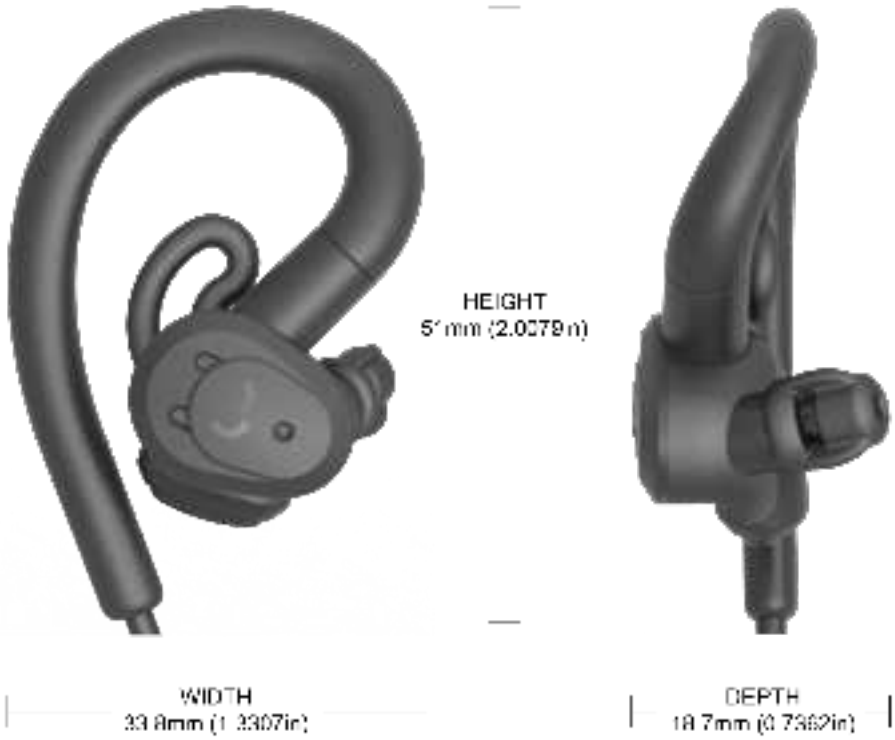
Bodytrak I - Technical User Manual

Version: 0.12

Bodytrak I is the first precision physiological monitoring solution compromising a non-invasive ear-based sensor device which measures physiology, motion and ambient noise exposure whilst simultaneously enabling ambient noise transparency and audio communications to maintain situational awareness. Since the product accesses the ear, the only body site from which all vital signs can be measured non-invasively, Bodytrak is able to continuously measure several key parameters, including: aural and core body temperature (CBT), heart rate (HR), heart rate variability (HRV) and biomechanical motion metrics.

Earpiece

The earpiece is the central node of the Bodytrak system combining purpose-built physiological and biomechanical sensors, an audio speaker and real-time onboard processing units inside a miniature plastic enclosure that securely fits the human ear cavity. The earpiece has been designed to sit flush with the ear contour and allow a full-size helmet to be worn.

