

Zephyr BioHarness™ BT

PRODUCT DESCRIPTION

The BioHarness™ BT is a compact electronics module. It is attached to a lightweight Smart Fabric strap which incorporates ECG and Breathing detection sensors.

The BioHarness™ module can transmit physiological data by Bluetooth or record it to internal memory.



Company Information

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Data subject to change

FEATURES

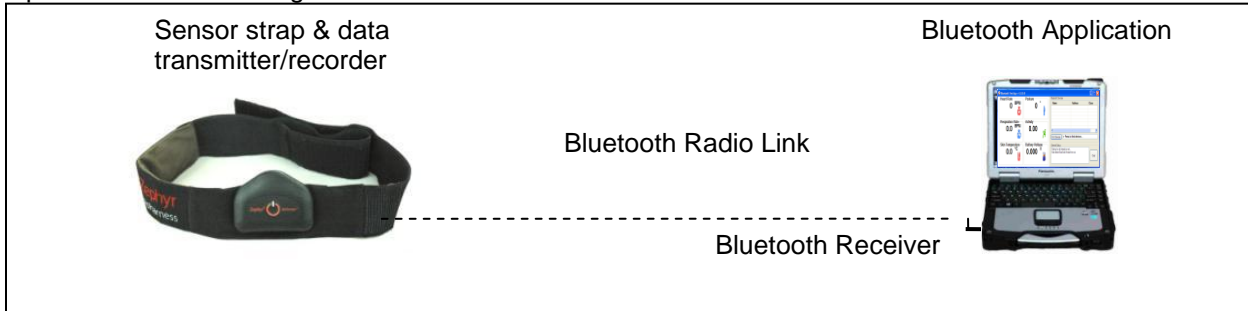
- Bluetooth Connectivity
- Configurable Output
- Heart Rate 25 – 240 BPM (± 1 BPM)
- Breathing Rate 3 – 70 BPM (± 1 BPM)
- IR Skin Temperature 10 – 60 °C (± 0.1 °C)
- Position/posture $\pm 180^\circ$
- Activity in VMU
- 3 axis Acceleration to 16g
- Skin Conductance Level
- Red / Orange / Green subject status indication
- Transmit and/or Logging Modes
- 250Hz ECG Logging
- 125Hz Accelerometer Logging
- USB connectivity for data download
- 570 hours data storage

APPLICATIONS

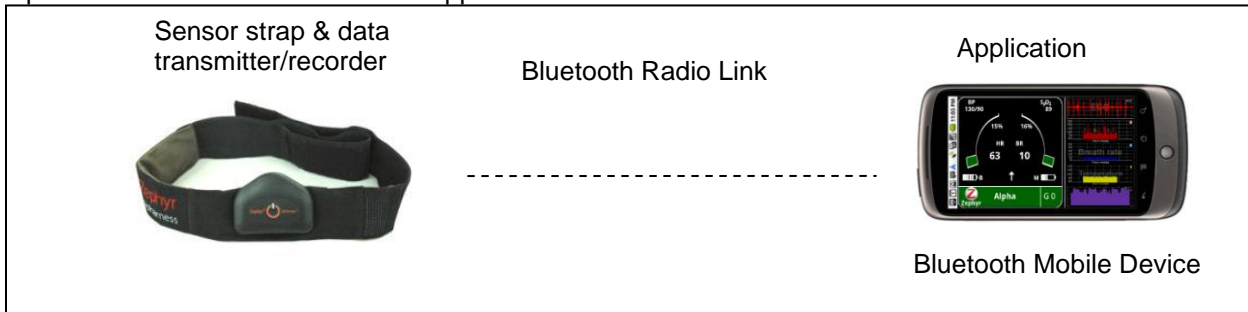
- Tele-Health
- Bio Mechanical Research
- First Responders
- Remote Patient Monitoring

