

OmniSense™ User Manual

Zephyr™ Performance Systems

Medtronic

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

CONTENTS (1/4)

ABOUT THIS MANUAL
About This Manual 5

GETTING STARTED

What's in the Box
What's In The Box 6

Software Installation
Recommended System Requirements 8
Installed Components 9
Installation Procedure 10
Troubleshooting 14
License Key 17
Motorola™* Barcode Scanner Support 18
Hardware Installation 21

SYSTEM OVERVIEW

The PSM System
The PSM System 22

OmniSense™ Web Portal
OmniSense™ Web Portal 24
OmniSense™ Cloud Account Definitions 25

Hardware Components
BioModule and Zephyr™ Strap 26
BioPatch™ HP 26
Garment Options 27
ECHO Gateway & Repeater 28
50 BioModule Charge Case 28
Charge Cradle 29
External Sensors 29
Barcode Scanner 30

SYSTEM SETUP

Setup Checklist
Setup Checklist 31

BioModule Configuration
Default BioModule Configuration 32
ECHO Short Address 32
Log Format 32
ECHO Transmit Power Level 33

Charge Devices
Charge Devices 34

Radio Network Options
Radio Network Options 35

Set Radio Network Type
Set Radio Network Type 36
Set ECHO Mode 37

OmniSense™ General Preferences
General Preferences 38

OmniSense™ Live Setup Overview
Database Setup Overview 40

Subjects
Add New Subject 42
Subject Parameters 43

Safety Alarm Limits
Safety Alarm Limits 45

Devices
Add/Edit BioModules by USB Connection 46
Add BioModules from an XML File 48
Add BioModules from a Database .FDB File 49
Add GPS Devices 50
Assign Devices to Subject 52
De-assign Devices from Subject 53
Manually Pair a GPS 54

Set Garment Type
Set Garment Type 55

Teams
Add/Edit/Remove teams 56
Populate Teams 57
Deploy Team 58
Un-deploy a Team 59

Barcode Scanner Operations
Print Pick Lists 60
Scanning Operations 61

BioModule Operation
Power On/Off 63
BioModule LED Indications 64
Zephyr™ Strap Fitting 65
BioModule Removal 66

Repeater Location
Repeater Location 67

OMNISENSE™ LIVE OPERATIONS

Startup Sequence
System Startup 68
OmniSense™ Live Startup Sequence 69

Live Screen Overview
Live Screen Components 70
Live Toolbar 72
Recording Logic 73
Multiple Recordings 74

BioGauge
Standard BioGauge 75
Training BioGauge 76
Configure BioGauge 77
BioGauge Parameters 78

Side Tabs
Details Tab 79
Acceleration Tab 80
Communications Tab 81
Communications Error Indications 82
GPS Tab 83
Workout Tab 84
Managing Workouts 85
Default Training Zone Thresholds 85
Workout Files 88
Send Team Workouts from Web Portal 89
Safety Tab 90
Medic Tab 91
Training Tab 92

Map Window
Map Window 93
Snail Trail 93

Session Names & Markers
Session Names 95
Session Markers 96

Notification Area
Notification Area 98

CONTENTS (2/4)

Preferences
Preferences 99
Intensity & Load 100
Training Thresholds 102
Speed Zones 103

Connection To Cloud Portal
Connection to Cloud Portal 104

Demo Mode
Demo Mode 105
Demo Team Setup 106

OMNISENSE™ ANALYSIS OPERATIONS

Overview
Overview 107
Features 108
Physiological Parameters 109
Demonstration Data 111
Database Rules 112
Recording Logic 113
Analysis Toolbar 114

Sessions
Session Naming 116
Workflow 117
Filter Sessions 118
Select Session 119
Session Options 119

Subsessions
Overview 121
Subsession by Mouse 122
Subsession by Wizard 123

Graph Types
Select Graph Type 124
Reports 125
Legend 126

Time Graphs
Select Time Variables 127

Summary Graphs
Select Summary Variables 128
Max/Min/Avg 129
Total 130
Summary 134
Summary Graph Preferences 135

Graph Functions
Background Shading 136
Cursor Values 139
Zoom and Pan 140
Real and Elapsed Time 141
Full screen 142

Print/Export
Print Graph 143
Export Graph Data 144
Export / Archive Session Data 145
Import Session Data 146

Data Filters
Filter Data 147
Create a Data Filter 148

GPS Data
Export GPS Data 149
View Physiological Data from a KML File 150

Readiness
Overview 151

ANALYSIS IMPACT PROCESSING

Overview
Accelerometry Overview 152
Accelerometer Magnitude 153
Enhanced Summary Data 154
Accel Waveform Data 155
Types of Impulse 156
Impact Zones of Severity 157
Impact Angle 158

AccelPro Impact Report
AccelPro Impact Report 159
Impact Processor Tool 160
Report Summary Tab 162
Impulse Data Lines Tab 164
Accelerometry Stream Tab 166

ANALYSIS REPORTS

Overview
Fitness Reports 168
Team Fitness Report 169
Training Reports 170

Parameters & Color Coding
Report Parameters 171
Report Table Coloring 172

Manage Reports
Create Report 173
Export Report 174
Edit Report 175

Report Categories
Group Consolidated Summary 176
Periodization Report 177
Summary GPS 178
Summary Physiological 179
Workout Compliance 180

LOG DATA

Overview
Overview 181
Log Download Times 183
BioModule Logging Capacity 184
Logging Configuration Checklist 185

Zephyr™ Downloader
Overview 186
Downloader Menu Options 187
Zephyr™ Downloader Operation 188
Expand Log View 189
Auto Download 190

OMNISENSE™ WEB PORTAL

Overview
OmniSense™ Local & OmniSense™ Cloud 191
Portal Access 192
Connecting OmniSense™ Local to the Cloud 193
How Accounts Work 195
User Roles and Permissions 197

Home Screen
Dashboard 199
Dashboard Header & Navigation 200

CONTENTS (3/4)

Configure Dashboard 201
Add/Configure Widget 202

Default Widgets
Forecast 203
My Status 204
Team Status 205
Athlete Status 206
Notes 207

Custom Widgets
Time Graph Widget Example 208
Summary Graph Widget Example 210
Create a Custom Widget 211
Update/Delete a Custom Widget 213

My Profile
My Profile 214

Live Screen
Live Screen 215
Subject BioGauge 216
BioGauge Settings 217

Analysis
Overview 218

Reports
Create a Report 220
Workflow 221
Over Time Graph 223
Summary Graph 228
Readiness Graph 230
Periodization Report 232
Table Style Report 235

Calendar
Calendar 237

Devices
View Devices 238

Teams
Manage Teams 239

Athletes
Athlete Status 241

Manage User Roles
Manage User Roles 243
Permissions 243

Manage Users
Manage Users 245
Create New User 245
Physiological Parameters 246

Training Plans
Overview 247
Workflow 250
Manage Goals 253
Manage Periodization Plans 255
Manage Training Plans 257
Manage Workouts 260
Manage Assignments 264
Send Team Assignments to PC Application 266
Manage Injury 267
Manage Competition 268

Preferences
General Preferences 269
Active Features 269

Threshold Settings
Intensity & Load 270
Training Zones 274
Speed Zones 275
Elevation Zones 275
Readiness Weights 276
Safety Thresholds 277

OMNISENSE™ MOBILE

Overview
Overview 278
Install 280
Screens 281
Settings 282
Link Device 283
HxM Firmware Upgrade 284
Store and Forward 285
Parameters 286

Application Screens
Home 287
Menu 288
Free Workout 289
Prescribed Workout 293
Calendar 294
Fitness Assessments 295
History 297
Training Thresholds 298

OMNISENSE™ TOOLS

Overview
Overview 299

Zephyr™ Config Tool
Operation 301
Configuration Tabs 304

ZUSBUpdate Tool
BioModule Firmware Updates 310

Zephyr™ Kubios Converter
External Processing of R-R files 311

Zephyr™ Data Plotter
Zephyr™ Data Plotter 312

BASELINE FITNESS TESTING

Overview/Test Protocols
Baseline Fitness Testing 316
Treadmill Test Protocol 317
Beep Test Protocol 318
Orthostatic Hypotension Readiness Test Protocol 319
OmniSense™ Mobile 320

Treadmill/Beep Test Analysis
OmniSense™ Live 321
Automatic Test Analysis 322
Manual Test Analysis 323
Manual AT Threshold Selection 324
Save Fitness Test Parameters 325

Orthostatic Hypotension Readiness Test Analysis
Orthostatic Hypotension Readiness Test Analysis 326
Readiness Survey 328
Display Readiness History 330
Configure Readiness Survey Weightings 331
Import Readiness History 332

CONTENTS (4/4)

FITNESS PARAMETERS

Intensity & Load

Overview 334

Interpreting Graphs

Average Physiological vs. Average Mechanical Intensity 337
Physiological vs. Mechanical Load 338
Training Load & Intensity 339
Recovery & Fatigue 340
Safety & Core Temperature 341
Time in HR Zones 342
Caloric Expenditure 343
Physiological Strain & Stress Indicators 344
HR_{avg} & HRR Indicating Stress & Anxiety 345

APPENDICES

1. BioModule Firmware Upgrade 346
2. BioModule Firmware Versions 350
3. BioModule Log Data Descriptions 353
4. BioModule Log Data Parameters 361
5. Security Advice 414

EULA 416

SUPPORT 422

INDEX 423

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

ABOUT THIS MANUAL

About This Manual

This manual provides comprehensive instructions on all aspects of setup, configuration and operation of Zephyr™ Performance Systems PSM (physiological status monitoring) training hardware and Zephyr™ OmniSense™ software.

This is an interactive PDF document.

When viewing online, use the panel on the left to navigate.

The section titles will expand to show sub-topics when you click on them. The section currently viewed is highlighted in blue and you will be relocated to the selected section.



The table of contents and index entries are also hyper linked - just click on them to relocate.

When browsing, you may find it easier to use the **View > Page Display > Two Page Scrolling** view.



Note

For brevity, some operations within the software are **not** explicitly described; for example, **Save**, **Cancel** and **OK** buttons where they are used. Their function is widely understood, and need not be described repeatedly. Any **Delete** operation is preceded by a dialog confirming that the user does want to delete an item.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
> What's in the Box
> Software Installation
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

What's In The Box

Items which will be shipped:

- Shipping List
  Match all items on the shipping list with those physically received.

Item		Description
		Medtronic USB Drive

- Contains the OmniSense™ Software Installer and soft copies of documents, including the Reference Manual (this manual).

Item		Description
		BioModule(s)

Item		Description
		Garment - compression shirt/ sports bra
		Garment - Zephyr™ strap

- Optional, multiple sizes available.

Item		Description
		GPS Receiver

- Optional

Item		Description
		BioModule charge cradle, 5 devices

- Single charge cradles also available.

Item		Description
		BioModule charge case, 50 devices

- USB connector and internal battery charge cable included.

Item		Description
		GPS charge cradle, 5 devices

- Wall charger and USB connector included.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
> What's in the Box
> Software Installation
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

GETTING STARTED
WHAT'S IN THE BOX (2/2)

Item		Description
		ECHO Gateway

- USB Mini connector included.

Item		Description
		ECHO Repeater

- USB charge connector included.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
> What's in the Box
> Software Installation
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

GETTING STARTED
Software Installation (1/14)

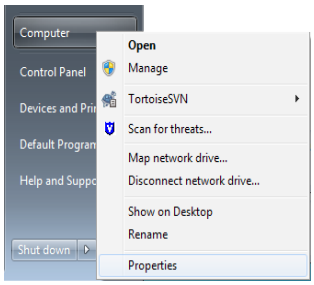
Applicable Version

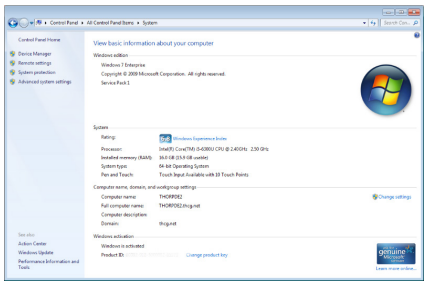
This manual describes operations for version 5.1 of the OmniSense™ software.

Recommended System Requirements

To check PC specifications:

1. Select **Start > Computer**
2. Right-click **Computer**
3. Select **Properties**





System Component	Description
PC Operating System	Microsoft™* Windows™* 7, 8.1 or 10 .NET 4.0 Framework required
PC Processor	32 or 64 bit 1.7 GHz dual core or higher
PC RAM	8GB minimum
PC Drive	250GB [Solid State HDD recommended]
Connectivity	USB
Graphics Card	NVIDIA™* or Radeon™* recommended
Screen Resolution	1024 x 768 [Touchscreen recommended]
Bluetooth™*	Default Microsoft™* Windows™* Bluetooth™* stack. This may not be the case for all PCs with built-in Bluetooth™*. (Not required unless using Bluetooth™* Direct or adding GPS devices to the system)

Warning

Do not connect any Zephyr™ hardware to your PC until after the driver files are installed automatically as part of the OmniSense™ software installation.

Warning

Do not install any Zephyr™ software on an Apple™* computer using a virtual PC interface, and then connect a BioModule to the computer via USB. The device may behave unpredictably during subsequent operations.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
> What's in the Box
> Software Installation
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Installed Components

The following components will be installed.

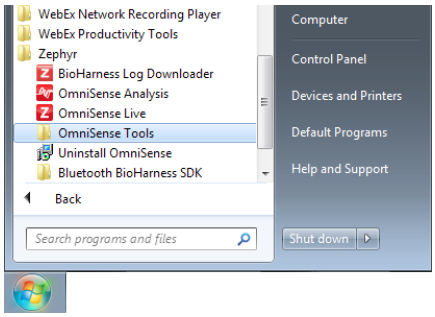
System Component	Description
Microsoft™* .NET3.5/SP1 & 4.0	Program framework required to operate the application software (already embedded in Microsoft™* Windows™* 7)
Zephyr™ USB Driver	Files needed to communicate with Zephyr™ hardware when they are connected directly to a PC
Firebird Database	Database for storing recorded physiological data (this doesn't show up in the Add/ Remove programs page in Microsoft™* Windows™*)
Zephyr™ OmniSense™ Live Module	Zephyr™ Application Software
Zephyr™ OmniSense™ Analysis Module	Zephyr™ Application Software
Zephyr™ Configuration Tool	Configuration Tool for Zephyr™ BioModules (to be used only after consultation with Zephyr™ or distributor)
Zephyr™ Downloader	A utility for importing log files from multiple BioModules simultaneously. Data can be sent to the OmniSense™ database and/or external csv files
ZUSBUpdater	Tool for updating BioModule firmware

Shortcuts for OmniSense™ Live and OmniSense™ Analysis will be installed on the PC desktop.





Tools can be accessed from the Start Menu.

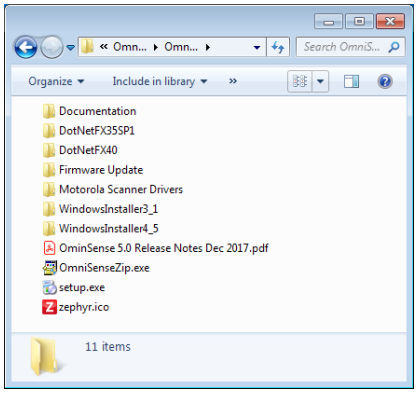


CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
> What's in the Box
> Software Installation
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Software Installation (3/14)

Installation Procedure

1. Browse the installation files at their location – either on CD, removable storage or on the PC itself.



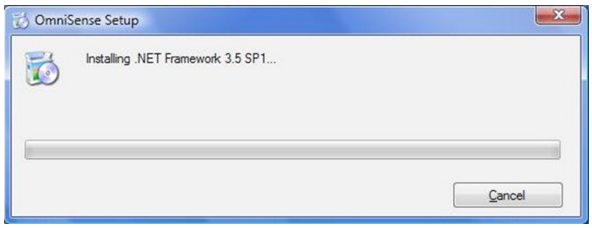
2. Double-click the **Setup.exe** file to start the installation. Do not click any other file, as setup.exe initiates Microsoft™*.NET, Zephyr™ USB driver and OmniSense™ software installation.

3. A Microsoft™*.NET Install dialog will display if you do not already have this component installed on your PC. (If using Microsoft™* Windows™* 7, you will not see this dialog as Microsoft™*.NET is already embedded).



4. Click **Accept** to continue.

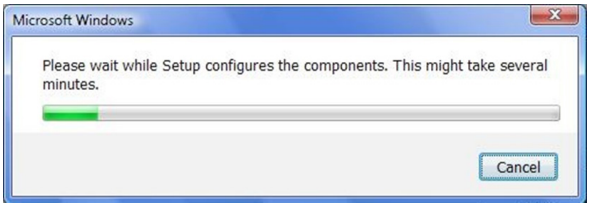
5. Some copying file dialogs will briefly display, followed by a progress bar. You may see a User Account Control dialog to approve the installation.



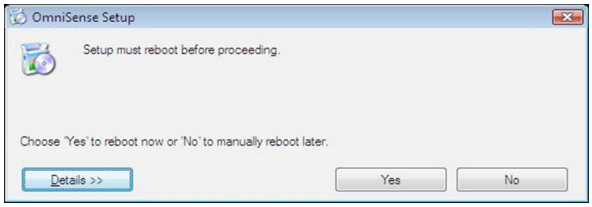
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
> What's in the Box
> Software Installation
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Software Installation (4/14)

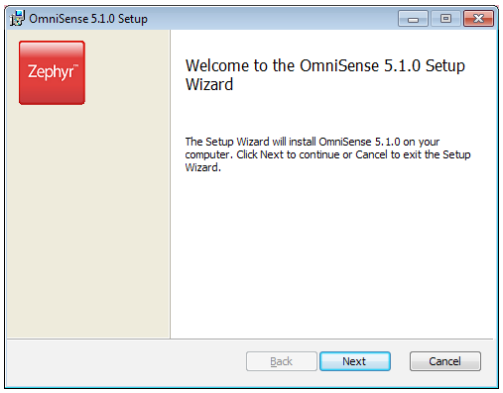
6. This will be followed by another dialog.



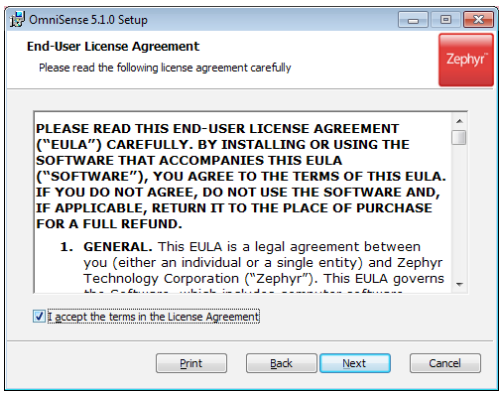
7. You may be asked to reboot your PC before proceeding.



8. Select **Yes**. Reboot your PC and the install process will continue automatically. The OmniSense™ installer dialog will display automatically.



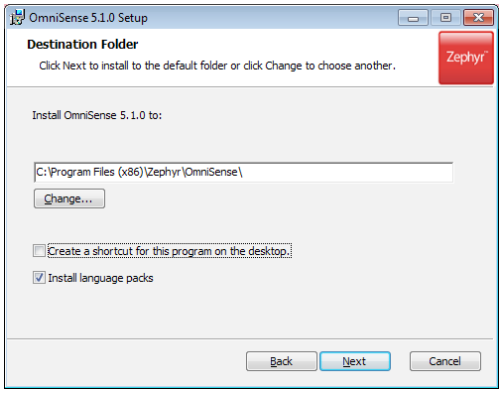
9. Select **Next** to continue. An end-user license agreement will display. Check the '**I accept...**' box and select **Next** to continue.



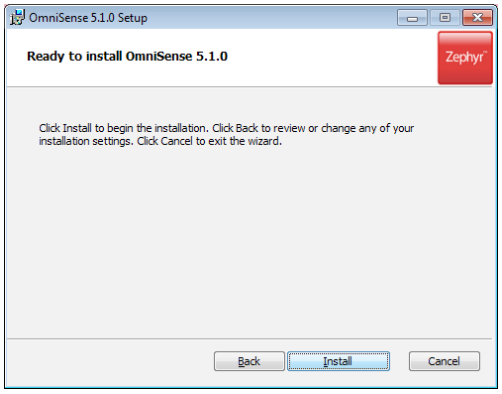
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
> What's in the Box
> Software Installation
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Software Installation (5/14)

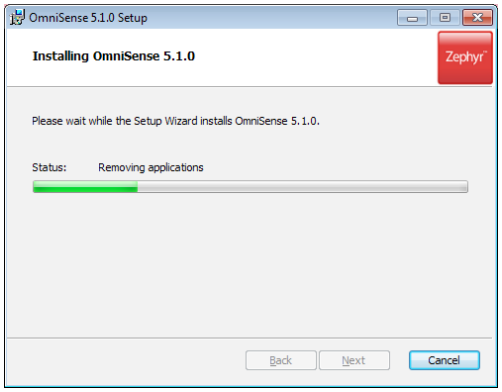
10. Browse and select an alternative location for the files if needed.



11. Click Next to continue, unless a location other than the default is preferred. Record where this alternate location is for future reference. A dialog will indicate the installer is ready to start. Click **Install** to continue.



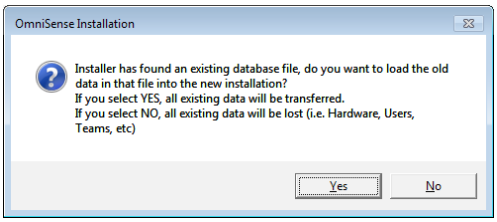
12. A progress bar will display during installation. There may be a short delay before it initiates.



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
> What's in the Box
> Software Installation
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

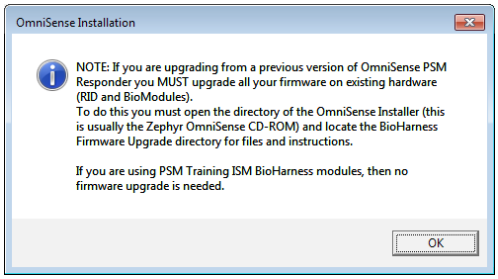
Software Installation (6/14)

13. If an existing OmniSense™ database file (from a previous installation) is detected, a dialog will ask whether you want to add the data from this existing file into the new database. If you select **No**, the old database file will be overwritten. If this is done in error, contact Zephyr™ for information on recovering the overwritten data.

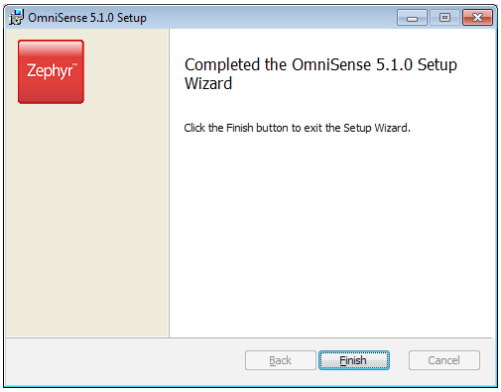


14. A firmware upgrade may be required for BioModules and Motorola™* XTS™* Speaker Microphones.

    An additional directory [**BioModule Firmware Upgrade**] supplied on the CD or download contains all the files needed for the user to perform the upgrade themselves. Firmware upgrade instructions are also included in an **Appendix** at the end of this manual.



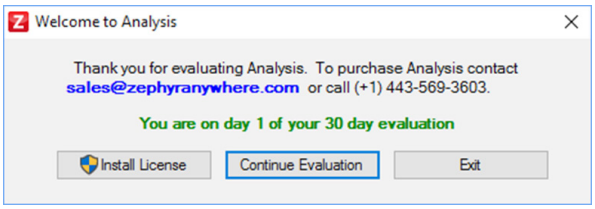
15. Click **Finish** to complete the installation.



16. Shortcuts for OmniSense™ Live and OmniSense™ Analysis will be placed on your desktop.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
> What's in the Box
> Software Installation
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

17. Install your license key when requested on first operation of the software. This key will be valid for subsequent updates.

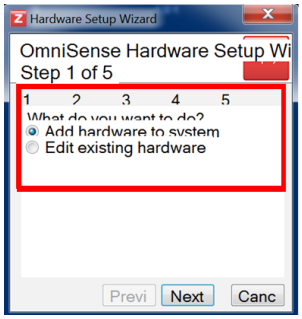


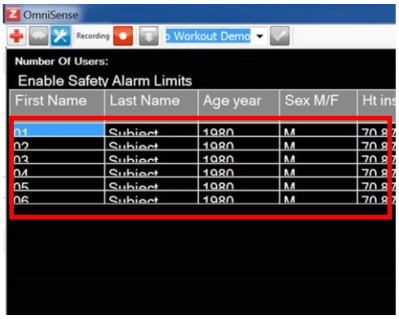
Note:

Customers are **advised to keep a record of the license key**, should they need to install the software on a different computer at any time in the future.

Troubleshooting

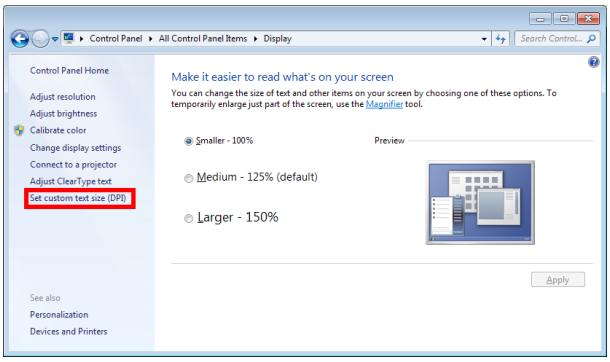
After install, some users may see overlapping of screen components:





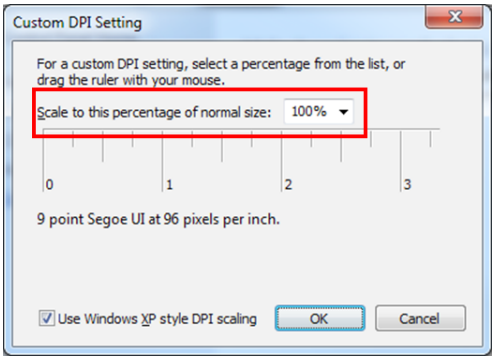
Microsoft™* Windows™* 7

1. Go to **Start > Control Panel > Display**



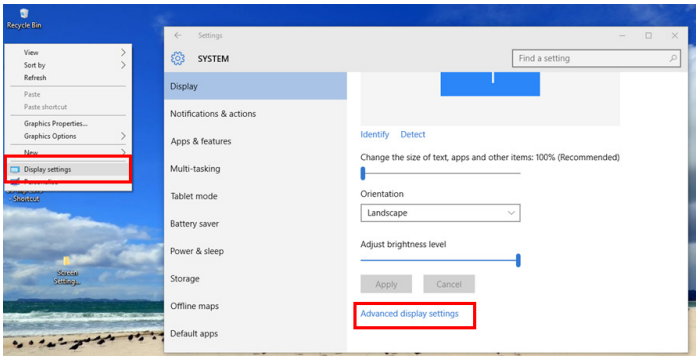
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
> What's in the Box
> Software Installation
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

2. Select **Set Custom text size (DPI)**, and in the dialogue displayed, set the **Scale to this percentage...** to 100%

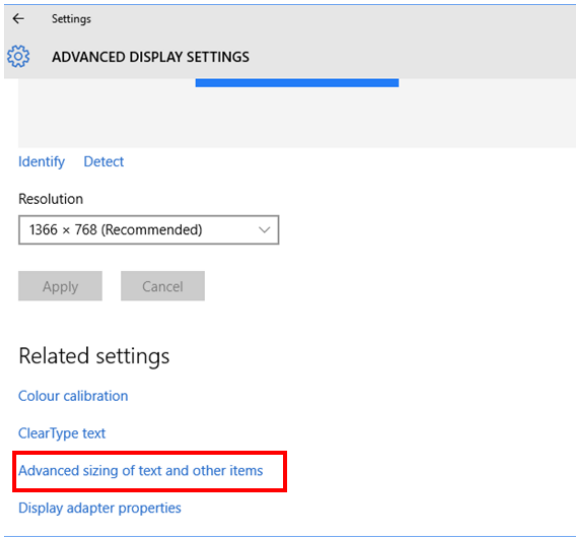


Microsoft™* Windows™* 10

1. Right-click on the desktop and select **Display Settings** from the context menu



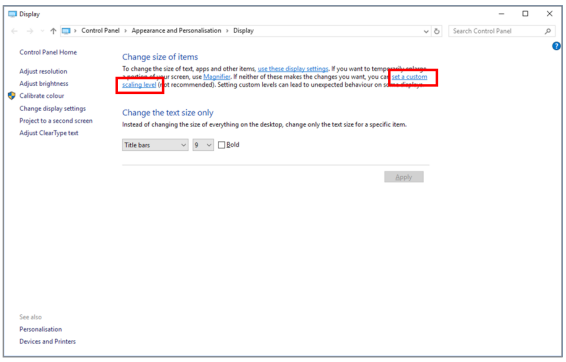
2. In **Advanced Display Settings**, select **Advanced sizing of text and other items.**



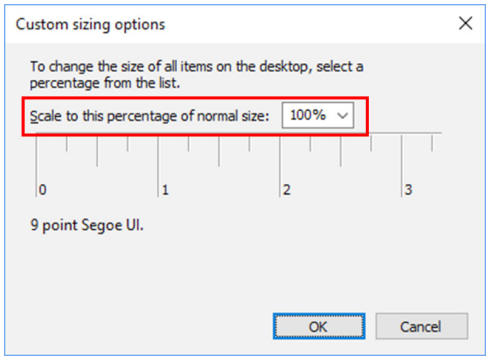
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
> What's in the Box
> Software Installation
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Software Installation (9/14)

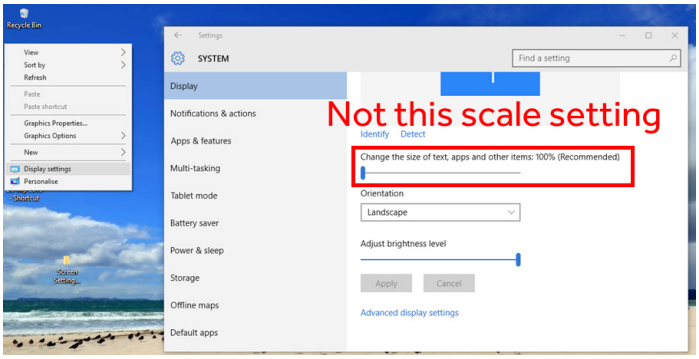
3. In the **Advanced Sizing...** dialog, select **Set a custom sizing level**



4. In the **Scaling Level** dialog, set **Scale to this percentage of normal size** to **100%**



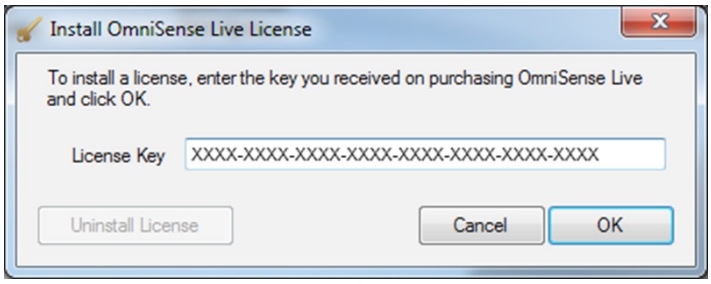
5. Note that the above scaling factor is **not** the same as that set in the initial **Display Settings** dialog.



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
> What's in the Box
> Software Installation
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

License Key

For OmniSense™ 4.x and 5.x a license key must be purchased with the software. A licence key dialog will appear the first time you run **OmniSense™ Live** or **Analysis**.



A 32-character license key will be supplied for all new instances of OmniSense™, or upgrades, purchased.

Note

Licenses purchased for a specific iteration of OmniSense™, e.g. 4.x.x or 5.x.x are not valid for any of the other iterations.

Note

Use of the OmniSense™ Web Portal, and connecting the PC software to the portal, is a subscription service which will be administered by the user's Account Administrator. The license will need to be renewed annually.

OmniSense™ 4.x does not connect to the web portal.

End-users wishing to use the portal must be created by the Account Administrator or a user with appropriate permissions.

The creation process will send an automatic email to the end-user's nominated email address, through which they can log in to the portal and validate their membership. See the **OmniSense™ Web Portal** section for more information.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
> What's in the Box
> Software Installation
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

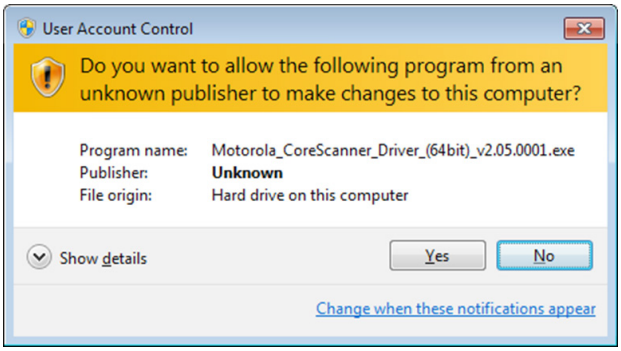
Motorola™* Barcode Scanner Support

Support is included for optional Motorola™*Barcode scanners for rapid deployment of teams, subjects and components. Driver files for these scanners must be installed independently.



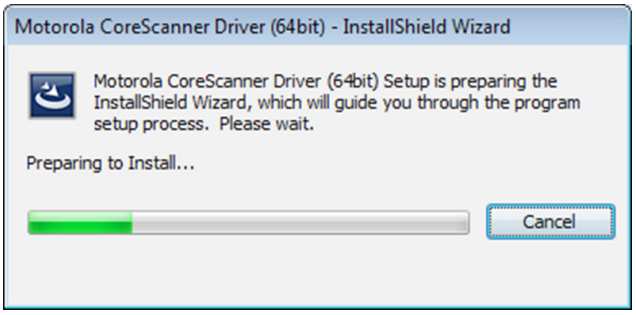
Motorola™* DS4208

1. Browse the OmniSense™ installation files to locate the Motorola™* Scanner Drivers directory, and then the driver file installer (32 bit or 64 bit) appropriate for your system. Double-click the installer file to initiate.



If a User Account Control dialog displays, select **Yes** to continue.

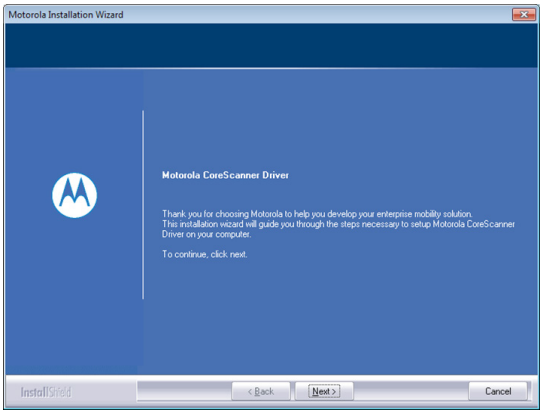
2. The installation wizard will start.



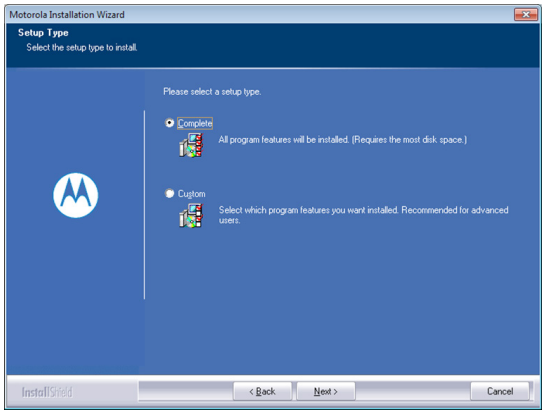
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
> What's in the Box
> Software Installation
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Software Installation (12/14)

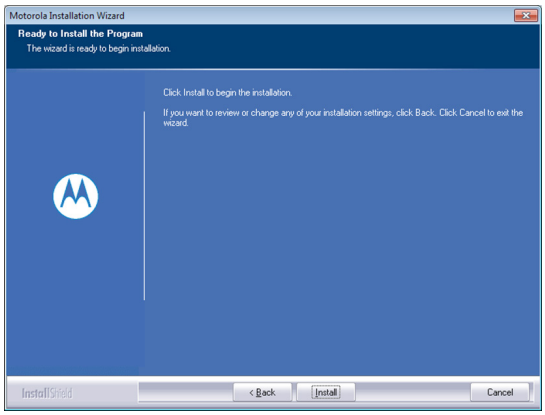
3. Select **Next** to continue.



4. Leave **Complete** checked. Select **Next** to continue.



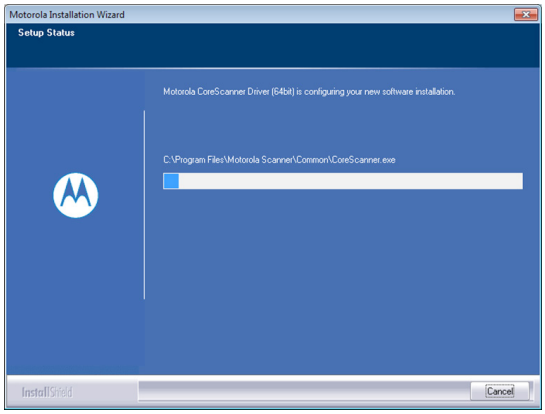
5. Select **Install** to continue.



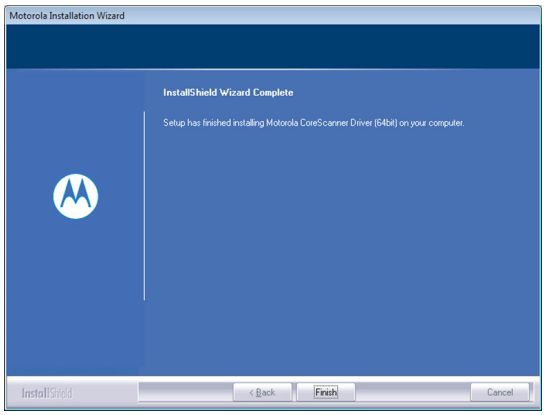
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
> What's in the Box
> Software Installation
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Software Installation (13/14)

6. The installation will proceed automatically.



7. Select **Finish** to complete the install.



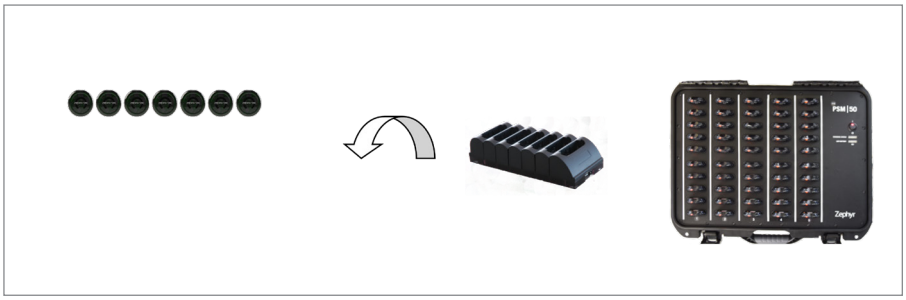
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
> What's in the Box
> Software Installation
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Hardware Installation

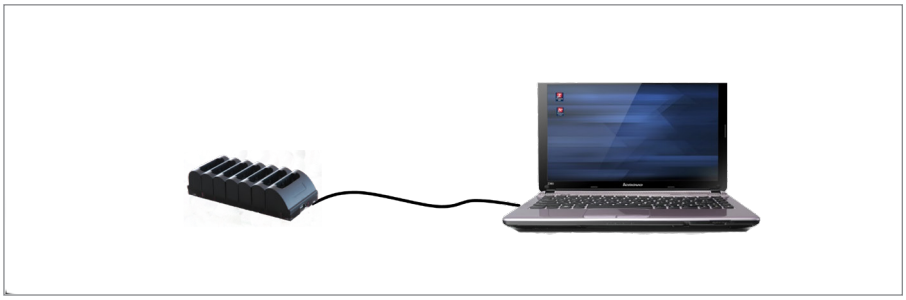
A PSM Training system is supplied with a charging and configuration cradle capable of holding one, five or fifty BioModules.

In order to communicate with and download logs from each BioModule to the PC platform, driver files must be installed for **each** of these devices. The best way to do this is to remove **ALL** BioModules from the cradle before its first connection to the PC, and relocate them one at a time, pausing for device driver files to load for each.

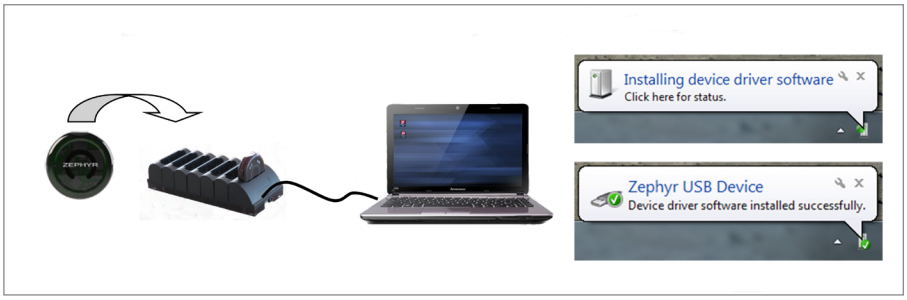
1. Install OmniSense™, and remove all devices from the USB charge cradle or system case.



2. Connect the empty cradle case to the PC by USB connector.



3. Replace the devices **one at a time** and allow the drivers to load.

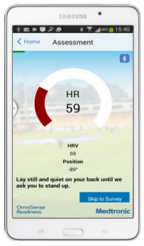


CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
> The PSM System
> OmniSense™ Web Portal
> Hardware Components
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

The PSM System



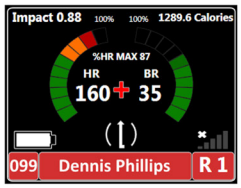
BioModule



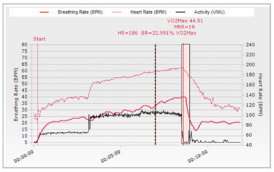
OmniSense™ Mobile



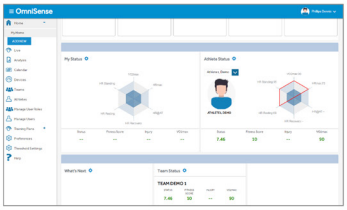
OmniSense™ Live



Live Physiological & Biomechanical Data



OmniSense™ Analysis



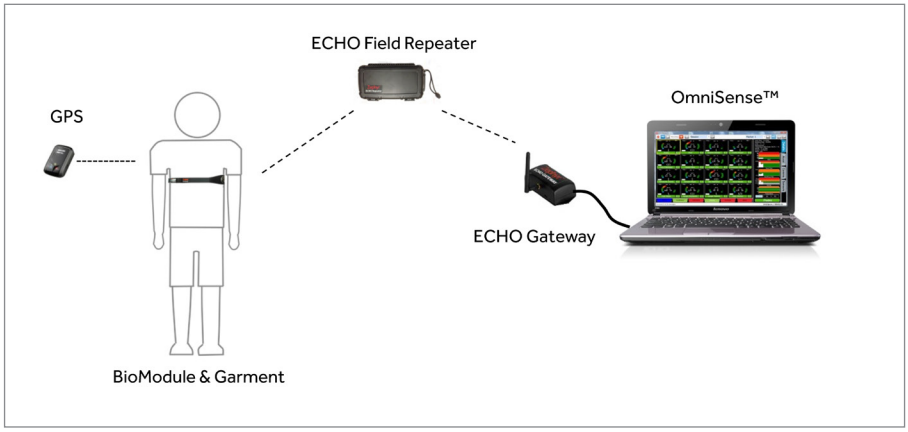
OmniSense™ Web Portal

- The PSM System transmits live physiological data from up to 100 subjects via a radio link to a remote PC station.
- Subjects can also transmit to and view data on a mobile device application.
- OmniSense™ Live and Analysis PC modules can receive and analyze transmitted data.
- Users with subscriptions to an OmniSense™ web account can view and analyze data from either a connected PC using the OmniSense™ cloud portal or mobile device session.
- BioModules can also log data during an offline session, for later upload to a PC via OmniSense™ Analysis
- Live data is displayed in OmniSense™ Live on a configurable BioGauge, including:

  - Heart Rate
  - Breathing Rate
  - Orientation
  - Activity Level
  - Estimated Core Temperature
  - Impact Data
  - Stress
  - Training Intensity
  - & many others

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
> The PSM System
> OmniSense™ Web Portal
> Hardware Components
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

SYSTEM OVERVIEW
The PSM System (2/2)

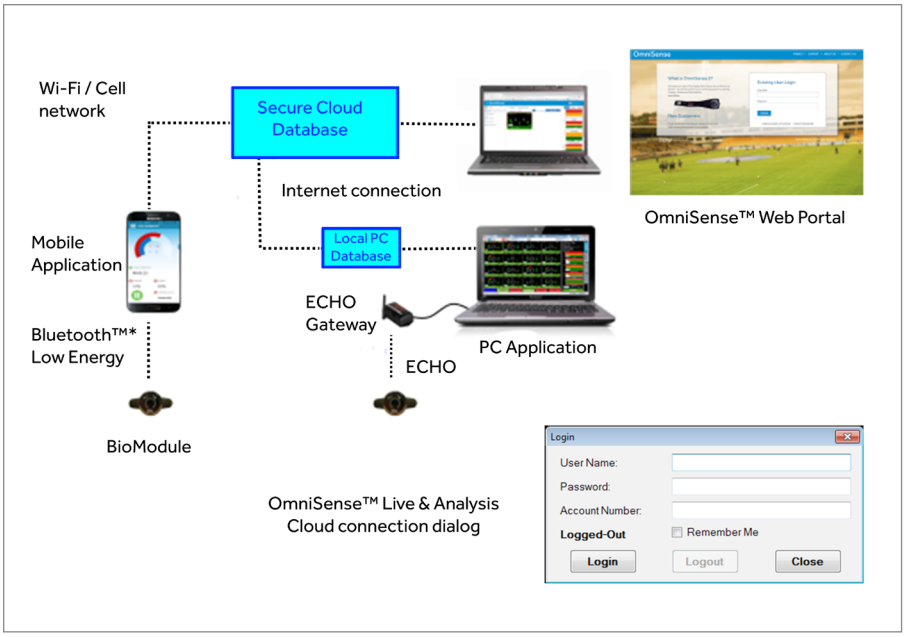


Zephyr™ PSM Training features:

- Remote relay of multiple physiological & biomechanical parameters, including
  - Heart Rate
  - Breathing Rate
  - Activity Level
  - Estimated Core Temperature
  - Subject Orientation
- Support of up to 100 subjects
- Range of up to 400 yards with optional field repeaters
- Optional GPS Speed & Distance, and Map display with supported Bluetooth™* GPS
- OmniSense™ Live streaming data display
- Visual sweep scale and color-coded display, fully configurable
- Red/Orange/Green subject status algorithms
- Full data recording and display using OmniSense™ Analysis
- Fitness and Training Reports
- Baseline fitness tests
- Training Plan Workouts, pushed automatically to mobile devices
- Offline data logging on the BioModule

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
> The PSM System
> OmniSense™ Web Portal
> Hardware Components
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

OmniSense™ Web Portal



OmniSense™ 5 now includes access to a web portal, and secure storage of data in a cloud database.

- Connection to the portal and cloud server is available via a toolbar button in either Live or Analysis.
- Customers must be members of an account and have a login and account number supplied by their Account Administrator.
- Data is uploaded automatically from a connected Live session.
- Data **cannot** be downloaded from the Cloud server to a local PC database – upload only is permitted.
- Data can be viewed and analyzed via a web version of OmniSense™ Analysis.
- Data is uploaded automatically from the OmniSense™ Mobile Application to the cloud server.

If a user wants to withdraw from acceptance of terms or wants their own user profile and data permanently deleted from the database for any reason, they can send a written request by email to support (zephyrperformancesupport@medtronic.com) originating from the email address associated with the user account. If the user profile is shared between multiple customer accounts, it must be specified which account's data (or all) should be deleted or retained. The support team will complete the action and send a reply email to the user to confirm completion.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
> The PSM System
> OmniSense™ Web Portal
> Hardware Components
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

OmniSense™ Cloud Account Definitions

Term	Description
Account	Client name for each customer.
Subscription Fee	Each account will have an affiliated monthly fee for each System, Administrator and Subject.
Subjects	Number of users of the system that are being monitored. Subjects can only view their own data, unless granted permissions. Some user types have wider permissions (e.g. Coaches).
Administrators	Number of back-end Admins who will have access to the data and who will be able to define who actually sees all, some or none of the data.
Reports	Customized or standardized graphs, spreadsheets or trends which are downloaded from the customer's data and sent to customer based upon their viewing contract. For example - five reports pulled for training loads weekly.
Hardware	Medtronic product such as the straps, BioModules, gateways, etc. that make up the performance monitoring solution.
OmniSense™ Local	Local version of OmniSense™ running on a host PC.
SLA	Service level agreement that is based on a per hour or annual basis.
Training	On-site Zephyr™ professional support for new customers learning the system.

For a complete description on how to use the web portal, refer to the **OmniSense™ Web Portal** section.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
> The PSM System
> OmniSense™ Web Portal
> Hardware Components
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

SYSTEM OVERVIEW
Hardware Components (1/5)

BioModule and Zephyr™ Strap



- Connectivity
  - ECHO transmitter module
  - Bluetooth™* + Bluetooth™* Low Energy transmitter module
  - USB for PC configuration
- Internal data logging, up to 450 hours*
- Log download by USB or Bluetooth™*
- Battery duration up to 35 hours
- 3 hour battery charge time
- IP67 water resistant
- Configurable firmware
- Internal algorithms for
  - Subject ROG (Red/Orange/Green) status
  - Estimated Core Temperature
  - Jump & Dash Tests
  - Heart Rate Variability
- 250 Hz ECG
- 100 Hz 16g 3-axis accelerometer
- Capacitive breathing detection
- Supports Bluetooth™* GPS
- Barcode labelling for rapid deployment

*Dependent on log format

BioPatch™ HP



- Skin attachment similar to standard ECG electrode
- Impedance breathing detection

Note

The BioModule will auto-detect whether the garment is a Zephyr™ Strap or BioPatch™ and use the appropriate breathing detection algorithm.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
> The PSM System
> OmniSense™ Web Portal
> Hardware Components
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

SYSTEM OVERVIEW
Hardware Components (2/5)

Garment Options



Strap | Loose Shirt | Front Mount Compression Shirts | Rear Mount | Rear Mount Sports Bra (Female)

Zephyr™ Strap

- Left side BioModule location
- Integrated ECG & capacitive breathing sensors
- Adjustable, elasticized
- Fabric-based
- Detachable shoulder strap
- Machine washable (replace after ~80 washes)

Loose Shirt

- Left side BioModule location
- Integrated Zephyr™ strap with low profile buckle
- Flame resistant
- Semi-fitted athletic style
- Quick Dry
- Machine washable
- Male & female options

Compression Shirt Front Mount

- Center chest BioModule location
- Integrated ECG sensor only
- Tight fit
- Polyester Lycra body
- Integrated GPS pocket

Compression Shirt or Sports Bra Rear Mount

- Rear facing BioModule between shoulder blades for protection
- Compression top
- Stretchable, protected internal wiring
- Compression shirt
- Unisex design
- Polyester/Spandex body
- Neoprene pad behind BioModule cup
- Stainless steel rivets & snaps

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
> The PSM System
> OmniSense™ Web Portal
> Hardware Components
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Hardware Components (3/5)

ECHO Gateway & Repeater



ECHO Gateway



Field Repeater

ECHO Gateway

- USB connection for power
- Plug & play for driver installation
- 200 yard range (line of sight)
- Short or long antenna options

Field Repeater

- External power or internal battery (24 hours/5300mAh)
- 3 hour charge time
- Maximum 4 repeaters per ECHO system
- Extend range to 400 yards

50 BioModule Charge Case





50 BioModule Charge Case

- 50 BioModule capacity
- USB connectivity to PC, 10 BioModules at a time
- BioModule configuration
- Log download via USB or Bluetooth™*
- External power or internal rechargeable battery
- Tough, durable storage and transportation for BioModules

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
> The PSM System
> OmniSense™ Web Portal
> Hardware Components
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Hardware Components (4/5)

Charge Cradle



- 5 BioModule capacity
- USB mini connectivity to PC
- BioModule configuration
- Log download via USB or Bluetooth™*
- External power pack supplied

External Sensors

GPS



QSTARZ 818XT



Charge Cradle

- Add sensor by Bluetooth™* in OmniSense™ Live
- Speed, distance travelled and location
- Supports streaming map display in OmniSense™ Live
- KML file export from OmniSense™ Analysis

Note:

When using the OmniSense™ Mobile application, speed and location data is acquired via the GPS module native to the mobile device.

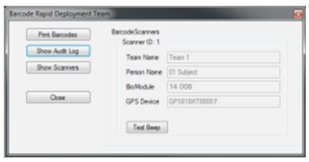
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
> The PSM System
> OmniSense™ Web Portal
> Hardware Components
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

SYSTEM OVERVIEW
Hardware Components (5/5)

Barcode Scanner



Motorola™* DS4208 wired scanner



OmniSense™ Live Rapid Deployment Tool

- Assign BioModules & GPS to subjects
- Assign subjects to teams
- Start Live operations
- Integrated tool in OmniSense™ Live
- Use device labels or printed sheets
- Wired (DS4208) scanner support

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Setup Checklist

Prior to Live operations, the following tasks should be completed using the OmniSense™ Live Setup screens, and Live Preferences.

Task	Description
Charge devices	▪ Ensure ECHO Repeaters, BioModules & GPS units have sufficient battery charge.
Radio Network Type	▪ Set **Radio Network Type** in Live Preferences. ▪ Set **ECHO Mode**.
Configure BioModules	▪ Set log format to **Summary + Waveform** or **Enhanced Summary + Waveform** if GPS devices are to be used, or waveform data is required.
Subjects	▪ Add subjects to database.
Hardware	▪ Add BioModules & GPS devices to database. ▪ Assign hardware to subjects.
Teams	▪ Create teams. ▪ Populate teams with subjects. ▪ Deploy teams to live when ready.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Default BioModule Configuration

The default settings for newly shipped BioModules are:

Setting	Value
Bluetooth™*	Enabled
ECHO	Enabled
Bluetooth™* Low Energy (BLE)	Enabled
Log Format	Enhanced Summary

ECHO Short Address

BioModules in an ECHO system each have a unique ECHO Short Address. There must be **no duplicate addresses** in any one system. When adding additional BioModules to an existing system, it may be necessary to change the ECHO Short Address.

Short Addresses are usually in sequence 1,2,3,... but may be any values in the range limit for the system (1-15, 1-20, 1-30, 1-64, 1-100 depending on **ECHO Mode** Setting, described later) as long as there are no duplicates.

Note:

When configuring an ECHO system, it is good practice to label the BioModules with a sticker which indicates the ECHO Short Address.



Zephyr™ production BioModule labelled 24-001. ECHO Channel is 24, Short Address is 001.

Log Format

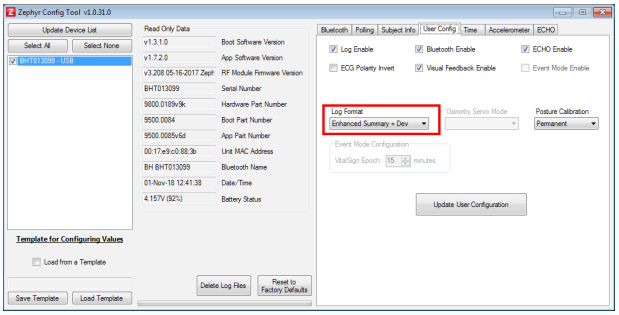
The default log format is **Enhanced Summary**. For a detailed description of all log formats and parameters, refer to Appendix 3 **BioModule Log Data Descriptions.**

GPS Data

To log GPS data internally in the BioModule, the log format must be changed to **Summary & Waveform,** or **Enhanced Summary & Waveform**.

Note:

To change BioModule default configurations, refer to the **OmniSense™ Tools > Zephyr™ Config Tool section.**



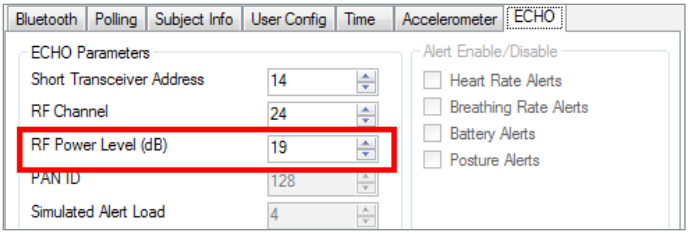
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

ECHO Transmit Power Level

ECHO Transmit power level is pre-set according to the destination region for the device. These settings are required to comply with local regulations.

Region	Maximum ECHO RF Power Level (dB)
USA & EU	19
Japan	12

ECHO Transmit power level is set using the Zephyr™ Config Tool.

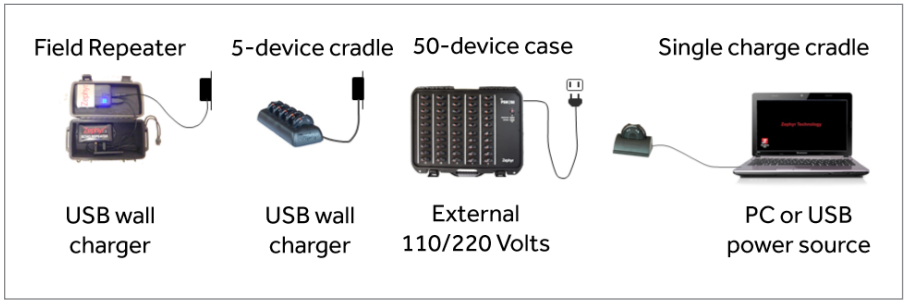


Note

Devices configured for the Japanese region may experience an approximate 10% reduction in maximum transmission range.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Charge Devices



ECHO Gateways are powered direct from the host PC by USB.

ECHO Field repeaters are power by an internal battery which needs periodic recharging.

A 50 BioModule Charge Case with its internal battery can charge BioModules for two charge cycles.

Device	Repeater	50-Device Charge Case Internal Battery	BioModules
Charge Times	1 hr to 90% 3 hrs to 100%	1 hr to 90% 3 hrs to 100%	1 hr to 90% 3 hrs to 100%

Battery Care

For all batteries - BioModules, 50-Device Charge Case Internal Battery & Field Repeaters

- Top-up charge when not in use, around once per month.
- Top-up charge BioModules after use. Repeated shallow charges will maintain battery condition better than less frequent deep charge cycles.
- Charge and store the devices in a cool place.

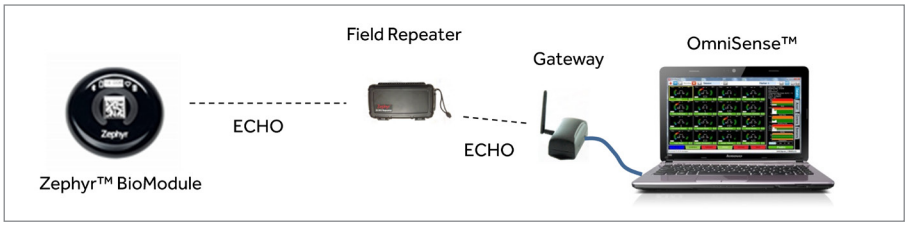
BioModule Battery Duration

Mode	Typical Battery Duration (new battery)
Transmitting	28 hrs
Logging	35 hrs

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Radio Network Options

ECHO



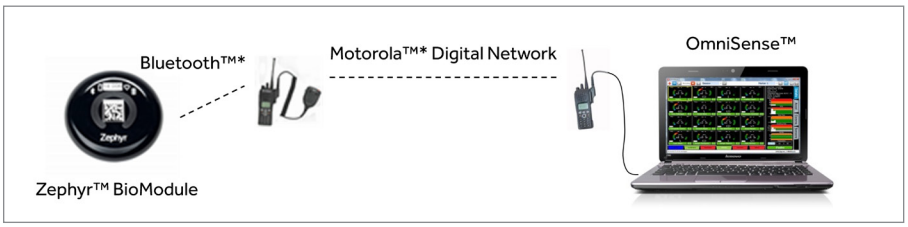
Range: 400 yards with repeater. 15-100 subjects, 1-5 second data update rate.

Bluetooth™* Direct



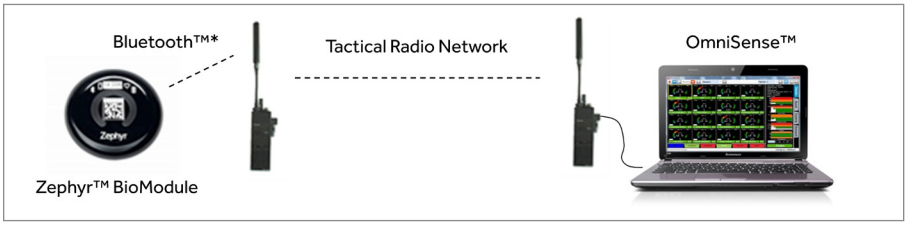
Range: up to 100 feet. 7 subjects. 1 second data update rate .

First Responder



Range per Motorola™* network. 64 subjects. 1 second data update rate.

Defense



Range per Tactical radio network. 64 subjects. Data update rate network dependent.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Set Radio Network Type (1/2)

Set Radio Network Type

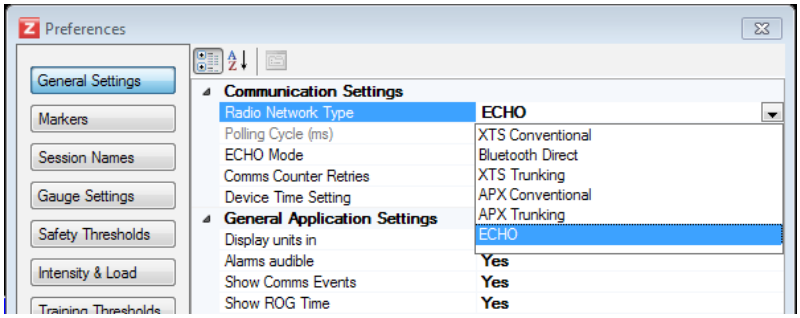
1. Start OmniSense™ Live using the desktop shortcut created when the software was installed.



2. Open the **Preferences** dialog using the **Preferences** button on the Live Toolbar.



3. Set the **Radio Network Type** using the pull down.

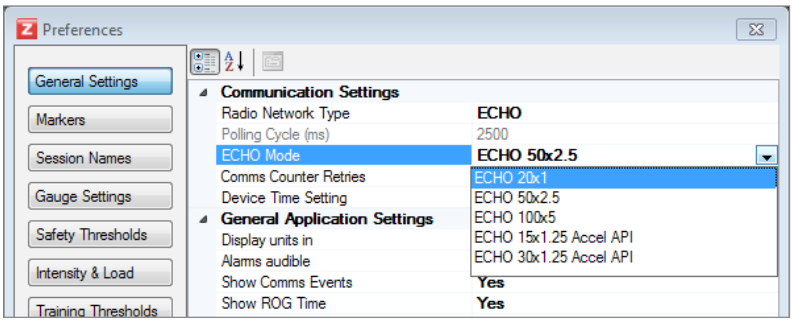


Radio Network Type	Description
XTS Conventional XTS Trunking	For use with Motorola™* XTS™* radios.
APX Conventional APX Trunking	For use with Motorola™* APX™* radios.
Bluetooth™* Direct	Bluetooth™* communication direct to BioModules from host PC.
ECHO	Zephyr™ ECHO system using ECHO Gateway

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Set Radio Network Type (2/2)

Set ECHO Mode



If **Radio Network Type i**s set to **ECHO**, then an **ECHO Mode** must be selected.

1. In the **Preferences** dialog, select the **ECHO Mode** option using the pull-down menu.

ECHO Mode	Description
20x1	Up to 20 devices, 1 second data reporting
50x2.5	Up to 50 devices, 2.5 second data reporting
100x5	Up to 100 devices, 5 second data reporting
15x1.25 Accel API	Up to 15 devices, 1.25 second data reporting in conjunction with OmniSense™ API, supporting 20Hz streaming accelerometer data.
30x1.25 Accel API	Up to 30 devices, 1.25 second data reporting in conjunction with OmniSense™ API, supporting 20Hz streaming accelerometer data.

Caution:

ECHO Short Addresses configured into BioModules must be appropriate for the ECHO mode. Thus for ECHO Mode 20x1, BioModule ECHO Short Addresses must be in the range 1-20, with no duplicates. Mode 50x2.5 in the range 1-50 etc.

Note:

Data is logged internally in the BioModules once per second (more often for waveforms) regardless of the **ECHO Mode**.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

OmniSense™ General Preferences (1/2)

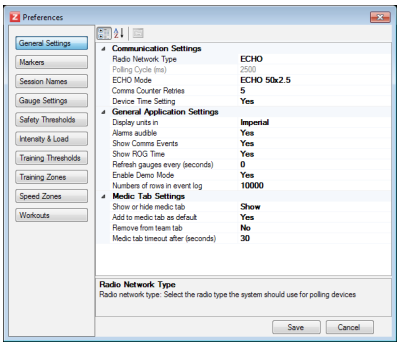
General Preferences

Preferences other than **General Settings** are described in other sections.

Click on the **Preferences** button in the Live toolbar.



The **Preferences** dialog will display.



Communication Setting	Description
Radio Network Type	Varies according to Radio Network Type
Comms Counter retries	How many data packets are missed before Comms Error (Blue Subject Status) is displayed
Polling Cycle (ms)	Leave at default 2400 - ECHO network only. Leave at default 1000 - MotorolaXTS network only
ECHO Mode	20x1 - 20 BioModules at 1 sec refresh rate 50x2.5 - 50 BioModules at 2.5 sec refresh rate 100x5 - 100 BioModules at 5 sec refresh rate 15x1.25 Accel API - 15 BioModules at 1.25 sec refresh rate, with 20 Hz Accelerometer data via an API 30x1.25 Accel API - 15 BioModules at 1.25 sec refresh rate, with 20 Hz Accelerometer data via an API
Slot Time (ms)	Leave at default 40 - ECHO network only Leave at default 1800 - MotorolaXTS network only

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

OmniSense™ General Preferences (2/2)

General Application Settings	
Display Units in	Imperial or metric (Height, weight, temperature)
Alarms Audible	ROG Status change audible alerts
Show Comms Events	Comms events recorded in notification area
Show ROG Time	Time in ROG-state displayed on subject status bar in BioGauge
Refresh gauges every (seconds)	How often default gauges are repainted. Default of 0 means after each cycle of device querying
Enable Demo Mode	Enables Demonstration Mode.
Numbers of rows in Event Log	Max. no. of lines displayed in notification area

Heart Rate Recovery Algorithm Settings	
Upper Activity threshold	The maximum activity level allowed during recovery phase (stationary approx.) for the HRR algorithm to auto-calculate HRR
Lower Activity Threshold	The minimum activity level needed (running approx.) before HRR algorithm can auto-calculate HRR
HRR detection time	Duration during which Upper Activity Threshold must not be exceeded e.g. sit or lie down during recovery, for auto-detection of HRR

Medic Tab Settings	
Show or hide Medic tab	Makes medic tab accessible during Live Mode
Add Medic Tab as default	Sets whether subjects whose status changes to Red are automatically moved to the Medic tab.
Remove from Team Tab	Automatically move BioGauge to Medic tab after time-out. 'No' means BioGauge will be displayed in both Team and Medic tabs
Medic Tab time-out	Time delay in seconds of Red status before subjects are automatically transferred to Medic tab

Additional parameters are configurable, dependent on the Radio Network Type set.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

OmniSense™ Live Setup Overview (1/2)

Database Setup Overview

Database setup is performed in the setup screens, accessed by the setup button in the OmniSense™ Live toolbar.



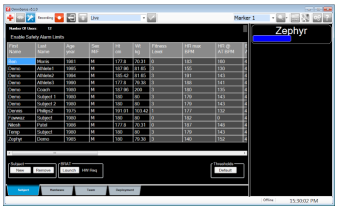
Navigate through the screens using the tabs below each screen.



The process of setting up an OmniSense™ database involves the following tasks:

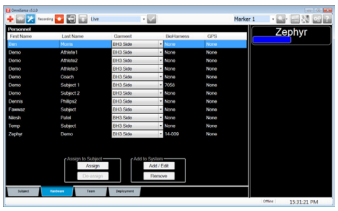
1. Add subjects
2. Add devices (BioModules, GPS)
3. Assign devices to subjects
4. Create & populate teams
5. Deploy teams

Subject



- Add subjects, basic physiological thresholds and baseline fitness values, or leave defaults set as is pending fitness testing.

Hardware



- Add BioModules (by USB connection) and optional GPS devices (by Bluetooth™*).

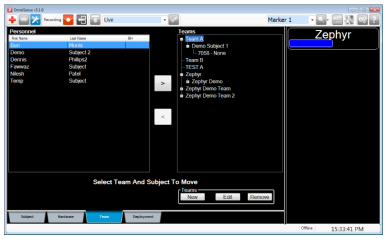
Note:

A new system supplied by Zephyr™ may include a file which will allow all hardware to be added to the system in a single operation. Refer to the **Add Hardware** section for details.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

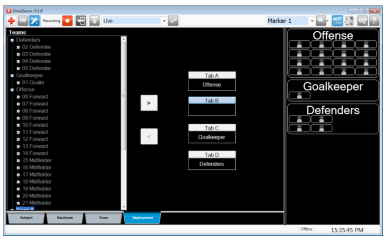
OmniSense™ Live Setup Overview (2/2)

Teams



- Assign BioModules & GPS devices to subjects, either in setup screen or using barcode rapid deployment tool (BRAT).
- Add subjects to Teams, either in setup screens or using BRAT.

Deployment

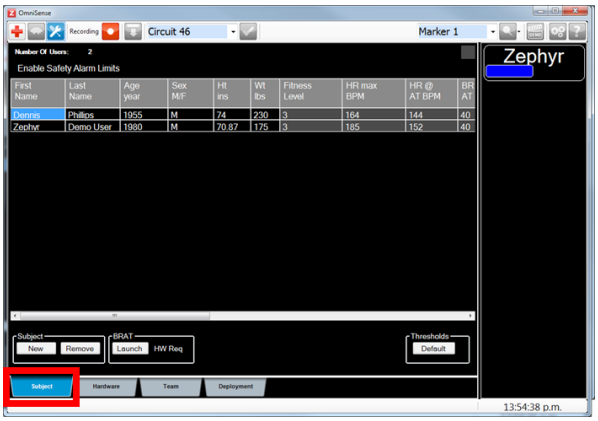


- Deploy Teams to live operations in setup screens or using BRAT.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Add New Subject

In the **Subject** tab of the **Setup** screens, click the **New** subject button.





Edit the new subject fields created.

First Name	Last Name	Age year	Sex M/F
New	Subject	1980	M

Note:

There is no Save Changes button - each value is automatically saved as the field is exited. The same applies when updating values for any existing subject.

Subject Parameters are described in the next section.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Subject Parameters

When a new subject is created, some fields are populated by default values. These can be left as is, deleted, or edited.

Parameter		Description
Name		Names in the database must be unique
Age		Used to auto-calculate default HR_{max}
Sex		Used to auto-calculate default HR_{max}
Height		Used for BMI calculations
Weight		Used for BMI calculations
Fitness Level		1 - 10 10 = elite athlete Used in Estimated Core Temperature algorithm
HR_{max} (maximum heart rate)		Default is auto-calculated. Determined and saved when analyzing the results of a ramped maximal fitness (treadmill or beep) test in OmniSense™ Analysis. Used to determine Physiological Load weightings and Training Thresholds.
Safety Alarm Limits	HR (Heart Rate) @ AT (Anaerobic Threshold)	Default is 80% of HR_{max}. Determined and saved by analyzing ramped fitness test results in OmniSense™ Analysis Used to calculate Training Zone Thresholds
	BR (Breathing Rate) @ AT	Determined and saved by analyzing ramped fitness test results in OmniSense™ Analysis
	HR High Red	Threshold for subject status = Red
	HR High Orange	Threshold for subject status = Orange
	HR Low Red	Threshold for subject status = Red
	BR High Red	Threshold for subject status = Red
	BR Low Red	Threshold for subject status = Red
	Core Temperature Red	Threshold for subject status = Red
	Idle Timeout	Time in seconds of an inactive subject before subject status changes to Red. Designed for First Responder systems. Disabled by default

Note:

Any single parameter with a safety alarm limit - **Heart Rate**/**Breathing Rate**/**Estimated Core Temperature** which crosses a safety threshold, will cause the subject status to change.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

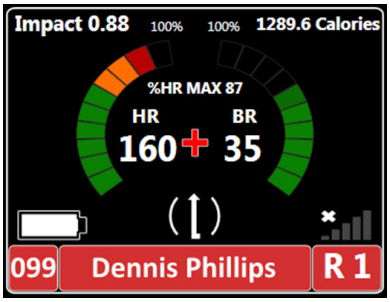
Subject Parameters (continued)

Parameter	Description
HR Resting	Determined by an orthostatic hypotension (Readiness) test
HR Standing	Determined by an orthostatic hypotension (Readiness) test
HRV Rest SDNN	Heart Rate Variability (Standard deviation in milliseconds) Determined by an orthostatic hypotension (Readiness) test
HRV RMSSD	Heart Rate Variability (Standard deviation in milliseconds) Determined by an orthostatic hypotension (Readiness) test
Web Email	'Activated' when subject has logged in to the web portal with password sent to their nominated email account by their account administrator, and validated their account.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Safety Alarm Limits

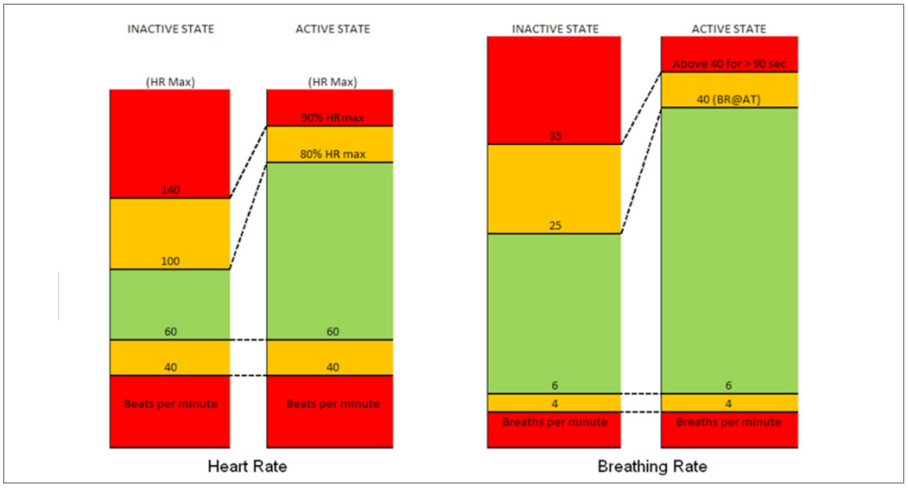
Safety Alarm limits are also called **ROG Subject Status** Thresholds. They are indicated by the color (red, orange, or green) of the subject name panel in each OmniSense™ Live BioGauge.



Upper and lower limits can be set for **Heart Rate** and **Breathing Rate**. An upper rate can be set for **Estimated Core Temperature**.

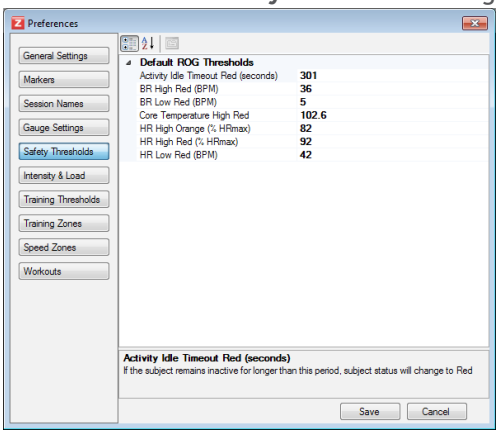
If any one threshold is crossed, the color of the subject name background in the BioGauge will reflect this.

Proprietary Zephyr™ ROG algorithm will adjust the thresholds automatically if the subject is detected as active, based on accelerometer data.



Safety Alarm Limit Defaults

Default values are assigned when a new subject is created. The default values can be set in the Live **Preferences > Safety Thresholds** dialog.



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Add/Edit BioModules by USB connection

1. Connect BioModule to PC in charge cradle.



2. Select the **Setup** button on the OmniSense™ Live toolbar.



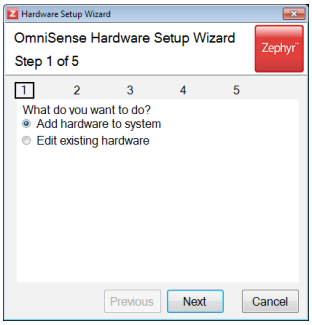
3. Select the **Hardware** tab.



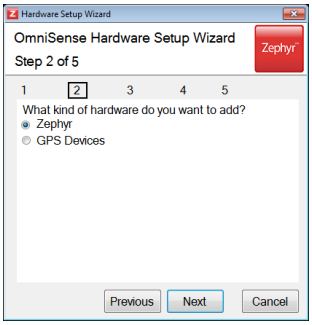
4. Select the Add/Edit button.



5. Select **Add** or **Edit** in the Hardware Setup Wizard when it displays and then select **Next.**

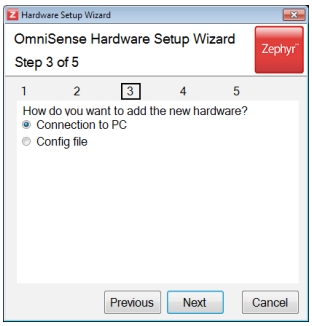


6. Select **Zephyr™**, then **Next.**

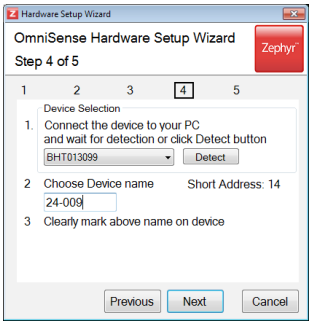


CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

7. Select **Connection to PC,** and **Next.**



8. OmniSense™ will normally auto-detect the BioModule in a few seconds, and populate the pull-down item with the device serial# (BHTxxxxx). Use the **Detect** button to retry manually if necessary. If more than one BioModule is connected, select the appropriate device from the pull-down list of identifiers.

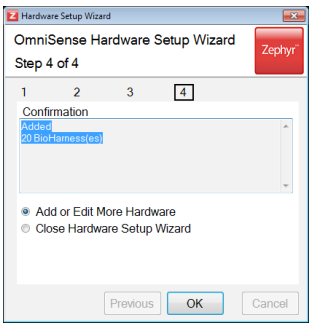


Enter a value for **Choose Device name** - this will be the identifier for your BioModule in OmniSense™ Live. It will appear on the subject BioGauge. If editing a BioModule already in the database, then the name field will contain the existing name. Click **Next**.

Note:

When assigning an identifier to a BioModule, best practice is to use any pre-existing Zephyr™ label (e.g. 14-009 indicating Channel-Short Address), or alternately attach a label to the front of the BioModule, so that it can be readily identified when attached to a strap or garment.

9. The final dialog will confirm that the device has been added.



Select **Add...** or **Close...** as necessary, and **OK** to complete the process.

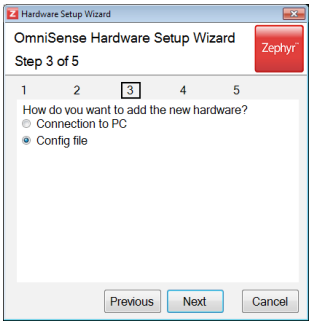
10. Repeat as required for additional BioModules.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

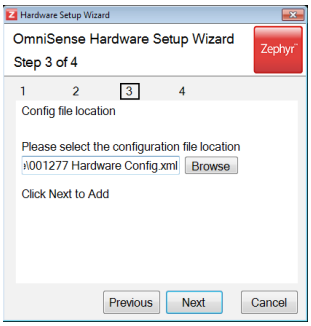
Add BioModules from an XML File

This method may be used to add multiple new BioModules to an existing system. This saves the effort of adding multiple devices manually.

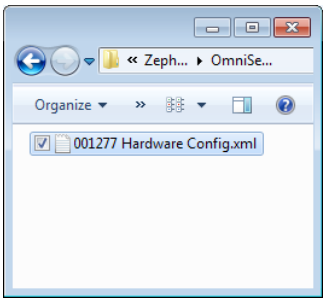
1. In the 3rd dialog of the Hardware Setup Wizard, select **Config File**, and **Next**.



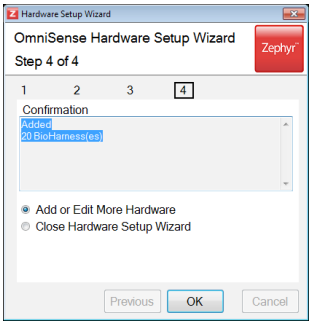
2. The next dialog allows you to browse to the (optional) xml config file supplied with the system.



