

# Zephyr™ PSM Responder



## Introduction

Physiological Status Monitoring (PSM) is the real time visibility into the physical status of personnel operating in high stress and extreme environments. PSM measures vital signs in the context of posture and movement, and interprets the signals to help determine whether personnel are fatigued, dehydrated, injured or healthy.

## PSM Responder Applications

Designed for teams of people deployed in harsh environments, the PSM Responder system enables remote monitoring of multiple personnel simultaneously. The PSM Responder system is for both training and live deployment situations for HAZMAT, CBRN, EOD, firefighters and any other team that deploys into extreme situations.

## PSM Responder Advantage

PSM Responder summarizes and delivers meaningful, actionable, concise data in a Red/Orange/Green display to Incident Commanders and Safety Officers. The system deploys over existing voice radio systems minimizing weight and cost of deployment. Real time PSM can improve the length of deployment and subsequent effectiveness of survey / insertion teams. Payback can be quantified by minimized rotation of personnel, equipment deployed; resources consumed and associated wear and tear on assets.

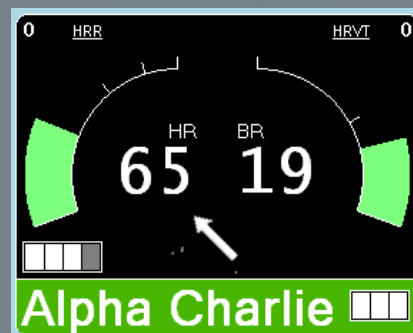
## How Do First Responders Use PSM?

PSM Responder is used as a command and control mechanism to track individuals who deploy in Personal Protective Ensemble (PPE), turnout gear or anyone working in high risk environments. Utilized to augment 1<sup>st</sup> Responder safety, PSM can be applied today in the following activities:

- Monitor deployment of CBRN, EOD, USAR and HazMat personnel in PPE gear
- Monitor candidate performance assessment trials (CPAT), workplace performance evaluations (WPE) and in-situ training of CBRN, HazMat, Urban Search & Rescue, EOD, firefighter, SWAT and other tactical operator positions.

The technology provides information that can assist in determining:

- Heat Stress
- Dehydration
- Fatigue
- Anxiety
- Rehabilitation



# Zephyr™ PSM Responder



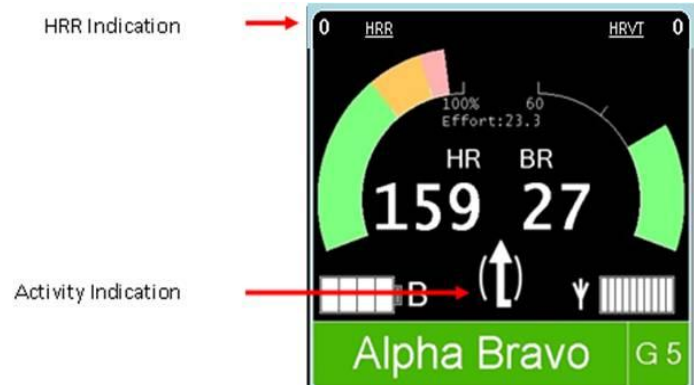
## Application - Field Use - CBRN, HazMat, EOD, Anyone in PPE Gear

CBRN, HazMat, EOD and industrial toxic response and clean-up teams deploy in various personnel protective ensembles (PPE). More often than not these teams are deployed to the hot zone in 90+ heat stress index environments (ambient temperature plus humidity = heat stress). While PPE prevent exposure to the ambient environment - by their nature they prevent the evaporative cooling effect of airflow across the skin. As these teams are constantly exposed to the effects of heat injuries, the only guidelines that exist today for the safe deployment of PPE encapsulated personnel are “tables of recommended deployment times” based on a variety of factors.

Heat injuries are caused by elevated core temperature. This usually results from a combination of work load, ambient temperature, humidity, equipment load, uniform (as an insulator), physical condition, and activity. Other factors may predispose an individual to heat injury. These include previous heat injury, viral infections, sleep deprivation, certain medications (including commonly used non-steroidal anti-inflammatory drugs like ibuprofen), poor nutrition, and dehydration.

Measurement of body core temperature as an indicator of heat injury is not practical in the field. Indirect measurements of rising core temperature, however, can be made by PSM that indicate the body's reaction to elevated core temperature. These indicators can be a predictor of heat injury and include increased heart rate, sustained activity beyond a subjects second ventilatory threshold, increased breathing rate, poor heart rate recovery, decreased movement (late in the game), and increased skin temperature.