Functional Block Diagram

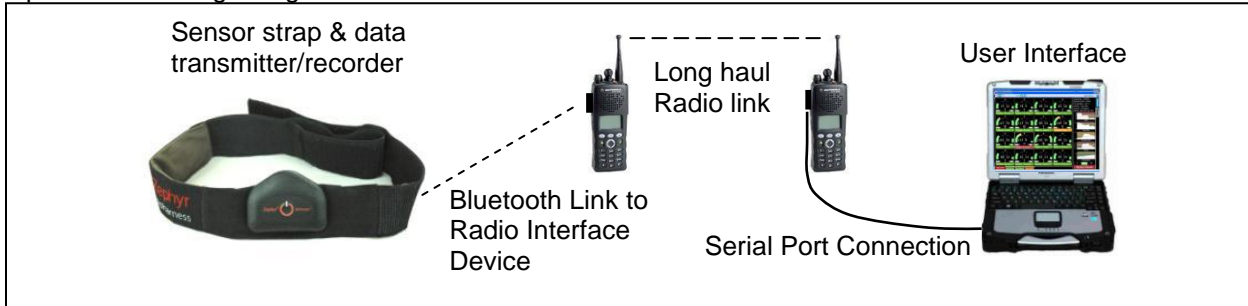
Optional Live Short-Range Data Transmission



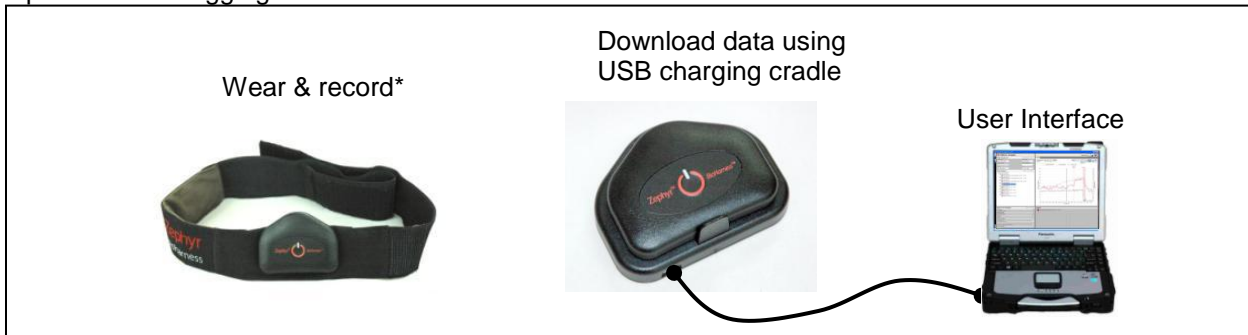
Optional Transmit to Mobile Device Application



Optional Live Long-Range Data Transmission



Optional Data Logging



*Device must be configured to log, BioHarness Application software needed for data import.

Specifications (Unless otherwise stated: Temperature = 25 °C, Pressure = 1 ATM)

Power Supply: Internal Lithium cell, rechargeable via USB charging cradle or USB wall charger.

| Parameter | Notes | Values | | | Acc'y | Unit |
|------------------------------------|-----------------|--------|------|-----|-------|------------------|
| | | Min | Typ. | Max | | |
| General | | | | | | |
| Logging capacity | 1 | | 570 | | | hours |
| Power supply voltage | USB | 4.5 | 5 | 5.5 | | V |
| Battery Life – Radio transmitting | 2 | 9 | | 21 | | hrs |
| Battery Life - Logging | 3 | | 24 | | | hrs |
| Charging Time | | | 3 | | | hrs |
| Storage | Between charges | | 6 | | | |
| Charging Cycles | 4 | | 300 | | | Cycles |
| Digital resolution | | | 10 | | | bits |
| DC Input impedance | Between snaps | 20 | | | | MΩ |
| Heart Rate | | | | | | |
| Range | | 25 | | 240 | ±1 | BPM |
| Time to first lock | At 60 bpm | | 7 | | | s |
| No Signal Response time | 60 to 0 bpm | | 7 | | | s |
| ECG sensor sampling interval | | | 4 | | | ms |
| Input dynamic range | | 0.1 | | 10 | | mV _{pp} |
| Breathing Rate | | | | | | |
| Rate range | | 3 | | 70 | ±1 | BPM |
| Breathing sensor sampling interval | | | 10 | | | ms |
| Skin Temperature | | | | | | |
| Range | 5 | 10 | | 60 | ±0.1 | °C |
| Accuracy | 30 to 40°C | | 0.2 | | | °C |
| Response Time | | | 5 | | | s |
| Sampling Interval | 6 | | 60 | | | s |

