Operating Instructions

A5™

Anesthesia System

mindray

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WARNING: Do not operate the A5 Anesthesia System before reading these instructions.

The operating instructions for the A5 Anesthesia Delivery System (hereinafter referred to as A5 Anesthesia System, A5 System, A5, or individual A5 is intended to provide information for proper installation, operation, and general maintenance of the A5 System to the user.

General knowledge and understanding of the features and functions of the A5 System are prerequisites for its proper use.

For servicing information or assistance, please contact an authorized representative in your area.

Rx only: U.S. Federal Law restricts this device to sale by or on the order of a physician or other practitioner licensed by state law to use or order the use of this device.

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

The A5 Anesthesia System is a device used to administer to a patient, continuously or intermittently, a general inhalation anesthetic, and to maintain a patient's ventilation.

The A5 is intended for use by licensed clinicians, for patients requiring anesthesia within a health care facility, and can be used for adult and pediatric populations.

WARNING: The A5 is intended to be operated only by licensed clinicians and qualified anesthesia personnel who have received adequate training in its use. Anyone unauthorized or untrained must not perform any operation on the A5.

WARNING: The A5 is not suitable for use in an MRI environment.

The proper function of the A5 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 A5 System must be operated by qualified and trained personnel only. All operators must fully observe these operating instructions and relevant additional documentation. They must also comply with the **A, I G**, **CA ,N** , and **, E** detailed in this manual.

Please adhere to all warnings, cautions, and notes that are listed throughout this manual. They are summarized here for your reference.

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

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

, E — Provides application tips or other useful information.

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

WARNING: **Do not use talc, zinc stearate, calcium carbonate, corn starch, or similar material to prevent sticking of the bellows, 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 respiratory hoses, face masks, sensors, sodalime, 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 a patient, do not perform testing or maintenance when the machine is in use.**

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

WARNING: **The A5 should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, the A5 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 A5, it should only be moved by qualified personnel.**

WARNING: **Overloading machine may cause tipping. Equipment attached to the side of the machine should fall within the rated weights to prevent tipping of the machine.**

WARNING: **Excess load may cause a tip hazard while moving the A5. Before moving, remove all equipment from the top shelf and all monitoring equipment mounted to the side of the A5. Use care when moving the A5 up or down inclines, around corners, and across thresholds. Do not attempt to roll the A5 over hoses, cords, or other obstacles.**

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

WARNING: **Connection of the A5 exhaust port to the hospital's waste gas scavenging system is strongly recommended to prevent exposure of hospital personnel to the A5 exhaust gases.**

WARNING: **Operation of the A5 below the minimum flow values may cause inaccurate results.**

WARNING: **Ensure that an independent means of ventilation (e.g. a self-inflating manually powered resuscitator with mask) is available whenever the A5 is in use.**

WARNING: **Usage of accessories with package damage may cause biocontamination or failure. The operator should check accessory packaging for storage integrity before use.**

WARNING: **Before using the A5 System (after cleaning or disinfecting), power up the system and follow the on-screen prompts to perform the leak test and the compliance test. See section 4.5 (page 4-9) "Leak and Compliance Tests".**

WARNING: **Improperly cleaned materials may result in biocontamination. Use a**

WARNING: **The mains plug is used to isolate the Anesthesia System circuits electrically from the SUPPLY MAINS. Do not position the Anesthesia System so that it is difficult to operate the plug.**

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

CAUTION: **Do not connect any devices to the SB ports other than Mindray approved USB storage devices and a supported USB mouse (see "Networking and USB Storage" on page A-4).**

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

CAUTION: **Do not autoclave the following components: Paw gauge, oxygen sensor, flow sensor, and bellows. These components cannot withstand immersion or the heat and pressure of autoclaving.**

CAUTION: **Users should monitor oxygen percentage (FiO_2%) when using the Auxiliary O_2/Air Flow Meters. Unknown oxygen concentrations may be delivered to the patient unless oxygen monitoring is used.**

CAUTION: **The A5 is NOT suitable for use in a magnetic resonance imaging (MRI) environment.**

CAUTION: **To ensure measurement accuracy and to avoid possible damage to the A5, use only Mindray-approved cables and accessories.**

CAUTION: **Use the power cord provided with the product. If a substitute is necessary, use only hospital grade power cords.**

CAUTION: **Do not use a damaged or broken unit 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 transducers 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 machine.**

CAUTION: **Turn the flow controls slowly. To avoid damaging the control valves, do not turn further when the flowmeter reading is outside the range. When turning a flow control knob clockwise to decrease flow, the flowmeter should reach zero before the knob reaches its most clockwise mechanical stop (Off) position. Do not turn any further when the knob has reached the Off position.**

Similarly, when turning a flow control knob counterclockwise to increase flow from zero, the flowmeter reading should not indicate a change from zero until the flow control knob is turned approximately one (1) rotation counterclockwise from the Off position, and only if permitted according to the gas ratio control system.

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 A5 is intended to be operated with its integral Breathing Pressure monitoring in use.**

NOTE: **The A5 is intended to be operated with its integral Breathing Pressure limitation devices in use.**

NOTE: **The A5 is intended to be operated with its integral Exhaled Volume monitoring in use.**

NOTE: **The A5 is intended to be operated with its integral Breathing System integrity Alarm System in use.**

NOTE: **The A5 is intended to be operated with its integral Continuing Pressure Alarm in use.**

NOTE: **The A5 is intended to be operated with its integral O_2 monitoring in use.**

NOTE: **The A5 is intended to be operated with an external CO_2 monitor complying with ISO 80601-2-55. Connection to the CO_2 monitor should be via a sample line from the patient circuit.**

NOTE: **The Anesthesia Vapor Delivery Device is to be used with an Anesthetic Agent Monitor complying withISO 80601-2-55. Connection to the Agent monitor should be via a sample line from the Patient Circuit.**

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 A5 System is designed to be equipped with an anesthetic vapor delivery device that complies with ISO 80601-2-13.**

NOTE: **The A5 battery supply is not a user serviceable component. Only an authorized service representative can replace the battery supply. If the system is not used for an extended period, contact a service representative to have the battery supply disconnected. The batteries may be subject to local regulations regarding disposal. 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 used for the repair of other equipment.**

NOTE: **Opening the cylinder valve quickly may cause unexpected pressure differentials and create a potential for fire or explosion arising from oxygen pressure shocks. Open and shut the cylinder valve slowly.**

NOTE: **Accuracy of the flowrate may be affected by varying inlet pressure, varying outlet resistance, or varying ambient temperature.**

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

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

NOTE: **For the method of connecting A5 to external monitor or other devices, please see Anesthesia Machine Bracket Installation Instructions.**

NOTE: **The A5 can be equipped with one scavenger system to provide the best match with the hospital's waste-gas disposal system. The scavenger system shall comply with ISO 80601-2-13.**

NOTE: **The Anesthesia System is compatible with gases (O2, N2O, and Air) and anaesthetic agents (Halothane, Enflurane, Isoflurane, Sevoflurane, and Desflurane).**

NOTE: **The leakage of AGSS is measured by the method recommended in ISO 80601-2-13.**

NOTE: **The Anesthesia System is compatible with gases (O2, N2O, and Air) and anaesthetic agents (Halothane, Enflurane, Isoflurane, Sevoflurane, and Desflurane).**

NOTE: **The leakage of AGSS is measured by the method recommended in ISO 80601-2-13.**

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This posting serves as notice under 35 U.S.C.§287(a) for Mindray patents: http://www.mindrayna.com/patents.

Product Improvements — Shenzen Mindray Bio-Medical Electronics Co., Ltd. retains the right to modify the machine and/or operating instructions without prior notification. These operating instructions explain all features of the A5 System and are correct at time of manufacture. Instructions and models produced at a later stage, may contain improvements or modifications that were not included in previous models.

A network of service representatives and factory-trained distributors is available. Prior to requesting service, perform a complete operational check of the instrument to verify proper control settings. If operational problems continue to exist, contact the Service Department at +86 755 26582479 / 26582888.

Please include the instrument model number, the serial number (located on the back of the A5), and a description of the problem with all requests for service.

Warranty questions should be directed to a local representative. A list of offices, along with their phone numbers, is provided at the end of this manual.

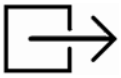
NOTE: **Upon request, calibration instructions or other information will be provided to assist the user's appropriately qualified technical personnel in repairing those parts of the A5 which are designated as repairable.**

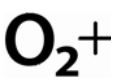
The effects on safety, reliability, and performance of the equipment are the manufacturer's responsibility only if:

Manufacturer:	Shenzhen Mindray Bio-Medical Electronics Co., Ltd.
Address:	Mindray Building, Keji 12th Road South, High-tech industrial park, Nanshan, Shenzhen 518057, P.R. China

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

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION





/T :

/T :

L

/T :
T

134°C

134°C

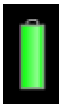
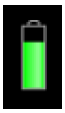
5 kg MAX
11 lbs MAX

L 60601-1, .60601- 1-8, . 80601-2-13, . 80601-2-55, .60601-1-6.

L T
(L

, 22.2 . 60601-1, , 22.2 .60601-1-8, . 80601-2-13, , 22.2 .80601-2-55, .60601-1-6.

IPX1

	Battery supply fully charged. AC power connected and powering system.		
	Battery supply partially charged. AC power connected, charging battery supply, and power system.		
	Battery supply fully charged and powering system. AC power not connected.		
	Battery supply partially charged and powering system. AC power not connected.		
	Battery supply low charged and powering system. Recharging recommended. AC power not connected.		
	Battery supply not installed.		

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1.1 General System Overview

1.1.1 F[illegible]

The A5 Anesthesia System is a device intended to administer, continuously or intermittently, a general inhalation anesthetic to a patient, and to maintain a patient's ventilation. The A5 also provides for ventilatory monitoring of the patient.

1.1.2

FEATURE	DESCRIPTION
	15
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F	3
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	),
T L	5 T 15 T

1.1.3 F

The A5 fresh gas dosing subsystem offers the following features:

- 2
-
- F
- L 2
- 2
- 2

Safety systems within the A5 work to prevent hypoxic mixtures from being delivered to the patient. Nitrous oxide will not be delivered unless oxygen flow is present. A pneumatic safety system assures that at least 21% O_2 is present when setting mixtures of O_2 and N_2O. Additionally, if the A5 is placed in the standby mode, O_2 fresh gas flow is not available.

WARNING: Ensure that both O_2 and N_2O flow controllers are turned OFF fully at the start and at the end of each case.

All A5 units are designed to maintain a safe O_2:N_2O ratio by allowing nitrous oxide to be set to a flow rate that is proportional to a previously adjusted flow of oxygen. The N_2O flow is limited by the flow of O_2 so that a safe ratio of no less than 21% oxygen can be maintained. The A5 is designed to maintain oxygen flow at its previously set level when N_2O is decreased.

When adjusting N_2O and O_2 flow rates, always adjust the oxygen flow first to enable the nitrous oxide flow. To add N_2O to the fresh gas flow, open the N_2O flowmeter valve, but only after opening the O_2 flowmeter valve.

1.1.4

F. C ... K. :

Three independent flow control knobs allow setting the input flow rates of N_2O, Air, and O_2 into the fresh gas flow.

A ... C ... :

An N_2O automatic cutoff valve stops the flow of N_2O if O_2 flow is less than 200 mL/min.

2, ... L A ... :

An O_2 pressure loss alarm annunciates when oxygen pressure is less than 220 kPa (32 psi).

C ... :

An O_2 ratio controller ensures that there is always at least 21% oxygen concentration in the fresh flow when N_2O is fully open.

1.1.4.1

The breathing system block contains patient flow and pressure sensors to measure inspiratory flow, expiratory flow, and inspiratory pressure. These sensors enable spirometry as well as standard pressure and flow monitoring.

1.1.5

Two (2) flow sensors in the breathing system measure inspired and expired gases for control and monitoring. Inspired oxygen concentration is monitored via a fuel-cell type sensor. Breathing pressure is monitored with both a PAW gauge (mechanical) and electronic gauge. The breathing system can be swiveled for ease of positioning. A leak test port is provided to allow for leak testing during startup.

The main pneumatic components of the breathing system are as follows:

- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]

The breathing system connects to the A5 main unit through the following ports:

- [illegible]
- [illegible]
- [illegible]
- [illegible]

The breathing system contains the following ports for end-user connections:

- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]

1.1.8 [illegible]

The A5 includes a waste gas scavenger that attaches to the side rail mount on the system. The A5 provides a port for the connection of the waste line from an anesthetic gas monitor.

1.1.9 [illegible]

The A5 includes a passive waste gas scavenger. The inlet port of the scavenger connects with the AGSS port and the exhaust port connects with the hospital's waste gas scavenging system.

1.1.10 [illegible]

The advanced power management system of the A5 provides AC power for main system functions while charging the system's internal battery supply. During AC power failure, the A5 will operate on battery power for a minimum of 150 minutes with two (2) new batteries installed. See "Battery Power Specifications" on page 9-7.

A recessed main switch is provided to power the system ON and to put the system on power standby where the battery supply continues to charge as necessary when the A5 is plugged into an external power source. The main switch also stops the O_2 fresh gas supply when the A5 is placed in Power Standby mode.

Auxiliary AC outlets on the rear of the machine operate independently of the main switch position. The A5 provides four (4) auxiliary AC outlets. The auxiliary AC outlets are not powered when operating the A5 on the internal battery supply.

NOTE: **Use the battery supply in the A5 at least once every month to extend battery life. Charge the battery supply before its power capacity is depleted.**

NOTE: **Inspect and replace the battery supply at regular service intervals. Long-term battery life depends on how frequent and how long the battery supply is used. For a properly maintained and stored lithium-ion battery, its long-term life expectancy is approximately three (3) years. In more aggressive usage, life expectancy can be shortened. Replacing lithium-ion batteries every three (3) years is recommended.**

NOTE: **The operating time of a battery depends on equipment configuration and operation.**

NOTE: **In case of battery failure, contact Mindray service personnel for battery supply replacement.**

NOTE: **When a battery has been stored for a long time, or the battery is depleted, recharge the battery at once. Otherwise, the low battery may not be sufficient to power the A5 if the AC power is unavailable.**

CAUTION: **Please replace your battery when it reaches the end of its service life. Failure to replace the battery may cause serious damage to your device from battery overheating.**

The A5 Anesthesia System is designed to operate on battery power whenever AC power is interrupted. When the A5 is connected to an AC power source, the battery supply is charged whether or not the A5 is turned on. In case of power failure, the A5 will automatically switch to run from the internal battery supply. When AC power source is restored within the specified time, the battery supply begins recharging, and power is switched from battery to AC automatically to ensure continuous system use.

When power is lost for less than or equal to 60 s, the alarm settings prior to the power loss shall be restored automatically.

The on-screen battery symbol indicates the battery status (see FIGURE 1-1).

PART(S)	DESCRIPTION
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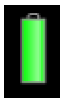
	5,

PART(S)	DESCRIPTION
	5,
	5,
	5,

1-1

If the battery capacity is too low, power supply failure will result. A high-level alarm will be triggered and the message **L B !** will be displayed in the technical alarm area. In this case, apply AC power to the A5 Anesthesia System to resume operation and charge the battery supply.

1.1.11

The A5 is a full-featured anesthesia delivery work station. The raised perimeter of its stainless steel work surface retains items that might otherwise roll or slide off its edge. The work surface light has high and low brightness settings. The wrap-around handle enables fine positioning of the machine. Three (3) large drawers are available for storage. All drawers can be locked with a key. Rail mounts on both sides of the machine enable mounting of patient monitors and most standard attachment arms for other devices. For the A5, a non-slip footrest and central brake are provided. The top shelf can be used to mount additional equipment.

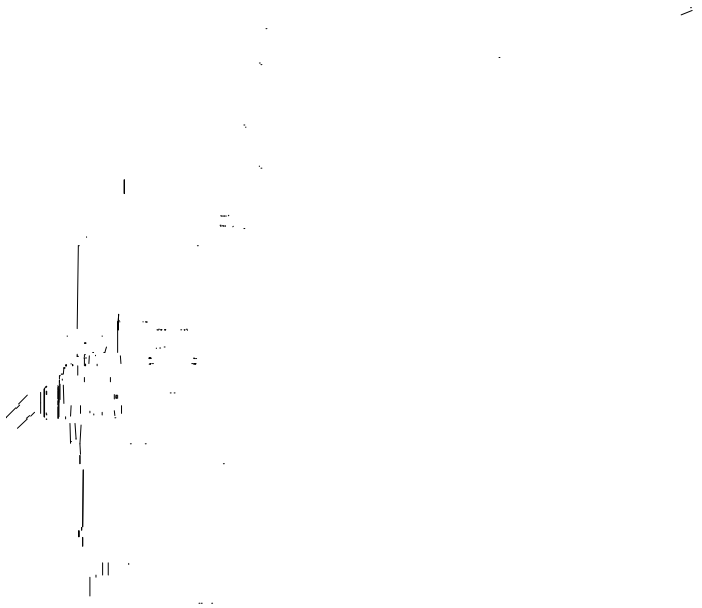
The operator of the A5 should be positioned in front of the monitor at a comfortable distance to view all displayed waveforms, text, and controls.

1.1.12

There is a hook located on the front of the breathing system that can be used to hang the tubes of the breathing circuit.

1.2 Physical Views

1.2.1 L T)



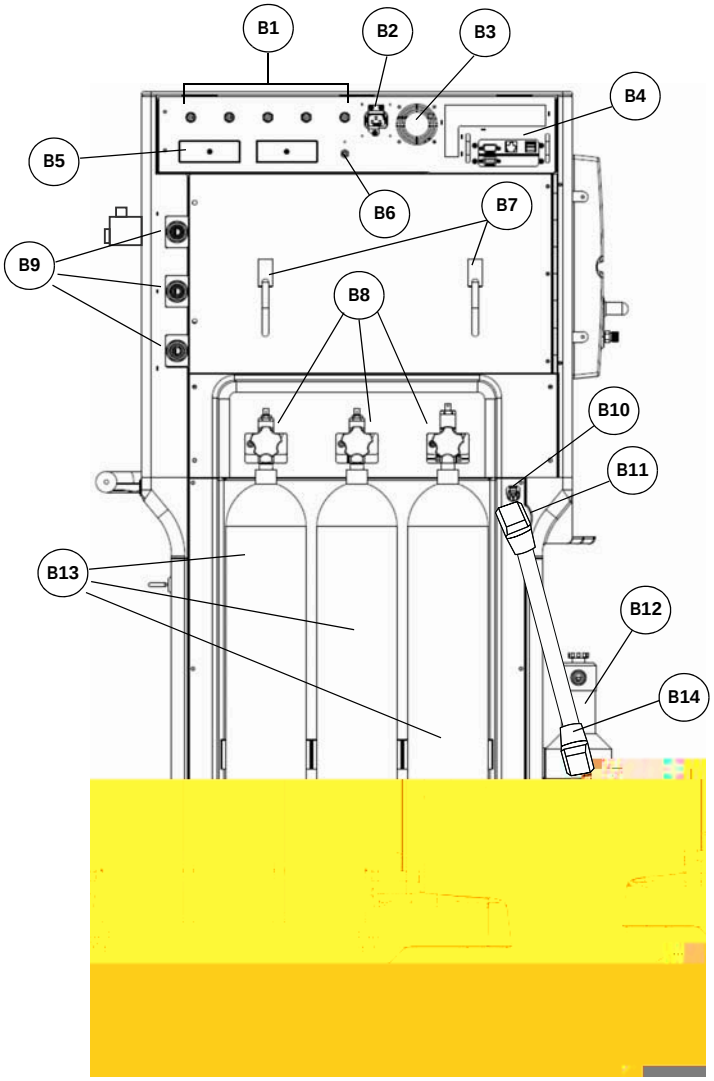
1- L T)

PART(S)		DESCRIPTION
A1	**Alarm Light**	
A2	**LCD Touchscreen Display / System Interface**	3-1
A3	**Auxiliary O_2/Air Flowmeters**	2/ 2/

PART(S)		DESCRIPTION
A4	Auxiliary O_2/Air Gas Outlet	
A5	Auxiliary O_2 Gas Power Outlet	
A6	Flow Control Knobs	
A7	Pressure Gauges (pipeline)	
A8	Pressure Gauges (cylinder)	
A9	Total Flow Meter	
A10	O_2 Sensor Electrical Port	
A11	O_2 Flush Button	
A12	Vacuum suction fixing clip	
A13	Touchpad	
A14	AGSS	
A15	Wheel Lock	
A16	Wheel Lock Indicator	
A17	Wheels	
A18	Work Light	
A19	Work Light Switch	
A20	Vaporizer Mounting Manifold / Mounting Bar	
A21	Vaporizer Mount Valve Cartridge	
A22	Vaporizer Parking Spot	
A23	Vaporizer Locking Device	
A24	AC Status LED	
A25	Battery Charging LED	
A26	Main Power Switch	
A27	Handle	

PART(S)		DESCRIPTION
A28	Key lock	
A29	Storage Drawers	(3) . (.)

1.2.2 L T (



1- L T (

PART(S)		DESCRIPTION
B1	Circuit Breakers	3 (4), 10 . (1)
B2	Mains Inlet	I

B3 **Exhaust Fan**

B4 **Communication Ports**

CAUTION: **Do not connect any devices to the SB ports other than Mindray approved USB storage devices and a supported USB mouse (see “Networking and USB Storage” on page A-4).**

B5 **Auxiliary AC Outlets**

1.2.3 L , T , (, ,)

1- L , T , (, ,)

PART(S)		DESCRIPTION
C1	**Auxiliary O_2/Air Flowmeters**	
C2	**Auxiliary O_2/Air Gas Outlet**	
C3	**Auxiliary O_2 Gas Power Outlet**	
C4	**Rail Mount**	5.
C5	**Module slot**	

1.2.4 L , T , (,)

1- L , T , (,)

PART(S)		DESCRIPTION
D1	**Vaporizer Mounting Manifold / Mounting Bar**	
D2	**Key Lock**	

1.2.5 Main Unit (Top View)

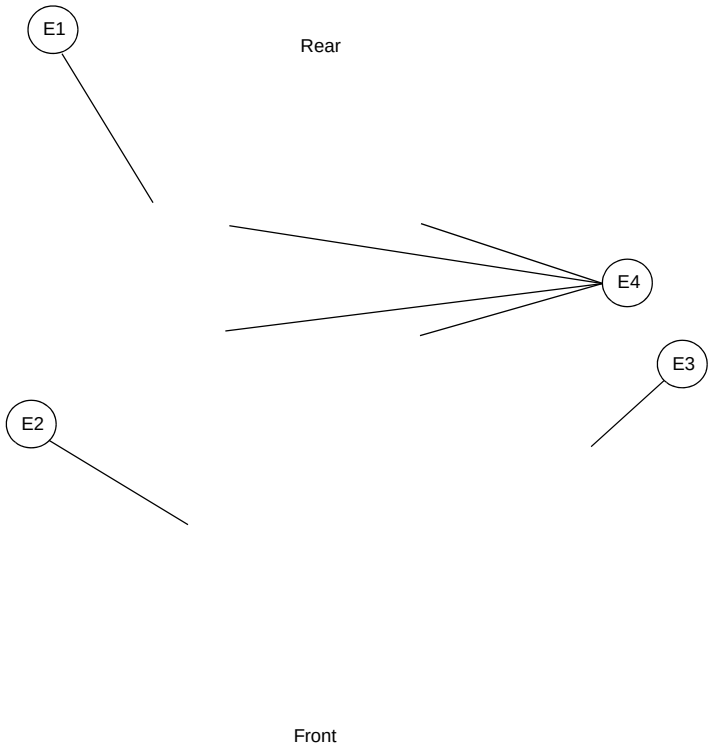
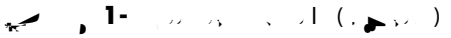


FIGURE 1-6 Main Unit (Top View)

PART(S)		DESCRIPTION
E1	Top Shelf	Top level surface
E2	Work Level Shelf	Work Level surface (stainless steel)
E3	Handle	Wrap-around metal bar used to assist moving the A5 device
E4	Mounting Holes	Allows mounting of optional equipment to the top shelf (i.e., DPM6 and DPM7 mounting plates and kits. See section A.7 (page A-3) "Mounting Accessories")

1.2.6



1-

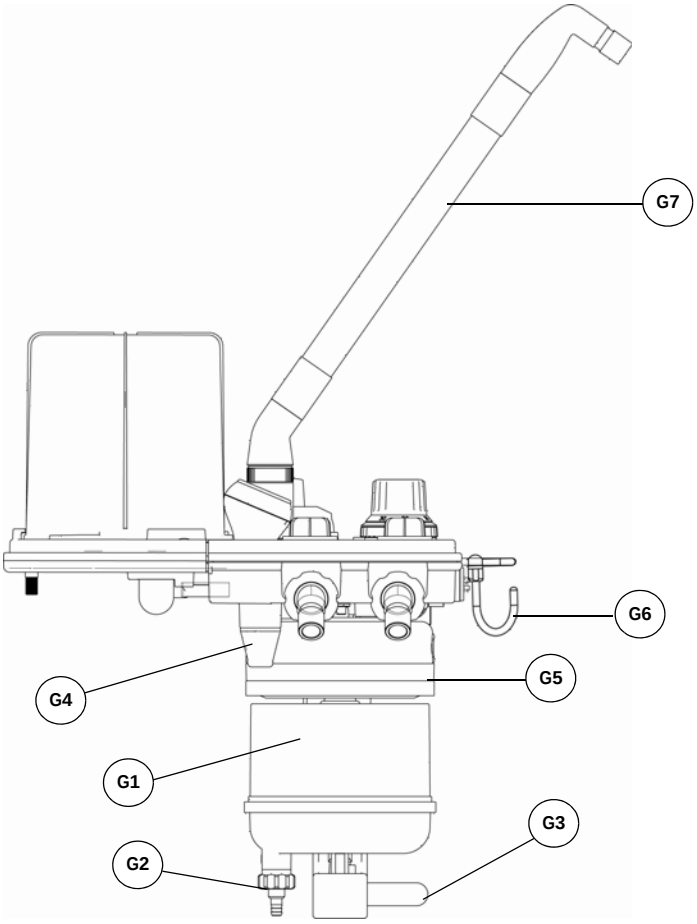
PART(S)		DESCRIPTION
F1	Bellows (including bellows dome)[1]	
F2	PAW Gauge[2]	
F3	Expiratory Limb	
F4	Inspiratory Limb	
F5	Expiration Valve	
F6	Inspiration Valve	
F7	O_2	

PART(S)		DESCRIPTION
F8	APL (Airway Pressure Limiting) Valve[2]	
	or	
	Quick Release APL Valve[2]	
F19	Auto/Manual Bag Switch	

1 *The bellows dome is a transparent cover with graduation marks from 300 to 1500 mL. These marks are for reference only. Tidal volume (Vt) should be read exclusively from the display of the user interface. Delivered Vt is a combination of bellows displacement and fresh gas flow.*

2 *The APL valve and Paw gauge numerics are for reference only. Calibrated patient airway pressure is displayed on the user interface.*

1.2.7



1-

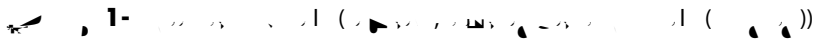
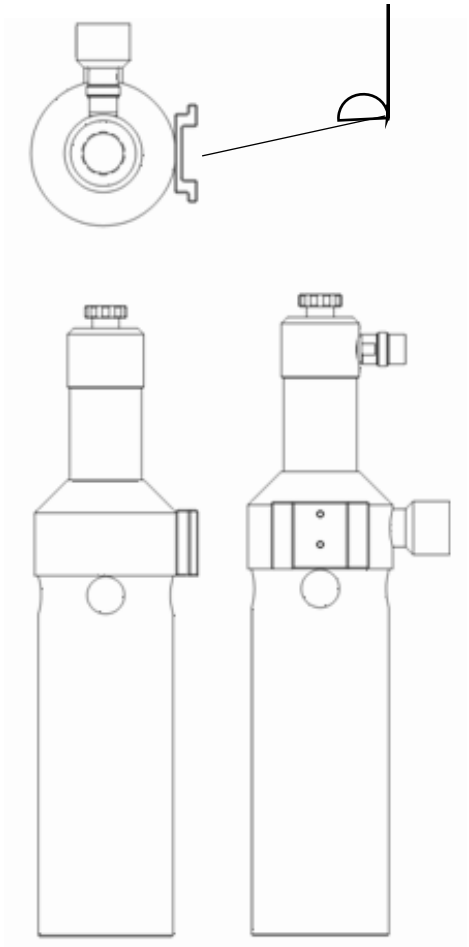


Figure 1-

PART(S)		DESCRIPTION
G1	**CO_2 Absorber Canister**	
G2	**Condensate Drain Valve**	

PART(S)		DESCRIPTION
G7	**Flexible Bag Arm**	360 .
G8	**Fixed Height Bag Arm**	

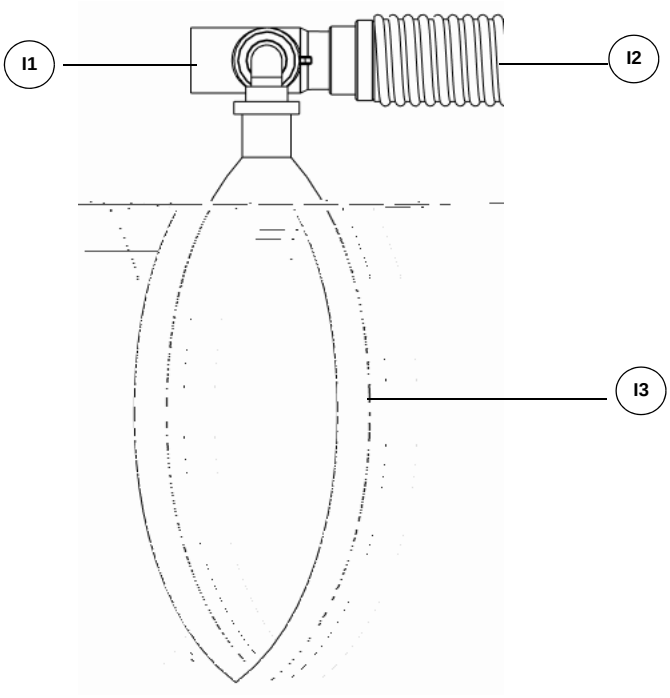
1.2.8 F I (F)(. , , ,)



1-10 F (. , , ,)

PART(S)		DESCRIPTION
H1	**Mounting Rail Attachment**	
H2	**Flow Adjust Knob**	
H3	**Exhaust Port**	
H4	**Inlet Port**	
H5	**Float**	

1.2.9



Rear View

PART(S)		DESCRIPTION
I1	Inlet Port	
I2	Exhaust Port	
I3	Manual Bag	

2.0

Unpacking 2-3

Initial Setup 2-4

Install the Vaporizer 2-5

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

WARNING: **Continuous use of desiccated sodalime may endanger patient safety. Adequate precautions should be taken to ensure that the sodalime 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 A5 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 A5 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 A5 "Product Specifications" on page 9-1.**

2.1 Unpacking

5. 5.

+86 755 26582479 / 26582888.