3. Browse and select the file.



4. Confirmation of the added devices will display.



5. Select **Add** ...or **Close...** and **OK** to continue or exit.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

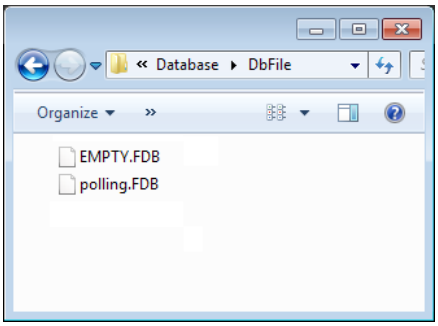
Add BioModules from a Database .FDB File

A completely new system may be supplied with a database file which contains all information on devices included with the system. OmniSense™ software should be installed first, and then the installed database file replaced by the pre-configured file.

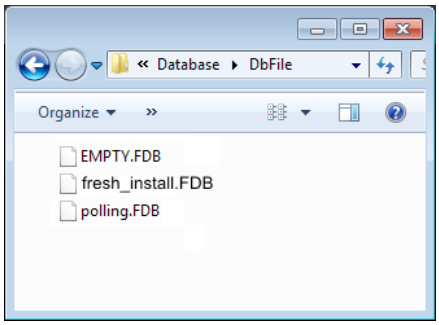
1. Install OmniSense™ software for the system.
2. Without OmniSense™ Live or OmniSense™ Analysis running, browse to the location

   C:\Program Files (x86)\Zephyr\OmniSense\Database\DbFile

   This directory contains two files - **EMPTY.FDB** is a surplus empty database created with all fresh installs, and **polling. FDB** which is the active database file. It contains Demo data only, in sessions dated year 2001. Set to 2001 the **From** field in the **Filter Session List** pane in OmniSense™ Analysis to access this data.



3. Rename the existing **polling.FDB** to fresh_install.FDB or similar. It can remain in the same directory, and can be recovered if needed.
4. Rename the pre-configured database file to **polling.FDB** and save it to the directory shown.



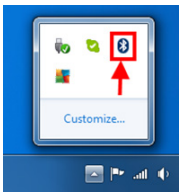
5. When using OmniSense™ Live to set up your system, all the shipped BioModules are now in the database and are available to assign to subjects. They may be edited as if they had been added manually.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

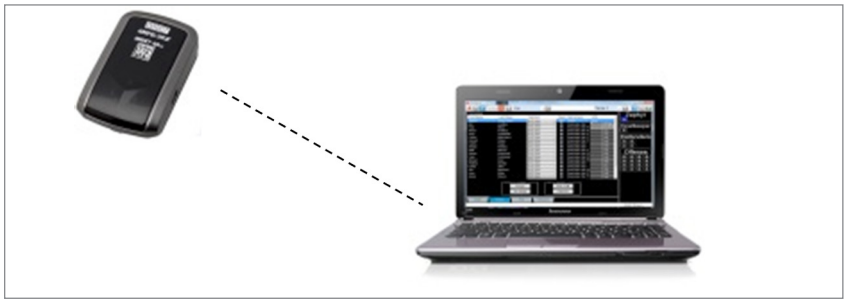
Add GPS Devices

GPS devices are added by Bluetooth™* connection to the PC. QStarz 818XT are the only GPS devices supported at this time.

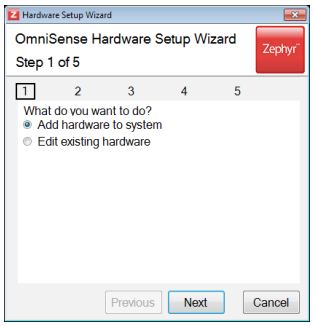
Bluetooth™* must be enabled in the host PC. If enabled, then the Bluetooth™* symbol will show in the PC System Tray.



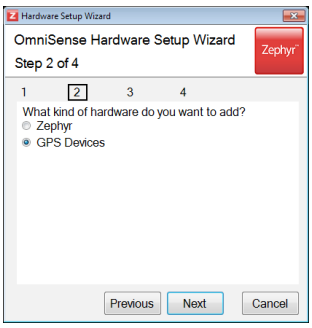
1. Power on the GPS.



2. Select the **Add/Edit** button to start the **Hardware Setup Wizard**, as for BioModules. Select **Add Hardware...**and **Next**.



3. Select **GPS Devices**.



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

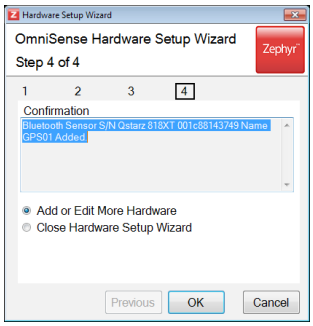
4. Wait while the GPS is detected. The Wizard will populate with GPS details. Use the manual **Detect** button to try again if necessary. Power cycle the GPS between attempts. A blue LED on the GPS will indicate that Bluetooth™* is active.



Note:

The GPS need **not** be Bluetooth™* paired to the PC to communicate. The GPS passkey of 0000 is entered automatically. The GPS cannot be paired to the PC by USB connection.

5. Label the GPS device according to the identifier you have selected for it. Label the device accordingly.



6. A confirmation message will display. Repeat as necessary.

   The 12-character string which is part of the serial number is the Bluetooth™* MAC Address of the device, normally displayed in the format XX:XX:XX:XX:XX:XX. The characters are hexadecimal, 0-9, a-f.

   The letters are not case sensitive.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Assign Devices to Subject

When BioModules and GPS units have been added to the system, they are available for assignment to subjects.

Warning

Once devices have been assigned in the software, ensure that the correct subject is given the devices. If not, then the data in the system may be assigned to the wrong subject. BioModules and GPS units cannot simply be swapped in the field, without first reassigning them in OmniSense™ Live.

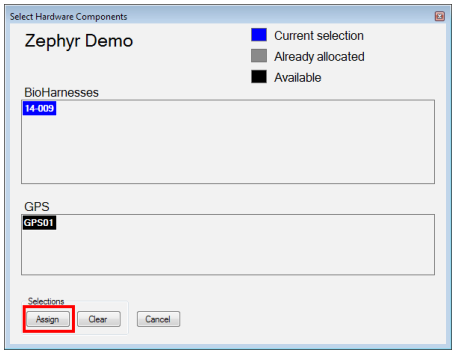
1. In the **Hardware** tab, select the subject to be assigned. They will highlight blue.

First Name	Last Name	Garment	BioHarness	GPS
Zephyr	Demo	BH3 Side	None	None

2. Click the Assign button.



3. A dialog will display. Select the BioModule and GPS to be assigned to the subject and click the **Assign** button in the dialog. Available devices are highlighted black as shown in the legend in the dialog.



4. The assigned devices will display in the personnel listing. No GPS was assigned in this example.

First Name	Last Name	Garment	BioHarness	GPS
Zephyr	Demo	BH3 Side	14-009	None

Note

The device fields in the screen are manually editable if the device identifiers are known.

Caution

The same device can be assigned to two different subjects, as long as they are not members of the same team, or in separate teams deployed at the same time. When another member of a team is selected, devices already assigned to existing members of the team will be greyed out for any assigned to existing members of the team.

If two subjects allocated the same device are assigned to a team **after** they have been assigned devices, a warning message will display, indicating an equipment conflict.

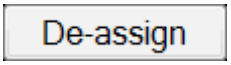
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

De-assign Devices from Subject

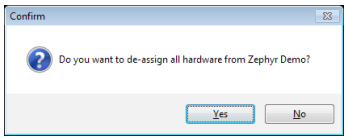
1. In the **Hardware** tab, select the subject.

First Name	Last Name	Garment	BioHarness	GPS
Zephyr	Demo	BH3 Side	14-009	GPS01

2. Click the **De-assign** button.



3. A **Confirm** dialog will display. Select **Yes** or **No** as required.



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Manually Pair a GPS

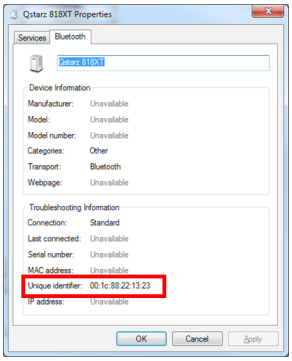
A BioModule can be manually configured to communicate with a GPS. The GPS MAC address is required. This is stored in the BioModule after it is powered off, unless updated manually or used in an ECHO system with no (or a different) GPS assigned.

Get GPS MAC Address

When the GPS is added using the **Add Hardware** Wizard in Live, the detection dialog shows this address.

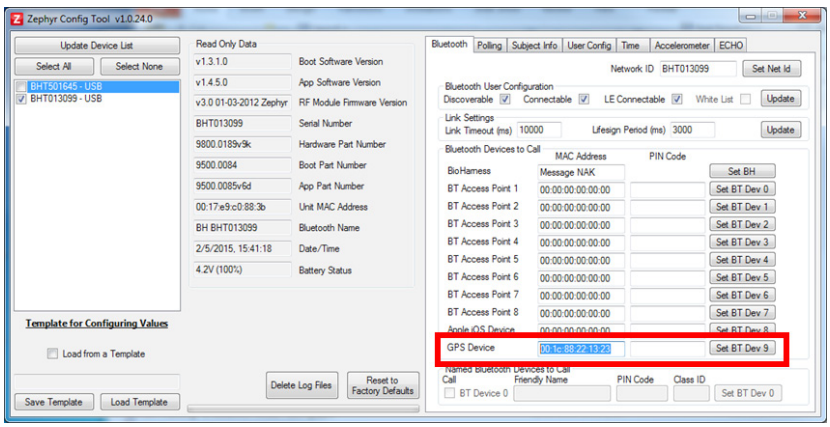


You can also detect the GPS using a PC from **Start > Devices and Printers > Add Device**, and show device Properties after it has been added.



The Address in this example is 00:1c:88:22:13:23. MAC Addresses are not case sensitive. Adding a device in Microsoft™* Windows™* does **not** add the device into OmniSense™.

Then, using the Zephyr™ Config Tool, enter the MAC Address in the **GPS Device** field and Save.



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Set Garment Type

Garment type must be set in OmniSense™ Live so that the orientation of the BioModule on the subject is known and posture can be properly interpreted.

1. Select the **Setup** button on the OmniSense™ Live toolbar



2. Select the **Hardware** tab



3. For each subject the garment type must be selected when assigning a BioModule. These are available from a pull-down list.



4. The front/side/back option refers to BioModule location. Select according to the garment type.

Example Garment Type Settings



Side Side Front Back Back Front

Note

Since the **BioPatch™ HP** is front mounted on the subject, use the **BH3 Front** option.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Add /Edit/Remove Team

Subjects may exist autonomously in the OmniSense™ database. In OmniSense™ Analysis, subjects are listed on a node labeled '**No Team Assigned**'.

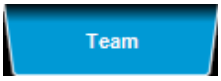
For OmniSense™ Live to receive transmitted data, they must be a member of a deployed team.

- A maximum of 4 teams may be deployed live.
- The maximum number of team members available per team is limited by the radio network and mode selected.
- The more members in a team, the smaller the subject BioGauges will become on-screen.

1. Select the **Setup** button on the OmniSense™ Live toolbar.



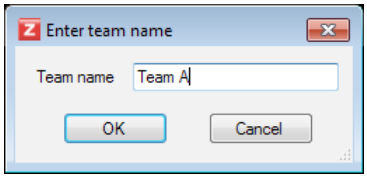
2. Select the **Team** tab.



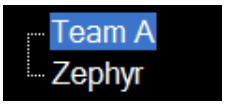
3. Select the **New** button.



4. Enter the team name in the dialog displayed.



5. A new entry ('**Team A**' below, highlighted in blue) will be created in the right hand panel.



6. To edit a team name, select the team in the right-hand panel, and click the **Edit** button.

7. To remove the team, select it and click the **Remove** button.

Note:

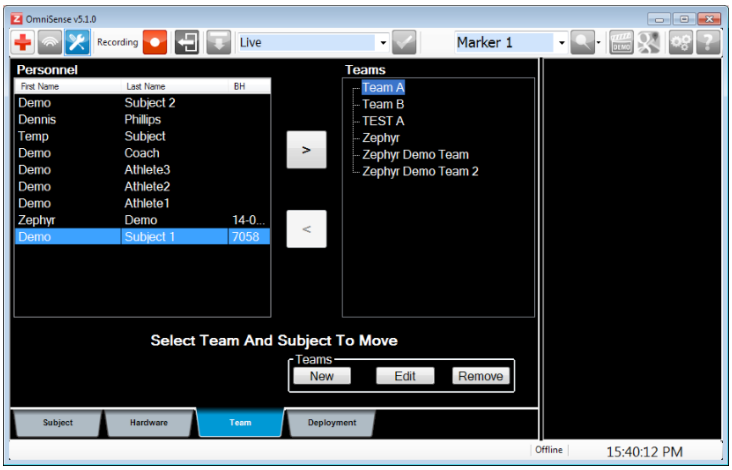
When a team is removed from the system, all members are returned to the personnel pool. No subject data is lost. In OmniSense™ Analysis, subjects are then listed under the node '**No Team Assigned**'

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Populate Teams

Add Subject

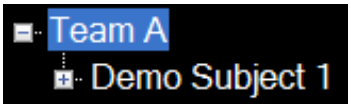
1. In the Team tab, select **both** the subject in the left panel, and the team in the right. They will highlight blue when selected.



2. Click the arrow button pointing to the **Team** panel.

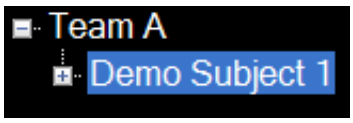


3. The subject will be added to the selected team node.



Remove Subject

1. Select the subject.



2. Use the reverse arrow to remove the subject.



3. The subject will return to the **Personnel** panel on the left.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Deploy Team

The final stage in preparing for a Live session is to deploy a team or teams.

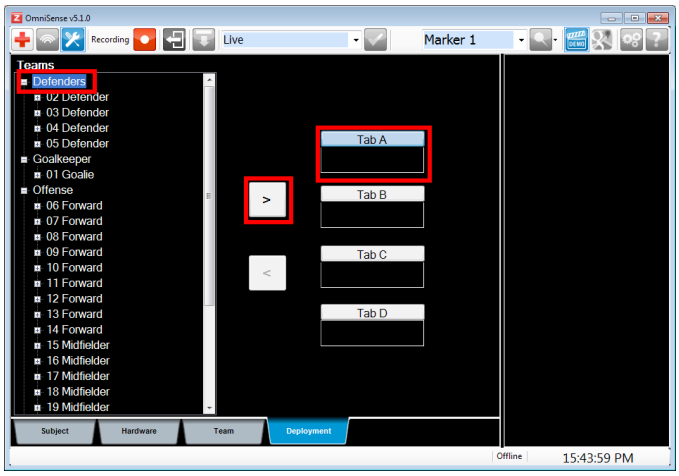
1. Select the **Setup** button on the OmniSense™ Live toolbar



2. Select the **Deployment** tab



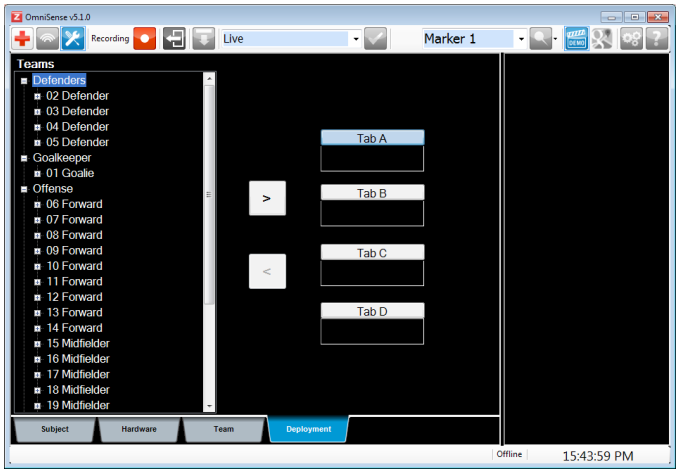
3. Select the team(s) to be deployed from the Teams pane, and a vacant tab from the Tab A/B/C/D array. A maximum of four teams can be deployed.



4. Click the arrow button pointing to the team array.



5. The **A/B/C/D** tabs will populate with the deployed teams. In addition, a series of Team and player tiles will display on the right-side panel.

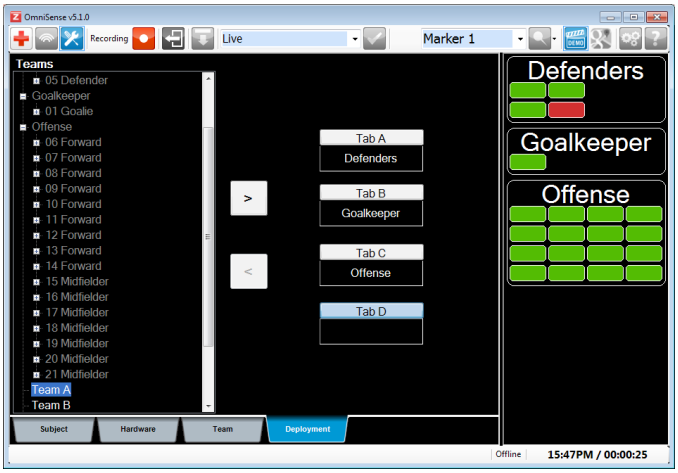


CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

6. Tiles displayed to the right of the setup tab will appear black until radio communication with the deployed BioModules has been established. To establish communication, click the Live button. Once connected, tiles will display subjects' red/orange/green status.



7. Once radio communication and subject status have been established, the subject tiles will be active.



8. The purpose of the right-hand tiles is to allow a user to maintain some oversight of subject status while using the **Setup** tab to make changes.

Un-deploy a Team

1. To un-deploy a team, select the team tab and use the arrow button pointing back to the **Teams** pane.



2. The team will re-display as available in the **Teams** pane.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Print Pick Lists

Using a supported Motorola™* Barcode scanner, devices can be rapidly assigned to subjects in the field by scanning barcode labels on the devices, or from printed pick lists which can be generated by OmniSense™. The host PC will need to be connected to a printer to generate these. All subjects and devices must already exist in the OmniSense™ database.

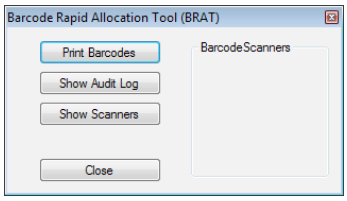
1. In OmniSense™ Live **Settings > Subject** tab, click on the BRAT (Barcode Rapid Assignment Tool) **Launch** button.



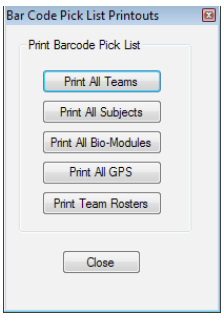
Note

The BRAT items will only be visible in the Setup Subject screen if the Motorola™* Drivers have been installed. Refer to **Getting Started > Software Installation**.

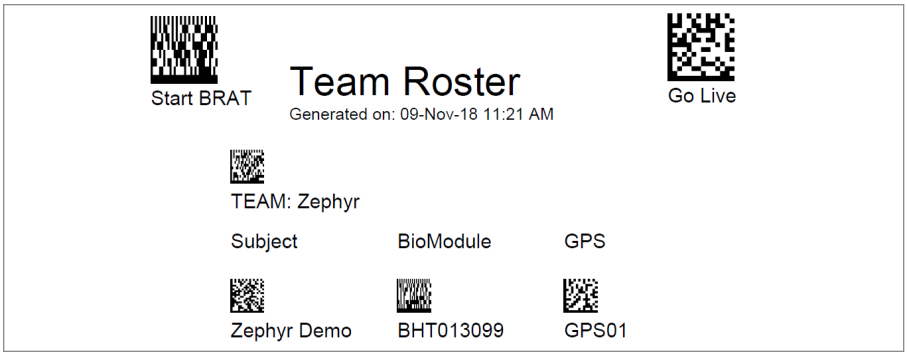
2. Select **Print Barcodes** from the displayed dialog.



3. Choose from the options. Each button press will generate a letter-size PDF file which can then be printed.



4. The **Print Team Rosters** button will generate a listing of all teams (separate page for each team), with subject and currently assigned devices adjacent.



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Barcode Scanner Operations (2/3)

Scanning Operations

1. Connect the barcode scanner to the host PC.



2. Start OmniSense™ Live and select the **Setup > Subject** screen.

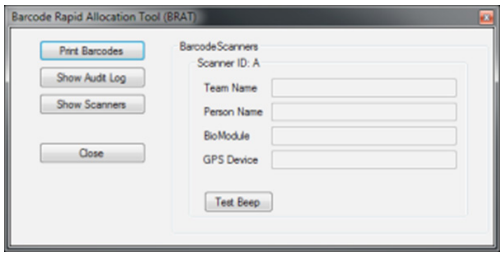


3. Scan the Start BRAT code on any of the printed pick lists.



Start BRAT

4. The BRAT dialog will launch.



As codes are scanned for team, subject and devices, the fields will populate. To change an assignment, simply re-scan with another barcode.

Each time a new subject is scanned, the device fields will empty.

Note
Consult the scanner User Manual for correct operation and troubleshooting.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Barcode Scanner Operations (3/3)

5. Scan the team, subject and device code in succession..



6. Approved DoD ID cards are supported.



The fields in the BRAT dialog on screen will populate as components are scanned successfully. If a wrong code is scanned in error, just re-scan the correct code.

7. When all scanning is complete, scan the Go Live code on any pick list, or select the Live button in OmniSense™.


Start BRAT

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

BioModule Operation (1/4)

Power On/Off

Power On

1. Press the centre of the BioModule to power on; this will operate a microswitch inside the device.



2. LEDs will illuminate according to the BioModule configuration.
3. Snap the BioModule into its receptacle in the Zephyr™ strap or garment. The orientation of the contact studs in the receptacle will confirm correct orientation.

Note

Best practice is to power the BioModule on while it is being worn by the subject. This avoids invalid data being transmitted by or logged on the device.

Caution

Long-term use of the BioModule may cause the contact springs on the rear of the device to become slightly depressed. This can cause poor contact with the garment receptacle contacts, particularly when the subject is active. A regular visual inspection is recommended.

If a spring becomes depressed, **very carefully** lift it up. When this is done, check that the spring does not protrude excessively, and that the BioModule can be inserted into a charge cradle without damaging the contacts. Take care when doing this, to avoid damaging the spring contact.



Power Off

1. Press and hold the centre of the BioModule until all four LEDs illuminate briefly. The device will power off.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

BioModule LED Indications

BioModule on Garment



	Constant	Flashing	Unlit
Blue	Cannot connect to configured GPS	Transmitting	Transmit not enabled
Orange	More than 30% battery	Transmitting, less than 30% battery	Less than 10% battery
Red	Garment worn, no HR detected	HR detected	Not worn
Green	Error	Logging	Logging not enabled

BioModule Charging



	Constant	Flashing	Unlit
Blue	**Error**	**Connected (possible if OmniSense™ Live is running)**	**Disabled**
Orange	**Battery fully charged**	**Battery charging**	**No power connected**
Red	**Always off**	**Always off**	**Always off**
Green	**Error**	**Downloading a log**	**No records/ finished downloading**

Note

During upgrades red/green LEDs will flash alternately while device App Software is updated, and blue/orange while ECHO Module firmware is upgraded. Not all firmware upgrades also upgrade the ECHO Module firmware.

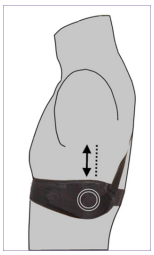
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Zephyr™ Strap Fitting

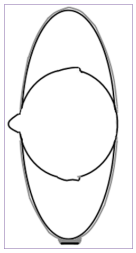
1. Fasten at front and adjust tension for a snug fit.



2. Rotate strap so device is under left arm.



3. For optimum breathing detection, device should be located at the apex of rib curvature.



4. Tension indicator loop at rear should be flush when subject inhales fully. It is shown un-tensioned here.



5. Adjust shoulder strap for minimal tension if used. Its function is to prevent strap slippage when worn under equipment which makes it awkward to access the strap.



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

BioModule Removal

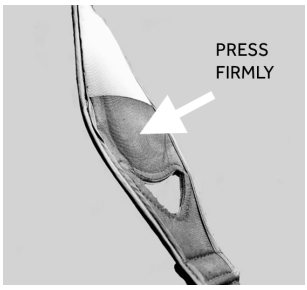
The Zephyr™ strap receptacle is designed for a very firm fit - this prevents the BioModule from becoming dislodged accidentally.

There is a specific technique to removing the BioModule from its receptacle easily, which involves pressure from the front **and** the rear of the receptacle simultaneously.

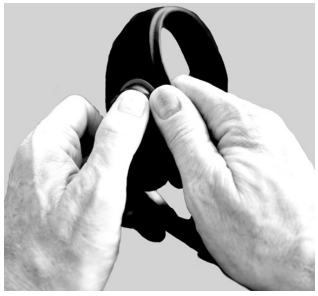
1. Grip holder by edge of flat surround next to the notch. Pull the BioModule gently by the notch - the greater pressure is applied to the **rear**.



2. Press the holder **firmly** from the rear to pop the BioModule out.



3. Use thumbs both to grip holder and pull on the BioModule.

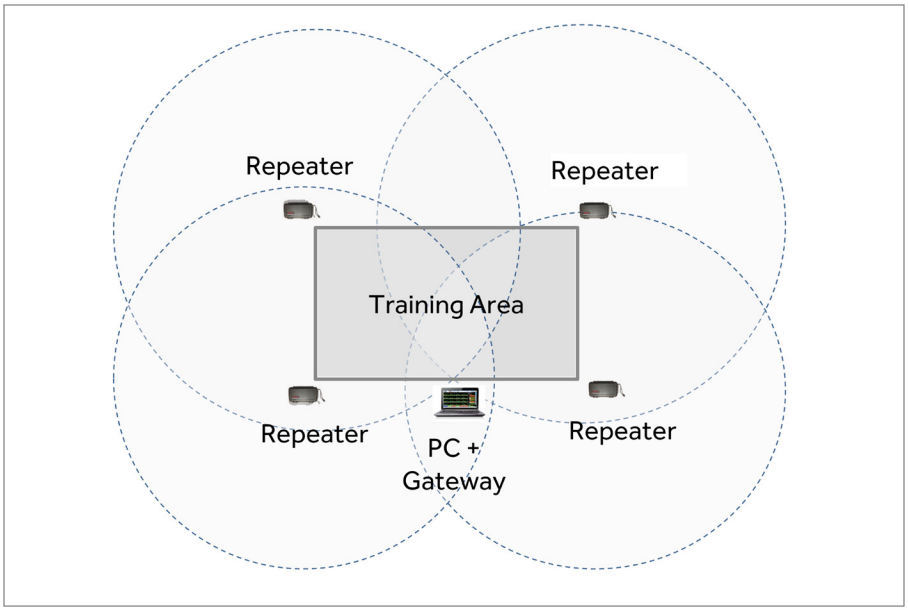


4. Press rear of strap with the knuckle of index finger.



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
> Setup Checklist
> BioModule Configuration
> Charge Devices
> Radio Network Options
> Set Radio Network Type
> OmniSense™ General Preferences
> OmniSense™ Live Setup Overview
> Subjects
> Safety Alarm Limits
> Devices
> Set Garment Type
> Teams
> Barcode Scanner Operations
> BioModule Operation
> Repeater Location
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Repeater Location



- For best coverage, place a repeater at each corner of the training area.
- Repeaters communicate directly with the Gateway, but not with each other.
- Maximum range with a repeater is doubled from 200 to 400 yards.*
- Best location diagrams can be found on the rear of each repeater.
- Repeater sited 5 feet above ground level is optimal.

* Line of sight, under optimal conditions. Environmental factors such as external radio interference and/or body blocking may reduce this distance in practice.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Startup Sequence (1/2)

System Startup

1. Power on all BioModules.



2. Power on all GPS units, if used.



3. Locate and power on all field repeaters, if used.



4. Attach Gateway to PC.



5. Start OmniSense™ Live.



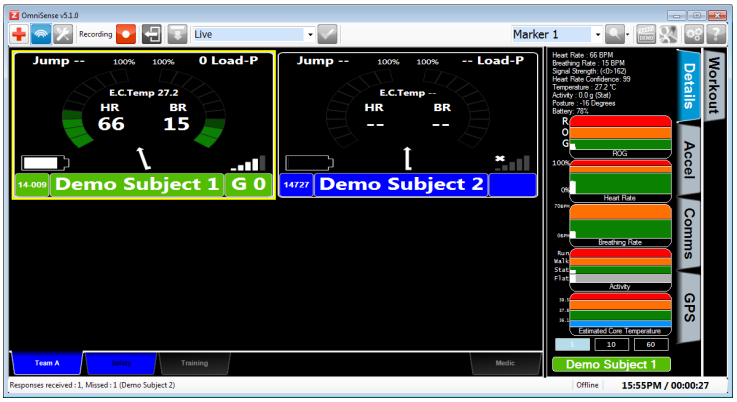
- Subject details and GPS MAC addresses are sent to each BioModule when Live starts up.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Startup Sequence (2/2)

OmniSense™ Live Startup Sequence

Immediately on startup, BioGauges will display for each subject, with subject status indicated by the background color of their subject name pane.



The subject status will change through a color sequence prior to any valid data becoming visible, as communications are established.

Subject Status Color	Description
Alpha Bravo	No data yet received - BioModules are being initialized
Alpha Bravo	Waiting on ECHO connection - Comms Error if persists
Alpha Bravo	Data received - **Not Worn** indication
Alpha Bravo	Valid data
Alpha Bravo	Valid data
Alpha Bravo	Valid data

Startup Times

Feature	Approximate Time To Validity
ECHO Connection	10 - 90 seconds, dependent on number of BioModules deployed
Heart Rate	30 seconds
Breathing Rate	30 seconds
Posture/Activity	5 seconds
Estimated Core Temperature	5 seconds
Heart Rate Variability (Configurable using the Zephyr™ Config Tool)	~5 minutes (300 heart beats) for SDNN ~15 seconds for RMSSD

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Live Screen Overview (1/5)

Live Screen Components



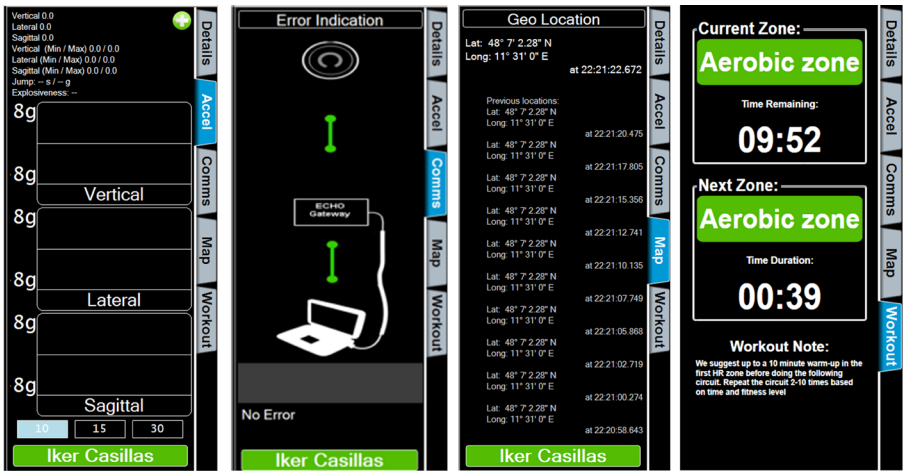
#	Component	Notes
1	Toolbar	▪ Constant on all screens.
2	Subject BioGauge array	▪ BioGauge size reduces as number of BioGauges increases.
3	Team/Medic/Training /Safety tabs	▪ A separate tab for each deployed team (maximum of 4). Tab colors reflect highest level of subject status on tab; Red = highest. ▪ Training BioGauges on the Training tab. ▪ Red status subjects shown on Medic tab. ▪ Subject ROG shown on Safety tab.
4	Comms Message notification area	▪ Toggle on or off from the toolbar.
5	Details/Accel/ Comms/GPS/ Workout tabs	▪ Additional information relevant to the selected BioGauge.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

OMNISENSE™ LIVE OPERATIONS

Live Screen Overview (2/5)

Side Tabs



Accel	Comms	Map	Workout
Raw accelerometer data	Graphic indication of comms errors	Streaming GPS location	Target training zone and elapsed time/time remaining

Safety Tab



Training Tab



Medic Tab



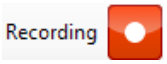
Subject BioGauges are shown on Medic tab after their status is Red for a configurable period (default 30 seconds). They must be removed manually by toolbar button.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Live Screen Overview (3/5)

Live Toolbar



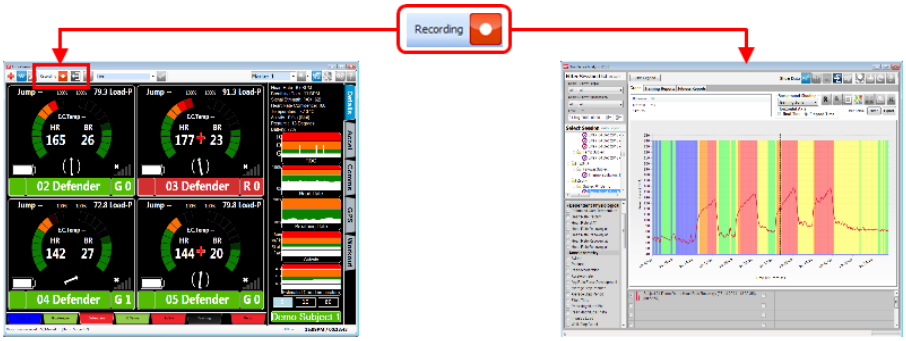
Item	Function
	Add subject to/Remove subject from Medic tab. Subject with Red status for longer than 30 seconds (default, configurable in Preferences) are moved to Medic tab automatically.
	Switch to Live mode - start communications.
	Switch to Setup mode - communications (if started) will continue in the background.
	Start/stop recording to OmniSense™ database. Default is recording. Text indicates status.
	Offline (left)/online (right) - connection status to Web portal and cloud database. Registered subject's live data will be uploaded to the portal automatically. Text indicates status.
	Display comms notification area beneath BioGauge array. Hidden by default.
	Session name and activate button. The name will be displayed in Analysis. Useful for filtering sessions in Analysis. Tick button must be used whenever name is changed. Default '**Live**'
	Marker name and place marker button. Markers will be displayed in OmniSense™ Analysis graphs. Set for Individual/Team/All subjects using pull down list next to button.
	Activate Demo mode. Virtual data will populate BioGauges. If any real subjects are deployed, they will display simultaneously.
	Show location data in a Google™* map window.
	Show Preferences (Settings) dialog.
	Show offline Help window.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Live Screen Overview (4/5)

Recording Logic

- Data must be recorded in Live for later display in OmniSense™ Analysis.
- Recording is the default state when Live mode is engaged



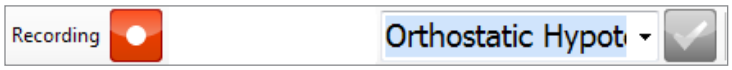
- Live and Analysis modules can be run simultaneously, but data must be refreshed manually in the Analysis module using the **Refresh** button.



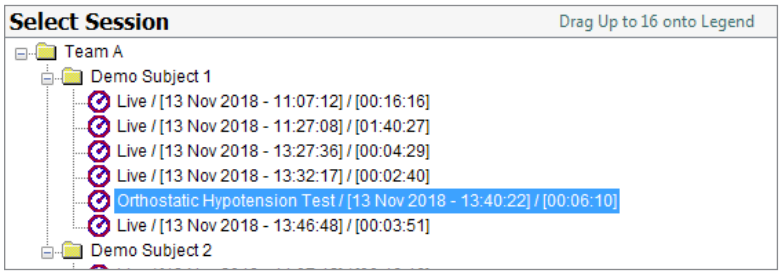
Session Names

In OmniSense™ Analysis, the session name will be the name assigned to the session in Live, using the session name button. Sessions default to 'Live',

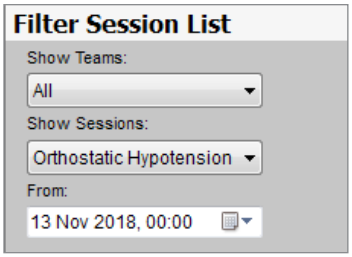
1. Set the session name in the Live toolbar.



2. The session name will appear in the **Select Session** pane in OmniSense™ Analysis.



3. For fast access in OmniSense™ Analysis, the session name can be selected in the **Filter Session List**.

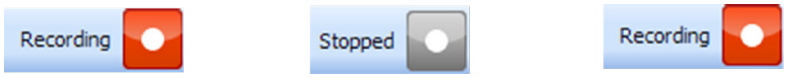


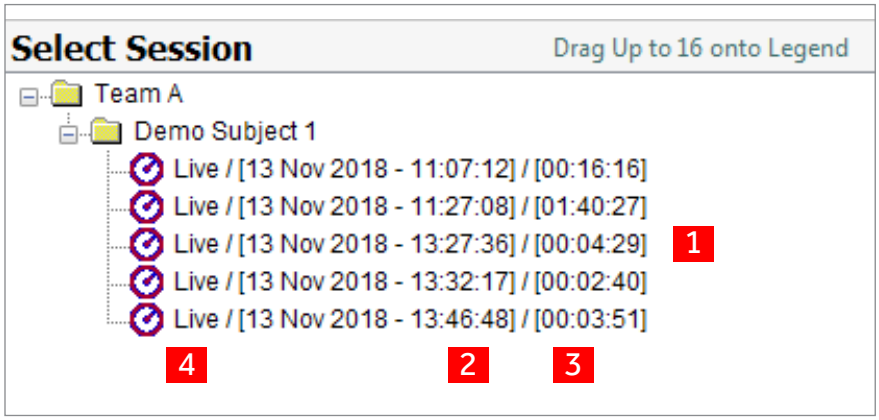
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Live Screen Overview (5/5)

Multiple Recordings

- Each time the **Record** button is pressed in a continuous session in the Live Module, a new individual subject session is created in the database for each subject deployed.





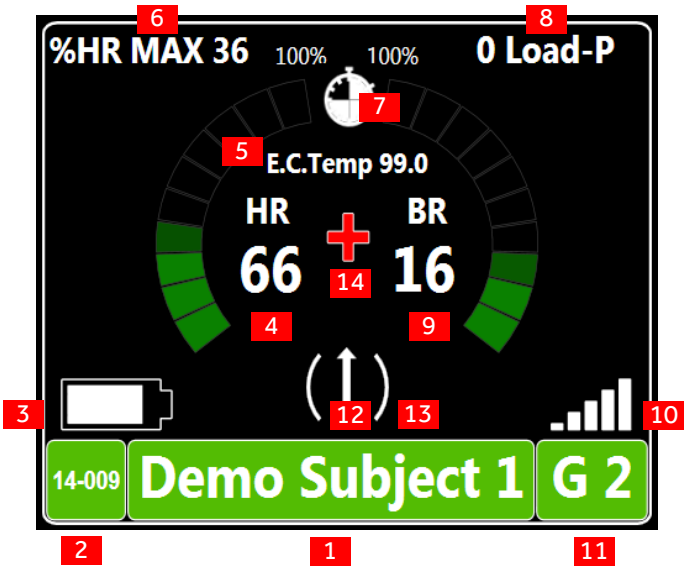
#	Description
1	Multiple sessions created by repeated Stop/Start recording in OmniSense™ Live
2	Session Start Time in hh:mm:ss format
3	Session Duration in hh:mm:ss format
4	Session Name

- Sessions can be renamed in OmniSense™ Analysis

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

BioGauge (1/4)

Standard BioGauge



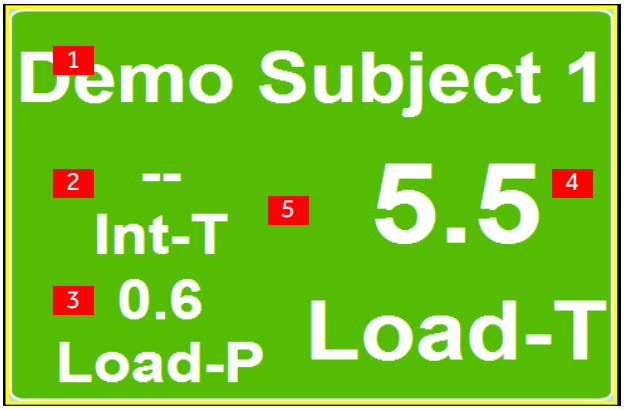
The standard BioGauge displays a number of subject physiological parameters, and updates at intervals varying from 1 - 5 seconds, depending on **ECHO Mode**.

#	Description
1	Subject name. Background color shows subject ROG status.
2	BioModule identifier as stored in database.
3	BioModule battery level.
4	Configurable sweep scale & numeric value, defaults to heart rate.
5	Configurable field 1.
6	Configurable field 2.
7	No data stopwatch icon 4 x 1 minute quadrants.
8	Configurable field 3.
9	Configurable sweep scale & numeric value, defaults to breathing rate.
10	Radio Signal Strength indicator.
11	Time in current ROG Status in minutes. Resets when status changes.
12	Posture indication. ↑ = upright subject.
13	Activity Level. (↑) = walking equivalent, ((↑)) = running equivalent.
14	Red cross indicates BioGauge also displayed in Medic tab.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

BioGauge (2/4)

Training BioGauge



#	Description
1	Subject Name.
2	Configurable field 1.
3	Configurable field 2.
4	Configurable field 3.
5	Tile background color shows the subject's current **Training Zone.**

- The Training BioGauge is used in the context of a Workout. Once a Workout has been enabled using Live Preferences, and then selected from the **Session Name** list, it becomes active.
- In the **Workout** side tab, two **Training Zone** segments are displayed - the current and next segment.
- The subject should work out as prescribed by their coach, and attempt to match their training zone color with the target zone color in the **Workout** tab.
- Training Zone color is determined by the subject's heart rate. The zone thresholds are configured in Live **Preferences**.



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

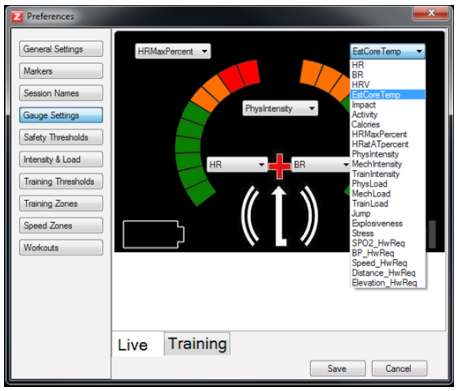
Configure BioGauge

Configure Standard BioGauge

- To configure the BioGauge, display OmniSense™ Live **Preferences** using the toolbar button.



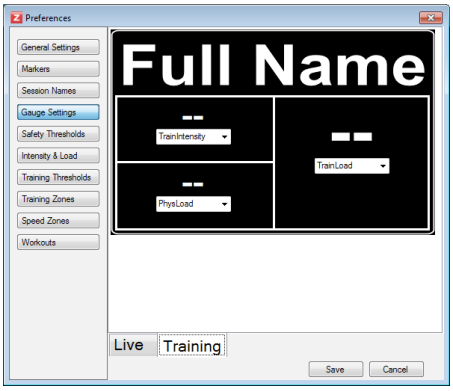
- In the **Preferences** dialog, select the **Gauge Settings** button.



- The dialog defaults to the standard BioGauge. Each configurable field has an associated pull-down menu. Select from the options (listed next page)
- **Save** when configuration is complete.

Configure Training BioGauge

- In the same dialog, select the **Training** tab. Three configurable fields are available.



- **Save** when configuration is complete.

Note

BioGauges can be reconfigured while a Live session is running. The fields displayed on the BioGauges do not affect what data is sent to the database.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

BioGauge Parameters

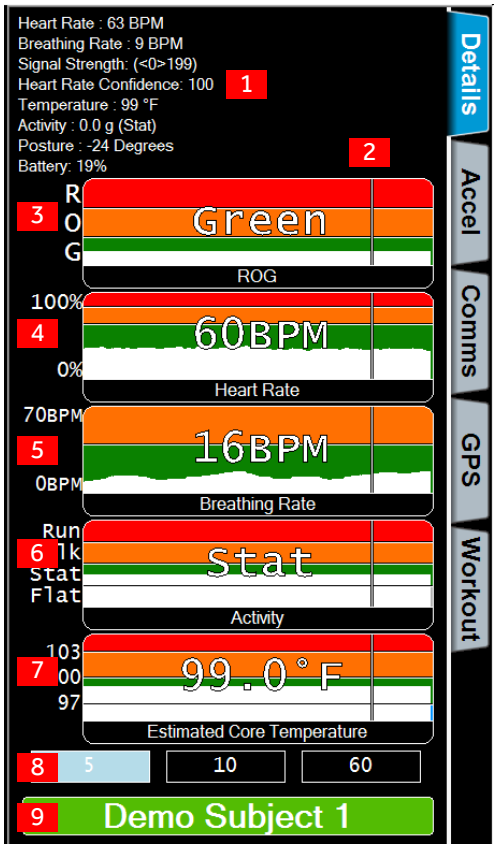
A variety of parameters are available for configurable fields in BioGauges.

List Item	Description
HR	Heart Rate
BR	Breathing Rate
HRV	Heart Rate Variability
EstCoreTemp	Estimated Core Temperature
Impact	Peak g of impact event
Activity	Peak activity VMU (g)
Calories Burned	Calories Burned (Heart Rate based)
HRMaxPercent	Percent of subject maximum heart rate
HRatATPercent	Percent of heart rate at Anaerobic Threshold
PhysIntensity	Physiological Intensity
MechIntensity	Mechanical Intensity
TrainIntensity	Training Intensity
PhysLoad	Cumulative physiological load
MechLoad	Cumulative mechanical load
TrainLoad	Cumulative training load (Avg. Phys + Mech)
Jump	Jump event peak g
Explosiveness	Dash event peak g
Stress	Stress Level 1 -10
SPO2_HwReq	No longer supported
BP_HwReq	No longer supported
Speed_HwReq	GPS Speed over ground
Distance_HwReq	GPS total distance traveled
Elevation_HwReq	GPS elevation above mean sea level
ImpulseLoad	Cumulative impulse load
WalkStepCount	Count of walking steps
RunStepCount	Count of running steps
BoundCount	Count of bounding steps
JumpCount	Count of jump events
MinorImpacts	Count of minor impacts
MajorImpacts	Count of major impacts
AvgForceDevRate	Average force development rate of step impulses
AvgStepImpulse	Average step impulse
AvgStepPeriod	Average time between steps
FlightTime	Time in air during a jump event
PeakMagniPhi	Peak magnitude phi angle of impact (from vertical)
PeakMagniTheta	Peak magnitude theta angle of impact (heading)

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

OMNISENSE™ LIVE OPERATIONS
Side Tabs (1/14)

Details Tab



- Values are for the selected BioGauge

#	Description
1	Subject/BioModule Parameters.
2	Cursor values on graph. Mouse over the graphs for numeric value.
3	Subject ROG Status.
4	Heart rate 0- 100% HR_{max} of subject.
5	Respiration rate 0 - 70 breaths per minute fixed scale.
6	Activity Level. Cursor value = Flat/Stat/Walk/Run.
7	Estimated Core Temperature. Set °C/°F in **Preferences.**
8	Buttons set graph horizontal scale to 5/10/60 minutes.
9	Subject name and ROG status.

Note

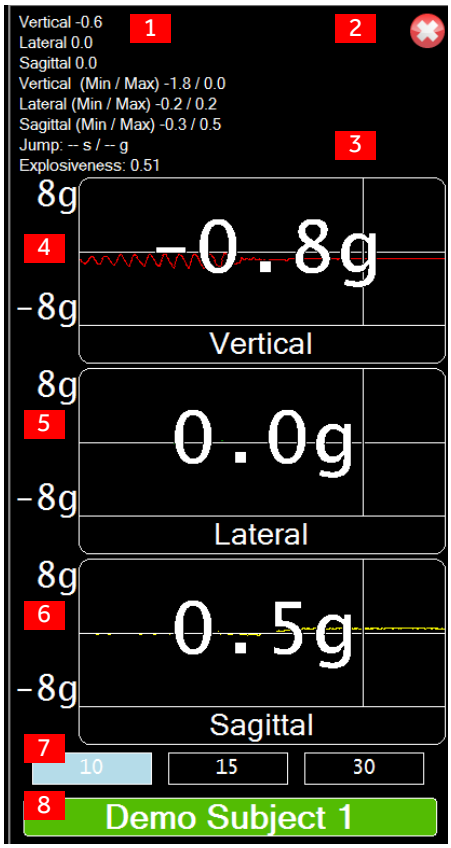
The **Heart Rate Confidence** level in the **Subject Parameters section** is a useful indication of the validity of the HR data. If this value drops below 20% the heart rate is considered invalid and will show '--'.

Check strap tension, that the strap sensor pads and skin are adequately moist, and the BioModule spring contacts have not become depressed. Any of these factors may cause poor conductivity, resulting in a noisy ECG signal. This will cause the HR to be invalid.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Side Tabs (2/14)

Acceleration Tab



- Values are for the selected BioGauge

#	Description
1	Raw accelerometer values. Min/Max are values from previous 1 second epoch.
2	Buttons to enable and disable accelerometer data for the selected subject.
3	Cursor values - float cursor over graphs to display numerical values.
4	Vertical acceleration. This value will include gravity of -1g.
5	Lateral (side to side) acceleration.
6	Sagittal (front to rear) acceleration.
7	Buttons set graph horizontal scale to 5/10/60 minutes
8	Subject name and ROG Status.

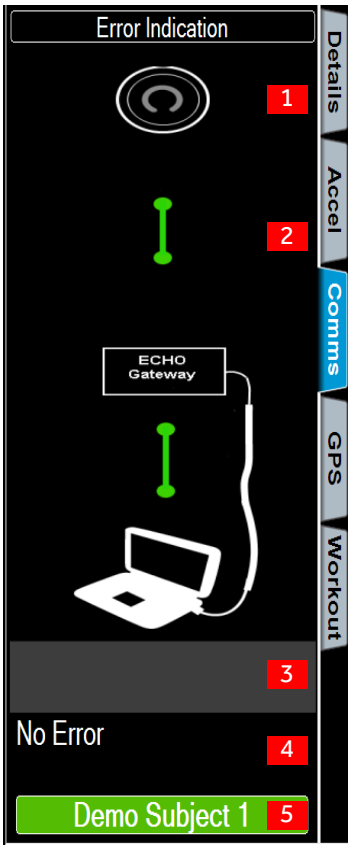
Note

The vertical acceleration data is not filtered to remove gravity. If gravity appears not to be exactly -1 g, it may be that the subject standing or seated posture does not result in the BioModule being oriented to absolute vertical.

If the subject is lying down, the effects of gravity will manifest in the sagittal axis.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Communications Tab



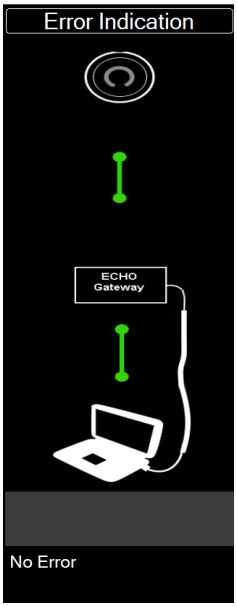
- Values are for the selected BioGauge

#	Description
1	BioModule/Gateway/PC icons. External sensor icon not shown, For **Bluetooth™* Direct** systems, only the BioModule and host PC are represented.
2	Link indicator. Green = working link, Red X = broken link
3	Error message icon area
4	Error message text
5	Subject name and ROG status

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

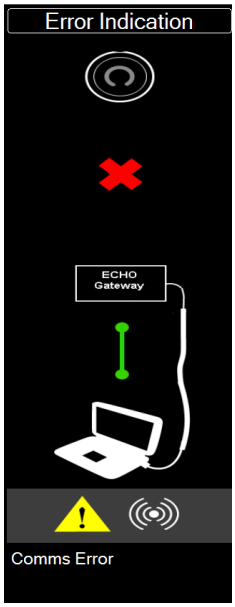
Communications Error Indications

No Error



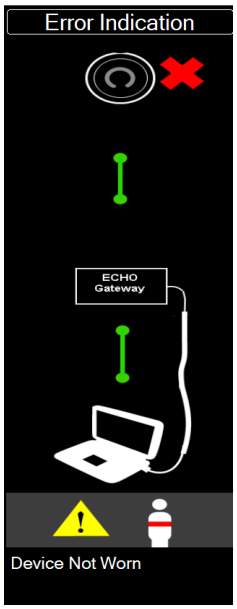
- System operating normally

No Response from Device



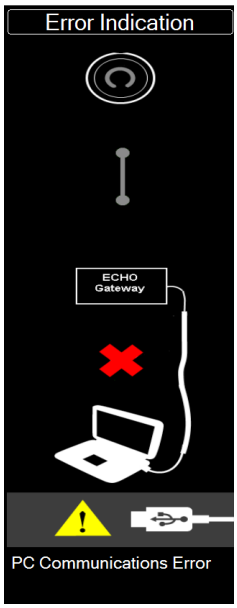
- BioModule powered off
- BioModule out of battery
- Out of range
- Signal blockage or interference
- Wrong device on subject
- Hardware fault
- Duplicated ECHO Short Address

Device Not Worn



- BioModule not in garment
- Sensor pads dry
- Depressed spring contacts on BioModule
- BioModule or garment fault

Gateway Error

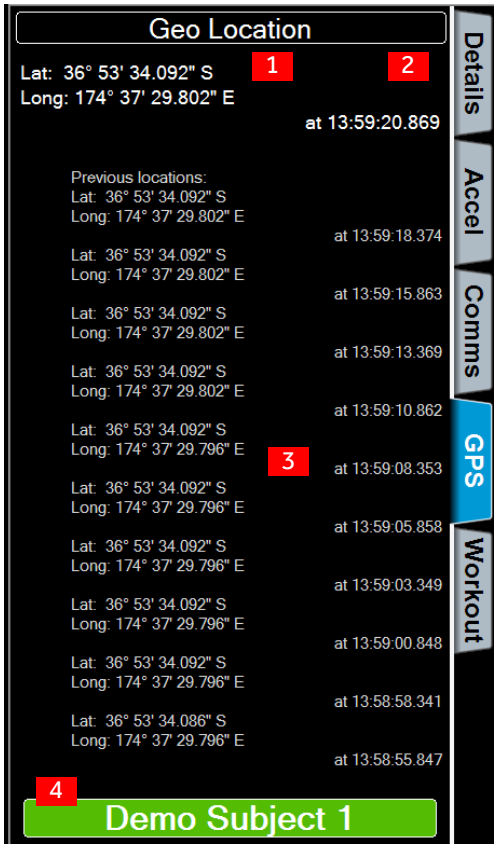


- Gateway not connected
- USB connector fault (replace)

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Side Tabs (5/14)

GPS Tab



- Values are for the selected BioGauge

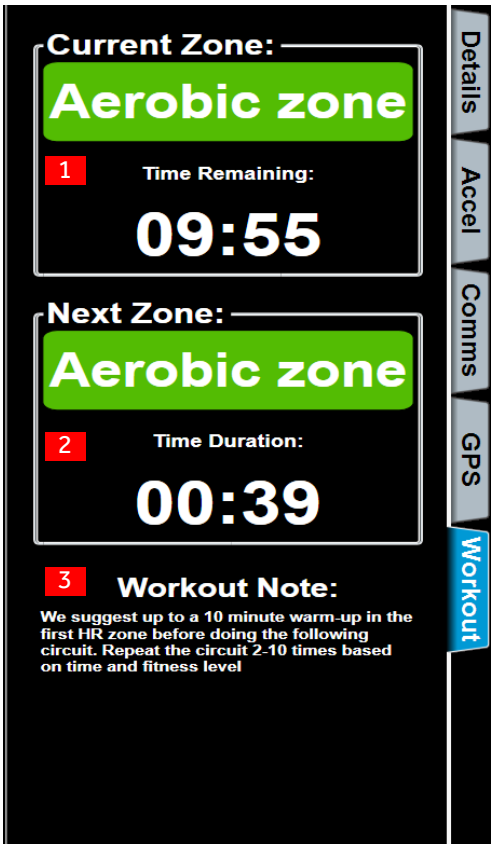
#	Description
1	Current location Latitude and Longitude
2	Timestamp of current location values
3	Historical location values
4	Subject name and ROG status

- Supported GPS and subject assignment is required
- BioModule must be configured to log in **Summary and Waveform** or **Enhanced Summary and Waveform** format

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Side Tabs (6/14)

Workout Tab



#	Description
1	Current Training Zone and time remaining
2	Next Training Zone and duration of next session segment
3	Workout note

- See the next section for workout operation.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

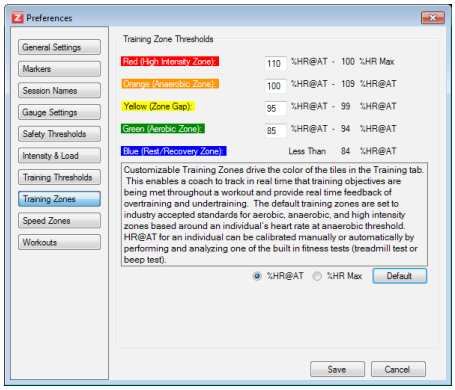
Managing Workouts

A **Workout** is a prescribed activity session in OmniSense™ Live with color HR indications based on **Training Zones**.

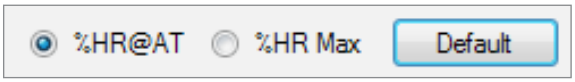
Training Zones are levels of exertion defined by heart rate thresholds. They are configured in Live **Preferences**.

1. Open the **Preferences** dialog using the Live toolbar button, and select the **Training Zones** button





2. Select the Heart Rate parameter used to determine the thresholds.



	Description
%HR@AT	Percentage of subject's HR at Anaerobic Threshold, as saved in database (default value, or saved from Fitness Test analysis).
%HR Max	Percentage of subject's maximum HR , as saved in database (default value, or saved from Fitness Test analysis).
Default	Return thresholds to their default settings

Default Training Zone Thresholds

%HR@AT

Zone	Lower Threshold %HR@AT	Upper Threshold %HR@AT
High Intensity	110	HR max
Anaerobic	100	109
Zone Gap	95	99
Aerobic	85	94
Rest/Recovery	Less than 84	84

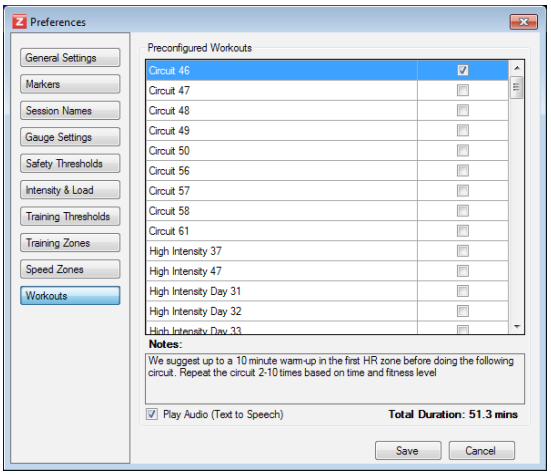
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

%HR Max

Zone	Lower Threshold %HR Max	Upper Threshold %HR Max
High Intensity	90	100
Anaerobic	80	89
Zone Gap	75	79
Aerobic	60	74
Rest/Recovery	Less than 84	59

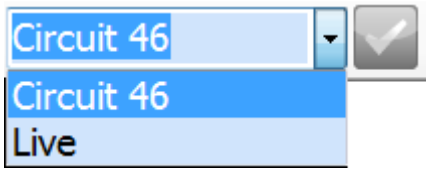
Lower Zone thresholds are editable; when a lower threshold is edited, the upper threshold of the zone below is adjusted automatically.

3. To enable Workouts, select the **Workouts** button in the Preferences dialog.



Check the boxes for those workouts to be enabled.

4. When a Workout has been enabled, it becomes available in the **Session Name** field in the Live toolbar.



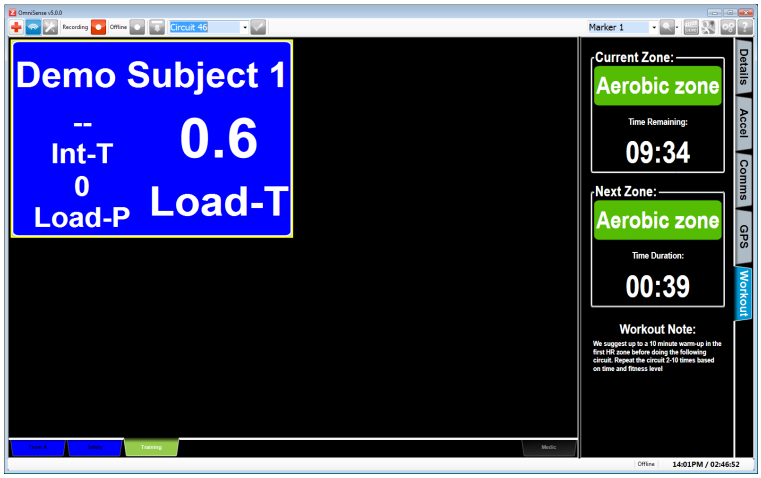
5. To activate the Workout, select it in the **Session Name** field, and click the adjacent button.



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

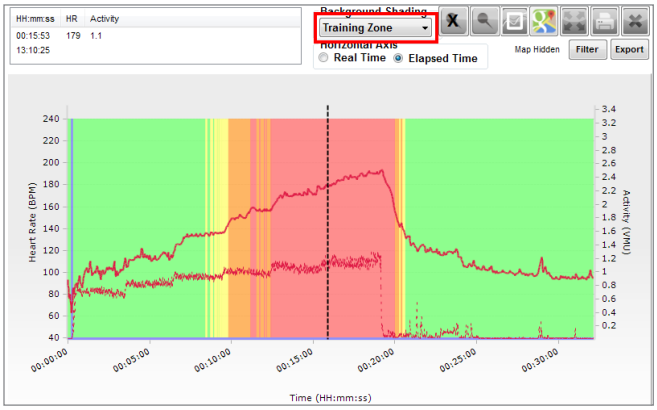
Side Tabs (9/14)

6. Select the **Training** tab at the bottom of the OmniSense™ Live screen. This displays subject Training BioGauges.



7. The aim of the workout is to engage in activity, which matches the background color of the subject Training BioGauge to the background color of the **Current Zone** in the Workout tab.

8. In OmniSense™ Analysis, Training Zones may be displayed as background shading to a displayed session.

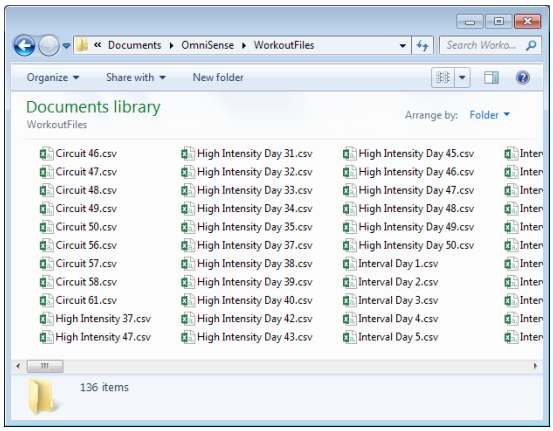


CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Workout Files

OmniSense™ workouts are based on the **Paul Robbins Periodization System**.

Workout files are stored at C:\...\Documents\OmniSense\WorkoutFiles in the form of csv (comma separated values) files which will open automatically in Microsoft™* Excel™*.



There are 136 separate workout files.

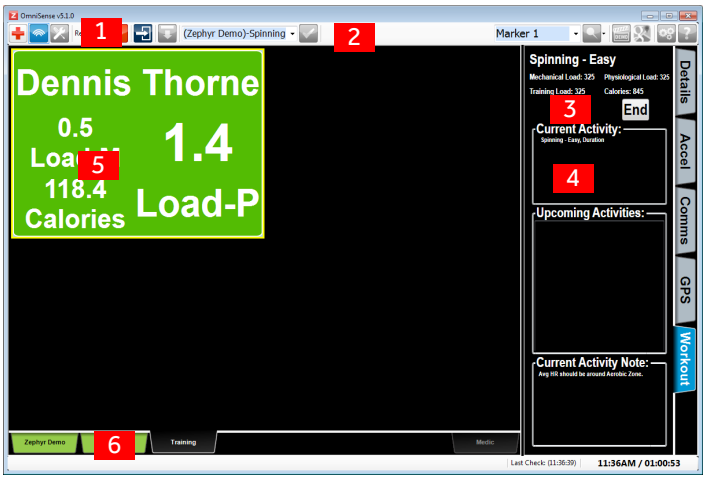
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Send Team Workouts from Web Portal

A coach can send a Team Workout from the web portal, as a single workout, or as part of a training plan.

No color-matching of BioGauge against workout tile is involved - athletes can see the target loads for the workout displayed, and should attempt to match those loads.

If a Team Workout has been assigned, it will be available in the **Session Names** pull down list on the scheduled date.



#	Description
1	Connect the PC application to the web portal.
2	Select the assigned team activity from the **Session Name** field, and enable using the **Change Session Name** button.
3	Use the **Start** / **End** buttons to manage the activity. Target load parameters (configured in the web portal as **Threshold Settings**) are displayed.
4	The workout tab displays information on current and upcoming activities.
5	Configure the BioGauge or Training BioGauge to show one or more of the target load parameters shown in the **Workout** tab.
6	Select the **Team** tab to show standard BioGauge, or **Training** tab for the training BioGauge as preferred.

Note

The PC session must be connected to the cloud database for workouts assigned from the portal to become available.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Safety Tab

The safety tab displays tiles showing the subject name and time-in-current-ROG status only, plus the ROG status itself as a background color.



- The color of the tab itself reflects the highest ROG status of any of the subject's displayed parameters.

- If any subject status remains red for greater than the time limit (configurable in **Preferences**, default 30 seconds), a red cross appears on the tile, and the subject's BioGauge displays on the **Medic** tab. The cross persists after Red status has downgraded, until the subject is manually removed from the Medic tab using the toolbar button.



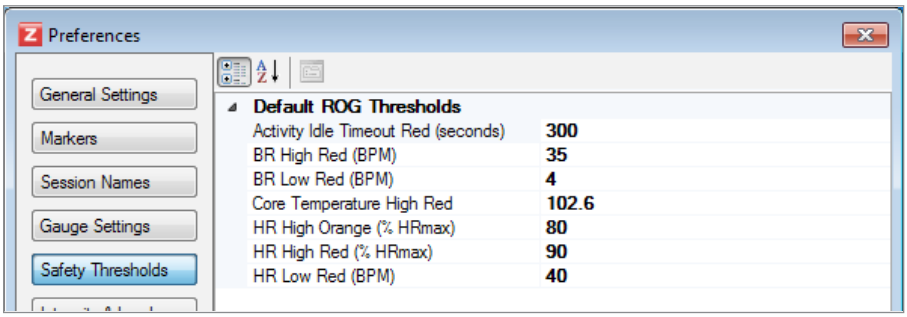


Safety Thresholds

Safety thresholds are set in the user's record in the **Setup > Subject** screen.



Default thresholds are set in **Preferences > Safety Thresholds**.



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Medic Tab

In Live **Preferences > General Settings** are Medic tab settings.

Medic Tab Settings	
Show or hide medic tab	**Show**
Add to medic tab as default	**Yes**
Remove from team tab	**No**
Medic tab timeout after (seconds)	**30**

The default settings are

- The Medic tab is displayed.
- Subjects whose status remains Red beyond the time limit are also displayed on the Medic tab.
- The BioGauge remains in the Team tab.
- The time threshold for Red status is 30 seconds.

The Medic tab displays the standard subject BioGauge.



A red cross displays in the center of the subject BioGauge to indicate the BioGauge is also displayed on the Medic tab.



To remove a subject from the Medic tab when the subject status is no longer red, use the **Remove** button on the Live toolbar.



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Side Tabs (14/14)

Training Tab



- The training tab displays Training BioGauges.
- There are three configurable fields on each BioGauge. Refer to the **Subject BioGauge** section for details.
- The background color for theTraining BioGauge shows Blue/Yellow/Green/Orange/Red and is **not** the Red/Orange/Green subject status indication.
- Training BioGauge background color reflects the **Training Zone** of the subject, which is a heart rate dependent metric, configured in Live **Preferences**. Training Zones are explained in the **Workout Tab** section.
- As the workout progresses, subjects attempt to match the color of their training BioGauge with the color of the current segment of the workout, indicated in the **Current Zone** section of the Workout tab.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

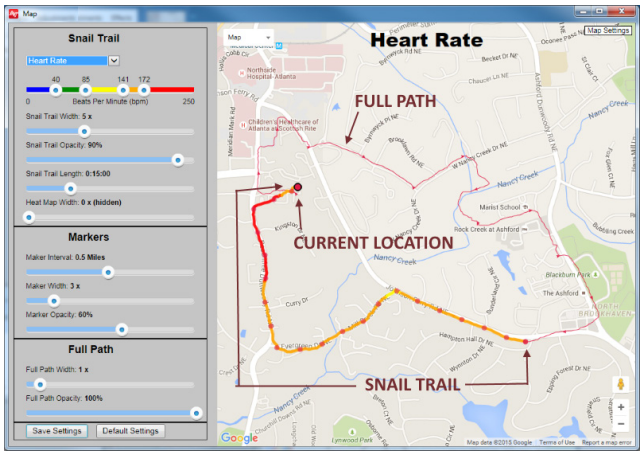
Map Window (1/2)

Map Window

- An internet connection is required.
- Subjects must be assigned GPS devices.
- A separate map window is enabled by a toolbar button.



- The Map/Satellite view can be adjusted by dragging the cursor in any direction.
- Use the +/- buttons at lower right, or mouse wheel, to zoom in/out on the map or satellite view.



- In the window above, non-default settings are used to emphasize trail features.

Snail Trail

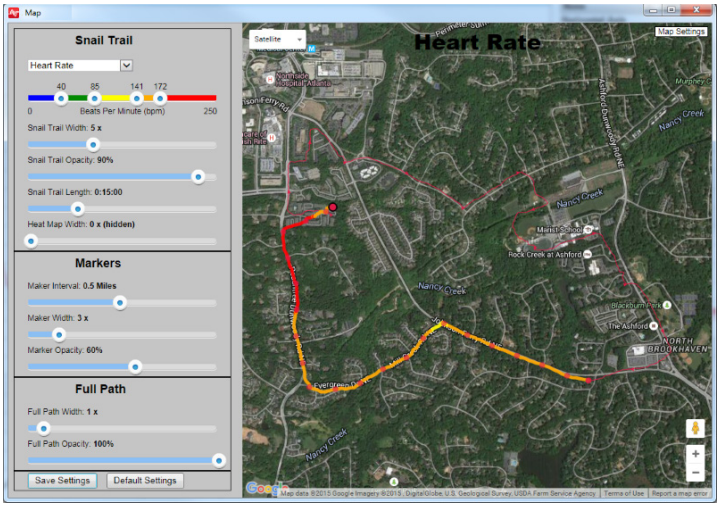
Snail Trail Parameter	Description
Parameter Pull-down	Select from HR (shown), %HR Max, %HR@AT, Physiological or Mechanical Intensity, Speed or Altitude zone, ROG Status or path only.
Color Thresholds	Slide buttons to set coloring of snail trail.
Width	Slide button for snail trail width. Extreme left = trail hidden.
Opacity	Slide button for % opacity.
Length	Slide button for time duration [hh:mm:ss] of snail trail, **preceding** current location.
Location Heat Map Width	Slide button to set background color behind snail trail. The color will turn from green to red as a location becomes prevalent. In a circuit run, Heat Map is always green unless the runner stops and holds location.
Marker Interval	Slide button to add distance markers at fixed intervals
Marker Width	Slide button to set marker width. Extreme left = markers hidden

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

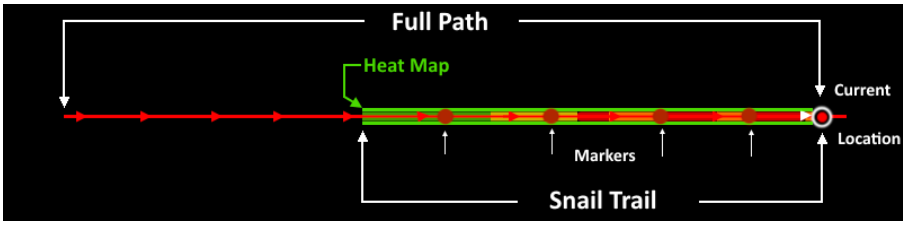
Map Window (2/2)

Snail Trail Parameter	Description
Marker Opacity	Slide button to set marker opacity
Full Path Width	Slide button to set width of path preceding snail trail. Extreme left = full path hidden.
Full Path Opacity	Slide button to set full path opacity
Save Settings	Save a preferred setting for repeated use.
Default Settings	Return to default settings.

Use the selector on the map to toggle between map and satellite view.



Heat Map



A heat map is an additional wider color trace surrounding a subject's snail trail.

A heat map is an indication of historical persistence at a location. If a subject remains stationary at the same location, then their heat map indication will progress from green to red.

On a sports field, if a subject moves returns to the same location repeatedly, then that location's heat map indication will progress from green to red over time.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Session Names & Markers (1/3)

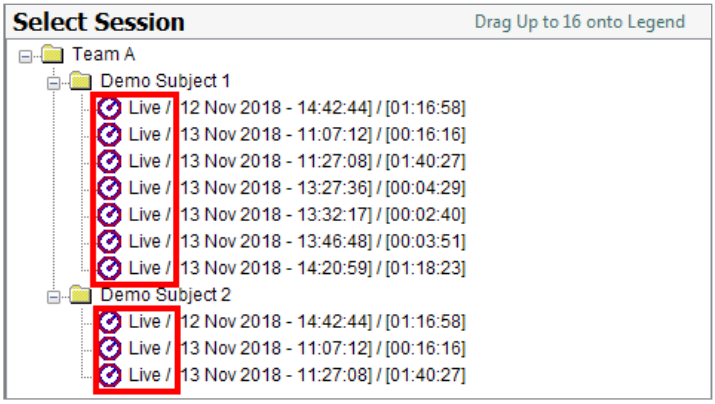
Session Names

Sessions can be named in OmniSense™ Live using the toolbar Session Name field pull-down, and adjacent **Change Session Name** button to activate the selection.



Their main purpose is to make it easier to identify and locate specific sessions in the **Select Session** pane of OmniSense™ Analysis. Sessions can be renamed in Analysis if needed.

The default Session Name is 'Live', but if all sessions are set to this, then the session time stamp becomes the only means of identifying a specific session.

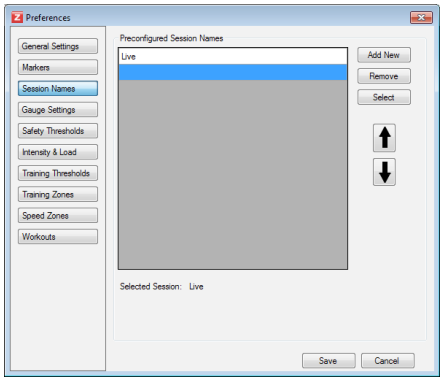


Create Session Name

1. Open the **Preferences** dialog in OmniSense™ Live using the toolbar button.



2. Select the **Session Names** button, then the **Add New** button.



3. Enter the session name in the new (blue) session name entry, and click **Save**.

Caution

Prescribed **Workouts** are displayed in the same field as **Session Names**. If you create a new session with the same name as a pre-existing workout, then the workout of that name will be activated when you click on the **Change Session Name** button.

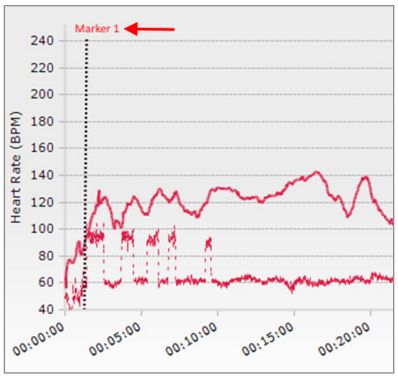
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Session Markers

Named markers can be added to sessions using the toolbar **Marker** field and adjacent **Add Marker** button.



The purpose of markers is to indicate specific events (start and stop of notable activities or tests during a session, etc) in the data displayed in OmniSense™ Analysis.



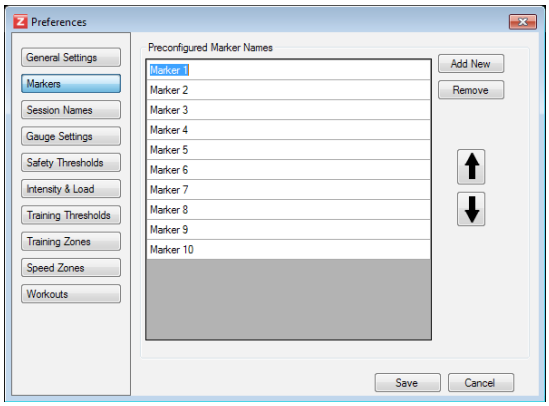
The markers are not exported when the data is exported from Analysis as a csv file, though they will appear in graphs exported as image files.

Create Marker

1. Open the **Preferences** dialog in OmniSense™ Live using the toolbar button.



2. There are ten default markers. You can **Remove** these, retain them, edit by selecting them, or **Add New**.

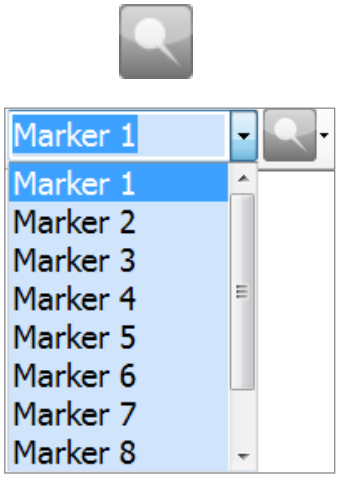


Save the new or edited marker when done.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

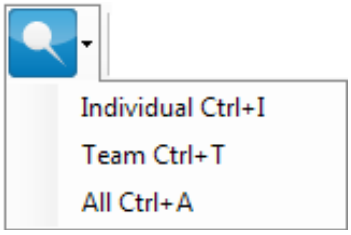
Session Names & Markers (3/3)

3. The order of the markers in the dialog is significant. Each time the **Add Marker** button is clicked to add a marker to a session, the list automatically increments to the next marker on the list.



4. In order to re-use the same marker on the list, you must re-select it from the pull down menu before adding it.

5. There are three options when adding a marker:



Select Individual (selected BioGauge), Team or All (' and ') all subjects in all teams - before clicking on the actual **Add Marker** button.

6. The elapsed time component of the clock at bottom right of the OmniSense™ Live window is reset to 00:00:00 each time a marker is placed.



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

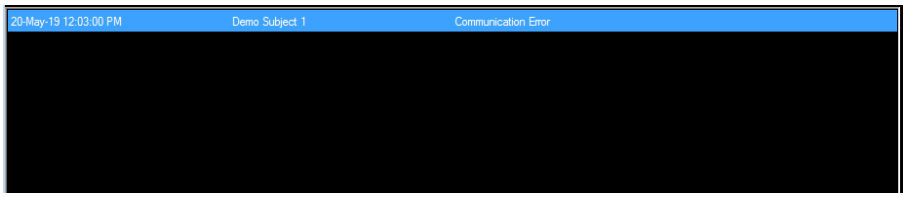
Notification Area

The notification area is displayed using the **Show/Hide Bottom Panel** button on the Live toolbar.





The Notification Area displays a variety of notifications which can confirm the system is operating correctly, or may help in analyzing system errors.

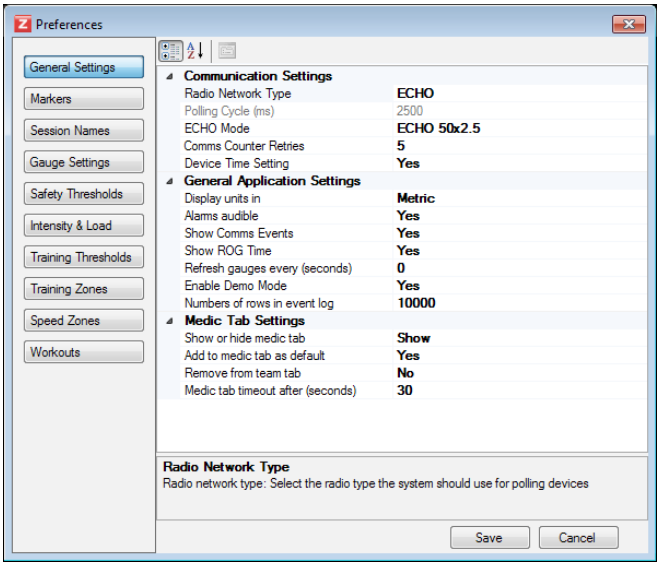


CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Preferences

The settings described in the following section do not include those listed in the table below.

