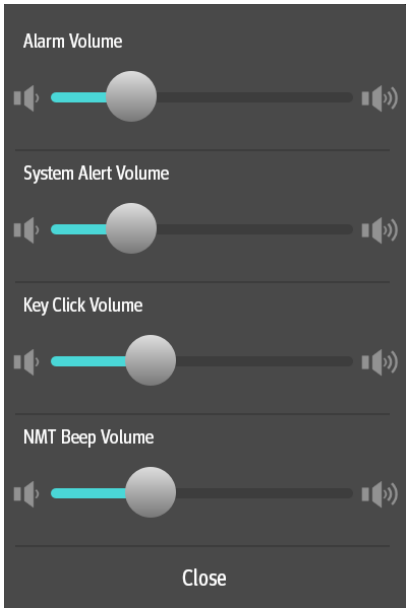

Figure 10-4 Setting Alarm Volume

WARNING: **Do not rely exclusively on the audible alarm system when using the anesthesia system. Adjustment of alarm volume to a low level may result in a hazard to the patient. Always keep the patient under close surveillance.**

NOTE: **The auditory alarm signal A-weighted sound pressure level shall be no less than 45dB and no more than 85dB.**

10.4 Pause Alarm Audio

Clicking the [**Audio Pause**] soft key will pause the alarm audio for 120 seconds, no matter whether the anesthesia system has active alarms. All the other alarming indicators work normally except the alarm audio. The alarm audio pause icon and 120 seconds countdown are displayed on the top of the screen. When [**Audio Pause**] is enabled, the audio of new alarms is also paused. After the 120 seconds countdown, the system will exit from the audio pause state. When [**Audio Pause**] is enabled, click the [**Audio Pause**] soft key again to exit from the audio pause state.

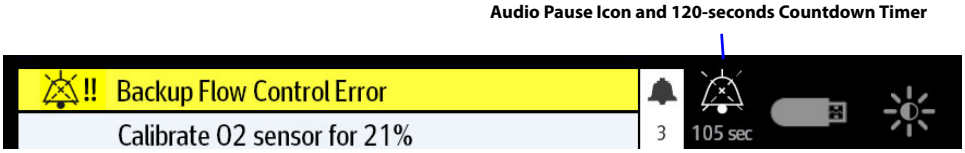

Figure 10-5 Alarm Audio Pause icon

10.5 Alarm Reset

When an alarm condition occurs and triggers an audio alarm, select the [**Alarm Reset**] soft key to pause the audio of all active alarms. If the reset alarms contain medium or high priority alarms, the alarm audio will be paused for 120 seconds. The Alarm Reset icon and the 120-seconds countdown timer are displayed on the top of the screen. Select the soft key again to resume the alarm audio. When the alarms are reset, all the alarming indicators work normally except the alarm audio.

NOTE: **If a new alarm occurs, the new alarm will sound even when the system is in an Alarm Reset status. In this case, you can select the [Alarm Reset] soft key again to pause the new alarm audio and reset the countdown to 120 seconds.**

Figure 10-6 Alarm Reset icon

If the reset alarms contain only low priority alarms, the alarm audio will be turned off. If a new alarm occurs, the new alarm will sound.

NOTE: **If a new alarm occurs, the new alarm will sound if the new alarm is a low priority one even when the alarm audio is turned off. In this case, you can select the [Alarm Reset] soft key again to turn off the alarm audio. If the new alarms occurred contain medium or high level alarms, then the new alarm audio will sound. In this case, you can select the [Alarm Reset] soft key again to pause the new alarm audio and start a 120-seconds countdown.**

Figure 10-7 Alarm Audio Off icon

10.6 Setting Alarm Limits

Users can set the limits of PEAK, MV, Vte, RR, FiO_2, EtO_2, FiN_2O, EtN_2O, $EtCO_2$ and $FiCO_2$ alarms to align the alarm conditions consistent with patient needs. The alarm is then triggered when the parameter value is greater than the High Limit or lower than the Low Limit.

WARNING: During equipment use, pay frequent attention to the alarm limits of parameters to ensure that they are appropriately set. Setting the alarm limits to limiting values will render the alarming system unhelpful.

NOTE: When using the anesthesia system, ensure that the alarm limits of each parameter are set to the appropriate values for the patient.

NOTE: When the anesthesia system restarts within 60 seconds after an 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.

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.

NOTE: If the airway pressure monitoring stays lower than the lower limit of alarm for 20 seconds or one automatic ventilation cycle (depending on which one is longer), a corresponding alarm will be triggered.

NOTE: If the Vte monitoring stays higher than the upper limit of alarm for three consecutive cycles, a corresponding alarm will be triggered.

NOTE: If the Vte monitoring stays lower than the lower limit of alarm for three consecutive cycles, a corresponding alarm will be triggered.

NOTE: In the manual ventilation mode, the system will disable the [Paw Too Low] alarm, and the PEAK low alarm limit in monitoring parameters area will display [Off].

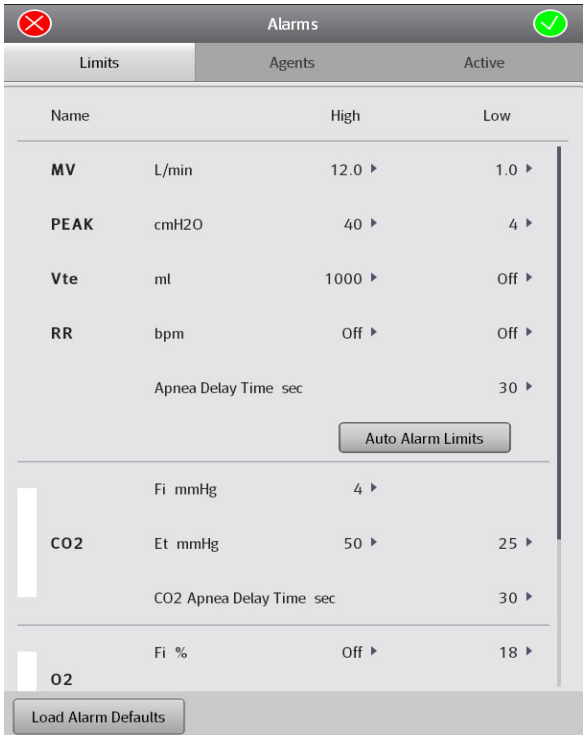

Figure 10-8 Limits Tab

To set alarm limits:

1. On the Main Screen, select the [**Alarms**] soft key > [**Limits**] tab.
   Or
   select the monitoring area to display the alarm limits settings menu.
2. Select a parameter softkey.

NOTE: **When the monitoring value on the Main Screen flashes due to an alarm, select the flashing area to open the corresponding Alarm Limits setting menu.**

3. Enter the desired parameter value using the keyboard on the screen. For each parameter, the range of values is displayed above the keypad.
4. You can select [**Load Alarm Defaults**] to restore the default values and restore the upper and lower limits of parameter alarms to the factory defaults.
5. Repeat Steps 3 and 4 for each parameter.
6. Select to save the changes (or select to discard the changes).
7. To save an alarm limit to a user profile:
   - Select the soft key > [**System**] soft key (system password required) > [**Profiles**] tab. Select a profile, and select the [**Create**] soft key. Set the profile name on the pop-up screen. After the profile is confirmed, the system will save the current profile as a user profile.
8. To load a user profile:
   - In the standby mode, select the [**Current Profile: xxxx**] soft key and select the desired profile on the pop-up screen.
   - Select the [**Manual**] ventilation mode, and select the [**Load Profile**] soft key on the pop-up screen, and then select the desired profile on the pop-up screen.

10.6.1 Auto Alarm Limits

The Auto Alarm Limits function uses an algorithm based on measured values. The relationship is shown in the table below.

When the System is in Standby mode or Manual mode, the [**Auto Alarm Limits**] button will be disabled. The [**Auto Alarm Limits**] key is also disabled when the current mode is PS, SIMV-VC, or SIMV-PC.

ALARM LIMIT	ADJUSTMENT FORMULA
PEAK High	PEAK+5 or PLAT+10, whichever is greater. Minimum: 35 cmH_2O.
PEAK Low	(PLAT-PEEP) x 0.6 + PEEP - 1 Minimum: 3 cmH_2O. Maximum (PEAK High - 1)
MV High	MV x 1.4 Minimum: 2.0 L/min
MV Low	MV x 0.6 Minimum: 0.1 L/min Maximum (MV High - 0.1)
Vte High	Vte x 1.4
Vte Low	Vte x 0.6
RR High	RR x 1.4
RR Low	RR x 0.6

Table 10-2 Auto Alarm Limits

The parameters in the formula are all measured parameters.

The alarm limits for PEAK are calculated on the basis of the average value for PEAK, PLAT, and PEEP. The value used for average uses the value of the last four ventilation cycles or the value in one minute, whichever is smaller. Spontaneous breaths by the patient are not taken into account.

The alarm limits for Vt and RR are calculated on the basis of the average value. The value used for average uses the value of the last four ventilation cycles or the value in one minute, whichever is smaller. Spontaneous breaths by the patient are not taken into account.

If there is no valid MV, Vte or RR measurement value, the corresponding alarm limits will not be adjusted.

If the average value of PEAK, PLAT, and PEEP cannot be calculated, the corresponding alarm limits will not adjust.

If the calculated alarm limit is more than the high threshold of setting range or less than the low threshold, the corresponding threshold is used as the auto alarm limit.

10.7 View Active Alarms

To display a list of all active alarms:

On the Main Screen, select the [**Alarms**] soft key or touch the Alarm Message area on the top of the screen. The Alarms window displays.

1. Select the [**Active**] tab.
   A list of all active alarm messages is displayed (Figure 10-9).

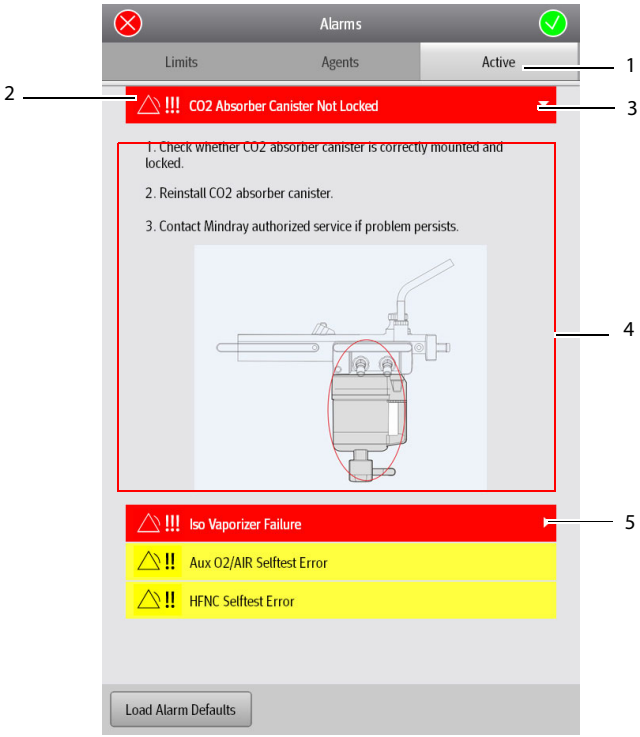

Figure 10-9 Active Alarms list in the Alarms window

2. Alarm Messages
   - Red: indicates high priority alarm.
   - Yellow: indicates medium priority alarm.
   - Cyan: indicates low priority alarm.
   - White: indicates prompt message.
3. Help information soft key
   Select the soft key to display the help information in the expanded window. Select the softkey again to close the Help information window. Only the alarms with high priority have help information.
4. Help information
5. Scroll bar
   Scroll the bar to view more alarm information.

10.8 Alarms and Prompt Messages

This section lists the following alarms and messages:

- Physiological Alarm Messages
- Technical Alarm Messages
- Prompt Message

For each alarm message, the system has provided corresponding troubleshooting measures. If the problem persists, contact your service personnel.

NOTE: The [Disable in Cardiac Bypass Mode] column indicates whether the physiological alarm is blocked in the Cardiac Bypass mode.

NOTE: The [Disable in Standby Mode] column indicates whether the physiological alarm is blocked in the standby mode.

NOTE: You can view past alarms in the [History] menu.

10.8.1 Physiological Alarm Messages

INFOR-MATION	CAUSE	ACTION	ALARM PRIORITY	DISABLED WHEN ALARM IS OFF	Disable in Cardiac Bypass Mode	DISABLE IN STANDBY MODE
Apnea	No breath has been detected within the apnea time.	1. Check alarm limit: Tapnea. 2. Check whether patient circuit is leaking or disconnected. 3. Ensure the position of Auto/ manual switch is correct.	Medium	Yes	Yes	N/A *
Apnea > 2 minutes	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 is correct.	High	Yes	Yes	N/A *
Paw Too High	Paw > high alarm limit setting.	1. Check alarm limit: PEAK High. 2. Check ventilation settings: Pinsp/ ΔPinsp, Vt, PEEP, etc. 3. Check whether patient circuit is kinked or blocked.	High	No	No	N/A *

Table 10-3 Physiological Alarm Messages

INFOR-MATION	CAUSE	ACTION	ALARM PRIORITY	DISABLED WHEN ALARM IS OFF	Disable in Cardiac Bypass Mode	DISABLE IN STANDBY MODE
Paw Too Low	Paw < low alarm limit setting for 20 seconds.	1. Check alarm limit: PEAK Low. 2. Check ventilation settings: Pinsp/ ΔPinsp, Vt, PEEP, etc. 3. Check whether patient circuit is leaking or disconnected.	High	Yes	Yes	N/A *
Pressure Limit	Paw ≥ Plimit.	Check ventilation settings: Plimit.	Low	N/A *	N/A *	N/A *
FiO_2 Too High	FiO_2 > high alarm limit setting.	1. Check alarm limit: FiO_2 High. 2. Check fresh gas O_2 setting. 3. Check fresh gas balance gas setting, and the balance gas source is connected correctly.	Medium	No	No	N/A *
FiO_2 Too Low	FiO_2< low alarm limit setting.	1. Check alarm limit: FiO_2 Low. 2. Check fresh gas O_2 setting. 3. Check whether patient circuit is leaking.	High	No	No	N/A *
MV Too High	MV > high alarm limit setting.	1. Check alarm limit: MV High. 2. Check ventilation settings: Pinsp/ ΔPinsp, Vt, RR, etc.	Medium	Yes	Yes	N/A *
MV Too Low	MV < low alarm limit setting.	1. Check alarm limit: MV Low. 2. Check ventilation settings: Pinsp/ ΔPinsp, Vt, RR, etc. 3. Check whether patient circuit is leaking or blocked.	Medium	Yes	Yes	N/A *
Vte Too High	Vte > high alarm limit setting.	1. Check alarm limit: Vte High. 2. Check ventilation settings: Pinsp/ ΔPinsp, Vt, etc.	Medium	Yes	Yes	N/A *
Vte Too Low	Vte < low alarm limit setting.	1. Check alarm limit: Vte Low. 2. Check ventilation settings: Pinsp/ ΔPinsp, Vt, etc. 3. Check whether patient circuit is leaking or blocked.	Medium	Yes	Yes	N/A *

Table 10-3 Physiological Alarm Messages

INFOR-MATION	CAUSE	ACTION	ALARM PRIORITY	DISABLED WHEN ALARM IS OFF	Disable in Cardiac Bypass Mode	DISABLE IN STANDBY MODE
RR Too High	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.	Low	Yes	Yes	N/A *
RR Too Low	RR < low alarm limit setting.	1. Check alarm limit: RR Low. 2. Check ventilation settings: RR, F-Trig, etc.	Low	Yes	Yes	N/A *
Continuous Airway Pressure Too High	Paw in the breathing circuit > continuous airway pressure alarm limit for 15 seconds. In ACGO mode, the continuous airway pressure alarm is disabled.	1. Check APL valve setting while in manual mode. 2. Check whether patient circuit or AGSS is blocked.	High	No	No	N/A *
Negative Pressure in Airway	Paw < -10 cmH_2O for 1 second.	1. Check whether the volume exchanger display stops motion. 2. Check the negative pressure suction. 3. Check whether AGSS works normally.	High	No	No	N/A *
$EtCO_2$ Too High	$EtCO_2$ > 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.	Medium	No	Yes	Yes
$EtCO_2$ Too Low	$EtCO_2$ < low alarm limit setting.	1. Check alarm limit: $EtCO_2$ Low. 2. Check whether the sampleline is disconnected.	Medium	No	Yes	Yes
$FiCO_2$ Too High	$FiCO_2$ > high alarm limit setting.	1. Check alarm limit: $FiCO_2$ High. 2. Check whether need to replace Soda Lime in the CO_2 absorber canister.	Medium	No	Yes	Yes

Table 10-3 Physiological Alarm Messages

INFOR-MATION	CAUSE	ACTION	ALARM PRIORITY	DISABLED WHEN ALARM IS OFF	Disable in Cardiac Bypass Mode	DISABLE IN STANDBY MODE
EtN_2O Too High	EtN_2O > high alarm limit.	1. Check alarm limit: EtN_2O High. 2. Check fresh gas balance gas setting.	Medium	No	No	Yes
EtN_2O Too Low	EtN_2O < low alarm limit.	1. Check alarm limit: EtN_2O Low. 2. Check whether the sampleline is disconnected. 3. Check fresh gas N_2O setting, and the N_2O source is connected correctly.	Medium	No	Yes	Yes
FiN_2O Too High	FiN_2O > high alarm limit.	1. Check alarm limit: FiN_2O High. 2. Check fresh gas balance gas setting.	Medium	No	No	Yes
FiN_2O Too Low	FiN_2O < low alarm limit.	1. Check alarm limit: FiN_2O Low. 2. Check whether the sampleline is disconnected. 3. Check fresh gas N_2O setting, and the N_2O source is connected correctly.	Medium	No	Yes	Yes
EtHAL Too High	EtHAL > high alarm limit setting.	1. Check alarm limit: EtHal High. 2. Check AA% setting.	Medium	No	No	Yes
EtHAL Too Low	EtHAL < low alarm limit setting.	1. Check alarm limit: EtHal Low. 2. Check AA% setting. 3. Check whether the sampleline is disconnected.	Medium	No	Yes	Yes
FiHAL Too High	FiHAL > high alarm limit setting.	1. Check alarm limit: FiHal High. 2. Check AA% setting.	Medium	No	No	Yes
FiHAL Too Low	FiHAL < low alarm limit setting.	1. Check alarm limit: FiHal Low. 2. Check AA% setting. 3. Check whether the sampleline is disconnected.	Medium	No	Yes	Yes
EtISO Too High	EtISO > high alarm limit setting.	1. Check alarm limit: EtIso High. 2. Check AA% setting.	Medium	No	No	Yes
EtISO Too Low	EtISO < low alarm limit setting.	1. Check alarm limit: EtIso Low. 2. Check AA% setting. 3. Check whether the sampleline is disconnected.	Medium	No	Yes	Yes

Table 10-3 Physiological Alarm Messages

INFOR-MATION	CAUSE	ACTION	ALARM PRIORITY	DISABLED WHEN ALARM IS OFF	Disable in Cardiac Bypass Mode	DISABLE IN STANDBY MODE
FiISO Too High	FiISO > high alarm limit setting.	1. Check alarm limit: FiISO High. 2. Check AA% setting.	Medium	No	No	Yes
FiISO Too Low	FiISO < low alarm limit setting.	1. Check alarm limit: FiIso Low. 2. Check AA% setting. 3. Check whether the sampleline is disconnected.	Medium	No	Yes	Yes
EtSEV Too High	EtSEV > high alarm limit setting.	1. Check alarm limit: EtSev High. 2. Check AA% setting.	Medium	No	No	Yes
EtSEV Too Low	EtSEV < low alarm limit setting.	1. Check alarm limit: EtSev Low. 2. Check AA% setting. 3. Check whether the sampleline is disconnected.	Medium	No	Yes	Yes
FiSEV Too High	FiSEV > high alarm limit setting.	1. Check alarm limit: FiSev High. 2. Check AA% setting.	Medium	No	No	Yes
FiSEV Too Low	FiSEV < low alarm limit setting.	1. Check alarm limit: FiSev Low. 2. Check AA% setting. 3. Check whether the sampleline is disconnected.	Medium	No	Yes	Yes
EtDES Too High	EtDES > high alarm limit setting.	1. Check alarm limit: EtDes High. 2. Check AA% setting.	Medium	No	No	Yes
EtDES Too Low	EtDES < low alarm limit setting.	1. Check alarm limit: EtDes Low. 2. Check AA% setting. 3. Check whether the sampleline is disconnected.	Medium	No	Yes	Yes
FiDES Too High	FiDES > high alarm limit setting.	1. Check alarm limit: FiDes High. 2. Check AA% setting.	Medium	No	No	Yes
FiDES Too Low	FiDES < low alarm limit setting.	1. Check alarm limit: FiDes Low. 2. Check AA% setting. 3. Check whether the sampleline is disconnected.	Medium	No	Yes	Yes

Table 10-3 Physiological Alarm Messages

INFOR-MATION	CAUSE	ACTION	ALARM PRIORITY	DISABLED WHEN ALARM IS OFF	Disable in Cardiac Bypass Mode	DISABLE IN STANDBY MODE
EtO_2 Too High	EtO_2 > high alarm limit setting.	1. Check alarm limit: EtO_2 High. 2. Check fresh gas O_2 setting. 3. Check fresh gas balance gas setting, and the balance gas source is connected correctly.	Medium	No	No	Yes
EtO_2 Too Low	EtO_2 < low alarm limit setting.	1. Check alarm limit: EtO_2 Low. 2. Check fresh gas O_2 setting. 3. Check whether patient circuit is leaking.	Medium	No	No	Yes
FiO_2 Too High	FiO_2 > high alarm limit setting.	1. Check alarm limit: FiO_2 High. 2. Check fresh gas O_2 setting. 3. Check fresh gas balance gas setting, and the balance gas source is connected correctly.	Medium	No	No	Yes
FiO_2 Too Low	FiO_2 < low alarm limit setting.	1. Check alarm limit: FiO_2 Low. 2. Check fresh gas O_2 setting. 3. Check whether patient circuit is leaking.	High	No	No	Yes
BIS Too High	BIS > high alarm limit setting.	Check alarm limit: BIS High.	Medium	No	No	Yes
BIS Too Low	BIS < low alarm limit setting.	Check alarm limit: BIS Low.	Medium	No	No	Yes
BIS L Too High	BIS L > high alarm limit setting.	Check alarm limit: BIS L High.	Medium	No	No	Yes
BIS L Too Low	BIS L < low alarm limit setting.	Check alarm limit: BIS L Low.	Medium	No	No	Yes
BIS R Too High	BIS R > high alarm limit setting.	Check alarm limit: BIS R High.	Medium	No	No	Yes
BIS R Too Low	BIS R < low alarm limit setting.	Check alarm limit: BIS R Low.	Medium	No	No	Yes

Table 10-3 Physiological Alarm Messages

INFOR-MATION	CAUSE	ACTION	ALARM PRIORITY	DISABLED WHEN ALARM IS OFF	Disable in Cardiac Bypass Mode	DISABLE IN STANDBY MODE
Apnea CO_2	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.	High	No	Yes	Yes

* *Not applicable. The alarm message does not exist within this mode and therefore it cannot be disabled or enabled.*

Table 10-3 Physiological Alarm Messages

10.8.2 Technical Alarm Messages

10.8.2.1 Startup Alarm Messages

NOTE: **Startup alarms will not trigger the alarm audio and alarm light.**

NOTE: **The priority of startup alarms is only displayed in the alarm log.**

NOTE: **Startup Result if Fail column indicates the result when the startup phase alarm is triggered, which may be All, Only Manual, and Non-Functional.**

NOTE: **[All] indicates that all Automatic Ventilation, Manual Ventilation, and Cardiac Bypass modes are enabled.**

[Only Manual] indicates that only Manual Ventilation and Cardiac Bypass modes are enabled.

[Non-Functional] indicates that the anesthesia system cannot be used.

INFORMA-TION	CAUSE	ACTION	ALARM PRIORITY	MACHINE MODE WHEN CHECKED	STARTUP RESULT IF FAIL
Bundle Version Error	Incompatible firmware version is installed.	Please contact Mindray Technical Support.	High	Startup	Non-Functional
Bundle Version: Timeout	Self-test result cannot be obtained due to an internal communication error.		High	Startup	Non-Functional
Flowmeter Self Test Error	1. Board self-test error. 2. Valve self-test error. 3. Branch leakage, etc.	1. Repeat the test. 2. Please contact Mindray Technical Support if the problem persists.	High	Startup	Non-Functional
Flowmeter Self Test: Time out	Self-test result cannot be obtained due to an internal communication error.		High	Startup	Non-Functional

Table 10-4 Startup Alarm Messages

INFORMATION	CAUSE	ACTION	ALARM PRIORITY	MACHINE MODE WHEN CHECKED	STARTUP RESULT IF FAIL
BFCS self-test error	BFCS self-test error	1. Restart machine to repeat the test. 2. Please contact Mindray Technical Support if the problem persists.	High	Startup	All
Aux Control Module Selftest Error	1. Board self-test error. 2. After being powered on, the CPU board failed to communicate with the auxiliary monitoring board.	1. Repeat the test. 2. Please contact Mindray Technical Support if the problem persists.	High	Startup	Non-Functional
Auxi Ctrl Module Self Test: Time out	Self-test result cannot be obtained due to an internal communication error.		High	Startup	Non-Functional
Ventilator Selftest Error	1. Board self-test error. 2. After being powered on, the CPU board failed to communicate with the ventilator.	1. Repeat the test. 2. Please contact Mindray Technical Support if the problem persists.	High	Startup	Non-Functional
Ventilator Control Board Self Test: Time out	Self-test result cannot be obtained due to an internal communication error.		High	Startup	Non-Functional
Ventilator Voltage Error	Ventilator voltage error.		High	Startup	Manual Only
PEEP Valve Failure	1. PEEP valve voltage error. 2. PEEP valve pressure error.	1. Repeat the test. 2. Please contact Mindray Technical Support if the problem persists.	Medium	Startup	Manual Only
Insp Valve Failure	1. Inspiratory valve voltage error. 2. Inspiratory valve flow error.	1. Repeat the test. 2. Please contact Mindray Technical Support if the problem persists.	Medium	Startup	Manual Only
Safety Valve Failure	Safety valve voltage error.	1. Repeat the test. 2. Please contact Mindray Technical Support if the problem persists.	Medium	Startup	Manual Only
Auto/Manual Switching Failure	Auto/Manual position switch failure	1. Repeat the test. 2. Please contact Mindray Technical Support if the problem persists.	High	Startup	Manual Only
	Auto/manual valve fault		High	Startup	Non-Functional
Flow Sensor Failure	Ventilator flow is out of range.	1. Repeat the test. 2. Please contact Mindray Technical Support if the problem persists.	Low	Startup	Manual Only

Table 10-4 Startup Alarm Messages

INFORMATION	CAUSE	ACTION	ALARM PRIORITY	MACHINE MODE WHEN CHECKED	STARTUP RESULT IF FAIL
Calibrate Flow Sensor and Insp Valve	1. Calibration table isn't found in EEPROM. 2. Checksum of the calibration table does not match.	1. Calibrate flow sensors through Service menu after entering Standby. 2. Please contact Mindray Technical Support if the problem persists.	Low	Startup	Manual Only
Calibrate Pressure Sensor and PEEP Valve	1. Calibration table isn't found in EEPROM. 2. Checksum of the calibration table does not match.	Please contact Mindray Technical Support for pressure calibration.	Low	Startup	Manual Only
Calibrate 21% and 100% O_2 Sensor	1. Calibration table isn't found in EEPROM. 2. Checksum of the calibration table does not match.	1. Calibrate O_2 sensors through System menu after entering Standby. 2. Please contact Mindray Technical Support if the problem persists.	Low	Startup	All
Ventilator Initialization Error	After power on, CPU board cannot send the parameter settings to the ventilator control board.	1. Repeat the test. 2. Please contact Mindray Technical Support if the problem persists.	High	Startup	Non-Functional
Ventilator Initialization: Time out	Self-test result cannot be obtained due to an internal communication error.		High	Startup	Non-Functional
Drive Gas Pressure Low	Drive Gas Pressure is low.	1. Connect the drive gas pipeline. 2. Check that until drive gas pressure become normal.	High	Startup	All
O_2 Supply Failure	O_2 Supply Failure.	1. Connect the O_2 pipeline. 2. Check that until O_2 supply pressure become normal.	High	Startup	All
Power Supply Voltage Error	Power supply voltage error.	1. Repeat the test. 2. Please contact Mindray Technical Support if the problem persists.	High	Startup	Manual Only
RT Clock Needs Battery	There is no button battery cell available in the system, or the button battery cell power is depleted.	1. Repeat the test. 2. Please contact Mindray Technical Support if the problem persists.	High	Startup	All
RT Clock Failure	RT chip malfunction.		High	Startup	All

