midmark®

Midmark Multiparameter Monitor
Veterinary Vital Signs Monitor

For Models:

8019-021
8019-022
8019-023

8020-001
8020-002

User Guide

003-10464-00 Rev. AA2 (04/12/2024)
Software Version V2.01

Product Information

Dealer:

Date of Purchase:

Model / Serial Number:

Midmark Authorized Service Company:

8019 (left), 8020 (right)

Product Registration

To register your product, go to www.midmark.com

Product User Guide in Digital Format

To view most recent User Guide in digital format, scan the QR code below or visit https://qrco.de/bemhsS

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SECTION 1 - PREFACE

1.1 General

The Midmark Multiparameter Monitor continuously monitors and displays the following physiological parameters: ECG waveforms and heart rate, peripheral capillary oxygen saturation, an estimate of the amount of oxygen in the blood, SpO2 is an estimate of arterial oxygen saturation and pulse rate, respiration rate, systolic (SYS), diastolic (DIA) and mean arterial pressure (MAP), and temperature. Available options for this monitor include Invasive Blood Pressure (8019), a built in printer (8019, 8020), and HDMI connection (8019).

This Midmark Multiparameter Monitor can be upgraded to offer CO2 (8019, 8020) or Multigas (8019) monitoring at any time. With the addition of a Respironics Capnostat® 5 mainstream sensor or Respironics LoFlo™ sidestream analyzer, one can measure end-tidal CO2 as well as inspired CO2. Alternatively, one can use Masimo IRMA™ Mainstream CO2 analyzer or NomoLine® ISA™ CO2 Sidestream gas analyzer for measuring the same. Masimo IRMA™ AX+ Mainstream multigas analyzer or ISA™ AX+ Sidestream multigas analyzer can be used to measure N2O as well as five anesthetic agents (HAL, ENF, ISO, SEV, DES) in addition to CO2.

This User Guide is an integral part of the product and contains detailed information about the performance specifications, operation, and maintenance of the Midmark Multiparameter Monitor and its intended use. Observance of this User Guide is a prerequisite for proper product performance and correct operation and ensures patient and operator safety. It should always be kept close to the equipment.

1.2 Compliance

The manufacturer's quality management system complies with the international standards ISO 13485:2016 and has a certificate issued by TUV. Additional quality compliance certification includes IEC 60601-1:2005 + A1:2012 + A2:2020, IEC 60601-1-2:2014+AMD1:2020, IEC 60601-1-6:2010 + A1:2013 + A2:2020, IEC 60601-1-8:2006 +A1:2013 +A2:2021, IEC 60601-2-27:2011, IEC 60601-2-34:2011, ISO 80601-2-30:2018, IEC 80601-2-49:2018, EN ISO 80601-2-55:2018, ISO 80601-2-56:2017 + A1:2018, ISO 80601-2-61:2017, UL 62133:2017, 47 CFR Part 18, RoHS Directive 2011/65/EU, IPX2 and NRTL (USA and Canada).

SECTION 2 - SAFETY

2.1 Safety Notice

2.1.1 Intended Use

The Midmark Multiparameter Monitor is a portable multi-parameter monitoring device for animals intended to monitor basic physiological parameters of one patient at a time within an animal health environment and make that monitored data available to be interpreted by licensed veterinarians or veterinary technicians.

2.1.2 Application Environment

This device is for use by trained veterinary personnel in veterinary centers. The device is to be used on one patient at a time.

Transport and Storage Conditions	
Temperature	-4°F (-20°C) to 140°F (60°C)
Humidity	30%-93% (non-condensing)
Atmospheric Pressure	700-1060mbar (hPa)

Working Conditions	
Temperature	41°F (5°C) to 104°F (40°C)
Humidity	30%-85% (non-condensing)
Atmospheric Pressure	700-1060mbar (hPa)

2.1.3 Operator Requirements

Only qualified veterinary personnel who have read the User's Guide should use this monitor. The monitor is intended only as an adjunct in patient assessment. It must be used in conjunction with clinical signs and symptoms. United States Federal Law restricts this device to sale, distribution and use by or on the order of a veterinarian.

2.1.4 Terminology

The terms **NOTE**, **CAUTION**, and **WARNING** are used throughout this User's Guide to point out hazards and to designate a degree or level of seriousness. Familiarize yourself with their definitions and significance.

NOTE
Provides application tips or other useful information to assure that you get the most from your equipment.

CAUTION
Indicates a potential hazard or unsafe practice which, if not avoided, could result in minor personal injury or product /property damage.

WARNING
Indicates a potential hazard or unsafe practice which, if not avoided, could result in death or serious injury.

2.1.5 Monitor Safety

The safety statements presented in this chapter refer to the equipment in general and in most cases, apply to all aspects of the monitor. There are additional safety statements in the parameter chapters, which are specific to that monitored parameter.

The order in which safety statements are presented in no way implies order of importance.

2.2 Safety Requirements

The following warnings and cautions must be read and understood before operating the monitor.

2.2.1 WARNING:

- The Midmark Multiparameter Monitor is intended for use by trained and qualified veterinary personnel only.
- The Midmark Multiparameter Monitor is not intended to be used as an apnea monitor.
- The Midmark Multiparameter Monitor is not intended to be used during MRI or CT scan.
- When a defibrillator is used, make sure the patient does not make contact with the ground, metal objects, or other conductors or devices. During defibrillation, never touch the patient, table or the device.
- Alarm functions of the Midmark Multiparameter Monitor must be checked regularly. The alarm limits may have been improperly set or the alarm may have been disabled.
- Before putting the system into operation, visually inspect all connecting cables for signs of damage. Damaged cables and connectors must be replaced immediately.
- When several devices are used on the same patient, leakage current may increase and become a danger to the patient. Before using, please consult a professional to do a leakage current test to make sure the leakage current is within safety limits.
- Use properly grounded power sockets and ensure adequate grounding. If there is any doubt about the grounding, please use battery operation.
- Before using on another patient, make sure the previous monitoring data is cleared.
- Do not use the monitor in a location where flammable gases such as anesthetics are not properly contained to prevent explosion or fire.
- The Midmark Multiparameter Monitor should only be used on one patient at a time.

2.2.2 CAUTION:

- Check accessories on a regular basis and discard damaged accessories properly.
- To ensure patient’s safety and performance of the product, use only the manufacturer recommended accessories.
- Service parts must be in conformity with IEC 60601 standards. The system configuration of the monitor must be in conformity with IEC 60601-1-1 medical electric standard; otherwise, it will reduce the safety of the monitor.
- Even while not being used, the battery may still discharge. Check battery level every month.
- The ECG cable socket is for connecting ECG lead wires only. Please do not connect it to any other signal source. Pay attention to the color label and marks of ECG lead wires.
- Ensure that the conductive parts of electrodes and associated connectors, including neutral electrodes, do not come in contact with earth or any other conducting objects.
- Clean the monitor and accessories according to instructions. Always unplug the power cord before cleaning.
- Electromagnetic Interference - This product is designed and built to minimize electromagnetic interference with other devices. However, if interference is noticed between another device and this monitor:
    - Remove interfering device from room.
    - Plug monitor into an isolated circuit.
    - Increase separation between Midmark Multiparameter Monitor and interfering device.
    - Contact Midmark if interference persists.
- For continual safe use of this equipment, it is necessary to follow the instructions. However, instructions listed in this User’s Guide in no way supersede established medical practices concerning patient care.
- In the event of interrupted data or loss of data, please keep patient under close observation until the device returns to normal.

- Other devices connecting to the device should meet IEC standards (for example, data processing device should meet IEC 950, and medical device should meet IEC60601-1) and the whole system should meet the latest version of IEC60601-1-1 standards.
- Plastic bags and other packaging materials should be disposed of in accordance with related regulations.
- At the end of product life, the monitor, accessories, battery, and other consumable goods may become contaminated from normal use. Consult local codes and ordinances for proper disposal of equipment and other consumable goods.
- Do not open the enclosure of the monitor to avoid the risk of electrical shock.

2.2.3 NOTE:

- Install the monitor in a location that is easy for observation, operation and maintenance.
- Keep the User Guide near the monitor for easy reference.

2.2.4 WARNING - Li-ion Battery

- Improper operation may cause the internal li-ion battery (hereinafter called battery) to become heated or to ignite or explode. It may also lead to a decrease in battery capacity. Please read the Operator's Manual carefully and thoroughly before operating the monitor.
- Do not reverse the anode and the cathode when installing the battery as it may cause an explosion.
- Do not use the battery near a fire or in an environment where the temperature exceeds 140°F (60°C).
- Do not heat the battery or throw it into fire.
- Do not splash the battery or throw it into water.
- Do not destroy the battery. Do not pierce, hit, step on, throw, drop, shock, or physically damage the battery in any way.
- Do not disassemble or modify the battery as it could lead to overheating, smoking, deformation, burning, or other dangerous results.
- If leakage or foul smell is found, stop using the battery immediately. If your skin or clothes come into contact with the leakage liquid, cleanse it with clean water at once. If the leakage liquid splashes into your eyes, do not wipe them. Irrigate them with clean water first and go see a doctor immediately.
- Only use batteries made specifically for this monitor.
- Properly dispose of or recycle the depleted battery according to local rules and regulations.

2.2.5 WARNING - Cleaning and Maintenance

- Turn off the power before cleaning and disinfecting. The mains power supply must be switched off if it is used, and the power cord and any patient cables must be removed.
- Do not allow any detergent to seep into the monitor.
- Never immerse the monitor and patient cables in liquid.
- Do not clean the monitor and accessories with abrasive fabric and avoid scratching the electrodes.
- Any remainder of detergent should be removed from the unit and the patient cable after cleaning.
- Do not use high-temperature, high-pressure vapor or ionizing radiation as disinfection methods. Do not use chloric disinfectant such as chloride, sodium hypochlorite etc.

2.3 Safety Symbols

NOTE
Some symbols may not appear on all equipment.

Symbol	Definition
	Type BF Applied Part: F-type, defibrillation proof applied part (floating/insulated) complying with the specified requirements of IEC 60601-1 Medical Standards to provide a higher degree of protection against electric shock than that provided by Type B applied parts. There are six BF type defibrillation proof applied parts (NIBP, TEMP1, TEMP2, Nellcor SpO2, Masimo or Respironics CO2, Masimo AA (Option - 8019)) and following exposure to a defibrillation event, the parameters will resume normal operation after 10 seconds.
	Type CF Applied Part: F-type, defibrillation proof applied part (floating/insulated) complying with the specified requirements of IEC 60601-1 Medical Standards to provide a higher degree of protection against electric shock than that provided by Type BF applied parts. There are three CF type defibrillation proof applied parts (ECG, IBP1 and IBP2 (Option - 8019)) and following exposure to a defibrillation event, the ECG parameter will resume normal operation after 5 seconds, while IBP will resume after 10 seconds.
	Attention: Consult accompanying documents.
	DC Power Supply
	Fuse
	Power Adapter
	Equipotentiality
	Power ON/OFF
	Alternating
	Current Earth Connector
	Network Interface
	USB Interface
	Caution: U.S. federal law restricts this device to sale by or on the order of a veterinarian.
	Liquid Protection Class
	Waste electrical and electronic equipment directive
	Notified Body Code
	Production Date
	Serial Number

	Manufacturer Info

2.4 Packaging Symbols

These symbols are used on the packaging material for the Midmark Multiparameter Monitor:

Symbol	Definition
	Keep Upright
	Fragile, Handle with Care
	Maximum Stacking
	Keep Dry
	Temperature Range Requirement
	Humidity Range Requirement
	Pressure Range Requirement

SECTION 3 - INSTALLATION & NAVIGATION

3.1 Installation and Connection

3.1.1 Environment Requirements

To ensure electric installation safety, the environment should be reasonably dust free, without corrosive or combustible gas, or extreme temperature or humidity.

Keep a space for the monitor at least 5cm from the wall to ensure good air ventilation.

Extreme temperature can affect the accuracy of the monitor and damage accessories or circuits.

Please ensure that water does not condense in the monitor when using the device. For instance, when the monitor is transferred between buildings, there is a risk of condensation because of exposure to humidity combined with a difference in temperature.

WARNING
Never use the monitor in an environment with combustible anesthetics that are not properly contained.

3.1.2 Power Supply Requirements

Rated Input Voltage	AC100V-240V
Rated Frequency	50Hz/60Hz
Rated Input Power	160VA
Fuses	T1.6AH, 250V*
Rated Battery Voltage	d.c. 11.1V
Battery Capacity	4400mAh
** Note: T1.6AL fuse can also be used*	

3.1.3 Shock Protection

The Midmark Multiparameter Monitor is a Class I device, in conformity with IEC60601/EN60601 requirements, with protective grounding (through three pin power plug).

WARNING
To turn off the AC power, please unplug the power cord from power socket or unplug the power cord from the AC power receptacle on the monitor.

The On/Off button will not turn off the AC power of the monitor.

3.1.4 Patient Grounding

During cardiac or cerebral examinations, in order to eliminate the potential difference between different equipment, the monitor has a special cable to connect to the grounding system. The grounding cable should be used when using high electrical output equipment such as a defibrillator or electric cautery, or any equipment that may cause interference with the monitor.

Connect the small end of the grounding cable to the grounding (equipotentiality) connector on the monitor as shown in Fig. 3-2, Item 6. The large end (which may be a clamp-like object) of the grounding cable should be connected to any metal surface or copper pipes.

3.1.5 Combination of Equipment

Both medical and non-medical equipment must comply with IEC60601-1-1 standard.

> ***CAUTION***
> *The use of several machines together can increase the current leakage which risks injury to patient and medical personnel.*

3.1.6 Unpacking

After confirming the outside packing is intact, please open the box and inspect the contents:

- Midmark Multiparameter Monitor
- Component Package

If any damage is found during shipping, please keep the package and contact Midmark immediately.

3.2 Before Monitoring

Before monitoring the patient, please check the following:

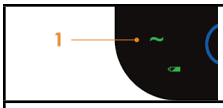
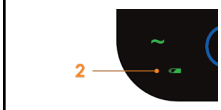
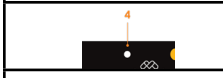
- Check if there is any mechanical damage.
- Check the external connections.
- Check if the monitor is in good working condition.

> ***WARNING***
> ***If any abnormalities are found or mechanical damage is suspected, please do not use the monitor and contact Midmark as soon as possible.***

3.3 Front Panel

The front panel of the Midmark Multiparameter Monitor is as shown in Fig.3.3-1:

The Midmark Multiparameter Monitor 8019 (left) and 8020 (right) front enclosures (Fig.3.3-1)

	1.	Power Indicator: AC power indicator. When the monitor is on and connected to AC power, the green LED will be on. If the monitor is not connected to AC power or if the monitor is not on, the LED will be off.
	2.	Battery Indicator: This is the battery power indicator. When the monitor is on and connected to AC power, the green LED will be on if the battery is properly installed. The battery will automatically charge when connected to AC power. When disconnected from AC, a blinking green LED will be on. The LED will be off if the battery is not installed or if the monitor is off.
	3.	Quick Access Buttons: Refer to 3.4.2 for details on each button.
	4.	Brightness Sensor: This is the sensor for the auto brightness setting. It will detect ambient light conditions and automatically adjust the brightness of the screen.
	5.	Alarm Indicator: Dual-color (red/yellow alarm indicator). This lights up whenever there is an alarm. For physiological alarms, it is dependent on the alarm level for each parameter. Red LED flashes if the parameter alarm level is set to High. Yellow LED flashes if the parameter alarm level is set to Medium. Yellow LED stays on without flashing if the parameter alarm level is set to Low. For technical alarms, the user is not able to adjust alarm levels. Therefore, it will also be a Yellow LED light, no flashing.

3.4 Navigation Options

3.4.1 Color TFT Touch Screen

The Midmark Multiparameter Monitor features a color touch screen for ease of navigation. Press on the screen to access menus and input data.

3.4.2 Quick Access Buttons

The Midmark Multiparameter Monitor has 5 (8019) or 4 (8020) quick access buttons on the front of the monitor.

	1.	Alarm Reset: This will silence audible technical alarms, physiological alarms and latching alarms that no longer exist.
	2.	Alarm Pause: This will pause the audible alarm for an interval designated by the user.
	3.	Start/Stop BP: Press this button to start blood pressure measurement; press it again to stop blood pressure measurement. If this button is not pressed to stop blood pressure measurement, the monitor will stop automatically when the measurement is completed.
	4.	Start/Stop Printing (8019 only): Press this button to start printing. Press it again to stop printing. If this button is not pressed to stop printing, the monitor will stop printing automatically after printing out 8 seconds worth of data/waveform. The monitor may also be set to print at user selected intervals.
	5.	Menu: This opens the Menu dock for additional options.

3.4.3 Main Touch Screen Display

Main screen display (Fig. 3.4.3-1)

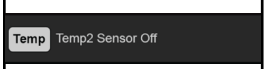
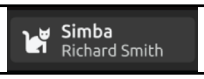
1.	Status Bar: Displays patient information and provides quick access to Alarm message center, Patient Setup, volume, date/time, and battery status.
2.	Menu Dock: Provides quick access to certain menu items.
3.	Waveform Area: Displays waveform for ECG, SpO2, and RESP/CO2. IBP and Multigas (Option - 8019).
4.	Numerical Data Area: Displays parameter values for ECG HR, Temperature, SpO2 %, SpO2 Pulse Rate, RESP/CO2 and NIBP. IBP and Multigas (Option - 8019).
5.	Tabular Trend data display or CO2 Catalog display when this option is turned on.

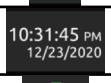
NOTE
Main Screen Display may vary from monitor to monitor depending on the number of parameters available on the monitor. Monitors with only standard parameters will not display optional parameter information.

3.4.3.1 Status Bar

The Status Bar is located at the top of the Main Screen and allows quick access to the following information:

Main screen status bar (Fig. 3.4.3.1-1)

Status Bar	No.	Definition
	1.	Alarm Badge: This is not an active icon. The icon represents the severity of the alarm.
	2.	Alarm Message Center: Press the alarm message to open the Alarm Message Center. This is where the user can view technical and physiological alarm messages, access the Troubleshooting Guide, choose to Reset or Pause an alarm, and access parameter setup menus. Demo Mode Status/Message prompts will also be displayed here if Demo Mode is turned on.
	3.	Patient Setup: Press this icon to open the Patient Setup Menu. Icon will display Patient info following Patient Setup.

	4.	Volume: Press this icon to open the Volume Setup Menu. This is where the user can set the volume for Alarm Volume, HR Beat Volume, Pulse Volume and Touch Volume.
	5.	Time/Date: Press the Time/Date to open the Time Setup menu. This is where the user can set the Date, Time, Date Format, and Time Format.
	6.	Battery: This is not an active icon. It cannot be changed by the user but rather indicates the battery status.
	7.	Network Connection: This icon shows the network connection status.

3.4.3.2 Alarm Badge

Alarm Badge: The Alarm Badge indicates the priority level of an alarm.

	The cyan no visual pulsing with simple audio pulse badge is for technical alarms only and is considered Low Priority.
	The yellow slow visual and audio pulsing badge is for physiological alarms and is considered Medium Priority.
	The red fast visual and audio pulsing is for physiological alarms and is considered High Priority.

3.4.3.3 Alarm Message Center

3.4.3.3.1 Demo Mode/Status Message Prompts

Demo Mode Status/Message Prompts: Strictly speaking, the message prompts are not alarms. The monitor will display some information associated with system status in addition to the physiological and technical alarms. If messages are occurring simultaneously, this area will rotate through all messages.

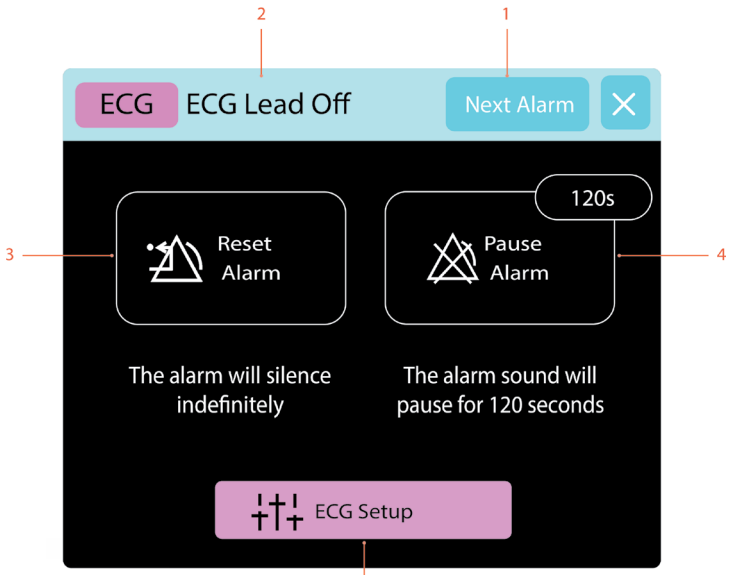
3.4.3.3.2 Physiological Alarm Messages

Physiological Alarm Messages: The physiological alarm messages are displayed in the physiological alarm area at the top of the screen under the technical alarm message area. A physiological alarm is triggered when a physiological parameter of the patient exceeds the alarm limit or the patient has physiological abnormalities. If multiple alarm events are occurring simultaneously, this area will rotate through all alarm event messages.

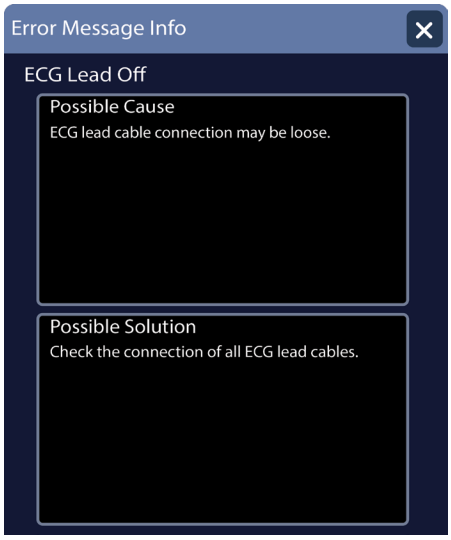
3.4.3.3.3 Technical Alarm Messages

Technical Alarm Messages: The technical alarm messages are displayed in the technical alarm area at the top of the screen. A technical alarm is also known as a system error message. These alarms are caused by improper operation or system failure which may result in system malfunction or distorted monitoring results. If multiple alarm events are occurring simultaneously, this area will rotate through all alarm event messages.

Pressing the Alarm Message, will display the Alarm Message Center and allows user to do the following:



1. Cycle through all alarms by selecting “Next Alarm” icon.
2. Access trouble shooting guide by selecting the associated alarms label on the top bar of the Alarm Message Center.



3. Reset individual alarms by pressing “Reset Alarm” icon.
4. Pause individual alarms by pressing “Pause Alarm” icon.
5. Access the associated parameters setup menu by pressing the “XXX Setup” bar at the bottom of the Alarm Message Center

3.4.3.3.4 Alarm Pause Status

Alarm Pause Status: To pause the alarm, select the Alarm Pause Quick Access Button or Alarm Pause icon from within the Alarm Message Center. The following icon will appear to the right of the alarm message(s) to indicate that the alarm sounds have been temporarily paused. The visual alarms are still active. A countdown for the pause will initiate and be displayed at the bottom of the Alarm Pause Quick Access Icon. The time for the countdown is defaulted to 120s but can be changed by the user. Once the countdown is complete, the alarm sounds will return.

3.4.3.3.5 Alarm Reset Status

Alarm Reset Status: To silence audible technical alarms, physiological alarms and latching alarms that no longer exist, select the Alarm Reset Quick Access Button or Alarm Reset icon from within the Alarm Message Center. The following icon will appear to the right of the alarm message(s) to indicate that the alarm sounds have been silenced. The visual alarms are still active. If a new alarm is initiated the alarm will overwrite the Alarm reset selection and sounds will return.

WARNING
Silencing the alarms completely is not recommended. Please make sure the patient is actively monitored by qualified and trained personnel at all times regardless of the Alarm Silence setting.

3.4.3.4 Patient Setup

Patient Setup: This area displays the patient species in picture format and the patient name. Pressing the screen in this area will open up the Patient Setup Menu. The only species available for display in picture format are cats, dogs, and horses. If “Other” is chosen, no picture will be displayed.

3.4.3.5 Volume

Volume: This area contains the icon for the volume settings. Pressing the icon will allow you access to the volume control menu, which will allow you to set the following volumes: Alarm Volume, HR Beat Volume, Pulse Volume, Touch Volume. Volume ranges from 0 to 5, with 5 being the loudest. When Alarm Volume is adjusted, the volume icon will change accordingly to indicate level of sound. When Alarm Volume is set to 0, the icon will change to indicate that alarm sounds have been disabled.

3.4.3.6 Time/Date

Time/Date: This is where the user can set the Date, Time, Date Format, and Time Format.

3.4.3.7 Battery Power Status

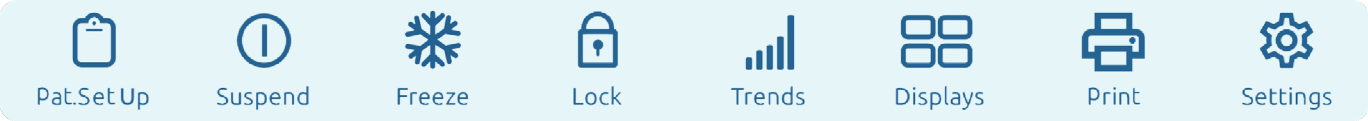
Battery Power Status: The battery icon shows the current battery status. This is not a button and cannot be pressed.

	Battery is full. The blue color indicates that the monitor is not connected to AC power.
	Battery status is indicated by the blue bar inside the battery. The lower it goes, the less battery power it has. The blue color indicates that the monitor is not connected to AC power.
	Battery is full. The lightning icon indicates that auto charge is on. The green color indicates that the monitor is connected to AC power.
	Battery is being charged when the green bar moves continuously upward in a cyclical pattern. This only occurs when the monitor is connected to AC power and the battery is not full.
	Battery is critically low. Connect the monitor to AC power immediately or the monitor may shut down.
	When connecting and disconnecting AC Power, the Battery icon will display as not detected momentarily.

3.4.3.8 Menu Dock

The menu dock is an additional row of menu icons that appear when selecting the Menu button and allows quick access to the following icons.

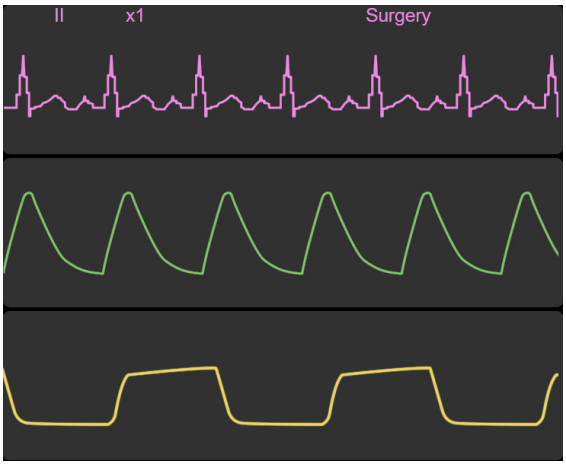
The following are the 8 quick access icons that appear in the Menu dock:



Menu Dock (Fig. 3.4.3.8-1)

Icon	Definition
Pat.Set Up	Pat.Set Up: This is the patient setup icon. Press this icon to open the Patient Setup Menu. The user may admit or discharge a patient and enter various patient data. Patient number is required for Midmark Anesthetic Record Interface subscribers.
Suspend	Suspend: Press this icon and confirm. The monitor will stop all waveform and parameter displays, trend recordings, and data within USB Data exports while suspended.
Freeze	Freeze: Press this icon to stop the movement of the waveform across the screen so that the user may analyze the current waveform more carefully. Press this again to restart the movement. Screen will remain frozen until the Freeze button is pressed again.
Lock	Screen Lock: Press this icon to lock up the touch screen function of the monitor to prevent accidental changes to settings. The Lock icon will change to an Unlock icon once it is pressed. Press the Unlock icon to unlock the touch screen function. The Unlock icon will then revert to the Lock icon.
Trends	Trends: Press this icon to open the Trend Menu to review Tabular, Graphic or NIBP trends.
Displays	Displays: Press this icon to select different display modes offered by the monitor: 3 Channels with Tabular Trend, Large Font, 4 Channels with Tabular Trend, 4 Channels without Tabular Trend, 7 Channel ECG (available when monitoring 5 lead ECG), and 5-8 Channel (available when monitoring IBP and Multigas, Option - 8019)
Print	Print: Press this icon to print current patient information. The printer will print up to a preset amount of minutes. Press this button again to stop printing before the preset time.
Settings	Settings: Press this icon to open the Settings Menu where the user may set preferences for various parameters and access major functions of the monitor.

3.4.3.9 Waveform Area



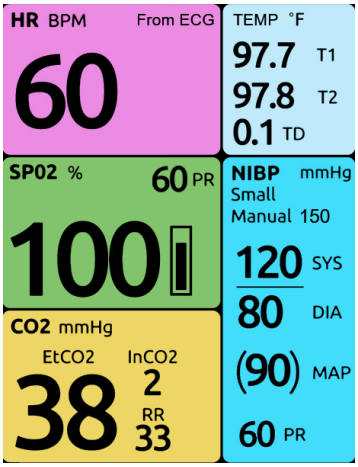
Main Screen Waveform Area (Fig. 3.4.3.9-1)

The Waveform Area displays real-time waveform data for ECG, SpO2, Respiration, CO2, or IBP1 and IBP2 (Option – 8019), N20 and AA (Option – 8019) depending on monitor features and settings. Press on a displayed waveform to access that parameter's setup menu.

Waveforms include the following:

- ECG 3-Leads: I, II, III
- ECG 5-Leads: I, II, III, V, avL, avR, avF
- SpO2
- Respiration Leads: RA-LA, RA-LL, LA-RL, LL-RL
- CO2 (Option – 8019, 8020)
- BP1 (Option – 8019): ART1, PA1, CVP1, AO1, RA1, ICP1, FA1
- IBP2 (Option – 8019): ART2, PA2, CVP2, AO2, RA2, ICP2, FA2
- AA (Option – 8019): CO2, N2O, ISO, DES, HAL, ENF, SEV

3.4.3.10 Numerical Data Area



Main Screen Numerical Data Area (Fig. 3.4.3.10-1).

The Numerical Data is located on the right side of the Main Screen and displays numerically the following parameter values in real-time: HR/PR, SpO2%, DIA/SYS/MAP NIBP, RESP, EtCO2, InCO2, RR, TEMP1, TEMP2, Temperature Difference, CO2 (Option – 8019, 8020), IBP (Option– 8019) and AA/N2O (Option – 8019) depending on monitor features and settings. Press on a displayed parameter to access that parameter's setup menu.

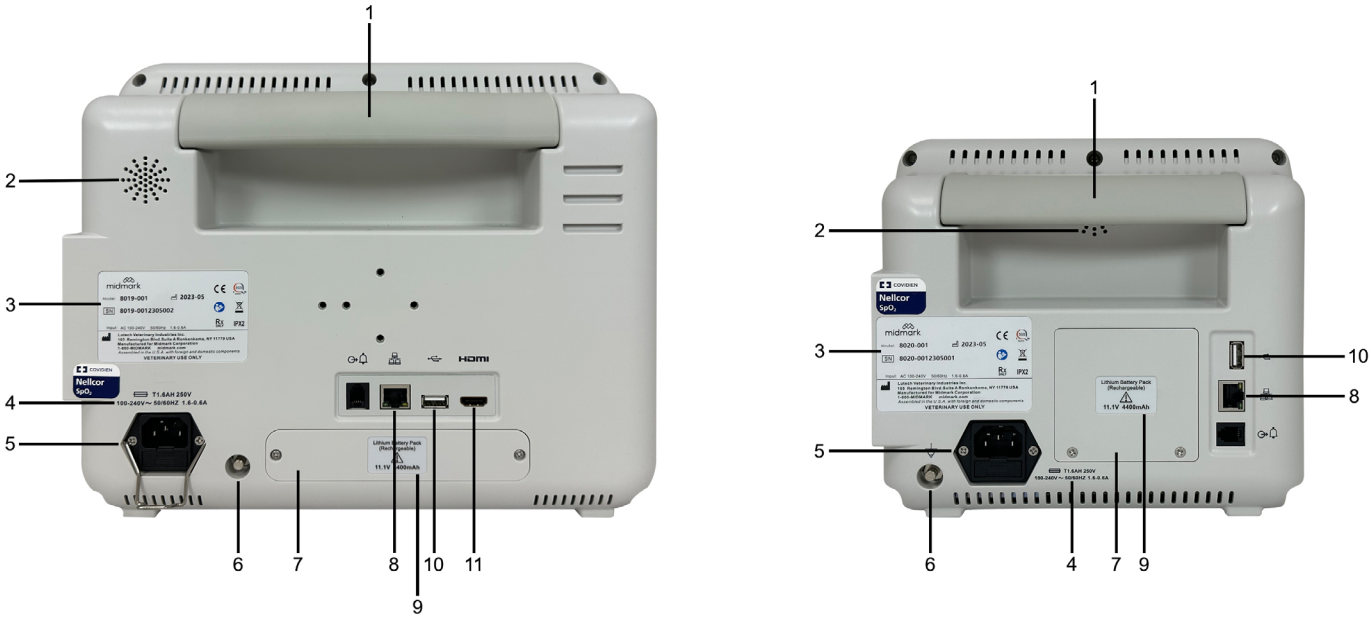
NOTE
Main Screen Display may vary from monitor to monitor depending on the number of parameters available on the monitor. Monitors with only standard parameters will not display optional parameter information.

3.4.3.11 Tabular Trend Display Area

The Tabular Trend Display Area displays the 4 most recent parameter values for a specific time and populates at a 1-minute interval. The parameter labels are displayed at the top along with their color identifier and the time populates under the Time column on the left side of the display. The parameters that can be viewed in the Tabular Trend Display Area: HR, SpO2, PR, T1, T2, SYS/DIA, MAP, RESP or EtCO2, InCO2, CO2RR (CO2 Optional – 8019, 8020) or AARR (AA Optional - 8019) depending on the monitor configuration or settings.

3.5 Rear Panel

The rear panel of the Midmark Multiparameter Monitor is as shown in Fig.3.5-1:



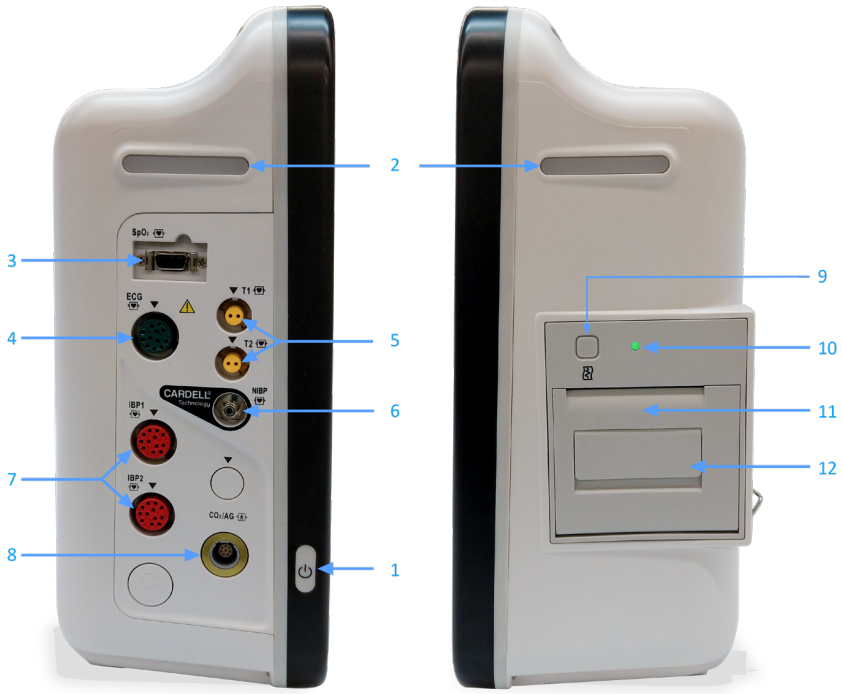
The Midmark Multiparameter Monitor 8019 (left) and 8020 (right) rear panels (Fig.3.5-1)

1.	Handle	7.	Battery Compartment
2.	Speaker	8.	Network Connection Port
3.	Label	9.	Battery Label
4.	Fuse Info	10.	USB Port
5.	AC Power Connector	11.	HDMI Port
6.	Grounding (Equipotentiality) Port		

WARNING
Other equipment connected to the device should be certified according to IEC standards (i.e. IEC 950 for data-processing equipment, IEC 60601-1 for medical equipment and IEC 60601-1-1 for whole system).