The table shows the section of this manual where they are described.



Setting	Described in Section
General Settings	System Setup > OmniSense General Preferences
Markers	Live Operations >Markers
Session Names	Live Operations > Session Names
Gauge Settings	Live Operations > Subject BioGauge > Configure BioGauge
Safety Thresholds	Live Operations > Safety Tab
Training Zones	Live Operations > Workout Tab > Managing Workouts
Workouts	Live Operations > Workout Tab > Managing Workouts

Which preferences are available may vary according to the Radio Network type selected.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

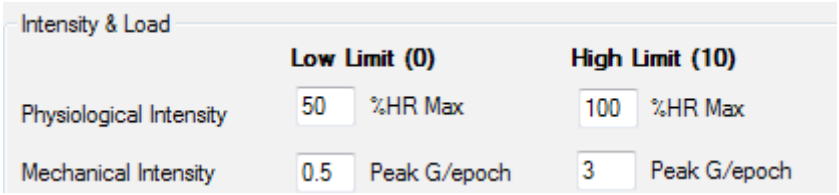
Intensity & Load

Intensity is an instantaneous measure of effort.

- Physiological Intensity is a measure of cardiovascular output, based on heart rate.
- Mechanical Intensity is a measure of musculoskeletal output, based on accelerometer data.
- Training Intensity is the arithmetic mean (average) of physiological and mechanical intensities

Equivalent Loads (Physiological, Mechanical, Training) are cumulative totals of intensity values, and reflect the total effort over an activity session.

Intensity is measured on a scale of 1 -10, with no units. These values indicate zones between absolute **Low** and **High** limits which are configurable in **Preferences > Intensity & Load**.



Physiological Intensity

Default Physiological Intensity Zone Thresholds

Intensity	Low (%HR max)	High (%HR max)
Null (no value)	Below 50	
1	50	54
2	55	59
3	60	64
4	65	69
5	70	74
6	75	79
7	80	84
8	85	89
9	90	94
10	95	100 or above

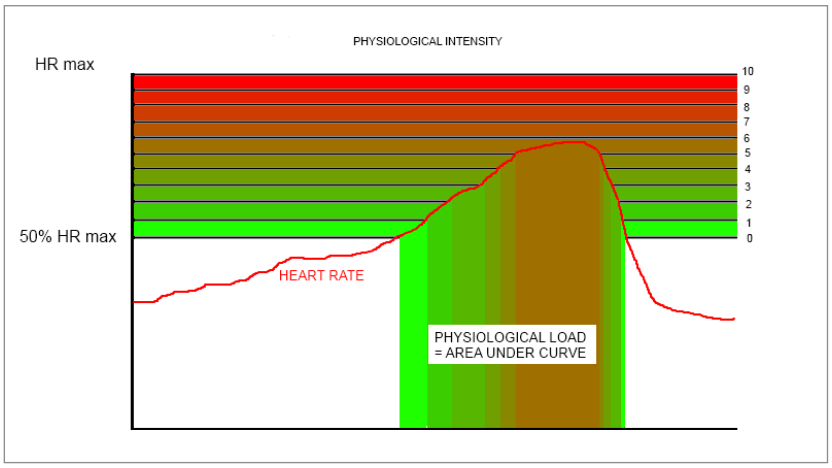
Intensity values inside a zone are calculated arithmetically. For example, a %HR max value of 52 equals an Intensity of 1.5.

If **Low** and **High** Limits are changed, then Intensity zone limits will adjust to allow 10 equal intensity zones between the new low and high limits.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Preferences (3/5)

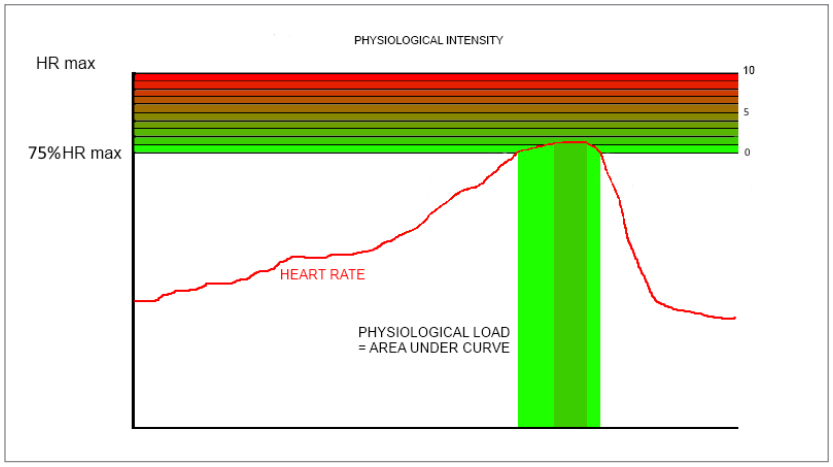
The graph below shows the default Low and High Physiological Intensity limits and how the ten intensity level zones are distributed between these limits.



Physiological Load is the per-second accumulation of the **Physiological Intensity** values, and can be represented by the colored area under the intensity/heart rate curve.

Note that for these limits, a heart rate of below 50% HR max - uncolored - has no (null) intensity value, and will not contribute towards a load value. The load value is the total colored area below the trace.

The second graph shows the effect of increasing the lower Physiological Intensity limit to 75% HR max. The ten zones are narrower.

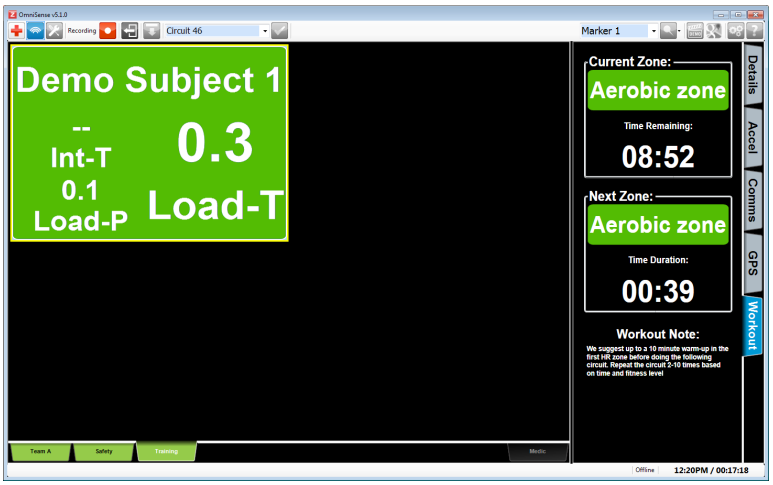


The corresponding Physiological Load is also reduced, as the same heart rate trace results in lower assigned Physiological Intensity values.

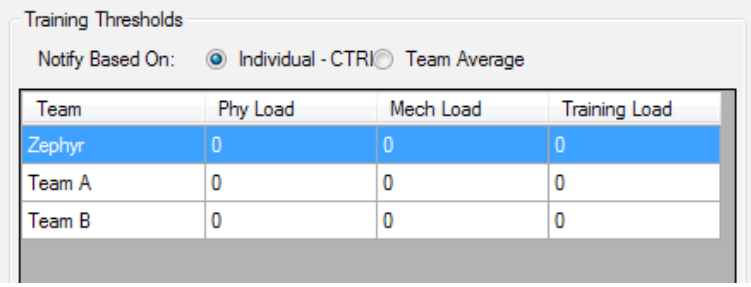
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Training Thresholds

Training Thresholds are used in conjunction with a Training BioGauge in the context of a Workout.



Threshold targets are set in **Preferences > Training Thresholds**.

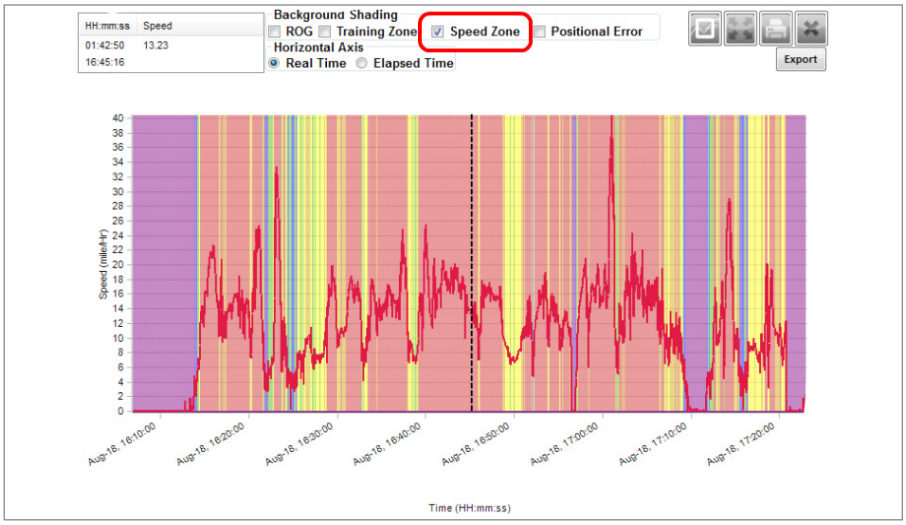


When the prescribed targets are met (individually, or team average), the subject name and target met will flash in a contrasting color on their Training BioGauge, either individually or as a team, dependent on the **Notify Based On** setting.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

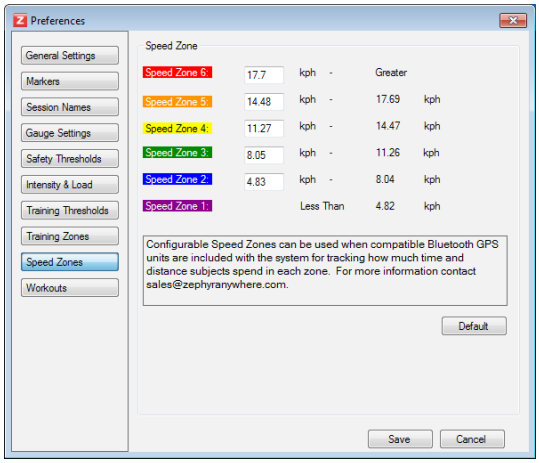
Speed Zones

Speed zones can be configured for subjects who are using a supported GPS device in conjunction with their BioModule.



- In OmniSense™ Analysis, select the check box above the time graph to show speed zones as background shading. Illustrated is speed over time in miles per hour over a cycle run tracked by GPS.

- As lower limits are adjusted, the upper limit for each zone adjusts automatically.



- Speed Zone data is not viewed in OmniSense™ Live, but in the Analysis module.

Note

When logging GPS data internally in a BioModule, it must be configured to log in **Summary and Waveform** or **Enhanced Summary and Waveform** format, using the Zephyr™ Config Tool.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

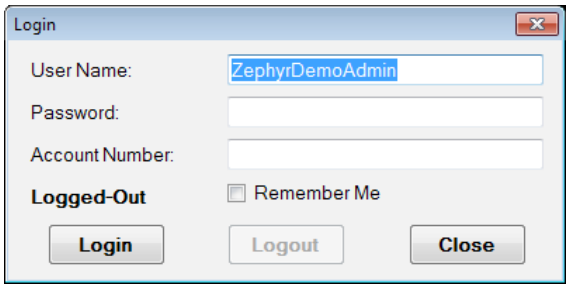
Connection to Cloud Portal

- An internet connection is required.
- Both OmniSense™ Live & Analysis can connect to the OmniSense™ Cloud Portal.
- When OmniSense™ Live is connected, streaming live data is automatically uploaded to the portal and can be viewed remotely. Data is only uploaded for those subjects who are registered with the portal.
- The registration process is described in the **OmniSense™ Web Portal** section.
- When OmniSense™ Analysis is connected, any log data imported from BioModules assigned to registered portal users is also uploaded.

1. Click on the connect button on the Live (or Analysis) toolbar.



2. Enter your **User Name** and **Password**. The user name will have been assigned to you, and password set by you as part of the registration process.



Click Login.

3. The toolbar button will toggle to show the application is connected to the web portal.



Note

No data is ever downloaded from the portal to a local OmniSense™ Analysis instance. It can only be viewed in the portal itself.

However, subject physiological parameters such as maximum heart rate, fitness level etc - are synchronized between the web portal and a local PC instance every time they are connected, to maintain integrity of these parameters.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Demo Mode

Demonstration mode exists for training and demonstration purposes. It consists of a number of subjects displaying virtual data.

- No ECHO Gateway need be connected to operate in Demo mode.
- If an ECHO system is active, then real subject data will display at the same time as the virtual subjects.
- Engage **Demo** mode using the toolbar button.



- 21 virtual subjects will display, on 3 team tabs: **Goalkeeper** / **Defenders** / **Offense**.



Team tab (Offense)



Training tab

All tabs and Standard or Training BioGauges will function, except for:

- Accel tab
- GPS tab
- Workouts - the Workout tab can be viewed, but subject data will not attempt to match the Workout targets.

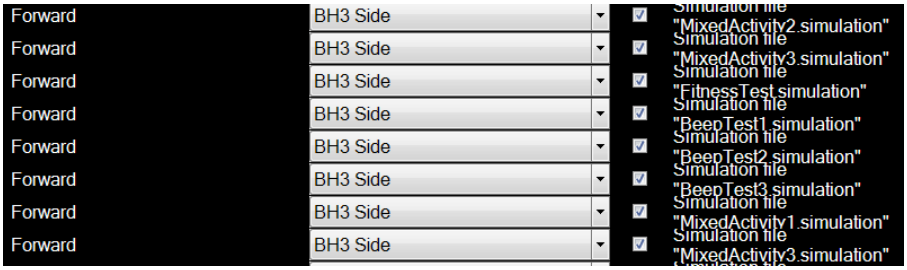
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
> Startup Sequence
> Live Screen Overview
> BioGauge
> Side Tabs
> Map Window
> Session Names & Markers
> Notification Area
> Preferences
> Connection to Cloud Portal
> Demo Mode
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Demo Mode (2/2)

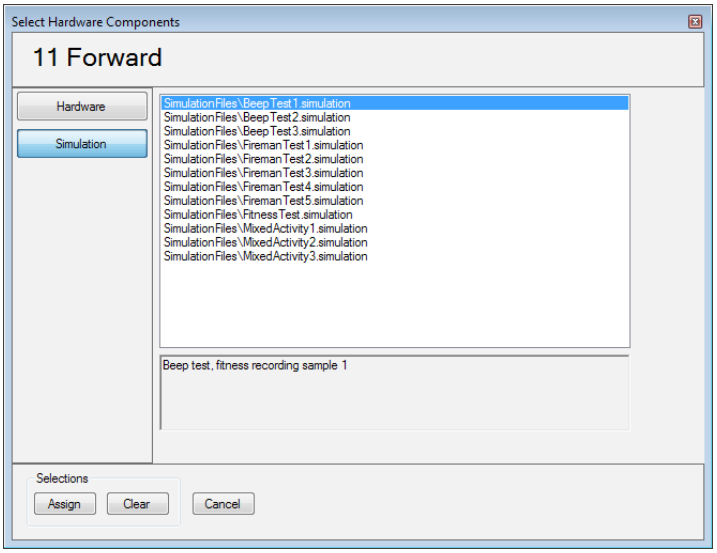
Demo Team Setup

In **Demo** mode, the subjects exist in all the setup tabs. Subject parameters can be edited, and subjects removed from teams or teams un-deployed as real subjects would.

No hardware is assigned to the demo subjects. They are assigned files of virtual data. These files can be selected from a range of options.



1. The simulation files can be assigned exactly as devices, by selecting the demo subject, and using the **Assign** button in the **Setup > Hardware** tab.
2. A **Select Hardware Components** dialog will display, with an additional **Simulation** tab.



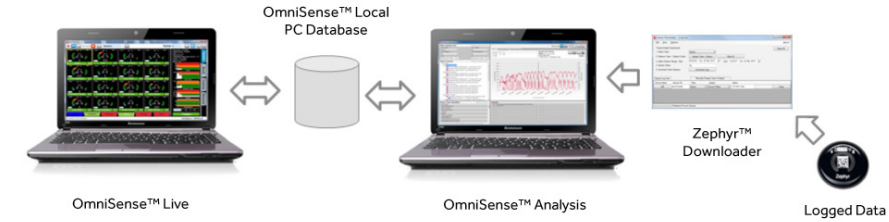
3. When a file is selected, a note below will describe the nature of the data,
4. Click **Save** to assign the simulation file.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Overview

OmniSense™ Local PC Database

- Both OmniSense™ Live and OmniSense™ Analysis send and receive data from and to the OmniSense™ Local PC database.



The database repository is a single file, **polling.fdb**, located at

C:\Program Files (x86)\Zephyr\OmniSense\Database\DbFile.

At each upgrade install, the existing database is backed up before a new instance is created and populated with any existing data.

The database contains:

- All subject & team data.
- All device data and who devices are assigned to.
- All session data.

The database is populated by:

- Receiving streaming data over ECHO from OmniSense™ Live.
- Importing BioModule Log data via OmniSense™ Analysis.
- Importing external .zsf session files from another instance of OmniSense™ Analysis, or previously archived from the current instance.

Note

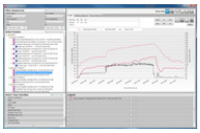
The database file is secure and cannot be opened directly - it can only be accessed via OmniSense™ Analysis. However, it can be copied and substituted into the same location in a second PC. All data will be transferred.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

OMNISENSE™ ANALYSIS OPERATIONS

Overview (2/9)

Features



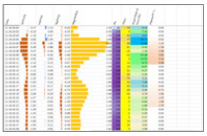
Time graphs



Summary graphs



Reports



Impact Reports

Filter Sessions By

- Team, Subject
- Session Name
- Subsession Name
- Time/Date

Legend

- Compare up to 16 color-coded sessions simultaneously

Manage Sessions

- Export, rename, move, delete & archive

Export Graph Data

- Multiple file and image formats

Time Graphs

- Show 2 parameters of 46 available
- Automatic & Manual Fitness Testing analysis
- Real or elapsed time
- ROG Status, training or speed zone background colors
- Subsessions

Summary Graphs

- Show 2 parameters of 46 available
- Min/Max/Avg/Total displayed as bar graphs

Fitness & Training Reports

- Compare individual against normative or team data
- Mean & Std Dev
- Table & radar plot format
- Group Consolidated Summary
- Periodization Report
- Summary GPS
- Summary Physiological
- Workout Compliance

Impact Reports

- 5 configurable impact zones by g force
- Based on 100 Hz 3-axis data
- Summary impact counts per zone
- Magnitude, duration & direction of impacts
- Automated grouping of impacts by type
  - Walk
  - Run/intense run
  - Bound/Jump
  - Detailed analysis showing peak g, rise time, duration, rate of force development & decline and total impulse load

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Physiological Parameters

The following parameters are available **in addition** to those displayed in OmniSense™ Live.

Parameter	Units	Description
From Fitness Test Analysis		
HR @ AT	Beats/minute	From detection of Anaerobic Threshold
BR @ AT	Breaths/minute	From detection of Anaerobic Threshold
VO_2max	ml/kg/min	Based on heart & breathing rates
HRmax	Beats/minute	Maximum heart rate of subject
BRmax	Breaths/minute	Maximum breathing rate of subject
Heart Rate Recovery	Beats per 30 sec	On cessation of test, subject stationary
%VO_2max @ AT	%VO_2max	Accepted performance indicator
Fitness Level	Scale 1 - 10	10 = elite athlete
From Summary Graphs		
Max, Min, Average	All parameters	
Speed	Box Plot	2nd, 9th, 25th, 50th, 75th,91st, 98th, 100th percentiles
Elevation	Box Plot	2nd, 9th, 25th, 50th, 75th,91st, 98th, 100th percentiles
Jump time in air	Seconds	Based on jump detection
Jump height	Feet / meters	Based on jump detection
Exercise Time	Duration	
Time above AT	Duration	
Time in HR Zones	% Total Duration	Banded histogram - % time in each zone
Time in Training Zones	% Total Duration	Banded histogram - % time in each zone
Time in Speed Zones	% Total Duration	Banded histogram - % time in each zone
Distance in Speed Zone	% Total Distance	Banded histogram - % time in each zone

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Physiological Parameters

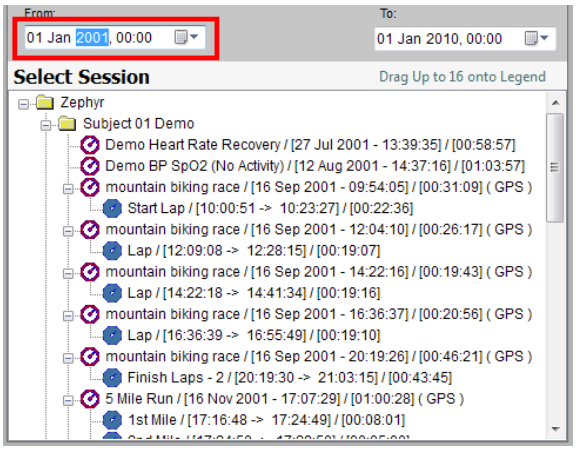
Parameter	Units	Description
From Reports (Group Consolidation Report contains all)		
Average Value		Of all parameters in report
Standard Deviation		Of all parameters in report
Significantly Low Value		Less than 1 STDDEV below average
Significantly High value		More than 1 STDDEV above average
% Time in HR Zones	% Total Time	Time in various zones
% Time > HR@AT	% Total Time	Time operating above Anaerobic Threshold (AT)
% Time < HR@AT	% Total Time	Time operating below AT
Peak HR	Beats/minute	For the session
Average HR	Beats/minute	For the session
Average, Max HRV	ms (STDDEV)	Average, Max in milliseconds
Average, Max HRR	Beats in 30 seconds	Subject stationary for 30 seconds
Average, Max Core Temp	Degrees C / F	For the session
Time in Training Zones	Duration	Blue/Green/Yellow/Orange/Red zones
Time in Speed Zones	Duration	Purple/Blue/Green/Yellow/Orange/ Red zones
Distance	Miles/km	Distance in above zones
Average, Max Speed	Miles or km per hour	For session
Elevation Climb, Descent	Feet / meters	Total climb & descent for session

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Demonstration Data

A number of demonstration sessions are available in every OmniSense™ installation which can be used to familiarize yourself with how Analysis works. Some sessions include GPS data which can be displayed on Google Maps™* within Analysis.

These sessions are all dated in the year **2001**. They will only become visible if the **From** date field is edited to start from this year.

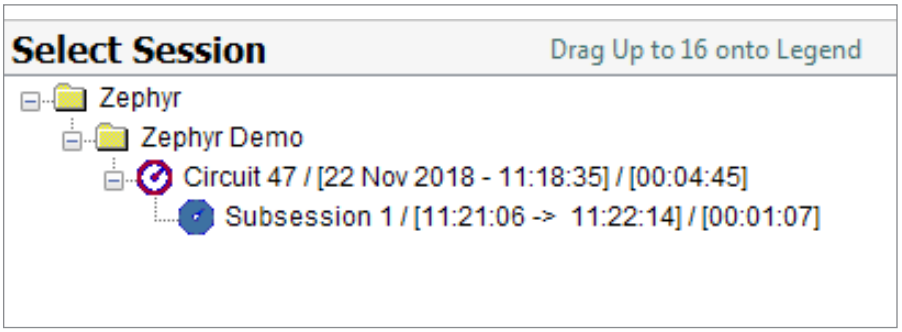


The sessions are:

Subject	Session
Subject 01 Demo	Demo Heart Rate Recovery
	Demo Blood Pressure*/Blood Oxygen*
	Mountain bike race x5 with subsessions (GPS)
	5 mile run with mile subsessions (GPS)
	Readiness Assessment
Subject 02 Demo	Beep Test
	Soccer Practice
	Treadmill Test
	5 mile run with mile subsessions (GPS)
Subject 03 Demo	Beep Test
	Soccer practice
	Treadmill Test
Subject 04 Demo	Beep Test
	Soccer Practice
Subject 05 Demo	Dash Test x 2
	Jump Test x 2
	Soccer Practice

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

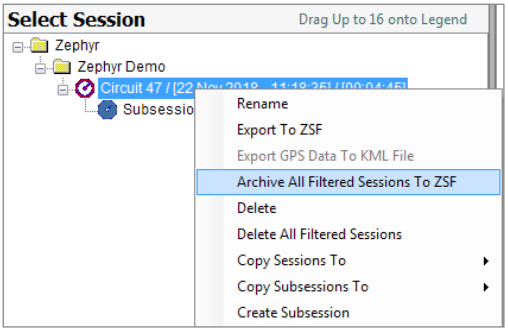
Database Rules



- Subject names must be unique (no duplicates)
- The hierarchy for displaying session data in OmniSense™ Analysis is

- **Team Name** (or **No Team Assigned**)
  - **Subject Name**
    - **Session Name**
      - **Subsession Name**

- Subjects are listed under the last team they were assigned to.
- If the subject has never been assigned to a Team (this is possible if log data is imported), they are listed as 'No Team Assigned'.
- Team names can be deleted and recreated as necessary.
- Sessions can be **Archived** – they are saved as an external .zsf file, and are deleted from the database. The external .zsf file can be re-imported at will. Use this function to 'de-clutter' a database and speed up database loading time.



Caution

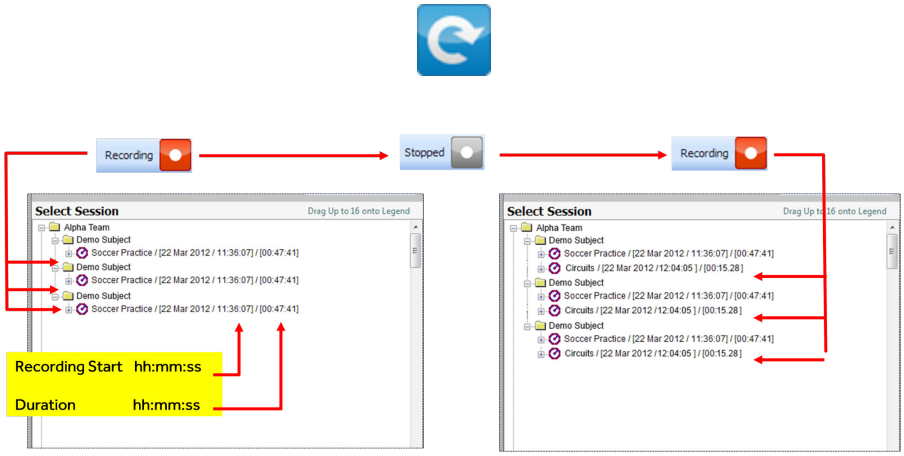
If a subject is deleted from the database, all of their sessions are deleted and cannot be recovered. If you re-use the name, you will be prompted to 'reactivate' a deleted subject, but their old data will no longer be available.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Recording Logic



- Data must be recorded in the Live module (or logged internally in BioModules) for later display in the Analysis module.
- Recording is the default state when Live mode is engaged.
- The default **Session Name** in Analysis will be **Live**, unless the session is renamed in Live, or renamed later in Analysis.
- Analysis and Live modules can run simultaneously, but data must be regularly refreshed manually in the Analysis module using the **Refresh** button.



- Each time the **Record** button is toggled off/on in a continuous session in the Live Module, new individual subject sessions are created in the database for each subject deployed.
- These are displayed as separate subject sessions in Analysis, for each individual subject.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Overview (8/9)

Analysis Toolbar

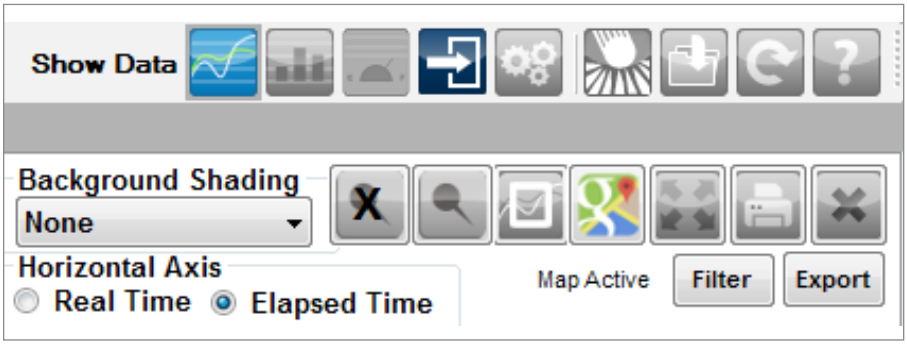


Illustration is for the Time Graphs toolbar - some items will not appear for Summary graphs.

Item	Description
	Show Time graph
	Show Summary graph
	Show Readiness graph
	Offline (left)/Online (right) Web Portal connection
	Preferences
	Start Impact Processor utility
	Import zsf file/BioModule log file
	Refresh database
	Help
	Remove all session markers
	Add a session marker
	Create a subsession
	Open Map pane/window
	Show graph full screen
	Print
	Clear all graph data

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Overview (9/9)

Item	Description
Background Shading: None	Set background shading of graph to **None/ROG Status/Training Zone/Speed Zone/Positional Error**
Horizontal Axis: Real Time / Elapsed Time	Show horizontal axis as real (absolute) time or elapsed time (starts at 00:00:00)
Filter	Apply conditional filter to data
Export	Export graph contents as csv or various graphical outputs

Note

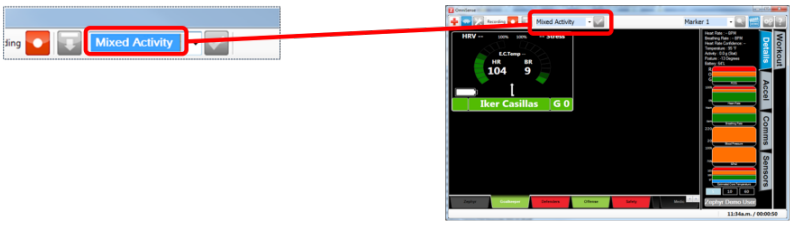
Markers, when added to a session, are exported when the output format is graphical e.g. pdf, jpeg etc, but **not** when the output is csv file format.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Session Naming

Custom Session names make for easy filtering of data for display in Analysis.

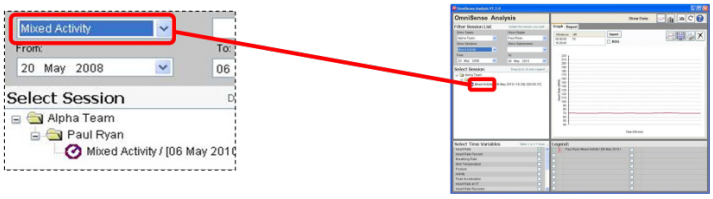
Session Naming in OmniSense™ Live



- Create a **Session Name** in **Live > Preferences** and name using the **Change Session Name** button

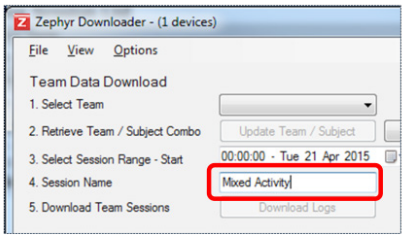


Session Name Filtering in OmniSense™ Analysis



- Use the **Show Sessions** filter to easily locate a named session.

Set Session Name in Zephyr™ Downloader



- Set the **Session Name** when importing log data using the Zephyr™ Downloader.

Note

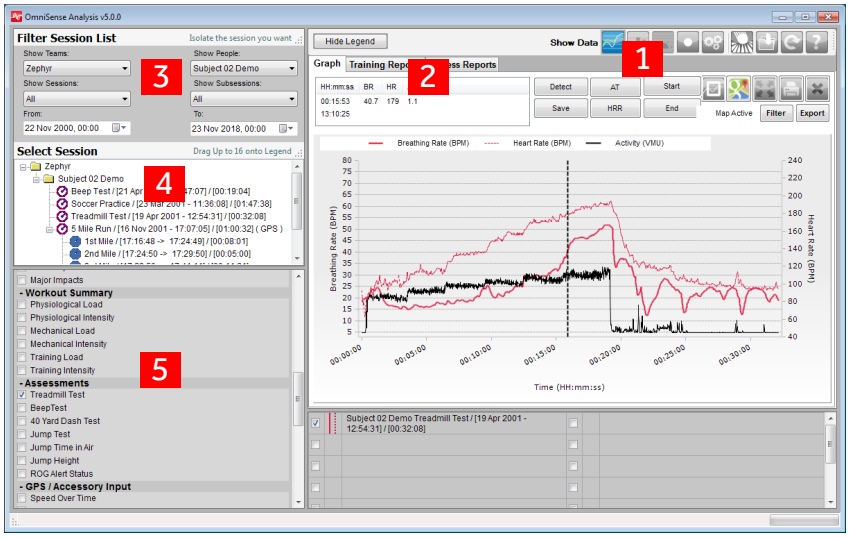
Sessions can be renamed at any stage in OmniSense™ Analysis by right-clicking on the session and selecting **Rename** from the context menu.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

OMNISENSE™ ANALYSIS OPERATIONS

Sessions (2/5)

Workflow



1. Select graph type using the appropriate toolbar button

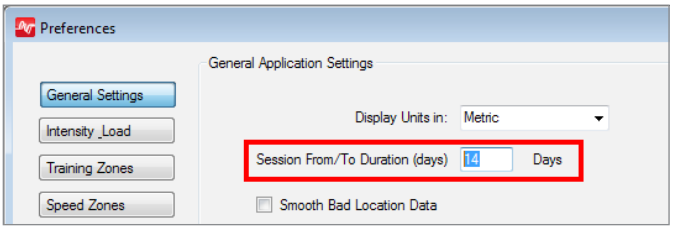
   Time (Line graph) 

   Summary (Bar graph) 

2. If a report is needed, rather than a graph, select the appropriate tab. Refer to the **Analysis Reports** topic.

3. Use filter pull downs to populate the **Select Session** tree. The **From** date defaults to 14 days before the current date. This is configurable in Analysis **Preferences**.

4. Drag and drop, or double-click sessions to populate the **Legend**.

5. Select 2 parameters to display on a graph (3 parameters are automatically displayed for **Treadmill** or **Beep** tests).

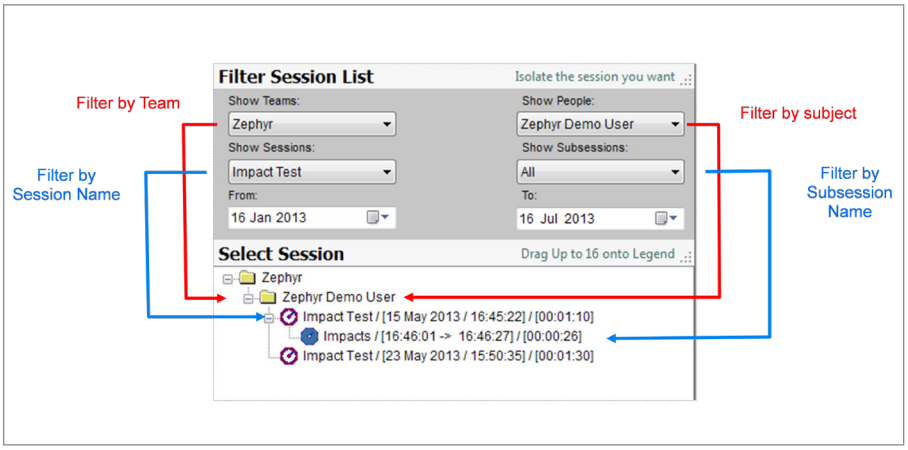
Note

When selecting parameters, the first parameter selected units display on the left-side vertical axis. If either parameter is de-selected, the remaining parameter's units will display on the left side vertical axis.

If a third parameter is selected, the second selected parameter displays on the left side axis, and the third on the right side. The first parameter selected is automatically de-selected.

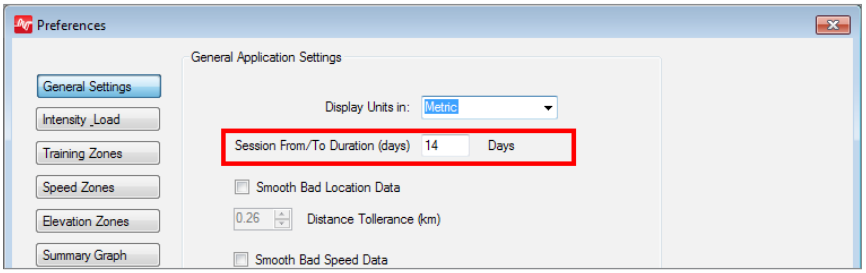
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Filter Sessions



- Effective naming of sessions at the time of recording or download of logged data will make for faster filtering (using **Show Sessions**) when retrieving data.
- The **To** date field defaults to midnight on the current day.
- The **From** field defaults to 14 days prior to the current day. This is configurable in Analysis **Preferences**.





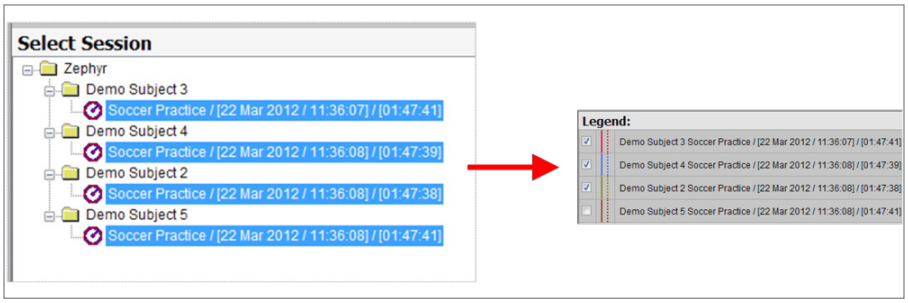
Note

To access Demonstration data, set the **From** field to Jan 2001.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Select Session

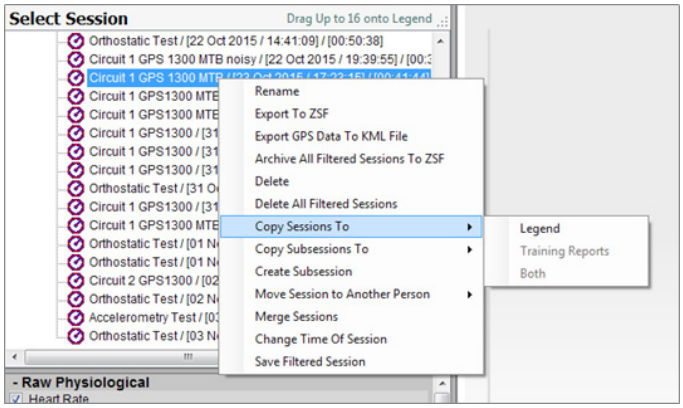
The **Select Session** pane in Analysis displays those sessions which have been filtered by the **Filter Session** pane.



- Click on a session to select it.
- Hold the **Control** key to multiple select.
- Click and drag a sessions or sessions to the **Legend**, or double-click to automatically populate the legend.

Session Options

- Right-click on a Team, subject, session or subsession to display a context menu of options.



Team

Option	Description
Permanently Delete	Permanently delete team, subjects in team, and data for those subjects.

Caution

Permanently deleting a team is a non-reversible action. All subjects in the team are also deleted, and their data. Teams can be recreated, and subjects, but not the deleted data, unless it has been uploaded to the web portal. It will still be available there if the subject is re-activated.

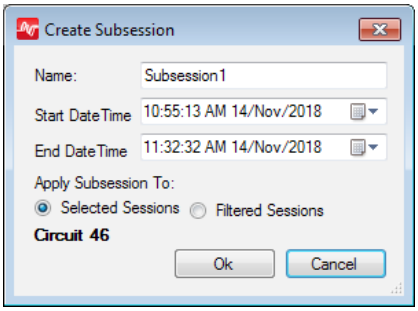
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Sessions (5/5)

Subject

Option	Description
Permanently Delete	Permanently delete subject and data (see Caution on previous page)
Change Team To	Transfer subject to another team, selected from list. No data is deleted.

Session & Subsession

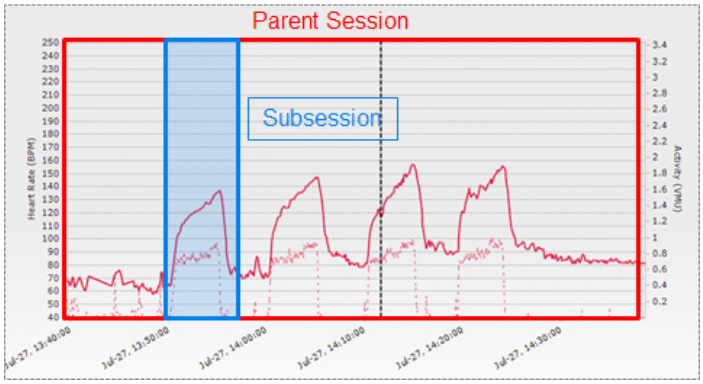
Option	Description
Rename	Rename session
Export to .zsf	Create external ZSF file for import to another instance of OmniSense™ Analysis
Export GPS data to external kml file	Export GPS and basic physiological data to a kml file for import & display in Google Earth™*.
Archive All Filtered Sessions to ZSF	Create an external ZSF of multiple sessions. Original sessions are deleted from database - a dialog will ask to confirm. This can be used as a means of de-cluttering the database of unnecessary data.
Delete	Permanently delete the selected session. Irreversible. Use Archive option to remove from database, but create an external file.
Delete All Filtered Sessions	Permanently delete. Irreversible. Use Archive option to remove from database, but create an external file.
Copy Sessions/ Subsessions to	Legend/Training Report/Fitness Report, depending which is active on the right-side panel.
Create Subsession	Display subsession dialog, Enter details as needed. 
Move Session to Another Person	Select another subject from pull-down list, in the event that data has been wrongly associated.
Merge Session	Select sessions which have an overlap (usually transmitted & log data from the same session). A new session will be created. No merge is created if no timestamps overlap in the sessions to be merged.
Change Time of Session	Change timestamps of session.
Save Filtered Session	Session Filters must be applied. See section on Applying Filters to Sessions.

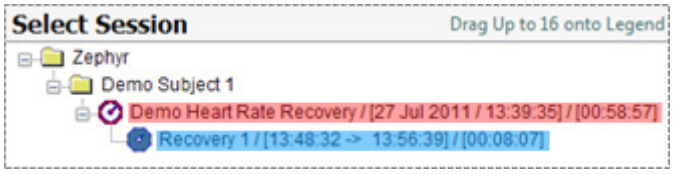
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Subsessions (1/3)

Overview

- A subsession is a user-generated section of a parent session, used to isolate data of interest, or exclude data of no interest so that it does not show on graphs or in reports.
- A parent session can have multiple subsessions, and the subsessions may overlap each other, but you cannot make a subsession from a subsession. Subsessions display as a sub-node to the parent session in the **Select Session** pane.
- The subsession name can be used for easier filtering of data in the **Filter Session** pane. Subsessions can be deleted and re-created at will.





Caution

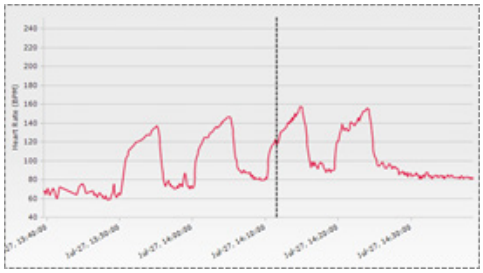
If a parent session is permanently deleted from the database, all subsessions are also deleted.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Subsessions (2/3)

Subsession by Mouse

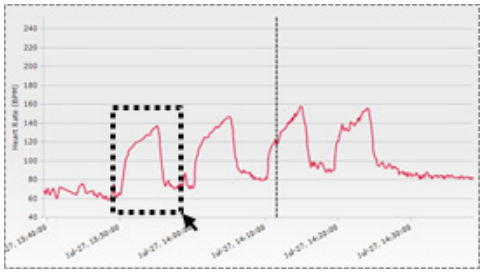
1. Display sessions and parameters as needed.



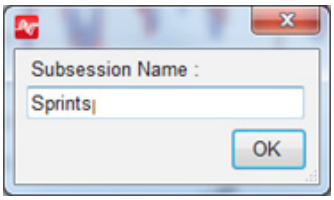
2. Select the **Subsession** button above graph.



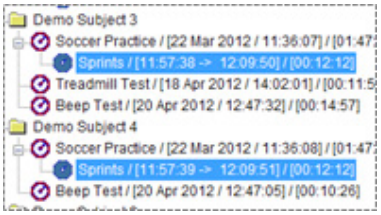
3. Use mouse arrow to click and drag a rectangular frame for the subsession. Both vertical and time axes will truncate automatically when the subsession displays on its own.



4. When the mouse button is released, a **Subsession Name** dialog will display. Select **X** and redraw the subsession if needed, or **OK** to create.



5. The subsessions will be created in the Select Session tree. If more than one session is graphed when a subsession is framed, then a separate subsession is created for each parent session.



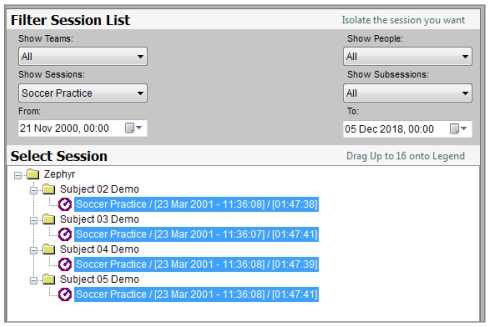
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Subsessions (3/3)

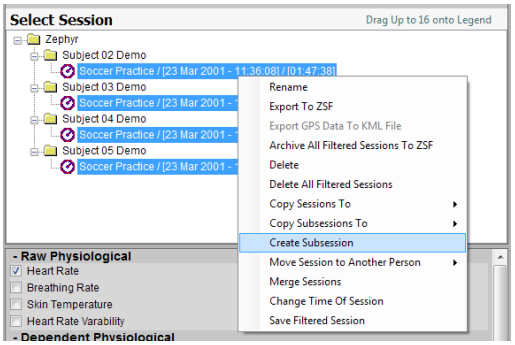
Subsession by Wizard

The subsession wizard is best used where **Start** and **End** times are known.

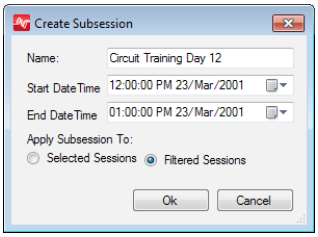
1. (Recommended) Use the **Show Sessions** filter and others if necessary to display only those sessions you want to use.



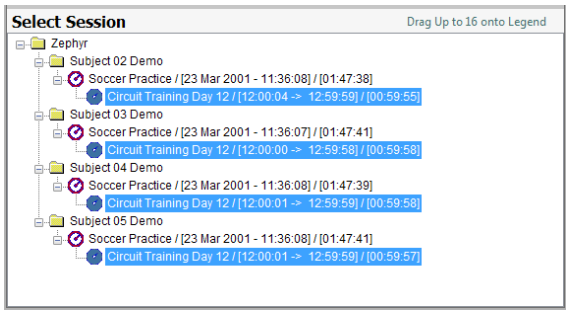
2. Right-click on a session to display the context menu, and select **Create Subsession**.



3. Edit the **Create Subsession** dialog as needed. Give the subsessions a meaningful name which can be used for filtering at a later date. Check **Filtered Sessions** if all the sessions displayed in the **Select Session** tree are to have subsessions created.



4. New subsessions will be created for each parent session.



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

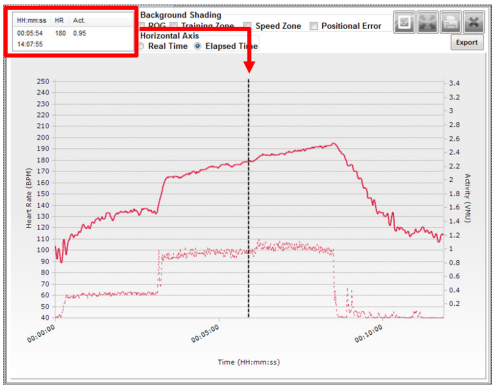
Graph Types (1/3)

Select Graph Type

Time Graph

Toolbar button:



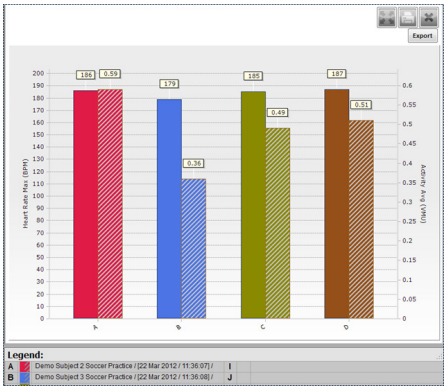


- Line graph, two parameters allowed per subject
- Drag vertical cursor to show exact values
- Compare up to 16 subjects
- Left axis = 1st parameter selected
- Right axis = 2nd parameter selected

Summary Graph

Toolbar button:





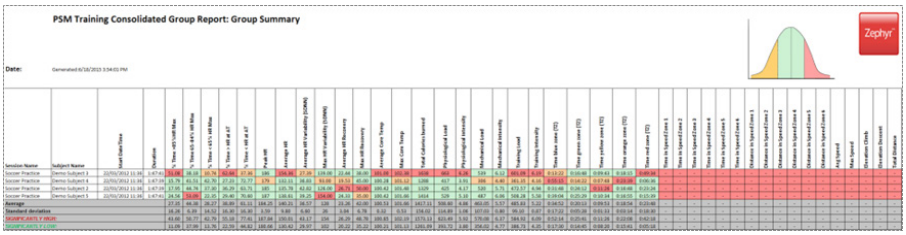
- Average, maximum, minimum or total values, dependent on parameter.
- Show historical trends over multiple sessions
- Compare up to 16 subjects.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Graph Types (2/3)

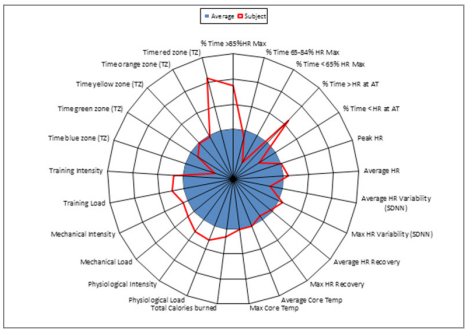
Reports

Training Reports



Training Reports display a selection of parameters in table format, color coded to relate each individual's statistics against the mean and standard deviation for the group. The activity or training session for which the report covers is decided by the user.

A radar plot compares individual subject statistics against the group's.



There are five Training report variations:

- Group Consolidated Summary (super-set of all parameters)
- Physiological Summary (heart rate related parameters)
- Periodization Report (Intensity & Load Parameters)
- Workout Compliance Report (Training Zone parameters)
- Summary GPS Report (GPS related parameters - Speed etc)

Fitness Reports

A fitness report compares a subject or team's fitness parameters against a selected normative (elite athletes or user-generated) in table, chart and radar plot format.

The fitness parameters used are:

- VO_2max
- %VO_2max @ AT
- HR max
- HR @ AT
- HR @ AT as % HR max
- BR @ AT
- HR Recovery 30 sec
- HR min Standing
- HR min Resting
- BR min Resting
- HRV @ Rest
- Fitness Level

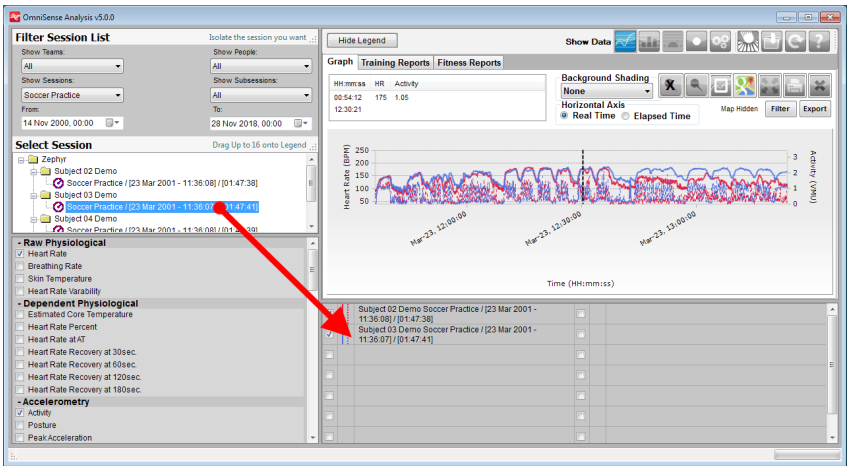
The data used are the subject fitness parameters which have been saved as a result of fitness test analyses.

Refer to the Analysis Reports section for details.

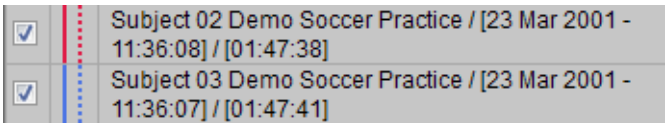
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Graph Types (3/3)

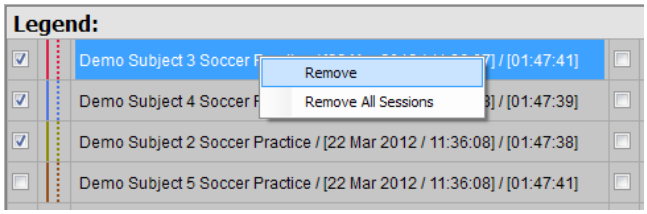
Legend



- Click and drag a session to the **Legend** or
- Double-click the session
- Ctrl+ click to multiple-select



Item	Description
	Check/uncheck to show/hide the session
	First parameter selected (left side axis)
	Second parameter selected (right side axis)



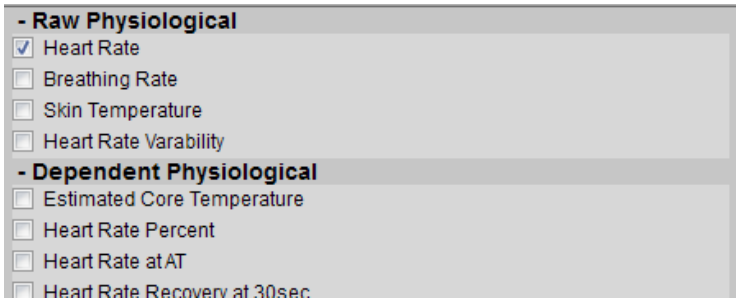
- Click on a session to select
- Right-click selected session for **Remove** options
- Use the **Clear Graph** button to empty the legend and graph of all sessions



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

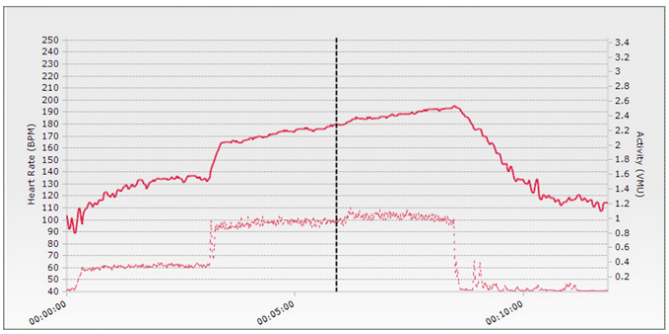
Select Time Variables

Select time variables to populate the graph.

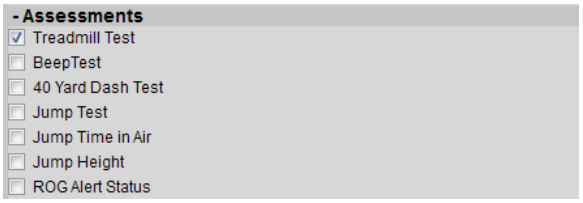


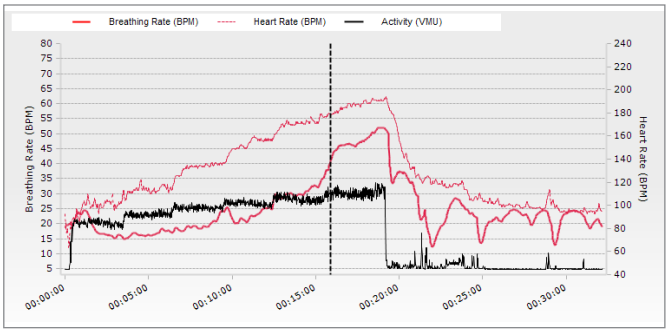
Select two variables.

- 1st variable selected = left axis, solid trace.
- 2nd variable selected = right axis, dashed trace



- If **Treadmill Test**, **Beep Test** or **ROG Status** is selected, heart rate, breathing rate & activity level will automatically display, with a legend identifying them. No other variables can be selected.





Note

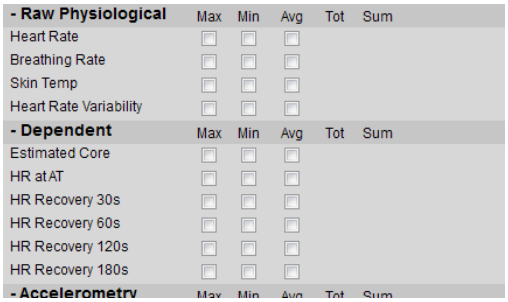
If a variable is de-selected, any remaining variable will display against the **left** axis.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

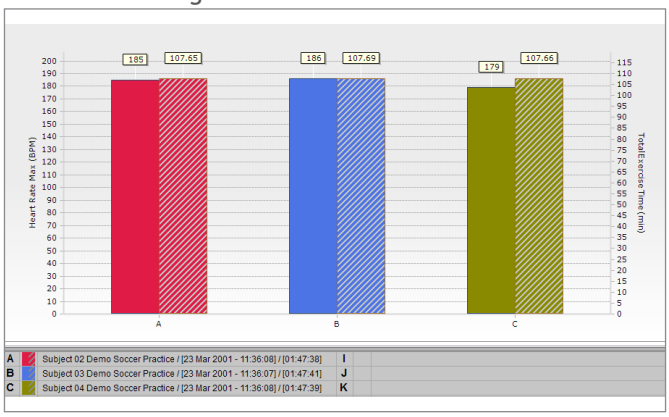
Summary Graphs (1/8)

Select Summary Variables

Select summary variables to populate the graph.

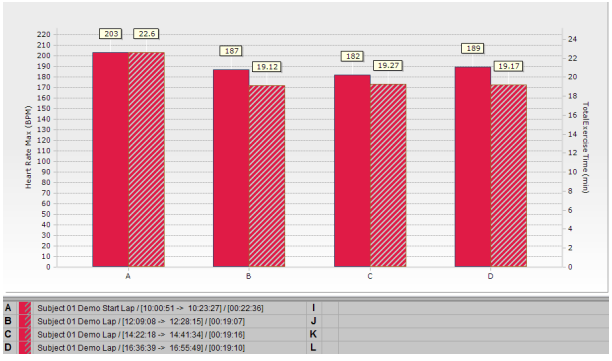


- Select two variables. **Maximum**, **Minimum**, **Average**, **Total** and **Summary** are available according to context.



- The columns are labelled **A - P** to correspond the Legend entries. As for line graphs, separate subjects will be colored differently.
- 1st variable selected = left axis, solid fill
- 2nd Variable selected = right axis, dashed fill
- As there is no vertical cursor, the value of each bar is shown as a call out above the bar 

.
- If all sessions are from the same subject, then they will be colored identically.



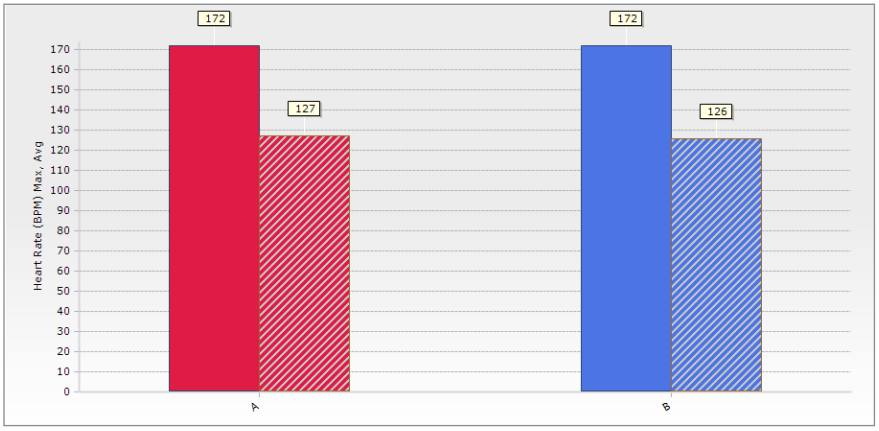
Note

If a variable is deselected, any remaining variables will display against the **left** axis.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Max/Min/Avg

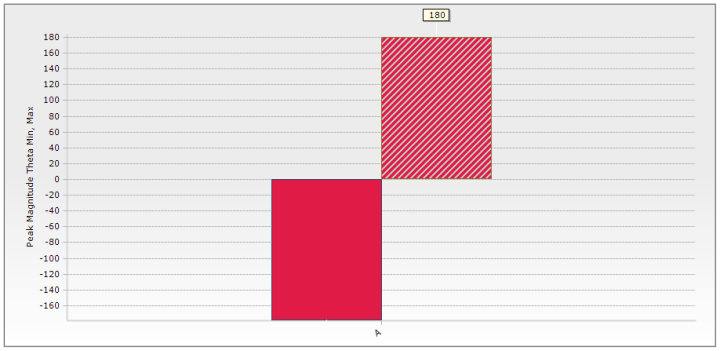
Maximum, minimum and average values for a given parameter and session are calculated each time the parameter is selected.



- Max/Min/Avg values are available for parameters which are recorded periodically during a session (such as heart rate, activity level). If the parameter is cumulative, such as the number of calories burned, or the total number of steps detected, then max/min/avg values have no meaning, and they are not available.
- If the two parameters selected have the same units (e.g. Max & Avg **Heart Rate**, as above, then they both display against the left axis. The axis title will indicate which summary variables are displayed.

Negative Values

Two parameters - **Posture** and **Peak Magnitude Theta** impact angle, may report negative values. If paired with a positive value on the chart, then the results may look initially confusing.



Peak Magnitude Theta Min & Max.

- Minimum is a negative value, maximum is positive.

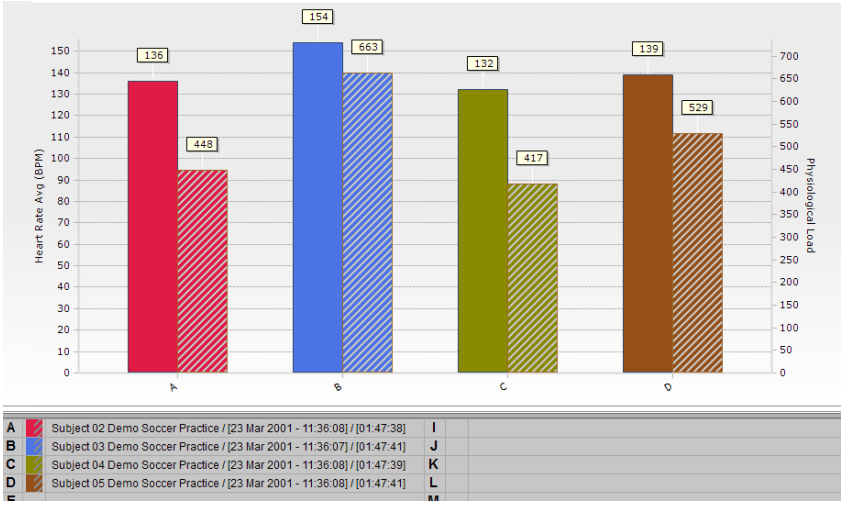
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Summary Graphs (3/8)

Total

Total values display exactly as max/min/avg, but are only relevant for some parameters; various impact counts, workout loads and distance travelled.

- Total values can be graphed simultaneously with max/min/avg values.

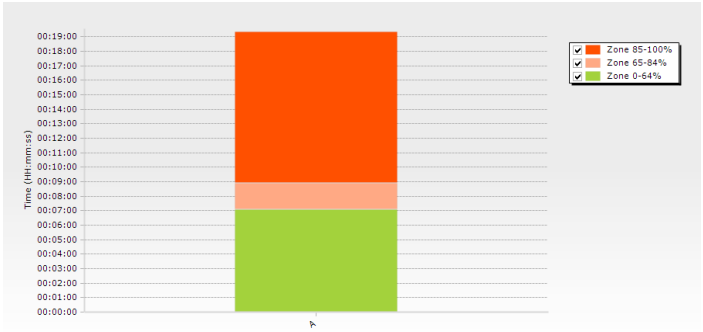


Average Heart Rate compared to Total Physiological Load.

Stacked Total Charts

In the **Workout Summary** parameter category, four parameters display as a stacked bar chart. These charts cannot be displayed against a second parameter.

Time in HR Zones

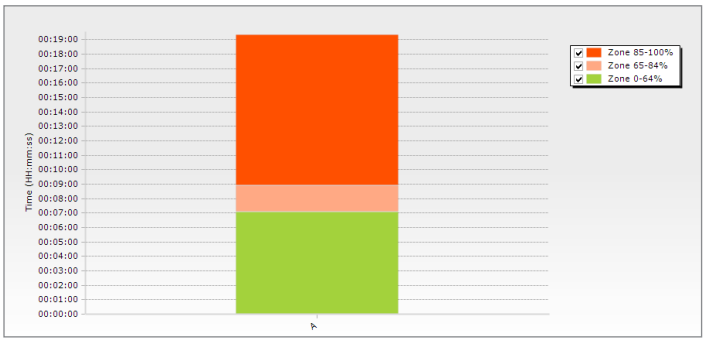


- Individual zones in the legend can be checked or unchecked to include or exclude them from the graph.
- The zone thresholds are fixed at 0-64/65-84/85-100 Subject HR max, and **not** related to **Safety Thresholds** or **Training Zones**

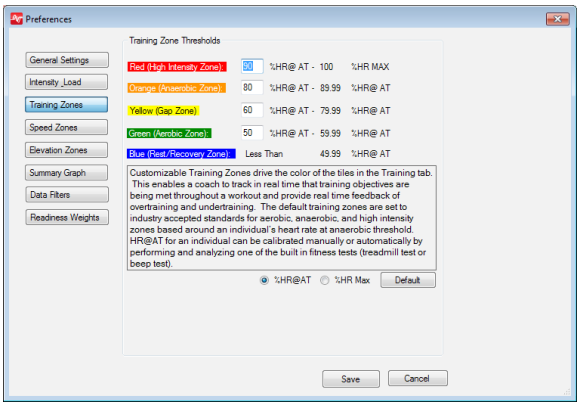
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Summary Graphs (4/8)

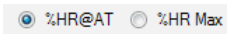
Time in Training Zone



- Individual zones in the graph legend can be checked or unchecked to include or exclude them from the graph.
- **Training Zone** thresholds are common to both OmniSense™ Live and OmniSense™ Analysis. They can be configured from **Preferences > Training Zones** in either application.



- Threshold percentage values are global across all subjects, but local to the subject's own maximum heart rate, or heart rate at Anaerobic threshold, depending on which is selected

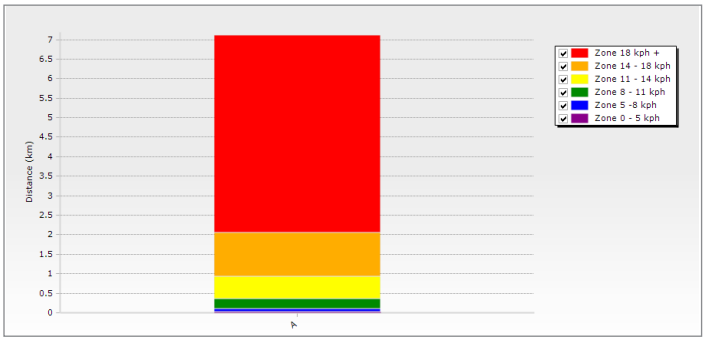


- Lower thresholds for each zone can be edited. The upper threshold of the adjacent zone will be updated automatically.

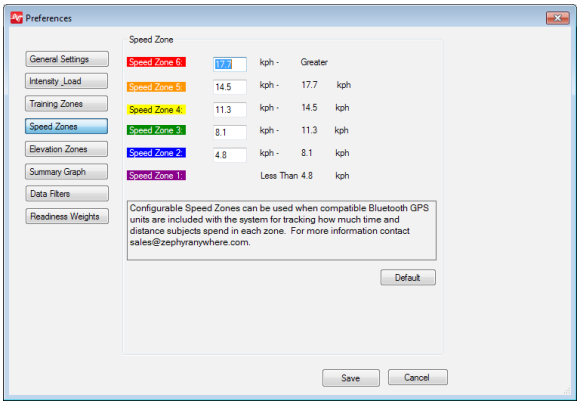
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Summary Graphs (5/8)

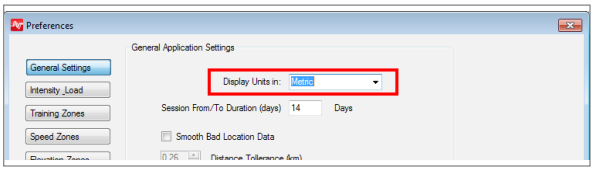
Distance in Speed Zone



- Speed zone data is available in any session with GPS data.
- Individual zones in the graph legend can be checked or unchecked to include or exclude them from the graph.
- **Speed Zone** thresholds are common to both OmniSense™ Live and OmniSense™ Analysis. They can be configured from **Preferences > Speed Zones** in either application.



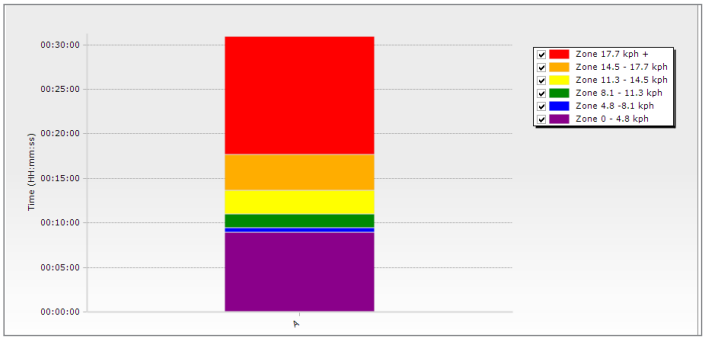
- Lower thresholds for each zone can be edited. The upper threshold of the adjacent zone will be updated automatically.
- Speed units can be metric or imperial; they are set from **Preferences > General Settings** in Live or Analysis (shown).



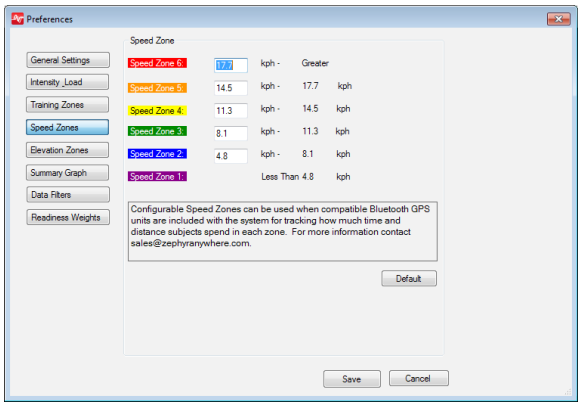
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Summary Graphs (6/8)

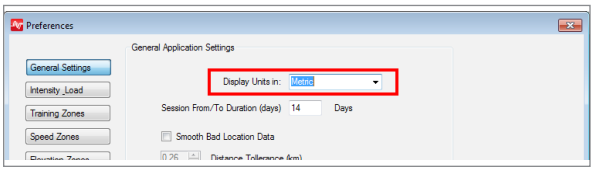
Time in Speed Zone



- Speed zone data is available in any session with GPS data.
- Individual zones in the graph legend can be checked or unchecked to include or exclude them from the graph.
- **Speed Zone** thresholds are common to both OmniSense™ Live and OmniSense™ Analysis. They can be configured from **Preferences > Speed Zones** in either application.



- Lower thresholds for each zone can be edited. The upper threshold of the adjacent zone will be updated automatically.
- Speed units can be metric or imperial; they are set from **Preferences > General Settings** in Live or Analysis (shown).



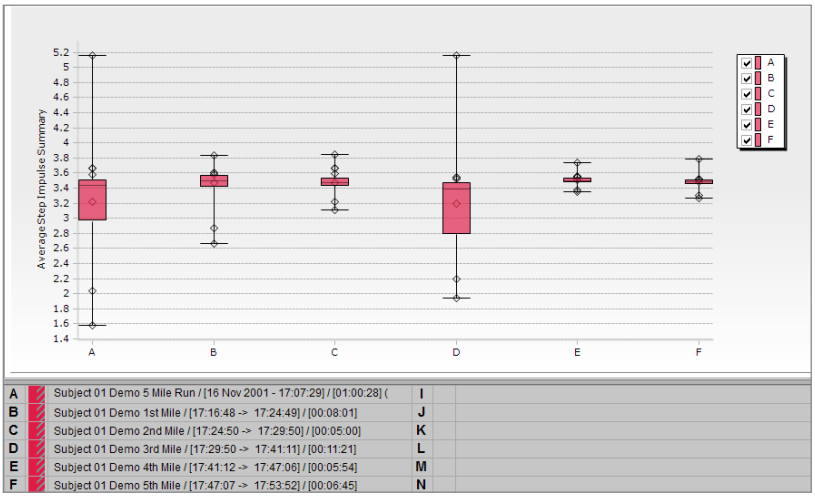
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Summary Graphs (7/8)

Summary

Summary charts are available for some impulse-related parameters, and speed and elevation GPS data.

The format of the chart is a 'box and whisker' chart. This style of chart indicates the range of values (minimum to maximum) and gives a graphic representation of the distribution of values within that range.

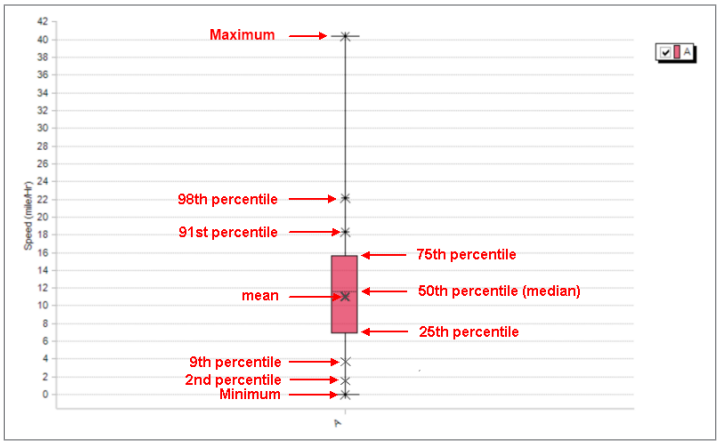


Average Step Impulse Summary data

- Individual sessions in the graph legend can be checked or unchecked to include or exclude them from the graph.

Box and Whisker Chart Format

This diagram shows how this chart type represents the distribution of data within a data set.



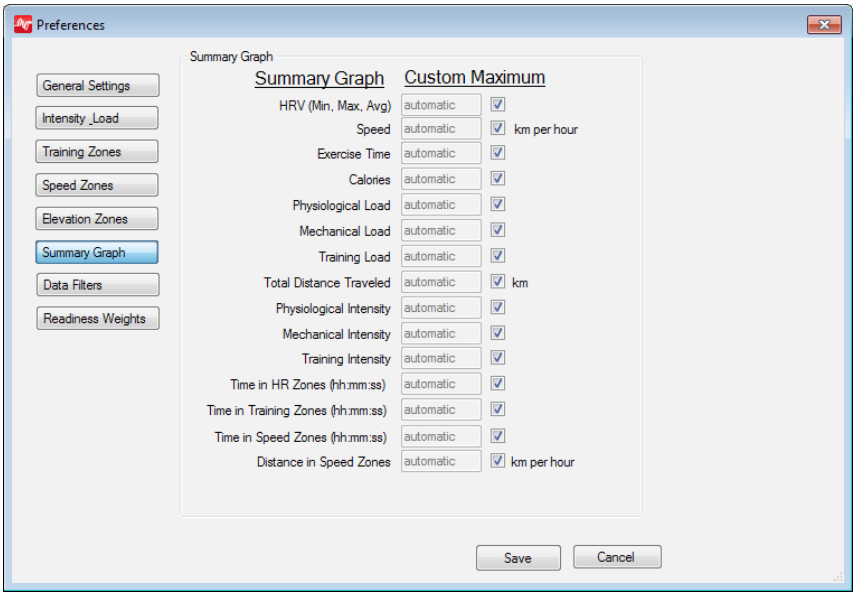
- The filled 'box' represents the spread of the middle 50% of the data in the set, centred on the median, the most common value. The taller the box, the more broadly the data is distributed between the maximum and minimum values. If the box is shorter (as above), then the data set is relatively more concentrated around the median value.
- An explanation of box plots, including the unusual upper and lower percentiles, can be found at http://en.wikipedia/wiki/BoxPlot

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Summary Graphs (8/8)

Summary Graph Preferences

The scaling of the vertical axis in some of the bar charts can be customized in **Preferences > Summary Graph**.



- The default setting is **Automatic**. This scales the vertical axis to show the maximum value of all sessions at the full height of the axis. If a large outlier value in one session reduces the relative height of all other bars, then Automatic can be set manually to a lower value.

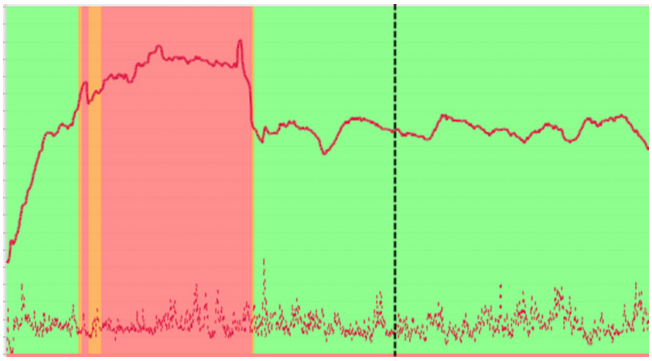
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

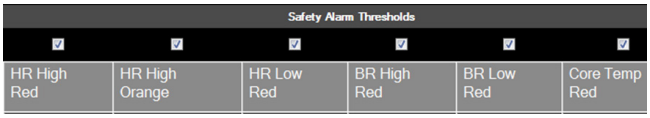
Background Shading

When any time graph is displayed - excluding fitness tests - background color can be set using the pull down list above the Time graph. Background color options do not apply to Time graphs showing fitness test analyses, or Summary graphs.

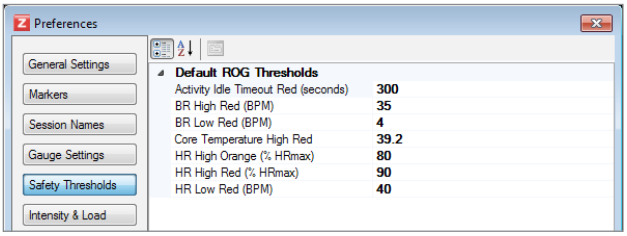


ROG Subject Status

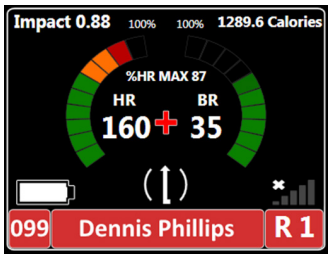




- Subject **ROG Status** is determined by the **Safety Thresholds** set in **Live Setup > Subject** screen. Defaults are set in **Live > Preferences >Safety Thresholds.**



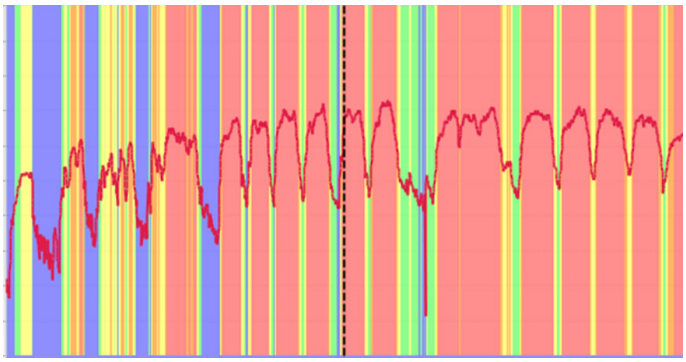
- ROG Status shows on the subject BioGauge, as the subject name panel background color.