Table 10-4 Startup Alarm Messages

INFORMATION	CAUSE	ACTION	ALARM PRIORITY	MACHINE MODE WHEN CHECKED	STARTUP RESULT IF FAIL
Keyboard Self Test Error	Keyboard Self Test Error.	1. Repeat the test. 2. Please contact Mindray Technical Support if the problem persists.	High	Startup	Non-Functional
Keyboard Self Test: Time out	Keyboard Self Test result cannot be obtained due to communication error.		High	Startup	Non-Functional
Calibrate Esophageal Pressure Sensor	1. Calibration table isn't found in EEPROM. 2. Checksum of the calibration table does not match.	Please contact Mindray Technical Support for esophageal pressure sensor calibration.	Low	Startup	All
AG Self Test Error	AG module self-test failure.	1. Re-plug or replace the AG module. 2. Repeat the test. 3. Please contact Mindray Technical Support if the problem persists.	Low	Startup	All
AG: Time out	External AG self test result cannot be obtained due to communication error.		Low	Startup	All
Internal AG Error 02	Internal AG Module Self Test failure.	1. Repeat the test. 2. Please contact Mindray Technical Support if the problem persists.	Low	Startup	All
Internal AG: Time out	Internal AG self test result cannot be obtained due to communication error.		Low	Startup	All
BIS Self Test Error	BIS Self Test failure.	1. Re-plug or replace the BIS module. 2. Restart machine to repeat the test. 3. Please contact Mindray Technical Support if the problem persists.	Low	Startup	All
BIS Self Test: Time out	BIS self test result can not be obtained due to communication error.	1. Check BISx/BISx4 host cable connection. 2. Restart machine to repeat the test. 3. Please contact Mindray Technical Support if the problem persists.	Low	Startup	All

Table 10-4 Startup Alarm Messages

INFORMATION	CAUSE	ACTION	ALARM PRIORITY	MACHINE MODE WHEN CHECKED	STARTUP RESULT IF FAIL
NMT Self Test Error	NMT self-test failure.	1. Re-plug or replace the NMT module. 2. Restart machine to repeat the test. 3. Please contact Mindray Technical Support if the problem persists.	Low	Startup	All
NMT Self Test: Time out	NMT self test result failed to be obtained due to communication error.		Low	Startup	All
AGSS Self Test Error	AGSS self-test failure.	1. Repeat the test. 2. Please contact Mindray Technical Support if the problem persists.	Low	Startup	All

Table 10-4 Startup Alarm Messages

10.8.2.2 CPU Board Runtime Alarm

INFORMATION	CAUSE	ACTION	ALARM PRIORITY	MACHINE MODE WHEN CHECKED	DISABLE IN STANDBY MODE
IP Address Conflict	The IP address of the anesthesia system is the same as the IP address of another device in the local network.	Check the IP setting.	Medium	Runtime	No
Manual Only	POST test failed and the result is [**Manual Only**].	1. Repeat the test. 2. Please contact Mindray Technical Support if the problem persists.	Medium	Runtime	No
Manual Only - Leak Test Fail	Circuit leakage test failed and the result is [**Manual Only**].		Medium	Runtime	No
Auto Ventilation is Non-Functional	The system's Auto Ventilation mode is not available.		High	Runtime	/
Status Screen Comm Stop	The CPU board lost communication with the status screen.	Please contact Mindray Technical Support.	High	Runtime	No
Aux O_2/AIR Comm Stop	The CPU board lost communication with the auxiliary O_2/air module.	Please contact Mindray Technical Support.	High	Runtime	No
HFNC Module Comm Stop	The CPU board lost communication with the HFNC module.	Please contact Mindray Technical Support.	High	Runtime	No
Storage Error	Data storage error.	Please contact Mindray Technical Support.	Low	Runtime	No

Table 10-5 CPU Board Runtime Alarm Messages

10.8.2.3 Power Supply Board Runtime Alarm

INFORMATION	CAUSE	ACTION	ALARM PRIORITY	MACHINE MODE WHEN CHECKED	DISABLE IN STANDBY MODE
Power System Comm Stop	Lost communication with CPU board for 10 seconds.	Please contact Mindray Technical Support.	High	Runtime	No
Power Supply Voltage Error	Power supply voltage error.		High	Runtime	No
Low Battery Voltage!	Battery voltage is low.	1. Check the power supply. 2. Connect AC power immediately.	High	Runtime	No
System going DOWN, Battery depleted!	Battery voltage is too low.	1. Connect AC power immediately. 2. In emergency, please use Manual ventilation.	High	Runtime	No
Battery Undetected	Battery undetected.	Please contact Mindray Technical Support.	Medium	Runtime	No
Battery in Use	AC power fail.	Connected to AC power source.	Low	Runtime	No
Heating Module Failure	1. The temperature difference between the two resistances is large. 2. The temperature of one of the resistances is too high.	Please contact Mindray Technical Support.	Low	Runtime	No
Battery Failure	Battery failure.	Please contact Mindray Technical Support.	High	Runtime	No

Table 10-6 Power Supply Board Runtime Alarm Messages

NOTE: **If the power supply board loses communication with the CPU board for 10 seconds, the alarm buzzer will be turned on.**

10.8.2.4 Flow Control System Runtime Alarm

INFORMATION	CAUSE	ACTION	ALARM PRIORITY	MACHINE MODE WHEN CHECKED	DISABLE IN STANDBY MODE
Electronic Flow Control Error	Power supply voltage abnormality, valve fault, flow sensor fault, flow abnormality of output fresh gas, etc.	Please contact Mindray Technical Support.	Medium	Runtime	No
No Fresh Gas	The flow rate of O_2 and balance gas is zero continuously for five seconds.	1. Check the O_2 source and the balance gas source are connected correctly. 2. Check fresh gas setting.	Medium	Runtime	Yes
O_2 Branch Flow not Achieved	The measured flow of the O_2 branch exceeds the target flow threshold for the O_2 branch.	1. Check O_2 source is connected correctly. 2. Please contact Mindray Technical Support if the problem persists.	Low	Runtime	Not applicable *
Balance Gas Branch Flow not Achieved	The measured flow of the balance gas branch exceeds the target flow threshold for the balance gas branch.	1. Check balance gas source is connected correctly. 2. Please contact Mindray Technical Support if the problem persists.	Low	Runtime	Not applicable *
Flowmeter Comm Stop	Lost communication with CPU board for 10 seconds.	Please contact Mindray Technical Support.	Medium	Runtime	No
Total Flow Sensor Self Test Time Out	The automatic flow sensor self-test times out	Please contact Mindray Technical Support.	Medium	Runtime	No
Backup Flow Control System is enabled	The backup flow control system is in use.	The backup flow control system is in use.	Low	Runtime	No
Backup Flow Control System Error	1. BFCS two-way valve fault. 2. The micro switches at the two locations of the mechanical gate are in inconsistent statuses.	Please contact Mindray Technical Support.	Medium	Runtime	No
Air Supply Failure	Air Supply Pressure Low.	Connect the air pipeline.	Medium	Runtime	No

Table 10-7 Electronic Flow Control System Runtime Alarm Messages

INFORMATION	CAUSE	ACTION	ALARM PRIORITY	MACHINE MODE WHEN CHECKED	DISABLE IN STANDBY MODE
N_2O Supply Failure	N_2O supply pressure is low.	Connect the N_2O pipeline supply.	Medium	Runtime	No

* *Not applicable. The alarm message does not exist within this mode and therefore it cannot be disabled or enabled.*

Table 10-7 Electronic Flow Control System Runtime Alarm Messages

10.8.2.5 Ventilator Control Board Runtime Alarm

INFORMATION	CAUSE	ACTION	ALARM PRIORITY	MACHINE MODE WHEN CHECKED	DISABLE IN STANDBY MODE
Aux Control Module Comm Stop	Lost communication with CPU board for 10 seconds.	Please contact Mindray Technical Support.	High	Runtime	No
Ventilator Voltage Error	Ventilator voltage error.		High	Runtime	No
PEEP Valve Failure	1. PEEP valve voltage error. 2. PEEP valve pressure error.		Medium	Runtime	No
Insp Valve Failure	1. Inspiratory valve voltage error. 2. Inspiratory valve flow error.		Medium	Runtime	No
Safety Valve Failure	Safety valve voltage error.		Medium	Runtime	No
Flow Sensor Failure	1. Inspiratory flow is out of range. 2. Expiratory flow is out of range.		Low	Runtime	No
Check Flow Sensors	1. Inspiratory reverse flow. 2. Expiratory reverse flow.	1. Check whether the check valves are OK. 2. Please contact Mindray Technical Support if the problem persists.	High	Runtime	N/A *
Pinsp Not Achieved	The Pinsp failed to reach the Pinsp setting in the pressure mode.	1. Check ventilation settings: Pinsp/ ΔPinsp, ΔPsupp, PEEP, etc. 2. Check whether the breathing tube is leaking. 3. Solve the [**Paw Too High**] alarm.	Low	Runtime	N/A *

Table 10-8 Ventilator Control Board Runtime Alarm Messages

INFORMA-TION	CAUSE	ACTION	ALARM PRIORITY	MACHINE MODE WHEN CHECKED	DISABLE IN STANDBY MODE
Vt Not Achieved	The Vt does not reach the Vt setting in volume mode.	1. Check ventilation settings: Vt, Plimit, etc. 2. Check whether patient circuit is leaking or blocked. 3. Solve the [**Pressure Limit**] alarm and [**Paw Too High**] alarm.	Low	Runtime	N/A *
ACGO 3-way Valve Failure	ACGO 3-way valve status error.	Please contact Mindray Technical Support.	Medium	Runtime	No
Pressure Monitoring Channel Failure	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.		Medium	Runtime	No
Aux Control Module Voltage Error	Auxiliary control module voltage error.		Low	Runtime	No
Breathing Circuit Not Installed	Breathing Circuit is not installed.	Install the breathing circuit.	High	Runtime	No
Volume Exchanger not Installed	The volume exchanger is not installed.	Install the volume exchanger.	High	Runtime	No
Auto/Manual Switching Failure	1. Auto/Manual position switch failure. 2. Auto/Manual valve failure.	Please contact Mindray Technical Support.	High	Runtime	No
Esophageal Pressure Sensor Failure	The esophageal pressure sensor is detected to be out of place.	Please contact Mindray Technical Support.	Medium	Runtime	No
Calibrate Esophageal Pressure Sensor	1. Calibration table isn't found in EEPROM. 2. Checksum of the calibration table does not match.	Please contact Mindray Technical Support.	Low	Runtime	No

Table 10-8 Ventilator Control Board Runtime Alarm Messages

INFORMATION	CAUSE	ACTION	ALARM PRIORITY	MACHINE MODE WHEN CHECKED	DISABLE IN STANDBY MODE
Patient Circuit Leak	1. Circuit leak. 2. The patient is not connected.	Check whether the patient circuit is leaking or disconnected.	Medium	Runtime	N/A *
CO_2 Absorber Canister Not Locked	CO_2 absorber canister is not installed.	1. Check whether CO_2 absorber canister is correctly installed and locked. 2. Re-install the CO_2 absorber canister. 3. Please contact Mindray Technical Support if the problem persists.	High	Runtime	No
O_2 Sensor Disconnected	The AG module and the O_2 sensor are not connected.	Connect O_2 cell or plug in external AG module.	Low	Runtime	No
Replace O_2 sensor	O_2 sensor is exhausted.	Replace the O_2 sensor.	Medium	Runtime	No
Calibrate O_2 sensor for 100%	O_2 value is greater than 110% or between 5% and 15% for 4 seconds.	Calibrate the O_2 sensor.	Low	Runtime	No
Ventilator Control Board Communication Stopped	Lost communication with CPU board for 10 seconds.	Please contact Mindray Technical Support.	High	Runtime	No
Drive Gas Pressure Low	Drive Gas Pressure is low.	1. Connect the drive gas pipeline. 2. In emergency, please use Manual ventilation.	High	Runtime	No
O_2 Supply Failure	O_2 Supply Failure.	Connect the O_2 pipeline.	High	Runtime	No
Fresh Gas Flow Too High	In VCV and SIMV-VC modes, the flow rate of fresh gas is greater than or equal to the desired flow rate.	1. Check fresh gas flow setting. 2. Check ventilation settings: Vt, Tinsp, etc.	Low	Runtime	N/A *
AMV: Cannot Meet Target	The ventilation failed to reach the target MV% setting in the AMV mode.	1. Check the ventilation parameter settings. 2. Check the alarm limits settings.	Low	Runtime	N/A *

* *Not applicable. The alarm message does not exist within this mode and therefore it cannot be disabled or enabled.*

Table 10-8 Ventilator Control Board Runtime Alarm Messages

10.8.2.6 AG Module Alarm Messages

INFORMATION	CAUSE	ACTION	ALARM PRIORITY	MACHINE MODE WHEN CHECKED	DISABLED IN STANDBY MODE
AG Module Error	AG module failure.	1. Replace the AG module. 2. Please contact Mindray Technical Support if the problem persists.	High	Runtime	No
O_2 Sensor Error	Paramagnetic O_2 sensor error.		High	Runtime	Yes
AG No Watertrap	The AG module watertrap was installed improperly or not installed.	Check the connections of the watertrap and re-connect it.	Low	Runtime	Yes
AG Watertrap Type Wrong	When the patient type is neonate, but the watertrap type is adult/ pediatric, this alarm will be triggered.	Check the patient size setup, make sure that a correct watertrap has been used.	Low	Runtime	Yes
AG Change Watertrap	Change the AG watertrap.	Replace the AG watertrap.	Low	Runtime	Yes
AG Airway Occluded	Flow rate is lower than 20 ml/min for 1 second.	1. Check whether airway is kinked or blocked. 2. Replace the airway. 3. Re-plug the module. 4. Please contact Mindray Technical Support if the problem persists.	Low	Runtime	Yes
AG Zero Failed	Gas measurements is of poor accuracy during zeroing.	1. Check for external interference sources. 2. Check whether there is a [**AG Airway Occluded**] alarm, remove the occlusion. 3. Re-plug the module. 4. Please contact Mindray Technical Support if the problem persists.	Low	Runtime	Yes
Mixed Agent	MAC < 3	Please turn off the anesthetic gas , increase the flow of the fresh gas and flush the residual anesthetic gas in the circuit.	Low	Runtime	Yes
	Mixed agents are detected but MAC is an invalid value.		Medium	Runtime	Yes
Mixed Agent and MAC ≥ 3	MAC ≥ 3.		Medium	Runtime	Yes

Table 10-9 AG Module Alarm Messages

INFORMATION	CAUSE	ACTION	ALARM PRIORITY	MACHINE MODE WHEN CHECKED	DISABLED IN STANDBY MODE
Incompatible AG Software Version	Incompatible version found for the AG module.	Replace the AG module.	High	Runtime	No
CO_2 Over Range	The monitoring value exceeds the measurable range.	1. Calibrate the AG module. 2. Replace the AG module. 3. Please contact Mindray Technical Support if the problem persists.	Low	Runtime	Yes
N_2O Over Range					
HAL Over Range					
ENF Over Range					
ISO Over Range					
SEV Over Range					
DES Over Range					
O_2 Over Range					
awRR Over Range					
Internal AG Error 01	1. Internal AG hardware error. 2. Internal AG self-test error. 3. Internal AG hardware fault. 4. Internal AG initialization error. 5. Internal AG communication stopped.	Please contact Mindray Technical Support.	Low	Runtime	Yes
Internal AG Error 02	Internal AG Zero Failed.				
Internal AG Error 03	Internal AG No Water trap.				
Internal AG Error 04	Internal AG airway occluded.				
Internal AG Error 05	Internal AG Change Water trap.				

Table 10-9 AG Module Alarm Messages

10.8.2.7 BIS Module Alarm Messages

INFORMATION	CAUSE	ACTION	ALARM PRIORITY	MACHINE MODE WHEN CHECKED	DISABLED IN STANDBY MODE
BIS Module Failure	1. BIS module initialization error. 2. BIS module communication abnormality. 3. BIS module self-test error.	1. Re-plug the BIS module. 2. Replace the BIS module or contact Mindray Technical Support.	High	Runtime	Yes
BIS Electrode Poor Contact	BIS electrode impedance too high	Check and reconnect the BIS sensor.	Low	Runtime	Yes
BIS Sensor Off	BIS sensor is off.	Please check whether the connect of the electrodes are firm and reconnect the electrode if necessary.	Low	Runtime	Yes
BIS Electrode 1 Poor Contact	Electrode impedance is high.	Check and reconnect the BIS sensor.	Low	Runtime	Yes
BIS Electrode 1 Lead Off	Electrode lead is off.	Please check whether the connect of the electrodes are firm and reconnect the electrode if necessary.	Low	Runtime	Yes
BIS Electrode 2 Poor Contact	Electrode impedance is high.	Check and reconnect the BIS sensor.	Low	Runtime	Yes
BIS Electrode 2 Lead Off	Electrode lead is off.	Please check whether the connect of the electrodes are firm and reconnect the electrode if necessary.	Low	Runtime	Yes
BIS Electrode 3 Poor Contact	Electrode impedance is high.	Check and reconnect the BIS sensor.	Low	Runtime	Yes
BIS Electrode 3 Lead Off	Electrode lead is off.	Please check whether the connect of the electrodes are firm and reconnect the electrode if necessary.	Low	Runtime	Yes
BIS Electrode 4 Poor Contact	Electrode impedance is high.	Check and reconnect the BIS sensor.	Low	Runtime	Yes

Table 10-10 BIS Module Alarm Messages

INFORMATION	CAUSE	ACTION	ALARM PRIORITY	MACHINE MODE WHEN CHECKED	DISABLED IN STANDBY MODE
BIS Electrode 4 Lead Off	Electrode lead is off.	Please check whether the connect of the electrodes are firm and reconnect the electrode if necessary.	Low	Runtime	Yes
BIS Electrode G Poor Contact	Electrode impedance is high.	Check and reconnect the BIS sensor.	Low	Runtime	Yes
BIS Electrode G Lead Off	Electrode lead is off.	Please check whether the connect of the electrodes are firm and reconnect the electrode if necessary.	Low	Runtime	Yes
BIS Electrode C Poor Contact	Electrode impedance is high.	Check and reconnect the BIS sensor.	Low	Runtime	Yes
BIS Electrode C Lead Off	Electrode lead is off.	Please check whether the connect of the electrodes are firm and reconnect the electrode if necessary.	Low	Runtime	Yes
BIS Electrode LE Poor Contact	Electrode impedance is high.	Check and reconnect the BIS sensor.	Low	Runtime	Yes
BIS Electrode LE Lead Off	Electrode lead is off.	Please check whether the connect of the electrodes are firm and reconnect the electrode if necessary.	Low	Runtime	Yes
BIS Electrode LT Poor Contact	Electrode impedance is high.	Check and reconnect the BIS sensor.	Low	Runtime	Yes
BIS Electrode LT Lead Off	Electrode lead is off.	Please check whether the connect of the electrodes are firm and reconnect the electrode if necessary.	Low	Runtime	Yes
BIS Electrode RE Poor Contact	Electrode impedance is high.	Check and reconnect the BIS sensor.	Low	Runtime	Yes

Table 10-10 BIS Module Alarm Messages

INFORMATION	CAUSE	ACTION	ALARM PRIORITY	MACHINE MODE WHEN CHECKED	DISABLED IN STANDBY MODE
BIS Electrode RE Lead Off	Electrode lead is off.	Please check whether the connect of the electrodes are firm and reconnect the electrode if necessary.	Low	Runtime	Yes
BIS Electrode RT Poor Contact	Electrode impedance is high.	Check and reconnect the BIS sensor.	Low	Runtime	Yes
BIS Electrode RT Lead Off	Electrode lead is off.	Please check whether the connect of the electrodes are firm and reconnect the electrode if necessary.	Low	Runtime	Yes
BISx Error	1. BIS DSC error. 2. BIS DSC failure.	Re-plug the module. Please contact Mindray Technical Support if the problem persists.	High	Runtime	No
BIS No Cable	BIS cable is not connected.	Check the BIS cables.	Low	Runtime	Yes
BIS No Sensor	Sensor is off from patient.	1. Check the BIS sensor. 2. Re-plug the BIS module. 3. Replace the BIS main cable. 4. Replace the BISx or BISx4.	Low	Runtime	Yes
BIS Sensor Too Many Uses	The number of sensor usage is exceeded.	Replace the sensor.	Low	Runtime	Yes

Table 10-10 BIS Module Alarm Messages

INFORMATION	CAUSE	ACTION	ALARM PRIORITY	MACHINE MODE WHEN CHECKED	DISABLED IN STANDBY MODE
BIS Signal Quality Too Low	SQI measurement value <15%.	1. Check the patient. 2. Check whether the sensor placement is correct and whether it is in good contact with the patient's skin. 3. Check whether the BISx or BISx4 is far away from the electric radiation equipment.	Low	Runtime	Yes
BIS Low Signal Quality	SQI measurement value <50%.		Low	Runtime	Yes
BIS L Signal Quality Too Low	SQI L measurement value <15%.		Low	Runtime	Yes
BIS L Low Signal Quality	SQI L measurement value <50%.		Low	Runtime	Yes
BIS R Signal Quality Too Low	SQI R measurement value <15%.		Low	Runtime	Yes
BIS R Low Signal Quality	SQI R measurement value <50%.		Low	Runtime	Yes
BIS Sensor Expired	Sensor expired.	Replace the BIS sensor.	Low	Runtime	Yes
BISx Disconnected	BIS cable is not connected to module or the communication error.	1. Check BISx or BISx4 connection. 2. Re-plug the BIS module. 3. Replace the BIS main cable. 4. Replace the BISx or BISx4.	Low	Runtime	Yes
BIS Wrong Sensor Type	The BIS sensor is non-specification type.	Check and use the right sensor.	Low	Runtime	Yes
BIS Sensor Fault	Sensor failure or electrode failure.	Replace the BIS sensor.	Low	Runtime	Yes
Disconnect/ Reconnect BIS	The BIS module should be re-installed.	Re-plug the BIS module.	Low	Runtime	Yes

Table 10-10 BIS Module Alarm Messages

10.8.2.8 NMT Module Alarm Messages

INFORMATION	CAUSE	ACTION	ALARM PRIORITY	MACHINE MODE WHEN CHECKED	DISABLED IN STANDBY MODE
NMT Module Failure	1. NMT module communication abnormality. 2. NMT module communication stopped. 3. NMT module communication error. 4. NMT module initialization error. 5. NMT module power failure. 6. NMT module self-test error.	1. Re-plug the NMT module. 2. Replace the NMT module or contact Mindray Technical Support.	High	Runtime	Yes
NMT No Main Cable	NMT main cable is not connected.	Check that NMT main cable is properly connected to the NMT module.	Low	Runtime	Yes
NMT No Sensor	NMT sensor is not connected.	1. Check that NMT sensor is properly connected to the NMT main. 2. If the alarm persists, replace the sensor.	Low	Runtime	Yes
NMT Stimulation Electrode Off	NMT Stimulation Electrode is off.	1. Check that NMT stimulation cable is properly connected to the NMT patient cable. 2. If the alarm persists, check the application of electrodes.	Low	Runtime	Yes
NMT Sensor Error	NMT sensor error.	Please contact Mindray Technical Support.	Low	Runtime	Yes
NMT Stimulation Current Over Limit	NMT stimulation current exceeds limits.		Low	Runtime	Yes
ST-Ratio Overrange	The monitoring value exceeds the measurable range.	Please contact Mindray Technical Support.	Low	Runtime	Yes
TOF-Ratio Overrange					
DBS-Ratio Overrange					

Table 10-11 NMT Module Alarm Messages

10.8.2.9 AGSS alarms

INFORMATION	CAUSE	ACTION	ALARM PRIORITY	MACHINE MODE WHEN CHECKED	DISABLED IN STANDBY MODE
Scavenging Flow is Too High	The AGSS flow rate is higher than the upper limit.	Set the vacuum flow so that the float position is between the Min and Max lines.	Low	Runtime	No
AGSS Failure	AGSS failure.	Please contact Mindray Technical Support.	Medium	Runtime	No

Table 10-12 AGSS alarms

10.8.2.10 Aux O_2/Air Module Alarms

INFORMATION	CAUSE	ACTION	ALARM PRIORITY	MACHINE MODE WHEN CHECKED	DISABLED IN STANDBY MODE
Aux O_2/Air Failure	1. O_2 branch flow sensor error. 2. Air branch flow sensor error. 3. O_2 branch switch valve error. 4. Air branch switch valve error.	Please contact Mindray Technical Support.	Medium	Runtime	No
Aux O_2/Air Selftest Error	1. EEPROM self-test error. 2. O_2 proportional valve self-test error. 3. Air proportional valve self-test error. 4. Zero reading error.	1. Restart the auxiliary O_2/air feature. 2. Please contact Mindray Technical Support if the problem persists.	Medium	Runtime	No
Calibrate Aux O_2/Air Module	1. Calibration table isn't found in EEPROM. 2. Checksum of the calibration table does not match.	Please contact Mindray Technical Support.	Low	Startup	No

Table 10-13 Alarms of the auxiliary O_2/Air module

10.8.2.11 HFNC module alarms

INFORMATION	CAUSE	ACTION	ALARM PRIORITY	MACHINE MODE WHEN CHECKED	DISABLED IN STANDBY MODE
HFNC Module Failure	1. O_2 branch flow sensor error. 2. Air branch flow sensor error.	Please contact Mindray Technical Support.	Medium	Runtime	No
HFNC Selftest Error	1. EEPROM self-test error. 2. O_2 proportional valve self-test error. 3. Air proportional valve self-test error. 4. Zero reading error.	1. Restart HFNC. 2. Please contact Mindray Technical Support if the problem persists.	Medium	Runtime	No
Calibrate HFNC Module	1. Calibration table isn't found in EEPROM. 2. Checksum of the calibration table does not match.	Please contact Mindray Technical Support.	Low	Startup	No

Table 10-14 HFNC module alarms

10.8.3 Prompt Message

10.8.3.1 Prompt Messages Displayed in Alarms Area

INFORMATION	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.
Load Configuration Failure	This message appears when loading user or latest configuration failed.
Save Profile Failure	This message appears when an error occurs during saving user profiles.
DEMO Mode - Not for Clinical Use	This message appears when the system works in the demo mode.
Service Mode - Not for Clinical Use	This message appears when the machine is working in Service Mode.
Mainboard Reset	This message appears when the mainboard is restarted abnormally.
Ventilator Reset	This message appears when the ventilator is restarted abnormally.
Aux Control Module Reset	This message appears when the auxiliary monitoring board is restarted abnormally.
Apnea Ventilation	This message appears when Apnea Ventilation is triggered in the PS/CPAP mode.
Calibrate O_2 sensor for 21%	This message appears when more than 72 hours have elapsed since the last successful calibration.
Calibrate O_2 sensor for 100%	This message appears when the O_2 Sensor 100% Calibrate data is not revised correctly after 21% O_2 sensor calibration is successful.
Auto-zero in process	This message appears when auto-zeroing of the pressure sensors is in process.

Table 10-15 Prompt Messages Displayed in Alarms Area

INFORMATION	REMARK
New functions activated, please restart!	This message appears when function activation completes successfully.
Restart to Activate New Flowmeter Standard	This message appears when Flowmeter Standard is changed.
Could not locate time server	This message appears when the SNTP Protocol is set to On but has not communicated with the time server for 5 intervals.
Total Flow Sensor Self Test in Progress	This message appears when an automatic total flow sensor self-test is in progress.
Leak Test Not Performed	This message appears when the Auto Leak Test or Manual Leak Test is skipped after system startup, or 24 hours has elapsed since last leak test.
Ventilation and Fresh Gas Flow Paused	This message displays when the Flow Pause is active..
All Physiological Alarms are OFF	This message displays when the Flow Pause is active..
Fresh Gas Sample Check in Progress	This message appears when the AG module is performing time-sharing sampling.
Fresh Gas Flow is Too Low	This message displays when the fresh gas flow is too low.
AG Loaded Successfully	External AG loaded successfully.
AG Unloaded Successfully	External AG unloaded successfully.
AG Startup	AG module is starting up.
AG Warmup	AG module is warming up.
AG Zeroing	AG module zeroing in progress.
BIS Sensor Checking	BIS sensor impedance check is being performed.
BIS Ground Checking	BIS ground check is being performed.
BIS Sensor Check Failed	BIS sensor check failed or some electrode impedance checks failed.
BIS in Demo	BIS module is connected with simulator.
BIS Interference	BIS signal is interfered.
NMT Block Recovery	The tested value exceeds the block recovery threshold.
NMT Loaded Successfully	NMT module is loaded successfully.
NMT Unloaded Successfully	NMT module is unloaded successfully.