3.6 Side Panels

The side panel of the Midmark Multiparameter Monitor is as shown in Fig. 3.6-1:



The Midmark Multiparameter Monitor side panels (Fig.3.6-1)

1.	Power Switch: When the monitor is connected to the wall socket or there is enough battery power, press and hold button and the monitor will turn on or off. After the monitor is turned off, the battery continues to charge if the monitor is connected to AC power.
2.	Alarm Indicator: Dual-color (red/yellow alarm indicator). This lights up whenever there is an alarm. For physiological alarms, it is dependent on the alarm level for each parameter. Red LED flashes if the parameter alarm level is set to High. Yellow LED flashes if the parameter alarm level is set to Med. Yellow LED stays on without flashing if the parameter alarm level is set to Low. For technical alarms, the user is not able to adjust alarm levels. Therefore, it will also be a Yellow LED light, no flashing.
3.	SpO2: Receptacle for SpO2 extension cable.
4.	ECG: Receptacle for ECG cable.
5.	Temperature 1/2: Receptacles for temperature probes.
6.	NIBP: Receptacle for NIBP inflation hose.
7.	IBP 1/2: Receptacles for IBP cables. (Option - 8019)
8.	CO2 /AA: Receptacle for Mainstream or Sidestream CO2 (Option - 8019, 8020) or AA module accessories (Option - 8019).
9.	Print Button: push this button to print the current data/waveform. Push it again to stop printing.
10.	Printer indicator light.
11.	Printer: Internal built in printer. (Option - 8019, 8020)
12.	Printer door latch. Use latch to open the printer door and access the internal printer paper compartment.

NOTE
The monitor you receive may differ from the image above depending on the parameters ordered.

3.7 Power

3.7.1 AC Power

When AC power is used, the Midmark Multiparameter Monitor may be turned on at any time. Before plugging it into AC power, compare the resident power output with the requirements of the device. On the rear panel, you can see the power supply requirements.

After confirming all cables are properly connected, press and hold the power button located on connector side panel as shown below.

The Midmark Multiparameter Monitor power button. (Fig.3.7.1-1)

The system will start a self-diagnostic test which lasts about 1 minute. If the tests are successful, the monitor will display the main screen. The device can then be used for vital signs monitoring, communication, and battery charging.

When the device is plugged into AC power and turned off, the power indicator on the front panel continues to be lit, indicating the monitor is in standby mode and the battery is being charged.

3.7.2 Battery Power

When AC power is shut off, the Midmark Multiparameter Monitor can still work using the internal battery. The internal battery is pre-installed inside the monitor. Before use, the battery must be charged. Whenever the device is plugged into AC power, the battery will automatically be charging. The battery needs to be charged for at least 5 hours before a full charge is achieved. To ensure the battery is fully charged, it is recommended that the device be plugged into AC power even when the device is not in use.

A fully charged battery can support a working device continuously for approximately 2-4 hours, depending on the parameters in use. The frequency of NIBP measurements and printing may accelerate the consumption of battery power. As the battery power depletes the battery icon in the top right hand corner of the monitor changes from solid blue when full to half blue as the level decreases and finally to red. When the battery power is low, Battery Low, a low level alarm, will be triggered and a yellow alarm indicator light will appear. Plug monitor into AC power to recharge battery if a Battery Low alarm exists. When the battery power is critically low, a high level alarm message, System will Shutdown, will be triggered and a red alarm indicator light will appear. Monitor could shut down within 2 minutes. Plug monitor into AC power immediately to keep patient parameter data from being interrupted or lost.

WARNING

- ***Even when the device is off, the battery power will be discharged slowly.***
- ***When the device is being stored for a long time, remove the battery prior to storage.***
- ***Check the battery status and recharge at least once a month.***

3.8 Software Version and MAC Address

Follow the steps below to determine the software version of your monitor:

Step 1: Press the “Settings” Touch Screen Quick Access Icon.

Step 2: Press the “Maintenance” button followed by the “Monitor Info” button.

The Monitor Information menu will open. The software version, Wi-Fi and LAN MAC Address, and other relevant manufacturing information is stored within this menu. To exit this menu, press the X in the upper right corner of the screen or press anywhere outside of the menu.

SECTION 4 - ALARM SETUP

4.1 General Information

Alarms are designed to give an alert when the monitoring results are abnormal. These alerts are given via audible sounds, visual LED indicators, and flashing alarm messages. Alarms have three levels: High (Emergency) (2 sets of 5 beeps every 5-10 seconds with continuous red flashing visual alarm), Medium: (3 beeps every 25 seconds with yellow flashing visual alarm) and Low (Warning) (1 beep every 25 seconds with yellow solid visual alarm).

	High Priority Alarms: Example: Asystole, Parameter values exceed set limits when Alarm Level is defaulted to “High”, SYS-DIA is too low, Apnea Alarm.
	Medium Priority Alarms: Example: Parameter values exceed set limits when Alarm Level is defaulted to Medium.
	Low Priority Alarms: Example: Equipment Alarms or when parameter values exceed set limits when Alarm Level is defaulted to Low.

Typical warning alarms for equipment conditions are as follows:

- ECG Lead Off
- SpO2 Sensor Off
- Cuff Leak
- Cuff Loose
- No Cuff
- NIBP Over Pressure

Other alarm messages will appear depending on the parameter in use.

When sensors or probes are unplugged, the screen will display “No Sensor Connected”. When sensors or probes are not connected to a patient, the screen will display “Sensor Off”.

> ***NOTE***
> *Reference 14.2 Troubleshooting section or individual Parameter Monitoring sections within the User Guide for alarms specific to each parameter.*

Different aspects of the alarm function such as Alarm Level (which will change the tone alarm) may be adjusted within the setup menu of each individual parameter.

4.2 Alarm Pause

To silence the alarm for a pre-determined amount of time, press the Alarm Pause Quick Access Button 

or Alarm Pause icon from within the Alarm Message Center.

To end the silence timer before the pre-determined time frame has elapsed, press the button or icon again. The alarm will also resume normal alarm functions when the pre-determined alarm silence period expires.

The default Alarm Pause time frame is 120 seconds.

The Alarm Pause duration can be changed by accessing the Alarm Parameter Setup Menu as described in Section 4.3.1 below.

When the alarm is silenced using the Alarm Pause button, the occurrence of a new technical alarm, such as ECG Lead Off, will sound a new alarm but old alarms will remain paused until the Alarm Pause timer runs out.

Alarm Reset: This will silence the audible alarm of technical, physiological and latching alarms that no longer exist.

Alarm Reset can be disabled by pressing Alarm Reset again to end the silence or by pressing Alarm Pause. The Alarm Pause will begin to countdown and audible alarms will trigger again if the condition is still present.

WARNING
New technical alarms, such as leads off, as well as new physiological alarms, such as exceeding upper limits, will cancel the silence feature.

WARNING
The Low Battery Power Alarm may be silenced by the Silence Button. Plug the monitor into AC power as soon as you see or hear the Low Battery Power Alarm.

WARNING
When the alarm sound is silenced using the Silence Button, the user should pay close attention to the patient and the monitor screen for visual cues to ensure the safety of the patient.

4.3 Alarm Parameter Setup

4.3.1 Alarm Parameter Setup Menu

Follow the steps below to access the Alarm Parameter Setup Menu:

Step 1: Select the “Settings” Touch Screen Quick Access Icon.

Step 2: Select “Maintenance”.

Step 3: Select “User Maintenance” and enter the password: 2013. Press “OK”.

Step 4: Select the “Alarm Parameter” Touch Screen Button.

Alarm Parameter Setup Menu Options:

ALARM	You may turn the ALARM feature ON or OFF.
ALARM VOLUME	ALARM VOLUME may be changed from 0 to 9, 9 being the loudest and 0 being silent. By default, the alarm volume is set to 4.
LATCHING ALARM	The user may choose the Latching or No-Latching option for the physiological alarms only. By default, the alarm system is set to No-Latching, which means that as soon as the physiological alarm is cleared, the system will no longer prompt the physiological alarm.
ALARM PAUSE TIME	ALARM PAUSE TIME is the setting used for the Alarm Silence feature. The alarm silence period can be set to 1min, 2min, 3min, 4min, 5min, 10min, 15min, 20min or Permanent. By default, it is set to 2min.
ALARM DELAY	ALARM DELAY allows the user to delay alarms. The user can set this to OFF, 5s, 10s, 15s, 20s or 25s. If turned on, an alarm event will not trigger an alarm until the set time has passed. If the alarm resolves before the set time has passed, no audio or visual alarms will sound at all. By default, it is set to Off.
ALARM REMINDER SIGNAL	The user may choose to turn the ALARM REMINDER SIGNAL ON or OFF. The Alarm Reminder Signal is a precautionary audible alert to remind users the Alarm Volume is set to 0. By default, it is set to Off.
ALARM REMINDER INTERVAL	The user may set the ALARM REMINDER INTERVAL to 1min, 2min or 3min when the Alarm Reminder Signal is set to ON.
ALARM LIMIT	The user may turn the ALARM LIMIT ON or OFF. Turning the ALARM LIMIT on will display the preset upper and lower limits of each parameter next to the actual parameter values from the patient within the Parameter Box when in Large Font Display.
SPO2 HIGH LIMIT SWITCH	The user may turn the SPO2 HIGH LIMIT SWITCH ON or OFF. Turning the SPO2 HIGH LIMIT SWITCH ON allows users to edit the SpO2 high limit.

4.3.2 Alarms Menu

Alarm limits include upper and lower limits that are user adjustable. All parameter limits are available within this menu on the Midmark Multiparameter Monitor.

Accessing the Alarm Setup Menu:

Step 1: Select the “Settings” Touch Screen Quick Access Icon.

Step 2: Select “Alarms” at the top of the menu.

Step 3: Select the alarm limits to be adjusted. The following parameter alarm limits are available by default: ECG, SpO2, NIBP, RESP, Temp (1 and 2). Alarm Setup for optional parameters will become available once those parameter modules are activated. Optional parameters include CO2 (8019, 8020), IBP (8019) and Multigas (8019).

NOTE
Changing the Alarm Limits for the default Dog, Cat or Horse profile will only stick until the monitor is turned off. To modify the alarm limits permanently, create a new user profile. See sections 4.3.3 and 4.3.4 for tips on how to do so.

Accessing Alarm Limits Through the Waveform Area:

Step 1: Press on any waveform within the Waveform Area to access the menu for that particular parameter.

Step 2: Press “Alarms” to open the Alarms Menu for that specific parameter.

Accessing Alarm Limits through the Parameter Box:

Step 1: Press on any data within the Parameter Box to access the menu for that particular parameter.

Step 2: Press “Alarms” to open the Alarms Menu for that specific parameter.

Changing Alarm Limits:

Step 1: Once inside the Settings/Alarm tab, press on the parameter you would like to set up. This will open the menu for that specific parameter. Make sure to press the title of the parameter such as ECG, TEMP…etc.

Step 2: The current number will be displayed. Select the + or - for incremental adjustments in alarm limits or press on the current number to display a number pad.

Step 3: When entering alarm limit with number pad, enter the new number and press “Enter” to save. If you entered the wrong number, press the back arrow to delete the numbers one at a time. Press the “X” button on the upper right corner of the number pad to leave without entering any new numbers. Once a new number has been entered and the “Enter” button has been pressed, the user will be returned to the setup menu for that specific parameter. Select “Save” to save the new number. Otherwise, press the “X” button on the upper right corner to exit the menu without saving your changes. Switching to a different parameter without first saving your changes will cause the changes to not take effect.

4.3.3 User Setup

User Setup allows a total of 7 customized users to be saved. Each User can save their preferred alarm limits and custom display.

Alarm parameter settings may be changed by different users throughout the day. It is important to select the appropriate profile when admitting a patient. The user may return to default alarm settings for each parameter by entering the Alarm Setup menu for each specific parameter. Alarm limit modifications saved to a default Dog, Cat or Horse profile will reset back to default limits when the monitor is turned off. Alarm limit modifications saved to a custom profile will continue to be a part of the custom profile following a monitor restart.

Follow the steps below to enter the User Setup screen:

Step 1: Press the “Menu” Quick Access Button.

Step 2: Press the “Settings” Touchscreen Quick Access Icon.

Step 3: Press the box with the User icon  and currently selected “Profile Name” at the top of the Settings window. This name will change based on the Users Profile that is currently selected. It will either be Dog, Cat or Horse or a custom user profile name.

4.3.4 Configuring a Profile

Follow the steps below to configure a profile:

Step 1: Select “Create User” and then you will be prompted to select a patient type. The patient type for this profile cannot be changed after it has been selected. A “New User” profile will then appear.

Step 2: Press “Edit” for New User.

Step 3: Select “New User” under Name and enter desired name.

Step 4: Press “My Alarms” to configure parameter alarm limits.

Step 5: Press “Save” to save customized parameter alarm limits.

Step 6: Press “Yes” to save alarm limit changes to User’s configuration.

Step 7: Press “My Display” to configure a customized display.

Step 8: Press “Save” to save customized display.

Step 9: Press “Save” to save the custom user profile name or “Cancel” to exit without saving.

4.3.5 Loading Saved User or Default Profiles

Loading a saved user profile or default profile can be achieved using two different methods.

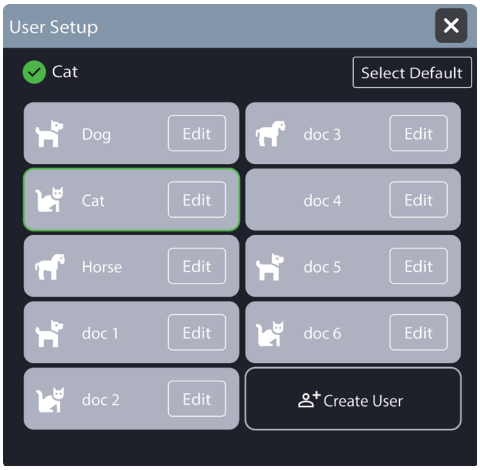
Method 1

Follow the steps below to use Method 1 to load a saved user profile or default profile:

Step 1: Select the “Menu” Quick Access Button.

Step 2: Press the “Settings” Touchscreen Quick Access Icon.

Step 3: Press the box with the User icon and currently selected “Profile Name” at the top of the Settings window. This will display the User Setup screen.



Step 4: Select the Profile you would like to use to load the settings into the monitor.

Step 5: Press the “X” on the upper right corner to exit.

Method 2

Follow the steps below to use Method 2 to load a saved user profile or default profile:

Step 1: Select the Patient Info icon in the Status Bar or “Pat.Set Up” located in the Menu dock.

Step 2: Select one of the default species profiles or a custom User profile.

Step 3: Enter the other relevant patient information and press “OK”.

CAUTION

It is recommended that before using the monitor on a patient, the desired User or default profile is pre-loaded onto the monitor using the steps described in Section 4.3.5.

4.3.6 Alarm Volume and Sound Setup

Volume Setup Menu

Press the VOLUME Quick Access Icon  located on the upper right corner of the screen to access the following volume options.

ALARM VOLUME	Choose from 0-5, 5 being the loudest. If ALARM VOLUME is set to 0, there will not be any audio alarms for either the physiological or technical alarms. However, the visual alarms will still be active.
HR BEAT VOLUME	Choose from 0-5, 5 being the loudest and 0 being silent.
PULSE VOLUME	Choose from 0-5, 5 being the loudest and 0 being silent.
TOUCH VOLUME	Choose from 0-5, 5 being the loudest and 0 being silent.

Follow the steps below to set the volume options:

Step 1: Select the VOLUME Quick Access Icon  .

Step 2: Select the + or - to change volume level between 0-5 where 0 is silent and 5 is the loudest. Stop at the level you wish to use. Select the “X” on the upper right corner to exit the menu.

> ***NOTE***
> *All volume settings listed above will remain the way it is set after restart except for Alarm Volume. Alarm Volume will remain the same as it was set unless it was set to 0. If set to 0, upon restart, the Alarm Volume will be changed to 1.*

4.3.7 Default Alarm Limit

The Midmark Multiparameter Monitor includes default alarm limits recommended by members of the American College of Veterinary Anesthesia for general veterinary practice. The user may return to the default alarm settings for each parameter by entering the Alarm Setup menu for each specific parameter.

The user may also revert the monitor settings to factory default by using the User Maintenance menu. Please refer to 5.9 Restore Monitor Default Settings to restore the monitor to the default settings.

> ***NOTE***
> *There are 4 animal categories to choose from when creating a user profile: Cat, Dog, Horse, and Other. Each has their own default settings for each parameter. Resetting to default on one profile does not mean that the parameter is reset for all other profiles. For example, resetting the default ECG upper limit for “Custom User 1” profile with Dog selected as the patient type does not mean the ECG upper limit is reset for the default Dog, default Cat, default Horse or any other custom profile.*

Step 1: Choose the appropriate Profile and press “OK” in the Patient Setup Menu or confirm that you are in the profile you want to be defaulted.

Step 2: Select Menu/Settings/Alarms or access Alarms within any parameter setup menu to display the Alarms Menu.

Step 3: Select the parameter you wish to reset at the top of this menu if accessing alarms through the Settings Menu.

Step 4: Select “Default” within that parameter menu. A pop up warning will be displayed letting you know all current settings for this particular parameter will be lost and all settings related to this particular parameter will be reset to factory default. Press “Yes” to proceed or “Cancel” to stay with the current settings.

Step 5: Repeat steps 2 and 3 until all the parameters you wish to reset to default has been completed.

Step 6: Select the “X” on the upper right of the menu to exit when done.

The following default alarm limits were set in the factory before delivery for each animal category. CO2 (8019, 8020), IBP (8019) and AA (8019) Alarms are only applicable if monitor is equipped with these optional features.

Parameter	Cat		Dog		Horse		Other	
	Low	High	Low	High	Low	High	Low	High
HR/PR (bpm)	90	180	50	180	24	50	50	180
SpO2 (%)	95	100	95	100	95	100	95	100
NIBP SYS (mmHg)	70	160	70	160	70	160	70	160
NIBP DIA (mmHg)	40	100	40	100	40	100	40	100
NIBP MAP (mmHg)	70	140	70	140	70	140	70	140
Resp. (rpm)	5	55	5	55	5	55	5	55
Temp. (°F)	96.8	104	96.8	104	96.8	104	96.8	104
AwRR (rpm)	5	55	5	55	5	55	5	55
Et CO2 (mmHg)	20	60	20	60	20	60	20	60
In CO2 (mmHg)	0	10	0	10	0	10	0	10
IBP SYS (mmHg) – ART1, ART2, AO, RA, FA	100	160	100	160	100	130	100	160
IBP DIA (mmHg) – ART1, ART2, AO, RA, FA	50	90	50	90	50	80	50	90
IBP MAP (mmHg) – ART1, ART2, AO, RA, FA	60	120	70	130	60	100	70	130
IBP SYS (mmHg) – PA	5	38	5	38	5	38	5	38
IBP DIA (mmHg) – PA	-4	4	-4	4	0	16	-4	4
IBP MAP (mmHg) – PA	12	16	12	16	8	25	12	16
IBP MAP (mmHg) – CVP	0	7	0	7	0	23	0	7
IBP MAP (mmHg) – ICP	0	4	0	4	0	10	0	4
AG: Et CO2 (mmHg)	20	60	20	60	20	60	20	60
AG: Fi CO2 (mmHg)	0	10	0	10	0	10	0	10
AG: AwRR (rpm)	5	55	5	55	5	55	5	55
AG: Et N2O (%)	40	70	40	70	40	70	40	70
AG: Fi N2O (%)	40	70	40	70	40	70	40	70
AG: Et HAL (%)	1.0	3.0	1.0	3.0	2.0	4.0	1.0	3.0
AG: Fi HAL (%)	1.0	3.0	1.0	3.0	2.0	4.0	1.0	3.0
AG: Et ENF (%)	2.0	5.0	2.0	5.0	2.0	5.0	2.0	5.0
AG: Fi ENF (%)	2.0	5.0	2.0	5.0	2.0	5.0	2.0	5.0
AG: Et ISO (%)	1.5	3.0	1.0	3.0	1.5	3.5	1.0	3.0
AG: Fi ISO (%)	1.5	3.0	1.0	3.0	1.5	3.5	1.0	3.0
AG: Et DES (%)	9.0	14	7.0	14	7.0	15	7.0	14
AG: Fi DES (%)	9.0	14	7.0	14	7.0	15	7.0	14
AG: Et SEV (%)	2.5	5.0	2.0	5.0	2.5	6.0	2.0	5.0
AG: Fi SEV (%)	2.5	5.0	2.0	5.0	2.5	6.0	2.0	5.0

SECTION 5 - SETTING UP THE MONITOR

5.1 Date and Time Setup

The monitor displays the date/time. Each time the machine is turned on, the system will display the current date and time in the status bar located at the top right corner of the screen.

Follow the steps below to enter the Date and Time Setup Menu:

Step 1: Press the Date and Time display located at the top right corner of the screen or the Date/Time button within the Settings Menu. This will bring up the Time Setup menu.

Step 2: Press the numbers next to the Date and Time fields. A number pad will pop up. Input the number and press “Enter”.

Step 3: Use the drop down menu for the Date Format and Time Format to select the option you would like to use.

Step 4: Once all the entries are complete, press the “X” on the upper right to exit the menu.

Time Setup Menu Options:

DATE	Enter the Day, Month and Year.
TIME	Enter the Hour, Minute, and Second.
DATE FORMAT	Choose between YYYY-MM-DD, MM-DD-YYYY, or DD- MM-YYYY.
TIME FORMAT	Choose between 12 hour or 24 hour format.

5.2 Brightness Setup

The screen brightness can be adjusted from 1 to 6, 6 being the brightest and 1 being the least bright. Auto can be selected and will allow the brightness to adjust based on room lighting. By default, the brightness level is set to 3.

Follow the steps below to enter the Brightness Setup Menu:

Step 1: Press the “Settings” Touch Screen Quick Access Icon and select the Brightness icon.

Step 2: Press the drop down box and select desired brightness level.

Step 3: Press the “X” on the upper right corner to exit the menu when finished.

5.3 Checklist Setup

The Checklist serves as a preliminary check for the user to review before an anesthetic procedure. The user will be prompted with the Checklist each time the monitor is turned on and when a new patient is setup after a patient is discharged. The user will check all items that apply and Submit checklist record to be saved for review.

To turn on the Checklist:

Step 1: Press the “Settings” icon.

Step 2: Select “Checklist”.

Step 3: Press Checklist drop down box and select “On”.

> ***NOTE***
> *The Checklist will appear immediately once turned on. It will not appear for the first patient that is admitted as it was already completed after being enabled.*

Checklist Menu Options:

Checklist: Turn the Checklist On or Off.

Staff Initials: Turn Staff Initials On or Off. If on, staff initials are required to be entered prior to submitting the Checklist.

Review Last Checklist: Review the last Checklist submitted.

Edit Checklist: Edit descriptions for rows 1 through 8, enter custom descriptions for slots 9 and 10 or Default the Checklist.

5.4 Modules Setup

Modules allow the user to enable or disable certain options and parameters that are applicable to the monitor's configuration. Restarting the monitor is required if changes are made within the Modules menu.

Module Menu Options:

PRINTER	Printer Off/On (8019, 8020). Printer On only functions on monitor models with a printer. Printer can be turned OFF on monitor models with the Printer option.
IBP	IBP Off/2IBP (8019). 2IBP only functions on monitor models with IBP option. IBP can be turned Off on monitor models with IBP option.
CO2	CO2 Off/Masimo/Respironics (8019, 8020). CO2 selection must coordinate with CO2 accessory being used. If using an IRMA™ or ISA™ CO2 analyzer, select Masimo. If using a Capnostat or Loflo sensor, select Respironics. AA module must be Off when CO2 module is On. If not using a CO2 accessory, select Off.
AA	AA Off/On (8019). If using an IRMA™ or ISA™ Multigas analyzer, select On. If monitoring AA, monitor can display CO2, AA and N2O parameters. CO2 module must be Off when AA module is On. If not using a Multigas accessory, select Off.

5.5 Display Setup

5.5.1 Waveform Display

The waveform display of each parameter can be changed by pressing on the waveform or parameter box. This will open the selected waveform's Setup menu. Depending on the parameter, the user may be able to change the Wave Gain, Wave Speed and Wave Mode of the waveform.

Wave Gain (applicable for ECG and RESP) can be adjusted to increase or decrease the amplitude of the signal.

Wave Speed is the speed the waveform travels across the screen. This value is in mm/sec.

Wave Mode is the option to show the waveform in Line or Fill. Line is a single line while Fill will make the underside of the waveform solid. This option is not available for ECG.

5.5.2 Display Modes

By default, the 3 Channels with Tabular Trend Screen is chosen. Select the "Displays" Quick Access Icon to see all the display options available based on the monitor's current setup. Certain displays are only available when the specific module related to the parameter is turned ON in the modules menu. For example, the 5 channel display is only available when 2 Channel ECG and AA analyzer (Option – 8019) have been turned ON.

3 CHANNELS WITH TABULAR TREND	The 3 Channels with Tabular Trend Display is set by default. It consists of 3 waveforms, numerical parameter data (ECG HR, SpO2, RESP, TEMP and NIBP), and last 4 minutes of Tabular Trend. If CO2 is in use, the CO2 numerical values will replace the RESP values.
LARGE FONT	The Large Font Display is used when observing the screen from a long distance. It will only show numerical values for ECG HR, SpO2, NIBP and RESP. If CO2 is in use, the CO2 numerical values will replace the RESP values.
4 CHANNELS WITH TABULAR TREND	The 4 Channels with Tabular Trend Display consists of 4 waveforms, numerical parameter data for ECG HR (5 Lead), SpO2, RESP, TEMP, and NIBP, and last 4 minutes of Tabular Trend. If CO2 is in use, the CO2 numerical values will replace the RESP values.
4 CHANNELS WITHOUT TABULAR TREND	The 4 Channels without Tabular Trend Display consists of everything the 4 Channels with Tabular Trend Display contains except for the historical data table.

7 CHANNEL ECG	The 7 ECG Wave Display consists of 7 ECG waveform when in 5 Lead ECG mode (Option – 8019, 8020). It also consists of numerical parameter data for ECG HR, NIBP, SpO2, RESP, and TEMP. If CO2 is in use, the CO2 numerical values will replace the RESP values. This display mode is only available for 5-Lead.
5-8 CHANNEL (8019 only)	The 5-8 Channel display is available if IBP (Option – 8019), AA (Option – 8019), or both IBP and AA are turned on in Modules. It will give you the option to display the IBP channels, AA Channels, or both IBP and AA Channels at the same time.

5.5.3 Custom Display

Custom Display allows the user to load an existing Profiles display and alarm settings.

My Display allows the user to customize the display by choosing a parameter for a specific channel. The user can configure up to 8 channels depending on the monitor configuration.

Follow the steps below to enter the My Display screen:

Step 1: Press the “Menu” Quick Access Button.

Step 2: Press the “Displays” Touchscreen Quick Access Icon.

Step 3: Press “My Display” to enter My Display menu.

Step 4: Press the individual drop downs for each channel to assign a parameter.

Step 5: Press “Save” to save your customized display or “Cancel” to exit without saving.

NOTE
If wanting to move a parameter from an already placed channel, select “None” or a different parameter from the drop down for the channel being moved and then the parameter will be available for desired channel.

NOTE
The user has the option to save Display within User Setup. Ref 4.3.3.

5.6 Printer Setup (Optional)

For monitors ordered with an internal printer option, follow the steps below to enter the Printer Setup Menu:

Step 1: Press the “Settings” Touch Screen Quick Access Icon.

Step 2: Select “Printer”.

Printer Setup Menu Options:

CHANNELS	CHANNELS denote the number of slots given to waveform printing. The user may choose between 2 or 3.
SPEED	The user may choose between 12.5mm/s, 25mm/s or 50mm/s. If the parameter waveform on screen was set at a different speed, the printer will still print at the speed designated here.
RECORD TIME	The default RECORD TIME is set to 8s, not including the time it takes to print the header. The user may choose from 4s, 8s, 16s or Continuous. This is the amount of time the printer will print when the print option is used.
AUTO PRINT	AUTO PRINT may be set up to print the data on the screen in specific intervals. By default, AUTO PRINT is set to Off. The user may choose between Off, 5min, 30min, 60min and 120min.
PRINT CURRENT DISPLAY	Print Current Display prints all parameter numerical data and the waveforms currently set in channels 1, 2 and 3 on the display. The user may choose between On or Off.
WAVE1	WAVE1 is the first waveform on the printout. By default, it is set to ECG lead II. However, the user may choose from Off, ECG lead I, ECG lead II, ECG lead III, SpO2 or RESP. If ECG is set to 5 Lead, aVR, aVL, aVf, or V may also be selected. If Multigas is on, CO2, AA or N2O may be selected. If IBP is on, IBP1 or IBP2 may be selected. If CO2 is on, CO2 may be selected.

WAVE2	WAVE2 is the second waveform on the printout. By default, it is set to ECG lead I. However, the user may choose from Off, ECG lead I, ECG lead II, ECG lead III, SpO2 or RESP. If ECG is set to 5 Lead, aVR, aVL, aVf, or V may also be selected. If Multigas is on, CO2, AA or N2O may be selected. If IBP is on, IBP1 or IBP2 may be selected. If CO2 is on, CO2 may be selected. If it is set to Off, more space will be allocated to WAVE1, as it will be the only waveform being printed in the waveform section.
WAVE3	WAVE3 is the third waveform on the printout. By default, it is set to Off. It can only be used if the CHANNELS option is set to 3 and WAVE2 is also being used. If WAVE2 is turned off, WAVE3 will automatically be turned off.

5.6.1 Printer

The Midmark Multiparameter Monitor uses a built-in 3-channel thermal array printer.

5.6.2 Manually Controlled Printing

Press the Quick Access Print Button 

(8019) or Print icon in the Menu Dock (8019, 8020) to print the physiological parameters, history data, and monitoring waveforms. The printer will print for 8 seconds by default. To stop the printing before the 8 seconds, press the Print Button or print icon again. The user may change the default print time by accessing the Printer Setup Menu and following the steps outlined above in section 5.6.

Follow the steps below to choose how many seconds to print every time:

Step 1: Press the “Settings” Touch Screen Quick Access Icon.

Step 2: Select “Printer” to display the Printer Setup Menu.

Step 3: Select the “Record Time” drop down and choose from 4s, 8s, 16s and “Continuous”. Press the “X” in the upper right corner to exit the menu. The monitor will now print up to the selected time frame. If “Continuous” is chosen, the monitor will continue to print until the user presses the print button again to manually stop.

5.6.3 Auto Printing

The monitor may be set to print at user selected intervals.

Follow the steps below to enable interval printing:

Step 1: Press the “Settings” Touch Screen Quick Access Icon.

Step 2: Select “Printer” to display the Printer Setup Menu.

Step 3: Select the “Auto Print” drop down and choose from Off, 5min, 10min, 15min, 30min, and 60min. Press the “X” in the upper right corner to exit the menu. The monitor will now print at the user designated interval until this setting is changed. Each time the monitor prints, it will print for the time set in the Record Time option, which is 8 seconds by default.

5.6.4 Printed Header and Content

The printed report includes a header and content. The header includes Name, Patient Number, Client, Doctor, Weight, Record Time, and Date and Time the recording started. The content includes parameter values and waveforms. Parameters printed include HR(bpm), SpO2(%), PR, RESP, NIBP, T1, T2 and TD. Optionally, EtCO2, InCO2, and CO2 RR (8019, 8020), IBP1, IBP2 (8019) and AA/N2O (8019) may be printed if the CO2, IBP, or AA modules are turned on and in use. If CO2 is in use, the CO2 waveform and values will replace RESP waveform and values. The waveform area will display the title of the waveform and the waveform speed.

Each time printing is initiated, the header will also be printed. However, the header does not take up the Record Time, which is reserved for the waveform content.

5.6.5 Printing Paper

The printing paper width is 50 mm. The paper should be kept in a cool and dry place, away from direct sunlight, high temperature, and humidity. For long-term storage (>5 years), it is recommended that photocopies be made.

5.6.6 Installing Paper

To install the paper roll in the printer, gently pull the grey-colored latch upward on the printer compartment. Place the roll of paper into the printer compartment. The paper should roll out from the bottom and hang over the edge of the door as shown below. Close the door and make sure that a small section of the paper is hanging out the door.

> ***NOTE***
> *Do not thread the paper under the black roller at the tip of the printer door.*

Printer and paper installation guide (Fig. 5.6.6-1)

5.7 HDMI Setup (Optional 8019)

The Multiparameter Monitor (8019) display can be viewed on a separate TV or monitor that is equipped with an HDMI port. The maximum TV size recommended is 65”.

Follow the steps below to mirror the Multiparameter Monitor display onto a TV or monitor:

Step 1: Locate the HDMI port on the back of the Multiparameter Monitor.

Step 2: Connect the HDMI cable to the Multiparameter Monitor’s HDMI port while it is off.

Step 3: Connect the other end of the HDMI cable to the TV or monitor’s HDMI input.

Step 4: Turn on the Multiparameter Monitor

Step 5: Select the correct HDMI input source on the TV or monitor to view the Multiparameter Monitor’s display.

> ***NOTE***
> *A 1.4 version or higher HDMI cable is recommended.*

5.8 Demo Mode

For the purpose of training, the Midmark Multiparameter Monitor provides a Demo Mode function.

> ***CAUTION***
> *Never attempt to use the Demo Mode while monitoring patients or while the monitor is connected in any way to the patient.*

Follow the steps below to enter Demo Mode:

Step 1: Press the “Menu” button.

Step 2: Press the “Settings” Touch Screen Quick Access Icon.

Step 3: Press “Demo Mode” to bring up the password dialogue box for Demo Mode.

Step 4: Press the empty field next to Enter Password. A keypad will pop up. Input “5555” and press “Enter”. This will bring you back to

the password screen. Press “OK” to confirm.

To show that the monitor is in Demo Mode, the word “Demo Mode” will be displayed at the top of the Waveform Area in yellow.

Follow the steps below to exit Demo Mode:

Step 1: Press the “Settings” Touch Screen Quick Access Icon.

Step 2: Press “Exit Demo”. A pop up warning box will be displayed: “To exit Demo Mode, the monitor will need to shut down. Would you like to continue?”. Press “Yes” to proceed.

Step 3: The monitor will automatically shut down. Press the power button to turn it back on in standard mode, ready to monitor.

5.9 Restore Monitor Default Settings

Follow the steps below to revert the monitor to factory settings:

Step 1: Press the “Settings” Touch Screen Quick Access Icon.

Step 2: Select the Maintenance icon.

Step 3: Press the “User Maintenance” Button.

Step 4: Enter the password: 2013. Press “Enter” Then press “OK”. This will open the User Maintenance menu.

Step 5: Press “Default” to set everything back to factory default. A warning will pop up. Press “Yes” to continue.

CAUTION
Using this DEFAULT option will affect Settings and Alarms for all parameters. If used, the current configuration will be lost and saved User Setups and Custom Displays will be cleared.

NOTE
Using this DEFAULT will NOT change the current module status. For example, if the CO2 module is ON, it will remain ON after using this default.

SECTION 6 - USING THE MONITOR

6.1 Power on the Monitor

Press and hold the power button located on the left side of the front bezel until the top light comes on to turn on the Multiparameter Monitor.

Follow the steps below when powering on the monitor:

Step 1: Complete the Checklist before each anesthetic procedure, enter initials, and press Submit.

Step 2: Review NIBP Best Practices.

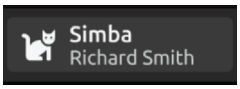
Step 3: Review soda lime absorbent weekly reminder if monitoring CO2.

6.2 Patient Setup

The Patient Setup menu can be accessed through the Patient Info icon in the Status Bar or “Pat. Set up” located in the Menu dock.

Fully admit the patient by entering any or all of the following: Patient Name, Patient Number, Client Name, Doctor, Profile, Gender, And Weight. Note: A Patient Number is required for Data Integration with Midmark Anesthetic Record Interface.

WARNING
The Patient Info Menu can also be accessed by pressing on the Patient Info area on the Status Bar. This menu shows the details of the current patient and allows the user to change these details. Never use this option to enter a new patient as the historical data from the previous patient will not be cleared.



NOTE
The Patient Info area on the status bar may display a patient name already or it may be empty. Pressing this area with or without a name displayed will allow access to the Patient Setup Menu.

Patient Info Menu Options:

PROFILE	Choose a profile. The default Cat, Dog and Horse profile will always be available to select. In addition up to 7 custom user profiles can be added. If the monitor has more than 1 custom profile, there will be a slider bar on the right side of the Profile dropdown menu. Every patient type assigned to a profile with the exception of Other will have a corresponding picture displayed next to the Patient Name on the Status Bar and next to the profile name within the Profile dropdown menu.
WEIGHT	Enter the weight of the animal. The weight unit may be set to lb or kg. Once set, the weight equivalent in the other unit is always displayed next to the field.
PATIENT NAME	Enter the Patient Name here. There is a 20 character limit.
GENDER	Enter the gender of the animal.
CLIENT NAME	Enter the Client Name here. There is a 20 character limit.
DOCTOR	Enter the Doctor Name here. There is a 20 character limit.
PATIENT NUMBER	Enter the Patient Number here. There is a 20 character limit. This is required for Data Integration with Midmark Anesthetic Record Interface.