2.2 Initial Setup

NOTE: The A5 is intended to be operated with an external CO2 monitor

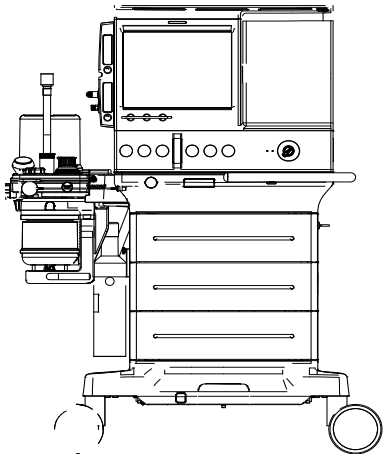
2.3 Install the Vaporizer

CAUTION: **Only vaporizers with Selectatec Interlock Systems may be used with the A5 unit.**

WARNING: **Use vaporizers compliant to ISO 80601-2-13. See section A.9 (page A-4) "Vaporizers". Refer to the vaporizer manufacturer's Instructions For Use for mounting, filling, or draining the vaporizer and other information.**

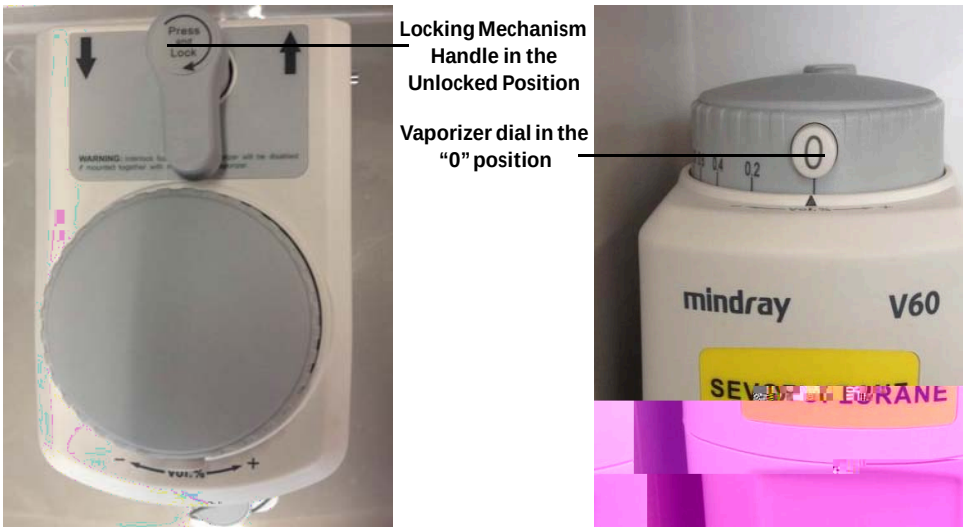
WARNING: **Use care in lifting and manipulating vaporizers during the mounting process as their weight may be greater than expected, based on their size and shape.**

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 outputted concentration is accurate.**



-1

1.



2-3.

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

1.

WARNING: **For the A5 Anesthesia System, using or turning on more than one vaporizer simultaneously is prohibited and prevented by a mechanical interlock. Do not attempt to override this safety mechanism.**

2.3.1

80601-2-13.

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 concentration of the anesthetic agent actually output will vary if the vaporizer is filled with the wrong agent.**

WARNING: **Do not reuse the agent drained from the vaporizer. Treat as a hazardous chemical and follow local regulations for proper disposal.**

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3.0 S, ' I, ', '

Main Screen Components 3-2

System Information Header 3-5

Fresh Gas Flow Display 3-10

Waveforms Tab 3-11

Spirometry Tab 3-13

Demographics Tab 3-19

Ventilation Mode Tabs 3-21

Measured Values Area 3-23

System Softkeys 3-24

Setup 3-32

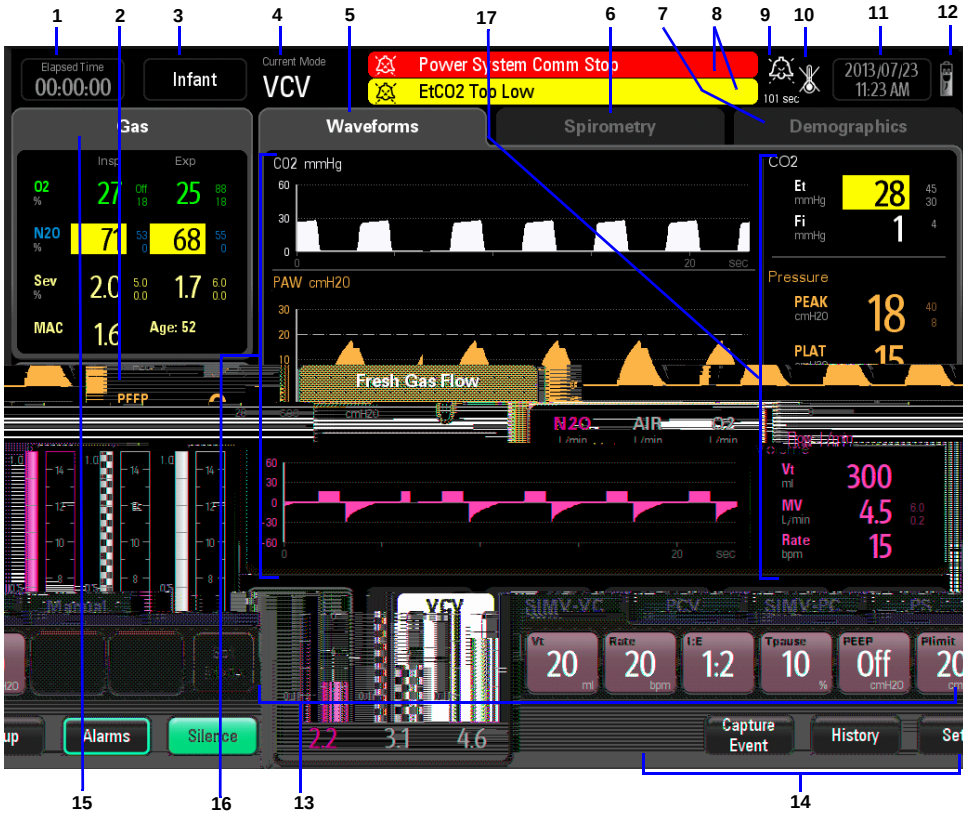
General Tab 3-32

Display Tab 3-34

System Tab 3-38

Service Tab 3-44

3.1 Main Screen Components



-1 A5 L

NUMBER	MAIN SCREEN COMPONENT	DESCRIPTION
1		3-11.
2		3-13.
3		3-19.
4		
5		
6		
7		

** Monitor mode is only available with the AG module.*
***SIMV-PC and Bypass are only available on A5.*

NUMBER	MAIN SCREEN COMPONENT	DESCRIPTION
8		
9		
10		
11		
12		
13		

** Monitor mode is only available with the AG module.*
***SIMV-PC and Bypass are only available on A5.*

14

Setup

Alarms

Silence

120

120

3.2 System Information Header

3.2.1

Displays the elapsed time, countdown time, or both. Located at the top left of the main screen. Select to start, stop, or reset the timer. Select the timer icon to open the menu (see FIGURE 3-2).

Elapsed Timer

Select the

Elapsed and Countdown Timer (software bundle version 02.06.00 and later)

Turn on both the elapsed and countdown timer, the figure below displays on the screen (see FIGURE 3-6).

3.2.2

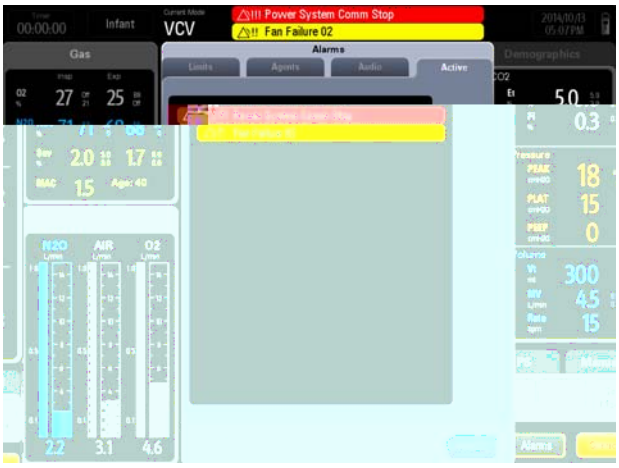
Displays the currently selected patient size (Adult, Pediatric, or Infant). Select to change the patient size when the A5 is in mode, mode or Monitor mode (available with the AG module). (FIGURE 3-7)

3.2.3

Displays physiological alarms, technical alarms, and prompt messages. The most recent highest priority alarm is displayed at the top.

The remaining alarms are displayed in the lower area and grouped by priority. The most recent of these alarms are displayed first.

Select this area to display a list of all active alarms. See "Alarms and Messages" on page 6-1 for tables that list the individual messages and their associated priority levels. High priority messages are red. Medium priority messages are yellow. Low priority messages are cyan. Prompt messages are black text on white background (see FIGURE 3-8).



3.2.4

The Alarm Silence icon and Alarm Silence countdown timer are displayed after selecting the softkey is selected, which indicates that all currently sounding alarms are silenced for 120 seconds (see FIGURE 3-9).

3.2.5 Date and Time

Displays the current system date and time (see FIGURE 3-10).

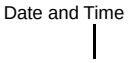


FIGURE 3-10 Date and Time Icon (with AG module connected)

To adjust the date and time:

1. Select the Date and Time icon. The Date/Time dialog is displayed (see FIGURE 3-11).
2. Use the dialog keypad and softkeys to adjust the date, time, 12/24 hour format, date format, and daylight savings time.

NOTE: If applicable, select Daylight Savings Time first before all other settings.

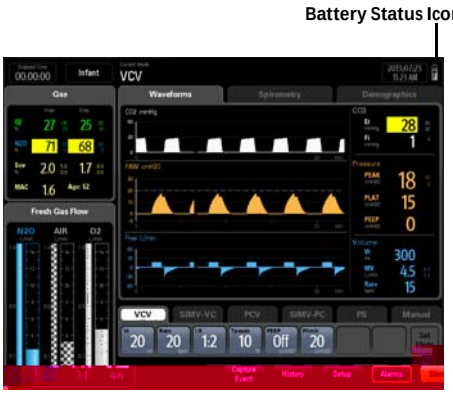
NOTE: If the Daylight Savings Time On/Off button in the Date/Time dialog (see FIGURE 3-11) is disabled and cannot be selected, it is because the Daylight Savings setting has been set to Auto in the System settings (see TABLE 3-10, •System Tab Settings Ž on page 39).

3. Select the •Accept Ž to finalize your changes.

FIGURE 3-11 Date and Time Menu

3.2.6

Displays the main power supply and battery state (see FIGURE 3-13). For more information on the advanced A5 power management system, see "Power Management / Battery Supply" on page 1-5.



-1

PART(S)	DESCRIPTION
	5,
	5,
	5,
	5,
	5,

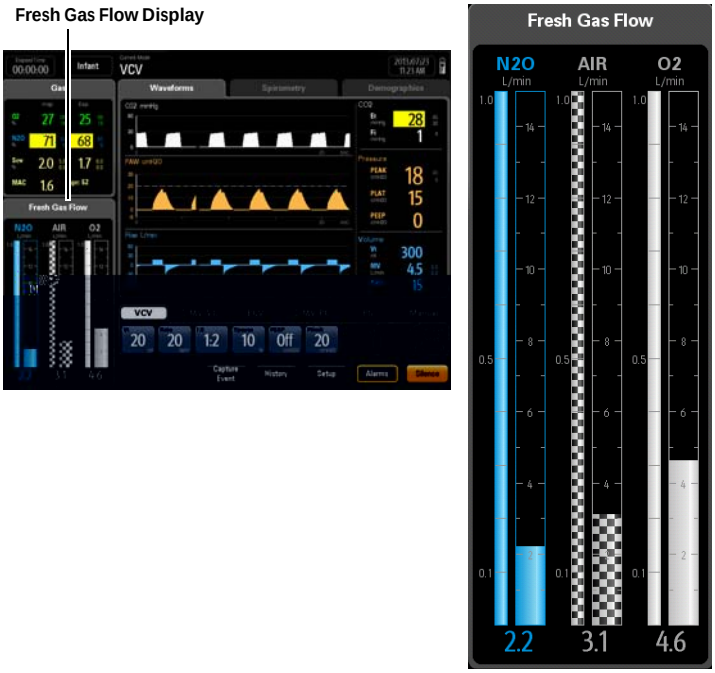
-1

3.3 Fresh Gas Flow Display

Displays real-time flowmeter levels for N_2O, Air, and O_2 (see FIGURE 3-14).

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

For the A5, the size (height) of the fresh gas flow tubes changes depending on whether the AG module is connected as shown in FIGURE 3-14.



3.4 Waveforms Tab

Displays PAW , Flow, Volume, CO2, O_2, N_2O and AA (AA stands for anesthetic agent) waveforms (see FIGURE 3-15).

NOTE: O2, N2O and AA waveforms are available in software bundle version 02.06.00 and later.

-1 L (F I .

3.4.1

If the measured value of Paw or Flow is larger than the boundary at the end of breath cycle, the system will auto scale the Paw or Flow at the beginning of the next breath cycle.

If the measured value of Paw or Flow is less than the boundary minus a margin at the end of two continuous breath cycles, the A5 System will auto scale the Paw or Flow at the beginning of next breath cycle.

:
The margin will be 10 cmH2O if pressure 30 cmH2O.

The margin will be 3 cmH2O if pressure <30 .

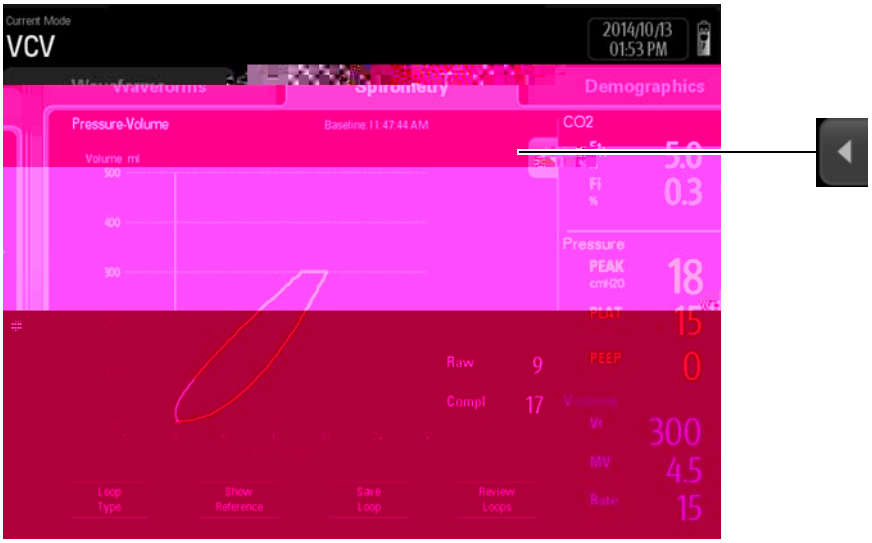
F. :

3.5 Spirometry Tab

Displays separate looped graphsand waveforms (see FIGURE 3-16).

NOTE: Displaying spirometry and waveforms simultaneously is

You can press the button (see FIGURE 3-17) to see the spirometry loop and waveforms (see FIGURE 3-16).



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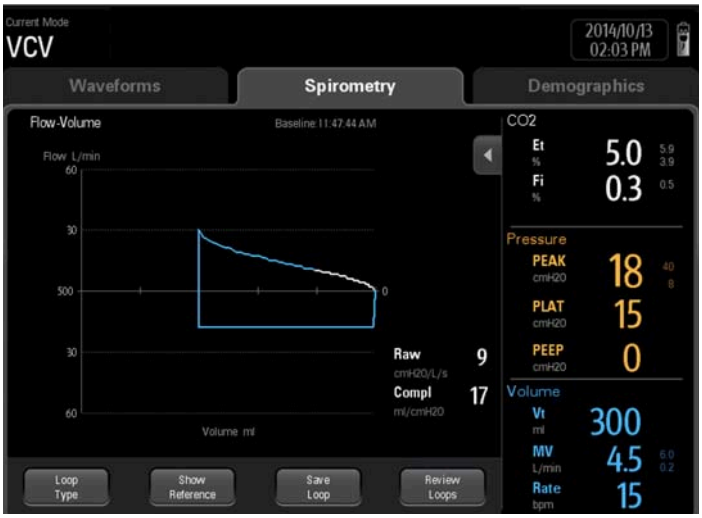
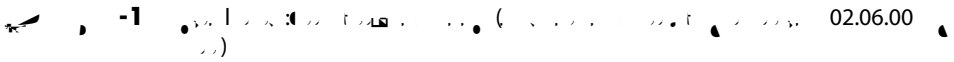


-1



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 spirometry loops: pressure - volume loop (see FIGURE 3-17), flow - volume

3.5.2

The Show Reference softkey can be selected only after a baseline has been saved via the Save Loop softkey.

The Show Reference softkey (see FIGURE 3-20) is used to select and display a saved baseline loop, reference loop, or no loop (Off) in the spirometry loop window, overlapped with the currently plotting loop. Only the four most recently saved reference loops are listed chronologically.

When a reference loop or baseline loop is selected to display in the spirometry loop window, the time stamp will also be displayed.

3.5.3

Select the Save Loop softkey (see FIGURE 3-20) to save the currently plotting loop (including its numeric data) as either a baseline loop or reference loop. Only one baseline loop and up to four reference loops can be saved. Additional plotting loops can be saved to replace the baseline loop or reference loops. Only the four most recent reference loops are saved.

The saved baseline or reference loop can be reviewed 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 A5 System will always make 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**

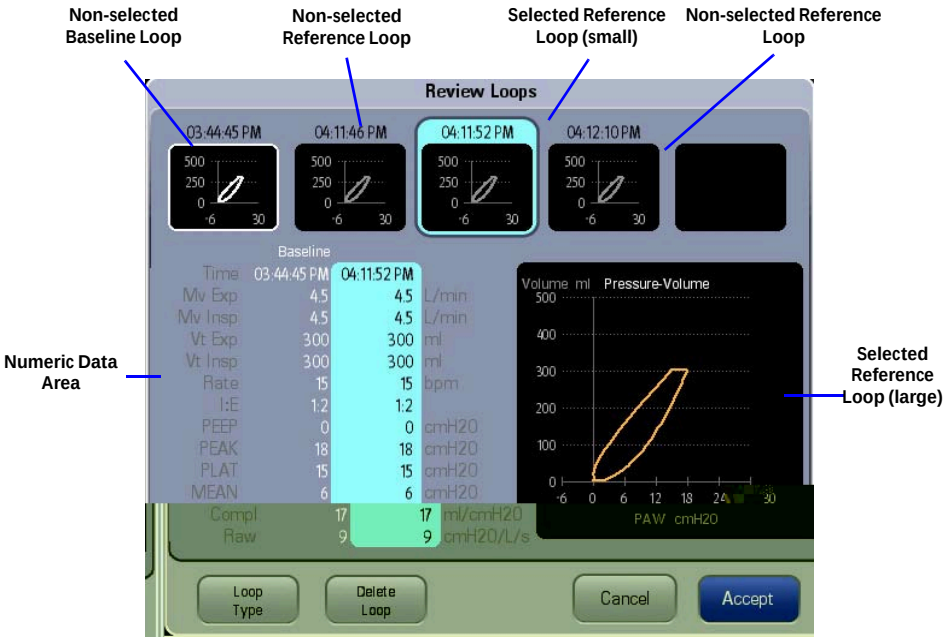
[illegible]: These small graphic windows show the baseline and reference loops. The baseline loop (only one) is always located on the left and has a white border around its graph. The reference loops (up to four) are located to the right of the baseline loop. The reference loops are displayed from oldest (left) to newest (right).

The baseline loop information is displayed below the small baseline loop window. The reference loop information is displayed in cyan highlight for the reference loop that is selected.

[illegible]: This graphic window shows an enlarged view of the selected reference loop overlapped with the baseline loop.

[illegible]: The Loop Type softkey is used to choose the type of loop to review. The choices are: [illegible] and [illegible]. Default loop type is [illegible] loop.

[illegible]: The [illegible] softkey is used to delete a selected Reference loop. When a reference loop is deleted, the newer reference loops will shift to the left. The [illegible] softkey will be disabled (grayed out) if no reference loops have been saved. The baseline loop cannot be deleted. It can only be replaced by another baseline loop.



[illegible] - 1

[illegible]: Displays the numerical data associated with a saved Baseline loop and saved Reference loops. The parameters listed in column form include:

Demographics Tab
Infant
VCV
Waveforms
Spirometry
Demographics
Gas
Fresh Gas Flow
N2O
AIR
O2
VCV
SIMV-VC
PCV
SIMV-PC
PS
Manual
Capture Event
History
Setup
Alarms
Silence

3.7 Ventilation Mode Tabs

Displays tabs for all ventilation modes. Each tab displays the ventilation mode and its parameters (see FIGURE 3-23 to FIGURE 3-29).

A5 ventilation modes:

- Volume Control Ventilation (VCV)
- Synchronized Intermittent Mandatory Ventilation with VC mode (SIMV-VC)
- Pressure Control Ventilation (PCV)
- Synchronized Intermittent Mandatory Ventilation with PC mode (SIMV-PC)
- Pressure Support ventilation (PS)
- Manual,
- Bypass
- Monitor (with AG module)

[illegible]

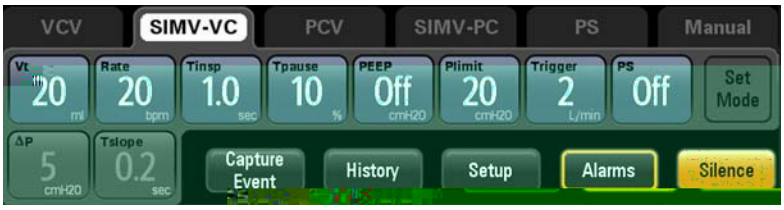
[illegible]

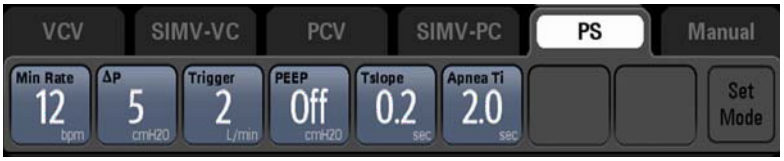
1. [illegible]

[illegible]

NOTE: **If the Set Mode softkey is not selected after several seconds, an audible reminder is sounded, and then the desired ventilation mode is cancelled.**

[illegible]





NOTE: **Monitor mode available when external AG module connected.**

3.8 Measured Values Area

The Measured Values area is used to display the numerical data. The parameters include: End tidal CO_2 (with AG module connected), Fractional CO_2 (with AG module connected), Peak Inspiratory Pressure (PEAK), Plateau Pressure (PLAT) (user can configure this to display Mean Pressure (MEAN) or PLAT (see "Pressure Display" on page 3-35)), Positive End Expiratory Pressure (PEEP), I:E Ratio, Expiratory Tidal Volume (Vt), Expiratory Minute Volume (MV),and Breath Rate (Rate), and Inspiratory O_2% (FiO_2).

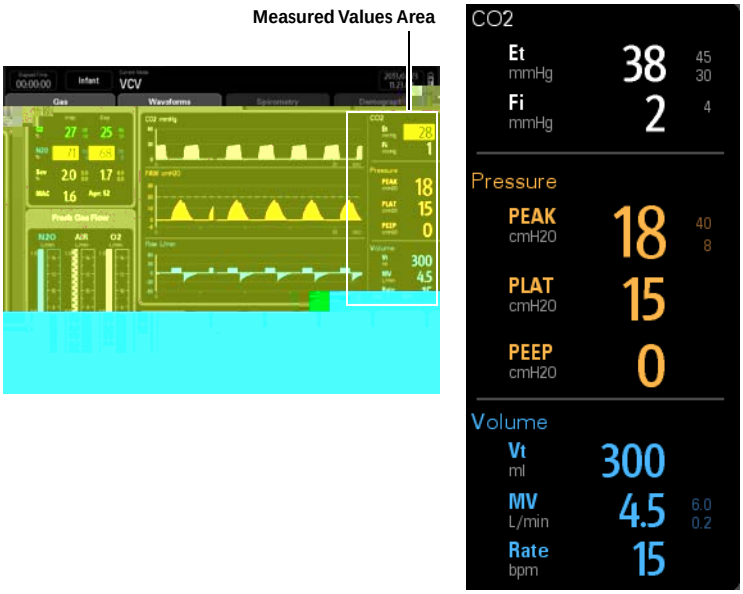


Figure 3-1 Location of Measured Values Area (Fi Shown)

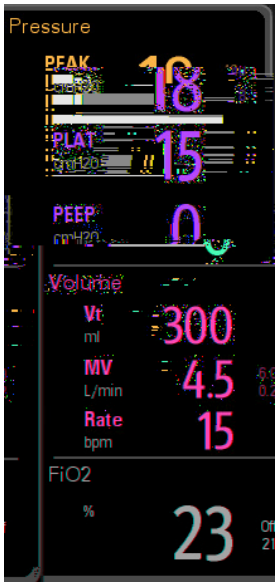


Figure 3-2 Location of Measured Values Area (FiO2 Shown)

3.9 System Softkeys

The A5 System provides system softkeys at the bottom right of the main screen for direct access to the history menu, system setup, and alarms menu, and for capturing events and silencing alarms (see FIGURE 3-33).

3.9.1

Select the softkey on the main screen to display the menu. See FIGURE 3-33, "System Softkeys," on page 24.

The menu contains the tab, tab, tab, and tab. See section 3.12 (page 3-34) "Display Tab".

3.9.2

Select the softkey on the main screen to open the menu to set alarm limits, set alarm volume, and view all active alarms. See "Alarms and Messages" on page 6-1.

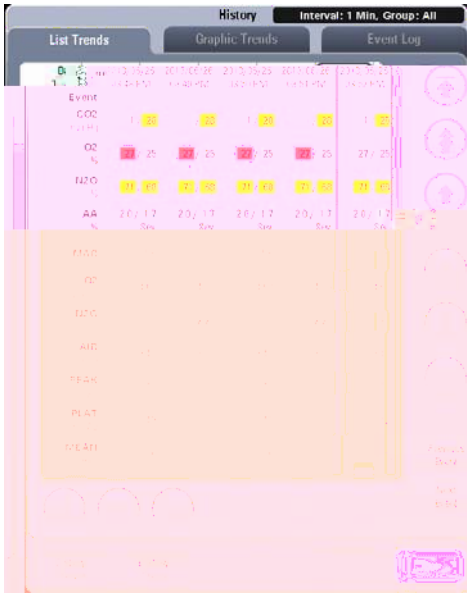
3.9.3

Select softkey to silence all currently sounding alarm tones. The alarm will sound if a new alarm occurs.

If the silenced alarms contain middle or high level alarms, the alarm audio will be paused for 120 seconds.The alarm silence icon and 120 second countdown time appear at the top of the screen. Select again to resume the alarm audio. Note, however, the alarm will sound if that a new alarm occurs while the system is in an audio-paused state. If this occurs, you can select the softkey again to silence the new alarm and reset the silence countdown timer to 120 seconds.

If the silenced alarms are only low level alarms, the alarm audio will be

The List Trends displays a tabular list of the physiological parameters. Trend data automatically displays in one minute intervals unless an alternate interval is selected.



3.9.5.1.1

- List Trends displays the time and date on the horizontal axis and it is always visible.
- List Trends displays the parameter data 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.
- ListTrends are not stored when the machine is in standby.
- The display period of data is a rolling 48 hours of continuous data.
- 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.

3.9.5.1.2

The dialog navigation buttons are described in TABLE 3-3.

NOTE: When a navigation button becomes disabled, this indicates that there is no more data available or the end of the data range was reached.

BUTTON	FUNCTION
	Moves the cursor to the oldest record from its current position.
	Moves the cursor one page back from its current position.

BUTTON	FUNCTION
	Moves the cursor one record back from its current position.
	Moves the cursor one record forward from its current position.
	Moves the cursor one page forward from its current position.
	Moves the cursor to the newest record from its current position.
Previous Event	Moves the cursor to the previous event from its current position.
Next Event	Moves the cursor to the next event from its current position.
	Moves the cursor up one parameter from its current position.
	Moves the cursor down one parameter from its current position.

3.9.5.1.3

Display Interval allows for the trends to be displayed in a specified time interval between two neighboring columns.

Set **D** to **1** , **5** , **10** , **15** , **30** , **1H** , or **2H** .

3.9.5.1.4

Display Group allows for the trends to be displayed in a specified parameter group.

Set **D** to **G** , **F** **G** , or **A** .

3.9.5.1.5 (02.06.00)

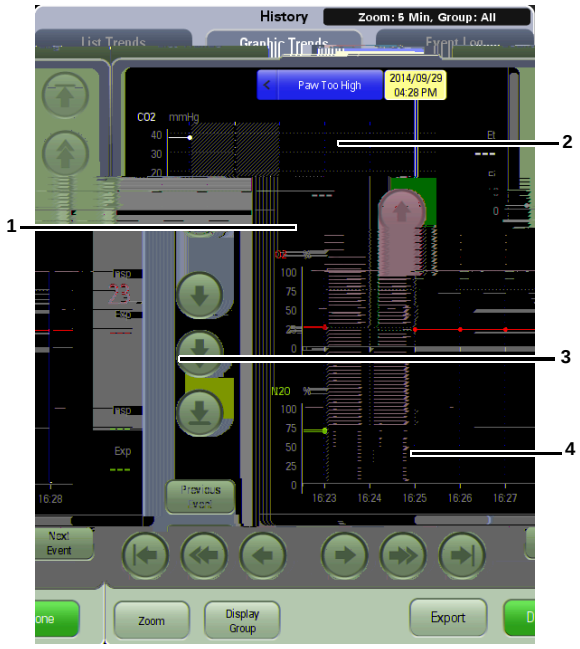
The **E** button on the **L** tab will allow the contents of the history to be exported to a USB mass storage device. The format of the data exported is a .html file which can be opened using Internet Explorer version 6.0, 7.0 and 8.0. The **E** button on the **L** tab is only available when the system is in mode.

NOTE: **If Internet Explorer greater than version 8.0 is used to view the exported file, set it to compatibility mode.**

3.9.5.2 F

Select the **H** button on the main screen and then select the **G** tab to access the **G** . The History dialog displays (see FIGURE 3-35) with the Graphic Trends tab selected.

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 tab displays end case event, captured event and parameter alarm event. Graphic trend data automatically displays in one minute intervals unless the zoom is selected.



F

NUMBER	DESCRIPTION
1	
2	( ). F 02.06.00 : (3-36) .
3	
4	

NOTE: **The Graphic Trends will be cleared after the anesthesia machine undergoes power failure or is turned off.**

3.9.5.2.1

- 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 on the right side of the grid.
- Graphic Trends are not stored when the machine 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.

3.9.5.2.2

The dialog navigation buttons are described in TABLE 3-5.

NOTE: When a navigation button becomes disabled, this indicates that there is no more data available or the end of the data range was reached.

BUTTON	FUNCTION
	Moves the cursor to the oldest record from its current position.
	Moves the cursor one page back from its current position.
	Moves the cursor one record back from its current position.
	Moves the cursor one record forward from its current position.
	Moves the cursor one page forward from its current position.
	Moves the cursor to the newest record from its current position.
Previous Event	Moves the cursor to the previous event from its current position.
Next Event	Moves the cursor to the next event from its current position.
	Moves the cursor up one parameter from its current position.
	Moves the cursor down one parameter from its current position.

