Model AA-2005
Anesthetic Agent
Analyzer
Operator's Manual

NOT FOR CLINICAL USE

BC Biomedical
A UNIT OF BC GROUP INTERNATIONAL, INC.

CE 0413

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Warranty

Workmanship & Materials

BC Biomedical warranties new equipment to be free from defects in workmanship and materials for a period of 24 months from date of shipment under normal use and service. The O_2 sensor carries a six month warranty. BC Biomedical's obligation under this warranty is limited to repairing or replacing, at BC Biomedical's option, any part which upon BC Biomedical's examination proves defective.

EXCEPT AS DESCRIBED IN THE PARAGRAPH ABOVE, BC GROUP INTERNATIONAL MAKES NO WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Exemptions

BC Biomedical's obligation or liability under this warranty does not include any transportation or other charges or liability for direct, indirect or consequential damages or delay resulting from the improper use or application of the product or the substitution upon it of parts or accessories not approved by BC Biomedical or repair by anyone other than a BC Biomedical authorized representative.

This warranty shall not extend to any instrument which has been subjected to misuse, negligence or accident; any instrument from which BC Biomedical's original serial number tag or product identification markings have been altered or removed; or any product of any other manufacturer.

Safety, Reliability & Performance

BC Biomedical is not responsible for the effects on safety, reliability and performance of the Model AA-2005 if: assembly operations, extensions, readjustments, modifications or repairs are carried out by persons other than those authorized by BC Biomedical, or

the Model AA-2005 is not used in accordance with the instructions for use, or

the electrical installation of the relevant room does not comply with NFPA 70: National Electric Code or NFPA 99: Standard for Health Care Facilities (Outside the United States, the relevant room must comply with all electrical installation regulations mandated by the local and regional bodies of government).

In Case of Emergency Contact

BC Group International, Inc.
3081 Elm Point Industrial Dr.
St. Charles, MO 63301-4333
USA

Telephone: (314) 638-3800
Toll Free: (800) 223-6763
Fax: (314) 638-3200

Internet: www.bcgroupintl.com

Service Return Policy

Return Procedure

Contact BC Group International's customer service department for details on returning equipment.

Incoming Inspection

The following incoming inspection is required whether it is a first time arrival or a return from service. Prior to clinical use, the instrument should be inspected for the following.

1. The quality inspection seal on the instrument should be unbroken. This seal indicates that the instrument has been tested according to manufacturers specifications.
2. No physical damage is observed.
3. The instrument's battery is to be charged by connecting the instrument to a power outlet for a minimum of 3 hours prior to clinical use.
4. When connecting the instrument to a power outlet and then turning the instrument on, all displays appear to function correctly and no system errors occur.

If a discrepancy to these inspection items is observed, do not use the instrument and immediately report the discrepancy to the BC Biomedical.

EC Declaration of Conformity

The Model AA-2005 Anesthetic Agent Analyzer is manufactured exclusively for BC Group International by Criticare Systems, Inc. All correspondence and ordering of the Model AA-2005 and its accessories must be directed to BC Group International.

Criticare Systems, Inc.
N7 W22025 Johnson Drive
Waukesha, WI 53186-1856

Representative in the European Union

MDSS GmbH
Schiffgraben 41
30175 Hannover
Germany

Section 1 — Introduction

Description

The Model AA-2005 anesthetic agent analyzer measures real time concentrations of anesthetic agent gases. The device measures gases using a sidestream method. The primary module measures concentrations of CO_2, N_2O, and five halogenated anesthetic agents. The device can also measure oxygen concentrations using a galvanic cell.

Intended Use

The Model AA-2005 is a service tool for checking vaporizer output concentrations. The Model AA-2005 is intended to measure concentrations of Halothane, Enflurane, Isoflurane, Sevoflurane, and Desflurane to verify vaporizer output concentrations.

THIS DEVICE IS NOT INTENDED FOR CLINICAL USE.

Model AA-2005 Features

The Model AA-2005 comes standard with five agent gas analysis, CO_2, N_2O, and O_2 monitoring. A color TFT screen with a three waveform display is standard.

Integrated CO_2 and Agent Gas Detector

The primary hardware module of the AA-2005 is an integrated CO_2/agent detector (bench). The integrated detector measures carbon dioxide (CO_2), nitrous oxide (N_2O), and five halogenated anesthetic agent gases using the same sample collection path and testing apparatus. The analyzer uses proprietary High IQ™ technology to identify and quantify agent gases. There are no moving parts, reducing size of the detector and enhancing reliability.

The AA-2005 uses the sidestream method of measuring CO_2 and anesthetic agent gases. Gas is drawn through an endotracheal adapter. The gas sample enters the monitor from a sampling tube into a water trap, which removes water vapor and particulate matter from the gas sample. The gas then enters the CO_2 (agent) detector where it is analyzed.

Capnometry (Measurement of CO_2)

The anesthetic agent analyzer measures CO_2 concentrations and sends data suitable for continuous waveform display. The AA-2005 also detects end-tidal and fractional Inspired CO_2 levels, sending the data to the monitor where it is displayed numerically. End-tidal CO_2 ($ETCO_2$) is defined as the maximum CO_2 concentration at the end of expiration. The monitor measures the CO_2 concentration and the monitor displays the numerical value. The $ETCO_2$ value is updated continuously with each breath cycle. The amount of CO_2 in the gas mixture inhaled by the patient is the fractional Inspired CO_2 ($FICO_2$).

The monitor measures CO_2 using the principles of infrared absorption spectrometry. An unknown concentration of gas (CO_2) is calculated by comparing its absorption of infrared light to that of a known standard. The absorption of light is directly related to the concentration of the gas. As infrared light passes through the sample gas chamber, the light transmitted is converted to a voltage signal. The monitor converts the voltage into CO_2 concentration data that can be expressed numerically or as waveforms by the monitor. The Beer's Law calculation is performed by the software of the Model AA-2005 service tool.

Infrared analysis of the gas samples is done using Beer's Law. The formula for Beer's Law is as follows:

$$I = I_0 e^{-\varepsilon(\lambda)cd}$$

- I Infrared value of measured sample.
- I_0 Infrared value of light source.
- e Exponential function.
- $\varepsilon(\lambda)$ Extinction coefficient.
- c Concentration of the gas sample
- d Distance measured through the sample

Agent Gas Measurement

The agent detector samples gas through a sidestream circuit. It measures the concentrations of CO_2, N_2O, and halogenated anesthetic agents in the sampled gas. The detector uses far-infrared measurements to identify concentrations of Halothane, Enflurane, Isoflurane, Sevoflurane, and Desflurane anesthetic agents and their mixtures.

The Model AA-2005 uses the principles of infrared absorption spectrometry to measure anesthetic gases in the same manner as explained for CO_2 measurement. The integrated detector determines the concentrations of anesthetic gases and CO_2 by measuring the optical absorption of the sampled patient gas at a number of specific wavelengths in the medium to long-wave infrared region.

Conditions of Use

This device has been calibrated with dry NIST-traceable calibration gases at room temperature and pressure (~ 21C, 740 mmHg). Given the small effect of water vapor on agent gas and CO_2 measurements and the system's built-in temperature and pressure measurements and compensations, this method of gas analysis per EN 864 is best described as ATPS (Ambient Temperature and Pressure, Saturated; 21C, 750mmHg, 100% Humidity Saturated).

The Model AA-2005 is suitable for sustained pressure (breathing circuit) monitoring environments and has been tested per Clause 102 (Sustained Pressure) of EN 864.

Stability of Accuracy

This device has an internal barometer and thermistor that allow compensation for changes over a range of temperature and atmospheric pressures. This device complies with EN 864 and EN12598 standards for cyclical pressure.

Agent Accuracy of Measurement

The accuracy of a single agent measurement is defined by the formula,

$$m - (0.04m + 0.1) \leq x \leq m + (0.04m + 0.1)$$

where "**m**" is equal to the measurement in percent and "**x**" is the tolerance range.

Example of 5% HAL measurement, calculating the high limit of the tolerance range.

$(5\%\ \text{HAL} \times 0.04_{\text{Reading}}) + 0.1\%_{\text{Absolute}} = 0.3\%$

$5\%\ \text{HAL} + 0.3\%_{\text{Tolerance}} = 5.3\%$

Final tolerance range is 4.7% to 5.3% HAL.

Measuring Oxygen (O_2)

The Model AA-2005 analyzer uses the sidestream method of measuring O_2. The gas is sampled from the same gas intake system used in CO_2 monitoring. The water trap removes moisture and particulate matter from the gas samples.

Method

The gas sample is measured using a reactive oxygen cell. The oxygen sensor is a galvanic electrochemical cell that works by a process known as “oxidation reduction.”

Oxygen from the air comes in contact with a highly reactive metal, reacts with the metal and produces a current. As the oxygen reacts, this reactive metal is gradually being used up. Once the metal is used up, the cell is depleted and can no longer sense oxygen.

The cell generates a voltage output proportional to the amount of oxygen in the sampled gas. This oxygen cell has an internal thermistor and circuitry that adjusts the output voltage based on the current temperature of the cell.

The voltage is read by the microprocessor and an O_2 measurement is generated using predictive circuitry. This predictive function enhances response time of the O_2 monitoring module.

The relationship between gas concentration and pressure is calculated by the microprocessor. The numerical value displayed by the monitor (O_2 Calculated) is generated using the following formula.

$$O_2\ \text{Calculated} = O_2\text{Measured} \times \frac{20.9}{O_2\text{Ambient}} \times \frac{P_C}{P_0}$$

The measured O_2 predictive value is multiplied by a fixed value derived from room pressure divided by room ambient oxygen levels. The measurement is further adjusted by multiplying the ratio of the pressure determined at calibration (P_C) with the current pressure (P_0).

There is a negligible effect on O_2 measurements due to humidity.

Conditions of Use

The O_2 function is appropriate for measuring respiratory O_2 concentrations in all patient populations. The O_2 monitor is suitable for use in breathing systems and with the use of inhalation anesthetic agents.

Stability of Accuracy

The oxygen cell contains temperature correction circuitry. The oxygen sensor temperature is maintained at a nominal 40° Celsius to maintain a consistent performance.

Specifications

Pneumatic System

Method:	Sidestream; non-dispersive infrared
Sample Line:	For use with 8 feet, PVC or PE
Occlusion Clearing:	Automatic, as needed
Sound Pressure of Pneumatics:	Automatic, as needed
Units (CO_2):	mmHg; Percent; kPa; Torr
Units (O_2, N_2O, Agents):	Volume Percent
Calibration:	Auto-calibrating, Manual Calibration (Automatic calibration: waveforms must be blanked for no more than 5 seconds.)
Flow rate:	100 ml/min, 150ml/min, or 200ml/min, User Selectable

Halogenated Agents

Resolution:	0.1 Volume Percent
Range:	Halothane; 0 to 10.0 vol. % Isoflurane; 0 to 10.0 vol. % Enflurane; 0 to 10.0 vol. % Desflurane; 0 to 20.0 vol. % Sevoflurane; 0 to 10.0 vol. %
Accuracy (Single Agent):	± (0.1% abs. + 4% of reading) for breath rates up to 60 breaths/minute
Identification Time for Single Agent:	<15 seconds @ 200 ml/min
Identification Threshold:	Halothane; 0.2 vol. % Isoflurane; 0.3 vol. % Enflurane; 0.3 vol. % Desflurane; 0.3 vol. % Sevoflurane; 0.3 vol. %
Mixed Gas Threshold:	0.2 vol. % + 10% of total concentration
Primary Agent Identification:	User Selectable or Automatic
Mixed Agent Identification:	Automatic (secondary agent)
Rise Time:	450 msec. for (10-90%) at 150 ml/min
Response Time:	2.5 seconds
Warm-up Time:	1 minute to first waveforms < 20 minutes to full accuracy
Auto Zeroing:	Occurs 30 to 60 minutes Duration 3.0 to 7.0 seconds
Display:	Primary agent inspired and expired numerical values, Numerical values for five agents, Primary agent waveform, Secondary (mixed) agent numerical values
Effect of Interfering Gases:	Ethyl alcohol: Negligible Metabolic ketones, Acetone: Negligible Carbon dioxide: Negligible Nitrous oxide: Negligible Helium: Negligible Ether: Contraindicated Cyclopropane: Contraindicated Methoxyflurane: Contraindicated

CO_2 Monitoring

Range:	0 to 99 mmHg, 0 to 12.5%, 0 to 12.5 kPa, 0 to 99 Torr
Display:	Inspired CO_2, Expired CO_2 (End-Tidal) Numerical values, capnogram, and breath by breath $ETCO_2$ bar graph.
Waveform Scale:	Selectable, percent only 0 to 3.13, 6.25, 12.5 or 25%
Resolution:	1 mmHg, 0.1%, 0.1 kPa, 1.0Torr
Accuracy:	± 2 % or 4% of reading for breath rates up to 60 breaths/minute
Flow Rate:	100, 150, 200 ml/min, user selectable

O2 Monitoring

Display:	Inspired O_2, expired O_2, Numerical values, Waveform
Method:	Oxidation-reduction galvanic cell
Range:	0-100%
Resolution:	1%
Accuracy:	± 3 vol% (0-90%), ± 4 vol% (91-99%) for breath rates up to 60 breaths/minute
System Response Time:	1.5 seconds
Rise Time:	(10-90%) 600 milliseconds @ 150 ml/min

N_2O Compensation

Range:	0 to 99 vol%
Resolution:	1%
Accuracy:	±(1.5% abs + 4% rel) for breath rates up to 60 breaths/minute
Identification Threshold:	5% (for single and mixed agents)
Response Time:	2.5 seconds
Rise Time:	(10-90%) 400 milliseconds
Display:	Numerical Inspired N_2O, Expired N_2O, N_2O Waveform

Respiratory Rate

Numeric Output:	Yes
Source:	Capnogram
Range:	1-100 breaths per minute
Accuracy:	±2 breaths per minute

Startup Times

To respiration and waveforms:	1 minute (±5 seconds)
To ET CO_2 waveforms:	1 minute (±5 seconds)
To agent concentrations:	<5 minutes, partial accuracy; 20 minutes full

Alarms

Characteristics:	EN 475, Adjustable
Indication:	Audible; Visual
Levels:	High, Medium, Low, Informational
Settings:	User Defaults, Hospital Defaults, Factory Defaults
Alarm Modes:	Adult/Pediatric/Neonate, High and low limit settings for each mode.
Volume:	User Adjustable (1-10)
Silence:	Yes; 2 minutes or permanent

Trend Reports

Types:	Tabular and Graphical
Trend memory:	24 hours
Tabular Intervals:	30 sec., 1, 2, 5,10, 30 min., 1, 2, 4 hrs. User Selectable
Graphical Span:	2, 4, 8, 12, or 24 hours
Data Types:	Resp., $ETCO_2$, $INCO_2$, Expired O_2, Inspired O_2, Expired N_2O, Inspired N_2O, 5 halogenated agents (Halothane, Isoflurane, Enflurane, Desflurane, and Sevoflurane)

Display

Screen:	5.5" active color TFT display area (internal display)
Resolution:	Internal Screen, 320 x 240 pixels External video output, 640 x 480 pixels
Waveforms:	3, maximum
Waveform Display Gain:	0.5×, 1×, 2×, 4× user selectable
Waveform Sweep Speed:	6.25, 12.5, 25 or 50 mm/sec, selectable
Languages:	English, French, German, Italian, Portuguese, Spanish

Controls

Keys:	7; membrane-activated
Rotary knob:	Push and rotate; 24 steps/turn

System Outputs

Com Ports:	Digital DB9 (COM 1); Mini-DIN8 (COM 2)
Analog Output:	mini-DIN8, Selectable waveform output
Video Port:	Serial VGA Compatible
Waveforms available:	CO_2, Agent, and N_2O

Mechanical/Electrical

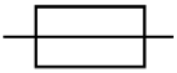
Weight:	13 lb; 5.9 kg
Size:	6.5” (H) x 11.0” (W) x 12.0” (D); 16.5 cm (H) x 27.9 cm (W) x 30.5 cm (D)
Mechanical Shock:	Negligible effect up to 40G
Vibration:	Negligible effect up to 0.5G at 200Hz
Voltage:	100 to 240VAC; 50/60 Hz
Number of Batteries:	One NiMH
Battery Life:	60 minutes, typical
Recharge time:	3.0 hours
Consumption:	40 Watts, typical

Environmental

Operating Temperature:	59° - 95°F, 15° - 35°C
Storage Temperature:	23° - 122°F, -5° - 50°C
Operating and Storage Humidity:	15% to 90%; non-condensing
Type of Protection:	Class I Equipment
Protection Degree:	Type CF, Defibrillator-Proof
Protection against ingress:	Ordinary

All specifications are subject to change without notice.

Symbols

Symbol	Definition
	Refer to Operator's Manual for Information
	European Community Mark
	Electrical Testing Laboratories (ETL) Mark
	Do not dispose of in municipal waste. Wheeled bin symbol indicates separate collection for electrical and electronic equipment. (WEEE Directive 2002/96/EEC)
	Not For Use with Flammable Anesthetic Gasses
	Type CF Equipment, defib proof
	Shock Hazard
	Fuse
	Alternating Current (AC)
	Communication port
	Video Out
	Technical Support Phone Number

Definitions for Warning and Caution symbols:

⚠WARNING⚠ Designates a possible dangerous situation. Non-observance may lead to death or the most severe injuries.