NOTE
The SUSPEND Quick Access Icon can be used when attaching the patient to the monitor or adjusting the monitor sensors or the patient position. It prevents the monitor from alarming or recording values during this time. If connected to Midmark Anesthetic Record Interface, data continues to stream to the interface when monitor is suspended.

WARNING
The Patient Info Menu can also be accessed by pressing on the Patient Info area on the Status Bar. This menu shows the details of the current patient and allows the user to change these details. If using this Patient Info area on the Status Bar to enter a new patient, select Discharge Patient/Export to USB if saving previous patient data to USB and/or Yes to stop data integration stream and clear historical data from the previous patient before entering new patient information.

WARNING
Please adjust settings as needed based on the specific condition and needs of the animal. Never rely exclusively on the suggested default settings.

6.2.1 Changing Patient Info

Follow the steps below to change the current patient's info:

Step 1: Press the Patient Info icon in the status bar. Alternately, you can press "Pat.Set Up" Quick Access Icon in the Menu Dock. This will bring you to the Patient Setup menu.

Step 2: Change the information of the current patient here. Press "OK" when done to save and exit the screen.

Follow the steps below once the patient information is entered and saved:

Step 1: Make sure the monitor is connected to the patient with the appropriate accessories.

Step 2: After connections are in place, there should be waveforms or data on the display, otherwise:

- Check the connections to the patient.
- Check the connections to the monitor.

6.3 Trend Display

6.3.1 Displaying Trend Table

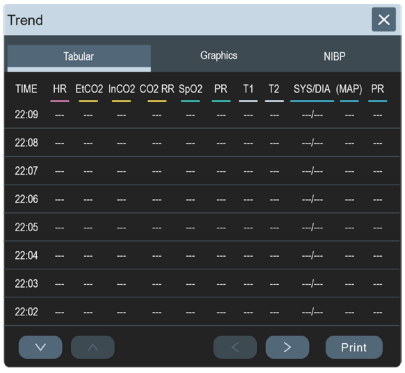
The monitor can store 7 days worth of Trend Data.

Follow the steps below to enter the Trend Table Screen:

Step 1: Press the "Trends" Touch Screen Quick Access Icon.

Step 2: Press the "Tabular" Touch Screen Quick Access Icon.

S**tep 3:** The Trend Table will display the following parameters: HR, RESP, SpO2, PR, T1, T2, SYS/DIA, (MAP), and NIBP PR. If the optional modules are turned on such as CO2 (8019, 8020) IBP (8019), or AA (8019), EtCO2, InCO2 and CO2 RR will replace the RESP values and the following will be added if applicable: IBP1 SYS, IBP1 DIA, IBP1 MAP, IBP2 SYS, IBP2 DIA, IBP2 MAP, EtAA, InAA, EtN2O, and InN2O.



Trend table (Fig. 6.3.1-1)

> ***NOTE***
> *CO2, IBP, and AA trend data are only available when the modules for these specific options are available and turned on.*

Step 4: Select the “Print” button (8019) or Tabular Trend Print icon (8019, 8020) to print all parameter data available that is currently within the time range displayed on the screen.

6.3.2 Displaying Trend Graph

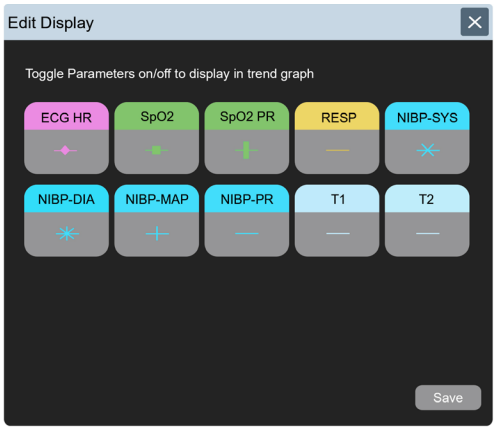
Follow the steps below to enter the Trend Graph Screen:

Step 1: Press the “Trends” Touch Screen Quick Access Icon.

Step 2: Press the “Graphic” Touch Screen Quick Access Icon.

Trend graph (Fig. 6.3.2-1)

Step 3: Select Edit Display and toggle the parameters on / off to customize the parameter graph. The screen can show up to 16 parameters. Choose to turn on / off the following: ECG, HR, SpO2, SpO2 PR, NIBP-SYS, NIBP-DIA, NIBP-MAP, NIBP-PR, T1, T2, TD, and RESP. If the optional modules are turned on such as CO2 (8019, 8020). IBP (8019), or AA (8019), EtCO2, InCO2 and CO2 RR will replace the RESP values and the IBP and/or AA options will also be added to the list and available for review.



Trend graph (Fig. 6.3.2-2)

Step 4: Use the Back arrow 

and Forward Arrow 

to move the timeline range. The parameter value will automatically update as the cursor moves within the timeline.

Step 5: Use the Start Arrow 

and End Arrow 

to move to the beginning or end of the timeline.

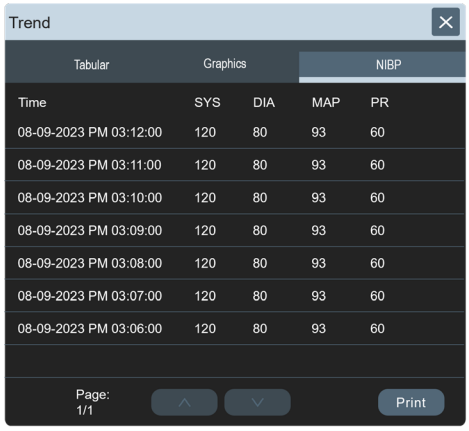
6.3.3 Displaying NIBP Trend Table

Follow the steps below to enter the NIBP Trend Table Screen:

Step 1: Press the “Trends” Touch Screen Quick Access Icon.

Step 2: Press the “NIBP” Touch Screen Quick Access Icon.

Step 3: The Trend Table will display the following parameters: Time, SYS, DIA, MAP and PR.



NIBP trend table (Fig. 6.3.3-1)

Step 4: Use the Arrow  and Arrow  to move forwards and backwards through the trend information timeline.

Step 5: Select the “Print” button (8019) or NIBP Trend print icon (8019, 8020) to print all parameter data available that is currently within the time range displayed on the screen.

6.3.4 Deleting Trend Information

To delete the trend information, the user may clear that specific information source within the Patient Setup Menu. Alternatively, the user may discharge the patient within the Patient Setup Menu to clear all data associated with that patient all at once.

Follow the steps below to clear the Trend information one by one from the Patient Setup Menu:

Step 1: Press the Patient Info icon in the status bar. Alternately, you can press “Pat.Set Up” Quick Access Icon in the Menu Dock. This will bring you to the Patient Setup menu.

Step 2: Press “Clear”. Then select “Tabular Trend”. A pop up window will ask you to confirm that you wish to clear the Tabular Trend. Select “Yes” to confirm your choice.

Step 3: Press “Clear”. Then select “NIBP Trend”. A pop up window will ask you to confirm that you wish to clear the NIBP Trend. Select “Yes” to confirm your choice.

CAUTION
The trend information cannot be retrieved once cleared. Do not clear trend information until you are sure you do not require it anymore or you have created a backup for it.

CAUTION
Restarting the monitor will not clear Trend data. Do not use restart as a method of changing patients.

Follow the steps below to clear all Trend information from the Patient Setup Menu all at once:

Step 1: Press the Patient Info icon in the Status Bar or “Pat.Set Up” Touch Screen Quick Access Icon in the Menu Dock.

Step 2: Press “Discharge Patient”. A pop up window will ask you to confirm that you wish to discharge the current patient as all data relating to the patient will be purged. Select “Yes” to stop data integration stream and confirm your choice to clear historical data from the previous patient before entering new patient information.

6.4 Recall Functions

6.4.1 NIBP Recall

NIBP historical data may be observed on the main screen if display mode includes Tabular trend. To see the NIBP historical data on its own screen, please reference Section 6.3.3 Displaying NIBP Trend Table.

6.4.2 Alarm Log

Follow the steps below to enter the Alarm Log:

Step 1: Press Menu button and Settings icon and select Alarms. This will open the Alarm menu.

Step 2: Select “Alarm Log”.

Step 3: Press the “Physiological Alarms” tab or the “Technical Alarms” tab to see alarm history of each type of alarm.

Step 4: Use the up and down arrow to move through the alarms from most current to past alarms.

Step 5: Select a Technical Alarm within the Technical alarms tab to view the Error Message Info for a Possible Cause and Possible Solution.

Step 6: Press the “X” on the upper right corner to exit the menu when finished.

6.4.3 Wave Recall

Follow the steps below to enter the Wave Recall screen:

Step 1: Press the “Settings” Touch Screen Quick Access Icon.

Step 2: Press the “Wave Recall” Button.

Step 3: Select the waveform you wish to see. Choose from Lead I, Lead II, SpO2 and CO2.

The WAVE RECALL Screen shows the last 30 seconds of ECG, SpO2 and CO2 waveforms for the above parameters.

Step 4: Press “Print” to print displayed Wave Recall waveform.

6.5 Export Trend and ECG Data

Follow the steps below to Export Trend and ECG Data:

Step 1: Plug the USB stick into the USB port at the back of the monitor.

Step 2: Press the “Settings” Touch Screen Quick Access Button or select the Patient Info icon in the status bar followed by Discharge Patient.

Step 3: Press “USB Data Export” or Discharge Patient/Export Data to USB to start exporting. An “Export Successful” message will be displayed when the export is finished. “Export Failed” will be displayed if the export was not successful.

One Excel file will be exported and placed onto the USB device under a folder named Trend. It will contain up to 20 hours of Trend Data. The file name format is as shown below:

YearMonthDayHoursMinutesSeconds

For example: 20230131171838.xls

NOTE
For data export, a USB 2.0 flash drive with a minimum storage capacity of 2GB and a maximum storage capacity of 16GB is recommended. USB 3.0 devices are not compatible with this monitor.

NOTE
Note that the hours are counted in the 24 hour format. For example, 17:00 hour is 5:00pm.

Saved files will not be deleted unless the user manually deletes it from the USB device. All new files will be saved onto the USB device until the USB device is full or until the USB becomes defective.

NOTE
If data export is used frequently, keep the USB storage device plugged into the monitor at all times. It is recommended that export be done after each case before discharge of patient. If integrating with Midmark Anesthetic Record Interface, it is recommended to keep the USB storage device plugged into the monitor as backup in the event of a lost network connection during a procedure.

6.6 Midmark Visualizer Tool

The Midmark Multiparameter Monitor comes with a USB device preloaded with the Midmark Visualizer Tool. This tool will summarize graphical trend data into an editable Anesthetic record form as well as take the last 6 minutes of exported ECG data and map it into a waveform for easy reference. The parameter data will also populate each of the corresponding Trend Graphs and initialed pre-procedure checklist is recorded for the user to view. This tool requires Microsoft Excel 2016, 2019, 2021, or Office 365 to work.

6.6.1 Converting the Parameter Data using the Midmark Visualizer Tool

Follow the steps below to convert the parameter data using the Midmark Visualizer Tool:

Step 1: Connect the USB device that is included with your monitor to the computer.

Step 2: Double click the MidmarkVisualizer.exe file and select Run to install the software onto the computer. The program may ask permission to make changes to your device and may ask for a destination location. Then it will prompt for desktop shortcut. Select “Yes” to allow installation and “Next” once desktop shortcut selection is made followed by “Install” and then “Finish”.

The Midmark Visualizer icon will appear on the desktop once installed.

Step 3: If you have not yet saved the parameter data file onto the USB stick, please refer to Section 6.5 Export Trend and ECG Data. If you already have the file saved on the USB stick, copy the exported data onto the computer.

NOTE
Move or Copy exported data file from USB to desired computer anesthetic record location. Do not open the parameter data file and save it to computer. Opening and saving file will alter exported content and data file will not be able to be converted into anesthetic record. Another option is to leave exported data on USB and locate USB data file for Anesthetic record conversion on USB.

Step 4: Double click on the Midmark Visualizer icon to open it.

Step 5: Once opened, the Start Menu will appear as shown below:

Step 6: Click on the “Select Data to Create Visualizer Record” button. Navigate to the parameter data excel file on USB or file moved/ copied onto your computer and click “Open”.

Step 7: Select ECG Lead to be converted and “Create Visual Anesthetic Record”.

Step 8: The exported file will now be converted by the visualizer into a new file with waveforms. The new converted file will automatically be saved in the same location as the original exported file. It will have the same file name but with a “M_” in the front.

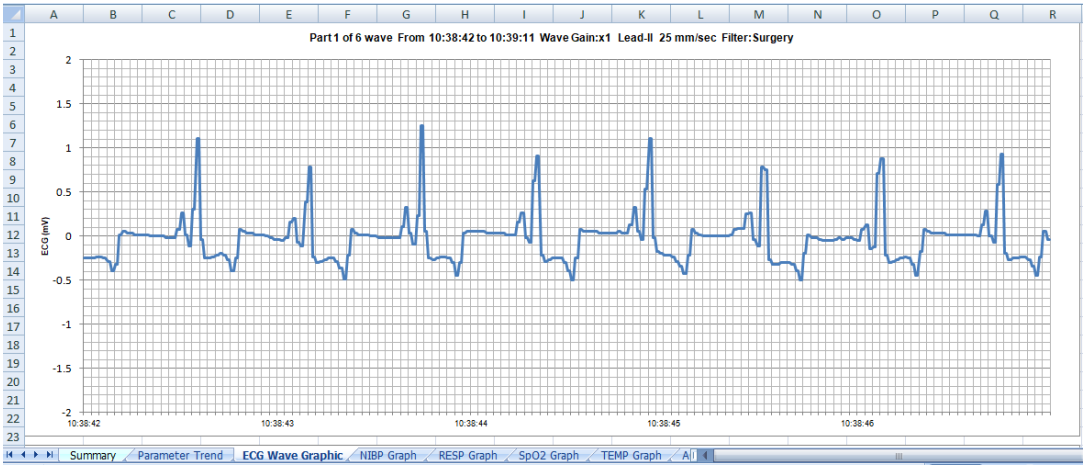
Step 9: Double click the new file to open for review. The new file will open using Excel.

6.6.2 Visualizer Data Tabs

The visualizer will look like an excel document. Depending on the monitor configuration, there will be at least 8 tabs for the standard parameters and checklist record. There will be a maximum of 11 tabs if CO2 (Option – 8019, 8020), IBP (Option – 8019), or AA (Option – 8019) are enabled.

SUMMARY	Displays the Patient Information, Anesthesia Record, and Graphical Trend graph.
PARAMETER TREND	All parameter data according to date and time.
ECG WAVE GRAPHIC	ECG data will be displayed as a waveform. Please see Section 6.6.3 for a more detailed explanation.
NIBP GRAPH	Displays NIBP Graphical Trend data.
RESP GRAPH	Thoracic Impedence Respiration Graphical Trend data if CO2 is not being monitored.
SPO2 GRAPH	SpO2 and SpO2-PR Graphical Trend data.
TEMP GRAPH	T1, T2, and TD Graphical Trend data.
CO2 GRAPH (Option - 8019, 8020)	EtCO2, InCO2, and RR Graphical Trend data if CO2 is enabled.
IBP1 GRAPH (Option - 8019)	SYS, DIA, and MAP Graphical Trend data for IBP1 if enabled.
IBP2 GRAPH (Option - 8019)	SYS, DIA, and MAP Graphical Trend data for IBP2 if enabled.
AA GRAPH (Option - 8019)	Et(HAL, ENF, ISO, SEV, DES), In(HAL, ENF, ISO, SEV, DES) and RR Graphical Trend data if enabled.
Checklist Record	Displays initialed pre-procedure checklist.

6.6.3 ECG Wave Graphic



The wave graphic includes the following information:

- Waveform Information. This includes Time, Lead Type, and Wave Speed.
- ECGmV.
- ECG waveform interpreted from the imported data.
- Time of date point.

The ECG Wave Graphic will interpret up to 6 minutes of ECG data. Move the scroll bar up and down to show different ranges of time within the 6 minutes.

6.6.4 Printing Waveforms

Follow the steps below to print the waveforms from the visualizer:

Step 1: Select “File” located at the top left corner of the spreadsheet.

Step 2: Select “Print” to display the print menu.

Step 3: Configure your desired print options. Select “Print” to print.

> ***NOTE***
> *The visualizer prints to your currently selected (default) printer. If another printer (such as PDF) is desired, select File > Print from the Excel menu and select that specific printer.*

6.7 Midmark Anesthetic Record Interface

The Midmark Anesthetic Record Interface is an annual software subscription that automatically transfers raw vital signs data, anesthetic record summary, ECG waveform and individual parameter graphs to the patient’s record within a practice management software. An initialed pre-procedure checklist is also part of the record when converting USB exported data within the interface.

To learn more visit midmark.com/ARI or scan QR code to secure annual software subscription and schedule installation.

License fees include the Midmark Anesthetic Record Interface, remote software installation, and ongoing user support. One license is

required per facility, regardless of the number of monitors used. There are no additional per-user fees.

6.8 Network Configuration

The monitors Network Settings need to be configured to allow for Data Integration with Midmark Anesthetic Record Interface. You may need to work with your IT department to identify what network your Practice Management server is on so that Wi-Fi and the IP settings of the monitor can be configured accordingly. If your facility has a MAC filtered network, the monitor's LAN and Wi-Fi MAC addresses can be found in the Monitor Info menu (Reference 3.8).

Follow the steps below to configure the Network Settings:

Step 1: Ensure your network switch (LAN) or wireless router (Wi-Fi) is connected to the same network that your Practice Management software is connected to. If using LAN, connect the ethernet cable to the network connection port located on the back of the monitor (Reference Fig 3.5-1).

Step 2: Press the "Settings" Touch Screen Quick Access Icon.

Step 3: Select the "Maintenance" icon.

Step 4: Press the "User Maintenance" Button.

Step 5: Enter the password: 2013. Press "Enter" then press "OK". This will open the User Maintenance menu.

Step 6: Select "Network Setup".

Step 7: Select Net Type: Select "LAN" if connected via ethernet cable. Select Wi-Fi if using a wireless connection. If Wi-Fi connection, proceed to 6.8.1 Wi-Fi Configuration. If LAN connection, proceed to 6.8.2 Network Configuration.

6.8.1 Wi-Fi Configuration

Follow the steps below to configure your Wi-Fi settings if Wi-Fi was selected as the Net Type:

Step 1: Select "Wi-Fi Setup".

Step 2: Configure your Wi-Fi settings according to your network.

- SSID: SSID is the primary name associated with the Wi-Fi network. If you are unsure what Wi-Fi network to join, work with your IT department to identify what network your Practice Management server is on before configuring the Wi-Fi setting on the monitor.

> ***NOTE***
> *In some cases, there will be multiple Wi-Fi networks available. If this is the case, you must choose the Wi-Fi network that has connectivty to your practice management software. The easiest way to determine this is to use the same SSID that is used by any wireless computers that access your practice management software.*

- Security Options: Select the encryption option appropriate for the network's security needs. If encryption type is unknown, try both option 2 and 3. The options are as follows.
    1. None: No password is required to join the Wi-Fi network.
    2. WPA2-PSK/TKIP: This encryption option is selectable by the user.
    3. WPA2-PSK/AES: This encryption option is selectable by the user.
- Key: Key is the Wi-Fi network password.

Step 3: Press "OK" to save Wi-Fi Setup selections.

Step 4: Continue to section 6.8.2 Network Configuration.

Step 5: (Optional) If you are trying to troubleshoot connection issues then follow these steps. Select "Network Setup," then select "Wi-Fi Setup" press "Link Test" to test your connection and Link State will display the status of the connection as the following.

X – Linking...: The monitor is attempting to connect.

X – √ X: Successfully connected to network.

X – √√: Successfully connected to Midmark Anesthetic Record Interface for data transfer.

6.8.2 Network Configuration

Configure the network addresses for a LAN or Wi-Fi connection.

Below are the default network addresses on the monitor. Network addresses are used to establish a connection with the Midmark Anesthetic Record Interface. These network addresses will need to change based on the configuration of your practices network. If you are unsure what network to join, work with your IT department to identify what network your Practice Management server is on before configuring the IP setting on the monitor. The monitor does not support dynamic IP address assignment. It is recommended that you work with your IT department to set up reserved IP addresses to avoid having issues connecting to the network or experiencing frequent lapses in connection.

• **Local IP:** 192.168.4.202

• **Remote IP:** 192.168.4.254

• **Subnet Mask:** 255.255.255.0

• **Gateway:** 192.168.4.1

• **Remote Port:** 2528

6.8.2.1 User Defined Network Settings

Below is the IP address assigned to this monitor by the clinic. (Write in the network settings assigned to this monitor.)

• **Local IP:** _ _ _ . _ _ _ . _ _ _ . _ _ _

• **Remote IP:** _ _ _ . _ _ _ . _ _ _ . _ _ _

• **Subnet Mask:** _ _ _ . _ _ _ . _ _ _ . _ _ _

• **Gateway:** _ _ _ . _ _ _ . _ _ _ . _ _ _

• **Remote Port:** _ _ _ _

After modifying these settings, select “Ok” to save the settings.

CAUTION
A firewall is necessary for LAN and Wi-Fi connections to protect the user’s environment.

NOTE
IP addresses must be unique among monitors if connecting more than one monitor.

NOTE
When configuring Wi-Fi, save the configured options in “Wi-Fi Setup” by selecting “OK” before modifying the settings in “Network Setup”. When changing settings in “Wi-Fi Setup” or configuring the IP in “Network Setup”, always select “OK” to save changes.

NOTE
If you are having issues connecting to your network, contact your IT department for help.

NOTE
User must enter Patient Number in Patient Setup to start Data Integration with Midmark Anesthetic Record Interface. This is a required field for LAN or Wi-Fi data transfer. Reference Patient Setup Section 6.2.

NOTE
Before performing "Link Test", save all "Wi-Fi Setup" and "Network Setup" selections by selecting "OK" on both menus and return to the Wi-Fi setup menu "Link Test".

NOTE
The "Link Test" may take up to several minutes to complete. Please allow it ample time to process.

NOTE
A USB should be plugged into the monitor in case network or Wi-Fi connection is lost impacting Data Integration with Midmark Anesthetic Record Interface.

6.8.3 Multiple Connected Monitors

The "Local IP" must be set by the user if there are multiple monitors connected to the same network since each monitor needs a unique IP address. The "Local IP" address should include the same first three number sets as the "Remote IP". For the fourth number set, enter a number less than 255 and be sure that it does not share an identical IP address with any other address on the network.

NOTE
The monitor does not support dynamic IP address assignment. If you are having issues connecting to the network or are experiencing frequent lapses in connection, you might need to work with your IT department to setup reserved IP addresses on your network that match the local IP of each connected monitor.

6.8.4 Midmark Anesthetic Record Interface Connection Status

Once your network settings are configured and the monitor establishes a connection with the Midmark Anesthetic Record Interface, the network connection icon located in the status bar will change to show a connected status. If the monitor is unable to establish a connection or if the network connection is lost, the icon will show a disconnected status.

Depending on the Net Type selected, the following icons will be displayed to show the current connection status.

Icon	Definition
	The Wi-Fi connected icon will be displayed if a connection to the Midmark Anesthetic Record Interface was established.
	The Wi-Fi disconnected icon will be displayed if a Wi-Fi connection was not established with the Midmark Anesthetic Record Interface or if the Midmark Anesthetic Record Interface connection was lost.
	The LAN connected icon will be displayed if a connection to the Midmark Anesthetic Record Interface was established.
	The LAN disconnected icon will be displayed if a LAN connection was not established with the Midmark Anesthetic Record Interface or if the Midmark Anesthetic Record Interface connection was lost.

6.8.4.1 Network Disconnect Error Message

If a disruption occurs while connected to the Midmark Anesthetic Record Interface you will receive the message shown in Fig. 6.8.4.1-1. This message indicates that the monitor lost connection with the Midmark Anesthetic Record Interface. The message will stay displayed on screen until cleared by a user. If the connection issue resolves itself before the message is cleared, the message will still be displayed to let the user know that some data may not have been sent to the Midmark Anesthetic Record Interface. It is possible for the monitor to reconnect to the Midmark Anesthetic Record Interface while still displaying this message. If you see this message, to ensure that you do not experience any significant data loss, export the current patient's data to USB by following the steps outlined in section 6.5 Export Trend and ECG Data prior to discharging the patient. If you would like to check the monitor's current connection status refer to the LAN/Wi-Fi connected/disconnected icon displayed on the top right corner of the monitors display.

Network Connection Warning (Fig. 6.8.4.1-1)

NOTE
Ensure the Wi-Fi symbol displays as connected when transferring patient data to Midmark Anesthetic Record Interface. The Wi-Fi connected icon indicates the monitor is connected to the Midmark Anesthetic Record Interface. If the monitor is connected to the practice network through Wi-Fi but is not connected to the Midmark Anesthetic Record Interface, the Wi-Fi disconnected icon will display. It is possible for the monitor to be connected to the network but not able to communicate with the Midmark Anesthetic Record Interface. Connection trouble shooting can be done with "Link Test" outlined in 6.8.1 Step 5.

SECTION 7 - ECG MONITORING

7.1 General Information

The Midmark Multiparameter Monitor records heart rate with electrode clips attached to the patient. Electrodes detect signals caused by changes of electrical conduction in the heart during the cardiac cycle. Heart rate is computed on a beat-to-beat basis using the R-R interval of the QRS complex. It is necessary to make sufficient preparations before monitoring in order to get accurate readings.

WARNING
There is a label  below the ECG socket, indicating that the signal input is insulated and defibrillation proof with a type CF applied part. Following exposure to a defibrillation event, ECG will resume normal operations after 5 seconds.

7.2 Patient Cable

The patient cables consist of the main cable (connected to the monitor) and the lead wires (connected to the patient).

CAUTION
Use only clips, ECG cable and lead wires recommended by Midmark.

7.3 Animal Preparation and Lead Contact

Accurate clip placement is very important for obtaining a clear quality ECG trace. Sites where leads are attached to the body must be properly prepared to optimize contact. Dogs and cats may have enough electrolyte material on their skin and hair so that merely moistening lead sites with 70% isopropyl alcohol is appropriate. This will usually be sufficient for ECG recording/monitoring for a short time, 30 to 60 minutes, depending upon the relative humidity.

However, to ensure a quality ECG trace, an electrode gel should be used especially when monitoring during longer periods of time. It is best to first wet the hair at the lead attachment site with alcohol; then place gel on the moistened hair and skin. It is important that the gel be in direct contact with skin. For patients with dense undercoat, rub gel with fingers to assure that it has made contact with skin.

Copper alligator clips are supplied with this monitor and they must be opened wide enough to firmly but gently grasp the skin.

7.4 Attaching ECG Electrodes

7.4.1 Lead Wires and Color

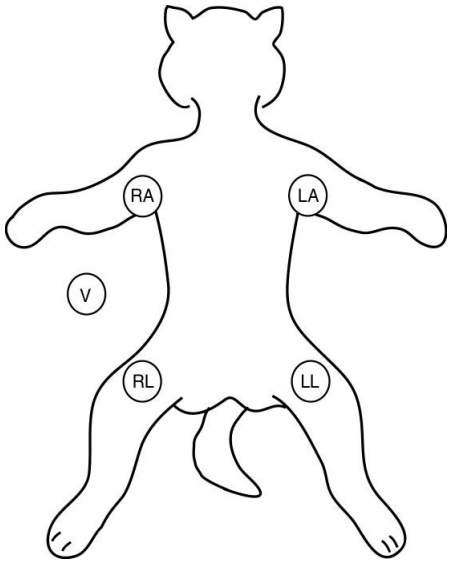
Table 7.4.1-1: 5-Lead Color and Coding

USA Standard
LA = black (Left Foreleg)
RA = white (Right Foreleg)
RL = green (Right Hind Leg)
LL = red (Left Hind Leg)
V = brown (explore)

Table 7.4.1-2: 3-Lead Color and Coding

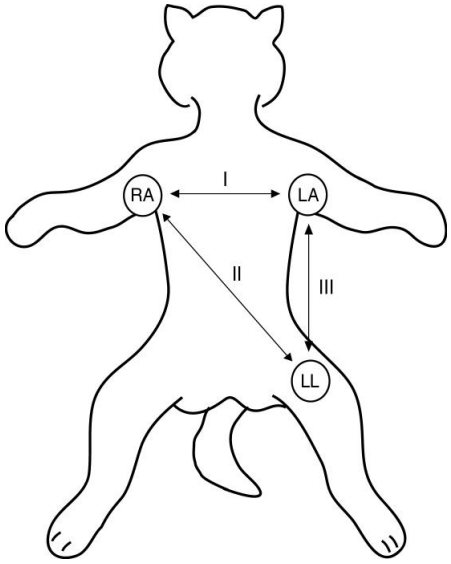
USA Standard
LA = black (Left Foreleg)
RA = white (Right Foreleg)
LL = red (Left Hind Leg)

7.4.2 Lead Placement



5-Lead Placement (Fig. 7.4.2-1)

For a 5 lead system, four limb leads can be applied (**RA**, **LA**, **RL**, and **LL**) with the exploring lead (**brown**) used for diagnostic purposes as needed. Otherwise, the exploring lead may be left unattached. Refer to Figure 7.4.2-1 and Table 7.4.1-1 for more information.



3-Lead Placement (Fig. 7.4.2-2)

For a 3 lead system, leads should be attached just below the elbow on the front leg and just above the stifle on the hind leg. The following lead sequence should be applied for a 3 lead system: Right Foreleg (**RA-white**); Left Foreleg (**LA-black**); Left Hind Leg (**LL-red**). Refer to Figure 7.4.2-2 and Table 7.4.1-2 for more information.

7.4.3 Positioning Anesthetized Patients

For ECG monitoring during anesthesia, it is most important to position patients properly on the table for the procedure. If standard lead placement as described above is not possible, leads should be attached to the body where they will be least subject to movement and away from the surgical site. It is preferable to view an upright QRS complex for monitoring ECG. A heart base to apex lead arrangement will be best if the negative lead is placed at the base (point of right shoulder at thoracic inlet) and the positive lead at the apex (low on caudal left thorax). Standard right forelimb lead is negative and standard left hind leg is positive in lead two; so if these leads are properly placed and the monitor is set to Lead II, an upright complex should be the result.

7.4.4 Positioning Conscious Patients

Standard position for recording diagnostic ECG in dogs is right lateral recumbency. Diagnostic tracings can be obtained in cats in either right lateral or sternal position. Limbs should be perpendicular to the spine and parallel with their opposite member. For awake cats and

dogs, it is best to have the patient held by a veterinary technician or veterinary assistant. One lead should be applied first to determine comfort level and adjustment made as needed. Then the other clamps can be placed in position. It is important that the patient be kept still. A moving patient may cause clips to saw into skin tissue leading to discomfort and change in position of electrodes.

NOTE
If lead (alligator clip) is touching both the patient's leg and body simultaneously this may distort the ECG waveform resulting in fluctuating or inaccurate HR.

7.5 ECG Setup

7.5.1 ECG Setup Settings Menu

Follow the steps below to enter the ECG Setup Menu:

Step 1: Select the ECG waveform or ECG data in the Parameter box to enter the ECG Setup Menu.

ECG Setup Settings Menu Options:

HR SOURCE	Choose between Auto, ECG or SpO2.
HR CHANNEL	This option is only available when Lead Type is set to 5 - Lead. Choose between Auto, I, II, V.
ECG1	When in 3 - Lead mode, choose between I, II or III. When in 5 - Lead mode, choose between I, II, III, aVR, aVL, aVF and V.
ECG2	This option is only available when Lead Type is set to 5 - Lead. Choose between I, II, III, aVR, aVL, aVF and V.
WAVE GAIN	Choose from Auto, x0.25, x0.5, x1, x2, or x4.
WAVE SPEED	Choose from 12.5, 25, or 50mm/s.
CASCADE	Choose On or Off. Choose On to allow the ECG waveform to continue onto a second line for a longer waveform display. If ECG Catalog is being displayed, Cascade is not an option.
CATALOG	Choose between On or Off. The ECG catalog displays a selection of ECG waveforms in the second ECG channel for the user to scroll through and use as reference on the ECG Catalog Screen.
FILTER	Choose from Diagnostic, Monitor, High Sensitivity or Surgery. See definitions in Section 7.5.2 below.
LEAD TYPE	Choose from 3 - Lead or 5 - Lead. When in 3 - Lead mode, certain options within this menu will not be available.
HR BEAT VOLUME	Choose between 0 - 5, 5 being the loudest and 0 being silent.
ECG SETUP ALARMS TAB	This will take you to the ECG Setup Alarms Menu. There, you can set the Alarm Priority, HR Low Limit, HR High Limit, and revert to Default factory settings for the ECG parameter. Please see 4.3.2 Alarms Menu for more details.
ECG SETUP TREND TAB	Use the left and right arrows to scroll through the timeline and view the last 30 seconds of ECG waveform. The HR for the last 7 minutes is also displayed at the top at a 1-minute interval. The wave recall, HR value, and 7 minute trend values do not update with time when inside the Trend tab. To update this area with the latest 30 seconds of waveform and 7 minutes of data, select the X to close window and reenter the Trend tab.

Once the parameters are all set up, press the "X" button located on the upper right side of the menu to exit to the Main Screen.

NOTE
When "Asystole" is displayed on the screen, please check patient first, then the ECG gain of the relative channel to see if it is too low to detect heart rate.

NOTE
If the patient's heart rate is double counting, then adjust the ECG Gain to a lower Gain until it stabilizes.

7.5.2 Filter Menu

The Diagnostic, Monitor, High Sensitivity and Surgery mode gives the user different levels of filters to accommodate various circumstances.

Diagnostic Mode: Displays the original ECG waveform unfiltered.

Monitor Mode: Filters out low-level interference.

High Sensitivity Mode: Allows detection of weak/low signals.

Surgical Mode: This is used during surgery where large amount of interference may exist. In this case the waveform displayed is significantly altered by the monitor's algorithm to negate the interference.

7.6 Alarm Setup

ECG monitoring alarms include parameter out of limit alarms and abnormal status alarms. When the monitored parameters are out of the preset limits, the monitor will give an audible and visible alarm.

7.6.1 Alarm Limit Setup

To set up the alarm parameters, reference Section 4.3.2 Alarms Menu.

> ***WARNING***
> ***The default alarm limits are designed as general guidelines and for convenience so that values can be reset automatically to common starting points, but these may be adjusted with each patient according to their individual circumstances.***

7.6.2 Parameter Adjustment Range

Parameter	Adjustment Range
HR	15-350 bpm

7.6.3 Abnormal Status Alarm

Abnormal Status alarm includes "Asystole" and "ECG Lead Off".

> ***CAUTION***
> *When ECG amplitude is too low (waveform is small), it may result in inaccurate heart rate or pseudo asystole. Try increasing the gain size and using the electrode gel to amplify the signal. Another option would be to try an alternate ECG lead which has a stronger amplitude or change Filter to "High Sensitivity". Otherwise, the monitor may give an "Asystole" alarm.*

For a complete list of abnormal status alarms, see the Monitor Troubleshooting Section 14.2.

7.7 Precautions

> ***WARNING***
> ***When a defibrillator is used, make sure the patient does not make contact with the ground, metal objects, or other conductors or devices. During defibrillation, never touch the patient, table or the device.***

> ***WARNING***
> ***Ensure conductive parts including electrodes of the patient cable do not come into contact with any conductive surfaces.***

WARNING
Do not use the monitor during MRI or CT scan.

CAUTION
Leads and cables should be away from patient's neck.

7.8 Cleaning and Maintenance

CAUTION
Prior to each patient use, inspect the ECG cable and lead wires for damage. If cable or lead wires are worn out or damaged, replace immediately.

7.8.1 ECG Cable Cleaning

In order to keep the cable dust-free, clean it with a clean cloth and soapy water or a mild detergent.

7.8.2 ECG Cable Disinfection

In order to avoid long-term damage to the cable, only disinfect the cable when it's necessary by wiping it with an agent such as 70% isopropyl alcohol or according to your hospital regulations. Do not immerse the cable in liquid.

CAUTION
Do not autoclave the cable.

7.9 Troubleshooting

7.9.1 Inaccurate Heart Rate

- Check patient's ECG signal.
- Check /adjust lead placement.
- Check/clean the patient's skin.
- Check/replace ECG electrodes.
- Check if ECG waveform amplitude is normal. Adjust Wave Gain if needed.

7.9.2 No ECG Waveform

After lead wires are connected but there is no ECG waveform and the screen shows "ECG Lead Off" or "ECG Communication Stop".