3.9.5.2.3 . . l

Zoom allows for the trends to be displayed in a specified time interval between two neighboring columns.

Set . . to **5** , **10** , **15** , **30** , **1H** , or **2H** .

3.9.5.2.4 F

Display Group allows for the trends to be displayed in a specified parameter group.

Set **D** **G** to **G** , **F** **G** , , or **A** .

3.9.5.2.5 F (02.06.00)

The **E** button on the **G** tab will allow the contents of the history to be exported to a USB mass storage device. The format of the data exported is a .html file which can be opened using Internet Explorer version 6.0, 7.0 and 8.0. The **E** button on the **G** tab is only available when the system is in mode.

NOTE: If Internet Explorer greater than version 8.0 is used to view the exported file, set it to compatibility mode.

3.9.5.3

Select the **H** button on the main screen and then select the

The **E L** tab logs such events as technical alarms, physiological alarms, capture events, delay power off, end case, delay power off canceled and system time change. Events can be physiological indicating that a patients physiological alarm thresholds have been violated or technical indicating that a specific technical issue has occurred.

An alarm entry and captured events in the Event Log displays the time, date, event, priority and additional information which includes the Ventilation Mode, Patient Size, and Monitored Parameters.

NOTE: The Event log will not be cleared after the anesthesia machine undergoes power failure or is turned off.

NOTE: The system can store up to 500 records of Event Logbook. When a new event occurs after 500 events are already stored, the new event overwrites the earliest one.

3.9.5.3.1

The dialog navigation buttons are described in TABLE 3-8.

NOTE: When a navigation button becomes disabled, this indicates that there is no more data available or the end of the data range was reached.

BUTTON	FUNCTION
	Moves the scroll up one record.
	-Moves the scroll up one page.
	Moves the scroll to the top most parameter.
	Moves the scroll down one record.
	L
	Moves the scroll to the bottom most parameter.

3.9.5.3.2

The **E** button allows for the Event Log Entries trends to be displayed in a similar Event type.

Set **E** to **H** , **L** , **I** or **A** . The A5 will display the corresponding event based on your setting.

3.9.5.3.3

The **E . . .** button on the Event Log tab will allow the contents of the history to be exported to a USB mass storage device. The format of the data exported is a .html file which can be opened using Internet Explorer version 6.0, 7.0 and 8.0. The **E . . .** button on the **E . L .** tab is only available when the system is in mode.

NOTE: **If Internet Explorer greater than version 8.0 is used to view the exported file, set it to compatibility mode.**

3.10 Setup

Select the Setup softkey (see FIGURE 3-33) to open the Setup menu (see FIGURE 3-37).

The Setup menu contains the General tab, Display tab, System tab, and Service tab. See section 3.12 (page 3-34) "Display Tab".

NOTE: The System tab is only available in Standby mode.

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

Many of these functions are only available if the A5 is in Standby mode.

3.11 General Tab

The General tab provides access to calibrate the O_2 sensor and flow sensor, perform system leak and compliance tests, activate the breathing system warmer, and zero flow meters. The General tab also displays information for the most recent calibrations and leak test results, whether they were passed, failed, or skipped (see FIGURE 3-37).

FIGURE 3-37 General Tab (with AG module connected)

Calibrate O_2 Sensor (without AG module connected)

To calibrate the O_2 sensor, select the Calibrate O_2 Sensor button. Follow the on-screen directions and prompts. See "O_2 Sensor Calibration" on page 7-6 for more information. Note that information for the last O_2 sensor calibration is displayed next to the button.

Calibrate Flow Sensor

To calibrate the flow sensor, select the Calibrate Flow Sensor button. Follow the on-screen directions and prompts. See "Flow Sensor Calibration" on page 7-5 for more information. Note that information for the last flow sensor calibration is displayed next to the button.

The button enables the A5 system to perform a manual leak test and automatic leak test, and calculates the compliance for the A5.

To perform a leak test, select the button. Follow the on-screen directions and prompts. See "Leak and Compliance Tests" on page 4-9 for more information. Note that information for the last Leak Test / Compliance is displayed next to the button.

To set the breathing system warmer, select (default) or . If the warmer is off or if AC power is not connected, the system displays an icon to indicate that the warmer is not active (see FIGURE 3-38).

After cycling power, the breathing system warmer will return to the default state.

NOTE: The breathing system warmer is inactive when the A5 is powered by the battery supply.

To zero the flow meters, select the button. Follow the on-screen directions and prompts. Note that information for the last zeroing of the flow meters is displayed next to the button.

NOTE: Before zeroing the flow meters, make sure to disconnect the gas supply (N_2O, Air, O_2).

To set the gas bench flow rate, select the button. The flow rate can be set to High, Medium, or Low (default).

3.12 Display Tab

The Display tab provides access to screen cleaning, screen calibration, pressure parameter display, CO2 waveform placement, gas scales, waveform display, screen brightness and key click volume (see FIGURE 3-39).

Screen Brightness

To adjust the screen brightness:

1. Select Setup softkey > Display tab (see FIGURE 3-39).
2. In the Screen Brightness area, select the +/- buttons to adjust the screen brightness.
3. Select the Accept button to confirm the change, or select Cancel button to disregard the change.

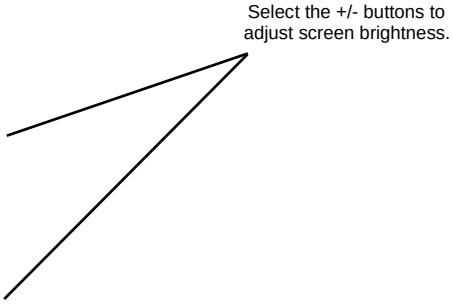
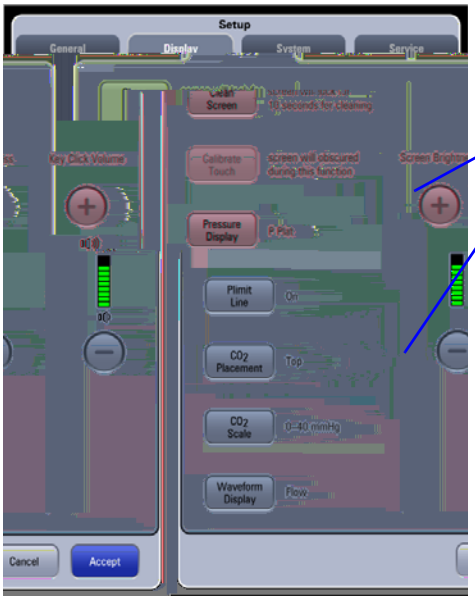


FIGURE 3-39 A5 Display Tab> Screen Brightness Area

1. Setup > Display
   - Key Click Volume +/-
   - Accept. Cancel.



1. Setup > Display
   - Clean Screen.
     10

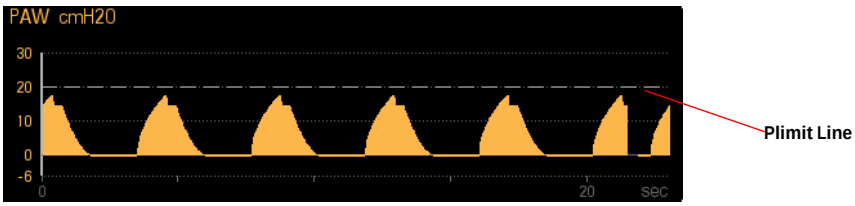
1. Setup > Display
   - Calibrate Touch.

1. Setup > Display
   - Pressure Display.
   - MEAN PLAT.

- Accept. Cancel.

Plimit Line

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, and PCV with VG on mode. The Plimit line function can be switched On or Off by the user. The default value for Plimit Line is On.



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.**

To turn the Plimit line function On or Off:

1. Setup > Display
   - Plimit Line.
   - Accept. Cancel.

CO_2 Placement (Flow, Pressure, and CO_2)

The CO_2 waveform/data can be positioned at the top or bottom of the Waveform area.

To select the CO_2 placement:

1. Setup > Display
   - CO_2 Placement.
   - Top. Bottom.
   - Accept. Cancel.

CO_2 Scale (Flow, Pressure, and CO_2)

The CO_2 scale of the CO_2 waveform can be adjusted to one of three settings. The table below shows the CO_2 scale options.

To select the CO_2 scale:

1. Setup > Display
   - CO_2 Scale.

- [illegible]:

CO_2 UNIT OF MEASURE	SCALE		
[illegible]	0-40	0-60	0-80
[illegible]	0.0-5.0	0.0-8.0	0.0-10.0
%	0.0-5.0	0.0-8.0	0.0-10.0

[illegible] 2 [illegible]

- [illegible] **Accept.** [illegible] **Cancel.** [illegible]

F [illegible] ([illegible] 02.06.00 [illegible] F [illegible])

[illegible] G [illegible]:

1. [illegible] **Setup** [illegible] > **Display** [illegible].
   - [illegible] **Gas Scales.** [illegible].
   - [illegible] **CO_2 Scale, AA Scale, O_2 Scale or N_2O Scale.** [illegible] **Sev Scale**, [illegible] **AA Scale.**
   - [illegible]:

GAS SCALES	UNIT OF MEASURE	SCALE		
[illegible] 2 [illegible]	[illegible]	0-40	0-60	0-80
	[illegible]	0.0-5.0	0.0-8.0	0.0-10.0
	%	0.0-5.0	0.0-8.0	0.0-10.0
[illegible] 2 [illegible]	%	0-35	0-50	0-100
[illegible] [illegible]	%	0-35	0-50	0-100
[illegible] [illegible]	%	0.0-6.0	0.0-9.0	0.0-18.0
[illegible] [illegible]	%	0.0-2.0	0.0-4.0	0.0-8.0
[illegible] [illegible]	%	0.0-1.2	0.0-2.5	0.0-5.0
[illegible] [illegible]	%	0.0-1.2	0.0-2.5	%
[illegible] [illegible]	%	0.0-1.2	0.0-2.5	0.0-5.0

[illegible] F [illegible]

- [illegible] **Load Scales Defaults.** [illegible] **Yes.** [illegible] **Accept.** [illegible] **Cancel.** [illegible]

GAS SCALE	FACTORY DEFAULT SCALE		
CO2 Scale	0-60 mmHg	0.0-8.0 kpa	0.0-8.0 %
O_2 Scale	0-100 %		
N_2O Scale	0-100 %		
Des Scale	0-9.0 %		
Sev Scale	0-4.0 %		
Iso Scale	0-2.5 %		

[illegible] E [illegible]

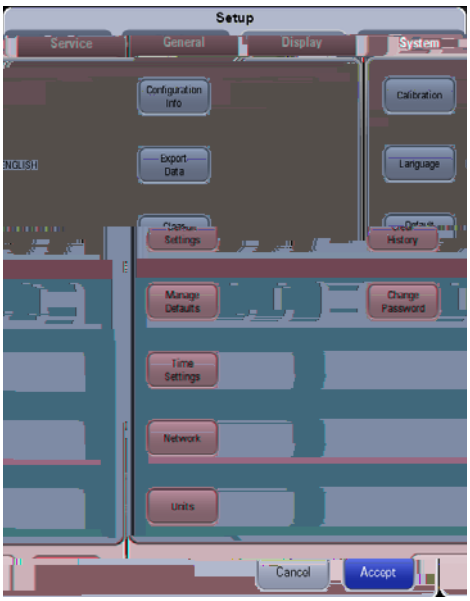
GAS SCALE	FACTORY DEFAULT SCALE
Hal Scale	0-2.5 %
Enf Scale	0-2.5 %

1. **Setup**
   - **Waveform Display.**
   - **Accept.** **Cancel.**

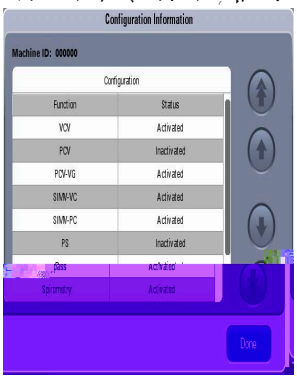
3.13 System Tab

The System tab is accessible only by authorized administrative service personnel with password access. The system tab can only be accessed in mode.

NOTE: The authorized administrator should change the default password immediately after the system is installed to prevent unauthorized access to the System tab. The password can be maximum of 6 digits in length containing numerals 0 to 9.



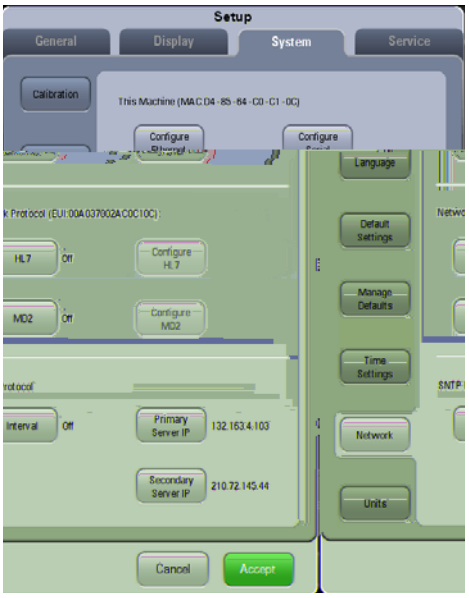
SYSTEM TAB BUTTON	CHOICES	DESCRIPTION
Calibration	**External AG Module** **O2 Sensor**	F L. 2 . l **O2 Sensor or External AG Module.** **NOTE:** F l . l F l . 5 l .
Language	**ENGLISH( )** **CHINESE** **FRENCH** **SPANISH**	. . . .
Default Settings	**Default Patient Size** **(=Infant, Adult, Pediatric**	. . . .
	Default Vent Mode (=VCV, SIMV-VC, PCV, SIMV-PC, PS)	. . l l . . :
	NOTE: Default changes take effect after next case or when O.R. defaults are loaded.	1. 2. . 3. .

SYSTEM TAB BUTTON	CHOICES	DESCRIPTION
Configuration Information		
Export Data		
Clear History	**On( )** **Off**	

-10

3.13.1

Network configuration settings can be set via the button (see FIGURE 3-43).
Select main screen > button > tab > button.



NOTE: Set HL7 Compatibility displayed on Network Configuration Screen is available in software bundle version 02.06.00 and later.

TABLE 3-11 lists the network settings and parameters.

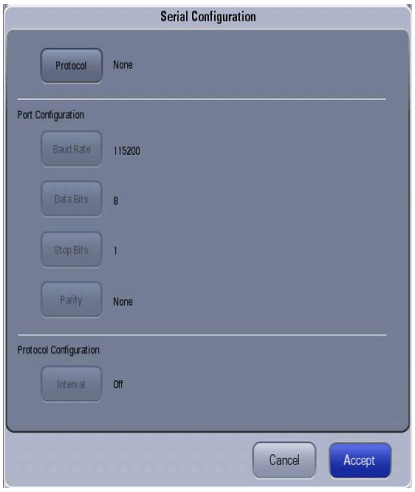
SETTINGS	PARAMETERS
This Machine	
	– IP Address (Default = **192.168.23.250**) – Subnet Mask (Default = **255.255.255.0**) – Default Gateway (Default = **[blank]**)

-11

SETTINGS	PARAMETERS
	: (**None** ( ), L - / 7, L - , (02.09.00)) (57600, **11520** ( )) (**8** ( ), 7, 6, 5) (**1**( ), 2) , **None** ( )) :
	: **Off** ( ); = 7:10 , 30 , **1 Min** ( ), 5 L , 30 L , 1 , 2 , 6 , 12 , 24 .

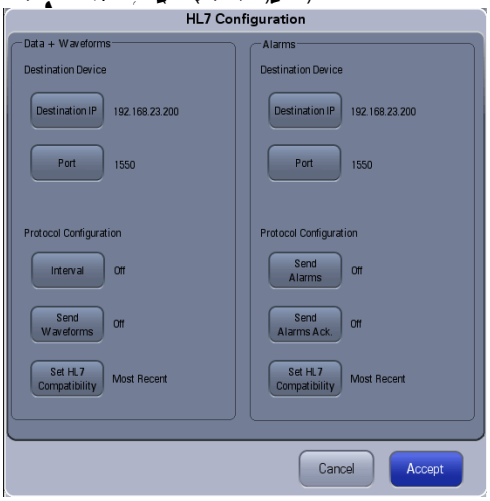
NOTE: When Protocol is set to MR-WATO, the A5 can communicate with the patient monitor of Mindray through Benelink module of Mindray.

NOTE: When Protocol is set to Philips, the A5 can communicate with the patient monitor of Philips through IntelliBridge or VueLink module of Philips.



Network Protocol

-11

SETTINGS	PARAMETERS
7	(10 , 30 , 1 l , ( ), 5 l , , 30 l , ,1 , 2 . , 6 . , 12 . , 24 .) (= 192.168.23.200) (= 1550) 7 , l (L . , ( ), 02.02.01 . 02.10.00, 02.00.00, 01.05.02, 01.00.00 . 01.05.01, .) . l ( ) l ( ) l ( ) 
2 (. 02.09.00 :)	( )
	NOTE: MD2 is a communication protocol. The A5 can connect to the eGateway through MD2, and communicates with the devices connected to the eGateway.
2 (2)	(= 192.168.23.99) (= 6678)
SNTP Protocol	
	: **Off** ( ), 10 , 30 , 1 l , , 5 l , , 30 l , , 1 . , 2 . , 6 . , 12 . , 24 .
l	: l (= **132.163.4.103**)
	: (= **210.72.145.44**)
-11	l

3.14 Service Tab

Accessible only by Mindray-authorized service personnel. Please contact Mindray Technical Support for assistance.

4.0 [illegible]

Preoperative Test Schedules 4-2

Inspect the System 4-3

Pre-Operative Checkout List 4-4

System Self-Test 4-6

Leak and Compliance Tests 4-9

Preoperative Check List (software bundle version 02.09.00 and later) 4-17

Pipeline Tests 4-18

Basic Ventilation Testing 4-19

Cylinder Tests 4-20

Flow Control System Test 4-21

Vaporizer Tests 4-22

Breathing System Tests 4-24

Alarm Tests 4-26

Preoperative Preparations 4-28

Inspect the Active/Passive Anesthetic Gas Scavenging System 4-29

4.1 Preoperative Test Schedules

Preoperative tests on the A5 follow the ASA guidelines and 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: **It is recommended that the user check that 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.**

4.1.1 エ

Perform the preoperative tests listed below at these events:

- **When required after a maintenance or service procedure**
- **Every day before the first patient:**
  - (4.4)
  - (4.5)
  - (4.8)
  - (4.9)
  - (4.10)
  - (4.11)
  - (4.12)
- **Before each patient:**
  - エ (4.2)
  - (4.3)
  - / (4.5)
  - (02.09.00) (4.6)
  - (4.13)
  - (4.14)
  - (4.15)
  - エ F (4.16)

NOTE: **Read and understand the operation and maintenance of each component before using the A5 anesthesia machine.**

NOTE: **Do not use the A5 anesthesia machine if a test failure occurs. Contact Mindray Technical Support for assistance.**

NOTE: **A checklist of the anesthetic system should be provided, 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.**

4.2 Inspect the System

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

Perform the following inspection checklist before operating the A5 unit:

1. 5

- :
  - 2
  - 2
- :
  - F
  - ( )
- .
- .
- .).
- .

10.

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

11.

1 . ( ).

1 .

1 .

1 . 5

4.3 Pre-Operative Checkout List

4.3.1 Introduction

The purpose of the pre-operative checkout 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 A5 pre-operative checkout procedures. In addition, it is recommended that the breathing circuit be tested for the ability to effectively deliver positive pressure ventilation before beginning each case. Testing the ability to properly ventilate a test lung can quickly identify an occluded circuit limb and other breathing circuit problems.

Before starting each case, test the machine's ability to ventilate the patient by removing the breathing bag from the bag arm and connecting it to the patient connection (elbow or Y-piece on the disposable circuit). Set the ventilator to deliver a specific tidal volume to the test lung and verify the exhaled tidal volume monitor. Observe that the test lung (breathing bag) inflates as the bellows descends, and that the test lung deflates during the exhalation phase. Observe that the measured exhaled volume matches the tidal volume set on the ventilator. With the ventilator running, lower the fresh gas flow to zero and observe if the bellows rapidly falls with each exhalation. If this occurs, then a leak should be suspected, identified, and repaired.

This test should be performed before starting each case. By verifying that a test lung (breathing bag) can be manually and mechanically ventilated, this indicates that the A5 is capable of ventilating a patient with the attached breathing circuit.

4.3.2 Suggested Pre-Operative Checkout List

Below is a suggested checkout list that should be conducted before administering anesthesia. This is a guideline which users are encouraged to modify according to their local clinical practice. Such local modifications should have appropriate peer review. Users should refer to the A5 Operating Instructions for special procedures, precautions, and step-by-step instructions.

WARNING: To ensure proper machine operation, user safety, and patient safety, follow all checkout procedures established by the facility before administering anesthesia to the patient.

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

1. With the anesthesia machine connected to AC Power, turn the Mains switch to ON and verify that the unit is operating on AC. Follow the on-screen prompts to perform and complete the automatic machine start-up tests.
2. a. Check the O_2 Supply fail-safe message and alarm.
   (See "O_2 Pipeline Test" on page 4-18.)
   b. Test low O_2 concentration alarm.
   (See "Test the O_2 Concentration Monitoring and Alarms" on page 4-26.
   c. Test high and low airway pressure alarms.
   (See "Test the High Paw Alarm" on page 4-27.)
   (See "Test the Low Paw Alarm" on page 4-28.)
   d. Test low minute volume and apnea alarms.
   (See "Test the Low Minute Volume (MV) Alarm" on page 4-27.)
   (See "Test the Apnea Alarm" on page 4-27.)
3. Verify that the O_2 sensor displays approximately 21% in room air and above 94% after exposure to 100% O_2 (see "Test the O_2 Concentration Monitoring and Alarms" on page 4-26).
4. Check that the vaporizers are properly installed and sufficiently filled and that filler ports are tightly closed. Verify that only one vaporizer turned ON at a time (see "Install the Vaporizer" on page 2-5).

- [illegible] 40 [illegible] 40 [illegible] ([illegible] 4-22).
- [illegible] 5 [illegible] ([illegible] 4-22).
- [illegible] F [illegible] ([illegible] F [illegible] 4-29).
- [illegible].
- [illegible].

[illegible]:

1. [illegible] 5 [illegible] ([illegible]).

- [illegible] ([illegible], 40 87).
- [illegible]: [illegible].
- [illegible] 21% [illegible]: [illegible] ([illegible]). [illegible] 21% [illegible].
- [illegible] 5 [illegible] ([illegible] 4-22).

- [illegible].
- [illegible].
- [illegible] ( ) [illegible] 5, [illegible] ([illegible] 4-20).
- [illegible] ( ) [illegible].

10. [illegible].

11. [illegible].

1 [illegible].

1 [illegible].

[illegible]:

– [illegible] 21% [illegible] ([illegible] 7-6).

– 21% 100% (7-6).

– (4-22).

4.4 System Self-Test

When the A5 is powered on, it performs a self-test to ensure its alarm system (alarm LED, speaker, and buzzer) and hardware (flowmeter board, ventilator board, assistant ventilator board, power board, and CPU board) are properly functioning.

1. ON 5. 4-1

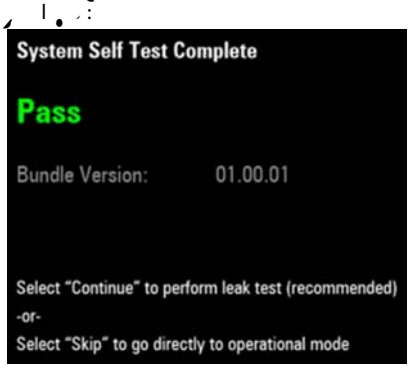
4-2 6.6.1.1

5.

1.	
2.	5
3.	
4.	
5.	
6.	
7.	

-1 A5 System Self-Test Sequence

Pass

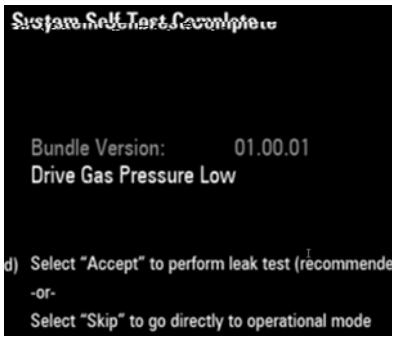


Pass 5

Continue

Skip **Standby**

All-Functional

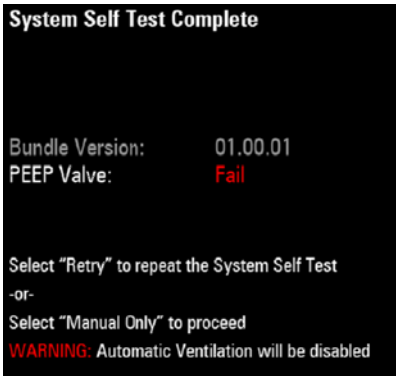


All-Functional

Accept

Skip

Manual Only



Manual Only 5

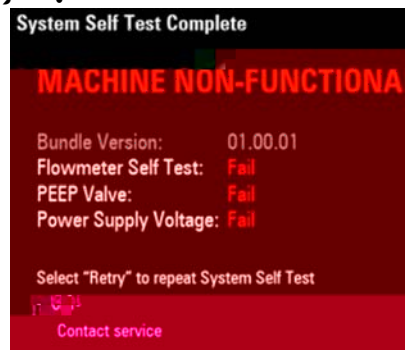
Retry

Manual Only **: Automatic Ventilation Disabled.**

WARNING: **Selecting the "Manual Only" button will disable automatic ventilation.**

- Types of System Self-Test Results

Machine Non-Functional



Machine Non-Functional

Retry

NOTE: **"Service Access" button: The Service Access button is only available to Mindray-authorized service personnel and requires a service password.**

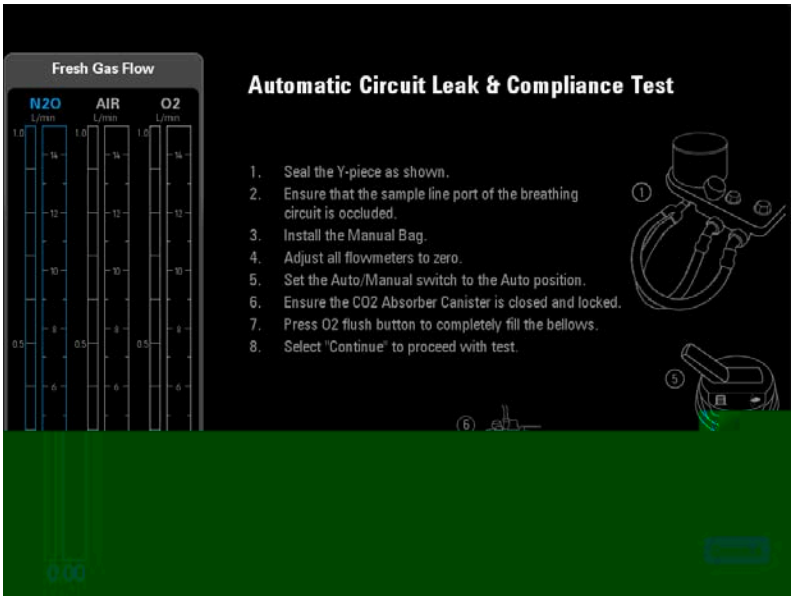
- Types of System Self-Test Results

B – The Bundle Version is displayed in all System Self-Test results. The Bundle Version is the version number of the package of software that is installed in the A5. If the Bundle Version displays a fail status, contact Mindray Technical Support.

4.5 Leak and Compliance Tests

4.5.1

The Automatic Circuit Leak Test screen is displayed in FIGURE 4-1.



-1 (. 03.13.00)

:

NOTE: **The A5 system records the result of the last Automatic Circuit Leak Test in the General tab, including if the test had passed, failed, or was skipped. To access this information, from the main screen, select the Setup softkey > General tab.**

NOTE: **If fresh gas is detected by the system before proceeding with the Automatic Circuit Leak & Compliance Test, a message is displayed on the screen to adjust all flowmeters to zero.**

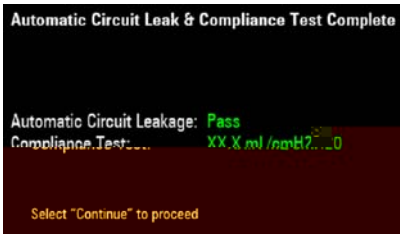
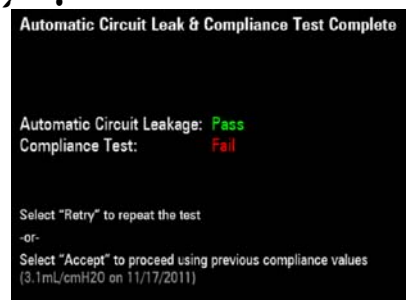
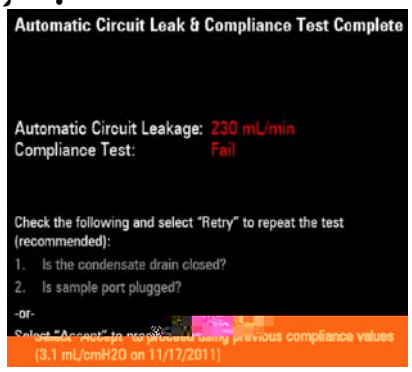
1. *From power up:*

5 **Preoperative Check List** **Continue** **Automatic Circuit Leak Test** **Manual Circuit Leak Test** **Skip.** **Automatic Circuit Leak Test** **Manual Circuit Leak Test**

From the main screen:

Setup > **General** > **Test Leak/Compliance.**

NOTE: **The "Continue" button can be selected only when the Auto/Manual switch is set to the Auto position and when no fresh gas is detected.**

: **Pass** : **XX.X mL/cmH_2O** :	200 l /l  **Continue** **Manual Circuit Leak Test**
: **Pass** : **Fail** :	200 l /l  ---. **Accept** **Manual Circuit Leak Test** **Retry** &
: **XXX mL/min** : **Fail** :	>200 l /l 1000 l /l  ---. **Accept** **Manual Circuit Leak Test** **Retry** &

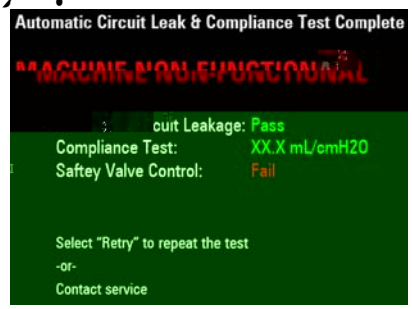
- Automatic Circuit Leak and Compliance Test Results

: **Fail: Fresh gas flow detected**

: **Fail**

MACHINE NON-FUNCTIONAL

: **Pass**
: **XX.X mL/cmH_2O**
: **Fail**
:



Retry &

NOTE: **The Service Access button is only available to Mindray-authorized service personnel and requires a service password.**

Time out
:

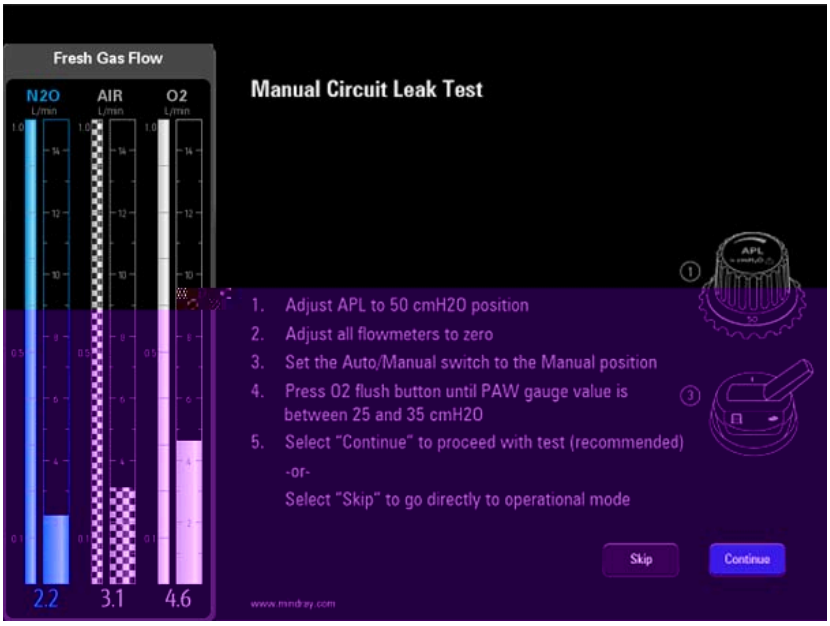
Retry &

Override .

