Trigno® Link

Communication Module

User's Guide

MAN-048-1-0
MP1483A

Important Information

Intended Use

The Trigno Link is a USB-powered communication module that supports the Bluetooth (BLE v4.2) and ANT+ wireless protocols as well as the Trigno wireless protocol for connecting BLE-enabled or ANT+ enabled devices to the Trigno Wireless Biofeedback System. The Trigno Link module is intended for research, educational/teaching, and general wellness/fitness purposes.

The Trigno Link module, sensors connected to it, and data resulting from theses sensors are not intended to be used for medical purposes.

Refer to manufacturer user guide of specific sensors for additional information.

Technical Service and Support

For information and assistance please visit our website at:
www.delsys.com
Contact us at:
E-mail: support@delsys.com
Telephone: (508) 545 8200

Warnings and Precautions

Consult all accompanying documents for precautionary statements and other important information.

Refer to accompanying user's guides of 3rd party devices for additional instructions.

Keep the device dry. The ingress of liquids into the device may compromise the safety features of the device.

Handle with care.

Sensitive electronic device. Avoid static discharges. Do not operate or store near strong electrostatic, electromagnetic, magnetic, or radioactive fields. Interference from external sources may decrease the signal-to-noise ratio or result in corrupted data.

Immediately discontinue use of the device if a change in the device's performance is noted. Contact Delsys technical support for assistance.

Delsys Inc. guarantees the safety, reliability, and performance of the equipment only if assembly, modifications, and repairs are carried out by authorized technicians; the electrical installation complies with the appropriate requirements; and the equipment is used in accordance with the instructions for use.

Report any serious incidents with the device to Delsys at 508 545 8200 or support@delsys.com.

Store and operate between 5 and 45 degrees Celsius.

Device Information

Complies with requirements put forth by the Radio Equipment Directive 2014/53/EU, the EMC Directive 2014/30/EU and the RoHS Direcive 2011/65/EU.

Date of Manufacturing (appears on device package)

Manufacturer:
Delsys Inc.
23 Strathmore Rd.
Natick, MA, 01760, USA

Serial Number (appears on device)

Dispose the device according to local rules for electronic waste.

Federal Commumunication Commission Interference Statement
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 an 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 of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

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

Contains FCC ID: SQGBL654PA

Contains IC/ISED: 3147A-BL654PA

Contains KC: R-C-LAI-BL654PA

This device complies with Industry Canada's license-exempt RSSs. 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.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence.

L'exploitation est autorisée aux deux conditions suivantes:

1. l'appareil ne doit pas produire de brouillage;

2. l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Radiation Exposure Statement

The product complies with the Canada portable RF exposure limit set forth for an uncontrolled environment and are safe for intended operation as described in this manual. The minimum separation distance for portable use is limited to 15mm assuming use of antenna with 2 dBi of gain. The further RF exposure reduction can be achieved if the product can be kept as far as possible from the user body or set the device to lower output power if such function is available.

Déclaration d'exposition aus radiations:

Le produit est conforme aux limites d'exposition pour les appareils portables RF pour les Etats-Unis et le Canada établies pour un environnement non contrôlé. La distance de séparation minimale pour l'utilisation portative est limitée à 15mm en supposant l'utilisation de l'antenne avec 2 dBi de gain. Le produit est sûr pour un fonctionnement tel que décrit dans ce manuel. La réduction aux expositions RF peut être augmentée si l'appareil peut être conservé aussi loin que possible du corps de l'utilisateur ou que le dispositif est réglé sur la puissance de sortie la plus faible si une telle fonction est disponible.

ISED ICES-003 Issue 7 Compliance Declaration This device was originally tested to the requirements of ICES-003 Issue 6, Information Technology Equipment (Including Digital Apparatus) — Limits and Methods of Measurement; and evaluated to the updates published in ICES-003, Issue 7, Information Technology Equipment (Including Digital Apparatus). Based on this evaluation, this product continues to observe compliance to the requirements set forth by The Innovation, Science and Economic Development Canada (ISED), and complies with the updates published in ICES-003, Issue 7, Information Technology Equipment (Including Digital Apparatus)

Pursuant to FCC 15.21 of the FCC rules, changes not expressly approved by Delsys Inc. could void the User's authority to operate the equipment.