- Check if the electrodes are in good contact with the patient and if the lead wires are in good condition.
- Check all the external connections of the ECG lead wires.
- Check the ECG electrodes. Prolonged placement of electrodes may result in polarized voltage and the electrodes should be replaced.
- If "ECG Communication Stop" is displayed on the ECG channel, then the ECG module has a communication problem with the main unit. Turn off the machine and turn it on again. If problem still remains, contact Midmark.

7.9.3 ECG Baseline Shift

ECG scan baseline is not stable on the display.

- Check if the working environment is too humid and if the machine has moisture inside. If yes, keep the machine on for 24 hours and keep the ambient environment dry.
- Check the electrode quality and whether the skin is clean where the electrode is placed.

7.9.4 ECG Notch Filter and Frequency

Follow the steps below to access the Notch Filter and Frequency options:

Step 1: Press the “Settings” quick access icon.

Step 2: Press the “Maintenance” icon.

Step 3: Press the “User Maintenance” button. Enter the password: 2013 and press “OK”.

Step 4: Press the “Module Maintenance” button.

Step 5: Press ECG to access the following ECG options:

NOTCH FILTER	Choose between On or Off. This option is only available in Diagnostic Mode. Depending on the country you are in, the power supply may cause interference. Turning On or Off the notch filter may improve signal acquisition.
NOTCH FREQ	The Notch Frequency may be set to 50Hz or 60Hz based on the country you are in.

SECTION 8 - NIBP MONITORING

8.1 General Information

The Midmark Multiparameter Monitor uses oscillometric principles to calculate the systolic (SYS), diastolic (DIA), and mean arterial pressure (MAP) values. The MAP is calculated as the lowest cuff pressure that provides the maximum cuff oscillations. Therefore, MAP is the largest signal received and is the most accurate reading using oscillometric methods. Systolic pressure is calculated as the cuff pressure at which an increase in cuff oscillations is perceived. The diastolic pressure is the cuff pressure when oscillations are no longer decreasing as pressure is released from the cuff. Special veterinary specific algorithms have been designed to ensure reliable and accurate measurements from kittens to horses.

The monitor features adaptive blood pressure and inflates the cuff to a pressure of 30 mmHg higher than the systolic pressure. Then, the cuff slowly deflates. When the cuff pressure is higher than systolic pressure, the artery is blocked and there are small amplitude oscillometric waveforms. When the cuff pressure is equal to the systolic pressure, the oscillometric amplitude will increase. With the decrease of the cuff pressure, the oscillometric amplitude increases. When the cuff pressure reaches a certain value, the oscillometric amplitude reaches a maximum value, and then the cuff pressure is mean arterial pressure. It uses the changes of the oscillometric amplitude under different cuff pressures to identify mean pressure and calculate the systolic and diastolic pressure.

WARNING

There is a label below the NIBP receptacle, indicating that the signal input is insulated and defibrillation proof with a type CF applied part. Following exposure to a defibrillation event, NIBP will resume normal operations after 10 seconds.

8.2 Cuff Placement

CAUTION

Only accessories recommended by Midmark should be used.

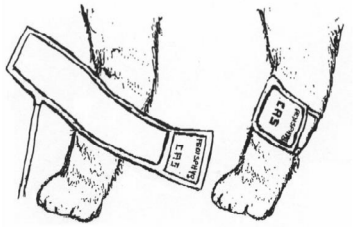
NOTE

Place the patient on a padded surface to provide comfort, and warmth. Any movement, even inadvertent shivering, may prevent the monitor from taking an accurate measurement.

8.2.1 Cuff Placement for Cat

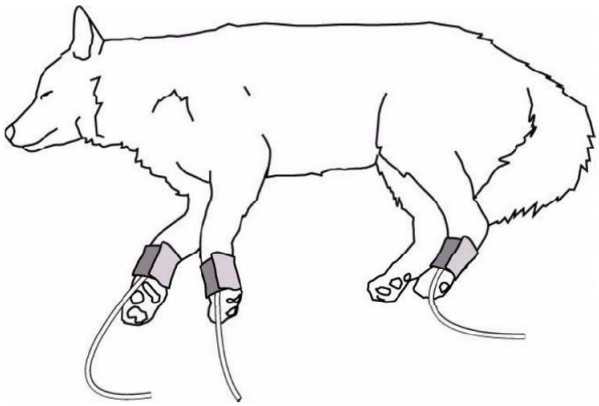
A cat may be left in its owner's lap to keep it calm. Measurements are best done in an area of the hospital away from noise and bright lights. The animal may be held so that the front limbs are free for cuff placement. In conscious patients, the tail may be the most appropriate location for placement of the cuff. Cats may be most comfortable in sternal recumbency making the tail a more preferable site. For the median artery on the foreleg, place the cuff around the forelimb, between the elbow and carpus. It is not necessary to center the cuff over the artery which is on the medial side of the leg because of the fully encircling bladder design. Hair does not need to be clipped except when heavily matted. In cats less than five (5) pounds when measurements are difficult to obtain, place the cuff around the leg above the elbow to obtain measurements from the brachial artery. Measurements from the coccygeal artery may be used by placing the cuff around the base of the tail but not in anesthetized patients.

Cat Cuff Placement



8.2.2 Cuff Placement for Dog

For measurements in dogs, it is preferable to use the right lateral, sternal or dorsal recumbent positions. That is not a problem in anesthetized patients, but it may be difficult to get large dogs to cooperate for proper positioning when conscious. If the dog is in a sitting position, place the front paw on the operator's knee and take measurements from the metacarpus. Sites for cuff placement are the metacarpus, metatarsus and anterior tibial. In anesthetized patients, most surgeries are done on the posterior part of the body so the metacarpal area of the forelimb is most convenient. In situations where this is not possible, the cuff should be wrapped around the metatarsus just proximal to the tarsal pad or around the hind leg just distal to the hock. The tail site should not be used for cuff placement during anesthesia. It is not necessary to center the cuff over the artery because of the fully encircling bladder design. If the hair over the artery site is too thick or matted for good contact, it should be clipped.



NOTE
To achieve the most accurate readings, it is important to keep the cuff on a horizontal plane with the heart.

8.2.3 Large Animals

A large animal such as a horse should be in a stall, standing still, or lying down. For horses and cows, the cuff can be wrapped around the base of the tail using the coccygeal artery on the ventral surface.

WARNING
When monitoring over an extended period of time, or at frequent intervals, periodically observe the patient's limb to make sure that the circulation is not impaired for a prolonged period of time.

8.2.4 Cuff Size Selections

The widest cuff that can be placed on the patient, without extending beyond the joint, should be selected. Appropriate sized cuffs may be selected based on published guidelines that cuff width should be 40 – 60% of limb circumference. The use of the Midmark Cuff Selector included with the accessory pack is recommended. The cuff should be wrapped for a snug fit.

Overlapping the cuff will not affect measurement results. Make sure the hook and loop sections of the cuff are fully engaged when it is wrapped around the limb. If not fully engaged, the cuff will detach during bladder inflation. If that happens, select the next size bigger cuff. Adhesive tape or other material should not be used to secure the cuff.

In addition to the Midmark Cuff Selector, the following table may be used as a guide to select the correct size.

Small Animal Cuff Selection

Cuff Reorder Number	Bladder Size (width)	Limb Circumference Range
SV1	2.0 cm	3-6 cm
SV2	2.5 cm	4-8 cm
SV3	3.5 cm	6-11 cm
SV4	4.0 cm	7-13 cm
SV5	5.0 cm	8-15 cm
SV600 (Kit)	Includes all the above	

Large Animal Cuff Selection

Cuff Reorder Number	Bladder Size (width)	Limb Circumference Range
SV8	8.0 cm	13-20 cm
SV10	10.2 cm	18-26 cm

References:

Pedersen KM, Butler MA, Ersboll AK, Pedersen HD (2002). Evaluation of an oscillometric blood pressure monitor for use in anesthetized cats. JAVMA 221: 646-650.

Sawyer DC, Guikema AH, Siegel EM (2004). Evaluation of a new oscillometric blood pressure monitor in isoflurane anesthetized dogs. Vet Anaesth Analg 31: 27 – 39.

NOTE
For species specific reference values, see Appendix 2.

8.3 NIBP Setup

8.3.1 NIBP Setup Menu

Follow the steps below to enter the NIBP Setup Menu:

Step 1: Select the NIBP data in the Parameter box to enter the NIBP Setup Menu.

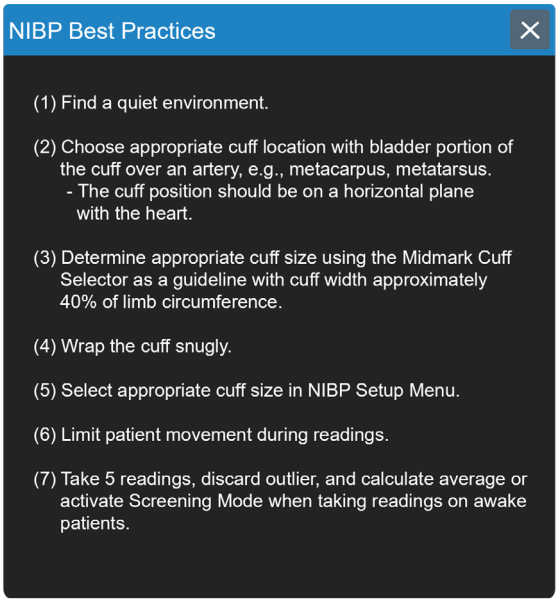
NIBP Setup Settings Menu Options:

UNIT	Choose between mmHg or kPa.
INTERVAL	Choose between Manual, 1min, 2min, 3min, 4min, 5min, 10min, 15min, 30min, 60min or 90min.
BEST PRACTICES	Turn NIBP Best Practices On or Off.
START MEASUREMENT	Press this to manually start the NIBP measurement. Only one measurement will be taken.
CONTINUOUS MEASUREMENT	Continuous measurement for 5 min with 5 sec between measurements. This is STAT mode.
CUFF SIZE	Choose between Small (SV1-SV5) or Large (SV8-SV10).
INITIAL PRESSURE	Set the Initial Inflation Pressure here. The default pressure is 150mmHg. Pressure selection varies for Small (SV1-SV5) and Large (SV8-SV10).
SCREEN MODE	The average Systolic, Diastolic, and MAP will be displayed on the 5th measurement. The monitor will record 5 consecutive NIBP measurements and will exclude the measuremet with the largest difference when computing the average.
NIBP SETUP ALARMS TAB	This will take you to the NIBP Alarms Setup Menu. There, you can set the Alarm Priority, SYS Low Limit, SYS High Limit, DIA Low Limit, DIA High Limit, MAP Low Limit, MAP High Limit, PR Low Limit, PR High Limit and revert to Default factory settings for the NIBP parameter. Please see 4.3.2 Alarms Menu for more details.
NIBP SETUP TREND TAB	View the last 7 minutes of NIBP measurements at a 1-minute interval.

Once the parameters are all set up, press the “X” button located on the upper right side of the menu to exit to the Main Screen.

NIBP Best Practices

Best Practices reminder can be turned on/off in the NIBP Setup Menu. It is important to follow these NIBP best practices to obtain accurate blood pressure readings.



8.3.2 Select Cuff Size

The current cuff size is displayed above the blood pressure value in the upper right corner of the NIBP Parameter Box. Choose from Small (SV1-SV5) or Large (SV8-SV10).

> ***CAUTION***
> *Before measurement, make sure you have chosen the right cuff size in the NIBP Setup Menu. Small corresponds to cuff sizes SV1-SV5. Large corresponds to cuff size SV8 or SV10.*

8.3.3 Select Measurement Mode

> ***NOTE***
> *The current NIBP Measurement Mode is displayed above the blood pressure value in the upper left corner of the NIBP Parameter Box on the Main Screen.*

Manual

Press the NIBP Quick Access Button 

on the front of the monitor to manually start the NIBP measurement.

> ***NOTE***
> *During an NIBP measurement, if the NIBP Start/Stop button is pressed again, the measurement will be stopped immediately.*

> ***CAUTION***
> *The initial inflation pressure default is 150 mmHg.*

Interval

The monitor will inflate the cuff at the start of each automatic measurement cycle.

During Automatic Mode, the user can select between the following time intervals: Manual, 1-5min, 10min, 15min, 30min, 60min, or 90min. The time interval means the time between the last NIBP measurement start to the next NIBP measurement start.

NOTE
Anytime during NIBP measurement, pressing the NIBP Start/Stop button will stop the NIBP measurement immediately.

WARNING
In Auto mode, if no NIBP value can be measured, the current measurement will be stopped, but the countdown will continue.

Continuous Measurement

Continuous Measurement Mode is located in the NIBP Setup Menu. This function will continuously measure patient's NIBP for 5 minutes, pausing 5 seconds between each measurement. After 5 minutes, it will stop automatically. The mode is mainly used to closely monitor a patient's blood pressure changes in emergency situations.

During the Continuous measurement, press the NIBP Start/Stop button on the front panel, and the measurement will immediately stop.

WARNING
Pressing the NIBP Start/Stop button during Continuous Measurement will stop the current measurement and cancel Continuous Measurement. The monitor will return to Manual measurement.

NIBP monitoring provides numerical information only - no waveform.

8.3.4 NIBP Screening Mode

The average Systolic, Diastolic, and MAP will be displayed on the 5th measurement. The monitor will record 5 consecutive NIBP measurements and will exclude the measurement with the largest difference when computing the average.

To turn on NIBP Screening Mode: Press and hold the BP button for 3 seconds.

Manual and Auto Mode: NIBP screening measurements can be taken using both modes. Manually pressing the BP Start icon will start the first Screening measurement in Manual Mode. For Auto Mode, select the desired interval and press the BP Start icon to start the first Auto Screening measurement.

Real-Time Display

Once NIBP Screening Mode is enabled, "Screen" will appear within the NIBP numerical reading display indicating a NIBP Screen measurement has not been recorded. The NIBP Screening State will update with following statuses after each measurement is recorded.

Measurement #1 will display as "Screen 1"

Measurement #2 will display as "Screen 2"

Measurement #3 will display as "Screen 3"

Measurement #4 will display as "Screen 4"

Measurement # 5 will display as "Scr-Avg" indicating the measurement values displayed are the computed average of the 4 measurements recorded (1 measurement removed with largest difference).

To turn off NIBP Screening Mode: Press and hold the BP button for 3 seconds. "Screen" will then disappear from the NIBP numerical reading display indicating NIBP Screening Mode is disabled.

8.3.5 Alarm Limit Setup

For different patients, different limits may be required. To set up the alarm parameters, reference Section 4.3.2 Alarms Menu.

Parameter	Alarm Range
Systolic Pressure	40 to 240 mmHg
Diastolic Pressure	10 to 210 mmHg
Mean Pressure	20 to 230 mmHg

8.4 Troubleshooting

The Alarm triggers when the following abnormal events occur and the following messages will be displayed in the Alarm Center:

Cuff Leak: If the NIBP status bar displays “Cuff Leak”, it means a small leak has been detected. Please check the position of the cuff first, and check whether the inflation hose is damaged.

Cuff Loose or No Cuff: If the NIBP status bar displays “Cuff Loose or No Cuff”, it means a large leak has been detected. Please check the cuffs and the extension tube for damage. If the NIBP cuff and extension tube is undamaged, check that they are connected properly to each other and that the tube is connected properly to the monitor. If this does not resolve the problem, try to measure the NIBP with a different cuff and tube set. If error persists, contact Midmark.

NIBP System Error: If the NIBP status bar displays “NIBP System Error”, it may be the result of a system self-test error, the patient being over excited, trembling or there may be an air leakage. Calm the patient down and perform the measurement again. If the message persists, please contact Midmark.

Measurement Timeout: This may occur if the NIBP is set to Continuous Measurement or Interval use. To correct this error, go into the NIBP Setup Menu and change the NIBP back to Manual. Then reset it to Continuous Measurement or Interval as desired. If error persists, contact Midmark.

For a complete list of abnormal status alarms, please see the Monitor Troubleshooting Section 14.2.

8.5 Precautions

The following circumstances may affect the measurement results:

1. Patient motion
2. Rapid change in pressure
3. Shock or hypothermia

WARNING

- **Make sure there is no other pressure on the cuff.**
- **Wrong cuff size may result in inaccurate measurements.**
- **Make sure monitor is set to Small (SV1-SV5) or Large (SV8-SV10) corresponding to cuff used and limb circumference.**
- **To ensure the patient’s safety, never use cuff on the same limb where an infusion is going on.**
- **Do not measure SpO2 or other parameters on the same limb where blood pressure is measured.**
- **Do not apply cuff on an injured limb.**
- **Do not measure a patient’s blood pressure continuously or repetitively for a long time.**
- **Use only accessories recommended by the manufacturer.**
- **Do not alter the monitor’s air hose. Proper monitor performance is not ensured if the tubing is altered. Modification of the air hose will void the warranty.**

8.6 Preparations

1. Use cuffs of proper size.
2. Ensure the cuff has been completely deflated.
3. Place the properly sized cuff on the patient’s limb.
4. Install the cuff hose to the NIBP connector of the monitor.

WARNING
When inserting or removing NIBP hose, do not turn the NIBP connector.

5. Make sure there is no block between the monitor and the hose. Avoid compression or restriction of pressure tubes.
6. Set blood pressure measurement correctly in the setup menu.
7. The cuff on the patient's limb should be at the same level as the heart.
8. Press the blood pressure start key and start measuring blood pressure.

8.7 Maintenance

8.7.1 Cuffs

Prior to each patient use, inspect the blood pressure cuff and its hose for proper connection, cracks, kinks and damage. If it is leaking or the Velcro does not hold securely then a replacement is needed.

NOTE
Do not submerse cuff. Liquid should not be permitted to enter the cuff bladder because instrument damage may occur. The cuff should be dry before use.

8.7.2 Reusable (Nylon) Large Cuffs

As necessary, wipe the cuff, hose and tubing with mild detergents/dilute bleach solution (1-2%), rinse with water and dry.

8.7.3 Disposable (Vinyl) Small Cuffs

As necessary, the preferred method for cleaning the cuff, hose and tubing is to wipe it down with a damp, soapy cloth. A damp, detergent-free cloth should then be used to rinse the cuff.

In certain situations, the cuff may become soiled during its use. In these situations a water-based detergent is suitable for wiping the cuff.

8.7.4 Calibrating NIBP

Calibration of NIBP is not typically necessary during the warranty period. NIBP calibration is not intended to be performed by the user. NIBP Calibration is included as part of the Preventative Maintenance service recommended every two years post warranty. Reference 14.3 System Calibration and Maintenance section.

SECTION 9 - SpO2 MONITORING

9.1 General Information

The Midmark Multiparameter Monitor continuously monitors and displays arterial blood oxygen saturation (SpO2) and pulse rate. If the ECG HR Source is set to SpO2 or Auto and there is no ECG signal, the monitor beeps with each pulse beat. It allows you to choose alarm limits and audible tone volumes. You can select the high and low alarm limits for SpO2 and pulse rate and choose the alarm level.

The Midmark Multiparameter Monitor determines SpO2 and pulse rate by passing two wavelengths of light, one red (660nm) and the other infrared (940nm), through body tissue to a photo detector. Pulse identification is accomplished by using plethysmography techniques, and oxygen saturation measurements are determined using spectrophotometric oximetry principles. During measurement, the signal strength resulting from each light source depends on the color and thickness of the body tissue, the sensor placement, the intensity of the light sources, and the absorption of the arterial and venous blood (including the time varying effects of the pulse) in the body tissues.

The monitor processes these signals, separating the time invariant parameters (tissue thickness, skin color, light intensity, and venous blood) from the time variant parameters (arterial volume and SpO2) to identify the pulse and calculate oxygen saturation. Oxygen saturation calculations can be performed because blood saturated with oxygen predictably absorbs less red light than oxygen depleted blood.

Since measurement of SpO2 depends on a pulsating vascular bed, any condition that restricts blood flow, such as use of a blood pressure cuff or extremes in systemic vascular resistance, may cause an inability to determine accurate pulse and SpO2 readings. The Pulse Quality Gauge to the right of the SpO2 value, displays the strength of the pulse rate signal. Bars rise and fall with each pulse, indicating pulse signal strength; the greater the number of bars indicates a greater pulse quality signal strength.

WARNING
There is a label  below the SpO2 socket, indicating that the signal input is insulated and defibrillation proof with a type CF applied part. Following exposure to a defibrillation event, SpO2 will resume normal operations after 10 seconds.

CAUTION
SpO2 sensors are fragile and must be handled with care.

9.2 Sensor Placement

WARNING
Use only Nellcor® veterinary oxygen sensors. Use of other oxygen sensors may cause improper performance.

Instructions for Use

WARNING
Sensor may be used on the same site for a maximum of 10 minutes provided the site is inspected routinely to ensure skin integrity and correct positioning. Because individual skin condition affects the ability of the skin to tolerate sensor placement, it may be necessary to change the sensor site more frequently with some patients.

1. Select a sensor and clip that is appropriate for the patient. There are two (2) sizes of VetSat veterinary sensor clips: model VSC-S (small), and model VSC-L (large).
2. Clean the VetSat sensor and clip separately before and after each use.
3. Open the clip by pressing with the thumb and forefinger.
4. Slide one of the sensor's alignment buttons along the clip slot until the sensor pad is fully engaged in the clip.
5. Slide the second sensor button along the other clip slot until the second sensor pad is fully engaged in its side of the clip.

NOTE
Verify the sensor pads are oriented so the optical components face each other directly.

6. The sensor is now ready to be applied to the patient. The preferred sensor application site for canine, feline and equine animals is on the tongue, with the sensor's optical components positioned on the center of the tongue. Alternatively, the sensor and clip may be applied to the animal's lip, toe, ear, prepuce, or vulva.

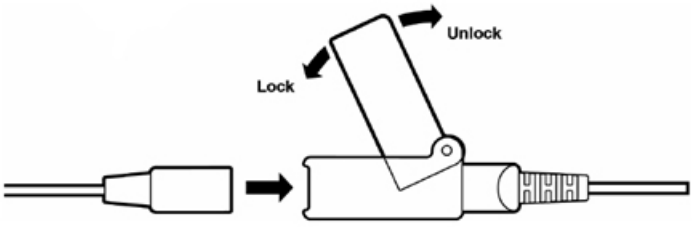
NOTE
If the sensor does not track the pulse reliably, it may be incorrectly positioned, or the sensor site may be too thick, thin, or deeply pigmented to permit appropriate light transmission. If any of these situations occur, reposition the sensor or try another sensor site. If the sensor site is covered with fur, try shaving the site and reapplying the sensor.

7. Be sure to position the sensor cable along the side of the animal's face and body to avoid entanglement with the animal.

WARNING
Do not use supplemental tape to adhere the clip and sensor directly to the site; this can restrict blood flow and cause inaccurate measurements. For best results, secure the sensor cable independently from the sensor.

8. Connect the sensor assembly to the Interface Cable:
9. Place the plastic hinged cover in the unlocked position (perpendicular to the connector).
10. Connect the sensor assembly to the Interface Cable.
11. Lock the plastic hinged cover to prevent accidental cable disconnection.

Sensor to Interface Cable



12. Plug the Interface Cable into the SpO2 connector on the side panel of the monitor. Push the cable in until you hear an audible "click".
13. Verify that the sensor is properly positioned by observing at least ten seconds of a continuous SpO2 waveform being displayed across the screen. When a valid signal is detected, the monitor displays the % SpO2 and Pulse Rate in the SpO2 Parameter box. If the perfusion light level is low, reposition the sensor or try a different sensor. If normal operation cannot be achieved, contact Midmark.

NOTE
Refer to the Directions For Use pamphlet enclosed with the sensor for more information.

NOTE
In addition to the V-SAT sensor and clips that are included with the monitor, there is an optional reflectance sensor, the MAXFAST-1 that can be used on the base of the tail. This is mainly used as an alternative when head/neck/dental procedures are being performed.

9.3 SpO2 Setup Menu

Follow the steps below to enter the SpO2 Setup Settings Menu:

Step 1: Select the SpO2 waveform or SpO2 data in the Parameter box to enter the SpO2 Setup Menu.

SpO2 Setup Menu Options:

WAVE SPEED	Choose between 12.5 or 25mm/s.
WAVE MODE	Choose between Line or Fill.
SAT SECONDS LIMIT	Choose between Off, 10, 25, 50, or 100s.
PULSE VOLUME	Choose between 0 - 5, 5 being the loudest and 0 being silent.
SPO2 SETUP ALARMS TAB	This will take you to the SpO2 Setup Alarms Menu. There, you can set the Alarm Priority, PR Low Limit, PR High Limit, SpO2 Low Limit, SpO2 High Limit and revert to Default factory settings for the SpO2 parameter. See 4.3.2 Alarm Setup Menu for more details.
SPO2 SETUP TREND TAB	Use the left and right arrows to scroll through the timeline and view the last 30 seconds of SpO2 waveform. The SpO2 for the last 7 minutes is also displayed at the top at a 1-minute interval. The wave recall, SpO2 value, and 7 minute trend values do not update with time when user is inside the Trend tab. To update this area with the latest 30 seconds of waveform and 7 minutes of data, select the X to close window and reenter the Trend tab.

SatSeconds™ Alarm Management

The SatSeconds function can be activated from the SpO2 Setup menu by selecting a SatSeconds limit, or “clock” of 10, 25, 50, 100 or Disabled SatSeconds. Clinicians who choose to employ the SatSeconds function should select a limit suited to their clinical environment and patient conditions. Think of SatSeconds as the product of magnitude and time a patient exceeds SpO2 alarm limits. For example, 3 points below the alarm limit for 10 seconds equals 30 SatSeconds. An alarm is only triggered if a desaturation event occurs that reaches the SatSeconds limit you selected. As a safety net, when three or more SpO2 alarm violations occur within 60 seconds, an alarm will sound even if the SatSeconds limit has not been reached.

When SatSeconds is set to Off, the monitor will immediately alarm for %SpO2 limit violations based on the selection made in the Alarm Limits menu.

Once the parameters are all set up, press the “X” button located on the upper right side of the menu to exit to the Main Screen.

9.4 Alarm Setup

The SpO2 alarm is for parameter out of limit or abnormal status. When the parameter exceeds the limit, the monitor will give both visual and audio alarms. For different patients, different limits may be required. To set up the alarm parameters, reference Section 4.3.2 Alarms Menu.

9.4.1 Alarm Range

Parameter	Range
SpO2	0 to 100%
Pulse Rate	20 to 300 bpm

WARNING
If the SpO2 upper limit is set to 100%, then, it is equivalent to no alarm limit.

For a complete list of abnormal status alarms, please see the Monitor Troubleshooting Section 14.2.

9.5 Preparation for Monitoring

1. Select a sensor and clip that is appropriate for the patient.
2. Apply the sensor to a proper position on the patient. If possible, keep the sensor at the same level of the patient’s heart.

WARNING

- ***Do not apply the SpO2 sensor to an extremity where there is arterial catheter, blood pressure cuff or injection tube.***
- ***Make sure the light emitting part and light detecting part face each other.***
- ***Make sure the sensor is applied to a region of arterial blood flow.***
- ***Make sure there is no extreme motion.***
- ***Make sure skin where the sensor is applied is neither too thick nor too thin.***
- ***Make sure there is no strong ambient light coming into the sensor. Cover the site with opaque material.***

3. Set the upper and lower limits of SpO2.

CAUTION
Handle the sensor and the wiring with care. There are sensitive electrical parts in the sensor that can be damaged by negligent treatment. Keep the wiring away from sharp items. Normal wear-and-tear caused by patient motion or sensor cleaning will limit the life of the sensor. Longevity can be extended by careful treatment.

Sensor Removal

CAUTION
For the comfort of the patient and to avoid damaging the sensor, do not pull on the interface or sensor cable when removing the sensor and clip from the sensor site, but rather, press the clip open and remove.

CAUTION
If the SpO2 sensor's photo detector is fully exposed to ambient light when off the patient, the monitor may display a phantom SpO2 waveform or readings.

When SpO2 monitoring is completed, remove the sensor from the patient.

To remove the sensor and clip from the patient, press the clip open and remove. When the sensor is removed from the patient, the message "SpO2 Sensor Off" is displayed and an audible alarm sounds, indicating a connection has been lost. To acknowledge the alarm, press the SILENCE/RESET pushbutton. The monitor silences the audible and visual alarms for the ALARM PAUSE TIME (default is 120 seconds) and the message "SpO2 Sensor Off" remains on the display.

9.6 Cleaning and Maintenance

CAUTION
Clean the sensor and sensor clip separately before and after each use.

CAUTION
Do not sterilize the sensor or clip by irradiation, steam, or ethylene oxide.

CAUTION
To avoid damage to the sensor, remove it from the clip before cleaning either piece.

9.6.1 Clean the Sensor and Clip

1. To remove the sensor from the clip, grasp the end of each sensor pad and pull it through to the inside of the clip. The sensor should pop out of the clip easily. Do not pull on the sensor or interface cable.

2. The sensor may be surface-cleaned by wiping it with an agent such as 70% isopropyl alcohol. Do not immerse the sensor in liquid. The clip may be cleaned by either wiping it with, or soaking it for ten minutes in, 70% isopropyl alcohol. If the clip is soaked, be sure to rinse it with water and air dry it prior to use on the next animal.

3. After each cleaning and prior to each use, inspect the sensor and cable for fraying, cracking, breakage, or other damage. Inspect the clip for cracking or breakage, or loss of spring tension that would allow slippage or movement of the sensor from its proper position. If defects are noted, do not use the sensor or clip.

9.6.2 Clean the Cable

1. Clean the cable surface with soapy water or alcohol. Do not let liquid enter the cable connections.

2. Dry it with clean cloth.

> ***CAUTION***
> *Do not immerse the cable or sensor in any liquid or let liquid enter the cable and sensor connection.*

9.7 Troubleshooting

9.7.1 No SpO2 Data

Failure Phenomenon: During monitoring process, there is no SpO2 waveform or data.

Inspection Method: Check if the red light on the sensor is on.

Solution: If there is no red light inside the sensor, the wiring connectors may have become loose, or the wire inside the cable may have grown frayed over time. Try it on your finger or earlobe, wait up to 30 seconds, and if no reading is obtained, it may indicate that the V-SAT sensor must be replaced. If “SpO2 Communication Stop” is displayed on the screen, then there is a communication problem between the SpO2 module and the host. Turn off the monitor and turn it on again. If the problem still remains, contact Midmark.

> ***CAUTION***
> *Certain drugs, including alpha-2 agonist, are vaso-constrictive, and may cause difficulty in obtaining readings on patient extremities. Moving the sensor further back on the patient’s tongue, or exploring alternate sites (lip, ear, toe webbing, prepuce, vulva), may restore the readings.*

9.7.2 Intermittent SpO2 Value

Failure Phenomenon: When patient SpO2 is measured, the SpO2 value is not continuous.

Inspection Method:

1. Check for patient motion.

2. Check for loose connections with the SpO2 extension cable or V-SAT sensor.

Solution: Keep the patient as still as possible. Value loss caused by patient motion can be considered normal.

SECTION 10 - TEMPERATURE AND RESPIRATION MONITORING

10.1 General Information

10.1.1 Temperature

A continuous temperature monitor is used to measure a patient's core body temperature during the administration of general anesthesia, detection and treatment of hyperthermia, post-surgical recovery, and other various cases that may require constant body temperature monitoring.

The monitor has 2 channels available to display continuous electronic temperature readings of the core body temperature via a rectal/ esophageal probe included with the monitor. ECG, respiration, and temperature can also be monitored with optional ECG esophageal probes.

Temperature monitoring provides numerical information only - no waveform. As with other parameters, data is displayed in the temperature parameter window on the right side of the screen.

WARNING
TEMP sockets are labeled with  ,showing the signal input part is insulated and defibrillation proof with a type CF applied part. Following exposure to a defibrillation event, TEMP will resume normal operations after 10 seconds.

10.2 Temperature Monitoring

1. Select temperature probe.

WARNING
Rectal/esophageal probes are not exchangeable.

2. Probe provided with the monitor may be used either in the esophagus or the rectum of the patient.

CAUTION
While esophageal temperatures are closest to core body temperature, probes should not be used in the esophagus during dental or oral procedures to prevent damage.

CAUTION
To avoid cross-contamination, label the probe with tape indicating which way it's been used.

3. Fully insert the temperature probe into either of the temperature receptacles on the side panel of the monitor.
4. Set temperature alarm limits. To set up the alarm parameters, reference Section 4.3.2 Alarms Menu.

WARNING
Before performing temperature measurement, do not get the temperature probe close to a heat source. If it has been close to a heat source, then let it cool down for 5 minutes before performing measurement.

5. Carefully insert temperature probe into patient and start to monitor patient's temperature.

CAUTION
It takes 8 seconds for the monitor to display stable reading.

10.3 Temperature Setup Menu

Follow the steps below to enter the TEMP Setup Menu:

Step 1: Select the TEMP data in the Parameter box to enter the TEMP Setup Menu.

TEMP Setup Menu Options:

UNIT	Choose from °F or °C.
TEMP SETUP ALARMS TAB	This will take you to the TEMP Setup Alarms Menu. There, you can set the Alarm Priority, T1 Low Limit, T1 High Limit, T2 Low Limit, T2 High Limit, TD High Limit and revert to Default factory settings for the TEMP parameter. Please see 4.3.2 Alarms Menu for more details.
TEMP SETUP TREND TAB	View the last 7 minutes of T1, T2, and TD measurements at a 1-minute interval.

Once the parameters are all set up, press the “X” button located on the upper right side of the menu to exit to the Main Screen.

10.4 Temperature Probe Cleaning

As necessary, the probes should be cleaned with a mild detergent and water to remove excess bioburden. When necessary, the probes may be disinfected using a soft cloth saturated with a 10% (1:10) solution of chlorine bleach in tap water or 70% isopropyl alcohol. When all of the surfaces have been disinfected, wipe the entire surface of the probe using a soft cloth dampened with fresh water to remove any trace amounts of residue and/or fumes.

10.5 Respiration Monitoring

The monitor provides two respiration monitoring methods: thoracic impedance referred to as RESP (standard) and through the Mainstream or Sidestream CO2 (Option – 8019, 8020) or AA sensors (Option – 8019).

For thoracic impedance respiration monitoring:

1. Place electrodes in proper positions.
2. Select proper respiration lead combination.
3. Set respiration alarm limits.

NOTE
ECG Clips must be placed in proper positions.

CAUTION
Patient motion may result in a respiration measurement error.

NOTE
If the patient is intubated, direct respiration monitoring through CO2 monitoring is recommended. If you choose to monitor respiration using the thoracic impedance method, place the ECG electrodes on the patient’s trunk for more reliable readings.

10.6 Respiration Setup Menu

NOTE
RESP will not be displayed if the CO2 (Option – 8019, 8020) or AA (Option - 8019) module is on. To display RESP waveform and numerical data, be sure to turn off the CO2 or AA module first.

NOTE
If the CO2 module is on, the display mode may show CO2 instead of RESP. Press the CO2 waveform or numerical data to enter the CO2 setup menu. Press the dropdown menu next to "SHOW" and choose RESP. This will display RESP information on the screen.

Follow the steps below to enter the RESP Setup Menu:

Step 1: Select the RESP waveform or RESP data in the Parameter box to enter the RESP Setup Menu.

RESP Setup Settings Menu Options:

APNEA TIME	Choose from 20, 25, 30, 35, 40, 45, 50, 55, or 60s. Within the specified time, if there is no respiration waveform, apnea alarm will be activated. Apnea alarm is independent of ALM Sound setting. The Apnea Alarm is not affected by the Alarm Silence feature.
WAVE GAIN	Choose between x0.25, x0.5, x1, x2, and x4.
WAVE SPEED	Choose between 6.25, 12.5, and 25mm/s.
WAVE MODE	Choose between Line or Fill.
RESP LEAD	Choose between RA-LA, RA-LL, LA-RL and LL-RL.
SENSITIVITY	Choose between 1, 2, 3, 4 and 5. The sensitivity should be increased as the signal strength decrease. 5 is the most sensitive setting.
SHOW	Choose between RESP or CO2. This setting allows you to choose to display either the RESP waveform or the CO2 waveform on the main screen. This setting is only available when the CO2 module is turned on.
CO2 SODA LIME ABSORBENT REMINDER	This is a reminder to change the CO2 soda lime absorbent. Choose from On or Off.
RESP SETUP ALARMS TAB	This will take you to the RESP Setup Alarm Menu. There, you can set the Alarm priority, RR Low Limit, RR High Limit and revert to Default factory settings for the RESP parameter. Please see 4.3.2 Alarms Menu for more details.
RESP SETUP TREND TAB	The RESP for the last 7 minutes is displayed at the top at a 1-minute interval.

Once the parameters are all set up, press the "X" button located on the upper right side of the menu to exit to the Main Screen.