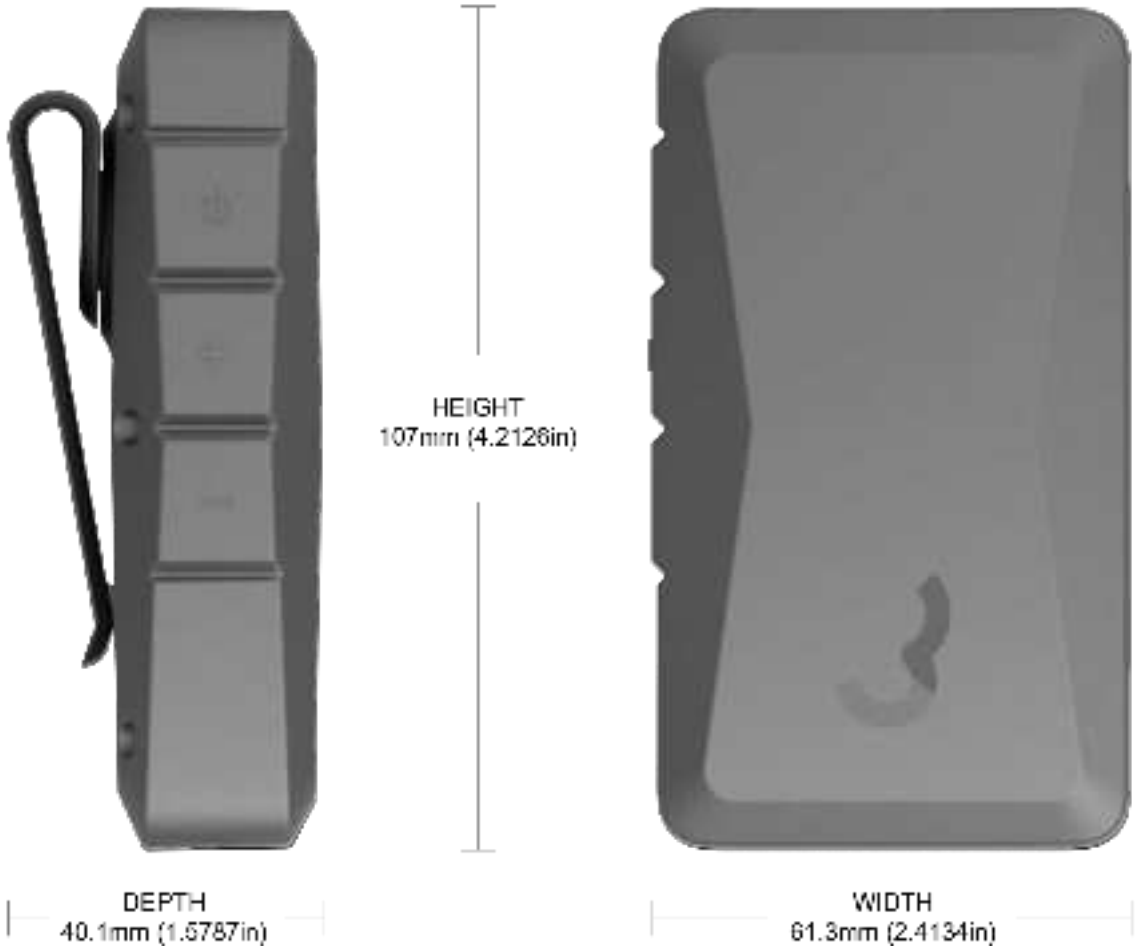


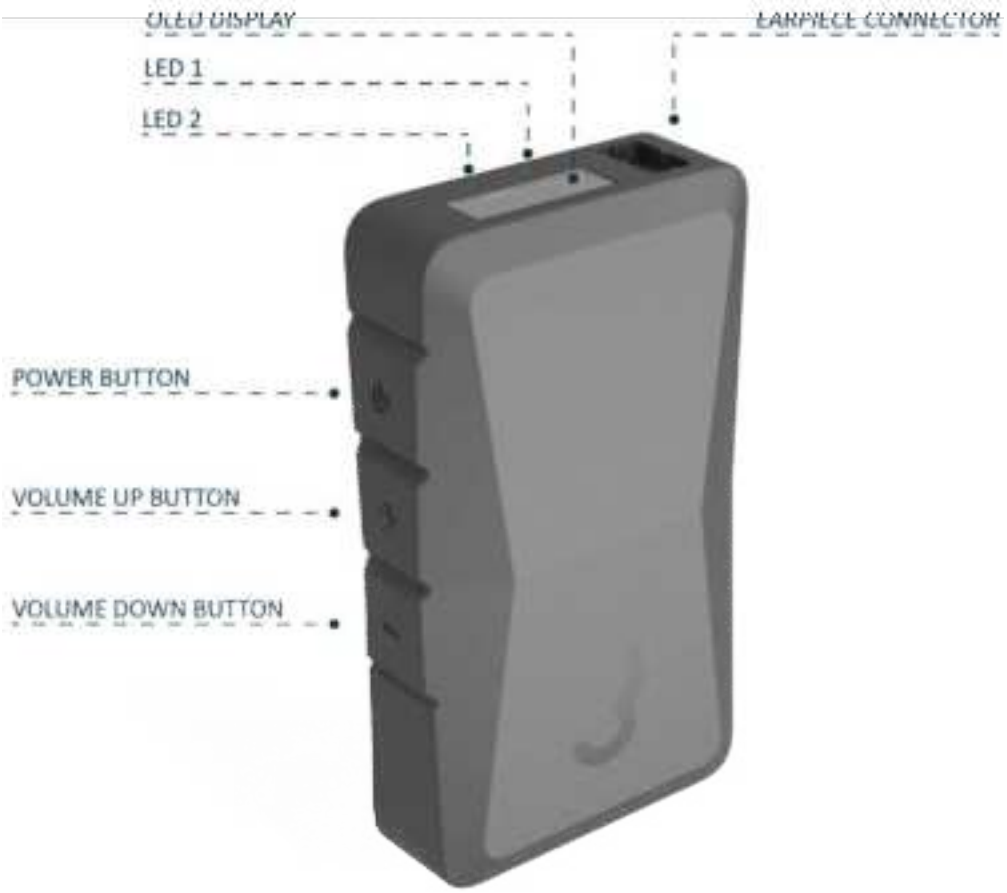
A flexible ear hook can be adjusted to wrap snugly around and behind the helix for a personalised fit. Provided replaceable silicone ear buds and wing tips have been designed to position and secure the earpiece in the ear cavity (the “concha”).