Requirements

- PC running Windows 10/11
- Two USB 2.0 (or higher) ports
- Trigno Wireless Biofeedback System
- Trigno Discover Software, V1.6.2 or later

Trigno Link Overview

The Trigno® Link communication module is designed to interface with ANT+ and BLE-compliant devices and stream data from these devices into Trigno Discover Software. The module operates in concert with the Trigno Wireless Biofeedback System, synchronizing data from connected BLE/ANT+ sensors with data from the Trigno Avanti sensors. A minimum of one Trigno Avanti sensor must be in operation in order for this synchronization and data transfer to occur. The Trigno Link module will communicate with either the ANT+ protocol or the Bluetooth Light Energy (BLE) protocol but cannot communicate with both simultaneously. Multiple ANT+ sensors or multiple BLE sensors can be supported at one time. Note that some sensors support both communication modes. To facilitate operation, the system will remember the previous configuration used.

Trigno Link Setup

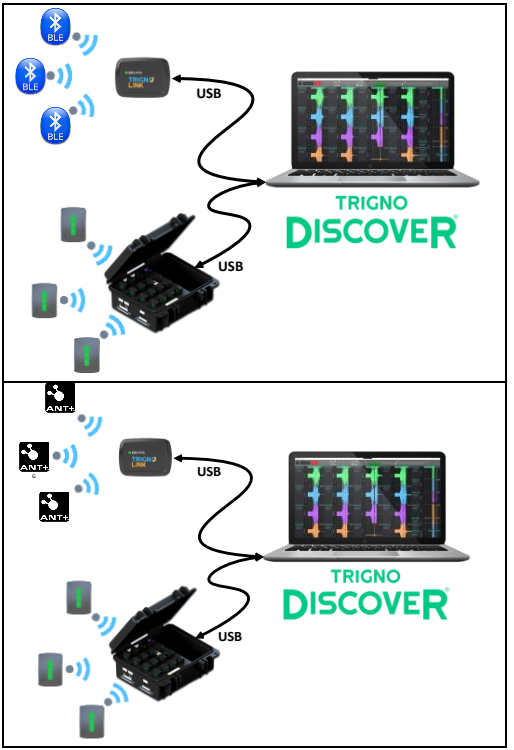

Figure 1: The Trigno Link Communication module working with the Trigno Wireless Biofeedback System, Trigno Discover software, and 3rd party BLE devices (top) and ANT+ devices (bottom).

Bluetooth Low Energy (BLE)

The BLE communication protocol (also known as Bluetooth Smart) is ubiquitous in commercial devices and operates in the same 2.4 GHz frequency space as the Trigno system and many other protocols (such as Wi-Fi for networking and Zigbee for IoT devices). Once identified in software, a formal connection is made to establish a two way connection between the BLE device and its host (Trigno Link). The Trigno Link can support up to 6 simultaneous BLE connections at one time. The Trigno Link automatically manages frequency allocations to prevent overlapping interferences between Trigno and BLE devices.

ANT+

Similar to the BLE communication protocol, the ANT+ protocol is designed to support communication on many wireless devices to a central node. This communication standard is defined and managed by Garmin Inc. and is often found in devices used in the fitness industry. Once turned on, ANT+ devices will immediately transmit data for any approved host in the vicinity. The Trigno Link can support up to 6 simultaneous ANT+ connections at one time. The Trigno Link automatically manages frequency allocations to prevent overlapping interferences between Trigno and ANT+ devices.

Trigno Link LED Feedback States

The Trigno Link module indicates its status through various LED indicator colors and blink patterns as outlined in the table below.

Trigno Link State		Color	Pattern
1	Off	off	n/a
2	Power On	amber	solid
3	USB Connection	green	solid
4	Searching ANT+ Sensors	amber	slow flash
5	Data gathering ANT+, synchronous	green	slow flash
6	Data gathering ANT+, asynchronous	green / amber	slow flash
7	Searching BLE Sensor	magenta	slow flash
8	Data gathering BLE, synchronous	blue	slow flash
9	Data gathering BLE, asynchronous	blue / magenta	slow flash
10	Stage I Firmware Update	red	breathing
11	Stage II Firmware Update	cyan	double flash
12	Firmware fault	red	rapid flash