Operating Modes:

- Active – device transmitting data + logging, if configured
- Standby – device not transmitting but connectable + logging, if configured

Guaranteed Performance Cycle:

- New Battery – 21hrs Active / 3hrs Standby / 24hrs logging
- After 1 year – 9hrs Active / 15hrs Standby / 24hrs logging

Notes:

1. General Logging (Gen + ECG = 140hrs, Gen + Acceleration = 280hrs)
2. Min Period – after 180 charge cycles. Max Period – new battery
3. Software required for data download.
4. After 300 deep discharge/charge cycles the battery will retain a minimum of 80% of its original capacity.
5. Accuracy (for ambient temperature 20 – 30°C, otherwise ±0.3°C)

| | |
|---------|----------|
| Range | Accuracy |
| 32 — 42 | ±0.2°C |
| 36 — 39 | ±0.1°C |
6. Min = device transmitting, Max = device logging

/Continued next page.

| Parameter | Notes | Values | | | Acc'y | Unit |
|-------------------------------|-------|--------|------|------|-------|---------|
| | | Min. | Typ. | Max. | | |
| Activity | | | | | | |
| VMU (vector magnitude units) | 1. | | | 16 | | g |
| Sampling Interval | | | 8 | | | ms |
| Epoch | | | 1 | | | s |
| Bandwidth | | 0.06 | | 9 | | Hz |
| Dynamic Range (any axis) | | -16 | | 16 | | g |
| Sensitivity | | | 10 | | | mg |
| Noise | | | 7.2 | | | mg |
| Posture | | | | | | |
| Dynamic Range | 2. | -180 | | +180 | | Degrees |
| Sampling Interval | | | 8 | | | ms |
| Epoch | | | 1 | | | s |
| Sensitivity | | 8 | | 1 | | Degrees |
| Skin Conductance Level | | | | | | |
| Range | | | TBD | | | nS |
| Sampling Interval | | | TBD | | | |
| Accuracy | | | TBD | | | |

Recommended storage temperature 20°C

Notes:

1. Vector Magnitude Units, 3 axis, sampled at 125 Hz, averaged to 1 second epoch.
2. 0° = vertical, 90° = horizontal. 180° = inverted. Subject anterior inclination is a positive value, posterior is negative. Mediolateral inclination does not affect sign of posture value.

Data Output – Transmitted Data

Data output is in the form of a number of messages, each of which can be enabled or disabled.