Bodytrak supplies the consumable silicones in a standard size which are applicable to the majority of users.

Communications Pack

The Communications Pack plays an integral role in the Bodytrak solution, depending on the targeted deployment. The Communications Pack supplies power to the Bodytrak earpiece and receives data input from it to be stored in its internal non-volatile flash memory, alongside a real-time timestamp supplied by an internal real-time clock (RTC). The Communications Pack can relay collected data in real-time through a Bluetooth-enabled third-party device using Bluetooth Low Energy (BLE) services, receive audio using Bluetooth EDR, and send real-time data to the Bodytrak Cloud using WiFi (2.4 GHz) and cellular (LTE and 3G) technologies.





Set Up

Connect the earpiece to the Communications Pack by pushing the earpiece connector into the Communications Pack USB-C connector. Pull lightly on the connection to ensure mating has occurred.

WARNING: USB-C connector is not compatible with generic USB accessories. Do not plug any accessories apart from the Bodytrak earpiece, otherwise warranty is void.

The Communications Pack has 3 buttons that are used for operating the device: “Power”, “Vol Up” and “Vol Down”. The buttons are designed to not be accidentally pressed and require a firm press with the tip of the finger or thumb. If the Communications Pack does not perform the desired action when a button is pressed, slightly more force will be required specifically through the center of the button.

Powering On/Off

To power on the Bodytrak system first set up the Communications Pack and earpiece as described above, with the earpiece plugged into the Communications Pack. Turn on the Communications Pack by holding the “Power” button for 2 seconds at which point the System light should flash green indicating a boot-up process has started. To turn off the Communications Pack hold the Power button for 5 seconds until the System light turns off.

Reset

To reset the Communications Pack press and hold both the “Vol Up” and “Vol Down” buttons for at least 10 seconds until the display turns off.

Charging (using Bodytrak Charging Cradle)

Insert the Communications Pack into the Bodytrak Charging Cradle making sure the device sits upright. Connect the Charging Cradle to the supplied USB-C wall adapter with a USB-C cable.

A breathing green light indicated the device is currently being charged. It may take up to 2.5 hours to charge the battery fully. Once charged, a solid green light will come up.

Device is designed to be charged by a dedicated USB charging port that can provide up to 2A 5Vdc (up to 10W). Charging current is internally limited to 1A 5Vdc (5W).

Charging (using Bodytrak Charging Hub)

Optional accessory is available to support up to 10 Communications Pack units charging simultaneously. Insert the Communications Pack into the Bodytrak Charging Hub making sure the device sits upright. Connect the Charging Hub to a conventional AC power socket using the supplied power cord. Activate the Charging Hub by toggling a power switch located next to the power cord exit.