Table 10-15 Prompt Messages Displayed in Alarms Area

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11.0 Maintenance

WARNING: **Do not use a malfunctioning anesthesia system. Have all repairs and service done by an authorized service representative.**

WARNING: **Use a cleaning and disinfection schedule that conforms to your institution's disinfection and risk-management policies.**

- **Refer to the material safety data sheet as applicable.**
- **Refer to the operation and maintenance manuals of all disinfection equipment.**
- **Do not inhale fumes produced during any disinfection process.**

WARNING: **Use extreme care while handling the CO2 absorbent as it belongs to caustic irritant.**

WARNING: **Only use lubricants approved for anesthesia or O_2 equipment.**

WARNING: **Do not use lubricants that contain oil or grease. They can burn or explode in the presence of high O_2 concentrations.**

WARNING: **Obey infection control and safety procedures. Utilized equipment may contain blood and body fluids.**

WARNING: **Movable parts and removable components may present a pinch or a crush hazard. Use care when moving or replacing system parts and components.**

CAUTION: **To prevent system damage:**

- **Refer to the documentations provided by the manufacturer of the cleaning agent.**
- **Never use organic, halogenated or petroleum-based solvents, anesthetic agents, glass cleaning agents, acetone or other irritant agents.**
- **Never use abrasive agents (i.e. steel wool or silver polish) to clean components.**
- **Keep all liquids away from electronic components.**
- **Prevent liquid from entering the equipment.**
- **All cleaning solutions used must have a pH value between 7.0 and 10.5.**

CAUTION: **Never immerse the oxygen sensor or its connector into any type of liquid. Dispose the O2 sensor according to the manufacturer's specifications.**

CAUTION: **Do not wash the inner surface of the oxygen sensor.**

CAUTION: **Do not perform soaking or high-temperature processing on the O2 sensor.**

NOTE: **No repair should ever be attempted by anyone not having experience in the repair of devices of this nature. Replace damaged parts with components manufactured or sold by Mindray. Then test the unit to ensure that it complies with the manufacturer's published specifications.**

NOTE: **If necessary, contact Mindray for the circuit diagram, list of parts and calibration instructions of products or other information related to equipment maintenance.**

11.1 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. Maintenance should be performed by a trained technician.

NOTE: During cleaning and setup, inspect the parts and seals for damage. Replace or repair as necessary.

MINIMUM MAINTENANCE FREQUENCY	MAINTENANCE
Every day	Clean the external surfaces.
Every 72 hours	Perform the 21% O2 calibration to keep O2 sensor accuracy for the anesthesia system not connected to the air supply.
Every 30 days	Visually check the equipment to ensure that worn or damaged parts are replaced in a timely manner.
Every two years	Perform periodic maintenance by a trained technician. Contact Mindray Technical Support for details.
Every three years	Replace the internal lead-acid cell and button cell.
On-demand	• Calibrate the O_2 sensor after replacing the O_2 sensor or when there is a larger error in O_2 concentration monitoring. • Replace the O_2 sensor if it cannot be calibrated. • Replace the soda lime in the canister if the soda lime color changes. Follow the manufacturer's instructions. • Replace the flow sensor if the seal for the flow sensor is damaged, the membrane inside the flow sensor is cracked or distorted, or the flow sensor is cracked or distorted. • Calibrate the flow sensor after re-installing the cleaned or disinfected flow sensor, after replacing with a new flow sensor, or when tidal volume measurement is inaccurate. • Clear the water gathered in the breathing system watertrap and the gas module watertrap.

Table 11-1 Maintenance schedule

11.2 Breathing System Service

When cleaning the breathing system, replace any parts that are visibly cracked, chipped, distorted or worn. For details, refer to "Inspect the System" on Pages 5-5 and "Cleaning and Disinfection" on Pages 11-9 for specific operations.

11.3 Flow Sensor Calibration

WARNING: Do not calibrate the flow sensor when the system is connected to a patient.

NOTE: During calibration, do not operate the pneumatic parts. Do not move or press the breathing tubes.

NOTE: Calibrate the flow sensor after re-installing the cleaned or disinfected flow sensor, after replacing with a new flow sensor, or when tidal volume measurement is inaccurate.

The flow sensor must be calibrated whenever the flow volume is out of specification or after changing the flow sensor.

To calibrate the flow sensor:

1. Ensure that the gas supply pressure is normal.
2. Turn off all fresh gas inputs.
3. Connect the Y piece on the breathing circuit to the leak test port to close the breathing system.
4. Remove the watertrap.
5. Ensure that the system is in Standby mode.
6. Select the  icon, and open the [**Setup**] menu.
7. Select the [**Calibrate**] soft key.
8. Follow the on-screen prompts. Select the [**Begin]** key to calibrate the flow sensor. The calibration may take several minutes. The system will display the results of the calibration status after the process is completed.
9. Select  to close the menu.
10. After the calibration is complete, install the watertrap.

NOTE: In case of repeated calibration failure, contact Mindray Technical Support.

11.4 O_2 Sensor Calibration

WARNING: Do not perform the calibration when the system is connected to a patient.

WARNING: To calibrate an O_2 sensor, the ambient pressure must be identical with the ambient pressure for O_2 transport monitoring of the breathing system. Otherwise, the monitoring may exceed the specified range.

WARNING: Prior to the O_2 sensor calibration, remove the O_2 sensor. Make sure there is no water on the O_2 sensor or where it is installed before installing the O_2 sensor.

WARNING: No O_2 calibration is required if O_2 sensor is not equipped or not used.

WARNING: Observe related biohazard regulations during disposal of discarded O_2 sensors. Do not burn O_2 sensors.

11.4.1 21% Oxygen Calibration

It is required to check the 21% O_2 calibration once around every 72 hours to keep O_2 sensor accuracy for the anesthesia system not connected to the air supply.

NOTE: **The breathing system automatically seals off the O_2 sensor port when the O_2 sensor is removed.**

1. Select the icon > [**O_2**] soft key.
2. Remove the O_2 sensor from the O_2 sensor port on the breathing system. Allow three (3) minutes for the sensor to acclimate to the environment.
3. Carefully follow the on-screen prompts to prepare for calibration.
4. Select the [**Begin**] key to start the O_2 sensor calibration. The system will display the calibration status after calibration has completed.
5. If an error code (such as 00 00 00 10) is displayed in red, see "O2 sensor calibration error codes", Table 11-2 on Pages 11-6 to learn more about troubleshooting. When the 21% O_2 calibration is complete, reinstall the O_2 sensor to the O_2 sensor port on the breathing system.

11.4.2 100% O_2 Calibration

When the measured O_2 concentration evidently diverges from other reference values, or when the O_2 sensor is replaced, the sensor should be calibrated. When the O_2 sensor is replaced, 100% O_2 calibration is required.

1. Make sure that the anesthesia system is in the standby mode.
2. Select the icon > [**System**] (system password required) > [**Calibrate**] > [**O_2 Sensor**] soft key.
3. Make sure that no [**O_2 Supply Failure**] alarm appears.
4. Carefully follow the on-screen prompts to prepare for calibration.
5. Select the [**Begin**] key to start the 100% O_2 sensor calibration. The system will prompt the calibration status after calibration has completed.
6. If error code (such as 00 00 00 10) is displayed in red, see "O2 sensor calibration error codes", Table 11-2 on Pages 11-6 to learn more about troubleshooting.
7. After the calibration is complete, select to close the menu.

NOTE: **If the 100% O_2 calibration failed, check for any technical faults and alarms. After the fault is cleared, calibrate the sensor again.**

NOTE: **If the calibration failed for several times, replace the O_2 sensor and calibrate the sensor again. If the calibration failure persists, contact Mindray Technical Support.**

11.4.3 O_2 Sensor Calibration Error Codes

ERROR CODE	DESCRIPTION	RECOMMENDED COUNTERMEASURES
1	21% calibration value is smaller than 249	1. Check that the O_2 sensor is connected to the cable correctly. 2. Check that the O_2 sensor is in 21 % O_2. 3. Check that the O_2 sensor output voltage in the calibration menu is steady. 4. Replace the O_2 sensor.
2	21% calibration value is greater than 523	1. Check that the O_2 sensor is connected to the cable correctly. 2. Check that the O_2 sensor is in 21 % O_2. 3. Check that the O_2 sensor output voltage in the calibration menu is steady. 4. Replace the O_2 sensor.
3	100% calibration value is smaller than 1301	1. Check that the O_2 sensor is connected to the cable correctly. 2. Check the O_2 supply pressure. 3. Check that the O_2 sensor output voltage in the calibration menu is steady. 4. Replace the O_2 sensor.
4	100% calibration value is greater than 2378	1. Check that the O_2 sensor is connected to the cable correctly. 2. Check the O_2 supply pressure. 3. Check that the O_2 sensor output voltage in the calibration menu is steady. 4. Replace the O_2 sensor.
5	Difference between 21% calibration value and 100% calibration value exceeds the threshold	Replace the O_2 sensor.
6	Error in correcting 100% calibration value using 21% calibration value	1. Replace the O_2 sensor. 2. Perform the calibration again. 3. Replace the CPU board.
7	System in BFCS status	Set the system to the EFCS status.
33	O_2 supply pressure low	1. Replace or connect the gas supply. 2. If the gas supply functions normally, check the gas supply pressure switch.
35	Air supply pressure low	1. Replace or connect the gas supply. 2. If the gas supply functions normally, check the gas supply pressure switch.
37	O_2 Sensor Disconnected	1. Check for any [**O_2 Sensor Disconnected**] alarm on the screen. If you see the alarm, check whether the O_2 sensor cable is connected correctly. 2. Check that the O_2 sensor output voltage in the calibration menu is steady. 3. Replace the O_2 sensor.
38	O_2 sensor failure	1. Check for any [**Replace O_2 Sensor**] alarm on the screen. If you see the alarm, check whether the O_2 sensor cable is connected correctly. 2. Check that the O_2 sensor output voltage in the calibration menu is steady. 3. Replace the O_2 sensor.

Table 11-2 O_2 sensor calibration error codes

ERROR CODE	DESCRIPTION	RECOMMENDED COUNTERMEASURES
39	Failure to save table	1. Perform the calibration again. 2. Replace the CPU board.
3B	ACGO switched on	Turn off the ACGO switch.

Table 11-2 O_2 sensor calibration error codes

11.5 Handling of Gathered Water

11.5.1 Avoid Water Gathering

Water comes from the condensation of exhaled gas and a chemical reaction between CO_2 and the soda lime in the CO_2 absorbent canister. At lower fresh gas flows more water builds up because of the following:

- More CO_2 stays in the CO_2 absorbent canister to react and produce water.
- More moist, exhaled gas stays in the breathing system and CO_2 absorbent canister to produce condensed water.

When the anesthesia system is in use, water build-up inside the flow sensor, watertrap, gas module watertrap, and patient tube results in abnormal flow waveform, unstable tidal volume or inaccurate measured value of gas. If there is water build-up, clear it immediately before use.

To prevent water build-up:

- Increase the fresh gas flow as appropriate. More water may be gathered when the fresh gas flow is lower than the optimizer, and less water is gathered when the fresh gas flow is higher than the optimizer.
- Enable breathing circuit heating can help reduce the gathered water in the circuit, but the water gathered in the breathing tube may increase on the contrary.
- Use a filter between the flow sensor and the patient to limit water condensation in the flow sensor.

11.5.2 Clear Gathered Water

Water build-up inside the flow sensor, watertrap, gas module watertrap, and patient tube results in abnormal flow waveform, unstable tidal volume or inaccurate measured value of gas. If there is water built up inside these parts, clear the water, then reinstall the parts for use.

WARNING: Check water build-up inside the flow sensor before every system use. Accumulated water in the flow sensor causes erroneous readings.

WARNING: Ensure that all breathing system parts are completely dried after the breathing system is cleaned and disinfected.

WARNING: Water may gather in the patient's breathing tube if the Auto Ventilation mode is used for a long time (such as longer than four hours). Clear the gathered water in time to avoid impact on the ventilation or ingress of water into the patient circuit.

11.6 Electrical Safety Inspection

NOTE: Perform electrical safety inspection after servicing or maintenance. Before the electrical safety inspection, make sure all the covers, panels, and screws are correctly installed.

NOTE: The electrical safety inspection should be performed once a year.

11.6.1 Auxiliary Outlet Test

Verify that the mains power voltage appears on each auxiliary outlet when the anesthesia system is connected to the mains power.

11.6.2 Electrical Safety Test

1. Perform protective earth resistance test:
   a. Connect the two probes for testing the grounding impedance of the safety analyzer to the protective grounding terminal and equipotentiality of the AC power supply respectively.
   b. Test the grounding impedance using a 25A testing current.
   c. Verify that the impedance value is not greater than 0.1 ohms (100mohms).
   d. Connect the two probes for testing the grounding impedance of the safety analyzer to the protective grounding terminal of the AC power supply and the protective grounding terminal of any auxiliary outlet respectively, and repeat Steps b and c.
   e. If the impedance value is greater than 0.1ohms (100mohms) but smaller than 0.2ohms (200mohms), remove the AC power cable, and connect the probe that was originally connected to the protective grounding terminal of the AC power supply to the protective grounding terminal of the AC power outlet. Then repeat Steps a to d.
2. Test the earth leakage currents in the following circumstances:
   - Normal polarity
   - Reverse polarity
   - Open neutral, normal polarity
   - Open neutral, reverse polarity
3. Verify that the maximum leakage current in the first two circumstances does not exceed 500μA (0.5mA), and that in the last circumstance does not exceed 1000μA (1mA).
4. If the BIS module is configured, test the patient leakage current in the following circumstances:
   - Normal polarity
   - Reverse polarity
   - Open neutral, normal polarity
   - Open neutral, reverse polarity
   - Open earth, normal polarity
   - Open earth, reverse polarity
   - Mains on AP, normal polarity
   - Mains on AP, reverse polarity
5. Verify that the maximum leakage current in the first two circumstances does not exceed 100μA (0.1mA), that in the middle four circumstances does not exceed 500μA (0.5mA), and that in the last two circumstances does not exceed 5000μA (5mA).
6. If the BIS module is configured, test the patient auxiliary current between each electrode and the rest ones in the following circumstances in sequence:
   - Normal polarity
   - Reverse polarity
   - Open neutral, normal polarity
   - Open neutral, reverse polarity
   - Open earth, normal polarity

- Open earth, reverse polarity

7. Verify that the maximum auxiliary current in the first two circumstances does not exceed 100μA (0.1mA), and that in the last two circumstances does not exceed 500μA (0.5mA).

NOTE: **Please use a certified safety analyzer (such as UL, CSA or AAMI) and perform related tests following their respective instructions.**

WARNING: **Leakage current tests are required when the normal saline or blood spills and after the start of each monitoring. A leakage current test is required immediately after a major surge appears in the residential electrical system.**

WARNING: **Keep in mind that liquids similar to normal saline and Ringer's solution and blood are excellent conductors. Avoid touching any part of the system using a wet hand. Always operate using clean and dry hands.**

11.7 Cleaning and Disinfection

ISO 17664 compliance:

The process for autoclave sterilization of the Anesthetic Breathing System has been tested and found to be in compliance with ISO 17664:2017.
Compliance to ISO 17664:2017 only applies when bacterial/viral filters are used to filters air coming in from the patient and returning air to the patient. Filters must be properly installed.
Refer to 3.3 "Breathing System" and " 11.7.1 "Cleaning Agents and Disinfectors/Autoclaving".

CAUTION: **Before using the anesthesia system after cleaning or disinfecting, power on the system and follow the on-screen prompts to perform leak test and compliance test. See (Pages 5-7) 5.4.2"Leak & Compliance Test".**

Observe all the **WARNINGs** and **NOTEs** at the beginning of this chapter. Before use, identify the cleaning and disinfecting frequencies and levels for the system following the infection control stipulations of the medical institution. If disinfection is required, make sure to follow the methods described in the following sections to clean and dry all parts.

11.7.1 Cleaning Agents and Disinfectors/Autoclaving

The cleaning agents and disinfectors listed have been tested and found to not cause harm to the Anesthesia System parts. Read the material safety data sheet (MSDS) for each cleaning agent and disinfector.

The cleaning agents and disinfectors listed may not be available or approved for use in all countries. Follow hospital guidelines for cleaning and cleaning agent use, disinfecting and disinfector use.

NOTE: **Cleaning and disinfecting solutions not shown in the cleaning agents and disinfectors listed must have a pH of 7.0 to 10.5. Organic, halogenated or petroleum-based solvents, anesthetic agents, glass cleaners, acetone, or other harsh cleaning agents and disinfectors are not recommended.**

Clean and disinfect the system before its first use. After the system has been used, clean or disinfect it on a daily basis or regularly at a desired interval. See "Maintenance schedule", Table 11-1 on Pages 11-3 for reference.

Table 11-3 to Table 11-6 introduces the cleaning agents and disinfectors, as well as the possible high-temperature and high-pressure processing procedures for the anesthesia system.

MANUAL CLEANING AGENT
Water*
Grafco® Tincture of Green Soap
MetriZyme

* *The water quality must never be less than drinking water quality.*

NOTE: **Recommend to refer to the manufacturer's directions for use.**

Table 11-3 Manual Cleaning Agent

MANUAL DISINFECTOR	
Surface disinfection	Sodium hypochlorite bleach 0.5%
	Isopropanol alcohol (70%)
	Alpet® D2 Surface Sanitizing Wipes
	PDI Super Sani-Cloth® Germicidal Disposable Wipe
	Metrex™ Cavi Wipes™
	PDI Sani-Cloth® HB Germicidal Disposable Wipe
	PDI Sani-Cloth® Plus Germicidal Disposable Cloth
Suction tubes of the negative pressure suction device	CIDEX® OPA

NOTE: **Recommend to refer to the manufacturer's directions for use.**

Table 11-4 Manual Disinfector

AUTOMATED CLEANING AGENT
MetriZyme
Neodisher Mediclean Forte

Table 11-5 Automated Cleaning Agent

AUTOCLAVING PROCESS
Autoclaving process*

* *Except O_2 sensors and airway pressure gauge, all the components of the breathing system are resistant to autoclaving process. The components can be autoclaved up to a maximum temperature of 134°C (273°F) for 20 minutes (recommended time).*

Table 11-6 Autoclaving process

11.7.2 Exterior

Clean all exteriors (including the external surface of the Anesthesia System, the external surface of the Anesthetic Vaporizer, the external surface of the gas monitoring module, the external surface of the BIS module, the external surface of the NMT module, the external surface of the gas supply hose assembly, the external surface of the scavenging hose assembly and the external surface of the bracket, etc.) and cables using soft cloths moistened with an authorized cleaning agent (See Table 11-3 "Manual Cleaning Agent" on Pages 11-10).

Disinfect all exteriors (including the external surface of the Anesthesia System, the external surface of the Anesthetic Vaporizer, the external surface of the gas monitoring module, the external surface of the BIS module, the external surface of the NMT module, the external surface of the gas supply hose assembly, the external surface of the scavenging hose assembly and the external surface of the bracket, etc.) and cables using soft cloths moistened with an authorized disinfectors (See Table 11-4 "Manual Disinfector" on Pages 11-10).

After the cleaning or disinfection is complete, use dry and lint-free cloths to remove the residual cleaning agent and disinfector solution.

11.7.3 Breathing System

WARNING: **Use extreme care while handling the CO2 absorbent as it belongs to caustic irritant.**

CAUTION: **Never immerse the oxygen sensor or its connector into any type of liquid. Dispose the O2 sensor according to the manufacturer's specifications.**

CAUTION: **Do not wash the inner surface of the oxygen sensor.**

CAUTION: **Do not perform soaking or high-temperature processing on the O2 sensor.**

NOTE: **Do not use water or high pressure gas to flush the inside of the flow sensor; otherwise, the flow sensor will be damaged.**

NOTE: **Do not insert any object into the flow sensor for cleaning; otherwise, the flow sensor will be damaged.**

NOTE: **Please disassemble and clean the bottom of the CO2 absorbent canister regularly.**

11.7.3.1 Disassembly

Disassemble the Breathing System at the point of use or at the designated cleaning area.

11.7.3.1.1 Breathing Tube

NOTE: **When removing a breathing tube, hold the joints at both ends of the tube to prevent damage to the tube.**

NOTE: **Do not reuse, reprocess, or sterilize disposable products.**

1. Pull the bacteria filter off the Y-piece.

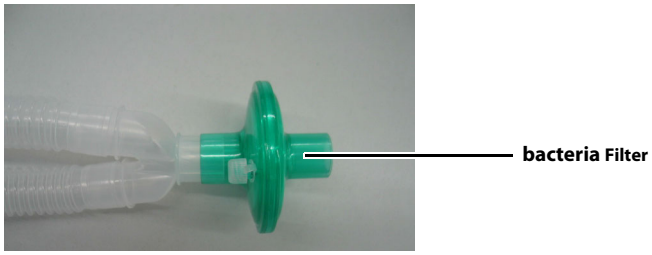


Figure 11-1 Remove the bacteria filter

2. Disconnect the expiratory tube and inspiratory tube from the expiration connector and the inspiration connector of the breathing system, respectively.

Figure 11-2 Remove the breathing tubes

11.7.3.1.2 Manual Bag

NOTE: **Do not reuse, reprocess, or sterilize disposable products.**

Directly draw out the manual bag to disassemble it.

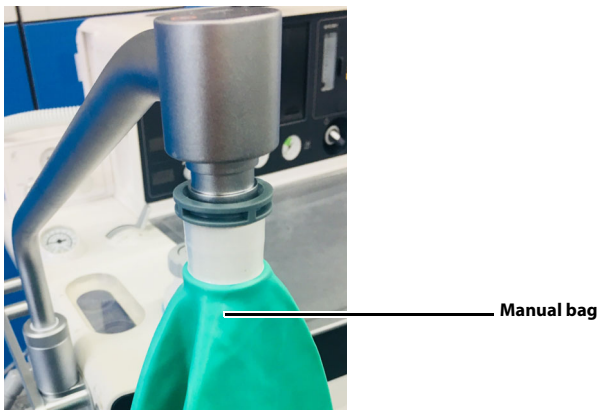


Figure 11-3 Remove the manual bag

11.7.3.1.3 O_2 Sensor

1. Press the O_2 sensor cover switch to open the O_2 sensor cover.

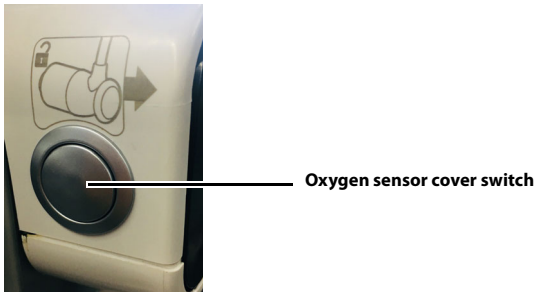


Figure 11-4 Open the O_2 sensor cover

2. Pull straight out the O_2 sensor cable from the O_2 sensor support.

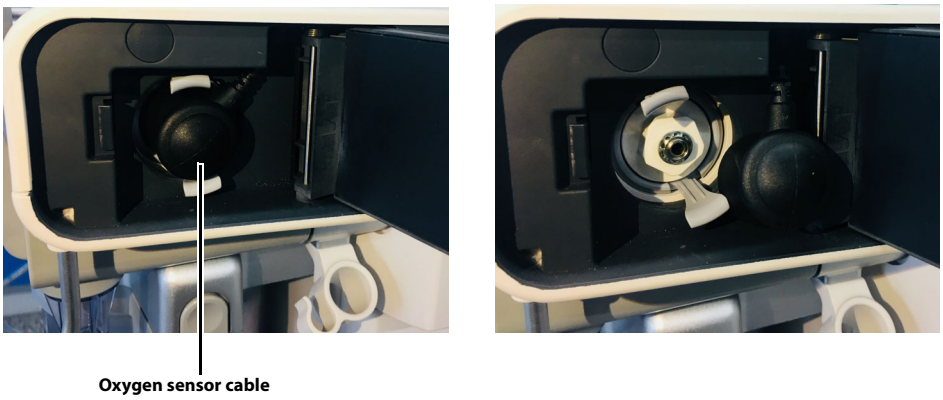


Figure 11-5 Remove the O_2 sensor cable

3. Press the buckle to pull out the O_2 sensor support from the breathing system..

Figure 11-6 Remove the O_2 sensor support from the breathing system

4. Rotate the O_2 sensor anticlockwise to remove it from the support.

Figure 11-7 Remove the O_2 sensor from the support

5. Close the O_2 sensor cover.

11.7.3.1.4 CO2 Absorbent Canister

1. Rotate the locking mechanism handle clockwise to the unlocked position.

Figure 11-8 Canister unlocking

Figure 11-9 Canister locking

2. Remove the absorber canister.

3. Remove the Pre-Pak or loose fill absorbent from the canisters.

WARNING: Use extreme care while handling the CO2 absorbent as it is a caustic irritant.

WARNING: Please dispose of discarded absorbent following the requirements of absorbent manufacturers.

WARNING: To disassemble the bypass assembly, hold the bypass assembly up with one hand to prevent it from falling and press the buckle button on the bypass assembly with the other hand.

11.7.3.1.5 Bypass

Press and hold the buckle on the bypass assembly to take out the bypass assembly downward.

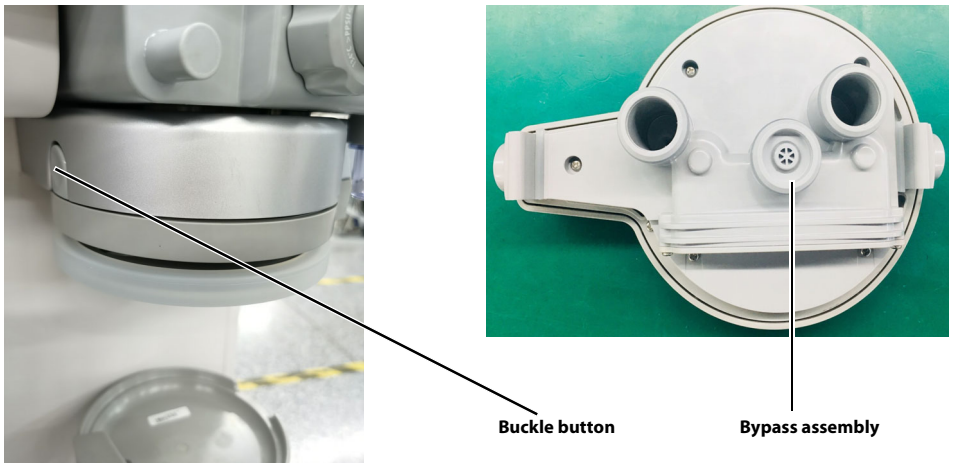


Figure 11-10 Remove bypass

11.7.3.1.6 Flow Sensor

1. Loosen the locking nut anticlockwise, remove the inspiration/expiration connector.

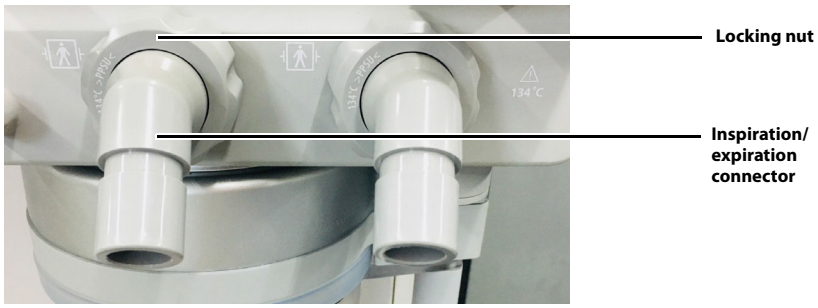


Figure 11-11 Remove the inspiration/expiration connector and locking nut

2. Remove the flow sensor from the breathing system.

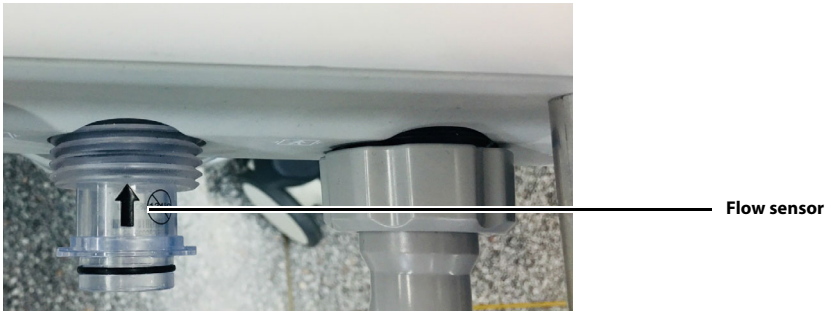


Figure 11-12 Remove the flow sensor

11.7.3.1.7 Bag Arm

At the base of the bag arm, locate the retaining ring. Turn the ring anticlockwise until it is no longer threaded.

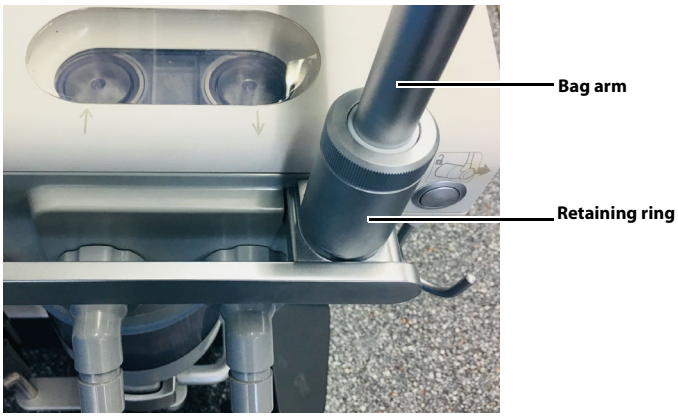


Figure 11-13 Remove the bag arm

3. Lift the bag arm from the breathing system body.

11.7.3.1.8 Breathing System Body

Hold the handrails on one side of the breathing system body, firmly separate and slide it away from its mounting arm.