10.7 Alarm Setup

The respiration and temperature alarms include a parameter out-of-limit alarm and an abnormal status alarm. When the parameter is out of limit, the monitor will give an alarm sound automatically, and the value displayed on the screen flashes at the same time.

WARNING
Alarm limits should be adjusted based on an individual patient's condition.

Parameter Range:

Parameter	Adjustment Range
Respiration	6 to 120 rpm
Temperature 1	32 to 122 °F
Temperature 2	32 to 122 °F

Alarm for abnormal status:

Parameter	Alarm
Respiration	"ECG Lead Off"
Temperature	"T1 Sensor Off", "T2 Sensor Off"

To set up the alarm parameters, reference Section 4.3.2 Alarms Menu.

For a complete list of abnormal status alarms, please see the Monitor Troubleshooting Section 14.2.

SECTION 11 - CO2 MONITORING (Optional - 8019, 8020)

11.1 General Information

The Midmark Multiparameter Monitor includes the capability to monitor end-tidal CO2 using the optional Mainstream or Sidestream CO2 monitoring device. This measures CO2 by using the infrared absorption technique, which has endured and evolved in the clinical setting for over two decades and remains the most popular and versatile technique today.

The principle is based on the fact that CO2 molecules absorb infrared (IR) light energy of specific wavelengths, with the amount of energy absorbed being directly related to the CO2 concentration. When an IR beam is passed through a gas sample containing CO2, the electronic signal from the photodetector (which measures the remaining light energy) can be obtained. This signal is then compared to the energy of the IR source and calibrated to accurately reflect CO2 concentration in the sample. To calibrate, the photodetector's response to a known concentration of CO2 is stored in the monitor's memory. A reference channel accounts for optical changes in the sensor, allowing the system to remain in calibration without user intervention.

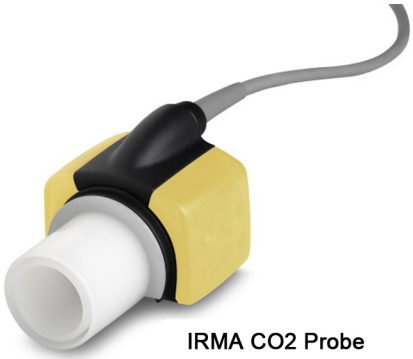
WARNING

There is a label  ***below the CO2 socket, indicating that the signal input is insulated and defibrillation proof with a type BF applied part. Following exposure to a defibrillation event, CO2 will resume normal operations after 10 seconds.***

If you have a Multigas analyzer (Option - 8019), refer to Section 13 for Multigas monitoring which includes CO2.

If you have a Respironics CO2 gas monitoring device, please refer to Section 11.2.

If you have a Masimo CO2 gas monitoring device, please refer to Section 11.3 as well as the Masimo User Guide provided with your IRMA™ CO2 analyzer and NomoLine® ISA™ CO2 analyzer.



IRMA CO2 Probe

NomoLine® ISA CO2™ analyzer

11.2 Respironics CO2

11.2.1 CO2 Setup Menu

The CO2 Menu will only be available if the CO2 sensor is turned on.

Follow the steps below to turn on the CO2 sensor:

Step 1: Press the “Settings” Touch Screen Quick Access Icon.

Step 2: Press “Modules” to open the Modules Menu.

Step 3: Press the drop down option next to CO2. Select Respironics to turn on the Respironics® CO2 sensor.

Step 4: Press the “X” on the upper right corner to exit the screen. A warning will pop up to let you know that a restart would be required and that all current patient alarm data will be purged. Press “Yes” to continue.

Step 5: The monitor will automatically shut down. After it shuts down, press the power button to turn it back on. The CO2 sensor should now be on.

CAUTION

This will turn off the RESP waveform automatically and replace the RESP waveform on the Main Screen with the CO2 waveform. However, the user may change it back to the RESP waveform if desired. Please see the “SHOW” option described below in the Setup Menu section. If the user uses the RESP waveform instead, the CO2 module will automatically be changed to Standby Mode and CO2 data will no longer be collected or monitored.

NOTE

Turning modules On or Off always requires a restart. During restart, the alarm data of the current patient will be purged. Please set up all modules before the start of monitoring.

Follow the steps below to enter the CO2 Setup Menu:

Step 1: Select the CO2 waveform or CO2 data in the Parameter box to enter the CO2 Setup Menu.

CO2 Setup Settings Menu Options:

APNEA TIME	Choose from 20s, 25s, 30s, 35s, 40s, 45s, 50s, 55s and 60s. Within the specified time, if there is no CO2 waveform, apnea alarm will be activated. The Apnea Alarm is not affected by the Alarm Silence feature.
OPERATING MODE	Choose from Standby or Measure.
UNIT	Choose from mmHg, Kpa or %.
WAVE SPEED	Choose from 6.25, 12.5 or 25.0mm/s.
WAVE MODE	Choose from Line or Fill.
SHOW	Choose from RESP or CO2. When the CO2 module is on, all the display modes will default to showing the CO2 waveform. However, if the user should choose to do so, they may switch it with the RESP waveform and data by using this option.
WAVE GRID	Choose from On or Off.
CO2 SODA LIME ABSORBENT REMINDER	Choose from On or Off.
CO2 CATALOG	This will display a collection of reference CO2 waveforms under the patient’s actual waveform to assist with waveform recognition. Choose from On or Off. Select in the Tabular Trend Display area on the Main Screen to display CO2 catalog.
START ZERO CALIBRATION	For use when manually adjusting the Respironics sensor - (See Section 11.2.5).
CO2 SETUP ALARMS TAB	This will take you to the CO2 Setup Alarm Menu. There, you can set the Alarm priority, EtCO2 Low Limit, EtCO2 High Limit, InCO2 High Limit, RR Low Limit, RR High Limit and revert to Default factory settings for the CO2 parameter. Please see 4.3.2 Alarms Menu for more details.

CO2 SETUP TREND TAB	Use the left and right arrows to scroll through the timeline and view the last 30 seconds of CO2 waveforms. The EtCO2 for the last 7 minutes is also displayed at the top at a 1-minute interval. The wave recall, EtCO2 value, and 7 minute trend values do not update with time when user is inside the Trend tab. To update this area with the latest 30 seconds of waveform and 7 minutes of data, select the X to close window and reenter the Trend tab.

Once the parameters are all set up, press the “X” button located on the upper right side of the menu to exit to CO2 Setup Menu.

Additional CO2 Options

Follow the steps below to access additional options:

Step 1: Press the “Settings” quick access icon.

Step 2: Press the “Maintenance” icon.

Step 3: Press the “User Maintenance” button. Enter the password: 2013 and press “OK”.

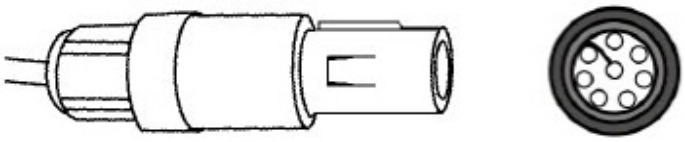
Step 4: Press the “Module Maintenance” button.

Step 5: Press CO2 to access the following CO2 options :

BALANCE GAS	Choose from Air, N2O, or Helium.
O2 COMPEN	Oxygen compensation, the user can input a number using the number pad. (See appendix 5)
ATM PRESSURE	Default set to 760 mmHg at 0 ft altitude but can be self calculated based on altitude.

11.2.2 Connecting the CO2 Sensor to the Monitor

1. Insert the CAPNOSTAT® 5 CO2 Sensor connector into the CO2/AG receptacle of the Midmark Multiparameter Monitor as shown below.

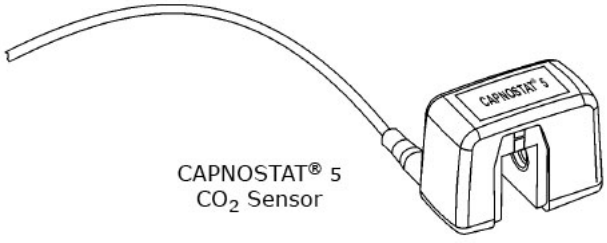


2. Make sure the arrows on the connector are at the top of the connector. Line up the two keys of the connector with the receptacle and insert.
3. To remove the connector, grasp the body portion of the connector, pull in direction of arrow and remove.

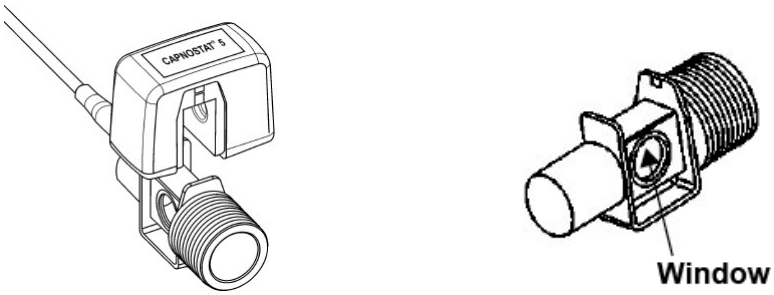
> ***NOTE***
> *Do not remove by pulling cable.*

11.2.3 CAPNOSTAT® 5 Sensor - Mainstream

The CAPNOSTAT® 5 CO2 Sensor is a rugged, solid-state, Mainstream sensor. It is factory calibrated and does not require further calibration.



Connecting the CAPNOSTAT® 5 CO2 Sensor to a Respironics CO2 airway adapter



CAPNOSTAT® 5 CO2 Sensor

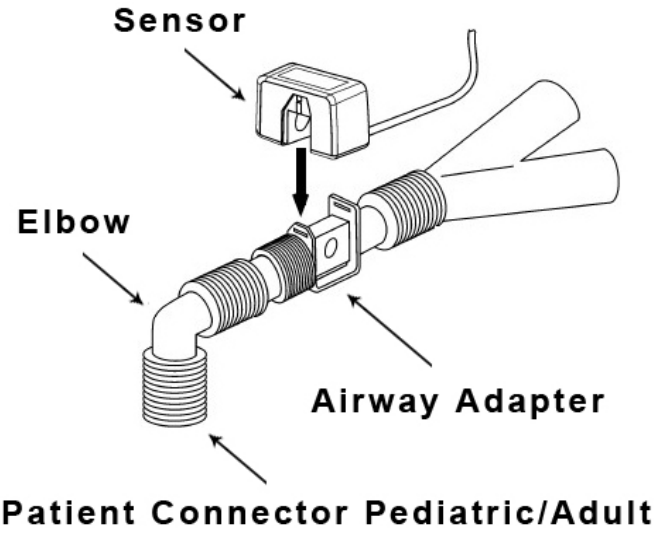
Select the correct airway adapter to minimize dead space. Large airway adapter for ET tubes > 4.0 mm (≈ 6 ml dead space). Small airway adapter for ET tubes ≤ 4.0 mm (≤ 1 ml dead space).

4. Connect: Press the CAPNOSTAT® 5 CO2 sensor onto the airway adapter. It will click into place when properly seated. Keep the windows of the adapter in the vertical position as shown during use. This will keep water and patient secretions from pooling on the windows.

5. When initially connected, your C-STAT5 will perform a zeroing procedure automatically (allow the C-Stat5 to warm up then select Start Zero Calibration to zero sensor). Make sure to successfully Zero your sensor before use. (See section 11.2.5)

6. Remove: Remove by sliding airway adaptor from CAPNOSTAT® 5 CO2 sensor.

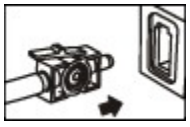
Shown below is the CAPNOSTAT® 5 CO2 Sensor with a patient circuit:



11.2.4 LoFlo CO2 Sensor - Sidestream

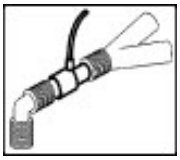
1. After connecting the sensor, wait two minutes to allow the sensor to initialize and warm up.

2. Select the correct sampling line to minimize dead space and snap into LoFlo sensor. Sampling line with large airway adapter for ET tubes > 4.0 mm (≈ 7 ml dead space). Sampling line with small airway adapter for ET tubes ≤ 4.0mm (≤ 1 ml dead space).



3. When initially connected, allow the LoFlo to warm up then select Start Zero Calibration to zero sensor. Make sure to successfully Zero your sensor before use. (See section 11.2.5)

4. For intubated patients requiring an airway adapter, install the airway adapter at the proximal end of the circuit, between the elbow and the ventilator Y-section.



5. For intubated patients with an integrated airway adapter in the breathing circuit, connect the male luer connector on the straight sample line to the female port on the airway adapter.

CAUTION
Capnostat® 5 CO2 airway adapters and LoFlo CO2 sampling lines are intended for single patient use.

WARNING
Always connect the airway adapter to the sensor before inserting the airway adapter into the breathing circuit. In reverse, always remove the airway adapter from the breathing circuit before removing the sensor.

11.2.5 Zeroing the CAPNOSTAT® 5 and LoFlo CO2 Sensors

WARNING
Incorrect probe zeroing will result in false gas readings.

The following instructions are for when a manual zero is needed, or an initial zero is unsuccessful.

CAUTION
Never zero the Capnostat® 5 or LoFlo sensor without an adapter or sampling kit installed. Alarms relating to the adapter may prevent a successful zero. When zeroing, always remove the adapter or cannula from the patient and keep all sources of CO2 away from the sensor, including your own breath. CO2 is heavier than air.

Follow the steps below to Zero your sensor:

Step 1: Plug in the Respironics CO2 sensor.

Step 2: Install the airway adapter or sampling line.

NOTE
For the best results, the Respironics® sensor should be plugged in before starting the monitor. Plugging the sensor in while the monitor is in use, may cause the sensor to not be recognized.

Step 3: Select the CO2 waveform or CO2 data in the parameter box to enter the CO2 Setup Settings Menu.

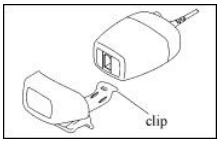
Step 4: Make sure the sensor is not being used or connected to the patient. Press “Start Zero Calibration”.

Step 5: The “Start Zero Calibration” function will now be grayed out on the menu. Upon successful completion, the “CO2 Zero Successful” message will be displayed in the CO2 menu. If Zeroing failed, the reason for failure will be displayed in the technical alarm status bar. Zeroing cannot be performed during the warm up period.

11.2.6 LoFlo CO2 Sensor Holder (Optional)

The Sidestream sensor holder can be used to clamp the sensor onto an IV pole or a shelf.

1. Push the sensor into the holder until it clicks into position.
2. Clamp the holder onto an IV pole, a shelf, or another appropriate location.
3. To remove the sensor from the holder, release the clip and pull the sensor out of the holder.



11.2.7 Removing Exhaust Gases from the System

> ***NOTE***
> *Regarding Anesthetics: When using the Sidestream CO2 measurement on patients who are receiving or have recently received anesthetics, you may connect the outlet to a scavenging system, to avoid exposing the veterinary staff to anesthetics.*

Use an exhaust tube to remove the sample gas to a scavenging system. Attach it to the Sidestream sensor at the outlet connector.

11.2.8 Alarm Setup

The CO2 alarm is for parameter out of limit or abnormal status. When the parameter exceeds the limit, the monitor will give both visual and audio alarms.

Alarm Range:

Parameter	Range
Airway Respiratory Rate	0 to 150 rpm
EtCO2	0 to 150 mmHg
InCO2	0 to 150 mmHg

> ***WARNING***
> ***Alarm limits should be adjusted based on an individual patient's condition.***

To set up the alarm parameters, please reference Section 4.3.2 Alarms Menu.

For a complete list of abnormal status alarms, please see the Monitor Troubleshooting Section 14.2.

11.2.9 Cleaning & Maintenance

Cleaning the *outside* of the CAPNOSTAT® 5 CO2 Sensor:

1. Ensure that the sensor is disconnected and cooled to room temperature for 30 minutes before cleaning.
2. Use a cloth dampened with isopropyl alcohol 70%, a 10% aqueous solution of sodium hypochlorite (bleach), or disinfectant spray cleaner such as Steris Coverage® Spray HB.
3. Wipe down with a clean water-dampened lint free cloth to rinse and dry before use. Make certain that the sensor windows are clean and dry before reuse. Extra care should be taken when cleaning the lens/windows of the probe as to not scratch them. Only use cotton-tipped applicators and distilled water.
4. Keeping an airway adapter installed when not in use will protect the sensor windows.

Cleaning the LoFlo CO2 Module case, Cable and connector:

1. Use a cloth dampened with isopropyl alcohol 70%, a 10% aqueous solution of sodium hypochlorite (bleach), a 2% gluteraldehyde solution, ammonia, mild soap or disinfectant spray cleaner such as Steris Coverage® Spray HB.
2. Wipe down with a clean water-dampened cloth to rinse and dry before use. Make certain that the sensor windows are clean and dry before reuse.

Airway Adapters

Capnostat® 5 airway adapters are intended for single patient use.

CAUTION
DO NOT insert any object, such as a brush, into the CAPNOSTAT® 5 CO2 airway adapter or sensor adapter channel. Irreparable damage may occur to the CO2 windows.

11.3 Masimo CO2

The CO2 Menu will only be available if the CO2 module is turned on.

Follow the steps below to turn on the CO2 module:

Step 1: Press the “Settings” Touch Screen Quick Access Icon.

Step 2: Press the “Modules” to open the Modules Menu.

Step 3: Press the drop down option next to CO2. Select Masimo to turn the Masimo module on.

Step 4: Press the “X” on the upper right corner to exit the screen. A warning will pop up to let you know that a restart would be required and that all current patient alarm data will be purged. Press “Yes” to continue.

Step 5: The monitor will automatically shut down. After it shuts down, press the power button to turn it back on. The CO2 module should now be on.

CAUTION
This will turn off the RESP waveform automatically and replace the RESP waveform on the Main Screen with the CO2 waveform. However, the user may change it back to the RESP waveform if desired. Please see the “SHOW” option described below in the Setup Menu section. If the user uses the RESP waveform instead, the CO2 module will automatically be changed to Standby Mode and CO2 data will no longer be collected or monitored.

NOTE
Turning modules On or Off always requires a restart. During restart, the alarm data of the current patient will be purged. Please set up all modules before the start of monitoring.

11.3.1 CO2 Setup Menu

Follow the steps below to enter the CO2 Setup Settings Menu:

Step 1: Select the CO2 waveform or CO2 data in the Parameter box to enter the CO2 Setup Settings Menu.

CO2 Setup Settings Menu Options:

APNEA TIME	Choose from 20s, 25s, 30s, 35s, 40s, 45s, 50s, 55s or 60s. This selected time is the additional delay before the apnea alarm/text will be activated. The Apnea Alarm is not affected by the Alarm Silence feature.
OPERATING MODE	Choose from Standby or Measure. (See Section 11.3.4).
O2 COMPEN	This is for the Oxygen Compensation. Choose from Low, Mid and High. Refer to Appendix 5 for more details.
N2O COMPEN	This is for the Nitrous Oxide Compensation Choose from On or Off. Refer to Appendix 5 for more details.
UNIT	Choose from mmHg, Kpa or %.
WAVE GRID	Choose from On or Off.
WAVE SPEED	Choose from 6.25, 12.5 or 25.0mm/s.
WAVE MODE	Choose from Line or Fill.
SHOW	Choose from RESP or CO2. When the CO2 module is on, all the display modes will default to showing the CO2 waveform. However, if the user should choose to do so, they may switch it with the RESP waveform and data by using this option.
CO2 SODA LIME ABSORBENT REMINDER	Choose from On or Off.

CO2 CATALOG	This will display a collection of reference CO2 waveforms under the patient's actual waveform to assist with waveform recognition. Choose from On or Off. Select in the Tabular Trend Display area on the Main Screen to display CO2 catalog.
START ZERO CALIBRATION	For use when manually adjusting the IRMA™ CO2 analyzer - (See Section 11.3.8).
CO2 SETUP ALARMS TAB	This will take you to the CO2 Setup Alarm Menu. There, you can set the Alarm priority, EtCO2 Low Limit, EtCO2 High Limit, InCO2 High Limit, RR Low Limit, RR High Limit and revert to Default factory settings for the CO2 parameter. Please see 4.3.2 Alarms Menu for more details.
CO2 SETUP TREND TAB	Use the left and right arrows to scroll through the timeline and view the last 30 seconds of CO2 waveform. The EtCO2 for the last 7 minutes is also displayed at the top at a 1-minute interval. The wave recall, EtCO2 value, and 7 minute trend values do not update with time when user is inside the Trend tab. To update this area with the latest 30 seconds of waveform and 7 minutes of data, select the X to close window and reenter the Trend tab.

Once the parameters are all set up, press the "X" button located on the upper right side of the menu to exit to the CO2 Setup Menu.

Additional CO2 Options

Follow the steps below to access additional options:

Step 1: Press the "Settings" quick access icon.

Step 2: Press the "Maintenance" icon

Step 3: Press the "User Maintenance" button. Enter the password: 2013 and press "OK".

Step 4: Press the "Module Maintenance" button.

Step 5: Press CO2 to access the following CO2 options:

ATM PRESSURE	Atmospheric pressure/Ambient pressure. This cannot be set by the user.
Atm Press-Cuvette Press	Atmospheric pressure/Ambient pressure minus the pressure in the measuring cuvette (ISA). This cannot be set by the user.
CO2 Calibration	This is the Span calibration. The service technician can set the % volume to a value between 4.0 and 11.0.
Zero Bef Calibration (CO2)	Zero Before Calibration (Zeroing) is used to establish a zero reference level for the gas measurements.
Calibration Module (CO2)	Manually perform a zero calibration.

11.3.2 IRMA™ CO2 Analyzer

NOTE
Please refer to the IRMA™ CO2 analyzer user guide for all technical specifications associated with this product.

NOTE
Please refer to the IRMA™ CO2 and AA analyzer Appendix 7 for all Warnings, Cautions, and Notes associated with this product.

The following parts are included with your IRMA™ CO2 analyzer kit.

1. IRMA™ (Mainstream) CO2 analyzer.
2. IRMA™ airway adapters.

Connecting the IRMA™ CO2 analyzer to the monitor.

The IRMA™ CO2 analyzer is an external and independent part of the Midmark Multiparameter Monitor.

Step 1: With the monitor off, plug the IRMA™ CO2 analyzer into monitor side panel by lining up the two keys of the connector with the receptacle and insert.

Step 2: Select the correct airway adapter to minimize dead space. Large airway adapter for ET tubes > 4.0 mm (≈ 6 ml dead space). Small airway adapter for ET tubes ≤ 4.0 mm (≤ 1 ml dead space).

Step 3: Snap the IRMA™ CO2 analyzer on top of the IRMA™ airway adapter. It will click into place when properly seated.

Step 4: Turn on the monitor.

Step 5: If CO2 is not displayed, turn on the CO2 module within the Module Setup Menu. Refer to Section 11.3.1 CO2 Setup Menu.

NOTE
The end user must turn on the CO2 module function within the monitor the first time the CO2 device is plugged in for use. Refer to Section 11.3.1 CO2 Setup Menu.

NOTE
The end user must plug in the CO2 analyzer prior to turning on the monitor for proper functioning of the device.

Step 6: A green LED indicates that the IRMA™ CO2 analyzer is ready for use.

Step 7: Connect IRMA™ airway adapter male connector to the breathing circuit Y-piece. Connect the IRMA™ airway adapter female connector to the patient's endotracheal tube. Position the IRMA™ CO2 analyzer with the LED pointing upwards.

A HME (Heat Moisture Exchanger) may be connected between the patient's endotracheal tube and the IRMA™ CO2 analyzer to protect the IRMA™ airway adapter from secretions and effects of water vapor and eliminate the need of changing the adapter. It allows free positioning of the IRMA™ CO2 analyzer as well.

NOTE
A HME will add Dead Space and Resistance to the breathing circuit. Refer to manufacturer's information for amounts and recommendations for replacement.

NOTE
Unless the IRMA™ CO2 analyzer is protected with a HME, always position the IRMA™ CO2 analyzer with the LED pointing upwards.

The IRMA™ disposable airway adapter is inserted between the endotracheal tube and the Y-piece of the breathing circuit. The respiratory gas measurements are obtained through the XTP windows in the sides of the adapter. As the airway adapter is positioned directly in the airway, its performance can be affected by water vapor, patient secretions or nebulized medications that can accumulate on the adapter's windows. For optimal results, the airway adapter shall not be placed between an endotracheal tube and an elbow, as this may allow patient secretions to block the adapter windows. The IRMA™ airway adapter shall be positioned with its windows in a vertical position to help keep patient secretions from pooling on the windows. The disposable IRMA™ airway adapter is treated to prevent moisture buildup and drift, so please do not clean the interior of the airway adapters.

When connecting the IRMA™ CO2 analyzer to a patient circuit it is important to avoid direct contact between the IRMA™ CO2 analyzer and the patient's body.

WARNING
The IRMA™ CO2 analyzer is not intended to be in patient contact.

WARNING
If, for whatever the reason, the IRMA™ CO2 analyzer is in direct contact with any parts of the patient's body, an insulation material shall be paced between the IRMA™ CO2 analyzer and the body.

Step 8: To remove the IRMA™ CO2 analyzer, grasp the body portion of the connector and pull to remove.

NOTE
Do not remove by pulling cable.

CAUTION
IRMA™ CO2 airway adapters are intended for single patient use.

11.3.3 NomoLine® ISA™ CO2 Gas Analyzer

NOTE
Please refer to the NomoLine® ISA™ CO2 Analyzer user guide for all technical specifications associated with this product.

NOTE
Please refer to the Nomoline ISA CO2 and AA analyzer Appendix 8 for all Warnings, Cautions, and Notes associated with this product.

The following parts are included with your NomoLine® ISA™ CO2 gas analyzer.

1. NomoLine® ISA™ CO2 (Sidestream) gas analyzer.
2. NomoLine® Sampling lines.

Follow the steps below to connect the NomoLine® ISA™ CO2 gas analyzer to the monitor.

The NomoLine® ISA™ CO2 gas analyzer is an external and independent part of the Midmark Multiparameter Monitor.

Step 1: Securely mount or place the NomoLine® ISA™ CO2 gas analyzer in a safe location.

Step 2: With the monitor off, plug the NomoLine® ISA™ CO2 gas analyzer into the monitor side panel.

Step 3: Select the correct sampling line to minimize dead space and connect sampling line to the NomoLine® ISA™ CO2 gas analyzer input connector. Sampling line with large airway adapter for ET tubes > 4.0 mm (≤6 ml dead space). Sampling line with small airway adapter for ET tubes ≤ 4.0 mm (≤0.7 ml dead space).

Step 4: Connect the gas sample exhaust port to a scavenging system or return the gas to the patient circuit to prevent pollution of the operation room when N2O and/or anesthetic agents are being used. See section 11.3.5 CO2 Exhaust.

Step 5: Turn on the monitor.

Step 6: A green LED indicates that the NomoLine® ISA™ CO2 gas analyzer is ready for use. Perform a pre-use check as described in the Section 11.3.6 Pre-Use Checks.

Step 7: If CO2 is not displayed, turn on the CO2 Module within the Main Menu. Refer to Section 11.3.1 CO2 Setup Menu

NOTE
The end user must turn on the CO2 module function within the monitor the first time the CO2 device is plugged in for use. Refer to Section 11.3.1 CO2 Setup Menu.

CAUTION
To ensure good ventilation of the analyzer, keep a minimum of 5cm from each side of the analyzer to the wall or cabinet.

It is recommended to place the NomoLine® ISA™ CO2 gas analyzer at a place higher or at the same level of patient position.

Step 8: To remove the NomoLine® ISA™ CO2 gas analyzer, grasp the body portion of the connector and pull to remove.

NOTE
Do not remove by pulling cable.

CAUTION
NomoLine® ISA™ CO2 sampling lines are intended for single patient use.

11.3.4 Turn On or Off the CO2 Work Mode

The IRMA™ CO2 analyzer defaults to Measure mode and will have to be switched to measure mode before use. Zeroing needs to be performed ONLY when an offset in gas values is observed, or when an unspecified accuracy message is displayed. Allow 10 seconds for warm up of the IRMA™ CO2 analyzer after power on and after changing the IRMA™ Airway Adapter before proceeding with the Zeroing procedure. The green LED on the analyzer will be blinking for approximately 5 seconds while zeroing is in progress.

A zero may to be performed manually by selecting “Start Zero Calibration”, please refer to section 11.3.8.

The monitor will default to Measure Mode. To save operational time, the user may elect to turn the monitor to Standby mode when not using the IRMA™ CO2 analyzer or NomoLine® ISA™ CO2 gas analyzer.

NOTE
The end user must plug in the CO2 analyzer prior to turning on the monitor for proper functioning of the device.

To change the Work Mode for the IRMA™ CO2 analyzer and NomoLine® ISA™ CO2 gas analyzer, follow the steps below:

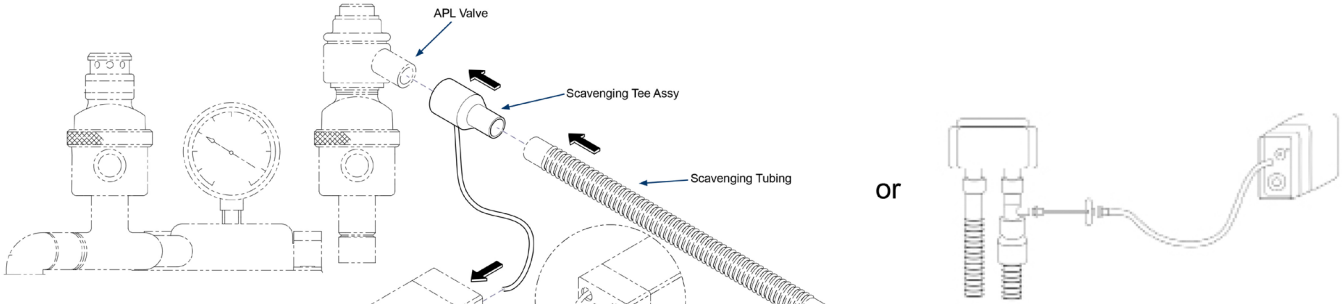
Step 1: Press on the CO2 Waveform Area or Parameter box to open the CO2 Setup Settings Menu.

Step 2: Press the “Operating Mode” drop down and choose between “Standby” or “Measure”.

Step 3: Press the “X” on the upper right corner of the menu to exit.

11.3.5 CO2 Exhaust

Connect the gas sample exhaust port to a scavenging system or return the gas to the patient circuit to prevent pollution of the operation room when N2O and/or anesthetic agents are being used.



NOTE
The exhaust line is not supplied with the NomoLine® ISA™ CO2 analyzer but a scavenging kit solution is available as an optional accessory (See Appendix 6).

11.3.6 Pre-Use Checks

IRMA™ CO2 Analyzer

Always verify gas readings and waveforms on the monitor before connecting the airway adapter to the patient circuit. To do this, breathe into the airway adapter with the IRMA™ CO2 analyzer attached.

Perform a tightness check of the patient circuit with the IRMA™ CO2 analyzer snapped on the IRMA™ airway adapter.

NomoLine® ISA™ CO2 Gas Analyzer

Before connecting the sampling line to the breathing circuit, do the following:

1. Connect the sampling line to the NomoLine® ISA™ CO2 gas analyzer light emitting gas inlet connector (LEGI).

2. Check that the LEGI shows a steady green light (indicating that the system is OK).
3. Breathe into the sampling line and check that valid CO2 waveforms and values are displayed.
4. Occlude the sampling line with a fingertip and wait for 10 seconds.
5. Check that an occlusion alarm, “Sampling Line Clogged”, is displayed and that the LEGI shows a flashing red light.
6. If applicable: Perform a tightness check of the patient circuit with the sampling line attached.

11.3.7 Using CO2

Follow the steps below to use the CO2 function:

Step 1: Connect the analyzer to the Midmark Multiparameter Monitor and turn the monitor on.

Step 2: If CO2 is not displayed, turn on the CO2 module. Refer to Section 11.3.1 CO2 Setup Menu.

Step 3: Connect the analyzer to the patient circuit. Once the analyzer detects breathing, the related values will automatically be displayed.

> ***NOTE***
> *The infrared gas analyzer needs to establish a zero reference level for the CO2 gas measurement. This zero calibration is referred to as “Start Zero Calibration”.*

11.3.8 Start Zero Calibration

> ***WARNING***
> ***Incorrect analyzer zeroing will result in false gas readings.***

IRMA™ CO2 Analyzer

In order to secure high precision of the IRMA™ CO2 analyzer measurements the following zeroing recommendations should be followed:

1. Special care should be taken to avoid breathing near the airway adapter before or during the Zeroing procedure. The presence of ambient air (21% O2 and 0% CO2) in the IRMA™ airway adapter is of crucial importance for a successful Zeroing. If a “Zero required” alarm should appear directly after a Zeroing procedure, the procedure has to be repeated.
2. Always perform a pre-use check after zeroing the analyzer. See section 11.3.6 Pre-Use Checks.
3. Zeroing should be performed only when an offset in gas values or an unspecified gas accuracy message is displayed.
4. The option to Zero will be unavailable during warm up and zeroing. The green LED on the analyzer will be blinking for approximately 5 seconds while zeroing is in progress.

Follow the steps below to zero the IRMA™ CO2 analyzer:

Step 1: Snap a new IRMA™ airway adapter onto the IRMA™ CO2 analyzer, without connecting the airway adapter to the patient circuit.

Step 2: Select the CO2 waveform or CO2 data in the Parameter box to enter the CO2 Setup Settings Menu.

Step 3: Press the “Start Zero Calibration” button. The visual technical alarm “CO2 is Zeroing” will appear along with the technical audible alarm. When completed, “CO2 Zero Success” will display. If Zeroing failed, the reason for failure will be displayed in the technical alarm status bar.

ISA™ CO2 Gas Analyzer

The highly stable NomoLine® ISA™ CO2 gas analyzer system spectrometer requires no regular zeroing. A room air reference measurement is performed when the NomoLine® is disconnected from the LEGI connector, provided that CO2 measurements are stable. This zeroing procedure is indicated by the LEGI blinking green.

11.3.9 Alarm Setup

The CO2 alarm is for parameter out of limit or abnormal status. When the parameter exceeds the limit, the monitor will give both visual and audio alarms.

Alarm Range:

Parameter	Range
Airway Respiratory Rate	0 to 150 rpm
EtCO2	0 to 150 mmHg
InCO2	0 to 150 mmHg

The Masimo CO2 sensors come with a LED status indicator on the analyzer themselves, shown in the table below.

Indication	Status
Steady Green Light	System OK
Blinking Green Light	Zeroing In Progress
Steady Red Light	Sensor Error
Blinking Red Light	Check Sampling Line or Adapter

The CO2 analyzer has alarms for values exceeding the preset limits, apnea, and for abnormal status.

Alarm for Parameters Exceeding Preset Limits

Alarm will be activated when the measured parameter exceeds the preset parameter alarm limits.

For CAT/DOG/HORSE/Other: EtCO2 low/high (mmHg) – 20/60, InCO2 low/high (mmHg) – 0/10, RR low/high (rpm)—5/55.

Apnea Alarm

If no breath is detected for the selected apnea time, the apnea alarm will be activated.

NOTE
The CO2 analyzer and the patient monitor system have a smart apnea alarm function. That is, there will be no alarm during the period when the monitor is just powered on. It will only activate the apnea alarm after it has detected respiration and later it identifies there is apnea.

NOTE
The apnea alarm is a high priority alarm. So when the apnea alarm occurs, the red light flashes on the monitor display. The Alarm Silence feature will only silence the audible portion of the Apnea Alarm.

Abnormal Status

Abnormal status refers to technical alarms such as “Sampling Line Clogged” or “Check Adapter (CO2)”. For a complete list of abnormal status alarms, please see the Troubleshooting section 14.2.

11.3.10 Cleaning and Maintenance

CAUTION
Anyone not properly trained and certified must not attempt to perform any service or maintenance of the Masimo product.

CO2 Analyzer Cleaning

WARNING
Do not use Chlorine disinfectants or Chlorine cleaners with the NomoLine® ISA™ CO2 or IRMA™ analyzers as this will damage them.

The IRMA™ CO2 analyzer can be cleaned using a cloth moistened with ethanol or isopropyl alcohol (< 70 %). Extra care should be

taken when cleaning the lens/windows of the analyzer as to not scratch them. Only use cotton-tipped applicators and alcohol.

CAUTION
Do not autoclave the IRMA™ analyzer and airway adapters.

CAUTION
Never sterilize or immerse the IRMA™ analyzer in liquid.

Cleaning of the NomoLine® ISA™ CO2 gas analyzer should be performed at regular intervals or in accordance with hospital, as well as local and governmental regulations.

WARNING
To avoid electric shock, always physically disconnect the NomoLine® ISA™ CO2 analyzer and all patient connections before cleaning.