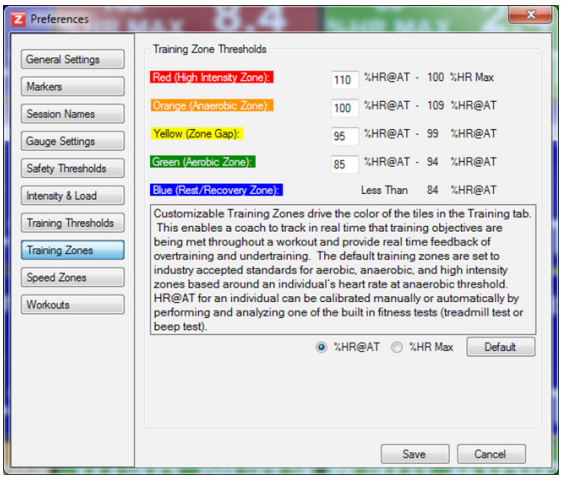
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Graph Functions (2/7)

Training Zone



- Training Zones are related to subject **HRmax** or **HR @ AT**. They will correlate closely to HR data, as seen above.
- They can be configured in **Live > Preferences > Training Zones**



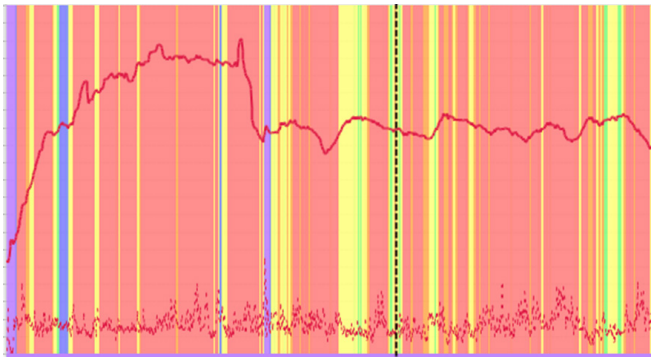
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Graph Functions (3/7)

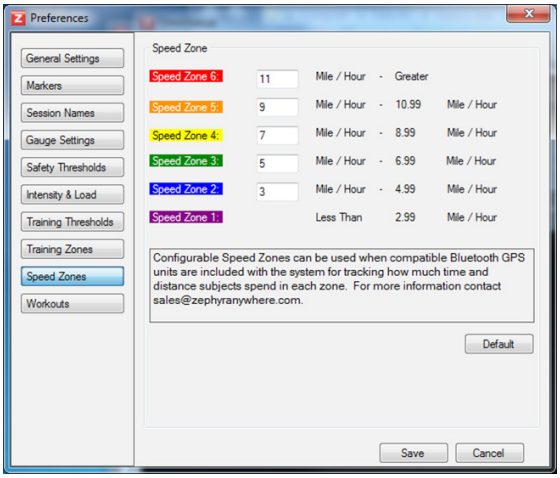
Speed Zone

Speed Zone background data will only display for sessions which incorporate GPS.

- Sessions which contain no GPS data will display a non-colored background if this option is chosen.



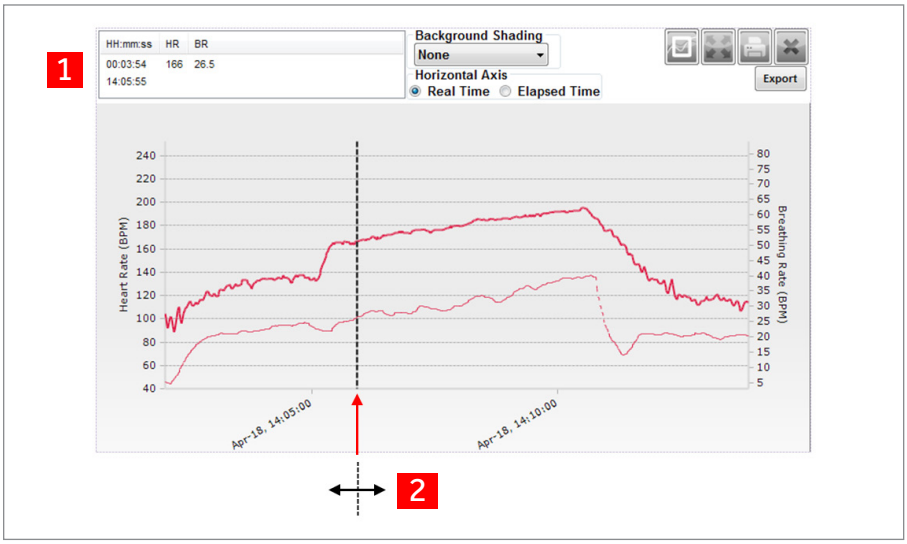
- Speed Zone thresholds can be configured in **Live > Preferences > Speed Zones**



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Graph Functions (4/7)

Cursor Values



#	Description
1	Parameter Values at the location of the vertical cursor.
	[HR] [BR] Selected parameters, first parameter on left-side vertical axis.
	hh:mm:ss Timestamp of vertical cursor location. [00:03:54] Upper value elapsed time from start of session. [14:05:55] Lower value absolute (real) time.
2	Click and drag the vertical cursor left or right to desired location.

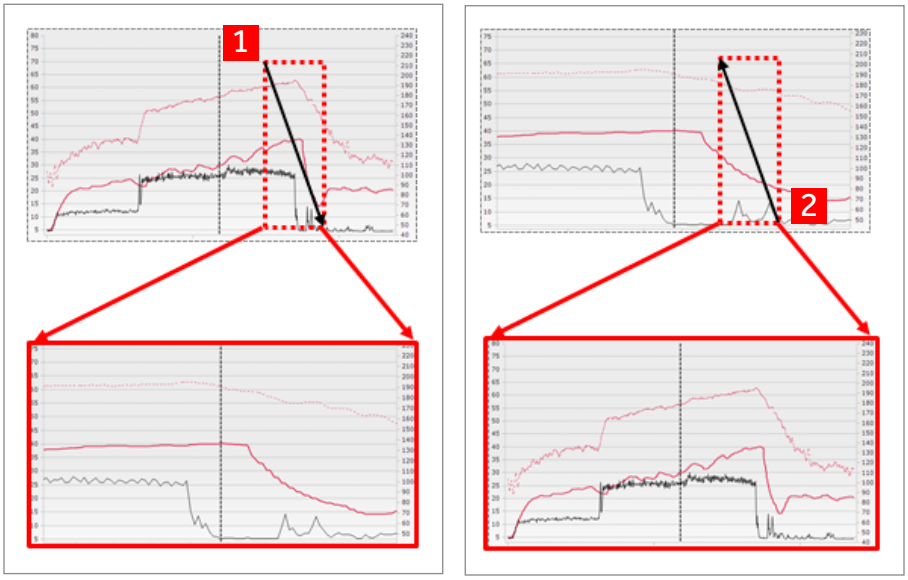
Note

The default location of the cursor is in the centre of the graph.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Zoom and Pan

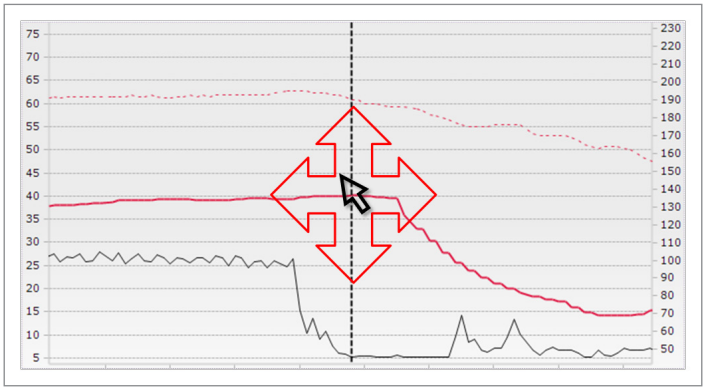
Zoom



Zoom In Zoom Out

#	Description
1	Click and drag a box from top left to bottom right around the area to be zoomed in. Multiple zoom-ins can be done successively.
2	Click and drag the cursor from bottom right to top left - anywhere on the graph - to zoom out. The zoom-out is always back to the graph's original state, regardless of how many zoom-ins have occurred.

Pan

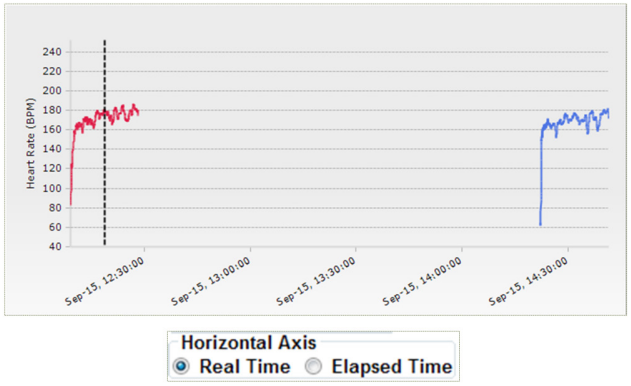


- **Right**-click and drag the graph in any direction. The vertical and horizontal axis values will adjust automatically.

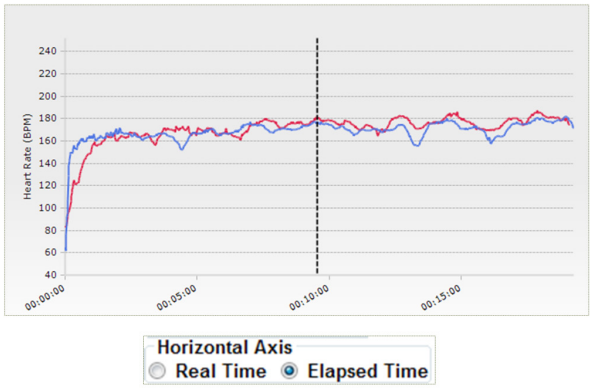
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Real and Elapsed Time

Elapsed time is made available so that sessions which didn't happen simultaneously in real time can be compared.



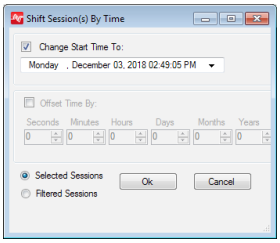
- The example shows two non-consecutive laps of the same circuit. In real time they don't overlap, so can't be compared directly.



- In elapsed time, both session Start Times are shifted to 00:00:00.
- If Elapsed Time data is exported from Analysis, the original timestamp data is replaced with new timestamps starting at 00:00:00 for all sessions exported.

Note

Two sessions could also be compared by adding an offset to the timestamp of one - right click on the session in the **Select Session** pane and select **Change Time of Session** from the context menu, but this will make the session time change permanent.

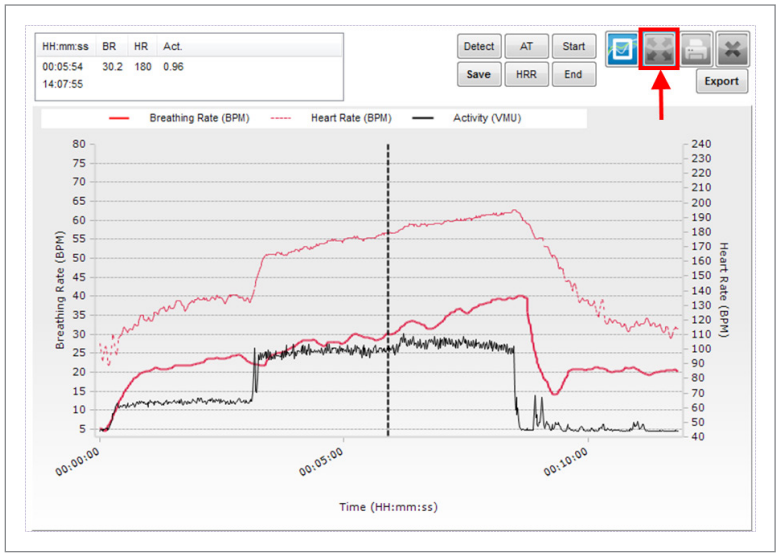


CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

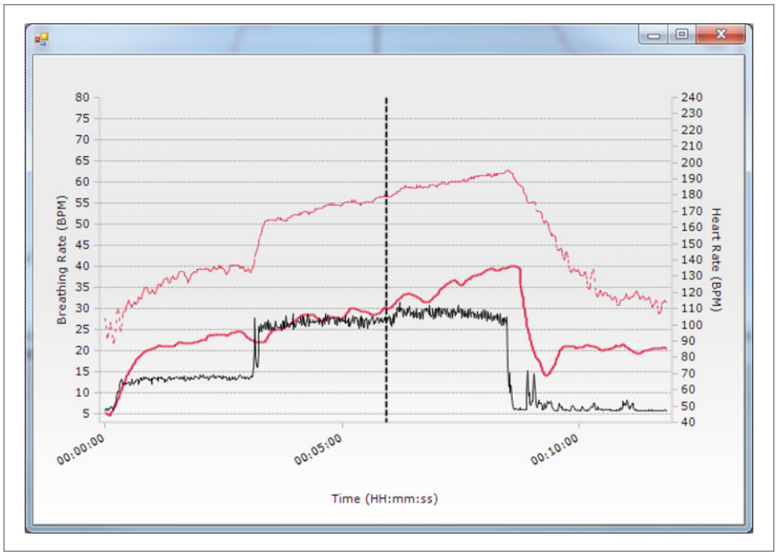
Graph Functions (7/7)

Full Screen

- The full-screen button will display the graph contents in a separate, re-sizable window.



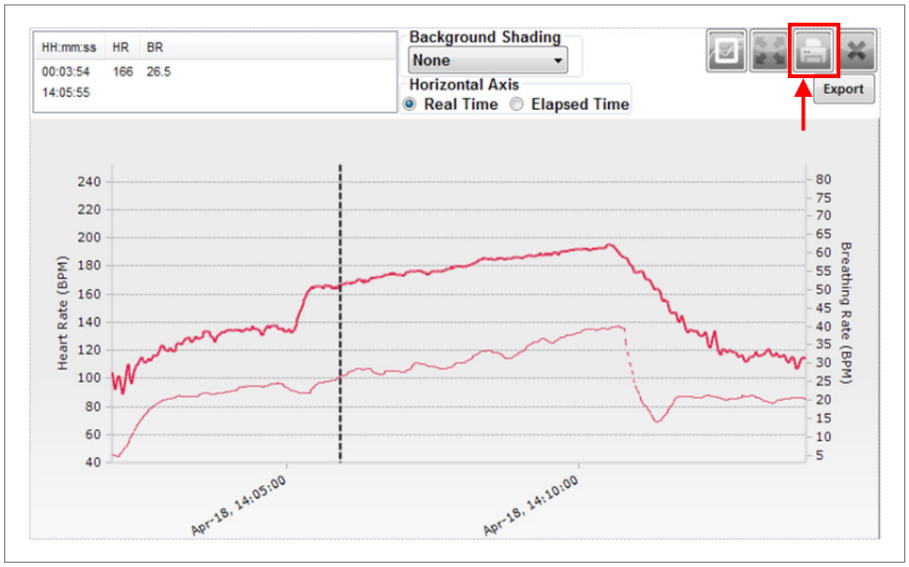
- **Zoom** and **Pan** are still active in this window.

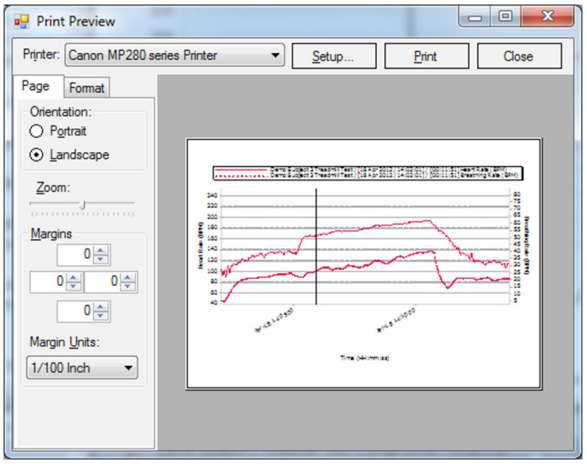


CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

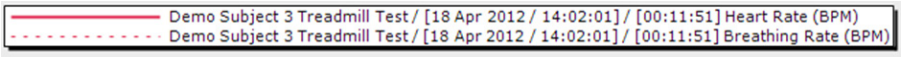
Print Graph

- The Time or Summary graph will print exactly as displayed i.e. if zoomed-in or panned.





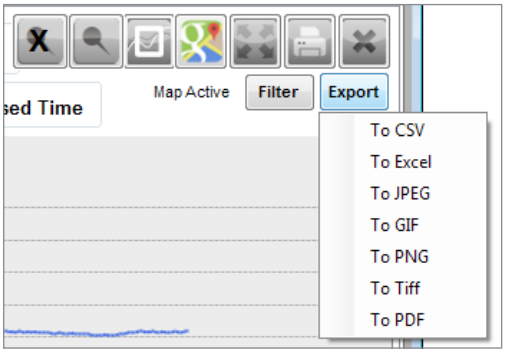
- A legend will be printed to identify sessions and parameters.



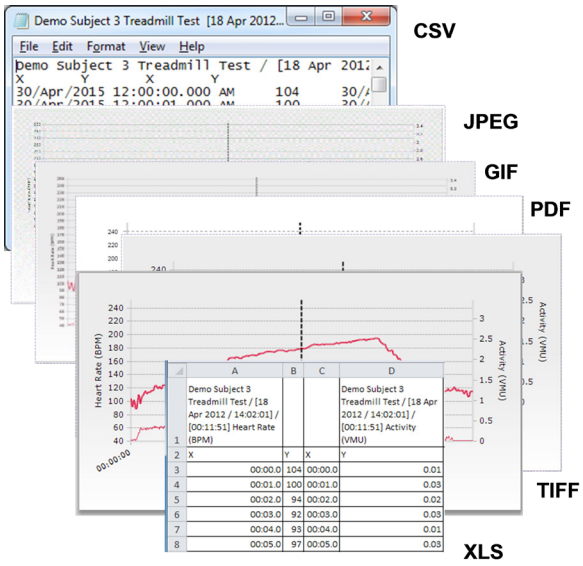
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Export Graph Data

The contents of the graph can be exported in a number of formats.



- Select the preferred output format.



Note

Image files (jpeg, etc) show **Session Markers** on the graphs; .csv and .xlsx files do not.

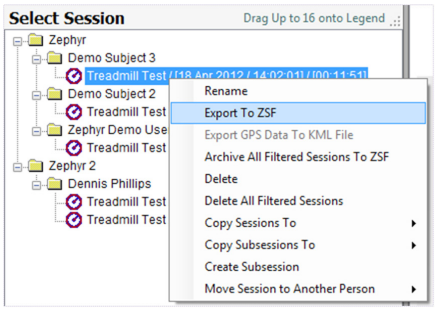
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Export / Archive Session Data

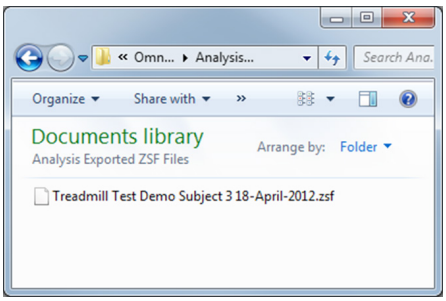
Export to .ZSF File

ZSF (Zephyr™ Serial Format) files are used to migrate data from one OmniSense™ instance to another, or to archive large amounts of data outside the database to speed up response time. The database will take longer to respond as it grows bigger.

- Right click a session for a context menu.
- Select **Export to ZSF**.
- Browse, name the .zsf file and save in your preferred location.



- The .zsf file will contain all parameters for that subject and that session only.

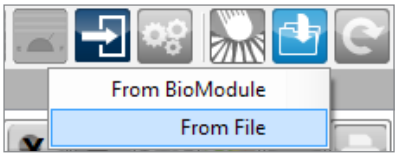


Note

An exported session is **not** removed from the database.

Archive to .ZSF File

- Use the **Filter Session** panel to populate the **Select Session** panel with only those sessions to be archived, and then select the **Archive All Filtered Sessions To ZSF** option.
- A single .zsf file will be created which contains **all** the archived data. Name it appropriately when saving.
- Archived sessions **are removed** from the database.
- Archived sessions can be re-imported to the database at any time using the **Import > From File** toolbar button.

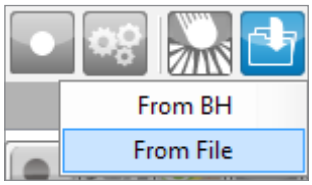


CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

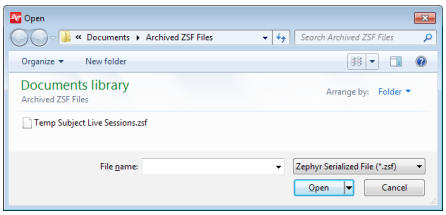
Import Session Data

Data can be imported into OmniSense™ as an external .zsf file. This file format is the **only** means of importing external data, other than directly from a BioModule.

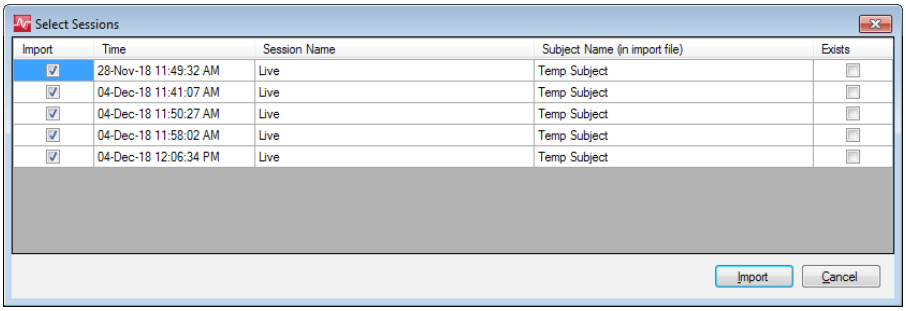
1. To Import external data click on the **Import** button and select the **From File** option from the list.



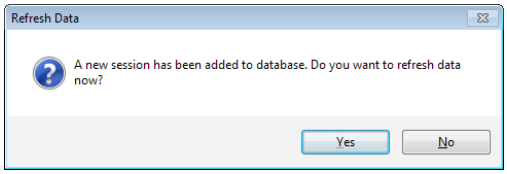
2. Browse to the .zsf file location and select it.



3. A **Select Sessions** dialog will display. If importing an archived .zsf file containing multiple sessions, then they will display as shown below.



4. Check or uncheck the box in the **Import** column as desired. Each entry contains the **Time**, **Session Name** and **Subject Name** of the original session. If the subject already exists in the database, the **Exists** column will be checked. If unchecked, a placeholder subject will be created in the database. Select **Import**.
5. When the sessions have been imported, you will be prompted to refresh the database.



Note

Importing data does not automatically change the **From** and **To** entries in the **Filter Session List** in order to display the imported sessions. If they contain older data, you will have to manually change the **From** entry.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Data Filters (1/2)

Filter Data

Data can be filtered for any graphed session, modifying what is displayed according to multiple parameter values. Filters can be applied to 8 parameters only, selected from the **Filter Variable** pull down list. 21 **Threshold Variables** are available.

Examples

- Use **Heart Rate Confidence** to filter heart rate to remove excessively high heart rate values caused by ECG noise, and interpolate - this will give more realistic values for calories burned, intensity and load calculations.

	Filter Variable	Threshold Variable	When	Value	Action	On/Off
	HR	Heart Rate Confidence	Less Than	25	Interpolate	☑

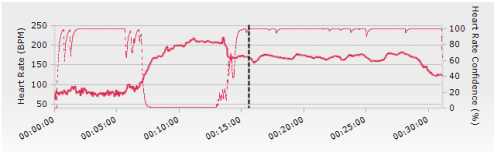
- Set realistic upper limits for **Speed** from GPS data and set to null any values greater than these, which may be outliers caused by poor GPS satellite reception.

	Filter Variable	Threshold Variable	When	Value	Action	On/Off
	Speed (mph)	Speed (mph)	Greater Than	18	Null	☑

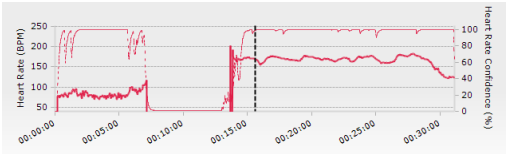
Action - Interpolate or Null?

Interpolate draws a straight line between points on either side of the interpolated segment. **Null** sets no value; the graph trace will show a vertical line either side of the null segment.

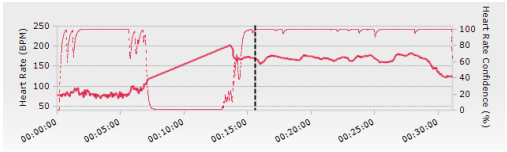
Choice of null or interpolate will depend on the scenario. The example below shows the **Subject 01 Demo Mountain Bike** race available in Analysis (date stamp **16 Sep 2001**).



- Unfiltered data, showing **HR** (solid trace) vs. **HR Confidence**. HR Confidence drops to zero soon after HR climbs above 200 beats per minute, most likely caused by too-dry sensor pads. This rectifies itself eventually, as the subject perspires.



- The same data with action **Interpolate**, when HR Confidence < 25%



- The same data with action **Null** when HR Confidence < 25%
- In the above scenario it would not be appropriate to set null HR values. The user must decide whether unfiltered or interpolated data best represents the subject's actual HR. Interpolate is not ideal, but a better compromise than null, or the original artificially high values.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Data Filters (2/2)

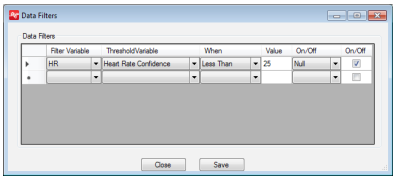
Create a Data Filter

Data filters are saved within OmniSense™ Analysis and are applied to **all** sessions unless disabled.

1. [Optional] Set up a session or sessions in Analysis, together with the parameters to be displayed.
2. Click on the **Filter** button above the graph. The text on the button is black when no filters are active/**On**.



3. The **Data Filters** window will display.



Item	Description
First column	▶ Saved filter ▪ New filter for editing (always available) Edited but not saved filter
Filter Variable	The variable to be filtered: ▪ HR Confidence ▪ HR ▪ BR ▪ Posture ▪ Activity ▪ Peak Acceleration ▪ HRV ▪ Speed
Threshold Variable	The variable which will determine filtering - 21 available, not listed here.
When	▪ Less than ▪ Greater than ▪ Equal ▪ Not Equal
Value	The threshold value the condition applies to
Action	Filter by interpolating or nullifying the filtered variable
On/Off	Enable or Disable the filter

4. Edit an existing filter or create new, and turn on or off as desired. **Save** the changes.
5. When any filter is checked **On**, the button text is red 

and the filter will apply to **any** graph displaying the **Filter Variable**, until it is set to **Off**.

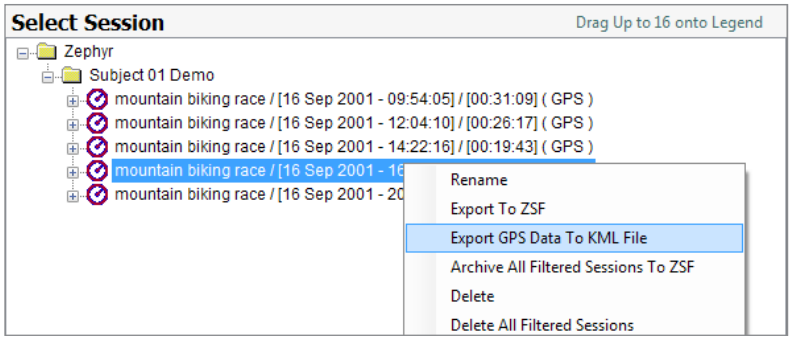
Note

To save a filtered session permanently, right click on the session in the **Select Session** tree, and select **Save Filtered Session** from the context menu.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Export GPS Data

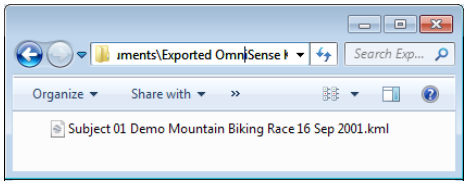
Data which has been received or downloaded from a BioModule using a supported GPS will show a suffix of **(GPS)** in the **Select Session** tree, and **Export GPS Data to KML File** will populate as a right-click context menu option.



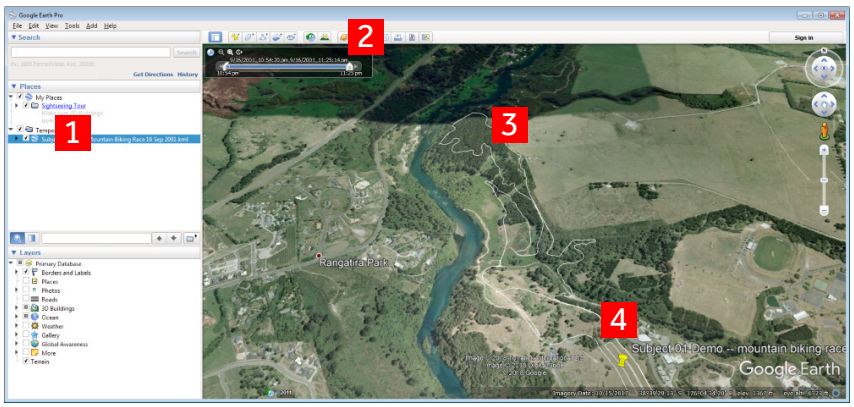
A **KML** (Keyhole Markup Language) file will open in Google Earth™* if installed. OmniSense™-generated .kml files also contain basic physiological data which can be viewed in the context of satellite or map view.

Export and Open Location Data

1. Save the kml file to a preferred location, and click to open.



2. Google Earth™* (if installed) will open. All built-in viewing functionality is available, and the .kml file will display in the **Temporary Places** node.



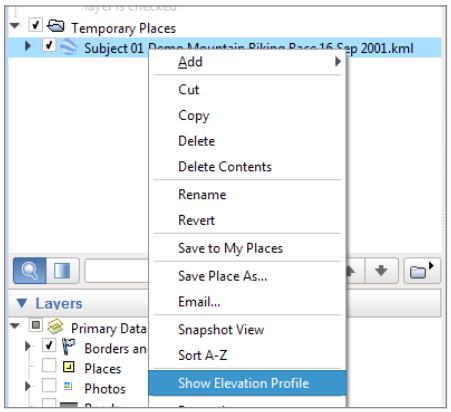
#	Description
1	KML file in **Temporary Places** node.
2	Slider control to move place mark around trace
3	Path contained in kml file
4	Place mark showing current location according to slider control.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

GPS Data (2/2)

View Physiological Data from KML File

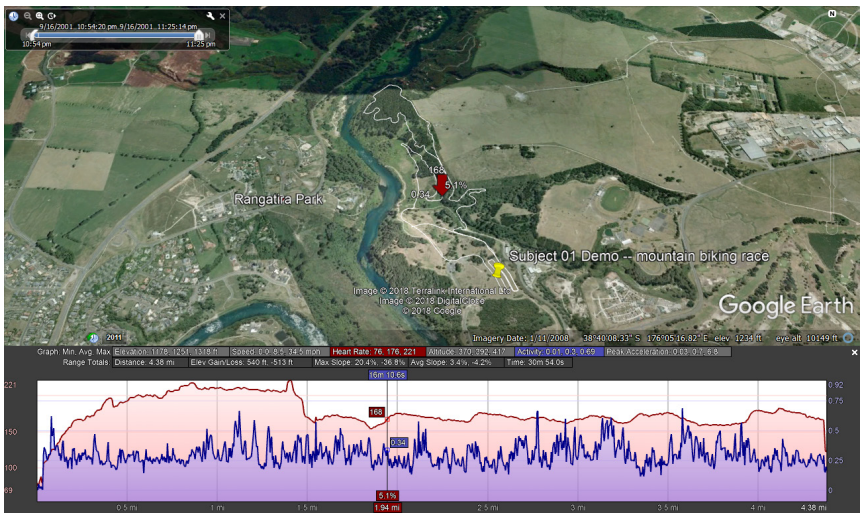
1. In Google Earth™*, right click on the imported .kml file, and select **Show Elevation Profile** from the context menu.



2. A chart will be inserted under the main satellite display. Above the chart are selectable fields of GPS and BioModule data; **Heart Rate**, **Activity** and **Peak Acceleration**. Two of these may be selected for display on the chart.



3. As the mouse cursor is floated along the chart, a red arrow marker will appear on the trace, with the selected parameters displaying beside it. The same values will also display as call outs on the chart below.



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
> Overview
> Sessions
> Subsessions
> Graph Types
> Time Graphs
> Summary Graphs
> Graph Functions
> Print / Export
> Data Filters
> GPS Data
> Readiness
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Readiness

Overview

A subject's Readiness rating is a score on a scale of 1 - 10. The score is relative for that subject, and is calculated algorithmically on two sets of factors.

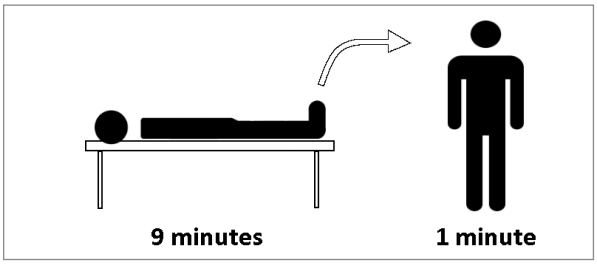
Objective Factor - Orthostatic Hypotension Readiness Test

Subjects perform an orthostatic hypotension readiness test while wearing a BioModule. The data can be transmitted Live to OmniSense™, via the OmniSense™ mobile device application, or logged on the BioModule and imported later.

Orthostatic Hypotension Readiness Test

The purpose of the test is to establish personal metrics which will contribute to a measure of Readiness.

- Resting Heart Rate
- Standing Heart Rate
- Resting Heart Rate Variability (HRV)



1. Subject should lie down in a comfortable quiet location for 9 minutes. They may be prompted earlier if using the mobile device application. This establishes resting HR and HRV.

2. Subject stands and remains stationary for 1 minute. This will establish standing HR.

Note

If conducting an orthostatic hypotension readiness test using OmniSense™ Live, it is good practice to create a session name appropriate to this test, and to name the session using it, for easier retrieval of sessions in OmniSense™ Analysis

Subjective Factor - Readiness Survey

The subject must rate themselves on a 1-10 scale for eight points. Each rating should be entered into a dialog window in OmniSense™ Analysis at the time of analyzing the orthostatic test data, or directly in to the mobile application.

The factors are:

- Training Load
- Training Intensity
- Sleep Quality
- Overall Stress
- Current Stress
- Eating habits
- Hydration level
- Injury

When the survey is saved into OmniSense™, both the objective and subjective factors are given weighted values in an algorithm, and a **Readiness Score** is calculated. Weightings of each factor are configurable in Analysis **Preferences**.

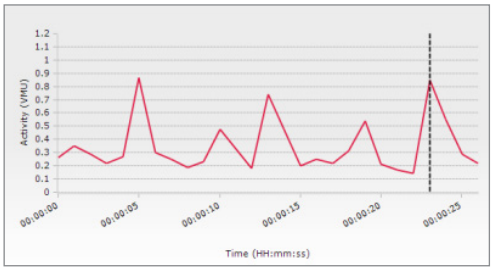
Analysis of the test and survey results are described in the **Baseline Fitness Testing** section.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
> Overview
> AccelPro Impact Report
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Accelerometry Overview

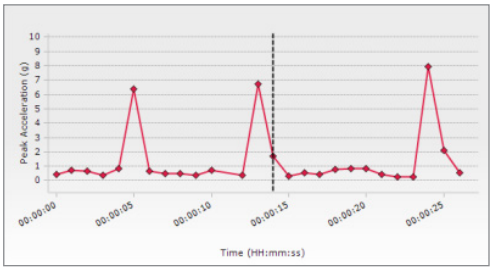
The BioModule contains a 3-axis accelerometer which samples at 100Hz over the range ±16g. The graphs below show the same data available for display in the Analysis module using a simple exercise - jumping from a 3 foot wall down to a hard surface on three occasions to show three clear (vertical) impact events.

Activity Level



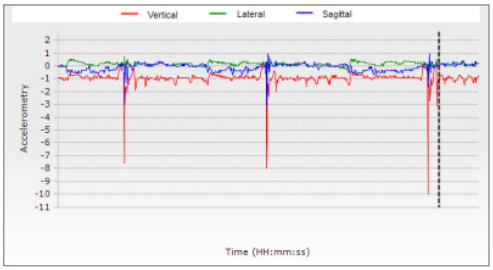
- Reported in Vector Magnitude Units (VMU, indicated in g), once per second. This metric represents the **average** acceleration in each axis, over the previous second. Max VMU is 0.85 in this example.

Peak Acceleration



- Reported in g, once per second. It uses the **peak** acceleration in any one single axis over the previous second. The value is always positive. Peak Acceleration is 7.95 g in this example.

Accelerometry



- Streaming data is reported in g at 50 Hz. Raw accelerometer data is shown. The effect of gravity is not filtered out. The minimum value in the example above is -10g in the vertical axis.

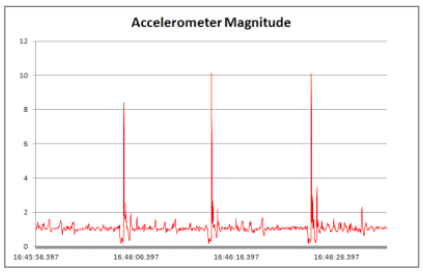
Although each of the three graphs above clearly show three major impacts, quantitative comparison of the impacts is not easy. Once meaningful data is collected in a session containing many large and small impacts, it is difficult to extract meaningful comparisons from raw accelerometer data.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
> Overview
> AccelPro Impact Report
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

ANALYSIS IMPACT PROCESSING
Overview (2/7)

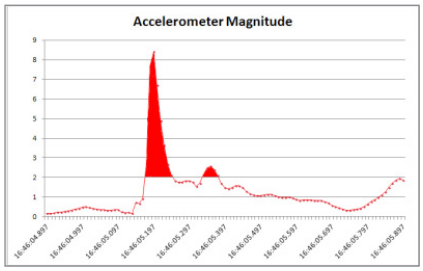
Accelerometer Magnitude

The same three impacts shown in the previous section are illustrated here using data from the external accelerometer magnitude (Accel) file generated by the Zephyr™ Downloader.



Three impacts

- Accelerometer Magnitude is calculated using the formula $\sqrt{(V_g^2 + L_g^2 + S_g^2)}$ where V_g, L_g and S_g are the three axial components of acceleration (Vertical, Lateral & Sagittal). This gives a single positive value.
- Two factors gauge how severe the impact is to the wearer:
  - Maximum value of the accelerometer magnitude
  - Duration of impact (in milliseconds)



Impact 1 detail

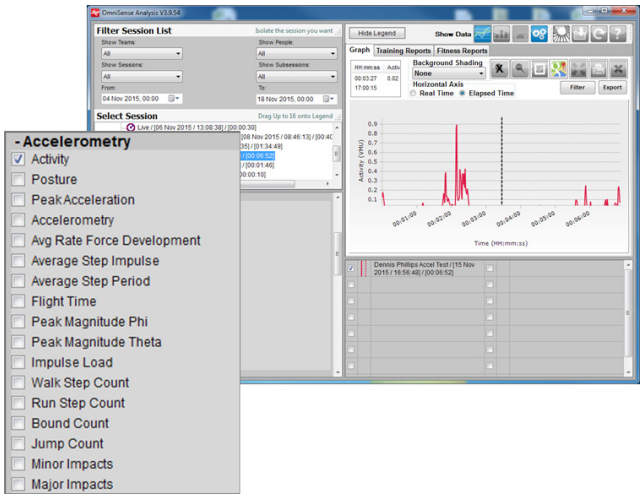
- Graph shows first of 3 impacts in more detail. Each dot is a single 100Hz sample.
- Maximum accelerometer magnitude is 8.4g
- The red area under the curve is split into two parts, where magnitude exceeds 2g - the impact, and rebound. The area, measured in Newton Seconds, gives an overall measure of the severity of the impact.
- The AccelPro report gives a very detailed breakdown of each detected impulse event.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
> Overview
> AccelPro Impact Report
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

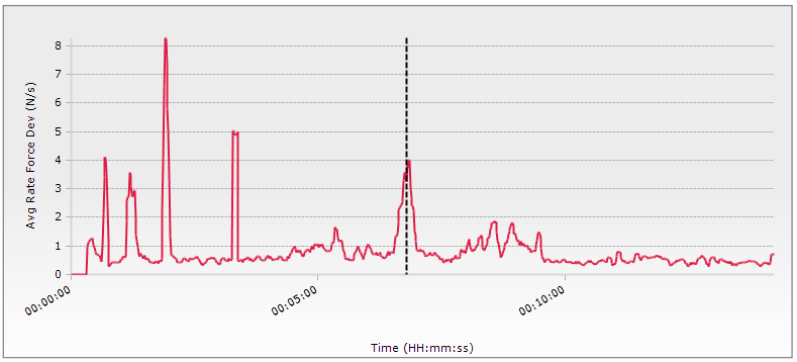
Enhanced Summary Data

Impact processing is dependent on detailed analysis of accelerometer data. Detailed 3-axis accelerometer data cannot be transmitted to OmniSense™ Live for more than one subject at a time, due to radio bandwidth limitations.

Some 3-axis impact calculations are performed internally in the BioModule, and parameters made available in OmniSense™ Analysis. They are available in the **Enhanced Summary** data packet and log format.



Most of the parameters listed above can be displayed from data received by OmniSense™ Live.



Average Rate of Force Development from an Enhanced Summary log

Note

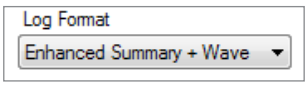
The **Accelerometry** parameter listed above will only contain data if accelerometer data has been enabled in OmniSense™ Live. This is only available for one BioModule at a time.

1. Go to the **Accel** side panel.
2. Select desired BioGauge.
3. Click the **Add** button on the Accel panel to enable accelerometry data for the device.
4. Streaming 3-axis accelerometer data will display on the panel and be available in OmniSense™ Analysis.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
> Overview
> AccelPro Impact Report
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

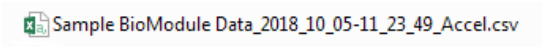
Accel Waveform Data

Detailed impact analysis - potentially on multiple subjects - is dependent on external files of accelerometer waveform data. The BioModule must be configured to log in **Summary and Waveform** or **Enhanced Summary and Waveform** format. These formats log 3-axis accelerometer waveform data at 100 Hz.



Log Format setting in the Zephyr™ Config Tool

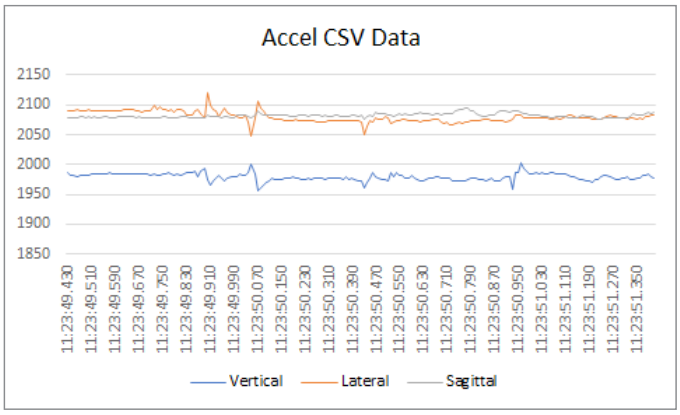
Specifically, the data is contained in the external CSV file generated by the Zephyr™ Downloader with the _Accel title suffix.



- This file contains raw accelerometer data in bits.

	A	B	C	D
1	Time	Vertical	Lateral	Sagittal
2	11:23:49.430	1986	2089	2078
3	11:23:49.440	1982	2090	2078
4	11:23:49.450	1982	2091	2078
5	11:23:49.460	1980	2093	2077
6	11:23:49.470	1982	2091	2080
7	11:23:49.480	1981	2091	2080

- Graphed, the three traces show the individual accelerometer data.



- This **Accel** CSV file contains the raw data for the Zephyr™ **Impact Processor** tool which will generate an **AccelPro Impact Report**.
- Refer to the **BioModule Log Data Descriptions** Appendix for converting accelerometer data from bits to g.

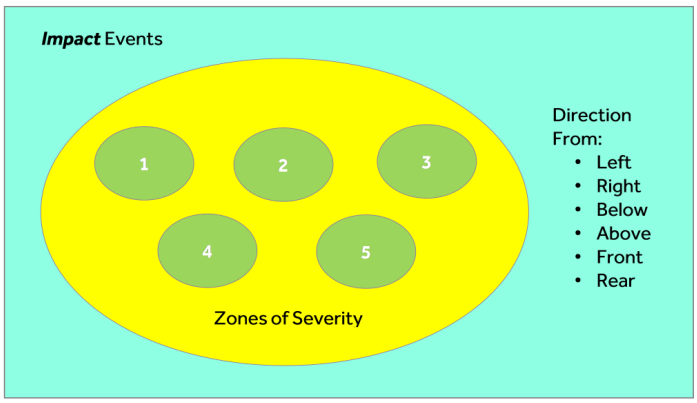
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
> Overview
> AccelPro Impact Report
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

ANALYSIS IMPACT PROCESSING
Overview (5/7)

Types of Impulse

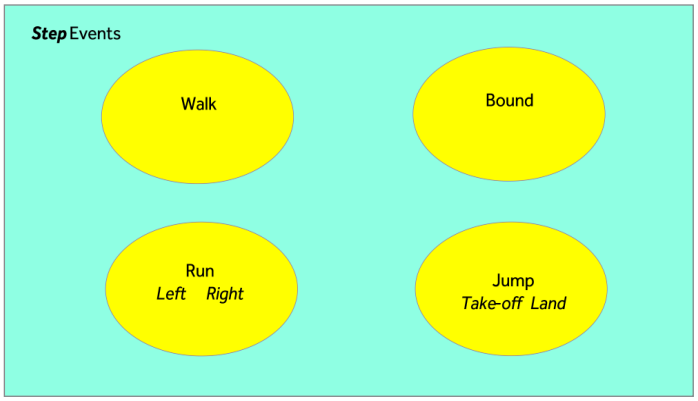
An impulse is any force event which results in a signature in the accelerometer data. OmniSense™ will analyze the accelerometer waveform data and classify impulse events into two types; impact events, and step events.

Impact Events



- An impact results from a collision between the BioModule wearer and an external object (including the ground) or another person, if in a contact sport.
- Impacts are classified into **Zones of Severity**, dependent on the **Peak Accelerometer Magnitude** value detected during the impulse.

Step Events



- A step event results from voluntary movement of the wearer.
- They are categorized into walking, running and bounding steps.
- Jumps have a recognized take-off and landing. These are specific stationary jumps, and not dynamic jumps occurring during periods of high activity.

In all event types, Zephyr™ proprietary algorithms analyze the magnitude, duration and direction of each impulse, together with intervals between successive events, to determine their type.

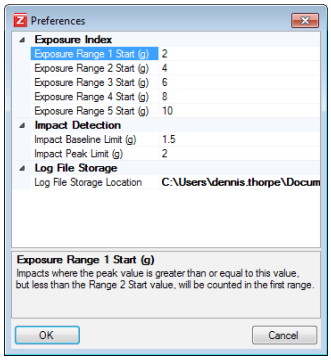
Some parameters e.g. **Step Period** are averaged over the 10 previous detected step events.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
> Overview
> AccelPro Impact Report
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

ANALYSIS IMPACT PROCESSING
Overview (6/7)

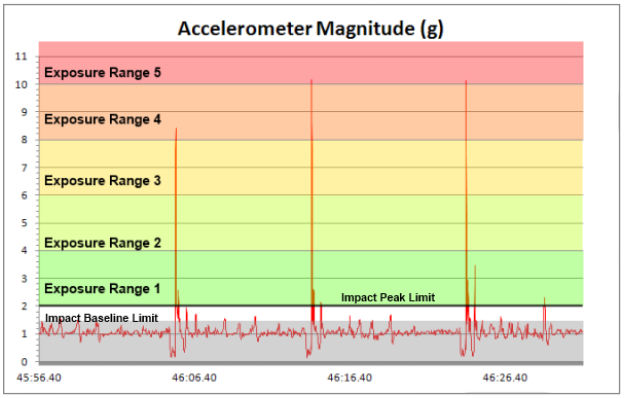
Impact Zones of Severity

Impacts are categorized into five **Zones of Severity** (Exposure Index) for ease of analysis. The zones are classified by Peak Accelerometer Magnitude and can be set in the **Edit > Preferences** menu option in the Zephyr™ Impact Processor Tool.



Item	Description
Exposure Index	Lower thresholds for the five zones, in g
Impact Detection	**Baseline Limit** - a data point with **Peak Accelerometer Magnitude** value above this limit will be considered part of the impact event. This will determine the beginning and the end of an event. **Impact Peak** - the impact event **Peak Accelerometer Magnitude** must be greater than this value to be considered a countable impact event. This allows for low peak value events to be discounted from analysis.
Log File Storage	Location from which the Zephyr™ Impact Processor looks to find **_Accel** waveform files. Defaults to where the Zephyr™ Downloader exports external CSV files.

This graph explains the zones in context of the raw accelerometer magnitude data.



- The majority of the data lies below the baseline limit of 1.5g - in the grey zone.
- From left to right, the first impact is in Exposure Range 4, with two following in Exposure Range 5. Each of these has a rebound which will be included in that impact event.
- One lesser impact in Exposure Range 1 follows at the end of the sample.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
> Overview
> AccelPro Impact Report
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

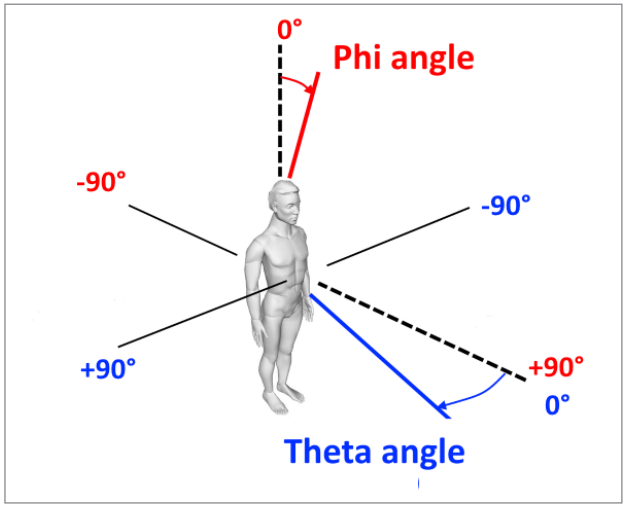
ANALYSIS IMPACT PROCESSING
Overview (7/7)

Impact Angle

Analysis of the X, Y & Z accelerometer components can determine the direction from which the impact event has originated.

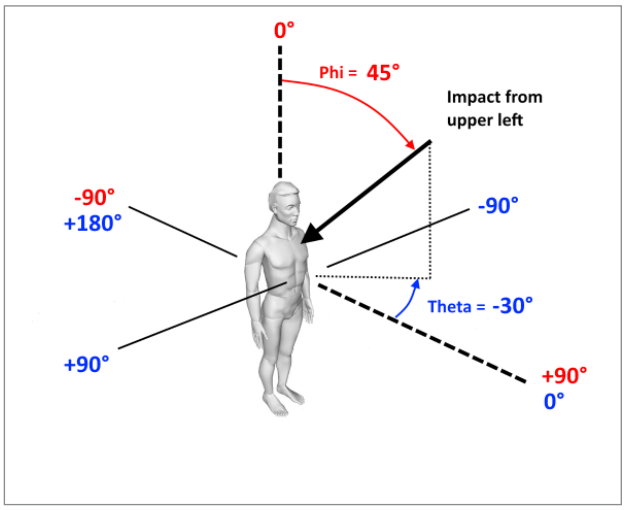
This is indicated by two angles, measured in degrees:

- **Theta** - angle in the horizontal plane. Subject straight ahead = 0°. From subject right is a positive value, from subject left is negative.
- **Phi** - angle in the vertical plane. Vertically upwards = 0°. Impact angle from in front of subject is a positive value, impact angle from behind subject is negative.



Theta and Phi angles of impact

Example



This example shows an impact from the subject's 10 o'clock position, angled from 45 degrees above the horizontal plane.

Theta is -30° (from subject's left), **Phi** is +45° (from vertical).

Any step-related impulse will have a Phi angle approaching +180° (from directly below the subject), which will flag the impulse event as a step.

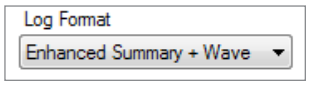
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
> Overview
> AccelPro Impact Report
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

AccelPro Impact Report

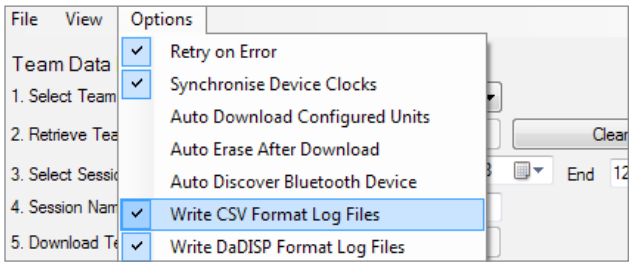
Prerequisites

In order to be able to generate an AccelPro report:

- Accelerometer waveform data must have been logged in the subject BioModule configured to log in **Summary and Waveform** or **Enhanced Summary and Waveform** format.



- The **Zephyr™ Downloader** must have the option **Write CSV Format Log Files** checked when data is imported from the subject BioModule. This preference is saved once it is checked.



- This will ensure that the '..**_Accel**' waveform files the **Zephyr™ Impact Processor** uses to generate a report are available.

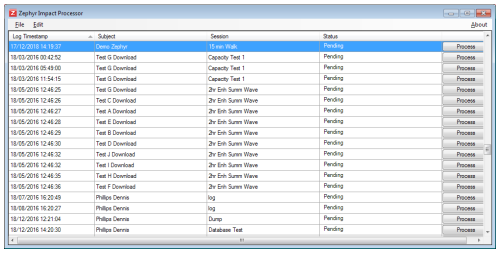
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
> Overview
> AccelPro Impact Report
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Impact Processor Tool

1. Start the Impact Processor Tool using the toolbar button in Analysis.



2. The Zephyr™ Impact Processor will display, showing all '**..._Accel**' files in the default file location which have not yet been processed by the tool. The default location can be reset in the Preferences of the tool . Use the column heading buttons to re-sort the entries by **Log Timestamp**, **Subject**, **Session Name** or **Status** to locate a record.



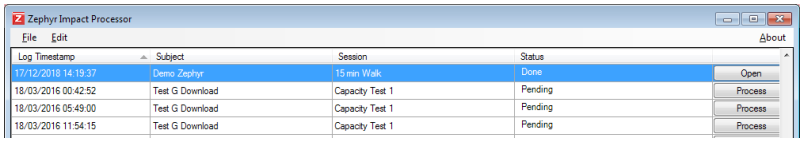
Note

Microsoft™* Excel™* 2010 or later must be installed to open a report.

Note

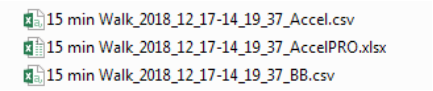
Naming sessions effectively when recording in OmniSense™ Live, or when importing data using the Zephyr™ Downloader, will make them easier to locate in the Impact Processor tool.

3. Click the **Process** button for the record or records to be processed.



The **Status** will change to **Done**, and the button will now show **Open**.

4. To locate the report directly, browse to the location containing the original '**..._Accel**' file. The report is an additional Microsoft™* Excel™* file saved to that location, with the same Session Name_Timestamp_ prefix as the original Accel file.



The report will have the suffix and file extension '**_AccelPro.xlsx**'

Menu > File Options

- **Open Manually** - browse to the **_Accel** file if not in the default location.
- **Process All Unprocessed Files** - will process all records and generate a report for each.
- **Generate Accel Pro Report** - legacy option. An AccelPro report will be generated whether checked or unchecked.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
> Overview
> AccelPro Impact Report
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

AccelPro Impact Report (3/9)

5. The report spreadsheet contains 3 page tabs:

- **Summary** - a breakdown of impulse types with some summary statistics

		Zone 1 Count < 4g	Zone 1 g Load	Zone 1 Impulse Load N*s	Zone 2 Count 4 - 6g	Zone 2 g Load	Zone 2 Impulse Load N*s	Zone 3 Count 6 - 8g	Zone 3 g Load	Zone 3 Impulse Load N*s	Zone 4 Count 8 - 10g	Zone 4 g Load	Zone 4 Impulse Load N*s	Zone 5 Count > 10g	Zone 5 g Load	Zone 5 Impulse Load N*s	Total Count	Total peak g Load	Total Impulse Load N*s	Ave Force Development N/s	Average Peak g	Average Impulse N*s	Average Period s	Max Flight Time s	Average L Period / Average R Period	(VALID FOR RUNNING ALONG A STRAIGHT PATH)
I	From Left	3	7.6	6.6	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	1	14.6	2.5	4	22.2	9.1							
M	From Right	0	0.0	0.0	1	5.1	1.3	0	0.0	0.0	0	0.0	0.0	1	11.0	2.2	2	16.2	3.5							
P	From Front	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	1	15.0	2.4	1	15.0	2.4							
A	From Back	0	0.0	0.0	1	4.8	1.2	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	1	4.8	1.2							
C	From Above	0	0.0	0.0	1	5.0	2.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	1	5.0	2.0							
T	From Below	2	2.8	4.7	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	2	2.8	4.7							
	Sub Total	5	10.4	11.3	3	14.9	4.5	0	0.0	0.0	0	0.0	0.0	3	40.6	7.1	11	65.9	22.9							
S	Walking																1397	2181.9	4464.6	0.655	1.56	3.196	0.561			
T	Running																53	151.7	105.9	5.623	2.86	1.999	0.393			
E	Intense Running																0	0.0	0.0							
P	Bounding																14	35.4	31.0	4.188	2.53	2.217	0.478			
S	Jumps																0	0.0	0.0					0.000		
	Sub Total																1464	2368.9	4601.6		1.62	3.143				
IMPULSE TOTAL																	1475	2434.9	4624.5							

- **Impulse Data Lines** - more detailed data on detected impulse events. Each entry includes a hyperlink to the section of the Accelerometry Stream tab pertaining to that event.

Time of Peak	Magnitude g	Impulse N*s	Duration s	Rise Time s	Fall Time s	30 ms Rate of Force Development N/s	30 ms Rate of Force Decline N/s	Time since last Peak s	Phi Peak	Theta Peak	Classification	Type	Orientation
14:19:38.49	1.41	2.17	0.17	0.00	0.00	0.36	-0.44	1.06	171	-154	Impact	Zone 1	From Below
14:19:39.38	1.38	2.55	0.21	0.00	0.00	0.10	-0.35	0.89	160	166	Impact	Zone 1	From Below
14:19:40.12	1.45	2.28	0.18	0.00	0.02	0.10	-0.86	0.74	167	169	Step	Walk	
14:19:40.86	1.33	3.28	0.27	0.00	0.00	0.01	-0.78	0.74	172	109	Step	Walk	
14:19:41.53	1.36	2.59	0.22	0.00	0.00	0.18	-0.52	0.67	162	166	Step	Walk	
14:19:42.25	1.36	3.25	0.27	0.00	0.00	0.31	-0.14	0.72	165	178	Step	Walk	
14:19:42.90	1.42	2.53	0.21	0.00	0.00	0.70	-0.16	0.65	158	160	Step	Walk	
14:19:43.67	1.33	3.29	0.27	0.00	0.01	0.03	-0.76	0.77	171	47	Step	Walk	
14:19:44.27	1.57	2.12	0.16	0.00	0.02	0.64	-0.75	0.60	163	175	Step	Walk	
14:19:44.96	1.33	2.71	0.22	0.00	0.00	0.22	-0.57	0.69	166	180	Step	Walk	
14:19:45.65	1.35	2.44	0.21	0.00	0.00	0.30	-0.66	0.69	158	177	Step	Walk	
14:19:46.40	1.48	4.20	0.38	0.00	0.01	0.54	-0.73	0.75	167	148	Step	Walk	
14:19:46.89	0.98	2.46	0.25	0.00	0.00	0.02	-0.02	0.49	160	121	Step	Walk	
14:19:54.70	1.35	2.61	0.22	0.00	0.02	0.45	-0.83	7.81	162	165	Step	Walk	
14:19:55.63	1.12	1.93	0.18	0.00	0.00	0.21	-0.23	0.93	171	-86	Step	Walk	
14:19:56.29	1.90	1.96	0.13	0.04	0.03	1.61	-1.20	0.66	169	139	Step	Walk	
14:19:56.81	2.02	1.69	0.10	0.02	0.03	1.03	-1.69	0.52	160	-69	Step	Bound	

- **Accelerometry Stream** - 100 Hz line-by-line values for accelerations in each axis and associated data.

Time	Vertical g	Lateral g	Sagittal g	Magnitude g	Phi	Theta	Instant Rate of Force N/s	Impulse N * s
14:19:38.40	-1.01	0.19	0.33	1.08	159	149	0.50	0.11
14:19:38.41	-1.08	0.17	0.37	1.16	159	155	0.80	0.23
14:19:38.42	-1.13	0.14	0.42	1.22	158	161	0.59	0.35
14:19:38.43	-1.14	0.13	0.43	1.23	158	163	0.14	0.48
14:19:38.44	-1.16	0.14	0.41	1.24	159	160	0.04	0.60
14:19:38.45	-1.18	0.12	0.37	1.24	161	162	0.09	0.73
14:19:38.46	-1.25	0.05	0.37	1.31	163	172	0.65	0.86
14:19:38.47	-1.33	0.00	0.30	1.36	167	180	0.52	1.00
14:19:38.48	-1.39	-0.06	0.24	1.41	169	-166	0.49	1.15
14:19:38.49	-1.40	-0.10	0.19	1.41	171	-154	0.07	1.29
14:19:38.50	-1.37	-0.16	0.13	1.39	171	-131	-0.26	1.43
14:19:38.51	-1.31	-0.13	0.07	1.32	173	-119	-0.68	1.57
14:19:38.52	-1.28	-0.12	0.04	1.28	174	-107	-0.39	1.70
14:19:38.53	-1.24	-0.08	0.04	1.24	175	-114	-0.40	1.82
14:19:38.54	-1.18	-0.04	0.08	1.18	175	-157	-0.61	1.95
14:19:38.55	-1.13	0.00	0.12	1.14	173	180	-0.46	2.06
14:19:38.56	-1.05	-0.02	0.12	1.06	172	-169	-0.85	2.17

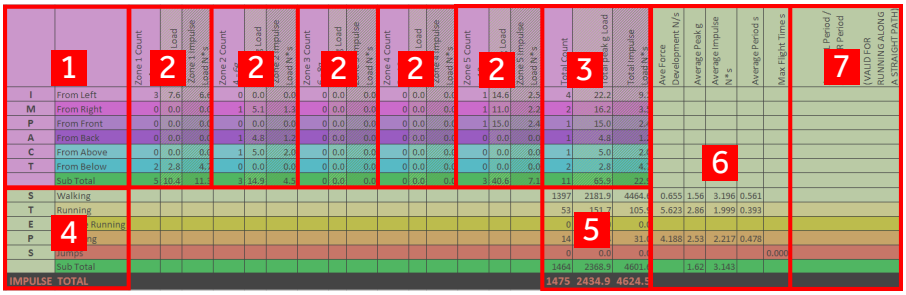
The following sections describe each part of the report in more detail.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
> Overview
> AccelPro Impact Report
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

ANALYSIS IMPACT PROCESSING
AccelPro Impact Report (4/9)

Report Summary Tab

The **Summary** tab shows counts of the various impulse types and some summary values for the impact severity zones and step types.



#	
1	Impact types by direction of incoming impact.
2	Impact Zones 1-5 with counts (by incoming direction), peak g and total impulse load.
3	All impact zones total counts, cumulative peak g and total impulse load.
4	Steps by type.
5	All step types total count, cumulative peak g and total impulse load
6	Summary Data (see below) for step types
7	Average left/right running step period for straight line running, if detected.

Impact Parameters

Parameter	Description
Zone # Count	The number of impacts in the 1/2/3/4/5 Impact Zones as configured in the Edit>Preferences menu option of the Impact Processor tool.
Zone # g Load	The sum of the Peak g values for each impact in the given category.
Zone # Impulse Load	A summation of the accelerometer magnitude samples for the impulse expressed in Newton Seconds.
Total Count	The total number of impact events in each given category.
Total Peak g Load	The total Peak g Load of events categorized as above.
Total Impulse Load	The total Impulse Load of events categorized as above.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
> Overview
> AccelPro Impact Report
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

AccelPro Impact Report (5/9)

Summary Parameters

Parameter	Description
Average Force Development Rate	Average of all events in each walking/running/bounding/jumping type in Newtons per Second. This is a measure of how 'sharp' or 'soft' an impulse is.
Average Peak g	Average Peak g of all events categorized as above.
Average Impulse	Measured in Newton seconds. This is the 'area under the curve' of accelerometer data.
Average Period	Average period between steps - a measure of cadence.
Max Flight Time	Maximum time in the air of all jump events.
Average L/R Period	Average left/right step time for running in a straight line.

Note

Flight Time for jump events is for a specific type of jump - that used in assessing a basketball player's performance.

The subject is stationary, crouches, pauses briefly, and then springs up vertically for their maximum upper reach to be measured.

Jumps which are embedded within other activities will not satisfy these criteria, and will not be registered as jump events.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
> Overview
> AccelPro Impact Report
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Impulse Data Lines Tab

The summary tab itemizes each detected impulse (impact or step type) and provides more detailed analysis. The first column in each record is a hyperlink to the relevant lines in the Accelerometry Stream tab of the report.

Note

The Impulse data lines contain **only** entries for

- Detected impact events which comply with impact filtering criteria set in the Preferences dialog of the Zephyr™ Impact Processor - the **Exposure Index**, **Impact Baseline Limit** and **Impact Peak Limit**.
- Step, run, bound or jump-type impulses.

Thus, **there will be gaps in the data** where impacts occur but these criteria are not met, or when the subject is perhaps stationary.

1	Time of Peak	Magnitude g	Impulse N*s	Duration s	Rise Time s	Fall Time s	30 ms Rate of Force Development N/s	30 ms Rate of Force Decline N/s	Time since last Peak s	Phi Peak	Theta Peak	Classification	Type	Orientation
2	14:19:38.49	1.41	2.17	0.17	0.00	0.00	0.36	-0.44	1.06	171	-154	Impact	Zone 1	From Below
3	14:19:39.38	1.38	2.55	0.21	0.00	0.00	0.10	-0.35	0.89	160	166	Impact	Zone 1	From Below
4	14:19:40.12	1.45	2.28	0.18	0.00	0.02	0.10	-0.86	0.74	167	169	Step	Walk	
5	14:19:40.86	1.33	3.28	0.27	0.00	0.00	0.01	-0.78	0.74	172	109	Step	Walk	
6	14:19:41.53	1.36	2.59	0.22	0.00	0.00	0.18	-0.52	0.67	162	166	Step	Walk	
7	14:19:42.25	1.36	3.25	0.27	0.00	0.00	0.31	-0.14	0.72	165	178	Step	Walk	
8	14:19:42.90	1.42	2.53	0.21	0.00	0.00	0.70	-0.16	0.65	158	160	Step	Walk	
9	14:19:43.67	1.33	3.29	0.27	0.00	0.01	0.03	-0.76	0.77	171	47	Step	Walk	
10	14:19:44.27	1.57	2.12	0.16	0.00	0.02	0.64	-0.75	0.60	163	175	Step	Walk	
11	14:19:44.96	1.33	2.71	0.22	0.00	0.00	0.22	-0.57	0.69	166	180	Step	Walk	

Column	Description
Time of Peak	Time stamp of peak g during the impulse event. A hyperlink to the relevant section in the **Accelerometry Stream**.
Magnitude g	Peak Magnitude g.
Impulse N*s	Total Impulse magnitude in newton seconds. This accumulates during the impulse and is the value shown on the final line in the accelerometer stream for the event. The 'area under the curve'.
Duration s	Duration of impulse.
Rise Time s	Time from start to peak g of impulse.
Fall Time s	Time from peak g to end of impulse.
30ms Rate of Force Development	Rate of increase of force in newtons per second, 30 milliseconds prior to peak g.
30ms Rate of Force Decline	Rate of decrease of force in newtons per second, 30 milliseconds after peak g.
Time since last peak	Time elapsed since peak g of previous detect impulse.
Phi Peak	Phi angle at peak g (see Impact Angle section).
Theta Peak	Theta Angle of peak g (see Impact Angle section).
Classification	Impact or Step.
Type	Impact Zone, or Step Type (walk, run, bound, jump).
Orientation	If impact, above/below left/right front/rear direction from which the impact originated.

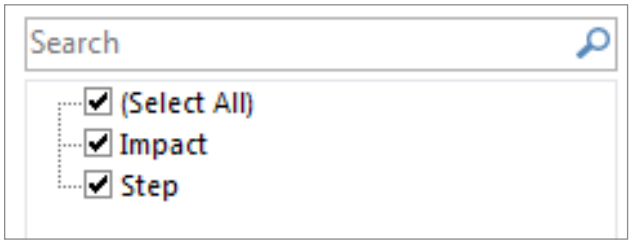
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
> Overview
> AccelPro Impact Report
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Report Summary Tab Data Filters

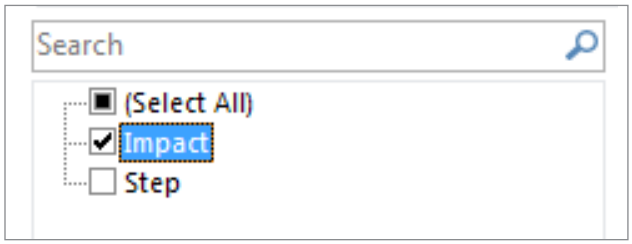
Each column heading in the Impulse Data Lines tab of the report has a data filtering pull down .

Use this to select specific entries of interest.

1. For example, to only see Impact impulses, select the pull-down in the **Classification** column heading.



2. De-select the **Select All** check box to clear both **Impact** and **Step** classifications, and then re-select **Impact** only.



3. Select **OK** in the dialog. The report will now only show impulse events of classification **Impact**.

1	Time of Peak	Magnitude g	Impulse N*s	Duration s	Rise Time s	Fall Time s	30 ms Rate of Force Development N/s	30 ms Rate of Force Decline N/s	Time since last Peak s	Phi Peak	Theta Peak	Classification	Type	Orientation
333	14:22:52.99	14.97	2.38	0.03	0.01	0.02	47.56	-45.43	0.70	116	-41	Impact	Zone 5	From Front
334	14:22:53.32	14.61	2.50	0.03	0.01	0.02	46.85	-44.74	0.33	76	-59	Impact	Zone 5	From Left
1250	14:31:24.80	11.03	2.22	0.04	0.01	0.03	33.78	-30.72	0.71	113	82	Impact	Zone 5	From Right
1268	14:31:35.21	4.76	1.21	0.04	0.01	0.03	12.85	-9.64	0.51	73	147	Impact	Zone 2	From Back
1274	14:31:38.68	2.03	3.89	0.26	0.06	0.06	4.42	-1.50	0.45	105	-134	Impact	Zone 1	From Left
1290	14:31:48.04	2.81	0.49	0.02	0.01	0.01	7.08	-5.04	0.34	102	-84	Impact	Zone 1	From Left
1312	14:32:01.31	2.77	2.20	0.11	0.04	0.04	7.09	-2.45	0.39	108	-116	Impact	Zone 1	From Left

4. Use a similar approach to filter by any column; text or numerical value.
   - Deselect the **Select All** check box, then select the required entries from the entire list of values. All lists default to ascending numeric or alphanumeric order.
   - Reselect the **Select All** to return to the unfiltered report.
   - Any filtered columns will display a filtered data icon.

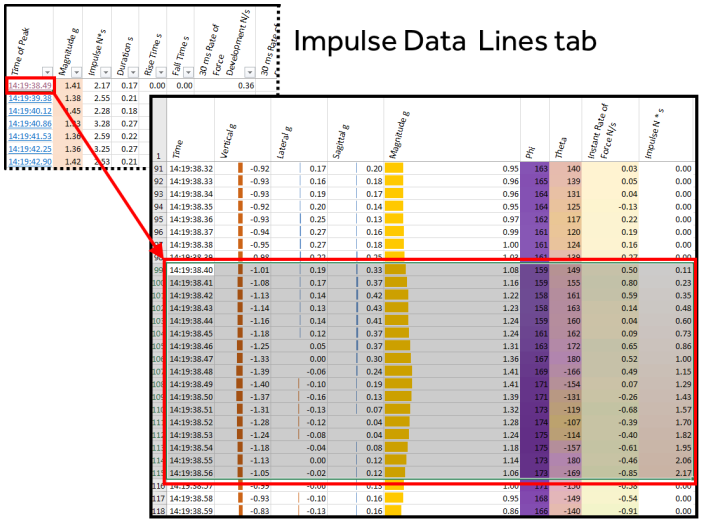


CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
> Overview
> AccelPro Impact Report
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Accelerometry Stream Tab

This tab contains a line for every individual accelerometer sample at 100 Hz, and as such may contain a very large number of lines of data. Browsing the tab itself will be time consuming.

It is best accessed from the **Impulse Data Lines** tab, by selecting the hyperlink in the **Time of Peak** column entry for the desired impulse event.



- All of the accelerometry stream lines for the selected impulse event will be auto-selected in the Accelerometry Stream tab.

Note

If you accidentally click on any cell in the **Accelerometry Stream** tab, the preselected lines for an impulse event will be de-selected. Return to the **Impulse Data Lines** tab and re-select the hyperlink to resume selection of the **Accelerometry Stream** lines for the event.

- **Vertical**. **Lateral**, **Sagittal** and **Magnitude g** values in the tab are represented graphically by horizontal colored bars, to better represent the location of any individual line within the envelope of the entire impulse. Other cells are color-coded and shaded to show progressions of magnitude or direction.

Time	Vertical g	Lateral g	Sagittal g	Magnitude g	Phi	Theta	Instant Rate of Force N/s	Impulse N * s
14:22:53.31	-0.72	0.31	0.43	0.90	143	144	0.47	0.00
14:22:53.32	3.36	-12.07	-7.52	14.61	76	-59	139.85	1.49
14:22:53.33	0.19	-5.60	-3.37	6.54	88	-59	-82.30	2.16
14:22:53.34	0.19	-3.20	-0.99	3.36	86	-73	-32.46	2.50
14:22:53.35	-0.29	-1.40	0.27	1.45	101	-101	-19.45	0.00

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
> Overview
> AccelPro Impact Report
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

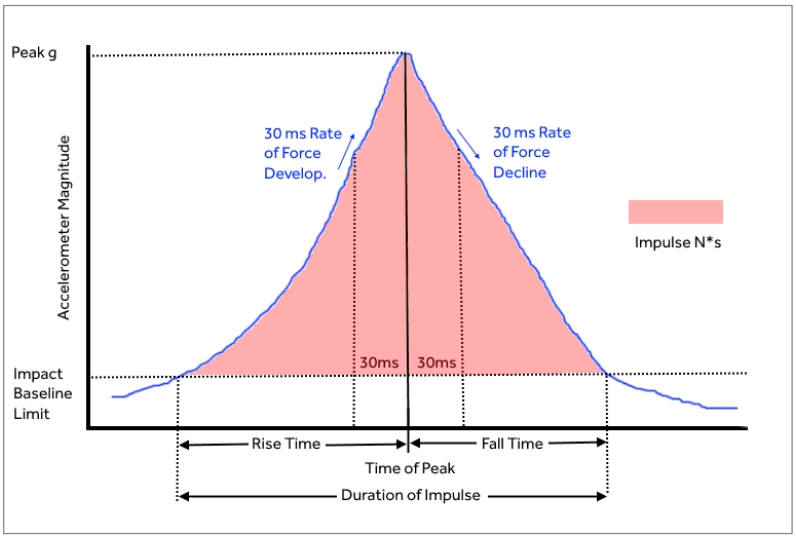
ANALYSIS IMPACT PROCESSING
AccelPro Impact Report (9/9)

Accelerometry Stream Parameters

Parameter	Description
Time	Timestamp of 100 Hz accelerometer data sample.
Vertical g	Vertical 3-axis g component.
Lateral g	Lateral (subject side to side) g component.
Sagittal g	Sagittal (subject front to rear) g component.
Magnitude g	$\sqrt{(x^2 + y^2 + z^2)}$ where x, y & z are the vertical, lateral and sagittal g components.
Phi Rad	Vertical angle of incoming impact in Radians. (1 Radian = 57.296 degrees)
Theta Rad	Horizontal angle (bearing) of incoming impact in Radians.
Instant Rate of Force N/S	Rate of change of force. Positive during the rise of the impulse, negative during the fall.
Impulse (Load) N*S	The 'area under the curve' of the accelerometer data. This starts at 0 for each event, and accumulates to a total (maximum) value on the last line for the event.

Anatomy of an Impulse

This diagram shows an impulse, with the major parameters illustrated.



The total **Impulse Load** (area under the curve) takes into account both the magnitude and duration of the impulse.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
> Overview
> Parameters & Color Coding
> Manage Reports
> Report Categories
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

ANALYSIS REPORTS
Overview (1/3)

Fitness Reports

Fitness Reports make comparisons for a selection of fitness parameters which are **already held** in the OmniSense™ database. Not all parameters need be present for each athlete.

- VO_2 max
- % VO_2max @ AT
- HR max
- HR @ AT
- HR @ AT as a % of HR max
- BR @ AT
- Heart Rate Recovery 30 sec
- Min Heart Rate Standing
- Min Heart Rate Resting
- Min Breathing Rate Resting
- Resting Heart Rate Variability

These parameters will exist in the database because they have been

- Entered manually in the OmniSense™ Live **Setup > Subject** screen:

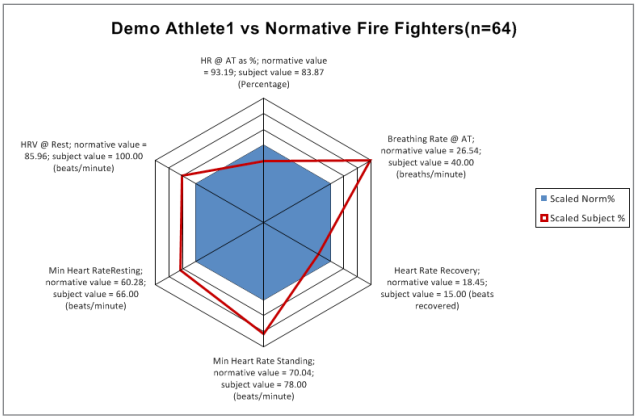
Enable Safety Alarm Limits

First Name	Last Name	Age year	Sex M/F	Ht cm	Wt kg	Fitness Level	HR max BPM	Wt kg	Fitness Level	HR @ AT BPM	BR @ AT BPM	HR High Red	HR High Orange	HR Low Red	BR High Red	BR Low Red	Core Temp Red	Idle Timeout	HR Rest BPM	HR Stnd BPM	HRV Rest SDNN ms
Demo	Athlete1	1981	M	177.8	70.3	0	183	70.31	0	160	40	165	146	40	35	4	39.2		52	65	94

- Saved as a result of performing a Readiness Test, or analysis of a Treadmill or Beep test. Refer to the **Baseline Fitness Testing** section.
- Both types of report (Individual & Team) compare an individual's parameters against a normative sample. For Individual reports, the Normative can be a template supplied by Zephyr™ containing data from one of four examples:
  - Fire Fighter
  - Military Special Forces
  - Pro Soccer Player
  - Female College Basketball player
- Users can create a custom normative if necessary.
- For Team Fitness reports, the normative is the average for the Team.

Each report has two separate components.

Radar Plot



Axes are scaled so that the normative values (blue solid) form a regular shape. If some parameters have no value for the subject, they are omitted in the radar plot. The subject values are represented by the red polygon.

Note that some values - such as VO_2max - are considered advantageous when **high**, where as other - such as standing heart rate - are superior when **low**.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
> Overview
> Parameters & Color Coding
> Manage Reports
> Report Categories
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

ANALYSIS REPORTS
Overview (2/3)

Table

FITNESS TEST REPORT

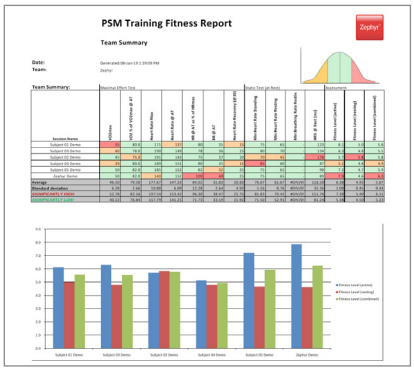
Name: **Demo Athlete1**
Comparison: Normative Fire Fighters(n=64)
Date: Generated:07-Jan-19 2:31:17 PM

Demo Athlete1	Scaled Subject %	Scaled Norm%	Min	Max	Subject	Normative	Description
HR @ AT as % of HRMax	0.40	0.50	48.51	137.87	83.87	93.19	HR @ AT as %; normative value = 93.19; subject value = 83.87 (Percentage)
Breathing Rate @ AT	0.79	0.50	3.54	49.55	40.00	26.54	Breathing Rate @ AT; normative value = 26.54; subject value = 40.00 (breaths/minute)
Heart Rate Recovery	0.41	0.50	-0.78	37.68	15.00	18.45	Heart Rate Recovery; normative value = 18.45; subject value = 15.00 (beats recovered)
Min Heart Rate Standing	0.72	0.50	51.52	88.55	78.00	70.04	Min Heart Rate Standing; normative value = 70.04; subject value = 78.00 (beats/minute)
Min Heart Rate Resting	0.61	0.50	34.69	85.87	66.00	60.28	Min Heart RateResting; normative value = 60.28; subject value = 66.00 (beats/minute)
HRV @ Rest	0.60	0.50	19.10	152.83	100.00	85.96	HRV @ Rest; normative value = 85.96; subject value = 100.00 (beats/minute)

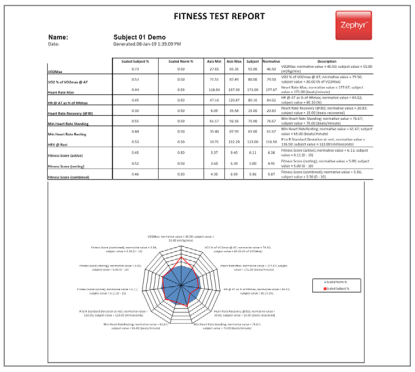
- The table gives the same information as in the radar plot.