Figure 11-14 Remove the breathing system body

11.7.3.1.9 Inspiration and Expiration Valves

1. Press the buckle to remove the valve dome from the breathing system body.

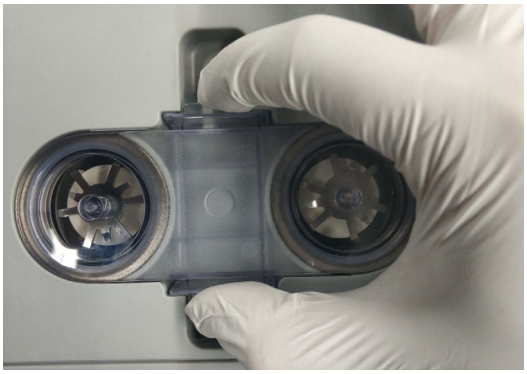


Figure 11-15 Remove the valve dome

2. Lift the inspiration and expiration valves from the breathing system body.

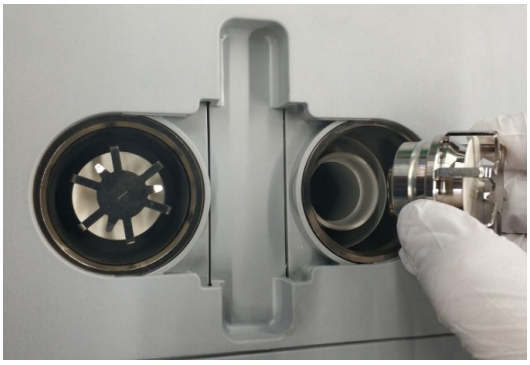


Figure 11-16 Remove the inspiration and expiration valves

11.7.3.1.10 Volume Exchanger

1. As shown in the figure, pull the unlocking button outward.

Figure 11-17 Open the volume exchanger cover

2. Put out the volume exchanger following the screen-printed instructions.

Figure 11-18 Put out the volume exchanger

3. Close the volume exchanger cover.

11.7.3.1.11 Visual Inspection

After the disassembly, inspect the following components for damage, wear and tear, and the visual inspection criteria is no damage, no creak, no distortion.

- Volume Exchanger
- Breathing System Body
- Bag Arm
- O_2 sensor support
- Bypass
- CO_2 Absorbent Canister
- Inspiration connector
- Expiration connector
- Flow sensors
- Inspiration valve
- Expiration valve
- Seals and sealing rings

If the components are damaged, worn and torn, contact your service personnel or Mindray.

11.7.3.2 Cleaning and Disinfection (Choose One)

11.7.3.2.1 Manual Cleaning

1. Submerge or rinse the Breathing System in an authorized cleaning agent (See Table 11-3 "Manual Cleaning Agent" on Pages 11-10) for the required period as specified by the manufacturer of the cleaning solution.
2. Rinse the Breathing System with the clean water.
3. Completely dry the Breathing System before use.
4. To disinfect the Breathing System, proceed to following steps. Otherwise, jump to 11.7.3.4 Reassembly.

11.7.3.2.2 Automated Cleaning and Disinfection

NOTE: Use a washer-disinfector that meets the requirements of the standard ISO 15883.

NOTE: Use cleaning adaptor kit (see the accompanying document) for automated cleaning and disinfection.

NOTE: Except O_2 sensors and airway pressure gauge, all the components of the breathing system are resistant to automated cleaning and disinfection.

NOTE: At least 250 reprocessing cycles are possible for the breathing system.

1. Pre-wash with water.
2. Cleaning using cleaning agent (See Table 11-5 "Automated Cleaning Agent" on Pages 11-10) in accordance with the manufacturer's instructions for use.
3. Rinse with water.
4. Thermal disinfection at a temperature of 90℃ (194 °F) for 5 minutes (recommended disinfection condition).
5. Repeat the cycle if necessary.
6. Allow the Breathing System to cool and dry completely before use.

11.7.3.3 Autoclaving (Additional Reprocessing)

NOTE: Before the disinfection, make sure that the assembly has been cleaned following 11.7.3.2.1 Manual Cleaning.

CAUTION: Ensure that the connectors of the volume exchanger is directed toward the water during the autoclaving.

1. To disinfect the Breathing System, use an authorized autoclaving process (See Table 11-6 "Autoclaving process" on Pages 11-10) to autoclave at a maximum temperature of 134℃ (273 °F) for 20 minutes (recommended disinfection time).
2. Allow the Breathing System to cool and dry completely before use.

11.7.3.4 Reassembly

NOTE: Before the reassembly, make sure that the assembly has been reprocessed and dried.

NOTE: Reassemble the breathing System at the point of use and at the designated cleaning area.

Before the reassembly, inspect the following components for damage, wear and tear, and the visual inspection criteria is no damage, no creak, no distortion.

- Volume Exchanger
- Breathing System Body
- Bag Arm
- O_2 sensor support
- Bypass
- CO_2 Absorbent Canister
- Inspiration connector
- Expiration connector
- Flow sensors
- Inspiration valve
- Expiration valve
- Seals and sealing rings

If the components are damaged, worn and torn, contact your service personnel or Mindray.

11.7.3.4.1 Volume Exchanger

1. As shown in the figure, pull the unlocking button outward.

Figure 11-19 Open the volume exchanger cover

2. Put in the volume exchanger following the screen-printed instructions.

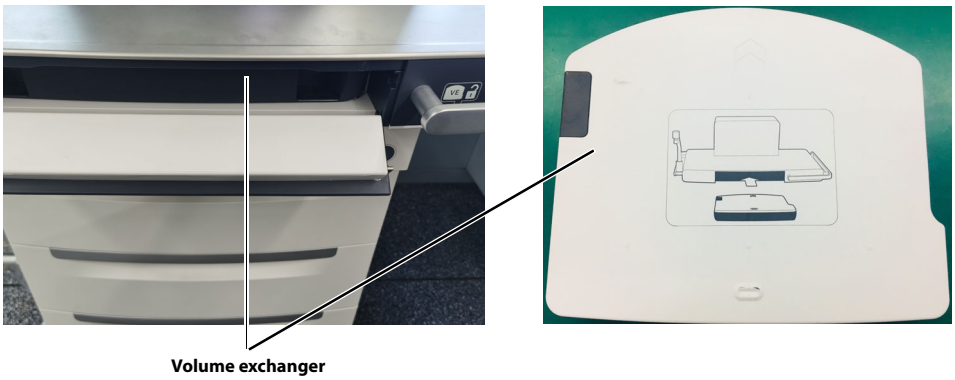


Figure 11-20 Put in the volume exchanger

3. Close the volume exchanger cover.

11.7.3.4.2 Inspiration and Expiration Valves

1. Insert the inspiration and expiration valves into the breathing system body.

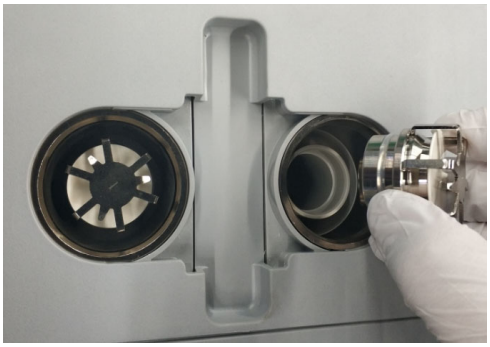


Figure 11-21 Insert the inspiration and expiration valves

2. Install the valve dome to the breathing system body. You will hear a snap when the valve dome is installed in place.

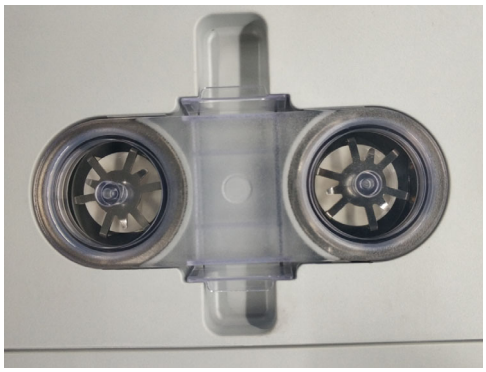
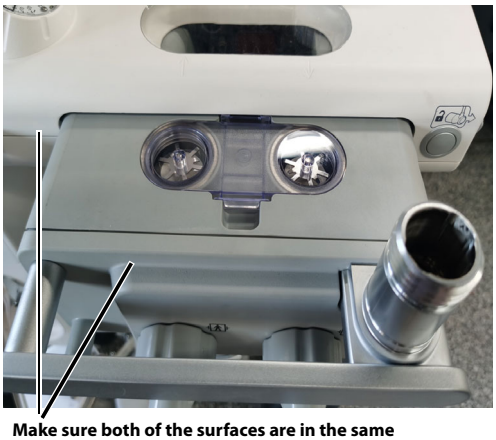


Figure 11-22 Install the valve dome

11.7.3.4.3 Breathing System Body

Hold the handrails on one side of the breathing system body and push the breathing system body into the anesthesia system. Make sure that the two surfaces in the following figure are in the same plane and hear a snap.



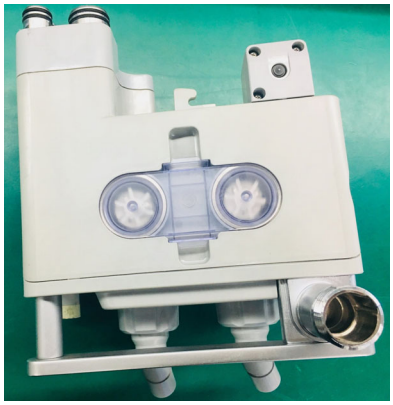


Figure 11-23 Install the breathing system body

11.7.3.4.4 Bag Arm

To install the bag arm, align it with the slot on the breathing system and screw the retaining ring clockwise until it is tightened.

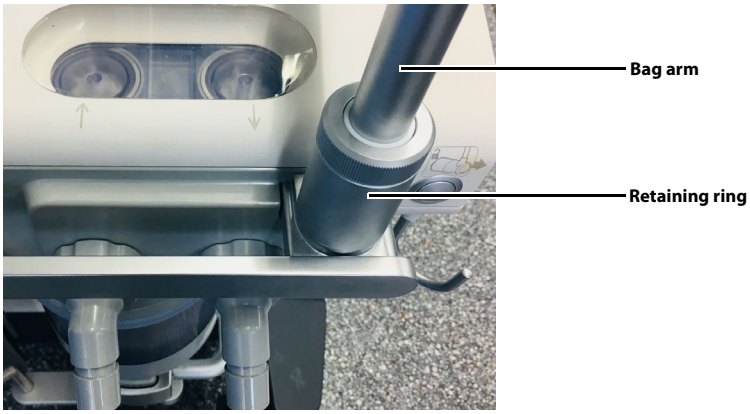


Figure 11-24 Install the bag arm

11.7.3.4.5 Flow Sensor

WARNING: **Tighten the locking nut of the screw cap at the inspiration/expiration connector when installing the flow sensor. Otherwise it may cause a failure of the flow sensor.**

WARNING: **Exercise caution when moving the anesthesia system to avoid damage to the flow sensor because of collision at the inspiration/expiration connector.**

WARNING: **Keep the breathing tube end that is connected to the inspiration/ expiration connector heading downward. Otherwise the water formed by condensed vapor may flow into the inspiration/expiration connector and affect measurement of the flow sensor.**

1. Insert the flow sensor in the direction shown in the figure and keep the side with the screen printing upward.

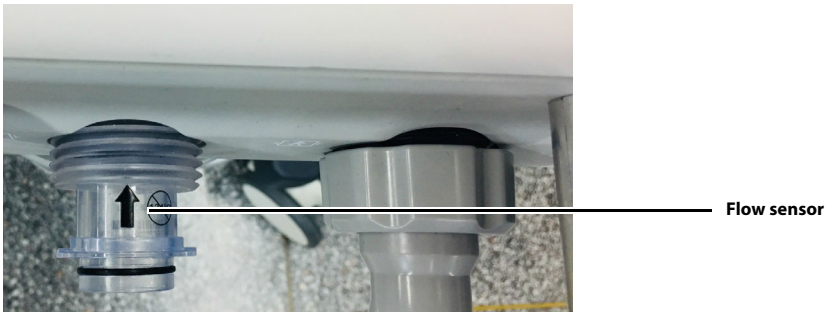


Figure 11-25 Install the flow sensor

2. Insert the flow sensor horizontally to the end.
3. Align the inspiration/expiration connector with the flow sensor slot, and tighten up the locking nut clockwise.

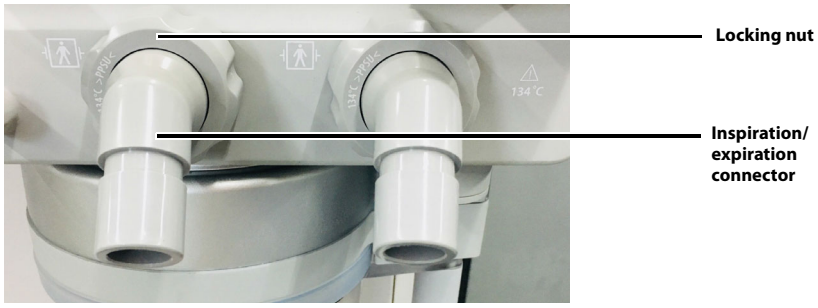


Figure 11-26 Install the inspiration/expiration connector and locking nut

11.7.3.4.6 Bypass

Press and hold the buckle button on the bypass assembly, align the bypass assembly with the bypass installing plate and push the assembly upward into position to install the bypass. You will hear a snap when the bypass is installed in place.

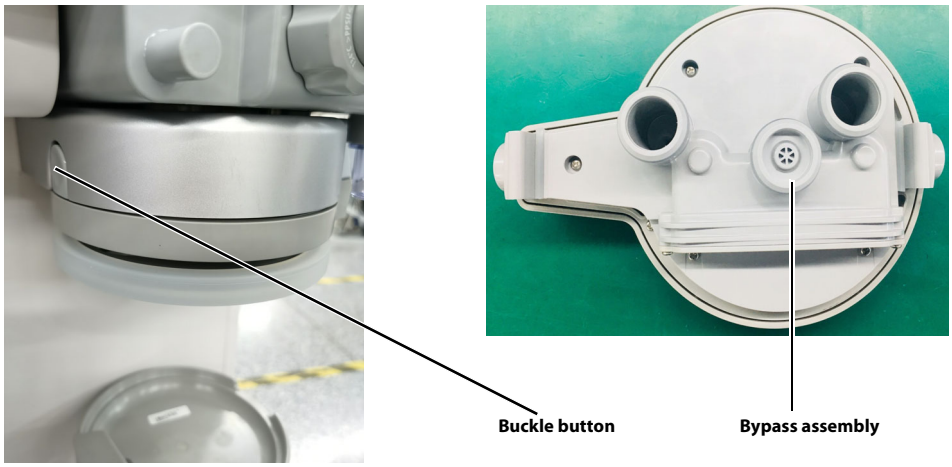


Figure 11-27 Install bypass

NOTE: **When the bypass is enabled, gases in the breathing system do not go through the CO_2 absorbent canister.**

11.7.3.4.7 CO_2 Absorbent Canister

Load absorbent into the canister and place the canister onto the underpan assembly. Rotate the handle counter clockwise to the horizontal position to lock the canister.

Figure 11-28 Canister unlocking

Figure 11-29 Canister locking

WARNING: **Use extreme care while handling the CO2 absorbent as it is a caustic irritant.**

WARNING: **Check if the gasket is properly installed in place while installing the canister. If the gasket is not properly installed, it may cause breathing system leaks.**

WARNING: **Before locking the canister, make sure that the gasket on the bypass assembly has no residual absorbent particles or powder. Otherwise it may cause breathing system leaks.**

NOTE: **Before adding the absorbent, make sure that the canister is fully dry.**

NOTE: **The absorbent poured in should not surpass the Max mark on the CO_2 absorbent canister.**

11.7.3.4.8 O_2 Sensor

1. Press the O_2 sensor cover switch to open the O_2 sensor cover.

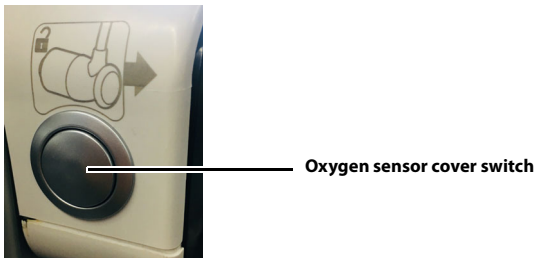


Figure 11-30 Open the O_2 sensor cover

2. Rotate the O_2 sensor clockwise to install it to the support.

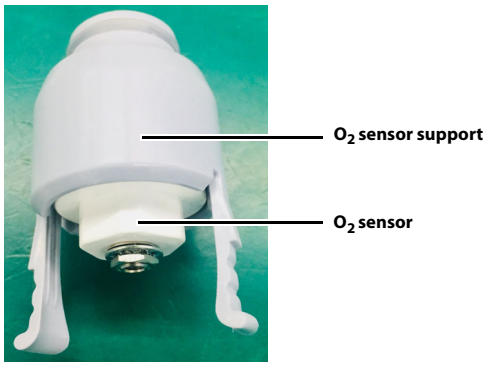


Figure 11-31 Install the O_2 sensor to the support

3. Insert the O_2 sensor support to the breathing system.

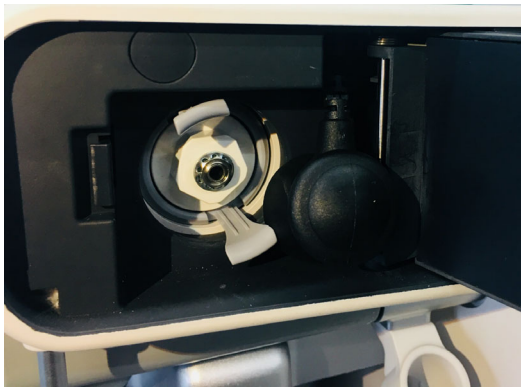


Figure 11-32 Insert the O_2 sensor support to the breathing system

4. Insert the O_2 sensor cable.

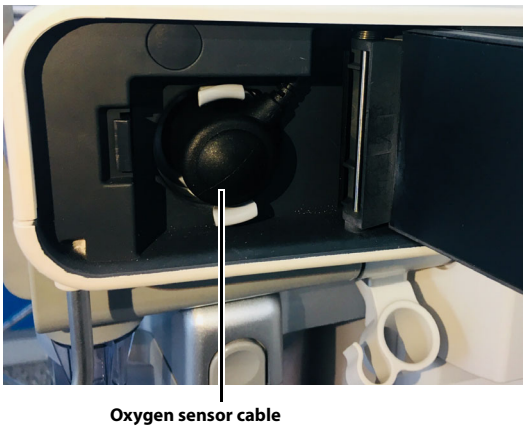


Figure 11-33 Insert the O_2 sensor cable

5. Close the O_2 sensor cover. The O_2 sensor is now fully Installed.

11.7.3.4.9 Manual bag

Directly insert or draw out the manual bag to install or disassemble it.

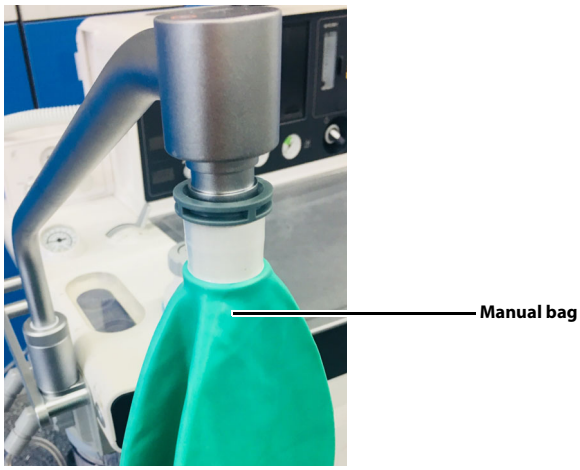


Figure 11-34 Install the manual bag

11.7.3.4.10 Breathing Tube

NOTE: **When installing a breathing tube, hold the joints at both ends of the tube to prevent damage to the tube.**

NOTE: **Do not reuse the bacteria filter repeatedly to prevent cross infection.**

NOTE: **Install the filter following the instructions in this manual to prevent dust or particles from entering the patient's lungs and prevent cross infection.**

CAUTION: **The bacteria filter shall comply with the requirements of ISO 23328-1 and ISO 23328-2.**

1. Install the expiratory tube and inspiratory tube to the expiration connector and the inspiration connector of the breathing system, respectively.

Figure 11-35 Install the breathing tubes

2. Install the bacteria filter onto the Y-piece.

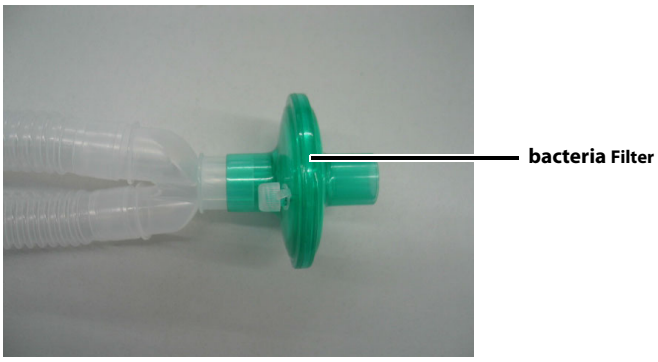


Figure 11-36 Install the bacteria filter

11.7.3.5 Check Before the Next Use

After reassemble the components of the breathing system, power on the Anesthesia System and follow the on-screen prompts to perform leak test and compliance test. See section 5.4.2 "Leak & Compliance Test".

11.7.4 Negative Pressure Suction Device

11.7.4.1 Disassembly

NOTE: Disassemble the Negative Pressure Suction Device at the point of use or at the designated cleaning area.

To disassemble the negative pressure suction device, pull out the suction tube and discard the filter.

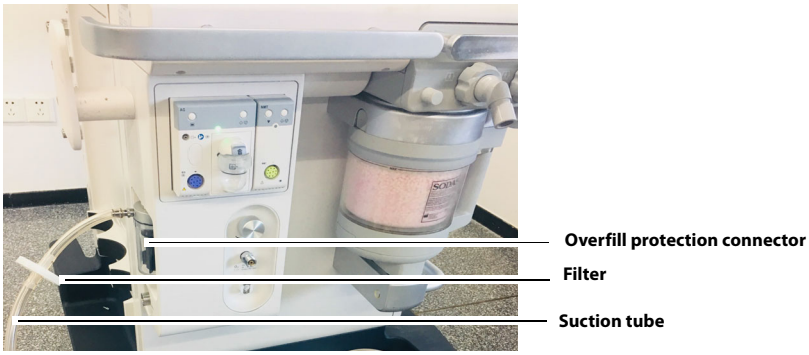


Figure 11-37 Disassemble the negative pressure suction device

NOTE: **Filters are disposable accessories. Please follow local regulations to dispose of discarded filters.**

11.7.4.2 Cleaning

1. Submerge or rinse the suction tube in an authorized cleaning agents (See Table 11-3 "Cleaning agent" on Pages 11-10) for the required period as specified by the manufacturer of the cleaning solution.
2. Rinse the suction tube with the clean water.
3. Completely dry the suction tube before use.
4. To disinfect the suction tube, proceed to 11.7.4.3 **Disinfection**. Otherwise, jump to 11.7.4.4 Reassembly.

11.7.4.3 Disinfection

NOTE: **Before the disinfection, make sure that the suction tube has been cleaned following 11.7.4.2 Cleaning.**

1. Submerge or rinse the suction tube in an authorized disinfectors (See Table 11-4 "Manual Disinfector" on Pages 11-10) for the required period as specified by the manufacturer of the disinfecting solution.
2. Rinse the suction tube with the clean water.
3. Completely dry the suction tube before use.

11.7.4.4 Reassembly

NOTE: **Before the reassembly, make sure that the assembly has been reprocessed and dried.**

NOTE: **Reassemble the Negative Pressure Suction Device at the point of use and at the designated cleaning area.**

1. Place the liquid collection bottle to the bracket. Connect the suction tube and the filter following the screen printed instructions.
2. Insert the suction tube to the overfill protection connector. The negative pressure suction device is now fully installed.

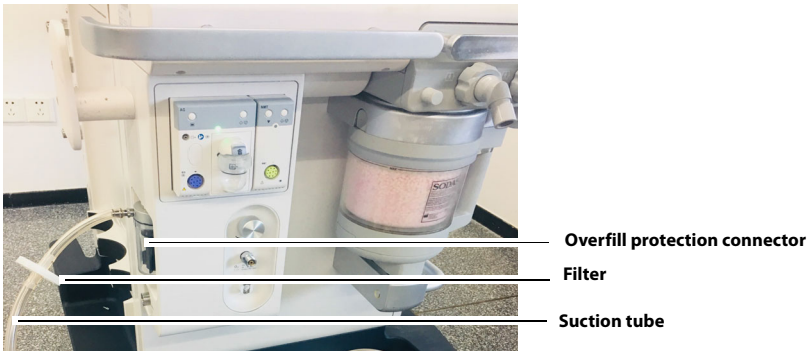


Figure 11-38 Install the negative pressure suction device

NOTE: **When install the filter to the suction tube, pay attention to keeping the side printed with IN facing the liquid collection bottle.**

NOTE: **Avoid twisting or bending suction tubes during use.**

11.7.4.5 Check Before the Next Use

NOTE: After reassemble the components of the negative pressure suction device, check the negative pressure suction device before use. See section 5.16 "Pre-operation Preparations".

11.8 Periodic Maintenance

WARNING: **To avoid endangering the patient, do not perform test or maintenance when the equipment is in use.**

Visual inspection should be performed every 30 days to ensure timely replacement of worn or damaged parts.

1. Power off the system.
2. Visually check the whole system.
3. Power on the system and follow the on-screen prompts to perform leak test and compliance test. See section 5.4.2 "Leak & Compliance Test".

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12.0 Product Specifications

12.1 Standards Compliance

The anesthesia system shall be used together with the monitoring devices, alarm system and protective devices below:

- The pressure measurement device in compliance with ISO 80601-2-13;
- The pressure restriction device in compliance with ISO 80601-2-13;
- The expiratory volume monitor in compliance with ISO 80601-2-13;
- The breathing system with alarm system in compliance with ISO 80601-2-13;
- The anaesthetic vapour delivery system in compliance with ISO 80601-2-13;
- The anaesthetic gas scavenging system in compliance with ISO 80601-2-13;
- The anesthetic gas delivery device in compliance with ISO 80601-2-13;
- The anesthetic ventilator in compliance with ISO 80601-2-13;
- The O_2 monitor in compliance with ISO 80601-2-55;
- The CO_2 monitor in compliance with ISO 80601-2-55;
- The AG monitor in compliance with ISO 80601-2-55.

The anesthesia system is integrated with the pressure measurement device, pressure restriction device, expiratory volume monitor, anaesthetic breathing system with alarm system, anaesthetic gas delivery system, anaesthetic vapour delivery system, anaesthetic ventilator, AG monitor in compliance with the afore mentioned standards, where:

- The pressure restriction device, expiratory volume monitor and breathing system with alarm system also comply with ISO 80601-2-13.
- AG monitor in compliance with ISO 80601-2-55.

12.2 Safety Designations

Type of Protection against Electric Shock:	Class I equipment with internal electric power supply. Where the integrity of the external protective earth (ground) in the installation or its conductors is in doubt, the equipment shall be operated from its internal electric power supply (i.e., battery supply).
Degree of Protection against Electric Shock:	Type BF, defibrillation-proof (Type CF for NMT Module)
Rated voltage and frequency of equipment:	External electric power supply: 220V to 240 VAC, 50/60 Hz 100V to 240 VAC, 50/60 Hz 100V to 120 VAC, 50/60 Hz Internal battery supply: Lead acid, 12VDC, 32 Ah (2 batteries installed) Lead acid, 12VDC, 16 Ah (1 battery installed)
Input power of equipment:	220 to 240VAC, 10A 100 to 240VAC, 10A 100 to 120VAC, 10A
Mode of Operation:	Continuous
Degree of Protection against Hazards of Explosion:	Not for use with flammable anesthetics.