- Automatic Circuit Leak and Compliance Test Results

4.5.2 L

The Manual Circuit Leak Test screen is displayed in FIGURE 4-2:



- L

L :

NOTE: **If fresh gas is detected by the system before proceeding with the Manual Circuit Leak Test, a message is displayed on the screen to adjust all flowmeters to zero.**

1. *From power up:*

5 **Preoperative Check List** **Continue** **Automatic Circuit Leak and Compliance Test** **Manual Circuit Leak Test.** **Skip.**

From the main screen:

Setup > **General** > **Test Leak/Compliance.**

:

1. **APL** 50
2. .
3. **Auto/Manual** **Manual.**
4. **O2** 25 35 .
5. **Manual Circuit Leak Test.**

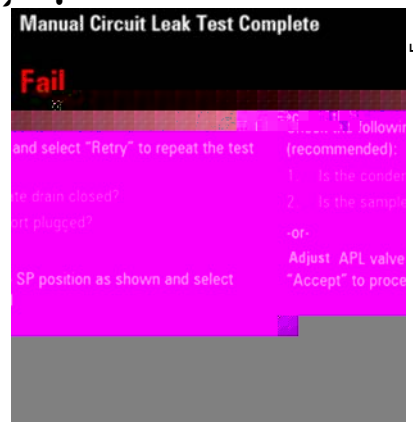
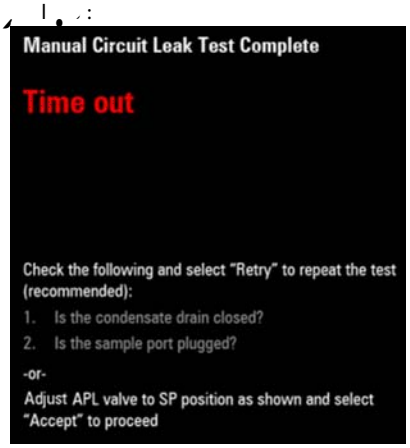
Skip .

NOTE: **The "Continue" button can be selected only when the Auto/Manual switch is set to the Manual position and when no fresh gas is detected.**

4-4, L
4-15,

Pass :	L **Continue**
Fail: Fresh gas flow detected :	L **Retry**

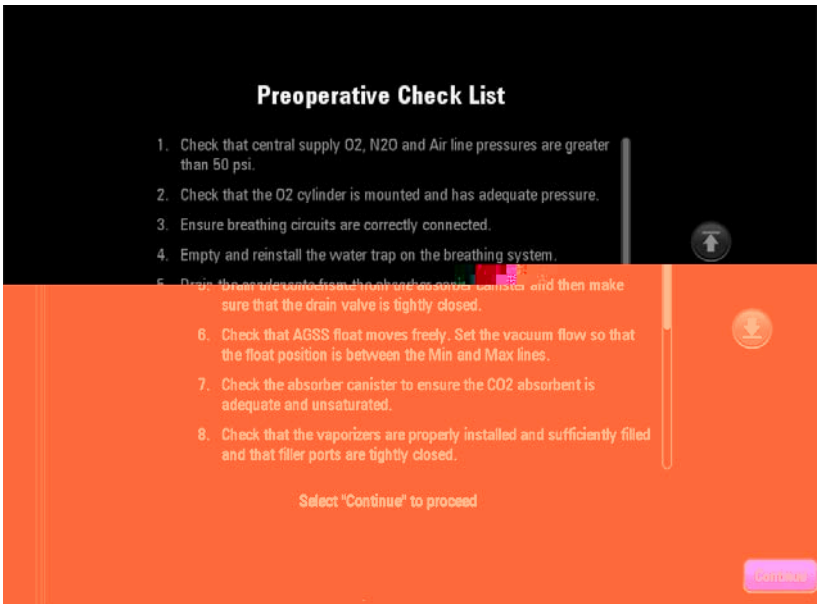
- Manual Circuit Leak Test Results

Fail 	**Accept** .
Time out 	**Retry** . & **Accept** .

- Manual Circuit Leak Test Results

4.6 Preoperative Check List (software bundle version 02.09.00 and later)

5, **Preoperative Check List** **Continue** . The **Preoperative Check List** screen is displayed in FIGURE 4-3 .



4.7 Power Failure Alarm Test

1. On.
   - .
   - "Battery in Use" .
   - .
   - "Battery in Use" .
   - Off.

4.8 Pipeline Tests

NOTE: **If the pipeline suply is unavailable,please use the cylinder.**

4.8.1 2

1. 2 .
   - 5 .
   - .
   - (6 /l).
   - 2 . 280 . 600 (40 . 87).
   - 2 .
   - 2 . 2 F .
   - 2 .

4.8.2

NOTE: **When doing the 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, no alarms related to N_2O pressure occur as N_2O pressure decreases.**

1. 2 2 .
   - 5 .
   - .
   - (6 /l).
   - 280 . 600 (40 . 87).
   - 2 2 .

4.8.3

NOTE: **Different from the O_2 pipeline supply, when the air pipeline supply is disconnected, no alarms related to Air pressure occur as Air pressure decreases.**

1.

- 5
- l
- l (6 /l).
- 280 . 600 (40 . 87).
-

4.9 Basic Ventilation Testing

1.

- 2 . 3 /l
- :

VENTILATOR CONTROLS	VENTILATOR SETTINGS
L.	
l F - **VtG**	
- **Pinsp**	20
- **Rate**	8
- **I:E**	1:2
- **PEEP**	
- **Tslope**	0.5

- **PCV**

4.10 Cylinder Tests

NOTE: **You do not need to perform cylinder tests if the A5 anesthesia machine is not equipped with cylinders.**

4.10.1

1.
- 2 : 6.9 . 15.5 L (1000 - 2250)
- 2 : 4.2 . 6 L (600 - 870)
- : 6.9 . 15.5 L (1000 - 2250)

4.10.2

2

1.
- 2 .
- 2
- 2

1.25 L (181),
1 6.

4.10.3

2

1.
- 2 .
- 2
- 2

0.5 L (73),
1 6.

4.10.4

1.

1.25 L (181),
1 6.

4.11 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: **Slowly open the cylinder valves to avoid damage. Do not use excessive force on the flow controls. After performing the cylinder tests, close all cylinder valves if cylinder supplies are not used.**

CAUTION: **Turn the flow controls slowly. To avoid damaging the control valves, do not turn further when the flowmeter reading is outside the range. When turning a flow control knob clockwise to decrease flow, the flowmeter should reach zero before the knob reaches its most clockwise mechanical stop (Off) position. Do not turn any further when the knob has reached the Off position.**

Similarly, when turning a flow control knob counterclockwise to increase flow from zero, the flowmeter reading should not indicate a change from zero until the flow control knob is turned approximately one (1) rotation counterclockwise from the Off position, and only if permitted according to the gas ratio control system.

1.

STEP	O_2 FLOW SETTING (L/MIN)	N_2O FLOW (L/MIN)
1	0	0
2	0.3	1.0
3	0.8	2.0 2.5
4	1.0	2.5 3.2
5	2.0	4.90 6.3
6	3.0	7.4 9.5
7	4.0	> 10.0 12.7
8	5.0	> 10.0 15.8
9	6.0	> 10.0 19.0
10	0	0

4.12 Vaporizer Tests

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

WARNING: To prevent damage, turn the flow controls fully clockwise (flow OFF) before using the system.

Before the test, ensure that the vaporizers are correctly installed. For details about vaporizer installation, see "Install the Vaporizer" on page 2-5.

4.12.1

1. 2 2 .
   - 2 . 6 /l .
   - 2 .
   - l 0 . 1%. 2 . l 1 /l .
   - .
   - .

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.

4.12.2 L

1. **Auto/Manual** . **Manual**.
   - l .
   - 75 l .
   - l .
   - 2 . 40 l .
   - 10 . .
   - .

4.12.3

1. **Auto/Manual** . **Manual**.
   - **SP** .

- [illegible]:

- L[illegible] 1%[illegible])
- [illegible] 200l /l[illegible].
- [illegible] 75 [illegible] 30 l [illegible] 2l[illegible].
- [illegible].
- [illegible] 4, 5, 6, 7 [illegible].

4.13 Breathing System Tests

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.**

1.

- :

1.

-

4.13.1

1. **End Case.** **Manual** .

- **Standby** .
- **Auto/Manual** . **Auto**.
-
-
- 2
- 15 .
-
- 300 /l .

4.13.2 L

1. **Auto/Manual** . **Manual**.

-
- **End Case.** **Manual** .
- **Standby** .
-
- (75).
- 2 2 . 0.15 /l .
-
- 2 . 30 .

10.

4.13.3

1. **End Case.** **Manual**

- **Standby**
- **Auto/Manual** **Manual**.
- 30
- 2 10 /
- 25 40
- 3 /
- 5
- 2 10
- 2 0

4.14 Alarm Tests

Alarms also can be verified by creating an alarm condition on the A5 and verifying the corresponding alarm indicators are present on the monitor.

4.14.1

1. .
   - **Auto/Manual** . **Auto**.
   - .
   - . **Standby** .
   - .
   - .
     - : .
     - : 500
     - : 12.
     - : 1:2
     - : 10%
     - .
     - : 30
   - 2 . 2 . 0.5 . 1 /.
   - 2 . .
   - **Standby** .
10. :
    - (9-28, . L. . 9-19).
    - .

4.14.2 2 . L. .

NOTE: **For A5s with an installed gas module, disconnect the sample tube from the Y-piece and breathe into it until you see a CO2 reading on the screen. Then reconnect the sample tube to the Y-piece. This will activate the gas module alarms.**

1. **Auto/Manual** . **Manual**.
   - . 2 . 21% 2 . 2 .
   - **Alarms** . **Limits** . 2 . . 50%.
   - 2 . 2 (2 .).
   - 2 . 2 .
   - .
     - 2 . .
     - **Alarms** . **Limits** . 2 . 50%.

- [illegible] 90%.
- [illegible].

10. [illegible] 100% [illegible].

4.14.3 [illegible] (Auto)

1. [illegible] **Auto/Manual** [illegible] **Auto**.

- [illegible]:
  - [illegible]:
  - : 500
  - : 12.
  - : 1:2
  - : 10%
  - [illegible]
  - : 30
- [illegible] **Alarms** [illegible] **Limits** [illegible] 8.0 /.
- [illegible] 60 [illegible].
- [illegible] **Alarms** [illegible] **Limits** [illegible].

4.14.4 [illegible]

1. [illegible]

- [illegible] **Auto/Manual** [illegible] **Manual**.
- [illegible] 10.
- [illegible]
- [illegible] 30 [illegible].

[illegible].

4.14.5 [illegible]

1. [illegible].

- [illegible].
- [illegible] 30.
- [illegible] **Auto/Manual** [illegible] **Manual**.
- [illegible] 15 [illegible].

[illegible].

- [illegible].

4.14.6 [illegible]

1. [illegible] **Auto/Manual** [illegible] **Auto**.

- **Alarms** **Limits** .
- 0 10 .
- 1

4.16 Inspect the Active/Passive Anesthetic Gas Scavenging System

4.16.1 F

1. **MIN** **MAX**).

- L

- F

NOTE: **Do not block the active AGSS pressure compensation openings during the inspection. If the float cannot rise, the possible reasons are:**
1. The float surface is tacky. Turn over the active AGSS and check if the float moves up and down freely.
2. The float is rising slowly. The filter may be blocked. Check if the filter is blocked.
3. The waste gas disposal system is not working or the pump rate is less than 50 L/min at which the active AGSS works normally. Check the waste gas disposal system.

NOTE: **The knob on the top of the scavenger is meant to adjust the flow from the EVAC. When the knob is fully closed it does not need to completely shut off flow.**

4.16.2 F

1. **Auto/Manual** **Auto**.

- F

- 2 10 /l

- 2

- F 15

This page intentionally left blank.

5.0 O. ', ,

Powering On the A5 Anesthesia System 5-2

Powering Off the A5 Anesthesia System 5-2

Patient Setup 5-3

Oxygen Sensor Calibration 5-5

Input Fresh Gas 5-6

Ventilation Modes 5-8

Start Mechanical Ventilation 5-19

Stop Mechanical Ventilation 5-19

Relationships of Ventilation Parameters 5-19

Parameter Monitoring (Numerics) 5-20

WARNING: **Before using the A5 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 Test are already completed. In case of test failure, do not use the system. Have a qualified Mindray service representative repair the system.**

5.1 Powering On the A5 Anesthesia System

1. 5.

5.2 Powering Off the A5 Anesthesia System

5 :

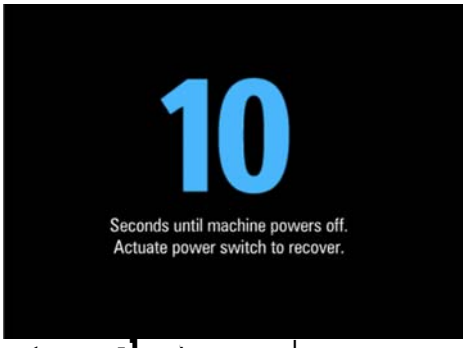
– 5.

– 5 12 12- 10 5,

– 10 . 1

– -

NOTE: **The powering off function is not implemented during Standby, only when actively ventilating.**



-

5.3 Patient Setup

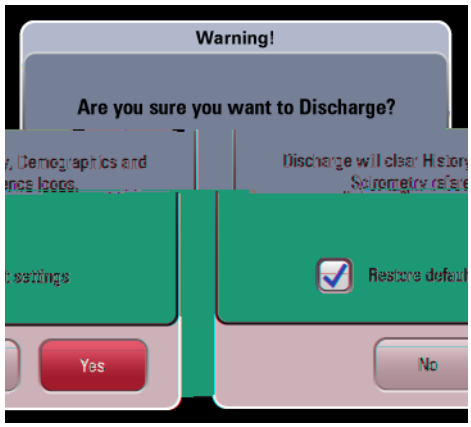
NOTE: **Discharge button was renamed End Case in software bundle version 02.06.00 and later.**

5.3.1 / L

End Case. **Manual** (5-2). **End Case.** **Auto/Manual** . **Manual,**

I ; I T I .
I ( );
I . **Standby** I . (5-4).

End Case. **Restore default settings** .
I . I . **Standby** I . (5-4).



Standby, I .

To end the case and enter Standby:

1. **Auto/Manual** **Manual**.

- 0.0 /l (< 0.05 /l).

NOTE: **The A5 system will not allow the**

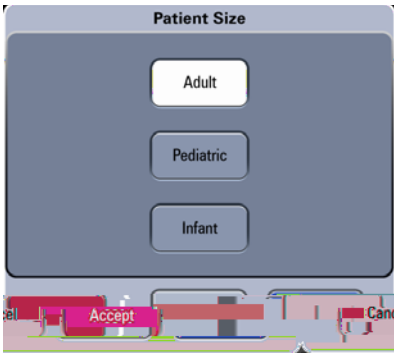
5.3.2 (, ,)

Manual , Standby , Monitor (F).

1. Manual End Case. (Manual) Standby .

- Patient Size .
- Patient Size: Adult, Pediatric, Infant.
- Accept .

NOTE: **The A5 saves the latest patient parameter settings (VCV, PCV, PCV-VG , PS, SIMV-VC, SIMV-PC , and Alarms) for each patient type: Adult, Pediatric, and Infant. Changing to another patient type does not erase the parameter settings from the previous patient type. For example, changing from Adult to Pediatric and back to Adult will result in the Adult patient parameter settings still saved.**



-

5.4 Oxygen Sensor Calibration

2 7-6.

5.5 Input Fresh Gas

5.5.1

1.

- 5
- 21%
- 5
- 21%.
-

NOTE: **You can adjust O_2 concentration in the breathing system through the O_2 flow control.**

NOTE: **The total flowmeter is calibrated based on 100% O_2. The accuracy of the flowmeter may degrade with other gas or mixed gas.**

NOTE: **When viewing 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.**

NOTE: **If the readings shown on the electronic flowmeters differ from that on the total flowmeter, the electronic flowmeter will prevail and the total flowmeter is an approximate value.**

NOTE: **When the AC power supply is not connected and batteries are depleted, the flow and the composition of the fresh gas are not affected. When the individual N_2O or Air supply fails, the corresponding fresh gas cannot be achieved. When O_2 supply fails, both O_2 and N_2O fresh gas cannot be achieved.**

5.5.2

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

NOTE: **The A5 anesthesia system can be mounted with vaporizers corresponding with halothane, enflurane, isoflurane, sevoflurane and desflurane. Only one vaporizer can be opened at a time because of the interlock system.**

5.5.2.1

1.

NOTE: **Install the vaporizers with a Selectatec interlock system that are compliant to ISO 80601-2-13 on the A5 unit. Refer to the manufacturer's vaporizer 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 concentration of the anesthetic agent actually output will vary if the vaporizer is filled with the wrong agent.**

- 5

2-5.

5.5.2.2

5.6 Ventilation Modes

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

NOTE: **When the drive gas supply fails, mechanical ventilation cannot work normally.**

5.6.1 L

NOTE: **The monitored parameters are measured in the condition of ATPS (ambient temperature and pressure saturated).**

5

PARAMETER	RANGE*	COMMENTS
	-20 120	
L	-20 120	
	0 3000	
	0 100	
	-20 120	
	0 120.	
	0 70	
2	18 100%**	

** If the monitored parameter is out of range, it will be displayed as "- - -".*
***FiO_2 measurements between 100% and 110% inclusive will be displayed as 100%. Above this range, the system will display "- - -".*

5.6.2 L

5

VENTILATION MODE	PARAMETERS
	),
	F F
	),
	L, ,
L	, L. (F

5.6.3 L

To change ventilation mode to Manual

T /L

To change ventilation mode to VCV, SIMV-VC, PCV, SIMV-PC , or PS:

1. [illegible] (see page 5-6).

- [illegible]
- [illegible]
- [illegible]

NOTE: **When the Auto/Manual switch is in Auto position, all the buttons in Manual tab (Alarms, Bypass, Monitor and End Case) are disabled; Alarms are set to On; and Bypass is set to Off.**

[illegible]

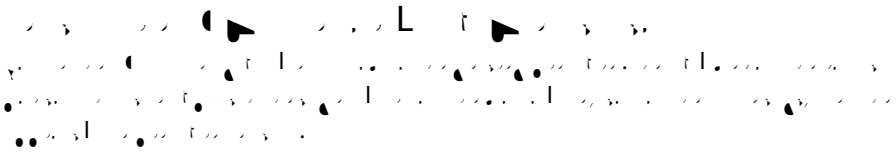
5.6.4 [illegible]

Manual [illegible] **Auto/Manual** [illegible] **Manual** [illegible] O_2 [illegible]

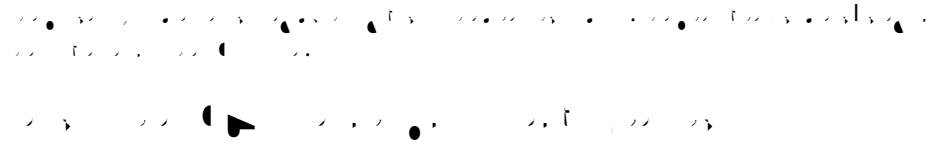
Auto/Manual [illegible] **Manual,** [illegible] **Alarms.** [illegible] **Manual** [illegible] **Off,** [illegible] **Pressure** **Volume** ([illegible]) [illegible] **Off** (see page 5-7).

Alarms. [illegible] **(On/Off),** [illegible] **Manual** [illegible] [illegible] **Manual** **Auto** [illegible] **Manual** [illegible] **Alarms.** [illegible] **Off,** [illegible] **Off** [illegible] **Auto** [illegible] **Manual** [illegible]

[illegible]



NOTE: **Clockwise rotation increases the pressure, and counterclockwise rotation decreases the pressure.**



5.6.5

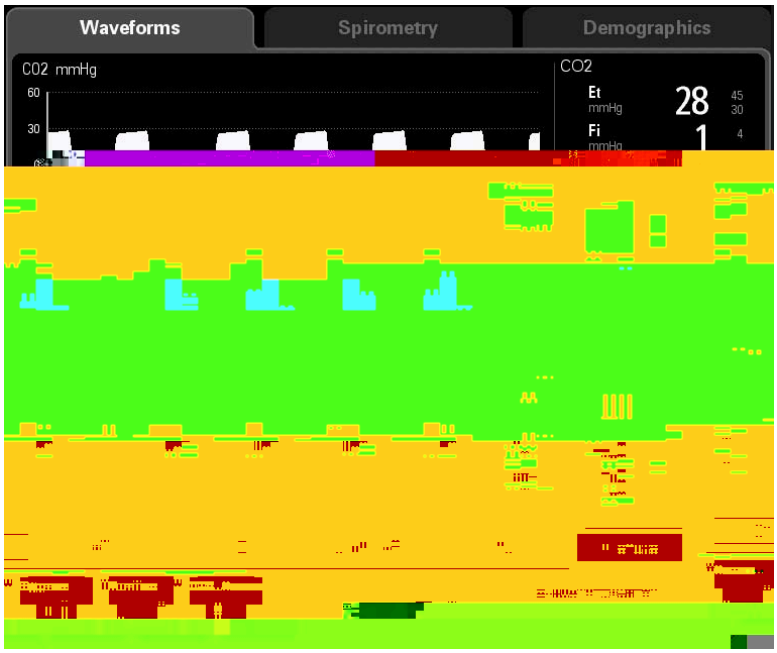
NOTE: When Monitor mode is On, the Alarms button is disabled and set to Off.

Manual

Monitor

Manual **Bypass** **Off,** **Alarms** **Off.** **Off.**

Alarms **On,**



-10

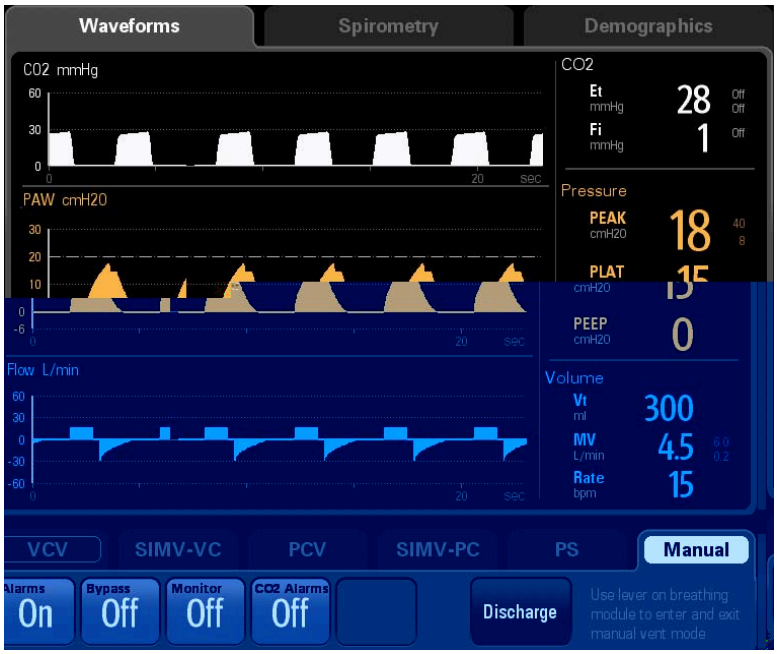
CO2 Alarms . . Off. Off CO2 and the CO2 Apnea Alarms are Off.

CO2 Alarms . . On.

NOTE: In mechanical ventilation mode, the CO2 alarms are turned on and cannot be turned off.

CO2 Alarms . On,

Manual . Auto. CO2 Alarms . Off . On. 30



-11

WARNING: Risk of inadequate monitoring.National standards require a minimum monitoring with some alarm functions. These standards may not be met if the alarm function of the CO2 monitoring parameter is disabled. Only disable this monitoring parameter after consulting national standards.

5.6.6 L

1. **Auto/Manual** **Manual**

5.6.7.1 . L .

1. **VCV . . Main Screen.**

• (5-12).

• **Set Mode** .

VCV parameters:

– : (I)

– : ( )

– :

NOTE: **The screen displays the calculated Tinsp when adjusting the I:E ratio (software bundle version 02.06.00 and later).**

– (%)

– ( )

– ( )

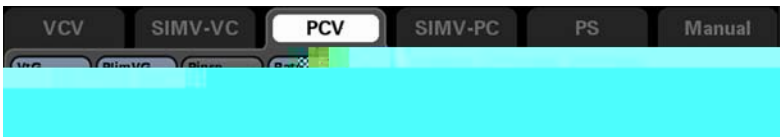
NOTE: **Before activating a new mechanical ventilation mode, ensure that all related parameters are set appropriately.**

5.6.8 ( )

5 F(F) F

F F F F F F F

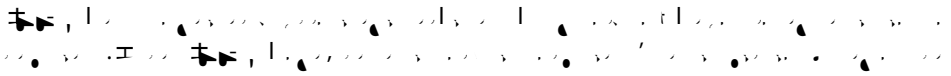
NOTE: **In PCV mode, even when the PlimVG or Pinsp parameters are inactive, they are restricted to the parameter relationship equations PlimVG≥PEEP+5 and Pinsp≥PEEP+5. See section C.9 (pg. C-15) "Ventilation Parameter Relationships".**



-1

5.6.8.1

1. **PCV Main Screen.**



- [illegible] (%)
- [illegible] (l_)
- [illegible]
- [illegible] (/l)
- [illegible]
- [illegible] (l_)
- [illegible] (l)

SIMV-PC parameters:

- [illegible] (l_)
- [illegible] (l)
- [illegible] ()

NOTE: **The screen displays the calculated I:E ratio based on Rate and Tinsp when adjusting the Tinsp (software bundle version 02.06.00 and later).**

- [illegible] (/l)
- [illegible] (l_)
- [illegible] (l)
- [illegible]
- [illegible] (l_)

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

5.6.10 [illegible] ()

[illegible] 5 [illegible]

[illegible] 5 [illegible]

5.6.10.1 [illegible]

[illegible]

1. [illegible] **PS** [illegible] **Main Screen.**

   - [illegible] **PS** [illegible] ([illegible] 5-16).

     [illegible]

     [illegible]

- **Set Mode**

PS parameters:

- L: L ( ),
- Δ: ( )
- (/l)
- ( )
- ( )
- ( )
- :

NOTE: **Apnea Ti permits the user to vary the inspiratory time of the apnea backup breaths. Apnea backup breaths are only triggered when the patient does not achieve the Min Rate that is set by the user. If the patient's spontaneous breaths meet or exceed the Min Rate, the apnea backup is not used.**

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

5.7 Start Mechanical Ventilation

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

To start mechanical ventilation from Standby mode:

1. **Auto/Manual** **Manual**.
   - **Standby.** 0.2 /l .
   - **Auto/Manual** **Auto**. 5
2. .

5.8 Stop Mechanical Ventilation

To stop mechanical ventilation:

1. .
   - **Auto/Manual** **Manual**
2. .

5.9 Relationships of Ventilation Parameters

.8 -13

.9 -15

5.10 Parameter Monitoring (Numerics)

The system displays parameter monitored values in the monitored parameter area. The monitored parameters are separated into three groups: pressure, volume and gas (available with the AG module) or FiO_2 (available without the AG module).

5.10.1

Pressure 3 (5-17):

- (L)
-). L (L)
- (PEAK)

NOTE: **The high alarm limit for Airway Peak Pressure (PEAK) is displayed to the top right of the reading. The low alarm limit for Airway Peak Pressure (PEAK) is displayed to the bottom right of the reading.**

NOTE: **The display of either Plateau Pressure (PLAT) or Mean Pressure (MEAN) is configured from the System menu tab.**

-1

5.10.2

Volume 3 (5-18):

- ( )
- L ( )
- ( )

NOTE: **The high alarm limit for Minute Volume (MV) is displayed to the top right of the reading. The low alarm limit for Minute Volume (MV) is displayed to the bottom right of the reading.**

-1

5.10.3 F (F l .)

l . l :

- 2 2)
- 2 2)
-)
-)
- L l (L)
-

I l

5.11.1

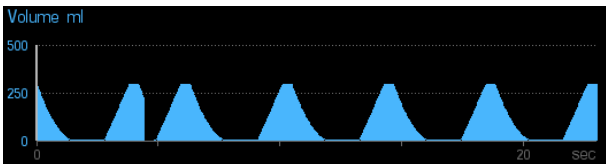
Pressure vs. Time

Pressure vs. Time

NOTE: **The purple in the waveform means it is a triggered breath.**

5.11.3 [illegible]

[illegible] **Volume vs. Time** [illegible] **Flow vs. Time** [illegible] **Setup** > **Display** > **Waveform Display.** [illegible] **Volume** [illegible]



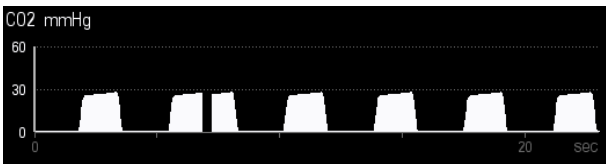
[illegible]

Volume vs. Time

[illegible] **Volume.** [illegible] **ml.** [illegible] 0.15 [illegible].

5.11.4 F [illegible] (Flow)

[illegible] **CO_2 vs. Time** [illegible]



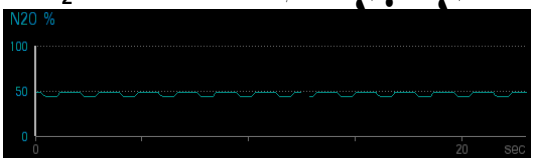
[illegible] 2 [illegible]

CO_2 vs. Time

[illegible] 2 [illegible] **CO_2.** [illegible] **mmHg, kPa, or %.** [illegible] 0.15 [illegible].