Table 1: Trigno Link LED functions

LED State Descriptions

1) **Power Off**: No LED activity is present when the module is off or disconnected from USB power.
2) **Power On:** Indicates a connection to USB port, otherwise dormant.
3) **USB Connection**: Device is initialized and ready for activity.
4) **Searching ANT+ Sensors**: Device is scanning to connect with any compatible ANT+ sensors that are broadcasting.
5) **Searching BLE Sensors**: Device is scanning to connect with any compatible BLE Sensors that are broadcasting.
6) **Data Gathering ANT+ Synchronous:** Data are streaming from connected ANT+ sensors and time synchronized with Trigno Sensor.
7) **Data Gathering BLE Synchronous:** Data are streaming from connected BLE sensors and time synchronized with Trigno Sensors.
8) **Data Gathering ANT+ Asynchronous:** Data are streaming from connected ANT+ sensors with no synchronization with Trigno sensors.
9) **Data Gathering BLE Asynchronous:** Data are streaming from connected BLE sensors with no synchronization with Trigno Sensors.
10) **Stage I Firmware Update:** Update firmware on stage I microcontroller.
11) **Stage II Firmware Update:** Update firmware on stage II microcontroller (Trigno com system).
12) **Firmware Fault**: Incompatible command, automatic device reset.

List of Compatible Devices

The Bluetooth and ANT+ standards define protocols for communicating between one or more host devices and with one or more sensor peripherals. While the protocols are standardized, the exact details of how to engage with and parse data from a sensor is unique to the sensor itself. The following is a list of devices and associated firmware versions that are compatible with the Trigno Link module. This list of compatible devices will be updated from time to time. Be sure check for the latest compatibility offerings in this user guide and on the Delsys web site.

Device Name	Manufacturer	Communication	Model	Firmware
Jamar Smart Hand Dynamometer	Performance Health www.performancehealth.com	BLE	081669928	N/A
H10 Polar Heart Rate Monitor	Polar Electro Oy www.polar.com	BLE ANT+	H10	3.1.1
MoxyMonitor Muscle Oxygen Sensor	Fortiori Design LLC www.moxymonitor.com	BLE ANT+	Moxy5	FW V 1.5.4
VO2 Master Metabolic Mask	VO2 Master www.vo2master.com	BLE	HW version 12	FW V1.5.3
Kickr Bike Cycle Ergometer	Wahoo www.wahoo.com	ANT+	WFBIKE1 (Kickr Bike 315A)	V1.27.0

Getting Started with the Trigno Link Module

Connecting the Link Module

The Trigno Link module is supplied with a standard USB Type C cable which is to be connected to the host PC and the Link module. The USB cable provides power and data transfer function to the Link module.

Figure 2: Connecting the Trigno Link module to the PC.

Connecting the Trigno Wireless Biofeedback System

The Trigno Link module requires use of the Trigno Wireless Biofeedback System to provide synchronized data between the connected devices. Refer to Trigno Wireless Biofeedback System User Guide for details on setting up the system.

Usage of the Trigno Wireless Biofeedback System with the Trigno Link Module is restricted to educational, general wellness, fitness and research purposes only and should not be used for any medical purposes.

Initiating the Trigno Discover Software

Once the Trigno Wireless Biofeedback System and the Trigno Link module are connected to the PC, launch the Trigno Discover Software. It is recommended to initiate the software after the two USB connections for the Link module and the Trigno System have been established with the PC. Refer to the Trigno Discover User Guide and the Trigno Wireless Biofeedback System User Guide for details on getting started with these elements. The Trigno Link module requires at least one Trigno Sensor to be connected to the system and software so that proper synchronization across all the sensors can be maintained.

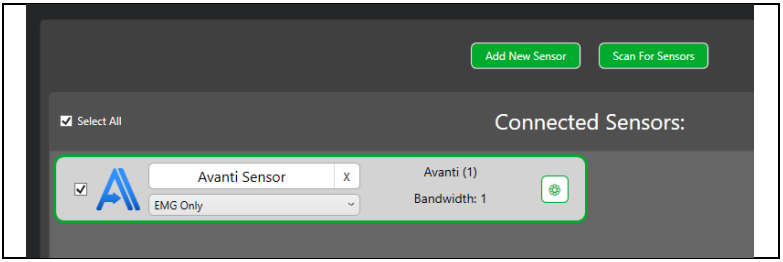

Figure 3: Connecting a Trigno sensor to the system by using the sensor control utility in Trigno Discover software.