Heart Rate Recovery (HRR) is a measure of a



person's fitness level and heat state. PSM can determine if a person is exercising or stationary. Combining activity with heart rate allows HRR to be measured. If the HRR is less than the individual's base line and the individual's surface temperature is elevated, heat injury is likely.

The PSM Responder System will give the incident commander, safety and medical monitoring personnel the actual real time status of personnel deployed downrange. Real time PSM can improve the length of deployment and subsequent mission effectiveness of deployed teams. Payback can be quantified by minimized rotation of personnel, equipment deployed; resources consumed and associated wear and tear on assets.

# Zephyr<sup>TM</sup> PSM Responder



## **Application – Training of New candidates**

Training, physical fitness and recovery is another application of PSM. An individual's response to stressful environments can be quantified and improvements measured allowing the effectiveness of training to be clearly determined. Physical fitness can be measured at various stages of an individual's career including post injury rehabilitation giving the best chance for deployment (operational) readiness over time. PSM implemented within training environments can be utilized to assess and safely monitor recruits with no prior knowledge of their physiology.

Below are three steps to implementing Zephyr PSM Responder in training activities:

1. Measure the candidate's baseline fitness indicators with a field based shuttle run test. This allows measurement of the candidates real-time stress levels utilizing quantified (vs. predicted) ROG status alerts & alarms.
2. During training activities use PSM technology to monitor stress with Heart Rate, Effort, HRR and HRVT real time indicators. After action analysis of parameters such as max heart rate vs. effort; average heart rate vs. effort; activity vs. effort can yield insight into candidates that are "efficient" in their movement and activities versus those that struggle. "Efficiency" – and the lack of it - is not always visible or evident during the training session.
3. Use the baseline fitness indicator test results to identify evidence-based training effect in all activities. Repeat the fitness test to gauge candidate improvement.

PSM Responder is a one stop solution to monitor and detect your personnel's wellbeing in the field focusing on the most common causes associated with active deployment these being: Heat stress, dehydration and fatigue.

# Zephyr™ PSM Responder



<p><b>PSM Responder</b></p> 	<p>MOTOROLA XTS Radio</p> 	<p>Bluetooth Radio Interface Device</p>		
<p>2 miles range 64 person Log OR Tx 15 sec polling</p>	<p>OmniSense Live OmniSense Analysis <i>Log and Tx: device transmits and logs to memory all the time</i></p>			

## What's in the box?

The System comprises three building blocks allowing teams to operate independently or as part of a networked force.

- BioHarness™: Chest Strap or Shirt
- Radio Interface Device (RID) attached to existing Tactical Radio or Short Range Z-Modem™ Training Radio
- OmniSense™ PC software

## BioHarness™

The BioHarness™ is available in chest worn strap or garment options. The BioStrap™ is available in front and side mount configurations. The components are a BioModule™ and BioStrap™ or BioShirt™ which measure:

- EKG
- Heart Rate,
- Breathing Rate
- Temperature (skin)
- Activity, Effort & Exertion (stationary, walking or running)
- Posture (laying or standing)

The BioHarness™ smart fabric sensors can be integrated into any shirt. Zephyr offers three shirt types with either front or side mount options:

- Combat shirt
- Fire Resistant Under Garment
- Custom 100% cotton T-shirt, available in front mount version only

The BioShirt™ integrates the BioHarness™ technology into the shirt and can be customized for each department. The BioShirt™ is made from 100% Cotton. The BioShirt™ and BioHarness™ are machine washable and guaranteed for up to 150 washings.

Operating Modes:

- Streaming - Secure Bluetooth – MAC paired, AES256, undiscoverable
- Logging – Logs data for up to 20 days for post event download



# Zephyr™ PSM Responder



## Charging

The BioModule™ battery is rechargeable and lasts 24hrs. It charges to full capacity in 3hrs and to 90% capacity in 1hr. The chargers are available in:

- Single module configuration or
- Four module configuration

The chargers not only recharge the batteries – they are also used to download log files from the BioModule™ to OmniSense™ software



BioMic



XTS RID



XTS Radio



Z-Modem™

## Radio Communications

Zephyr offers two Radio Interface Device (RID) options for Push-to-Talk and Hands Free applications. The BioMic is for those that utilize a remote speaker microphone peripheral communications method. The XTS RID is available for those that utilize headset or in-mask microphone communications peripherals.