Team Fitness Report

Where the fitness report is for a team, no normative file is selected. The normative is the set of average values for the team.



Session Summary Page



Subject Page

- The **Session Summary** page shows a table and a bar chart with an entry for each team member. There is a separate **Subject Page** for each team member.

Note

Subscribed subjects can perform remote Readiness and Fitness Tests which will update their individual fitness parameters to the OmniSense™ Cloud database via the OmniSense™ Mobile application.

This will render fitness parameters saved in a local PC database out of date, until the PC user connects to the web portal.

At this point subject fitness parameters will be automatically synchronized with the cloud.

An equivalent process will trigger if fitness tests are carried out using a local PC - the cloud database will be updated with any fitness parameters established locally.

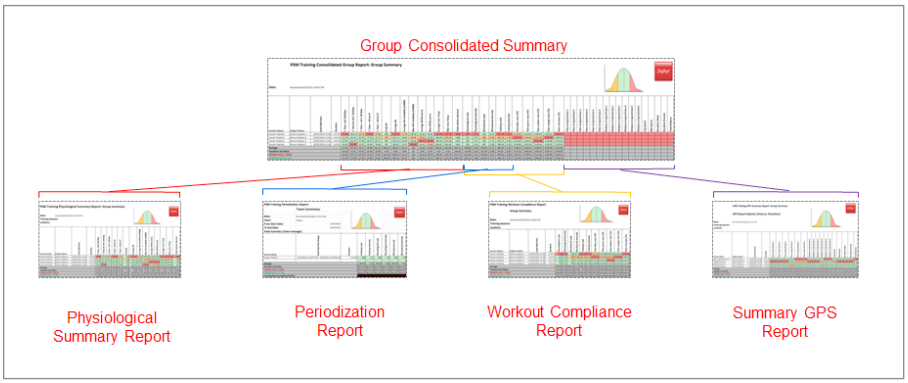
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
> Overview
> Parameters & Color Coding
> Manage Reports
> Report Categories
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

ANALYSIS REPORTS
Overview (3/3)

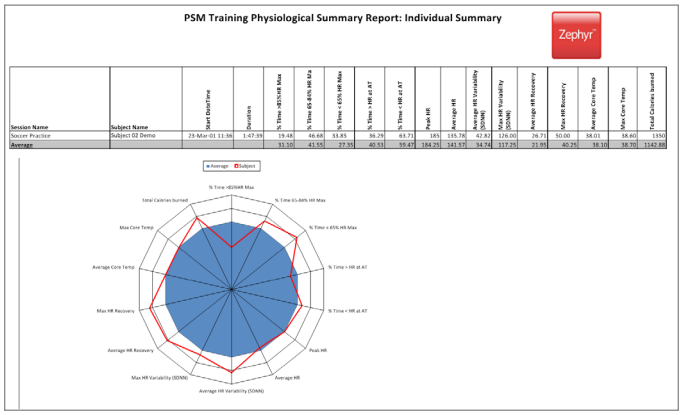
Training Reports

To create a Training Report, select specific sessions or subsessions from the **Select Sessions** pane and drag them to the **Training Report** pane. The Training Report will reflect a subject's performance - compared to the mean for all the sessions in the report.

There are five report options. Four are subsets of the **Group Consolidated Summary**, which shows all available parameters.



- As for Fitness Reports, the format is a multi-tab spreadsheet, with individual subject tabs.



- Each subject tab compares the subjects values compared to the session averages, in table and radar plot form.

Note

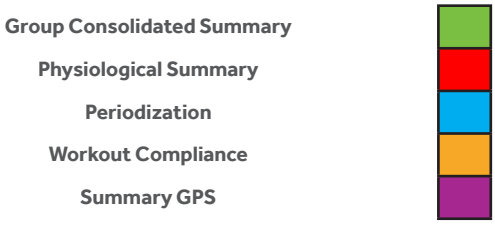
When a report of any kind is exported as an Microsoft™* Excel™* Spreadsheet, it can then be edited. Removing unwanted or empty parameter columns will also remove their axes from the radar plot.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
> Overview
> Parameters & Color Coding
> Manage Reports
> Report Categories
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Report Parameters

This table shows the parameters available in each report type.

Parameter		
Start Time	All	Start time of session.
Duration	All	Duration of session.
%Time >85%HRmax		% Time a subject's heart rate was above 85% of their maximum HR
%Time 65-84%HRmax		% Time a subject's heart rate was between 65-84% of their maximum HR
%Time <64%HRmax		% Time a subject's heart rate was below 64% of their maximum HR
%Time > HR at AT		%Time a subject's heart rate was above their HR at Anaerobic Threshold.
%Time < HR at AT		%Time a subject's heart rate was below their HR at Anaerobic Threshold.
Peak HR		Peak heart rate.
Average HR		Average heart rate.
Average HRV		Average heart rate variability.
Max HRV		Peak heart rate variability.
Average HRR		Average heart rate recovery (30sec).
Max HRR		Peak heart rate recovery (30sec.)
Average Core Temp		Average core body temperature (HR-based algorithm)
Max Core Temp		Peak core body temperature
Total Calories burned		Calculated from ACSM formula.
Physiological Load/Intensity		See Fitness Parameters section.
Mechanical Load/Intensity		See Fitness Parameters section.
Training Load/Intensity		See Fitness Parameters section.
Time in Workout Zones		Zones configured in OmniSense™ Live.
Time in Speed Zones		Zones configured in OmniSense™ Live. GPS data.
Distance in Speed Zones		GPS data.
Average Speed		GPS data.
Maximum Speed		GPS data.
Elevation Climb		GPS data.
Elevation Descent		GPS data.
Total Distance		Total distance travelled. GPS Data.

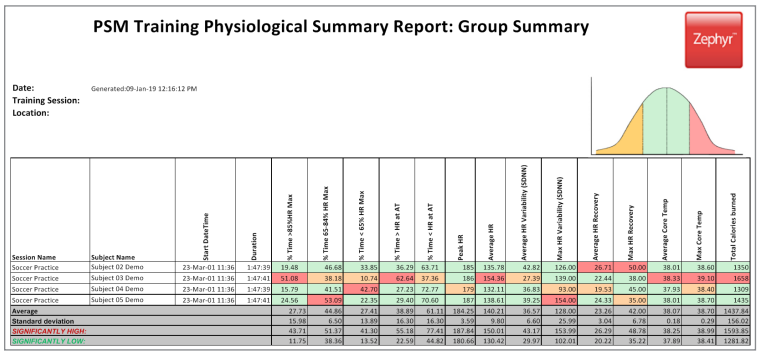


CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
> Overview
> Parameters & Color Coding
> Manage Reports
> Report Categories
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Parameters & Color Coding (2/2)

Report Table Coloring

All training report SessionSummary tables use cell coloring to give an immediate representation of how one subject is performing relative to the team.



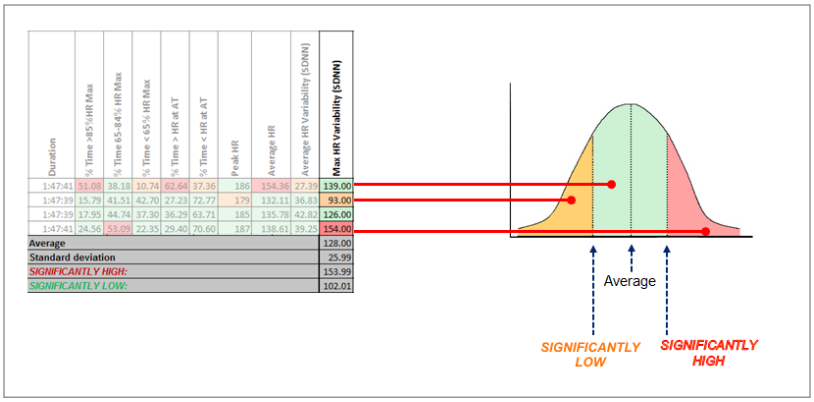
PSM Training Physiological Summary Report: Group Summary

Zephyr™

Date:
Training Session:
Location:
Generated:09-Jan-19 12:16:12 PM

Session Name	Subject Name	Start Date/Time	Duration	% Time >85%HR Max	% Time 65-84% HR Max	% Time < 65% HR Max	% Time > HR at AT	% Time < HR at AT	Peak HR	Average HR	Average HR Variability (SDNN)	Max HR Variability (SDNN)	Average HR Recovery	Max HR Recovery	Average Core Temp	Max Core Temp	Total Calories burned
Soccer Practice	Subject 02 Demo	23-Mar-01 11:36	1:47:39	19.48	46.68	33.85	36.29	63.71	185	135.78	42.82	126.00	26.71	50.00	38.01	38.60	1350
Soccer Practice	Subject 03 Demo	23-Mar-01 11:36	1:47:41	51.08	38.18	10.74	62.64	37.36	186	154.38	27.39	139.00	22.44	38.00	38.33	39.10	1658
Soccer Practice	Subject 04 Demo	23-Mar-01 11:36	1:47:39	15.79	41.51	42.70	27.23	72.77	179	132.11	36.83	93.00	19.53	45.00	37.93	38.40	1309
Soccer Practice	Subject 05 Demo	23-Mar-01 11:36	1:47:41	24.56	53.09	22.35	29.40	70.60	187	138.61	39.25	154.00	24.33	35.00	38.01	38.70	1435
Average				27.73	44.86	27.41	38.89	61.11	184.25	140.21	36.57	128.00	23.26	42.00	38.07	38.70	1437.84
Standard deviation				15.98	6.50	13.89	16.30	16.30	3.59	9.80	6.60	25.99	3.04	6.78	0.18	0.29	156.02
SIGNIFICANTLY HIGH:				43.71	51.37	41.30	55.18	77.41	187.84	150.01	43.17	153.99	26.29	48.78	38.25	38.99	1593.85
SIGNIFICANTLY LOW:				11.75	38.36	13.52	22.59	44.82	180.66	130.42	29.97	102.01	20.22	35.22	37.89	38.41	1281.82

- The SIGNIFICANTLY LOW and SIGNIFICANTLY HIGH thresholds are one standard deviation above and below the average value for the group.
- Any green cell value is within one standard deviation of the group average (above or below).
- Any orange (amber) cell value is more than one standard deviation below the group average.
- Any red cell is more than one standard deviation above the group average.



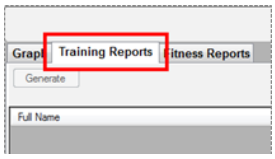
Duration	% Time >85%HR Max	% Time 65-84% HR Max	% Time < 65% HR Max	% Time > HR at AT	% Time < HR at AT	Peak HR	Average HR	Average HR Variability (SDNN)	Max HR Variability (SDNN)
1:47:41	51.08	38.18	10.74	62.64	37.36	186	154.38	27.39	139.00
1:47:39	15.79	41.51	42.70	27.23	72.77	179	132.11	36.83	93.00
1:47:39	17.95	44.74	37.30	36.29	63.71	185	135.78	42.82	126.00
1:47:41	24.56	53.09	22.35	29.40	70.60	187	138.61	39.25	154.00
Average									128.00
Standard deviation									25.99
SIGNIFICANTLY HIGH:									153.99
SIGNIFICANTLY LOW:									102.01

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
> Overview
> Parameters & Color Coding
> Manage Reports
> Report Categories
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

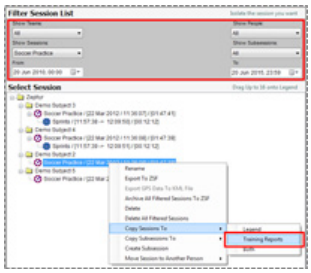
ANALYSIS REPORTS
Manage Reports (1/3)

Create Report

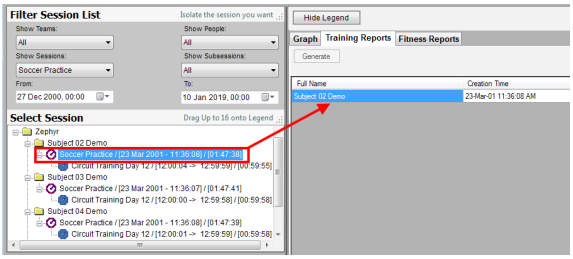
1. Select **Training Reports** tab.



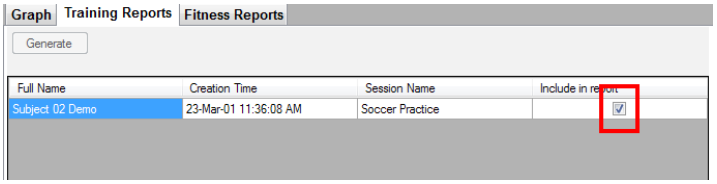
2. Use the **Filter Session List** to populate the **Select Session** pane with desired subjects and sessions.



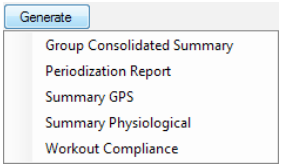
3. Right-click a session and select **Copy Sessions To > Training Reports** to populate the report pane, or click-and-drag individual sessions.



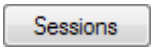
4. To remove a session from a report, de-select the check box at the right side of the entry.



5. When all desired sessions have been added, click the **Generate** button and select report type from list.



6. Once the report has been generated, you can return to the session list at any time using the **Sessions** button.



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
> Overview
> Parameters & Color Coding
> Manage Reports
> Report Categories
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Export Report

Once a report has been generated, viewing within the Analysis window is restricted by screen size. The best option is to export the report.

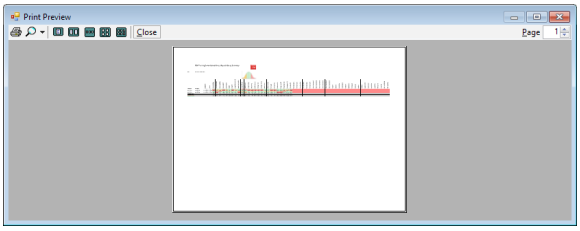
There are two options.

Print Report

1. Print the report using the Print button on the top right side of the report pane.



2. A print dialog will display.



Note

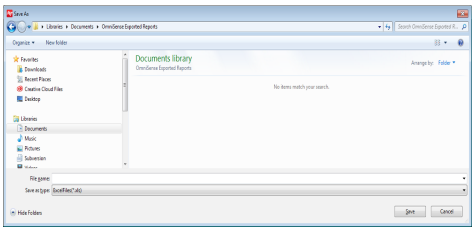
The print function only prints the page (tab) of the report currently displayed. For a multi-tab report, each tab must be printed separately.

Export Report as a Spreadsheet

1. Export the entire report to an external Microsoft™* Excel™* spreadsheet using the export button.



2. A Save dialog will display. Save the report to your preferred location. (Microsoft™* Excel™* or an alternative will be needed to open the report).



3. Once saved externally, the report can be edited to remove any unwanted or redundant data columns, to reduce clutter in tables and radar plots. See the next page.

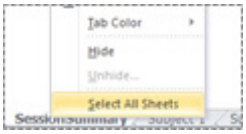
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
> Overview
> Parameters & Color Coding
> Manage Reports
> Report Categories
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Edit Report

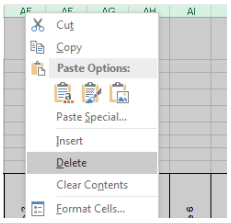
Some reports, particularly the Group Consolidated Summary, may contain columns with no data (usually GPS data), or columns of data supported by the Enhanced Summary data packet/log format, which are not used by other data packets or log formats.

These blank fields create unnecessary clutter in the report.

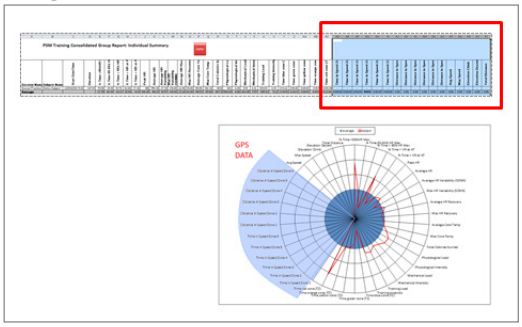
1. Export the report as an Microsoft™* Excel™* spreadsheet.
2. Open the report, right click on the tabs at the foot of the spreadsheet and select **Select All Sheets**. This will modify all tabs in the report in a single operation.



3. In the **SessionSummary** sheet, select all columns of data to be deleted. Click and drag mouse across all lettered column heading cells, and then right click and select **Delete** from the context menu.

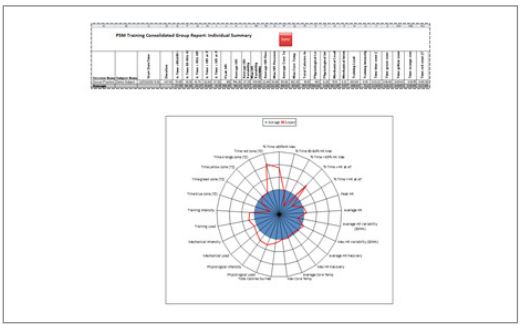


Report Before Editing



Report showing highlighted GPS data columns and blue segment in radar plot

Report After Editing



Report with truncated table and reduced-axes radar plot

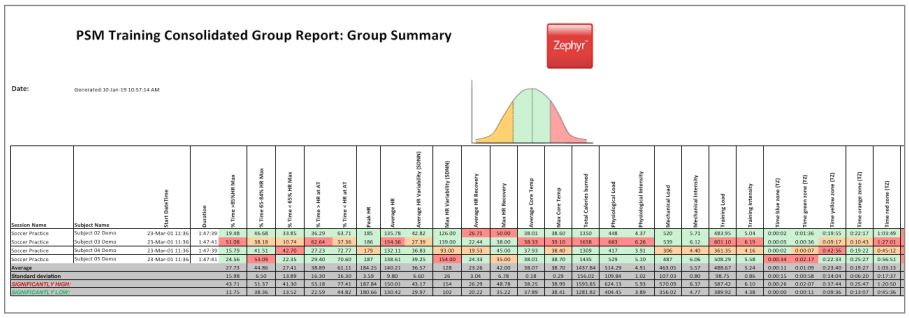
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
> Overview
> Parameters & Color Coding
> Manage Reports
> Report Categories
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

ANALYSIS REPORTS
Report Categories (1/5)

Group Consolidated Summary

The Consolidated Summary is the super-set of all other reports, and contains all available data parameters.

SessionSummary Tab


PSM Training Consolidated Group Report: Group Summary

Zephyr

Date:

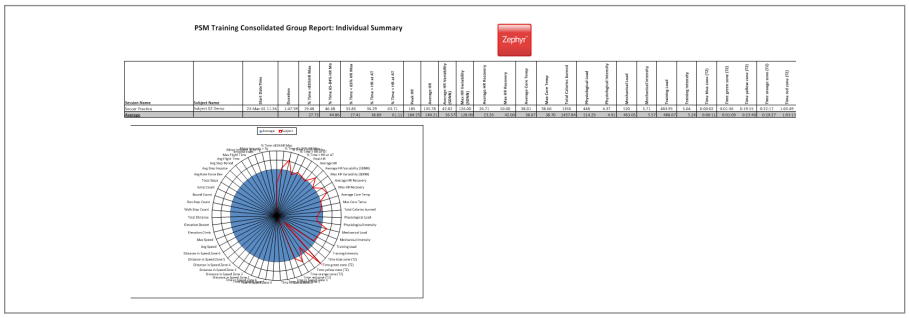
Session Name	Subject Name	Start Date/Time	Duration	% Time > 85%HR Max	% Time 85-94% HR Max	% Time > 95% HR Max	% Time > HR at AT	% Time < HR at AT	Peak HR	Average HR	Average HR Variability (SDNN)	Max HR Recovery	Average HR Recovery	Max HR Recovery	Average Core Temp	Max Core Temp	Total Calories Burned	Physiological Load	Physiological Intensity	Mechanical Load	Mechanical Intensity	Training Load	Training Intensity	Time blue zone (TZ)	Time green zone (TZ)	Time yellow zone (TZ)	Time orange zone (TZ)	Time red zone (TZ)
Soccer Practice	Subject 02 Demo	23-Mar-01 11:36	1:47:39	19:48	46:48	33:01	36:29	53:21	185	155:78	42:82	126:00	26:71	34:00	38:01	38:60	1150	648	6:37	5:40	5:71	483:95	5:04	0:00:02	0:01:36	0:19:16	0:22:32	1:03:49
Soccer Practice	Subject 03 Demo	23-Mar-01 11:36	1:47:41	51:08	38:18	10:74	62:64	37:36	186	154:56	27:39	135:00	22:44	38:00	38:53	39:10	1058	661	6:26	5:99	6:12	601:30	6:18	0:00:05	0:05:56	0:09:17	0:10:43	1:27:01
Soccer Practice	Subject 04 Demo	23-Mar-01 11:36	1:47:39	15:79	41:51	42:70	27:23	72:77	179	152:11	36:83	93:00	19:53	45:00	37:93	38:40	1309	417	3:91	306	4:40	361:35	4:16	0:00:02	0:00:07	0:42:56	0:15:22	0:45:12
Soccer Practice	Subject 05 Demo	23-Mar-01 11:36	1:47:41	24:36	53:05	22:15	29:40	70:60	187	148:61	39:25	114:00	24:33	35:00	38:01	38:70	1435	529	5:10	497	6:06	508:29	5:48	0:00:14	0:02:17	0:22:33	0:25:27	0:56:54
Average			27:73	44:86	27:41	38:89	61:11	184:25	340:21	36:57	128	23:26	42:00	38:07	38:70	1457:84	514:29	4:91	463:05	5:37	488:67	5:24	0:00:11	0:01:09	0:23:40	0:15:27	1:03:18
Standard deviation			15:98	6:50	13:89	16:20	16:30	3:19	9:80	6:60	26	3:06	6:78	0:18	0:29	154:02	109:84	1:02	107:03	0:80	98:75	0:86	0:00:15	0:02:18	0:14:04	0:06:20	0:17:37
SIGNIFICANTLY ABOVE			43:71	51:37	41:30	55:18	77:41	187:44	350:01	43:17	154	26:25	48:78	38:25	38:99	1555:85	624:13	5:91	570:09	6:37	587:42	6:10	0:00:26	0:03:27	0:37:46	0:25:47	1:20:50
SIGNIFICANTLY LOW			11:75	38:36	13:52	22:59	44:82	180:66	330:42	29:97	102	20:22	35:22	37:89	38:41	1281:82	404:45	3:89	356:02	4:77	389:92	4:38	0:00:00	0:00:11	0:08:36	0:13:07	0:45:36

- Red/green/amber cell coloring indicates individual performance vs. group average performance for all sessions in report. Thresholds are 1 standard deviation in either direction of the average.

Parameter Categories

- Physiological - various relating to HR, BR, HRV, HRR, HR Zones, Estimated Core Temperature & Calories Burned.
- Physiological/Mechanical Training Load & Intensities. See **Fitness Parameters** section.
- Time in HR Zones
- Time/distance in speed zones (GPS data)
- Summary GPS data
- Accelerometer - counts of impulse (step & impact) types, summary impulse data.

Subject Tab


PSM Training Consolidated Group Report: Individual Summary

Zephyr

- Table of subject values and session averages for report
- Radar plot of the same.

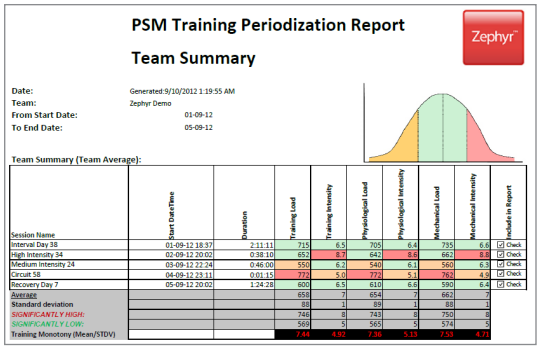
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
> Overview
> Parameters & Color Coding
> Manage Reports
> Report Categories
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Periodization Report

This report shows Mechanical, Physiological and Training (average of Mechanical & Physical) loads and intensities. See the **Fitness Parameters** section for more detail. Its intended use is for a team training over a variety of different workouts for an extended period of time.

The **SessionSummary** and **Subject** tabs are identical in format.

Data Table


PSM Training Periodization Report

Team Summary

Zephyr™

Date: Generated:9/10/2012 1:19:55 AM
Team: Zephyr Demo
From Start Date: 01-09-12
To End Date: 05-09-12

Team Summary (Team Average):

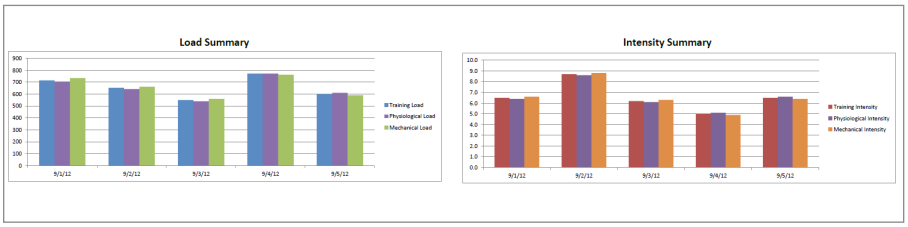
Session Name	Start Date/Time	Duration	Training Load	Training Intensity	Physiological Load	Physiological Intensity	Mechanical Load	Mechanical Intensity	Include in Report
Interval Day 38	01-09-12 18:37	2:11:11	715	6.5	705	6.4	735	6.6	☑ Check
High Intensity 34	02-09-12 20:02	0:38:10	652	8.7	642	8.6	662	8.8	☑ Check
Medium Intensity 24	03-09-12 22:24	0:46:00	550	6.2	540	6.1	560	6.3	☑ Check
Circuit 58	04-09-12 23:11	0:01:15	772	5.0	772	5.1	762	4.9	☑ Check
Recovery Day 7	05-09-12 20:02	1:24:28	600	6.5	610	6.6	590	6.4	☑ Check
Average			658	7	654	7	662	7	
Standard deviation			88	1	89	1	88	1	
SIGNIFICANTLY HIGH:			746	8	743	8	750	8	
SIGNIFICANTLY LOW:			569	5	565	5	574	5	
Training Monotony (Mean/STDV)			7.44	4.92	7.36	5.13	7.53	4.73	

- Entries are aggregated by workout type.
- In the **SessionSummary** tab, the **Average** and **Standard Deviation** values are for the entire team over all workouts.
- In the **Subject** tabs, the same values are for that subject only, and each session/workout is itemized.
- Cell coloring is as previously described.

Caution

If multiple occurrences of only a single workout type are used (e.g. if all are 'Interval Day 38'), then by aggregation the table will contain a single entry, and the Average & Standard Deviation fields will contain a **#DIV/0!** error message as they cannot be calculated.

Summary Charts



- The charts aggregate activities by date, and so give a calendar progression of training efforts.
- In the **SessionSummary** tab, the charts show the team average values.
- In the **Subject** tabs, they show the calendar progression of workout levels for each individual subject.

Training Monotony

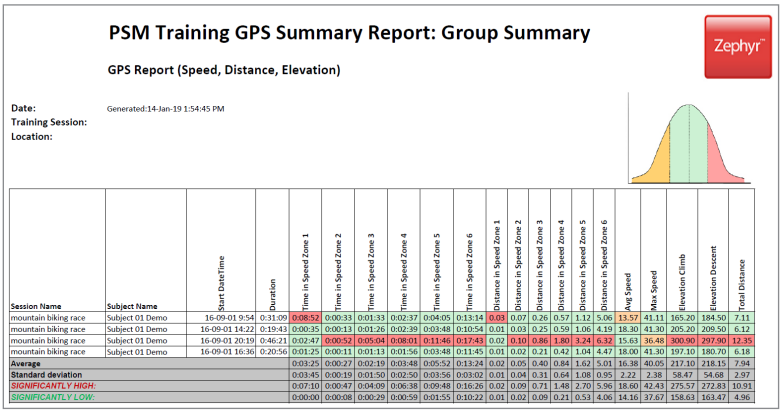
The report gives a measure of training consistency: Average value divided by Standard Deviation. This is intended as a guide to indicate when over-training may be occurring (variation in Training Monotony can help prevent this).

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
> Overview
> Parameters & Color Coding
> Manage Reports
> Report Categories
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Summary GPS

This report contains distance, speed and elevation values derived from GPS data. The **Speed Zones** referred to are configurable in **Preferences** in both Live and Analysis.

Session Summary Tab



PSM Training GPS Summary Report: Group Summary

GPS Report (Speed, Distance, Elevation)

Zephyr

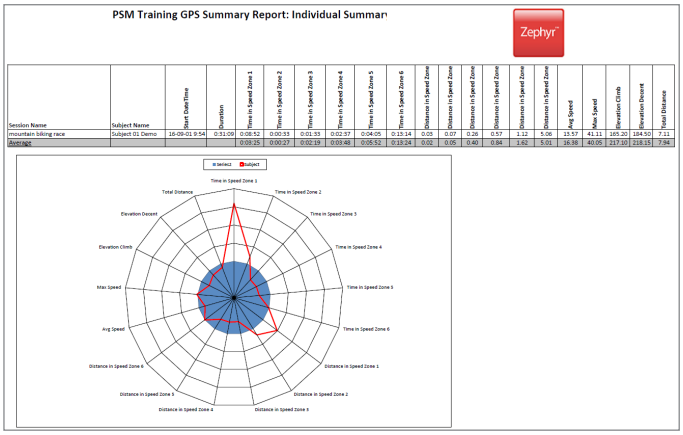
Date:
Training Session:
Location:

Generated:14-Jan-19 1:54:45 PM

Session Name	Subject Name	Start DateTime	Duration	Time in Speed Zone 1	Time in Speed Zone 2	Time in Speed Zone 3	Time in Speed Zone 4	Time in Speed Zone 5	Time in Speed Zone 6	Distance in Speed Zone 1	Distance in Speed Zone 2	Distance in Speed Zone 3	Distance in Speed Zone 4	Distance in Speed Zone 5	Distance in Speed Zone 6	Avg Speed	Max Speed	Elevation Climb	Elevation Descent	Total Distance
mountain biking race	Subject 01 Demo	16-09-01 9:54	0:31:09	0:08:52	0:00:33	0:01:33	0:02:37	0:04:05	0:13:14	0.03	0.07	0.26	0.57	1.12	5.06	13.57	41.11	165.20	184.50	7.11
mountain biking race	Subject 01 Demo	16-09-01 14:22	0:19:43	0:00:35	0:00:13	0:01:26	0:02:39	0:03:48	0:10:54	0.01	0.03	0.25	0.59	1.06	4.19	18.30	41.30	205.20	209.50	6.12
mountain biking race	Subject 01 Demo	16-09-01 20:19	0:46:21	0:02:47	0:00:52	0:05:04	0:08:01	0:11:46	0:17:43	0.02	0.10	0.86	1.80	3.24	6.32	15.63	36.48	300.90	297.90	12.35
mountain biking race	Subject 01 Demo	16-09-01 16:36	0:20:56	0:01:25	0:00:11	0:01:13	0:01:56	0:03:48	0:11:45	0.01	0.02	0.21	0.42	1.04	4.47	18.00	41.30	197.10	180.70	6.18
Average				0:03:25	0:00:27	0:02:19	0:03:48	0:05:52	0:13:24	0.02	0.05	0.40	0.84	1.62	5.01	16.38	40.05	217.10	218.15	7.94
Standard deviation				0:03:45	0:00:19	0:01:50	0:02:50	0:03:56	0:03:02	0.01	0.04	0.31	0.64	1.08	0.95	2.22	2.38	58.47	54.68	2.97
SIGNIFICANTLY HIGH:				0:07:10	0:00:47	0:04:09	0:06:38	0:09:48	0:16:26	0.02	0.09	0.71	1.48	2.70	5.96	18.60	42.43	275.57	272.83	10.91
SIGNIFICANTLY LOW:				0:00:00	0:00:08	0:00:29	0:00:59	0:01:55	0:10:22	0.01	0.02	0.09	0.21	0.53	4.06	14.16	37.67	158.63	163.47	4.96

- Sessions are listed individually (no aggregation).
- Sessions can be for the same subject or a mixture of subjects.
- Cell coloring is as previously described.

Subject Tab



PSM Training GPS Summary Report: Individual Summar

Zephyr

Session Name	Subject Name	Start DateTime	Duration	Time in Speed Zone 1	Time in Speed Zone 2	Time in Speed Zone 3	Time in Speed Zone 4	Time in Speed Zone 5	Time in Speed Zone 6	Distance in Speed Zone	Distance in Speed Zone	Distance in Speed Zone	Distance in Speed Zone	Distance in Speed Zone	Distance in Speed Zone	Avg Speed	Max Speed	Elevation Climb	Elevation Descent	Total Distance
mountain biking race	Subject 01 Demo	16-09-01 9:54	0:31:09	0:08:52	0:00:33	0:01:33	0:02:37	0:04:05	0:13:14	0.03	0.07	0.26	0.57	1.12	5.06	13.57	41.11	165.20	184.50	7.11
Average				0:03:25	0:00:27	0:02:19	0:03:48	0:05:52	0:13:24	0.02	0.05	0.40	0.84	1.62	5.01	16.38	40.05	217.10	218.15	7.94

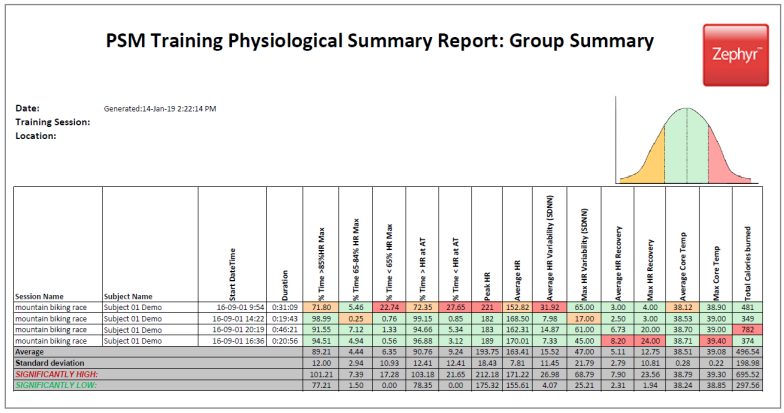
- Each record in the SummarySession tab is represented in a separate subject tab.
- The data table shows the individual session and the average values for all sessions in the report.
- The radar plot shows average value for all sessions (blue solid) against the individual subject (red polygon).

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
> Overview
> Parameters & Color Coding
> Manage Reports
> Report Categories
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Summary Physiological

This report contains a number of parameters, all of which are heart rate-derived.

Session Summary Tab



PSM Training Physiological Summary Report: Group Summary

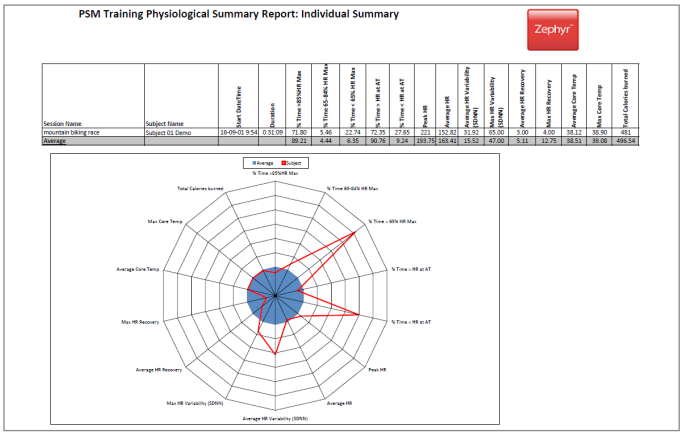
Zephyr™

Date: Generated:14-Jan-19 2:22:14 PM
Training Session:
Location:

Session Name	Subject Name	Start DateTime	Duration	% Time >85%HR Max	% Time 65-84% HR Max	% Time < 65% HR Max	% Time > HR at AT	% Time < HR at AT	Peak HR	Average HR	Average HR Variability (SDNN)	Max HR Variability (SDNN)	Average HR Recovery	Max HR Recovery	Average Core Temp	Max Core Temp	Total Calories burned
mountain biking race	Subject 01 Demo	16-09-01 9:54	0:31:09	71.80	5.46	22.74	72.35	27.65	221	152.82	31.92	65.00	3.00	4.00	38.12	38.90	481
mountain biking race	Subject 01 Demo	16-09-01 14:22	0:19:43	98.99	0.25	0.76	99.15	0.85	182	168.50	7.98	17.00	2.50	3.00	38.53	39.00	349
mountain biking race	Subject 01 Demo	16-09-01 20:19	0:46:21	91.55	7.12	1.33	94.66	5.34	183	162.31	14.87	61.00	6.73	20.00	38.70	39.00	782
mountain biking race	Subject 01 Demo	16-09-01 16:36	0:20:56	94.51	4.94	0.56	96.88	3.12	189	170.01	7.33	45.00	8.20	24.00	38.71	39.40	374
Average				89.21	4.44	6.35	90.76	9.24	193.75	163.41	15.52	47.00	5.11	12.75	38.51	39.08	496.54
Standard deviation				12.00	2.94	10.93	12.41	12.41	18.43	7.81	11.45	21.79	2.79	10.81	0.28	0.22	198.98
SIGNIFICANTLY HIGH:				101.21	7.39	17.28	103.18	21.65	212.18	171.22	26.98	68.79	7.90	23.56	38.79	39.30	695.52
SIGNIFICANTLY LOW:				77.21	1.50	0.00	78.35	0.00	175.32	155.61	4.07	25.21	2.31	1.94	38.24	38.85	297.56

- Sessions are listed individually (no aggregation).
- Sessions can be for the same subject or a mixture of subjects.
- Cell coloring is as previously described.

Subject Tab



PSM Training Physiological Summary Report: Individual Summary

Zephyr™

Session Name	Subject Name	Start DateTime	Duration	% Time >85%HR Max	% Time 65-84% HR Max	% Time < 65% HR Max	% Time > HR at AT	% Time < HR at AT	Peak HR	Average HR	Average HR Variability (SDNN)	Max HR Variability (SDNN)	Average HR Recovery	Max HR Recovery	Average Core Temp	Max Core Temp	Total Calories burned
mountain biking race	Subject 01 Demo	16-09-01 9:54	0:31:09	71.80	5.46	22.74	72.35	27.65	221	152.82	31.92	65.00	3.00	4.00	38.12	38.90	481
Average				89.21	4.44	6.35	90.76	9.24	193.75	163.41	15.52	47.00	5.11	12.75	38.51	39.08	496.54

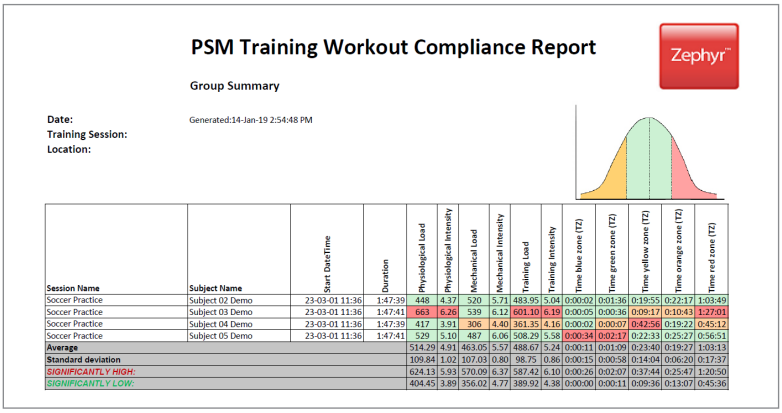
- Each record in the SummarySession tab is represented in a separate subject tab.
- The data table shows the individual session and the average values for the report.
- The radar plot shows average values for all sessions (blue solid) against the individual subject (red polygon).

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
> Overview
> Parameters & Color Coding
> Manage Reports
> Report Categories
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Workout Compliance

This report shares some parameters with the Periodization report, but also contains **Training Zone** data. Training Zone thresholds are configurable in Live & Analysis Preferences.

Session Summary Tab



PSM Training Workout Compliance Report

Zephyr™

Group Summary

Date:
Training Session:
Location:

Generated:14-Jan-19 2:54:48 PM

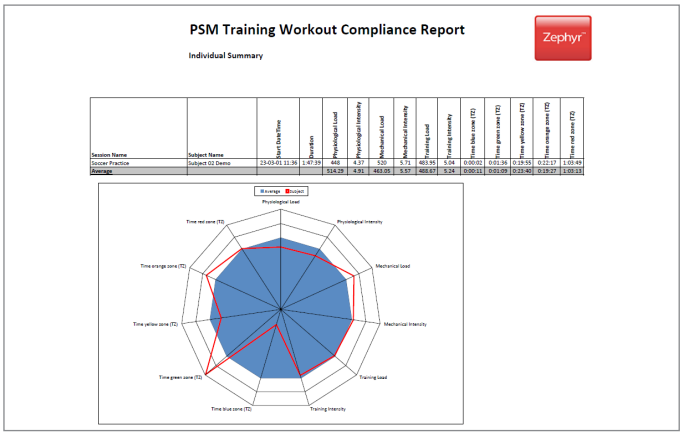
Session Name	Subject Name	Start DateTime	Duration	Physiological Load	Physiological Intensity	Mechanical Load	Mechanical Intensity	Training Load	Training Intensity	Time blue zone (TZ)	Time green zone (TZ)	Time yellow zone (TZ)	Time orange zone (TZ)	Time red zone (TZ)
Soccer Practice	Subject 02 Demo	23-03-01 11:36	1:47:39	448	4.37	520	5.71	483.95	5.04	0:00:02	0:01:36	0:19:55	0:22:17	1:03:49
Soccer Practice	Subject 03 Demo	23-03-01 11:36	1:47:41	663	6.26	539	6.12	601.10	6.19	0:00:05	0:00:36	0:09:17	0:10:43	1:27:01
Soccer Practice	Subject 04 Demo	23-03-01 11:36	1:47:39	417	3.91	306	4.40	361.35	4.16	0:00:02	0:00:07	0:42:56	0:19:22	0:45:12
Soccer Practice	Subject 05 Demo	23-03-01 11:36	1:47:41	529	5.10	487	6.06	508.29	5.58	0:00:34	0:02:17	0:22:33	0:25:27	0:56:51
Average				514.29	4.91	463.05	5.57	488.67	5.24	0:00:11	0:01:09	0:23:40	0:19:27	1:03:13
Standard deviation				109.84	1.02	107.03	0.80	98.75	0.86	0:00:15	0:00:58	0:14:04	0:06:20	0:17:37
SIGNIFICANTLY HIGH:				624.13	5.93	570.09	6.37	587.42	6.10	0:00:26	0:02:07	0:37:44	0:25:47	1:20:50
SIGNIFICANTLY LOW:				404.45	3.89	356.02	4.77	389.92	4.38	0:00:00	0:00:11	0:09:36	0:13:07	0:45:36

- Sessions are listed individually (no aggregation).
- Sessions can be for the same subject or a mixture of subjects.
- Cell coloring is as previously described.

Note

The Training Zone data is **not** cross-correlated with the relative proportions of each zone directed in the original workout, if selected from the Training Workouts. Thus comparisons in zone demographics can only be made between subjects in the report, and not related back to the demands of the original workouts.

Subject Tab



PSM Training Workout Compliance Report

Zephyr™

Individual Summary

- Each record in the SummarySession tab is represented in a separate subject tab.
- The data table shows the individual session and the average values for the report.
- The radar plot shows average values for all sessions (blue solid) against the individual subject (red polygon).

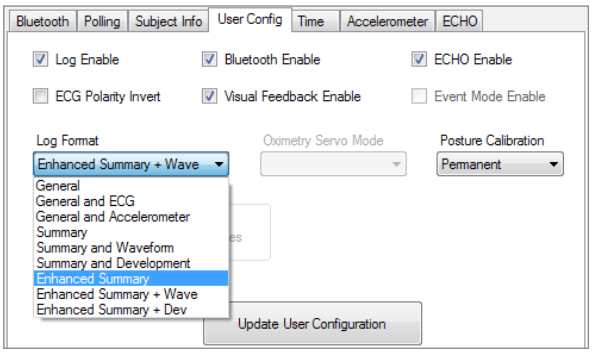
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
> Overview
> Zephyr™ Downloader
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

LOG DATA
Overview (1/5)

Overview

When new BioModules are shipped:

- Logging is enabled.
- The default logging format is **Enhanced Summary** (see Appendices 3 & 4 for complete descriptions of all the log formats).
- Log format is configured using the **Zephyr™ Config Tool**. Refer to the **OmniSense™ Tools** topic.



Log Format	Brief Description
Enhanced Summary	1 Hz data (default log format)
Enhanced Summary & Waveform	Additional 250Hz ECG + 100Hz Accelerometry [+ 1 Hz GPS]
Enhanced Summary & Development	Additional 1KHz ECG + 50 Hz Accelerometry, no GPS

Other legacy log formats are also available - General log and its variants.

Note

Waveform data is not viewable, or stored in the OmniSense™ database. It must be accessed by external files generated by the **Zephyr™ Downloader** tool.

Note

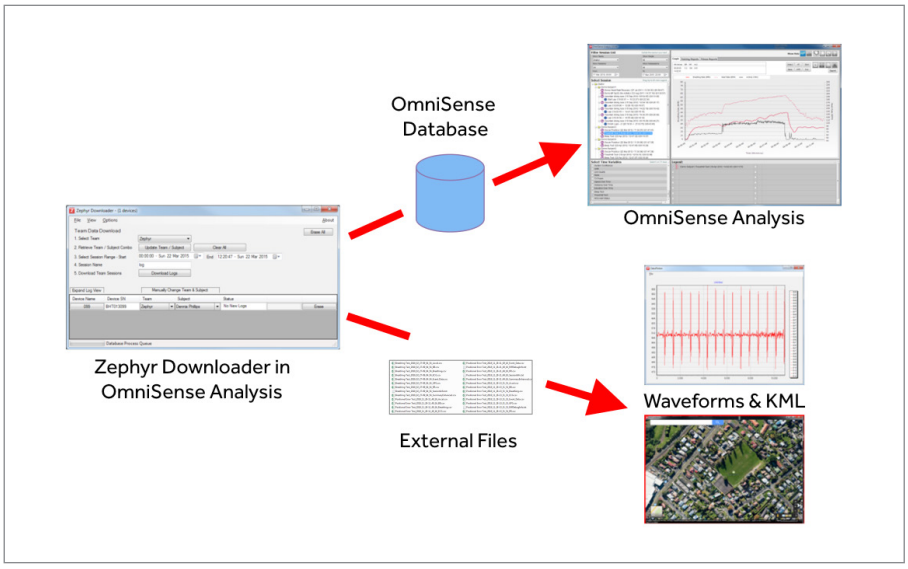
Data logging frequencies are as stated above, and are not dependent on radio network type or ECHO Mode.

Caution

When the log format is reconfigured in a BioModule, memory is reformatted and all previous logs are deleted. Thus all important log data should be downloaded before the log format is changed.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
> Overview
> Zephyr™ Downloader
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

LOG DATA
Overview (2/5)



- A menu option in the Zephyr™ Downloader will cause external files to be generated when data is imported from the BioModule into OmniSense™ Analysis.
- All log data is generated to the external files - 1 Hz data + waveforms and others.
- Four formats of external file are available.

External File Format	Description
CSV	Default external format. A separate file for each reporting frequency is generated, for asynchronous HR beat-beat and BR breath-breath data, and for waveform data.
DaDISP	Binary files in .HED/.DAT pairs, specifically for import into DaDISP™* Data Analysis software
KML	GPS data, for import into Google Earth™*, if a supported GPS has been used.
TXT	Metadata - Session Info & debug data, generated automatically when CSV format option is selected.

Note

CSV files will open by default in Microsoft™* Excel™*, making available all of the functionality of this application. However, Microsoft™* Excel™* graphs are limited to 32,000 data points. This equates to approximately 5 minutes of ECG waveform data, so graphing large ECG data sets is not possible. The csv files must be imported into other 3rd party applications designed for large data sets.

Zephyr™ provides a script for importing ECG data into Matlab™* software, available from www.zephyranywhere.com

The Zephyr™ Data Plotter, available from the same website, can also be used. It is described in the **OmniSense™ Tools** section

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
> Overview
> Zephyr™ Downloader
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

LOG DATA
Overview (3/5)

Log Download Times



- Download data via a 50 BioModule Charge Case (shown above), single- or 5-device cradles.
- The 50 BioModule Charge Case has 5 separate USB connectors to allow parallel download of 5 vertical banks of 10 devices. The USB connector must be manually moved between case connectors. This is a limitation of Microsoft™* Windows™*, which will not handle more than 10 simultaneous USB connections reliably.
- A menu option can configure the Downloader tool to detect powered-on BioModules via Bluetooth™*, and will download logs via Bluetooth™*. This method takes 5-10 times longer than direct USB connection, due to Bluetooth™* bandwidth limitations.

Log Format	1 Device	5 Devices	10 Devices	50 Devices
Enhanced Summary	12 sec	15 sec	50 sec	6 min
Enhanced Summary + Waveform	45 sec	65 sec	95 sec	9 min

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
> Overview
> Zephyr™ Downloader
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

LOG DATA
Overview (4/5)

BioModule Logging Capacity

- The Summary format is an extended format compared to General.
- Enhanced Summary contains extended accelerometer data (BioModule 3.0 only, firmware version v1.4.12.0 onwards).

Log Format	Total Logging Capacity (Hours)
Summary	450
Summary & Waveform	60
Summary & Development	30
Enhanced Summary	450
Enhanced Summary & Waveform	60
Enhanced Summary & Development	30

Caution

When BioModule memory has reached capacity, the processor will start to overwrite the oldest logs. As soon as an older log has been partially overwritten, it is no longer available for download.

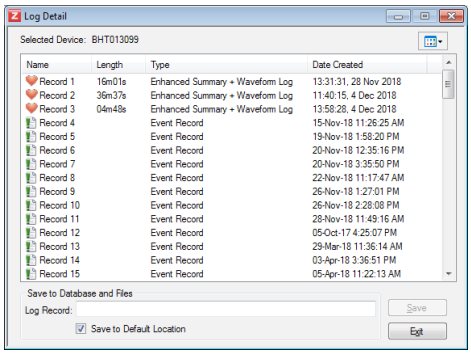
Caution

Changing the log format in a BioModule erases all existing logs. Download old logs first if they are important.

Note

It is good practice when using BioModules for research studies, to download the logs as often as possible, rather than use the BioModules as storage devices for log data.

- The **Log Detail** dialog, accessed from the **Zephyr™ Downloader** tool, can be used to directly view/download all logs on a device to ascertain current memory use.

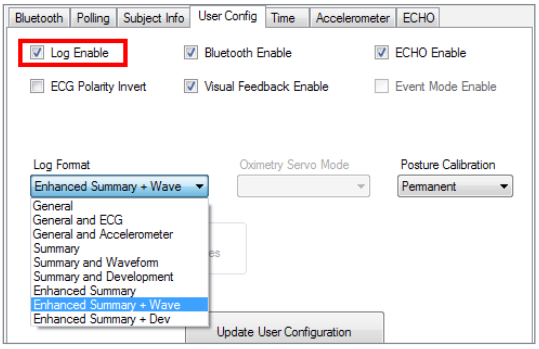


CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
> Overview
> Zephyr™ Downloader
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

LOG DATA
Overview (5/5)

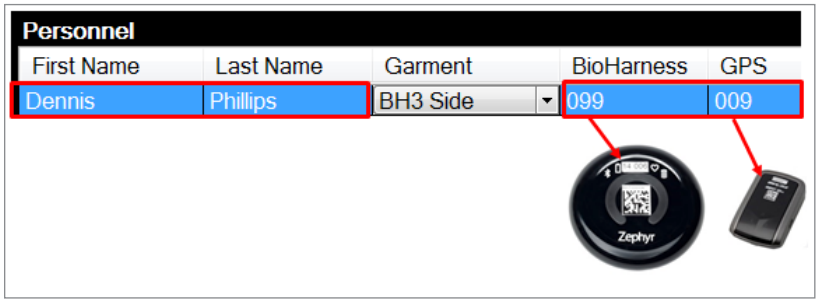
Logging Configuration Checklist

1. The BioModule must be configured to log (**Log Enable** is the default configuration for shipped BioModules).



2. Log Format: **Enhanced Summary** for general use, **Enhanced Summary + Wave** for use with a GPS.

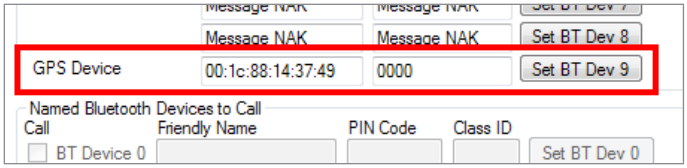
3. GPS should be assigned to the subject in OmniSense™. When used over ECHO, the GPS MAC address will be configured into the BioModule (otherwise this must be done manually - see **OmniSense™ Tools** section).



Caution

When a BioModule and GPS are assigned to a subject in OmniSense™ and the hardware deployed Live in an ECHO session, the GPS MAC address is relayed to the BioModule over ECHO, so they can communicate with each other over Bluetooth™*. This configuration is saved in the BioModule. However, if the BioModule is subsequently used over ECHO with no GPS assigned to the subject, then the previous GPS MAC address is overwritten with the value 00:00:00:00:00:00.

The GPS must be re-assigned to address. This will enable continued GPS use..



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
> Overview
> Zephyr™ Downloader
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

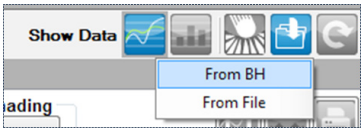
LOG DATA
Zephyr™ Downloader (1/5)

Overview

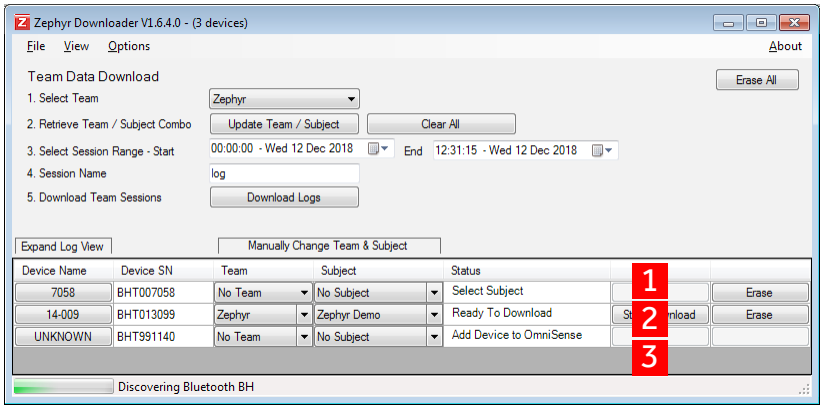
- Connect BioModules to the host PC in charge cradles or a 50 BioModule Charge Case:



- Start the Downloader using the **Launch Log Downloader** button, selecting the **From BH** option.



- BioModules **must** be assigned to a subject who exists in the database - the log data must be associated with a subject.
- The Downloader is designed to streamline download of logs from a set of devices assigned to the members of a currently-deployed team in OmniSense™ Live. If devices are not assigned to deployed subjects, then they may have to be assigned manually in the Downloader.



#	Status	Description
1	Select Subject	Device assigned to subject not in the selected Team. Select Team/Subject manually.
2	Ready to Download	Logs present which have not been downloaded.
3	Add Device to OmniSense™	Device does not exist in database. Must first be added using OmniSense™ **Live > Setup > Hardware**

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
> Overview
> Zephyr™ Downloader
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

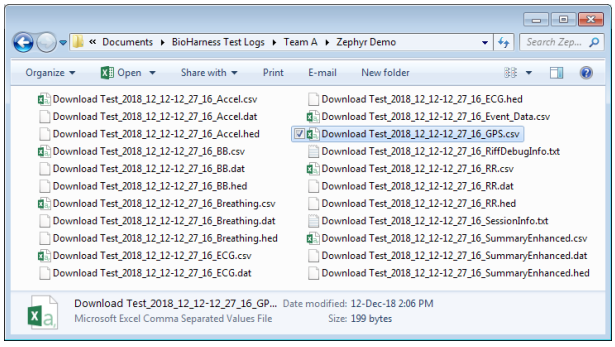
Downloader Menu Options

Menu Item	Description
File/Exit	Exit downloader
View/Show Wizard	Hide Show top panel with 1-5 step 'Wizard'.
Options	
Retry on Error	Automatically retry download if interrupted.
Synchronize Device Clocks	Synchronize BioModule internal clocks on connection. Recommended.
Autodownload Configured Units	If all units are assigned to members of a currently-deployed team, then team and subject will be selected automatically, and download initiated.
Auto Erase after Download	Erase logs after download.
Auto Discover Bluetooth Device	Search for Bluetooth™* devices. To be used when more than 10 devices require downloading. BioModule firmware version must support Bluetooth™* download of logs.
Write CSV Format Log Files	Generate external CSV files of logs.
Write DaDISP Format Log Files	Generate external .HED/.DAT files of logs.
Write GPS Data to KML File	Generate KML files of GPS data.

- Logs which have previously been downloaded to the database are not re-downloaded.
- External files (all types) are downloaded to the location

  My Documents > Bioharness Test Logs > Team > Subject

  where the **Team** and **Subject** directories will be created. If the subject is not in a currently deployed team, the logs will be saved to a '**No Team Assigned**' directory.
- An example of a set of external CSV & DaDISP Files saved externally



The **Session Name** was set to **Download Test** in the Downloader wizard.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
> Overview
> Zephyr™ Downloader
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

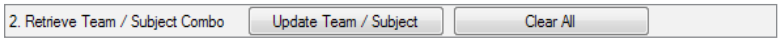
Zephyr™ Downloader Operation

- Connect BioModules to PC using 50 BioModule Charge Case. Any other BioModule powered on will be detected over Bluetooth™* if the option is selected.

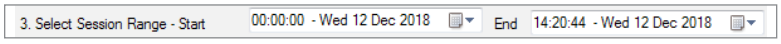
Team Data Download Wizard



1. **Select Team**
If all, or most of the BioModules connected are assigned to members of the same team, select the team from the pull down list.



2. **Retrieve Team/Subject Combo**
Clicking the **Update Team/Subject** button will populate the **Team** and **Subject** entries for all the listed BioModules automatically. Any devices assigned to subjects not in the selected team will have these entries as **No Team** and **No Subject**. They must be selected manually. A different team can be selected.



3. **Select Session Range**
The **Start** field defaults to midnight at the start of the current day. Only logs not previously downloaded will be imported.



4. **Session Name**
This name will appear in Analysis, and can be used in the **Filter Session List** to locate the session. It also prefixes all externally exported file names. Sessions in Analysis and external files can be renamed at any time to suit. The default is '**log**'. A user-set name is recommended.



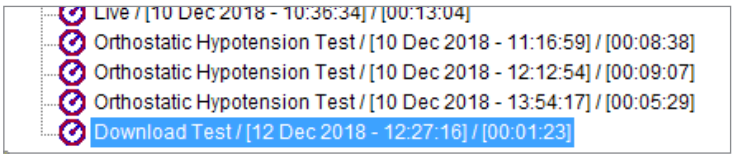
5. **Download Team Sessions**
When steps 1-4 have been completed, devices with logs for download will display '**Ready to Download**' in the status field. Manually select **Team** and **Subject** for any entries not populated automatically. Selecting the **Download Logs** button initiates download of outstanding logs for all devices.

Caution

Care should be exercised when manually selecting subjects for log download. The system has no way of validating that the correct subject is chosen. If the wrong subject is selected in error, then data will be associated that subject. This can be corrected - if the error is realized - later in Analysis, by reassigning the session to a different subject.

Note

Selecting the **Session Name** appropriately will make for much easier retrieval of log data later.



'**Download Test**' in this example is descriptive, but too generic. '**Download Test #001**' would be more flexible, should more tests be likely.

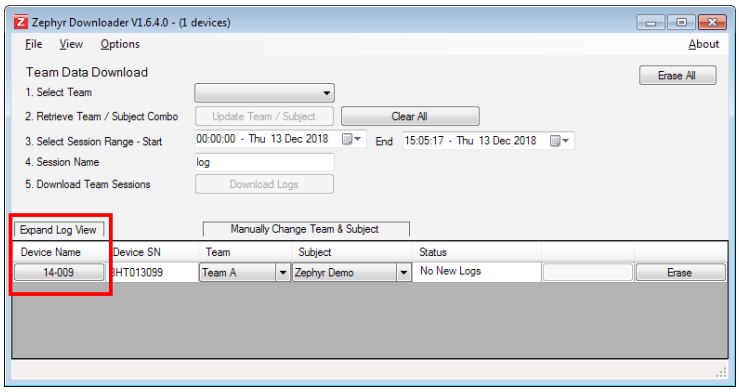
Note

If duplicate entries for any BioModule appear in the list of BioModules, disconnect the USB cable connecting the PC to the charge cradle or 50 BioModule charge case. Wait a few seconds, then reconnect the USB cable. Duplicate entries should no longer appear.

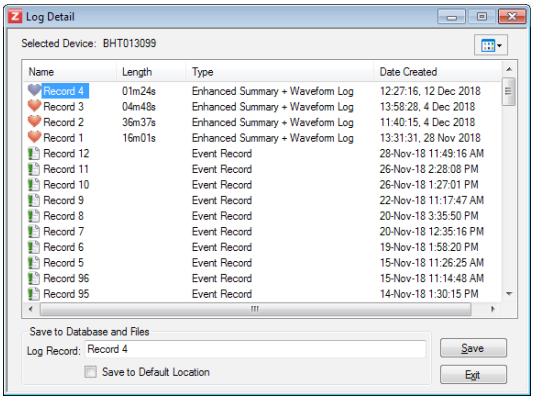
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
> Overview
> Zephyr™ Downloader
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Expand Log View

When a known device is detected by the Downloader, a button will appear in the first column of each entry. This button will display all the logs in the device.



1. Click on the button for a device to display the **Log Detail** window.



The window shows all logs currently on the device, with log format, duration, and date saved.

2. Select any record to save to database, and generate external CSV files. They will be saved the default location of **My Documents/BioHarness Test Logs/Team/Subject** unless **Save To Default Location** is unchecked.

3. **Event Record** log files are not erased when logs are erased, or log file format changed. They contain event information and can be downloaded for reference.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
> Overview
> Zephyr™ Downloader
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Auto Download

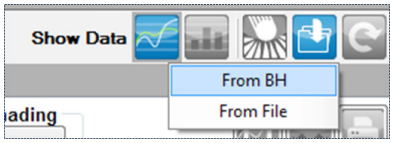
The Zephyr™ Downloader has been designed to streamline log download from multiple devices, but there are some pre-requisites:

- All BioModules are assigned to a Team which is **currently deployed in Live mode** – the data will be associated with the subject the BioModules are currently assigned to.
- The logs are downloaded on the day they are recorded (otherwise Session Start Time will have to be selected manually.)
- Selecting the menu option **Auto Download Configured Units** (it is unchecked by default) will cause all new logs to be downloaded automatically.
- If **Auto Discover Bluetooth Device** is also checked, all BioModules in the case not located in USB-enabled bays will have logs downloaded over Bluetooth™*.

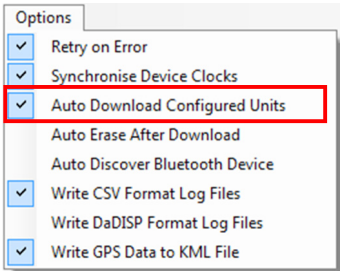
1. Locate all BioModules in 50 BioModule Charge Case.



2. Start the Zephyr™ Downloader.



3. Check the menu option **Auto Download Configured Units**.



4. All new logs will be downloaded automatically with no further input.

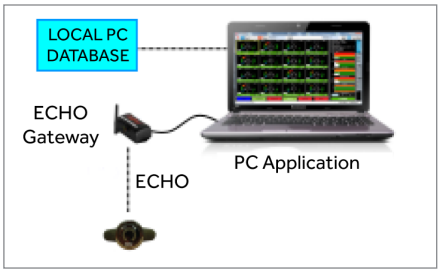
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

OmniSense™ Local & OmniSense™ Cloud

OmniSense™ Local

OmniSense™ Local exists solely on the PC on which it is installed. The components are:

- OmniSense™ Live
- OmniSense™ Local Database
- OmniSense™ Analysis
- Tools

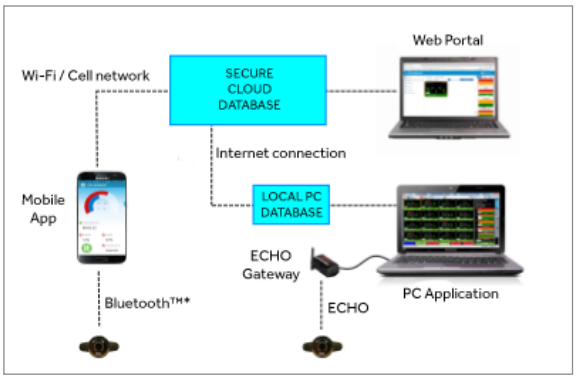


Use of the software requires the payment of a one-off license fee.

OmniSense™ Cloud

OmniSense™ Cloud features all the components of OmniSense™ Local but in addition has:

- OmniSense™ Web Portal
- OmniSense™ Secure Cloud Database
- OmniSense™ Mobile Application



Use of Software requires an annual subscription, which depends on the preferred level of service and product mix.

- A customer Account Administrator will create accounts for individual users.
- Users with the appropriate permissions can connect to the Cloud database from within OmniSense™ Live or Analysis on a PC.
- Data from subscribed users will be automatically uploaded from the local to the cloud database (it will exist in both locations).
- Users with the appropriate permissions can access the cloud data via the web portal.
- Subscribed users can use OmniSense™ Mobile, along with a BioModule or HxM device communicating via Bluetooth™* Low Energy to the mobile device, to upload data directly to the cloud database.

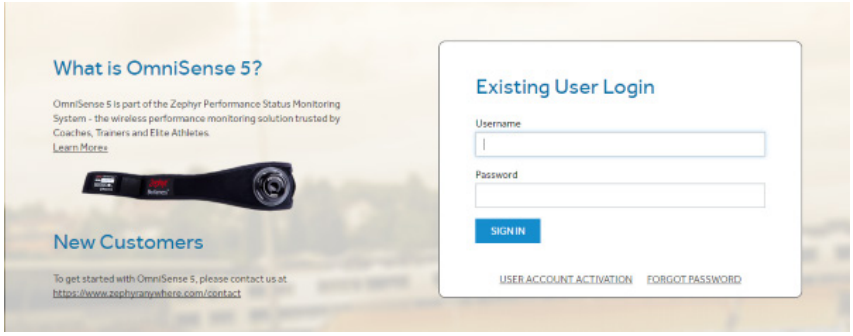
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Portal Access

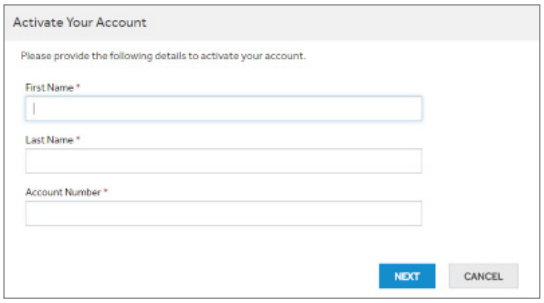
Prior to access, users must supply an email to their Account Administrator.

They will receive an email supplying a **Username**, **Password** and **Customer Number**.

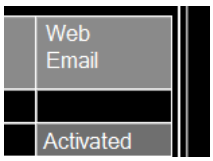
- To access the web portal, go to **https://os.zephyranywhere.com/om/login**.



- First access to the portal will require a user to activate their account.



- Once activated, this is recorded in their details in the **Setup > Subject** tab in the local OmniSense™ Live.



The data that users will be able to access on the portal will depend on the permissions they have been allocated by their Account Administrator.

- Athletes may be able to see their own data only.
- Coaches, Manager and Trainers may have wider access.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

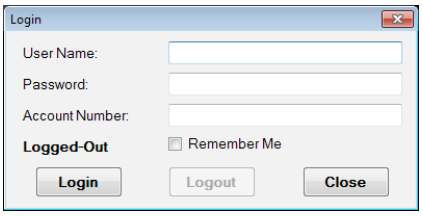
Connecting OmniSense™ Local to the Cloud

Both Live and Analysis local instances may be connected to the cloud database if a customer account exists. In both cases, there is an online/offline button in the application toolbar.



Offline

When this is selected, a **Login** dialog will display.



The user should enter the **Username**, **Password** and **Account Number** with which they originally validated their account. The Account Number will then be saved, so need not be remembered for subsequent logins.

The toolbar button will change to reflect their connection status.



Online

Note

An internet connection is required to connect to the cloud database.

Note

OmniSense™ users who have never subscribed to a cloud account will still see the offline/online button on their application tool bars, and the login dialog will display, but it is redundant without a valid customer account number.

Note

When a Live instance of OmniSense™ is connected to the cloud, two things will happen:

- User fitness parameters - which may have been updated remotely when using fitness or readiness tests in the OmniSense™ Mobile application, will be updated in the local database.
- Live streaming data (from subscribed users only) will be automatically uploaded to the cloud database. It will also exist in the local database. Non-subscribed users may coexist in a Live session, but their data will not be uploaded.

Note

When an Analysis instance is connected to the cloud:

- Any data which has been uploaded to the local database from BioModule log sessions from subscribed users, will be uploaded to the cloud database. It will continue to exist in the local database.
- At no point is any subject data ever downloaded from the cloud database to a local database, nor can it be. This is a security measure.

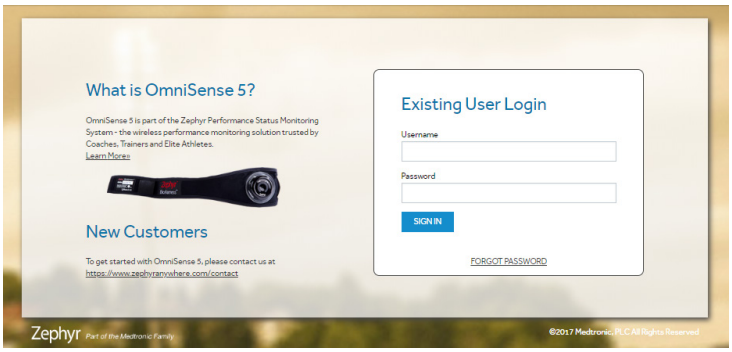
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Lost Password

If a password is forgotten, you will need to return to the web portal itself.

https://os.zephyranywhere.com/om/login

- Enter your username into the login, and click on the **FORGOT PASSWORD** link below the **Sign In** button.
- An email will be sent to the email address you have opted to associate with OmniSense.



- For a forgotten username, contact your customer account administrator or coach. They can access your user name, but not the password.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

How Accounts Work

Definitions

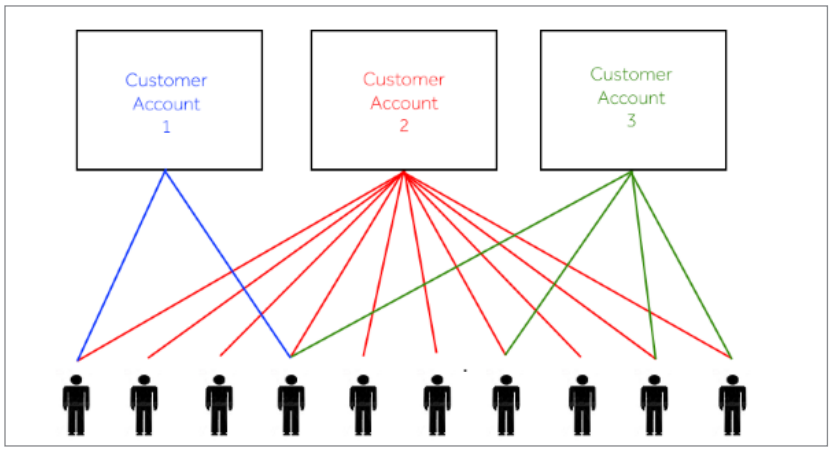
Term	Description
Account	Client name for each customer.
Subscription Fee	Each account will have an affiliated monthly fee for each System, Administrator and Subject.
Subjects	Number of users in the system that are being monitored. Subjects can only view their own data, and not anyone else's.
Administrators	Number of back end admins who will have access to the data and who will be able to define who actually sees all, some or none of the data.
Reports	Customized or standardized graphs, spreadsheets or trends which are downloaded from the customer's data, and sent to the customer based on their viewing contract. An example would be five reports pulled for mechanical loads weekly.
Hardware	Zephyr™ product such as the straps, BioModules, gateways, etc., that make up the performance monitoring solution.
OmniSense™ Local	Local version of OmniSense™ running in conjunction with 5.X version.
Training	On-site Zephyr™ professional support for new customers learning the system.

- If a user wants to withdraw from acceptance of terms or wants their own user profile and data permanently deleted from the database for any reason, they can send a written request by email to support (**zephyrperformancesupport@medtronic.com**) originating from the email address associated with the user account. If the user profile is shared between multiple customer accounts, it must be specified which account's data (or all) should be deleted or retained. The support team will complete the action and send a reply email to the user to confirm completion.
- When you log in on the mobile or PC application, you will have to choose which account, if you are a member of more than one.

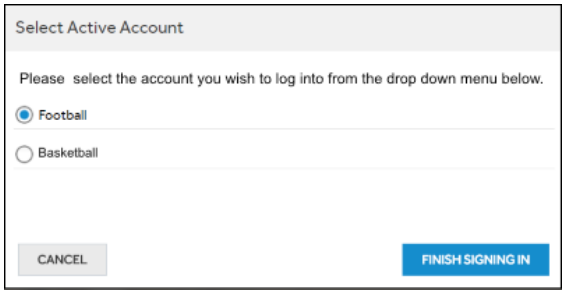
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Overview (6/8)

- Each account can have multiple users & multiple roles.



- A user can be a member of multiple accounts (team, personal trainer etc.).
- If you are a member of multiple accounts, you will be prompted on login as to which to use, on a PC or using the Mobile Application.



- When logged on, any data uploaded is only uploaded to one account.
- You cannot transfer data between accounts.

Note

All account, user and session data is securely encrypted.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

User Roles and Permissions

- Different roles of user have different sets of permissions within an account, from **Administrator** to **Athlete.**
- The roles below are optional - they need not all be used.
- These roles can be customized, and additional roles created, by the **Admin** as needed.
- First and Last name must be unique to each user.

Pre-configured Roles

Role	Description
Admin	A customer user who has access to view and support a specific customer account with all customer permissions.
Assistant Coach	Has access to view a specific customer account with all customer permissions except Manage Account Settings & Defaults, Manage Roles and Manage Teams by default, with Include as Athlete enabled.
Athlete	Has access to view their own data, view Training Plans, view Workouts, view Live (own data only) and Included as Athlete.
Data Analyst	Has permissions to view all data, Workouts and Training Plans for any team they are assigned, and can Manage Reports and Dashboards for the same.
Head Coach	Has access to view a specific customer account with all customer permissions by default, with Include as Athlete enabled.
Team Captain	Has access to view own and View Team Data and View Workouts, Training Plans and Dashboards assigned to their own team(s).
Team Manager	Has all permissions except Manage Account Settings and Defaults, Manage Roles, Manage Teams, Manage Users, Manage Workouts and Manage Training Plans.
Undefined User	No permissions - existing users moving to a new account are automatically assigned this type until the new account Admin assigns their user role and permissions manually.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Overview (8/8)

Permission Specifics

	Admin	Assistant Coach	Athlete	Data Analyst	Head Coach	Team Captain	Team Manager	Undefined User
Manage Account Settings & Defaults	•				•			
Manage Roles	•				•			
Manage Teams	•				•			
Manager Users	•	•			•			
View Team Data	•	•		•	•	•	•	
View Own Data	•	•	•		•	•	•	
View Training Plans	•	•	•	•	•	•	•	
View Workouts	•	•	•	•	•	•	•	
Manage Workouts	•	•			•			
Manage Training Plans	•	•			•			
Manage Reports & Dashboards	•	•		•	•		•	
Include as Athlete		•	•		•	•	•	
Include as Coach	•	•		•	•		•	
View Live	•	•	•		•	•	•	
View Device	•	•			•	•	•	
Manage Device	•	•			•	•	•	

- This user/permission matrix is pre-configured in the web portal, and a user type selected from a pull down list will have the permissions above allocated automatically.
- Any user can be individually customized later by the Account Administrator.

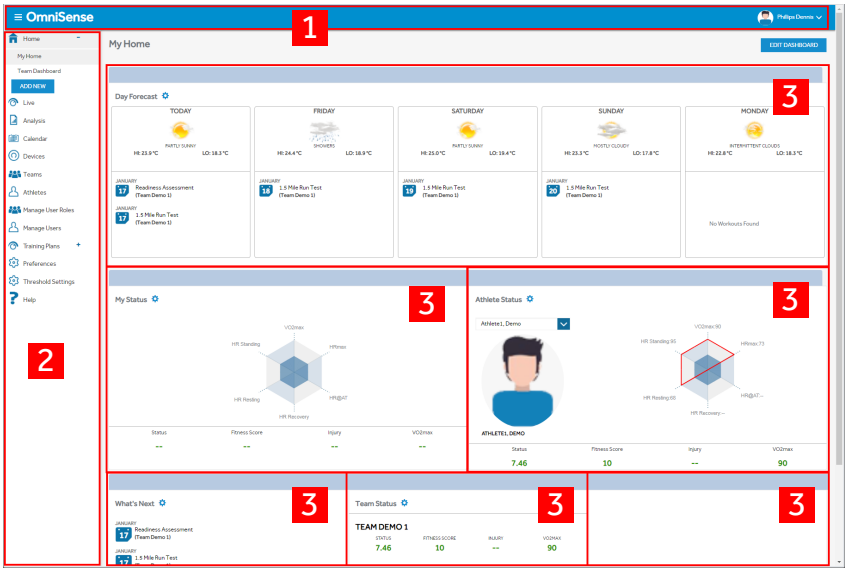
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Home Screen (1/4)

Dashboard

On initial login, a user will be presented with their **Home** screen. The main panel within this is a **Dashboard**.

- The dashboard consists of an array of **Widgets** which can dynamically update their data at each login.
- The appearance of the dashboard will depend on the permissions granted the logged in user - an **Administrator** or **Coach** will have access to more information than an **Athlete**.
- The dashboard layout is completely configurable.



- The dashboard provides an overview of ongoing training programs, and performance and status of teams and individuals within those training programs.
- Workouts assigned to athletes within a training program are automatically pushed out to mobile devices hosting OmniSense™ Mobile.

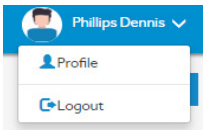
#	Description
1	Header - maximize or minimize menu panel, show own profile, log out.
2	Navigation panel to access all other screens.
3	Dashboard array of 'widgets' - components which display a variety of summary aspects of training plans , team and individual performance.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

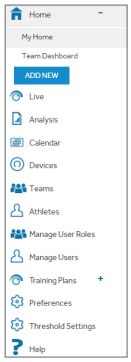
Dashboard Header & Navigation

Header

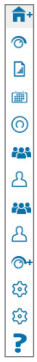
There are three active components in the header:

Item	Description
	Maximize or minimize (icons only) the navigation pane.
	Click to return to dashboard from other screens.
	Display own Profile, or log out.

Navigation



Maximized



Minimized

Item	Description
	Link to a specific screen. Not all users will see all items, depending on permissions.
	Click to expand the navigation item to view sub-items. A ' - ' will display, to collapse the item.
	Add new navigation item such as an additional dashboard.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Configure Dashboard

The dashboard consists or an array of rows of widgets. Each row can be configured to show 1,2 or 3 widgets. Some widgets require full row width for display.