⚠CAUTION⚠ Designates a possible dangerous situation. Non-observance may lead to minor injuries or damage to the product.

Safety

⚠WARNING⚠

- Read this manual entirely before attempting clinical use of this device.
- A possible explosion hazard exists! Do not use the in the presence of flammable anesthetics.
- Cables, cords, and leadwires may present a risk of entanglement or strangulation! Verify safe and proper positioning of these items after patient application.
- Unapproved modifications to the device may cause unexpected results and present a hazard to patients.
- Risk of electrical shock! Do not remove cover. Refer servicing to qualified personnel.

⚠CAUTION⚠

- Use the anesthetic agent analyzer only with recommended accessories! Use of unapproved accessories may cause inaccurate readings.
- Equipment accuracy may be affected at extreme temperatures.
- Do not store equipment at extreme temperature. Temperatures exceeding specified storage temperatures could damage the system.
- Do not press on the keys with surgical instruments or other tools. Sharp or hard objects could damage the keys. Use only your fingertips to press on the keys.
- Changes or modifications not expressly approved by the manufacturer, may void the user's authority to operate the equipment and may also void the warranty.

Leakage Current

This device complies with leakage current limits required by medical safety standards for patient-connected devices. Standards include Underwriter's Laboratories (UL) 2601 and the International Electrotechnical Commission (IEC) 601-1, 2nd edition, 1988 Part 1. A hazard caused by the summation of leakage currents is possible, when several pieces of equipment are interconnected.

Voltage Fluctuations

When operated in the line voltage range specified in this manual any fluctuation will have a negligible effect. Very low line voltage will cause the device to revert to battery power. Very high line voltage may cause damage to the charger circuits. This device is designed with circuitry that will turn the unit off before spurious readings can be caused by a low battery condition.

Software Error Related Hazard Mediation

The manufacturer has quality control practices and procedures in place to review potential hazards as they relate to software. The device is Year 2000 Compliant and utilizes a four digit year for all date, time, and leap year calculations.

Potential Interference

This device has been successfully tested to IEC 601-1-2 specified levels for emissions of and resistance to electromagnetic energy fields. External disturbances which exceed these levels may cause operational issues with this device. Other devices which are sensitive to a lower level of emissions than those allowed by IEC 601-1-2 may experience operational issues when used in proximity to this device.

MAGNETIC FIELDS

Use of this device in an MRI environment may interfere with MRI image quality. Use of MRI may interfere with the analyzer.

RADIO FREQUENCY INTERFERENCE

This device conforms with IEC 1000-4-3 for radio frequency interference, and will operate with negligible adverse effects.

CONDUCTED TRANSIENTS

This device conforms with IEC 1000-4-4, and IEC 1000-4-5 for conducted transients, and will operate with negligible adverse effects.

X-RAY

This device will operate with negligible adverse effects in an x-ray environment. However, the device should not be placed directly in the x-ray beam, which could damage the internal electronics.

OTHER INTERFERENCE

There is a negligible adverse effect to this device from electrocautery and electrosurgery, infrared energy, and defibrillation.

Use of Anesthetics

Do not use this device in conjunction with flammable anesthetics such as cyclopropane and ether. The Model AA-2005 can sample from pure oxygen environments, but the analyzer itself should never be placed inside an oxygen tent or gas containment apparatus. Proper anesthetic gas waste recovery should be used.

Biocompatibility

All patient-contact or user-contact materials in this device and it's accessories have passed ISO 10993-5, -10, & -11 biocompatibility tests or have been in use in clinical environments in large numbers over an extended period of time predating these standards.

Latex Content

This device and its accessories are free from latex in any location that may result in patient contact.

Section 2 — Controls and Connections

This section provides an overview of the Model AA-2005 anesthetic agent analyzer. The control panels, switches, accessory connections, and communication ports for the Model AA-2005 are described.

Model AA-2005 Anesthetic Agent Analyzer

The Model AA-2005 is an external stand-alone gas sampling device. Sampling for the tool is conducted through its own sampling port located on the front panel. The gas intake manifold is designed to accept WaterChek™ water traps.

The Model AA-2005 is an AC-powered device. A green LED, located on the upper right side of the front panel by the ON/OFF key, indicates that the monitor module is receiving AC power.

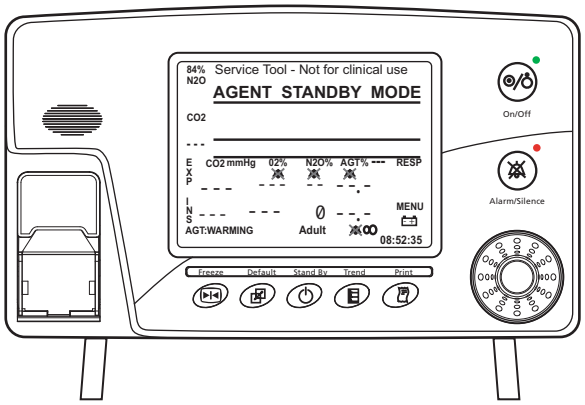


Figure 2-1: Front Panel

An exhaust port is located on the rear panel. An ambient air intake port (located next the exhaust port) is used for making zero gas concentration calibrations. Do not block or attach anything to the air intake port.

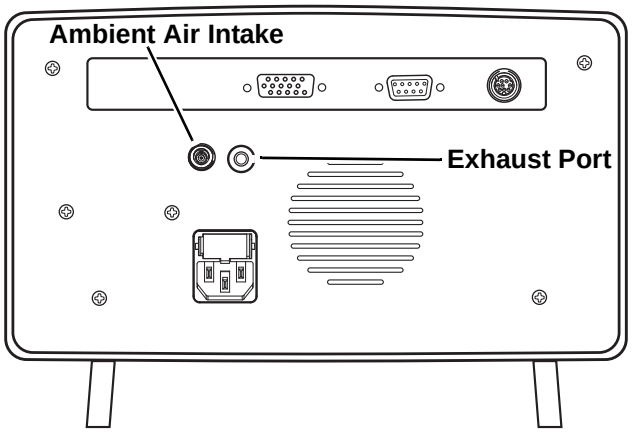


Figure 2-2: Rear Panel

Model AA-2005 Controls and Displays

The front panel of the Model AA-2005 features a color flat-screen display. Located below the screen is the control panel, equipped with dedicated five function keys and a menu knob. To the right of the flat-screen display is the ON/OFF key and the ALARM SILENCE key. The main menu is displayed on the screen and can be selected by using the menu knob on the lower right corner. The keypad is push-button style, composed of a touch-sensitive membrane.

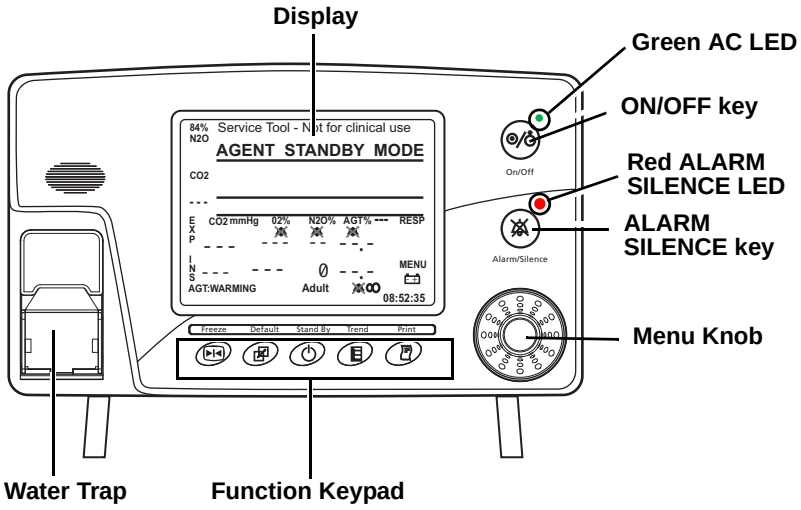


Figure 2-3: Front Controls

A removable water trap and the gas sampling connection are located on the front of the monitor. This connection is supplied for use with an internal capnometer.

A green LED indicator is located above the ON/OFF (power) key. The indicator is on if AC (mains) power is connected.

Keypad

There are seven keypad buttons, including the ON/OFF key, located on the front panel. Some of the keys have two functions. The primary function is activated with a momentary press of the key. A secondary function, if present, is activated when the key is pressed and held for two seconds.

An audible beep notifies the user that a primary function has been activated. A double beep notifies the user that a secondary function has been selected by pressing and holding the key.

	Key	Function
	On/Off	Power button. Press to activate the agent gas monitor and press and hold to turn the agent gas monitor off.
	Alarm Silence	Press this key momentarily to begin a two minute alarm silence. The red LED to the upper right of the ALARM SILENCE key illuminates. Press and hold the key to permanently silence the alarms. The red LED to the upper right of the ALARM SILENCE key flashes. Press the key again, a second time, to resume normal alarms.
	Freeze	Freezes all waveforms on the screen. Numerical parameters continue to be updated. Press the key again to resume continuous waveform display.
	Default	Press this key momentarily to return to hospital defaults. Press and hold the key to enter the password-protected default menu.
	Standby	Press this key momentarily to enter standby mode. Press the key again to confirm exit of the standby menu. The ALARM SILENCE LED flashes and the permanent alarm silence icon displays.
	Trend	Displays the trend table when pressed momentarily. Press the key to exit the trend window. While the trend table is displayed, press and hold to access the trend settings menu.
	Print	Press this key to begin printing or serial output. Press the key again to stop printing. **NOTE:** The Model AA-2005 does not have an internal printer. The device must be connected to an external printer to print data.

Menu Knob

The knob can be turned left or right to make selections from any of the menus that appear on the front display. The selected menu option can then be activated by pressing in on the knob.

Color Display

The display is a 5.9-inch color, active TFT screen. The display provides real-time waveform data and numerical data of the measured gas parameters. The display screen also provides main-screen menu options that are selected and activated by the menu knob. Additional menus that appear on the display screen are also selectable with the menu knob.

Water Trap and Gas Sampling Connection

The water trap is accessed on the front of the monitor. The gas sampling connection is made at the connector extending from the water trap. The internal gas sampling connector is used for both the CO_2 and the O_2 sampling attachments. The fitting is a standard Luer style connector.

Side View

The Model AA-2005 features a handle for ease of transport.

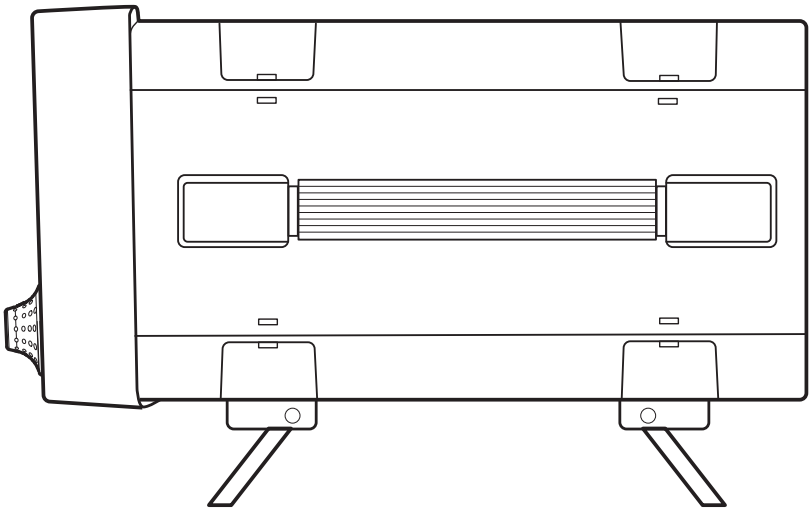


Figure 2-4: Side View

Rear Panel

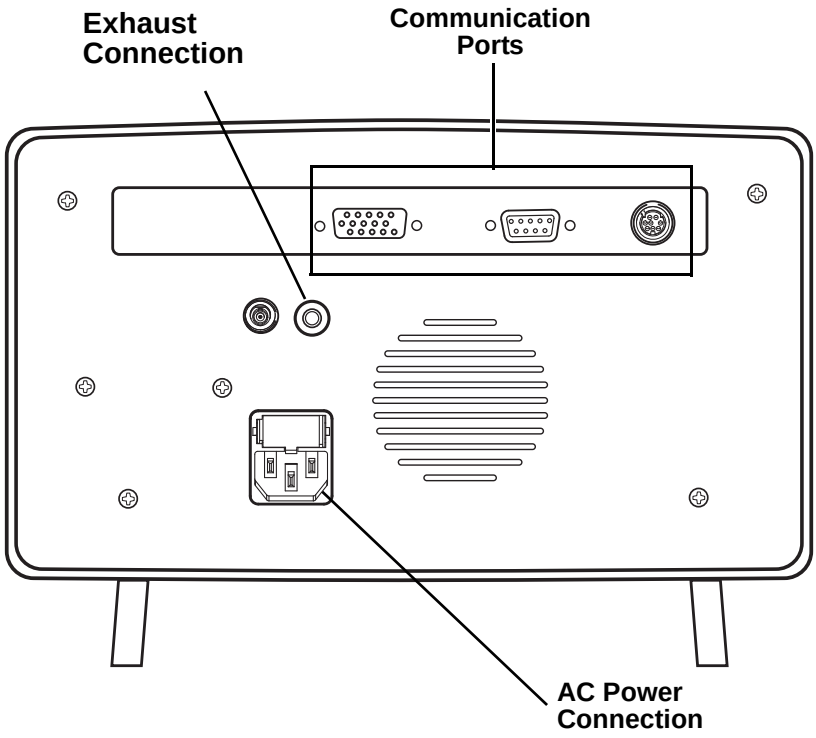


Figure 2-5: Rear View

Communication Ports

There are three communications ports available along the back of the device. The ports provide communication links to external printers, computers and external displays.

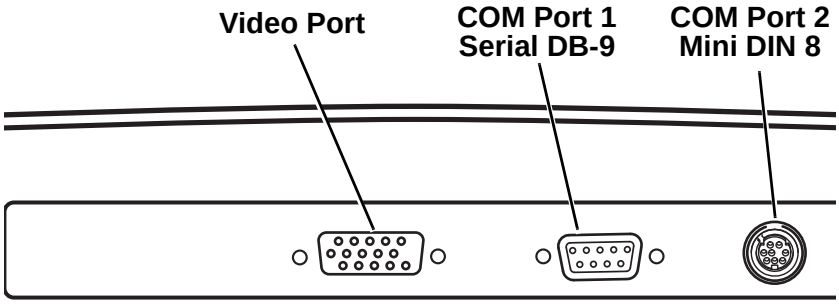


Figure 2-6: Communications Ports

Screen Display and Interface

The display is divided into several areas that are dedicated to different types of data and interface functions. The top half of the display contains three slots for continuos waveform data. The waveforms are user selectable and can be custom configured. The *AGENT STANDBY MODE* message displays in the top waveform slot when the unit is first powered up or the STANDBY key is pressed. Priority messages display at the appropriate waveform.

The lower half of the display provides space for the reporting of physical parameter data in numerical form.

Each parameter has a selectable color for the parameter numerical data that matches the color of the waveform displayed in the slots.

The bottom portion of the display has space dedicated to the following message types and functions.

- Information messages
- Patient size
- System status
- The alarm silence icon
- Current time

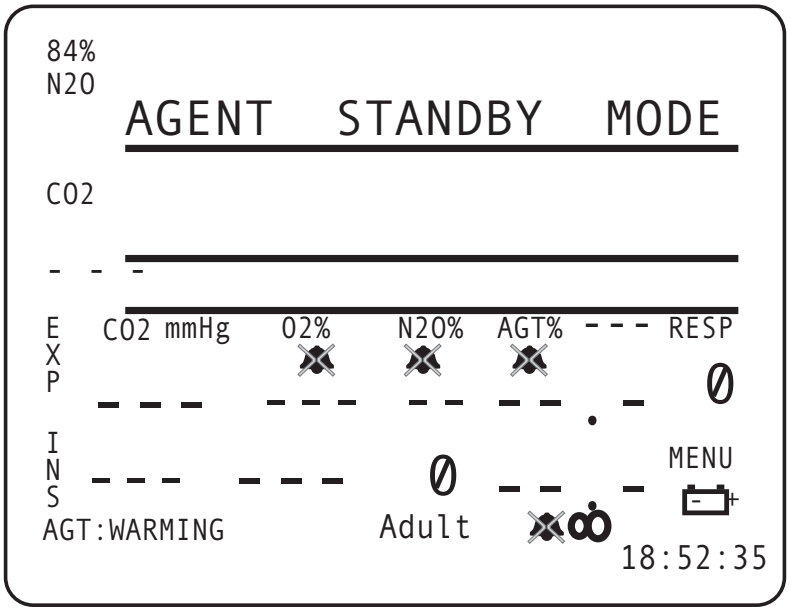


Figure 2-7: Screen Diagram

Waveforms

The waveform area is located in the top half of the display. The monitor can display up to three waveforms simultaneously. Waveform configurations are described in “Setup Procedure” in Section 3.

PRIMARY AGENT WAVEFORM
The primary agent waveform is displayed in the same units selected for displaying the primary agent numerical data. The waveform is auto-ranging within the slot. This waveform can be generated only from the device’s agent detector data. Secondary agents are not displayed as waveforms.