The Zephyr PSM Responder utilizes the packet data functionality of the Motorola XTS 1500, 2500 and 5000 Series tactical radios. The RID acts as the Bluetooth pick-up for the BioModule™.

Motorola's packet data is supported on P25 conventional (point-to-point) communications. PSM is implemented on a digital conventional channel using the Astro Personality. In this configuration voice comms have priority on all radios.

The RID is powered from the radio and uses less than 5% of the radio battery power. When using the XTS Series Radios; one radio will be dedicated to the command post acting as a gateway to the OmniSense Software. This gateway radio polls the individual radios to retrieve vital sign information for display by OmniSense.

For communication in fitness training scenarios (where tactical radios would be cumbersome), Zephyr offers the Z-Modem™, which is a short range data radio supporting distances up to 300 yards. In this configuration, one Z-Modem will be required to act as a gateway replacing the tactical radios in the previous scenario.

Direct Bluetooth connection to a laptop or Android device can be used for personal viewing or to share with the medic and or command post

# Zephyr™ PSM Responder



## OmniSense™ Software

PSM Responder's data is presented by using Zephyr's OmniSense™ software. There are two operating modes encompassed by OmniSense™:

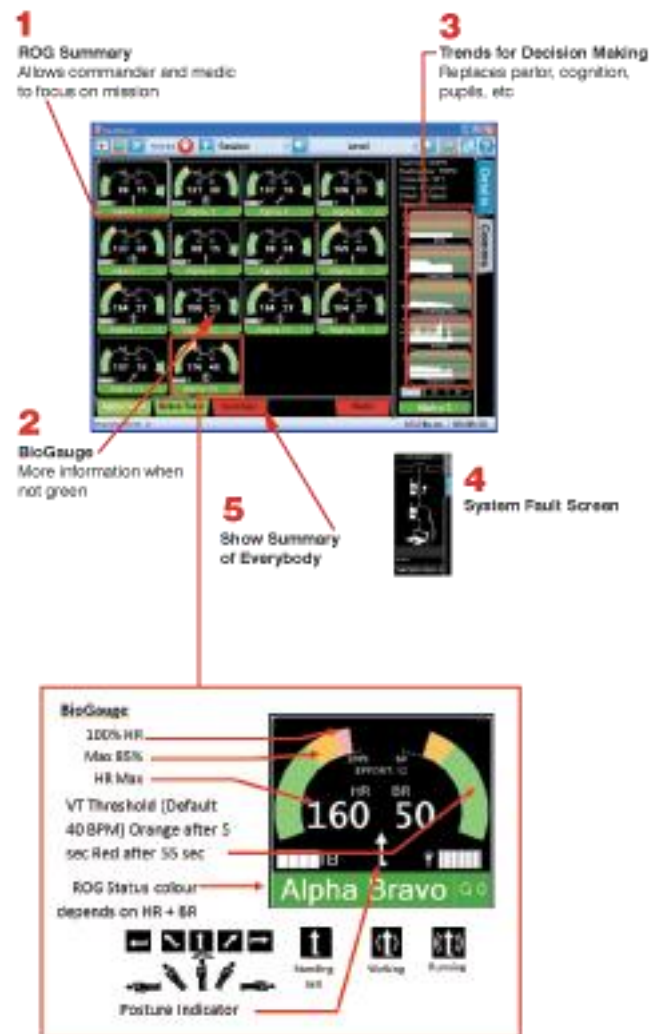
- OmniSense™ Live – Displays real time information on the individual and team's physiological status.
- OmniSense™ Analysis – Used for review and assessment after the completion of a training scenario or live operation.

## OmniSense™ Live

OmniSense™ Live graphical user interface has been designed in conjunction with US Special Forces for Medics and Squad commanders in training and down range.

Easy to interpret screens provide:

- **Summary** screen of the entire team
- **Deployment Screen** to add and organize team members
- **Team** based viewing of operational groups
- **Medic Group** for prioritization of casualties
- **Status** summary for each individual Red-Orange-Green with configurable settings.
- **BioGauge™** view for instantaneous physiology update of individuals.
- **Trends** for time based diagnostic by remote medical personnel.