CAUTION
To avoid permanent damage to the NomoLine® ISA™ CO2 analyzer, do not use undiluted bleach (5% - 5.25% sodium hypochlorite) or any other cleaning solution not recommended.

NOTE
To prevent cleaning liquids and dust from entering the NomoLine® CO2 gas analyzer through its sampling gas inlet connector, keep the sampling line fitted while cleaning ISA™ CO2 analyzer.

The surfaces of the NomoLine® ISA™ CO2 gas analyzer may be cleaned with the following solution(s):

- 70% ethyl alcohol
- 70% isopropyl alcohol
- Glutaraldehyde Solution
- Quaternary Ammonium Chloride Wipe
- 0.5% Sodium Hypochlorite/Water Solution
- Accelerated Hydrogen Peroxide

CAUTION
Never sterilize or immerse the NomoLine® ISA™ CO2 sidestream gas analyzer in liquid.

NomoLine® ISA™ CO2 Gas Analyzer Maintenance

Annual maintenance with use of kit, 002-10849-00, is recommended for the ISA™ CO2 analyzer.

Airway Adapters and Sampling Lines

IRMA™ airway adapters and NomoLine® sampling lines are intended for single patient use.

SECTION 12 - IBP MONITORING (Optional - 8019)

12.1 General Information

The device displays the maximum systolic pressure, minimum diastolic pressure, mean pressure and an IBP waveform. The IBP waveform can be observed in 2 channels, and the waveform speed is defaulted at 25mm/s. The sweep speed for both channels are linked but may be altered to the user's requirements as needed. In the IBP waveform channel has a scale on the left and the IBP reading is displayed to the right of the waveform in the parameter box.

WARNING

There is a label [♥] below the IBP sockets, indicating that the signal input is insulated and defibrillation proof with a type CF applied part. Following exposure to a defibrillation event, IBP will resume normal operations after 10 seconds.

NOTE

For a thorough discussion, see Appendix 4; Direct Blood Pressure Monitoring, by Marc R. Raffe DVM, MS, DACVA, DACVECC, IVECCS proceedings.

12.2 IBP Setup Menu

The IBP Setup Menu will only be available if the IBP module is turned on.

Follow the steps below to turn on the IBP module:

Step 1: Press the "Settings" Touch Screen Quick Access Icon.

Step 2: Press the "Modules" to open the Modules Menu.

Step 3: Press the drop down option next to IBP. Select 2IBP to turn the module on.

Step 4: Press the "X" on the upper right corner to exit the screen. A warning will pop up to let you know that a restart would be required and that all current patient alarm data will be purged. Press "Yes" to continue.

Step 5: The monitor will automatically shut down. After it shuts down, press the power button to turn it back on. The IBP module should now be on.

Follow the steps below to enter the IBP Setup Settings Menu:

Step 1: Select the IBP waveform or IBP data in the Parameter box to enter the IBP Setup Settings Menu.

NOTE

If IBP waveform and data is not on the screen after the module is turned on, press the "Displays" Quick Access Icon to rotate through the display options. Stop at the display option that shows the IBP parameter.

WAVE SPEED	Choose between 12.5 or 25mm/s. The Wave Speed for Channel 1 and Channel 2 are connected. Therefore, the two channels cannot have different sweep speeds.
WAVE MODE	Choose between Line or Fill.
UNIT	Choose between mmHg or kPa.
PRESSURE	Set the option for IBP Channel 1 and 2. For Channel 1, choose from: ART1, PA1, CVP1, AO1, RA1, ICP1, and FA1. For Channel 2, choose from: ART2, PA2, CVP2, AO2, RA2, ICP2 and FA2.
WAVE SCALE	The user may adjust the maximum and minimum pressure value for Channel 1 and Channel 2. The user may choose from Auto, (-10,10), (-20,20), (-30,30), (-50,50), (0,40), (0,120), (0,200), (0,300) and (0,400).
IBP1 ZERO	The user may zero IBP1. Please reference Section 12.5 Zeroing the IBP Sensor.
IBP2 ZERO	The user may zero IBP2. Please reference Section 12.5 Zeroing the IBP Sensor.
SHOW	The user may choose to display Arterial or MAP readings within the IBP channels.

IBP SETUP ALARMS TAB	This will take you to the IBP 1&2 Alarm Setup Menu. There, you can set the Alarm priority, ART1 Low Limit (for SYS, DIA and MAP), ART1 High Limit (for SYS, DIA and MAP), CVP2 Low Limit, CVP2 High Limit, PR Low Limit, PR High Limit and revert to Default factory settings for the IBP parameter. Please see 4.3.2 Alarms Menu for more details.
IBP SETUP TREND TAB	View the last 7 minutes of SYS1, DIA1, MAP1, SYS2, DIA2, and MAP2 measurements at a 1-minute interval.

Once the parameters are all set up, press the “X” button located on the upper right side of the menu to exit to the Main Screen.

12.3 Transducer

IBP transducers provided are in conformity with ANSI/AAMI BP22:1994 standards and with sensitivity 5uV/V/mmHg. Check transducer cable before connecting it to the device.

NOTE
The disposable transducer is for single use only. Never attempt to reuse the parts. Discard the used transducers properly.

WARNING
Use only the recommended IBP cable and transducers.

12.3.1 Transducer Connection

Follow the steps below to connect the transducer:

Step 1: When the device is turned on and the IBP module is activated, the IBP channels will be displayed on the main screen without any waveforms.

Step 2: Plug the transducer cable into the IBP1 or IBP2 socket, the other end of the transducer cable is connected as follows:

IBP Transducer Connection Diagram (Fig. 12.3.1-1)

The T (1) is used to open the transducer (2) to air.
The T (3) is used to block (2) from (3) and (4).
The pressure monitoring tube (4) is to ensure the accuracy of the measurement.
The (5) in the above diagram is to connect patient catheter.

Step 3: Fill in the catheter system from T (3) and make sure there is no bubble in the system.

Step 4: Connect patient catheter to pressure monitoring tube, make sure there is no air in catheter, pressure monitoring tube or transducer.

WARNING
If there are bubbles in the pressure tube or transducer, flush the catheter system with physiological saline.

12.4 Preparation for Measurement

CAUTION
Make sure the IBP sensors are properly zeroed before use. See Section 12.5 Zeroing the IBP Sensor.

Follow the steps below to prepare for measurement:

Step 1: Make sure your monitor comes with the IBP feature (Option - 8019). Check the side panel to see if there are 2 IBP connectors. If it does, then the unit you ordered has IBP.

Step 2: Connect the IBP cable to the monitor and turn the monitor on. Follow the directions in 12.3.1 Transducer Connection to make certain the transducer is connected accurately.

Step 3: Prepare the pressure tube and sensor. To do so, fill up the system with normal saline, making sure there are no bubbles within the tube system.

Step 4: Connect the patient tube to the pressure tube, making sure there is no air in the tubes or the sensor.

Step 5: Make sure the IBP transducers are not connected to the patient in any way.

Step 6: Place the sensor and the heart at the same level, approximately at middle axillary line, and vent the sensor to air.

Step 7: Make sure that you have selected the correct designation. Refer to Section 12.2 IBP Setup Menu for available designations.

Step 8: Zero the sensor. Please refer to Section 12.5 Zeroing the IBP Sensor.

12.5 Zeroing the IBP Sensor

Transducer zeroing is very important for accurate measurement, so zeroing should be performed regularly and before each new sensor is used. Before zeroing, be certain to vent the transducer to atmosphere at a level consistent with the heart of the patient.

Follow the steps below to zero the sensor:

Step 1: Press on the IBP Waveform Area to open the IBP Setup Menu.

> ***NOTE***
> *If IBP waveform and data is not on the screen after the module is turned on, press the "DISPLAYS" Quick Access Icon to rotate through the display options. Stop at the display option that shows the IBP parameter.*

Step 2: Press either the "IBP1 Zero" or "IBP2 Zero" to zero the channel you are using for IBP. If you are using both channels, you must zero both channels separately. Once you press the "IBP1 Zero" or "IBP2 Zero" button, the button will turn yellow indicating that Zeroing is in progress. Once it is complete, the message will change to "IBP1 Zero Success" or "IBP2 Zero Success". If the zeroing failed, the message will be "IBP1 Zero Fail" or "IBP2 Zero Fail".

12.6 IBP Labeling

The Midmark Multiparameter Monitor allows you to label various sites for monitoring pressure. The possible labels consist of: ART1, PA1, CVP1, AO1, RA1, ICP1, FA1, ART2, PA2, CVP2, AO2, RA2, ICP2, and FA2.

ART1 or ART2: Arterial Pressure, i.e. the arterial blood pressure being monitored

PA: Pulmonary Artery Pressure

CVP: Central Vein Pressure

AO: Aorta Pressure

RA: Radial Artery Pressure

ICP: Intracranial Pressure

FA: Femoral Artery Pressure

12.7 IBP Setup Alarms Menu

IBP monitoring alarm includes parameter limit alarm and abnormal status alarm. Alarm is to give alert when the monitoring results are abnormal. It is audible and visual with LED indicators and flashing readings.

> ***NOTE***
> *Adjust default alarm limits according to the circumstances and the patient status.*

	Cat		Dog		Horse		Other	
Parameter	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
IBP SYS (mmHg) – ART1, ART2, AO, RA, FA	100	160	100	160	100	130	100	160
IBP DIA (mmHg) – ART1, ART2, AO, RA, FA	50	90	50	90	50	80	50	90
IBP MAP (mmHg) –ART1, ART2, AO, RA, FA	60	120	70	130	60	100	70	130
IBP SYS (mmHg) – PA	5	38	5	38	5	38	5	38
IBP DIA (mmHg) – PA	-4	4	-4	4	0	16	-4	4
IBP MAP (mmHg) – PA	12	16	12	16	8	25	12	16
IBP MAP (mmHg) – CVP	0	7	0	7	0	23	0	7
IBP MAP (mmHg) – ICP	0	4	0	4	0	10	0	4
PR	20	300	20	300	20	300	20	300

NOTE
If CVP or ICP mode is selected, there are no SYS and DIA alarms.

To set up the alarm parameters, please reference Section 4.3.2 Alarms Menu.

12.8 Precautions

WARNING:

- If liquid enters the monitor, turn it off immediately, and contact Midmark.
- If liquid enters the accessories, turn off the monitor and disconnect the sensors from the patient. Switch to another sensor and alert hospital technicians or contact Midmark to repair or replace the original sensor as needed.
- When the monitor is connected to electrosurgical units, make sure the transducers and cables do not make contact with the electrosurgical unit. The patient lead and conducting wire must be far away from the operating table and other devices. The electrosurgical unit should be properly grounded.
- When a defibrillator is used, make sure the patient cable is not in contact with metal or other conductors or device grounding part. During defibrillation, do not touch the patient, table or device.
- When using an accessory, make sure that the selected accessory meets medical instrument safety requirements.
- When connecting or using an accessory, avoid touching any metal part connected to an electric appliance.
- When the monitor is connected to high frequency electrosurgical equipment, do not allow the sensor from the monitor to come into contact with the high frequency electrosurgical equipment or its cables. Otherwise, electric leakage may occur and may cause burns to the patient.
- Do not repeatedly use a disposable pressure sensor.
- Before starting monitoring, check to make sure the sensor cable is working and undamaged.

CAUTION

- Before starting IBP monitoring, the user should carry out zeroing on the transducer.
- During monitoring, the user should make certain the pressure sensor is at the heart level at all times to prevent the tube from clogging. Heparin saline should be continuously injected to wash the tube and maintain the unobstructed condition of the pressure measurement path. The tube must be securely fixed to prevent it from moving or coming off, which will affect invasive blood pressure measurement.

SECTION 13 - MULTIGAS MONITORING (Optional - 8019)

13.1 General Information

The Midmark Multiparameter Monitor multigas analyzer (AA) measures CO2, N2O, and one of the five anesthesia gases (Halothane, Isoflurane, Enflurane, Sevoflurane, Desflurane) The Multigas sensor will detect Anesthetic agent and adjust alarm defaults accordingly. Each gas is displayed in a monitoring channel, with waveforms showing minimum inhalation volume and maximum exhalation volume. Multigas monitoring is available by using the optional Masimo IRMA™ AX+ and ISA™ AX+ analyzers.

Please refer to this chapter as well as the Masimo User Guide provided with your IRMA™ AX+ and ISA™ AX+ analyzers.

WARNING
There is a label [⏚] below the AA socket, indicating that the signal input is insulated and defibrillation proof with a type BF applied part. Following exposure to a defibrillation event, AA will resume normal operations after 10 seconds.

NOTE
Each channel displays only one gas at a time.

Gas Measurement: Non-dispersive infrared technology is used in the multigas measurement.

13.2 Installation and Connection

13.2.1 Parts

The following parts are included with your Multigas kit:

- Multigas ISA™ AX+ (Sidestream) analyzer or IRMA™ AX+ (Mainstream) analyzer.
- IRMA™ airway adapters (with Mainstream kit).
- NomoLine® sampling lines (with Sidestream kit).

NOTE
Please refer to the IRMA™ CO2 and AA analyzer Appendix 7 for all Warnings, Cautions, and Notes associated with this product.

NOTE
Please refer to the Nomoline ISA™ CO2 and AA analyzer Appendix 8 for all Warnings, Cautions, and Notes associated with this product.

13.2.2 IRMA™ AX+ Connection Procedures

Follow the steps below to connect the IRMA™ AX+ analyzer to the monitor:

Step 1: With the monitor off, plug the IRMA™ AX+ analyzer into the monitor side panel by lining up the two keys of the connector with the receptacle and insert.

Step 2: Select the correct airway adapter to minimize dead space. Large airway adapter for ET tubes > 4.0 mm (≈ 6 ml dead space). Small airway adapter for ET tubes ≤ 4.0 mm (≤ 1 ml dead space).

Step 3: Snap the IRMA™ AX+ analyzer on top of the IRMA™ airway adapter. It will click into place when properly seated.

Step 4: Turn ON the monitor.

NOTE
The end user must plug in the Multigas IRMA™ AX+ analyzer prior to turning on the monitor for proper functioning of the device.

NOTE
The end user must turn on the Multigas module function within the monitor the first time the Multigas device is plugged in for use. Refer to Section 13.2.4 Turn on the Multigas module. Keep the Multigas analyzer plugged in during all restarts of the monitor. Otherwise, the monitor will alarm as it will no longer be able to detect the analyzer. To use the monitor without Multigas, the end user must turn the module off again.

NOTE
The end user must turn on the Multigas display (AG Screen) once the Multigas module is turned on. Refer to Section 13.2.5 Turn on the Multigas Screen Display.

Step 5: A green LED indicates that the IRMA™ AX+ analyzer is ready for use.

Step 6: Connect IRMA™ airway adapter male connector to the breathing circuit Y-piece. Connect the IRMA™ airway adapter female connector to the patient's endotracheal tube. Position the IRMA™ AX+ analyzer with the LED pointing upwards.

A HME (Heat Moisture Exchanger) may be connected between the patient's endotracheal tube and the IRMA™ AX+ analyzer to protect the airway adapter from secretions and effects of water vapor and eliminate the need of changing the adapter. It allows free positioning of the IRMA™ AX+ analyzer as well.

NOTE
A HME will add Dead Space and Resistance to the breathing circuit. Refer to manufacturer's information for amounts and recommendations for replacement.

NOTE
Unless the IRMA™ AX+ analyzer is protected with a HME, always position the IRMA™ AX+ analyzer with the LED pointing upwards.

The IRMA™ disposable airway adapter is inserted between the endotracheal tube and the Y-piece of the breathing circuit. The respiratory gas measurements are obtained through the XTP windows in the sides of the adapter. As the airway adapter is positioned directly in the airway, its performance can be affected by water vapor, patient secretions or nebulized medications that can accumulate on the adapter's windows. For optimal results, the airway adapter shall not be placed between an endotracheal tube and an elbow, as this may allow patient secretions to block the adapter windows. The IRMA™ airway adapter shall be positioned with its windows in a vertical position to help keep patient secretions from pooling on the windows. The disposable IRMA™ airway adapter is treated to prevent moisture buildup and drift, so please do not clean the interior of the airway adapters.

When connecting the IRMA™ AX+ analyzer to a patient circuit it is important to avoid a direct contact between the IRMA™ AX+ analyzer and the patient's body. If, for whatever the reason, the IRMA™ AX+ analyzer is in direct contact with any parts of the patient's body an insulation material shall be placed between the IRMA™ AX+ analyzer and the body.

WARNING
The IRMA™ analyzer is not intended to be in patient contact.

WARNING
If, for whatever the reason, the IRMA™ analyzer is in direct contact with any parts of the patient's body, an insulation material shall be placed between the IRMA™ analyzer and the body.

Step 7: To remove the IRMA™ AX+ analyzer, grasp the body portion of the connector and pull to remove.

NOTE
Do not remove by pulling cable.

CAUTION
The IRMA™ airway adapters are intended for single patient use.

13.2.3 ISA™ AX+ Analyzer Connection Procedures

Follow the steps below to connect the ISA™ AX+ analyzer to the monitor:

The ISA™ AX+ multigas analyzer is an external and independent part of the Midmark Multiparameter Monitor.

Step 1: Securely mount or place the ISA™ AX+ analyzer in a safe location.

Step 2: With the monitor off, plug the ISA™ AX+ analyzer into the monitor side panel by lining up the two keys of the connector with the receptacle and insert.

Step 3: Select the correct sampling line to minimize dead space and connect sampling line to the ISA™ AX+ analyzer input connector. Sampling line with large airway adapter for ET tubes > 4.0 mm (≤6 ml dead space). Sampling line with small airway adapter for ET tubes ≤ 4mm (≤0.7 ml dead space).

Step 4: Connect the gas sample exhaust port to a scavenging system or return the gas to the patient circuit to prevent pollution of the operation room when N2O and/or anesthetic agents are being used. See Section 13.2.7 Multigas Exhaust.

Step 5: Turn ON the monitor.

Step 6: A green LED indicates that the ISA™ AX+ analyzer is ready for use. Perform a pre-use check as described in the Section 13.4.1 Pre-Use Checks.

Step 7: Please refer to the instructions included in the Multigas kit.

- Enter Module Setup and press AG drop down. Select “Masimo” and restart monitor.
- Turn on the Multigas Module within the Settings/Module Setup menu. Refer to Section 13.2.4 Turn on the Multigas Module.
- Turn on the Multigas Screen Display. Refer to Section 13.2.5 Turn on the Multigas Screen Display.

NOTE
The end user must turn on the Multigas module function within the monitor the first time the Multigas device is plugged in for use. Refer to Section 13.2.4 Turn on the Multigas Module. Keep the Multigas device plugged in during all restarts of the monitor.

NOTE
The end user must turn on the Multigas display (AA Screen) once the Multigas module is turned on. Refer to Section 13.2.5 Turn on the Multigas Screen Display.

CAUTION
To ensure good ventilation of the module, keep a minimum of 5cm from each side of the analyzer to the wall or cabinet.

It is recommended to place the Multigas ISA™ AX+ analyzer at a place higher or at the same level of patient position.

Step 8: To remove the NomoLine® sampling line, grasp the body portion of the connector and pull to remove.

NOTE
Do not remove by pulling cable.

CAUTION
The NomoLine® sampling lines are intended for single patient use.

13.2.4 Turn on the Multigas Module

Follow the steps below to turn on the Multigas Module:

Step 1: Press the “Settings” Touch Screen Quick Access Icon.

Step 2: Press the “Modules” to open the Module Setup Menu.

Step 3: Press the drop down option next to AA. Select Masimo to turn the Masimo AA module on.

Step 4: Press the “X” on the upper right corner to exit the screen. A warning will pop up to let you know that a restart would be required and that all current patient alarm data will be purged. Press “Yes” to continue.

Step 5: The monitor will automatically shut down. After it shuts down, press the power button to turn it back on. The AA module should now be on.

13.2.5 Turn on the Multigas Screen Display

The user must turn on the Multigas Screen Display in order to see the Multigas data.

Follow the steps below to turn on the Multigas Screen Display:

Step 1: Turn on the monitor.

Step 2: Press the “Displays” Touch Screen Quick Access Icon to select one of the 5-8 Channel Display options.

13.2.6 Turn On or Off the Multigas Work Mode

When IRMA™ AX+ analyzer is connected to the monitor, the monitor will automatically detect the sensor and change to Measure mode. To use multigas, the user will need to turn this feature on manually.

Following the steps below to turn on Measure Mode:

Step 1: Press the CO2 or AA data in the parameter box to enter the CO2 or AA Setup Settings Menu.

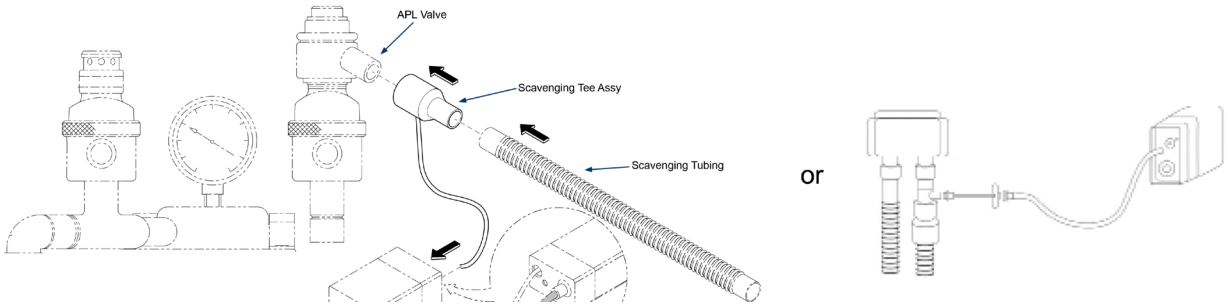
Step 2: Press the drop down option next to Operating Mode. Select Measure to turn the Masimo AA module on.

Step 3: Press the “Measure” button.

For the ISA™ AX+ analyzer, no matter if it was plugged in before or after the monitor is turned on, it will always switch automatically to Measurement mode in order to Zero itself. To save operational time, the user may elect to turn on Standby mode for the AA option. However, the ISA™ AX+ analyzer will always go into measurement mode upon restart of the monitor.

13.2.7 Multigas Exhaust

Connect the gas sample exhaust port to a scavenging system or return the gas to the patient circuit to prevent pollution of the operation room when N2O and/or anesthetic agents are being used. Due to the risk of patient cross-infection, always use a bacteria filter on the exhaust port side if sampled gas is intended to be re-breathed.



NOTE
The exhaust line is not supplied with the NomoLine® ISA™ CO2 analyzer but a scavenging kit solution is available as an optional accessory (See Appendix 6).

13.3 Multigas Setup Menu

13.3.1 Multigas Measurement Menu

The AA Menu will only be available if the AA module is turned on. Follow the steps in Section 13.2.4 to turn on the AA Module.

Follow the steps below to enter the AA Setup Menu:

Step 1: Press the CO2, N2O, or AA waveform to enter the desired setup menu below.

13.3.2 CO2 Setup Settings Menu Options

APNEA TIME	The IRMA™ AX+ analyzer or ISA™ AX+ analyzer are programmed to display “0” values after 20 seconds without a detected breath. Choose from 20s, 25s, 30s, 35s, 40s, 45s, 50s, 55s and 60s. The Apnea Alarm is not affected by the Alarm Silence feature.
OPERATING MODE	Choose from Standby or Measure.
O2 COMPEN	This is for the Oxygen Compensation. Choose from Low, Mid and High. Refer to Appendix 5 for more details.
UNIT	Choose from mmHg or kPa.
WAVE SPEED	Choose from 6.25, 12.5 or 25.0 mm/s.
WAVE MODE	Choose from Line or Fill.
WAVE GRID	Choose from On or Off
CO2 SODA LIME	This is a reminder to change the CO2 soda lime absorbent. Choose from On or Off
CO2 CATALOG	This will display a collection of reference CO2 waveforms under the patient’s actual waveform to assist with waveform recognition. Choose from On or Off
START ZERO CALIBRATION	For use when manually zeroing the IRMA™ AX+ analyzer or ISA™ AX+ analyzer.
CO2 SETUP ALARMS TAB	This will take you to the CO2 Setup Alarm Menu. There, you can set the Alarm Priority, EtCO2 Low Limit, EtCO2 High Limit, InCO2 High Limit, RR Low Limit, RR High Limit and revert to Default factory settings for the CO2 parameter. Please see 4.3.2 Alarm Setup Menu for more details.
CO2 SETUP TREND TAB	Use the left and right arrows to scroll through the timeline and view the last 30 seconds of CO2 waveform. The EtCO2 for the last 7 minutes is also displayed at the top at a 1-minute interval. The wave recall, EtCO2 value, and 7 minute trend values do not update with time when user is inside the Trend tab. To update this area with the latest 30 seconds of waveform and 7 minutes of data, select the X to close window and reenter the Trend tab.

13.3.3 N2O Setup Settings Menu Options

N2O Display must be turned “On” in the AA Setup menu.

APNEA TIME	The IRMA™ AX+ analyzer or ISA™ AX+ analyzer is programmed to display “0” values after 20 seconds without a detected breath. Choose from 20s, 25s, 30s, 35s, 40s, 45s, 50s, 55s and 60s. The Apnea Alarm is not affected by the Alarm Silence feature.
OPERATING MODE	Choose from Standby or Measure.
O2 COMPEN	This is for the Oxygen Compensation. Choose from Low, Mid and High. Refer to Appendix 5 for more details.
WAVE SPEED	Choose from 6.25 or 12.5 mm/s.
WAVE SCALE	Choose Auto, 20%, 40%, 60%, 80%, 100%.
WAVE MODE	Choose from Line or Fill.
WAVE GRID	Choose from On or Off.

AA DISPLAY	Choose from On or Off.
N2O DISPLAY	Choose from On or Off.
START ZERO CALIBRATION	For use when manually zeroing the IRMA™ AX+ analyzer or ISA™ AX+ analyzer.
N2O SETUP ALARMS TAB	This will take you to the N2O Alarm Setup Menu. There, you can set the Alarm Priority, EtN2O High Limit, EtN2O Low Limit, InN2O High Limit, InN2O Low Limit and revert to Default factory settings for the N2O parameter. Please see 4.3.2 Alarm Setup Menu for more details.
N2O SETUP TREND TAB	View the last 7 minutes of N2O measurements at a 1-minute interval.

13.3.4 AA Setup Settings Menu Options

APNEA TIME	The IRMA™ AX+ analyzer or ISA™ AX+ analyzer are programmed to display “0” values after 20 seconds without a detected breath. Choose from 20s, 25s, 30s, 35s, 40s, 45s, 50s, 55s and 60s. The Apnea Alarm is not affected by the Alarm Silence feature.
OPERATING MODE	Choose from Standby or Measure. Please reference Section 13.2.6 Turn On or Off the Multigas Work Mode.
O2 COMPENSATE	This is for the Oxygen Compensation. Choose from Low, Mid and High. Refer to Appendix 5 for more details.
WAVE SPEED	Choose from 6.25 or 12.5 mm/s.
WAVE SCALE	Choose Auto, 20%, 40%, 60%, 80%, 100%.
WAVE MODE	Choose from Line or Fill.
WAVE GRID	Choose from On or Off.
AA DISPLAY	Choose from On or Off.
N2O DISPLAY	Choose from On or Off.
START ZERO CALIBRATION	For use when manually adjusting the IRMA™ AX+ analyzer. Please reference Section 13.4.3 Zeroing IRMA™ AX+ analyzer.
AA SETUP ALARMS TAB	This will take you to the CO2 Alarm Setup Menu. There, you can set the Alarm Priority, EtAA Low Limit, EtAA High Limit, InAA Low Limit, InAA High Limit and revert to Default factory settings for the AA parameter. Please see 4.3.2 Alarm Setup Menu for more details.
AA SETUP TREND TAB	View the last 7 minutes of EtAA at a 1-minute interval.

13.4 Monitoring

13.4.1 Pre-Use Checks

IRMA™ AX+ Analyzer

> ***NOTE***
> *Please refer to the IRMA™ CO2 and AA analyzer Appendix 7 for all Warnings, Cautions, and Notes associated with this product.*

- Always verify gas readings and waveforms on the monitor before connecting the airway adapter to the patient circuit. To do this, breathe into the airway adapter with the IRMA™ AX+ analyzer attached.
- Perform a tightness check of the patient circuit with the IRMA™ AX+ analyzer snapped on the IRMA™ airway adapter.

ISA™ AX+ Analyzer

> ***NOTE***
> *Please refer to the Nomoline ISA™ CO2 and AA analyzer Appendix 8 for all Warnings, Cautions, and Notes associated with this product.*

Before connecting the sampling line to the breathing circuit, do the following:

1. Connect the sampling line to the ISA™ AX+ analyzer light emitting gas inlet connector (LEGI).

2. Check that the LEGI shows a steady green light (indicating that the system is OK).
3. Breathe into the sampling line and check that valid CO2 waveforms and values are displayed.
4. Occlude the sampling line with a fingertip and wait for 10 seconds.
5. Check that an occlusion alarm, “check sampling line”, is displayed and that the LEGI shows a flashing red light.
6. If applicable: Perform a tightness check of the patient circuit with the sampling line attached.

13.4.2 Using Multigas

Follow the steps below to use the Multigas:

Step 1: Connect the analyzer to the Midmark Multiparameter Monitor and turn the monitor on.

Step 2: Turn on the multigas module. Refer to Section 13.2.4.

Step 3: Turn on the multigas display screen. Refer to Section 13.2.5.

Step 4: The ISA™ AX+ analyzer will perform a zeroing procedure automatically. For the IRMA™ AX+ analyzer, please refer to Section 13.4.3 to manually zero the analyzer.

Step 5: Connect the analyzer to the patient circuit. Once the analyzer detects breathing, the related values will automatically be displayed.

NOTE
The infrared gas analyzer needs to establish a zero reference level for the CO2, N2O and anesthetic agent gas measurement. This zero calibration is referred to as “zeroing”.

WARNING
Incorrect analyzer zeroing will result in false gas readings.

13.4.3 Zeroing IRMA™ AX+ Analyzer

In order to secure high precision of the IRMA™ AX+ analyzer measurements the following zeroing recommendations should be followed:

- Special care should be taken to avoid breathing near the airway adapter before or during the Zeroing procedure. The presence of ambient air (21% O2 and 0% CO2) in the IRMA™ airway adapter is of crucial importance for a successful Zeroing. If a “Zero required” alarm should appear directly after a Zeroing procedure, the procedure must be repeated.
- Always perform a pre-use check after zeroing the analyzer. Refer to Section 13.4.1.
- Zeroing should be performed every time the IRMA™ airway adapter is replaced, or whenever an offset in gas values or an unspecified gas accuracy message is displayed.
- Allow 30 seconds for warm up of the IRMA™ AX+ analyzer after power on and after changing the IRMA™ airway adapter before proceeding with the Zeroing Procedure. The option to Zero will be unavailable during warm up and zeroing. The green LED on the analyzer will be blinking for approximately 5 seconds while zeroing is in progress.

Step 1: Snap a new IRMA™ airway adapter onto the IRMA™ AX+ analyzer, without connecting the airway adapter to the patient circuit.

Step 2: Select the AA waveform area to enter the AA Setup Menu.

Step 3: Press the “Start Zero Calibration” button. The visual technical alarm “AA is Zeroing” will appear in the technical alarm status bar as well as within the AA Setup Menu. An audible alarm will also be present. When completed, “AA Zero Successful” will display within the AA Setup Menu only. If Zeroing failed, the reason for failure will be displayed within the technical alarm status bar.

13.4.4 Zeroing ISA™ AX+ Analyzer

ISA™ AX+ analyzer performs zeroing by switching the gas sampling from the respiratory circuit to ambient air. The automatic zeroing is performed 1 to 3 times per day, and takes less than 3 seconds for NomoLine® ISA™ CO2 gas analyzers and less than 10 seconds for ISA™ AX+ multigas analyzers.

During zeroing, if ISA™ exhaust gas is returned to the patient circuit, the returned gas level will be different from the gas level at the sampling site.

13.5 Alarm Setup

The Masimo analyzers come with a LED status indicator on the analyzer themselves, shown in the below table.

Indication	Status
Steady Green Light	System OK
Blinking Green Light	Zeroing In Progress
Steady Blue Light	Anesthetic Agent Present
Steady Red Light	Sensor Error
Blinking Red Light	Check Sampling Line or Adapter

The multigas module has alarms for values exceeding the preset limits, apnea, and for abnormal status.

Alarm for Parameters Exceeding Preset Limits

Alarm will be activated when the measured parameter exceeds the preset parameter alarm limits.

	Cat		Dog		Horse		Other	
AA: Et CO2 (mmHg)	20	60	20	60	20	60	20	60
AA: Fi CO2 (mmHg)	0	10	0	10	0	10	0	10
AA: AwRR (rpm)	5	55	5	55	5	55	5	55
AA: Et N2O (%)	40	70	40	70	40	70	40	70
AA: Fi N2O (%)	40	70	40	70	40	70	40	70
AA: Et HAL (%)	1.0	3.0	1.0	3.0	2.0	4.0	1.0	3.0
AA: Fi HAL (%)	1.0	3.0	1.0	3.0	2.0	4.0	1.0	3.0
AA: Et ENF (%)	2.0	5.0	2.0	5.0	2.0	5.0	2.0	5.0
AA: Fi ENF (%)	2.0	5.0	2.0	5.0	2.0	5.0	2.0	5.0
AA: Et ISO (%)	1.5	3.0	1.0	3.0	1.5	3.5	1.0	3.0
AA: Fi ISO (%)	1.5	3.0	1.0	3.0	1.5	3.5	1.0	3.0
AA: Et DES (%)	9.0	14	7.0	14	7.0	15	7.0	14
AA: Fi DES (%)	9.0	14	7.0	14	7.0	15	7.0	14
AA: Et SEV (%)	2.5	5.0	2.0	5.0	2.5	6.0	2.0	5.0
AA: Fi SEV (%)	2.5	5.0	2.0	5.0	2.5	6.0	2.0	5.0

Apnea Alarm

If no breath is detected for the selected apnea time, the apnea alarm will be activated.

NOTE
The Multigas module and the patient monitor system have a smart apnea alarm function. That is, there will be no alarm during the period when the monitor is just powered on. It will only activate the apnea alarm after it has detected respiration and later it identifies there is an apnea.

NOTE
The apnea alarm is a high priority alarm. So when the apnea alarm occurs, the red light flashes on the monitor display. The Alarm Silence feature will only silence the audible portion of the Apnea Alarm.

Abnormal Status

Abnormal status refers to technical alarms such as “Sampling Line Clogged” and “Check Adapter (AA)”. For a complete list of abnormal status alarms, please see the Troubleshooting section 14.2.

13.6 Cleaning and Maintenance

CAUTION
Anyone not properly trained and certified must not attempt to perform any service or maintenance on the Masimo product.

Multigas Analyzer Cleaning

The IRMA™ AX+ analyzer can be cleaned using a cloth moistened with ethanol or isopropyl alcohol (< 70 %).

CAUTION
The IRMA™ analyzer and airway adapters are non-sterile devices. Do not autoclave the devices as this will damage them.

CAUTION
Never sterilize or immerse the IRMA™ analyzer in liquid.

The ISA™ AX+ sidestream gas analyzers and sampling line adapter can be cleaned using a cloth moistened with ethanol or isopropyl alcohol (< 70 %).

To prevent cleaning liquids and dust from entering the ISA™ AX+ Multigas analyzer through its LEGI connector, keep the sampling line connected while cleaning the analyzer.

WARNING
Never sterilize or immerse the ISA™ AX+ sidestream gas analyzer in liquid.

ISA™ AX+ Multigas Analyzer Maintenance

Annual maintenance with use of kit, 002-10849-00, is recommended for the ISA™ AX+ Multigas analyzer.

SECTION 14 - CLEANING, TROUBLESHOOTING, WARRANTY

14.1 Cleaning

> ***CAUTION***
> *DO NOT open the monitor to clean or repair it. Contact Midmark for service needs.*

> ***WARNING***
> ***DO NOT, under any circumstances, perform any testing or maintenance on the monitor while the monitor is being used to monitor a patient. The monitor must be turned "OFF". Unplug the monitor from AC power source and remove the internal battery.***

> ***CAUTION***
> *Disconnect all accessories from the monitor before cleaning. DO NOT immerse any part of the electrical connectors of cables or accessories in the cleaning or disinfection solution at any time. DO NOT use an abrasive cloth or cleaner on the accessories. Immersing the cables or lead wires in any liquid may result in moisture entering. This may cause internal damage and reduce the product life. Alcohol and organic solvents may cause stiffness and brittleness.*

14.1.1 The Monitor

Examine the monitor's case daily for damage and check the AC power cord for bent or broken prongs, cracks or fraying. Neither the monitor nor the power cord should be used if damaged. If any damage is noted, contact Midmark.