When the *Agt to Monitor* is set to a selected agent (manual mode), the abbreviation for that agent appears with the waveform and the numerical values. If *Auto* is chosen for *Agt to Monitor*, the monitor displays the abbreviation for the primary gas it detects at the waveform and with the numerical values. If the unit detects no agent, *AGT* appears in the waveform slot and a dashed line appears with the numerical value.

CAPNOGRAM
The CO_2 waveform, capnogram, is displayed in percent units.This waveform is generated from the infrared photo-detector of the agent detector. The maximum range of the capnogram is 12.5%.

BREATH BY BREATH BAR GRAPH (B×B)
The label “B×B” appears at the beginning of the graph. The user may select the CO_2 data to be displayed as a breath by breath bar graph. The breath by breath data is always displayed in percent. The maximum range of the capnometer bar graph is 12.5%.

OXYGEN WAVEFORM
The maximum range of the oxygen waveform is 100%. The units are always in percent. The waveform is auto-ranging within the slot.

NITROUS OXIDE (N_2O)
The N_2O waveform is derived from the agent detector. The source of the waveform and color matches the source for N_2O numerical values. The respiration waveform is auto-ranging within the waveform slot.

NOTE: The source of the respiration numerical value and the respiration waveform can be from independent sources.

Numerical Parameter Slots

The parameter slots are below the waveform area. The slots remain in this order from left to right: *CO2*, *O2*, *N2O*, *AGT*, and *RESP*.

A bell icon may appear in a numerical parameter box indicating an alarm limit is set to off. The bell icon is red with a white “X” indicating that no audible alarm will sound.

The CO_2 numerical parameters slot displays data generated from the agent detector. A bell icon displays to indicate that a CO_2 alarm limit is set to off.

The label “Mixed” appears before secondary agent concentrations listed at the bottom of the display. The abbreviated name of the secondary agent is located after the “Mixed” label together with the expired (*E*) and inspired (*I*) values.

System Status

At the bottom of the display appear system status messages and icons. These include informational messages, patient size, icons for silenced alarms, battery status, secondary agents detected in the system, and system time.

Section 3 —Setup Procedure

Monitor Setup

This section provides an overview of the setup procedures for the Model AA-2005 anesthetic agent analyzer.

If the unit is new, preparations such as loading batteries should be performed.

Charging the Monitor

The rechargeable battery is a nickel metal hydride battery and is maintenance free. If the battery becomes defective, it should be replaced. Refer to the battery replacement procedure described in the Model AA-2005's service manual or contact the Service Department.

- Do not short circuit the battery terminals! The resulting high-current discharge can cause burns.
- Do not crack, cut, or burn the internal battery. Contact with battery contents can cause severe burns and eye damage.

Environmental hazard! When replacing the battery, dispose of the old battery in accordance with local and federal laws. Do not incinerate.

⚠WARNING⚠

- If the electrical integrity of the earth ground is in doubt, the power cord should be disconnected and the machine should be operated from its internal electrical power source.
- Explosion hazard. Keep lighted cigarettes, sparks, and flames away from the battery.
- The battery contains sulfuric acid electrolyte which can cause severe burns and eye damage, as well as illness from sulfur oxide fumes.
- Do not short circuit the battery terminals. The resulting high-current discharge can cause burns.

The device functions if plugged into AC (mains) power while batteries are completely drained. Do not leave defective batteries inside the monitor. The analyzer can also function without batteries, running on AC power only, but this is not recommended in a clinical setting.

Allow the batteries to charge to full strength before using. If the batteries are not fully charged before use, the batteries do not hold as much charge in the future. Insufficient charging also degrades the batteries.

System Start and Auto-calibration

Press the ON/OFF (power) key, located on the right side of the front control panel, to start the Model AA-2005.

- The informational message *AGENT ONLY* is briefly displays indicating that this device is for anesthetic agent analysis only.
- Audible alarms are suspended for each parameter until the first valid measurement has been taken for each parameter. Visual alerts are always active.
- The analyzer defaults to *AGENT STANDBY MODE* at power up. This disables all audible alarms so that setup can be done without annoying alarms. When ready, press the STANDBY key to remove the monitor from the standby mode.

The analyzer is composed of several technology modules that measure different physiologic parameters. Some modules such as the oximeter are ready for use within seconds of powering up. Agent analysis requires a short warm-up period but can monitor within minutes.

Numerical Gas Displays

Gas numerical parameter headers appear on start up. Adjustment of the display may be necessary to view the desired waveforms.

The numerical parameter slots are below the waveform area. The slots remain in this order from left to right: *CO2*, *O2*, *N2O*, *AGT*, and *RESP*.

Agent Alarm Standby Mode

The *AGENT STANDBY MODE* message appears in the top waveform slot in large red letters. The symbol for permanent alarm silence also appears at the bottom of the display.

The ALARM SILENCE key is not active during Agent Alarm Standby Mode. All audible alarms are suspended until the STANDBY key is pressed.

The Agent Alarm Standby Mode is provided so that the device can be set up and checked with an anesthetic delivery system prior to clinical use without generating distracting alarms.

Perform any preparatory procedures as required by your hospital's protocols. See "Agent Monitoring" in Section 4 for more information concerning use.

Press the STANDBY key to begin patient monitoring. The standby message disappears and normal alarms resume. The SILENCE key also returns to normal operation.

Auto-calibration and Warm Up

The agent gas detector may require a short warm up period and auto-calibration sequence similar to an internal capnometer. The message *AGT:WARMING* appears in the information message area. The informational message *AGT:MANUAL* or *AGT:AUTOMATIC* also appears indicating that the monitor is in either manual or automatic primary agent identification mode. *AGT: AUTO CAL* appears to indicate that the agent calibration is in progress.

Respiration waveforms, capnogram, and numerical breath rate are available in one minute from powering the monitor. The monitor reaches full accuracy for agent concentrations in less than 20 minutes.

If the device fails to auto-calibrate upon being plugged in the message *AGT:BAD CAL* or *AGT:CAL MISSING* appears. If the unit continues to fail auto-calibration contact the Technical Service Department.

The oxygen monitoring module also requires an auto-calibration sequence and is performed at the same time as the agent detector calibration. If the O_2 module fails to auto-calibrate the message *O2: SENSOR* appears.

Once auto-calibration is complete the monitor displays values for monitored gases.

Display Softkey Functions

Softkeys are selected by turning the rotary knob clockwise or counterclockwise until the desired softkey is highlighted. In the sample below the *CO2* softkey is highlighted indicating that the CO_2 settings window displays if the menu knob is pressed.

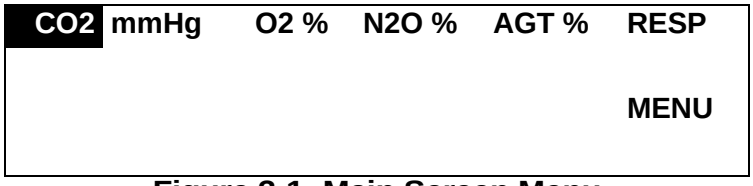


Figure 3-1: Main Screen Menu

If the knob is rotated, the window associated with the highlighted softkey is displayed when the knob is pressed. Knob control goes to that new menu window.

The top item (*EXIT*) on each menu window automatically highlights when the window is activated. The user may simply press the menu knob a second time to exit each window without making changes.

Agent menus simply allow the user to set alarm settings and waveform and numerical colors. The *MENU* option opens up a menu that leads to windows to set operation settings.

Changing Settings

Turn the rotary knob to highlight items on these menu windows. Press the knob to select the item. A single short beep is generated. The key press beep is audible even when alarms are silenced.

Some of the settings require a letter or number to be entered. Rotate the knob to select the desired character. Press the knob to select the character. Rotate the knob to move to the next character space. If an error is made while entering a text string select the arrow character to back over the existing text.

Alarm Limit Settings

Select the *CO2*, *O2*, *N2O*, *AGT*, and *RESP* softkeys to set the alarm limits for these parameters. You can also set the alarms settings with the *MENU* softkey. Select *Alarms* to set alarm limits for respiration, *CO2 Ins*, *CO2 Exp*, *O2 Ins*, *O2 Exp*, *Apnea*, *Alarm volume*, and *Patient size*. Select *2nd Alarms* to set the *High* and *Low* limits for both *Inspired* and *Expired* values for the five halogenated gases the device can monitor.

Alarms activate when a high alarm limit is exceeded or the measured value drops below a low alarm limit. High and Low limit values can be set to the same values. In such a case, the monitor alarms when any value but the selected value is measured.

The low limit alarm can never be set higher than the high limit alarm. The high limit adjustment is similarly restricted. When adjusting limit values some of the range may not be available because the device does not display ranges beyond the point that the other limit is set.

The alarm windows appear initially the same for *Adult*, *Pediatric*, and *Neonate* mode. Alarm limits can be set independently and saved, or stored as defaults if desired.

Any changes made are saved to current memory when *EXIT* is selected.

Colors

The colors for the waveforms and numerical displays can be set with the *CO2*, *O2*, *N2O*, and *AGT* softkeys. Colors can also be set with the *MENU* softkey under the *Parameters* option. Color choices are blue, green, red, purple, yellow, white, dark orange, and light orange.

The color sample indicates the current color selected for the display of the numerical values and waveforms for the that monitoring module. The numerical values and the waveforms will always be in matching colors with the exception of the breath by breath display which is always in white.

The colors can be changed as desired.

NOTE: The *Agent Color* setting indicates waveform color of the user selected primary halogenated agent.

CO2 Softkey

This softkey allows the user to set the waveform and numerical *Color*, *Unit of measure*, and *Alarm Settings* for *High* and *Low Expired* and *Inspired* readings of CO_2 in the system.

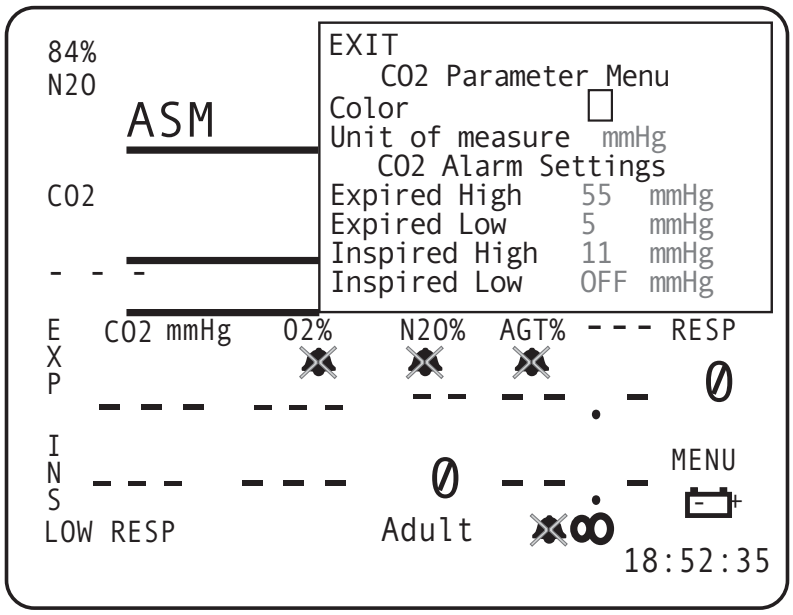


Figure 3-2: *CO2 Parameter Menu* Window

O2 Softkey

This softkey allows the user to set the waveform and numerical *Color* and *Alarm Settings* for *High* and *Low Expired* and *Inspired* readings of O_2 in the system.

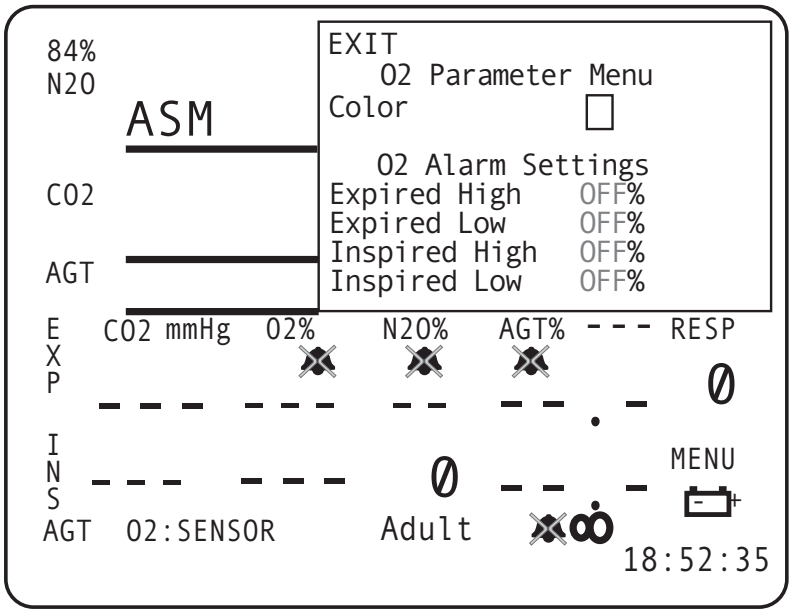


Figure 3-3: *O2 Parameter Menu* Window

N2O Softkey

This softkey allows the user to set the waveform and numerical *Color* and *Alarm Settings* for *High* and *Low Expired* and *Inspired* readings of N_2O in the system.

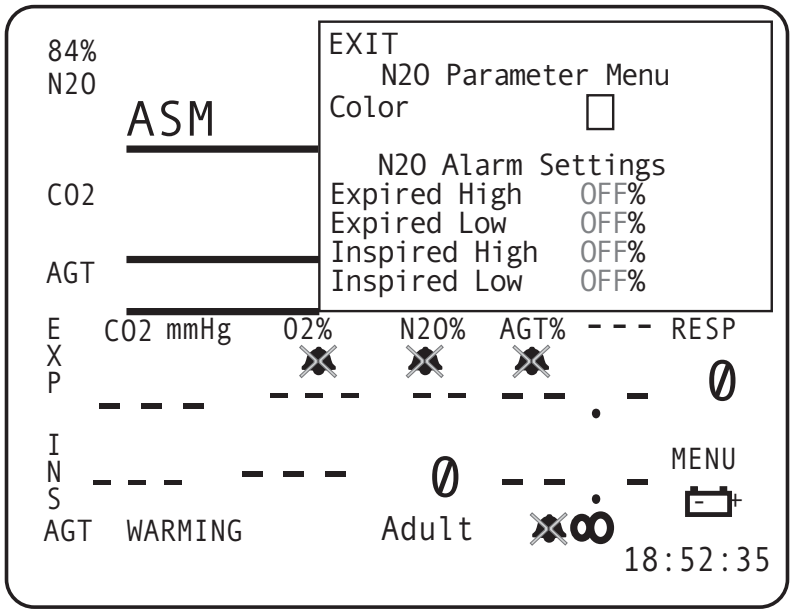


Figure 3-4: *N2O Parameter Menu* Window

The second setting is for the nitrous oxide (N_2O) alarm limits. Nitrous oxide has its own set of alarms. The medium priority alarms, *LOW INS N2O, HIGH INS N2O, LOW EXP N2O*, and *HIGH EXP N2O* are active unless the limits are individually set to off.

Agent (AGT) Softkey

This softkey allows the user to set the waveform and numerical *Color*, the *Agt to Monitor*, *Flow Rate*, *Flow Mode*, and *Alarm Settings* for *High* and *Low Expired* and *Inspired* readings of agent gases in the system.

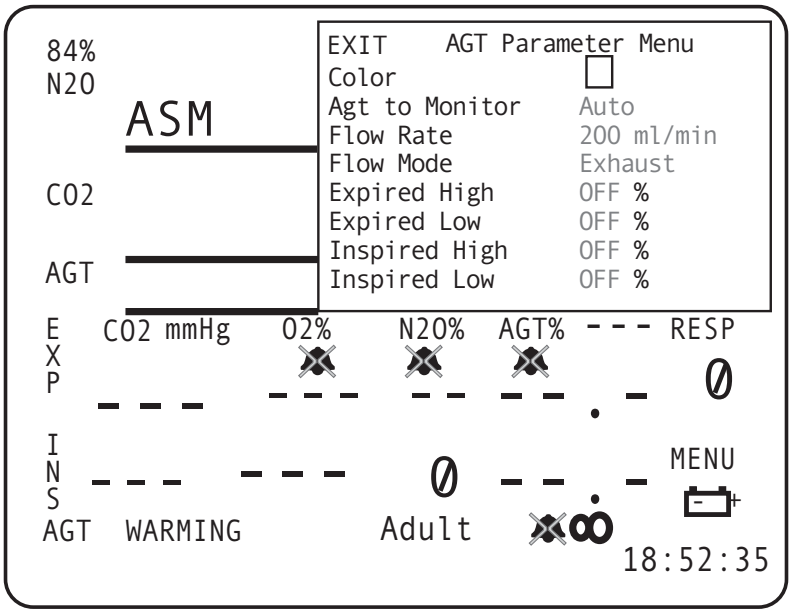


Figure 3-5: *AGT* (Agent) *Parameter Menu* Window

The *Agt to Monitor* can be set to *Auto*, which detects and displays which primary agent is being analyzed as well as display any mixed (secondary) agents at the bottom of the display. You can select the primary agent specifically that you want to monitor. Choices are *HAL* (Halothane), *ENF* (Enflurane), *ISO* (Isoflurane), *DES* (Desflurane), and *SEV* (Sevoflurane).