Working with Link Control Utility

The Trigno Link Control Utility in the Trigno Discover Software manages the sensors connected to the Link module. The Link module can operate either in Bluetooth mode or in ANT+ mode, but not in both modes at the same time. Some sensors have the ability to operate in both modes; refer to manufacturer information for details.

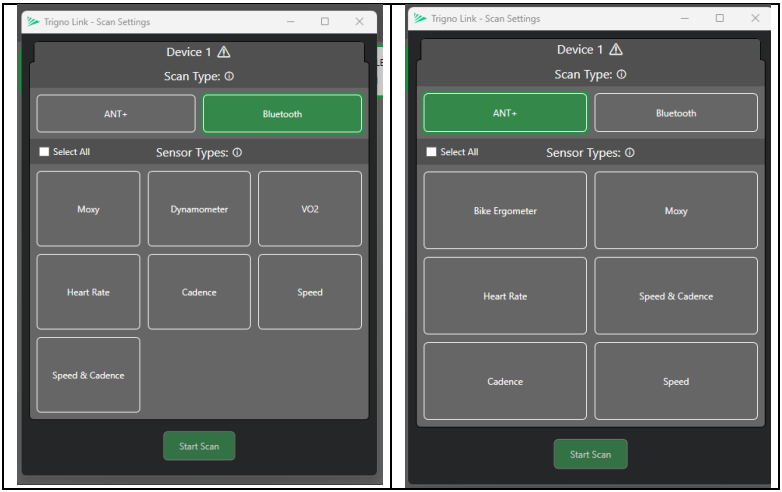

Figure 4: Selecting between Bluetooth (BLE) or ANT+ sensors in the scan settings option of the Trigno Link Control Utility in Trigno Discover software.

Once connected, sensor options (if available) can be set in the options icon of specific sensors. Sensors can be disconnected by right clicking and selecting “disconnect sensors” which may be necessary when changing sensor configurations, particularly on startup.

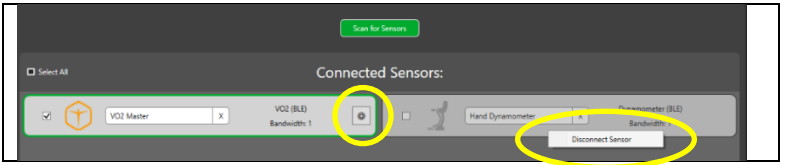

Figure 5: Identifying the options (gear) icon (left) and disconnecting sensors with a right mouse click (right).

Jamar Dynamometer

This device can be operated manually or in Bluetooth mode, which will report hand grip force in lbs or kg to the Link module as determined by the unit switch on the device. Be sure to set the switch to the preferred unit prior to data acquisition. Refer to the device user's guide for additional details on how to engage Bluetooth mode and set the units switch.

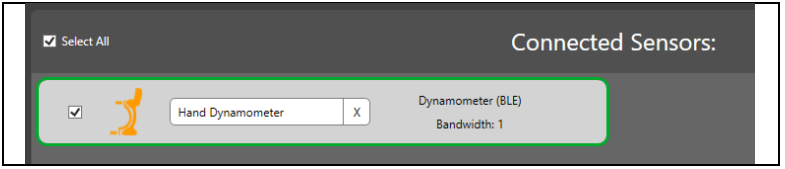

Figure 6: Jamar Hand Grip Dynamometer reported by the Link Control Utility.

MoxyMonitor

The MoxyMonitor is a tissue oxygenation monitor that reports % saturation of the muscle tissue oxygen (SmO2) as well as total hemoglobin (THb). The device can be configured to a 0.5, 1.0, or 2.0 Hz (samples/second) update rate with or without signal smoothing. While the device can operate in Bluetooth mode or ANT+ mode, these device configuration options are only accessible when communicating via Bluetooth. Refer to MoxyMonitor documentation for additional details on device usage.