| Parameter | Reporting Frequency (Hz) | Range | Units | Description |
|-----------------------------------|--------------------------|----------------|---------|--|
| General Data Packet | | | | |
| Heart Rate | 1 | 25 – 240 | BPM | Beats per Minute |
| Breathing Rate | 1 | 3 – 70 | BPM | Breaths per Minute |
| Skin Temperature | 1 | 10 – 60 | °C | |
| Posture | 1 | ±180 | Degrees | Vertical = 0° |
| Activity Level | 1 | ±16 | VMU (g) | |
| Peak Acceleration | 1 | ±16 | g | |
| Battery Voltage | 1 | 3.5 – 4.2 | V | |
| Breathing Wave Amplitude | 1 | | V | Indicative only |
| ECG Amplitude | 1 | | V | Indicative only |
| ECG Noise | 1 | | V | Indicative only |
| X Acceleration Min | 1 | ±16 | g | Vertical axis, output 1/10 g's |
| X Acceleration Peak | 1 | ±16 | g | |
| Y Acceleration Min | 1 | ±16 | g | Lateral axis |
| Y Acceleration Peak | 1 | ±16 | g | |
| Z Acceleration Min | 1 | ±16 | g | Sagittal axis |
| Z Acceleration Peak | 1 | ±16 | g | |
| ROG Status | 1 | R,O,G | | See section 3.4.2 |
| Strap Worn Status | 1 | 0,1 | | 0 = not worn. |
| Device Button pressed status | 1 | 0,1 | | 0 = not pressed |
| Battery Percentage of Full Charge | 1 | 0 – 100 | % | % of full capacity |
| Breathing Data Packet | | | | |
| Breathing sensor output | 18 | 0 – 4095 | bits | Does not indicate breathing depth |
| ECG Packet | | | | |
| ECG Sensor output | 250 | 0 – 1024 | bits | For debugging purposes only 1 bit = 0.013405 mV Reference generated at 60bpm |
| Heart Rate R-R Packet | | | | |
| HR RR value | 18 | Minimum 250 | ms | Alternating ± sign at new detection |
| Accelerometer Data packet | | | | |
| X axis acceleration | 50 | ±16 | bits | Scaled 0 – 1023, 512 = 0g 102.25 bits = 1g (3.3g device) 19.5 bits = 1g (16g device) |
| Y axis acceleration | 50 | ±16 | bits | |
| Z axis acceleration | 50 | ±16 | bits | |

1. All data packets are time stamped in milliseconds.

Data Output – Logged Data

General Log

| Parameter | Reporting Frequency (Hz) | Range | Units | Description |
|-------------------------|--------------------------|-----------|---------|-------------------------------------|
| Heart Rate | 1 | 25 – 240 | BPM | |
| Breathing Rate | 1 | 3 – 70 | BPM | |
| Skin Temperature | 1 | 10 – 60 | °C | |
| Posture | 1 | ±180 | Degrees | Vertical = 0° |
| Vector Magnitude | 1 | ±16 | VMU(g) | |
| Peak Acceleration | 1 | ±16 | g | |
| Battery Voltage | 1 | 3.5 – 4.2 | V | |
| Breathing Wave Amp | 1 | | V | Indicative |
| ECG Amplitude | 1 | | V | Indicative |
| ECG Noise | 1 | | V | Indicative |
| X Acceleration Min | 1 | ±16 | g | |
| X Acceleration Peak | 1 | ±16 | g | |
| Y Acceleration Min | 1 | ±16 | g | |
| Y Acceleration Peak | 1 | ±16 | g | |
| Z Acceleration Min | 1 | ±16 | g | |
| Z Acceleration Peak | 1 | ±16 | g | |
| Breathing Sensor output | 18 | 0 - 4095 | bits | |
| HR RR Value | 18 | | ms | Alternating ± sign on new detection |
| Skin Conductance Level | 1 | TBD | nS | Indicative |

ECG Log

| Parameter | Reporting Frequency (Hz) | Range | Units | Description |
|-----------|--------------------------|----------|-------|-------------|
| ECG | 250 | 0 – 1024 | Bits | Indicative |

Accelerometer Log

| Parameter | Reporting Frequency (Hz) | Range | Units | Description |
|------------------------|--------------------------|-------|--------|--------------------------|
| Acceleration Magnitude | 125 | ±160 | g x 10 | $\sqrt{X^2 + Y^2 + Z^2}$ |