The Model AA-2005 provides alarm limit settings for Halothane, Enflurane, Isoflurane, Desflurane and Sevoflurane. Only one of these five monitored gases has active alarm limits depending on which has been designated or automatically determined as the primary agent for monitoring.

NOTE: The anesthetic agent Halothane has also been referred to as “Fluothane”; Enflurane has been referred as “Ethrane”; Isoflurane has been referred to as “Forane”; and Desflurane as “Suprane” or by other brand names. It is the responsibility of the operator to correctly recognize and administer anesthetic gases. The device uses international standard abbreviations; HAL, ENF, ISO, DES, SEV for the anesthetic gases Halothane, Enflurane, Isoflurane, Desflurane, and Sevoflurane respectively.

The agent high priority alarm *WRONG AGENT*, the medium priority alarms for *LOW INS AGENT*, *HIGH INS AGENT*, *LOW EXP AGENT*, and *HIGH EXP AGENT* only apply to the primary agent.

NOTE: Parameter limit alarms for the remaining four monitored non-primary agents are not active even though their numerical values may appear on the main screen as a mixed (secondary) agent. Any halogenated agent not designated or determined as the primary agent (that exceeds its threshold limit) are treated as a component of a mixed gas for alarm purposes.

Respiration (RESP) Softkey

This softkey allows the user to set the *High* and *Low* alarm settings for Breaths per minute (*Br/m*).

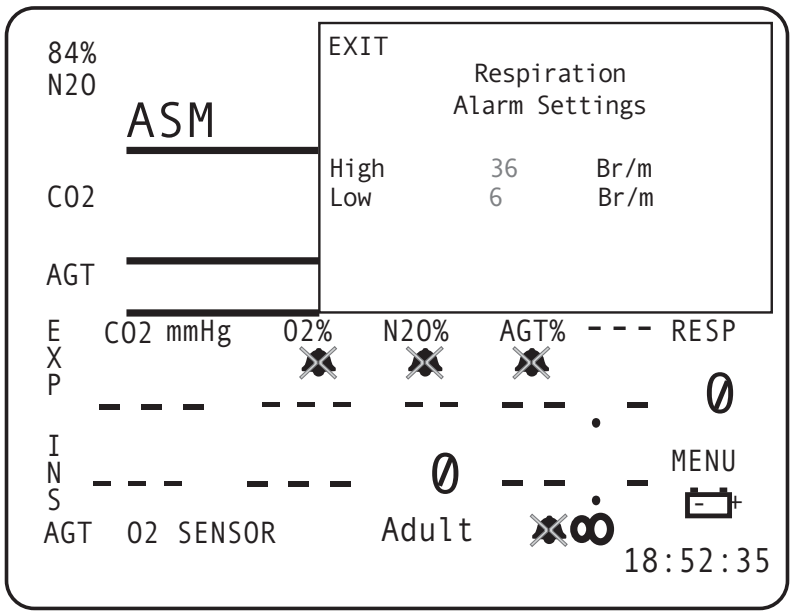


Figure 3-6: *Respiration Alarm Settings* Window

MENU Softkey (System Menus)

This softkey allows access to all the system settings. Selecting this softkey brings up a submenu with menu choices for monitor performance. Menu choices are *Display*, *Configuration*, *2nd Configuration*, *Parameters*, *Alarms*, and *2nd Alarms*.

The settings in these windows affect the way physiological data is collected and displayed.

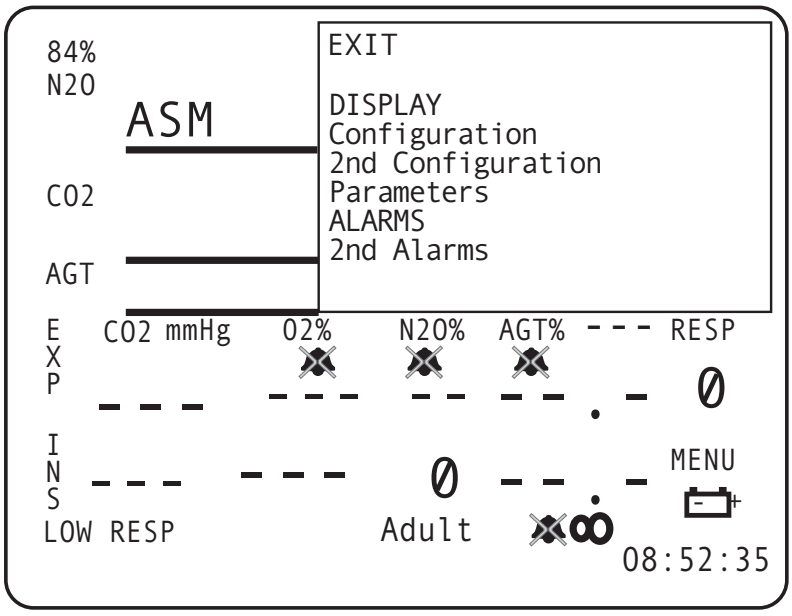


Figure 3-7: *MENU* Window

Display controls the waveforms display on the top half of the display.

Configuration controls the monitor's *Date* and *Time* and the external communications for the monitor. The Service mode is also initiated from *Configuration*.

2nd Configuration controls FREEZE key functions as well as monitor *Language* and *Alarm* warning.

Parameters control waveform and numerical colors for CO_2, O_2, agents, and N_2O as well as the *Unit of measure* for CO_2, which agent is monitored, *Flow Rate*, and *Flow Mode*.

Alarms controls the *High* and *Low* alarm limits for respiration, inspired and expired CO_2 and O_2, apnea time, *Alarm Volume*, and *Patient size*.

2nd Alarms controls the *High* and *Low* alarm limits for inspired and expired agents.

Display Window

The *Display* window allows the user to choose what elements are displayed in waveform format

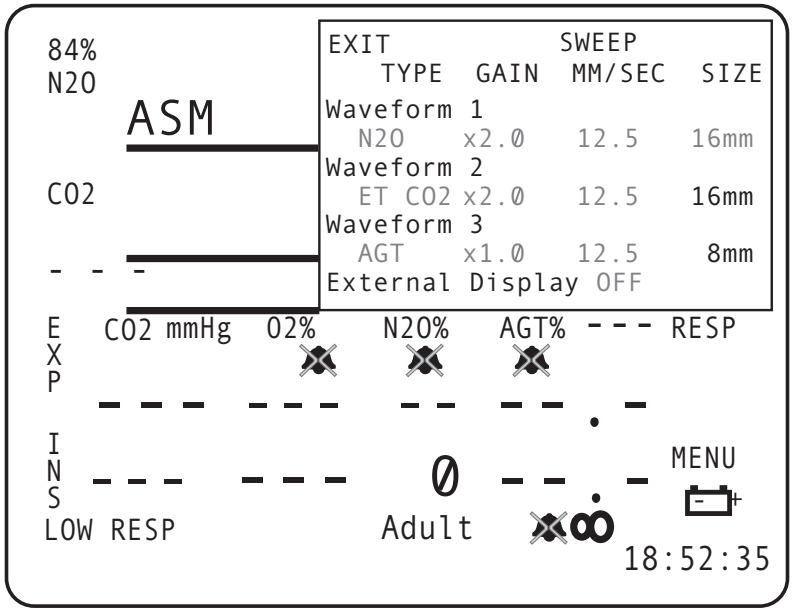


Figure 3-8: *Display* Menu Window

WAVEFORM TYPE

Choices for waveforms are *ET CO2*, *O2*, *AGT* (agent), *N2O*, *BxB*, and *OFF*. *Waveform 2* also has the option of *Cascade* which allows it to "cascade" with *Waveform 1*.

WAVEFORM DESCRIPTION

The waveform area is located in the upper left-hand portion of the display. The service tool has the capability to display three waveforms simultaneously. The top waveform slots (1 and 2) are 16 mm in height. Waveform slot 3 is 8 mm in height. Waveform slot 1 goes to 32 mm in height when *Cascade* is selected for waveform slot 2.

Only waveform 1can be adjusted in size and dimension by using the settings provided when waveform 2 is set to *Cascade*. The choices for waveform 1 then is 16 mm and 32 mm.

The gain listed on the *DISPLAY* window settings increases the display size of the waveforms. It does not control the amplification gain of the source signal.

The waveforms displayed are user selectable.

The device displays waveforms in two 16mm slots and one smaller 8mm slots. The 16mm slots can be combined to form a 32mm slots. To combine the slots to form a larger area to display waveforms set the lower slot *TYPE* to *Cascade*. The slot above automatically increases in size to fill the space.

Each waveform slot displays the parameter or source along the left edge of the screen. The colors of the waveforms are also user selectable in the parameter softkey windows. The numerical parameters colors match the selected waveform color.

CASCADE

The unit can cascade a waveform 1 into the next lower slot and it is then displayed as twice its original length.

The cascaded data is a continuous band of waveform using the sweep speed as set in the original waveform slot. The gain and range settings are the same for the entire cascaded waveform. The waveform label and scale are not shown for slots where data has been cascaded from a higher slot.

To cascade a waveform 1 into waveform slot 2, set waveform slot 2 *TYPE* to *Cascade*. Waveform 1 automatically cascades into waveform slot 2. Only waveforms 1 and 2 can be linked in cascade.

GAIN AND SWEEP

The *GAIN* and *SWEEP* settings found in the *DISPLAY* menu can also be used to modify the way waveforms are displayed on the screen.

The upper two (12.5mm) slots of the display allow for larger waveforms to display. Gain settings from the upper set of slots do not correspond to the gain settings of the lower slot. In order to obtain identical waveform sizes in the top and bottom slots, set the gain of waveform slot 3 one step higher than the top two slots.

A minimum of four and a half seconds worth of data at a sweep speed of 25mm per second displays. Waveforms can have sweep speeds of *50*, *25*, *12.5*, or *6.25* mm per second.

The user can also set the *GAIN*, *SWEEP MM/SEC*, and *SIZE* of each waveform. Options for *GAIN* are *0.5*, *1.0*, *2.0*, and *4.0*. Options for *SWEEP* (measured in mm/sec) are *6.25*, *12.5*, *25.0*, and *50.0*. *SIZE* defaults at *16mm* for *Waveform 1* and *Waveform 2* and at *8mm* for *Waveform 3*. *Waveform 1* defaults to a size of *32mm* when *Waveform 2* is set to *OFF*. *Waveform 1* can still be set to *16mm* at this point.

If an external display is connected to the device, set the *External Display* to *Big Disp* to view the internal display on the larger monitor or *Graph* to view the enhanced trend display. The default is *OFF*.

Configuration

Use the *Configuration* menu to set the analyzer configuration.

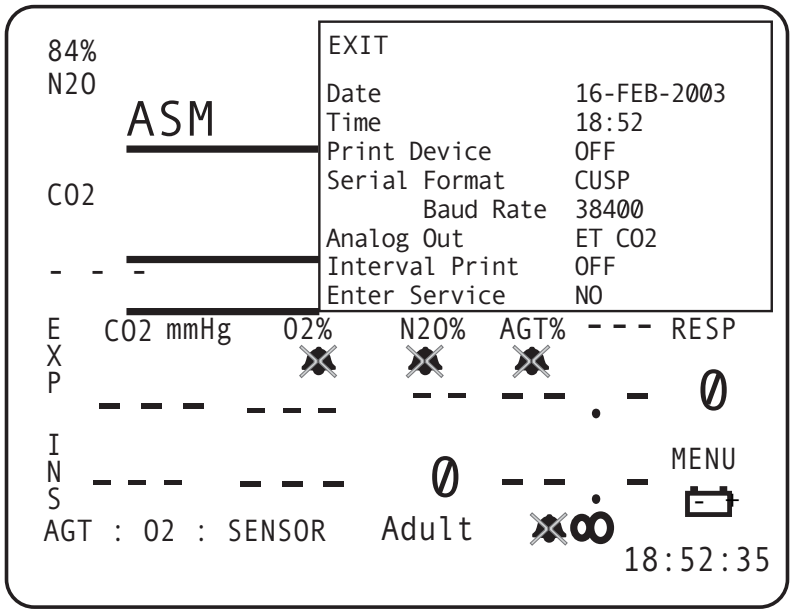


Figure 3-9: *Configuration* Menu Window

Rotate the menu knob to set the correct *Date* and *Time* for the analyzer. *Date* is set in day-month-year format with the month abbreviated to its three-letter abbreviation and the year in four-digit format. *Time* is in military (24 hour) format.

If a *Print Device* is connected, select *Serial*. The default is *OFF*.

Select *Serial Format* as *TEXT*, *CVP*, and *CUSP*. The default is *CUSP*. The *Baudrate* options are *2400*, *4800*, *9600*, *19200*, and *38400*. The default is *38400*.

Analog Out options are *ET CO2*, *O2*, *AGT* (agent), *N2O*, and *OFF*. The default is *ET CO2*.

Interval Print sets periodic automatic printouts as selected by the user in the *Configuration* menu. The Interval Print only works when an external printer is connected to the device. The selections available for Interval Print are 1, 2, 5, 10, 15, 20, and 30 seconds; 1, 2, 5, 10, 15, 30, and 60 minutes; 2, 4, 8, 12, and 24 hours; and *OFF*. The default setting is *OFF*.

Enter Service allows the user to access the service mode. A password is needed to enter the service mode. Options are *NO* and *YES* with the default as *NO*.

2nd Configuration

Use the *2nd Configuration* menu to set more monitor configurations.

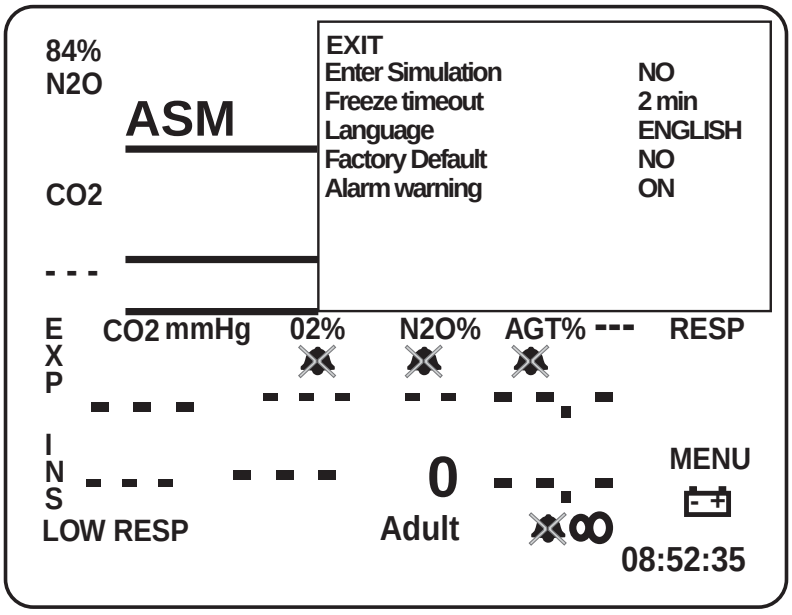


Figure 3-10: *2nd Configuration* Menu Window

Enter Simulation allows the user to access the simulation mode. A password is needed to enter the simulation mode. Options are *NO* and *YES* with the default as *NO*.

Freeze timeout determines how long the waveforms are “frozen” when the FREEZE key is pressed. Monitoring still continues numerically and waveforms collected during the “freeze” are viewable in the Trend data. Options are 30 seconds, 1 to 5 minutes, and *OFF*. The default is *2 min*.

Language determines the language the display appears in. Options are *ENGLISH*, *SPANISH*, *GERMAN*, *FRENCH*, *ITALIAN*, and *PORTUG.* (Portuguese). The default is *ENGLISH*.

Factory Default allows the user to revert to the factory default settings. Options are *NO* and *YES*. The default is *NO*.

Alarm warning allows the user to turn the alarm warning *ON* or *OFF*. A password is needed to set the alarm warning. The default is *ON*.

Parameters

This menu allows the user to set display qualities on the monitor.

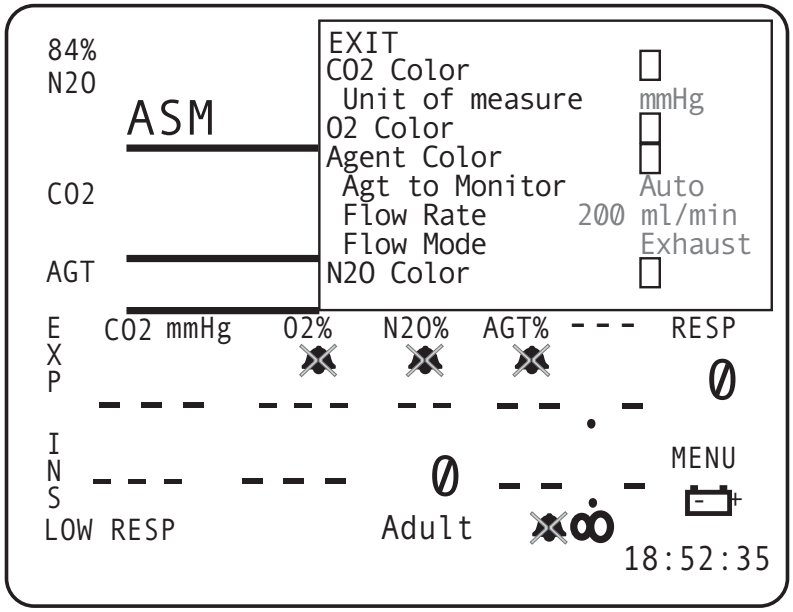


Figure 3-11: *Parameters* Menu Window

AGENT COLOR

This is the color of the primary agent waveform and numerical values when setting the primary agent manually. Color choices are blue, green, red, purple, yellow, white, dark orange, and light orange.

