

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

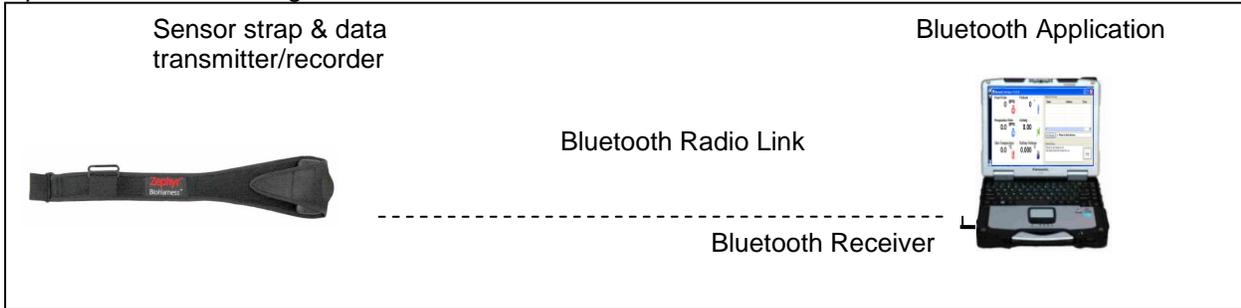
- Bluetooth Connectivity
- Configurable Output
- Heart Rate 25 – 240 BPM (± 1 BPM)
- Breathing Rate 3 – 70 BPM (± 1 BPM)
- IR Skin Temperature 10 – 60 °C (± 0.1 °C)
- Position/posture $\pm 180^\circ$
- Activity in VMU
- 3 axis Acceleration to 16g
- Skin Conductance Level
- Red / Orange / Green subject status indication
- Transmit and/or Logging Modes
- 250Hz ECG Logging
- 100Hz Accelerometer Logging
- USB connectivity for data download
- 570 hours data storage

APPLICATIONS

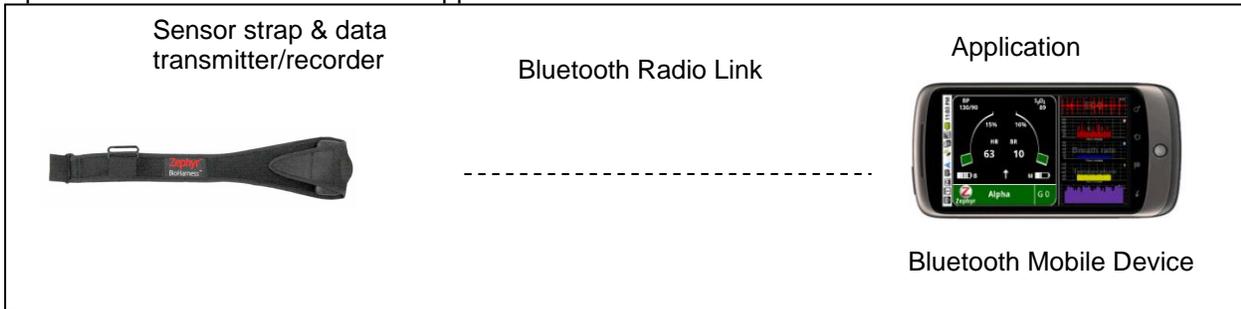
- Tele-Health
- Bio Mechanical Research
- First Responders
- Remote Patient Monitoring