TABLE 12-1 Safety Designations

Degree of Protection against Harmful Ingress of Water:	IPX1 (IPX4 for BIS Module)
Electrical Connection between Equipment and Patient:	Electrical connections
Degree of Mobility:	Mobile (including the base and casters)
Disinfection methods:	Steam autoclavable or disinfectable
Application parts with protection against electric shock:	All application parts
Signal input or output part:	Both signal input and output parts
Permanent or non-permanent installation:	Non-permanent installation

TABLE 12-1 Safety Designations

12.3 Physical Specifications

Dimensions:	Height: 1490 mm Width: 910 mm Depth: 705 mm
Weight:	Approximately 160 kg (Standard configured mass) Approximately 290 kg (Maximum configured mass)
Worktable (stainless steel):	Weight limit: 30kg Width: 590 mm Depth: 325 mm Height: 850 mm
Top Shelf:	Weight limit: 15kg Width: 480mm Depth: 310mm
Side Mounting Rails:	Supporting weight: 27 kg at a maximum distance of 0.41 m with a safety factor of 6 times the weight
Bag Arm:	**Fixed Height Bag Arm:** Length: 312 mm Height: 1130 mm Swiveling angle: ± 120 degrees **Flexible Bag Arm:** Length: 550mm The height and angle of the flexible bag arm can be adjusted freely.
Drawers (internal dimensions):	Weight limit: 5 kg Drawers are of equal size: • Height: 140 mm • Width: 420 mm • Depth: 315 mm
Caster:	4 casters Diameter: 125 mm Brake: central brake with lock/unlock indicator Cable pusher: cable pusher with each caster
System Noise (under the typical working mode):	≤42dB(A)

TABLE 12-2 Physical Specifications

12.4 Software Specifications

Host CPU	ARM 3358
Primary programming language	C++
Operating system	Linux
AC power input	1
Network connector(LAN1,LAN2,LAN3)	1, standard RJ45 connectors, 100 Base-TX
Serial bus connector (MSB)	1
USB connector	2, USB 2.0
Satellite module rack (SMR) connector	3
Video output connector (VP1,VP2)	1, VGA
Nurse call connector	0
Equipotential grounding terminal	1

TABLE 12-3 Software Specifications

12.5 Environmental Specifications

Operating Temperature:	+10°C to +40°C
Storage Temperature:	-20°C to +60°C (Oxygen Cell: -20°C to 50°C)
Operating Humidity:	15 to 95% RH, non-condensing
Storage Humidity:	10 to 95% RH, non-condensing
Operating Atmospheric Pressure:	70 kPa to 106.7 kPa
Storage Atmospheric Pressure:	50 kPa to 106.7 kPa

TABLE 12-4 Environmental Specifications

12.6 Electrical Specifications

12.6.1 Main Electrical Power Specifications

Power Supply Input Voltage:	220V to 240 VAC, 50/60 Hz 100V to 240 VAC, 50/60 Hz 100V to 120 VAC, 50/60 Hz
Power Supply Input Current:	10 A maximum (5 A maximum for anesthesia system, 5A maximum for auxiliary outlets)
Length of Power Cord:	5 m
Grade of Power Cord:	Normal grade

TABLE 12-5 Main Electrical Power Specifications

12.6.2 Battery Power Specifications

Battery Type:	Lead acid battery, One (1) battery: 12VDC, 16Ah Two (2) batteries: 12VDC, 32Ah
Battery Run-time:	≥ 90 minutes (powered by one piece new fully-charged battery under the typical condition) ≥ 180 minutes (powered by two pieces new fully-charged batteries under the typical condition) ≥ 50 minutes (powered by one piece new fully-charged battery under the worst power consumption condition) ≥ 100 minutes (powered by two pieces new fully-charged batteries under the worst power consumption condition)
Time to Shutdown from Lower Battery Alarm:	5 minutes at least (powered by new fully-charged batteries after the first low-power alarm)
Battery Charge Time:	New Battery: < 12 hours (powered by new depleted batteries at 25°C ambient temperature under typical working mode).

TABLE 12-6 Battery Power Specifications

12.6.3 Auxiliary Electrical Outlets

Number of Outlets:	4 (3 for anesthesia machines complying with Indian and South African standards)
Output Voltage:	Corresponds to power supply input voltage
Output Current of Each Auxiliary Outlet:	3 A max.
Output Current for Total Auxiliary Outlet:	5 A max.
Breaker Rating Current of Each Auxiliary Outlet:	3 A
Breaker Rating Current for Total Auxiliary Outlet:	5 A

TABLE 12-7 Auxiliary Electrical Outlets

12.6.4 Communication Ports

RS-232 Communication Port:	One DB9 male connector
Network Port:	Two separate RJ-45 network ports
SB Ports:	Four SB ports
Video Signal Port:	One DB15 female port

TABLE 12-8 Communication Ports

12.7 Pneumatic Specifications

12.7.1 Pipeline Supply

Pipeline Input Pressure Range:	O_2: 280 to 600 kPa (40 to 87 psi) N_2O: 280 to 600 kPa (40 to 87 psi) Air: 280 to 600 kPa (40 to 87 psi)
Pipeline Input Flow Rate Range:	O_2: V'max. 190 L/min Air: V'max. 70 L/min N_2O: V'max. 20 L/min
Pipeline Connections:	DISS NIST
Gas Configuration:	N2O, Air, O2

TABLE 12-9 Pipeline Supply

12.7.2 Backup O_2 Supply

Backup O_2 Pressure Range:	280 to 600 kPa (40 to 87 psi)
Pipeline Input Flow Rate Range:	V'max. 190 L/min
Pipeline Connections:	DISS NIST

TABLE 12-10 Backup O_2 Supply

12.7.3 Cylinder Supply

Cylinder Supply:	E-cylinder and pin indexed
O_2 Cylinder Input Pressure Range:	6.9 to 20.0 MPa (1000 to 2900 psi)
N_2O Cylinder Input Pressure Range:	4.2 to 6.0 MPa (600 to 870 psi)
Air Cylinder Input Pressure Range:	6.9 to 20.0 MPa (1000 to 2900 psi)
Cylinder Input Flow Rate Range:	O_2: V'max. 190L/min Air: V'max. 70L/min N_2O: V'max. 20 L/min
Cylinder Connections:	Pin-Index Safety System (PISS)
Yoke Configuration:	Air, N_2O, O_2

TABLE 12-11 Standard Cylinder Supply

O_2 Cylinder Input Pressure Range:	280 kPa to 600 kPa(40 psi to 87 psi)
N_2O Cylinder Input Pressure Range:	280 kPa to 600 kPa(40 psi to 87 psi)
Cylinder Input Flow Rate Range:	O_2: V'max. 190L/min N_2O: V'max. 20 L/min
Cylinder Connections:	NIST
Yoke Configuration:	N_2O, O_2

TABLE 12-12 Large Cylinder Supply

12.7.4 Auxiliary Common Gas Outlet (ACGO)

Control type	Mechanical
Connector:	Coaxial 22mm male/15mm female conical connector
Safety pressure:	A relief valve limits fresh gas pressure at the ACGO outlet port to not more than 12.5 kPa.

TABLE 12-13 ACGO

12.7.5 Anesthetic Vaporizer

Vaporizer Positions:	Double
Mounting Mode:	Selectatec®, with interlocking function (Selectatec® is registered trademark of Datex-Ohmeda Inc.)
Type:	Penlon Sigma Delta anesthetic vaporizers. Three types of vaporizers with anesthetic agents halothane, isoflurane, sevoflurane are available. Mindray V60 anesthetic vaporizers. Three types of vaporizers with anesthetic agents halothane, isoflurane, sevoflurane are available. Drager D-Vapor Desflurane anesthetic vaporizers.

TABLE 12-14 Selectatec® Anesthetic Vaporizer

12.7.6 Drive Gas

O_2

12.7.7 O_2 Controls

O_2 supply failure alarm: ≤220.6kPa

12.8 Breathing System Specifications

12.8.1 Breathing System Volume

Mechanical Ventilation:	1800mL
Manual Ventilation:	1950mL

2.1.7.

TABLE 12-15 Breathing System Volume

Cirkuliuojančių dujų kiekis kvėpavimo sistemoje 1,950ml

12.8.2 Volume Exchanger Volume

Volume:	1500mL

TABLE 12-16 Volume Exchanger Volume

12.8.3 CO_2 Absorber Assembly

Absorber Capacity:	1 Pre-Pak (1500ml)
Absorber Canister Contents:	1 Pre-Pak canister or Loose Fill absorbent

TABLE 12-17 CO_2 Absorber Assembly

12.8.4 Breathing System Connections

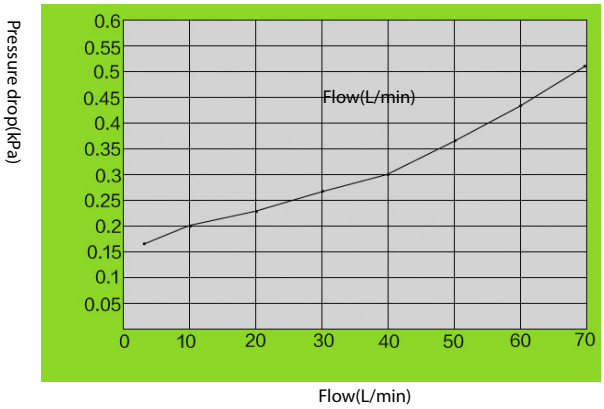
Exhalation Connection:	Coaxial 22mm male/15mm female conical connector
Inhalation Connection:	Coaxial 22mm male/15mm female conical connector
Manual bag connection:	Coaxial 22mm male/15mm female conical connector
Exhaust port:	30mm male conical connector

TABLE 12-18 Breathing System Connections

12.8.5 APL Valve

Range:	SP, 5 to 70 cmH_2O
Control accuracy	± 3 cmH_2O or ±15% of the setting value, whichever is greater, but is not more than +10 cmH_2O
Adjustable Range of Motion:	> 300 degrees
Tactile Knob Indication:	30 cmH_2O and above
Opening pressure:	≤ 0.2kPa (test gas flow of 20mL/min in dry or wet conditions)

Resistance of APL valve in dry gas:



Resistance of APL valve in wet gas:

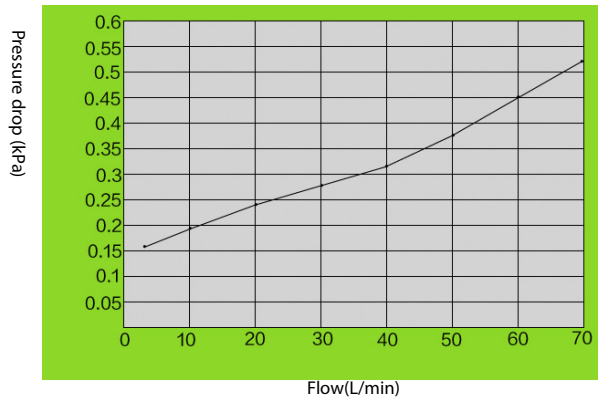
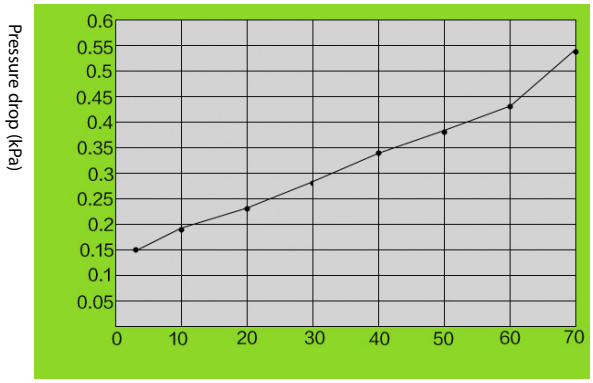


TABLE 12-19 Breathing System Connections

Resistance of APL valve in dry gas (Lift the APL Valve):



Resistance of APL valve in wet gas (Lift the APL Valve):

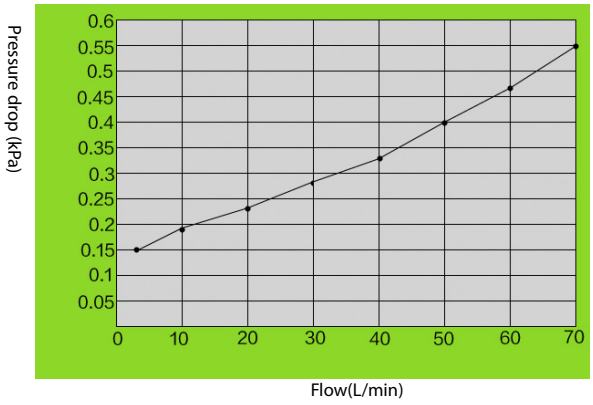
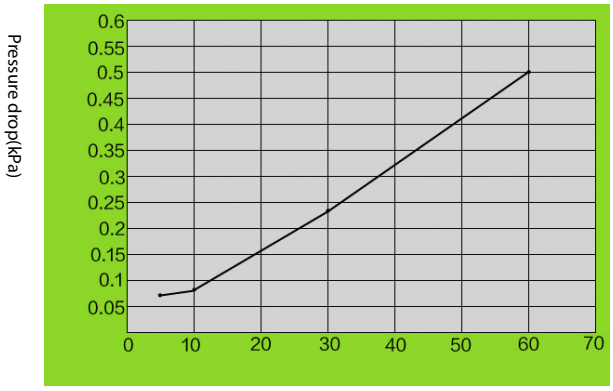


TABLE 12-19 Breathing System Connections

12.8.6 Resistance

Expiratory resistance in mechanical ventilation mode:



Inspiratory resistance in mechanical ventilation mode:

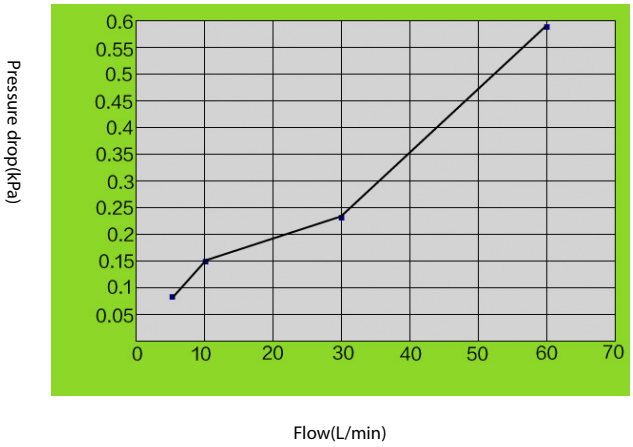
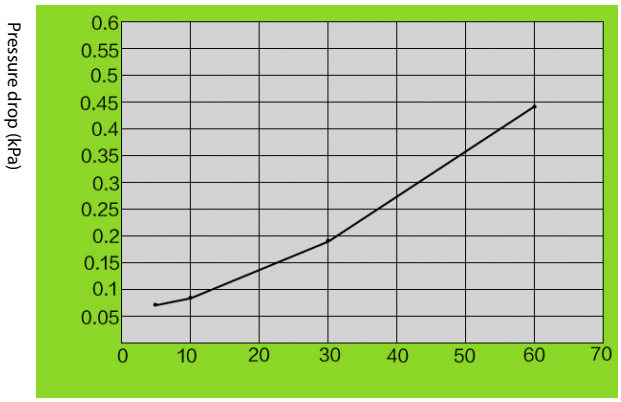


TABLE 12-20 Resistance

Expiratory resistance in manual mode:



Inspiratory resistance in manual mode:

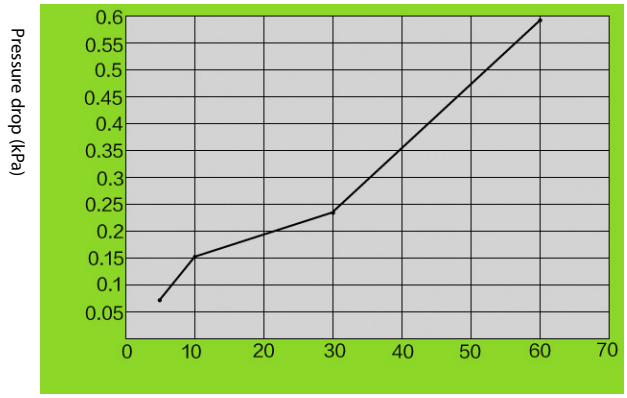


TABLE 12-20 Resistance

12.8.7 Breathing System Temperature Controller

10°C≤T(Ambient temperature)≤20°C:	ΔT=T (Temperature at metal test point of the pressure sampling body near the inspiratory check valve)-T (Ambient temperature)≥11°C
20°C≤T Ambient temperature)≤40°C	T (Temperature at metal test point of the pressure sampling body near the inspiratory check valve)≥31°C
10°C≤T(Ambient temperature)≤40°C	ΔT=|T (Temperature at test point of Y-piece patient connection)-T (Ambient temperature)|≤2°C and T (Temperature at test point of Y-piece patient connection)≤41°C
Single fault condition	T (Temperature at test point of Y-piece patient connection)≤41°C

Note: The block heater does not operate while the system is being powered by the internal battery supply.

TABLE 12-21 Breathing System Temperature Controller

12.8.8 Breathing Circuit Parameters

System Compliance:	≤ 2 ml/cm H_2O
Resistance:	≤ 0.6 kPa
Leakage:	≤ 50 ml/min @ 3.0 kPa (under BTPS condition)
System Safety Pressure on Breathing System:	110 cmH_2O

TABLE 12-22 Breathing Circuit Parameters

12.9 Anesthetic Gas Scavenging System (AGSS)

Type of the Applicable Disposable System:	Low flow
Extract Flow:	25 to 50 L/min
Resistance:	≤ 0.05 kPa @ 25 L/min ≤ 0.05 kPa @ 30 L/min ≤ 0.35 kPa @ 50 L/min ≤ 0.35 kPa @ 75 L/min

TABLE 12-23 Anesthetic Gas Scavenging System with Low Flow (AGSS)

Type of the Applicable Disposable System:	High flow
Extract Flow:	75 to 105L/min
Resistance:	≤ 0.05 kPa @ 30 L/min ≤ 0.35 kPa @ 75L/min ≤ 0.35 kPa @ 105 L/min

TABLE 12-24 Anesthetic Gas Scavenging System with High Flow (AGSS)

12.10 Negative Pressure Suction device

12.10.1 Continuous Suction Regulator

Performance Category:	Pharyngeal Suction
Gas Supply:	External vacuum system
Gas Supply Pressure Range:	-72 kPa to -40 kPa
Flow Input Range:	20 L/min to 40 L/min
Maximum Vacuum:	69 kPa to 72 kPa (517.5 mmHg to 540 mmHg) with external vacuum applied of 72 kPa (540 mmHg) and 40 L/min free flow
Maximum Flow:	39 L/min to 40 L/min with external vacuum applied of 72 kPa (540 mmHg) and 40 L/min free flow
Minimum Flow:	20 L/min
Vacuum Gauge Accuracy:	± 5 % of full scale

TABLE 12-25 Continuous Suction Regulator

12.10.2 Venturi Suction Regulator

Performance category:	Pharyngeal Suction
Supply	Air from system gas supply
Drive Gas Consumption	Approximately 28 L/min with pipeline drive gas at 280 kPa Approximately 52 L/min with pipeline drive gas at 600 kPa
Maximum vacuum	≥ 72 kPa (540 mmHg) with pipeline drive gas at 280 kPa ≥ 73 kPa (547.5 mmHg) with pipeline drive gas at 600 kPa
Maximum Flow (without suction bottle and filter)	≥ 25 L/min with pipeline drive gas at 280 kPa ≥ 32 L/min with pipeline drive gas at 600 kPa
Minimum Flow	20 L/min
Vacuum Gauge Accuracy	± 5 % of full scale

TABLE 12-26 Venturi Suction Regulator

12.11 Monitor Module

12.11.1 AG Module

Warm-up time:	ISO accuracy mode: < 45 s Full accuracy mode: <10 min
Sampling rate:	Sampling rate: Adult/Pediatric AG watertrap and sample line: 150/180/200 ml/min Neonate AG watertrap and sample line: 100/110/120 ml/min Accuracy: ± 10 ml/min or ± 10 % of the setting value, whichever is greater
Watertrap emptying interval [1]	Neonate AG watertrap: ≥24h@100ml/min [2] ≥22h@110ml/min ≥20h@120ml/min Adult/Pediatric AG watertrap: ≥19h@150ml/min ≥18h@180ml/min ≥17h@200ml/min
Gas:	CO_2, O_2, N_2O, and any of the five anesthetic agents: DES, ISO, ENF, SEV and HAL.
Range:	CO_2 : 0.0 to 30 % (0.0 to 30 kPa, 0.0 to 226 mmHg)
	O_2 : 0 to 100 %
	N_2O : 0 to 100 %
	DES : 0.0 to 30 %
	SEV : 0.0 to 30 %
	ENF : 0.0 to 30 %
	ISO : 0.0 to 30 %
	HAL : 0.0 to 30 %

TABLE 12-27 AG Module

Resolution:	CO_2 : 0.1 %		
	O_2 : 1 %		
	N_2O : 1 %		
	DES : 0.1 %		
	SEV : 0.1 %		
	ENF : 0.1 %		
	ISO : 0.1 %		
	HAL : 0.1 %		
ISO accuracy mode	Add ± 0.3 $\%_{ABS}$ to full accuracy for CO_2; Add ± 8 $\%_{REL}$ to full accuracy for all agents; N_2O accuracy is ± (8 $\%_{REL}$ + 2 $\%_{ABS}$).		
Full accuracy mode	**Gas**	**Range (%)**	**Accuracy (vol.%)**
	CO_2	0 to 1	± 0.1
		1 to 5 (not including 1)	± 0.2
		5 to 7 (not including 5)	± 0.3
		7 to 10 (not including 7)	± 0.5
		> 10	Unspecified
	N_2O	0 to 20	± 2
		20 to 100 (not including 20)	± 3
	O_2	0 to 25	± 1
		25 to 80 (not including 25)	± 2
		80 to 100 (not including 80)	± 3
	DES	0 to 1	± 0.15
		1 to 5 (not including 1)	± 0.2
		5 to 10 (not including 5)	± 0.4
		10 to 15 (not including 10)	± 0.6
		15 to 18 (not including 15)	± 1
		> 18	Unspecified
	SEV	0 to 1	± 0.15
		1 to 5 (not including 1)	± 0.2
		5 to 8 (not including 5)	± 0.4
		> 8	Unspecified
	ENF, ISO, HAL	0 to 1	± 0.15
		1 to 5 (not including 1)	± 0.2
		> 5	Unspecified

TABLE 12-27 AG Module

Rise Time	Gas	Measured by using adult/pediatric water trap and 2.5m sampling line	Measured by using neonatal water trap and 2.5m sampling line
	CO_2	≤250ms@150ml/min ≤250 ms@180ml/min ≤250 ms@200ml/min	≤250 ms@100ml/min ≤250 ms@110ml/min ≤250 ms@120ml/min
	N_2O	≤250ms@150ml/min ≤250 ms@180ml/min ≤250 ms@200ml/min	≤250 ms@100ml/min ≤250 ms@110ml/min ≤250 ms@120ml/min
	O_2	≤500ms@150ml/min ≤500ms@180ml/min ≤500ms@200ml/min	≤600ms@100ml/min ≤600ms@110ml/min ≤600ms@120ml/min
	ENF	≤350ms@150ml/min ≤350 ms@180ml/min ≤350 ms@200ml/min	≤350 ms@100ml/min ≤350 ms@110ml/min ≤350 ms@120ml/min
	HAL, DES, SEV, ISO	≤300ms@150ml/min ≤300 ms@180ml/min ≤300 ms@200ml/min	≤300 ms@100ml/min ≤300 ms@110ml/min ≤300 ms@120ml/min
System Total Response Time	**Gas**	**Measured by using adult/pediatric water trap and 2.5m sampling line**	**Measured by using neonatal water trap and 2.5m sampling line**
	CO_2	≤5 s @150ml/min ≤5 s @180ml/min ≤5 s @200ml/min	<6 s @100ml/min <6 s @110ml/min <6 s @120ml/min
	N_2O	≤5.5 s @150ml/min ≤5 s @180ml/min ≤5 s @200ml/min	<6 s @100ml/min <6 s @110ml/min <6 s @120ml/min
	O_2	≤5.5 s @150ml/min ≤5 s @180ml/min ≤5 s @200ml/min	<6 s @100ml/min <6 s @110ml/min <6 s @120ml/min
	DES, SEV, ISO, HAL, ENF	≤5.5 s @150ml/min ≤5 s @180ml/min ≤5 s @200ml/min	<6 s @100ml/min <6 s @110ml/min <6 s @120ml/min
Primary agent ID threshold[3]	0.15% (0.4% during ISO accuracy mode)		
Secondary agent ID threshold[4]	0.3% (0.5% during ISO accuracy mode) or $5\%_{REL}$ ($10\%_{REL}$ for Isoflurane) of primary agent if Primary agent >10%		
Measurement accuracy drift	Meets accuracy requirements within 6 hours		
Rate measurement	Measurement range: 2 bpm to 100 bpm Resolution: 1 bpm Measurement accuracy: 2 bpm to 60 bpm: ± 1 bpm 61 bpm to 100 bpm: ± 2 bpm		

TABLE 12-27 AG Module

1. *Experiment condition: temperature of sampled gas is 37 °C, ambient temperature is 23 °C, relative humidity of sampled gas is 100%.*
2. *Cleaning time of watertrap ≥24h means that the liquid level will not exceed the MAX line within 24 hours.*
3. *For Halothane: Increase in threshold by $0.1\%_{ABS}$.*
4. *For Halothane: Increase in threshold by $0.1\%_{ABS}$.*

NOTE: **Inaccuracy specifications are affected by the breath rate and I:E change. The end-tidal gas reading is within specification for breath rate below 15BPM and I:E ratio smaller than 1:1 relative to the gas readings without breath; Add ±6%$_{REL}$ to inaccuracy for HAL and O2 for breath rate larger than 15 BPM; Add ±6%$_{REL}$ to inaccuracy for all gases for breath rate larger than 30 BPM (inaccuracy for HAL and O2 are unspecified in this case); inaccuracy is unspecified for breath rate larger than 60 BPM.**

NOTE: **The ability to properly resolve end-tidal values can be measured by using the set-up described in ISO 80601-2-55:2011 figure 201.101. In short, the method consists of sampling gas from two different sources connected to an electrically controlled pneumatic valve to permit rapid switching between the two sources. During the test, the valve is set to switch gas source at a number of frequencies (simulating the range of specified breath rates) and for each frequency the end-tidal value presented by the gas analyzer is noted. From a diagram of end-tidal value over frequency, the frequency at which the gas analyzer is no longer able to resolve end-tidal values according to specification is identified. This ability to properly resolve end-tidal values is listed in the corresponding AION^{TM} Multigas Analyzer technical specification.**

NOTE: **Data sample rate 25 Hz. Data presentation is 50 Hz, every second data point is interpolated.**

NOTE: **Inspiratory and end tidal CO2 concentration readings are identified by AION^{TM} Platinum Multigas Analyzers using the lowest and highest values respectively of the temporal CO2-curve. Corresponding readings of N2O and anesthetic agents are taken at the same point in time. Inspiratory and end-tidal O2 concentration readings are identified by the O2 mean value during the respiratory phase as identified by the temporal CO2 curve. Once correctly identified, the highest and lowest O2 concentration readings during each part of the phase will be presented as inspiratory and end-tidal O2 respectively.**

NOTE: **The rated respiration rate measurement range for AG module is 2 to 100 bpm. The data sample rate is 25 Hz. The $EtCO_2$ concentration reading uses the highest value of the CO_2 waveform within the breathing cycle. The EtN_2O and EtAA concentration readings use the value measured at the moment when the $EtCO_2$ concentration is recorded. The FiO_2 concentration reading uses the highest value of the O_2 waveform within the breathing cycle.**

NOTE: **The rated respiration rate measurement range for AG module is calculated based on the CO_2 waveform. The test method used to determine the rated respiration rate range: Utilize the valves to switch the two sampling gases at different frequencies (simulating specified breath rates). Record the $EtCO_2$ value at each frequency. By drawing the coordinate diagram which indicates the corresponding relationship between end-tidal value and breathing frequency, the range of breathing frequency can be obtained.**

12.11.1.1 Alarms

AG Alarm Limits	Range	Step	Unit
$EtCO_2$ High Limit	Off, 2 to 99	1	mmHg (% and kPa should be optional)
$EtCO_2$ Low Limit	Off, 0 to 97		
$FiCO_2$ High Limit	Off, 1 to 99		

TABLE 12-28 Alarms

EtO_2 High Limit	Off, 12 to 100	1	%
EtO_2 Low Limit	Off, 10 to 98		
FiO_2 High Limit	Off, 20 to 100		
FiO_2 Low Limit	18 to 98		
EtN_2O High Limit	Off, 2 to 100	1	%
EtN_2O Low Limit	Off, 0 to 98		
FiN_2O High Limit	Off, 2 to 100		
FiN_2O Low Limit	Off, 0 to 98		
EtHal High Limit	Off, 0.2 to 5.0	0.1	%
EtHal Low Limit	Off, 0.0 to 4.8		
FiHal High Limit	Off, 0.2 to 5.0		
FiHal Low Limit	Off, 0.0 to 4.8		
EtEnf High Limit	Off, 0.2 to 5.0	0.1	%
EtEnf Low Limit	Off, 0.0 to 4.8		
FiEnf High Limit	Off, 0.2 to 5.0		
FiEnf Low Limit	Off, 0.0 to 4.8		
EtIso High Limit	Off, 0.2 to 5.0	0.1	%
EtIso Low Limit	Off, 0.0 to 4.8		
FiIso High Limit	Off, 0.2 to 5.0		
FiIso Low Limit	Off, 0.0 to 4.8		
EtSev High Limit	Off, 0.2 to 8.0	0.1	%
EtSev Low Limit	Off, 0.0 to 7.8		
FiSevHigh Limit	Off, 0.2 to 8.0		
FiSev Low Limit	Off, 0.0 to 7.8		
EtDes High Limit	Off, 0.2 to 18.0	0.1	%
EtDes Low Limit	Off, 0.0 to 17.8		
FiDes High Limit	Off, 0.2 to 18.0		
FiDes Low Limit	Off, 0.0 to 17.8		

TABLE 12-28 Alarms

12.11.1.2 Effect of Interfering Gas on AG Measured Value

Gas Under Test	Concentration	Quantitative Effect (Volume Fraction)							
		CO_2	N_2O	HAL	SEV	ISO	ENF	DES	O_2
N_2O	**60 %**	0.1%	/	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%
HAL	**4 %**	0.1%	0.1%	/	0.1%	0.1%	0.1%	0.1%	1.0%
SEV	**5 %**	0.1%	0.1%	0.1%	/	0.1%	0.1%	0.1%	1.0%
ISO	**5 %**	0.1%	0.1%	0.1%	0.1%	/	0.1%	0.1%	1.0%
ENF	**5 %**	0.1%	0.1%	0.1%	0.1%	0.1%	/	0.1%	1.0%
DES	**15 %**	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	/	1.0%

NOTE: Test GAS LEVELS shall be ±20% of the specified level.