The *Unit of measure* for CO_2 can also be set in this menu.

PRIMARY AGENT SELECTION

Agt to Monitor sets whether the analyzer automatically detects and records primary agent data (*Auto*) or the user can select a primary agent to monitor. If the agent used is not the agent selected for monitoring, a *WRONG AGENT* message appears. Choices are *Auto*, *HAL* (Halothane), *ENF* (Enflurane), *ISO* (Isoflurane), *DES* (Desflurane), and *SEV* (Sevoflurane). The default is *Auto*.

The primary agent for monitoring must be correctly entered depending on the monitoring alarm characteristic desired by the user. The unit has two modes of agent gas monitoring. The user may select a specific halogenated agent to be designated as the primary agent. The user may otherwise set the monitor to automatically detect and identify the current primary gas of a mixture.

⚠WARNING⚠

- Always confirm the primary agent selection before use. Incorrect primary agent setting may result in erroneous limit alarms. Alarm characteristics of the monitor are altered when automatic primary agent detection is activated.
- Never substitute a primary agent setting for a different halogenated agent, or any agent not listed! The agent detection is specific to the listed gases only.
- The alarm, *WRONG AGENT*, appears when the primary agent (that is manually selected by the physician) does not match the primary agent detected. The *WRONG AGENT* alarm is deactivated when automatic primary agent detection is selected.
- The halogenated agent waveform and waveform label may automatically change to a different halogenated agent when automatic primary agent detection is used. If no primary agent is detected, dashes appear in the waveform label, when automatic primary agent detection is used.

The selected primary halogenated agent has its own set of alarm limits as described earlier in this section. This is for use when the primary agent is selected manually. When automatic primary agent detection is used, the agent alarm limits are updated at the time of identification from the “Default Alarm Limits by Agent” settings. If the primary agent is redefined automatically, the alarm limits again are updated from the agent specific limits defined in the menu.

The primary agent is the halogenated agent having the highest concentration during mixed gas conditions. Where only one halogenated agent is to be used, the single agent should always be the primary agent. The primary agent can be set to Halothane, Isoflurane, Enflurane, Desflurane, Sevoflurane or automatic.

FLOW RATE SETTING

The user can also set the *Flow Rate* for agent gases. Options are *100*, *150*, and *200ml/min*. Default is *200ml/min*. The “Flow Rate” setting adjusts the amount of sample gas that is drawn in by the gas monitoring system. When the agent settings are active the flow setting control changes, such that 200, 150, 100 ml/min options are available for selection. Response time decreases with lower flow rates. The default setting of 150ml/min is recommended for general monitoring purposes.

FLOW MODE

The flow mode of the is permanently set to exhaust and cannot be changed.

Alarms

Alarm settings for all parameters except for agent gases are set in this menu. *High* and *Low* settings can be set in this window.

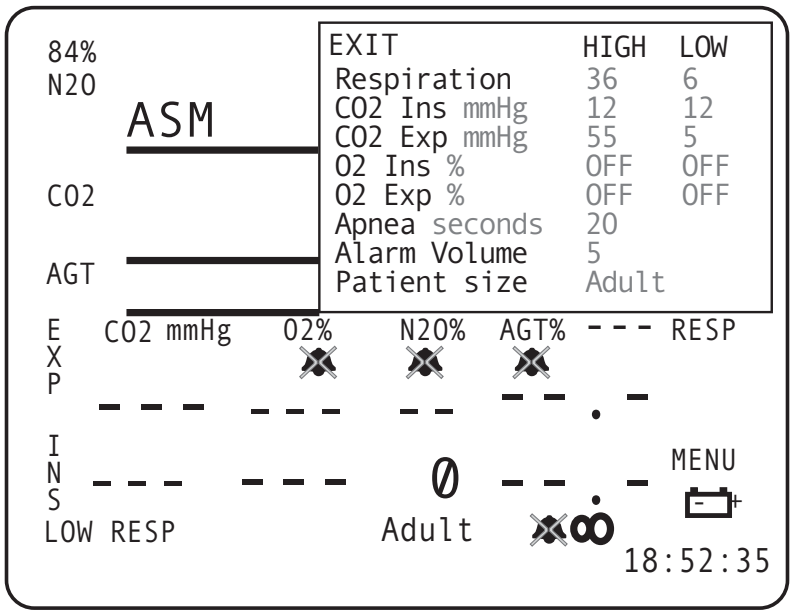


Figure 3-12: *Alarm* Menu Window

Ranges for alarm settings are described in the following tables.

Table 3-1: Alarm Menu Settings: Adult and Pediatric

Parameter	High	Low	Increment	Default High	Default Low
Respiration	6-150, OFF	6-150, OFF	1.0	36	OFF
CO2 (mmHg)	0-100, OFF	0-100, OFF	5.0	10 (I)	OFF (I)
				55 (E)	5 (E)
CO2 (Torr.)	0-94.0, OFF	0-94.0, OFF	0.5	na	na
CO2 (%)	0-12.5, OFF	0-12.5, OFF	0.5	na	na
CO2 (kPa.)	0-12.5, OFF	0-12.5, OFF	0.5	na	na
O2	18-100, OFF	18-100, OFF	1.0	OFF (I)	18 (I)
				OFF (E)	OFF (E)

Table 3-2: Alarm Menu Settings: Neonate					
Parameter	**High**	**Low**	**Increment**	**Default High**	**Default Low**
Respiration	6-150, OFF	6-150, OFF	1.0	60	14
CO2 (mmHg)	0-100, OFF	0-100, OFF	5.0	10 (I)	OFF (I)
				55 (E)	5 (E)
CO2 (Torr.)	0-94.0, OFF	0-94.0, OFF	0.5	na	na
CO2 (%)	0-12.5, OFF	0-12.5, OFF	0.5	na	na
CO2 (kPa.)	0-12.5, OFF	0-12.5, OFF	0.5	na	na
O2	18-100, OFF	18-100, OFF	1.0	OFF (I)	18 (I)
				OFF (E)	OFF (E)

The CO_2 parameters can be measured in terms of mmHg, Torr, kPa, or volume percent.

Apnea monitors apnea time and the options are 5 to 60 seconds, in 5 second increments, and *OFF*. The default is *20 seconds*.

The *Alarm Volume* sets the volume the alarm is heard. The range is 1-10 and *OFF*. The default is *OFF*. If the *Alarm Volume* is set to a value below *2*, the unit defaults to *2* when the monitor is powered off and on.

2nd Alarms

Alarm settings for agent gases are set in this menu. *High* and *Low* settings can be set in this window.

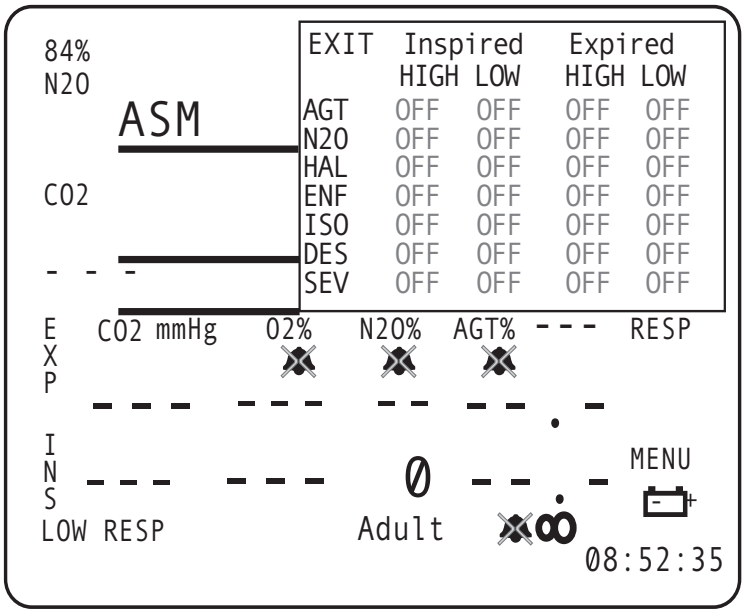


Figure 3-13: *2nd Alarm* Menu Window

Ranges for alarm settings are described in the following table.

Table 3-3: Alarm Settings

Parameter	High	Low	Increment	Default High	Default Low
AGT (Inspired)	0.1-20.0, OFF	0.1-10.0, OFF	0.1	OFF	OFF
(Expired)	0.1-20.0, OFF	0.1-10.0, OFF	0.1	OFF	OFF
N2O (Inspired)	20-100	1-50	1	OFF	OFF
(Expired)	20-100	1-50	1	OFF	OFF
HAL (Inspired)	0.1-20.0, OFF	0.1-20.0, OFF	0.1	OFF	OFF
(Expired)	0.1-20.0, OFF	0.1-20.0, OFF	0.1	OFF	OFF
ENF (Inspired)	0.1-20.0, OFF	0.1-20.0, OFF	0.1	OFF	OFF
(Expired)	0.1-20.0, OFF	0.1-20.0, OFF	0.1	OFF	OFF
ISO (Inspired)	0.1-20.0, OFF	0.1-20.0, OFF	0.1	OFF	OFF
(Expired)	0.1-20.0, OFF	0.1-20.0, OFF	0.1	OFF	OFF
DES (Inspired)	0.1-20.0, OFF	0.1-20.0, OFF	0.1	OFF	OFF
(Expired)	0.1-20.0, OFF	0.1-20.0, OFF	0.1	OFF	OFF
SEV (Inspired)	0.1-20.0, OFF	0.1-20.0, OFF	0.1	OFF	OFF
(Expired)	0.1-20.0, OFF	0.1-20.0, OFF	0.1	OFF	OFF

N2O COMPENSATION

Since nitrous oxide has a similar infrared signature to that of CO_2, and it also affects infrared signature characteristics of CO_2, special care must be taken when measuring CO_2 while nitrous oxide is being used. There are two forms of N_2O compensation with the device. N_2O compensation for the internal capnometer and the gas monitor function independently and differently.

A manual form of N_2O compensation is provided with the settings for the internal capnometer. Since the capnometer does not measure the amount of N_2O present, the compensation is generalized for N_2O levels within a 40 to 80 percent range. This feature must be manually activated when N_2O is being used.

The device uses a polychromatic infrared technology to measure N_2O and CO_2 levels independently. The measuring process used in the detector is inherently unaffected by CO_2 and N_2O mixtures. If the N_2O level exceeds its threshold for the detection limit, the monitoring system (when set) can accurately compensate for a range of N_2O concentrations.

Factory Defaults

CO2 Settings

Table 3-4: CO_2 Settings

Parameter	Range	Default	Unit of Measurement
Unit of measure	mmHg, Torr., %, kPa	mmHg	
Alarm Settings:			
Expired High	0-100, OFF (increments of 5)	55	mmHg
	0-94.0, OFF (increments of 0.5)		Torr.
	0-12.5, OFF (increments of 0.5)		%
	0-12.5, OFF (increments of 0.5)		kPa
Expired Low	0-100, OFF (increments of 5)	5	mmHg
	0-94.0, OFF (increments of 0.5)		Torr.
	0-12.5, OFF (increments of 0.5)		%
	0-12.5, OFF (increments of 0.5)		kPa
Inspired High	0-100, OFF (increments of 5)	10	mmHg
	0-94.0, OFF (increments of 0.5)		Torr.
	0-12.5, OFF (increments of 0.5)		%
	0-12.5, OFF (increments of 0.5)		kPa
Inspired Low	0-100, OFF (increments of 5)	OFF	mmHg
	0-94.0, OFF (increments of 0.5)		Torr.
	0-12.5, OFF (increments of 0.5)		%
	0-12.5, OFF (increments of 0.5)		kPa

O2 Settings

Table 3-5: O_2 Settings

Parameter	Range	Default	Unit of Measurement
Alarm Settings:			
Expired High	18-100, OFF	OFF	%
Expired Low	18-100, OFF	OFF	%
Inspired High	18-100, OFF	OFF	%
Inspired Low	18-100, OFF	18	%

N2O Settings

Table 3-6: N_2O Settings			
Parameter	**Range**	**Default**	**Unit of Measurement**
Alarm Settings:			
Expired High	20-100, OFF	OFF	%
Expired Low	0.1-20.0, OFF	OFF	%
Inspired High	20-100, OFF	OFF	%
Inspired Low	0.1-20.0, OFF	OFF	%

AGT (Agent) Settings

Table 3-7: Agent Settings		
Parameter	**Selectable Options**	**Factory Default**
Agent to Monitor (Primary)	Halothane, Isoflurane, Enflurane, Sevoflurane, Desflurane, Automatic	Automatic
Gas Flow Rate	100, 150, 200 mL	200 mL
Flow Mode	Exhaust	Exhaust
Expired High	See “2nd Alarms” on page 3-20.	OFF
Expired Low	See “2nd Alarms” on page 3-20.	OFF
Inspired High	See “2nd Alarms” on page 3-20.	OFF
Inspired Low	See “2nd Alarms” on page 3-20.	OFF

Alarm	Type	Range	Adult	Pediatric	Neonate
Primary Inspired	High	0-20.0%	2.3	2.3	2.3
Primary Inspired	Low	0-20.0%, Off	OFF	OFF	OFF
Primary Expired	High	0-20.0%	1.5	1.5	1.5
Primary Expired	Low	0-20.0%, Off	OFF	OFF	OFF
N_2O Inspired	High	0-99%	75	75	75
N_2O Inspired	Low	0-99%, Off	OFF	OFF	OFF
N_2O Expired	High	0-99%, Off	OFF	OFF	OFF
N_2O Expired	Low	0-99%, Off	OFF	OFF	OFF
HAL Inspired	High	0-20.0%, Off	2.3	2.3	2.3
HAL Inspired	Low	0-20.0%, Off	OFF	OFF	OFF
HAL Expired	High	0-20.0%, Off	1.5	1.5	1.5
HAL Expired	Low	0-20.0%, Off	OFF	OFF	OFF
ENF Inspired	High	0-20.0%, Off	4.8	4.8	4.8
ENF Inspired	Low	0-20.0%, Off	OFF	OFF	OFF
ENF Expired	High	0-20.0%, Off	3.2	3.2	3.2
ENF Expired	Low	0-20.0%, Off	OFF	OFF	OFF
ISO Inspired	High	0-20.0%, Off	3.6	3.6	3.6
ISO Inspired	Low	0-20.0%, Off	OFF	OFF	OFF
ISO Expired	High	0-20.0%, Off	2.4	2.4	2.4
ISO Expired	Low	0-20.0%, Off	OFF	OFF	OFF

Alarm	Type	Range	Adult	Pediatric	Neonate
DES Inspired	High	0-20.0%, Off	18.0	18.0	18.0
DES Inspired	Low	0-20.0%, Off	OFF	OFF	OFF
DES Expired	High	0-20.0%, Off	12.0	12.0	12.0
DES Expired	Low	0-20.0%, Off	OFF	OFF	OFF
SEV Inspired	High	0-20.0%, Off	5.1	5.1	5.1
SEV Inspired	Low	0-20.0%, Off	OFF	OFF	OFF
SEV Expired	High	0-20.0%, Off	3.4	3.4	3.4
SEV Expired	Low	0-20.0%, Off	OFF	OFF	OFF

RESP (Respiration) Settings

Table 3-8: Respiration Settings

Parameter	Range	Default	Unit of Measurement
High	6-150, OFF	36	Br/m
Low	6-150, OFF	OFF	Br/m

MENU Settings

DISPLAY

Table 3-9: Display Menu Settings

Waveform	Type	Gain	Sweep	Size
Waveform 1: Default	ET CO2	x1.0	12.5	16 mm
Range				
Waveform 2: Default	O2	x1.0	12.5	16 mm
Range				
Waveform 3: Default	AGT	x1.0	12.5	8 mm
Range				
External Display: Default			OFF	
Range				

CONFIGURATION

Table 3-10: Configuration Menu Settings		
Parameter	**Range**	**Default**
Date	dd-mmm-yyyy	dd-mmm-yyyy
Time	00.00-23.59	hh:mm
Print Device	Off, Serial	Serial
Serial Format	TEXT, CSV, CUSP	CUSP
Baudrate	2400, 4800, 9600, 19200, 38400	38400
Analog Out	Off, ETCO2, O2, Agent, N2O	ET CO2
Interval Print	1, 2, 5, 10, 15, 20, 30 seconds; 1, 2, 5, 10, 15, 30, 60 minutes; 2, 4, 8, 12, 24 hours; OFF	OFF
Enter Service	Yes, No	NO

2ND CONFIGURATION

Table 3-11: Second Configuration Menu Settings		
Parameter	**Range**	**Default**
Enter Simulation	Yes, No	NO
Freeze Timeout	30 seconds, 1, 2, 3, 4, 5 minutes, Off	2 min
Language	English, French, German, Spanish, Portuguese, Italian	ENGLISH
Factory Default	Yes, No	NO
Alarm warning	On, Off	ON

PARAMETERS

Table 3-12: Parameters Menu Settings		
Parameter	**Range**	**Default**
Unit of measure		mmHg
Agt to Monitor		Auto
Flow Rate		200 ml/min
Flow Mode		Exhaust

