petMAP™

ETCO$_2$ Module

Operator's Manual

Compatible with

petMAP+*II* and petMAP*XM*

www.petmap.com

Developed by:
RAMSEY MEDICAL INC

Manufactured, Distributed and Serviced by:
cardio COMMAND

This manual applies to the operation of the CO2 Module (REF# 9078), available as an option with the petMAP+*II* and petMAP *XM* multi-parameter monitors. The CO2 Module requires a petMAP+*II* or petMAP *XM* monitor to be useful. Read this manual and the relevant petMAP manual completely before using the equipment.

petMAP+*II* and petMAP *XM* are to be operated by qualified personnel only. Before use, familiarize yourself with the device and read the manuals, including all warnings and cautions. The user should check that the petMAP, along with its accessories, is functioning both safely and effectively prior to use.

CO2 Module OPERATOR'S MANUAL

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INTRODUCTION

Device Description

The petMAP CO2 Module incorporates a mainstream type of CO2 sensor for use on intubated patients and allows the petMAP+*II* or *XM* to display the capnograph as well as the CO2 values: ETCO2 (End Tidal CO2), InspCO2 (Inspired CO2), RtCO2 (Realtime CO2) and RRCO2 (Respiration Rate from the CO2 waveform). The CO2 sensor resides on the airway and has a nine-foot cable that plugs into the connector labeled "CO2" on the side of the petMAP. The Module includes two airway adapters, one for larger endotracheal (ET) tubes and one for smaller ET tubes.

Intended Uses

The petMAP CO2 Module is intended for use on veterinary patients when measuring or monitoring of carbon dioxide is desired. When configured with a mainstream CO2 Module, the petMAP+*II* or XM will also display the CO2 waveform, CO2 values and RRCO2. It can be used on a wide variety of veterinary patients, but is primarily designed for companion animals. Applications include use for surgical, ICU and trauma monitoring as well as use during procedures (imaging, dentals, etc.) in which an ET tube is used.

Principles of Operation

The petMAP CO2 Module uses advanced dual channel non-dispersive infrared absorption spectrum technology. Infrared light is generated by the sensor and beamed through the sample cell to a detector on the opposite side. CO2 from the patient absorbs some of the infrared energy. The sensor determines the CO2 concentration by measuring the light absorbed by these gases. Respiration rate is calculated by measuring the time interval between detected breaths.

Configurations & Accessories

The following table summarizes the standard accessories and optional accessories available for the petMAP CO2 Module:

	Product Code	Description
Standard Accessories (included with the Module)	**9078 CO2 Module**	➢ CO2 mainstream sensor with Connector Cable (≈9') ➢ 2 airway adapters (large & small) ➢ Operator's Manual
	9034	Large Airway Adapter
	9035	Small Airway Adapter

SYMBOLS

Caution Symbol

Consult Manual Symbol

CE Complies with the requirements of Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to electromagnetic compatibility (recast) and Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (recast).

UK CA United Kingdom Conformity Assessed - Complies with the requirements of Great Britain Legislation, The Product Safety and Metrology etc. (Amendment etc.) (EU Exit) Regulations 2019.

WARNINGS & CAUTIONS **(Please read and understand)**

⚠ The petMAP+*II* , petMAP XM and petMAP CO2 Module are intended for VETERINARY USE ONLY. Do not use on a human patient.

⚠ The user should be aware that erroneous measurement of ETCO2 due to any cause (eg., improperly placed or secured ET tube, airway disconnect, equipment or sensor damage, excess humidity in the ventilation circuit, electronic failure, etc.) could lead to potentially less than effective or inappropriate ventilator adjustments or other inappropriate changes or interventions. Always confirm that the CO2 monitoring system is setup and connected properly and correlate unexpected or unexplained changes in CO2/capnograph readings with the clinical circumstances and environment and an arterial blood gas measurement comparison.

⚠ Use of an Electrosurgical Unit (ESU) can potentially result in interference on the CO2 trace and the CO2 numeric values. If ESU interference adversely impacts the CO2 waveform, do not use the CO2 data until the CO2 waveform has been stable for 10 seconds or more after ESU use. The BP and SpO2 are typically not adversely affected by ESU usage, but under certain circumstances the ESU could adversely affect them. Always assure that the ESU ground plate is well placed on the patient and placed distant from the ECG electrodes.

⚠ The following factors can influence the ETCO2 measurement: nitrous oxide, elevated oxygen levels, barometric pressure, vapor or patient secretions, halogenated agents, aerosolized pharmaceuticals or nitric oxide.