Please refer to the Bodytrak Charging Hub (BCH1X) user manual for further information.

Over-the-Air Software Updates

The Communications Pack automatically downloads the latest software over-the-air (OTA) while it is placed on charge. Device will attempt to connect to the Bodytrak Cloud via cellular or WiFi during the first few seconds after being inserted into the Charging Cradle. Display provides information about the current stage of the update cycle.

If new software is available for the Bodytrak earpiece, it will be installed next time it's inserted into the Communications Pack. The earpiece update procedure adds 60-90 seconds to the boot-up time.

NOTE: Do not disconnect the earpiece during the update procedure. Refer to the on-screen information to learn about the current software installation stage.

Technical Specifications

Size

Communications Pack:

108 x 62 x 28mm (no belt clip)

160g (with belt clip)

UI

Monochrome OLED 128 x 32 pixels

3x multifunction buttons

2x RGB lights

Audio prompts (via earpiece)

Battery Rating

Rechargeable Li-Po 2400mAh

Full charge time within 2.5h

Approvals:

EN 62133-2:2017

UL 2054

Battery Cell Operational Temperature:

-10°C to 60°C (14°F to 140°F)

Battery Cell Charging Temperature:

0°C to 45°C (32°F to 113°F)

Battery Cell Storage Temperature:

-20°C to 45°C (-4°F to 113°F)

Ingress Protection

Designed to meet IP54

Radio Modules

Cellular:

LTE B1, B3, B8, B20, B28 (BCP1E)

LTE B2, B4, B5, B12 (BCP1N)

3G 2100 MHz (BCP1E)

3G 850MHz, 1900MHz (BCP1N)

Wi-Fi:

802.11b/g/n 2.4GHz

Bluetooth:

BLE + EDR (HFP profile)

GNSS:

Galileo, GLONASS, GPS

NFC:

Passive tag (Type 2 and IEC14443 Type A)

Approvals

BCP1N:

FCC: 2A3CVA, IC: 27774A

Contains Radio Modules:

FCC ID: 2A3CV-CL

IC ID: 27774-CL

FCC ID: 2A3CV-BT

IC ID: 27774-BT

BCP1E:

RoHS, CE compliant

Environmental Considerations

Bodytrak I is certified to be used down to -10°C measured at the battery cell. Due to various environmental and atmospheric conditions, the battery cell temperature does not always correlate to the ambient temperature. Bodytrak I will continue to operate below -10°C ambient temperature for a short period of time until the internal cell temperature reaches -10°C and the device shuts off safely. It is recommended to protect the device from exposure to extremely negative temperatures by wearing it inside personal protective equipment where applicable.

Similarly, Bodytrak I is certified to be used up to +60°C measured at the battery cell. Bodytrak I can be used in environments with higher ambient temperatures providing the device is protected from direct sunlight and heat exposure. At no point the internal temperature of the device should exceed +120°C.

Bodytrak I should never be used in a potentially explosive environment.

Bodytrak I is not suitable for full water submersion. Device can be cleaned by wiping its surfaces with a soft cloth and a suitable disinfectant.

Bodytrak I should never be operational at an altitude exceeding 4,000m (13,000ft) above sea level.

Legal Notices

Battery Safety

Battery pack (Varta VKB 56456 702 099) is certified to and fully compliant to UL2054 and IEC 62133. Technical specifications for the safe temperature range refer to the battery cell temperature, not the ambient temperature. Battery cell temperature is monitored by an integrated ±1% NTC thermistor.

Device automatically stops charging if the measured battery cell temperature falls outside 0°C-45°C (32°F-113°F), but still remains operational.

Device automatically shuts down if the measured battery cell temperature falls outside -10°C-60°C (14°F-140°F).

Communications Pack USB-C Interface

The USB-C interface port is not compliant with USB specification. Do not insert any cables or accessories into this port other than Bodytrak Earpiece or other accessories specifically approved by Bodytrak. Failure to comply with this notice will void Bodytrak factory warranty.