A newly-created dashboard, using the Add New button, with no rows or widgets.

Note

All widgets update dynamically with the latest available data, according to their settings.

ROW 1		
Widget 1		
ROW 2		
Widget 2	Widget 3	Widget 4
ROW 3		
Widget 5	Widget 6	Widget 7
...add additional rows and widgets		

- A scroll bar on the right side of the screen will allow continuous expansion of a dashboard if needed.

Item	Description
EDIT DASHBOARD	Enter Edit mode to add or remove rows and columns for more widgets.
My Home	Edit the dashboard name, in Edit mode.
Add a Row	In Edit mode, Add a Row. A dialog will prompt for how many new rows and how many columns in each.
Delete Row	In Edit mode, delete a row and all the widgets in it.
	In Edit mode, delete a specific widget.
	In Edit mode, show the settings dialog for a specific widget.
Add Widget	In Edit mode, an Add Widget button will appear in each column of a newly created row.
EXIT EDIT MODE	Exit Edit mode.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Add/Configure Widget

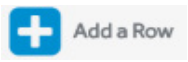
1. First select the **Edit Dashboard** button to enable editing.



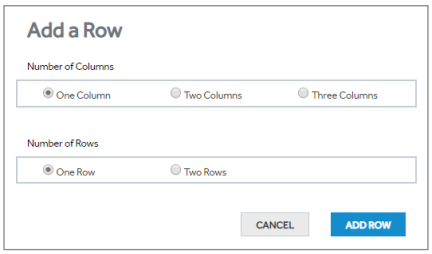
2. If space is available in an existing row, select the **Add Widget** button.



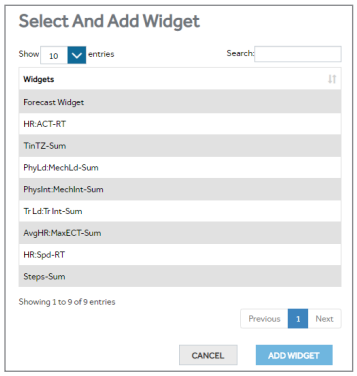
3. If no space is available, select the **Add Row** button at the foot of the dashboard.



4. An **Add a Row** dialog will display. Select the preferred number of rows and columns. They can easily be deleted at any time.



5. After selecting **Add Widget**, a **Select and Add Widget** dialog will display.



Select the preferred widget (described in the next section), and **Add Widget**.

6. A widget will be selected, but it may need configuration before anything displays. Click on the **Settings** cogwheel beside the widget name.



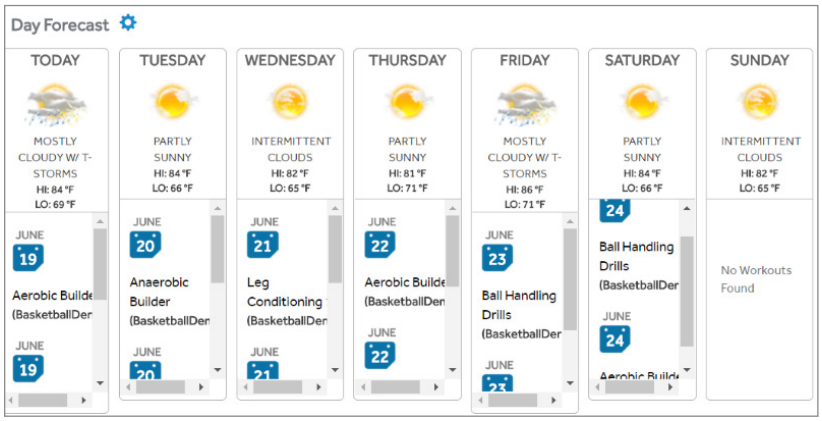
Note

Some widgets e.g. **Forecast**, may only be available if the **Number of Columns** is 1.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

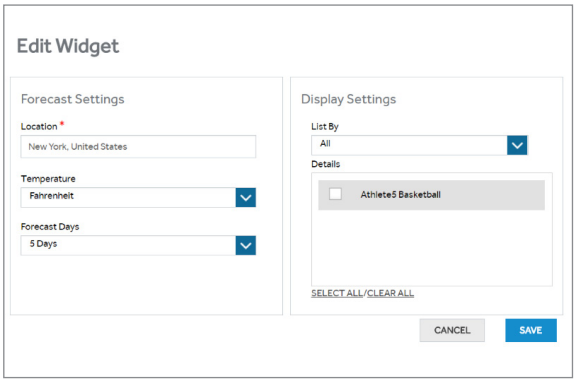
OMNISENSE WEB PORTAL
Default Widgets (1/5)

Forecast



- Weather for chosen location.
- Assigned workouts, if any.
- Only available in a single-column row.

Edit Widget 

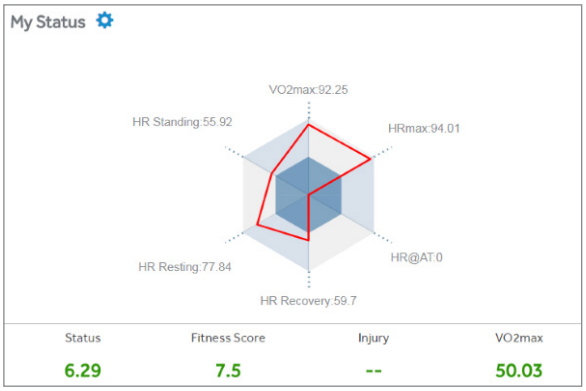


Component	Description
Location	Select from list.
Temperature	Fahrenheit or Celsius.
Forecast Days	3, 5 or 7 days ahead.
List By	All, Teams, No Team Assigned, Myself.
Details	Check the athletes whose workouts should be displayed.
SAVE	When saved, the filter settings will be retained, and the data updated each time you log in again. Re-edit the widget to update the settings at any time.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

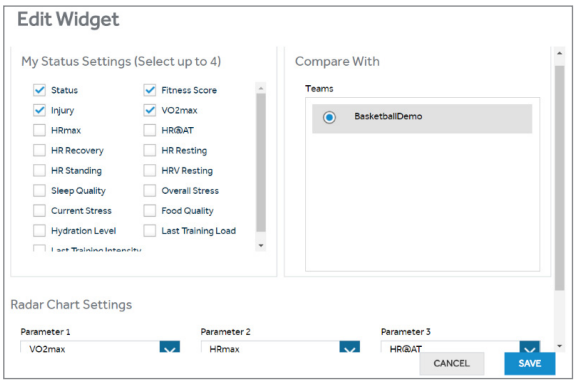
Default Widgets (2/5)

My Status



- A radar chart showing your own (or selected athlete, if coach) choice of 6 performance parameters (red line) versus a selected team (dark & light polygons).
- Team data polygons - the boundary between inner dark and outer light polygons is the team average.
- Axes are scaled per parameter, with the outer edge of the polygon representing the 'best' value captured for that parameter, e.g. a low Standing HR is deemed better than high. Thus a red line which is always outside the inner dark polygon reflects performance above team average in all parameters.
- Four selectable parameters display performance measures below the radar chart.

Edit Widget

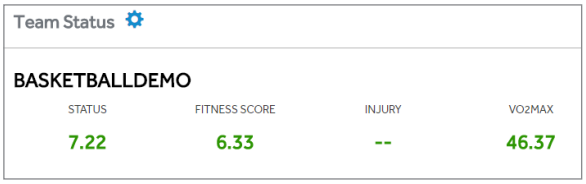


Component	Description
My Status Settings	Select up to 4. They will display below the radar chart
Compare With	Select a Team from those available for comparison (the solid polygons in the radar chart)
Radar Chart Settings	Select the parameters to display on the radar chart
SAVE	When saved, the filter settings will be retained, and the data updated each time you log in again. Re-edit the widget to update the settings at any time.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
>Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

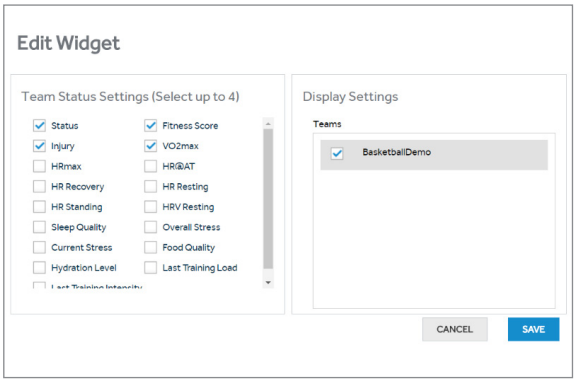
Dashboard Widgets (3/5)

Team Status



- Four selectable parameters display team performance measures.
- Only available to those with appropriate permissions.

Edit Widget

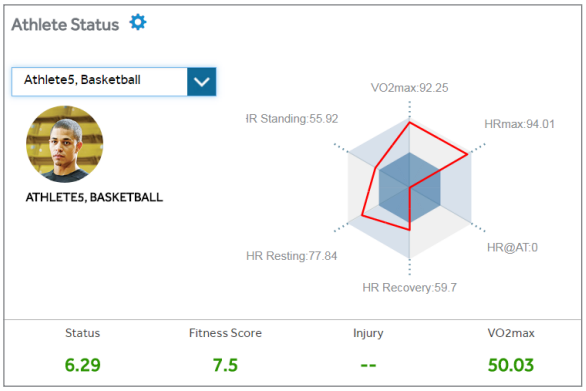


Component	Description
Team Status Settings	Display up to four parameters from the list (default selections are shown).
Status	Average of most recent Readiness Assessment and most recent Fitness Assessment for all team members.
Fitness Score	Most recent Fitness Assessment score average for all team members.
Injury	Most recent input from Readiness Survey submission average for all team members.
VO_2max	Most recent result saved from Fitness Assessment analysis for all team members.
Display Settings	Select a team from those available.
SAVE	When saved, the filter settings will be retained, and the data updated each time you log in again. Re-edit the widget to update the settings at any time.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

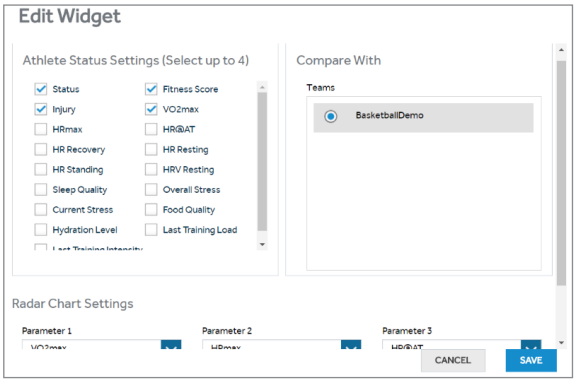
Default Widgets (4/5)

Athlete Status



- A radar chart showing performance parameters (red line) versus a selected team (dark /light polygons) of selected athlete.
- Team data polygons - inner dark section is below mean value, outer light polygon shows above mean to maximum value.
- Axes are scaled per parameter, with the outer edge of the polygon representing the 'best' value captured for that parameter, e.g. a low **Standing HR** is deemed better than high.
- Four selectable parameters display performance measures below the radar chart.

Edit Widget



Component	Description
My Status Settings	Select up to 4. They will display below the radar chart.
Compare With	Select a Team from those available for comparison (the solid polygons in the radar chart). Only available if you have permission to access other team's data.
Radar Chart Settings	Select the parameters to display on the radar chart.
SAVE	When saved, the filter settings will be retained, and the data updated each time you log in again. Re-edit the widget to update the settings at any time.

Note

The **Athlete Settings 'Status'** is the average of the most recent **Readiness Assessment** and the most recent **Fitness Assessment**.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Default Widgets (5/5)

Notes

Not yet implemented.

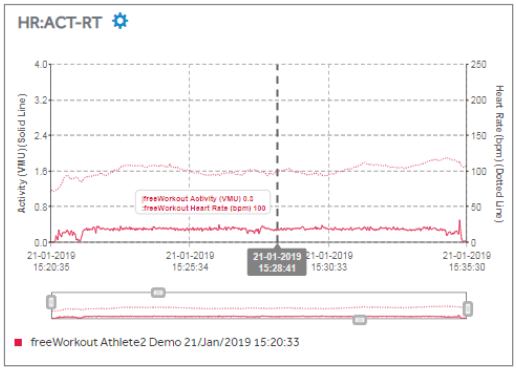
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Custom Widgets (1/6)

Time Graph Widget Example

- Created from the Analysis screen - two parameters from a Time or Summary graph
- Some accounts may already contain custom widgets when they are initiated.
- Naming Convention is 'First Parameter:Second Parameter - RT/ET/Summ'

HR:ACT - RT (Real Time)



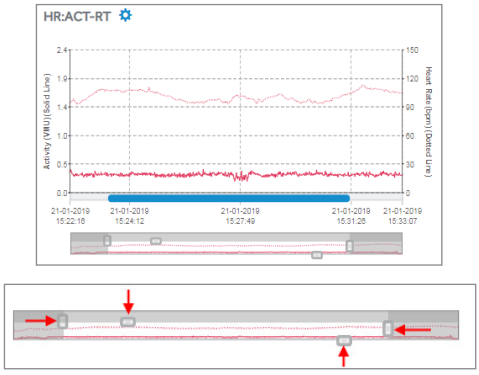
- **Heart Rate** & **Activity Level**, Real Time (not Elapsed Time).
- Sessions and athlete/team filters are fixed, editable in **Edit Widget**.
- Will automatically populate with data for a fixed period to the current date. Default is previous 24 hours.
- Float the mouse cursor over the graph for exact data values.

Note

Time graphs are less suited to use on the dashboard, unless the data is highly filtered, by athlete and activity. This is due to the small screen area available. Time graphs with multiple subjects and activities rapidly become difficult to interpret as traces are added.

Graph Zoom

The feature below the graph uses drag-able handles to allow horizontal and vertical zooming.

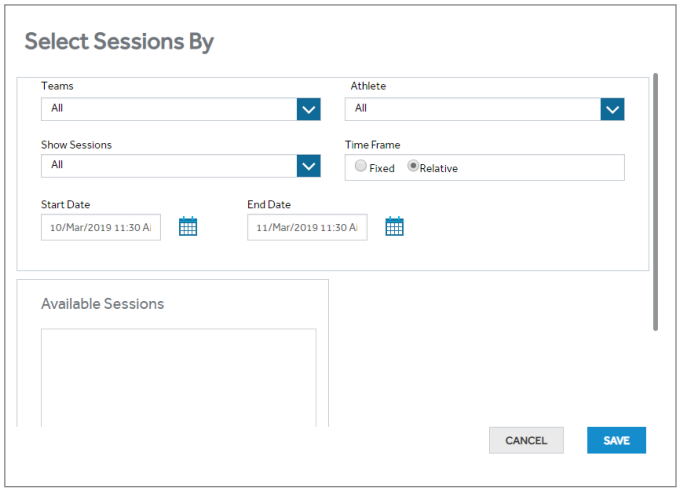


- Drag the handles inwards to zoom in.
- Use the scroll bar to pan the graph left and right.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Custom Widgets (2/6)

Select Sessions



Component	Description
Teams	Select team
Athlete	Select athlete
Show Sessions	Select sessions by name from the **Available Sessions** list.
Time Frame	Fixed - Real Time Relative - Elapsed Time (starts at 00:00:00)
Start Date	Click the Calendar icon to select a date.
End Date	Click the Calendar icon to select a date.
Available Sessions	Shows all available sessions in the date range selected. They can be selected by name from the **Show Sessions** field.
SAVE	When saved, the filter settings will be retained, and the data updated each time you log in again. Re-edit the widget to update the settings at any time. **Cancel** to exit without saving.

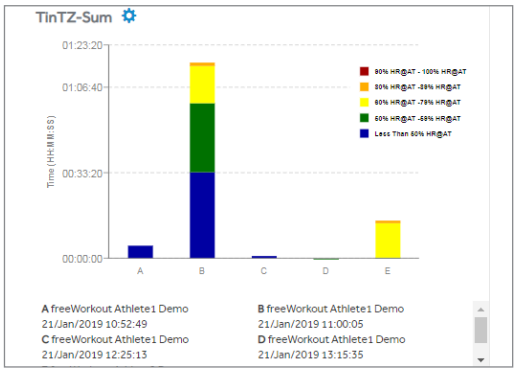
Note

The **Show Sessions** filter only becomes useful if some discipline is exercised in naming sessions, so that they may be easily located.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Summary Graph Widget Example

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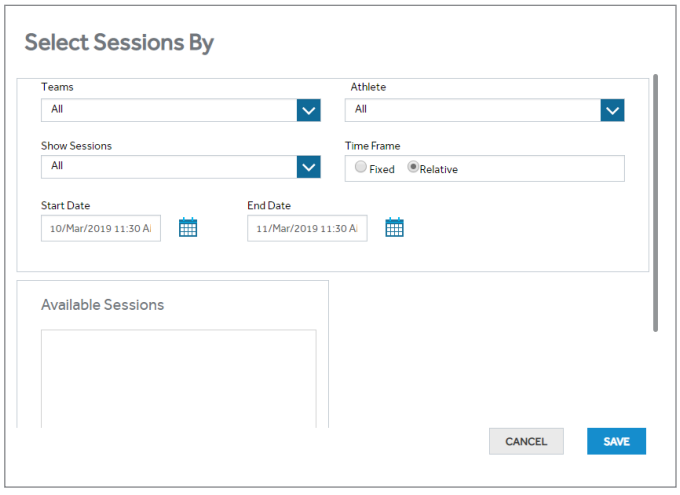


- This example shows a single parameter, **Time in Training Zone**, with a legend.
- Sessions and athlete/team filters are fixed, editable in **Edit Widget**.
- Will automatically populate with data for a fixed period prior to the current date. Default is previous 24 hours.
- Training Zone Thresholds - and all other thresholds, can be configured in the **Threshold Settings** screen of the portal, accessed from the navigation panel. It is only visible to those with appropriate permissions. If the same thresholds are updated from a PC, then the new thresholds will be synchronized in the portal when the PC session is connected online (and vice versa).

Note

Summary graphs are more suitable as dashboard widgets, as the columns do not obscure each other, and are designed for at-a-glance comparisons between athletes or sessions.

Edit Widget



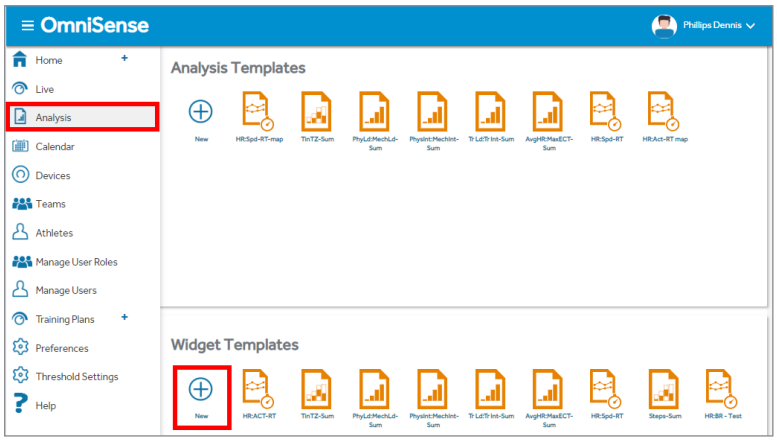
- All editing functionality and fields are as described in the previous example.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

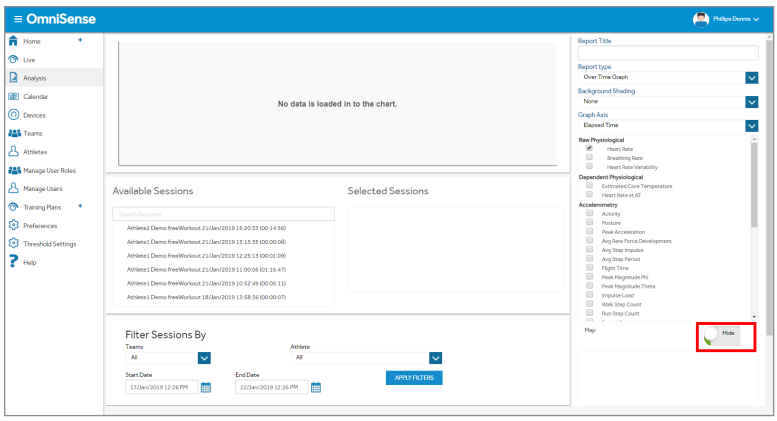
Create a Custom Widget

Custom widgets are created in the **Analysis** screen of the portal.

1. Access **Analysis** from the navigation panel, and select the '**+**' **Add** button in the **Widget Templates** panel.



2. The screen presented is identical to that for creating a new graph to save in Analysis as a template. The process for populating it is identical, but it will be saved as a widget, available for adding to the **Home** screen dashboard.



3. A map panel will be included - not shown above. Switch the map from **Show** to **Hide** using the button on the right. Maps do not display on the dashboard because of the space restrictions. This makes more screen area available for setup of the widget.



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Custom Widgets (5/6)

4. Enter the **Report Title** as preferred. The format Parameter1:Parameter2 - RT/ET/SUM is recommended.



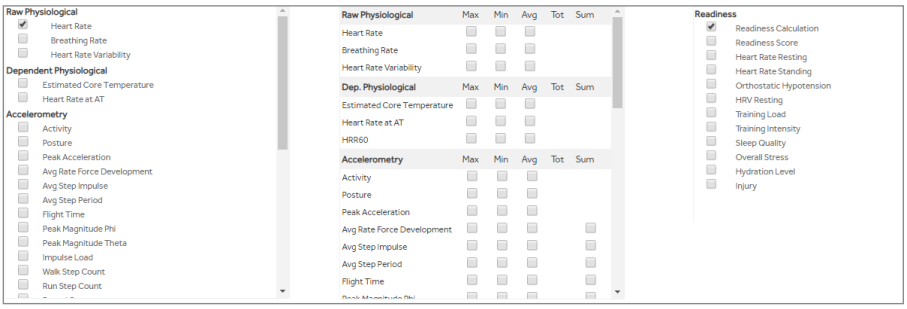
5. Select **Report Type** as **OverTime Graph**, **Summary Graph** or **Readiness Graph**. The list of parameters displayed below will adjust to match.



6. Select **Background Shading** from **None/ROG/Training Zone/Speed Zone** and **Graph Axis** as **Elapsed Time** (ET) or **Real Time** (RT). These options are available for **Over Time Graphs** only.

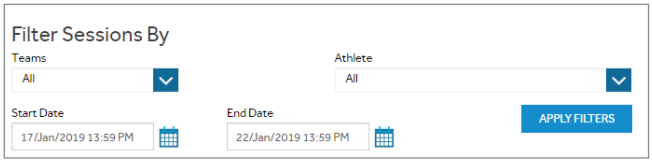


7. Selected the desired parameters from the list displayed below.



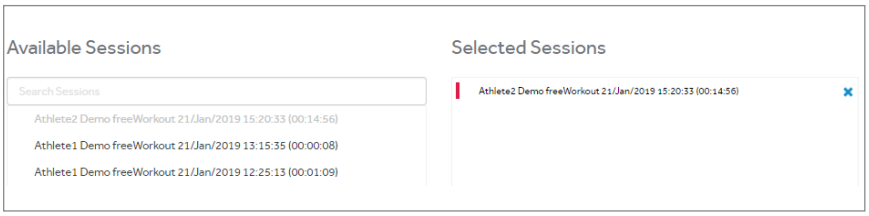
Over Time Parameters **Summary Parameters** **Readiness Parameters**

8. Choice of **Selected Sessions**, and **Filter Sessions By** are optional - these can be selected when editing the widget once it is on your dashboard.



Use the **Filter Sessions By** fields to narrow down the **Available Sessions** list.

9. Double-click on a session in the **Available Sessions** list to move it to **Selected Sessions**. Use the blue **X** in the selected session to remove if needed.



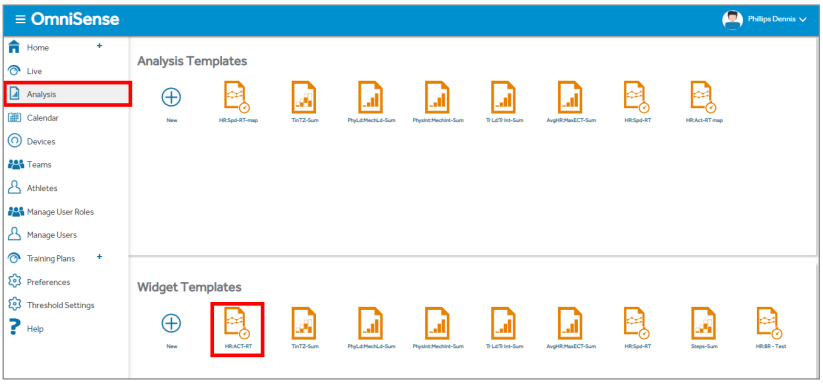
10. Use the **Save As** button to save as a widget. It then becomes available when adding widgets to the **Home** screen dashboard.



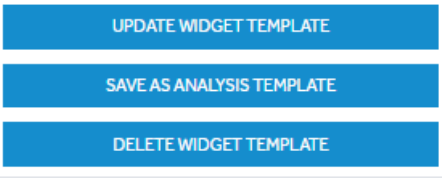
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Update/Delete Custom Widget

1. In the Analysis screen, click on any existing widget to reopen it.



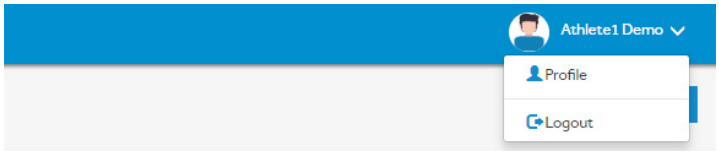
2. When the widget opens, make any necessary changes, and use one of the available buttons to update, make a copy of, or delete the widget.

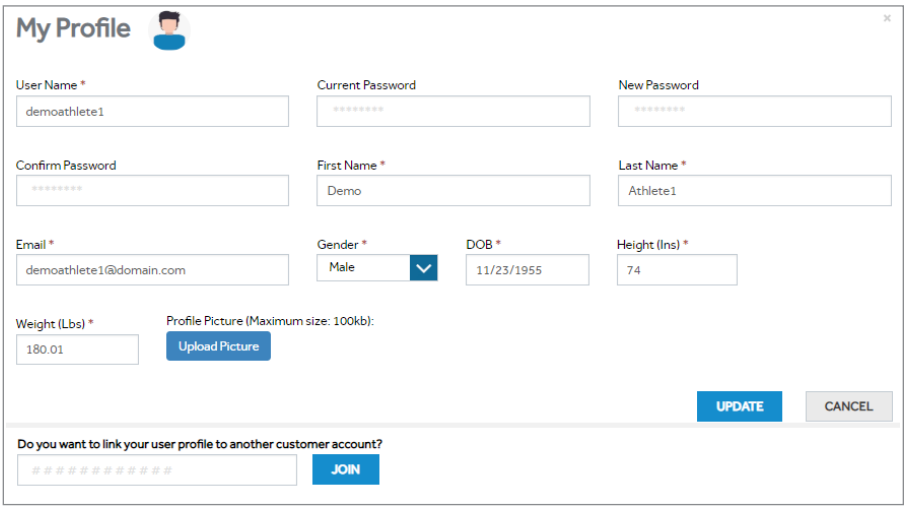


CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

My Profile

- Access your profile via the pull-down list at top right in the screen header.



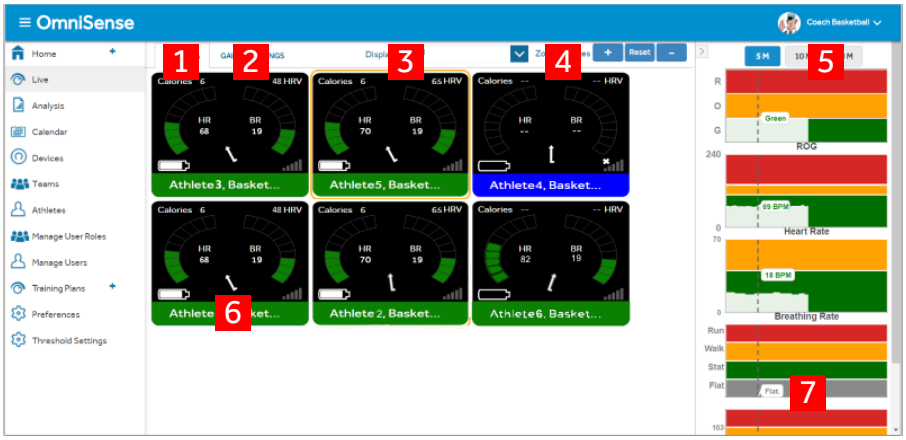


Item	Description
User Name	The name you use to log in to the portal using the PC version or OmniSense™ Mobile.
Current/New/Confirm Password	Use to change your password.
First/Last Name	Your name as it will appear on screens.
Email	Initially, the email address to which your account validation message was sent to. Forgotten Password links will be sent here.
Gender	Gender.
DOB	Date of Birth.
Height	Height. Units can be set in Preferences screen.
Weight	Weight. Units can be set in Preferences screen.
Profile Picture	Upload a profile picture.
Other Customer Account	Enter a second customer account number here. When logging in, a dialog will display to allow you to choose which account to log into.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Live Screen

- Live in the portal resembles OmniSense™ Live on a PC.
- It can be used to remotely view a connected ECHO session on a PC (PC user is logged in to portal), or a remote user using the OmniSense™ Mobile app, or a combination of the two.
- Portal users must have permission to see other's data. Athletes can only see their own data.

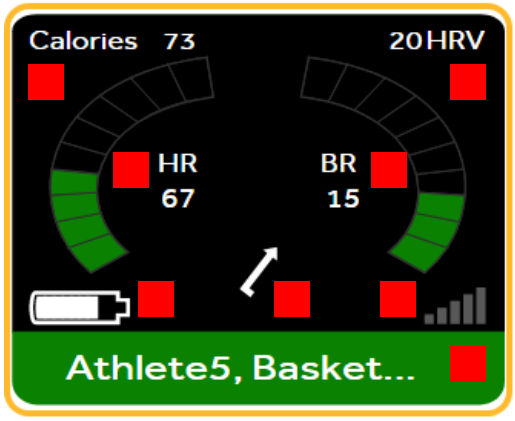


#	Description
1	LIVE DATA - Display BioGauges with streaming data for all those connected to the portal using either the mobile application, or with an ECHO system also connected to the portal.
2	GAUGE SETTINGS - Configure the appearance of the subject BioGauge.
3	Display by - Filter which athletes to show (coaches).
4	Zoom Gauges - Change subject BioGauge size to fit more or fewer on the screen.
5	5M/10M/60M -Set the time range of the trend graphs in minutes.
6	Subject BioGauges
7	Trend graphs for the selected BioGauge. Float cursor over for specific data value. ROG Status / Heart Rate / Breathing Rate / Activity Level / Estimated Core Temperature.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Subject BioGauge

- The BioGauge in the portal is designed to match the BioGauge in PC OmniSense™ in form & function.

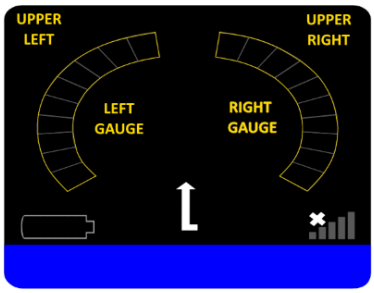


#	Description
1	Configurable fields. See next section.
2	Configurable sweep scales. See next section.
3	Device battery level.
4	Subject posture and activity level indicator.
5	Device signal strength indication.
6	(Color). Subject ROG status.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

BioGauge Settings

- Select parameters from the lists on the right of the screen.



Parameter	Description
Heart Rate	Heart Rate
Breathing Rate	Breathing Rate
HRV	Heart Rate Variability
EstCoreTemp	Estimated Core Temperature
Impact	Peak g of impact event
Activity	Peak activity VMU (g)
Calories	Calories Burned since power-on
HRMaxPercent	Heart Rate as a % of HRmax
HRatAtPrecent	Heart Rate as a % of HR at Anaerobic Threshold
PhysIntensity	Physiological Intensity
MechIntensity	Mechanical Intensity
TrainIntensity	Training Intensity (Avg of Phys + Mech Intensity)
PhysLoad	Physiological Load
MhLoad	Mechanical Load
TrainLoad	Training Load
Jump	Peak g during a jump event
Stress	Stress Level
Speed_HWReq	Speed (GPS or mobile device required)
Distance_HWReq	Distance Traveled (GPS or mobile device required)
Elevation_HWReq	Elevation (GPS or mobile device required)
ImpulseLoad	Impulse Load
WalkStepCount	Number of walking steps
RunStepCount	Number of running steps
BoundCount	Number of bounding steps
JumpCount	Number of jumps
MinorImpacts	Number of minor impacts
MajorImpacts	Number of major impacts
AvgForceDev	Average Force Development rate of impulses
AvgStepImpulse	Average Step Impulse
AvgStepPeriod	Average Step Period
FlightTime	Flight Time
PeakMagniPhi	Peak Magnitude Phi angle of impulses
PeakMagniTheta	Peak Magnitude Theta angle of impulses

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Analysis (1/2)

Overview

The Analysis landing screen in the portal shows sets of pre-configured Reports:

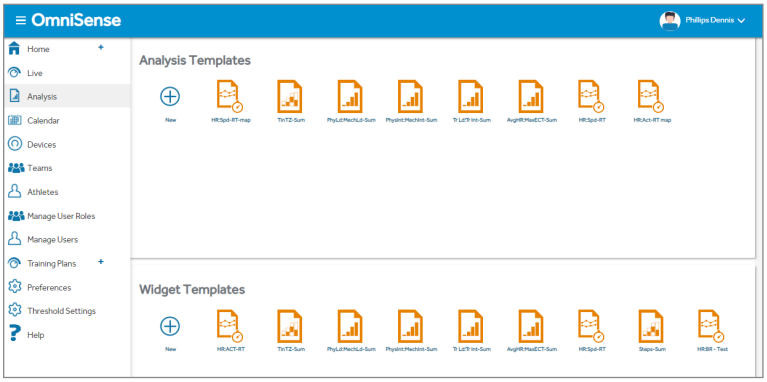
- **Analysis Templates** to create reports to review directly in **Analysis**.
- **Widget Templates** for components of the **Home** screen dashboard.

This is to streamline use; if the parameters are being viewed regularly, then select graph type, parameters, background color, real/elapsed time etc. and save the desired Report,

- Portal accounts may contain a set of pre-existing templates.

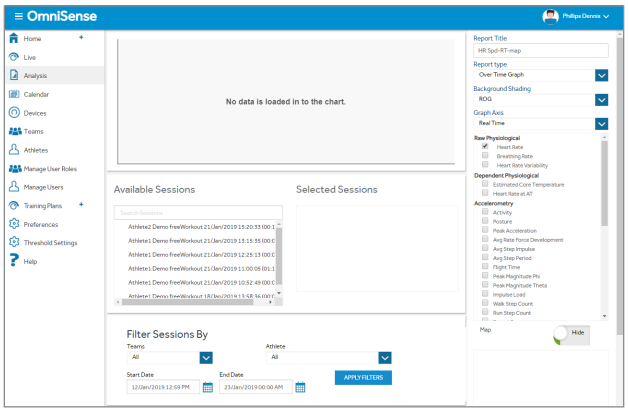
Using a pre-existing template

1. The only task is to select the sessions from which to populate the report.



   The template icon will show whether the graph is **Over Time**, **Summary** (bar or stacked bar chart), a **Table** or a **Periodization** report.

2. Select the template.

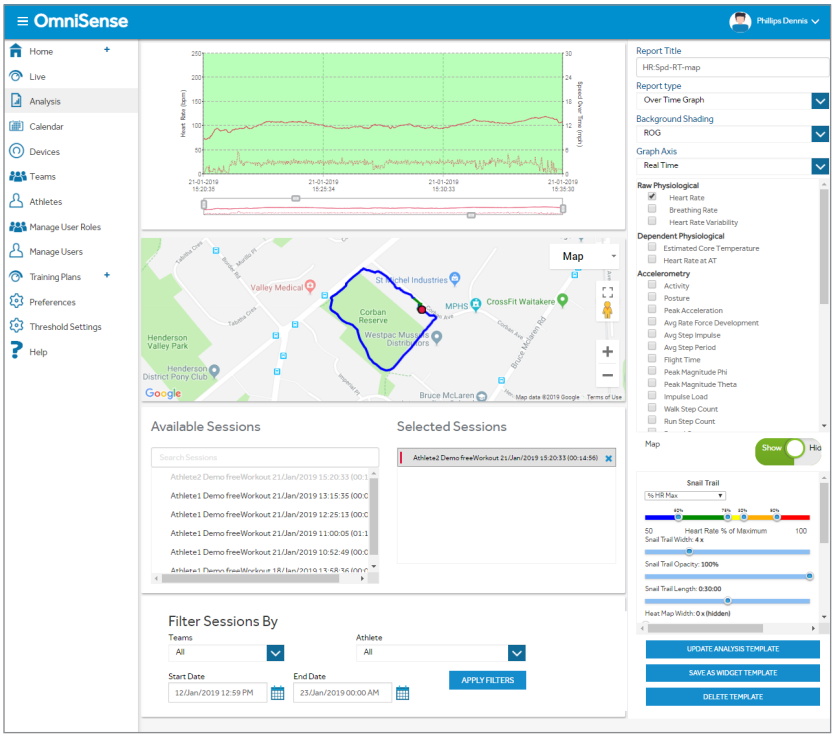


3. The **Filter Sessions By** panel will be configured to the **Start Date** and **End Date** values at last update. Set these and use the **Apply Filters** button to populate the **Available Sessions** panel.
4. Click on sessions in the **Available Sessions** panel to add to the **Selected Sessions** panel. The graph will then show the selected data.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Analysis (2/2)

5. If the **Map** setting is set to **Show**, and GPS data is available for the session, a map with snail trail will display.



6. At any time, **Report Title**, **Report Type**, **Background Shading**, **Graph Axis**, selected parameters and **Snail Trail** settings may be changed.

7. Use the **Update Analysis Template** button to save these changes permanently.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Create a Report

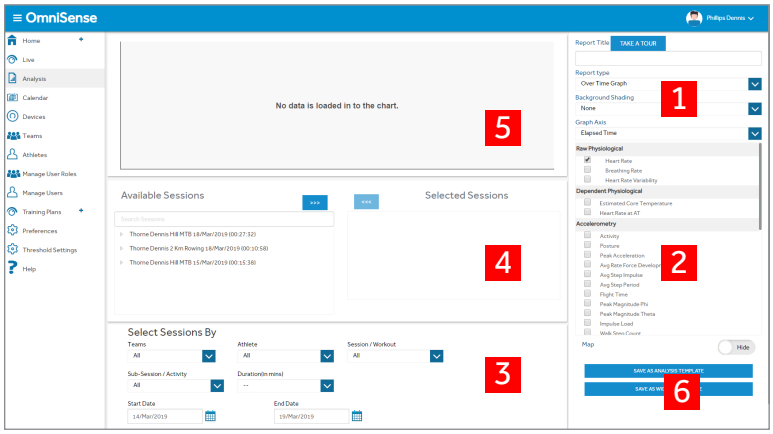
This section describes the general workflow for creating a report, or graphical data representation in Analysis. Once created, the report can be saved as a template for re-use.

There are five types of report. The common tasks will be described here - where each report type differs in its settings is described in the following sections.

1. Navigate to the **Analysis** screen and select the **New** icon in the **Analysis Templates** section.



2. The initial new report screen defaults to an **Over Time Graph** report. Screen details vary for different report types, but the overall layout remains the same.

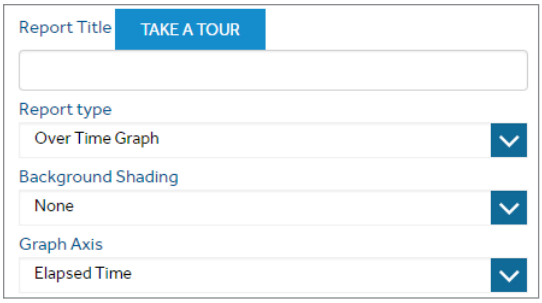


#	Description
1	Report title, report type & related settings.
2	List of parameters to select for graph.
3	Select Sessions filters.
4	Available/selected sessions, once filters are set.
5	Graph area, initially unpopulated.
6	Save/update report as a template or dashboard widget.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

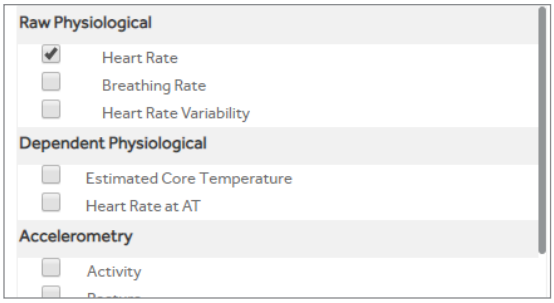
Workflow

1. Enter a **Report Title** - this will be used if the report is saved as an Analysis Template or Dashboard Widget.

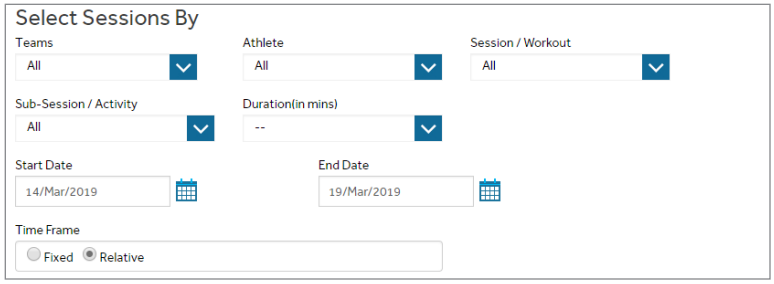


2. Select **Report Type** from the pull down list:
   - Over Time Graph
   - Summary Graph
   - Readiness Graph
   - Periodization
   - Table Style Report

3. The **Background Shading** and **Graph Axis** items shown refer to **Over Time** graphs. These items will vary according to the **Report Type** selected. See the following sections.



4. Select the parameters to be displayed. As a rule the first parameter selected will refer to the left vertical axis, and the second to the right. Available parameters will depend on **Report Type**.



5. Use the **Select Sessions By** pane to populate the **Available Sessions** pane. The details of this pane will vary according to Report Type. See the following sections.

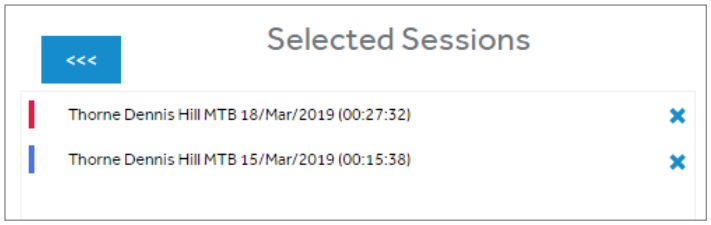
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

6. As the fields in the **Select Sessions By** pane are configured, the **Available Sessions** pane will populate with sessions.



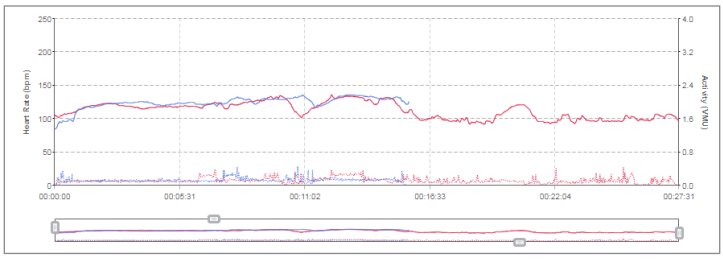
- Double-click an Available session to make it a Selected Session
- Use the >>> and <<< buttons to move all sessions.

7. As sessions are selected, they will display with a color indication which refers to the color trace or in-fill on the graph (over time or summary graph type).

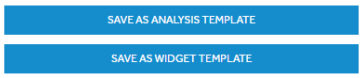


- Each selected session has an **X** button to remove it.

8. The graph will display the sessions as they are selected.



9. Save the report as an analysis template or widget template as needed.

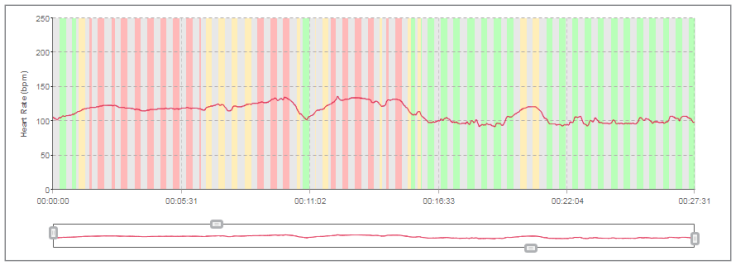


If the template is pre-existing, then an **Update** button will also display.

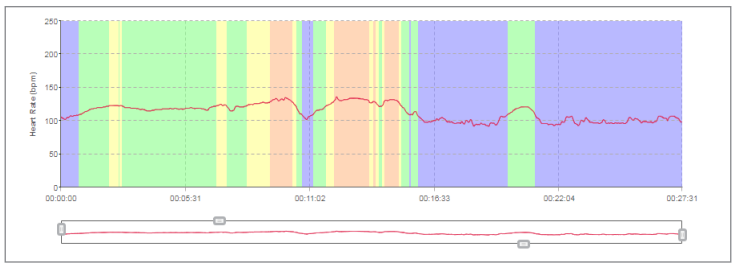
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Over Time Graph

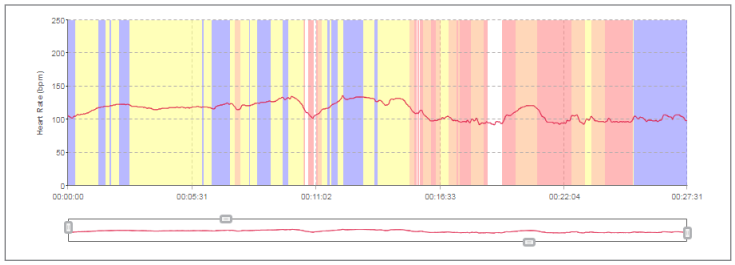
1. Select **Report Type** as **Over Time Graph**.
2. Select **Background Shading** as preferred. Default is no shading.



ROG



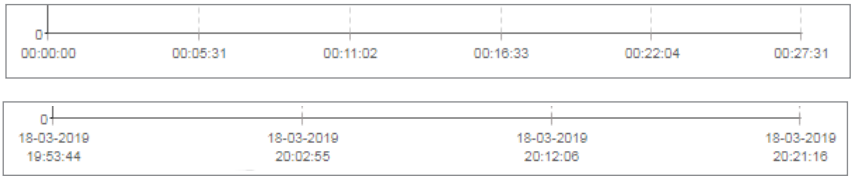
Training Zones



Speed Zones (GPS data required)

- Set ROG thresholds in **Threshold Settings > Safety Thresholds**.
- Set Training Zone in **Threshold Settings > Training Zones**.
- Set Speed Zone thresholds in **Threshold Settings > Speed Zones**.

3. Select Elapsed Time or Real Time.

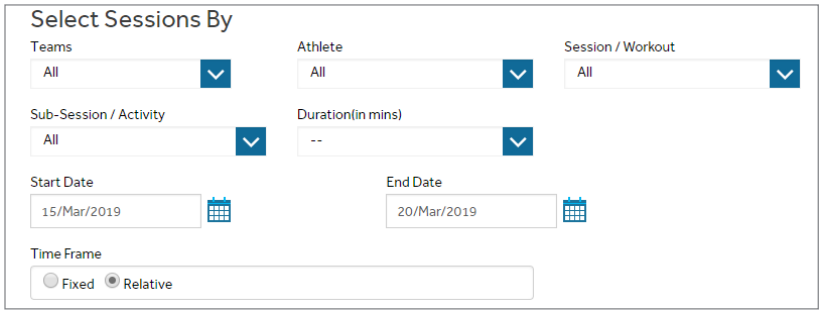


Elapsed (top) vs. Real Time

- Elapsed time starts every session at **00:00:00** and is necessary when comparing sessions not recorded simultaneously.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

4. Filter the sessions from the **Select Sessions By** pane.



Item	Description
Teams	Select from '**No Team Assigned**' or available teams.
Athlete	Select individual athlete.
Session/Workout	Only sessions recorded within the displayed start/end date periods will be available.
Subsession/ Activity	Only subsessions recorded within the displayed start/end date periods will be available.
Duration	Select the minimum session duration in minutes.
Start/End Date	Set start and end date of time period.
Time Frame	Fixed: the **Start Date** and **End Date** will remain fixed calendar values when the template is saved and reopened. Relative: the **Start Date** and **End Date** are dynamic, and will increment by 1 day every 24 hours.

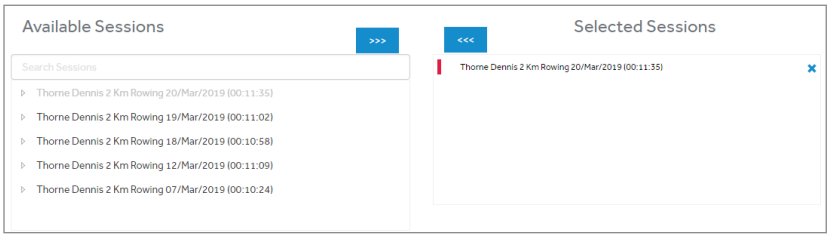
Note

Recommended practice is to set the **From Date** and **To Date** values first - this will limit the options available in the other fields and make final selections easier.

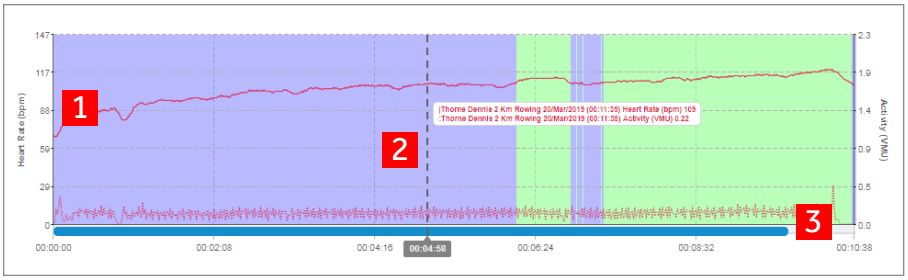
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

5. The **Available Sessions** pane will populated as selections are made in **Select Sessions By**.

   Double-click any session in Available Sessions to move it to Selected Sessions, or use the >>> button to move all.



- The <<< button can be used to de-select all sessions, or the individual '**X**' button for each.
- The color bar preceding each selected session corresponds to the color of its graph trace.
- The graph or table will populate automatically as soon as graph parameters and selected sessions are available.



Over Time graph showing two parameters and Training Zone background coloring.

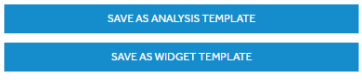
#	Description
1	First selected parameter - solid trace, left vertical axis.
2	Float cursor over graph for call out of exact data values.
3	Second selected parameter, dotted trace, right vertical axis

6. Use the 4 grab handles on the scaling bar below the graph to zoom in vertically or horizontally.



7. Any of the above settings can be changed at any time to refine or adjust the graph display.

8. Save the report as an **Analysis Template** or **Widget Template** if re-use is anticipated.



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

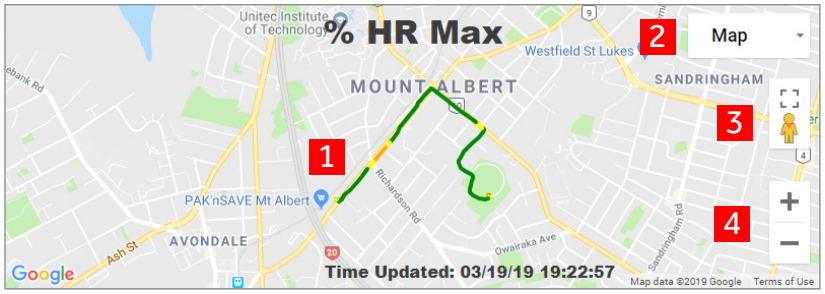
Google™* Map Display

If GPS data is available for a session, then data can be displayed on a map or satellite view.

- Click on the map button below the parameter list to set to Show.



- A map panel will display below the graph, with a Snail Trail panel below the parameters.



Map display, no terrain, partial path

#	Description
1	Subject path snail trail (defaults to last 10 min of data)
2	Set map/terrain or satellite/labels
3	View map full screen or Google Street View™*
4	Map zoom - also use Ctrl + Mouse scroll

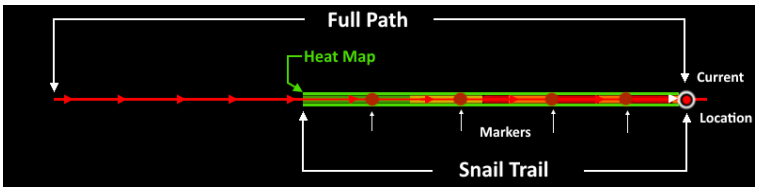


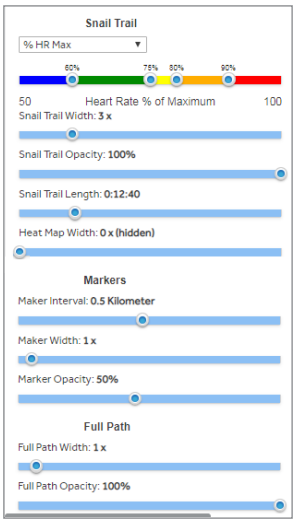
Satellite display, no labels, full path

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Map Snail Trail

A snail trail showing subject path and color indication of a selected parameter, plus a heat map, is displayed on the map.



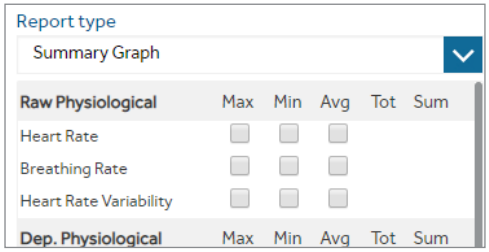


Item	Description
Parameter Pull down	Select from seven available parameters.
Color scale	Adjust according to parameter selected. Thresholds set at default. Adjust if needed.
Snail Trail Width	Width of snail trail.
Snail Trail Opacity	Opacity.
Snail Trail Length	Defaults to last 10 min of full path. Right-most setting full path.
Heat Map Width	Heat is an indication of persistence of location. A moving subject shows green, a stationary subject shows red. If a subject crosses the same location repeatedly, the heat map tends from green to red. For use with ball games. Heat map is displayed as a halo around the path.
Marker Interval	Set spacing of markers along path/snail trail.
Marker Width	Set size of markers.
Marker Opacity	Set opacity of markers.
Full Path Width	Set width of full path. Left-most setting hidden.
Full Path Opacity	Set full path opacity.

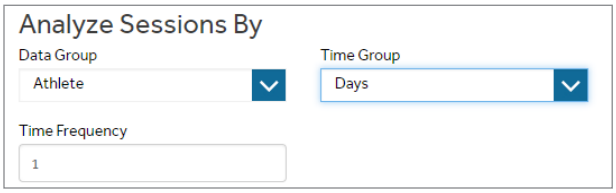
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Summary Graph

1. Select **Report Type** as **Summary Graph**.
   - No background color or elapsed/real time selection is available for a summary graph.
2. Select parameters



   - Parameter type **Max/Min/Avg/Total/Summary** availability depends on the parameter e.g. Max Calories does not make sense; there is a single Calories Burned value per session.
   - A Summary parameter and some Total parameters cannot display alongside any other selection. If selected it will deselect any other active parameters. See the graph examples below.
3. Filter sessions and select sessions exactly as for Over Time graphs in the previous section.
4. Group the summary graph bars using the **Analyze Sessions By** pane.



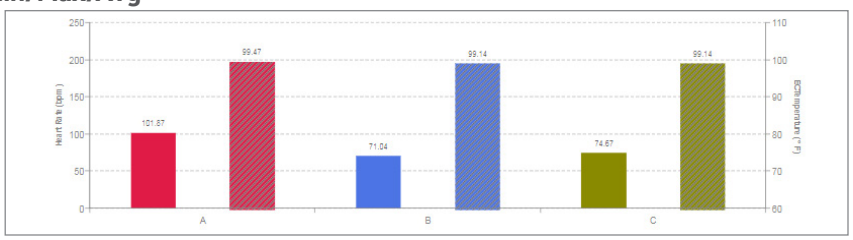
Item	Description
Data Group	Select from None, Team, Athlete, Session Name, Subsession Name.
Time Group	Select from None/Days.
Time Frequency	Select number of days.

   - Data will be organized according to the settings.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

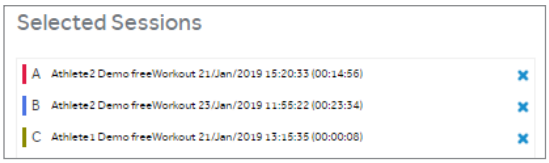
5. A summary graph will display, its type depending on the parameters selected.

Min/Max/Avg



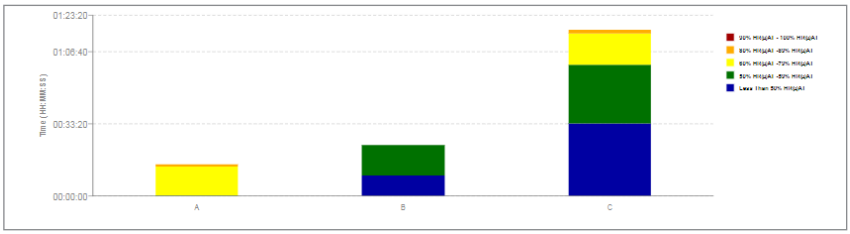
Min/Max/Avg graph

- Bar colors match indications in the Selected Sessions pane.



- Solid bar is first selected parameter, left vertical axis.
- Striped bar is second selected parameter, right vertical axis.
- Some **Total** parameters also display in this graph type.

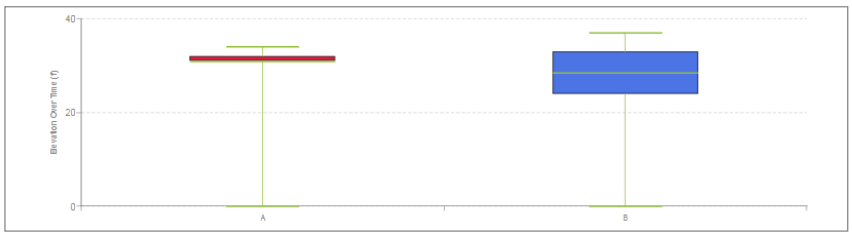
Total



Time in Training Zones stacked bar chart

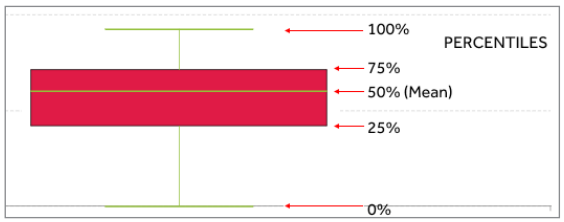
- Time in Zones graphs are 'stacked' bar charts with legend.
- These graphs can only show a single parameter

Summary



Summary 'Box & Whisker' chart

- Summary charts give a visual indication of the **distribution** of data within the session



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

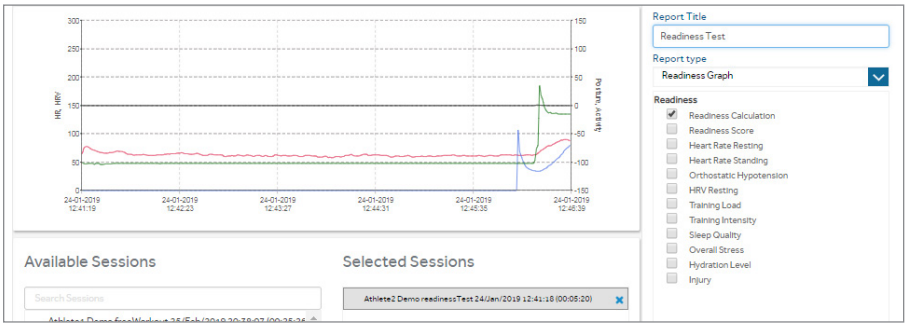
Readiness Graph

Readiness graphs have two types :

- Display the data from a Readiness (Orthostatic Hypotension) test.
- Display selected historical readiness parameters, including the data collected from readiness surveys.

Readiness Calculation

1. Select **Graph Type** as **Readiness Graph**.



2. The default selected parameter is **Readiness Calculation**. This displays **Heart Rate**, **Activity Level**, **Posture** and **HRV** which are acquired during a readiness test.
3. Use the **Select Sessions By** filters to select available readiness test sessions.
4. Readiness Calculation graph will only accommodate a single session.

Readiness Parameters

Readiness parameters are either calculated from analysis of orthostatic hypotension readiness test results (objective), or are subjective responses to the Readiness Survey conducted after each test.

Objective Readiness Parameters

- Readiness Score
- Heart Rate Standing
- HRV Resting
- Orthostatic Hypotension
- Heart Rate Resting

Subjective Readiness Parameters

- Training Load
- Sleep Quality
- Hydration Level
- Training Intensity
- Overall Stress
- Injury

Note

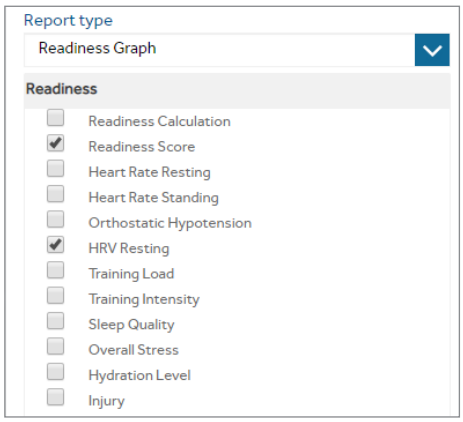
The '**Training Load**' referred to in the Readiness Survey is not the same as the Train Load parameter calculated for a given workout. The latter value is the average of the Physiological and Mechanical Loads for a workout, which is an objective measurement.

Similarly, '**Stress**' referred to in the Readiness Survey is not the same as the Stress parameter which can be displayed in a BioGauge in a Live session - that is an HRV-related parameter.

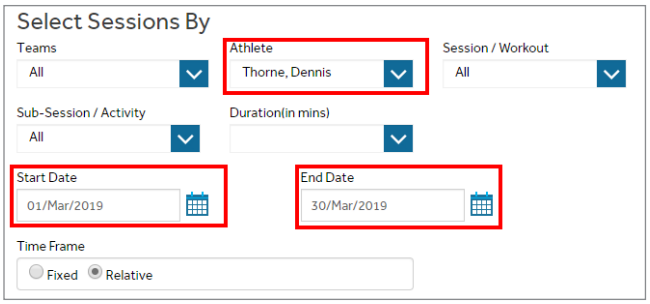
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Reports (12/17)

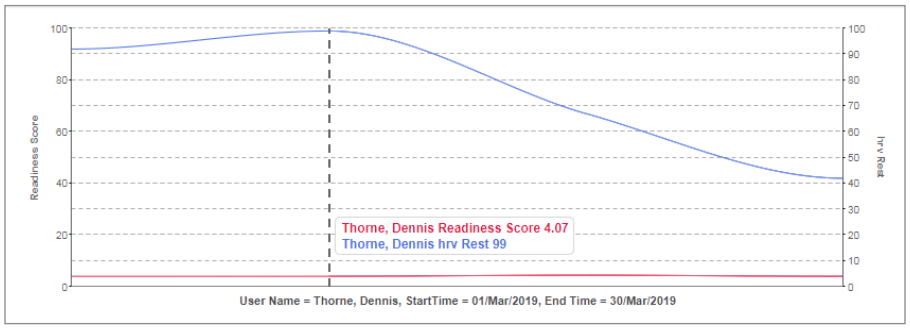
1. When Readiness Parameters are selected (other than Readiness Calculation), the graph will display historical values for the selected date range, for the selected athlete. A maximum of 2 parameters are allowed.



2. The only relevant **Select Sessions By** fields are **Athlete**, **Start Date** and **End Date**. Session/Workout need **not** be selected. Readiness Test sessions will automatically be retrieved from the database, ignoring the value set in the Session/Workout field.



3. The selected parameters will display on the graph. Float the mouse cursor over the graph to display data point values as a call out.



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Periodization Report

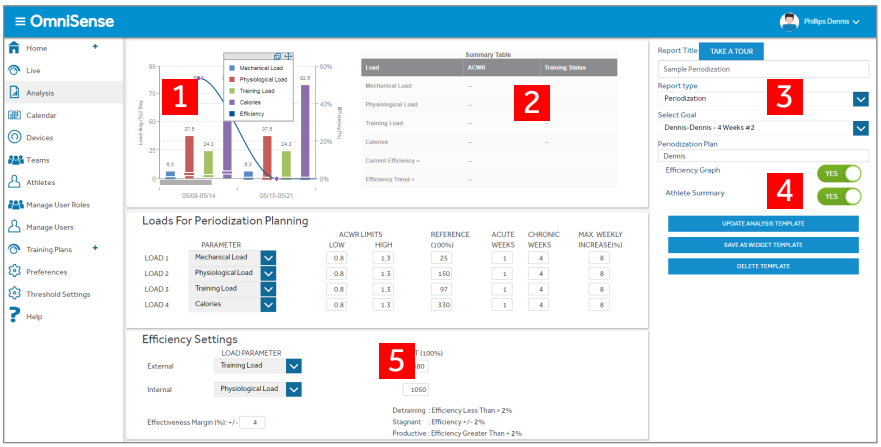
A Periodization Report provides a summary of an athlete or team's progress within a Periodization Plan, grouped into weekly periods.

The periodization report references a specific **Goal**.

In graphical and table formats, it presents summary parameters:

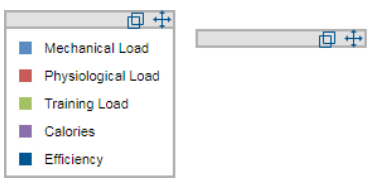
- Weekly physiological loads as selected in **Threshold Settings**
- Training Efficiency
- Acute: Chronic Workload Ratio (ACWR)

To create a periodization report, select **Report Type** as **Periodization**, and select Goal. The periodization report will populate automatically, using all assigned workout data for the individual or team assigned in the goal.



#	Description
1	Summary graph with legend
2	Summary table
3	Select **Goal**
4	Buttons to show/hide graph and table
5	**Loads for Periodization Planning** and **Efficiency Settings** are not editable here. They are for reference only. They can be edited in the **Threshold Settings** screen.

- The legend on the graph is active. Check or uncheck the color tiles beside each entry to show or hide the parameter on the graph. To minimize the legend, select the icon at the top.



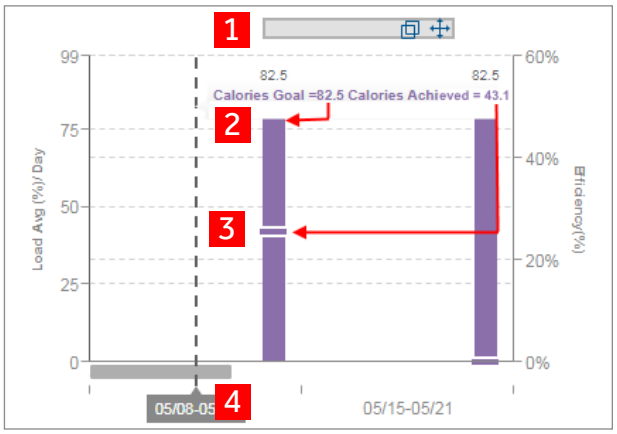
Graph legend maximized, and minimized

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Reports (14/17)

Summary Graph

The Summary graph indicates relative progress towards daily average goals.



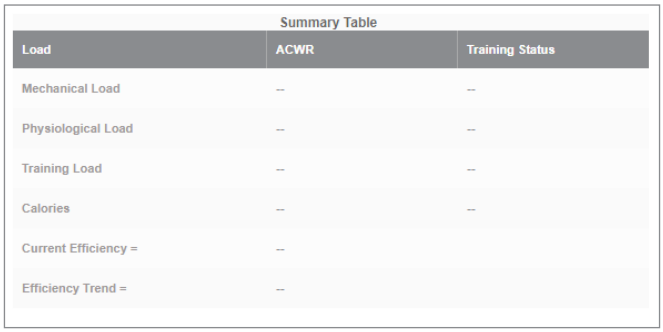
Periodization graph with legend minimized and single load parameter displayed

#	Description
1	Legend minimized - all parameters except calories de-selected.
2	Daily % Average parameter Load Goal - top of bar
3	Daily % Average parameter load Achieved - horizontal rectangle
4	Float mouse cursor over the graph to display the values as call-outs.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Summary Table

The summary table presents ACWR and Training Status statistics for the selected goal in the report.



Summary Table

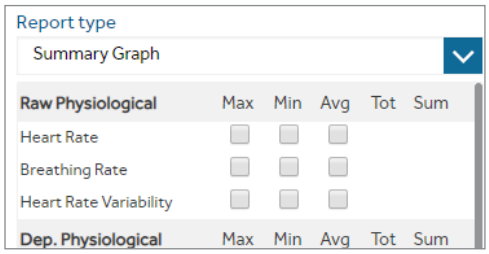
Load	ACWR	Training Status
Mechanical Load	--	--
Physiological Load	--	--
Training Load	--	--
Calories	--	--
Current Efficiency =	--	
Efficiency Trend =	--	

- This table will populate automatically when data is available.

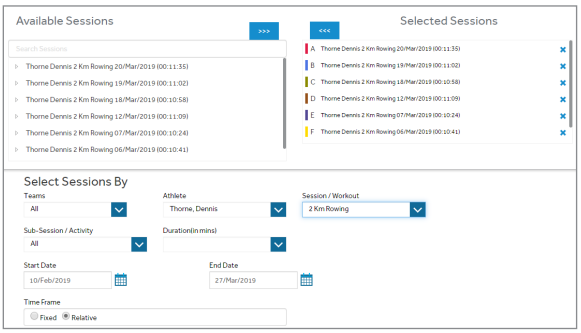
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Table Style Report

1. Select **Report Type** as **Table Style Report**.
   - The available parameters are the same as for a **Summary Report**.
2. Select all desired parameters. There is no limit on number selected. The report itself will expand and a scroll bar will appear if fields extend beyond screen area.



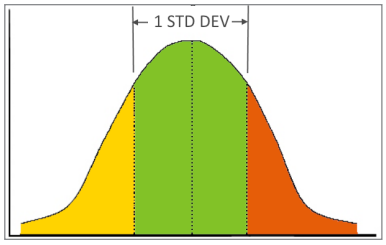
3. Filter sessions and select sessions exactly as for **Summary** reports.



4. The Report will display as a color-coded table.

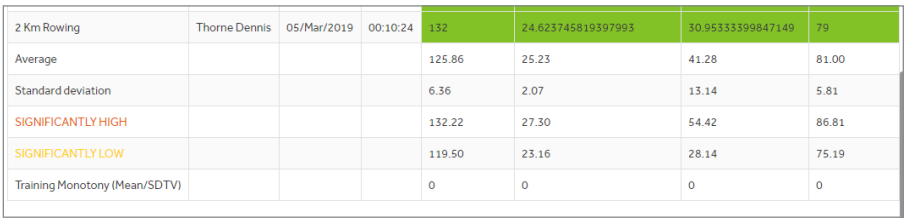
Session Name	Subject Name	Start Date	Duration	Max Heart Rate	Average Heart Rate Variability	Physiological Load	Min Heart Rate
2 Km Rowing	Thorne Dennis	20/Mar/2019	00:11:35	120	29.28	57.42	68
2 Km Rowing	Thorne Dennis	19/Mar/2019	00:11:02	123	28.02	56.40	82
2 Km Rowing	Thorne Dennis	18/Mar/2019	00:10:58	118	24.16	56.46	82
2 Km Rowing	Thorne Dennis	12/Mar/2019	00:11:09	133	25.47	30.16	85
2 Km Rowing	Thorne Dennis	07/Mar/2019	00:10:24	134	23.57	31.72	87
2 Km Rowing	Thorne Dennis	06/Mar/2019	00:10:41	121	23.76	28.32	84
2 Km Rowing	Thorne Dennis	05/Mar/2019	00:10:24	132	24.62	30.95	79

5. The cells are color coded according to their distribution from the mean (average) value of all of the selected sessions.



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

6. Below the table entries, the values which delineate the color boundaries are listed.



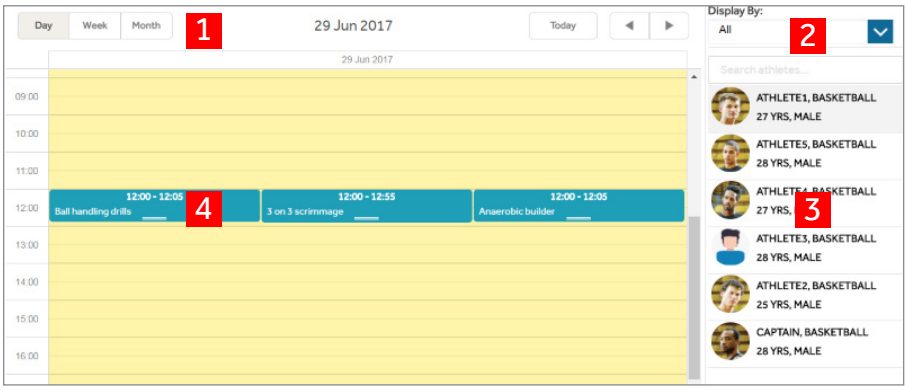
2 Km Rowing	Thorne Dennis	05/Mar/2019	00:10:24	132	24.623745819397993	30.95333399847149	79
Average				125.86	25.23	41.28	81.00
Standard deviation				6.36	2.07	13.14	5.81
SIGNIFICANTLY HIGH				132.22	27.30	54.42	86.81
SIGNIFICANTLY LOW				119.50	23.16	28.14	75.19
Training Monotony (Mean/SDTV)				0	0	0	0

Item	Description
Significantly High	One standard deviation above the mean value. Values greater than this will be colored red.
Significantly Low	One standard deviation below the mean value. Values less than this will be colored yellow.

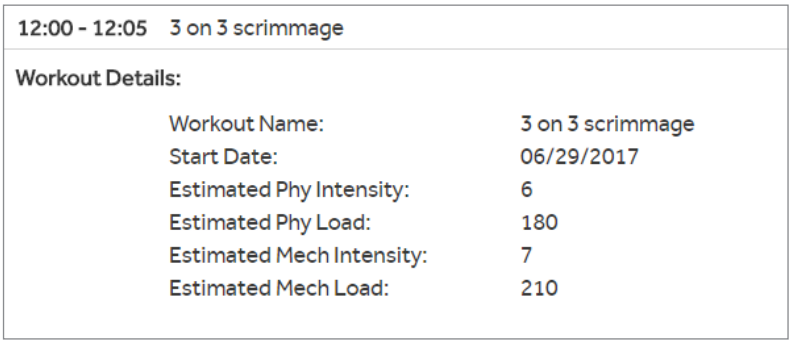
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Calendar

- Display a calendar showing assigned workouts for an athlete by day, week or month.
- Available to coaches and managers.



#	Description
1	Display Calendar by Day/Week/month
2	Sort the athlete list.
3	Click on an athlete to display their workouts.
4	Click on an individual workout to display details.



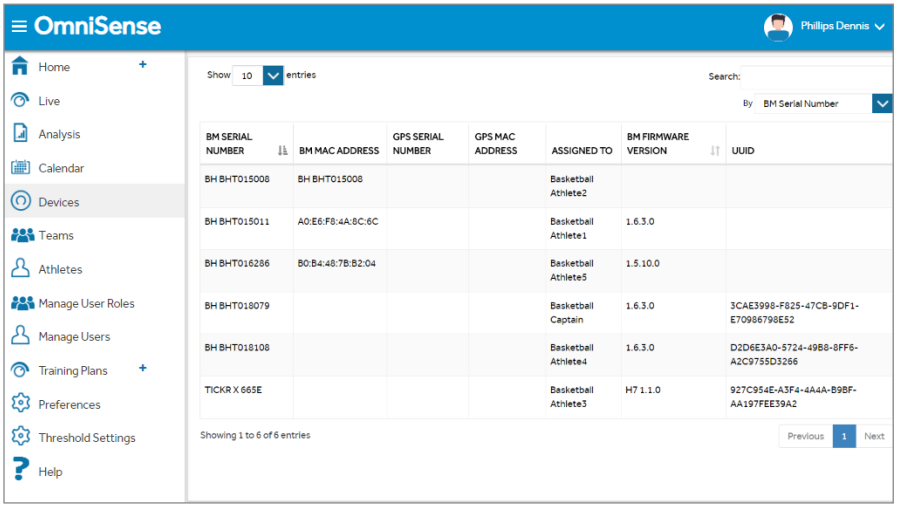
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

View Devices

Devices are not managed from the portal.

They are assigned to subjects from a PC installation of OmniSense™ Live, or subjects may associate and assign a device when using OmniSense™ Mobile.

The entries shown in the **Devices** screen of the portal are populated and updated automatically.



Item	Description
BM Serial Number	The serial # on the rear of the BioModule.
BM MAC Address	Bluetooth™* Address of the BioModule, needed for communication with mobile device or supported GPS.
GPS Serial Number	Serial # of supported QStarz GPS. If a mobile device is used, and GPS data obtained from the device internal GPS, this value will be blank.
GPS MAC Address	Serial # of supported QStarz GPS, if used with BioModule.
Assigned To:	Athlete the BioModule is currently assigned to. If the athlete uses a different BioModule, this will update automatically.
BM Firmware version	Version of internal firmware in the BioModule.
UUID	Universal Unique ID of a device, used to support iOS™*.

Note

A new release of OmniSense™ may come with a new firmware version, which should be installed to support any additional functionality.

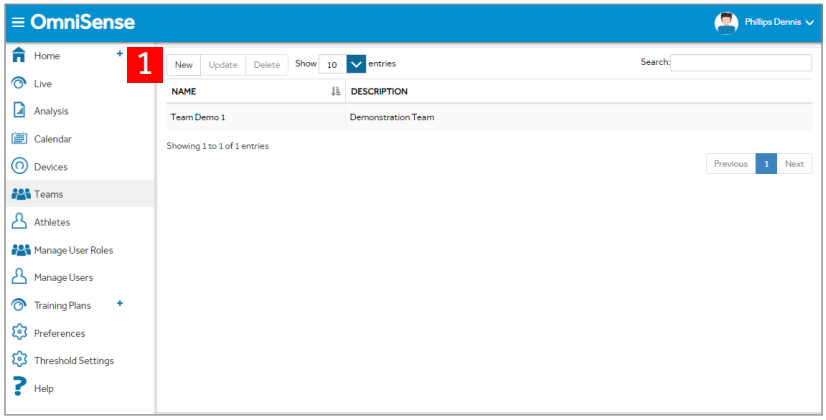
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Manage Teams

Team entities exist in the portal in order to manage who has access to specific data. A team captain can generally view only his own team's data. Coaches and managers can view those teams they have been assigned.

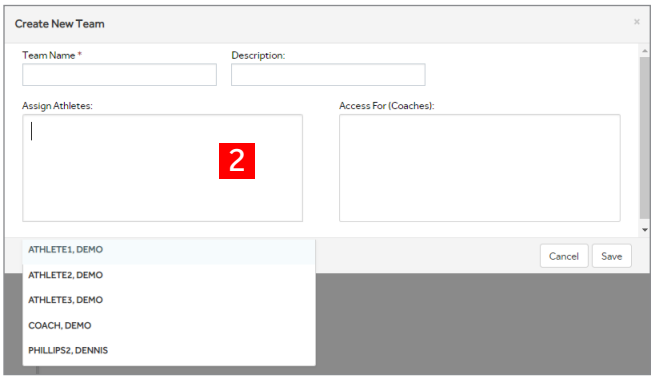
- Teams are synchronized between the Portal and a PC instance of OmniSense™, when the user is connected to the cloud.

The **Teams** screen displays those teams created within the portal.