⚠ Do not use the CO2 Module if it does not respond as it is intended and expected to perform, if it is wet or damp, or if the module or the cable or the connector appears to have been dropped or damaged in any way.

⚠ A loss of the ETCO2 reading, an acute change in the CO2 reading or waveform or a diminished reading or waveform may be the result of excessive moisture or secretions on the two airway adapter “windows” that are the infrared light path that is used to measure the CO2 level. Remove the airway adapter from the monitoring circuit and observe if there is moisture on the “windows”. If so, clean and dry excess moisture and secretions from the inside of the airway adapter, taking care not to damage the clear “windows” of the adapter. Always keep the infrared "windows" in vertical position and level with or above the patient so that secretions do not drain into the sensor.

⚠ Do not store the CO2 Module at temperatures less than 14 degrees F or greater than 131 degrees F. Do not operate the sensor at temperatures less than 50 degrees F or greater than 104 degrees F.

⚠ Do not immerse the CO2 sensor in water or any liquid. If the CO2 sensor is accidentally wetted, it should be thoroughly dried before use. If the CO2 Module has been dropped into water or other fluid, it should not be used and should be returned to the manufacturer for service. Never sterilize or immerse the sensor in liquids.

⚠ If the CO2 Sensor has been dropped or damaged in any way, it should be checked by qualified service personnel to ensure proper operation prior to use.

⚠ Use of accessories other than those specified by Ramsey Medical may result in danger to the patient, malfunction of the monitoring unit, and additional increased electro-magnetic (EM) emissions or decreased EM immunity of the device.

⚠ Follow local governing ordinances and recycling instructions regarding disposal and recycling of device components and packaging

⚠ The petMAP is not intended for use on patients being imaged with an MRI device since the petMAP device contains magnetically active materials and could result in injury if used or placed too close to an MRI device, even if the MRI is not operating, since the MRI magnet is still active even if not in use.

⚠ Do not gas sterilize or autoclave the device.

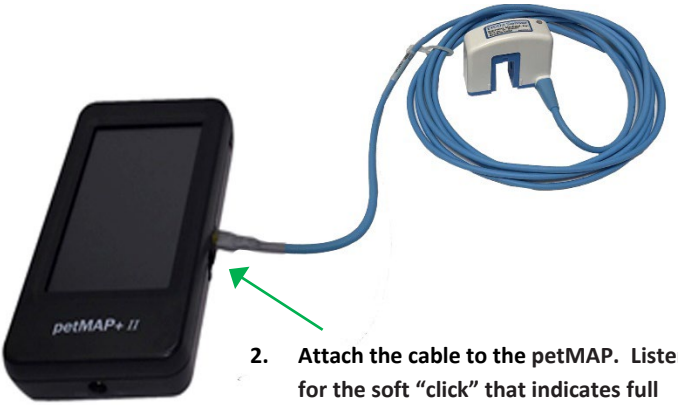
EMC DECLARATION

The CO2 Module (REF# 9078) has been tested together with its host petMAP as a system. Please refer to the petMAP+II and/or petMAP *XM* Manuals (R400257 and R400375, respectively) for detailed EMC compliance information.

DEVICE OVERVIEW & OPERATING INSTRUCTIONS

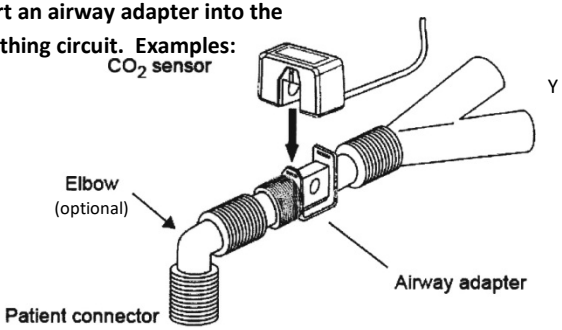
Controls & Connections. Note the below diagram for connecting the CO2 Module to the petMAP+*II* or XM and the patient's respiratory circuit.