Logging Modes

- General (default)
- General + ECG
- General + Acceleration

RF Characteristics

| | |
|----------------------|---|
| Bluetooth Compliance | Version 2.0 + EDR |
| Supported Profile | Serial Port |
| Discoverability | Configurable |
| Operating Frequency | 2.4 to 2.835 GHz |
| Output Power | 2 mW |
| Operating Range | 30ft / 10m typical radius indoors (line of sight) |
| Antenna Type | Internal |

Red / Orange / Green Subject Status Indication

This is a value which is calculated in the device. It is dependent upon four thresholds:

- Heart Rate minimum
- Heart Rate Maximum
- Breathing Rate Minimum
- Breathing Rate Maximum

Current and previous Heart Rate and Breathing Rate values are used in conjunction with activity level to establish a subject's status, using Zephyr proprietary algorithms.

Threshold levels are stored within the device and are configurable by USB.

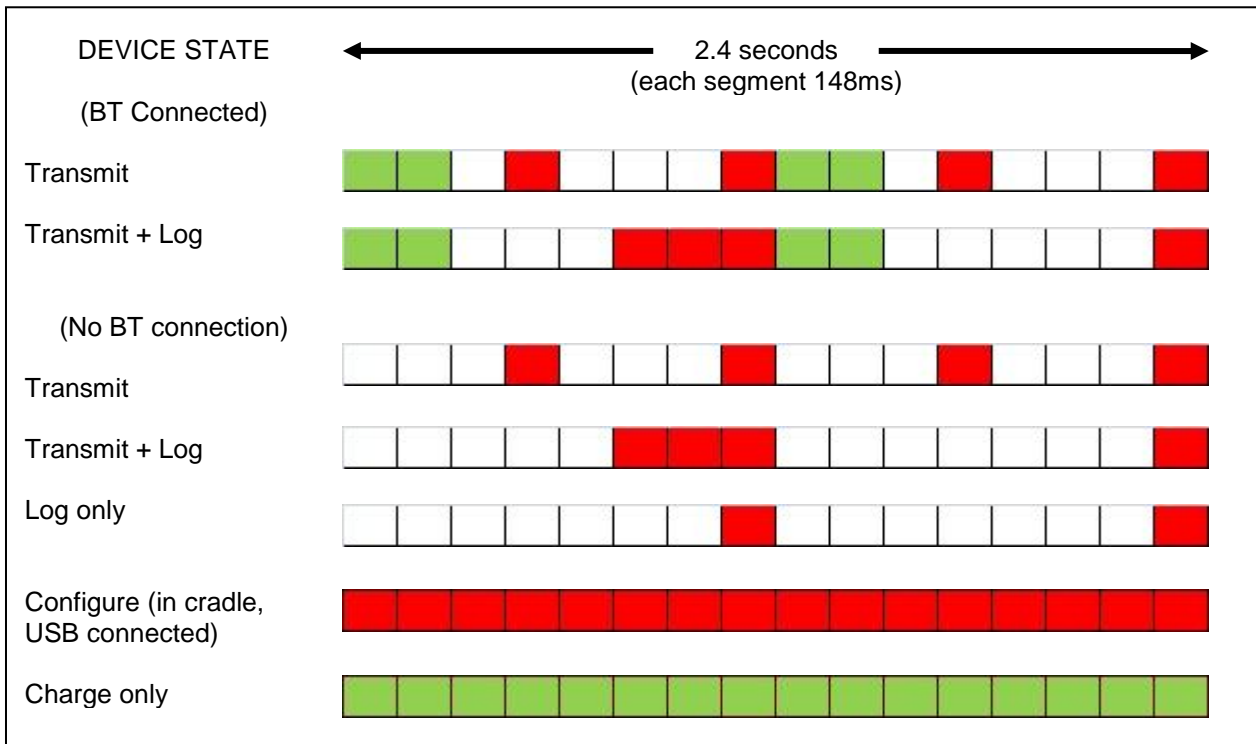
LED Behaviour

The BioHarness module can operate in three modes:

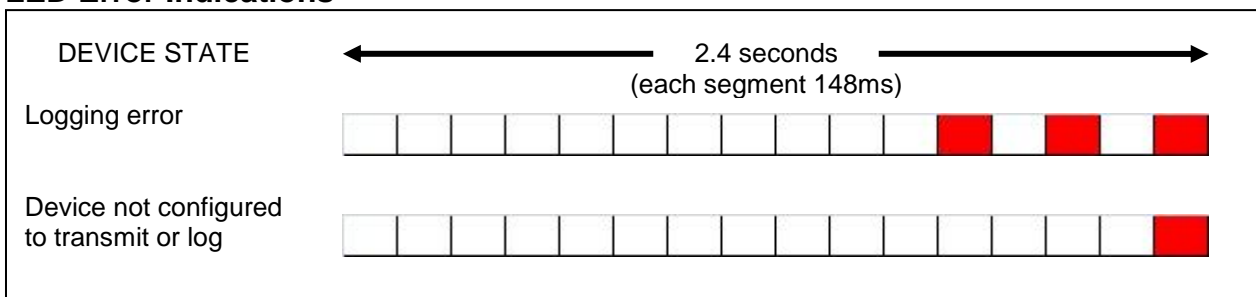
- Transmit data by Bluetooth
- Log data to internal memory (no transmit)
- Both Transmit and log the same data simultaneously

The device can be configured to these modes using the BT Config Tool. A flashing RED LED will indicate which of the above modes the device is in.

A BioHarness can transmit data, but it must have also established a Bluetooth connection with a receiving device. A device may transmit data – and indicate it is doing so by red LED flash – even although it is not connected to a receiving device. A flashing GREEN LED will indicate that this connection is present.



LED Error Indications



Standards/Compliance/Certification

The BioHarness has been designed to conform to the following:

| | |
|------------------------------|---------------------|
| RTTE: | Directive 1999/5/EC |
| Contains Transmitter Module: | |
| FCC ID: | QOQWT12 |
| Industry Canada ID: | 5123A-BGTW12A |



Environmental

| | |
|-----------------------|---------------|
| Operating Temperature | -30°C / +60°C |
| Storage Temperature | -40°C / +85°C |
| Charging Temperature | 0°C / +45°C |
| ESD | IEC 801-2KV |
| IP Rating: | IP67 |

Portable Military Standards 810F

| | |
|---------------------|-------|
| High Temperature: | 501.4 |
| Low Temperature: | 502.4 |
| Temperature Shock | 503.4 |
| Low Pressure: | 500.4 |
| Solar Radiation: | 505.4 |
| Ran & Blowing Rain: | 506.4 |
| Humidity: | 507.4 |
| Salt Fog: | 509.4 |
| Dust: | 510.4 |
| Vibration: | 514.5 |
| Shock: | 516.5 |

FCC Declaration

NOTE: THE MANUFACTURER IS NOT RESPONSIBLE FOR ANY RADIO OR TV INTERFERENCE CAUSED BY UNAUTHORIZED MODIFICATIONS TO THIS EQUIPMENT. SUCH MODIFICATIONS COULD VOID THE USER'S AUTHORITY TO OPERATE THE 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.