TABLE 12-29 Effect of Interfering Gas on AG Measured Value

12.11.2 Monitor Mode

The system supports **Monitor** mode when the anesthesia system is configured with an external AG module.

When the anesthesia system is in **Monitor** mode, the external AG module continues to function, while the ventilation monitors and alarms of the anesthesia system will be off.

12.11.3 Oxygen Monitor Using Oxygen Cell

Oxygen monitor	Type	Galvanic Fuel Cell
	Range	18 to 100 vol% O_2
	Accuracy	±(volume fraction of 2.5%+2.5%gas level)
	Accuracy Drift	Meets accuracy requirements within 6 hours
	System Total Response Time (21% Air to 100% O_2)	< 20 s

TABLE 12-30 Oxygen Monitor Using Oxygen Cell

12.11.3.1 Alarms

O_2 Alarm Limits	**Range**	**Step**	**Unit**
FiO_2 High Limit	Off, 20 to 100	1	%
FiO_2 Low Limit	18 to 98		

TABLE 12-31 Alarms

12.11.3.2 Effect of Interfering Gas on Oxygen Cell Measured Value

Gas Under Test	**Concentration**	**Quantitative Effect (Volume Fraction)**
		O_2
N_2O	**60 %**	1.0%
HAL	**4 %**	1.5% to 2.0%
SEV	**5 %**	1.0% to 1.5%
ISO	**5 %**	1.2% to 1.8%
ENF	**5 %**	1.2% to 1.8%
DES	**15 %**	2.0%

NOTE: Test GAS LEVELS shall be ± 20% of the specified level.

TABLE 12-32 Effect of Interfering Gas on Oxygen Cell Measured Value

12.11.4 Agent Usage Calculation and Agent Usage Speed

Agent Usage Calculation	
Calculation range:	0 to 3000 ml
Accuracy:	± 2 ml, or ± 15 % of the actual reading, whichever is greater.
Agent Usage Speed	
Anesthetic agents	Desflurane, Isoflurane, Sevoflurane and Halothane

TABLE 12-33 Agent Usage Calculation and Agent Usage Speed

Usage speed range	Desflurane: 0 to 900 ml/h Sevoflurane: 0 to 450 ml/h Isoflurane and Halothane: 0 to 250 ml/h
Accuracy	± 2ml/h or ±15% of the actual reading, whichever is greater.

TABLE 12-33 Agent Usage Calculation and Agent Usage Speed

12.11.5 Anesthesia Prediction

Patient Information:	Height: 150 cm to 200 cm Weight: 40 kg to 140 kg Age: 18 years to 90 years	
Anesthetic agents (AA):	Desflurane, Isoflurane, Sevoflurane and Halothane	
Prediction deviation:	EtAA=0	≤ 0.05vol.%
	EtAA≠0	-20% to 30% of the actual measured EtAA, or -5% to 7.5% of the vaporizer maximum setting, whichever is greater
	EtO_2	-10% to 15% of the actual measured EtO2, or -5vol.% to 7.5vol.%, whichever is greater

TABLE 12-34 Anesthesia Prediction

12.11.6 BIS Module

Measured parameters:	**Type**	**BISx**	**BISx4**	**Parameter Range**
	Bispectral index	BIS	BIS L, BIS R	0 to 100
Calculated parameters:	**Type**	**BISx**	**BISx4**	**Parameter Range**
	Signal quality index	SQI	SQI L, SQI R	0% to 100%
	Electromyography	EMG	EMG L, EMG R	0 dB to 100 dB
	Suppression ratio	SR	SR L, SR R	0% to 100%
	Spectral edge frequency	SEF	SEF L, SEF R	0.5 Hz to 30.0 Hz
	Total power	TP	TP L, TPR	40 dB to 100 dB
	Burst count	BC	BC L,BC R	0 to 30
	BIS variability index	/	sBIS L, sBIS R	0 to 10.0
	EMG variability index	/	sEMG L, sEMG R	0 to 10.0
	Asymmetry	/	ASYM	0% to 100%
EEG signal amplitude	50 uV/Scale, 100 uV/Scale, 200 uV/Scale, 500 uV/Scale			
Sweep speed:	6.25 mm/s, 12.5 mm/s, 25 mm/s or 50 mm/s			

TABLE 12-35 BIS Module

Alarm Item	**Setting Range**	**Step**
BIS High Limit	2 to 100	1
BIS Low Limit	0 to 98	

TABLE 12-36 Alarms

12.11.7 NMT Module

Stimulation output:	Pulse width	100, 200, or 300 µs; monophasic rectangle pulse Accuracy: ± 10 %
	Stimulation current peak	Output range: 0 to 60 mA Step: 5 mA Accuracy: ± 5 % or ± 2 mA, whichever is greater
	Maximum skin resistance	3 kΩ @ 60 mA, 5 kΩ @ 40 mA
Block Recovery:	OFF, 1,2, 3, 4, 5%, 10%, 20%, 30%, 40%. 50%, 60%, 70%, 80%, 90%, 100%	
TOF (Train Of Four) mode:	TOF-Ratio (response percentage)	5% to 160%
	TOF-Count (number of responses)	0 to 4
	TOF-T1% (response to the first stimulus as percentage of the reference value)	0% to 200%
ST (Single Twitch) mode:	ST-Ratio (response percentage)	0% to 200%
DBS (Double-Burst Stimulation) 3.2/ 3.3 mode:	DBS-Ratio (response percentage)	5% to 160%
	DBS-Count (number of responses)	0 to 2
PTC (Post-Tetanic Count) mode:	PTC-Count (number of responses)	0 to 20

TABLE 12-37 NMT Module

12.12 Ventilator Specifications

General Ventilator Specifications	
Drive Pressure:	280 to 600 kPa
Maximum Inspiratory Flow:	180 L/min
Low Flow Anesthesia:	The accuracy of Tidal Volume shall be within the specification at 0.2L/min to 1L/min total fresh gas flow.

TABLE 12-38 General Ventilator Specifications

Ventilator Setting Parameter	Range
Apnea Tinsp:	0.2 to 10 s, Step: 0.1 s
Vt:	10 to 2000 ml (VCV, SIMV-VC), 5 to 2000 ml (PCV-VG, SIMV-VG), Step: 1 ml
RR:	2 to 100 bpm, Step: 1 bpm
Min RR:	2 to 60 bpm, Step: 1 bpm
I:E	4:1 to 1:8, Step: 0.5

TABLE 12-39 Ventilator Setting Parameter and Range

Apnea I:E:	4:1 to 1:8, Step: 0.5
Tinsp:	0.2 to 10 s, Step: 0.1 s
Pinsp:	5 to 90cmH_2O, Step: 1 cmH_2O
ΔPinsp:	5 to 70cmH_2O, Step: 1 cmH_2O
ΔPsupp:	0, 3 to 60cmH_2O Note: Under Pressure Support Ventilation Mode, ΔPsupp can be adjusted to 0, meaning CPAP mode. Step: 1 cmH_2O
ΔPapnea:	3 to 60cmH_2O, Step: 1 cmH_2O
Plimit:	5 to 100 cmH_2O, Step: 1 cmH_2O
PEEP:	0 to 50 cmH_2O, Step: 1 cmH_2O
Tpause:	OFF, 5 to 60 % of Tinsp, Step: 1 %
Trig Window:	5 to 90 %, Step: 1 %
F-Trig (under BTPS condition):	0.2 to 15 L/min, Step: 0.1 L/min
P-Trig:	-20 to -1cmH_2O, Step: 1 cmH_2O
Tslope:	0.0 to 2.0 s, Step: 0.1 s
Phigh:	3 to 90 cmH_2O, Step: 1 cmH_2O
Plow:	0 to 50 cmH_2O, Step: 1 cmH_2O
Thigh:	0.2 to 10 s, Step: 0.1 s
Tlow:	0.2 to 10 s, Step: 0.1 s
Exp%	5 to 80 %, Step: 1 %
MV%	25 to 350%, Step: 1 %
MV	0.5 to 35.0 L/min, Step: 0.1 L/min

TABLE 12-39 Ventilator Setting Parameter and Range

Ventilator Monitored Parameters	Range
PEAK:	-20 to 120 cmH_2O
PLAT:	-20 to 120 cmH_2O
MEAN:	-20 to 120 cmH_2O
PEEP:	0 to 70 cmH_2O
Vt/Vt insp (under BTPS condition):	0 to 3000 ml
MV/MV insp (under BTPS condition):	0 to 100 L/min
RR:	0 to 150 bpm
I:E:	4:1 to 1:10
Raw:	0 to 600 cmH_2O/(L/s)
Compl:	0 to 300 mL/cmH_2O
MVLeak (under BTPS condition):	0 to 10.0 L/min

TABLE 12-40 Ventilator Monitored Parameters and Range

Control Parameters	Accuracy
Vt (VCV, SIMV-VC, under BTPS condition):	10 to 60 ml: ± 10 ml 60 to 210 ml (not including 60 ml): ± 15 ml 210 to 2000 ml (not including 210 ml): ± 7 % of the setting value
Vt (PCV-VG, SIMV-VG, under BTPS condition):	5 to 60 ml: ± 10 ml 60 to 210 ml (not including 60 ml): ± 15 ml 210 to 2000 ml (not including 210 ml): ± 7 % of the setting value
Pinsp:	± 2.0 cmH_2O or ± 7 % of the setting value, whichever is greater
ΔPinsp:	
ΔPsupp:	
ΔPapnea:	
Plimit:	
PEEP	
Tslope:	± 0.2 s or ± 20 % of the setting value, whichever is greater
RR:	± 1 bpm or ± 10 % of the setting value, whichever is smaller
Min RR:	
I:E:	2:1 to 1:4: ±10% of the setting value Other range: ±25% of the setting value
Apnea I:E:	
Apnea Tinsp:	± 0.2 s
Tinsp:	
Tpause:	±8 % (absolute error)
Trig Window:	±10 % (absolute error)
F-Trig (under BTPS condition):	±1 L/min
P-Trig:	± 2 cmH_2O
Phigh:	± 2.0 cmH_2O or ± 7 % of the setting value, whichever is greater
Plow:	
Thigh:	± 0.2 s or ± 10 % of the setting value, whichever is greater
Tlow:	
Exp%	±10 % (absolute error)
MV%	±10 % or ±10 % of the setting value, whichever is greater
MV	±0.1 L/min or ±8 % of the setting value, whichever is greater

TABLE 12-41 Ventilator Control Accuracy

Monitored Parameters	Accuracy
Vt/Vt insp (under BTPS condition):	0 to 60 ml: ± 10 ml 60 to 210 ml (not including 60 ml): ± 15 ml 210 to 3000 ml (not including 210 ml): ± 7% of the actual reading
MV/MV insp (under BTPS condition):	± 0.1 L/min or ± 8 % of the actual reading, whichever is greater

TABLE 12-42 Ventilator Monitoring Accuracy

PEAK:	± 2.0 cmH_2O or ± 4 % of the actual reading, whichever is greater
PLAT:	
MEAN:	
PEEP:	
RR:	± 1 bpm or ± 5 % of the actual value, whichever is smaller
I:E:	2:1 to 1:4: ± 10 % of the actual reading 4:1 to 2:1 and 1:4 to 1:10 (not including 2:1 and 1:4): ± 25 % of the actual reading
Raw:	0 to 20 cmH_2O/(L/s): ± 10 cmH_2O/(L/s) 20 to 600 cmH_2O/(L/s) (not including 20 cmH_2O/(L/s)): ±50% of the actual reading
Compl:	± (10 mL/cmH_2O+20% of the actual reading)
MV Leak (under BTPS condition):	± 0.1 L/min or ± 8 % of the actual reading, whichever is greater

TABLE 12-42 Ventilator Monitoring Accuracy

Lung Recruitment		
Lung Recruitment Tool includes Multi-Step Recruitment and One-Step Recruitment.		
One-Step Recruitment	**Pressure Hold:**	Range: 20 to 60 cmH_2O
	Hold Time:	Range: 10 to 40 s
	PEEP on Exit*:	Range: 0 to 50 cmH_2O
	Cycle Interval:	Range: Off, 1 to 180 min

** When the ventilation mode is APRV before entering the recruitment, the button name **PEEP on Exit** will indicate **Plow on Exit**.*

TABLE 12-43 Lung Recruitment Tool

Auxiliary Pressure Monitoring	
PtpI:	Range: -99 cmH_2O to 99c cmH_2O Accuracy: ± (2 cmH_2O + 4 % of the actual reading)
PtpE:	
ΔPtp:	Range: -99 cmH_2O to 99c cmH_2O Accuracy: ± (2 cmH_2O + 4 % of the actual reading)
PesI:	Range: -40 cmH_2O to 120 cmH_2O Accuracy: ± (2 cmH_2O + 4 % of the actual reading)
PesE:	
ΔPes:	Range: -99 cmH_2O to 99c cmH_2O Accuracy: ± (2 cmH_2O + 4 % of the actual reading)

TABLE 12-44 Auxiliary Pressure Monitoring

12.13 Displays and Controls Specifications

12.13.1 Electronic Controls

Main Display:	18.5 inch, 1920 * 1080 resolution with touch screen
Status Display:	8.4 inch, 800 * 600 resolution

TABLE 12-45 Electronic Controls

AC Power Indicator:	Green illuminated = active AC power Not illuminated = inactive AC power
Battery Status Indicator:	Green illuminated = battery supply is charging Not illuminated = battery supply is discharging or not charging
Working Light:	Settings: Off, Low, High
Mouse:	The Anesthesia System utilizes the SB port for a wired mouse that allows control of the touch screen.

TABLE 12-45 Electronic Controls

12.13.2 Pneumatic Controls

Line Pressure Gauges:	Gauges: O_2, N_2O, Air, Range: 0 to 140 psi (0 to 1000 kPa) Accuracy: ± (4 % of full scale reading + 8 % of actual reading) Units of measure: kPa, psi
Cylinder Pressure Gauges:	Gauges: O_2, N_2O, Air O_2: 0 to 3500 psi (0 to 25 MPa) N_2O: 0 to 1400 psi (0 to 10 MPa) Air: 0 to 3500 psi (0 to 25 MPa) Accuracy: ± (4 % of full scale reading + 8 % of actual reading) Units of measure: kPa, psi
Electronic Flowmeter:	**Direct Flow Control Mode:** O_2 flow range: 0.00 L/min, 0.20 to 15.0 L/min Air flow range: 0.00 to 15.0 L/min N_2O flow range: 0.00 to 12.0 L/min O_2 flow accuracy: ± 50 mL/min or ± 5 % of setting value, whichever is greater Balance gas (Air/N_2O) flow accuracy: ± 50 mL/min or ± 5 % of setting value, whichever is greater O_2 concentration range in the O_2/N_2O mixed gas: ≥ 25 % **Total Flow Control Mode:** Total flow range: 0.00 L/min, 0.20 to 20.0 L/min Total flow accuracy: ± 100 mL/min or ± 5 % of setting value, whichever is greater O_2 concentration range: 21 % to 100 % (The balance gas is Air) 26 % to 100 % (The balance gas is N_2O) O_2 concentration accuracy: Volume fraction of ±5% (Flow <1L/min) ± 5 % of the setting value (Flow ≥1L/min)
Backup Flowmeter, Control Needle Valve and Knob:	**Flow display on screen:** O_2 flow range: (1.0±0.5) L/min to 15 L/min Air flow range: 0 to 15 L/min Flowmeter display accuracy: ± 10 % of the indicated value (under the condition of 20°C and 101.3kPa, for flow between 10% and 100% of full scale) **Glass tube flow display:** Glass tube flowmeter display range: 0 to15 L/min Flowmeter display accuracy: ± 10 % of the indicated value (under the condition of 20°C and 101.3kPa, for flow between 10% and 100% of full scale)

TABLE 12-46 Pneumatic Controls

Auxiliary Flowmeter:	Total flow adjustable range: 0.0 L/min to 15.0 L/min Total flow control accuracy: ± 100 mL/min or ± 10 % of the setting value, whichever is greater O_2 concentration adjustable range: 21% to 100% O_2 concentration control accuracy: Volume fraction of ± 5 % Glass tube flowmeter display range: 0 L/min to 15 L/min Glass tube flowmeter display accuracy: ± 10 % of the indicated value (under the condition of 20°C and 101.3kPa, for flow between 10% and 100% of full scale)
High Flow Nasal Cannula Oxygen (HFNC)	O_2 concentration setting range: 21 % to 100 % O_2 concentration control accuracy: Volume fraction of ± 5 % Flow control range: 2 L/min to 100 L/min Flow control accuracy: ± (2 L/min + 10 % of the setting value)
High Pressure Oxygen Outlet:	Pressure range: 280 to 600 kPa Maximum flow: ≥ 90 L/min
O_2 Flush:	Flow range: 35 to 50 L/min
Airway Pressure Gauge:	Range: -20 to 100 cmH_2O Accuracy: ± (2 % of full scale reading + 4 % of actual reading)

TABLE 12-46 Pneumatic Controls

12.14 Alarms

Alarm Indicators:	Audible: speaker Visual: alarm light and on-screen alarm messages (Audible and visual alarms comply with the requirements of IEC 60601-1-8.)
Alarm Categories:	Physiological alarms: three levels (high, medium, low) Technical alarms: three levels (high, medium, low)
Sound Levels:	10 alarm sound levels, adjustable (levels 1 to 10)

TABLE 12-47 Alarms

Vte:	High Limit	5mL to 2200mL
	Low Limit	OFF, 0mL to 2195mL
MV:	High Limit	0.2L/min to 100L/min
	Low Limit	0.0L/min to 99L/min
RR:	High Limit	4bpm to 100bpm, OFF
	Low Limit	OFF, 2bpm to 98bpm
Paw:	High Limit	2cmH_2O to 100cmH_2O
	Low Limit	0cmH_2O to 98cmH_2O
Apnea alarm delay time is adjustable, Range: 5s to 60s, Accuracy: ±3s CO2 apnea delay time is adjustable, Range: 10s to 40s, Accuracy: ±3s		
It has Negative Pressure alarm function, when **Negative Pressure in Airway** alarm is triggered, Paw shall be less than -10cmH2O.		

TABLE 12-48 Alarm Limits

A.0 Accessories

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

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

WARNING: **Please do not use the accessory if its package or itself is damaged.**

WARNING: **At the end of its service life, the equipment, as well as its accessories, must 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.**

WARNING: **Parts which are intended to contact patients must comply with the biocompatibility requirement of ISO 10993-1 to prevent any adverse reactions arising from such contact.**

CATEGORIES OF FEATURES	PART NUMBER	DESCRIPTION
Gas supply hose	082-001210-00	Gas supply hose assembly.Air supply EN 34I-AIR-BS/NS-5
	082-001209-00	Gas supply hose assembly.O_2 supply EN 34I-OXY-BS/NS-5
	082-001211-00	Gas supply hose assembly.N_2O supply EN 34I-N_2O-BS/NS-5
	082-001212-00	Gas supply hose assembly.O_2 supply DIN 34I-OXY-GS/NS-5
	082-001213-00	Gas supply hose assembly.Air supply DIN 34I-AIR-GS/NS-5
2.1.38 Dujų tiekimo žarnos su greita fiksacijos sienine jungtimi	082-001214-00	Gas supply hose assembly.N_2O supply DIN 34I-N_2O-GS/NS-5
	082-001215-00	Gas supply hose assembly.O_2 supply AS 34I-OXY-SIS/NS-5
	082-001216-00	Gas supply hose assembly.Air supply AS 34I-AIR-SIS/NS-5
	082-001217-00	Gas supply hose assembly.N_2O supply AS 34I-N_2O-SIS/NS-5
	082-001218-00	Gas supply hose assembly.O_2 supply NFE 34I-OXY-FS/NS-5
	082-001219-00	Gas supply hose assembly.Air supply NFE 34I-AIR-FS/NS-5
	082-001220-00	Gas supply hose assembly.N_2O supply NFE 34I-N_2O-FS/NS-5
	082-001227-00	Gas supply hose assembly.O_2 supply ANSI 34U-OXY-BS/DS-5
	082-001228-00	Gas supply hose assembly.Air supply ANSI 34U-AIR-BS/DS-5
	082-001229-00	Gas supply hose assembly.N_2O supply ANSI 34U-N_2O-BS/DS-5
	082-001354-00	Gas supply hose assembly.N_2O ANSI Chemetron 34U-N_2O-CH/DS-5
	082-001355-00	Gas supply hose assembly.Air ANSI Chemetron 34U-AIR-CH/DS-5
	082-001356-00	Gas supply hose assembly.O_2 ANSI Chemetron 34U-OXY-CH/DS-5
	082-001373-00	Gas supply hose assembly.N_2O ANSI Ohmeda 34U-N_2O-OH/DS-5
	082-001374-00	Gas supply hose assembly.Air ANSI Ohmeda 34U-AIR-OH/DS-5
	082-001376-00	Gas supply hose assembly.O_2 ANSI Ohmeda 34U-OXY-OH/DS-5
	082-001375-00	Gas supply hose assembly.O_2 ANSI P-B 34U-OXY-PB/DS-5
	082-001377-00	Gas supply hose assembly.N_2O ANSI P-B 34U-N_2O-PB/DS-5
	082-001378-00	Gas supply hose assembly.Air ANSI P-B 34U-AIR-PB/DS-5

Vaporizer	115-005345-00	Isoflurane (Key Filler) Vaporizer material package (international)
	115-005346-00	Sevoflurane (Key Filler) Vaporizer material package (international)
	115-005348-00	Isoflurane (Pour Fill) Vaporizer material package (international)
	115-005349-00	Sevoflurane (Pour Fill) Vaporizer material package (international)
	115-005350-00	Sevoflurane (Quik-Fil) Vaporizer material package (international)
	115-014138-00	Halothane (Key Filler) Vaporizer material package (international)
	115-014139-00	Halothane (Pour Fill) Vaporizer material package (international)
	115-026747-00	Sevoflurane Quik-Fil adapter assembly (0605)
	040-000067-00	Quik-Fil Drain Funnel Adaptor 54909
	040-000063-00	Key Filler Adaptor for Halothane 53450
	040-000065-00	Key Filler Adaptor for Isoflurane 53453
	040-000066-00	Key Filler Adaptor for Sevoflurane 53454
	040-001997-00	Desflurane vaporizer (Drager), ANSI
	040-002839-00	D-Vapor Desflurane vaporizer (Drager), EN
	040-002840-00	D-Vapor Desflurane vaporizer (Drager), BS
AGSS	115-009073-00	AGSS low-flow active blow-down pipe assembly
	115-009097-00	AGSS high-flow active blow-down pipe assembly
	115-020745-00	AGSS British Standard connector material package
	115-002342-00	Passive blow-down pipe material package
	115-026796-00	AGSS 3-way connector assembly
	082-001372-00	AGSS receiving hosing, from AGSS assembly to vacum system

Reusable mask/ breathing bag/ breathing tube	040-001850-00	Silicone bellows, adult, 1.5m
	040-001851-00	Silicone bellows, child/infant, 1.5m
	040-001854-00	Silicone bellows, adult, 0.45m
	040-001866-00	Reusable Y piece, with thermometer hole/pressure tap
	040-001868-00	Reusable L piece 22M/15F, 22F
	040-001835-00	Silicone mask, #0, infant
	040-001836-00	Silicone mask, #1, infant large
	040-001837-00	Silicone mask, #2, child
	040-001841-00	Economical silicone mask, #3, child large
	040-001842-00	Economical silicone mask, #4, adult
	040-001843-00	Economical silicone mask, #5, adult large
	040-001856-00	Silicone breathing bag, 0.5L
	040-001857-00	Silicone breathing bag, 1L
	040-001858-00	Silicone breathing bag, 2L
	040-001859-00	Silicone breathing bag,3L
	115-031780-00	Reusable accessory kit (no flow sensor/adult/international)
	115-031781-00	Reusable accessory kit (no flow sensor/child/international)
Disposable mask/breathing bag/breathing tube	040-001817-00	Air cushion mask #0 including air cushion and hook
	040-001818-00	Air cushion mask #1 including air cushion and hook
	040-001819-00	Air cushion mask #2 including air cushion and hook
	040-001820-00	Air cushion mask #3 including air cushion and hook
	040-001821-00	Air cushion mask #4 including air cushion and hook
	040-001822-00	Air cushion mask #5 including air cushion and hook
	040-001827-00	Disposable non-latex breathing bag, 0.5L
	040-001828-00	Disposable non-latex breathing bag, 1L
	040-001829-00	Disposable non-latex breathing bag, 2L
	040-001830-00	Disposable non-latex breathing bag, 3L
	040-001831-00	Disposable anesthetic breathing filter
	040-001876-00	Disposable anesthetic circuit suite (non-latex bag) for adult
	040-001878-00	Disposable anesthetic circuit suite (non-latex bag) for child
	040-001704-00	Mapleson C circuit
	040-001703-00	T-piece system circuit

Negative Pressure Suction Device	082-001333-00	Gas supply hose assembly, negative pressure, American standard, 35U-VAC-DS/DS-5
	082-001334-00	Gas supply hose assembly, negative pressure, American standard, 35U-VAC-PB/DS-5
	082-001335-00	Gas supply hose assembly, negative pressure, American standard, 35U-VAC-OH/DS-5
	082-001336-00	Gas supply hose assembly, negative pressure, American standard, 35U-VAC-CH/DS-5
	082-001340-00	Gas supply hose assembly, negative pressure, American standard, 35U-VAC-BS/DS-5
	082-001337-00	Gas supply hose assembly, negative pressure, Australia standard, 35I-VAC-SIS/NS-5
	082-001338-00	Gas supply hose assembly, negative pressure, French standard, 35I-VAC-FS/NS-5
	082-001339-00	Gas supply hose assembly, negative pressure, German standard, 35I-VAC-GS/NS-5
	082-001341-00	Gas supply hose assembly, negative pressure, British standard, 35I-VAC-BS/NS-5
	040-001532-00	Vacuum liquid collecting bottle (with overflow protection)
	040-001533-00	Vacuum liquid collecting bottle (without overflow protection)
	115-054836-00	Bracket for liquid collecting bottle
	115-033264-00	Negative pressure suction tube material package
HFNC Oxygen and Humidifier	043-010620-00	Hook
	115-066007-00	Humidifier (810/Australia standard/adult)
	115-004516-00	Humidifier (810/115V/adult)
	115-008358-00	Humidifier (810/British standard/adult)
	115-008359-00	Humidifier (810/European standard/adult)
	115-008360-00	Humidifier (810/230V general/adult)
	115-018050-00	Humidifier (HS330/India)
	115-032090-00	Humidifier (810/230V/Brazil/adult)
	115-032091-00	Humidifier (810/115V/Brazil/adult)
	115-018049-00	Humidifier (HS330/Europe)
	115-018051-00	Humidifier (HS330/US/110V)
	115-018053-00	Humidifier (HS330/UK)
	115-018054-00	Humidifier (HS330/US/220V)
	115-032096-00	Humidifier (HS330/Brazil/230V)
	115-032097-00	Humidifier (HS330/Brazil/110V)
	040-006057-00	Disposable HFNC tube (adult)
	040-006058-00	Disposable HFNC heating tube (adult)
	040-002376-00	Nasal cannula (small)
	040-002377-00	Nasal cannula (medium)
	040-002378-00	Nasal cannula (large)