NOTE: **N2O, O2, and AA waveforms are available for software bundle version 02.06.00 and later.**

[illegible] **N_2O vs. Time** [illegible]

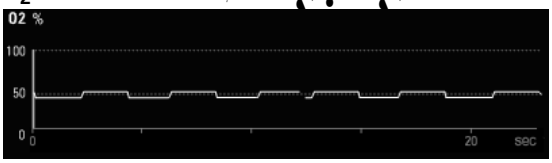


[illegible] 2 [illegible] (Flow)

N_2O vs. Time

N_2O. **%**. 02.06.00 3-37.). 0 . 15

O_2 vs. Time



O_2 vs. Time

O_2. **%**. 02.06.00 3-37.). 0 . 15

AA vs. Time

AA vs. Time

%. 02.06.00 3-37.). 0 . 15 5-27). 5-28)..

5.11.5

(see Table 5-1)

SCALE	MARGIN
	10 l _ 30 l _ 3 l _ < 30 l _
	10 /l 30 /l 15 /l > 30 /l
	25 l 100 l 100 l > 100 l

-1

5.12 Parameter Monitoring (Spirometry)

( )

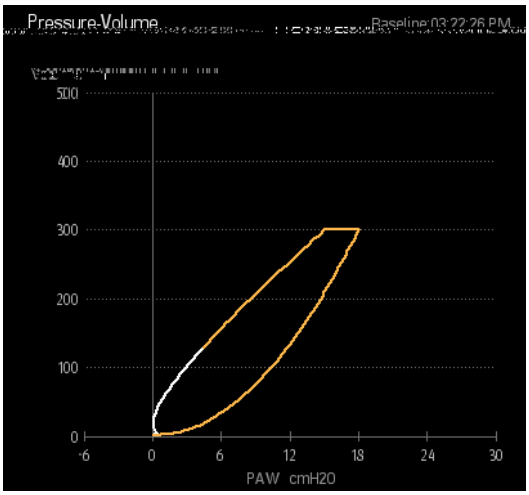
Spirometry Loop Window. SPIROMETRY .

NOTE: **Thespirometry and waveforms can be displayed on the same screen in software bundle version 02.06.00 and later (see section 3.5 (page 3-14) "Spirometry Tab (A5 Only)").**

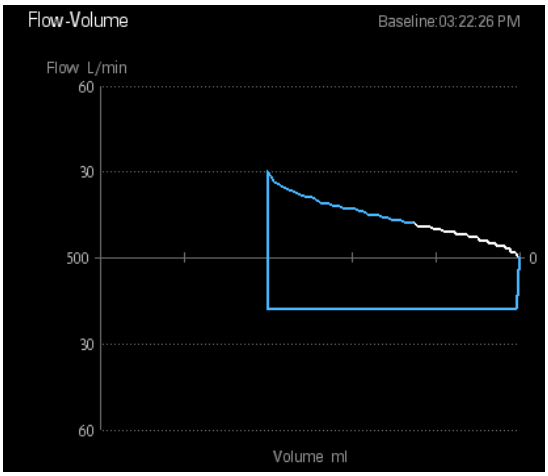
( ).

NOTE: **This will not occur when the Restore default settings box is unselected .**

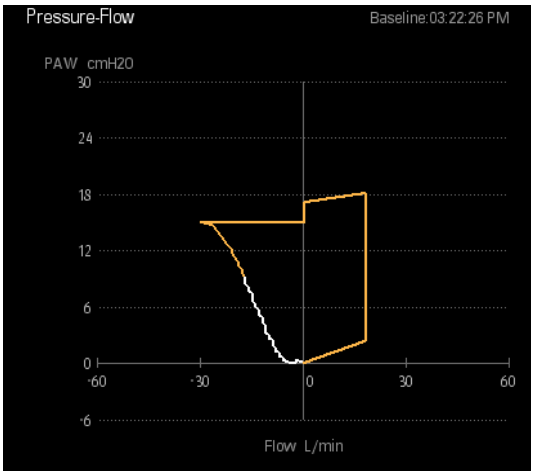
( ).



Volume. **Paw** (**Airway Pressure**).



Flow. **Volume**.


Pressure-Flow
Baseline:03:22:26 PM
PAW cmH2O
30
24
18
12
6
0
-6
-60
-30
0
30
60
Flow L/min

PAW **Flow.**

This page intentionally left blank.

6.0 A, , , , : M, , , ', ,

Introduction 6-2

Displaying Alarms 6-5

Setting Alarm Volume 6-7

Silencing Alarms 6-8

Alarm Limits 6-9

Alarm and Prompt Messages 6-15

6.1 Introduction

The A5 System provides alarms and messages that are indicated to the user by visual and audible alerts. Alarms and messages appear at the top of the and in the **A** window (see FIGURE 6-1). Users can adjust alarm properties, which include setting alarm limits to trigger alarm conditions, adjusting alarm volume, and silencing alarms.

-1

6.1.1

The **A5** System performs a self-test of its alarm system when powered on. The self-test includes the alarm LED and speaker 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 will produce one tone after the alarm light is in self-test.

6.1.2

The A5 provides the following types of alarms and messages below. See section 6.6 (page 6-15) "Alarm and Prompt Messages" for the list of alarms and messages:

- **:**
  This is an alarm caused by a patient-related variable. It requires a response from the user. It can have the following priority: high, medium, or low.
- **:**
  This is an alarm caused by a machine-related variable. It requires a response from the user. It can have the following priority: high, medium, or low.
- **:**
  This is a message to the user. It does not require a response from the user. It always has the lowest priority, below Physiological and Technical alarms. It is displayed in black text on white background.

6.1.3 Alarm Indicators

The A5 provides the following alarm indicators:

- An alarm LED located on top of the LCD monitor. The LED can illuminate red, yellow, cyan, or OFF depending on the alarm condition.

  TABLE 6-1 describes the alarm behavior of different alarm types and different alarm priority labels. If multiple alarms occur simultaneously, the audio and LED behavior will follow the highest priority active alarm.

- 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 black text, white background. Messages are listed according to priority and time. (See "Displayed Order of Alarm Messages" on page 6-6.)

- Alarm audio through the system alarm speaker. TABLE 6-1 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 sound, the interval between each play is 5 ± 1 sec.	white text red background, high priority icon.	Red
	Medium	Play medium priority alarm sound, the interval between each play is 5 ± 1 sec.	black text yellow background, medium priority icon.	Yellow
	Low	Play low priority alarm sound, the interval between each play is 17 ± 1 sec.	white text cyan.	

TABLE 6-1 Alarm Indicators (Audio and On-screen Messages)

6.2 Displaying Alarms

On the LCD monitor screen, alarm messages are automatically displayed at the top area of the when alarm conditions occur (see FIGURE 6-3). Additionally, a list of all active alarms and an alarm log can be found in the **A** window (see FIGURE 6-2).

Each message is displayed with an associated priority symbol as follows:

- High priority !!!
- Medium priority !!
- Low priority !

:

1. **Main Screen,** **Alarms** .

Alarms

- **Active** .

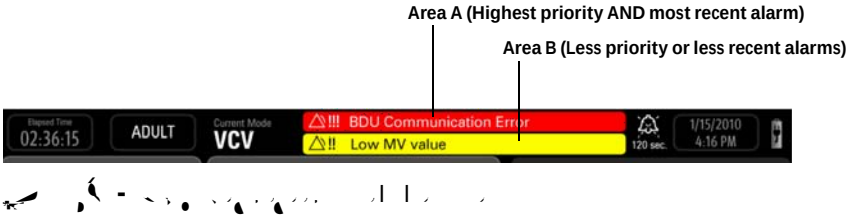
(FT 6-2). T . 15

6.2.1 (6-6)"

-

6.2.1

Alarm messages are displayed in order of priority and time of occurrence. FIGURE 6-3 shows the alarm messages list divided into two areas (Area A and Area B).



Alarm messages are displayed in Area A and Area B 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 less priority than alarms in Area A are displayed immediately 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: highest priority, medium priority, low priority, and prompt messages. In each group, the most recent alarm is displayed first.
- If the alarm in Area A is removed, then the most recent and highest priority alarm from Area B is moved to Area A.

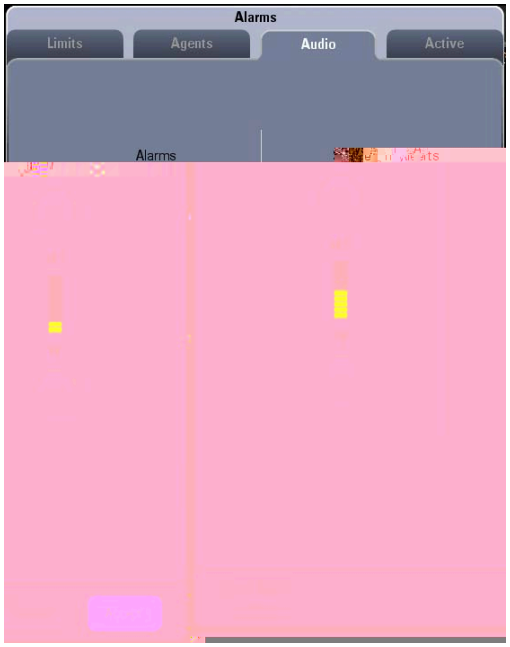
6.3 Setting Alarm Volume

Users can set the audio level of alarms and system alerts by selecting the **A** softkey on the to display the **A** window (see FIGURE 6-4).

The **A** volume settings adjust the audio level of all High, Medium, and Low Priority sounding alarms. The **A** volume settings adjust the audio level of all sounding pop-up prompts and non-confirmed ventilation mode alerts.

A :

1. **Alarms** .
   Alarms .
   - **Audio** .
     . **Alarms** **System Alerts** .
   - + ( ). – ( ). .
     10 . 3.
     10 . 3.
   - **Accept** . . (**Cancel** .)



-

WARNING: **Do not rely exclusively on the audible alarm system when using the A5 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 is within 45 to 85 dB.**

6.4 Silencing Alarms

When an alarm condition occurs and the alarm audio is sounded, the user can select the softkey at the bottom of screen to silence the alarm audio. In silenced status, all the alarm indicators work normally except audible alarm tones.

Select softkey to silence all currently sounding alarm tones. The alarm will sound if a new alarm occurs.

If the silenced alarms contain middle or high level alarms, the alarm audio will be paused for 120 seconds.The alarm silence icon and 120 second countdown time appear at the top of the screen. Select again to resume the alarm audio.

NOTE: The alarm will sound if that a new alarm occurs while the system is in an

6.5 Alarm Limits

6.5.1

Users can set the high and low alarm limits of Paw, MV, and FiO_2 to create alarm conditions consistent with patient needs. The alarm is then triggered when the parameter value is greater than the High Limit or lesser than the Low Limit.

NOTE: **When using the A5 Anesthesia System, ensure that the alarm limits of each parameter are set to the appropriate values for the patient.**

1. **Alarms** **Alarms**

Alarms

- **Limits** **Agents** (6-7 6-8 6-9.)
- T

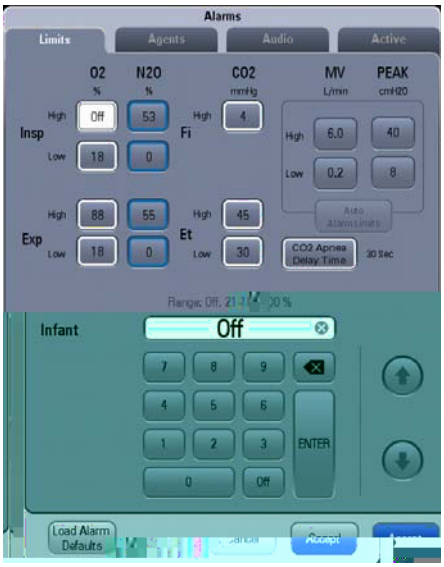
- **Load Alarm Defaults.**

3. 4.

Accept (**Cancel**).

Alarms
Limits
Audio
Active
FiO2
%
MV
L/min
PEAK
cmH2O
High
Off
6.0
40
Low
18
0.2
8
Auto Alarm Limits
Range: Off, 21-100 %
Infant
Off
7
8
9
4
5
6
1
2
3
ENTER
0
Off
Load Alarm Defaults
Cancel
Accept

- (


Alarms
Limits
Agents
Audio
Active
O2
%
N2O
%
CO2
mmHg
MV
L/min
PEAK
cmH2O
Insp
High
Off
53
Low
18
0
Fi
High
4
High
6.0
40
Low
0.2
8
Exp
High
88
55
Low
18
0
Et
High
45
Low
30
Auto Alarm Limits
CO2 Apnea Delay Time
30 Sec
Infant
Off
7
8
9
4
5
6
1
2
3
ENTER
0
Off
Load Alarm Defaults
Accept

- (

Alarms
Limits
Agents
Audio
Active
Des
Sev
Iso
Hal
Enf
%
High
Insp
Low
6.0
5.0
2.0
2.0
2.0
0.0
Exp
8.0
3.0
Range Off, 0.2-18.0 %
Infant
6.0
ENTER
Off
Load Alarm Defaults
Cancel
Accept

6.5.2

Users can load the user alarm limit defaults of all modules from the **A** window.

1. **Main Screen**, **Alarms**
   Alarms
   - **Load Alarm Defaults.** **Alarms**
   - **Accept.** **Alarms**

Load Alarm Defaults button

-10 **Load Alarm Defaults.** **Alarms** (F l)

Load Alarm Defaults button

-11 **Load Alarm Defaults.** **Alarms** (F l)

Load Alarm Defaults button

-1 Load Alarm Defaults. Agents

6.5.3

The Auto Alarm Limits function uses an algorithm based on measured values. The relationship is shown in the TABLE 6-2.

The Auto Alarm Limits button is disabled when the A5 is in Standby mode, Manual mode or Monitor mode (with AG module). The Auto Alarm Limits button is also disabled when the current mode is PS, SIMV-VC, or SIMV-PC.

ALARM LIMIT	ADJUST FORMULA
Paw High	+5. +10, 35
Paw Low	) 0.6 + - 1 3 - 1
MV High	1.4 2.0
MV Low	0.6 0.3 - 0.1

The parameters in the formula are all measured parameters. The new alarm limits for Paw are calculated on the basis of average values 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.

If there is not a valid measured minute volume (MV), the corresponding MV alarm limits will not be adjusted.

If the average value for PEAK, PLAT, and PEEP cannot be calculated, the corresponding alarm limits will not be adjusted.

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.

6.5.4 2 02.09.00)

The **Apnea CO_2** alarm is triggered when no breath is detected within a specified time.

:

1. **Alarms** .
   Alarms
   - **Limits** . (6-7 6-8)
   - **CO2 Apnea Delay Time.** . **10 sec, 15 sec, 20 sec, 25 sec, 30 sec, 35 sec, 40 sec.**

6.6 Alarm and Prompt Messages

This section lists the following alarms and messages:

- Physiological Alarm Messages
- Technical Alarm Messages
- Prompt Messages

For each alarm message, corresponding actions are given instructing you to troubleshoot problems. If the problem persists, contact your service personnel.

NOTE: The Disable in Manual and Cardiac Bypass mode column indicates how this alarm is controlled by the alarm on/off button and the cardiac bypass mode button in manual mode.

NOTE: The Disabled in Standby mode column indicates which physiological alarms will be disabled automatically in Standby mode.

NOTE: The Disabled in Monitor mode column indicates which physiological alarms will be disabled automatically in Monitor mode.

MESSAGE	CAUSE	ALARM PRIORITY	DISABLED WHEN ALARM IS OFF	DISABLED IN STANDBY MODE	DISABLED IN MONITOR MODE
Apnea				/ *	
Apnea >2 min				/ *	
Paw Too High				/ *	
Paw Too Low				/ *	
Pressure Limiting			/ *	/ *	/
FiO_2 Too High				/ *	
FiO_2 Too Low				/ *	
MV Too High				/ *	
MV Too Low				/ *	
Continuous Airway Pressure				/ *	
Negative Pressure				/ *	

* *N/A - Not Applicable. This alarm message does not exist within this mode and therefore cannot be disabled or enabled.*

EtCO2 Too High	2 >	L	. .
EtCO2 Too Low	2 <	L	. .
FiCO2 Too High	2 >	L	. .
EtN2O Too High	>	L	. .
EtN2O Too Low	<	L	. .

F954 Tf 8.3308 0 T-22.08 0 T-22.08 0 T-22.08 0 T-22.08 0 T-22.08 0 T-22.08 0 T-22.08 0 T-22.08 0 T-22.08 0 T-22.08 0 T-22.08 0

MESSAGE	CAUSE	ALARM PRIORITY	DISABLED WHEN ALARM IS OFF	DISABLED IN STANDBY MODE	DISABLED IN MONITOR MODE
FiSEV Too Low	<	L	.		.
EtDES Too High	>	L	.		.
EtDES Too Low	<	L	.		.
FiDES Too High	>	L	.		.
FiDES Too Low	<	L	.		.
EtO_2 Too High	$_2$ >	L	.		.
EtO_2 Too Low	$_2$ <	L	.		.
Apnea CO2					.

* *N/A - Not Applicable. This alarm message does not exist within this mode and therefore cannot be disabled or enabled.*

NOTE: **If an Apnea CO2 alarm occurs, the CO2 apnea elapse timer will display on the CO2 waveform screen. The time displayed is the time since the last breath and the time will reset once the CO2 Apnea alarm has cleared (software bundle version 02.06.00 and later).**

6.6.1 [illegible]

6.6.1.1 [illegible]

NOTE: **Startup alarms will not trigger the alarm sound and alarm light.**

NOTE: **Startup alarms priority is only used to display in the Service menu alarm logbook.**

NOTE: **Startup Result if Fail column indicates the result when this 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 A5 Anesthesia System cannot be used.

MESSAGE	CAUSE	ALARM PRIORITY	MACHINE MODE WHEN

MESSAGE	CAUSE	ALARM PRIORITY	MACHINE MODE WHEN CHECKED	STARTUP RESULT IF FAIL	REMARK
Ventilator Self Test Error / Ventilator Self Test: Fail	1. 2.				
Ventilator Self Test: Time out					
Ventilator Voltage Error / Ventilator Voltage: Fail	5 12				
PEEP Valve Failure / PEEP Valve: Fail	1. 2.				
Insp Valve Failure / Insp Valve: Fail	1. 2.				
Safety Valve Failure / Safety Valve: Fail					
Flow Sensor Failure / Flow Sensor: Fail					
Calibrate Flow Sensor and Insp Valve	1. 2.				
Calibrate Pressure Sensor and PEEP Valve	1. 2.				
Perform 100% O_2 Sensor Calibration	1. 2.				
Ventilator Initialization Error / Ventilator Initialization: Fail					

MESSAGE	CAUSE	ALARM PRIORITY	MACHINE MODE WHEN CHECKED	STARTUP RESULT IF FAIL	REMARK
Ventilator Initialization: Time out					
Drive Gas Pressure Low					
O_2 Supply Failure / O_2 Supply: Fail					
Power Supply Voltage Error / Power Supply Voltage: Fail					
RT Clock Needs Battery					
RT Clock Failure / RT Clock: Fail					
External AG Self Test Error					
External AG: Time out					

6.6.1.2

MESSAGE	CAUSE	ALARM PRIORITY	MACHINE MODE WHEN CHECKED	DISABLE IN STANDBY MODE
IP Address Conflict				
Fan Failure	20%.			
Fan Failure O2	< 3640			

MESSAGE	CAUSE	ALARM PRIORITY	MACHINE MODE WHEN CHECKED	DISABLE IN STANDBY MODE
O_2-N_2O Ratio Error	0.5 / 4 1.6			
Flowmeter Comm Stop	10			
NO Fresh Gas	50 5 **Standby**			
Internal N_2O Flow Failure				
Internal O_2 Flow Failure	2			
Internal Air Flow Failure				

6.6.1.5

MESSAGE	CAUSE	ALARM PRIORITY	MACHINE MODE WHEN CHECKED	DISABLE IN STANDBY MODE
Aux Control Module Comm Stop	10			
Ventilator Voltage Error	5 12			
PEEP Valve Failure	1. 2.			
Insp Valve Failure	1. 2.			
Safety Valve Failure				
Flow Sensor Failure	1. 2.			

* *N/A - Not Applicable. This alarm message does not exist within this mode and therefore cannot be disabled or enabled.*

6.6.1.6 [illegible]

MESSAGE	CAUSE	ALARM PRIORITY	MACHINE MODE WHEN CHECKED	DISABLE WHEN EXTERNAL AG IS IN STANDBY MODE
AG Hardware Error	[illegible]	[illegible]	[illegible]	
O2 Sensor Error				

MESSAGE	CAUSE	ALARM PRIORITY	MACHINE MODE WHEN CHECKED	DISABLE WHEN EXTERNAL AG IS IN STANDBY MODE
External AG Module Disconnected	F			
Incompatible AG Software Version	F F 1.7.3.0.			
CO2 Over Range				
N2O Over Range				
HAL Over Range				
ENF Over Range				
ISO Over Range				
SEV Over Range				
DES Over Range				
O2 Over Range				
Rate Over Range				

6.6.2

6.6.2.1

MESSAGE	TIMEOUT	REMARK
Pressure, Volume and Apnea Alarms are OFF		**Alarms, Manual Off.**
CO2 and CO2 Apnea Alarms are OFF		2
Load Configuration Failure	10	
DEMO Mode - Not for Clinical Use		
Service Mode - Not for Clinical Use		
Apnea Ventilation		
Calibrate O_2 sensor for 21%	– 72	**"Calibrate O2 sensor for 21%"** – **"Calibrate O2 sensor for 21%"**, **Standby** 5 72 – **"RT Clock Needs Battery"**. **"RT Clock Failure"** **"Calibrate O2 sensor for 21%"** – **"Calibrate O2 sensor for 21%"**.
Auto-zero in process		
Fresh Gas Is On		
New functions activated, please restart!		
Calibrate)2 sensor for 100%	02	100% 21% 2
Could not locate time server		(5),
External AG Loaded Successfully	5	F F T
External AG Unloaded Successfully	5	
External AG Startup	/	F F.

-10

MESSAGE	TIMEOUT	REMARK
External AG Warmup	/	F.
External AG Zeroing	/	F
Leak Test Not Performed		24 02.06.00).

-10

6.6.2.2

MESSAGE	TIMEOUT	REMARK
Can only End Case i in Manual Mode!	5	**End Case** **Manual** **Auto**
Invalid Age! Please check DOB or current system time.	5	(0-150).
Patient Size can only be changed in Manual Mode or in Standby	5	**Patient Size**
Vent modes can only be changed using "Set Mode" button below	5	**Current Mode**
Out of Range	5	
Invalid Password	5	
Saving User Configuration has failed.	5	**Saving User Configuration**
New password input is inconsistent.	5	
Automatic ventilation disabled. Check lever on breathing system.	15	**Standby** **Auto/Manual** **Auto**
Fresh gas flow detected! Adjust all flowmeters to zero	"L " " &	"L " " & "

-11

7.0 M

Theory of Operation 7-3

Block Diagram 7-3

Maintenance Schedule 7-4

Breathing System Maintenance 7-4

Flow Sensor Calibration 7-5

O_2 Sensor Calibration 7-6

Water Build-up in the Flow Sensor 7-9

AGSS Transfer Tube Maintenance 7-9

Electrical Safety Inspection 7-9

Cleaning and Disinfection 7-11

Regular Maintenance 7-29

WARNING: **Do not use a malfunctioning A5 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 as applicable.**
- **Refer to the operation and maintenance manuals of all disinfection equipment.**
- **Do not inhale fumes that may result from any disinfection process.**

7.1 Theory of Operation

The A5 System is a pneumatically-driven and electronically-controlled anesthesia machine. Three types of supply gases are available: N_2O, O_2, and Air. The user adjusts supply gas flows through the flowmeters. The mixed gas outputted from the flowmeters is further mixed with the anesthetic agent inside the anesthetic vaporizer to form fresh gas.

During the inspiratory phase, the microprocessor-controlled inspiratory valve produces the preset drive gas inspiratory flow and the expiratory valve closes. The drive gas enters the bellows dome in the patient circuit and depresses the bellows inside the dome to move downward. This forces the gas inside the bellows to enter the patient's lungs until the end of the inspiratory phase.

During the expiratory phase, the inspiratory valve closes and the expiratory valve opens. The patient can expire freely. The patient's expired gas, mixed with the fresh gas, enters and lifts the bellows inside the dome. The drive gas outside the bellows is scavenged to the Anesthetic Gas Scavenging

7.3 Maintenance Schedule

The schedules listed in TABLE 7-1 are the minimum frequency based on 2000 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 FREQUENCY	MAINTENANCE
72	l 21% 2 (2 l). 5 l 21% 2 (2).
L.	F l.
	l F L
	l L
	l 100% 2 2 – 2 – l – – l – 2 l

-1 L

7.4 Breathing System Maintenance

When cleaning the breathing system, replace any parts that are visibly cracked, chipped, distorted or worn. For details, refer to "Inspect the System" on page 4-3 and "Cleaning and Disinfection" on page 7-11.

7.6 O_2 Sensor Calibration

Perform O_2 calibration when the measured value of O_2 concentration has a large deviation from other reference sources or when the O_2 sensor is replaced. If the O_2 sensor is replaced, 100% O_2 sensor calibration is required.

For continued O_2

7.6.1 [illegible] 2 [illegible]

10. **Begin.** 100% $_2$ (., 00 00 00 10), 7-2, $_2$

7.7 Water Build-up in the Flow Sensor

7.7.1

Water comes from the condensation of exhaled gas and a chemical reaction between CO_2 and the sodalime in the CO_2 absorbent canister. At lower fresh gas flows more water builds up because of the following:

- L.
- L.

Check the inspiratory and expiratory flow sensors when abnormal flow waveform or unstable tidal volume fluctuation is detected. Check the sensor for water. If there is water build-up, clear it immediately before use.

- T
-

7.7.2

The water build-up inside the flow sensor will result in inaccurate measured value of tidal volume. If there is water built up inside the flow sensor, remove the sensor and clear the water. Then reinstall the sensor for use.

WARNING: Check water build-up inside the flow sensor before every system use. Pooled 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.

7.8 AGSS Transfer Tube Maintenance

Check the tube of the AGSS transfer system.Replace it if it is damaged.

7.9 Electrical Safety Inspection

NOTE: Perform electrical safety inspection after servicing or routine 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.

7.9.1

Verify the mains voltage is present at each auxiliary outlet when the A5 is connected with power.

7.9.2

1.

25

0.1 (100)

0.1 (100), 0.2 (200
),

300 (0.3), 1000
(1).

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

7.10 Cleaning and Disinfection

CAUTION: Before using the A5 System (after cleaning or disinfecting), power up the system and follow the on-screen prompts to perform the leak test and the compliance test. See section 4.5 (page 4-9) "Leak and Compliance Tests".

CAUTION: To prevent system damage:

- **Refer to the literature supplied by the manufacturer of the cleaning agent.**
- **Never use organic, halogenated or petroleum-based solvents, anesthetics, 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 between 7.0 and 10.5.**
- **Do not use Cavacide: Cavacide is known to cause degradation of plastic polymers.**
- **Do not use Oxicide: May cause discoloration of device hardware.**

7.10.1 F Fr

Follow all WARNINGS and CAUTIONS listed at the beginning of this chapter. Prior to use, refer to the facility's infection control policy to determine the frequency and level at which cleaning and disinfection should be performed. If disinfection is required, all components must first be cleaned and dried as described in the following sub-sections. For additional information about infection control practices, refer to the *APIC Guidelines for Selection and Use of Disinfectants*, published in the American Journal of Infection Control, Vol. 24, No. 4, August 1996.

For additional information about infection control, refer to the ASA's Recommendations for Infection Control for the Practice of Anesthesiology, second edition. For additional information on reprocessing medical devices, refer to AAMI TIR 30:2003, A compendium of process, materials, test methods, and acceptance criteria for cleaning reusable medical devices.

7.10.2 / r

The A5 should be cleaned and disinfected before its first use, then daily and as often as needed. (see TABLE 7-1, "Maintenance Schedule," on page 7-4.)

TABLE 7-3 lists the cleaning and disinfecting agents and autoclaving process that may be used on the A5 Anesthesia System.

AGENT	CLASSIFICATION
F	
10%	
(70%)	

* *All breathing system components are autoclavable except the Paw gauge, flow sensor, O_2 sensor, and bellows. The components can be autoclaved up to a maximum temperature of 134 ºC (273 ºF).*

7.10.3

Use a soft cloth with an approved cleaning agent (see section 7.10.2 (page 7-11) "Cleaning and Disinfecting Agents / Autoclaving") to clean all outer surfaces, hoses, and cables.

7.10.4

Read all content in this section before disassembling, cleaning, disinfecting, and re-assembling the bellows to avoid equipment malfunction and patient injury.

1. 300 . 1500 (7-5).

(Figure 7-6).

(Figure 7-7).

(7-8).

Grooves on adapter ring face downward.

(7-9).

Cleaning

7.10.2 (7-11) "

NOTE: **Dry the bellows by allowing it to hang so that it is fully expanded. This will facilitate thorough drying and prevent it from sticking to itself.**

CAUTION: **Do not autoclave the following components: Paw gauge, oxygen sensor, flow sensor, and bellows. These components cannot withstand immersion or the heat and pressure of autoclaving.**

CAUTION: **If moisture remains in the bellows after cleaning, the bellows surface folds may become tacky and prevent the bellows from properly expanding. Ensure all moisture is removed from the bellows after cleaning.**

7, 8.

- **Disinfection**

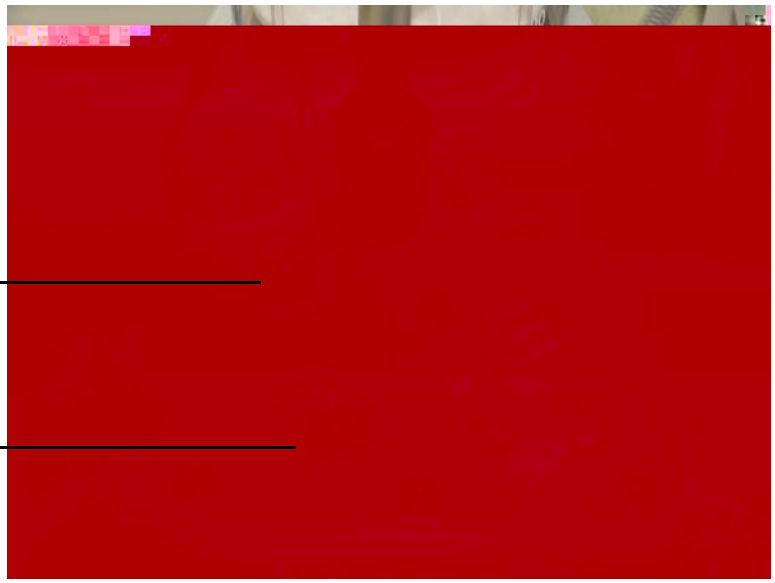
NOTE: **Ensure that all bellows components have been cleaned as described in step 6 before disinfecting.**

7.10.2 (7-11) "

(4.5 (4-9) ").