Functional Block Diagram

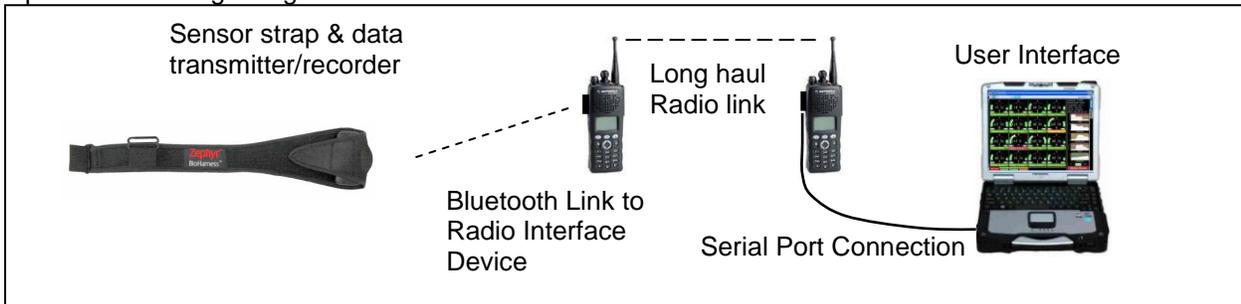
Optional Live Short-Range Data Transmission



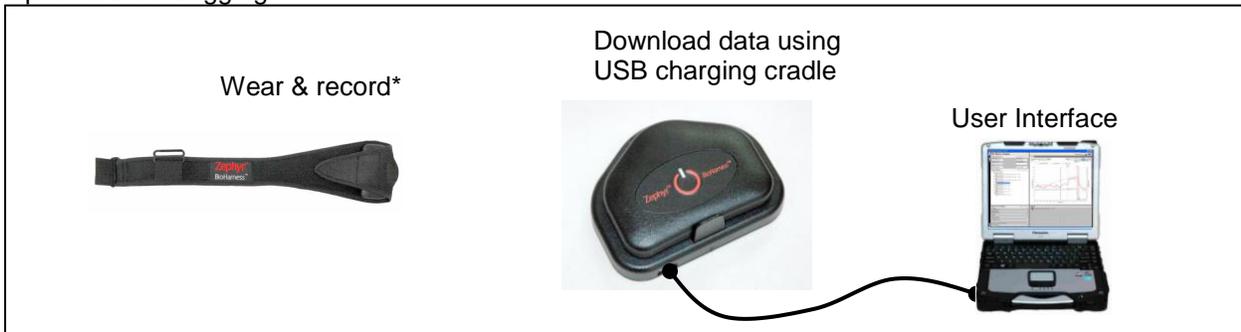
Optional Transmit to Mobile Device Application



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

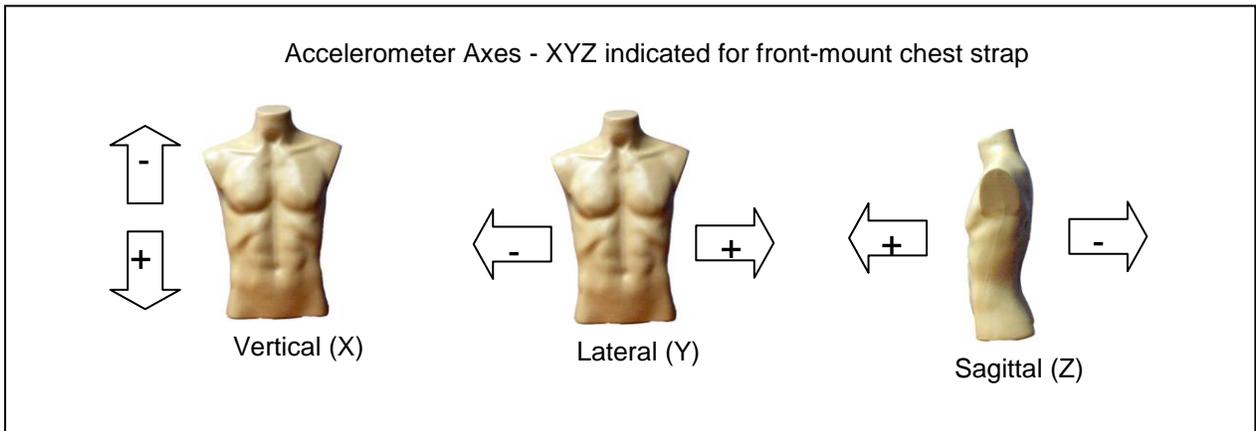
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Parameter	Notes	Values			Acc'y	Unit
		Min.	Typ.	Max.		
Activity						
VMU (vector magnitude units)	1.			16		g
Sampling Interval			8			ms
Epoch			1			s
Bandwidth		0.06		9		Hz
Dynamic Range (any axis)		-16		16		g
Sensitivity			10			mg
Noise			7.2			mg
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.