Earpiece USB-C Interface

The USB-C interface plug is not compliant with the USB specification. Do not insert the Earpiece USB-C plug into any USB-C ports (such as wall chargers, PC and laptop ports) other than Bodytrak Communications Pack or other accessories specifically approved by Bodytrak. Failure to comply with this notice will void Bodytrak factory warranty.

Charging

Charging Cradle is supplied with a country-specific USB-C wall adapter and USB-C cable. Charging Cradle can be used with any approved USB downstreaming charger port as long as the output ratings comply with 5V DC.

Charging Cradle is designed to be used indoors only and bears no water ingress protection.

FCC Compliance

This device (version BCP1N) 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.

Note: Any changes / modifications not approved by Bodytrak will void the user's authority to operate Bodytrak I equipment.

Note: 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:

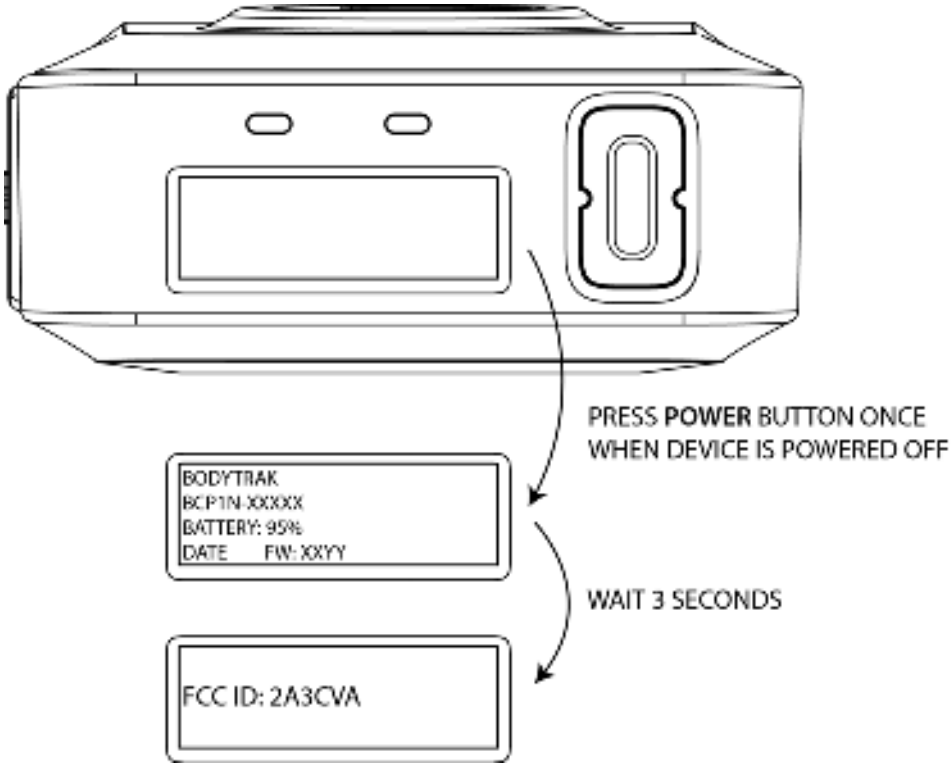
- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.
- Changes or modifications to this product not authorized by Bodytrak could void the electromagnetic compatibility (EMC) and wireless compliance and negate your authority to operate the product.

This product has demonstrated EMC compliance under conditions that included the use of compliant peripheral devices and shielded cables between system components. It is important that you use compliant peripheral devices and shielded cables between system components to reduce the possibility of causing interference to radios, television sets, and other electronic devices.

SAR RF exposure has been tested with the belt clip removed.

Bodytrak I (version BCP1N only) contains an electronic label (eLabel), which can be invoked as follows:

- When the device is powered off, press on the “Power” button once
- Wait for 3 seconds until FCC ID is displayed



CE Compliance

This device (version BCP1E) complies with EU Radio Equipment Directive 2014/53/EU and RoHS directive 2011/65/EU. Contact Bodytrak support to obtain a copy of the EU Declaration of Conformity.