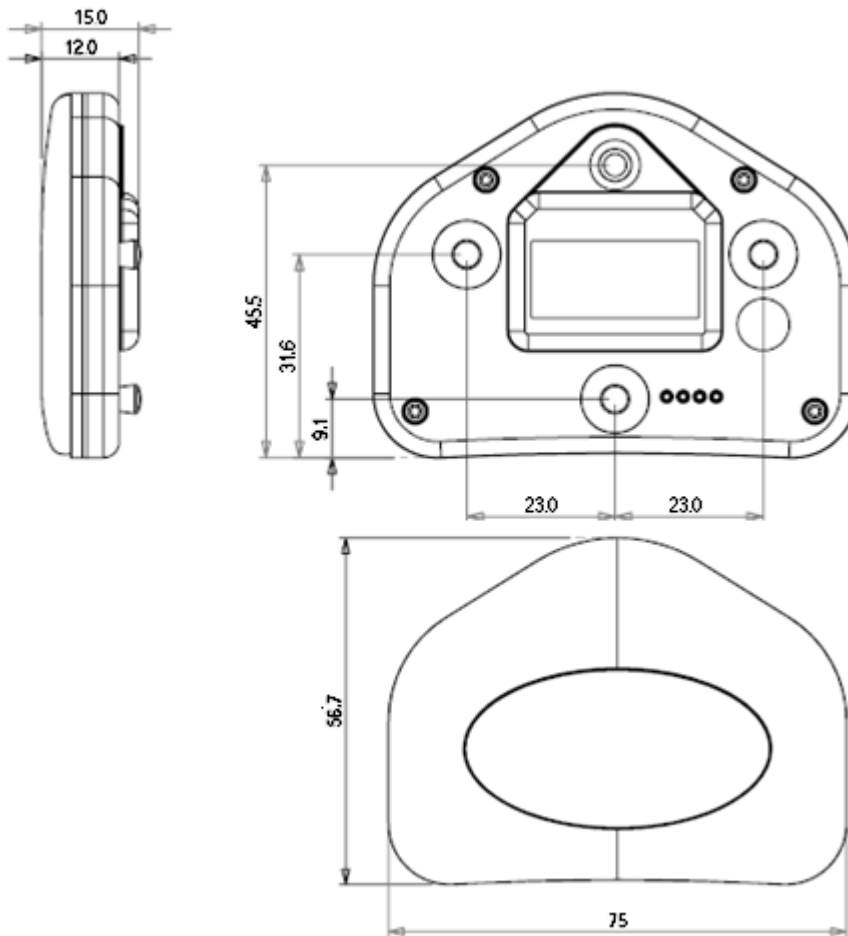
Any computer used in conjunction with this device must be covered by a Declaration of Conformity or must be FCC certified in its own right.

Mechanical Characteristics

| | | |
|---------------|------------------------------------|---------------------------------|
| Dimensions | Transmitter/recorder | 75 x 57 x 15 mm |
| | Charging Cradle (Single device) | 87 x 68 x 30 mm |
| Weight | Harness | 50 grams |
| | Transmitter/recorder | 35 grams |
| Case Material | ABS | Acrylonitrile Butadiene Styrene |

Bio Harness Transmitter/Recorder

All dimensions in millimetres



Accessories

Part Numbers for the Zephyr BioHarness™ BT and associated components:

| Component | ZPN |
|--|-----------|
| BioHarness™ BT Bluetooth Electronics Module | 9600.0097 |
| BioHarness™ Smart Fabric Strap XSmall | 9600.0145 |
| BioHarness™ Smart Fabric Strap Small | 9600.0114 |
| BioHarness™ Smart Fabric Strap Medium | 9600.0115 |
| BioHarness™ Smart Fabric Strap Large | 9600.0116 |
| BioHarness™ Smart Fabric Strap XLarge | 9600.0146 |
| BioHarness™ Smart Fabric Strap Side fitting XS to M adjustable | 9600.0189 |
| BioHarness™ Smart Fabric Strap Side Fitting M to XL adjustable | 9600.0190 |
| BioHarness™ Single Unit Charging Cradle | 9600.0098 |
| BioHarness™ Multi Unit Charging Cradle (4 bay) | 9600.0135 |
| | |

Hazards

- Subjects fitted with a heart pacemaker should not use this device
- Device should not be worn in explosive atmospheres (such as gas stations)
- Device should not be worn near blasting areas where radio detonation methods may be used
- Charging at high temperatures has risk of fire or explosion (> 45 °C).
- Unit should not be disposed of in fire

Notes

- Should not be used for swimming or similar water-based activities
- No user-serviceable components
- Warranty void if opened

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