O_2 sensor	0611-10-45654	Sensor Oxygen (O_2 sensor) MedicelMOX-2
	115-064181-00	O_2 sensor base assembly
	115-065993-00	Oxygen cell material package
Anesthesia module	115-030379-00	Double-slots anesthesia module upgrade kit (with O_2/with accessory/international)
	115-030380-00	Double-slots anesthesia module upgrade kit (without O_2/with accessory/international)
	115-030381-00	Double-slots anesthesia module upgrade kit (with O_2/with BIS/ without BIS accessory/international)
	115-030382-00	Double-slots anesthesia module upgrade kit (without O_2/with BIS/without BIS accessory/international)
	115-030383-00	Double-slots anesthesia module upgrade kit (with O_2/with BIS/ with accessory/international)
	115-030384-00	Double-slots anesthesia module upgrade kit (without O_2/with BIS/with accessory/international)
	115-030368-00	Double-slots anesthesia module main unit kit (with O_2) international (without accessory/with packaging materials)
	115-030369-00	Double-slots anesthesia module main unit kit (without O_2) international (without accessory/with packaging materials)
	115-030370-00	Double-slots anesthesia module main unit kit (with O_2/with BIS) international (without accessory/with packaging materials)
	115-030371-00	Double-slots anesthesia module main unit kit (without O_2/with BIS) international (without accessory/with packaging materials)
	115-030385-00	Double-slots anesthesia module accessory kit (international)
	115-043024-00	DRYLINE II water trap, Adult(10 pcs)
	115-043025-00	DRYLINE II water trap, Neonate(10 pcs)
	115-043017-00	Sampling line, Adu/Ped, 2.5 m(25 pcs)
	115-043018-00	Sampling line, Neonate, 2.5 m(25 pcs)
	115-043020-00	Dryline airway adapter, straight (10 pcs)
	115-043019-00	Dryline airway adapter, Neonate (10 pcs)
	115-043021-00	Dryline airway adapter, elbow(10 pcs)

BIS Module	6800-30-50880	BIS module upgrade kit (with accessory/overseas)
	6800-30-50427	BIS module upgrade kit (with accessory/pediatric/overseas)
	115-030406-00	BISx4 module upgrade kit (with accessory/overseas)
	115-013194-00	BIS module main unit kit international (without accessory/with packaging materials)
	115-005614-00	BISx4 accessory kit
	6800-30-50144	BIS accessory kit (pediatric/overseas)
	6800-30-50878	BIS accessory kit (adult/overseas)
	6800-30-50761	BIS measuring cable assembly
	115-005707-00	BISx4 measuring cable assembly
	0010-10-42672	BIS sensor (QUATRO)(186-0106)
	0010-10-42673	BIS sensor (pediatric)(186-0200)
	040-000392-00	BISx4 sensor (Bilateral)(186-0212)
NMT	115-020916-00	NMT module main unit kit (without accessory/with packaging materials)
	115-020917-00	NMT module main unit kit (with accessory/with packaging materials)
	040-001462-00	NMT main cable
	040-001463-00	NMT sensor cable
	040-001464-00	NMT stimulation cable
	115-018586-00	NMT accessory kit
	040-002258-00	NMT sensor binding tape (20pcs)
Flow sensor	115-041519-00	Flow sensor material package (sterilizable through high temperature)
	115-041507-00	Inspiration flow sensor assembly (sterilizable through high temperature)
	115-041508-00	Expiration flow sensor assembly (sterilizable through high temperature)

Bracket	115-066074-00	N12/N15/N17 two-joint monitor bracket (fixed height)
	115-069066-00	T5/ePM15 two-joint monitor bracket (fixed height)
	115-069067-00	T8 two-joint monitor bracket (fixed height)
	115-069068-00	T5 two-joint monitor bracket and module cabinet fixed kit (fixed height)
	115-069069-00	T8 two-joint monitor bracket and module cabinet fixed kit (fixed height)
	115-048035-00	Flexible arm assembly
	115-024461-00	Support arm assembly
	115-066029-00	N12/15/17/ePM15 monitor bracket kit (height adjustable)
	115-070767-00	ePM10/ePM12/uMEC monitor bracket kit (fixed height)
	115-070768-00	ePM10/ePM12/uMEC monitor bracket kit (height adjustable)
	115-069443-00	N19/N22 monitor bracket kit (fixed height)
	115-069585-00	TE7 bracket
	115-004003-00	Top shelf mounting kit for Beneview T8
	115-004004-00	Top shelf mounting kit for Beneview T5
	115-069445-00	Top shelf upgrade kit
	115-070794-00	Bracket kit for N15/17, fixed
	115-074073-00	Bracket kit for N12, fixed
Others	0348-00-0185	SPECIAL SEAL
	115-033063-00	Cylinder wrench assembly
	115-017631-00	Vaporizer storage install package
	115-066324-00	Sodalime canister
	115-030717-00	Disposable basic accessory package (Adult, without flow sensor)
	115-030718-00	Disposable basic accessory package (Child, without flow sensor)
	115-017042-00	Quick connector assembly (sample gas recirculation)
	0010-10-12304	Disposable ECG electrodes
	115-021015-00	Elastic hook material package
	034-000460-00	External GCX auxiliary work surface bracket
	115-024056-00	Wire clips material package for support arm
	115-011304-00	Cable management kit
	115-024614-00	M-series arm material package (with cable manager)
	045-004527-00	Cleaning adaptor kit
	115-030486-00	GCX bracket kit for Pumps

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B.0 Parameters and Factory Defaults

B.1 Spirometry Screen

ITEM	DEFAULT
Loop Type	P-V loop
Save Loop	Reference loop
Show Reference	Off
Review Loops	P-V loop

B.2 BIS Screen

ITEM	DEFAULT
View	BIS&EEG
Trend Length	6 min
EEG Size	100 μV
EEG Speed	25 mm/s

B.3 NMT Screen

ITEM	DEFAULT
Settings: Mode	TOF
Settings: Measurement Interval: TOF	1 min
Settings: Measurement Interval: ST	10 sec
Settings: Measurement Interval: DBS	1 min

B.4 Limits

PARAMETERS	DEFAULT
Alarms: Limits: PEAK High	Adult: 50 cmH_2O Pediatric: 40 cmH_2O Neonate: 40 cmH_2O
Alarms: Limits: PEAK Low	Adult: 4 cmH_2O Pediatric: 4cmH_2O Neonate: 4cmH_2O
Alarms: Limits: MV High	Adult: 12 L/min Pediatric: 6 L/min Neonate: 6 L/min
Alarms: Limits: MV Low	Adult: 1 L/min Pediatric: 1 L/min Neonate: 0.2 L/min
Alarms: Limits: Vte High	1000 ml
Alarms: Limits: Vte Low	Off
Alarms: Limits: RR High	Off
Alarms: Limits: RR Low	Off

PARAMETERS	DEFAULT
Alarms: Limits: $EtCO_2$ High	Adult or Pediatric: 50 mmHg Neonate: 45 mmHg
Alarms: Limits: $EtCO_2$ Low	Adult or Pediatric: 25 mmHg Neonate: 30 mmHg
Alarms: Limits: $FiCO_2$ High	4 mmHg
Alarms: Limits: Apnea Delay Time	30 sec
Alarms: Limits: CO_2 Apnea Delay Time	30 sec
Alarms: Limits: FiO_2 High	Off
Alarms: Limits: FiO_2 Low	18 %
Alarms: Limits: EtO_2 High	100 %
Alarms: Limits: EtO_2 Low	Off
Alarms: Limits: FiN_2O High	53 %
Alarms: Limits: FiN_2O Low	0 %
Alarms: Limits: EtN_2O High	55 %
Alarms: Limits: EtN_2O Low	0 %
Alarms: Limits: BIS High	70
Alarms: Limits: BIS Low	20
Alarms: Limits: AGSS Alarms	On
Alarms: Agents: EtHal High	3 %
Alarms: Agents: EtHal Low	0 %
Alarms: Agents: FiHal High	2 %
Alarms: Agents: FiHal Low	0 %
Alarms: Agents: EtEnf High	3 %
Alarms: Agents: EtEnf Low	0 %
Alarms: Agents: FiEnf High	2 %
Alarms: Agents: FiEnf Low	0 %
Alarms: Agents: EtIso High	3 %
Alarms: Agents: EtIso Low	0 %
Alarms: Agents: FiIso High	2 %
Alarms: Agents: FiIso Low	0 %
Alarms: Agents: EtSev High	6 %
Alarms: Agents: EtSev Low	0 %
Alarms: Agents: FiSev High	5 %
Alarms: Agents: FiSev Low	0 %
Alarms: Agents: EtDes High	8 %
Alarms: Agents: EtDes Low	0 %
Alarms: Agents: FiDes High	6 %
Alarms: Agents: FiDes Low	0 %

B.5 Main Menu

PARAMETERS	DEFAULT
Setup: Ventilation: Vt/IBW	7 ml/Kg
Setup: Ventilation: Vt Source	IBW
Setup: Ventilation: Time Control	I:E
Setup: Ventilation: Pressure Display	PLAT
Setup: Ventilation: Plimit Line	On
Setup: Ventilation: Breathing System Warmer	On
Setup: O_2: O_2 Sensor Monitoring	On
Setup: AG: CO_2 Scale	0-60 mmHg
Setup: AG: O_2 Scale	0-100 %
Setup: AG: N_2O Scale	0-100 %
Setup: AG: Des Scale	0-9.0 %
Setup: AG: Sev Scale	0-4.0 %
Setup: AG: Iso Scale	0-2.5 %
Setup: AG: Hal Scale	0-2.5 %
Setup: AG: Enf Scale	0-2.5 %
Setup: AG: Flow Rate	High
Setup: BIS: BIS Module	On
Setup: BIS: Impedance Check	On
Setup: BIS: EEG Filter	On
Setup: BIS: Smoothing Rate	On
Setup: BIS: SQI	On
Setup: BIS: SR	On
Setup: BIS: EMG	On
Setup: BIS: SEF	On
Setup: BIS: TP	On
Setup: BIS: BC	On
Setup: BIS: sBIS	On
Setup: BIS: sEMG	On
Setup: BIS: ASYM	On
Setup: NMT: Stimulation Current	Supra (60mA)
Setup: NMT: Pulse Width	200 μs
Setup: NMT: Block Recovery	Off
Setup: NMT: DBS Mode	DBS 3.3
Setup: Screen: CO_2 Location	Top
Setup: Screen: Screen Saver	30 min
Setup: System: Setup: Ventilation: Insp Pressure	Pinsp
Setup: System: Setup: Ventilation: AMV Setting	MV%
Setup: System: Setup: Quick Key: Alarm Reset	On
Setup: System: Setup: Quick Key: Capture Event/Screen	On
Setup: System: Setup: Quick Key: Lung Recruitment	On
Setup: System: Setup: Quick Key: Flow Pause	On

PARAMETERS	DEFAULT
Setup: System: Setup: Quick Key: Bypass in Auto mode	Off
Setup: System: Setup: AG: Null for 30s from zeroing	On
Setup: System: Setup: AG: Types of Agent	Hal, Enf, Iso, Sev, Des
Setup: System: Setup: Language/Unit: Language	English
Setup: System: Setup: Language/Unit: Pressure Unit	cmH_2O
Setup: System: Setup: Language/Unit: CO_2 Unit	mmHg
Setup: System: Setup: Language/Unit: Gas Supply Pressure	kPa
Setup: System: Setup: Language/Unit: Agent Cost Unit	$
Setup: System: Setup: Language/Unit: Patient Height	cm
Setup: System: Setup: Language/Unit: Patient Weight	Kg
Setup: System: Setup: Optimizer: Optimizer	On
Setup: System: Setup: Optimizer: Agent Usage	On
Setup: System: Setup: Optimizer: Cost/ml of Liquid Agent: Sev	0.00
Setup: System: Setup: Optimizer: Cost/ml of Liquid Agent: Des	0.00
Setup: System: Setup: Optimizer: Cost/ml of Liquid Agent: Iso	0.00
Setup: System: Setup: Optimizer: Cost/ml of Liquid Agent: Hal	0.00
Setup: System: Setup: Optimizer: Cost/ml of Liquid Agent: Enf	0.00
Setup: System: Setup: History: Clear History	Off
Setup: System: Setup: Time/Date: 24 Hour Time	Off
Setup: System: Setup: Time/Date: Time Zone	UTC-05:00
Setup: System: Setup: Time/Date: Time	00(24h),12AM(12h)
Setup: System: Setup: Time/Date: Date Format	Year-Month-Day
Setup: System: Setup: Time/Date: Date	2009-1-1
Setup: System: Setup: Time/Date: Daylight Savings Time	Off
Setup: System: Setup: Time/Date: Start: Week of the Month	First
Setup: System: Setup: Time/Date: Start: Day of the Week	Sunday
Setup: System: Setup: Time/Date: Start: Month	Apr
Setup: System: Setup: Time/Date: Start: Time	2:00 AM
Setup: System: Setup: Time/Date: End: Week of the Month	Last
Setup: System: Setup: Time/Date: End: Day of the Week	Sunday
Setup: System: Setup: Time/Date: End: Month	Oct
Setup: System: Setup: Time/Date: End: Time	3:00 AM
Setup: System: Setup: Flow Control: Quick Key 1: L/min	1
Setup: System: Setup: Flow Control: Quick Key 1: %O_2	100
Setup: System: Setup: Flow Control: Quick Key 2: L/min	2
Setup: System: Setup: Flow Control: Quick Key 2: %O_2	100
Setup: System: Setup: Flow Control: Quick Key 3: L/min	5
Setup: System: Setup: Flow Control: Quick Key 3: %O_2	100
Setup: System: Setup: Flow Control: Quick Key 4: L/min	10
Setup: System: Setup: Flow Control: Quick Key 4: %O_2	100
Setup: System: Setup: Flow Control: Total Flow	2.0 L/min
Setup: System: Network: Ethernet: Obtain IP Address Automatically	Off
Setup: System: Network: Ethernet: IP Address	192.168.23.250

PARAMETERS	DEFAULT
Setup: System: Network: Ethernet: Subnet	255.255.255.0
Setup: System: Network: Ethernet: Default Gateway	-
Setup: System: Network: Ethernet: Obtain DNS Server Address Automatically	Off
Setup: System: Network: Ethernet: Preferred DNS Server	-
Setup: System: Network: Ethernet: Alternate DNS Server	-
Setup: System: Network: Ethernet: Device Name	-
Setup: System: Network: Serial: Protocol	None
Setup: System: Network: Serial: Baud Rate	115200
Setup: System: Network: Serial: Data Bits	8
Setup: System: Network: Serial: Stop Bits	1
Setup: System: Network: Serial: Parity	None
Setup: System: Network: Serial: Data Internal	1 min
Setup: System: Network: HL7: Data+Waveforms: Destination IP	192.168.23.200
Setup: System: Network: HL7: Data+Waveforms: Port	1550
Setup: System: Network: HL7: Data+Waveforms: Data Internal	Off
Setup: System: Network: HL7: Data+Waveforms: Compatibility	Most Recent
Setup: System: Network: HL7: Data+Waveforms: Send Waveforms	Off
Setup: System: Network: HL7: Alarms: Destination IP	192.168.23.200
Setup: System: Network: HL7: Alarms: Port	1550
Setup: System: Network: HL7: Alarms: Compatibility	Most Recent
Setup: System: Network: HL7: Alarms: Send Alarms	Off
Setup: System: Network: HL7: Alarms: Send Alarm Ack	Off
Setup: System: Network: MD2: MD2	Off
Setup: System: Network: MD2: Destination IP	192.168.23.99
Setup: System: Network: MD2: Port	6678
Setup: System: Network: SNTP: Interval	Off
Setup: System: Network: SNTP: Primary Server IP Address	132.163.4.103
Setup: System: Network: SNTP: Secondary Service IP Address	210.72.145.44
Setup: System: Network: ADT: ADT	Off
Setup: System: Network: ADT: Destination IP	192.168.23.99
Setup: System: Network: ADT: Port	3501
Setup: System: Network: Optimizer Source: IP Address	-
Setup: System: Network: Optimizer Source: Multicast Address	255.0.0.8

B.6 Screen Brightness

PARAMETERS	DEFAULT
Main Screen	50% of maximum brightness
Status Screen	50% of maximum brightness

B.7 Volume

PARAMETERS	DEFAULT
Alarm Volume	30% of maximum volume
System Alert Volume	30% of maximum volume
Key Click Volume	30% of maximum volume
NMT Beep Volume	30% of maximum volume

B.8 History

PARAMETERS	DEFAULT
List Trends: Show Interval	1 min
List Trends: Show Group	All
Graphic Trends: Zoom	5 min
Graphic Trends: Show Group	All
Event Log: Filter	High

B.9 Lung Recruitment

PARAMETERS	DEFAULT
Multi-Step Recruitment: Select Procedure	Procedure 1
One-Step Recruitment: Pressure Hold	Adult: 35 cmH_2O Pediatric: 20 cmH_2O
One-Step Recruitment: Hold Time	15 sec

B.10 Fresh Gas Control

PARAMETERS	DEFAULT
Fresh Gas Control: Control Mode	Total Flow
Fresh Gas Control: Balance Gas	AIR
Fresh Gas Control: Purge Flow Rate	10 L/min
Fresh Gas Control: Total Flow: Total	2.0 L/min
Fresh Gas Control: Total Flow: O_2%	100 %
Fresh Gas Control: Direct Flow: O_2	2.0 L/min
Fresh Gas Control: Direct Flow: AIR	0.0 L/min
Fresh Gas Control: Direct Flow: N_2O	0.0 L/min
Fresh Gas Control: Direct Flow: None	0.0 L/min

B.11 Patient Information

PARAMETERS	DEFAULT
Patient Size	Neonate
Gender	Unspecified
Height	—
IBW	—
Weight	—
Age	—
Patient ID	—
Visit Number	—
First Name	—
Last Name	—
DOB	—
Bed	—
Room	—
Department	—
Facility	—

B.12 Ventilation Mode

ITEM	DEFAULT
Ventilation Mode Tab	VCV

PARAMETERS	VCV	SIMV-VC	PCV	PCV-VG	SIMV-PC	CPAP/PS	SIMV-VG	APRV	AMV	MANUAL
Vt	Adult: 500 mL Pediatric: 120 mL Neonate: 20 mL	Adult: 500 mL Pediatric: 120 mL Neonate: 20 mL	—	Adult: 500 mL Pediatric: 120 mL Neonate: 20 mL	—	—	Adult: 500 mL Pediatric: 120 mL Neonate: 20 mL	—	—	—
RR	Adult: 12 bpm Pediatric: 15 bpm Neonate: 20 bpm	Adult: 12 bpm Pediatric: 15 bpm Neonate: 20 bpm	Adult: 12 bpm Pediatric: 15 bpm Neonate: 20 bpm	Adult: 12 bpm Pediatric: 15 bpm Neonate: 20 bpm	Adult: 12 bpm Pediatric: 15 bpm Neonate: 20 bpm	—	Adult: 12 bpm Pediatric: 15 bpm Neonate: 20 bpm	—	—	—
Min. RR	—	—	—	—	—	Adult: 4 bpm Pediatric: 6 bpm Neonate: 12 bpm	—	—	—	—
I:E	1:2	—	1:2	1:2	—	—	—	—	—	—
Tinsp	Adult: 2.0 s Pediatric: 1.0 s Neonate: 1.0 s	Adult: 2.0 s Pediatric: 1.0 s Neonate: 1.0 s	Adult: 2.0 s Pediatric: 1.0 s Neonate: 1.0 s	Adult: 2.0 s Pediatric: 1.0 s Neonate: 1.0 s	Adult: 2.0 s Pediatric: 1.0 s Neonate: 1.0 s	—	Adult: 2.0 s Pediatric: 1.0 s Neonate: 1.0 s	—	—	—
Pinsp	—	—	Adult: 15 cmH_2O Pediatric: 10 cmH_2O Neonate: 10 cmH_2O	—	Adult: 15 cmH_2O Pediatric: 10 cmH_2O Neonate: 10 cmH_2O	—	—	—	—	—
ΔPinsp	—	—	Adult: 15 cmH_2O Pediatric: 10 cmH_2O Neonate: 10 cmH_2O	—	Adult: 15 cmH_2O Pediatric: 10 cmH_2O Neonate: 10 cmH_2O	—	—	—	—	—
Tpause	Off	Off	—	—	—	—	—	—	—	—
Plimit	Adult: 30 cmH_2O Pediatric: 30 cmH_2O Neonate: 20 cmH_2O	Adult: 30 cmH_2O Pediatric: 30 cmH_2O Neonate: 20 cmH_2O	—	Adult: 30 cmH_2O Pediatric: 30 cmH_2O Neonate: 20 cmH_2O	—	—	Adult: 30 cmH_2O Pediatric: 30 cmH_2O Neonate: 20 cmH_2O	—	—	—

PARAME-TERS	VCV	SIMV-VC	PCV	PCV-VG	SIMV-PC	CPAP/PS	SIMV-VG	APRV	AMV	MANUAL
PEEP	0 cmH_2O	0 cmH_2O	0 cmH_2O	0 cmH_2O	0 cmH_2O	0 cmH_2O	0 cmH_2O	—	0 cmH_2O	—
ΔPsupp	—	Adult: 8 cmH_2O Pediatric: 5 cmH_2O Neonate: 5 cmH_2O	—	—	Adult: 8 cmH_2O Pediatric: 5 cmH_2O Neonate: 5 cmH_2O	Adult: 8 cmH_2O Pediatric: 5 cmH_2O Neonate: 5 cmH_2O	Adult: 8 cmH_2O Pediatric: 5 cmH_2O Neonate: 5 cmH_2O	—	—	—
F- Trig	—	Adult: 3 L/min Pediatric: 2 L/min Neonate: 2 L/min	—	—	Adult: 3 L/min Pediatric: 2 L/min Neonate: 2 L/min	Adult: 3 L/min Pediatric: 2 L/min Neonate: 2 L/min	Adult: 3 L/min Pediatric: 2 L/min Neonate: 2 L/min	—	Adult: 3 L/min Pediatric: 2 L/min	—
Trig Window	—	25%	—	—	25%	—	25%	—	—	—
Tslope	—	0.2 s	0.2 s	0.2 s	0.2 s	0.2 s	0.2 s	0.2 s	0.2 s	—
Exp%	—	25 %	—	—	25 %	25 %	25 %	—	25 %	—
ΔPapnea	—	—	—	—	—	Adult: 15 cmH_2O Pediatric: 10 cmH_2O Neonate: 10 cmH_2O	—	—	—	—
Apnea I:E	—	—	—	—	—	1:2	—	—	—	—
Apnea Ti	—	—	—	—	—	Adult: 2.5 s Pediatric: 1.5 s Neonate: 1.0 s	—	—	—	—
Phigh	—	—	—	—	—	—	—	15 cmH_2O	—	—
Plow	—	—	—	—	—	—	—	5 cmH_2O	—	—
Thigh	—	—	—	—	—	—	—	Adult: 2.5 s Pediatric: 1.3 s Neonate: 1.0 s	—	—
Tlow	—	—	—	—	—	—	—	Adult: 5.0 s Pediatric: 2.7s Neonate: 2.0 s	—	—
MV%	—	—	—	—	—	—	—	—	100 %	—
Alarm	—	—	—	—	—	—	—	—	—	On
CO_2 Alarms	—	—	—	—	—	—	—	—	—	On

B.13 Ventilation Linkage Parameters

The table below describes how ventilation mode changes impact parameter values. For example, when the ventilation mode changes, its parameter values may be shared by the other ventilation mode with the same parameters. When the ventilation mode changes, other parameters may have different values set.

CURRENT VENTILATION MODE & AFFECTED PARAMETERS		PREVIOUS VENTILATION MODE								
		VCV	**SIMV-VC**	**PCV**	**PCV-VG**	**SIMV-PC**	**CPAP/PS**	**SIMV-VG**	**APRV**	**AMV**
VCV	**Vt**	—	*	Vti measurement or the closest approximation	*	#	#	*	#	#
	RR	—	*	*	*	*	#	*	#	#
	I:E	—	#	*	*	#	#	#	#	#
	Tpause	—	*	#	#	#	#	#	#	#
	PEEP	—	*	*	*	*	*	*	#	*
	Plimit	—	*	#	*	#	#	*	#	#
SIMV-VC	**Vt**	*	—	Vti measurement or the closest approximation	*	#	#	*	#	#
	RR	*	—	*	*	*	#	*	#	#
	Tinsp	#	—	#	#	*	#	*	#	#
	Tpause	*	—	#	#	#	#	#	#	#
	PEEP	*	—	*	*	*	*	*	#	*
	Plimit	*	—	#	*	#	#	*	#	#
	ΔPsupp	#	—	#	#	*	*	*	#	#
	F-Trig/P-Trig	#	—	#	#	*	*	*	#	*
	Exp%	#	—	#	#	*	*	*	#	*
	Trig Window	#	—	#	#	*	#	*	#	#
	Tslope	#	—	*	*	*	*	*	*	*

* *In the event that the previous ventilation mode and the current one share some parameter values, the parameter setting remains unchanged.*

\# *For the parameters that are not shared by the previous ventilation mode and the current one, the most recent settings of the parameters apply.*

CURRENT VENTILATION MODE & AFFECTED PARAMETERS		PREVIOUS VENTILATION MODE								
		VCV	**SIMV-VC**	**PCV**	**PCV-VG**	**SIMV-PC**	**CPAP/PS**	**SIMV-VG**	**APRV**	**AMV**
PCV	**Pinsp**	PLAT or 80% of PEAK or the closest approximation	#	—	PLAT or the closest approximation	*	#	#	#	#
	RR	*	*	—	*	*	#	*	#	#
	I:E	*	#	—	*	#	#	#	#	#
	Tslope	#	*	—	*	*	*	*	*	*
	PEEP	*	*	—	*	*	*	*	#	*
PCV-VG	**Vt**	*	*	Vti measurement or the closest approximation	—	#	#	*	#	#
	RR	*	*	*	—	*	#	*	#	#
	I:E	*	#	*	—	#	#	#	#	#
	Tslope	#	*	*	—	*	*	*	*	*
	PEEP	*	*	*	—	*	*	*	#	*
	Plimit	*	*	#	—	#	#	*	#	#

* *In the event that the previous ventilation mode and the current one share some parameter values, the parameter setting remains unchanged.*

\# *For the parameters that are not shared by the previous ventilation mode and the current one, the most recent settings of the parameters apply.*

CURRENT VENTILATION MODE & AFFECTED PARAMETERS		PREVIOUS VENTILATION MODE								
		VCV	**SIMV-VC**	**PCV**	**PCV-VG**	**SIMV-PC**	**CPAP/PS**	**SIMV-VG**	**APRV**	**AMV**
SIMV-PC	**Pinsp**	PLAT or 80% of PEAK or the closest approxima-tion	#	*	PLAT or PEAK or the closest approxi-mation	—	#	#	#	#
	RR	*	*	*	*	—	#	*	#	#
	Tinsp	#	*	#	#	—	#	*	#	#
	ΔPsupp	#	*	#	#	—	*	*	#	#
	F-Trig/P-Trig	#	*	#	#	—	*	*	#	*
	PEEP	*	*	*	*	—	*	*	#	*
	Exp%	#	*	#	#	—	*	*	#	*
	Trig Window	#	*	#	#	—	#	*	#	#
	Tslope	#	*	*	*	—	*	*	*	*
CPAP/PS	**Min RR**	#	#	#	#	#	—	#	#	#
	ΔPsupp	#	*	#	#	*	—	*	#	#
	F-Trig/P-Trig	#	*	#	#	*	—	*	#	*
	PEEP	*	*	*	*	*	—	*	#	*
	Exp%	#	*	#	#	*	—	*	#	*
	Apnea I:E or Apnea Ti	#	#	#	#	#	—	#	#	#
	ΔPapnea	#	#	#	#	#	—	#	#	#
	Tslope	#	*	*	*	*	—	*	*	*

* *In the event that the previous ventilation mode and the current one share some parameter values, the parameter setting remains unchanged.*

\# *For the parameters that are not shared by the previous ventilation mode and the current one, the most recent settings of the parameters apply.*

