



MUSCLE OXYGEN MONITOR

Owner's Manual

# Introduction

Thank you for purchasing the Moxy Muscle Oxygen Monitor. This manual covers functionality in Moxy firmware version 1.0 and higher.

## **Warning:**

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

## **Technical Support:**

There is technical support on our Forum at <http://forum.moxymonitor.com/>. Contact technical support by emailing [info@moxymonitor.com](mailto:info@moxymonitor.com) or by calling 320-296-1010.

## **Moxy Software:**

Go to [www.moxymonitor.com/downloads](http://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.

## **ANT+ Compatibility:**



This product is ANT+™ certified for Muscle Oxygen. Visit [www.thisisant.com/directory/](http://www.thisisant.com/directory/) for a list of compatible products and apps.

# Muscle Oxygen Monitoring

Moxy uses Near Infrared Spectroscopy (NIRS) to measure oxygen levels in muscle. Hemoglobin is the molecule in red blood cells that carries oxygen; it changes color depending on whether it is carrying oxygen or not. Near-Infrared light generated by the Sensor travels from the emitter through the skin to interact with the muscle, after which the light is scattered back to the detectors in the Sensor. 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, and Muscle Oxygen are the abbreviation,  $SmO_2$  are used interchangeably.  $SmO_2$  is the percentage of hemoglobin in the capillaries of the muscle that is carrying Oxygen. The number can be from 0 to 100%. Total hemoglobin, THb, is a relative measure of the amount of hemoglobin in the optical path of the sensor

Muscle Oxygenation is a localized measurement. Even muscles that are close to each other, such as 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 training intensity, and to set an optimal race pace. Refer to the Moxy website at [www.moxymonitor.com](http://www.moxymonitor.com) for more information.

# Moxy Overview



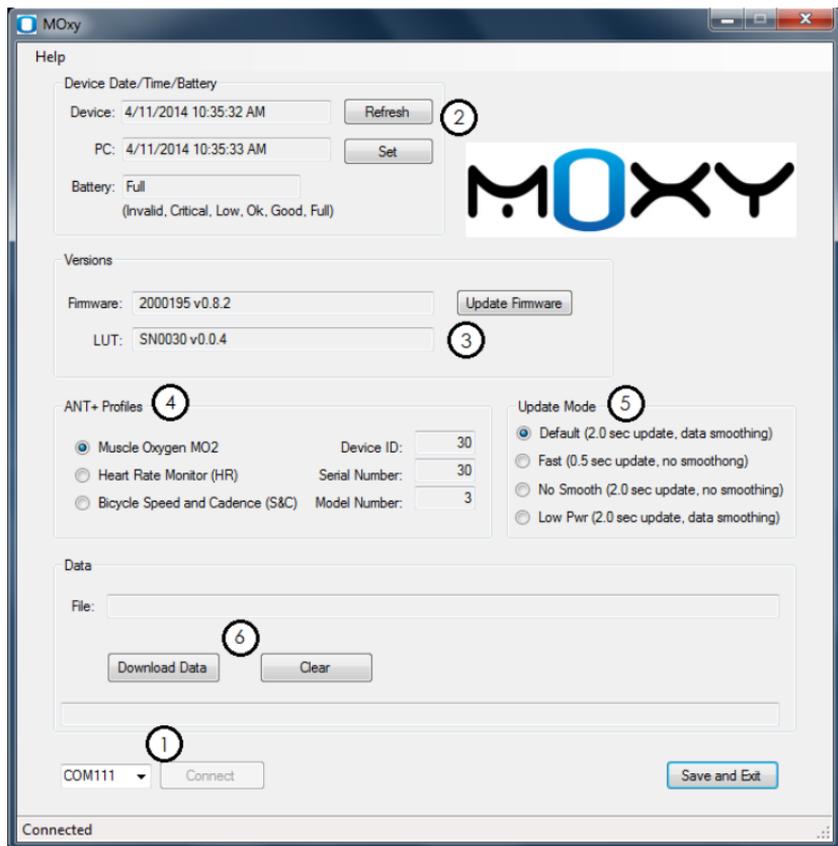
# Moxy Overview

1. On/Off Button. Hold for 3 seconds to turn the sensor on or off. Holding the button for more than 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 time stamps in the stored data. Short click the button to make the green LED indicate the battery charge level. A short click also marks a lap in the data stored on the sensor.
2. Yellow Indicator LED.
  - On solid indicates connection to the Moxy PC App.
  - A blink after a short button click indicates that the sensor is on.
3. USB Port. This is a micro USB port. It is used for charging the Sensor or downloading data.
4. Green Indicator LED. This is used to indicate battery status.
  - Short blinks while the USB cable is plugged in indicate charging in progress.
  - After a short button click, the number of blinks indicates charge level
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 Moxy 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 and it will turn off when the sensor is fully charged.
- A short click of the On/Off button will cause the green indicator LED to blink a certain number of times to indicate the current charge level. 4 blinks indicate fully charged with 3, 2, or 1 blink indicating a lower level of charge.
- 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 repair.

# 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](http://www.moxymonitor.com/downloads) to download the latest version of the PC application.