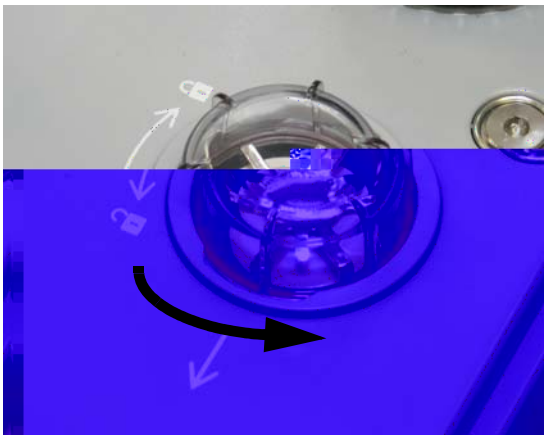
7.10.5

The following procedure is written generically for a single, unspecified valve. It should be performed on both the inspiration and expiration valves.



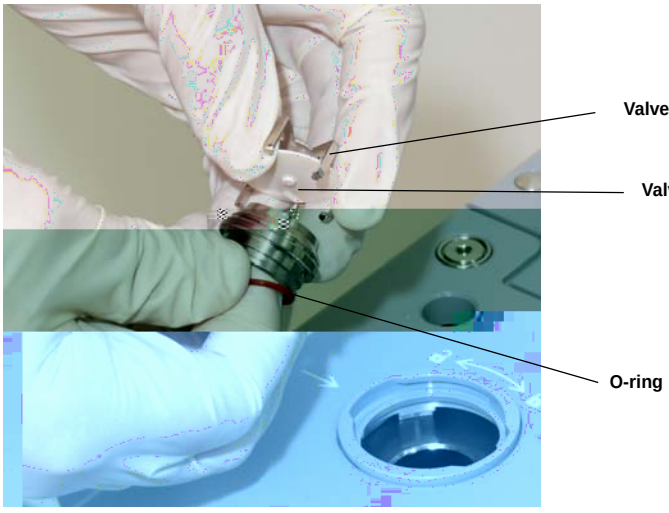
-10

1. (7-11),



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 removing the valve cage from the valve assembly.**

- (7-12). **CAUTION,**
- (7-12).
- (7-12.



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 removing the valve cage from the valve assembly.**

- **Cleaning**

- **Disinfection**

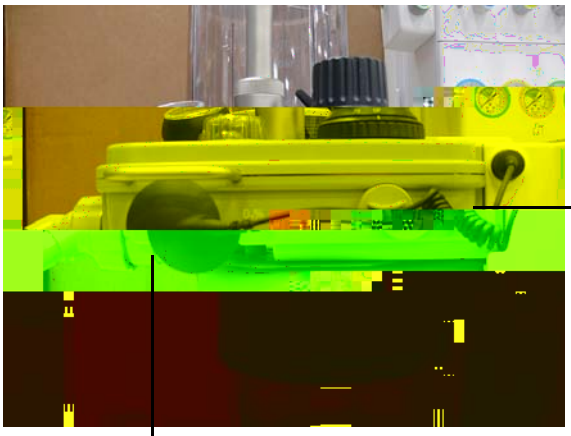
NOTE: Ensure that all valve components have been cleaned as described in step 5 before disinfecting.

- **Reassembly**

CAU-
TION.

7.10.6

1.



-1

CAUTION: **Never immerse the oxygen sensor or its connector in any type of liquid.**

- **Dispose of the oxygen sensor per the manufacturer's specification.**

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

CAUTION: **Do not autoclave the following components: Paw gauge, oxygen sensor, flow sensor, and bellows. These components cannot withstand immersion or the heat and pressure of autoclaving.**

-

(7.10.2 (7-11) "

/ ").

-

-

7.10.7

1.

7.10.8 F

1. (7-15).

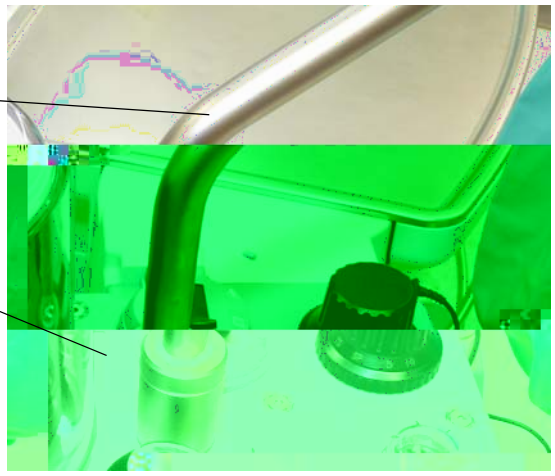
-1 F

CAUTION: **Do not autoclave the following components: Paw gauge, oxygen sensor, flow sensor, and bellows. These components cannot withstand immersion or the heat and pressure of autoclaving.**

- (7.10.2 (7-11) " / ").
- (4.5 (4-9) " ").

7.10.9

1.



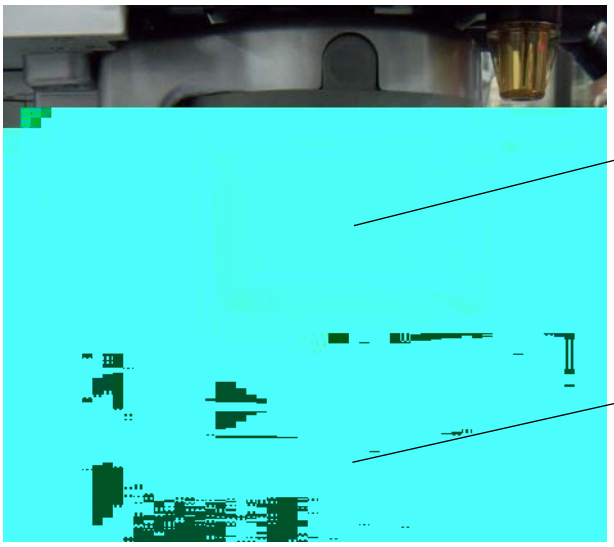
- **Cleaning**

- **Disinfection**

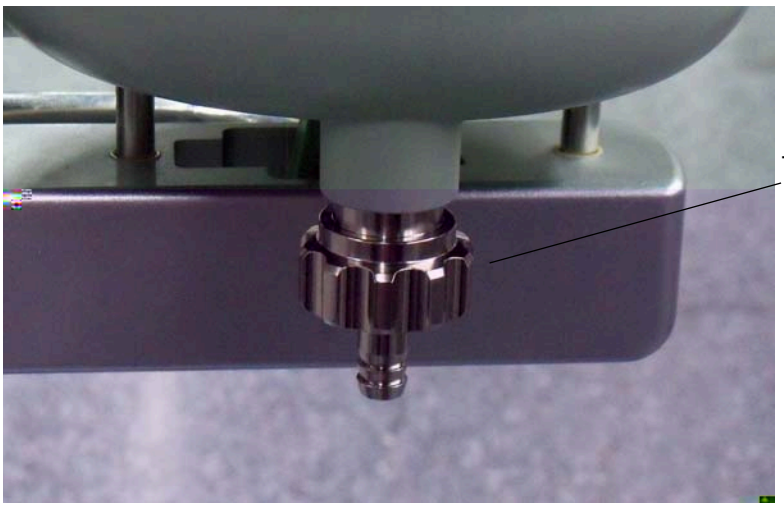
NOTE: **Ensure that the bag arm has been cleaned as described in step 2 before disinfecting.**

7.10.10

1.



-1



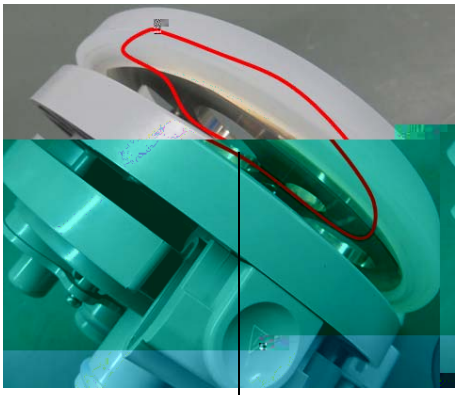
-1 (T)

WARNING: **Use extreme care while handling the absorbent as it is a caustic irritant.**

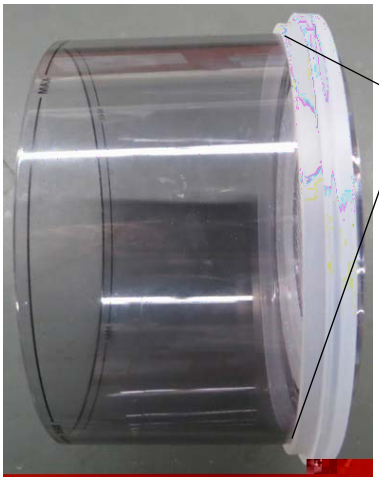
(7-19).

WARNING,

Correct installation



Incorrect installation



Correct installation

Incorrect installation

WARNING: **Use extreme care while handling the absorbent as it is a caustic irritant.**

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

NOTE: **Ensure that the absorber canister is completely dry before adding absorbent.**

WARNING: **The gasket on the absorber canister should be cleaned before adding new absorbent.**

WARNING,

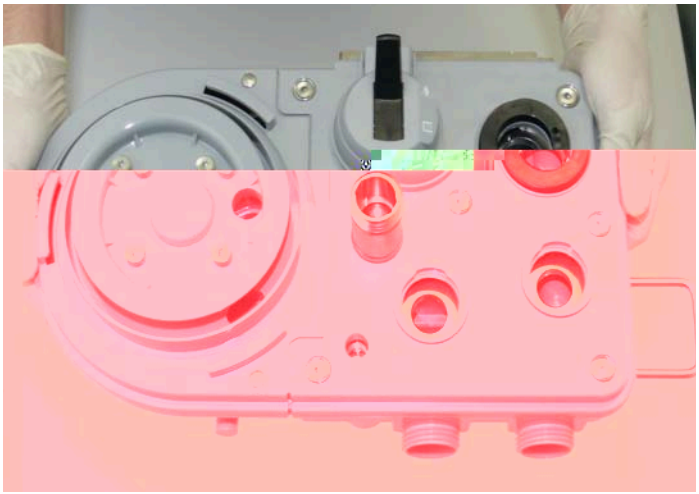
7.10.11

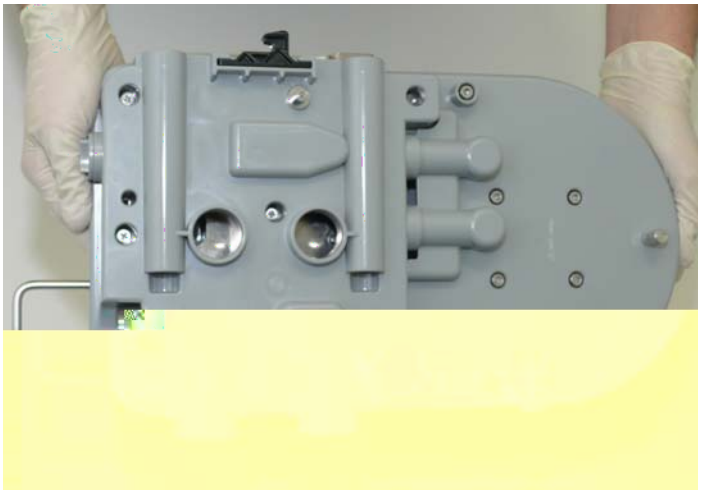
1.

- 7.10.10 (7-22) "").

CAUTION: **Use care in lifting and manipulating the breathing system block during removal from its mounting arm as handling may be awkward due to its weight and shape.**

CAUTION: **The breathing system block is calibrated and matched with the anesthesia machine at the factory. A label in the back of the machine indicates the serial number of the matching breathing system block. When reassembling, ensure that the breathing system block and anesthesia machine are properly matched. Otherwise, the breathing system must be recalibrated.**





- **Cleaning**

  (7.10.2 (7-11) "
  / ").

  7, 8.

- **Disinfection**

NOTE: **Ensure that the breathing system block has been cleaned as described in step 6 before disinfecting. High level disinfection of the breathing system block can be performed through steam autoclaving up to a maximum temperature of 134 ºC (273 ºF).**

Using an autoclave, follow the manufacturer's instructions for high level disinfection of the breathing system block while adhering to facility policies and procedures.

(4.5 (4-9) " ").

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

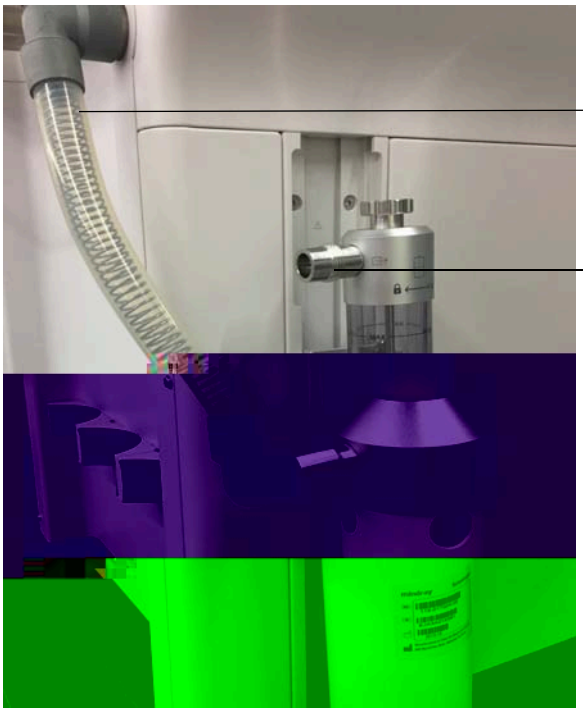
CAUTION: **To ensure measurement accuracy and to avoid possible damage to the A5, use only Mindray-approved cables and accessories.**

CAUTION: **Inspiratory and expiratory flow sensors are flow-direction-sensitive.**

7.10.12 F (F)

1. F (7-26).

5.



F

- F 7.10.2 (7-11) "
  / ").
- F .エ F (T 7-27).エ

- F 5,

7.11 Regular Maintenance

WARNING: To avoid endangering a patient, do not perform testing or maintenance when the machine is in use.

Visual inspection should be performed every 30 days to ensure timely replacement of worn or damaged parts.

1. .
   - .
   - . - (4.5 (4-9) "
     ").

8.0 AG , : O2 C , , ' , , M , , , (O. .)

Introduction 8-2

Understand MAC Values 8-3

Identify External AG Modules 8-4

Prepare to Measure AG 8-6

Make AG Settings 8-6

Measurement Limitations 8-8

Troubleshooting 8-8

Scavenge the Sample Gas 8-9

Calibrate the AG Module 8-10

8.1 Introduction

The Anaesthetic Gas (AG) module measures the patient's anesthetic and respiratory gases, and incorporates the features of the O2 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. The amount of IR light transmitted after it has been passed though an IR absorbing gas is measured. 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 O2 sensor are two nitrogen-filled glass spheres mounted on a strong rare metal taut-band suspension. 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.

The measurement provides:

1.

- L

where, AA stands for any of the five anesthetic agents: Des (desflurane), Iso (isoflurane), Enf (enflurane), Sev (sevoflurane), or Hal (halothane),

8.2 Understand MAC Values

Minimum alveolar concentration (hereinafter referred to as MAC) can be displayed on the screen when the anesthesia system is configured with an 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%	1.7%	2.1%	0.77%	105%*

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

1 L

NOTE: **The data shown in this table is 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 A5 accounts for patient age, the effects of weight and other factors on the inhaled anesthetic agent should be considered.**

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

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

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

The formula for calculating age correction of 1MAC is:

$$MAC_{age} = MAC \times \quad - \quad \times age -$$

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

For example, for a 60-year-old patient, if the AG module detects 0.9% Iso and 50% N_2O in the patient end-tidal mixed gas, the 1MAC of Iso is 1.01% and 1MAC of N_2O is 92.7% of the 60-year-old patient based on the above age correction formula. The MAC value is calculated as follows:

$$MAC = \frac{\quad}{\quad} + \frac{\quad}{\quad} =$$

8.3 Identify External AG Modules

8.4 Prepare to Measure AG

1.

CAUTION:

8.5 Make AG Settings

F

8.5.1 2T

2T :

1. **Setup** > **System** .
   - **CO2 Unit.**
   - **mmHg, kPa** **%.**
   - **Accept.**

8.5.2 2

2 :

1. **Setup** > **Display** .
   - **CO2 Placement.**
   - **TOP** **Bottom.**
   - **Accept.**

8.5.3 2

2 :

1. **Setup** > **Display** .
   - **CO2 Scale.**
   - **0-40, 0-60** **0-80.**
   - **Accept.**

8.5.4 F

F :

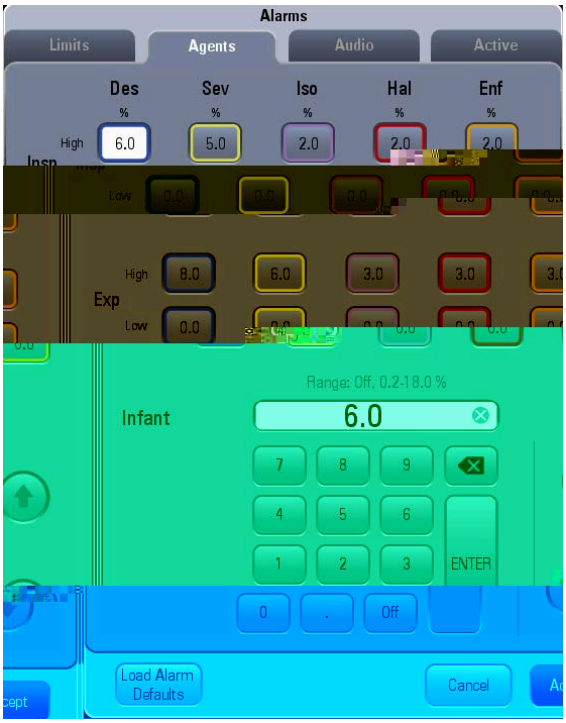
1. **Setup** > **G** .
   - **Gas Bench Flow Rate.**
   - **High** ( ), **Med** **Low,** :
     High: 200 /l ; 120 /l ;
     Med: 150 /l ; 90 /l ;
     Low: 120 /l ; 70 /l ;
   - **Accept.**

8.5.5

Users can set the high and low alarm limits of N2O, CO2, and Agents to create alarm conditions consistent with patient needs. The alarm is then triggered when the parameter value is greater than the High Limit or lesser than the Low Limit.

NOTE: **When using the A5 Anesthesia System, ensure that the alarm limits of each parameter are set to the appropriate values for the patient.**

1. **Alarms**
   - **Limits** (6-8). **Agents** (8-3).
   - T
   - **Accept** (**Cancel**).
   - 3 . 6



8.6 Measurement Limitations

Measurement accuracy may degrade due to:

- Leakage or internal leakage of the sample gas
- Mechanical shock
- Humidity or condensate
- Cyclic pressure which is greater than 10 kPa (100 cmH2O)
- Other interference source (if available)

NOTE: **Gas data is reported as zero if the measured concentration is below the defined threshold level during more than 3 s: CO_2 - 0.1/0.3%; N_2O - 3/3%; O_2 - 0/0%, Agents - 0.15/0.3% (Full/ISO accuracy).**

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.**

8.7 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.

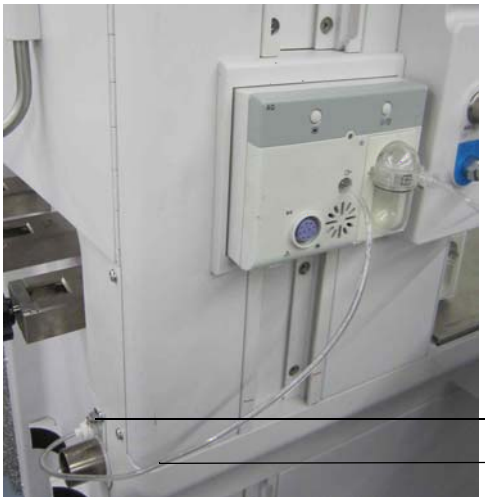
To remove the occlusion:

- Check the airway adapter for occlusion and replace if necessary.
- Check the sampling tube for occlusion or kinking and replace if necessary.
- Check the watertrap for water build-up. Empty the watertrap. If necessary, replace the watertrap.

If that does not resolve it, internal occlusions may exist. Contact your service personnel.

If the expired $_2$ concentration is higher than the inspired $_2$ concentration, it is possible that the pump rate is too low. Setting to is recommended.

8.8 Scavenge the Sample Gas



To scavenge the sample gas to the waste gas disposal system, depress the metal lever and then plug the exhaust tube to the sample gas return port marked **A.** as shown in the above picture.

WARNING: **When using the AG module to perform AG measurements on the patients who are receiving or have recently received anesthetic agents, connect the outlet to the sample gas return port to prevent the medical staff from breathing in the anesthetic agents.**

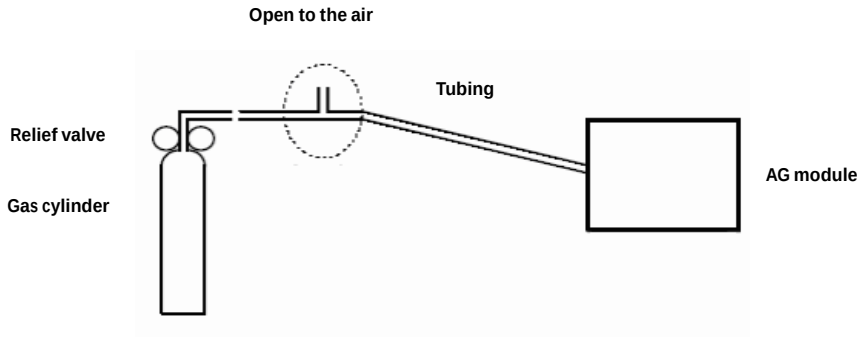
8.9 Calibrate the AG Module

Prepare the following before doing the calibration:

- Gas cylinder, with a certain standard gas or mixture gas. Gas concentration should meet the following requirements: AA≥1.5%, CO2≥1.5%, N2O≥40%, O2≥40%, of which AA represents an anesthetic agent. a/c≤0.01 (a is the gas absolute concentration accuracy; c is the gas concentration).
- T-shape connector
- Tubing

Follow this procedure to perform a calibration:

1. [illegible]



- [illegible] **Standby** [illegible] **End Case.** [illegible] end the case [illegible] **Standby** [illegible].
- [illegible] **Setup** [illegible] > **System** [illegible].
- [illegible] **Calibration.** [illegible].
- [illegible] **External AG Module.** [illegible].
- [illegible] completely [illegible].
- [illegible].
- [illegible].
- [illegible] **Calibrate.** [illegible].
10. [illegible] **Done** [illegible] **Calibration** [illegible].
11. [illegible] **Accept** [illegible] **Setup** [illegible].

9.0 [illegible]

Standards Compliance 9-2

Safety Designations 9-4

Physical Specifications 9-5

Stability Configurations and Conditions 9-5

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Electrical Specifications 9-7

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Monitor Module 9-13

Ventilator Specifications 9-18

Displays and Controls Specifications 9-20

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ASTM F 1208 – 89 (2005) Disclosures 9-23

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Electromagnetic Compatibility 9-24

9.1 Standards Compliance

The A5 Anesthesia System is in compliance with the following industry standards.

▙ 14971: 2007	L
IEC 62304: 2006	L
CA /C A-C22.2 ▙ . 60601-1:2014	L 1: F
IEC 60601-1-2: 2014-E .3.0	L 1-2: F
IEC 60601 1 6 1 3 1-3.5 0)5.509( )-1 .03 60 1-2: G 66.2( )5.1( )-5.3( )4.3( ) 0	

The anesthesia workstation shall be used together with the monitoring devices, alarm system and

9.2 Safety Designations

E :	( ), ( ).
D E :	
C :	100 . 120 , 60 , 12 : 11.1 , 4.5 (1. 2.)
:	
D H E :	
D H I :	1 (, 60529)
E C E :	
D :	L
D :	

TABLE 9-2

9.2.1

The A5 complies with the standards for oxygen-enriched environments by staying below the required power threshold or by providing forced ventilation and ventilation failure monitoring and alarm.

9.2.2 L

The A5 complies with NRTL standards for wiring and PC board materials. Primary wiring is double insulated (jacketed). All wires are UL recognized.

9.3 Physical Specifications

D :	: 1400 l l 25 l l : 1050 l l 25 l l (l) : 805 l l 25 l l
( ):	160 (353) 5
( ):	: 616 l l (24.3,) 25 l l : 380 l l (15.0,) 25 l l : 850 l l (33.5,) 25 l l
:	: 40 (88.2) : 616 l l (24.3,) 25 l l : 362 l l (14.3,) 25 l l l . : : 258 l l 0.3 l l : 150 l l 0.3 l l l . : 11.5 l l : L 4
:	: 25 l l 0.41 l
B A :	**Fixed Height Bag Arm:** : 312 l l 10 l l : 1150 l l 10 l l : 150 10 **Flexible Bag Arm:** : 550 l l 10 l l l .
D):	: : 135 l l 10 l l : 440 l l 10 l l : 385 l l 10 l l
C :	l : 15 l (6,) : / :
H :	: 650 l l 25 l l

TABLE 9-3

9.4 Stability Configurations and Conditions

Maintains stability when tilted 10 degrees, as required by IEC60601-1, clause 9.4.

WARNING: Due to the size and weight of the A5, it should only be moved by qualified personnel.

WARNING: To avoid tip hazards, use care when moving the A5 up or down inclines, around corners and across thresholds. Remove all equipment from the top shelf and mounted to the side of the A5 before moving. Do not attempt to roll the A5 over hoses, cords or other obstacles.

9.5 Environmental Specifications

[illegible]:	+10 . +40 , +50 . 104
[illegible]:	-20 . +60 , -4 . 140
[illegible]:	-20 . +50 ,
H [illegible]):	15 . 90%
A [illegible]):	70 . 106.7
A [illegible]):	50 . 106.7
[illegible]:	11.6.3, 60601-1 60529 . (1)

TABLE 9-4

9.6 Electrical Specifications

9.6.1 L

The A5 complies with IEC 60601-1 for its main power supply.

	100 . 120 , @60
	12 l (2 l 5 . 10 l 5)
	5 0.05 l ( ),

TABLE 9-5 L

9.6.2

B :	, 11.1 , 4.5 . (2).
B :	(1) : >75 l . (2) : >150 l l . (= 500 l , = 10. l , = 1:2, l , = 30 l)
L B A :	>5 l ( )
B G :	: <8 l 10% **A5** l .

TABLE 9-6

9.6.3

:	4
:	100 . 120 , @60 ( )
C E A :	3
C :	10
B A :	3
B :	10

TABLE 9-7

9.6.4

C	9 5. 232, **CAUTION: Do not connect any non-isolated devices to the DB9/RS232C interface of the A5.**
(C 1):	I-45
B, (B1, B2):	**CAUTION: Do not connect any devices to the SB ports other than Mindray approved USB storage devices and a supported USB mouse (see "Networking and USB Storage" on page A-4).**
D (D, 1):	L

TABLE 9-8

9.7 Pneumatic Specifications

9.7.1

:	: 280 . 600 (40 . 87) : 280 . 600 (40 . 87) 2: 280 . 600 (40 . 87)
F. :	2: L .190 /l, (l l l . l l l 2) : L .20 /l, : L .20 /l,
C :	F -5
G C :	2 2

TABLE 9-9

9.7.2

C :	( ) F -1
2 C :	6.9 . 15.5 L (1000 . 2250)
C :	4.2 . 6 L (600 . 870)
C :	6.9 . 15.5 L (1000 . 2250)

TABLE 9-10

9.7.3

9.7.4

O_2

9.7.5

An N_2O automatic cutoff stops the flow of N_2O when O_2 flow is less than 200 mL/min.

9.7.6

O_2 supply failure alarm: 185.5 to 254.5 kPa (27 to 36 psi)

9.7.7

Provides 25% ± 4% O_2 when N_2O valve is fully open and O_2 flow range is 0.8L/min to 3L/min

9.8 Breathing System Specifications

9.8.1

9.8.2

9.8.3

C :	6 1 l

TABLE 9-14

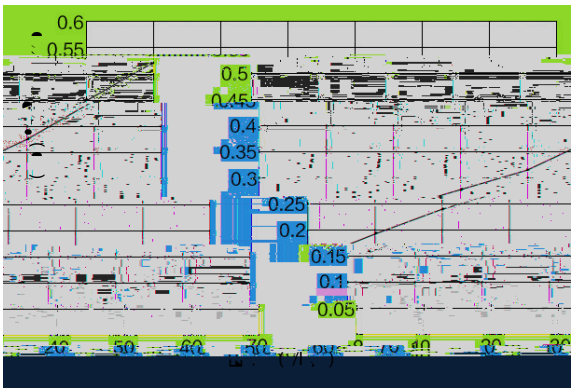
9.8.4

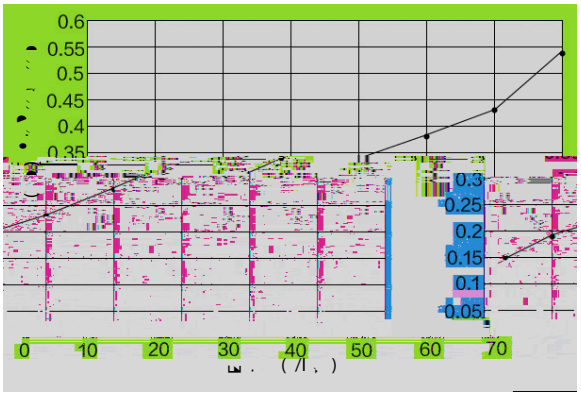
E C :	22 l 15 l
I C :	22 l 15 l
C B :	30 l

TABLE 9-15

9.8.5

:	l 0 . 75 l
A :	330 10


0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05


0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
10
20
30
40
50
60
70

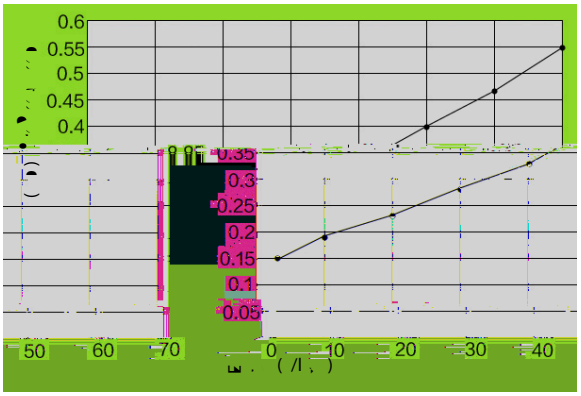
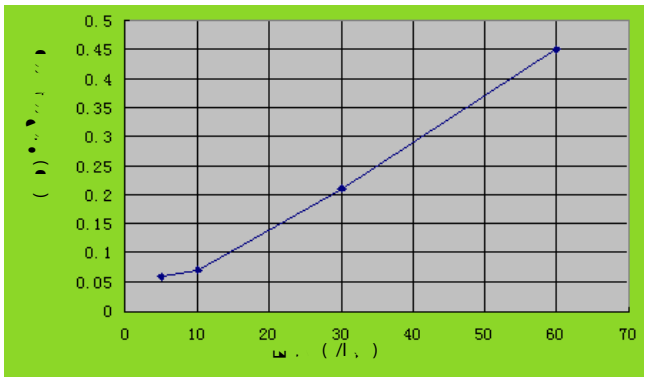

0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
50
60
70
0
10
20
30
40

TABLE 9-16

9.8.6 Resistance

E [illegible]:



I [illegible]:

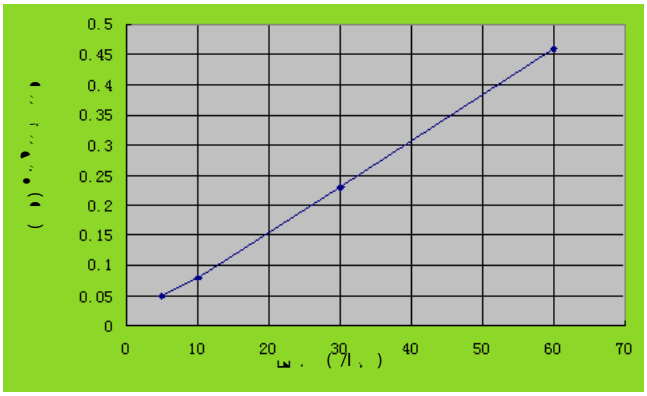


TABLE 9-17 [illegible]

9.8.7 [illegible]

B [illegible]:	35— [illegible] 20— [illegible]

Note: The block heater does not operate while the system is being powered by the internal battery supply.