ALARMS

Table 3-13: Alarm Menu Settings: Adult and Pediatric					
Parameter	**High**	**Low**	**Increment**	**Default High**	**Default Low**
Respiration	6-150, OFF	6-150, OFF	1.0	36	OFF
CO2 (mmHg)	0-100, OFF	0-100, OFF	5.0	10 (INS)	OFF (INS)
				55 (EXP)	5 (EXP)
CO2 (Torr.)	0-94.0, OFF	0-94.0, OFF	0.5	na	na
CO2 (%)	0-12.5, OFF	0-12.5, OFF	0.5	na	na
CO2 (kPa.)	0-12.5, OFF	0-12.5, OFF	0.5	na	na
O2	18-100, OFF	18-100, OFF	1.0	OFF (INS)	18 (INS)
				OFF (EXP)	OFF (EXP)

Table 3-14: Alarm Menu Settings: Neonate					
Parameter	**High**	**Low**	**Increment**	**Default High**	**Default Low**
Respiration	6-150, OFF	6-150, OFF	1.0	60	14
CO2 (mmHg)	0-100, OFF	0-100, OFF	5.0	10 (INS)	OFF (INS)
				55 (EXP)	5 (EXP)
CO2 (Torr.)	0-94.0, OFF	0-94.0, OFF	0.5	na	na
CO2 (%)	0-12.5, OFF	0-12.5, OFF	0.5	na	na
CO2 (kPa.)	0-12.5, OFF	0-12.5, OFF	0.5	na	na
O2	18-100, OFF	18-100, OFF	1.0	OFF (INS)	18 (INS)
				OFF (EXP)	OFF (EXP)

2ND ALARMS

Table 3-15: Second Alarm Menu Settings					
Parameter	**High**	**Low**	**Increment**	**Default High**	**Default Low**
AGT (Inspired)	0.1-20.0, OFF	0.1-10.0, OFF	0.1	OFF	OFF
(Expired)	0.1-20.0, OFF	0.1-10.0, OFF	0.1	OFF	OFF
N2O (Inspired)	20-100	1-50	1	OFF	OFF
(Expired)	20-100	1-50	1	OFF	OFF
HAL (Inspired)	0.1-20.0, OFF	0.1-20.0, OFF	0.1	OFF	OFF
(Expired)	0.1-20.0, OFF	0.1-20.0, OFF	0.1	OFF	OFF
ENF (Inspired)	0.1-20.0, OFF	0.1-20.0, OFF	0.1	OFF	OFF
(Expired)	0.1-20.0, OFF	0.1-20.0, OFF	0.1	OFF	OFF
ISO (Inspired)	0.1-20.0, OFF	0.1-20.0, OFF	0.1	OFF	OFF
(Expired)	0.1-20.0, OFF	0.1-20.0, OFF	0.1	OFF	OFF
DES (Inspired)	0.1-20.0, OFF	0.1-20.0, OFF	0.1	OFF	OFF
(Expired)	0.1-20.0, OFF	0.1-20.0, OFF	0.1	OFF	OFF
SEV (Inspired)	0.1-20.0, OFF	0.1-20.0, OFF	0.1	OFF	OFF
(Expired)	0.1-20.0, OFF	0.1-20.0, OFF	0.1	OFF	OFF

Section 4 — Agent Monitoring

Introduction

This section provides instructions for gas sampling connections and monitoring. The user is expected to be fully familiar with monitoring techniques and with the functions of the device before use.

Before you Begin

Read the precautions for each measured parameter that appears in this section.

These instructions describe the use of basic sampling devices and accessories that come with Model AA-2005. An extended list of approved accessories can be found in “Accessories” in Appendix A.

The device should always be checked by the user before use for actual monitoring. Perform the following procedure before using the device.

1. Make sure that unit has been fully charged before use. Check that the AC power cord is plugged in for long-term monitoring situations. Check the communications cable for secure connection to the unit.
2. Check the menus and default settings on the unit to confirm that the anesthetic agent analyzer is setup correctly.
3. Examine the accessories for wear, damage or contamination. Replace or disinfect the accessories as required.
4. Select the correct mode of operation (*Adult*/*Pediatric*/*Neonate*) by entering the patient size in the Alarms menu of the *MENU* window.

⚠WARNING⚠

- All accessories connected to the analyzer must comply with applicable UL (Underwriters Laboratories) standards and IEC standards for such products.
- Substitution of recommended sensor and sampling accessories may cause inaccurate measurements and degrade patient safety, or may damage the unit.

Gas Monitoring Safety

The following instructions describe precautions and contraindications for agent analysis. Use all safety procedures and protocols for anesthetic safety as designated by your health care facility.

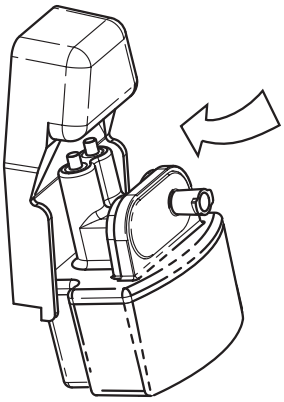
⚠WARNING⚠

- Do not use this device in conjunction with highly flammable anesthetics such as cyclopropane or ether.
- The unit is not intended for monitoring gas mixtures containing methoxyflurane or halogenated hydrocarbons not specifically listed as a monitored gas.
- Environmental pollution of nitrous oxide and halogenated agents may cause accuracy errors. Always use anesthetic gas scavenging systems (AGSS) with the unit.
- Infectious agents may be transferred between patients through the return of the units exhaust to the breathing circuit.
- Never place the unit inside an oxygen tent or any gas containment apparatus.
- Do not use anti-static or electrically conductive breathing tubes in the presence of electrocautery or electrosurgery equipment.

⚠CAUTION⚠

- Gas mixtures of xygen or nitrous oxide with agents such as Halothane, Methoxyflurane or Enflurane can be flammable. Do not operate the agent gas monitor if high ambient agent concentrations or anesthetic gas leaks are suspected.

Water Trap Connections



The unit has a front-mounted water trap. The trap slides out and can quickly be replaced if it becomes occluded. Use the designated water trap for this device (BC20-43001). The water trap has a fitting located at the top that connects into the trap receptacle (gas manifold) of the analyzer. The unit's gas sampling connection (from the water trap) accepts gas sampling lines using the male Luer style connections.

The attachment location of the sampling line is shown below with the water trap properly inserted. This sampling line (BC20-43000) is used for agent gas monitoring with the Model AA-2005. Use the gas sampling accessories only as directed.

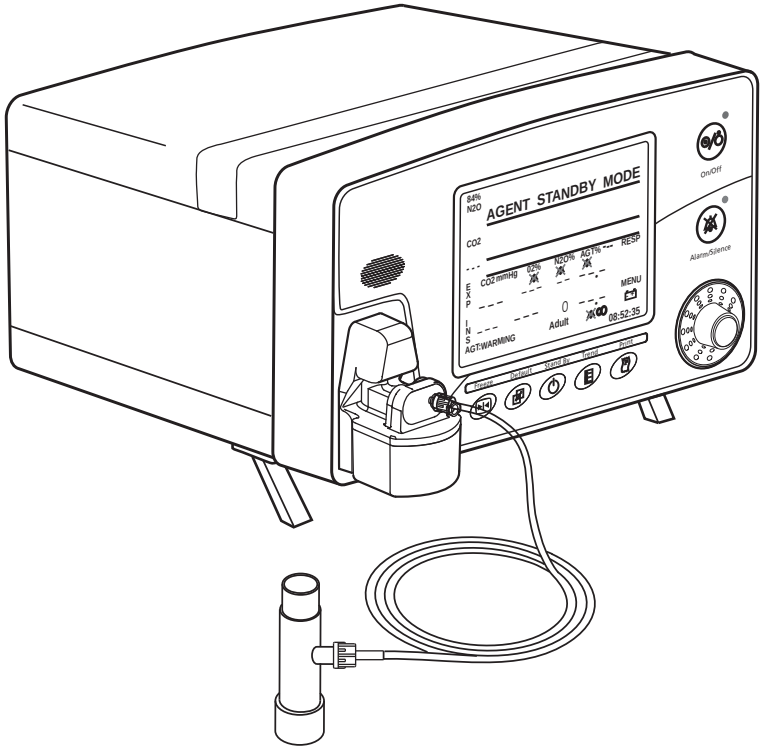


Figure 4-1: Sampling Line Connection

Startup and Calibration

Allow the unit to warm up and auto-calibrate before use. It is necessary to have the water trap and sampling line attached so that the unit draws the correct air flow.

The unit automatically begins an auto-calibration sequence when powered up. During calibration the unit displays flat waveforms for gas concentrations. When the calibration and warm up sequence is over normal operation begins. See "Setup Procedure" in Section 3 for more information about zero calibrations.

Procedure for Gas Monitoring

The following description is provided for general monitoring of single or multiple gas conditions with the Model AA-2005. Read the entire section for complete instructions for monitoring specific gases.

1. Verify the *Primary Agent* setting in the *Parameters* menu in the *MENU* window. The primary agent may be designated by the user or set to automatic identification.
2. Check the *Flow Rate* setting in the *Parameters* menu in the *MENU* window.
3. Slide the water trap into the trap receptacle.
4. Attach a scavenging line to the rear exhaust port of the unit if anesthetic agents are being used.
5. Attach a sample line to the Luer connector located on the front of the water trap.
6. Make sure there are no kinks or other obstructions in the line extending from the water trap.
7. Attach the sampling device to the sampling line.
8. Replace sampling devices, lines, and water traps if they become blocked.

Occlusions

The analyzer displays a visual message *AGT: OCCLUSION* if the gas sampling system is blocked. The Model AA-2005 momentarily attempts to clear a blockage automatically drawing it into the collection basin of the water trap. If the sampling line or water trap becomes completely blocked, replace the sample line and/or the water trap. There is a brief interruption in gas monitoring during automatic occlusion clearing.

The unit displays *NO EXHAUST* if the scavenging line is blocked.

Anesthetic Gas Measurement

Allow the unit to warm up and auto-calibrate before use. Connect one end of the sample line to the water trap that is attached to the AA-2005 and the other end of the sample line to the endotracheal connector. Connect the endotracheal connector to the common gas outlet on the anesthesia machine or the vaporizer outlet, if testing a standalone vaporizer. Refer to the vaporizer OEM for specific testing procedures, which may include the carrier gas to be used, the flow rate of the carrier gas, the dial settings to be tested along with the acceptable concentration tolerances for each of the dial settings.

Anesthetic Agent Identification and Quantification

The unit is an agent-specific monitor, which means that it is capable of simultaneously distinguishing between and quantifying various halogenated anesthetic agents. The halogenated agents which can be identified and simultaneously quantified at any given time are Halothane, Enflurane, Isoflurane, Desflurane, and Sevoflurane.

Nitrous oxide and carbon dioxide are also identified and quantified and their effect in quantifying mixtures with the five halogenated agents is negligible. The presence of ethyl alcohol, metabolic ketones, helium, and acetone do not interfere with the agent detector and does not significantly affect accuracy. If any anesthetic agent other than those specified for monitoring is present, it won't be identified and may interfere with reported agent concentrations.

Primary Agent

If a waveform for a halogenated agent displays, it is the primary agent that was manually selected in the *Parameter* menu of the *MENU* window, or the primary agent as determined through automatic detection. The abbreviation for the agent also appears above the values in the gas numerical slots. The abbreviation for the agent also appears at the beginning of the agent waveform channel.

The primary agent is the halogenated agent having the highest concentration during mixed gas conditions. The primary agent can be set to Halothane, Isoflurane, Enflurane, Desflurane, Sevoflurane, or automatic. See "Setup Procedure" in Section 3 for additional information and precautions for setting the primary agent.

User Selected Primary Agent

When the unit is manually set for a specific primary agent, the alarms are keyed to the halogenated agent selected. The alarm limit levels are the current primary alarm limits and should be manually updated if a new primary agent is selected. The current agent alarm limits do not change while monitoring unless done manually.

The *WRONG AGENT* alarm are active and the unit continually checks for an incorrect agent. If another halogenated agent exceeds the selected primary agent, a high priority alarm occurs. If the agent is being displayed in a waveform, the alarm message appears in large red text in the waveform slot. If the *WRONG AGENT* alarm appears, immediately check the anesthetic delivery system for incorrect anesthetic gases.

When the user selects a specific halogenated agent as the primary, that is the agent that always displays in the waveforms. A flat line appears when the halogenated agent is not present.

Automatic Primary Agent Detection

The primary agent is identified by the unit as the agent with the highest current concentration. In mixed gas conditions the primary agent may change as the measured gas concentrations change. The waveform and waveform heading also change to the new agent. When the unit is set for automatic primary agent detection, the alarms adjust to the current primary agent as defined in the *Alarms* menu (see “Setup Procedure” in Section 3). The alarm limits update to those specified for whichever agent is currently at the higher concentration.

Secondary Agent Detection

When more than one halogenated agent is detected above its threshold limits the second highest halogenated agent is identified as a secondary agent. The *MIXED AGENT* message is activated at the bottom of the display. Measurements for secondary agent expired and inspired values appear. The secondary agent is automatically identified by its three letter abbreviation.

DURING AUTOMATIC PRIMARY AGENT SELECTION

If the primary agent concentration falls and/or is exceeded by another agent, the primary agent may become the secondary agent when automatic primary agent selection mode is used. The three letter agent name and values for the secondary agent may switch with the primary agent when the concentration of one agent exceeds another.

MIXED AGENT CONDITIONS

The message *MIXED AGENT* appears as a medium level alarm whenever more than one halogenated agent is detected. The alarm is active whether automatic or manual primary agent selection is used. There are no concentration limit alarms associated with the secondary agent that displays. The presence of additional halogenated agents below the concentration of the secondary agent is not reported by the anesthetic agent analyzer.

Agent Identification Thresholds

To identify an agent the concentration of the agent individually or in mixture must be above the identification threshold limit. A secondary agent is considered part of a mix if that agent is above its mix threshold limit.

Interfering Gasses For Anesthetic Agents

The unit reports small changes in agent concentrations when anesthetic agents and other gasses are used. Expected agent changes are provided here for the purpose of comparison.

Table 4-1: For Gas Mixtures of 2% Halothane

Agents	Balance	Change of Halothane
Helium 50%	N_2 48%	0.0%
N_2O 80%	N_2 18%	+0.1%
CO_2 5%	N_2 93%	-0.1%
Ethanol 1%	N_2 97%	-0.1%
Acetone 1%	N_2 97%	-0.1%
Enflurane 5%	N_2 93%	+0.2%
Isoflurane 5%	N_2 93%	+0.2%
Desflurane 5%	N_2 93%	+0.3%
Sevoflurane 5%%	N_2 93%	+0.5%

Table 4-2: For Gas Mixtures of 2% Enflurane

Agents	Balance	Change of Enflurane
Helium 50%	N_2 48%	0.0%
N_2O 80%	N_2 18%	+0.1%
CO_2 5%	N_2 93%	-0.1%
Ethanol 1%	N_2 97%	-0.1%
Acetone 1%	N_2 97%	-0.1%
Halothane 5%	N_2 93%	-0.1%
Isoflurane 5%	N_2 93%	+0.1%
Desflurane 5%	N_2 93%	-0.2%
Sevoflurane 5%%	N_2 93%	-0.1%

Table 4-3: For Gas Mixtures of 2% Isoflurane		
Agents	**Balance**	**Change of Isoflurane**
Helium 50%	N_2 48%	0.0%
N_2O 80%	N_2 18%	+0.1%
CO_2 5%	N_2 93%	-0.1%
Ethanol 1%	N_2 97%	-0.1%
Acetone 1%	N_2 97%	0.0%
Halothane 5%	N_2 93%	-0.4%
Enflurane 5%	N_2 93%	0.0%
Desflurane 5%	N_2 93%	+0.1%
Sevoflurane 5%%	N_2 93%	-0.3%

Table 4-4: For Gas Mixtures of 2% Desflurane		
Agents	**Balance**	**Change of Desflurane**
Helium 50%	N_2 48%	0.0%
N_2O 80%	N_2 18%	+0.1%
CO_2 5%	N_2 93%	0.0%
Ethanol 1%	N_2 97%	-0.1%
Acetone 1%	N_2 97%	0.0%
Halothane 5%	N_2 93%	+0.1%
Enflurane 5%	N_2 93%	+0.1%
Isoflurane 5%	N_2 93%	+0.4%
Sevoflurane 5%%	N_2 93%	-0.1%

Table 4-5: For Gas Mixtures of 2% Sevoflurane		
Agents	**Balance**	**Change of Sevoflurane**
Helium 50%	N_2 48%	0.0%
N_2O 80%	N_2 18%	0.0%
CO_2 5%	N_2 93%	-0.1%
Ethanol 1%	N_2 97%	-0.1%
Acetone 1%	N_2 97%	0.0%
Halothane 5%	N_2 93%	-0.1%
Enflurane 5%	N_2 93%	-0.1%
Isoflurane 5%	N_2 93%	-0.1%
Desflurane 5%%	N_2 93%	-0.1%

CO_2 Monitoring (Capnometry)

When a sampling device is connected, the unit begins displaying the end-tidal and inspired CO_2 values in the parameter box. The capnogram, CO_2 waveform, if selected as a displayed waveform, will provide a graphic representation of the patient's respiration cycle.