> ***CAUTION***
> *Do not spray or pour any water or cleaning solution directly onto the monitor.*

As needed, clean the monitor using a soft cloth dampened with a mild dishwashing detergent solution. Gently rub the soiled area until clean. Use a clean, soft cloth to dry the monitor. Do not use abrasive cleaners on the monitor. Do not use either isopropyl alcohol or solvent to clean the monitor. Use of these cleaners can cause damage to the monitor's surface. Do not immerse the monitor or power cord in the cleaning solution.

When necessary, the monitor surfaces may be disinfected using a soft cloth saturated with a 10% (1:10) solution of chlorine bleach in tap water. When all of the surfaces have been disinfected, wipe the entire surface of the monitor using a soft cloth dampened with fresh water to remove any trace amounts of residue and/or fumes.

> ***NOTE***
> *Thoroughly wipe off any excess cleaning solutions. Care should be taken to prevent water or cleaning solution to run into connector openings or crevices.*

14.1.2 The Display

> ***CAUTION***
> *Use care when cleaning the display. Do not use a paper towel to clean the display as this may cause scratches.*

Occasionally, as needed, clean the display window using a soft, lint-free cloth sprayed with an alcohol-free glass cleaner. When necessary, the monitor display may be disinfected using a .5% Hydrogen Peroxide or a Potassium peroxymonosulfate/sodium chloride oxidizing agent according to manufacturer's directions. When display has been disinfected, wipe the entire surface using a soft cloth dampened with fresh water to remove any residual film. The use of paper towels is not recommended as it may scratch the surface.

NOTE
Smudges and fingerprints on the surface of the touch screen can cause it to malfunction. Care should be taken to clean the screen when such errors occur.

14.1.3 Patient Accessories

Refer to individual parameter sections 7 thru 13 of this user guide for cleaning recommendations related to parameter specific components.

14.2 Troubleshooting

The Midmark Multiparameter Monitor displays a variety of messages to aid the user in monitor operation. If a technical message is displayed during a measurement, follow the actions listed to correct the situation.

If the monitor needs servicing, it must be referred to the appropriate service personnel. Service performed by unauthorized personnel could be detrimental to the monitor and may void the warranty. For service, contact Midmark.

Technical Alarm/Parameter Message	Possible Cause	Possible Solution
ECG		
Asystole	ECG amplitude is too low.	Increase the gain and use electrode gel, or change the ECG lead to a larger amplitude.
ECG Communication Stop	ECG module can't communicate with the main system.	Restart the monitor. If error persists, contact Midmark.
ECG Lead Off	ECG lead cable connection may be loose.	Check the connection of all ECG lead cables.
ECG V Lead Off	ECG V-lead cable connection may be loose.	Check the connection of the ECG V-lead cable.
ECG LL Lead Off	ECG LL-lead cable connection may be loose.	Check the connection of the ECG LL-lead cable.
ECG LA Lead Off	ECG LA-lead cable connection may be loose.	Check the connection of the ECG LA-lead cable.
ECG RA Lead Off	ECG RA-lead cable connection may be loose.	Check the connection of the ECG RA-lead cable.
ECG Overload	One of the leads may have overloaded.	Check the connections of the leads to the patient.
RESP		
RESP Interference	This error will occur when HR and RESP rate are nearly the same.	This physiological reaction from the animal creates the interference to the monitor. Therefore, RESP Interference will continue until HR and RESP are no longer similar.
SPO2		
SpO2 Communication Stop	SpO2 module can't communicate with the main system.	Restart the monitor. If error persists, contact Midmark.
SpO2 No Sensor Connected	SpO2 cable has disconnected from the sensor or monitor.	Check the connection of the SpO2 sensor and cable.
SpO2 Sensor Off	SpO2 sensor has disconnected from the patient.	Check the connection of the SpO2 sensor and cable.
SpO2 Search Timeout	The SpO2 sensor may have fallen off or may have disconnected from the monitor. The SpO2 sensor may have malfunctioned or a sensor that is not specifically recommended by the manufacturer is being used.	Check the SpO2 sensor's connection to the monitor and the patient. Check to see if the SpO2 sensor has any damage. Reconnect the sensor properly an dmake sure only recommended sensors are used.

SpO2 Pulse Search	The SpO2 sensor is trying to find the pulse of the patient.	Allow time for the pulse and SpO2 to be detected.
SpO2 Defective Sensor	The SpO2 sensor may have malfunctioned or there is fault with the connection.	Check the SpO2 sensor's connection to the extension cable. Check to see if the SpO2 sensor has any damage. Reconnect the sensor properly and make sure only recommended sensors are used. If error persists, contact Midmark.
TEMP		
TEMP1 Sensor Off	TEMP sensor 1 has disconnected from the monitor.	Check the connection of the TEMP sensor.
TEMP2 Sensor Off	TEMP sensor 2 has disconnected from the monitor.	Check the connection of the TEMP sensor.
NIBP		
NIBP Signal Weak	Patient's pulse may be weak or cuff is too loose.	Check the condition of the patient and place the cuff in a suitable position. If the error persists, replace the cuff.
NIBP Communication Stop	NIBP module can't communicate with the main system.	Restart the monitor.
NIBP Selfcheck Error	NIBP module may have failed.	Restart the monitor.
NIBP System Error	If failure occurs during measurement, the system may not be able to analyze and calculate the data.	Check the patient's condition and the position and connection of the cuffs.
Measurement Timeout	NIBP measurement process has gone beyond the allotted time for detection.	Verify that connections are sound and patient is still. Change setting to Manual, and then back to Interval or Continuous Measurement. If error persists, contact Midmark.
Cuff Type Error	The cuff being used does not match the set patient category.	Verify the patient category and replace the cuff.
Cuff Loose or No Cuff	NIBP cuff isn't placed or connected properly or there is an air leak.	Check that the cuff is connected properly and there are no leaks in the cuff or tubing.
Cuff Leak	There may be an air leak in the cuff or tubing.	Check the cuff and tubing for air leaks.
Air Pressure Error	NIBP was not able to stabilize the pressure value. The tubing may have kinks.	Confirm that the environment complies with the monitor's specifications, and check the tubing for kinks.
NIBP Over Range	NIBP values are beyond the measurement range.	Reset the NIBP measurement module or restart the monitor. If error persists, contact Midmark.
NIBP Signal Unstable	Excessive patient movement may result in too much motion artifact or interference in the signal during measurement.	Calm the patient and prevent movement during measurement.
NIBP Signal Saturated	Excessive patient movement detected.	Calm the patient and prevent movement during measurement.
NIBP Over Pressure	Cuff and tubing may be blocked or constricted.	Check the path of the air and make sure the tubing is not tangled, blocked or constricted.
CO2		
CO2 Communication Stop	CO2 module or sensor can't communicate with the main system.	Reconnect the CO2 sensor with the monitor and restart the monitor. If errors persist, contact Midmark.
Check Adapter (CO2)	CO2 sensor cannot detect the airway adapter.	Insert the Airway Adapter or Zero the CO2 sensor.
Check Sampling Line	The sampling line is clogged.	Replace the sampling line.
Software Error (CO2)	There's an error with the sensor software.	Restart CO2 sensor. If error persists, contact Midmark.

Hardware Error (CO2)	There's an error with the sensor hardware.	CO2 sensor should be serviced.
Sampling Line Clogged	The sampling line is clogged.	Replace the sampling line.
No Sampling line	There's no sampling line detected.	Insert the sampling line.
No Adapter (CO2)	No adapter detected	Install new adapter.
CO2 Out of Accuracy	CO2 is outside of the specified accuracy range.	Restart the CO2 sensor. If error persists, contact Midmark.
Temp Out of Accuracy (CO2)	The internal temperature of the probe is outside of the operating range for Masimo CO2.	Allow CO2 sensor to cool down. If error persists, contact Midmark.
Pressure Out of Accuracy (CO2)	The ambient pressure is outside of the operating range.	CO2 sensor should be serviced.
Zero Required (CO2)	Zero reference calibration (Zeroing) of IR level is required for accurate measurements.	Zero the CO2 sensor.
CO2 is Zeroing	The CO2 sensor is performing zeroing calibration.	Wait for the zeroing process to be completed.
CO2 is Sleeping	Changing the Operating Mode is required to operate the sensor.	See Section 11 for details.
Span Calibrating (CO2)	The CO2 module is calibrating.	Wait for the calibration process to be completed.
Span Cal Error (CO2)	A CO2 module calibration error occurred.	Restart CO2 sensor. If error persists, contact Midmark.
CO2 Out of Range	CO2 value is outside of the specified accuracy range.	CO2 sensor may require a zero or servicing.
TEMP Out of Range (CO2)	The internal temperature of the probe is outside of the operating range for Respironics CO2.	CO2 sensor should be allowed to cool down or serviced.
CO2 is Warming Up	The CO2 sensor is activating and warming to operational temperatures.	Allow sensor to warm to operational temperatures.
Sensor Faulty (CO2)	CO2 sensor is faulty.	CO2 sensor should be serviced.
CO2 Zero Successful	CO2 sensor zero calibration is successful.	
IBP		
IBP Communication Stop	IBP module can't communicate with the main system.	Restart the monitor. If error persists, contact Midmark.
IBP CH1 Sensor Off	IBP1 cable has disconnected from the sensor or monitor.	Check the connection of the IBP1 sensor and cable.
IBP CH2 Sensor Off	IBP2 cable has disconnected from the sensor or monitor.	Check the connection of the IBP2 sensor and cable.
Zero Required (IBP1)	IBP1 Zero calibration needed.	Zero IBP1. Disconnect and reconnect IBP1 cable if unable to zero. If error persists, contact Midmark.
Zero Required (IBP2)	IBP2 Zero calibration needed.	Zero IBP2. Disconnect and reconnect IBP2 cable if unable to zero. If error persists, contact Midmark.
IBP1 Zero Success	IBP1 Zero calibration has been successfully performed.	
IBP2 Zero Success	IBP2 Zero calibration has been successfully performed.	
AA		
AA Communication Stop	AA analyzer can't communicate with the main system.	Reconnect the multigas sensor with the monitor and restart the monitor if needed. If error persists, contact Midmark.
Software Error (AA)	There's an error with the sensor software.	Multigas sensor should be serviced.
Hardware Error (AA)	There's an error with the sensor hardware	Multigas sensor should be serviced.
Motor Out of Accuracy (AA)	The analyzer's motor speed is out of bounds.	Multigas sensor should be serviced.

Factory Calibration Lost (AA)	The factory calibration is lost or missing.	Multigas sensor should be serviced.
Replace Adapter (AA)	The AA adapter is dirty or damaged.	Replace the AA adapter.
No Adapter (AA)	No adapter detected.	Install new adapter.
N2O Out of Accuracy (AA)	N2O is outside of the specified accuracy range.	Multigas sensor may require a zero or servicing. Restart your AA sensor. If error persists, contact Midmark.
AA Out of Accuracy (AA)	At least one anesthetic agent is outside of the specified accuracy range.	Multigas sensor may require a zero or servicing.
Temp Out of Accuracy (AA)	The internal temperature of the probe is outside of the operating range.	Multigas sensor should be allowed to cool down or should be serviced.
Pressure Out of Accuracy (AA)	The ambient pressure is outside of the operating range.	Multigas sensor should be serviced.
Mixed Agents	Multigas module detected more than two agents.	
Zero Required (AA)	Zero reference calibration (Zeroing) of IR level is required for accurate measurements.	Zero multigas sensor.
AA ID&Conc Unreliable	Agent identification and concentrations are unreliable.	Switch AA sensor to Measure mode.
AA is Zeroing	Zeroing in progress.	Allow sensor to complete the zeroing process.
AA is Sleeping	AA sensor has been put on Standby.	Switch multigas sensor to Measure mode.
Span Calibrating (AA)	Span calibration and validation in progress.	Wait for calibration to be completed.
Span Cal Error (AA)	Latest span calibration command failed.	Multigas sensor should be serviced.
AA Zero Successful	AA Zero calibration successfully performed.	
Printer		
No Printer	No printer installed.	Restart monitor. If error persists, contact Midmark.
No Paper	No printer paper installed.	Install printer paper.
Printer Error	Printer paper jammed.	Ensure paper is fed through opening of printer door.
System		
System will shutdown	Battery level is low. Monitor will turn off.	Charge the battery.
Battery		
Battery Low	Rechargeable battery is depleted.	Plug monitor in. Contact Midmark for service if error does not resolve.

14.3 System Calibration and Maintenance

Besides the routine cleaning of the monitor and accessories outlined in this user guide, and replacement of accessories due to normal wear and tear, calibration of the monitor should not be necessary during the warranty period.

If the monitor needs repair, it must be referred to the appropriate service personnel. Service performed by unauthorized personnel could be detrimental to the monitor and may void the warranty. For service, contact Midmark.

Following the warranty period, preventative maintenance can be an important factor in ensuring the monitor's continuing accurate and reliable performance. It is recommended that preventative maintenance be performed every two (2) years following the warranty period.

14.4 Limited Warranty

14.4.1 Registration

Register your monitor at midmark.com/vet-register to:

- Log your product warranty with Midmark
- Keep you informed on important warranty information and product updates
- Provide you with faster, more convenient service in the event you experience a problem
- Enhance customer service benefits tailored to your product and account

14.4.2 Scope of Warranty

Midmark Corporation (“Midmark”) warrants to the original retail purchaser that it will repair or replace components of the animal health products manufactured by Midmark (except for products and components not warranted under “Exclusions”) that are defective in material or workmanship under normal use and service. The sole remedy under this limited warranty is the repair or replacement, at Midmark’s option, of the applicable products or components. This limited warranty shall only apply to defects that: (i) are reported to Midmark within the applicable warranty period; and (ii) are determined to exist upon examination by Midmark. This limited warranty extends only to the original retail purchaser of a product, and is not transferable or assignable.

14.4.3 Applicable Warranty Period

The applicable warranty period for each Midmark product commences on the date of delivery to the original retail purchaser of the product and shall continue for the period specified. The Midmark Multiparameter Monitor is warranted against defect in material and workmanship for a period of two years from the time of delivery.

Monitor acessories are warranted against defect in material and workmanship for a period indicated below from the time of delivery:

Capnostat® 5 Mainstream and LoFlo Sidestream CO2 Sensors	1 year
Masimo Mainstream and Sidestream CO2 and Multigas Analyzers	2 years
Temperature, IBP Cables and battery	1 year
Nellcor V-SAT SpO2 Sensors	9 months
ECG Esophageal Probes, Nellcor DOC-10 SpO2 Cable	6 months
Blood pressure cuffs, CO2 Sidestream sampling lines, CO2 Mainstream adapters, Multigas filterline, Multigas adapters and ECG cable/wire sets	*

*The warranty as to these products or components only applies if such products or components are defective in material or workmanship at the time of delivery to the original retail purchaser and such defects are reported to Midmark within three (3) days from the date of delivery.

14.4.4 Exclusions

This limited warranty does not cover and Midmark shall not be liable for the following:

- Defects, damage, or other conditions caused, in whole or in part, by misuse, abuse, negligence, alteration, accident (including animal acts of any kind), freight damage, tampering, or failure to seek and obtain repair or replacement in a timely manner.
- Matching of color, grain, or texture except to commercially acceptable standards.
- Changes in color caused by natural or artificial light.
- Products which are not installed, used, and properly cleaned and maintained as required in the User Manuals and Quick Reference Guide for the applicable product.
- Products considered to be of a consumable nature.
- Accessories or parts not manufactured by Midmark.
- Specially manufactured products.
- Charges by anyone (including Midmark’s authorized dealers) for adjustments, repairs, replacement parts, installation, or other work performed upon or in connection with such products which are not expressly authorized in writing in advance by Midmark.
- Costs and expenses of routine maintenance and cleaning.
- Representations and warranties made by any person or entity other than Midmark.

14.4.5 Exclusive Remedy; Consequential Damages Disclaimer

Midmark's only obligation under this LIMITED warranty is the repair or replacement of defective parts. Midmark shall not be liable for and hereby disclaims any direct, special, indirect, incidental, exemplary or consequential damages or delays including, but not limited to, damages for loss of profits or income, loss of use, downtime, cover, and employee or independent contractor wages, payments, and benefits. This disclaimer shall survive any failure or asserted failure of the essential purpose of this limited warranty or its remedies specified herein.

14.4.6 No Authorization

No person or firm is authorized to create or approve for Midmark any other obligation or liability in connection with Midmark products.

14.4.7 Warranty Disclaimer

THIS WARRANTY IS MIDMARK'S ONLY WARRANTY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED. MIDMARK MAKES NO IMPLIED WARRANTIES OF ANY KIND INCLUDING ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

14.4.8 Statute of Limitations

No action may be brought against Midmark for breach of this limited warranty, an implied warranty, if any, or for any other claim arising out of or relating to the products, more than ninety (90) days following expiration of the warranty period. In the event multiple warranty periods exist with respect to a product, the ninety (90) day period provided for herein shall begin to run from expiration of the warranty period for the component to which the claim relates.

14.5 After-sale Service and Support

To obtain service or product support, please contact Midmark at 800-643-6275 or visit the website at midmark.com. Have the following information available:

- Model and serial number of the equipment
- Date of purchase and distributor name

It is the retail purchaser's obligation to arrange for delivery of a product to Midmark or one of its authorized dealers for warranty service, which delivery shall be at retail purchaser's expense. It is also the retail purchaser's obligation to comply with the warranty service instructions provided either by Midmark or its authorized dealer. The retail purchaser must provide Midmark with completed warranty registration information within thirty (30) days after purchase in order to obtain the benefits of this limited warranty.

APPENDIX 1 - SPECIFICATIONS

I. Safety

Type	Class I, with internal power supply
Protection	BF, CF
Category	Continuous operation non AP/APG common device

II. Power Supply Requirements

Rated Input Voltage	AC 100V-240V
Rated Frequency	50Hz/60Hz
Rated Input power	160VA
Fuses	T1.6AH, 250V fuse*
Battery	11.1V, 4400 mAh Lithium polymer
	** Note: T1.6AL can also be used*

III. Parameter Specifications

A. ECG

Heart Rate Measurement and Alarm Range	15-350bpm
Accuracy	+/-1bpm or 1% whichever is greater
Connector	AAMI 12-1 pin
Lead Selection	3-lead: I, II, and III 5-lead: I, II, III, aVR, aVL, aVF, and V
Lead Off Alarm	Visual and audible
Input	3-lead ECG cable or 5-lead ECG cable
QRS Indicator	Visual and audio
Sweep Speed	12.5 /25 /50mm/s
Amplitude Selection	Auto, x0.25, x0.5, x1, x2, x4
Trend	7 days of data and 1000 NIBP data points.
Bandwidth	Monitoring Mode: 0.5 to 40Hz
	Diagnostic Mode: 0.05 to 100Hz
	Surgical Mode: 1 to 25 Hz
	High Sensitivity Mode: 1 to 25 Hz
Heart Rate Alarm Response Time	Less than 7 seconds

B. Pulse Oximetry (SpO2) - Nellcor

Measurement and Alarm Range	0-100%
SpO2 Average	8 beat average
Accuracy	±2% (70-100%), ±3% (50-69%)
SpO2 Pulse Rate Range	20-300bpm
SpO2 Pulse Rate Average	8 seconds

SpO2 Pulse Rate Accuracy	±3 bpm
Refresh Time	Approx. ≤3 seconds
Pulse Sound	Pulse sound indication
Sensor Type	Nellcor V-SAT digital lingual sensor provided with small and large clip

C. Non-invasive Blood Pressure (NIBP) – Cardell®

Measurement Method	Oscillometric
Parameters	Systolic, Diastolic, Mean, Pulse Rate
Unit	mmHg or kPa
Operation Mode	Auto, Manual, Continuous Measurement, Screening
Measurement Range	Systolic: 30-265mmHg
	Diastolic: 15-220mmHg
	Mean: 20-235mmHg
Alarm Range	Systolic: 40-240mmHg
	Diastolic: 10-210mmHg
	Mean: 20-230mmHg
Cuff Pressure Range	60-240 mmHg (small cuff), 80-240 mmHg (large cuff)
Initial Cuff Inflation Pressure	150mmHg
Subsequent Cuff Inflation	30mmHg (4.0kPa) higher than last systolic pressure.
Auto Cycle Time	1, 2, 3, 4, 5, 10, 15, 30, 60, 90min

D. CO2

Respironics® (Optional)

Method	Mainstream or Sidestream Capnography
Principle of Operation	Non-dispersive infrared (NDIR) single beam optics, dual wavelength, no moving parts
Initialization time	Displayed in less than 15 seconds, full specifications within 2 minutes
Measurement range	0-150mmHg, 0 to 19.7%, 0 to 20kPa (at 760mmHg)
Rise time	Less than 60ms.
CO2 Resolution	0.1mmHg 0 to 69 mmHg
	0.25 mmHg 70 to 150 mmHg
CO2 Accuracy	0-40 mmHg ±2 mmHg
	41-70mmHg ±5% of reading
	71-100mmHg ±8% of reading
	101-150mmHg ±10% of reading
Respiration range	0 to 150 Breaths/minute
Respiration accuracy	±1 breath
Calibration	No routine user calibration required

Masimo (Optional)

Method	Mainstream or Sidestream Capnography
Detection Equipment	Ultra compact multi-channel infrared micro bench and barometric pressure sensor
Classification	Please reference the IRMA™ CO2 analyzer and the NomoLine® ISA™ CO2 analyzer user guides for complete classification information of these products.
Warm-up time	Less than 10 seconds for concentrations reported and full accuracy
Measurement range	0-114mmHg, 0 to 15%, 0 to 15.2kPa (at 760mmHg)

IRMA™ CO2 Rise time* (@ 10 l/min)	CO2 ≤ 90 ms N2O ≤ 300 ms HAL, ISO, ENF, SEV, DES ≤ 300 ms * Measured @ 10 l/min with gas concentration steps corresponding to 30% of total measuring range for each gas.
NomoLine® ISA™ CO2 Rise time** at 50 sml/min sample flow	ISA CO2 ≤ 200 ms ISA OR+/AX+ CO2 ≤ 300 ms N2O, O2, ENF, ISO, SEV, DES ≤ 400 ms Hal ≤ 500 ms
CO2 Accuracy	±(0.2vol% + 2% of reading) for dry single gases at 22 ± 5 °C and 101.3 ± 4.0 kPa
CO2 Accuracy (all conditions)	±(0.3kPa + 4% of reading)
Respiration range	0 to 150 breaths/minute, displayed after 3 breaths, average updated every breath
Respiration accuracy	±1 breath
Calibration	No span calibration required for the IR Bench

E. Temperature (2-channel)

Measurement and Alarm Limit	32~122°F (0-50°C)
Probe	Skin surface or rectal /esophageal
Unit	Fahrenheit/Celsius
Accuracy	±0.1°F (±0.1°C)
Resolution	0.1°F (0.1°C)
Refresh time	Approx. 1 second

F. Respiration

Measurement Mode	Thoracic Impedance (indirect) Respiration is also available from CO2. Please see the CO2 section for information on Respiration through Capnography (direct).
Respiration Rate Measurement and Alarm Range	6-120brpm +/-2brpm
Waveform Display Speed	6.25, 12.5 and 25mm/s
Refresh time	2 seconds

G. Multigas (Option - 8019)

Please reference the IRMA™ AX+ analyzer and the ISA™ AX+ analyzer user guides for complete classification information of these products.

IRMA™ AX+ Accuracy - Standard Conditions

The following accuracy specifications are valid for dry single gases at 22 ± 5 °C and 1013 ± 40 hPa.

Gas	Range*	Accuracy
CO2	0 to 15 vol% 15 to 25 vol%	±(0.2 vol% + 2% of reading) Unspecified
N2O	0 to 100 vol%	±(2 vol% + 2% of reading)
HAL, ISO, ENF	0 to 8 vol% 8 to 25 vol%	±(0.15 vol% + 5% of reading) Unspecified

SEV	0 to 10 vol% 10 to 25 vol%	±(0.15 vol% + 5% of reading) Unspecified
DES	0 to 22 vol% 22 to 25 vol%	±(0.15 vol% + 5% of reading) Unspecified

IRMA™ AX+ Accuracy - All Conditions

The following accuracy specifications are valid for all specified environmental conditions except for interference specified in section 8.6 (effects from water vapor partial pressure on gas readings and section 11.7 (interfering gas effects) within the IRMA™ developer's Manual. Please reference the IRMA™ developer's manual for complete details.

Gas	Accuracy
CO2	±(0.3 kPa + 4% of reading)
N2O	±(2 kPa + 5% of reading)
Agents**	±(0.2 kPa + 10% of reading)
**The accuracy specification for IRMA™ AX+ is not valid if more than two agents are present in the gas mixture.	

ISA™ AX+ Accuracy - Standard Conditions

The following accuracy specifications are valid for dry single gases at 22 ± 5 °C and 1013 ± 40 hPa.

Gas	Range*	Accuracy
CO2	0 to 15 vol% 15 to 25 vol%	±(0.2 vol% + 2% of reading) Unspecified
N2O	0 to 100 vol%	±(2 vol% + 2% of reading)
HAL, ISO, ENF	0 to 8 vol% 8 to 25 vol%	±(0.15 vol% + 5% of reading) Unspecified
SEV	0 to 10 vol% 10 to 25 vol%	±(0.15 vol% + 5% of reading) Unspecified
DES	0 to 22 vol% 22 to 25 vol%	±(0.15 vol% + 5% of reading) Unspecified
O2	0 to 100 vol%	±(1 vol% + 2% of reading)

ISA™ AX+ Accuracy - All Conditions

The following accuracy specifications are valid for all specified environmental conditions except for interference specified in section 11.7 (effects from water vapor partial pressure on gas readings) and section 11.8 (interfering gas effects) within the ISA™ developer's Manual. Please reference the ISA™ developer's manual for complete details.

Gas	Accuracy
CO2	±(0.3 kPa + 4% of reading)
N2O	±(2 kPa + 5% of reading)

H. IBP (Option - 8019)

Measurement and alarm range	ART1, ART2, AO, RA	0-300mmHg
	FA	-50 to 300mmHg
	ICP/CVP	-10 to 40mmHg
	PA	-6 to 120mmHg
Unit	mmHg/kPa	
Channel	1 or 2	
Resolution	1 mmHg	
Trend	7 days of data	
Sweep Speed	12.5, 25 mm/s	

I. Display

Display type	Color TFT LCD Touch Screen Size: 12.1 inches (8019), 8 inches (8020)
Resolution	800 (H) x 600 (V) pixels
Display channel	Minimum of 3. Maximum of 7.

J. Printer (Optional)

Type	3-channel thermal printer
Printing mode	Manual or Auto.
Resolution	Vertical (400dpi), Horizontal (800dpi)
Printing speed	12.5, 25.0, and 50mm/s.

K. Physical Specifications

Net weight with batteries	8019: 9.5 lbs (4.3kg) 8020: 6.0 lbs (2.7kg)
Dimensions	8019: 12.875in (32.70cm) x 11in (27.94cm) x 4.5in (11.43cm) 8020: 9.0in (23.0cm) x 4.7in (11.85cm) x 8.2in (20.9cm)
Weight subject to change depending on parameters and materials chosen.	
Specifications are subject to change without prior notice.	

APPENDIX 2 - BP REFERENCE VALUES

Which Blood Pressure is Normal in Dogs or Cats?[1]

It is essential to know the reference range of blood pressure in a given species in order to properly evaluate the animal's blood pressure and detect hypertension or hypotension. When using different measurement techniques (oscillometry or direct blood pressure measurements), one must also remember that methodological factors influence results. Therefore, technique-specific reference values should be known. Species-specific, breed- specific, and individual differences in normal blood pressure ranges can be observed. The most accurate assessments are made by comparing different blood pressure readings over time using serial measurements made at regular intervals (at least once yearly). This makes it possible to detect the initial signs of related disease (e.g. cardiovascular and renal disease) more sensitively and at an earlier stage. The normal values for dogs and cats are not identical.

FELINE NORMAL VALUES

The blood pressure values for cats are not breed-specific. However, the most sensitive way to detect changes in feline blood pressure is also by comparing individual blood pressure readings taken over time.

Normal feline blood pressure: 124/84

Feline Reference Values		
Systolic (mmHg)	**Diastolic (mmHg)**	
125 ± 11	89 ± 9	Brown et al, 1997
123 ± 14	88 ± 15	Curtet, 2001
125 ± 12	86 ± 15	Weber et al, 2002

Other investigators have reported comparable reference values.

CANINE NORMAL VALUES

The normal values for dogs are breed-specific. Those for Golden Retrievers, Labradors and giant breeds tend to be lower than the overall average and those for greyhounds and in general racing hounds tend to be higher. The table that follows lists the normal values for common dog breeds using oscillometric blood pressure monitors.

Average canine blood pressure: 133/75

This figure was calculated as the mean of 1782 oscillometric measurements in clinically healthy dogs of different breeds. The overall average serves as a point of reference only. The individual or at least breed-specific value must be known to accurately determine whether a given patient's blood pressure deviates from normal.

Breed	Systolic (mmHg)	Diastolic (mmHg)	Pulse Rate
Labrador Retriever	118 ± 17	66 ± 13	99 ± 19
Golden Retriever	122 ± 14	70 ± 11	95 ± 15
Great Pyrenees	120 ± 16	66 ± 6	95 ± 15
Yorkshire Terrier	121 ± 12	69 ± 13	120 ± 14
West Highland	126 ± 6	83 ± 7	112 ± 13
Border Collie	131 ± 14	75 ± 12	101 ± 21
King Charles Spaniel	131 ± 16	72 ± 14	124 ± 24
German Shepherd	132 ± 13	75 ± 10	108 ± 23
Terrier	136 ± 16	76 ± 12	104 ± 16
Bullterrier	134 ± 12	77 ± 17	122 ± 6
Chihuahua	134 ± 9	84 ± 12	109 ± 12
Miniature Breeds	136 ± 13	74 ± 17	117 ± 13
Pomeranian	136 ± 12	76 ± 13	131 ± 14
Beagle	140 ± 15	79 ± 13	104 ± 16
Dachshund	142 ± 10	85 ± 15	98 ± 17
Saluki	143 ± 16	88 ± 10	98 ± 22
Greyhound	149 ± 20	87 ± 16	114 ± 28

Pointer	145 ± 17	83 ± 15	102 ± 14

GUIDELINES[1]

Mean Arterial Pressure (MAP): Minimum to adequately perfuse all peripheral tissue beds: 60-70 mmHg.

Hypertension: Suspect with systolic pressure greater than 150 mmHg; affirmed when above 160 170 mmHg; also affirmed in cats when diastolic pressure is above 100 mmHg.

Hypotension: During anesthesia, generally maintain systolic pressure above 80 mmHg.

[1]Info per Dr. Donald Sawyer, Michigan State University

APPENDIX 3 - DEAD SPACE

Cause, Effect, & Control in Small Animal Anesthesia

Robert M. Stein, D.V.M.. DAAPM

Founder www.VASG.org

Dead space is an often misunderstood and overlooked aspect of veterinary anesthesia patient management. Dead space is always present as a component of the patient's airway and, to a variable degree, as a component of the anesthetic system. Ignoring the harmful consequences of system dead space can lead to potentially fatal patient outcomes. This is especially worrisome when managing small patients.

There are three different types of dead space: anatomic, alveolar, and mechanical (equipment). Dead space ventilation involves that component of the respiratory gases that does not participate in gas exchange. Simply said, there is no patient benefit from dead space ventilation. If mechanical dead space volume equals or exceeds alveolar ventilation volume the patient will not be able to clear carbon dioxide at all. Ideally, your goal should be to minimize dead space through proper patient planning and to detect excess dead space consequences through end-tidal CO2 monitoring.

Anatomic dead space is comprised of the upper airway structures that do not participate in gas exchange. This includes the gases in the nasal passages, nasopharynx, larynx, trachea, and in the larger airways. **Alveolar dead space** represents those alveoli that are ventilated with fresh gas but not perfused by the pulmonary circulation. **Mechanical or equipment dead space** is made up of any portion of the endotracheal tube extending beyond the patient's incisors, veterinary monitor adaptors (ET CO2, apnea alert, etc.), any adaptors used to facilitate patient/system positioning (right-angle or swivel adaptors used to reduce the risk of tracheal trauma during patient rotation), the pace within a mask not occupied by the patient's nose, humidification management exchangers (HME), and the "Y" piece (defined as the terminal end of an F circuit or noncircle system and the inhalation/exhalation hose connector in a circle system).

Exhausted soda lime or malfunctioning one-way valves can also contribute to increasing mechanical dead space. Dead space also increases in a non-rebreathing system when fresh gas flows are inadequate or when certain defects are present in the system (for instance, when the center tube of a Bain system or F circuit is cracked or broken). These dead space contributors can all be controlled through proper system inspection and maintenance.

Mechanical dead space gas is the first gas inhaled at the beginning of the each respiratory cycle. As the mechanical dead space volume increases, less fresh gas moves into the patient's alveoli, limiting gas exchange.

Anesthetic System							
	Norman Elbow	Jackson-Rees	Bain	Ped circle	Adult circle	Adult F	Ped F
Dead space	<1 ml	3 ml	4 ml	4 ml	8 ml	8 ml	15 ml

Adaptors					
	ET tube	Monitor - ped	Monitor - adult	Positional	Heat & Moisture Exchanger (HME)
Dead Space	2 ml	2 ml	7 ml	8 ml	2.5 to 90 ml

The consequences of excessive mechanical dead space can be substantial and, potentially, fatal. As dead space volume from any cause increases, effective alveolar ventilation decreases. In patients breathing 100% oxygen there may be negligible initial effect on arterial oxygen tension. Arterial CO2, however, can reach impressive levels. It is possible to have an end-tidal CO2 level greater than 110 mmHg in patients with a normal pulse oximeter reading.

- Increased arterial CO2 causes:
    - Respiratory acidosis
    - Sympathetic stimulation
    - Cardiac arrhythmias
    - A mix of sympathetic stimulation and hypoxemic effects
    - Variable peripheral vasoconstriction (sympathetic effect) followed by peripheral vasodilation as a direct effect on peripheral vessels
    - CNS depressant effect and, eventually narcosis
    - Pa CO2 levels above 100 mmHg have an anesthetic effect

- Increased cerebral blood flow and intracranial pressure
- Tachypnea and an increased work of breathing which can negatively impact a debilitated patient

- Arterial O2 levels may eventually decrease enough to cause hypoxemia, especially in a patient breathing room air
- Inadequate ventilation interferes with adjustments in anesthetic levels

Controlling mechanical dead space is a simple matter.

- Mechanical dead space is most concerning for patients under 6 kg body weight
  - Minimize the connectors attached to the endotracheal tube, particularly in small patients.
    - For example, in a 6 kg patient under anesthesia the patient's alveolar ventilation volume would be 31.5 ml. Using a pediatric F circuit with adult EtCO2 monitor and right angle adaptor (or apnea alert adaptor) could create 30 ml of mechanical dead space; effectively eliminating 95% of normal spontaneous alveolar ventilation.
- Make sure you regularly inspect all anesthetic machines and systems paying particular attention to valve function and inner hose integrity
- Make sure that the ET tube is not excessively long
- Select your anesthetic system carefully
  - DO NOT use a pediatric F circuit as a substitute for conventional pediatric circle hoses or a noncircle system
- Using no more than one monitor adaptor
  - Make sure it is a pediatric, low volume adaptor for smaller patients to avoid any significant impact on total mechanical dead space
- Avoid the use of positional (right angle) adaptors in smaller patients
- Avoid maintaining anesthesia with a facemask

Simply put, anesthetized patients should have their end-tidal CO2 monitored for maximal patient safety.

APPENDIX 4 - DIRECT BP MONITORING

Marc R. Raffe DVM, MS, DACVA, DACVECC

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Blood pressure is considered an important component of patient monitoring in emergency and critical care medicine. Blood pressure is a product of several cardiovascular parameters including cardiac output (stroke volume x heart rate), volumetric compliance of peripheral blood vessels (systemic vascular resistance) and effective circulating blood volume. Veterinary medicine has

embraced blood pressure measurement as an important monitoring tool for a variety of medical and surgical situations. In most cases, current clinical practice measures blood pressure by an indirect technique which relies on surface pressure occlusion of a superficial artery using a pneumatic cuff and a method to detect blood flow distal to the site of cuff occlusion. Accepted detection methods to identify blood flow include auscultation, oscillometry, palpation, ultrasonic, and photoelectric methods. Although valuable, it has long been recognized that all indirect methods have limitations in accurate measurement associated with both patient and operator factors. Also, indirect blood pressure measurement is not robust, meaning that it cannot be accurately measured during low pressure and vasoconstricted states.

Because there are limits to indirect blood pressure measurement, there is increased interest in direct blood pressure monitoring in patients demonstrating abnormal physiology that may render indirect measurement techniques inaccurate or impossible. Direct blood pressure measurement requires introduction of a catheter into an arterial or venous lumen and equipment and supplies to transfer pressure from the catheter tip to a measurement device. For this reason, direct measurement is technically more demanding than indirect techniques but less prone to measurement error. The purpose of this presentation is to review the theory, practice, and techniques for direct arterial blood pressure measurement in dogs and cats.