Create Team

1. Click on the **New** button.



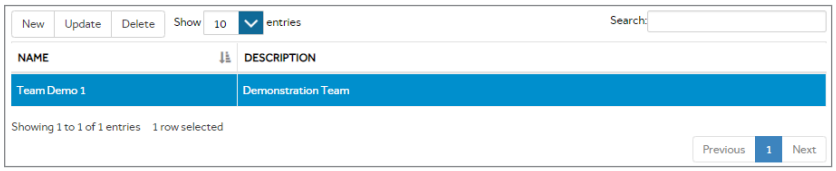
2. Enter **Team Name** and **Description**. When you click inside the **Assign Athletes** and **Access For (Coaches)** fields, a list will appear, from which you can select as needed.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

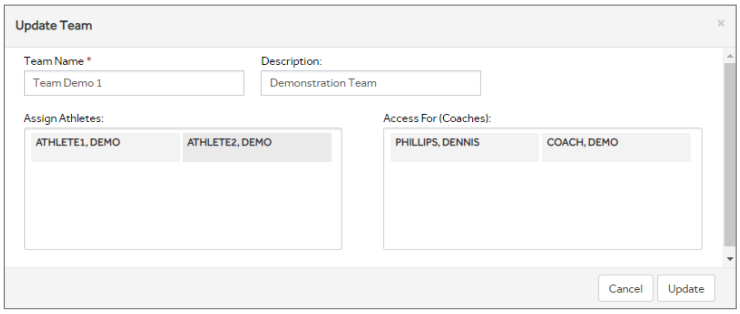
Teams (2/2)

Update Team

1. Click on a team to select it, and enable the **Update**/**Delete** buttons.



2. Select the **Update** button.



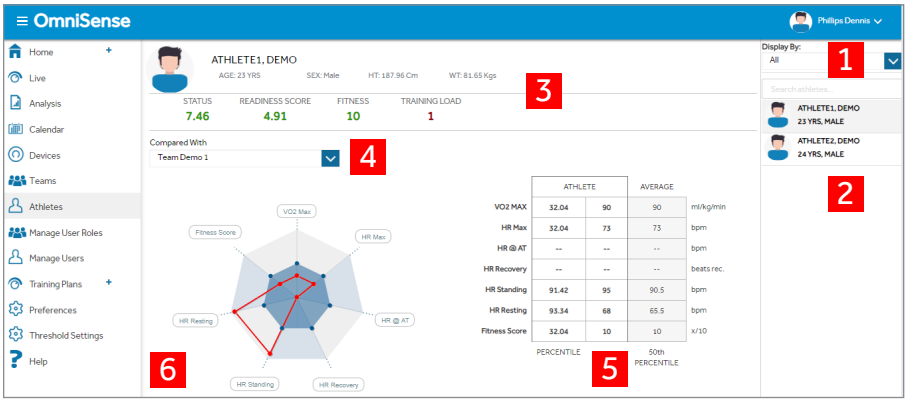
- Edit **Team Name** and **Description** as needed.
- To add more entries, click in the **Assign Athletes** or **Access For** panels, and select from the lists which appear.
- To delete an entry, click on it to select - it will turn a darker shade of grey. Delete with the **Delete** keyboard button.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Athletes (1/2)

Athlete Status

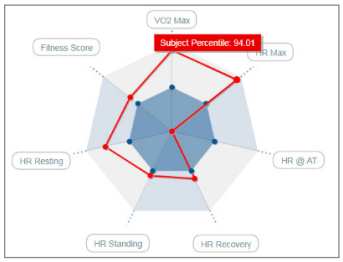
The Athletes screen in the portal gives an overview of an athlete's status, using all physiological metrics established during Readiness and Fitness tests. These are presented in table and radar plot format, allowing comparison with the athlete's team average values.



- You must have permission to view an athlete's data.

#	Description
1	Select Team from pull down list.
2	Select the Athlete from the list.
3	Summary of fitness metrics for selected athlete.
4	Select the team average to compare the selected athlete's statistics.
5	Athlete's metric compared to selection in 4, in table format.
6	Radar plot - see below.

Radar Plot

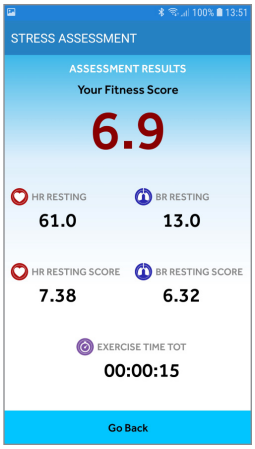


- Axes on radar plot are all scaled to give regular blue & gray polygons.
- Blue inner and gray outer polygons - the 50% and 100% levels for the team selected in **Compared With**.
- Axes are oriented so that outside the blue polygon indicates better than team average performance - for some values this is higher, such as VO_2max, and for others lower, such as resting HR.
- If the red value is inside the blue inner polygon, then the athlete's level is below average compared to the selected team.
- Float cursor over plot to get exact percentile values.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Athletes (2/2)

Radar Plot Parameter	Description
VO_2 MAX	Determined by analyzing results of a ramped maximal Fitness Test such a treadmill or beep test.
HR Max	Determined by analyzing results of a ramped maximal Fitness Test such a treadmill or beep test.
HR @ AT	Determined by analyzing results of a ramped maximal Fitness Test such a treadmill or beep test.
HR Recovery	Determined by analyzing results of a ramped maximal Fitness Test such a treadmill or beep test.
HR Standing	Determined by a Readiness Test
HR Resting	Determined by a Readiness Test
Fitness Score	Calculated automatically after most recent Fitness Assessment, as shown below.



Fitness Score displayed on post-assessment summary screen (Stress Test, OmniSense™ Mobile)

Refer to the **Baseline Fitness Testing** section for more information. (Instructions for the Stress Test and 1.5 Mile Run Test appear in the OmniSense™ Mobile application.)

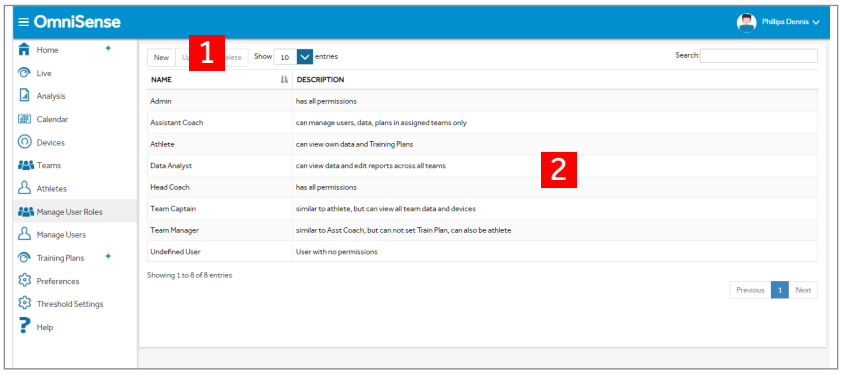
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Manage User Roles (1/2)

Manage User Roles

Managing user roles requires the appropriate permission to do so - normally reserved to customer account administrators and coaches.

Note that user **roles** are not the users themselves, but the category of user allocated to each new user. It provides a systematic way of allocating permissions to users.

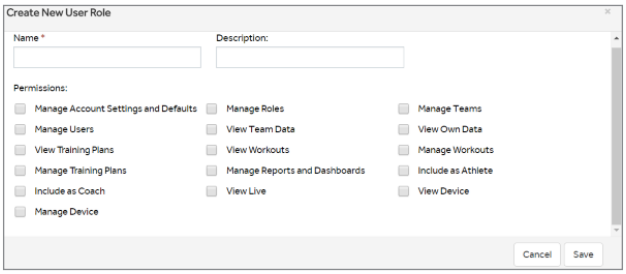


Note

An **Undefined User** role exists, with no permissions. This is the default role assigned to an existing user who registers with a second customer account. It forces the second account administrator to actively assign a new role to them, rather than transfer their existing role, which may not be appropriate.

#	Description
1	Select **New**/**Update**/**Delete** user role as needed
2	List of existing user roles with descriptions. Each new account will have a list of suggested roles. These can be deleted or updated as needed.

Permissions



Role	Recommended User
Manage Account Settings & Defaults	General Admin only
Manage Roles	Admin or Coach
Manage Teams	Coach
Manage Users	Coach
View Team Data	Coach & Team Captain
View Own Data	Athlete

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Manage User Roles (2/2)

Role	Recommended User
View Training Plans	Coaches
View Workouts	Coaches
Manage Workouts	Coaches
Manage Training Plans	Coaches
Manage Reports & Dashboards	Coaches
Include as Athlete	Use as appropriate
Include as Coach	Use as appropriate
View Live	All users (athletes may be limited to their own data)
View Device	All users (athletes may be limited to their own device)
Manage Device	Coaches. Athletes may update their device when using with mobile application

- If a user has restricted permissions, then they may have items missing from their navigation menu, or items which are disabled.
- Admin normally has all permissions, but does not exist as an athlete within the system.
- Permissions can also be managed from the **Manage Users** screen.

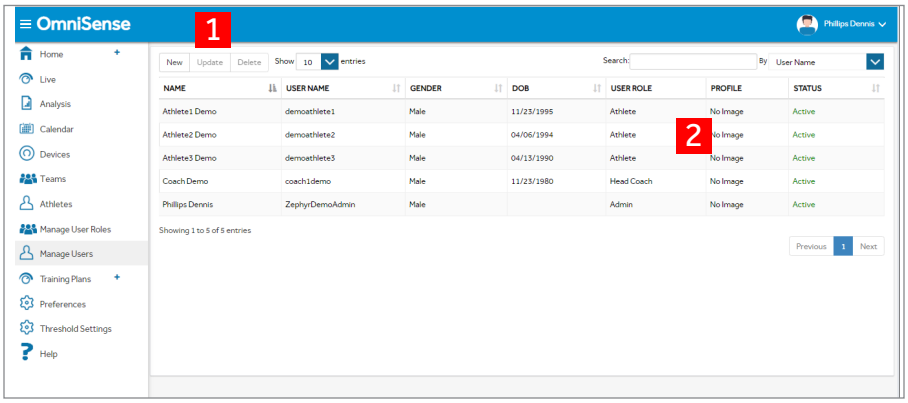
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Manage Users (1/2)

Manage Users

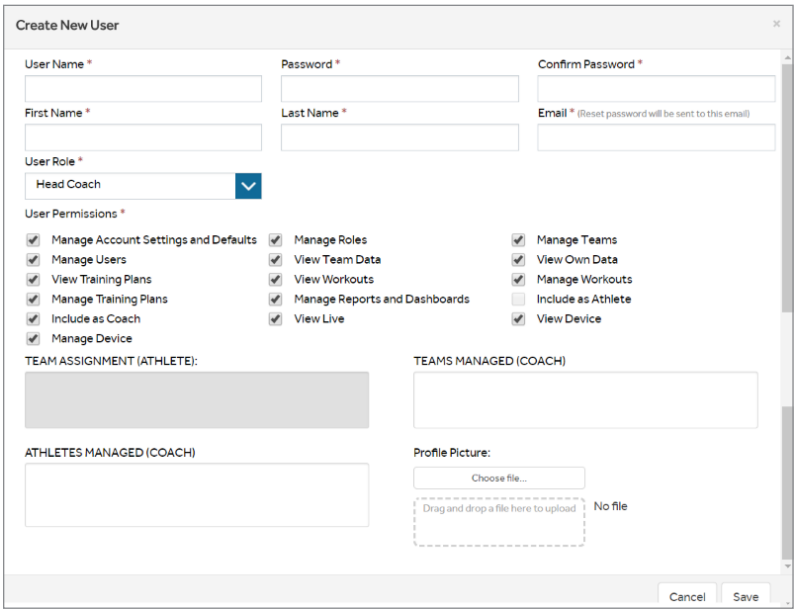
Managing users requires the appropriate permission to do so - normally reserved to customer account administrators and coaches.

User roles and permissions, and all personal and physiological details are managed from this screen.



#	Description
1	Select **New/Update/Delete** user role as needed
2	List of existing users.

Create New User

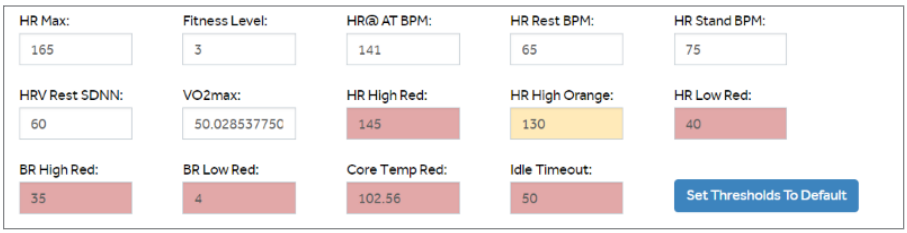


- Create a new user, assign a login and placeholder password. They will choose their own password when they validate their account.
- Allocate user role and/or permissions.
- Assign to **Teams** and **Coach** as appropriate (click any panel to display a list for selection).
- Permissions can also be managed from the **Manage Users** screen.
- Upload Profile picture if available.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Manage Users (2/2)

Physiological Parameters



Parameter	Description
HR Max	Saved automatically when the results of a ramped maximal fitness test are saved. It can be updated manually here.
Fitness Level	Most recent Fitness Level determined after a Fitness Test has been performed on the PC Application or OmniSense™ Mobile.
HR @ AT	Saved automatically when the results of a ramped maximal fitness test are saved. It can be updated manually here.
HR Rest / Stand	Saved automatically when the results of a Readiness test are saved. It can be updated manually here.
HRV Rest SDNN	Saved automatically when the results of a Readiness test are saved. It can be updated manually here.
VO_2 max	Saved automatically when the results of a ramped maximal fitness test are saved. It can be updated manually here.
HR High/Low Red/ Orange	Safety Threshold for determining Subject ROG Status, displayed on the subject BioGauge in OmniSense™ Live.
BR High/Low Red	Safety Threshold for determining Subject ROG Status, displayed on the subject BioGauge in OmniSense™ Live.
[Est.] Core Temp Red	Safety Threshold for determining Subject ROG Status, displayed on the subject BioGauge in OmniSense™ Live.
Idle Timeout	Time period in seconds before a subject status is set to red due to inactivity. This is for use with First Responders (e.g. Fire Crew) for whom inactivity may be an indication that they have become incapacitated. Default is disabled.
Set Thresholds To Default	Set to the thresholds saved in the **Threshold Settings** screen.

Note

No data is ever downloaded from the cloud database to a local PC database, but physiological/fitness parameters are, when the local PC users connect to the cloud account.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

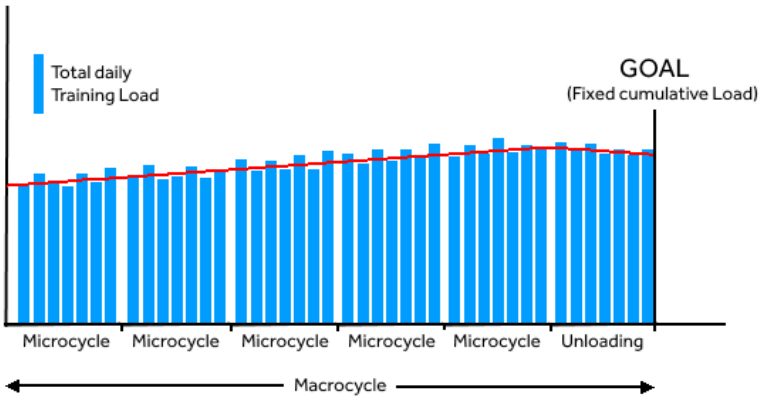
Overview

Training Plans & Periodization Plans

Training Plans and Periodization plans can be created independently of each other, but they are designed to be used in parallel.

Periodization Plan

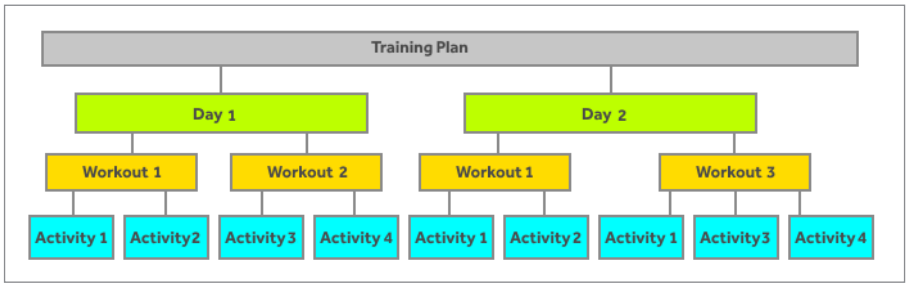
The Periodization plan is a long-term framework of weekly training load targets. These targets can be configured to increase the training load, within safe limits, towards a set of calendar goals within a training season.



A Periodization Plan does not detail individual workouts; it only serves as a set of targets to aim training towards, and measure progress against.

Training Plan

A Training Plan consists of a number of workouts, scheduled for a sequence of days. Each workout in turn consists of a number of specified activities.



The training plan may be created to cover the period of an entire periodization plan, or may be a smaller repeated segment (say weekly) within a longer term periodization plan.

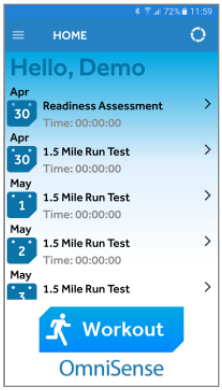
When creating a training plan, coaches assemble activities and workouts to achieve the weekly and daily training targets dictated by the periodization plan, or they can create separate training plans independent of any target setting.

Plans can be assigned to individuals or teams.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Training Plans (2/22)

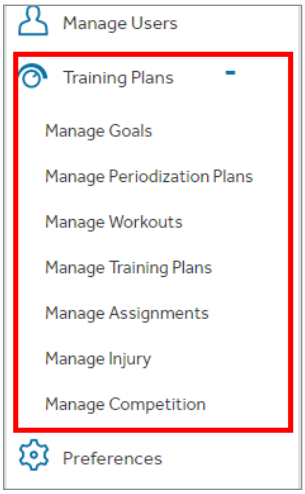
Coaches can use the portal to push the training plan (or individual workouts) out to athletes' mobile devices.



OmniSense mobile Home screen showing prescribed workouts

The workouts will appear on the athlete's **Home** screen when they log in to OmniSense Mobile.

Periodization plans, training plans and workouts are managed via the **Training Plans** node in the navigation menu, which expands (**+**) into individual components.



Only coaches and users with appropriate permissions will see this node in the navigation pane of the web portal.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

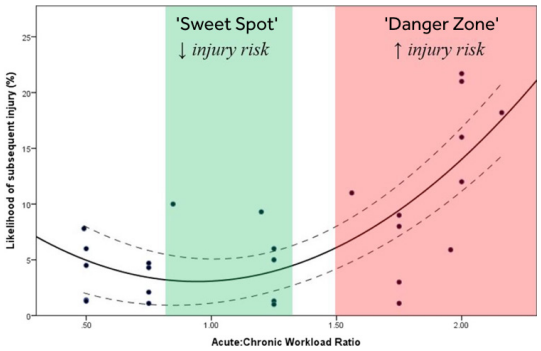
Goals

Training plans are intended to work towards a goal which is a calendar event.

A managed training plan will set overall targets for physiological, mechanical and training loads over the period leading up to the goal event.

ACWR

Planning toward a goal will take into account the **Acute to Chronic Workload Ratio** (ACWR), which is a measurement of relative increase of workout load during the course of a training program, or the ratio of short-term (Acute) load to long-term (Chronic) load.



A well-managed training program will set training load targets which keep athletes in the 'sweet spot' zone above, where loads increase towards the goal event, but at a rate which will minimize the likelihood of over-training injuries in the danger zone.

The training program will consist of recurring periodization microcycles - typically of one week duration. Training loads will gradually increase, leading to a prescribed unloading period immediately prior to the goal.

- Recurring periodization workout sequences are called **microcycles**.
- The entire training period up to the goal (including unloading) is called a **macrocycle**.

ACWR = (Current microcycle training load)/(Average of all previous microcycle training loads)

Note

The current widely-accepted range for ACWR is 0.8 to 1.3 for safe training.

If the training load is the same for each microcycle, then ACWR = 1.0

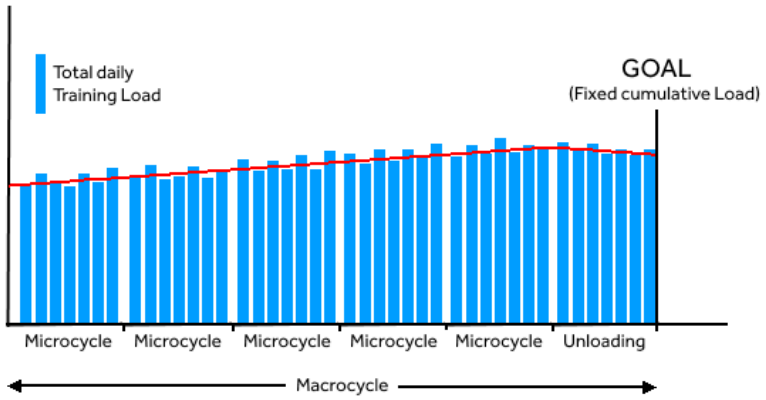
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Workflow

Periodization Plans and Training Plans operate in parallel.

Goals & Periodization Plans

For the periodization plan, a goal is created which sets cumulative target loads for the entire (multi-week/macrocycle) training cycle.

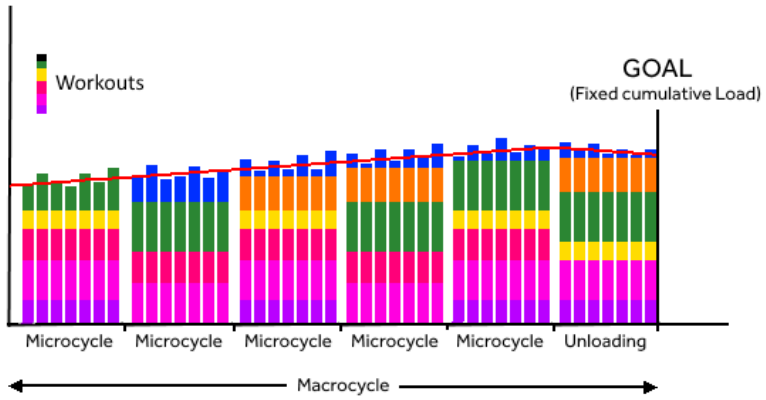


- When creating a **Goal**, **ACWR** and **Weekly Increase %** load values will be calculated for load parameters which are set globally in the **Threshold Settings > Loads For Periodization Planning** section of the portal.
- No detail of workouts or activities are contained in a Periodization Plan - only daily total load targets.
- The Periodization Plan serves as an envelope of target loads within which to construct a Training Plan.

Training Plans

A Training Plan uses a Periodization Plan as a template, but fills in the detail of daily activities and workouts. The total daily load parameters for all workouts should match the daily totals in the periodization plan.

This is dependent on baseline load parameter estimates for the activities in the workouts being known.



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Workouts and Activities

A Training Plan consists of a sequence of Workouts. Workouts, in turn, consist of a sequence of activities, or a single activity.

An activity is the basic building block of all training plans.

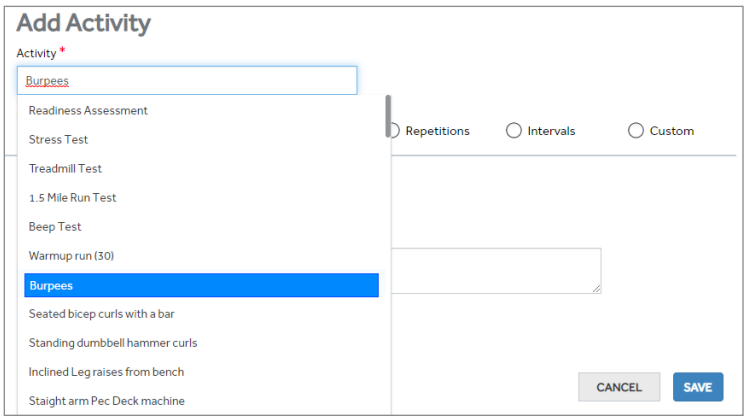
The hierarchy is:

Activity >> Workout >> Training Plan >> Periodization Plan

- Activities and Workouts typically describe a day of training.
- Training Plans typically describe a week or weeks of training.
- Periodization Plans describe a complete multi-week cycle of training towards a goal.

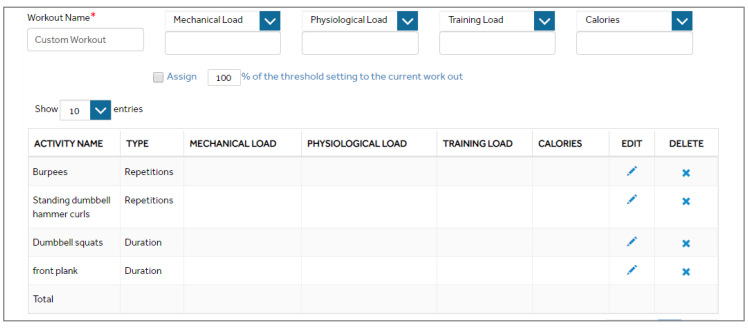
Create/ Add Activity

A number of pre-configured activities already exist in the portal database. These can be selected when creating a workout. New custom activities can be created as needed.



Create Workout

A workout is created by adding a sequence of activities.

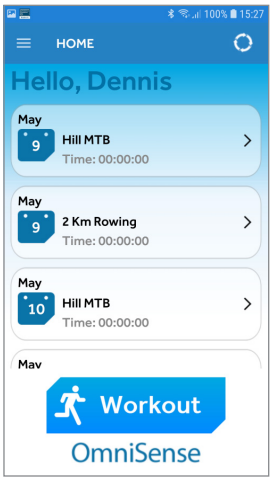


These tasks are described in detail in the next sections.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Steps to Create a Periodization Plan

1. Create a **Goal**.
   - Select the team or individual.
   - Set Start and End dates, and any unloading period.
   - Set Starting & Peak Weekly loads for the selected parameters. ACWR will be calculated automatically.
2. Create a **Periodization Plan**.
   - Select the Goal - Start and End dates will populate automatically.
   - Define the duration in days, and number of microcycles.
   - Populate the array of individual days with load targets. Percentage progress towards daily and weekly load targets will be indicated.
3. Using the periodization plan as a template, create a **Training Plan**.
   - Add a sequence of Workouts from the list available, specifying which day of the training plan they are assigned to, and a starting time, if needed. A day can consist of one or more workouts.
4. Create **Workouts** by adding a series of **Activities**.
   - Select the activities from a list, or create a new activity.
   - Specify the activity type and any parameter (e.g. weight, duration, repetitions) applicable. Add a note which will be displayed on the athlete mobile device when they see the workout.
   - Estimated load parameters will display for the activity if an average value can be retrieved from the portal database.
   - Estimate the workout load parameter totals by summing the load totals for the individual activities.
5. **Assign** the Training Plan (or individual workouts) to the team or individual concerned. The workouts will display on the athletes' mobile devices.



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Manage Goals

A goal is created as a set of target loads appended to a fixed calendar date. It's intended use is in the context of a **Periodization Plan**. When a periodization plan is created, an existing goal must be referenced. The goal specifies:

- A time interval (start and end dates).
- An unloading period at the end of the goal duration, if required.
- Intended **Starting** and **Peak** (final week of the cycle) loads for those parameters selected in the **Threshold Settings** screen of the portal.

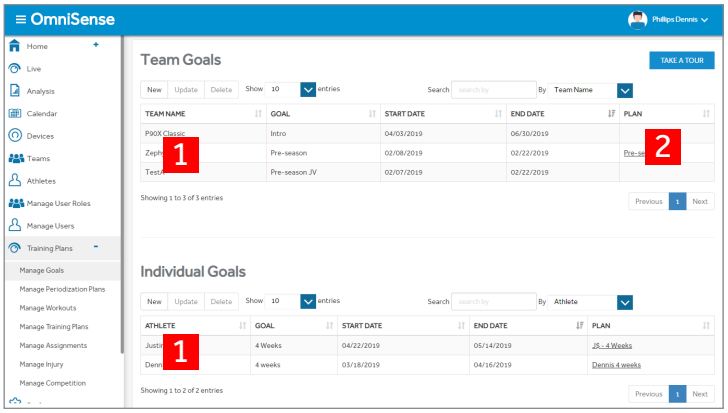
Note

Starting and **Peak** weekly load targets can only be set if there is prior knowledge of typical loads achieved for various activities and workouts.

Recommended practice is to create baseline workouts for athletes and assign them as part of a training plan that is not part of a periodization plan. Examining real athlete data will allow a coach to set target loads.

Once a coach has better knowledge of what are realistic daily and weekly targets, then a periodization plan can be planned and implemented. Only at this point can goal targets be set.

- Expand the **Training Plans** node in the Portal and select **Manage Goals**. Any existing goals will be displayed.



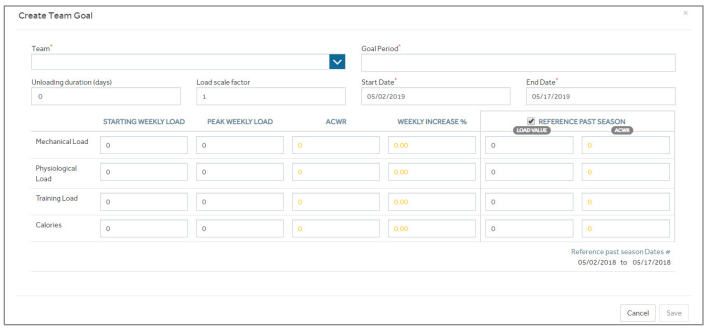
Manage Goals screen

#	Description
1	Select an existing **Team** or **Individual** goal and use the buttons to edit or delete it.
2	An entry in the **Plan** column indicates the goal has been referenced in a **Periodization Plan**.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Create a Goal

Select the **New** button in the **Team Goals** or **Individual Goals** section. The creation process is identical, other than selecting the Team or Individual concerned.



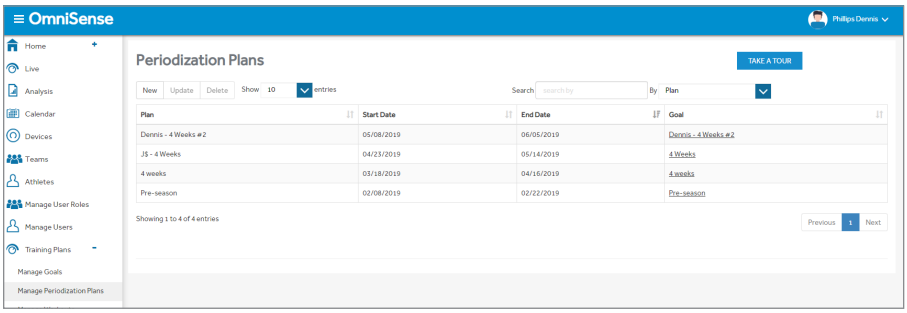
Item	Description
Team/Individual	Select the Team or Individual from the pull down list.
Goal Period	This is the name of the goal as it will be referenced in the **Periodization Plan** screen. It is helpful to include the duration e.g. " A Team 4 weeks".
Unloading Duration	Include any unloading duration in days, if applicable. This will cause the final week of the cycle to be truncated in the Periodization screen. As an alternative, simply reduce target loads during the final days of the periodization cycle, and leave the Unloading Duration as zero.
Load Scale Factor	When implemented, an existing goal may be loaded as a template, and all load values incremented by this factor to quickly generate a new goal without manually entering values. Save the new goal under a different name.
Start/End Date	Select from calendar pop-ups. The End Date must be later than 4 weeks after the Start Date for ACWR to be calculated.
Load Parameters x 4	Displayed parameters correspond to those selected in the Threshold Settings screen of the portal.
Starting Weekly Load	Baseline weekly load for the training cycle. These fields will pre-populate with data from the previous week, if available. Edit as needed.
Peak Weekly Load	Weekly load for the final week of the training cycle.
ACWR	Calculated automatically if the goal period is 4 weeks or more.
Weekly Increase %	Calculated automatically as Starting and Peak weekly loads are added.
Reference Past Season	When checked, the Peak weekly load and corresponding ACWR will be retrieved from the database from the same period in the previous year, if available. It is for reference only.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Manage Periodization Plans

A periodization plan creates a framework within which a training plan operates. It contains no daily workout or activity detail - it consists only of a set of daily load targets arrayed over the periodization plan macrocycle.

A periodization plan references a specific **Goal**.



Manage Periodization Plans screen

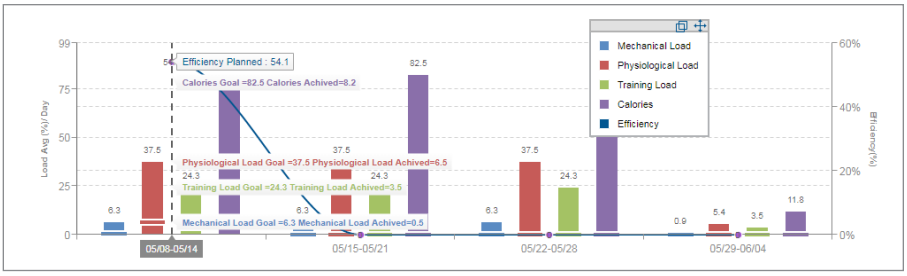
- Select an existing plan and use the buttons to update or delete it.

Note

The **Start** and **End** dates cannot be edited for an existing plan. A new plan must be created to change these values.

Periodization Report

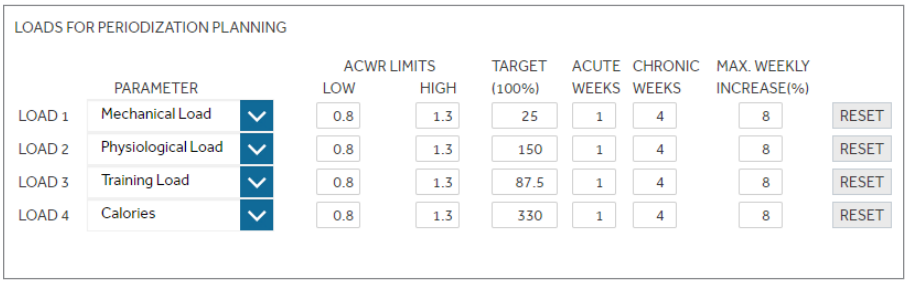
The purpose of the Periodization Plan is to establish a sequence of daily training load limits, with oversight on the **ACWR** ratio, **Training Efficiency**, and **Training Effectiveness**. These can be displayed graphically as a **Periodization Report**.



Periodization Report

Loads for Periodization Planning

Periodization Plans reference daily load parameters and targets configured in the **Threshold Settings** screen.

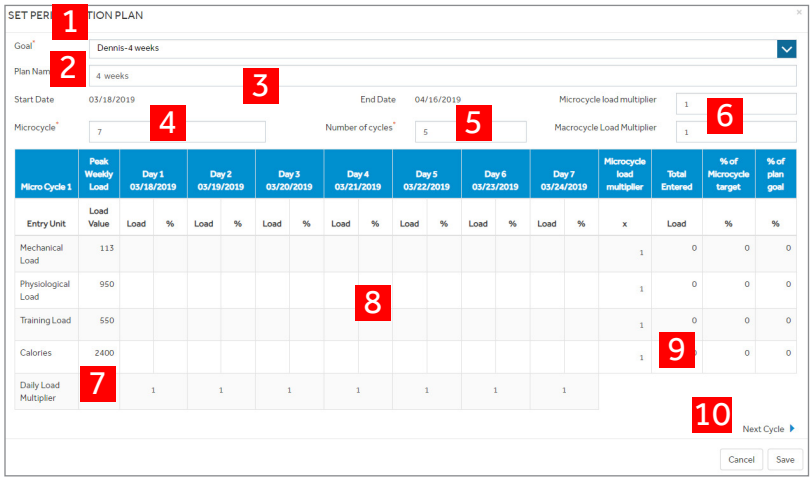


Loads in the Threshold Settings screen

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Create Periodization Plan

- Select the **New** button in the **Manage Periodization Plans** screen.



#	Description
1	Select Goal - a list of available goals will display.
2	Name the plan.
3	The Start and End Dates referred from the goal will display automatically. To change these, you must create a new goal.
4	Microcycle - typically 7 (days). Set as desired.
5	Macrocycle - number of microcycles. E.g. 4 = 4 x 7 days.
6	Load Multipliers - these allow an existing plan to be cloned and incremented by a percentage. Microcycle load multiplier applies to the currently displayed microcycle.
7	Peak Weekly load values referred from goal - used for reference.
8	One microcycle, laid out in days. Manually enter Load values for each day.
9	Percentage toward microcycle target, and macrocycle target, are populated automatically when load values entered.
10	Next and Previous (not shown) buttons to increment to next week/ microcycle. All microcycles must be populated to complete the periodization plan.

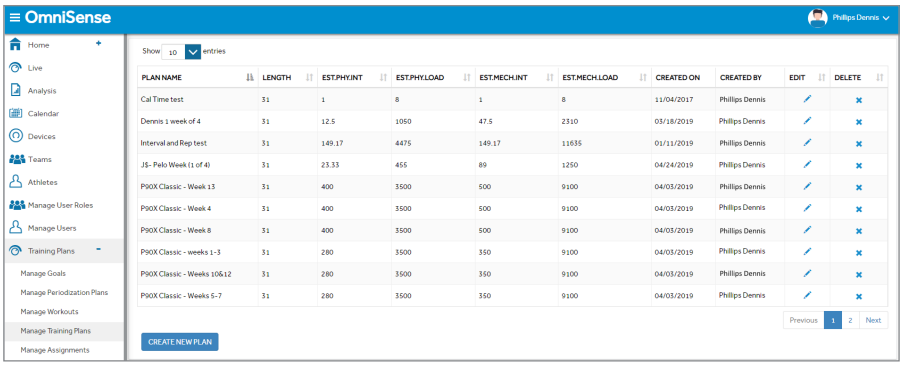
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Manage Training Plans

A Training Plan is a collection of workouts, one or more per day. Each workout in turn is a collection of activities.

A Periodization Plan allows planning of daily load targets within which to assemble a training plan.

Once created, a Training Plan can be assigned to a team or individual, and the activities are pushed to their mobile devices for individual participation.



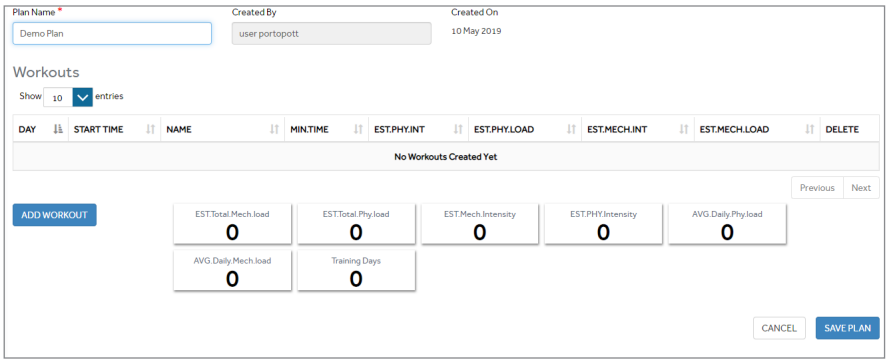
Manage Training Plans Screen

- Use the buttons to edit or delete existing plans, or create a new plan.
- Training Plans do not have a specified **Start Date**, only a number of days, shown in the **Length** column.
- These **Estimated Load** parameters are determined by summing the estimated loads of individual workouts within the plan.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

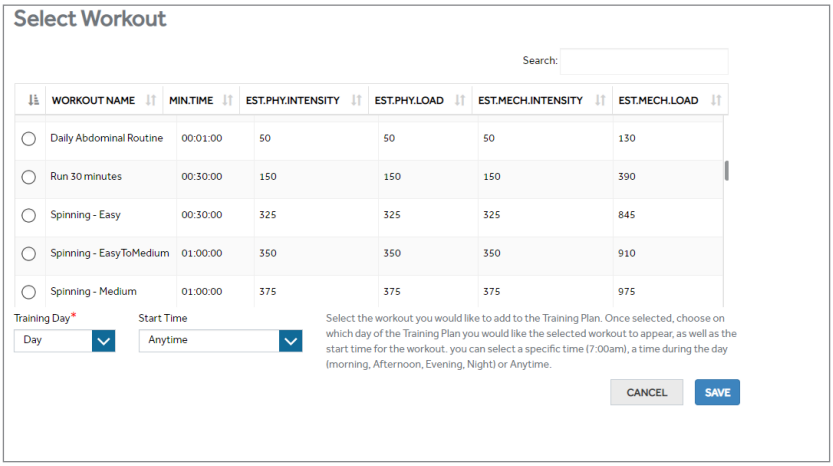
Create a Training Plan

- Select the **Create New Plan** button.



Create Training Plan screen

1. Add a name for the plan.
2. Select **Add Workout**.



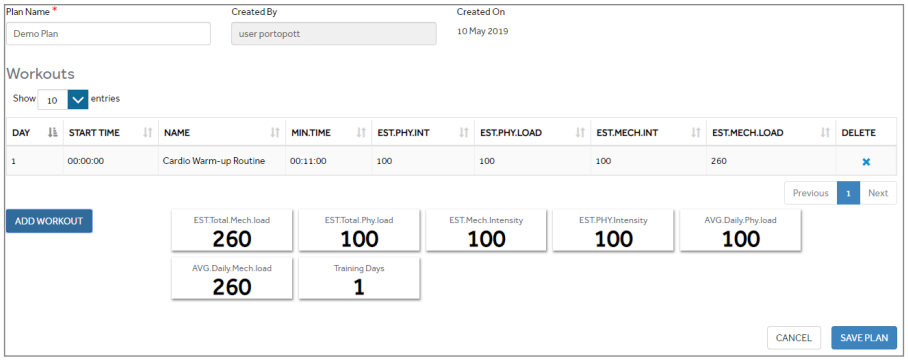
Select Workout Screen

3. Browse the list and select a workout using the button in the first column.
4. Select the **Training Day** - the pull-down list corresponds to the Length of the training plan.
5. **Save** the workout to the training plan.

   If the desired workout is not available from the list, then it must be created from the **Manage Workouts** screen.

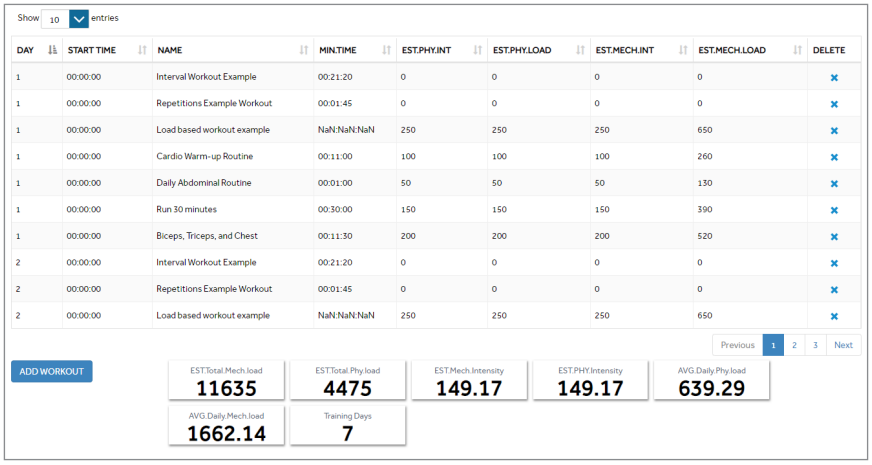
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

6. When saved, the estimated load totals will be added to the training plan.



7. Repeat the process as necessary to populate all the training program days with workouts. Specific days can be omitted if they are designated rest days.

8. A fully-completed training plan may occupy several screens - use the Previous/Next and page number buttons to view or delete workouts if necessary.



Completed Training Plan

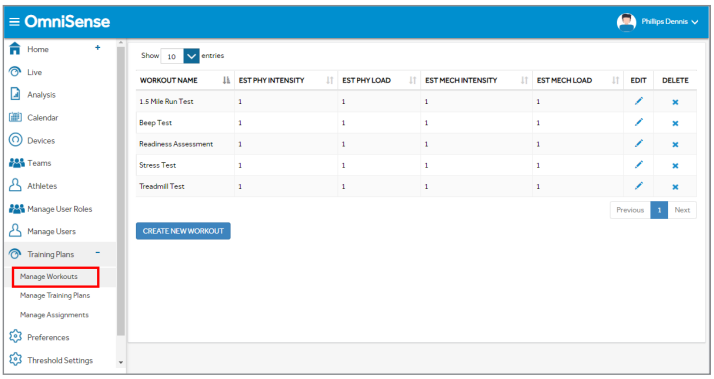
9. When complete, a training plan can be assigned to a team or individual in the **Manage Assignments** screen.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

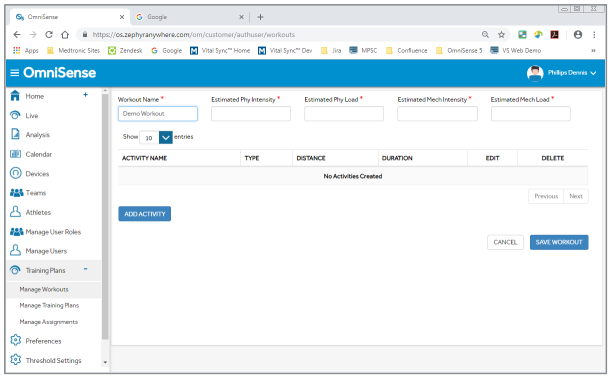
Manage Workouts

Before a Training Plan can be created, Workouts must be available. Workouts consist of a series of Activities. These in turn must also be created. Only Admins,Coaches and Managers can manage Training Plans.

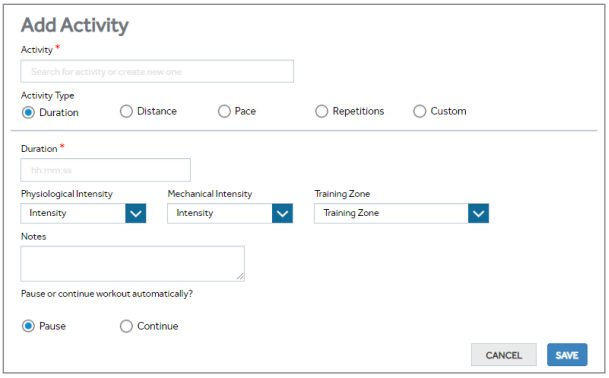
1. Expand the **Training Plans** node in the navigation panel, and select the **Manage Workouts** node.



2. A number of pre-configured workouts already exist, which correspond to fitness tests which can be analyzed specifically in OmniSense™ Analysis. These can be assigned at any time to suit.



3. Select the **Create New Workout** button. In the **Create New Workout** screen, name the workout, and select the **Add Activity** button.



4. The **Add Activity** dialog contains a large number of individual activities which can be selected from the **Activity** field.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

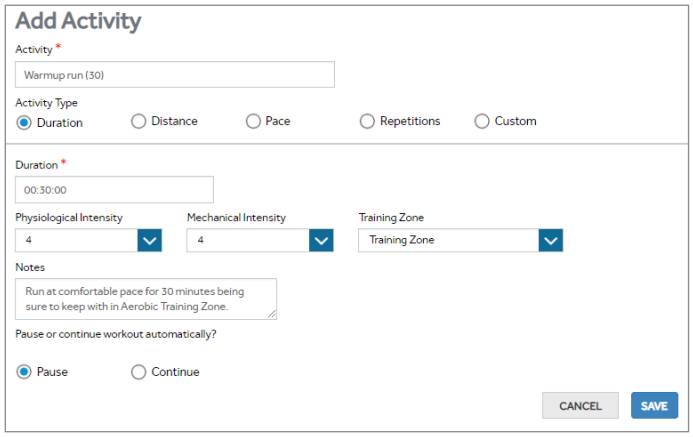
List of Available Activities

Over 60 activities can be selected from the pull down list in the **Activities** field.

- Warm up run (30)
- Burpees
- Seated biceps curls with bar
- Standing dumbbell hammer curls
- Inclined leg raises from bench
- Straight arm Pec Deck machine
- Bent arm Pec Deck Machine
- Seated single arm biceps curls with dumbbell
- Inclined bench press with bar
- Inclined bench dumbbell straight arm extensions
- Standing back stretch
- Forearm stretch
- Overhead triceps stretch
- Bar squats
- Dumbbell squats
- Inverted 45 degree leg press
- Seated knee extensions
- Lunges with bar
- Dead lifts with bar
- Reverse single leg knee extensions
- V leg hamstring stretch
- Seated back stretch
- Standing Quad Stretch
- Bent upright row with bar
- Wide arm lat pull down
- Wide arm pull ups
- Bent row on bench with dumbbell
- Seated triceps extensions behind head with bar
- Laying on bench triceps extensions with bar overhead
- Standing triceps extension with V handle on cable machine
- Standing single arm chest stretch
- Standing double arm chest stretch
- Straight arm front dumbbell raises
- Seated upright military shoulder press with dumbbells
- Bent over lateral raises with dumbbells
- Abdominal flexor crunches
- Hip flexor leg raises from stand
- Vertical inclined leg raises from stand
- Back extensions
- Pushup inverted crunch combo
- Arm across chest shoulder stretch
- Laying back stretch
- Standing straight arm chest stretch
- Burpees jumping jacks pull ups combo
- Spinning Easy/ Medium/Hard
- Spinning EasyToMedium
- Body Combat
- 3x Hill Easy/Medium/ Hard
- Hamstring Stretch
- Inclined upright row with bar
- Pike Sit ups
- Horizontal leg raise stretch
- Sit ups

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

5. Depending on the activity selected, other fields in the dialog may populate automatically.



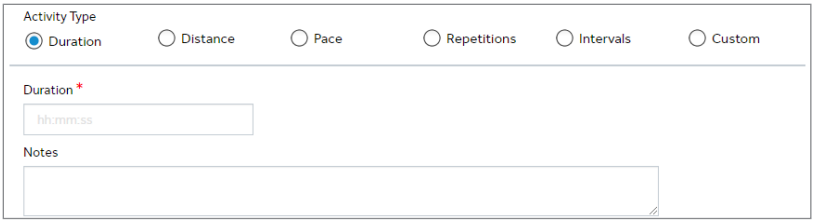
in the above example, **Warm up Run (30)** is selected, and **Activity Type**, **Duration**, **Physiological Intensity**, **Mechanical Intensity**, **Training Zone** and **Notes** will be automatically set. Training Zone can be selected as a field in OmniSense™ Mobile.

Select **Pause** or **Continue**. If Pause is selected, the athlete will need to select the **Resume** button on their mobile device when they wish to continue the workout.

Activity Type

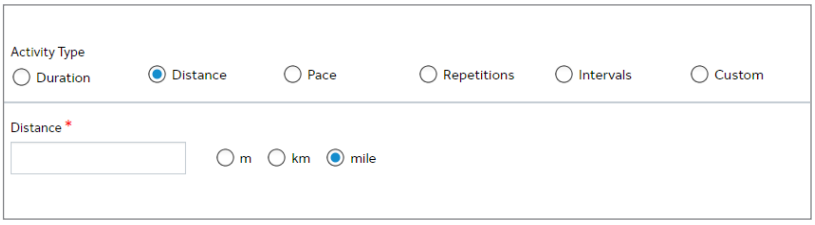
Required parameters will vary according to the Activity Type.

Duration



Item	Description
Duration	Duration of activity in **hh:mm:ss** format
Notes	Add as appropriate for all activities.

Distance



Item	Description
Distance	Distance, in the selected unit.

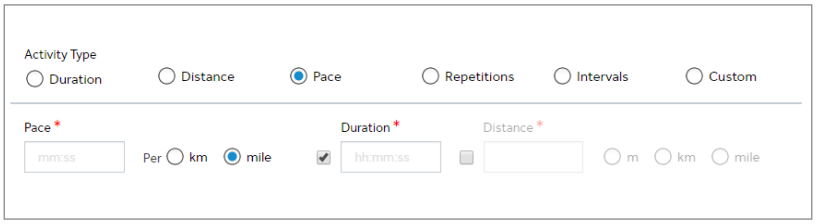
Note

Notes will be enunciated from the mobile application, if enabled in the app.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

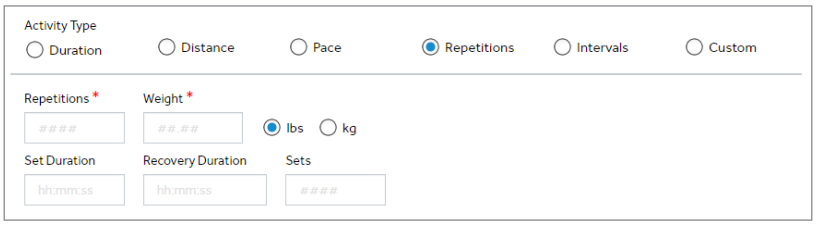
Training Plans (17/22)

Pace



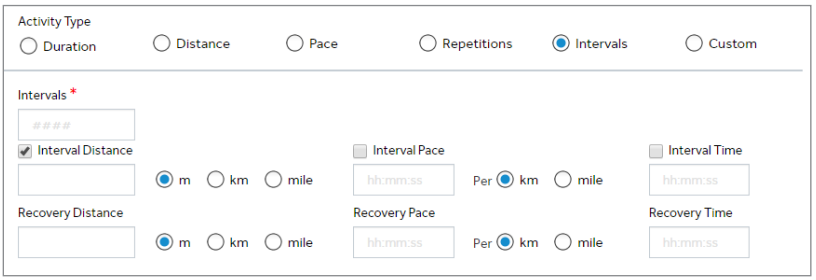
Item	Description
Pace	**hh:mm** for the selected unit.
Duration/Distance	Select one. Sets an upper limit for the activity.

Repetitions



Item	Description
Repetitions	Number of repetitions.
Weight	Weight used in selected unit.
Set Duration	Time duration of set.
Recovery Duration	Allocated time delay before start of following set.
Sets	Number of sets.

Intervals



Item	Description
Intervals	Total number of intervals for distance work.
Interval Distance/ Pace/Time	Select one, with appropriate units.
Recovery Distance/ Pace/Time	Select values for recovery/cool down at the end of the activity.

Custom

No custom parameters to enter. Add **Notes** as appropriate.

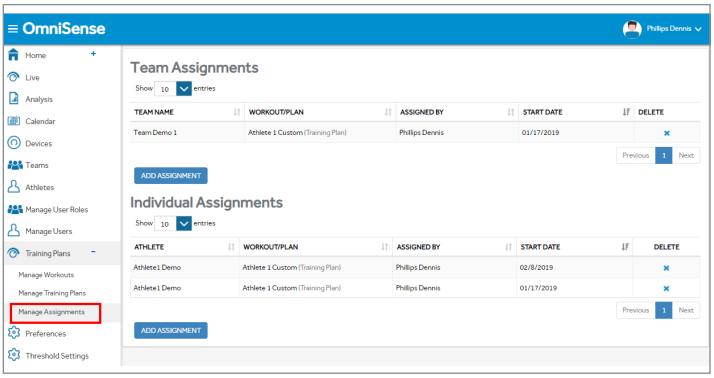
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Manage Assignments

The **Manage Assignments** screen allows coaches to assign entire training plans, or single workouts, to a team or individual subject.

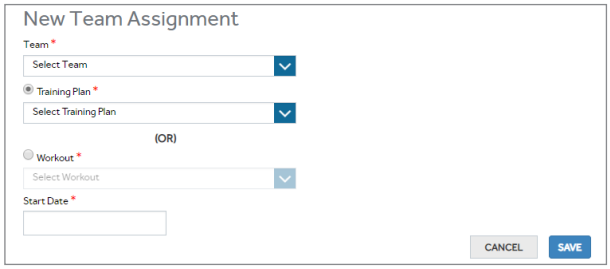
- Training plans and workouts must already exist.
- Once assigned, the assignments will be pushed out to athlete's mobile devices, and can be viewed on their - and the coaches, - dashboards in the portal.

1. Expand the **Training Plans** node in the navigation panel, and select the **Manage Assignment** node.



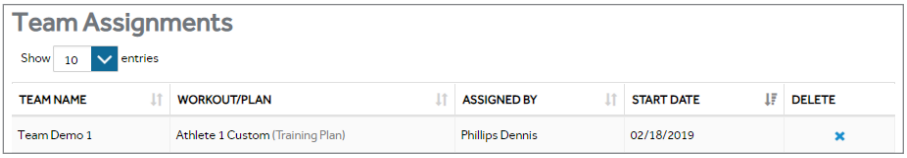
Existing assignments can be deleted, but not updated.

2. Select the **Add Assignment** button in the **Team Assignments** or **Individual Assignments** section as appropriate..



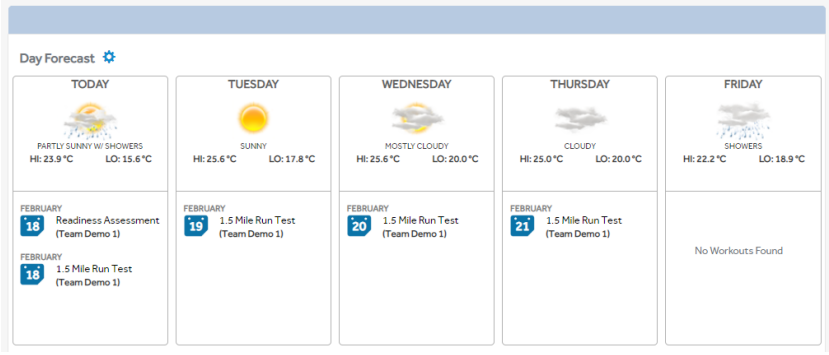
Shown is the **New Team Assignment** dialog. The **New Athlete Assignment** dialog has the same layout. Select the **Team/Athlete** and training plan or workout and **Start Date** as needed, and **Save**.

3. A new entry will appear in the relevant assignments section.

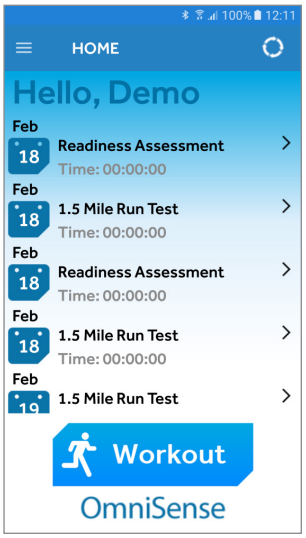


CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

4. The newly-assigned training plan/workout will appear in the coach's dashboard calendar **Forecast** widget.



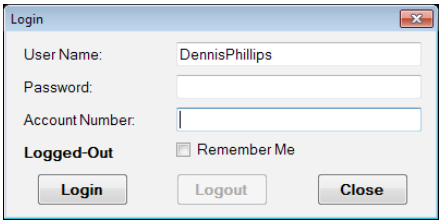
When athletes next log in to OmniSense™ Mobile, the assignments will be displayed on their home screen.



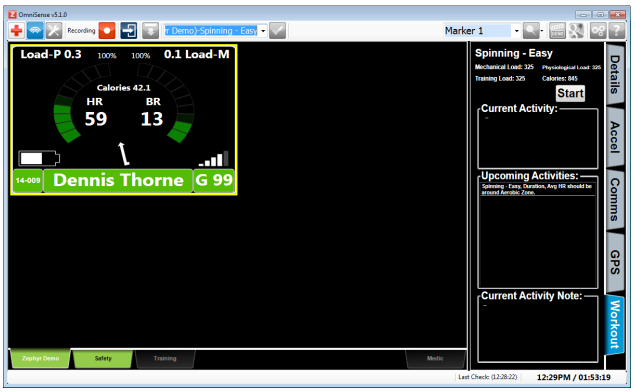
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Send Team Assignments to PC Application

Team assignments are available on the OmniSense Live PC application when it is connected to the web portal on the date of the assignment.



1. Connect the PC OmniSense Live application to the web portal.



2. Select the assigned activity from the **Session Names** pull down list, and enable using the **Select Session Name** button.

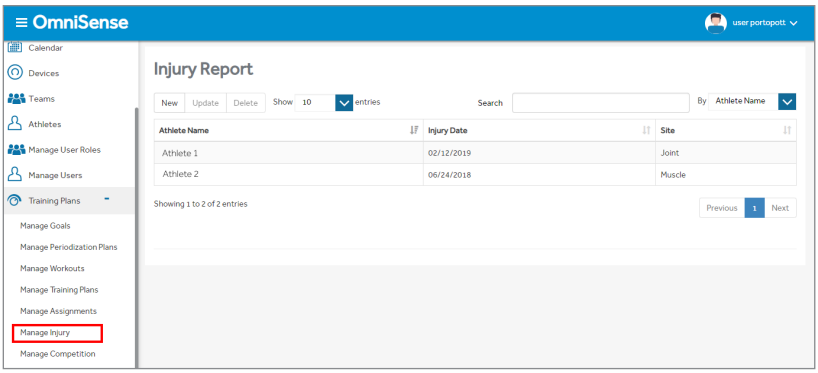
3. Configure the BioGauge (standard or training) to show one or more of the target load parameters displayed at the top of the workout side panel.

4. **Start** and **Stop** the activity using the button at the top of the Workout side tab.

   - Activity information is displayed in the panels in the workout side tab.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

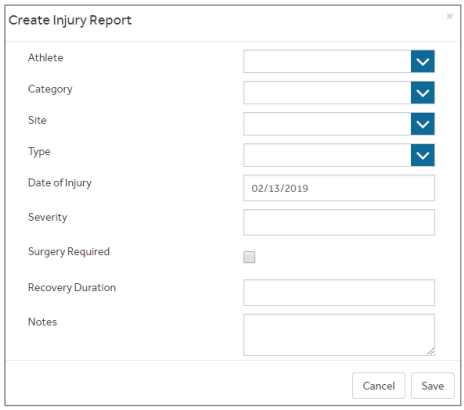
Manage Injury



- Access the **Manage Injury** screen from the navigation panel.
- The screen displays a historical summary of athletes and injuries.

Create Injury Report

1. Select the **New** button.

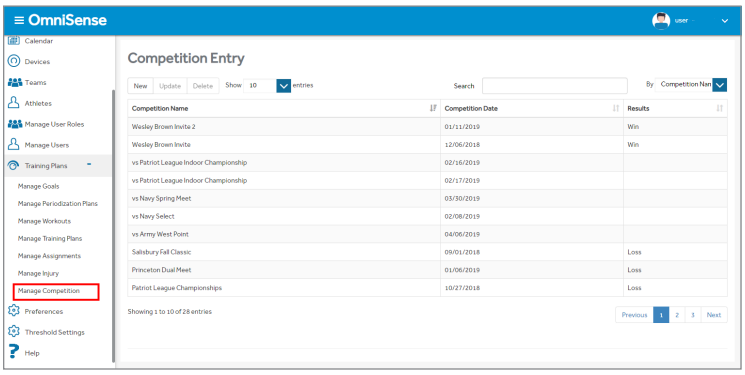


Item	Description
Athlete	Select from pull down list.
Category	Select from pull down list.
Site	Select from pull down list.
Type	Select from pull down list.
Date	Click in field to display calendar
Severity	0-10 scale
Surgery Required	Check if necessary
Recovery Duration	Enter duration
Notes	Add as appropriate

2. **Save** the Report.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

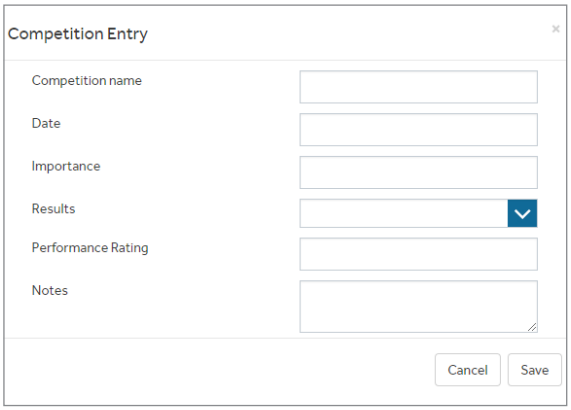
Manage Competition



- Access the **Manage Competition** screen from the navigation panel.
- Use the competition dates to set long term Training Goals.

Create Competition Entry

1. Select the **New** button.



Item	Description
Competition Name	Add name
Date	Click in field to display calendar
Importance	0-10 scale
Results	Select Win/Lose from pull down
Performance Rating	0-10 scale
Notes	Add as appropriate

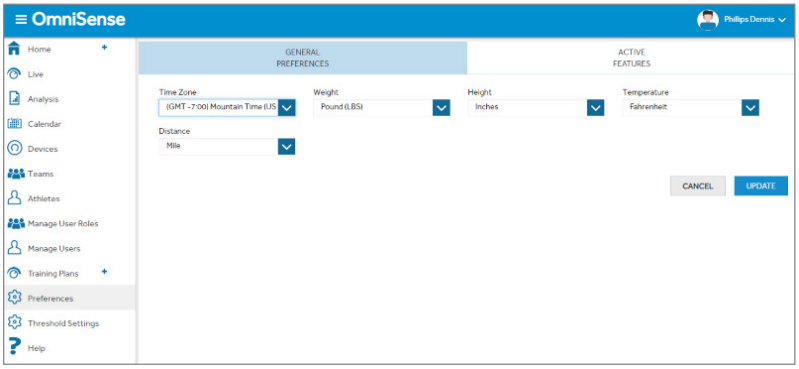
2. **Save** the Entry.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Preferences

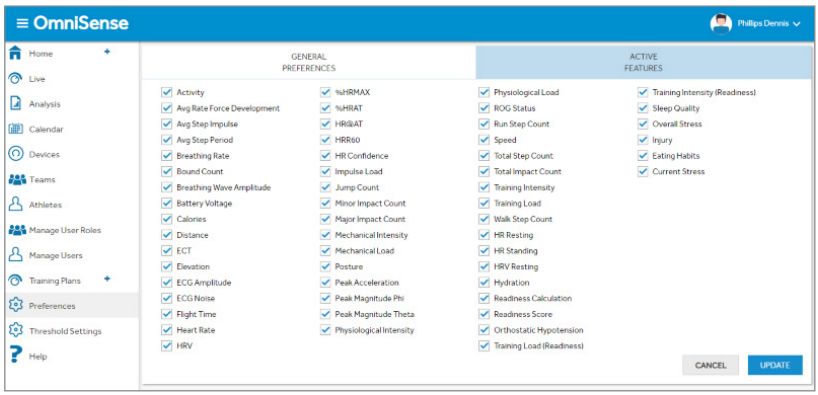
General Preferences

Access portal **Preferences** from the navigation pane. Only Admins and Coaches can see this option.



Item	Description
Time Zone	Select from list.
Weight	Select metric or imperial units.
Height	Select metric or imperial units.
Temperature	Select metric or imperial units.
Distance	Select metric or imperial units.

Active Features



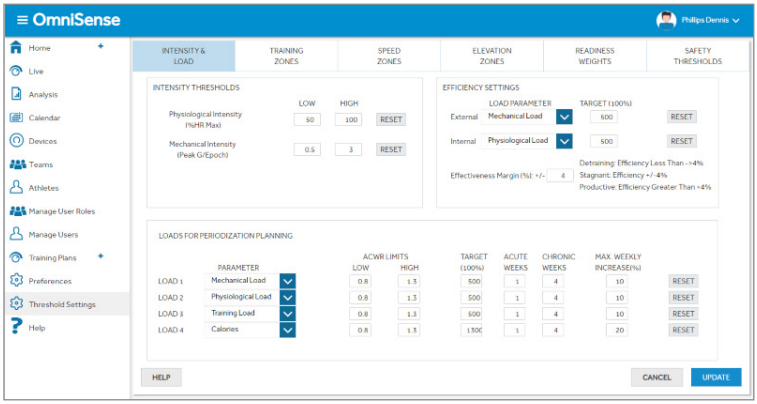
- Check those parameters which are to be viewable on the portal. Parameters not selected will not be available for **Reports** or **Dashboard** items.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Threshold Settings (1/8)

Intensity & Load

For all Threshold Settings, access from the navigation pane, and then select the tab from the top of the screen.



Intensity Thresholds

Item	Description
Physiological Intensity LOW/HIGH % HRmax	The intensity scale 1 - 10 is divided equally into 10 zones between the Low and Max thresholds. Below the lower limit e.g. below 50% of maximum heart rate, Intensity has no (null) value for calculations. Defaults are: Low: 50% HRmax Max: 100% HR max
Mechanical Intensity LOW/HIGH Peak g/Epoch	The intensity scale 1 - 10 is divided equally into 10 zones between the Low and Max thresholds. Below the lower limit, e.g. below 0.5g, Intensity has no (null) value for calculations. Defaults are: Low : 0.5g Max: 3.0g

- Any value above the max limit has an intensity of 10. This is the maximum value.
- Actual values are evaluated geometrically within the zone lower and upper limits, so decimal values for Intensity are displayed.
- The **Reset** buttons reset values to their defaults.
- Physiological & Mechanical Load values are the cumulative totals of the corresponding Intensities. See **Fitness Parameters** section.

Note

All Threshold Settings in the portal and local PC are synchronized whenever a PC instance of OmniSense™ is connected to the cloud. The most recent settings are considered valid.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Efficiency Settings

Training Efficiency is defined as the ratio of an External Load to an Internal Load expressed as a percentage for any given workout. If the trend of this value is monitored over time, it can give an indication as to whether the training is effective or not.

External Load

An External Load could be described as the 'effect' of training. The load parameter chosen is at the discretion of the coach, but it must measure some external parameter (i.e. not an athlete internal physiological parameter), such as:

- Exercise Time
- Impulse Load
- Major Impact Count
- Total Step Count
- Distance
- Mechanical Load
- Training Load

Internal Load

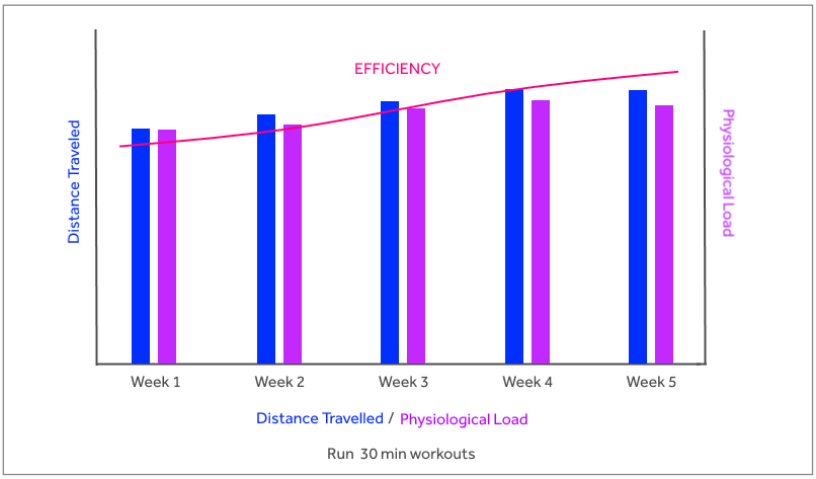
An Internal Load could be described as the 'cost' of training. It must measure some internal physiological parameter, such as:

- Physiological Load
- Calories burned
- Training Load

Training Efficiency

As an athlete's condition improves, then a fixed external load (such as distance covered running for 30 min) should steadily increase for a given internal load, or if the distance stays the same, it should require less effort.

The **ratio** of (Distance / Physiological Load) will vary each time the workout is measured.



Indicative graph showing Efficiency as Ratio of an External to Internal Load parameter.

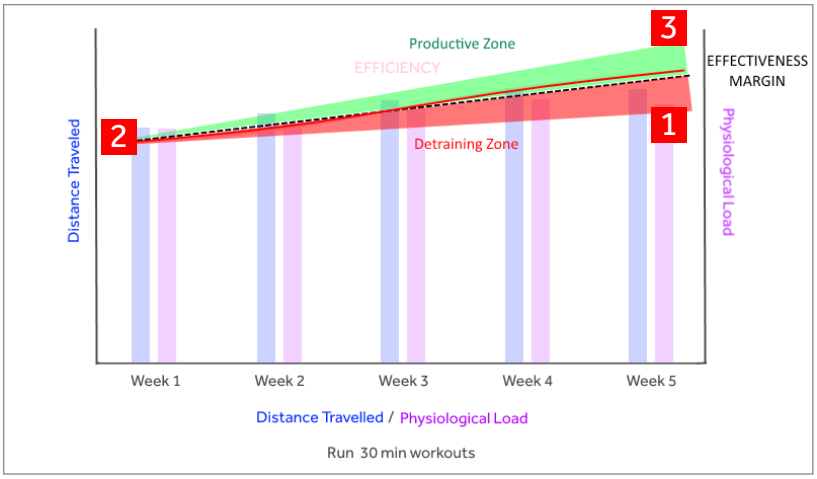
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Threshold Settings (3/8)

Training Effect

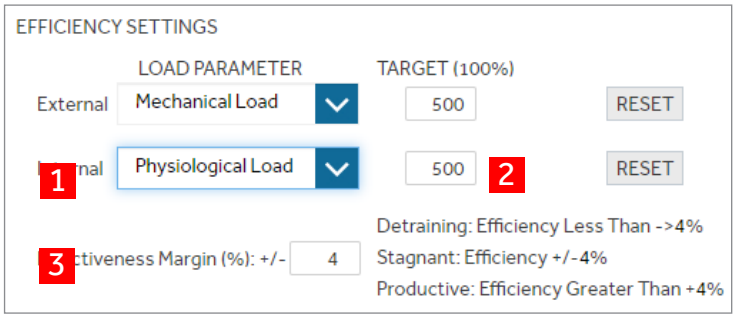
If Efficiency increases gradually over time, then the training is said to be **Productive** if above a configurable value. If it decreases, then **Detraining** is taking place.

The **Effectiveness Margin** setting allows a coach to determine what magnitude of percent increase is deemed to be productive.



#	Graph	Training Effect
1	Red Zone	Detraining - Efficiency less than Effectiveness Margin.
2	Black dash line	Stagnant - Efficiency equals Effectiveness Margin.
3	Green Zone	Productive - Efficiency greater than Effectiveness Margin.

- Coach experience will allow them to set an Effectiveness Margin which meets their training expectations. The default is 4%.



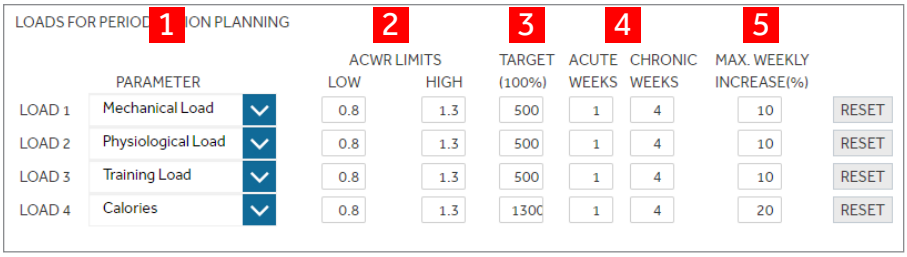
#	Training Effect
1	Select internal & external parameters for efficiency calculation.
2	Set the daily target for each.
3	Set the Effectiveness Margin.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Threshold Settings (4/8)

Loads for Periodization Planning

The loads for Periodization planning will be referred when creating a goal for a **Periodization Plan**.

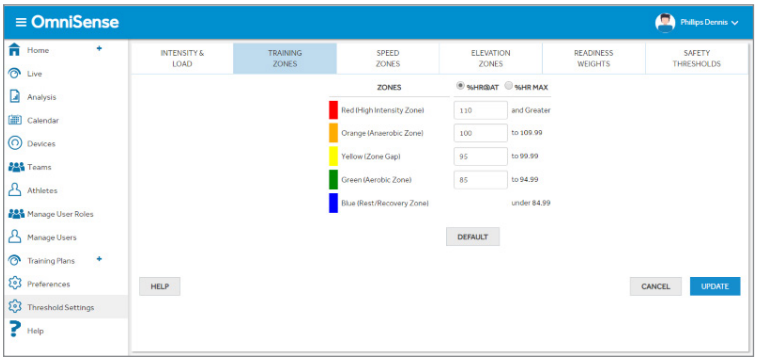


#	Description
1	Select the parameters which be used as target-setting criteria when creating a goal for a Periodization Plan. The defaults are shown.
2	Set ACWR limits. Values which are outside these limits will be flagged by color when displayed in Periodization reports.
3	Set the daily target levels intended for athletes. These targets will be pushed to athlete mobile devices, where they can monitor their progress towards daily targets in the Thresholds screen of the app.
4	Specify the Acute/Chronic week values over which ACWR calculations will be made.
5	Set an upper limit for percentage weekly increase in load. Values above this level will be flagged in color when creating periodization plans.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Training Zones

Training Zones are used in the Workout side tab of OmniSense™ Live local version. The Workout tile background color shows the target training zone. Athlete Training BioGauges will display, and athletes should attempt to match the color of their Training BioGauge with that of the Workout tile.



Item	Description
Zones	Set the lower limits for the zones. Adjacent upper limits will adjust accordingly.
%HR@AT / %HRmax	Choose the preferred Reference parameter for calculating zone limits.
Default	Button returns thresholds to default.



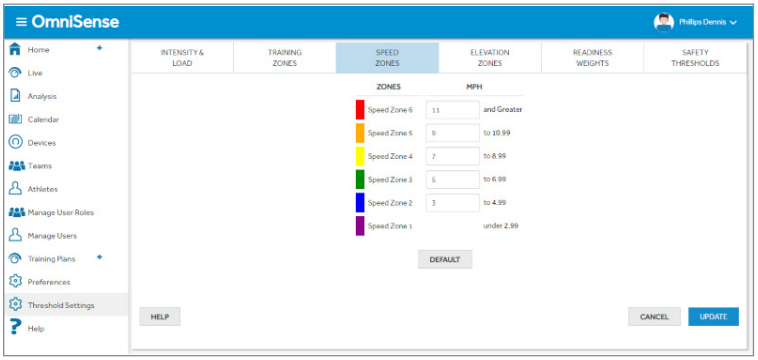
OmniSense™ Live showing the Green Zone on the Training BioGauges, and on the Workout tiles in the Workout tab on the right.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Threshold Settings (6/8)

Speed Zones

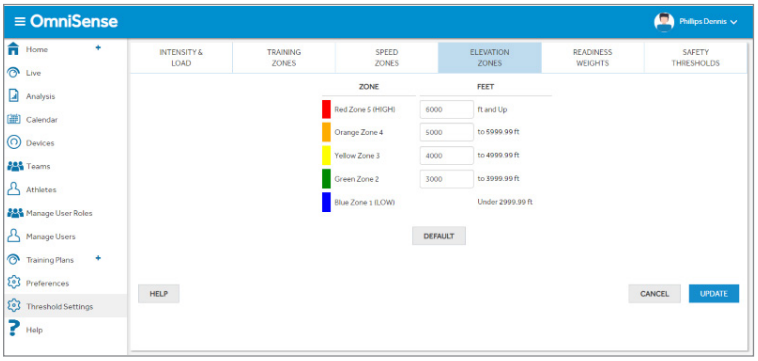
Speed Zones can be displayed as background color on any Over Time graph in Analysis on the portal, or local PC instance. They refer to speed as measured by GPS, so the subject must use a GPS device if data is gathered over ECHO, logged directly into the BioModule, or optionally the GPS on their mobile device if using the OmniSense™ Mobile application.



Item	Description
Zones	Set the lower limits for the zones. Adjacent upper limits will adjust accordingly.
Default	Button returns thresholds to default.

Elevation Zones

Elevation Zones can be displayed as background color on any Over Time graph in Analysis on the portal, or local PC instance. They refer to speed as measured by GPS, so the subject must use a GPS device if data is gathered over ECHO, logged directly into the BioModule, or optionally the GPS on their mobile device if using the OmniSense Mobile application.

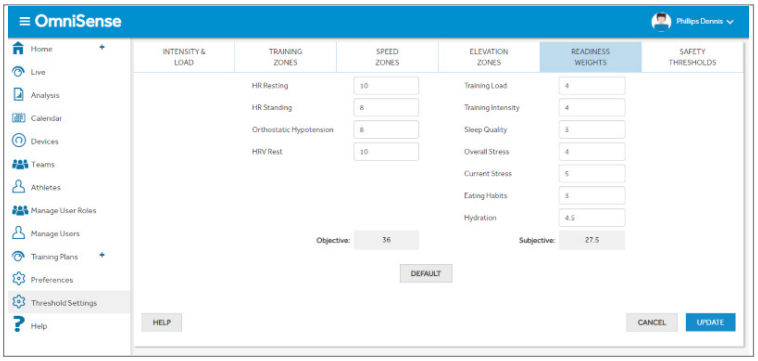


Item	Description
Zones	Set the lower limits for the zones. Adjacent upper limits will adjust accordingly.
Default	Button returns thresholds to default.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Readiness Weights

Readiness Weights are applied when a subject completes the survey following an orthostatic hypotension readiness test.



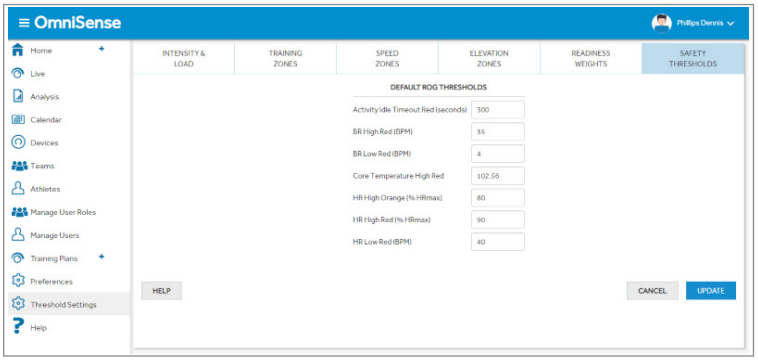
Item	Description
Objective Parameters	The four objective parameters are established from the test data.
Subjective Parameters	The seven subjective values are evaluated from the responses to the survey. Athletes score all responses on a 1 - 10 scale for user friendliness, but the weighting values can be used to prioritize the importance of one response against another.
Objective/Subjective Total Values	It is recommended that the objective value total should always exceed the subjective value total.
Default button	Button returns weightings to default.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
> Overview
> Home Screen
> Default Widgets
> Custom Widgets
> My Profile
> Live Screen
> Analysis
> Reports
> Calendar
> Devices
> Teams
> Athletes
> Manage User Roles
> Manage Users
> Training Plans
> Preferences
> Threshold Settings
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Threshold Settings (8/8)

Safety Thresholds

Safety Thresholds determine the athlete's ROG status as displayed on their subject BioGauge. It can also be applied as a background color on Over Time graphs in Analysis.