Bodytrak Communications Pack version BCP1E operates at the following frequency bands and maximum power:

Technology	Frequency band (MHz)	Maximum power
LTE Band 1	2100	< 23 dBm
LTE Band 3	1800	< 23 dBm
LTE Band 8	900	< 23 dBm
LTE Band 20	850	< 23 dBm
LTE Band 28	750	< 23 dBm
WCDMA/HSPA Band 1	2100	< 24 dBm
WLAN 802.11 b/g/n	2400-2483.5	< 18.3 dBm
Bluetooth BR/EDR/LE	2402-2480	< 8 dBm

Bodytrak I is designed to be compliant with the limits of electromagnetic exposure to radio waves set by the Council of the European Union. The device has been developed with a substantial safety margin to assure safety for its users. The radio equipment has been tested by an independent international laboratory with a separation distance of 0 mm with the following reported SAR values:

Measurement method	SAR limit	Measured value
Body-worn SAR averaged over 10 g	2 W/kg	1.72 W/kg max
Extremity-worn SAR averaged over 10 g	4 W/kg	1.72 W/kg max

Device End of Life

Bodytrak Communications Pack contains a Li-Po rechargeable battery, which must not be disposed of with general waste. Contact Bodytrak support to be advised regarding recyclability and disposal of your device.

Medical Device Interference

Bodytrak Communications Pack contains radio equipment that emits electromagnetic waves and might cause interference with medical devices. Consult your physician and medical device manufacturer to obtain specific information about the electromagnetic compatibility of your medical device with other equipment.

To avoid any potential interactions with medical devices such as pacemakers, glucose meters and defibrillators, keep your Bodytrak Communications Pack a safe distance away from your medical device (more than 15cm/6in), but consult with your physician and medical device manufacturer for specific guidance.

If you suspect the Bodytrak Communications Pack is interfering with your medical device, stop using the Bodytrak device immediately and consult with your physician and medical device manufacturer for specific guidance.

Warnings

Bodytrak Communications Pack contains a non-replaceable Li-Po rechargeable battery. Do not attempt to replace the integrated battery otherwise warranty is void. Contact Bodytrak support for the battery pack to be factory-serviced.

Do not operate your device outside of the specified battery cell temperature range. Always contact Bodytrak support if you intend to use Bodytrak devices outside stated temperature range.

Bodytrak devices are classified as electrical equipment and might be hazardous if misused.

Bodytrak devices are not suitable for use where any of the following applies:

- Hypersensitivity to silicone
- Current ear infection or ear conditions that may be exacerbated by the use of Bodytrak earpiece device
- Taking part in an activity where there is likely impact or contact to the head area
- In a potentially explosive atmosphere
- Full water submersion

Contact Details

For support and service information please reach out at support@bodytrak.co

Version control

Version	*Date*	*Author*	*Changes*
0.1	27 Sept 2021	Dmitry Iakovlev	Initial draft
0.2	8 Oct 2021	Dmitry Iakovlev	Added FCC and IC identifiers Added “Reset” section
0.3	28 Oct 2021	Dmitry Iakovlev	Added clarifications about battery cell temperature to the Technical Specification section. Added explanation of battery safety to the Safety Notice section.
0.4	9 Nov 2021	Dmitry Iakovlev	Added PSU requirements clarifications
0.5	9 Dec 2021	Dmitry Iakovlev	Updated artwork
0.6	23 Dec 2021	Dmitry Iakovlev	Added safety notices
0.7	14 Jan 2022	Dmitry Iakovlev	Added contact details. Added CE Compliance information. Added Environmental Considerations.
0.8	26 Jan 2022	Dmitry Iakovlev	Added CE frequency bands and SAR. Added medical device compatibility notice.
0.9	8 Feb 2022	Dmitry Iakovlev	Added reference to the Bodytrak Charging Hub.
0.10	24 Feb 2022	Dmitry Iakovlev	Added eLabel information
0.11	3 May	Dmitry Iakovlev	Corrected eLabel information since both the cellular and BT radio modules are covered by the BCP1N FCC ID
0.12	25 May	Dmitry Iakovlev	Removed ISED notice. Added FCC notice about voiding the authority of using the equipment.