The primary source of the numerical respiration rate is determined from the capnogram. The respiration source can be set in the *Parameters* menu of the *MENU* softkey window of the unit to "smart switch" between using the capnograph or ECG impedance respiration. A capnograph waveform is displayed using the agent detector data.

The numerical respiration displayed value can be manually set to the capnogram source if desired. The anesthetic agent analyzer can also generate a breath by breath bar chart in the waveform slots that can graphically indicate the relative strength of each breath.

INTERFERING GASSES FOR CO2

The unit reports small changes in CO_2 when anesthetic agents and other gasses are used. Expected CO_2 changes are provided here for the purpose of comparison.

Table 4-6: For Gas Mixtures of 5% CO_2

Agent	Agent Volume*	Change of CO_2
Oxygen	95%	-0.1%
N_2O	89%	+0.2%
Halothane	3%	+0.2%
Enflurane	5%	+0.2%
Isoflurane	5%	+0.1%
Sevoflurane	5%	+0.2%
Desflurane	15%	+0.2%

* Gas mixtures balanced with nitrogen.

The Model AA-2005 automatically compensates for the presence of N_2O. The table above indicates interference after this compensation has occurred.

Oxygen (O_2) Monitoring

When a sampling device is connected, the unit begins displaying the expired and inspired O_2 numerical values in the parameter box. All procedures for patient setup, water traps, and occlusions apply to the O_2 measurement because the sample is taken from the same source as the CO_2 and the halogenated gases.

When in operation, agent gas numerical values appear in the box normally used for display of oxygen concentrations. The oxygen numerical values still appears in the same location inside the box.

INTERFERING GASSES FOR O_2

The unit reports small changes in O_2 when anesthetic agents and and other gasses are used with oxygen. Expected O_2 changes are provided here for the purpose of comparison.

Table 4-7: For Gas Mixtures of O_2

Agents	Balance	Change of O_2
Helium 50%	Oxygen 50%	+0.7%
N_2O 65%, CO_2 5%	Oxygen 30%	+0.7%
N_2O 80%	Oxygen 20%	+1.3%
Halothane 4%, N_2O 66%	Oxygen 30%	+0.8%
Enflurane 5%, N_2O 65%	Oxygen 30%	+0.7%
Isoflurane 5%, N_2O 65%	Oxygen 30%	+0.1%
Desflurane 15%, N_2O 55%	Oxygen 30%	-2.7%
Sevoflurane 5%, N_2O 65%	Oxygen 30%	-0.4%

Section 5 — Alarms and Messages

Alarm Description

The Model AA-2005 provides both audible and visible alarm indicators to alert the operator of status alarms and physiological parameter alarms. All alarms conform to EN 475 requirements and are produced by the unit.

Message Categories

HIGH PRIORITY ALARMS
The high priority audible alarm consists of a pair of bursts. Each burst consists of five tone pulses. The pair of bursts repeat every eight seconds. For each burst there is a short delay between the third and fourth pulse. The frequency of each pulse is 1000 Hz such that the high priority alarm has the highest pitch tone produced by the unit.

The text message appears as red characters in the waveform slot.

MEDIUM PRIORITY AUDIBLE ALARMS
Each burst consists of three pulses. The frequency is 800 Hz and the repeat cycle is approximately 25 seconds. The text message appears as yellow characters in the waveform slot or in the information box or in the waveform slot as described later in this section.

LOW PRIORITY AUDIBLE ALARMS
Each burst consists of two pulses. The frequency is 350 Hz and the repeat cycle is 15 seconds. The text message appears as yellow characters in the information box.

INFORMATIONAL MESSAGES
Informational text messages appear as yellow characters in the information box. There is no alarm tone.

Physiological Alarms

Alarms are provided for all monitored parameters. Each parameter limit alarm condition triggers both audible and visible alarms until one of the following events occurs:

- The parameter value returns to within the alarm limit.
- The alarm limit is set beyond the present parameter value.
- The ALARM SILENCE key is pressed. (Audible alarms only).
- The monitor is placed in Standby Mode.

Visible text alarms appear on the display screen.

FLASHING NUMERICAL PARAMETERS
If a physiological parameter exceeds a high limit or falls below a low limit value the numerical value display flashes. This function cannot be suspended and is visible when pop up menus are activated.

Visual Alerts

TEXT MESSAGES

There is space for one line of text at the bottom of the screen. Multiple messages alternate in this space.

Low priority alarms and informational messages always display in the text boxes.

For the vital signs that have a waveform display, medium and high level alarms appear with the waveform. For parameters that do not have a waveform displayed, all level of alarms are reported in the alarm text boxes near the bottom of the screen.

The informational, low, and medium priority text messages are colored yellow and the high alarm messages are red.

VISUAL ALERTS IN WAVEFORM SLOTS

When a high or medium alarm occurs for a vital sign that has an active waveform, the message displays in the top center of the waveform in large text. If there are multiple alerts to display in a waveform slot, the messages alternate.

If the waveform exists in multiple slots, either through cascade or duplicate waveforms from alternate sources, the waveform slot messages only occur in the top most slot.

Waveform slot messages are not visible during the following conditions.

- The waveform is not selected to be displayed.
- A pop-up window or menu covers the slot.
- Auto-calibration of the gas monitor.

If a high or medium level alarm message cannot be displayed in the waveform slot due to a pop up window, the alarm message displays in the priority text box near the bottom of the screen.

SUSPENDED ALARM ICONS

A red bell icon with a “X” indicates that an alarm limit has been turned to “OFF” when the icon occurs in the numerical parameter poxes.

When the red bell icon appears in the top of the first waveform slot, all the monitor’s audible alarms have been silenced. The duration of the silence condition appears to the right of the bell icon.

2 min = 2 minutes
∞ = permanent

Visual alarms continue to be displayed as described.

Alarms at Start Up

Audible alarms do not occur until the first valid measurement has occurred for that parameter. Visual messages and alarms are present immediately when a module is activated.

Low Battery Alert

The Low Battery Alert has its own audible alarm burst that is distinguished from the low priority alarm by its lower pitch and slower repeat cycle. Each burst consists of two pulses with a 300Hz frequency and the repeat cycle of approximately five minutes. The text message appears as yellow characters in the information box (lower text box).

Alarm Messages List

Included here is a list of messages and warnings that may appear in the waveform channels or the two alarm message lines located on the display screen.

Respiration Alarms

Alarms and messages for respiration may be generated by more than one sampling technology module.

	Priority	Description
LOW RESP	Medium	The respiration value has dropped below the value set in the *Alarms* or *RESP* menu.
HIGH RESP	Medium	The respiration value has exceeded the value set in the *Alarms* or *RESP* menu.

CO_2 Alarms and Messages

	Priority	Description
CO2:NO BREATH	High	No breath detected. Check sampling device and adjust placement if necessary. May indicate a leak in the breathing circuit.
LOW ETCO2	Medium	The end-tidal CO_2 value has dropped below the value set in the *Alarms* or *CO2* menu.
HIGH ETCO2	Medium	The end-tidal CO_2 value has exceeded the value set in the *Alarms* or *CO2* menu.
LOW INCO2	Medium	The inspired CO_2 value has dropped below the value set in the *Alarms* or *CO2* menu.
HIGH INCO2	Medium	The inspired CO_2 value has exceeded the value set in the *Alarms* or *CO2* menu.
CO2:OCCLUSION	Medium	The sampling line or trap to the capnometer is completely blocked. Replace sampling accessories as needed.
CO2:INSERT TRAP	Medium	The trap on the unit is not inserted. Trap is partially blocked, wrong type of trap, or defective. Replace trap.

	Priority	Description
CO2:ZEROCAL	Low	The device is calibrating the gas module to current ambient conditions. Monitoring is suspended.
CO2:HI AMBIENT	Low	There is an excessive amount of CO_2 in the ambient air measurement. May indicate a calibration problem. Contact the Service Department.
CO2:NO EXHAUST	Low	Scavenging line on the unit is blocked or the scavenging system is defective. Remove blockage or correct gas scavenging system.
CO2:FCAL ERROR	Low	The unit has detected a fault with the gas calibration table for the capnometer. Contact the Service Department.
CO2:UCAL ERROR	Low	The unit has detected a fault with the user calibration of the internal capnometer. Perform a user calibration. Contact the Service Department if the problem continues.
CO2:ERROR	Low	Invalid factory calibration of the internal capnometer. Contact the Service Department.
CO2:BENCH FAIL	Low	The monitor has detected a fault with the internal capnometer. Contact the Service Department.

Agent Gas Alarms and Messages

	Priority	Description
AGT:NO BREATH	High	No breath detected. Check sampling device and adjust placement if necessary. May indicate a leak in the breathing circuit.
WRONG AGENT	High	The primary agent that the operator has selected does not match the highest concentration agent detected by the analyzer. Check the primary agent setting and the agent delivery system immediately. This alarm is not active when automatic primary agent detection is selected.
MIXED AGENT	Medium	More than one halogenated agent is present.
LOW INS AGENT	Medium	The inspired agent value has dropped below the value set in the *2nd Alarms* or *AGT* menu.
HIGH INS AGENT	Medium	The inspired agent value has exceeded the value set in the *2nd Alarms* or *AGT* menu.
LOW EXP AGENT	Medium	The expired agent value has dropped below the value set in the *2nd Alarms* or *AGT* menu.
HIGH EXP AGENT	Medium	The expired agent value has exceeded the value set in the *2nd Alarms* or *AGT* menu.

	Priority	Description
LOW INS N2O	Medium	The inspired N_2O value has dropped below the value set in the *2nd Alarms* or *N2O* menu.
HIGH INS N2O	Medium	The inspired N_2O value has exceeded the value set in the *2nd Alarms* or *N2O* menu.
LOW EXP N2O	Medium	The expired N_2O value has dropped below the value set in the *2nd Alarms* or *N2O* menu.
HIGH EXP N2O	Medium	The expired N_2O value has exceeded the value set in the *2nd Alarms* or *N2O* menu.
AGT:OCCLUSION	Medium	The sampling line or water trap to the unit is completely blocked. The unit will attempt to clear the block by drawing the occlusion into the water trap. Replace sampling line as necessary.
AGT:INSERT TRAP	Medium	The water trap on the unit is not inserted. Trap is partially blocked, wrong type of trap, or defective. Replace the trap.
AGT: NO EXHAUST	Low	Scavenging line on the unit is blocked or the scavenging system is defective. Remove blockage or correct gas scavenging system.
AGT: BENCH FAIL	Low	The unit as detected a hardware failure. Contact the Service Department.
AGT:IR FAIL	Low	The unit as detected a hardware failure. Contact the Service Department.
AGT:PNEUMATICS	Low	The unit as detected a hardware failure. Contact the Service Department.
AGT: BADCAL	Low	The unit was unable to calibrate the agent gas detector. Contact the Service Department.
AGT: MISSING CAL	Low	The unit was unable to calibrate the agent gas detector. Contact the Service Department.
AGT: WARMING	Informational	The unit has not attained full accuracy for agent concentrations.
AGT:MANUAL	Informational	The unit is set to manual identification of a selected primary agent. The *WRONG AGENT* warning appears if the selected agent does not match the detected primary agent.
AGT:AUTOMATIC	Informational	The unit is set to automatic identification of the current primary agent.

Oxygen Monitoring (O_2) Alarms

	Priority	Description
LOW ETO2	Medium	The expired O_2 value has dropped below the value set in the *Alarms* or *O2* menu.
HIGH ETO2	Medium	The expired O_2 value has exceeded the value set in the *Alarms* or *O2* menu.
LOW INO2	Medium	The inspired O_2 value has dropped below the value set in the *Alarms* or *O2* menu.
HIGH INO2	Medium	The inspired O_2 value has exceeded the value set in the *Alarms* or *O2* menu.
O2:SENSOR	Low	The O_2 cell inside the unit is expended and requires replacement. Contact Technical Service.
O2:FCAL ERROR	Low	The analyzer has detected a fault in the O_2 calibration data. Perform a gain and delay adjustment. The O_2 cell of the unit may be expired. Contact the Service Department if the problem continues.
O2:UCAL ERROR	Low	The unit has detected a fault with the user calibration of the internal oxygen monitoring module. Perform a user calibration. Contact the Service Department if the problem continues.

Other Messages

	Priority	Description
LOW BATTERY	*Special**	Battery power is low. Recharge batteries.
WAVEFORMS FROZEN	Informational	The user has selected the waveforms to be frozen. Press the FREEZE key again to resume normal display.

* LOW BATTERY has unique alarm characteristics, see page 5-3.

⚠CAUTION⚠

- Additional alarms may alternate with any of the alarms listed in this section. At no time does any alarm, message or alert cause another message to not be displayed.

Section 6 — Trends

Description

The trend memory stores data at regular intervals for review at a later time. Trend data can be reviewed by printing it out on an external printer connected to the Model AA-2005.

To view the tabular trend, press the TREND key and the table appears in the right side of the waveform display.

Trend Interval

To change the trend interval press and hold the TREND key while viewing the tabular trend. A second window appears. Change the trend to the desired interval by rotating the knob.

Trend data for each parameter is stored every 30 seconds at the zero and 30 seconds mark. Trend data is sampled every ten seconds and the three samples are averaged and stored in trend memory every 30 seconds.

Capacity

The trend memory can store up to 24 hours of trend data at 30 second intervals.

When the trend memory is filled to maximum capacity, the new trend data begins to overwrite the oldest trend data in the memory.

Trend Screen Update

The table is not updated while it is being viewed. Scroll up to view data that is recorded after the trend screen is activated. The trend screen automatically returns to the main screen after 45 seconds.

Trend Setup

The trends may be viewed in graphical format in the trend window. Up to two parameters may be viewed in graphical format.

The trend view may be changed in the trend setup window.

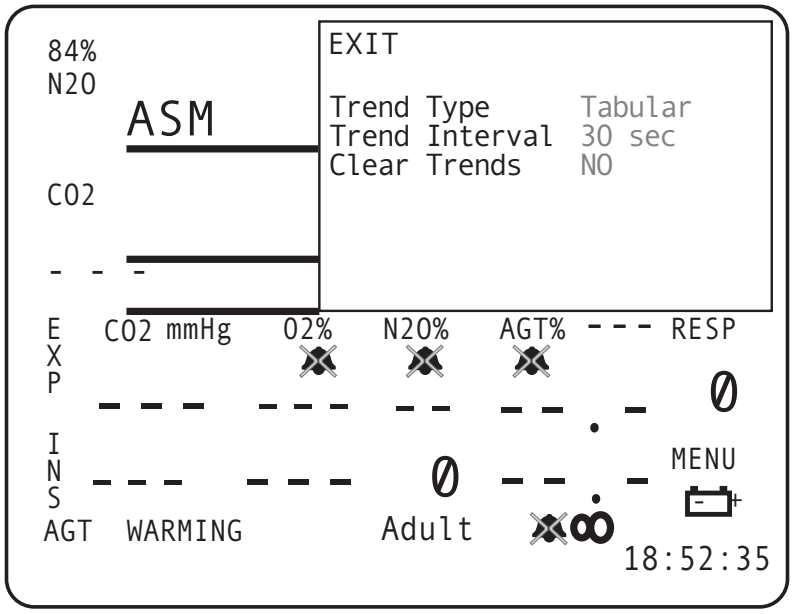


Figure 6-1: Trend Setup Window

To view trends:

1. Press the TREND key to enter the trend window.
2. Either the *Tabular* or *Graphical* Trend appears.
3. Press and hold the TREND key to enter the trend settings.
4. Set the trend type to *Graphical* or *Tabular*.
5. If *Graphical* is selected, set the *Trend Interval* as desired.
6. *EXIT* the trend setting window. Press the TREND key to view the trend displays.
7. Rotate the knob clockwise to see older data.
8. Press the TREND key to exit trends.

NOTE: The trend setting window defaults to *Tabular* trend. The setting for *Trend Interval* is not visible until the *Trend Type* is set to *Graphical*.

Graphical Trends

The graphical trend window covers the upper right corner. The physiological parameter and the unit of measurement is listed horizontally on the first two rows.

The graphical trend window displays for about 45 seconds before timing out. The trend window does not update automatically. The trend window updates each time it is accessed.

The most current data is always displayed on the top. Time stamps for the selected *Trend Interval* are indicated to the left of the line graphs.

Scrolling The Graph

The trend window can be set to display up to 24 hours of data. Rotate the knob clockwise to scroll the graph to show older data. Rotate the knob counter-clockwise to scroll back towards the most current data.

The rate of advance varies with the selected *Trend Interval*.

Trend Interval	Minutes per each click
2 hours	1
4 hours	2
8 hours	3
12 hours	4
24 hours	4

The time stamps update each time the knob is rotated. It is not possible to scroll past the current time.

The trend graph resets to the current time stamp upon exiting to the main screen and returning to the trend window. The trend graph remains at the selected time location while entering and returning from the trend settings window.

Interruption Due To Power Cycling

The graphical trend has gaps due to power cycling of the analyzer. If the period of missing data is within the last 24 hour period the gaps appear where the power was turned off.

If the power was turned off for a length period of more than a day, a blank period is inserted between the new and old data. The new data begins on a new window with new time stamps. The gap between the monitoring sessions is equal to the *Trend Interval* in length.

Trend Display

Two physiological parameters may display at the same time in the graphical trend window. The line graphs are shown in the color corresponding to the numerical display. The color of the line graph changes to the color of the source data.

