MOXY

MUSCLE OXYGEN MONITOR

Owner's Manual

©2013 Fortiori Design LLC
All rights reserved. Under copyright laws, this manual may not be copied, in whole or in part, without the written consent of Fortiori.

Moxy and MOXY are registered trademarks of Fortiori Design LLC

US and International Patents Pending

09202013

Introduction

Thank you for purchasing the Moxy Muscle Oxygen Monitor.

Warning:
Always consult your physician before starting or altering any exercise program.

Technical Support:
Contact technical support for your Moxy by emailing info@moxymonitor.com or by calling 320-296-1010.

Moxy Software:
Go to www.moxymonitor.com/downloads to download a PC application that allows you to setup your Moxy and download data from it.

Warning:
There are no user serviceable parts inside the Moxy Sensor. Do not attempt to open the case.

Declaration of Conformity

Refer to the Moxy website at www.moxymonitor.com

Industry Canada Compliance

Category I radio communication devices comply with Industry Canada Standard RSS-210. Category II radio communication devices comply with Industry Canada Standard RSS-310. This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Conformité aux normes d'Industrie Canada

Les appareils de radiocommunication de catégorie I sont conformes á la norme RSS-210 d'Industrie Canada. Les appareils de radiocommunication de catégorie II sont conformes á la norme RSS-310 d'Industrie Canada. **Cet appareil est conforme aux normes RSS sans licence d'Industrie Canada.** Son fonctionnement est soumis au conditions suivantes: (1) cet appareil ne doit pas causer d'interférences et (2) doit accepter toute interférence, y compris les interférences pouvant entraîner un fonctionnement indésirable de l'appareil.

Muscle Oxygen Monitoring

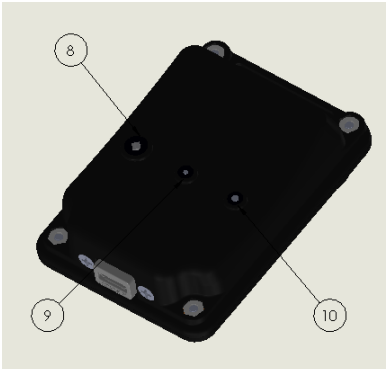
Moxy uses Near Infrared Spectroscopy to measure oxygen levels in muscle. Hemoglobin is the molecule in Red Blood Cells that carries oxygen and it changes color depending on whether it is carrying oxygen or not. Near Infrared light from the sensor travels from the emitter, through the skin, interacts with the muscle and is scatter back up to the detectors. The Moxy algorithm uses the information from the light striking the detectors to determine the Muscle Oxygen Saturation.

The terms Muscle Oxygen Saturation, Muscle Oxygenation, or Muscle Oxygen are often used interchangeably. The abbreviation, SmO_2 is often used as well. SmO_2 is the percentage of hemoglobin in the capillaries of the muscle that is carrying Oxygen. The number can be from 0 to 100%.

Muscle Oxygenation is a localized measurement. Even muscles that are close by each other like the Rectus Femoris and the Vastus Lateralis in the Quadriceps group can have different values. Contralateral muscles may also have different readings.

Muscle Oxygen Monitoring can be used to determine optimal training zones, to monitor intensity, and to set an optimal race pace. Refer to the Moxy website at www.moxymonitor.com for more information.

Moxy Overview



FCC Compliance Statement

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

FCC WARNING

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Wearing the Sensor

The Moxy sensor should be worn over the muscle of interest. Typically, the primary power producing muscles for the given exercise will be used but other muscles may also be of interest.

The sensor should be secured so that the emitter and detector optodes are in contact with the skin. The optodes don't need to be pressed to the skin, but just in contact. Even if the sensor loses contact during vigorous exercise by less than 1 mm, it will still function properly. The sensor can be secured with the Elastic strap or with athletic tape or it may be tucked under compression clothing. Care should be taken to not apply the strap or tape so tight as to restrict blood flow in the muscle.

When using the Moxy sensor under bright lights or in direct sunlight, the light shield that is provided with the Moxy elastic strap will need to be used. The light shield has materials that block the ambient near infrared light. The shield blocks the light from travelling through the tissue and interfering with the Moxy detectors. The Moxy algorithm detects when there is too much ambient light and stops calculating Muscle Oxygen values.

Moxy Overview

1. On/Off Button. Hold for 3 seconds to turn the sensor on or off. Holding the button for 10 seconds will cause a hard reset of the sensor microcontroller. A hard reset will not delete any stored data, but it will reset the clock that is used for timestamps in the stored data. Click the button to mark an event in the stored data.
2. Yellow Indicator LED. This LED is on solid when the sensor is connected with the PC App or when the button has been held long enough for a hard reset
3. USB Port. This is a micro USB port. It is used for charging the sensor or downloading data.
4. Green Indicator LED. This blinks while the sensor is charging and goes on solid when fully charged.
5. The ANT+ antenna is located here.
6. Pressure Equalization Vent Port. The port is covered with a waterproof membrane on the inside.
7. Serial Number. This serial number is used in ANT+ to identify this individual sensor. It is also stored in data files to identify which sensor acquired the data.
8. Emitter Optode
9. Short Spacing Optode
10. Long Spacing Optode

Charging the Moxy Sensor

- Moxy can be charged with any micro USB charger that has the following ratings.
    - UL or CE markings
    - 5V DC Output
    - Output Current between 300 mA and 1.0 A
- Moxy can also be charged with a computer through a micro USB cable.
- Charge time from completely dead to full charge is about 2 hours
- The green indicator LED will blink about once per second during normal charging.
- The green indicator LED will go on solid when the sensor is fully charged.
- The green indicator LED will blink rapidly to indicate a charging fault. To clear the fault, unplug the micro USB charger cable, make sure the sensor is turned off, and plug the micro USB charger cable back in. If the fault persists, the sensor must be returned to the factory for battery replacement.