Axis mapping for the appropriate garment type should be set using the BioHarness BT Configuration Tool. Garment types are indicated by name.

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	100	±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.

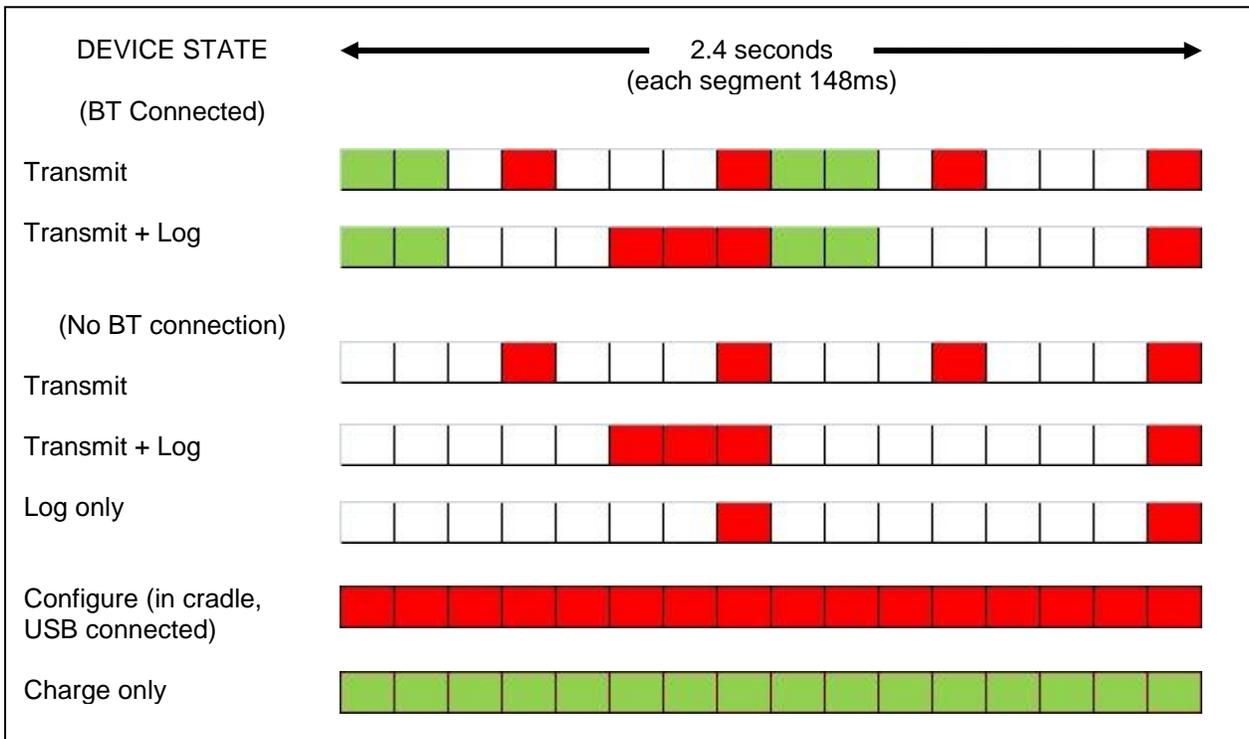
LED Behaviour

The BioHarness module can operate in three modes:

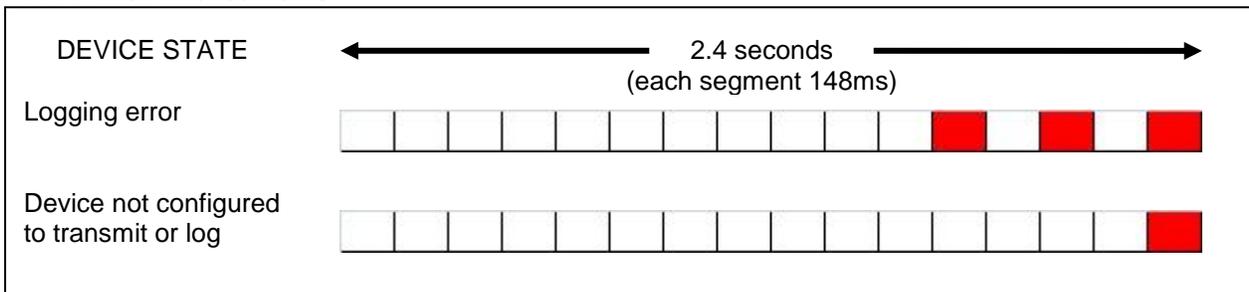
- Transmit data by Bluetooth
- Log data to internal memory (no transmit)
- Both Transmit and log the same data simultaneously

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.

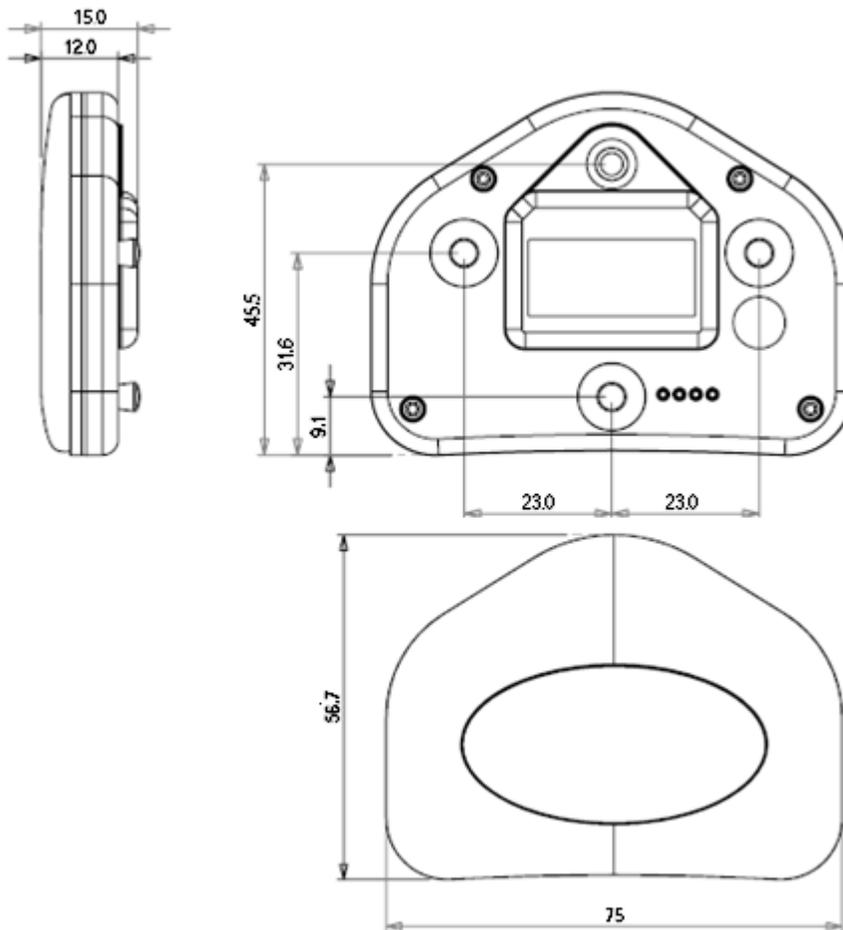
Any computer used in conjunction with this device must be covered by a Declaration of Conformity or must be FCC certified in its own right.

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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