- 1) Connecting to the Moxy Sensor (Sensor can be On or Off)
  - a. Use a micro USB cable to connect the Sensor to the PC. The first time you connect a sensor to a PC, it will automatically download the communication driver. This can take several minutes.
  - b. Start the Moxy PC Application and Click on Connect.
  - c. If there is no COM port showing next to the Connect button that means the driver download failed. Contact tech support.
- 2) Setting the Time
  - a. Refresh shows the current time on the Moxy Sensor.
  - b. Set sets the Moxy sensor time to match the PC clock time.
  - c. Note that some display devices will automatically set the Moxy Sensor time to match the display device time when they pair.
- 3) Versions – These boxes show the Firmware version and the calibration information on the Moxy Sensor. Use to Update Firmware button to load new versions of Firmware on the sensor.
- 4) ANT+ Profiles – Select the radio button to set which ANT+ profile the Sensor will use to transmit data.
- 5) Update Mode – Select the radio button to set the data update rate mode.
- 6) 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 will be saved as 2 files with different formats.
  - The .FIT format is useful for importing the data into other software packages that support .FIT such as Golden Cheetah.
  - The .CSV file is useful for analysis in software like a spreadsheet. The .CSV format is:  
mm-dd, hh:mm:ss, SmO<sub>2</sub> Live, SmO<sub>2</sub> Averaged, THb, Lap

# Update Mode

- Default Mode has the Moxy sensor calculate new SmO<sub>2</sub> and THb readings every 2 seconds. The displayed value is the average of the 5 most recent readings.
- Fast Mode has the Moxy sensor calculate a new SmO<sub>2</sub> reading every 0.5 seconds. There is no averaging.
- No Smooth Mode is the same as Default but with no averaging.
- Low Power mode is the same as Default except fewer LED cycles are used so the batter life is extended.

# Display Live Muscle Oxygen Data

A third party product is required to Display Live Muscle Oxygen Data. Moxy can transmit data over 3 different ANT+ profiles:

- Muscle Oxygen
- Heart Rate Monitor
- Bicycle Speed and Cadence

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

## Muscle Oxygen Profile

The Muscle Oxygen Profile is the preferred profile for connecting Moxy to a display or recording device because it supports all of the functions of the Moxy Sensor. Follow the instructions with your Muscle Oxygen compatible product for pairing to the Moxy. The following products have the Muscle Oxygen Profile capability. Visit [www.thisisant.com/directory/](http://www.thisisant.com/directory/) for the latest complete list of compatible products.

Peripedal – [www.peripedal.com](http://www.peripedal.com)

PerfPro – [www.perfprostudio.com](http://www.perfprostudio.com)

IpBike – [www.iforpowell.com](http://www.iforpowell.com)

Wimu and Quiko – [www.realtracksystems.com](http://www.realtracksystems.com)

SelfLoops - [www.selfloops.com](http://www.selfloops.com)

Golden Cheetah – [www.goldencheetah.org](http://www.goldencheetah.org)

Garmin ConnectIQ – [www.garmin.com](http://www.garmin.com)

IT4Cycling – [www.it4cycling.com](http://www.it4cycling.com)

Training Mate – [www.training-mate.com](http://www.training-mate.com)

# Pairing Moxy to Legacy Devices

Many display devices have not yet implemented the Muscle Oxygen profile. Devices that are capable of displaying ANT+ 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.
- SmO<sub>2</sub> will be displayed in the Cadence Field and THb in the Speed Field.



# Wearing the Sensor

The Moxy Sensor should be worn over the muscle of interest. Typically, the primary power-producing muscles for a 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 rather just in contact with it. 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 Moxy Adhesive Attachments, athletic tape, or tucked under compression clothing or wraps.



When using the Moxy Sensor under bright lights or in direct sunlight, the Moxy Light Shield (purchased separately) or some suitable equivalent needs 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 is water resistant so protection from perspiration is not required. If Moxy is used under water, it should be placed in a small clear ziplock bag for added protection and to allow the pressure equalization port to function properly.



# 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.

# 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 à la norme RSS-210 d'Industrie Canada. Les appareils de radiocommunication de catégorie II sont conformes à la norme RSS-310 d'Industrie Canada. **Cet appareil est conforme aux normes RSS sans licence d'Industrie Canada.** Son fonctionnement est soumis aux 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.

# Declaration of Conformity

Application of Council Directive: 1999/5/EC

Standards to Which Conformity is Declared:

IEC 60950-1 Issued:2005/12/08 Ed:2 Information Technology equipment – Safety - Part 1: General Requirements; Corrigendum 1: 08/2006; Amendment 1:2009/12/17

ETSI EN 300 440-2 Issued:2004/07/01 V1.1.2 Electromagnetic compatibility and Radio spectrum Matters (ERM); Short range devices; Radio equipment to be used in the 1 GHz to 40 GHz frequency range; Part 2: Harmonized EN under article 3.2 of the R&TTE Directive

ETSI EN 301 489-3 Issued:2002/08/01 V1.4.1 (ERM) & (EMC) Standard for Radio Equipment and Services; Part 3: Specific Conditions for Short-Range Devices (SRD) Operating on Frequencies between 9 KHz and 40 GHz

Manufactured by: Fortiori Design LLC  
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Hutchinson, MN 55350

Type of Equipment: Information Technology Equipment (Muscle Oxygen Monitor)

Model Number: MOXY3

The undersigned does hereby declare that the equipment complies with the above directives.

Roger W Schmitz September 25, 2013  
Chief Engineer – Fortiori Design LLC

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