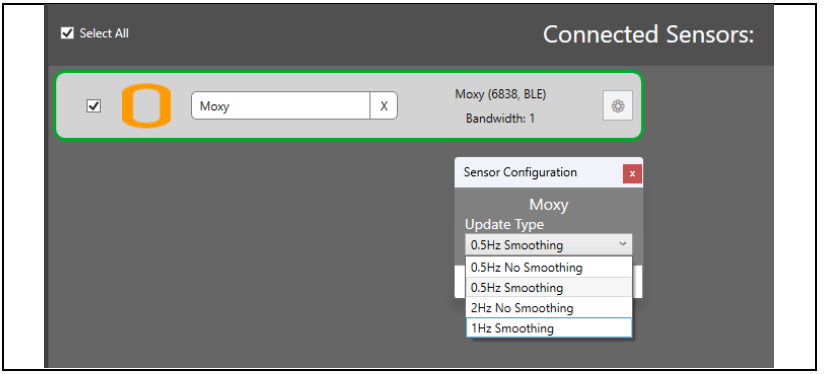

Figure 7: MoxyMonitor device settings.

VO2 Master

The VO2 Master is a portable oxygen analyzer for tracking the following parameters: O_2 volume (L), O_2 tidal volume (L/breath), O_2 ventilation (L/min), respiration rate (breath/min), and fraction of expired oxygen (Fe O_2 %). For optimal results, ensure that the options for mask size (petite, extra small, small, medium, and large) are selected to match the mask size used and that the vent size is appropriately selected for the type of intended activity ("resting", "medium", or "large"). Optimal results are obtained when calibration is performed on the device.

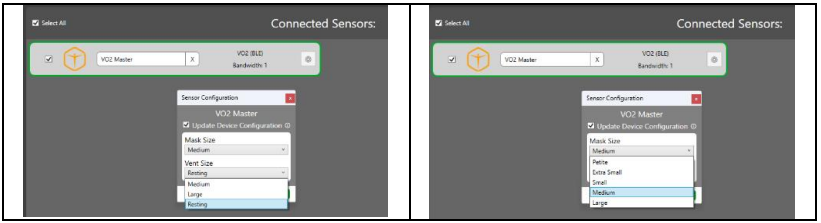

Figure 8: VO2 Master device setting for mask size and for vent size. Refer to VO2 Master documentation for information on these parameters.

VO2 Master Calibration

The VO2 Master device supports two stages of calibration when used with the Link module:

a) ***Stage 1 – Idle Calibration***: This is a mandatory calibration phase that is automatically initiated upon device power up. This stage happens over

the course of 5 seconds and requires the device to be idle (i.e., not worn and not moving). This stage occurs every time the device is power cycled, occurring only once during a usage cycle.

b) ***Stage 2 – Active Breathing Calibration***: This phase automatically follows Stage 1 calibration and requires the device to observe multiple cycles of breathing and to pass an expected volume of air as determined by the vent size selected. An improperly selected vent size will compromise this calibration. Breath cycles can be performed by wearing the device as intended or by using a volumetric syringe (refer to VO2 Master documentation for details on obtaining and using a calibration syringe). When data streaming is initiated in the software during this calibration phase, the calibration progress will be shown. Once calibration completes, the progress bar will read 100% and the display will automatically switch to displaying device data.

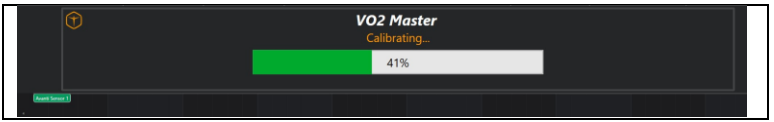

Figure 9: Stage 2 calibration progress of the VO2Master device.

Note that additional calibration options are available in the VO2 Master App included with the device. VO2 Master will maintain its calibration when switching from the App to Trigno Discover, as long as the device is not turned off. Power cycling the device will restart the calibration process. Refer to the VO2 Master documentation for additional details.

Reference Specifications

Item	Value
Dimensions	69.5mm x 50.5mm x 21.0mm
RF communication band	2400 – 2483 MHz
RF communication protocols	Trigno®, Bluetooth Low Energy 4.2, ANT+
PC Connection	USB 2.0 or higher
Typical operating distance	10 m
Max number of devices	6
Max Trigno Sensor Latency	<1 sampling period
Bluetooth Latency	<500 ms, device dependent
ANT+ Latency	device dependent
Power Consumption (max)	144 mW
Operating Temperature Range	5 – 45 deg C
Enclosure Material	ABS