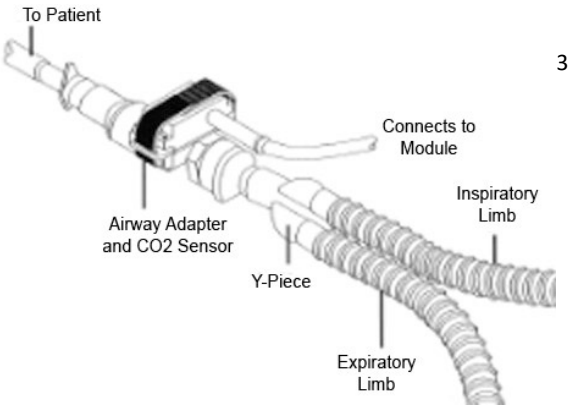
1. **Locate the connector labeled "CO2" on the side of the petMAP, taking care to avoid plugging the CO2 connector into the larger ECG connector of the +II.**
   NOTE: If a petMAP cover is in use, lift the flap to reveal the connector.



2. **Attach the cable to the petMAP. Listen for the soft "click" that indicates full insertion.**

3. **Insert an airway adapter into the breathing circuit. Examples:**





3. **Attach the sensor to the airway adapter.**
   ******Note that the airway and sensor must be in the upright vertical position as shown.**

Operating Instructions/User Selections.

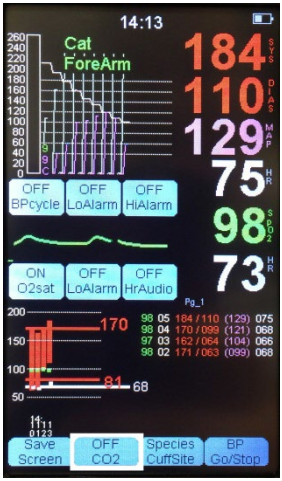
Note 1: The CO2 Module is shipped with the large airway adapter attached to the sensor. The sensor has been "zeroed" with that airway adapter attached prior to shipment and should not need to be zeroed again before use. However, anytime the airway adapter is changed on the sensor, the sensor must be "zeroed" with the new airway adapter in place.

Zeroing the sensor:

1. Ensure no CO2 gas is in the airway adapter.
2. Access the CO2 sensor zero screen on the petMAP setup menu by pressing and holding your finger on bottom left quadrant of the touch screen while powering ON the petMAP with the power button. Release the touch screen at the count of 10 to enter the CO2 sensor zeroing mode.
3. Observe the on-screen messages for warm-up and zeroing. Both warm-up and zeroing should complete within 2 minutes each.
4. Wait for the petMAP to report "Finished Zeroing" on the display—the petMAP will automatically power OFF. Power the petMAP unit ON and turn on the CO2 function. Verify the displayed instantaneous CO2 value (not the ETCO2 CO2) is 0 or 1, and if not, re-zero the device.

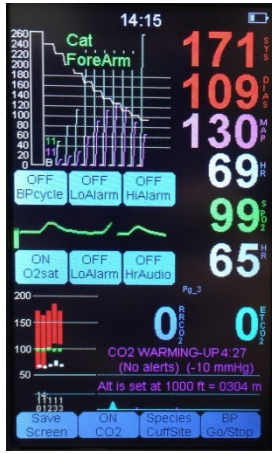
Note 2: During the CO2 warm-up period, the petMAP's programmed altitude is displayed and should be confirmed by the user to be acceptably close to their actual altitude (or elevation). The petMAP unit is set by default at time of manufacture to assume a user altitude of 1000 feet (304 meters) which will give CO2 accuracy within +/- 3 mmHg for user altitudes anywhere from sea level to approximately 2000 feet (610 meters). For best accuracy of CO2 measurement, the user's current altitude should be set using the Set Altitude/Time/Date option #6 on the setup menu (see the petMAP Operator's Manual for instructions to get into the set-up menu or refer to the instructions above). This #6 setup option will allow the user to set the elevation to the nearest 100 feet (30 meters) which will eliminate the potential small offsets mentioned above if the user is substantially different from 1000 feet (304 meters) altitude programmed in as the default altitude at time of manufacture. After changing the altitude, the unit will retain the new altitude until it is changed by the user again.

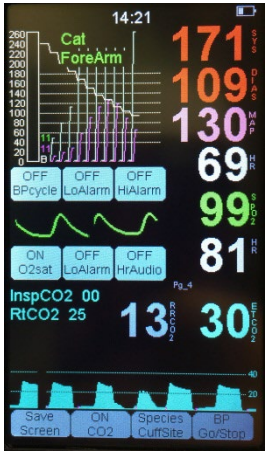
1) Follow the earlier instructions for installing an airway adapter and placing the CO2 sensor on the adapter.