Pairing Moxy to Legacy Devices

Many display devices have not yet implemented the Muscle Oxygen profile. Devices that are capable of displaying Bicycle Speed and Cadence data can be used to display Moxy Muscle Oxygen data.

- Use the Moxy PC Application to set the ANT+ Profile to Bicycle Speed and Cadence.
- Turn on the Moxy.
- Follow the watch's instructions for pairing to a new speed and cadence sensor and for configuring the display.
- **IMPORTANT:** The wheel size parameter must be set to the following in order to scale the THb values correctly
    - 2070 mm if the speed is displayed in km/hr
    - 3330 mm if the speed is displayed in mi/hr
    - If there is an automatic wheel size function, it must be turned off.
- SmO2 will be displayed in the Cadence Field and THb in the Speed Field.

Display Live Muscle Oxygen Data

Moxy can transmit data over 3 different ANT+ profiles.

- Muscle Oxygen
- Heart Rate Monitor (Typically not used)
- Bicycle Speed and Cadence

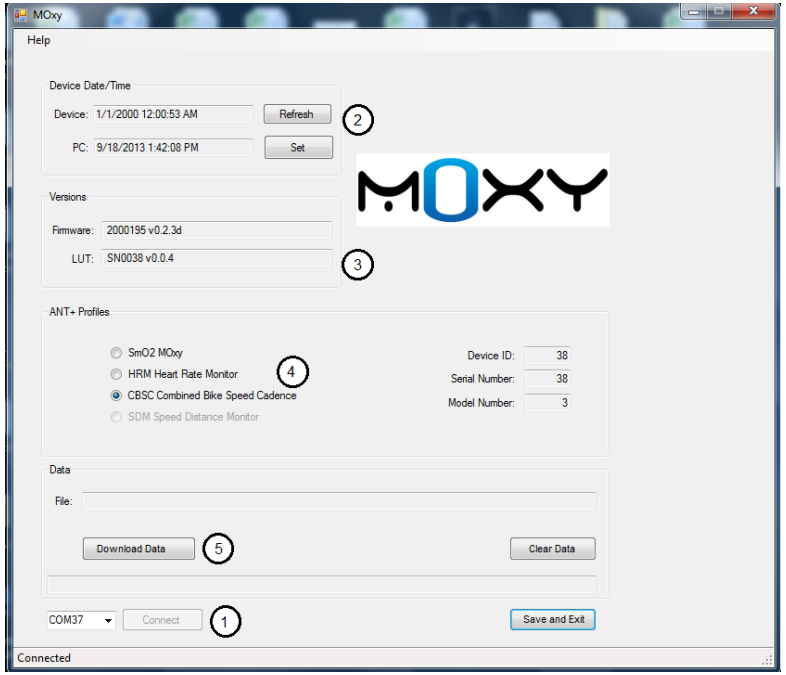
The mode you select will depend on the type of display device that you want to use.

Pairing Moxy to PeriPedal

PeriPedal Software (www.peripedal.com) uses the Muscle Oxygen Profile. To pair to your Moxy Sensor:

- Use the Moxy PC Application to set the ANT+ Profile to Muscle Oxygen.
- In PeriPedal, Click on Edit Profiles.
- Select the User profile that you wish to associate with your Moxy Sensor
- Scroll down to the ANT+ Muscle Oxygen Senor Information
- Turn on the Moxy Sensor
- Click “Search” and then click on “Pair” when it finds the sensor

Moxy PC Application



Moxy PC Application

The Moxy PC Application is used to set up the Moxy and to download data that is stored on the sensor. Go to www.moxymonitor.com/downloads to download the PC application.

1) Connecting to the Moxy Sensor
    a. Use a micro USB cable to connect the Sensor to the PC.
    b. Turn on the Moxy Sensor.
    c. Start the Moxy PC Application.
    d. Pull down the list of COM ports next to the Connect button.
    e. If there is only one sensor connected to the PC, there will only be one COM port listed. Select it.
    f. Click on the Connect Button.
2) Setting the Time
    a. Click on the Refresh button to see the current time that is set on the Moxy Sensor.
    b. Click on the Set button to set the Moxy sensor time to match the PC clock time.
3) Versions – These boxes show the Firmware version and the calibration information on the Moxy Sensor.
4) ANT+ Profiles – Click the radio buttons to set which ANT+ profile the sensor will use to transmit Data.
5) Use the Download and Clear Data buttons to for downloading data from the sensor and deleting the data on the sensor.

Downloading Data

- The Moxy PC Application will prompt you for a file name and location when you download the data.
- The download operation makes a copy of the sensor data on your PC, but it does not delete the data on the sensor.
- You must click on the clear data button to delete the data on the sensor.
- DOWNLOADING MAY TAKE SEVERAL MINUTES if there are hours of data stored on the sensor.
- The data are saved as a .csv file in the following format:

  mm-dd, hh:mm:ss, SmO2 Live, SmO2 Averaged, THb, Lap

- The Date and Time data are based on the time set on the sensor.
- SmO2 Live is the raw SmO2 value that is calculated every 3 seconds.
- SmO2 Averageds is a rolling average of the previous 5 readings.
- THb is the relative Total Hemoglobin measurement calculated every 2 seconds. It is not averaged.
- The Lap number is incremented whenever the on/off button is clicked while data is being recorded.