TABLE 9-18 [illegible]

9.8.8 [illegible]

C [illegible]:	[illegible] (I [illegible]): 2l / l
I C [illegible]:	4l / l
I [illegible]:	6 l (20 [illegible] 1)
I A [illegible]:	6 l (20 [illegible] 1)

TABLE 9-19 [illegible]

L :	150 l @ 3
:	110 10 l @ 10-110 /l

TABLE 9-19

9.8.9 L

l 2 10993-1, 10993-5, 10993-10.

9.9 Anesthetic Gas Scavenging System (AGSS)

A D :	
:	430l l 132l l 114l l : +/- 5l l
	2.15 +/- 0.05
F :	25 50 /l
:	0.35 @ 75 /l

TABLE 9-20 F (F)

9.10 Monitor Module

9.10.1 F L

:	l
:	: <45 : <10 l
:	l : : 120/150/200 l /l : l F 70/90/120 l /l : l F : 10 l /l 10%,
E):	: 17 @ 200 l /l , 37 , 100% F : 20 @ 120 l /l , 37 , 100%
G :	2 2 l 2 l), ,

1): 10% to 90%. Sample gas flow: 200 ml/min. DRYLINE™ watertrap. Adult DRYLINE™ sampling line (2.5 m).
2): 10% to 90%. Sample gas flow: 120 ml/min. DRYLINE™ watertrap. Pediatric DRYLINE™ sampling line (2.5 m).

TABLE 9-21 F L

: 0 . 30 %

2: 0 . 100 %

2: 0 . 100 %

: 0 . 30 %

: 0 . 30 %

: 0 . 30 %

: 0 . 30 %

: 0 . 30 %

:

0.3% 2;

8% ;

(8% +2%).

@120 / 2)	2: 250 l
	2: 500 l
	: 250 l
	: 350 l
	: 300 l
D	<4
C	
ID	0.15% (0.4% l.)
ID	0.3% (0.5% l.). 5% (10%). l l >10%
ID	3. 12
	L 6.
	: 2. 100. : 1. : 2. 60. : 1. 60. 100. : 2.

1): 10% to 90%. Sample gas flow: 200 ml/min. DRYLINE™ watertrap. Adult DRYLINE™ sampling line (2.5 m).
2): 10% to 90%. Sample gas flow: 120 ml/min. DRYLINE™ watertrap. Pediatric DRYLINE™ sampling line (2.5 m).

TABLE 9-21 F L.

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™ 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™ 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.**

9.10.2

AG Alarm Limits	Range	Default	Step	Unit
	, 2 . 99	:50 :45	1	, % ,
	, 0 . 97	:25 :30		
	, 1 . 99	4		
	, . +2 . 100	88%		

	, 0.2 .	18.0	8%	0.1 %
	, 0.0 .	17.8	0%	
	, 0.2 .	18.0	6%	
	, 0.0 .	17.8	0%	
		> 3 L ,		

TABLE 9-22 ,

9.10.3 , . , F . F L ,

Gas Contaminants	Quantitive effect(%$_{ABS}$)[3]			
	CO_2	N_2O	Agents [1]	O_2
CO_2	0	0.1	0.1	0.2
N_2O	0.1	0	0.1	0.2
Agents [1] [2]	0	0.1	0.1[4]	1.0
<100% Xenon	0.1	0	0	0.5
<50% Helium	0.1	0	0	0.5
<0.1% Ethanol	0	0	0	0.5
<1% Acetone	0.1	0.1	0	0.5
<1% Methane	0.1	0.1	0	0.5
Saturated Isopropanol vapour	0.1	0	0	0.5
Metered dose inhaler propellants	T	T	T	0.5

1) Agents represents one of DES, ISO, ENF, SEV, and HAL.
2) Multiple agent interference on CO_2, N_2O and O_2 is typically the same as single agent interference.
3) For CO_2, N_2O and Agents, maximum interference from each gas at concentrations within specified accuracy ranges for each gas. The total interference of all gases is never larger than 5%$_{REL}$.
4) Interference for one of the five agents with secondary agent.

TABLE 9-23 , . , F . F L ,

9.11 Ventilator Specifications

G [illegible]	
[illegible]:	–L [illegible] – [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] – [illegible] [illegible] – [illegible] [illegible]
[illegible]:	[illegible]
F [illegible] G F C [illegible]:	[illegible]
I [illegible] F (L/[illegible]):	[illegible] 5 [illegible] (.[illegible]) [illegible] 110 L/[illegible] 2.4 L/[illegible]
I [illegible] F [illegible]:	2.4 110 L/[illegible]
L F A [illegible]:	[illegible] 1 L/[illegible]
[illegible]:	[illegible]
I [illegible] [illegible]:	1 15 L/[illegible]
[illegible] (E I):	[illegible] 5 60%. [illegible]

TABLE 9-24 F [illegible]

[illegible]	
A [illegible]:	0.2 5.0 [illegible], [illegible]: 0.1 [illegible]
[illegible]:	20 1500 L/[illegible], [illegible]: 1 L
[illegible]:	4 100 L/[illegible], [illegible]: 1 L
[illegible]:	2 60 L/[illegible], [illegible]: 1 L
I:E	4:1 1:8 [illegible], [illegible]: 0.5
[illegible]:	0.2 5 [illegible], [illegible]: 0.1 [illegible]
[illegible]:	5 70 L/[illegible], [illegible]: 1 L/[illegible] 5 1500 L [illegible]
[illegible]:	[illegible] 5 60% [illegible], [illegible]: 1%
[illegible]:	10 100 L/[illegible] [illegible], [illegible]: 1 L/[illegible]
[illegible]:	[illegible] 3 30 L/[illegible] [illegible], [illegible]: 1 L/[illegible]
[illegible]:	3 50 L/[illegible] [illegible], [illegible]: 1 L/[illegible]
[illegible]:	1 15 L/[illegible] [illegible], [illegible]: 1 L/[illegible]
[illegible]:	0.0 2.0 [illegible], [illegible]: 0.1 [illegible] **NOTE:** [illegible]

TABLE 9-25 [illegible]

G*	, 20 . 1500 l ( ), : 1
G*	5 . 100 l ( ), : 1 l

TABLE 9-25 l

D :	280 . 600
I :	2.4 . 110 /l
F. :	1 . 110 /l

TABLE 9-26 l

:	F : 18 . 100 . % 2 : (l 2.5%+2.5%) : 20 . L l : L 6 .
:	: 0 . 70 l : -20 . 120 l : -20 . 120 l : -20 . 120 l
:	. l : 0 . 3000 l L . l : 0 . 100 /l
:	: 0 . 120 . l

TABLE 9-27 L .

C *	
. C ( ):	<60 l 10 l 60 l 210 l 15 l >210 l 7% .
C . :	: 2.5 l . 7% . l l : 10% .
EE C . :	3 . 30 l : 2.0 l , 10% . l : .
. ( ):	<60 l 10 l 60 l 210 l 18 l >210 l 9% .
:	2.0 l . 5% . l
EE :	0 . 30 l : 2.0 l , 10% . l > 30 l : .
:	1 . l . 10% . l

TABLE 9-28 L .

A :	0 . 30 /l 15%. 5%. 1- .

** Specifications are applicable after warm-up time of the Breathing System (Section 9.8.6).*

TABLE 9-28 L

9.12 Displays and Controls Specifications

9.12.1

D :	, 15, , 4:3 , 1024 768 .
G :	.
G F. :	(2): 0 . 15 /l (2): 0 . 15 /l ( ): 0 . 10 /l : 10%. 0.12 /l , 50 l /l @ 0 . 1 /l 100 l /l @ 1 . 15 /l
D:	. l , L . l . l , L 2
AC . l LED:	F l = l =
B l LED:	l = l =
L :	

9.12.2

	F : 2 : 0 . 145 (0 . 1000) : (4% + 8%) T :
,	F : 2 : 0 . 1400 (0 . 10 L) : 0 . 3500 (0 . 25 L) 2: 0 . 3500 (0 . 25 L) : (4% + 8%) T :
F. , C.	: 2 : 2: 0 . 15 /l (2): 0 . 10 /l ( ): 0 . 15 /l 2): 0 . 15 /l : 10% 0.12 /l : 50 l /l @ 0 . 1 /l 100 l /l @ 1 . 15 /l : 5 (l 0 . l l .)
F. :	0 . 10 /l 10%. 10% 100%.
F. :	: 0 . 15 /l
:	: 280 . 600 : 90 /l
F ( ):	: 35 . 50 /l
:	: -20 . 100 l 2 : (2% + 4%)

TABLE 9-30

9.13 Alarms

:	(l), l 5 l .
:	: / : l (l l l , 60601-1-8.)
:	: (l l) : (l l)
:	10 l . (1 . 10)
:	l : l : l ; l
(	60 1 l , 1 l l 1 l .

TABLE 9-31

9.14 Safety Specifications

	: 10 . 2000 10 . 100 : 1.0 (I / 2)2/ 100 . 200 : -3 200 . 2000 : 0.5 (I / 2)2/ : 10 I (3 .)
	: 150 I / 2 (15) : 11 I : 3 (18 .)
D. :	. I 15.3.5, , 60601-1.
H I :	. I 11.6.3, , 60601-1 . 60529 . (1).
:	. I 11.1, , 60601-1.
:	. I 9.4, , 60601-1.
I E C :	. I 15.4, , 60601-1.
E :	. I 15.3.2, 15.3.3, 15.3.6, 15.3.7, , 60601-1.
I C . :	. I 13.2.7, , 60601-1.
C :	. I 8.7, , 60601-1.
	: – . I 500 – 1000
	: – . I 100 – 300
	: – . I 100 – 500
	: – . I 10 – 50
	: – . I 100 – 500
	( ): – 5000
D :	. I 8.8.3, , 60601-1.
	L (- 1): 1500 L , 1 I
	L (-): 4000 L , 1 I
	(-): 1500 L , 1 I
	: 1500 L , 1 I

TABLE 9-32

G. :	8.6, , 60601-1. ( ) 0.1. .
G. :	8.6, , 60601-1.

TABLE 9-32

9.15 ASTM F 1208 – 89 (2005) Disclosures

Based on the following disclosures, the A5 meets ASTM Standard Specification F1208 for Anesthesia Breathing Systems.

9.15.1

	10.19 /l	@3
(.)		
	15.10 /l	@3
(.)		
	8.15 /l	@3
(.)		
	14.77 /l	@3
(.)		

TABLE 9-33

9.15.2

The typical pressure drops due to inspiratory and expiratory gas flow in the breathing system at reference flows of 0.5 and 1.0 L/sec are:

- Manual, Inspiratory flow: flow rate = 0.5 L/s @ 0.59 kPa resistance
- Manual, Inspiratory flow: flow rate = 1.0 L/s @ 0.24 kPa resistance
- Manual, Expiratory flow: flow rate = 0.5 L/s @ 0.21 kPa resistance
- Manual, Expiratory flow: flow rate = 1.0 L/s @ 0.43 kPa resistance
- Auto, Inspiratory flow: flow rate = 0.5 L/s @ 0.23 kPa resistance
- Auto, Inspiratory flow: flow rate = 1.0 L/s @ 0.58 kPa resistance
- Auto, Expiratory flow: flow rate = 0.5 L/s @ 0.44 kPa resistance
- Auto, Expiratory flow: flow rate = 1.0 L/s @ 0.20 kPa resistance

9.15.3

2

For a filled CO_2 absorber, resistance at 1 L/sec flow = 0.14 kPa

9.15.4

2

CO_2 absorber capacity is 1 Pre-Pak or 1500 mL.

9.15.5 T

Dry: 0.03 kPa opening pressure
Wet: 0.05 kPa opening pressure.

9.16 Data Storage (Non-Volatile) and Recording

C	5
L	500 500 500 500

TABLE 9-34 ( )

9.17 Electromagnetic Compatibility

The A5 meets the requirements of IEC 60601-1-2: 2014.

NOTE: **Using accessories, sensors and cables other than those specified may result in increased electromagnetic emission or decreased electromagnetic immunity of the equipment.**

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

NOTE: **The anesthesia machine 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 interfere with this equipment even though they meet the requirements of CISPR.**

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

NOTE: **Use of portable or mobile communications devices can degrade the performance of the equipment.**

NOTE: **The A5 is intended for use in professional healthcare facility environment, If it is used in special environment, such as magnetic resonance imaging environment, the equipment 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.**

GUIDANCE AND DECLARATION - ELECTROMAGNETIC EMISSION

EMISSIONS TEST	COMPLIANCE	ELECTROMAGNETIC ENVIRONMENT - GUIDANCE
11	F 1	5
11		5
60601-1-2 61000-3-2	Not applicable	
/ 60601-1-2 61000-3-3	Not applicable	

TABLE 9-35 F

GUIDANCE AND DECLARATION - ELECTROMAGNETIC IMMUNITY

IMMUNITY TEST	IEC 60601 TEST LEVEL	COMPLIANCE LEVEL	ELECTROMAGNETIC ENVIRONMENT - GUIDANCE
( ) 61000-4-2	8 15	8 15	30%.
/ 61000-4-4	2 1 / (3)	2 1 / (3)	
61000-4-5	1 ( ). ( ) 2 ( ).	1 ( ). ( ) 2 ( ).	
61000-4-11	0 % T 0,5 0 % T 1 70 % T 25/ 30 0 % T 250/300	0 % T 0,5 0 % T 1 70 % T 25/ 30 0 % T 250/300	

TABLE 9-36 F ±

	30 /l	30 /l	
l , 61000-4-8			

U_T is the A.C. mains voltage prior to application of the test level.

GUIDANCE AND DECLARATION - ELECTROMAGNETIC IMMUNITY

5,
5

IMMUNITY TEST	IEC 60601 TEST LEVEL	COMPLIANCE LEVEL	ELECTROMAGNETIC ENVIRONMENT - GUIDANCE
, 61000-4-6	3 l 150 . 80 L_	3 l (1)	. l l .
	6 l L . l 0,15 L_ 80 L_	6 l (2)	: 150 . 80 L_ 80 L_ . 800 L_ 800 L_ . 2.7 F_
L , 61000-4-3			( ) (l) . :

GUIDANCE AND DECLARATION - ELECTROMAGNETIC IMMUNITY

5 5

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. L ( ). 150 80 L 6.765 L . 6.795 L ; 13.553 L . 13.567 L ; 26.957 L . 27.283 L ; 40.66 L . 40.70 L . 0,15 L 80 L 1,8 L . 2,0 L , 3,5 L . 4,0 L , 5,3 L . 5,4 L , 7 L . 7,3 L , 10,1 L . 10,15 L , 14 L . 14,2 L , 18,07 L . 18,17 L , 21,0 L . 21,4 L , 24,89 L . 24,99 L , 28,0 L . 29,7 L 50,0 L . 54,0 L .

b. L 150 . 80 L 80 L . 2.7 F /I . 10/3 .

c. (/.)

d. 150 . 80 L , 3 /I .

RECOMMENDED SEPARATION DISTANCES BETWEEN PORTABLE AND MOBILE RF COMMUNICATIONS EQUIPMENT AND THIS EQUIPMENT

5, ( ) .

RATED MAXIMUM OUTPUT POWER OF TRANSMITTER WATTS (W)	SEPARATION DISTANCE ACCORDING TO FREQUENCY OF TRANSMITTER m		
	150 kHz to 80 MHz $d = \left[\frac{}{V}\right]\sqrt{P}$	80 MHz to 800 MHz $d = \left[\frac{}{E}\right]\sqrt{P}$	800 MHz to 2.7 GHz $d = \left[\frac{}{E}\right]\sqrt{P}$
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

(I) ( ) .

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.**

NOTE: **At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.**

NOTE: **An additional factor of 10/3 is used in calculating the recommended separation distance for transmitters in the ISM frequency bands between 150 kHz and 80 MHz and in the frequency range 80 MHz to 2,7 GHz to decrease the likelihood that mobile/portable communications equipment could cause interference if it is inadvertently brought into patient areas.**

NOTE: **These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.**

ANESTHESIA SYSTEM'S ESSENTIAL PERFORMANCE		ESSENTIAL PERFORMANCE TESTED DURING EMC IMMUNITY TESTS	CRITERIA DURING EMC IMMUNITY
1	1.1	1.1.1	2 2
	1.2	1.2.1	1. T 2. 3.
	1.3	/	/

ANESTHESIA SYSTEM'S ESSENTIAL PERFORMANCE		ESSENTIAL PERFORMANCE TESTED DURING EMC IMMUNITY TESTS	CRITERIA DURING EMC IMMUNITY
2.	2.1	/	/
	2.2	2.2.1	
	2.3	2.3.1	: 30 10 l : 30 1. l 10 %. L : 30 10 l : 30 1. l 10 %. : 2.0 l 5%.
	2.4	/	/
	2.5 F l	2.5.1 F l	: 0.2 0.1 /l
	2.6	/	/
3.	3.1	/	/
	3.2	3.2.1	(%): 2: 0 0.43% : 0 2% 2: 21 (2.5%+2.5%) : 2 (0.2%+15%) ( )
4.	4.1	/	/
5. L	5.1 L	/	/
	5.2	/	/
	5.3	/	/
	(F l		

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A

Accessory Kits A-2

AG Accessories A-2

CO_2 Absorbent Canister A-2

Gas Cylinder Accessories A-2

Gas Supply Hoses A-3

Manuals and Reference Cards A-3

Mounting Accessories A-3

Networking and USB Storage A-4

Vaporizers A-4

WARNING: Use only accessories specified in this chapter. Using other accessories may cause incorrect measured values or equipment damage.

WARNING: Disposable accessories cannot be reused. Reuse may degrade performance or cause cross-contamination.

WARNING: Check the accessories and their packages for damage. Do not use them if any sign of damage is detected.

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.

The following accessories are designed for the A5 Anesthesia System. The use of other accessories is not recommended. To place an order for these or other accessories, contact Customer Service at +86 755 26582479 / 26582888 or order accessories online at www.mindray.com.

A.1 Accessory Kits

PART NUMBER	DESCRIPTION
121-000994-00	5 , T

A.2 AG Accessories

PART NUMBER	DESCRIPTION
125-000005-00	( )
125-000006-00	( )
115-043017-00	( )
115-043018-00	( )
115-043020-00	( )
115-043021-00	( )
6800-30-50842	(3-)
115-016612-00	2

A.3 CO_2 Absorbent Canister

PART NUMBER	DESCRIPTION
0683-00-0326-12	2 (12)

A.4 Gas Cylinder Accessories

PART NUMBER	DESCRIPTION
0348-00-0185	

A.5 Gas Supply Hoses

PART NUMBER	DESCRIPTION (15 FOOT LENGTH)
082-001825-00	[illegible]
082-001826-00	[illegible]
082-001827-00	[illegible]
082-001828-00	[illegible]
082-001829-00	[illegible]
082-001830-00	[illegible]
082-001831-00	[illegible]
082-001832-00	[illegible]
082-001833-00	[illegible]
082-001834-00	[illegible]
082-001835-00	[illegible]
082-001836-00	[illegible]
082-001837-00	[illegible]
082-001838-00	[illegible]
082-001839-00	[illegible]
082-001840-00	[illegible]
082-001841-00	[illegible]
082-001842-00	[illegible]
082-001843-00	[illegible]
082-001844-00	[illegible]

A.6 Manuals and Reference Cards

PART NUMBER	DESCRIPTION
046-002773-01	[illegible]
115-040734-00	[illegible]
801-0631-00081-00	[illegible]
801-0631-00082-00	[illegible]

A.7 Mounting Accessories

PART NUMBER	DESCRIPTION
0436-00-0169	[illegible]
0386-00-0344	[illegible]
0040-00-0452	[illegible]
115-009637-00	[illegible]
0436-00-0198	[illegible]
0436-00-0258	[illegible]

PART NUMBER	DESCRIPTION
045-000250-00	[illegible]
0436-00-0259	[illegible]
0992-00-0256	[illegible]
0436-00-0207	[illegible]
050-000702-00	[illegible]
115-011304-00	[illegible]
115-004003-00	[illegible]
115-004004-00	[illegible]
008-000468-00	[illegible] 3-4.5 /7.6-11.4 [illegible]
008-000468-01	[illegible] 1.5-3 /3.8-7.6 [illegible]
008-000468-02	[illegible] 4.5-7 /11.4-17.8 [illegible]
008-000468-03	[illegible] 7-9.5 /17.8-24.1 [illegible]
115-021015-00	[illegible]
034-000288-00	[illegible]
121-001106-00	[illegible]
121-001111-00	[illegible]
045-000794-00	[illegible]
045-000795-00	[illegible]
115-017467-00	[illegible]

A.8 Networking and USB Storage

A.9 Vaporizers

PART NUMBER	DESCRIPTION
115-025532-00	L,
040-000067-00	L,
115-026747-00	L,
115-025535-00	L,
040-002707-00	L,
801-0631-00076-00	L.

A.10 Scavenging Accessories

PART NUMBER	DESCRIPTION
115-037548-00	

NOTE: The Active AGSS comes standard with the A5 system.

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Active AGSS B-2

Breathing System B-2

CO_2 Absorbent Canister B-2

Flow Sensor B-2

Gas Cylinder Accessories B-3

O_2 Sensor B-3

Battery B-3

The following spare parts are designed for the A5 Anesthesia System. The use of other spare parts is not recommended. To place an order for these or other spare parts, contact Customer Service at +86 755 26582479 / 26582888 or order spare parts online at www.mindray.com.

B.1 Active AGSS

PART NUMBER	DESCRIPTION
115-023175-00	F
801-0631-00074-00	F
115-052160-00	F F

B.2 Breathing System

PART NUMBER	DESCRIPTION
801-0631-00054-00	
0601-30-78968	
801-0631-00057-00	
801-0631-00059-00	
801-0631-00058-00	
801-0631-00061-00	
801-0631-00104-00	
115-048600-00	
115-048035-00	
115-051819-00	
801-0631-00062-00	
115-046756-00	
115-025569-00	5

B.3 CO_2 Absorbent Canister

PART NUMBER	DESCRIPTION
801-0631-00066-00	2
801-0631-00099-00	2
801-0631-00092-00	2
801-0631-00100-00	2

B.4 Flow Sensor

PART NUMBER	DESCRIPTION
801-0631-00056-00	
801-0631-00060-00	
115-008264-00	

B.5 Gas Cylinder Accessories

PART NUMBER	DESCRIPTION
115-033063-00	F

B.6 O_2 Sensor

PART NUMBER	DESCRIPTION
040-001270-00	2
801-0631-00102-00	2
801-0631-00091-00	2

B.7 Battery

PART NUMBER	DESCRIPTION
115-018012-00	

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C Preoperational Functional Checkout

Waveform/Spirometry Tabs C-2

Alarm Limits C-3

Setup Menu C-5

Alarm Volume and History C-8

Date and Time C-8

Demographics C-9

Ventilation Modes C-9

Linked Ventilation Parameter C-13

Ventilation Parameter Relationships C-15

C.1 Waveform/Spirometry Tabs

OBJECT	RANGE	DEFAULT	Current selection saved when powered off
Waveform/Spirometry Tab			
Spirometry Tab: Loop Type			
Spirometry Tab: Save Loop			
Spirometry Tab: Show Reference			
Spirometry Tab: Review Loops: Loop Type			

PARAMETER	RANGE	DEFAULT	UNIT	Current selection saved when powered off
EtEnf Low	, 0.0 . (, -0.2) : 0.1	0	%	
FiEnf High	, (. +0.2) . 5.0 : 0.1	2	%	
FiEnf Low	, 0.0 . (, -0.2) : 0.1	0	%	
EtIso High	, (. +0.2) . 5.0 : 0.1	3	%	
EtIso Low	, 0.0 . (, -0.2) : 0.1	0		
FiIso High	, (. +0.2) . 5.0 : 0.1	2	%	
FiIso Low	, 0.0 . (, -0.2) : 0.1	0	%	
EtSev High	, (. +0.2) . 8.0 : 0.1	6	%	
EtSev Low	, 0.0 . (, -0.2) : 0.1	0		
FiSev High	, (. +0.2) . 8.0 : 0	5	%	
FiSev Low	, 0.0 . (, -0.2) : 0.1	0	%	
EtDes High	, (. +0.2) . 18.0 : 0.1	8	%	
EtDes Low	, 0.0 . (, -0.2) : 0.1	0	%	
FiDes High	, (. +0.2) . 18.0 : 0.1	6	%	
FiDes Low	, 0.0 . (, -0.2) : 0	0	%	
EtO2 High	, (. +0.2) . 100 : 1	88	%	
EtO2 Low	, 10 . (, -2) : 1		%	
CO2 Apnea Delay Time	10 , 15 , 20 , 25 , 30 , 35 , 40	30	,	

C.3 Setup Menu

PARAMETER	RANGE	DEFAULT	Current selection saved when powered off
General Tab: Breathing System			
General Tab: Gas Bench Flow Rate			
Display Tab: Pressure Display			
Display Tab: Plimit Line			
Display Tab: Screen Brightness	1-10	5	
Display Tab: Key Click Volume	1-10	3	
Display Tab: CO2 Placement			
Display Tab: Gas Scales:CO2 Scale	0-40 0-60 0-80	0-60	
Display Tab: Gas Scales:Des Scale	0-6.0%, 0-9.0%, 0-18.0%	0-9.0%	
Display Tab: Gas Scales:Sev Scale	0-2.0%, 0-4.0%, 0-8.0%	0-4.0%	
Display Tab: Gas Scales:Iso Scale	0-1.2%, 0-2.5%, 0-5.0%	0-2.5%	
Display Tab: Gas Scales:Hal Scale	0-1.2%, 0-2.5%, 0-5.0%	0-2.5%	
Display Tab: Gas Scales:Enf Scale	0-1.2%, 0-2.5%, 0-5.0%	0-2.5%	
Display Tab: Gas Scales:O2 Scale	0-35%, 0-50%, 0-100%	0-100%	
Display Tab: Gas Scales:N2O Scale	0-35%, 0-50%, 0-100%	0-100%	

PARAMETER	RANGE	DEFAULT	Current selection saved when powered off
Display Tab: Waveform Display			
System Tab: Language		F	
System Tab: Default Settings: Default Patient Size			
System Tab: Default Settings: Default Vent Mode			
System Tab: Manage Defaults			
System Tab: Change Password			
System Tab: Units: Pressure			
System Tab: Units: CO2			
System Tab: Clear Historys			
System Tab: Time Settings: Daylight Savings			
System Tab: Network: This Machine: Configure Ethernet: IP Address	0 - 255	192.168.23.250	
System Tab: Network: This Machine: Configure Ethernet: Subnet	0 - 255	255.255.255.0	
System Tab: Network: This Machine: Configure Ethernet: Default Gateway	0 - 255		
System Tab: Network: This Machine: Configure Serial: Baud Rate	4800, 9600, 57600, 115200	9600	
System Tab: Network: This Machine: Configure Serial: Parity			
System Tab: Network: This Machine: Configure Serial: Data Bits	8, 7, 6, 5	8	

PARAMETER	RANGE	DEFAULT	Current selection saved when powered off
System Tab: Network: This Machine: Configure Serial: Protocol	. , 7, L - ,	.	
System Tab: Network: This Machine: Configure Serial: Interval	10 , 30 , 1 l , 5 l , 30 l , 1 . , 2 . , 6 . , 12 . , 24 .	1 l	
System Tab: Network: This Machine: Configure Serial: Stop Bits	2, 1.	1	
System Tab: Network: Network Protocol: Configure HL7: Interval	10 , 30 , 1 l , 5 l , 30 l , 1 , 2 , 6 , 12 , 24	1 l	
System Tab: Network: Network Protocol: Configure HL7: Destination IP		192.168.23.200	
System Tab: Network: Network Protocol: Configure HL7: Port	0 - 65535	1550	
System Tab: Network: Network Protocol: Configure HL7: Set HL7 Compatibility	L. , 02.02.01 . 02.10.00, 02.00.00, 01.05.02, 01.00.00 . 01.05.01, .	L.	
System Tab: Network: Network Protocol: Configure HL7: Send Waveforms			
System Tab: Network: Network Protocol: Configure HL7: Send Alarms			
System Tab: Network: Network Protocol: Configure HL7: Send Alarms Ack.			
System Tab: Network: Network Protocol: MD2			
System Tab: Network: Network Protocol: Configure MD2: Destination IP		192.168.23.99	
System Tab: Network: Network Protocol: Configure MD2: Port		6678	
System Tab: Network: SNTP Protocol: Interval	10 , 30 , 1 l , 5 l , 30 l , 1 , 2 , 6 , 12 , 24		

PARAMETER	RANGE	DEFAULT	Current selection saved when powered off
System Tab: Network: SNTP Protocol: Primary Server IP	0 - 255	132.163.4.103	
System Tab: Network: SNTP Protocol: Secondary Server IP	0 - 255	210.72.145.44	

C.4 Alarm Volume and History

PARAMETER	RANGE	DEFAULT	Current selection saved when powered off
Alarm Volume	1-10	3	
System Alerts Volume	1-10	3	
Event Log: Filter			
Display Interval		1	
Display Group			

C.5 Date and Time

PARAMETER	RANGE	DEFAULT	Current selection saved when powered off
Day	1-31	1	
Month	1-12	1	
Year	1900-2099	2009	
Hour		00 (24) 12 (12)	
Minute	00-60	00	
AM/PM			
12/24 hour	12, 24	12	
Date format			
Daylight Savings Time			

C.6 Demographics

PARAMETER	RANGE	DEFAULT
Patient ID		
Bed		
First Name		
Room		
Last Name		
Point of Care		
DOB		
Age		
Weight(Lbs.)		
Facility		

C.7 Ventilation Modes

OBJECT	RANGE	DEFAULT	Current selection saved when powered off
Ventilation Mode Tab			

** SIMV-PC available only on A5.*

VENTILATION MODE	PARAMETERS

*** SIMV-PC, VtG, PlimVG, and Bypass are available only on A5.*

PARAMETER	VCV	SIMV-VC	PCV	SIMV-PC	PS	MANUAL
Vt	: 20 . 1500 l : 1 : 600 l : 120 l : 20 l	: 20 . 1500 l : 1 : 600 l : 120 l : 20 l				
VtG			: 20 . 1500 l : 1 :			
VG			:			
Rate	: 4 . 100. l : 1. l : 8. l : 15. l					

PARAMETER	VCV	SIMV-VC	PCV	SIMV-PC	PS	MANUAL
ΔP		: 3 , 50 l ▁ 1 : 1 : : 8 l ▁ 1 : 5 l ▁ 1 : 5 l ▁ 1		: 3 , 50 l ▁ 1 : 1 : : 8 l ▁ 1 : 5 l ▁ 1 : 5 l ▁ 1	: 3 , 50 l ▁ 1 : 1 : : 8 l ▁ 1 : 5 l ▁ 1 : 5 l ▁ 1	
Trigger		: 1 , 15 /l , : 1 : : 3 /l , : 2 /l , : 2 /l ,		: 1 , 15 /l , : 1 : : 3 /l , : 2 /l , : 2 /l ,	: 1 , 15 /l , : 1 : : 3 /l , : 2 /l , : 2 /l ,	
Tslope *		: 0.0 , 2.0 , : 0.1 , : 0.2 ,	: 0.0 , 2.0 , : 0.1 , : 0.2 ,	: 0.0 , 2.0 , : 0.1 , : 0.2 ,	: 0.0 , 2.0 , : 0.1 , : 0.2 ,	
PS		: :		: :		
Bypass						: :
Alarm						: :
Apnea Ti					: 0.2 , 5.0 , : 0.1 , : 5.0 , ( ) 3.0 , (,) 2.0 , ( )	

*** The Tslope setting is an approximation. The exact waveform shape may not be realized under certain clinical scenarios.**

C.8 Linked Ventilation Parameter

The table below lists how parameter values are affected when changing ventilation modes. For example, ventilation modes that share the same parameters may also share the same parameter values when changing from one ventilation mode to the other. Other parameters may have their values set differently when changing ventilation modes.