2) Turn CO2 ON by pressing the highlighted CO2 ON/OFF button on the bottom of the petMAP *display*.

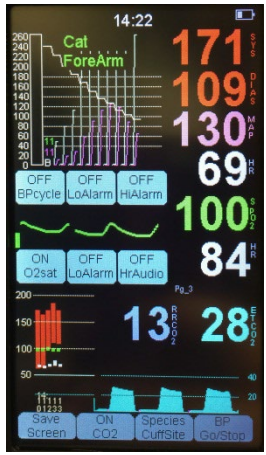
3) Wait 2minutes for warm-up—note the message counts down from 2 minutes. Note also that during this warm-up time no alerts are displayed or sounded. The warm-up message also displays the altitude setting. To change the altitude, please refer to the petMAP Operator's Manual and instructions, above.





4) When the warm-up is complete, the bottom portion of the petMAP display will look like this if Pg_4 is selected, displaying the capnograph, ETCO2 value and RRCO2 (Respiration Rate from CO2). InspCO2 (Inspired CO2) and RtCO2 (Realtime CO2) are also displayed.

5) Pg_3 is an alternate display format showing a short trend of the BP and other values in addition to the ETCO2, RR and a shorter capnograph. NOTE: Alternate displays are achieved by touching the screen area in the lower portion of the screen above the bottom row of buttons repeatedly until the desired display is reached.



6) When monitoring is complete, turn CO2 OFF by touching the ON CO2 button.

Alarms Generated by the CO2 Monitoring System

The following alarms (No Breath, Low CO2 and High CO2) can be generated by the CO2 Module and displayed on the petMAP to alert the user to very abnormal CO2 conditions.

NOTE: The levels chosen for high and low ETCO2 alarm trigger points are designed solely as a backup for a vigilant user, to alert the user if they have inadvertently failed to previously detect an adverse patient CO2 level or trend. Consequently, it is imperative for the user to understand that the absence of a CO2 alarm does not mean that the patient's CO2 is appropriate or acceptable for that patient, and the presence of an alarm should not be viewed as anything but an alert that CO2 levels have trended way beyond the normally expected CO2 ranges. As always, the user is expected to detect CO2 problems and correct them long before the alarms have been triggered. For all of the CO2 alarms, there is a startup delay of approximately 2 minutes during the warm-up period where no alarms will sound. After warm-up, there is a delay before sounding the CO2 alarms of approximately 20 seconds to allow the user to detect and correct CO2 conditions without the disturbance of the alarm actually sounding and also to prevent annoying inappropriate alarms for transient events or user initiated changes in CO2 monitoring setup.

CO2 is an important parameter to monitor for assessing the patient's ventilation and physiologic status during anesthesia, and its routine use is highly recommended by monitoring experts. However, CO2 monitoring can be somewhat complex due to its ability to indicate major and minor problems with the patient's breathing, the patients cardiovascular status, the patient's metabolic status, the ventilation setup/equipment and user techniques. Because of this complexity, the user should educate themselves thoroughly in the CO2 monitoring procedure and the interpretation of the CO2 values and CO2 waveforms. There are many resources in print, in video and on the internet that teach capnography use and interpretation. The user of the petMAP CO2 Module is urged to avail themselves of these educational resources early so that they are educated in CO2 monitoring and interpretation before using the device on actual patients.

ALARMS	
No Breathing CO2	The CO2 capnograph waveform amplitude is insufficient for breaths to be detected. Possible causes include: the ventilator is not functioning properly, there is a ventilation tubing disconnect, the ET tube is not in the patient or the patient is not breathing for whatever reason, etc, etc. Identify and correct the problem.
High End Tidal CO2	Displayed when ETCO2 > 60 mmHg This can be caused by the patient not being adequately ventilated due to airway problems, ventilation tubing problems, ventilator settings, bagging frequency and/or by a problem/malfunction with the ventilation system including the setup, the valves, the CO2 absorber or other components. Refer to CO2 monitoring educational material for all causes and cures. Identify the problem(s) and correct.
Low End Tidal CO2	Displayed when ETCO2 < 15 mmHg This can be caused by the patient being over ventilated due to ventilator settings, bagging frequency and/or by a problem/malfunction with the ventilation system including the setup, the valves, the CO2 absorber or other components. Refer to CO2 monitoring educational material for all causes and cures. Identify the problem(s) and correct.

Alarms can be silenced by touching the screen.
The above alarms are self-canceling when the cause of the alarm is resolved.