Measures up to 64 People

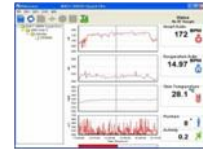


# Zephyr™ PSM Responder



## PSM Product Catalog

### PSM Research



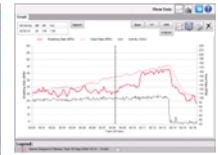
50 ft range 1 person Log or Tx  
120Hz Streaming

Research Waveforms e.g. EKG

### PSM Training



Zephyr Wrist  
Modem



300 yd range 64 person Log or Tx  
0.5Hz polling

OmniSense Live & Analysis

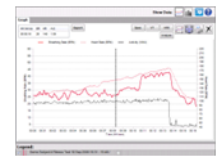
### PSM Responder



MOTOROLA  
XTS Radio



Bluetooth  
Radio Interface Device



2 miles range 64 person Log OR Tx  
15 sec polling

OmniSense Live & Analysis  
*Log and Tx: device transmits and logs to memory all the time*

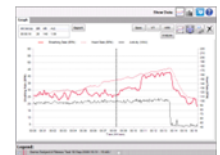
### PSM Defense



TYPE 1  
Tactical radio



Bluetooth / Wired  
Radio Interface Device



2 miles range 64 person Log OR Tx  
15 sec polling

*Tactical radios are voice priority. Data delay may occur on some models*

# Zephyr<sup>TM</sup> PSM Responder



## PSM Specification

### BioHarness<sup>TM</sup> Module

PARAMETER	SPECIFICATION
Heart Rate:	25 – 240 Beats per Minute $\pm$ 1 BPM
Breathing Rate:	3 – 70 Breaths per Minute
Skin Temperature:	10 – 60 °C $\pm$ 0.2°C in range 30 - 40°C
Battery Duration:	24 hrs Standby Mode, 18 hrs Active Mode
Charge Time:	3 hours to 100%, 1 hour to 90%
Battery Life:	Capacity 80% after 300 deep discharge cycles (4500hrs of use)
Storage Life:	6 months between charges (for optimal – recharge monthly)
Strap Sizes:	XS (22 – 26”), S (26 – 32.5”), M (32.5 – 39”), L (39 – 45.5”), XL (45.5 – 52”)
Strap Washing:	Remove Device.
Wash durability:	Typically 150 washes
Environmental-Operating	
Humidity:	5 - 90 %RH
Temperature:	-10 - 50°C
Environmental – Storage:	
Humidity:	5 - 90 %RH
Temperature (< 1 month):	(Power off) -20 - 45°C
Temperature (< 6 months):	(Power off) -20 - 35°C
Water Resistance (Device):	Splash Proof
Bluetooth Compliance:	Version 2.0 + EDR
Operating Frequency:	2.4 - 2.835 GHz
Output Power:	2 mW
Regulatory Approvals	FCC Part 15 Subpart C FDA - Pending CE - Pending

# Zephyr<sup>TM</sup> PSM Responder



## XTS RID

### ELECTRICAL

Power Source	XTS Radio
Operating Voltage Range	Range: 6 – 12VDC (7.4V Nominal)
Current Drain	<20mA (12mA Nominal)
Radio Battery Life Impact	< 1%

### COMMUNICATIONS

Bluetooth Compliance	Version 2.1 + EDR
Supported Profile	Serial Port
Operating Frequency	2.4 GHz to 2.835 GHz
Output Power	2 mW
Operating Range	30 ft / 10 m typical radius indoors (line of sight)
Antenna Type	Internal

### REGULATORY:

Contains Transmitter Module

FCC ID	QQQWT12
IC ID	5123A-BGTW12A
EMC Europe	Article 3.1b of the RTTE Directive 1999/5/EC.
EMC US	CFR 47 FCC Part 15 Subpart C.

### ENVIRONMENTAL

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

### MECHANICAL

Dimensions	16mm x 60mm x 20mm
Weight	25 grams (0.88 oz)
Case Material	Macroblend
Attachment	Jedi Latch

# Zephyr<sup>TM</sup> PSM Responder



## Zephyr Background

Zephyr Technology is a global leader in real-time performance and biomechanical monitoring or "Physiological Status Monitoring" (PSM) solutions for Defense, First Responder, Training and the Academic Research markets. Zephyr Technology leverages a world class team of engineers, scientists, physiologists and business experts.

Founded in 2003, Zephyr Technology has been a pioneer in the use of PSM in training and high stress operational environments. The company's ongoing collaboration with fire departments, NASA Ames Research Center, National Guard Civil Support Teams, and US Special Operations Forces has been invaluable in the development and validation of Zephyr's technology and its application in the most extreme operating environments to

**Measure Life . . . Anywhere**

## CONTACT:

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**Zephyr** Measure Life ... Anywhere