CURRENT VENTILATION MODE & AFFECTED PARAMETERS		PREVIOUS VENTILATION MODE								
		VCV	SIMV-VC	PCV	PCV-VG	SIMV-PC	CPAP/PS	SIMV-VG	APRV	AMV
SIMV-VG	RR	*	*	*	*	*	#	—	#	#
	Tinsp	#	*	#	#	*	#	—	#	#
	ΔPsupp	#	*	#	#	*	*	—	#	#
	F-Trig/P-Trig	#	*	#	#	*	*	—	#	*
	PEEP	*	*	*	*	*	*	—	#	*
	Exp%	#	*	#	#	*	*	—	#	*
	Trig Window	#	*	#	#	*	#	—	#	#
	Vt	*	*	Vt measurement or the closest approximation	*	#	#	—	#	#
	Plimit	*	*	#	*	#	#	—	#	#
	Tslope	#	*	*	*	*	*	—	*	*
APRV	Phigh	#	#	#	#	#	#	#	—	#
	Plow	#	#	#	#	#	#	#	—	#
	Thigh	#	#	#	#	#	#	#	—	#
	Tlow	#	#	#	#	#	#	#	—	#
	Tslope	#	*	*	*	*	*	*	—	*
AMV	MV%	#	#	#	#	#	#	#	#	—
	PEEP	*	*	*	*	*	*	*	#	—
	F-Trig/P-Trig	#	*	#	#	*	*	*	#	—
	Tslope	#	*	*	*	*	*	*	*	—
	Exp%	#	*	#	#	*	*	*	#	—

* *In the event that the previous ventilation mode and the current one share some parameter values, the parameter setting remains unchanged.*

\# *For the parameters that are not shared by the previous ventilation mode and the current one, the most recent settings of the parameters apply.*

B.14 Constraints Among Ventilation Parameters

VENTILATION MODES	PARAMETERS	PARAMETER RELATION FORMULA
VCV	RR	$Tinsp = \frac{60}{RR} \times \frac{I:E}{1+I:E} \geq 0.2$ $Tinsp = \frac{60}{RR} \times \frac{I:E}{1+I:E} \leq 10$ $Texp = \frac{60}{RR} - Tinsp \geq 0.4$ 2≤ RR ≤ 100
	Vt	$20 \leq \frac{Vt}{Tinsp(1-TP)} \leq 3000$ $\frac{Vt * RR}{1000} \leq 60$ 10 ≤ Vt ≤ 2000
	Plimit	Plimit ≥ PEEP+5
SIMV-VC	RR	$Texp = \frac{60}{RR} - Tinsp \geq 0.4$ 2 ≤ RR≤ 100
	Vt	$20 \leq \frac{Vt}{Tinsp(1-TP)} \leq 3000$ $\frac{Vt * RR}{1000} \leq 60$ 10 ≤ Vt ≤2000
	ΔPsupp (from VCV, PCV-VG)	ΔPsupp ≤ Plimit-PEEP 3 ≤ ΔPsupp ≤ 60
	Plimit	Plimit ≥ PEEP+5 Plimit ≥ ΔPsupp+PEEP

VENTILATION MODES	PARAMETERS	PARAMETER RELATION FORMULA
PCV	RR	$Tinsp = \frac{60}{RR} \times \frac{I:E}{1+I:E} \geq 0.2$ $Tinsp = \frac{60}{RR} \times \frac{I:E}{1+I:E} \leq 10$ $Texp = \frac{60}{RR} - Tinsp \geq 0.4$ 2 ≤ RR ≤ 100
	Pinsp	If Pinsp is configured: Pinsp≥PEEP+5 5≤Pinsp≤90 If ΔPinsp is configured: ΔPinsp≤90 - PEEP 5≤ΔPinsp≤70
PCV-VG	RR	$Tinsp = \frac{60}{RR} \times \frac{I:E}{1+I:E} \geq 0.2$ $Tinsp = \frac{60}{RR} \times \frac{I:E}{1+I:E} \leq 10$ $Texp = \frac{60}{RR} - Tinsp \geq 0.4$ $\frac{Vt * RR}{1000} \leq 60$ 2 ≤ RR ≤ 100
	Plimit	Plimit ≥ PEEP+5
SIMV-PC	RR	$Texp = \frac{60}{RR} - Tinsp \geq 0.4$ 2 ≤ RR ≤ 100
	ΔPsupp	3 ≤ ΔPsupp ≤ 60
	Pinsp	If Pinsp is configured: Pinsp≥PEEP+5 5≤Pinsp≤90 If ΔPinsp is configured: ΔPinsp≤90 - PEEP 5≤ΔPinsp≤70
SIMV-VG	RR	$Texp = \frac{60}{RR} - Tinsp \geq 0.4$ $\frac{Vt * RR}{1000} \leq 60$ 2 ≤ RR ≤ 100
	ΔPsupp (from VCV, PCV-VG)	ΔPsupp ≤ Plimit-PEEP 3 ≤ ΔPsupp ≤ 60
	Plimit	Plimit ≥ PEEP+5 Plimit ≥ ΔPsupp+PEEP

C.0

Operating Principles

C.1 Pneumatic Diagram

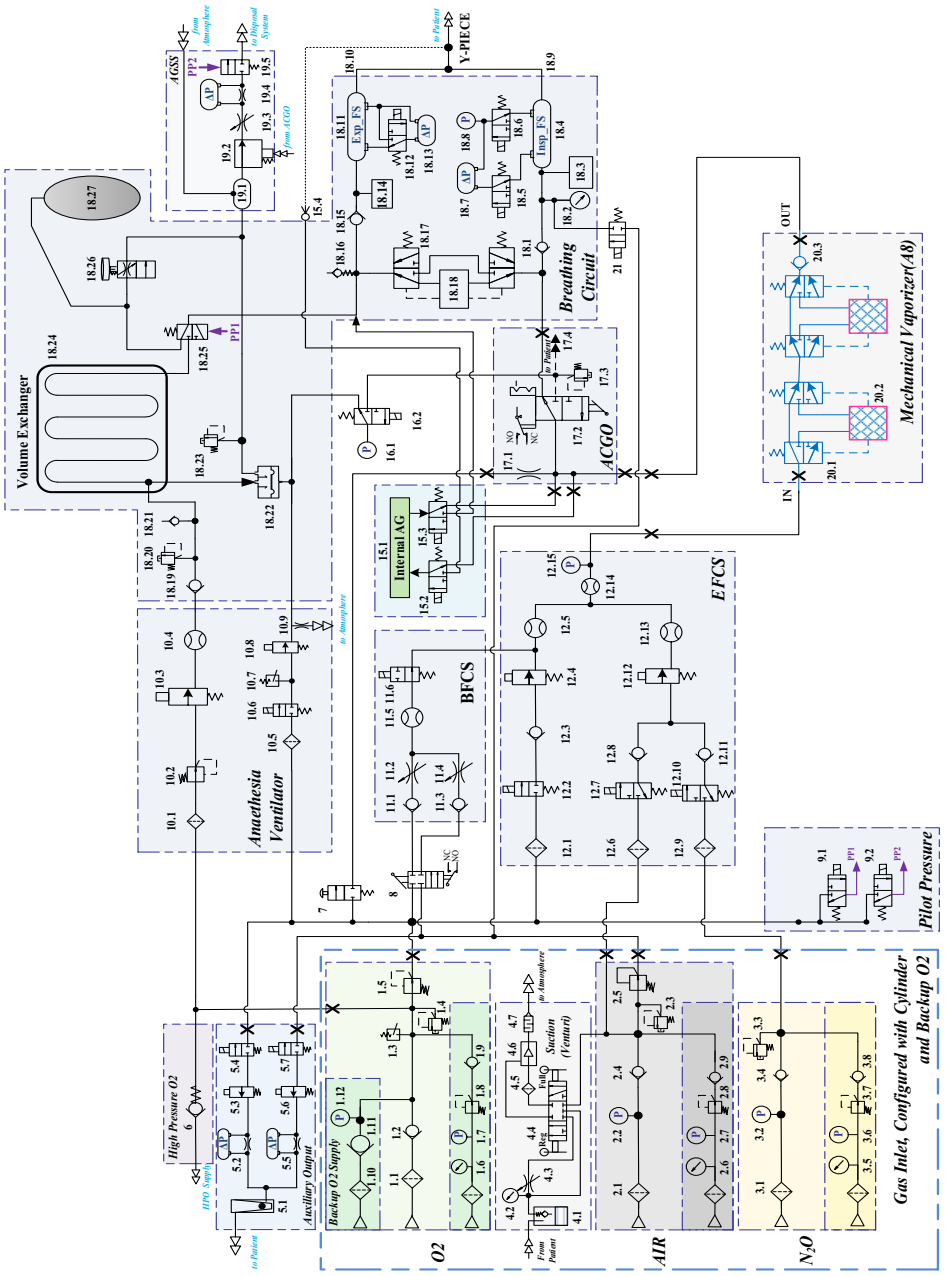

Figure C-1 Pneumatic Diagram

SERIAL NO.	MODULE	SERIAL NO.	MODULE	SERIAL NO.	MODULE
1.1	Filter	5.7	Normally-closed switch valve	17.1	Flow restrictor
1.2	Check valve	6	High-pressure O2 output	17.2	ACGO switch
1.3	Pressure switch	7	O2 flush	17.3	11kPa pressure relief valve
1.4	Pressure relief valve	8	System switch	17.4	ACGO port
1.5	Pressure regulating valve	9.1	Pilot-operated valve of manual/auto switch	18.1	Check valve
1.6	Cylinder pressure gauge	9.2	Pilot-operated valve of AGSS on/off	18.2	Airway pressure gauge
1.7	Electronic pressure sensor of cylinder	10.1	Filter	18.3	O_2 sensor
1.8	Pressure regulating valve of cylinder	10.2	Pressure regulating valve	18.4	Differential pressure gauge of inspiration
1.9	Check valve of cylinder	10.3	Proportional valve	18.5	2/3 switch-over valve
1.10	Filter	10.4	Flow sensor	18.6	2/3 switch-over valve
1.11	Check valve	10.5	Filter	18.7	Inspiration flow sensor
1.12	Electronic pressure sensor of pipeline	10.6	Normally-closed switch valve	18.8	Pressure sensor
2.1	Filter	10.7	Pressure switch	18.9	Inspiratory port
2.2	Electronic pressure sensor of pipeline	10.8	Proportional valve	18.10	Expiratory port
2.3	Pressure relief valve	10.9	Flow restrictor	18.11	Differential pressure gauge of expiration
2.4	Check valve	11.1	Check valve	18.12	2/3 switch-over valve
2.5	Pressure regulating valve	11.2	O2 needle valve	18.13	Pressure sensor of expiration
2.6	Cylinder pressure gauge	11.3	Check valve	18.14	Watertrap
2.7	Electronic pressure sensor of cylinder	11.4	Air needle valve	18.15	Check valve
2.8	Pressure regulating valve of cylinder	11.5	Float flowmeter (0-15LPM)	18.16	Self-sealing sampling tube
2.9	Check valve	11.6	Normally-open switch valve	18.17	Bypass
3.1	Filter	12.1	Filter	18.18	CO2 absorber canister
3.2	Electronic pressure sensor of pipeline	12.2	Normally-closed switch valve	18.19	Check valve
3.3	Pressure relief valve	12.3	Check valve	18.20	11kPa pressure relief valve
3.4	Check valve	12.4	Proportional valve	18.21	Check valve
3.5	Cylinder pressure gauge	12.5	Flow sensor	18.22	Expiratory valve
3.6	Electronic pressure sensor of cylinder	12.6	Filter	18.23	1kPa pressure relief valve
3.7	Pressure regulating valve of cylinder	12.7	2/3 switch-over valve	18.24	Volume exchanger (VE)
3.8	Check valve	12.8	Check valve	18.25	Manual/auto switch valve
4.1	Overfill protector	12.9	Filter	18.26	APL valve
4.2	Negative pressure gauge	12.10	2/3 switch-over valve	18.27	Manual bag
4.3	Negative pressure regulating switch	12.11	Check valve	19.1	Gas reservoir
4.4	Mode selector switch	12.12	Proportional valve	19.2	Waste gas discharging Y-piece

4.5	Filter	12.13	Flow sensor	19.3	Negative pressure regulating valve
4.6	Venturi negative pressure generator	12.14	Flow sensor	19.4	Differential negative pressure gauge
4.7	Muffler	12.15	Pressure sensor	19.5	Pilot-operated
5.1	Float flowmeter	15.1	Internal AG	20.1	Vaporizer bypass
5.2	Differential pressure gauge	15.2	2/3 switch-over valve	20.2	Mechanical Vaporizer
5.3	Proportional valve	15.3	2/3 switch-over valve	20.3	Check valve
5.4	Normally-closed switch valve	15.4	Self-sealing sampling tube	21	Normally-closed switch valve
5.5	Differential pressure gauge	16.1	Pressure sensor	/	/
5.6	Proportional valve	16.2	2/3 switch-over valve	/	/

The pneumatic system of the anesthesia system is composed of six parts: the anesthetic gas delivery system, the anesthetic gas delivery equipment (mechanical vaporizer), the anesthetic ventilator, the breathing system, the negative pressure suction system, and the Anesthetic Gas Scavenging System (AGSS).

The pneumatic circuit of the anesthetic gas delivery system is used to generate the mixed agent (fresh gas), with O2, N2O and Air as the input and the mixed agent (that is, fresh gas), the auxiliary O2 supply gas, and the O2 flush gas among others as the output.

The anesthetic gas delivery equipment (mechanical vaporizer) supplies concentration-controlled anesthetic gas vapor, for temperature compensation, flow compensation and pressure compensation purposes. Isoflurane, Sevoflurane, Halothane and Desflurane agents are supported.

The pneumatic circuit of the anesthetic ventilator serves to drive the respiration process of patients.

The breathing system provides a closed loop for the anesthetic gas. The CO2 in the patient's exhaled gas is absorbed in the inspiration phase, so that the exhaled gas can be recycled for inhalation to ensure the temperature, humidity and other conditions of the gas. The breathing system has two modes available: the manual ventilation and the automatic ventilation, controlled by the manual/auto ventilation switch. Meanwhile, the system also outputs corresponding electrical signals to update the Control Board on its own status.

The Anesthetic Gas Scavenging System (AGSS) is composed of the AGSS delivery system, the AGSS absorption system and the AGSS disposal system, with the waste gas discharged from the anesthesia system outlet as the input. Its output is channeled to the facility's disposal system (AGSS disposal system).

C.2 Electric System Structure

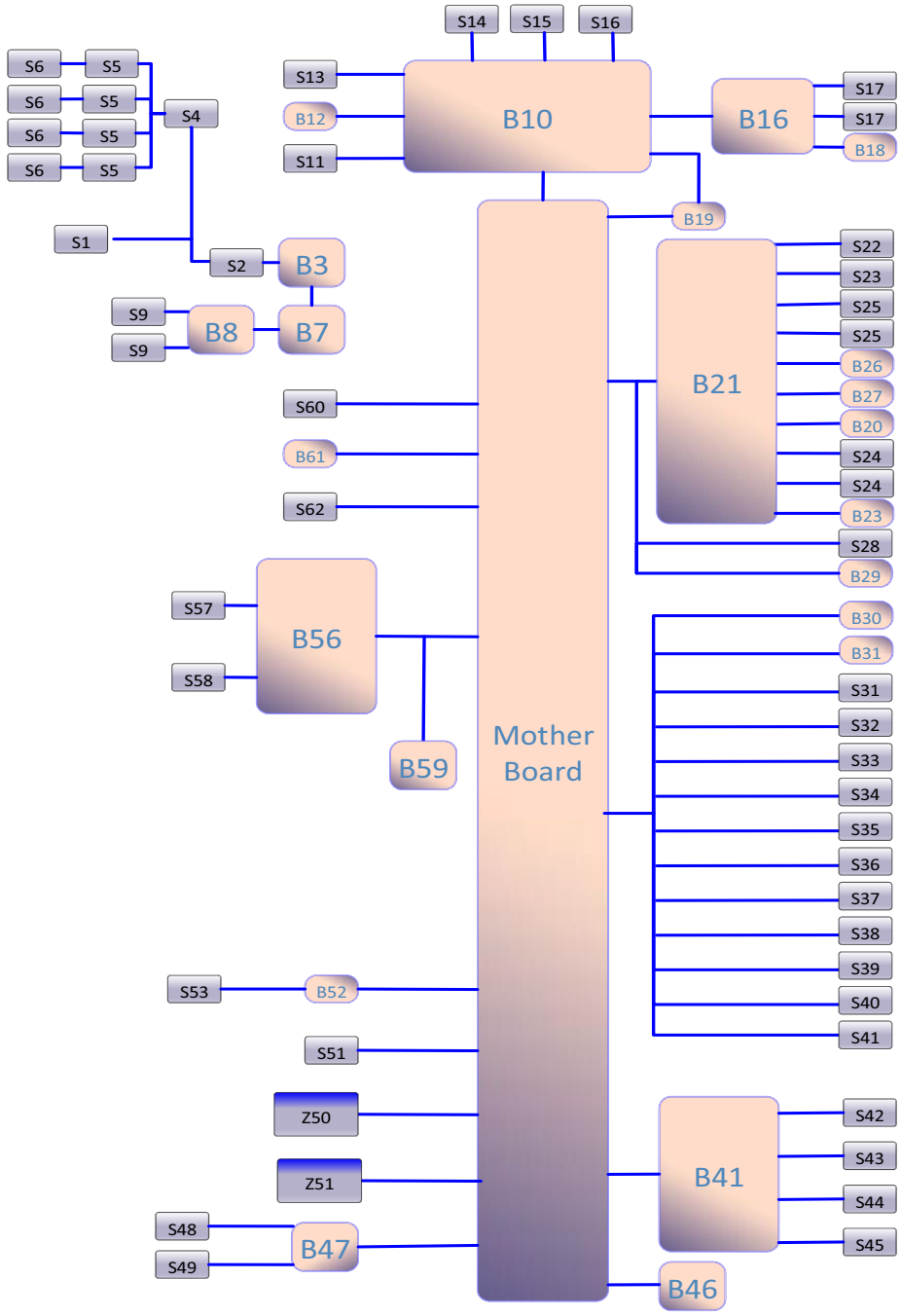

Figure C-2 Electric System Structure

SERIAL NO.	DESCRIPTION	SERIAL NO.	DESCRIPTION
S1	AC input socket	S31	Circle switch
S2	Main input fuse	S32	O_2 sensor
B3	AC-DC power panel	S33	CO2 absorber canister switch
S4	Main auxiliary output circuit breaker	S34	ACGO switch
S5	Auxiliary output circuit breaker	S35	Warmer module
S6	Auxiliary outlet	S36	Auto/Manual valve
B7	DC-DC power panel	S37	VE switch
B8	Battery adapter	S38	Manual/Auto switch
S9	Lead-acid cell	S39	Ventilator pneumatic block
B10	Control board	S40	Ventilator flow sensor
S11	Speaker	S41	O2 concentration calibration valve
B12	Alarm LED board	B41	Electronic Flowmeter Board
S13	Wi-Fi module	S42	Flow sensor
S14	Touch screen	S43	Proportional valve
S15	Display	S44	Two-way valve
S16	IOT module	S45	Y-piece
B16	Key control board	B46	Monitor module board
S17	Electronic flowmeter encoder	B47	Sensor connector board
B18	Main unit encoder board	S48	Zero Y-piece
B19	External interface board	S49	Intrapulmonary pressure switching 3-way valve
B21	Small screen control board	Z50	Card cage module
S22	Small screen	S51	AG switch 3-way valve
S23	Segment code screen	Z51	AG module
S25	Auxiliary O2/air encoder	B52	AGSS interface board
B26	BFCS flowmeter switchboard	S53	AGSS pneumatic block
B27	Power indicator board	B56	Auxiliary O_2/air control board
B20	EFCS switchboard	S57	Proportional valve
B23	Auxiliary O_2/air keyboard	S58	Two-way valve
S24	EFCS electromagnet	B59	Auxiliary O_2/air flowmeter backlight
S28	System switch	S60	Pressure switch of O_2 supply inlet
B29	Standby flowmeter backlight	B61	Pipelined gas supply sensor board
B30	APL valve indicator board	S62	Gas supply sensor of cylinder
B31	Soda lime canister light board	/	/

D.0

Abbreviations, Symbols, and Units of Measure

D.1 Abbreviations

ABBREVIATIONS	DESCRIPTION
AA	anesthetic agent
ACGO	auxiliary common gas outlet
AGSS	anesthetic gas scavenging system
Alpha	power/total power of Alpha waveband
AMV	adaptive minute ventilation
APL	airway pressure limit
Apnea I:E	ratio of inspiratory time to expiratory time of apnea
APRV	airway pressure release ventilation
BC	burst count
Beta	power/total power of Beta waveband
BIS	bispectral index
BSR	burst suppression rate
BTPS	body temperature and pressure, saturated
C	Cdyn
CPAP/PS	Continuous positive airway pressure/pressure support ventilation
Cardiac Bypass Mode	cardiopulmonary bypass
DBS	double burst stimulation
Delta	power/total power of Delta waveband
EMG	muscle activity and high frequency artifacts
Exp%	expiration trigger level
FiO_2	Fraction of inspired oxygen
Flow	flow
F-Trig	flow trigger level
IBW	ideal body weight
I:E	ratio of inspiratory time to expiratory time
MEAN	mean pressure
MF	median frequency
Min RR	minimum respiratory rate
MV	minute volume
MV%	percentage of minute ventilation
MVi	inspiratory minute ventilation
MVleak	minute leakage
N_2O	nitrous oxide
NMT	neuromuscular transmission
O_2	Oxygen
P_{insp}	pressure control level of inspiration
P_{limit}	pressure limit level
PAW	airway pressure
PCV	pressure controlled ventilation
PCV-VG	pressure controlled ventilation-volume guarantee

ABBREVIATIONS	DESCRIPTION
PEAK	peak pressure
PEEP	positive end-expiratory pressure
PLAT	plateau pressure
PPF	peak power frequency
ΔPapnea	apnea pressure
ΔPsupp	pressure support level
PTC	post tetanic counting
P-Trig	pressure trigger level
R	airway resistance
RR	respiratory rate
SEF	spectral edge frequency
SIMV-PC	synchronized intermittent mandatory ventilation - pressure control
SIMV-VC	synchronized intermittent mandatory ventilation - volume control
SIMV-VG	synchronized intermittent mandatory ventilation - volume guarantee
SP	Spontaneous breathing
SQI	signal quality index
ST	single twitch stimulation
T1	response value to the first stimulation
T1%	T1 to reference value ratio
Theta	power/total power of Theta waveband
T_{insp}	time of inspiration
TOF	train-of-four
TP	total power
T_{pause}	percentage of inspiratory pause time
T_{slope}	rise time
Trig Window	trigger window
VCV	volume control ventilation
Vt	tidal volume
Vti	inspiratory tidal volume

D.2 Symbols

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
-	minus, negative	>	greater than
%	percent	≤	less than or equal to
/	per, divide, or	≥	greater than or equal to
≈	approximately	±	plus or minus
^	power, involution	×	multiply
+	plus, positive	©	copyright
=	equal to	™	trademark
<	less than	®	registered trademark

D.3 Units of Measure

UNITS OF MEASURE	DESCRIPTION	UNITS OF MEASURE	DESCRIPTION
A	Ampere, Amp	m	meter
Ah	Amp hour	mAh	milliampere hour
bpm	breath per minute	mbar	millibar
°C	degree Celsius	mg	milligram
cc	cubic centimeter	min	minute
cm	centimeter	ml, mL	milliliter
cmH_2O	centimeter of water	mm	millimeter
dB	decibel	mmHg	millimeter of mercury
°F	Fahrenheit	ms	millisecond
g	gram	mV	milliVolt
hr	hour	mW	milliWatt
Hz	Hertz	ppm	part per million
hPa	hectoPascal	s, sec	second
inch	inch	V	Volt
k	kilo	VA	Volt Amp
kg	kilogram	VAC	Volts alternating current
kPa	kiloPascal	Ω	Ohm
psi	pound-force per square inch	µA	microAmp
L, l	liter	µV	microVolt
lb	pound	W	Watt
nm	nanometer		

E.0 *Electromagnetic Compatibility*

A8 meets the requirements of IEC 60601-1-2:2014.

NOTE: **The anesthesia system 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 A8.**

NOTE: **A8 is intended for use in professional healthcare facility environment. If it is used in special environment, such as magnetic resonance imaging environment, A8 may be disrupted by the operation of nearby equipment.**

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

WARNING: **Use of this device adjacent to or stacked with other device should be avoided because it could result in improper operation. If such use is necessary, this device 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 this device, including cables specified by the manufacturer. Otherwise, degradation of the performance of this device could result.**

WARNING: **Other devices may interfere with A8 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.**

GUIDANCE AND DECLARATION - ELECTROMAGNETIC EMISSIONS

A8 is intended for use in the specified electromagnetic environment. The customer or the user of A8 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	A8 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 (configured with BIS and/or D-Vapor and/or NMT)	Class A	A8 is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Radio frequency (RF) emissions CISPR 11 (not configured with BIS or D-Vapor or NMT)	Class B	A8 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	

TABLE E-1 Guidance and declaration - electromagnetic emissions

NOTE: The device needs special precautions regarding EMC and needs to be installed and put into service according to the EMC information provided below.

NOTE: Other devices may affect this device even though they meet the requirements of CISPR.

NOTE: When the inputted signal is below the minimum amplitude provided in technical specifications, erroneous measurements could result.

NOTE: The EMISSIONS characteristics of this device make it suitable for use in industrial areas and hospitals (CISPR 11 class A). If it is used in a residential environment (for which CISPR 11 class B is normally required) this device might not offer adequate protection to radio-frequency communication services. The user might need to take mitigation measures, such as relocating or re-orienting the device.

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 the EQUIPMENT and contact the service personnel.**

GUIDANCE AND DECLARATION - ELECTROMAGNETIC IMMUNITY

A8 is intended for use in the specified electromagnetic environment.The customer or the user of A8 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 (EFT) 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	Mains power quality should be that of a typical commercial or hospital environment.
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.

U_T is the A.C. mains voltage prior to application of the test level.

TABLE E-2 Guidance and declaration - electromagnetic immunity

GUIDANCE AND DECLARATION - ELECTROMAGNETIC IMMUNITY

A8 is suitable for use in the electromagnetic environment specified below. The customer or the user of A8 should assure that it is used in such an environment.

IMMUNITY TEST	IEC 60601 TEST LEVEL	COMPLIANCE LEVEL	ELECTROMAGNETIC ENVIRONMENT - GUIDANCE
Conducted RF IEC 61000-4-6	3 Vrms 150k to 80 MHz	3 Vrms (V1)	Portable and mobile RF communications equipment should be used no closer to any part of the device, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. **Recommended separation distance** $d = \left[\frac{3.5}{V1}\right]\sqrt{P}$ 150k to 80 MHz $d = \left[\frac{3.5}{E1}\right]\sqrt{P}$ 80MHz to 800 MHz $d = \left[\frac{7}{E1}\right]\sqrt{P}$ 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:: 
	6 Vrms in ISM bands and amateur radio bands[a] between 0,15 MHz and 80 MHz	6 Vrms (V2)	
Radiated RF EM fields IEC 61000-4-3	3V/m 80 MHz to 2.7 GHz (for NMT or BIS function)	3 V/m (E1)	
	10V/m 80 MHz to 2.7 GHz (for RGM function)	10 V/m	
Proximity fields from RF wireless communications equipment IEC61000-4-3	27 V/m 380 MHz to 390 MHz	27 V/m	
	28 V/m 430 MHz to 470 MHz, 800 MHz to 960 MHz, 1700 MHz to 1990 MHz, 2400 MHz to 2570 MHz	28 V/m	
	9 V/m 704 MHz to 787 MHz, 5100 MHz to 5800 MHz	9 V/m	

TABLE E-1 Guidance and declaration - electromagnetic immunity

GUIDANCE AND DECLARATION - ELECTROMAGNETIC IMMUNITY

A8 is suitable for use in the electromagnetic environment specified below. The customer or the user of A8 should assure that it is used in such an environment.

IMMUNITY TEST	IEC 60601 TEST LEVEL	COMPLIANCE LEVEL	ELECTROMAGNETIC ENVIRONMENT - GUIDANCE
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 the device is used exceeds the applicable RF compliance level above, the device should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the device.

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

TABLE E-1(Continued) Guidance and declaration - electromagnetic immunity

RECOMMENDED SEPARATION DISTANCES BETWEEN PORTABLE AND MOBILE RF, COMMUNICATIONS EQUIPMENT AND A8

A8 is intended for use in an electromagnetic environment in which radiated RF disturbance are controlled. The customer or the user of A8 can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and A8 as recommended below, according to the maximum output power of the communication equipment.

RATED MAXIMUM OUTPUT POWER OF TRANSMITTER (W)	**SEPARATION DISTANCE ACCORDING TO FREQUENCY OF TRANSMITTER** (m)		
	150 kHz to 80 MHz $d = \left[\frac{3.5}{V1}\right]\sqrt{P}$	**80 MHz to 800 MHz** $d = \left[\frac{3.5}{E1}\right]\sqrt{P}$	**800 MHz to 2.7 GHz** $d = \left[\frac{7}{E1}\right]\sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.20	1.20	2.30
10	3.80	3.80	7.30
100	12.00	12.00	23.00

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 V_{del} control accuracy, V_{del} monitoring accuracy, CO_2 monitoring accuracy, O_2 monitoring accuracy, airway pressure monitoring accuracy, anesthetic gas monitoring accuracy, PEEP control accuracy and PEEP monitoring accuracy.

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