CURRENT VENTILATION MODE & PARAMETERS AFFECTED		PREVIOUS VENTILATION MODE				
		VCV	SIMV-VC	PCV	SIMV-PC	PS
VCV	Vt		*	L	*	*
	Rate		*	*	*	*
	I:E		*	*	*	*
	Tpause		*	*	*	*
	PEEP		*	*	*	*
	Plimit		*	*	*	*
SIMV-VC	Vt	*		L	*	*
	Rate	*		*	*	*
	Tinsp	*		*	*	*
	Tpause	*		*	*	*
	PEEP	*		*	*	*
	Plimit	*		*	*	*
	PS	*		*	*	
	ΔP	*		*	*	*
	Trigger	*		*	*	*
	Tslope	*		*	*	*
PCV	VtG	*	*		*	*
	Pinsp		*		*	*
	Rate	*	*		*	*
	I:E	*	*		*	*
	PEEP	*	*		*	*
	PlimVG	F	F	F	F	F
	Tslope	*	*		*	*

* *The parameter value is shared between the previous and current ventilation modes.*

CURRENT VENTILATION MODE & PARAMETERS AFFECTED		PREVIOUS VENTILATION MODE				
		VCV	SIMV-VC	PCV	SIMV-PC	PS
SIMV-PC***	Pinsp	80%	*	*		*
	Rate	*	*	*		*
	Tinsp	*	*	*		*
	PS	*	*	*		
	ΔP	*	*	*		*
	Trigger	*	*	*		*
	PEEP	*	*	*		*
	Tslope	*	*	*		*
PS	Min Rate	*	*	*	*	
	ΔP	*	*	*	*	
	Trigger	*	*	*	*	
	Peep	*	*	*	*	
	Tslope	*	*	*	*	
	Apnea Ti	*	*	*	*	

* *The parameter value is shared between the previous and current ventilation modes.*

C.9 Ventilation Parameter Relationships

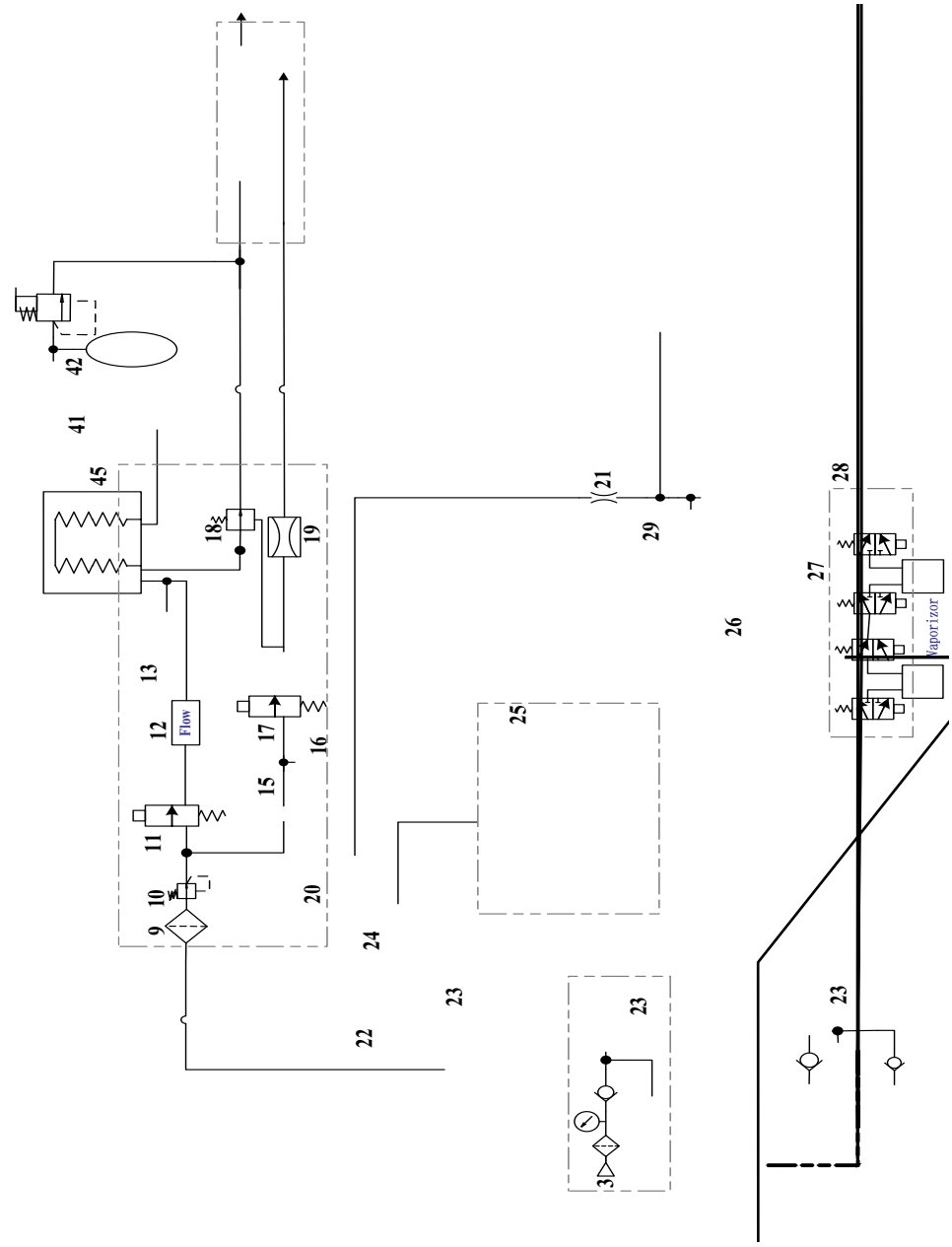
VENTILATION MODE	Parameter	Parameter Relationship Equation (s)
VCV		$Rate \le 300 \times \frac{I:E}{1+I:E}$ $Rate \le 150 \times \frac{1}{1+I:E}$ 4 100
		$Vt \le 1833 \times \frac{60 \times \left(\frac{I:E}{1+I:E}\right) * (1-TP)}{Rate}$ $Vt \ge 20 \times \frac{60 \times \left(\frac{I:E}{1+I:E}\right)(1-TP)}{Rate}$ 20 1500
		+5 10 100
SIMV-VC		$Rate \le \frac{60}{Tinsp + 0.4}$ 4 100
		$20 \times Tinsp(1-TP) \le Vt \le 1833 \times Tinsp(1-TP)$ 20 1500
		3 50
		+5 10 100

VENTILATION MODE	Parameter	Parameter Relationship Equation (s)
PCV		$Rate \le 300 \times \frac{I:E}{1+I:E}$ $Rate \le 150 \times \frac{1}{1+I:E}$ 4 100
	F	F $VtG \le 1833 \times \frac{60 \times \left(\frac{I:E}{1+I:E}\right)}{Rate}$ 20 1500
		+5 5 70
	F	F +5 5 F 100
SIMV-PC		4 100
		+5 5 70

NOTE: **Even when the PlimVG, Pinsp, or ΔP parameters are inactive, they are restricted to the parameter relationship equations.**

Pneumatic Diagram of the A5 System.....D-2

D.1 Pneumatic Diagram of the A5 System



NO.	DESCRIPTION	NO.	DESCRIPTION
1.		33.	
2.		34.	
3.		35.	
4.		36.	
5.		37.	
6.		38.	
7.		39.	
8.		40.	
9.		41.	
10.		42.	
11.		43.	
12.		44.	
13.		45.	
14.		46.	
15.		47.	
16.		48.	
17.		49.	
18.		50.	
19.		51.	
20.		52.	
21.		53.	
22.		54.	
23.		55.	
24.		56.	
25.		57.	
26.		58.	
27.		59.	
28.		60.	
29.		61.	
30.		62.	
31.		63.	
32.		64.	

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.0 A S N M

Abbreviations, Symbols, and Units of Measure E-2

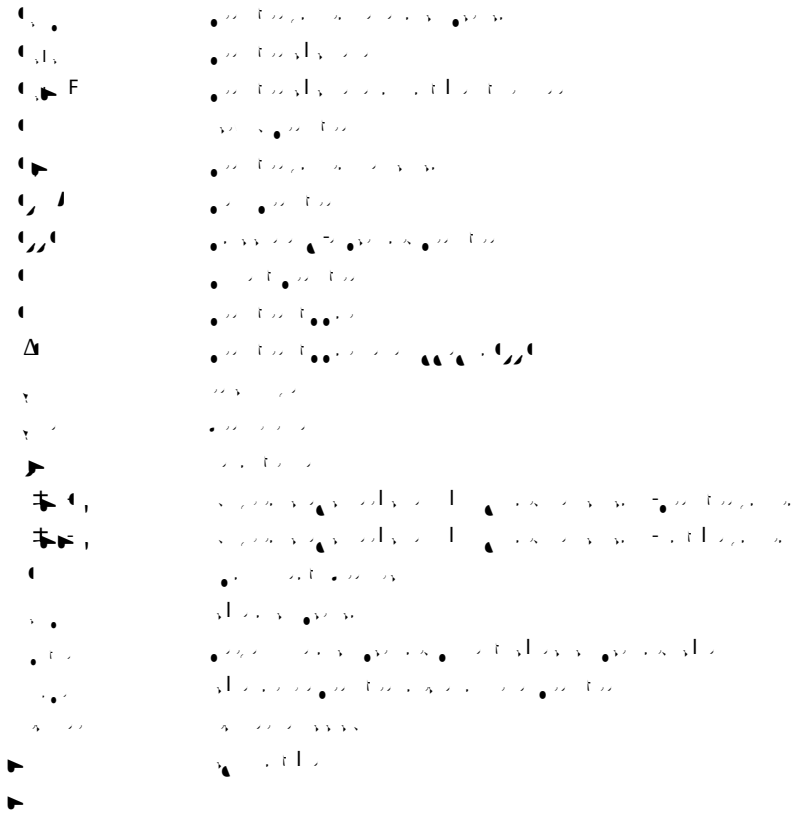
Symbols E-4

Units of Measure E-5

Attention Symbols E-6

E.1 Abbreviations

ABBREVIATION	DESCRIPTION
F	
F	
2	
2	
2	
2	
TH	
2	



E.2 Symbols

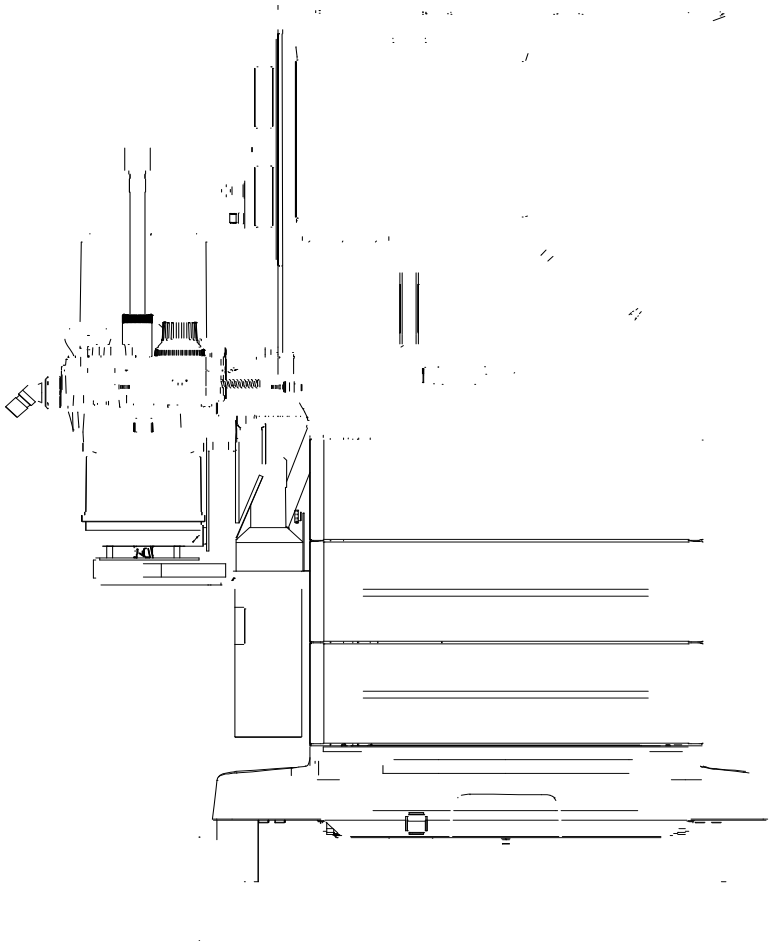
SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
-		>	
%			
/			
+			
=			
<			

E.3 Units of Measure

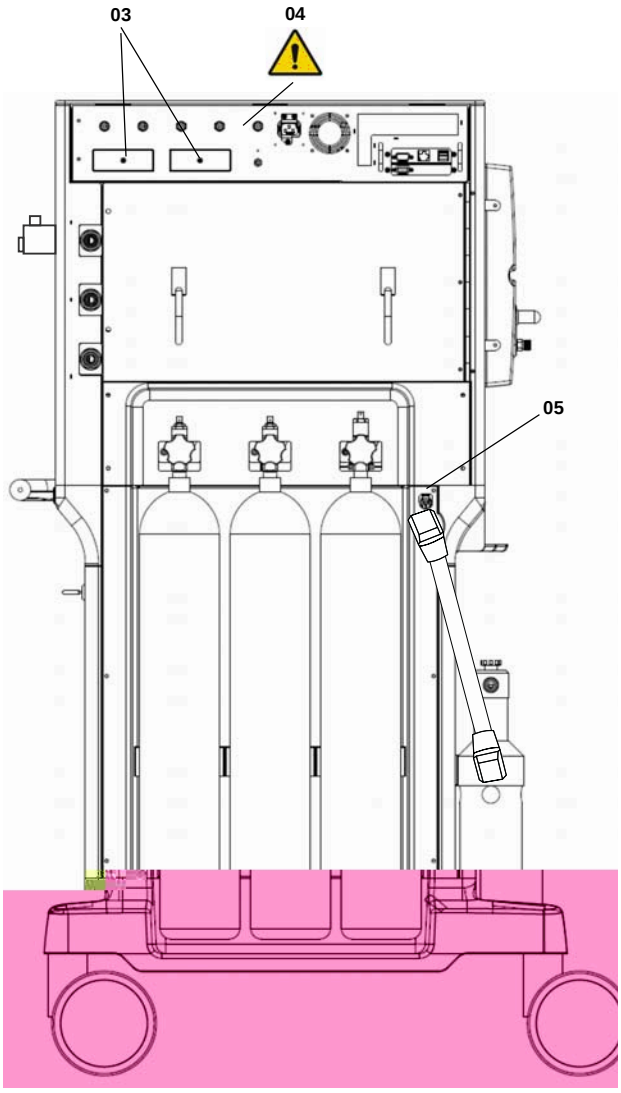
UNIT OF MEASURE	DESCRIPTION	UNIT OF MEASURE	DESCRIPTION

E.4 Attention Symbols

The following figures provide descriptions of symbols of Attention that are used on the device and/or within this manual.

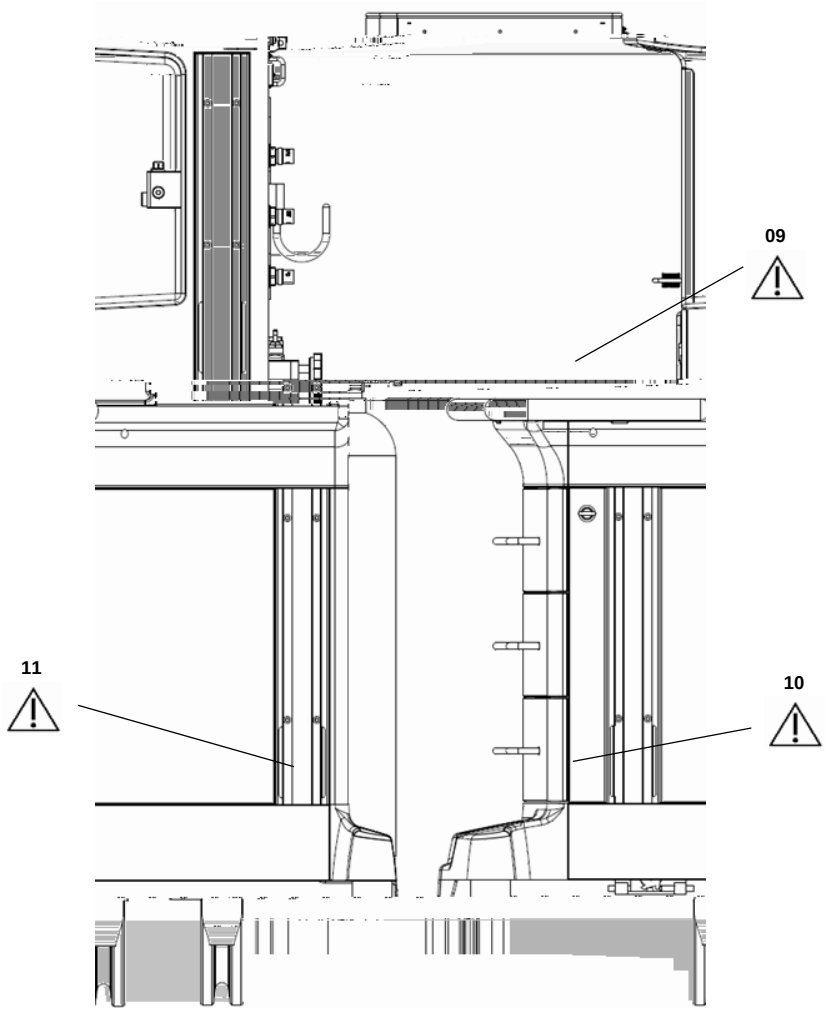


ATTENTION! NUMBER	DESCRIPTION
01	[illegible]
02	[illegible]



L T (

ATTENTION! NUMBER	DESCRIPTION
03	100 . 120 , @60_ .
04	3 . . 10 .
05	F . L F .



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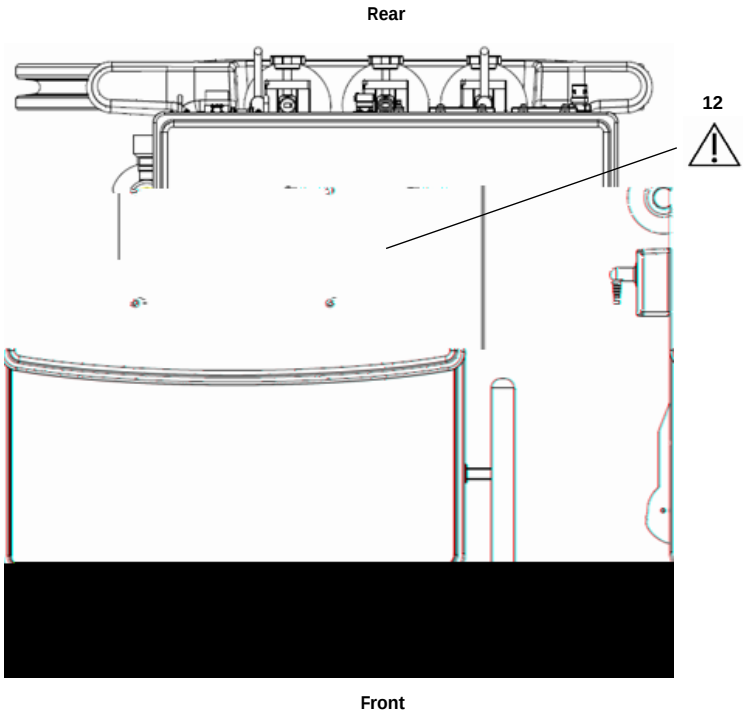

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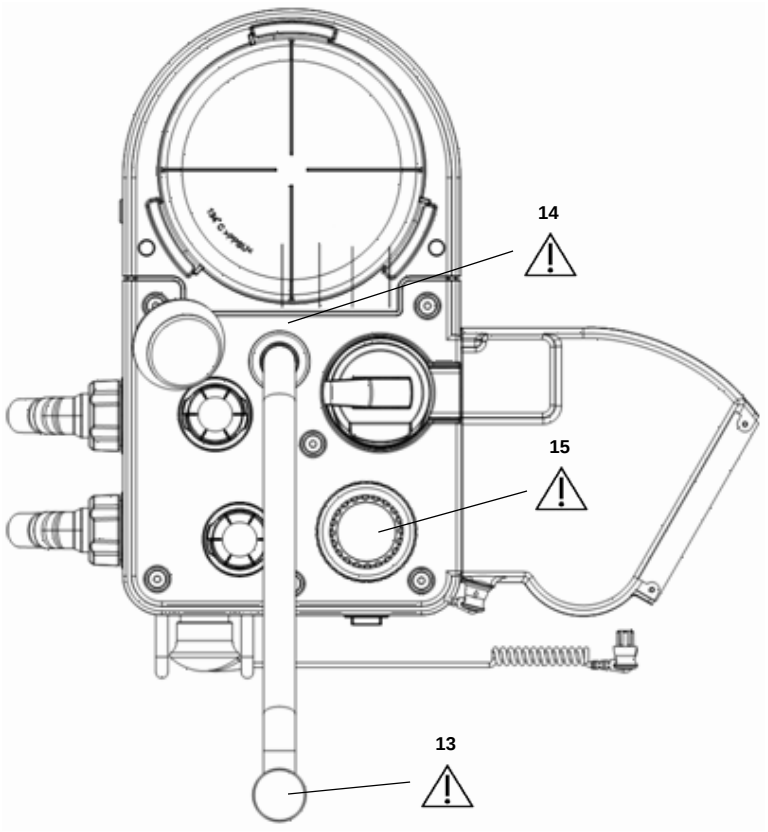

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14	[illegible] 134, [illegible] T).
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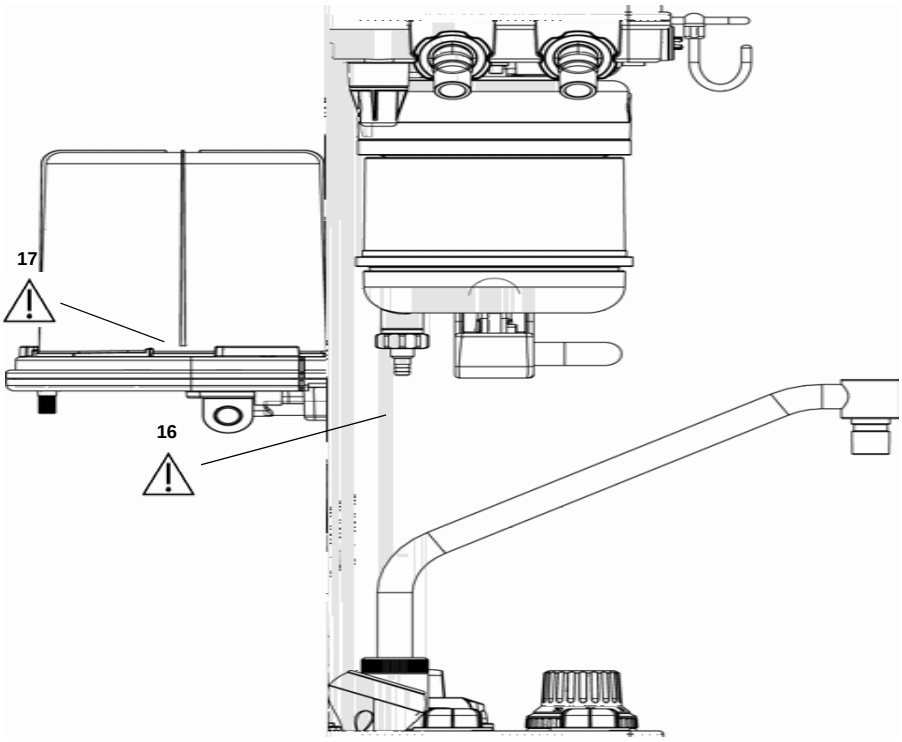

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17	: 300. 1500.))

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Malignant Hyperthermia Causes, Effects and Treatment F-2

Malignant Hyperthermia Washout F-2

Washout Procedure for Malignant Hyperthermia Susceptible Patients with A5 Anesthesia Delivery Systems F-2

References F-4

F.1 Malignant Hyperthermia Causes, Effects and Treatment

Malignant Hyperthermia (MH) is an uncommon inherited, life-threatening pharmacokinetic skeletal muscle disorder involving the dysregulated myoplasmic Ca^{2+}, hypercontracture, and hypermetabolism. Triggering factors include exposure to potent volatile anesthetic gases and depolarizing muscle relaxants.[1-4]

The disorder is characterized by skeletal muscle hypermetabolism, which is related to an uncontrolled release of calcium from skeletal muscle sarcoplasmic reticulum. These results in increased carbon dioxide production, increased core temperature, and generalized muscle rigidity with resultant rhabdomyolysis, acidosis, and hyperkalemia. If untreated, MH may lead to cardiac arrhythmia, multiorgan system failure, and death.[2,3]

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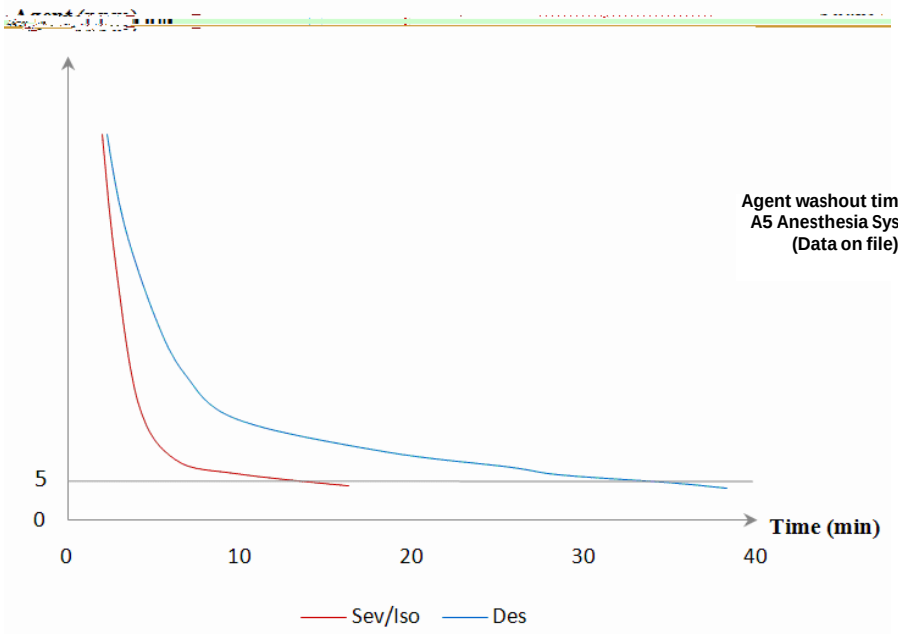
Agent washout time with
A5 Anesthesia Systems
(Data on file)
5
0
0
10
20
30
40
Time (min)
Sev/Iso
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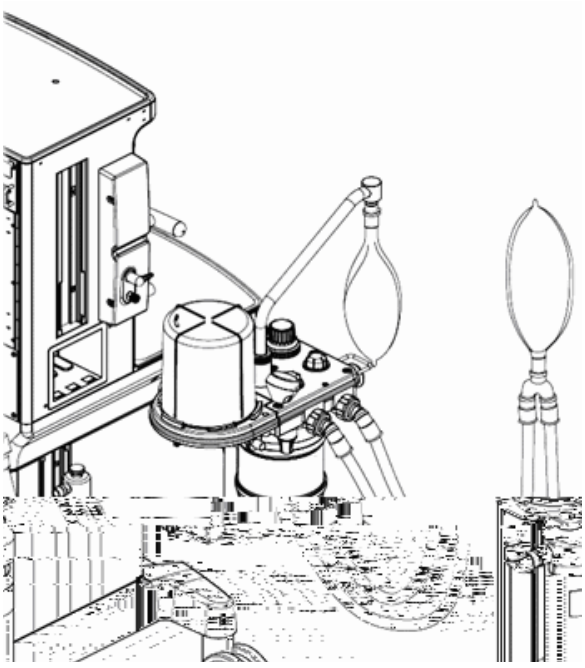

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The following guidelines are recommended by the Malignant Hyperthermia Association of the United States (MHAUS)*

Preparation of Anesthesia Workstations to Anesthetize MH Susceptible Patients

Recommendations (4 alternatives):

1. Flush and prepare workstation according to manufacturer's recommendations or published studies; this may take 10 to >90 minutes. Most studies also physically disconnect vaporizers from the workstation; use a new, disposable breathing circuit; and replace the carbon dioxide absorbent. During the case, fresh gas flow should be kept at 10 liters per minute to avoid "rebound phenomenon" (increased release of residual volatile anesthetic agent when fresh gas flow is reduced after a set period of flushing). or
2. Use commercially available charcoal filters that have been shown to remove trace levels of volatile anesthetic agents within 10 minutes of application, without additional preparation. These filters may have to be regularly replaced during the anesthetic.++ or
3. If available, use a dedicated "vapor free" machine for MH-susceptible patients. The machine must be regularly maintained and safety-checked. or
4. If appropriate to the institution, use an ICU ventilator that has never been exposed to volatile anesthetic agents.

For further information contact the Malignant Hyperthermia Association of the United States at http://www.mhaus.org/

*: Guidelines are excerpted from the MHAUS website and do not replace the indicated instructions for preparation of the A5.

++: This method has not been tested with A5.

F.4 References

1. Hopkins PM. Malignant hyperthermia: pharmacology of triggering. Br J Anaesth. 2011 Jul; 107 (1): 48-56.
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