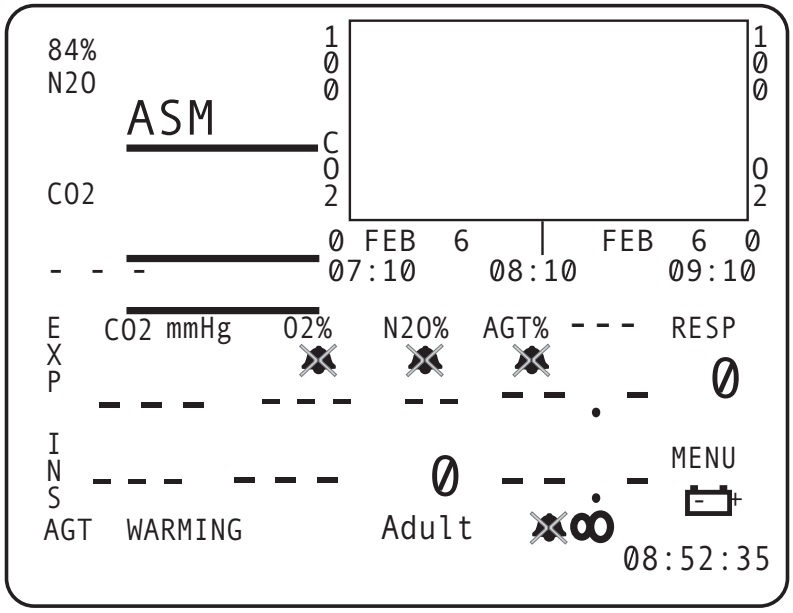


Figure 6-2: Graphical Trend Screen

The sample trend screen shows CO_2 and O_2 data.

7:10 a.m.	Earliest data from range selected.
8:10 a.m.	Mid-point of data.
9:10 a.m.	Latest data

Tabular Trends

Tabular Trend Markers

Various messages appear in the tabular trend to indicate that system events occurred. A complete list is as follows:

FREEZE ON	FREEZE OFF
AUDIO ON	AUDIO OFF
POWER	

NOTE: Permanent silence and 2 minute silence are both recorded as an *AUDIO ON/OFF* event in the tabular trend table.

Trend Messages

The trend also records messages in the trend table that indicates the status of the analyzer at that time. The time and date stamp are also recorded when one of the following messages is recorded. All messages appear in the trend table regardless of the interval selected for the table or the time that the message occurred.

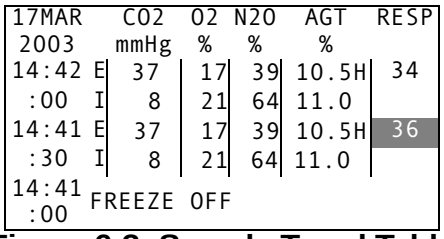
- When the analyzer enters and exits Standby Mode an *AUDIO ON* or *AUDIO OFF* message is recorded in the trend table.
- When the analyzer enters and exits Silence Mode an *AUDIO ON* or *AUDIO OFF* message is recorded in the trend table. This includes two minute silence and permanent silence conditions.
- When the monitor's waveforms are "frozen" and "unfrozen," a *FREEZE ON* or *FREEZE OFF* message is recorded in the trend table.
- When the monitor is turned off and on the message *POWER* is recorded in the trend table.

At midnight the analyzer records the date change into the trend table. This does not occur if the analyzer was turned off at midnight.

Data Format

The parameters are listed in the first row followed by the units in the second row.

- Measured parameters that exceed or drop below alarm limits are highlighted.
- When a sampling module is on and no value can be determined for the parameter, three dashes "---" display in the trend table.
- If a sampling module is turned off in the *Alarm* window, the word *OFF* displays in the trend.
- If a sampling module is turned on and no valid measurement is taken, the word *ERR* displays in the trend.
- Newest trend data displays at the top of the trend window.



17MAR 2003		CO2 mmHg	O2 %	N2O %	AGT %	RESP
14:42 :00	E	37	17	39	10.5H	34
	I	8	21	64	11.0	
14:41 :30	E	37	17	39	10.5H	36
	I	8	21	64	11.0	
14:41 :00	FREEZE OFF					

Figure 6-3: Sample Trend Table

The agent (AGT) column denotes the primary agent with the initial letter of the agent name:

- H = Halothane
- E = Enflurane
- I = Isoflurane
- D = Desflurane
- S = Sevoflurane
- U = Unknown

Clearing the Memory

To clear the trend memory:

1. Press the TREND key to display the trend.
2. Press and hold the TREND key again to display the trend setup window.
3. Select the clear trend option and select *YES* to confirm the clearing of the trend data.

The trend memory is automatically cleared when:

- The time and/or date are changed in the menu
- The patient size is changed (adult/pediatric/neonate).

Section 7 — Printing and Data Ports

Description

The Model AA-2005 is capable of printing all agent gas parameters in tabular (text). The anesthetic agent analyzer can also produce graphical (waveforms) formats as specified by the user. The Model AA-2005 needs an external printer attached to the device to perform printing functions.

Snapshot Size

The period of time (in a graphical print) that starts 4.5 seconds prior to pressing the PRINT key and lasting the duration of the "Snapshot" setting in the print menu. (i.e. if the print type is set to graphical and snapshot is set to 6 seconds then the unit prints out the waveform data selected 4.5 seconds prior to a PRINT keypress and 1.5 seconds after the PRINT keypress).

History Size

History size is a period of time defined by the user that is prior to the snapshot time period. History size can be selected as 6 or 12 seconds.

Print Modes

Demand Print

If the print type is set to tabular pressing the PRINT key causes an immediate print-out of the vital signs numbers, date, time, and patient data in a “tabular” text format.

If the print type is set to graphical pressing the PRINT key causes an immediate print-out of the selected waveforms for a duration as selected by “snapshot size.”

Freeze Print

A freeze print is initiated by depressing the PRINT key after setting the monitor in “Freeze” mode (pressing the FREEZE key). The printout is determined by the settings in the Print menu. This strip represents the history size added to the snapshot data.

If print type is set to graphical, the waveforms selected are printed out. The data printed is for a history time period followed by a snapshot time period.

If print type is set to tabular, a demand tabular print is issued using the “frozen” numeric vital signs data on the screen.

Trend Print

After displaying a trend on the unit's screen (by pressing the TREND key), depressing the PRINT key causes a trend print of the data displayed on the screen.

Depressing and holding the PRINT key (while a trend displays on the monitor’s screen) causes all of the stored Trend data to print out.

Print Formats

Tabular Printing

A header is printed containing the device model, the operating software revision, the time and date, and the patient information. The title for each parameter follows.

The format of the TEXT print is as follows:

TIME	RESP	ETCO2	INCO2	ETO2	INO_2	AGT EXP	AGT INS	N_2O EXP	N_2O INS
03:13:44	60*	37	8 mmHg	17 %	21 %	HAL 11.0 %	10.5 %	39 %	64 %

Numerical values for all current parameters are printed. The sample below shows a tabular print out.

Graphical Printing

If both waveform 1 and 2 have been set to a physical parameter the print out is a split dual waveform. If only one of the waveforms is turned on, a single waveform is printed using the entire waveform area. If both waveforms are turned off, the waveform area of the print out is blank.

Selectable options for waveforms are *ET CO2*, *O2*, *AGT* (agent), *N2O*, *BxB*, and *OFF*.

Numerical values for respiration, $ETCO_2$, $INCO_2$, ETO_2, INO_2 and agent gases are printed below the waveform grid.

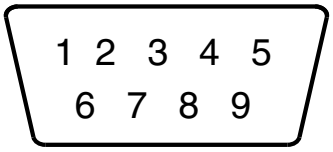
Data Output Ports

The unit supports a variety of communication connections. The communications ports are located along the left edge of the back of the device. The ports are as follows:

- COM1 Port, RS232 Serial DB-9
- COM2 Port, MiniDIN 8, Service/Analog
- Video Port

COM1 Port

The unit uses a serial port (DB-9 female) for the external data output port. The monitor uses a standard RS232 communication protocol with a full hardware handshake.



Pinout,
DB-9 connector

PINOUT CHART

Pin	Signal
1	(Unused)
2	RX1
3	TX1
4	DTR
5	Ground
6	DSR
7	RTS
8	CTS
9	(Unused)

Figure 7-1: COM1 Pinout Diagram

SERIAL PRINTING

The COM 1 port supports sending data to an external serial printer or computer terminal. To send the data as described in the beginning of this section to the COM 1 port, the print device must be set to *Serial* in the *Configuration* menu. Printing, except for trend printing, is then routed to the COM1 port.

Set the serial format to “TEXT” in the *Configuration* menu to simulate the tabular printout. Set the serial format to “CSV” in the *Configuration* menu to create a “comma separated variable” table. The CSV format can be used by software programs. A description of the CSV format is located at the end of this section.

SENDING DATA TO A COMPUTER

Use a standard null modem serial cable to connector to the computer. A common computer terminal program and an unused RS232 serial port is needed for external communications.

BC Biomedical recommends using the Windows HYPERTRM.EXE program provided with MS Windows 95/98. HYPERTRM.EXE can be found in the Windows accessory directory. For older computers using MS Windows 3.1, the communications program TERMINAL.EXE can be found in the Windows directory.

Set the analyzer to interval printing with serial output selected. With the computer terminal connected, a data file may be collected. The file may then be further evaluated by computer. See the description for CSV format at the end of this section.

TERMINAL CONFIGURATION

The cable connections should be completed and the terminal program should be configured before attempting to send data.

The recommended settings are as follows:

Baud Rate:	9600 or 19200
Parity:	No Parity
Stop Bits:	1
Data Bits:	8
Hardware Control:	None

EXTERNAL SERIAL PRINTER ACCESORY

The Seiko DPU-414 is pinned out as a modem would be (DCE - data communications equipment) rather than as a typical printer/computer (DTE - data terminal equipment). Use a null modem serial cable to connect the analyzer to the printer.

A standard DB-9 serial connector is located on the back of the DPU-414 thermal printer. Read the manual provided with the printer kit for additional instructions.

Configure the selected external printer so that it can communicate with the unit. Follow the configuration instructions provided with your printer.

The required settings are as follows:

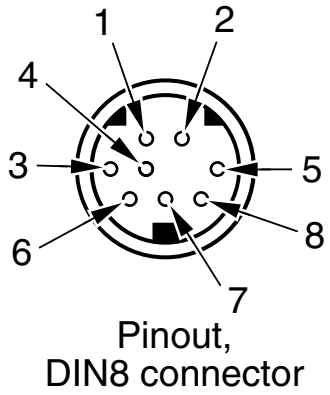
Baud Rate:	9600 or 19200
Parity:	No Parity
Stop Bits:	1
Data Bits:	8

COM2 Port

The unit uses of the COM2 serial port (8-pin Mini DIN) for loading system software updates and for reprogramming. The communications ability of this port are for service use only. Software is downloaded using the Download Station. Contact Customer Service for more information about the software loader.

There is also an analog output signal available at pin 2. For information about sending analog data to a plotter or chart recorder contact Technical Support.

The connector pinouts are shown below.



PINOUT CHART

Pin	Signal
1	Boot 2
2	Analog Wave
3	RX 2
4	Ground
5	TXL
6	TX3
7	RX3
8	Boot 1

Figure 7-2: COM2 Port Pinout Diagram.

Video Port

The analyzer has a DB-15 VGA video port that is functional on monitors with TFT screens. Contact customer service for more information about remote video screens approved for use with this device.

CSV Data Format

The Comma-Separated Variable output presents the data in a form that is easily imported into a spreadsheet application where further analysis can be done on the data. The data is output in ASCII format with each field (time, expired and inspired CO_2, expired and inspired O_2, expired and inspired N_2O, respiration, and expired and inspired agent gases) separated with a comma. Using the Windows 3.1 TERMINAL.EXE program and EXCEL (4.0), here is an example of how it may be used:

1. Connect the COM1 port to the serial port on the computer.
2. Start Terminal from the Accessories menu.
3. Choose Settings|Communications to set the computer's connector to the proper port. Check communications settings.
4. Choose Transfers|Receive Text File. Assign a name to the data (e.g. DATA.TXT) and press OK.
5. At this point, all data transmitted from the monitor will appear on the screen and will be saved in DATA.TXT.
6. When all the desired data has been accumulated, choose Transfers|Stop to close DATA.TXT.
7. Start EXCEL and choose File|Open.
8. Enter/Click on the file name and press the Text button.
9. For Column Delimiter, choose "Comma". For File Origin, choose "Windows (ANSI)". Then choose OK.
10. Choose OK again from the Open dialog to open and display DATA.TXT.

The data is organized in a table by field. Using the EXCEL presentation options, this data could be graphed, printed in tabular form, or analyzed statistically in some other way.

Section 8 —Maintenance

Cleaning and Disinfecting

⚠WARNING⚠

- Shock Hazard! Unplug the power cable from the unit before cleaning device.
- Shock Hazard! Never immerse the unit.
- Additional cleaning and maintenance warnings and cautions are listed in the *Model AA-2005 Service Manual*.

Do not use abrasive cleaners on the unit or on any sensors or probes. Abrasive cleaners can damage the unit, sensors, and probes.

The exterior surface of the unit may be wiped clean with alcohol and dried with a soft, dry cloth. It is best to use a cotton cloth for cleaning.

Accidental Wetting

⚠WARNING⚠

- Shock Hazard! The unit is AC powered. Saturated electronic devices present a danger to anyone who handles the them.

The action to be taken following accidental wetting of the equipment is as follows:

1. Turn the power off! Disconnect the AC power cord from the unit.
2. Use a clean, dry towel or cloth to remove the liquid from the device housing.
3. The unit should be inspected by an service technician as soon as possible.
4. If the internal mechanism is saturated, allow the liquid to drain out for 24 hours before shipping.
5. If liquid has entered the unit, it needs to be dried and cleaned internally. Full testing is required before the device can be used. Contact the Service Department as soon as possible.

Time is critical! The longer any liquid remains in the device, the more damage it can do. It is important to service the monitor immediately after any liquid spills into it.

Testing and Calibration

Refer to the *Model AA-2005 Service Manual* for information about calibration and testing.

Safety Testing

The unit should be electrically tested annually. Have a qualified service technician perform annually the safety testing listed in the service manual.

- Perform complete functional testing of the unit.
- Test the monitor for electrical safety.

Service Checks

If the unit shows any signs of physical damage, return it to the Service Department for repair.

Do not remove the cover. Refer all servicing to a qualified technician. Descriptions of these tests can be found in the *Model AA-2005 Service Manual*. Some tests may require specialized equipment.

Maintenance Schedule

Every Use	• Inspect the accessories and cables for damage and proper connection. • Change the gas sampling device, sampling line.
Every Week	• Change the water trap or as needed.
Every 3 Months	• Clean the exterior of the unit (or clean as needed). • Check the O_2 cell. Change if necessary.
Every 6 Months	• Verify the agent gas auto-calibration. Return for service if verification fails.
Every Year	• Perform the annual safety tests. • Change the O_2 cell. • Check the gas flow rate. Adjust if necessary. • Check the CO_2 absorber and replace if necessary.

NOTE: Failure to change the O_2 cell annually as required in the maintenance schedule may result in damage to the device requiring repair and/or replacement of internal components as a result of degraded O2 cells.

Battery Power

The unit contains an internal battery that requires exposing internal circuits during replacement. See the service manual for battery replacement procedures.

Expendable Components

The internal oxygen cell (O_2 sensor) and carbon dioxide absorber will degrade over time. Replacement requires opening the analyzer's case and should be performed by a qualified service technician. See the service manual for instructions.

Long-Term Storage

No special preparation is necessary for long term storage.

Disposal

At the end of its useful life, the unit and its accessories may be disposed of according to your institution's policies and procedures for disposal of patient-contact medical waste.

Appendix A — Accessories

Gas Monitoring Accessories

Sampling Devices	Agent Sample Lines (Box of 25)	BC20-43000
	Water Traps (Box of 30)	BC20-43001
	Ventilation Adapters (Box of 10)	BC20-43019
	Scavenging Kit (Exhaust Line & Adaptor)	BC20-43003
	Replacement O_2 Cell	BC20-43002
	Replacement CO_2 Absorber	BC20-43020
Calibration Accessories	Hardware Regulator For Cylinder	BC20-43004
	Regulator Tubing	BC20-43005
	Cal Gas Cylinder (5% CO_2, Balance N_2)	BC20-43011
	Cal Gas Cylinder (10% CO_2, Balance N_2)	BC20-43012
	Cal Gas Cylinder (80% O_2, Balance N_2)	BC20-43013
Verification Accessories	Agent Verification Aerosol	
	(1% Isoflurane, 5% CO_2, 60% N_2O, Bal N_2)	BC20-43014
	(1% Enflurane, 5% CO_2, 60% N_2O, Bal N_2)	BC20-43015
	(1% Halothane, 5% CO_2, 60% N_2O, Bal N_2)	BC20-43016
	(4% Desflurane, 5% CO_2, 60% N_2O, Bal N_2)	BC20-43017
	(1% Sevoflurane, 5% CO_2, 60% N_2O, Bal N_2)	BC20-43018

Power Cord

	Power Cord (U.S. Domestic)	BC20-43006

User Manuals

Operator's Manuals	Paper	BC20-43007
	Compact Disc	BC20-43008
Service Manuals	Paper	BC20-43009
	Compact Disc	BC20-43010