MAINTENANCE

CO2 Sensor and Connection Cable: Clean as needed with a cloth dampened with 70% isopropyl alcohol or other disinfectant solution. Do not immerse the sensor or cables in any fluid and do not sterilize the sensor.

Airway Adapter: The airway adapter can be cleaned with water and mild detergent and must be thoroughly rinsed and fully dry inside and out before use. The "windows" must be clear and without moisture or contamination of any kind. Shaking the airway adapter will help to remove water from the inside of the adapter.

Note: For the sensor to function properly, the two clear sensor "windows" on the inner portion of the sensor itself and on the airway adapter must be clean and free of contaminants of any sort, including dust, dirt, grease, or moisture. Anything on the sensor or airway windows will render the CO2 reading erroneous, useless and potentially dangerously inaccurate.

TROUBLESHOOTING

Note: Always check the patient condition first before working to correct any perceived monitoring problems! The perceived problem with the CO2 reading and capnogram monitors may be due to a patient problem, such as not breathing properly or not being ventilated properly which needs to be detected and remedied immediately. Always crosscheck other patient status inputs when there is a perceived problem with any monitor.

Failure to display a usable CO2 waveform and clinically appropriate numbers can be caused by a number of problems and can usually be fixed by correcting one or more of the following technical/equipment problems after patient problems have been detected and eliminated:

1) *Is the CO2 sensor properly connected to the CO2 connector on the petMAP?*

Try disconnecting it and then reconnecting it making sure that it is in the "CO2" connector (not the "ECG" connector of the petMAP +II) and that it is securely seated and is properly retained in the unit if gently pulled.

2) *Are the CO2 sensor and airway adapter properly placed in the ventilation circuit?*

Make sure the sensor is connected in the breathing circuit close to the patient's airway (ET tube) and if a ventilator is being used, make sure the sensor is close to the patient and between the patient and the "Y" of the ventilator. Confirm that the ventilation circuit and all of its elements are properly placed and securely connected.

3) *Is the automatic ventilator (or the "bagger") functioning properly?*

Make sure that the respiratory rate and volume are set correctly and are functioning properly.

WARRANTY/SERVICE

Warranty

Ramsey Medical, Inc. warrants that the CO2 Module, when new, is covered by a one-year warranty against defects in materials and workmanship. All warranties begin at the date of original purchase from CardioCommand, Inc. or its authorized distributors.

Airway adapters are warranted to be free from defects in materials and workmanship for 90 days. These items will require periodic replacement due to normal wear.

Ramsey Medical's obligation under this warranty is limited to repairing or, at its option, replacing defective parts or entire units without charge, if such defects occur as a result of normal use with prompt notification within the warranty period.

Damage resulting from inappropriate use or physical abuse is not covered by the warranty.

THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THOSE EXPRESSLY LISTED ABOVE. IN ADDITION, THERE ARE NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Customer Service & Repairs

All units returned for service and/or repairs (warranty and non-warranty) must have a RMA obtained by calling Customer Service at CardioCommand, Inc. The RMA number obtained should be written on the outside of the shipping container and the device should be sent to:

CardioCommand, Inc.
4920 W. Cypress St., Ste. 110
Tampa, FL 33607
Phone: 800-231-6370
813-289-5555
Fax: 813-289-5454

Please include a complete description of the difficulty with all items returned for service and/or warranty claims.

SPECIFICATIONS

For Veterinary Use Only

CO2 Accuracy: ± .43% +8% of Gas level @25° C

CO2 Measurement Range: 0 – 152 mmHg/0-20%/0-20.3 kPa

Initialization Time: Capnograph and CO2 numerics displayed in less than 20 seconds, reaching full specifications after 2 minutes of warm-up. Alarms are not active during the warm-up period.

RR Accuracy: ±1 breath

RR Measurement Range: 0- 150 breaths per minute

Temperature/Humidity:

Operating:	0°C – 40°C; 10-90% RH, non-condensing
Storage:	-40°C – 70°C; <90% RH, non-condensing

Dimensions: Sensor: 1.95" x .87" x 1.55 "
Cable: Approx. 99"

Weight : .18lbs

HISTORY OF REVISIONS

Document # & Revision	Date	Comments
R400513-A	08/06/21	Manual Released. ECO 210402
R400513-B	11/15/22	Manual updated with UKCA mark. Added CE and UKCA standards to page 6. ECO 221107

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Manual Revision B
11/15/22

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