Equipment needed for direct blood pressure measurement

Equipment and supplies: Essential equipment and supplies needed for direct blood pressure monitoring include arterial catheters (see below), side port catheter adapter, low compliance extension tubing, three way stopcocks, pressure measurement device (transducer), pressure analysis and display device (ECG/BP monitor), heparinized saline, and syringes/needles. For long term placement, a constant flush device (Intraflow®), IV tubing, 1L normal saline, heparin, and pressure infuser device permits continuous flush infusion to prevent clot formation. General supplies such as elasticized and regular tape, suture, scrub solution, and assorted needles should be available. Local anesthesia (2% lidocaine HCl) may be injected in the vicinity of the artery to reduce vasospasm during the procedure.

Catheter selection: Either short or long catheters may be successfully used for direct blood pressure measurement. The preferred biomaterials for arterial catheters are either PFE (Teflon®) or polyurethane. In most cases, short length catheters (2-3”)are used in patients who require short term blood pressure monitoring (i.e. anesthesia, short term procedures) or are relatively immobile. Long length indwelling catheters (4+”) are preferred for long term monitoring or in mobile patients. The gauge of catheter is based on vessel diameter at the placement site. In dogs, 20-24 G x 2-3” over the needle catheters are used in the dorsal pedal, metatarsal, and popliteal arteries. In cats, a 22-24G x 2” catheter is selected for the same arterial sites. Large diameter arterial segments (femoral and brachial a.) may accommodate a 20 G x 2-3” over the needle catheter in the dog and a 22 G x 2-3” catheter in the cat. Several manufacturers (Arrow, BD) offer an over the needle catheter system with a built in guide wire that is intended to facilitate arterial catheter placement. In these systems, the guide wire is first advanced and the catheter is then placed over the guide wire. This system is helpful when challenging cases are encountered. Long catheters are generally selected in large bore (femoral and brachial a.) arteries where stabilization is challenging. The additional length of the catheter allows the catheter tip to be located in a more central arterial location and adds additional length that reduces accidental catheter dislodgment.

Technique for setting up direct blood pressure monitoring

Equipment set up and preparation: Prior to beginning the procedure, all equipment and supplies should be assembled and be ready to use. The first step is to attach the pressure transducer to the patient monitor at the appropriate plug site. Following attachment, connect three way stopcocks to the luer adapters in the transducer housing. In permanent transducers, two stopcocks are required, in disposable units, only one may be necessary.

Leave one stopcock “open” to room air and fill the chamber with heparinized saline being sure that ALL air bubbles are removed. After filling, leave the stopcock open and “zero” the transducer to the machine by pressing the zero control button on the monitor panel. This adjusts the electronics to provide accurate measurement. This step will be repeated after patient attachment occurs. After filling and zeroing the transducer, a flush infusion device is attached to one stopcock unless it is embedded in the transducer device. An IV bag with heparinzed saline is placed in a pressure sleeve and an IV infusion set (microdrip) is attached to the flush device and the bag pressurized to 300 mm Hg. A 6-12” length of low compliance IV tubing is attached to a stopcock to interface the catheter to the transducer. This tubing is flushed and filled with heparinzed saline. The stopcock is turned off to prevent fluid drainage once the tubing is filled. A catheter adapter with a side port is flushed with heparinized saline filled syringe with the syringe attached after flushing. The catheter, catheter supplies, and prep solution are assembled and organized on a work surface for easy access.

Catheter placement sites: A superficial artery amenable to catheter placement is identified. Reported sites for arterial catheter placement in dogs and cats include the dorsal pedal, metatarsal, popliteal and femoral arteries in the hind limb and the brachial artery

in the forelimb. In general, distal rear limb sites are selected based on ease of identification, catheter placement, and stabilization following catheter insertion. The selected site must be clipped and surgically prepped prior to catheter placement. Failure to aseptically prepare the area can lead to systemic infection.

Catheterization technique: The artery is palpated for pulse quality. In hypotensive patients, peripheral arterial sites may not be detectable due to low blood flow and poor pulse quality. Following identification, a small amount of 2% lidocaine is infiltrated in proximity to the vessel to reduce vasospasm and desensitize the area for catheter placement. Do not remove the filter cap from the needle hub prior to placement. You will be entering a high pressure vessel and will have a sudden burst of blood back through the catheter hub if it is uncovered. The catheter is initially introduced through the skin. In some cases, a pilot wound is created if skin is tough and may damage initial catheter insertion. Once the catheter is inserted through the skin, it is SLOWLY advanced while a finger is kept over the artery to “feel” when the catheter intersects the vessel. You can feel the vessel wall because it is a muscular structure and may actually feel a pulsation as the needle tip engages the arterial wall. At this point, a “flash” may be noted in the needle hub. Once the “flash” is noted, stabilize the catheter unit. If you are using a guide wire catheter, slowly advance the wire stylette. It should move easily or only encounter slight resistance if you are in the vessel lumen. Once the guide wire is inserted full length, slowly advance the catheter until the catheter hub is at the skin surface. If using a standard catheter, slowly advance the catheter. There should be slight resistance due to tissue “drag” but the catheter should go smoothly. After catheter placement is confirmed, gently compress over the vessel at the catheter tip, remove the stylette and needle, and cap the catheter hub with the adapter. An initial aspiration should easily produce a blood “flash” into the saline solution. Flush in 2-3 cc of heparinized saline solution to clear blood from the catheter lumen. Secure the catheter in place prior to proceeding further.

Connection to BP monitor: Flush the connecting tubing with saline using the flush device embedded in the disposable transducer or by using a saline filled syringe attached to the stopcock immediately adjacent to the extension tubing. Be sure that there are no visible air bubbles following the flush procedure. Attach the connecting tubing to the catheter adapter extension. You should see a pressure waveform on the monitor screen after opening the stopcocks to the system. Level the transducer at the estimated base of the heart (point of the shoulder). Close the line to the patient and open it up to room air using the stopcock. Press the zero button again to recalibrate the system to the patient. Close the stopcock to air and open the line to the patient. You are now measuring direct blood pressure.

Blood pressure waveform

Arterial waveforms emanate from the pulse pressure created by ventricular systole and diastole. The arterial pulse pressure wave begins as left ventricular contraction and forward blood flow (stroke volume) creates aortic distention within the closed vascular system. Peak aortic blood flow produces the initial upstroke in the pressure pulse while continuous ejection of blood from the ventricle during systole fills out or sustains the pulse waveform. As pressure and flow reach their maximum values, the curve flattens and reaches peak pressure. The rounded, sustained portion of the pressure wave represents a combined effect of ventricular volume ejection, distention of the entire aorta, and runoff into aortic branches. Following this point, the curve begins to descend until a defined upstroke or “notch” on the downside of the pressure curve is noted. This notch, referred to as the dicrotic notch, represents closure of the aortic valve and secondary pressure generation that occurs by distention and compression of the aortic root following valve closure. As pressure falls further during “run off” of blood into the arterial ranches, the pressure curve descends to its lowest pressure point just prior to the next cardiac cycle.

The arterial waveform varies with the site of catheter placement and its distance from the aortic root. The further the distance from the heart, the more “tented” or “peaked” the waveform appears. This is accompanied by a narrower base or distance from the beginning to end of the waveform. This appearance change is due to several factors including pressure drop and diameter of blood vessel. The important point is that the waveform change reflects a lower mean arterial pressure, which is essential for forward blood flow to all tissues and organs.

When concurrently monitoring electrocardiogram (ECG) and arterial blood pressure, one notes a slight “delay” between the ECG signal and blood pressure waveform during a cardiac cycle. This delay represents the time required to produce electromechanical coupling and isometric ventricular contraction prior to forward blood flow and pressure wave generation.

Factors affecting measurement

Direct blood pressure measurement is affected by both patient and technical factors. Physiologic status of the patient including circulating blood volume, cardiac contractility, neuroendocrine status, and peripheral vascular state all contribute to blood pressure values. Support measures such as mechanical ventilation or other procedures which impact on cardiovascular physiology also contribute to accurate measurement. The reader is referred to reference material for further discussion of these issues. Technical issues also affect accurate measurement. Technical issues generally fall into three categories, catheter management, appropriate set up and management of the measurement apparatus, and operator error. Arterial catheter management is a critical issue in success. Placement should be on a “flat” surface away from joints or other structures which may intermittently occlude the catheter lumen due to position or movement.

Continuous flushing of the catheter to avoid intraluminal clots is essential for long term patency and accuracy of measurement. Ensuring an uninterrupted fluid interface between the catheter and transducer device is essential. Air bubbles in the transducer or extension tubing may “dampen” the signal producing errors. Correct procedural set up with “zeroing” the system is critical to ensure accurate values are measured. Attention to detail of the catheter and operating system by personnel is important to avoid errors and complications. Any break in the protocol may contribute to inaccurate measurement and increased patient risk.

Complications

Reported hazards of invasive arterial pressure monitoring include vascular injury, disconnection, accidental injection of drugs, infection, and damage to nearby nerves. In the author's experience, accidental disconnection and infection are two most common complications. Accidental disconnection can produce rapid exsanguination with the risk of hypotension, shock and death is possible if not immediately identified. Constant monitoring of the extension tubing and connection points is important to avoid this complication. Nosocomial infection may lead to bacteremia and sepsis. Sources of infection include catheter wound site, contamination of tubing and stopcocks during routine maintenance procedures, and reuse of non-sterile transducers. Attention to standard protocols targeted to reduce introduction of pathogens at tubing connection sites or ports is also important to decrease risk in these patients. In recent years, "closed" tubing systems which isolate operator maintenance functions from the primary system have become popular in human medicine.

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APPENDIX 5 - SPECTRAL BROADENING

(Taken from Appendix B of IRMA™ CO2 Probe Developer's Manual, and Section 7.8 of NomoLine® ISA™ CO2 Analyzer Developer's Manual)

The presence of oxygen and nitrous oxide can cause some interference in the CO2 measurement. This is known as spectral broadening, and must be compensated.

I. Nitrous oxide, N_2O

Nitrous oxide is measured and automatically compensated for in all IRMA™ or NomoLine® ISA™ CO_2 probes except for in IRMA™ CO_2 or NomoLine® ISA™ CO_2 analyzers that don't measure N_2O. When using a gas analyzer without this capability, the current nitrous oxide concentration should be transmitted to the NomoLine® ISA™ CO_2 or IRMA™ Gas analyzer using the SetN_2O command.

For most applications, sufficient CO_2 accuracy will be achieved by setting N_2O to one of two standard values depending on the N_2O concentration in the patient circuit. If for instance a SetN_2O value of 0 is used for patient circuit concentration below 30 vol% N_2O and 50 is used otherwise, the maximum CO_2 error will be limited to 3.2 % relative (please refer to the table below).

N_2O range	SetN_2O parameter	Midmark Multiparameter Monitor Setting "N_2O Compensate"
0-30 vol%	0	OFF
30-70 vol%	50	ON

Below is the typical effect if using the default value (0 vol% N_2O) when measuring on gas mixtures with different N_2O concentrations:

N_2O conc. in gas mix	Effect on gas reading	Displayed value if true conc. is 5.0 vol% CO_2
0 vol%	0 % relative	5.0 vol%
30 vol%	5.17 % relative	5.3 vol%
60 vol%	10.34 % relative	5.5 vol%
82 vol%	14.14 % relative	5.7 vol%

II. Oxygen O_2

The current oxygen concentration should be transmitted to the IRMA™ or NomoLine® ISA™ CO_2 probe using the SetO_2 command.

For most applications, sufficient CO_2 accuracy will be achieved by setting O_2 to one of three standard values depending on the O_2 concentration in the patient circuit. If for instance a SetO_2 value of 21 is used for patient circuit concentrations below 30 vol% O_2, 50 is used for patient concentrations in the range 30 to 70 vol% O_2 and 85 is used otherwise, the maximum CO_2 error will be limited to 1.2 % relative (please refer to table below).

O_2 Range	SetO_2 Parameter	Midmark Multiparameter Monitor Setting "O_2 Compensate"
0 – 30 vol%	21	LOW
30 – 70 vol%	50	MED
70 – 100 vol%	85	HIGH

Below is the typical effect if the default value (21 vol% O_2) when measuring on gas mixtures with different O_2 concentrations:

O_2 conc. in gas mix	Effect on gas reading	Displayed value if true conc. is 5.0 vol% CO_2
21 vol%	0 % relative	5.0 vol%
50 vol%	-2.76 % relative	4.9 vol%
70 vol%	-4.67 % relative	4.8 vol%
95 vol%	-7.05 % relative	4.7 vol%

APPENDIX 6 - ACCESSORIES

The following items are included in the standard monitor kit and can be reordered from your distributor or directly from Midmark using the associated reorder codes.

Reorder #	Description	Qty.
SV1	Small animal BP cuff for 3-6cm limb circumference	1
SV2	Small animal BP cuff for 4-8cm limb circumference	2
SV3	3.5cm BP cuff for 6-11cm limb circumference	3
SV4	4.0cm BP cuff for 7-13cm limb circumference	3
SV5	5.0cm BP cuff for 13-20cm limb circumference	2
SV8	Large animal BP cuff for 13-20cm limb circumference	1
SV10	Large animal BP cuff for 18-26cm limb circumference	1
NIBP-TUBE	NIBP Inflation Tube	1
016-10177-00	ECG trunk cable	1
016-1604-00	3-lead ECG wire set	1
016-10178-00	3-lead ECG cable/lead/clip set	1
ECG-A3	Copper ECG alligator clips	3
V-SAT	Nellcor VetSat SpO2 sensor w/ lingual clips	1
VSC-S	Small animal SpO2 sensor clip	1
VSC-L	Large animal SpO2 sensor clip	1
01-02-0183	Nellcor SpO2 extension cable	1
016-10164-00	Esophageal/Rectal temperature probe	1
PAPER-4F	Printer paper (50mm) (1 package contains 4 rolls)	1
015-1338-06	Power cord, domestic, hospital grade	1
015-10793-00	Rechargeable Li-ion battery, 8019 AH Multiparameter Monitor	1
015-11201-00	Rechargeable Li-ion battery, 8020 AH Multiparameter Monitor	1
PL-200	Redux gel for ECG use	1
015-3091-00	Ground wire	1
061-1016-00	Blood pressure cuff selector	1
015-3322-02	USB, Visualizer, 8019-021 thru -023 and 8020-001 thru -002	1
015-3404-00	Midmark USB for data storage	1
016-10180-00	IBP Trunk cable for IBP monitors only (8019 w/IBP Option)	1
016-1587-00	Disposable IBP transducer and administrative set for IBP monitors only (8019 w/IBP Option)	1
016-1586-00	Disposable IBP Transducer with integral stopcock and flush device, stand alone (8019 w/ IBP Option)	1

The following are optional accessories for use with the Midmark Multiparameter Monitor series:

Reorder #	Description
C-STAT5	Capnostat® 5 Mainstream CO2 Sensor
LoFlo	LoFlo Sidestream CO2 Sensor
6063-00	Capnostat small animal airway adapter
6312-00	Capnostat exotic airway adapter
3473ADU-00	LoFlo large airway adapter
3473INF-00	LoFlo small airway adapter
3475-00	LoFlo filterline with luer lock adapter
1027730	LoFlo mounting bracket
016-1431-00	Protective silicone rubber skin for C-STAT5
016-1455-00	Protective silicone rubber skin for LoFlo

002-1895-00	Masimo CO2 Mainstream sensor kit
002-1896-00	Masimo CO2 Sidestream sensor kit
002-10171-00	Scavenging kit, Masimo Sidestream, CO2 and Multigas
SV600	Set of 5 small animal BP cuffs (1 of each size)
MaxFast-1	Nellcor MaxFast Reflectance sensor & posey wrap
016-10232-00	Extra small esophageal ECG
016-10233-00	Small esophageal ECG
016-10234-00	Large esophageal ECG
CD-0019	Flat ECG clips (5PK)
016-1603-00	5-lead ECG wire set
016-10179-00	5-lead ECG Cable/lead/clip set
ECG-SN	Snap-on ECG clip
01-05-0507	Small pregelled electrode for snap-on wire sets 60/box
NIBP-TUBE10	NIBP Equine Inflation Tube
015-0363-03	Power cord, UK
015-0363-04	Power cord, Australia
015-0363-00	Power cord, Europe
8008-005	Monitor mount for Rolling stand w/basket
8008-006	Monitor mount for Canis Major lift table
9A465009	Monitor mount for VMS Plus anesthesia machine
9A465010	Monitor pole mount
9A465011	Monitor Stud mount
9A465012	Monitor wall mount
002-1684-00	5-lead conversion kit
016-1651-00	Masimo small airway adapter
016-1652-00	Masimo exotic airway adapter
016-1653-00	Masimo sampling line with large airway adapter
016-10120-00	Masimo sampling line with small airway adapter
016-1655-00	Masimo tee airway adapter
002-1745-00	Multigas Mainstream sensor kit (Option - 8019)
002-1746-00	Multigas Sidestream sensor kit (Option - 8019)
002-10849-00	NomoLine® ISA™ Maintenance Kit

APPENDIX 7 - IRMA™ CO2 and AA Analyzer Warnings, Cautions, and Notes

IRMA™ CO2

WARNING:

- IRMA™ should only be used for the purpose and in the manner described in this manual.
- Do not adjust, repair, open, disassemble, or modify the IRMA™ or IRMA™ Airway Adapters. Damage to the device may result in degraded performance and/or patient injury.
- If for whatever the reason the IRMA™ device is in direct contact with any parts of the infant's body an insulation material shall be placed between the IRMA™ and the body.
- The IRMA™ is not designed for MRI environments.
- Do not use the IRMA™ Adult/Pediatric Airway Adapter with infants as the Adapter adds 6 ml dead space to the patient circuit.
- Do not use the IRMA™ Infant Airway Adapter with adults/pediatrics as this may cause excessive flow resistance.
- IRMA™ should not be used as the sole basis for medical decisions. It must be used in conjunction with clinical signs and symptoms.
- Use only IRMA™ Airway Adapters manufactured by Masimo.
- Light transmission can be affected by secretions and moisture pooling on the IRMA™ Airway Adapter XTP™ windows. When using heated humidifiers special care should be paid to position the Airway Adapter in a vertical position and to change Airway Adapter if necessary.
- Do not place the IRMA™ Airway Adapter between the endotracheal tube and an elbow as this may allow patient secretions to block the adapter windows and result in incorrect operation.
- Do not use IRMA™ with metered-dose inhalers or nebulized medications as this may affect the light transmission of the IRMA™ Airway Adapter windows.
- Use of this equipment adjacent to or stacked with other equipment should be avoided because it could result in improper operation. If such use is necessary, this equipment and the other equipment should be observed to verify that they are operating properly.
- Make sure that IRMA™ is used in the electromagnetic environment specified in this manual.
- Use of high-frequency electrosurgical equipment in the vicinity of IRMA™ may produce interference and cause incorrect measurements.
- Portable RF communications equipment (including peripherals such as antenna cables and external antennas) should be used no closer than 30 cm (12 inches) to any part of the IRMA™ including cable. Otherwise, degradation of the performance of the IRMA™ could result.
- Incorrect zeroing of IRMA™ will result in false gas readings.
- Use of accessories and cables other than those specified or provided could result in increased electromagnetic emissions or decreased electromagnetic immunity of this equipment and result in improper operation
- Replace the airway adapter if rainout/condensation occurs inside the airway adapter.
- To avoid electric shock, always physically disconnect the IRMA™ and all patient connections before cleaning.
- Any changes or modifications not expressly approved by Masimo shall void the warranty for this equipment and could void the user's authority to operate the equipment.

CAUTION:

- IRMA™ is to be operated by, or under the supervision of, qualified personnel only. Read this Operator's Manual, accessories directions for use, all precautionary information, and specifications before use. Refer to the medical backboard devices operator's

manual or user's guide for additional safety information, warnings and cautions.

- Do not operate IRMA™ outside of the specified operating environment.
- Never submerge or saturate IRMA™ in water or any other liquid solution this may cause permanent damage to the IRMA™.
- Do not apply excessive pressure on the IR-windows.
- Only perform maintenance procedures specifically described in the manual; otherwise, return IRMA™ for servicing. Improper maintenance may result in damage to the internal parts. Damage to internal parts may result in no or inaccurate readings.
- Do not clean IRMA™ with any chemical other than those specified in Maintenance and Cleaning of this manual. These substances may affect the device's materials and damage internal parts.
- The IRMA™ and IRMA™ Airway Adapters are non-sterile devices. Do not submerge IRMA™ or IRMA™ Airway Adapters in any cleaning solution or attempt to sterilize by autoclave, irradiation, steam, gas, ethylene oxide or any other method. This will seriously damage the device.
- Do not use undiluted bleach (5% - 5.25% sodium hypochlorite) or any cleaning solution other than those recommended in Maintenance and Cleaning of this manual. Permanent damage to IRMA™ may occur if other unspecified solutions are used.
- Disposal of Product: Comply with local laws in the disposal of the device and/or its accessories.
- IRMA™ Airway Adapters shall be disposed of in accordance with local regulations for biohazardous waste.

NOTE:

- Disconnect the device from power by removing the device cable connection from the medical backboard device.
- Use and store the IRMA™ in accordance with specifications. See the Specifications section in this manual.
- A trained medical professional must determine the proper IRMA™ Airway Adapter model for each patient application. No hardware or software configuration changes result from the IRMA™ Airway Adapter model selected.
- The presence of ambient air (0% CO2) in the IRMA™ Airway Adapter is of crucial importance for a successful Zeroing. Special care should be taken to avoid breathing near the IRMA™ Airway Adapter before or during the Zeroing procedure.

IRMA™ AX+

WARNING:

- IRMA™ should only be used for the purpose and in the manner described in this manual.
- IRMA™ is intended for use by authorized health care professionals only.
- Do not adjust, repair, open, disassemble, or modify the IRMA™. Damage to the device may result in degraded performance and/or patient injury.
- The IRMA™ is not intended to be in patient contact.
- If for whatever the reason the IRMA™ device is in direct contact with any parts of the infant's body an insulation material shall be placed between the IRMA™ and the body.
- The IRMA™ is not designed for MRI environments.
- IRMA™ Airway Adapters shall not be reused. Reuse of single use Adapters can cause cross infection.
- Do not use the IRMA™ Adult/Pediatric Airway Adapter with infants as the Adapter adds 6 ml dead space to the patient circuit.
- Do not use the IRMA™ Infant Airway Adapter with adults/pediatrics as this may cause excessive flow resistance.
- IRMA™ should not be used as the sole basis for medical decisions. It must be used in conjunction with clinical signs and symptoms.
- Use only IRMA™ Airway Adapters manufactured by Masimo.
- No modification of the IRMA™ probe or the IRMA™ Airway Adapters is allowed.

- Light transmission can be affected by secretions and moisture pooling on the IRMA™ Airway Adapter XTP™ windows. When using heated humidifiers special care should be paid to position the Airway Adapter in a vertical position and to change Airway Adapter if necessary.
- Do not place the IRMA™ Airway Adapter between the endotracheal tube and an elbow as this may allow patient secretions to block the adapter windows and result in incorrect operation.
- Do not use IRMA™ with metered-dose inhalers or nebulized medications as this may affect the light transmission of the IRMA™ Airway Adapter windows.
- Use of this equipment adjacent to or stacked with other equipment should be avoided because it could result in improper operation. If such use is necessary, this equipment and the other equipment should be observed to verify that they are operating properly.
- Make sure that IRMA™ is used in the electromagnetic environment specified in this manual.
- Use of high-frequency electrosurgical equipment in the vicinity of IRMA™ may produce interference and cause incorrect measurements.
- Portable RF communications equipment (including peripherals such as antenna cables and external antennas) should be used no closer than 30 cm (12 inches) to any part of the IRMA™ including cable. Otherwise, degradation of the performance of the IRMA™ could result.
- Incorrect zeroing of IRMA™ will result in false gas readings.
- Use of accessories and cables other than those specified or provided could result in increased electromagnetic emissions or decreased electromagnetic immunity of this equipment and result in improper operation.
- Replace the airway adapter if rainout/condensation occurs inside the airway adapter
- To avoid electric shock, always physically disconnect the IRMA™ and all patient connections before cleaning.
- Any changes or modifications not expressly approved by Masimo shall void the warranty for this equipment and could void the user's authority to operate the equipment.

CAUTION:

- IRMA™ is to be operated by, or under the supervision of, qualified personnel only. Read this Operator's Manual, accessories directions for use, all precautionary information, and specifications before use. Refer to the medical backboard devices operator's manual or user's guide for additional safety information, warnings and cautions.
- Do not operate IRMA™ outside of the specified operating environment.
- Never submerge IRMA™ in water or any other liquid solution this may cause permanent damage to the IRMA™.
- Do not apply excessive pressure on the IR-windows.
- Never saturate IRMA™ completely with any disinfection solution.
- Only perform maintenance procedures specifically described in the manual; otherwise, return IRMA™ for servicing. Improper maintenance may result in damage to the internal parts. Damage to internal parts may result in no or inaccurate readings.
- Do not clean IRMA™ with any chemical other than those specified in Maintenance and Cleaning of this manual. These substances may affect the device's materials and damage internal parts.
- The IRMA™ and IRMA™ Airway Adapters are non-sterile devices. Do not submerge IRMA™ or IRMA™ Airway Adapters in any cleaning solution or attempt to sterilize by autoclave, irradiation, steam, gas, ethylene oxide or any other method. This will seriously damage the device.
- Do not use undiluted bleach (5% - 5.25% sodium hypochlorite) or any cleaning solution other than those recommended in Maintenance and Cleaning of this manual. Permanent damage to IRMA™ may occur if other unspecified solutions are used.
- Disposal of Product: Comply with local laws in the disposal of the device and/or its accessories.
- IRMA™ Airway Adapters shall be disposed of in accordance with local regulations for bio hazardous waste.

NOTE:

- Disconnect the device from power by removing the device cable connection from the medical backboard device.

- Use and store the IRMA™ in accordance with specifications. See the Specifications section in this manual.
- A trained medical professional must determine the proper IRMA™ Airway Adapter model for each patient application. No hardware or software configuration changes result from the IRMA™ Airway Adapter model selected.
- The presence of ambient air (0% CO2) in the IRMA™ Airway Adapter is of crucial importance for a successful Zeroing. Special care should be taken to avoid breathing near the IRMA™ Airway Adapter before or during the Zeroing procedure.

APPENDIX 8 - Nomoline® ISA™ CO2 and AA Analyzer Warnings, Cautions, and Notes

Nomoline® ISA™ CO2

WARNING:

- Do not use NomoLine® ISA™ CO2 if it appears or is suspected to be damaged. Damage to the device can result in exposed electrical circuits that may cause patient harm.
- Do not adjust, repair, open, disassemble, or modify the NomoLine® ISA™ CO2. Damage to the device may result in degraded performance and/or patient injury.
- Do not start or operate the NomoLine® ISA™ CO2 unless the setup was verified to be correct. Improper set-up of this device may result in degraded performance and/or patient injury.
- Do not place the NomoLine® ISA™ CO2 or accessories in any position that might cause it to fall on the patient.
- Only use Masimo authorized devices with NomoLine® ISA™ CO2. Using unauthorized devices with NomoLine® ISA™ CO2 may result in damage to the device and/or patient injury.
- Carefully route the sampling line to reduce the risk of patient entanglement or strangulation.
- Do not use the NomoLine® ISA™ CO2 during magnetic resonance imaging (MRI) or in an MRI environment.
- Only use sample lines intended for anesthetic agents if N2O and/or anesthetic agents are being used.
- Do not re-use disposable single-patient use NomoLine® Family sampling lines due to the risk of cross contamination.
- Do not use the NomoLine® Infant/Neonate Airway Adapter Sets for adults/pediatrics as they may cause excessive flow resistance (0,7 ml dead space).
- Do not use the NomoLine® Adult/Pediatric Airway Adapter Sets for infants/neonates as the airway adapter adds 6 ml dead space.
- Do not apply negative pressure to remove condensed water from the NomoLine® Family sampling line.
- NomoLine® ISA™ CO2 is not intended to be used for returning exhaust gases to the patient circuit. Exhaust gases should be returned to a scavenging system.
- NomoLine® ISA™ CO2 should not be used as the sole basis for medical decisions. It must be used in conjunction with clinical signs and symptoms.
- Use of high-frequency electrosurgical equipment in the vicinity of NomoLine® ISA™ CO2 may produce interference and cause incorrect measurements.
- Do not use the NomoLine® ISA™ CO2 with metered-dose inhalers or nebulized medications as this may clog the bacteria filter.
- Properly apply sampling lines according to the sampling lines directions for use. Misapplied sampling lines that become partially dislodged may cause no or incorrect readings.
- Replace the sampling line if the sampling line input connector starts flashing red, or host device displays a check sampling line type of message.
- Use of this equipment adjacent to or stacked with other equipment should be avoided because it could result in improper operation. If such use is necessary, this equipment and the other equipment should be observed to verify that they are operating properly.
- Too strong positive or negative pressure in the patient circuit might affect the sample flow.
- Strong scavenging suction pressure might affect the sample flow.
- Any changes or modifications not expressly approved by Masimo shall void the warranty for this equipment and could void the user’s authority to operate the equipment.
- Use of accessories and cables other than those specified or provided could result in increased electromagnetic emissions or decreased electromagnetic immunity of this equipment and result in improper operation.

- Dispose NomoLine® Family sampling lines in accordance with local regulations for biohazardous waste.
- Do not lift the NomoLine® ISA™ CO2 by the NomoLine® capnography sampling line as it could disconnect from the NomoLine® ISA™ CO2, causing the device to fall on the patient.
- Portable and mobile RF communications equipment (including peripherals such as antenna cables and external antennas) should be used no closer than 30cm (12 inches) to any part of the NomoLine® ISA™ CO2 including the cable. Otherwise, degradation of the performance of the NomoLine® ISA™ CO2 could result.
- To avoid electric shock, always physically disconnect the NomoLine® ISA™ CO2 and all patient connections before cleaning.
- Do not attempt to remanufacture, recondition or recycle the NomoLine® ISA™ CO2 as these processes may damage the electrical components, potentially leading to patient harm.

CAUTION:

- NomoLine® ISA™ CO2 is to be operated by, or under the supervision of, qualified personnel only. Read this Operator's Manual, accessories directions for use, all precautionary information, and specifications before use. Refer to the host device operator's manual or user's guide for additional safety information, warnings and cautions.
- Do not sterilize or immerse NomoLine® Family sampling lines in liquid.
- Disposal of Product: Comply with local laws in the disposal of the device and/or its accessories.
- Do not operate NomoLine® ISA™ CO2 outside of the specific operating environment.
- NomoLine® ISA™ CO2 should be mounted securely to avoid risk of damage to the NomoLine® ISA™ CO2.
- To avoid permanent damage to the NomoLine® ISA™ CO2, do not use undiluted bleach (5% - 5.25% sodium hypochlorite) or any other cleaning solution not recommended.
- Do not use petroleum-based or acetone solutions, or other harsh solvents, to clean the NomoLine® ISA™ CO2. These substances affect the device's materials and device failure can result.
- Do not submerge the NomoLine® ISA™ CO2 in any cleaning solution or attempt to sterilize by autoclave, irradiation, steam, gas, ethylene oxide or any other method. This will seriously damage the device.

NOTE:

- Disconnect the device from AC mains by removing the device cable connection from the host device.
- Use and store the NomoLine® ISA™ CO2 in accordance with specifications. See the Specifications section in this manual.

Nomoline® ISA™ AX+

WARNING:

- Do not use NomoLine® ISA™ AX+ if it appears or is suspected to be damaged. Damage to the device can result in exposed electrical circuits that may cause patient harm.
- Do not adjust, repair, open, disassemble, or modify the NomoLine® ISA™ AX+. Damage to the device may result in degraded performance and/or patient injury.
- Do not start or operate the NomoLine® ISA™ AX+ unless the setup was verified to be correct. Improper set-up of this device may result in degraded performance and/or patient injury.
- Do not place the NomoLine® ISA™ AX+ or accessories in any position that might cause it to fall on the patient.
- Only use Masimo authorized devices with NomoLine® ISA™ AX+. Using unauthorized devices with NomoLine® ISA™ AX+ may result in damage to the device and/or patient injury.
- Carefully route the sampling line to reduce the risk of patient entanglement or strangulation.
- Do not lift the NomoLine® ISA™ AX+ by the NomoLine® capnography sampling line as it could disconnect from the NomoLine® ISA™ AX+, causing the device to fall on the patient.
- Do not use the NomoLine® ISA™ AX+ during magnetic resonance imaging (MRI) or in an MRI environment.

- Only use sample lines intended for anesthetic agents if N2O and/or anesthetic agents are being used.
- Do not re-use disposable single-patient use NomoLine® Family sampling lines due to the risk of cross contamination.
- Do not use the NomoLine® Infant/Neonate Airway Adapter Sets for adults/pediatrics as they may cause excessive flow resistance (0,7 ml dead space).
- Do not use the NomoLine® Adult/Pediatric Airway Adapter Sets for infants/neonates as the airway adapter adds 6 ml dead space.
- Do not apply negative pressure to remove condensed water from the NomoLine® Family sampling line.
- Since a successful zeroing requires the presence of ambient air (21% O2 and 0% CO2) ensure that the NomoLine® ISA™ AX+ is placed in a well ventilated place. Avoid breathing near the NomoLine® ISA™ AX+ before or during the zeroing procedure.
- Exhaust gases should be returned to the patient circuit or to a scavenging system.
- Due to the risk of patient cross-infection, always use a bacteria filter on the exhaust port side if sampled gas is intended to be re-breathed.
- NomoLine® ISA™ AX+ should not be used as the sole basis for medical decisions. It must be used in conjunction with clinical signs and symptoms.
- Use of high-frequency electrosurgical equipment in the vicinity of NomoLine® ISA™ AX+ may produce interference and cause incorrect measurements.
- Do not use the NomoLine® ISA™ AX+ with metered-dose inhalers or nebulized medications as this may clog the bacteria filter.
- Properly apply sampling lines according to the sampling lines directions for use. Misapplied sampling lines that become partially dislodged may cause no or incorrect readings.
- Replace the sampling line if the sampling line input connector starts flashing red, or host device displays a check sampling line type of message.
- Use of this equipment adjacent to or stacked with other equipment should be avoided because it could result in improper operation. If such use is necessary, this equipment and the other equipment should be observed to verify that they are operating properly.
- Portable and mobile RF communications equipment (including peripherals such as antenna cables and external antennas) should be used no closer than 30cm (12 inches) to any part of the NomoLine® ISA™ AX+ including the cable. Otherwise, degradation of the performance of the NomoLine® ISA™ AX+ could result.
- Too strong positive or negative pressure in the patient circuit might affect the sample flow.
- Strong scavenging suction pressure might affect the sample flow.
- To avoid electric shock, always physically disconnect the NomoLine® ISA™ AX+ and all patient connections before cleaning.
- Do not attempt to remanufacture, recondition or recycle the NomoLine® ISA™ AX+ as these processes may damage the electrical components, potentially leading to patient harm.
- Any changes or modifications not expressly approved by Masimo shall void the warranty for this equipment and could void the user's authority to operate the equipment.
- Use of accessories and cables other than those specified or provided could result in increased electromagnetic emissions or decreased electromagnetic immunity of this equipment and result in improper operation.
- Dispose NomoLine® Family sampling lines in accordance with local regulations for biohazardous waste.

CAUTION:

- NomoLine® ISA™ AX+ is to be operated by, or under the supervision of, qualified personnel only. Read this Operator's Manual, accessories directions for use, all precautionary information, and specifications before use. Refer to the host device operator's manual or user's guide for additional safety information, warnings and cautions.
- Do not operate NomoLine® ISA™ AX+ outside of the specified operating environment.
- NomoLine® ISA™ AX+ should be mounted securely to avoid risk of damage to the NomoLine® ISA™ AX+.
- Do not sterilize or immerse NomoLine® Family sampling lines in liquid.
- To avoid permanent damage to the NomoLine® ISA™ AX+, do not use undiluted bleach (5% - 5.25% sodium hypochlorite) or any

other cleaning solution not recommended.

- Do not use petroleum-based or acetone solutions, or other harsh solvents, to clean the NomoLine® ISA™ AX+. These substances affect the device's materials and device failure can result.
- Do not submerge the NomoLine® ISA™ AX+ in any cleaning solution or attempt to sterilize by autoclave, irradiation, steam, gas, ethylene oxide or any other method. This will seriously damage the device.
- To prevent damage, do not soak or immerse NomoLine® ISA™ AX+ in any liquid solution.
- Disposal of Product: Comply with local laws in the disposal of the device and/or its accessories.

NOTE:

- Disconnect the device from AC mains by removing the device cable connection from the host device.

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