Item	Description
Activity Idle Timeout Red	Normally disabled by de-selecting this parameter in OmniSense Local Live **Subject > Settings**, so it does not apply. If enabled, and the subject remains inactive for longer than this number of seconds, their status will report Red. This was intended for use with First Responders - specifically fire crew - where a prolonged period of inactivity might indicate they were incapacitated.
BR High Red	High breathing rate threshold.
BR Low Red	Low breathing threshold.
Core Temperature High Red	Estimated Core Temperature high threshold.
HR High Orange	High heart rate first threshold.
HR High Red	High heart rate second threshold.
HR Low Red	Low heart rate threshold.

Note

Any single parameter crossing a threshold will cause the athlete's ROG status to elevate to whichever is the highest state (red is highest).

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
>Overview
> Applications Screens
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Overview

The OmniSense™ Mobile application has both Android™* and iOS™* versions. Its use is limited to users who are registered with an OmniSense™ Cloud customer account.

The app supports both the BioModule and the Zephyr™ HxM Smart device.



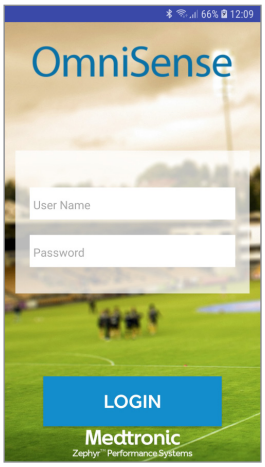


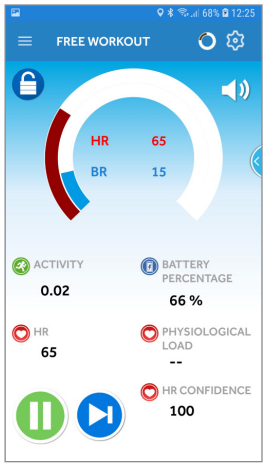
Both devices use **Bluetooth™* Low Energy** (BLE) to communicate with the mobile device.

Note

The BioModule has more parameters available than the HxM Smart - when configuring Workout screens, only those parameters the device can supply will be available.

- The user login for the app will be the same as that used for the web portal.
- Users register using the portal when they receive their user name, account number and an email requesting they validate their account. See the **OmniSense™ Web Portal** section.

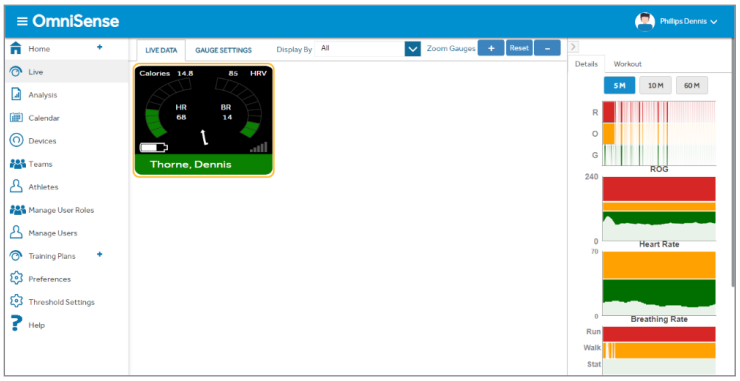




- All workouts assigned via training plans are pushed to the mobile device automatically. The user will see them on their **Home** and **Calendar** screens.
- When used during a workout, the screen shows a BioGauge and a number of configurable fields.
- The app supports fitness and readiness tests, so that they can be performed remotely.
- Audio prompting and notifications (time, distance etc) can be enabled.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
>Overview
> Applications Screens
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

- While a session is active, a user with appropriate permissions can view the subject remotely using the web portal.



Notifications

Notification icons may appear on screen while the app is running, either next to the app icon, or at the top of the mobile device desktop.

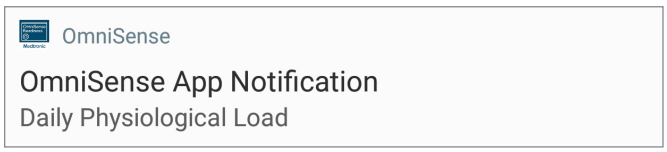


Android™* desktop showing an active notification (left), and that OmniSense™ Mobile is running (right)



Notification at App icon

- A notification may inform that a daily load threshold has been met, or that an individual workout threshold or duration has been reached.



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
>Overview
> Applications Screens
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

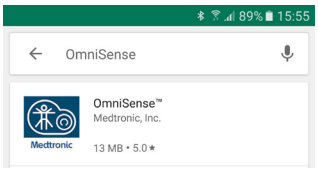
Overview (3/9)

Install

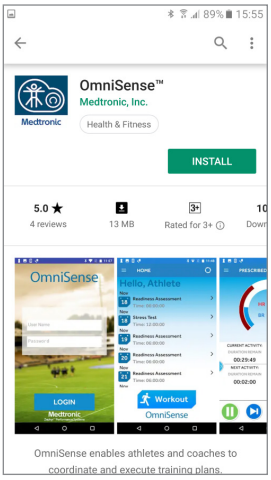
The Android™* app is available from Google Play™* Store; the iOS™* version from the Apple™* App Store™*

iOS™* App Store™* Android™* Play Store

1. Go to the appropriate app store and search for '**OmniSense™**'.



2. Install the application from the store as you would for any other application. The app will request access to location data.



3. A shortcut will be placed on the mobile device apps page.



Note

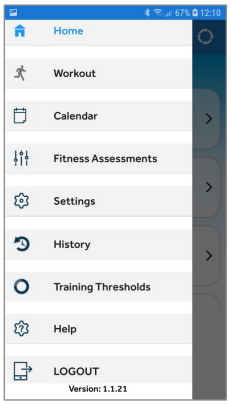
Screen captures throughout these sections are taken from an Android™* mobile device unless otherwise stated. The screens are very similar when using an iOS™* device.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
>Overview
> Applications Screens
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

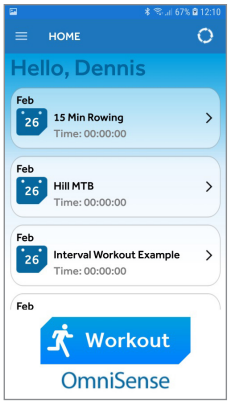
Overview (4/9)

Screens

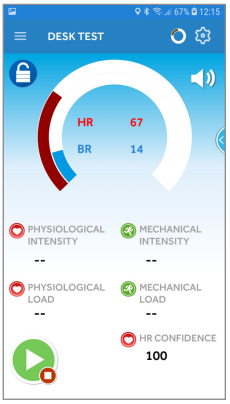
These screen captures provide a brief overview of the application. Their operation is described in detail in the sections following.



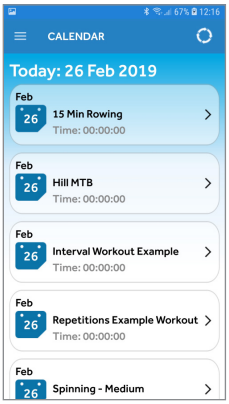
Menu



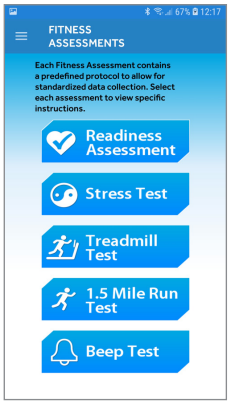
Home



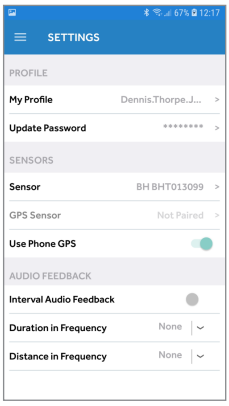
Workout



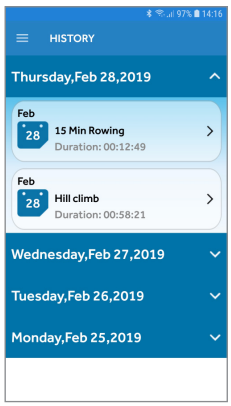
Calendar



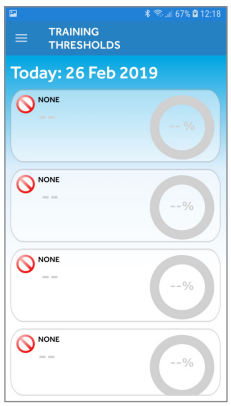
Fitness Assessments



Settings



History

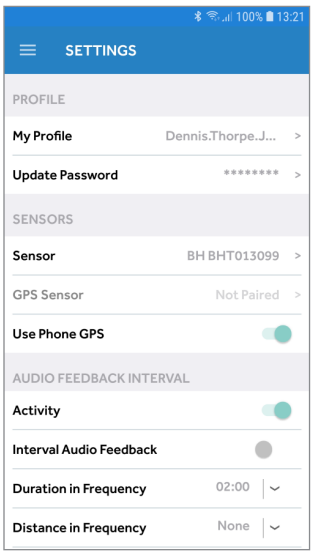


Training Thresholds

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
>Overview
> Applications Screens
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Settings

Access the Settings screen from the application menu



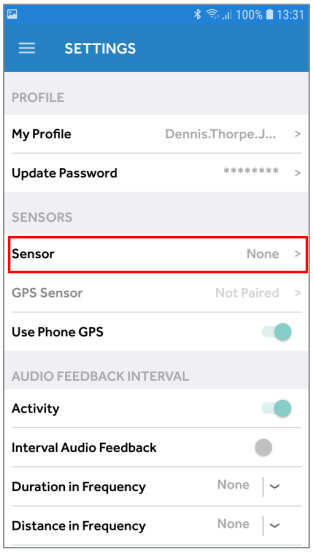
Item	Description
My Profile	Edit name/gender/date of birth/height/weight/ time zone/language
Update Password	Update password for application and portal
Sensor	Select BioModule/HxM Smart - see next section
GPS Sensor	Select GPS sensor
Use Phone GPS	Use phone, not external GPS. Default is On. If an external GPS is used, the BioModule must be configured to communicate with it. See OmniSense™ Tools > Zephyr™ Config Tool.
Activity	Receive audio notification of start/finish of activity
Interval Audio Feedback	Enable/disable audio interval feedback.
Duration in frequency	Set interval for audio announcements at regular time intervals. 15 seconds resolution.
Distance in frequency	Set interval for audio announcements at regular distance intervals. One eighth mile resolution.

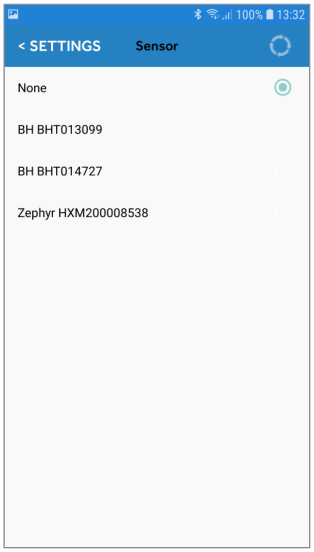
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
>Overview
> Applications Screens
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Link Device

For both Android™* and iOS™* version of the application, devices are linked from within the application itself. No Bluetooth™* pairing process is necessary.

1. Power on your device. If an HxM Smart is not worn, it will power off automatically after ~ 30 seconds.
2. Access the **Sensor** screen from **Menu** > **Settings** > **Sensor**





3. The phone will automatically start scanning for and detect Zephyr™ devices. You can re-scan by tapping the circular arrow icon at top right.
4. Select a device by tapping it. A notification will display '**Updating sensor information in portal**'.

   When the sensor has been successfully linked and the portal updated, a second message ' **Sensor information updated in portal successfully**'. will display.
5. If your sensor is not detected initially, power cycle it and repeat the process.

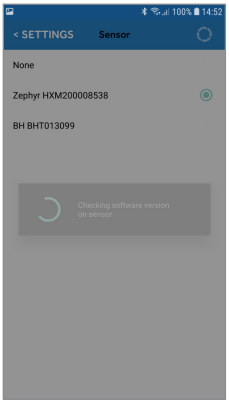
   Once a sensor is linked, the process need not be repeated unless a different sensor is used.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
>Overview
> Application Screens
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

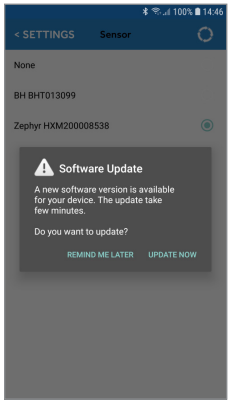
HxM Firmware Upgrade

When the mobile application is used in conjunction with a Zephyr™ HxM Smart, it will check the device firmware version when it first connects.

If an update is available, you will be asked if you wish to upgrade. The process takes a few minutes. You will be notified if the HxM battery should be replaced before updating.



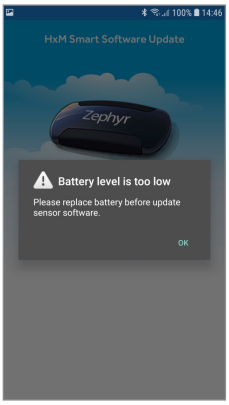
Automatic firmware check.



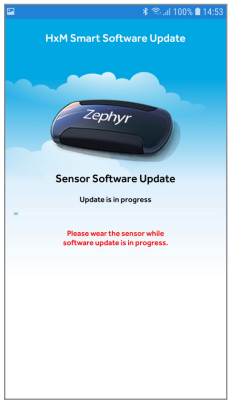
Available update notification.



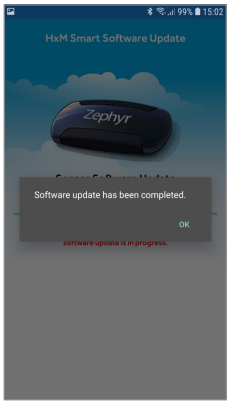
Wear the sensor to keep it powered on.



Low battery notification. Change battery and restart the process.



Update in progress.



Update complete.

Note

Automatic firmware updates are available for the HxM Smart only, not the Zephyr™ BioModule.

Caution

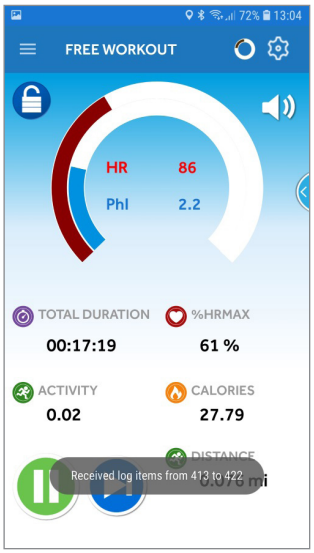
If a low battery notification is shown, replace the battery before updating the firmware. A battery failure during firmware update may break the device.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
>Overview
> Application Screens
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Store and Forward

The mobile applications store-and-forward HxM Smart data for user convenience. This is supported for the Zephyr™ HxM Smart, but not the BioModule.

- Open the mobile application and establish a connection with the HxM
- Start a Workout (Free, Scheduled or Fitness Assessment).
- Leave the application running on the mobile device, and complete the workout away from the device.
- On return to Bluetooth™* range with the HxM, the application will automatically download workout data.



- A series of messages will display as sections of the stored data are downloaded.
- The workout can continue within phone range if necessary.
- Terminate the workout when finished.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
>Overview
> Application Screens
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Parameters

The fields which display physiological parameters in Free & Prescribed Workouts and Fitness Assessments are all configurable. Just select and hold the field until a screen displays all parameters available.

A more restricted set of parameters is available from the HxM Smart.

Parameter	BM	HxM	Parameter	BM	HxM
% HR@AT	•	•	Jump Count	•	
% HR_{max}	•	•	Major Impact Count	•	
Activity	•	•	Mechanical Intensity	•	•
Avg Rate Force Development	•		Mechanical Load	•	•
Avg Step Impulse	•		Minor Impact Count	•	
Avg Step Period	•		Pace	•	•
Battery Percentage	•	•	Peak Acceleration	•	•
Bound Count	•		Peak Magnitude Phi	•	
Breathing Rate	•		Peak Magnitude Theta	•	
Breathing Wave Amplitude	•		Physiological Intensity	•	•
Cadence	•		Physiological Load	•	•
Calories	•	•	Posture	•	•
Distance	•	•	Run Step Count	•	
Distance Interval Distance	•	•	Speed	•	•
Distance Interval Time	•	•	Time Interval Distance	•	•
ECG Amplitude	•		Time Interval Time	•	•
ECG Noise	•		Time of Day	•	•
Est.Core. Temperature	•		Total Duration	•	•
Elevation	•		Total Impact Count	•	
Flight Time	•		Total Step Count	•	
Heart Rate	•	•	Training Intensity	•	•
HR Confidence	•		Training Load	•	•
HRV	•	•	Training Zone	•	•
Impulse Load	•		Walk Step Count	•	

Note

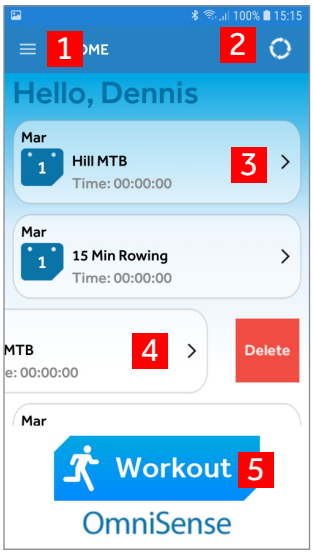
The default configuration in the application is for all location and speed-related data to be calculated using location supplied from the mobile device's own internal GPS.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
>Overview
> Application Screens
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Application Screens (1/12)

Home

The **Home** screen is the first screen displayed after logging in.



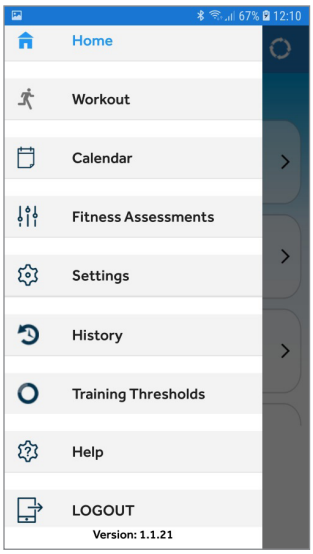
#	Description
1	The three-line 'hamburger' icon is present on most screens, and will display the application menu.
2	Refresh button - tap to update any new workouts sent from the portal.
3	Workouts assigned by a coach as part of a training plan. Tap on the notification to proceed to the workout. Swipe up or down to scroll through the complete list of workouts.
4	Swipe left on any workout to display a **Delete** button.
5	Tap the **Workout** button to proceed to a **Free Workout** screen. You can rename the workout before starting.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
>Overview
> Application Screens
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Application Screens (2/12)

Menu

Access the menu from any screen showing the three-line 'hamburger' icon at top left.



- Tap any menu item to proceed to the relevant screen.

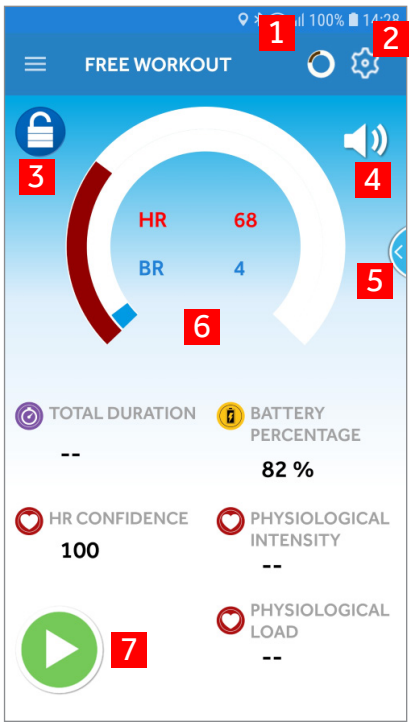
Note

You may need to scroll the menu up to see the **LOGOUT** option, depending on mobile device screen size.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
>Overview
> Application Screens
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Free Workout

1. Tap the **Free Workout** icon on the **Home** screen to start a free workout.

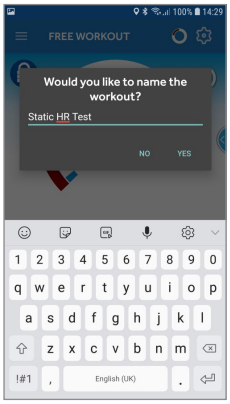


#	Description
1	Daily loads screen icon.
2	Settings screen icon.
3	Lock/unlock screen to prevent accidental input. A slider will appear at the bottom of the screen to unlock.
4	Turn on/off audio notifications.
5	Swipe the sweep scales left to show map screen.
6	All on-screen fields - including sweep scales - can be configured. Tap any to show a list of alternative parameters, before or during the workout.
7	Start/pause stop button.

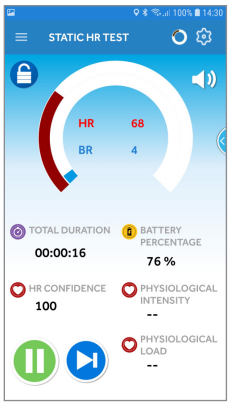
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
>Overview
> Application Screens
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Application Screens (4/12)

2. On starting a free workout, you are given the option of renaming it.



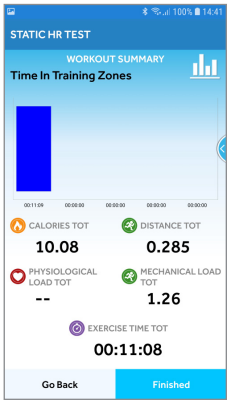
3. The start button will be replaced a pause button.



4. When the green pause button is used, it will be replaced by Restart/Stop buttons.



5. When the session is stopped, a summary data page will display.

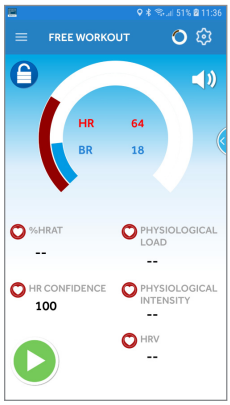


CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
>Overview
> Application Screens
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

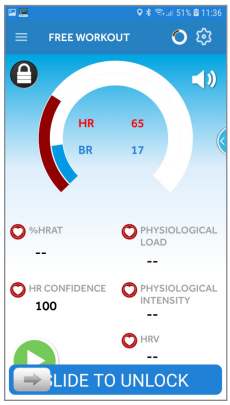
Application Screens (5/12)

Lock Screen

All active workout and fitness assessment screens have a lock screen option, to prevent accidental activation whilst carrying the device.



- Touch the lock icon at top left in the screen to activate.



- Slide the arrow from left to right as indicated, to unlock.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
>Overview
> Application Screens
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Application Screens (6/12)

Markers & Subsessions

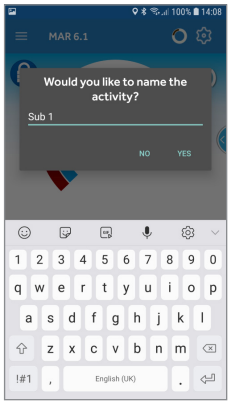
Markers and subsessions can be created during a free workout, so that if a subject changes activity, it can be noted.

No change will be visible in the mobile application, but the markers and subsessions will be visible when the data is displayed in the Analysis screen of the web portal.

1. Tap the **Marker** button during the workout.

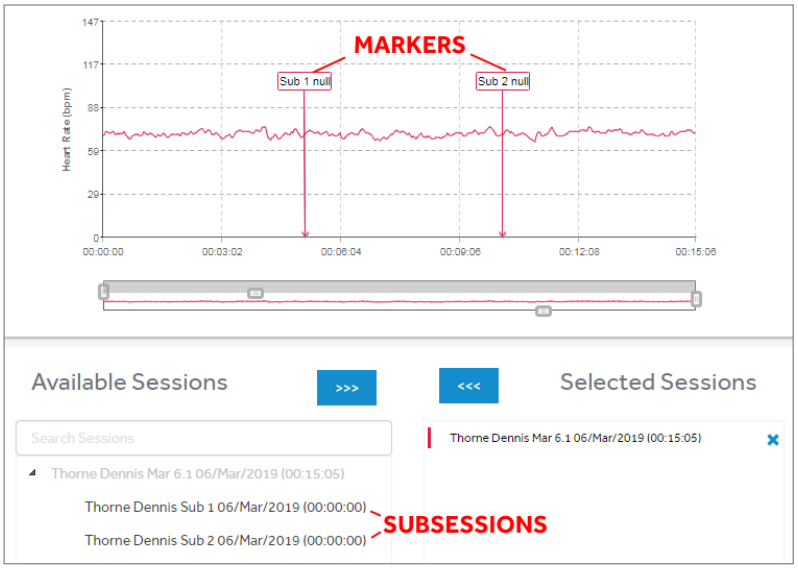


2. Label the marker and select **Yes** - this label can be viewed in Analysis in the portal, by any user with permission to view the data.



If **No** is selected, no marker or subsession is created. You can repeat the process within the same workout.

3. The Marker(s) and Subsession(s) will be visible in Analysis in the portal.



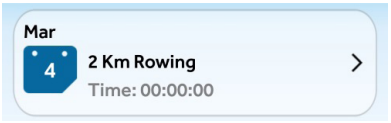
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
>Overview
> Application Screens
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Prescribed Workout

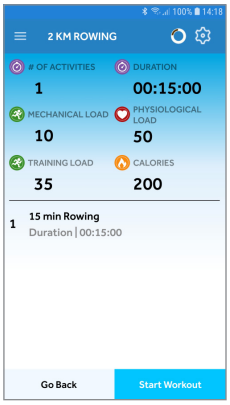
A prescribed work is one which has been created by a coach as part of a Training Plan and assigned to an individual or team.

It will appear on each athlete's **Home** screen when they log in to the mobile application, and also on their **Calendar** screen.

1. Tap on the workout tile to open it.

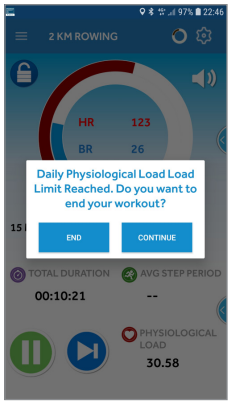


2. A summary screen of the workout will display. Select **Start Workout** to start.



3. All fields in the workout screen are configurable - see the previous Free Workout section.

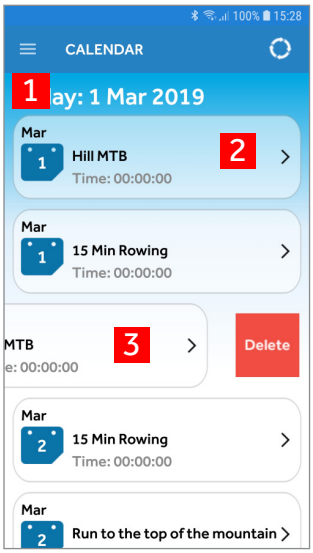
4. A notification may display to say that the workout, or daily, load limit has been reached. This need not be acknowledged - the workout continues by default. Select **End** to terminate the workout.



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
>Overview
> Application Screens
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Calendar

The **Calendar** screen is the first screen displayed after logging in.



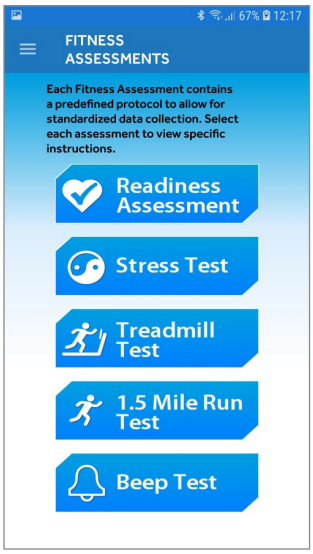
#	Description
1	The three-line 'hamburger' icon is present on most screens, and will display the application menu.
2	If any workouts have been assigned by a coach as part of a training plan, they will appear here. Tap on the notification to proceed to the workout. Swipe up or down to scroll through the complete list of workouts.
3	Swipe a workout left to display the **Delete** button.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
>Overview
> Application Screens
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Application Screens (9/12)

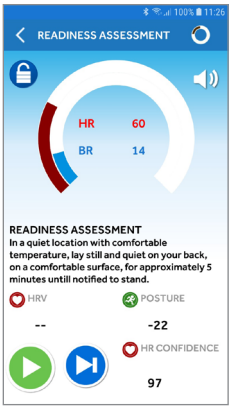
Fitness Assessments

Use this screen for a pre-configured Fitness Assessment.

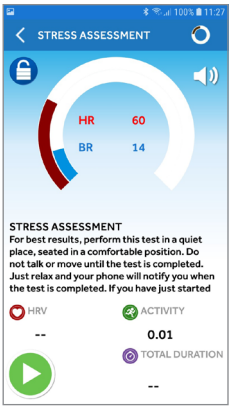


Tap any button to proceed to test instructions.

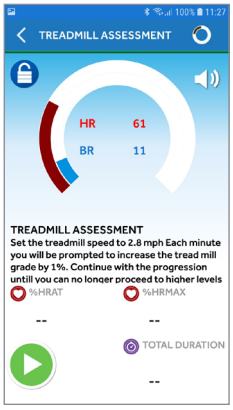
Assessment Screens



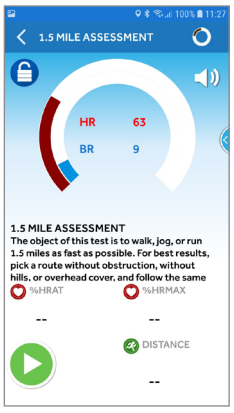
Readiness



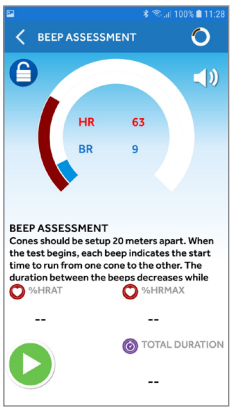
Stress



Treadmill



1.5 Mile Run



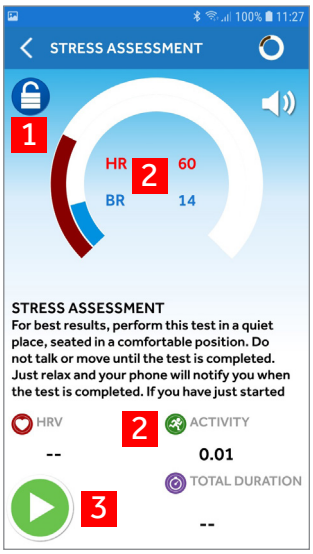
Beep

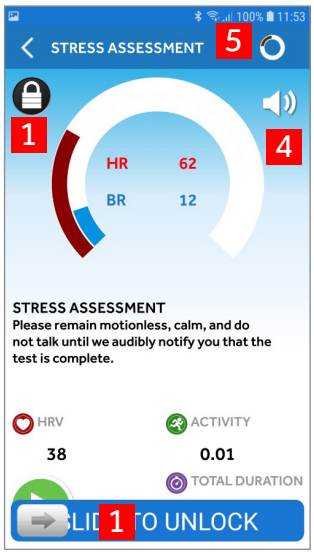
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
>Overview
> Application Screens
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Application Screens (10/12)

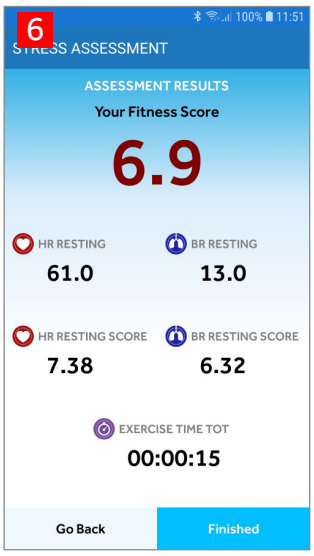
Perform Fitness Assessment

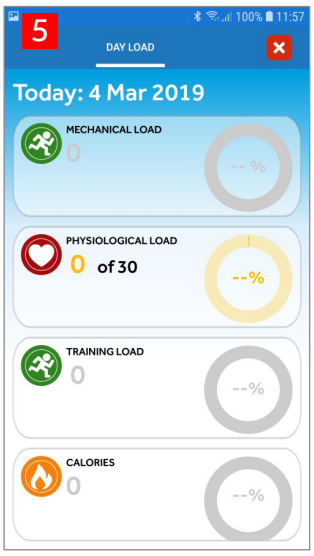
Operation of the assessment screens is similar for each test.





#	Description
1	Lock/unlock the screen to prevent accidental inputs. A slide will appear to unlock the screen, once locked.
2	Configurable fields (including sweep scales). Tap any to display a list of optional parameters.
3	Start/stop/pause button.
4	Turn audio off/on for audio instructions. In-test distance and time interval audio announcements can be enabled/disabled in the **Settings** screen.
5	Tap the circular progress icon to show current day's load threshold screens.
6	When the assessment is stopped, a screen of summary data for that test will display.



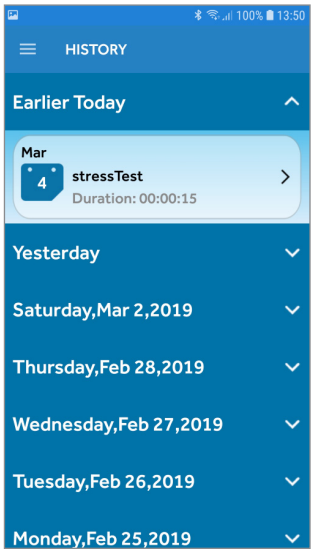


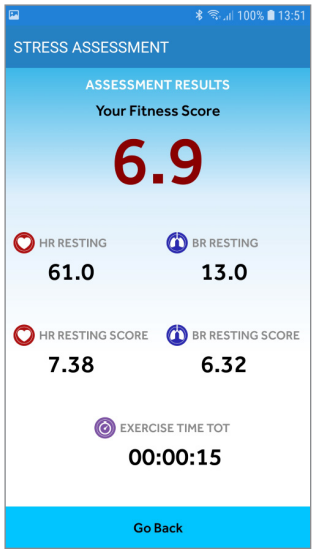
For more information, refer to the **Baseline Fitness Testing** section.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
>Overview
> Application Screens
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

History

The history screen allows access to completed workout summaries.



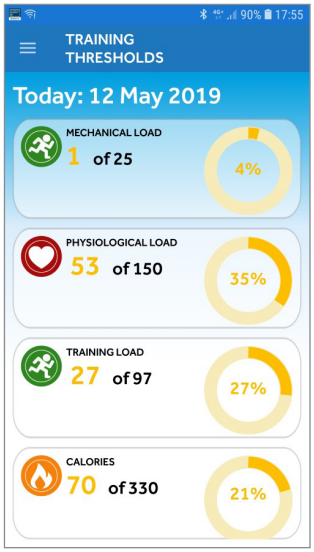


- Tap on any day to expand and show completed workouts for that day.
- Tap on any workout to display the **Assessment Results** or **Workout Summary** screen.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
>Overview
> Application Screens
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Training Thresholds

The Training Thresholds screen will show the percent achievement of load and calorie thresholds, if these have been prescribed by your coach when designing a **Training Plan**.



Thresholds screens showing loads achieved.

- Threshold target values and percent reached are reset at midnight.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
>Overview
> Zephyr™ Config Tool
> ZUSBUpdate Tool
> Zephyr™ Kubios Converter
> Zephyr™ Data Plotter
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

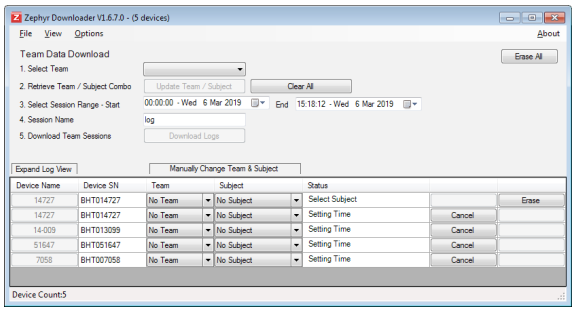
Overview

Zephyr™ Tools are available in two categories:

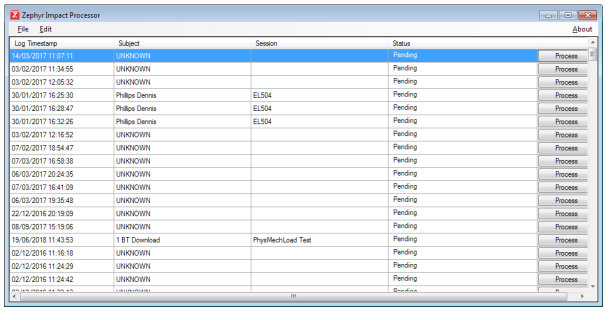
Embedded Tools

These tools are available as components of OmniSense™ Analysis. Their use is described in the appropriate section elsewhere in this manual.

- **Zephyr™ Downloader**, incorporating **Log Detail** download tool - see the Log Data Section.



- **Impact Processor Tool** - see Analysis Impact Processing section.



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
>Overview
> Zephyr™ Config Tool
> ZUSBUpdate Tool
> Zephyr™ Kubios Converter
> Zephyr™ Data Plotter
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Overview (2/2)

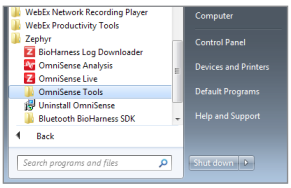
Standalone Tools

These tools are installed as part of an OmniSense™ Local PC installation, but they are not accessed from within OmniSense™ Live or OmniSense™ Analysis.

In a standard install, their default location is

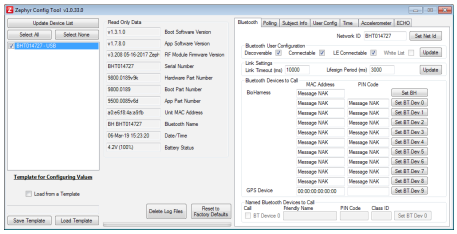
C:\Program Files (x86)\Zephyr\OmniSense\Tools

or they can be accessed from the Start Menu in the **All Programs** list, under the **Zephyr™** node.

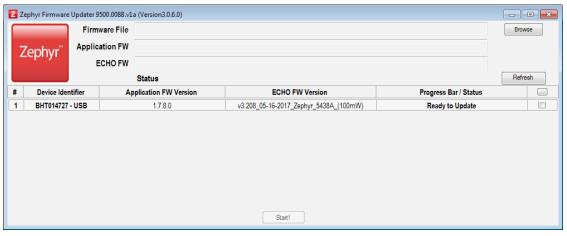


Either route will take you to the directory containing the tool .exe files. Double click on an .exe file to open the tool. The two relevant files are:

- Zephyr™ Config Tool - **Zephyr™ Config Tool.exe**



- BioModule Firmware Updater Tool - **ZUSBUpdater.exe**



Both of the embedded tools above are also located in this folder, but they are accessed from the OmniSense™ Analysis toolbar.

In addition, two additional tools are described. These can be downloaded for free from the Zephyr™ website.

Note

It may be helpful to add shortcuts to these tools to the computer desktop, if they are going to be used regularly.



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
>Overview
> Zephyr™ Config Tool
> ZUSBUpdate Tool
> Zephyr™ Kubios Converter
> Zephyr™ Data Plotter
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

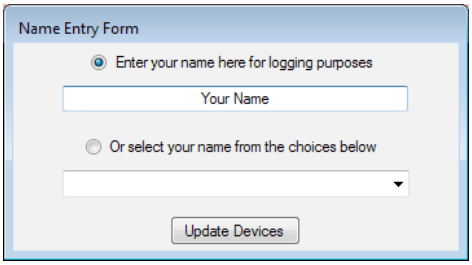
Zephyr™ Config Tool (1/9)

Operation



1. Connect the BioModule(s) to a PC in a single or multi device cradle.

2. Double-click the **Zephyr™ Config Tool.exe** file to open. An initial **Name Entry Form** will display.



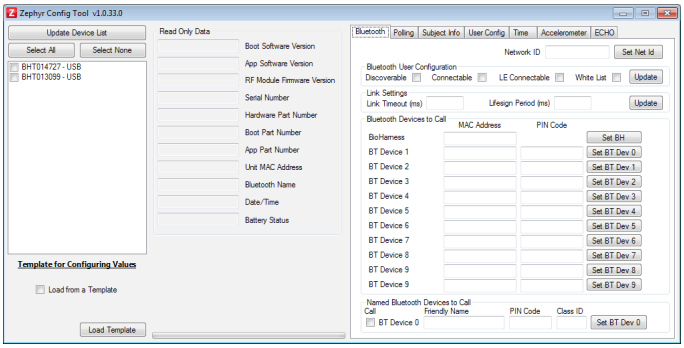
3. Enter your name, or retrieve it using the lower pull-down list. It is remembered once used. This is NOT a security check. The tool maintains a record of who has used it, and which BioModules have been configured. This is kept in a .csv file located at

C:\ProgramData\Zephyr\ZephyrDeviceUpdateLog.csv

14/06/2018 23:07	1	UserConfi	Denr	BHT01309	v1.3.1.0	v1.6.16.0	v3.208_05	9800.0189	9500.008	9500.0085	00:17:e9:c0:88:3	BH_BHT013099	4.2V_(100	BHT01309
29/07/2018 22:11	1	UserConfi	Denr	BHT01309	v1.3.1.0	v1.6.16.0	v3.208_05	9800.0189	9500.008	9500.0085	00:17:e9:c0:88:3	BH_BHT013099	4.2V_(100	BHT01309
29/07/2018 22:11	1	UserConfi	Denr	BHT01309	v1.3.1.0	v1.6.16.0	v3.208_05	9800.0189	9500.008	9500.0085	00:17:e9:c0:88:3	BH_BHT013099	4.2V_(100	BHT01309
05/09/2018 22:22	1	UserConfi	Denr	BHT01309	v1.3.1.0	v1.6.23.0	v3.208_05	9800.0189	9500.008	9500.0085	00:17:e9:c0:88:3	BH_BHT013099	4.2V_(100	BHT01309
16/10/2018 20:52	1	UserConfi	Denr	BHT01309	v1.3.1.0	v1.7.2.0	v3.208_05	9800.0189	9500.008	9500.0085	00:17:e9:c0:88:3	BH_BHT013099	4.185V_(9	BHT01309
16/10/2018 21:17	1	UserConfi	Denr	BHT01309	v1.3.1.0	v1.7.2.0	v3.208_05	9800.0189	9500.008	9500.0085	00:17:e9:c0:88:3	BH_BHT013099	4.199V_(9	BHT01309
23/10/2018 23:16	1	UserConfi	Denr	BHT01309	v1.3.1.0	v1.7.2.0	v3.208_05	9800.0189	9500.008	9500.0085	00:17:e9:c0:88:3	BH_BHT013099	4.2V_(100	BHT01309

This allows a basic audit of all device changes to be maintained.

4. Enter/select a name, click **Update Devices** and the tool will open.

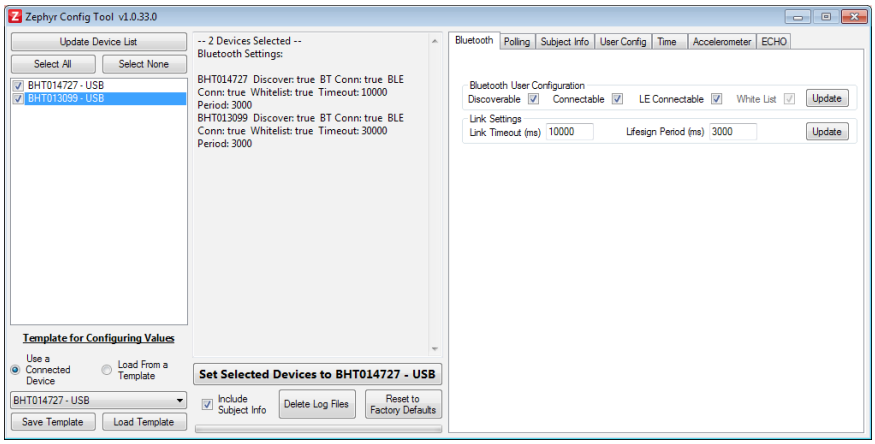


If multiple devices are detected, they will display, but none are selected in the capture above, so no data shows in the tool.

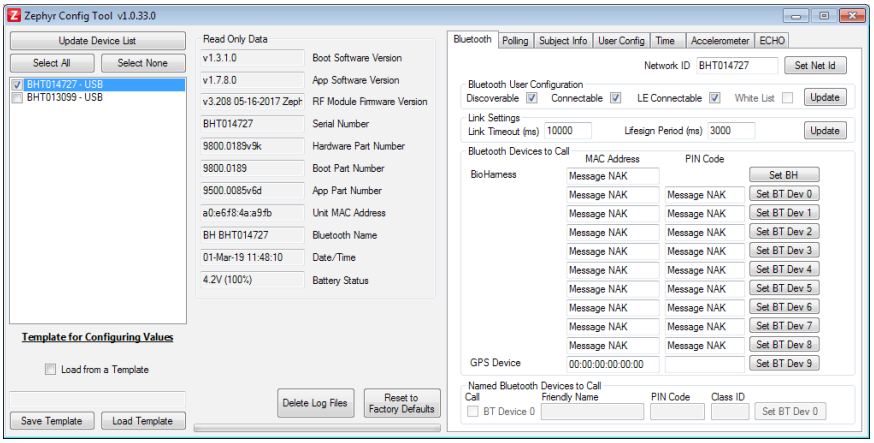
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
>Overview
> Zephyr™ Config Tool
> ZUSBUpdate Tool
> Zephyr™ Kubios Converter
> Zephyr™ Data Plotter
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Zephyr™ Config Tool (2/9)

5. If multiple devices are selected, the left hand panel will show partial parameters.

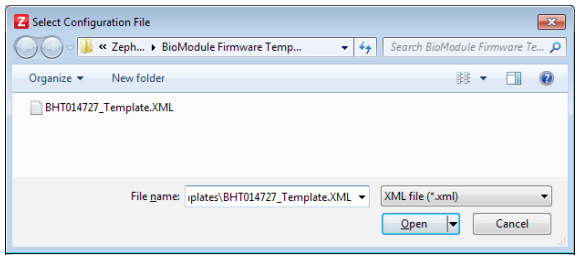


6. If a single device is selected, more detail will show.



Configure From a Template

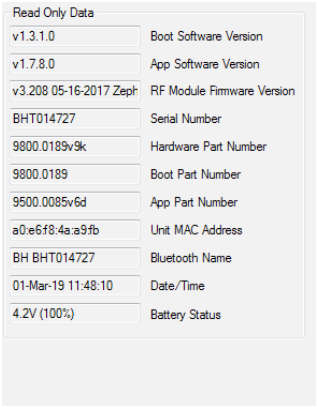
- BioModules can be configured from a Template. No default templates exist - a BioModule must first be configured manually, and then this configuration saved as an XML template file. Use the **Save Template/Load Template** buttons appropriately.
- When saving, create a directory in a suitable location.



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
>Overview
> Zephyr™ Config Tool
> ZUSBUpdate Tool
> Zephyr™ Kubios Converter
> Zephyr™ Data Plotter
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

OMNISENSE™ TOOLS
Zephyr™ Config Tool (3/9)

Read-Only Data



These values cannot be changed using the Config Tool, except for **Date/Time**.

Item	Description
Boot Software Version	App software boot loader - not user updatable
App Software Version	Device Firmware Version - can be updated with update tool.
RF Module Firmware	May be updated by some firmware versions automatically.
Serial, Hardware & Boot & App Part Nos.	Zephyr™ internal part numbers
Unit MAC Address	Bluetooth™* Address
Bluetooth™* Name	Name when detected over Bluetooth™*
Date/Time	Internal device time. Update in **Time** tab.

Delete Log Files

Use this button to delete all log files. This operation can also be done from the Zephyr™ Downloader.

Note

Deletion of log files is not strictly necessary, except for housekeeping purposes. When new logs are being created, the oldest log will be deleted / over-written automatically to free up memory space.

Reset To Factory Defaults

Use this button to return the device to the configuration it was shipped with. You can also save the shipped configuration as a template prior to making any custom changes.

Caution

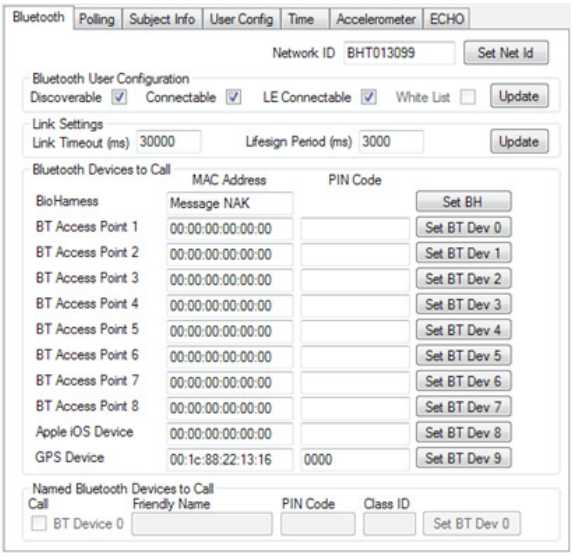
Manually change BioModule settings with care. Changing some settings may cause the device to stop working or give invalid data.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
>Overview
> Zephyr™ Config Tool
> ZUSBUpdate Tool
> Zephyr™ Kubios Converter
> Zephyr™ Data Plotter
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Zephyr™ Config Tool (4/9)

Configuration Tabs

Bluetooth™*

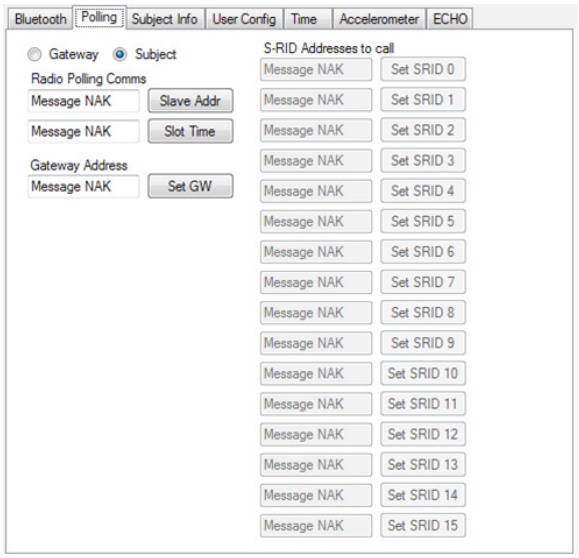


Item	Description
Network ID	Device ID when detected over Bluetooth™*.
Discoverable	Make device discoverable or 'hide' from BT detection.
Connectable	Enable Bluetooth™* Connectivity.
LE Connectable	Enable Bluetooth™* Low Energy Connectivity, if device supports it.
Link Timeout, Lifesign Period	Default settings will ensure BioModule never terminates BT connection.
BioHarness™	Not used to configure BioModule.
BT Access Point #	Legacy Settings for older BT access Point systems (out of production).
Apple™* iOS™* Device	Not Implemented.
GPS Device	This is normally configured automatically over ECHO, but can be manually paired here if the MAC address of the supported GPS device is known.
Named Bluetooth™* Device To Call	Not used in PSM ECHO systems

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
>Overview
> Zephyr™ Config Tool
> ZUSBUpdate Tool
> Zephyr™ Kubios Converter
> Zephyr™ Data Plotter
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

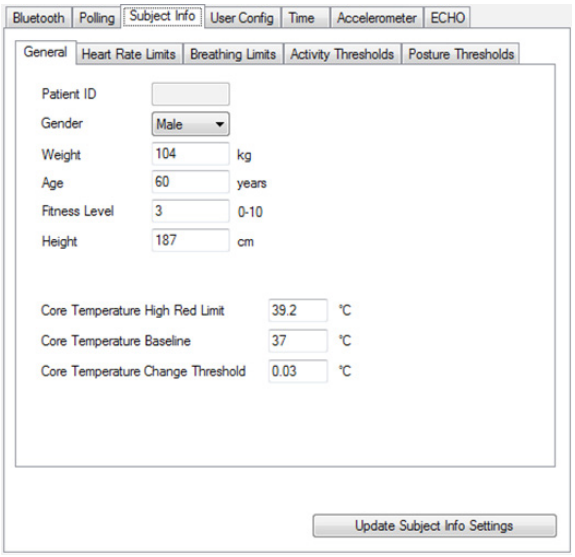
Zephyr™ Config Tool (5/9)

Polling



The Polling tab is not used in PSM ECHO Systems.

Subject Info



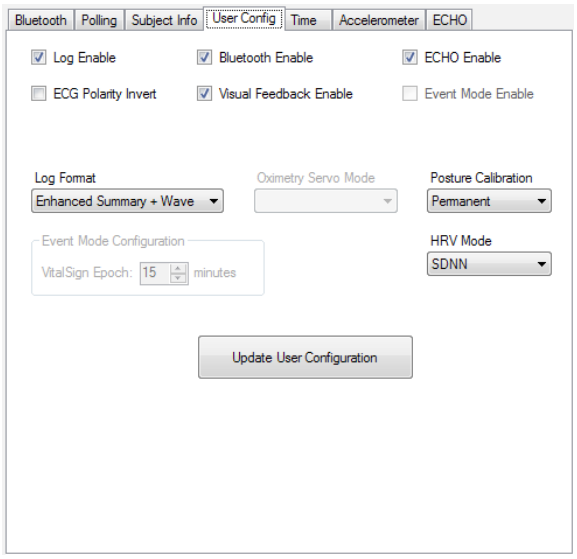
Caution

Subject Info Parameters are used to configure various parameters in the Subject Status algorithms. They are populated over-the-air by an ECHO system and should **not** be edited manually.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
>Overview
> Zephyr™ Config Tool
> ZUSBUpdate Tool
> Zephyr™ Kubios Converter
> Zephyr™ Data Plotter
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Zephyr™ Config Tool (6/9)

User Config

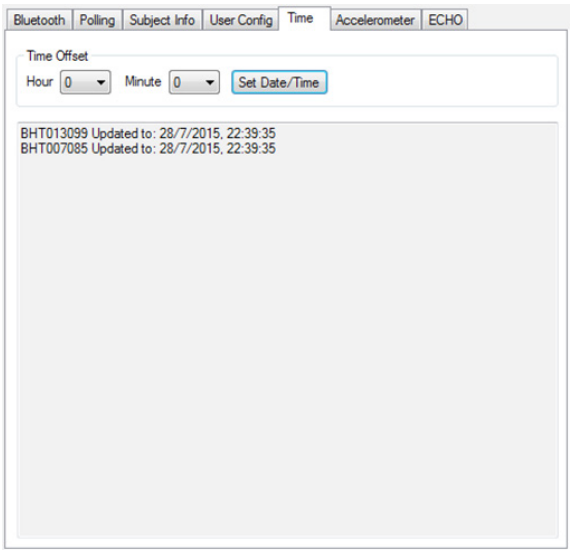


Item	Description
Log Enable	Enable Logging (checked by default).
Bluetooth™* Enable	Enable Bluetooth™* transmit.
ECHO Enable	Enable ECHO transmit.
ECG Polarity Invert	Invert the ECG waveform (intended to accommodate future garment orientations).
Visual Feedback Enable	If unchecked, all LEDs turn off after 30 seconds.
Event Mode Enable	For non-PSM systems.
Log Format	Set as needed. Must be Summary & Waveform or Enhanced Summary & Waveform for use with a GPS. Default is Summary.
Posture Calibration	Default is permanent - current calibration is maintained after power cycle. For manual calibration while wearing a garment, push the button three times before inserting into garment, then get into laying flat on back position, and remain stable for about 10 seconds. The BioModule LEDs will light in a rotating sequence while in calibration mode.
HRV Mode	SDNN - rolling 300-beat calculation. RMSSD - rolling 15-second calculation.
Update User Configuration	Save any changes.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
>Overview
> Zephyr™ Config Tool
> ZUSBUpdate Tool
> Zephyr™ Kubios Converter
> Zephyr™ Data Plotter
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Zephyr™ Config Tool (7/9)

Time



Item	Description
Time Offset	Add an offset if needed (e.g. PC time is not appropriate).
Set Date/Time	Use to set the device clock, with or without an offset.

Time Auto-set

BioModule clocks are automatically set to local PC time under two conditions:

- On Startup of OmniSense™ Live in a PSM ECHO system, when initial radio connection with the device is made.
- When the device logs are read by the Zephyr™ Downloader in OmniSense™ Analysis (this can be turned off in the Downloader options menu).

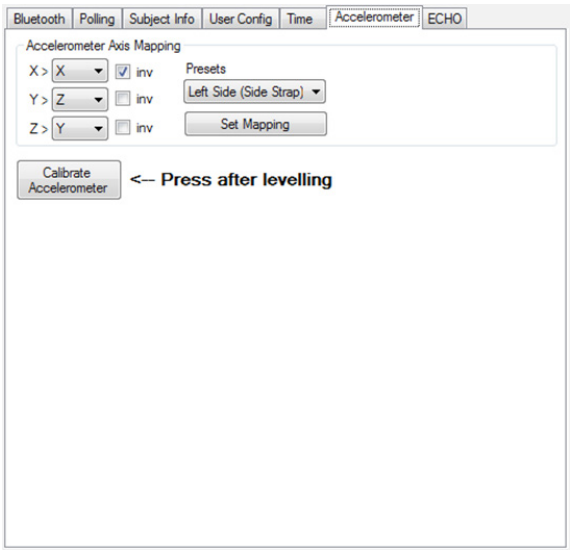
Note

If a BioModule is used directly in logging mode after being powered off, re-synchronize the clock manually using the Config Tool, or by using OmniSense™ Live in ECHO mode, or by simply reading the device using the Zephyr™ Downloader (no logs need be downloaded) otherwise there may be an offset of a few seconds from real time.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
>Overview
> Zephyr™ Config Tool
> ZUSBUpdate Tool
> Zephyr™ Kubios Converter
> Zephyr™ Data Plotter
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

OMNISENSE™ TOOLS
Zephyr™ Config Tool (8/9)

Accelerometer



Item	Description
Presets	Set to required garment type.
Set Mapping	Use to commit a new setting.
Calibrate Accelerometer	Use to zero-reset accelerometer orientation. See Caution below. BioModules can now be set while worn, to eliminate individual offsets. See the **User Config** section of this tool for details.

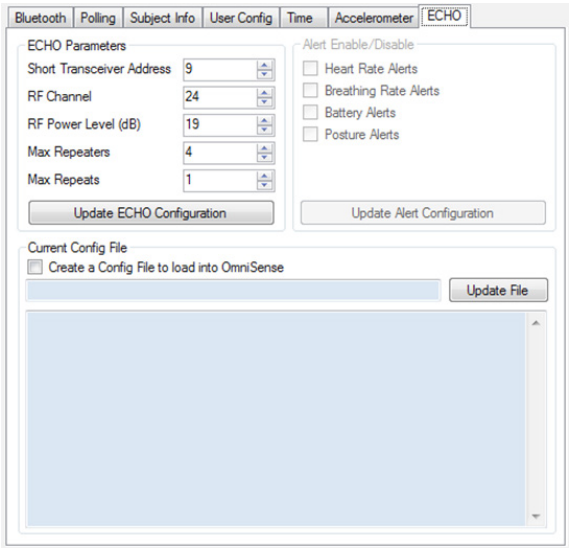
Caution

Device accelerometers are factory calibrated and should never normally require recalibration. Recalibrating may create an offset in device orientation. It should only be attempted on a calibrated horizontal surface. **The BioModule should be located vertically in a cradle when this is done.** The BioModule should be reset to factory defaults on left panel of Config Tool first.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
>Overview
> Zephyr™ Config Tool
> ZUSBUpdate Tool
> Zephyr™ Kubios Converter
> Zephyr™ Data Plotter
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

OMNISENSE™ TOOLS
Zephyr™ Config Tool (9/9)

ECHO



Item	Description
Short Transceiver Address	Should be different for each BioModule in a PSM system, within a range appropriate for ECHO Mode. See Setup section. Assigned on shipment.
RF Channel	Must be same as ECHO Gateway and all repeaters. Do not change. Two separate PSM ECHO systems operating on the same site should be set to different channels. Contact Zephyr™ support for details on reconfiguring an ECHO Gateway.
RF Power Level	Set to 19 for USA and Europe, 12 for Japan.
Max Repeaters	Set to 4
Max Repeats	Set to 1
Alerts	Disabled - not for PSM Systems
Config File Panel	Used by Zephyr™ before shipping a PSM system to generate a config file to allow new users to add large numbers of BioModules to their database, without having to add each BioModule individually.

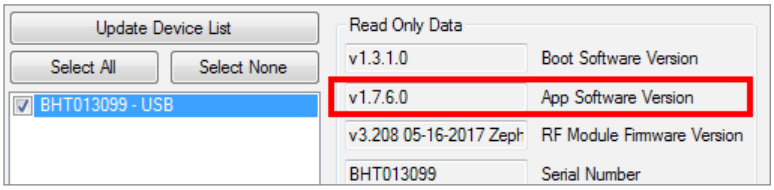
Caution

No two BioModules in a PSM system should have the same **Short Transceiver Address,** otherwise a conflict may occur. No data, or the wrong data, may be received from either device.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
>Overview
> Zephyr™ Config Tool
> ZUSBUpdate Tool
> Zephyr™ Kubios Converter
> Zephyr™ Data Plotter
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

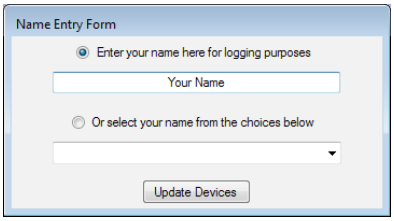
BioModule Firmware Updates

BioModule device internal Firmware - referred to as '**App Software**' version in the Zephyr™ Config Tool - is updated periodically, as new functionality is added to the system. Each new revision of OmniSense™ is accompanied with files for updating device firmware, and the ZUSBUpdater tool to update devices.

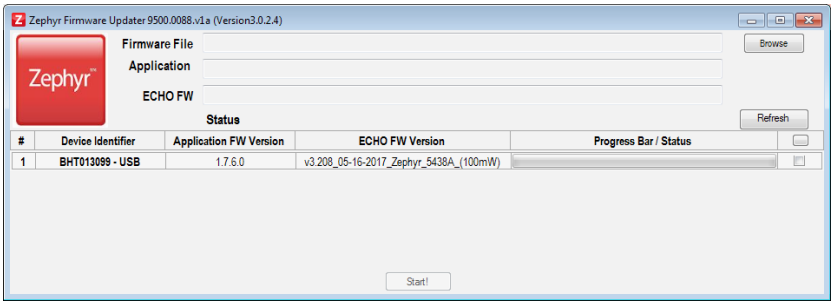


BioModule Firmware version in Zephyr™ Config Tool

- Double-click the ZUSBUpdater.exe file to start the tool, and enter a name in the Name Entry dialog to start the updater.



- Operation of the updater tool is described fully in **Appendix 1: BioModule Firmware Upgrade**



Caution

Care must be taken to load the appropriate 1G/2G/3G version of the firmware update file, corresponding to the hardware type of the BioModule.:

- 1G/first generation Bluetooth™* only
- 2G/second generation Bluetooth™* + ECHO
- 3G/third generation Bluetooth™* + ECHO + Bluetooth™* Low Energy.

The BioModule Firmware Upgrade appendix shows how to use the Hardware Part # to identify which version your devices are.

If in doubt contact Zephyr™ Support for assistance.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
>Overview
> Zephyr™ Config Tool
> ZUSBUpdate Tool
> Zephyr™ Kubios Converter
> Zephyr™ Data Plotter
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

External Processing of R-R Files

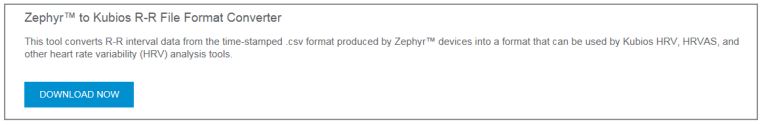
Kubios HRV is a third-party application for producing comprehensive analysis of RR data, producing graphical and metrical representations of Heart Rate Variability.

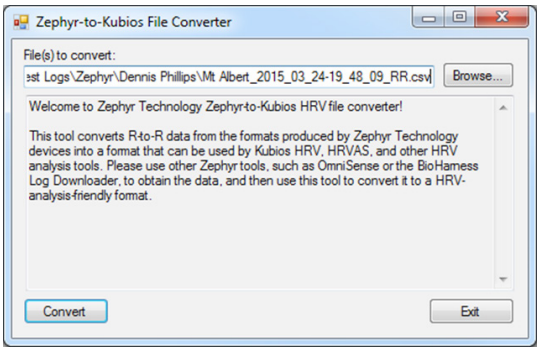
It is available from **https://www.kubios.com**. There is a free version for researchers.

The Zephyr™ Kubios Converter is a utility for processing RR files exported from BioModule log sessions. It converts them into a text file suitable for importing into Kubios HRV.

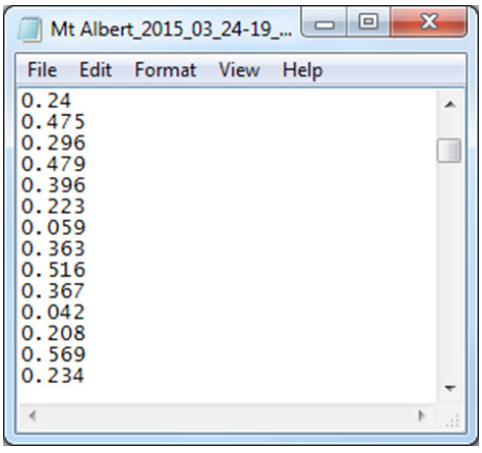
The Kubios Converter can be downloaded from

https://www.zephyranywhere.com/resources/developer-user-tools





1. Run the tool and browse for any _RR external csv file generated by the Zephyr™ Downloader from a BioModule log session.
2. Click the **Convert** button and a .txt file will be created in the same location.



3. This file can be imported into Kubios.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
>Overview
> Zephyr™ Config Tool
> ZUSBUpdate Tool
> Zephyr™ Kubios Converter
> Zephyr™ Data Plotter
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Zephyr™ Data Plotter

The Zephyr™ data plotter is a basic graphing tool for viewing larger data sets. It is for viewing only – no analysis or exporting of data can be performed.

It is useful for casual visual inspection of larger data sets - Microsoft™* Excel™* can only graph a maximum of 5 minutes of an ECG file due to a 32,000 data point limit.

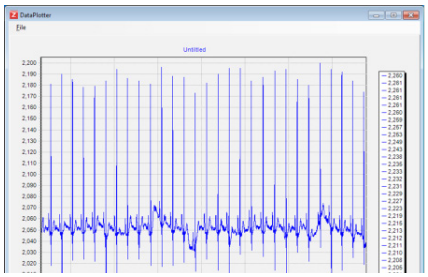
It can be downloaded from the Zephyr™ website at

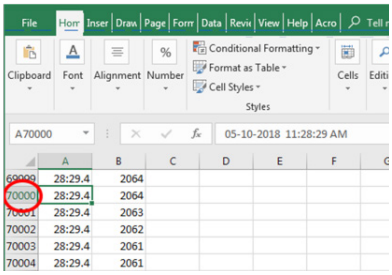
https://www.zephyranywhere.com/resources/developer-user-tools

Supported Files

Any parameter from a csv file can be plotted, by selecting the column (by number – 1st, 2nd etc) containing the data. However, the plotter cannot parse the date timestamp field which is in the first column of BioModule Log data files.

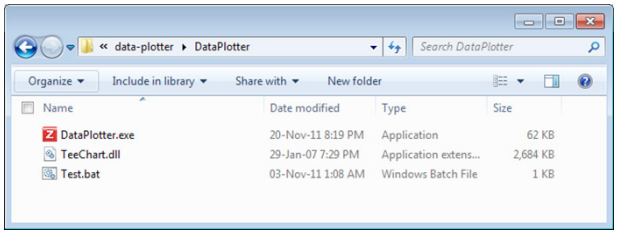
Thus, the X values (horizontal axis on the plot) must be set to **Autonumber** in the **Add Trace** dialog. The values will be numbered sequentially in the plot. To identify a specific feature on the plot within the original csv file, use the horizontal axis number and relate it to the row number in the corresponding Microsoft™* Excel™*/.csv file.



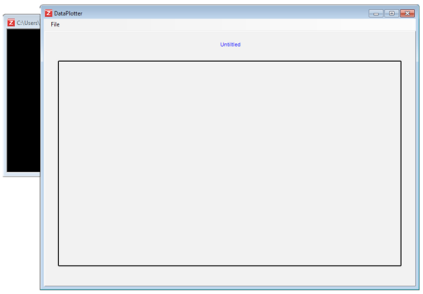


Using the Plotter

1. When downloaded from the Zephyr™ website , the directory should contain the following files:



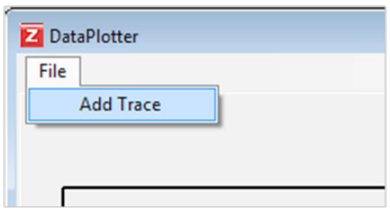
2. Double-click the **DataPlotter.exe** file to open the plotter. A black windows Command window will open at the same time.

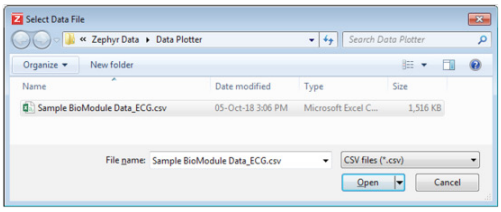


CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
>Overview
> Zephyr™ Config Tool
> ZUSBUpdate Tool
> Zephyr™ Kubios Converter
> Zephyr™ Data Plotter
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

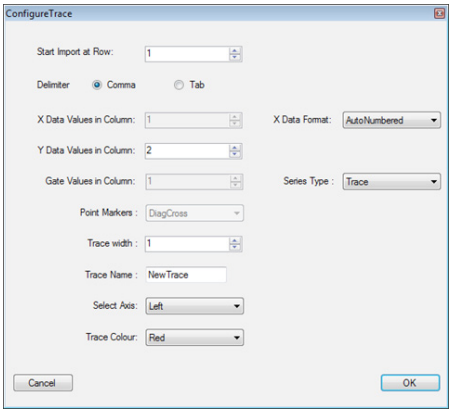
Zephyr™ Data Plotter (2/4)

3. Select the **File > Add Trace** menu option to open a dialog to browse to the desired csv file.





4. On file import, the Configure Trace dialog will display.

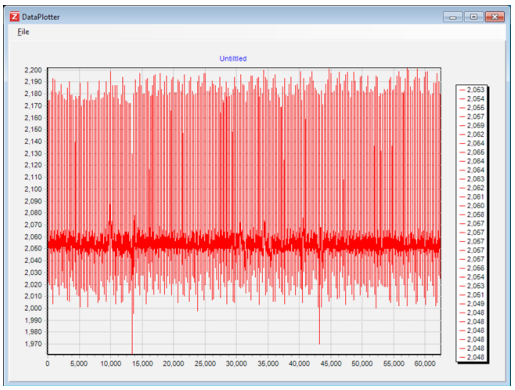


Item	Value	Description
Start Input at Row	1	Leave as 1 – column headings will be ignored.
Delimiter	Comma	Default.
X Data Values in Column	1	The timestamp column (Column A in Microsoft™* Excel™*).
X Data Format	Autonumbered	Horizontal axis will be numbered sequentially, ignoring the timestamp value.
Y Data Values in Column	2	Second column in the ECG file example (Column B in Microsoft™* Excel™*). Select column as desired.
Gate Values in Column	-	N/A
Trace width	1	1 pt
Trace Name	New Trace	Change as needed
Select Axis	L or R	Default left.
Trace Color	Select	Set as needed

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
>Overview
> Zephyr™ Config Tool
> ZUSBUpdate Tool
> Zephyr™ Kubios Converter
> Zephyr™ Data Plotter
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Zephyr™ Data Plotter (3/4)

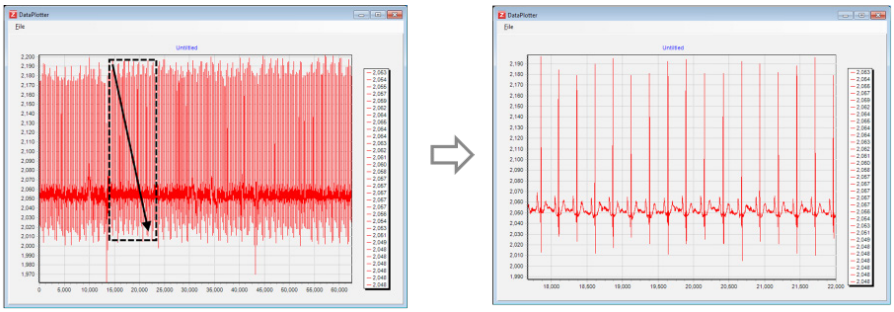
5. The trace will display



Plotter Functions

Zoom In

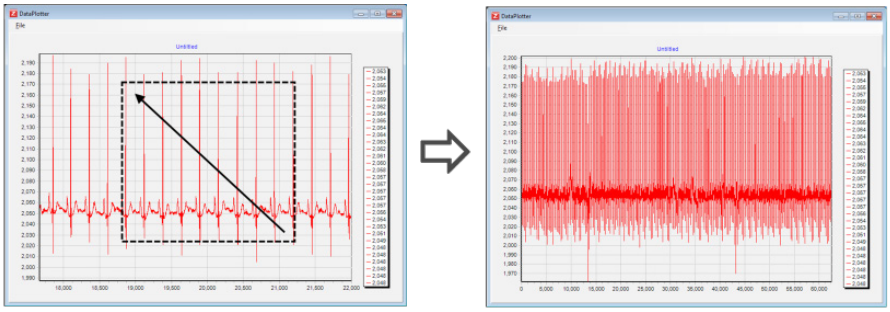
- To zoom in on a section of the plot, left-click drag a rectangle from top left to bottom right.



- Zoom in actions can be repeated continuously to isolate the desired part of the trace.

Zoom Out

- To zoom out, left-click drag a rectangle from bottom right, to top left in any location on the plot.



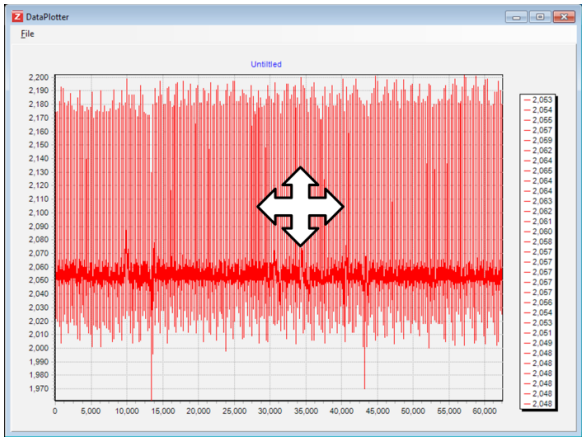
- When zooming out, the graph always returns to its original un-zoomed state – you cannot zoom back out in stages.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
>Overview
> Zephyr™ Config Tool
> ZUSBUpdate Tool
> Zephyr™ Kubios Converter
> Zephyr™ Data Plotter
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Zephyr™ Data Plotter (4/4)

Pan

- To move the plot in any direction, **right**-click and drag with the mouse cursor in any direction. If the graph is zoomed in, the zoom will be maintained.

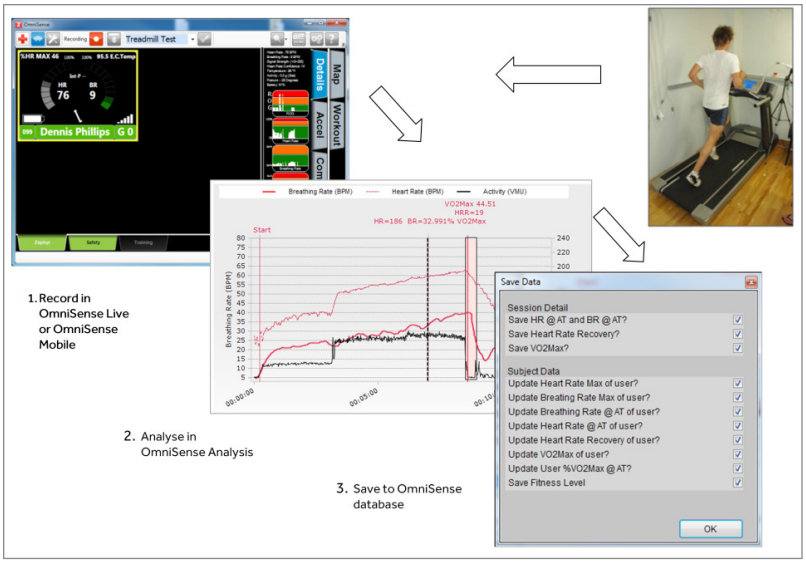


CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
> Overview/Test Protocols
> Treadmill/Beep Test Analysis
> Orthostatic Hypotension Readiness Test Analysis
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Baseline Fitness Testing

Use either a ramped maximal effort treadmill test or a ramped maximal effort beep test to establish baseline levels of fitness such as:

- Maximum Heart Rate (HR_{max})
- Heart Rate at Anaerobic Threshold (HR@AT)
- Heart Rate Recovery (HRR)
- VO_2max



Baseline fitness testing using OmniSense™ Local Live & Analysis

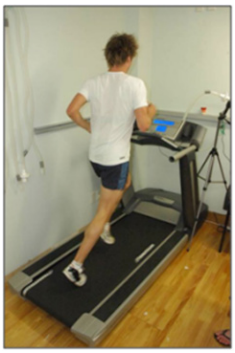
- If a fitness test is recorded in OmniSense™ Live, then the data can be retrieved in OmniSense™ Analysis, and analyzed automatically or manually.
- Fitness Assessments in the OmniSense™ Mobile application can be performed off site, and the data uploaded to the web portal.
- Fitness parameters can then be saved into the OmniSense™ database, and used as metrics in subsequent Fitness Reports for that subject.

Note

When a local PC session is connected to the cloud server, no session data is ever downloaded to the PC, but the athlete's fitness parameters **are** downloaded or uploaded, so they are synchronized in both locations. The most recent values always replace older versions.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
> Overview/Test Protocols
> Treadmill/Beep Test Analysis
> Orthostatic Hypotension Readiness Test Analysis
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Treadmill Test Protocol



Use an ACSM ramp protocol, or a modified Conconi test.

1. 10 minute warm up, including stretches
2. Set the treadmill gradient at 5%
3. Set the start speed at 6 kph (3.7 mph)
4. Every 3 minutes, increase the treadmill speed by 2 kph (1.25 mph)
5. For maximum benefit, provide verbal encouragement to the athlete, especially during the latter part when effort is maximal.
6. The test finishes when the athlete can no longer continue.
7. The subject should remain stationary or reduce to walking for 30 seconds after they stop running, to allow a heart rate recovery measurement to be measured.

Caution

It is important that the above speed and timing criteria be observed, as the automatic VO_2max calculation is determined by the speed at which the subject stops running – specifically the duration they have been running for.

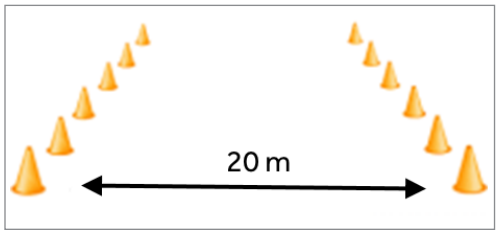
If different speed, gradient and timing criteria are used, the VO_2max calculation will be less accurate.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
> Overview/Test Protocols
> Treadmill/Beep Test Analysis
> Orthostatic Hypotension Readiness Test Analysis
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

BASELINE FITNESS TESTING
Overview/Test Protocols (3/5)

Beep Test Protocol

Also called a PACER (Progressive Aerobic Cardiovascular Endurance Run) test or a 20-meter shuttle run, athletes are prompted by an audio file (supplied with every OmniSense™ install) which announces beeps at steadily shortening intervals. This forces the athletes to run faster between the cones/markers, until they fail to reach a cone by the next beep.



1. Place marks or cones 20 meters apart.
2. Athletes should warm up and stretch for 20 minutes.
3. Start the audio recording to initiate the test.

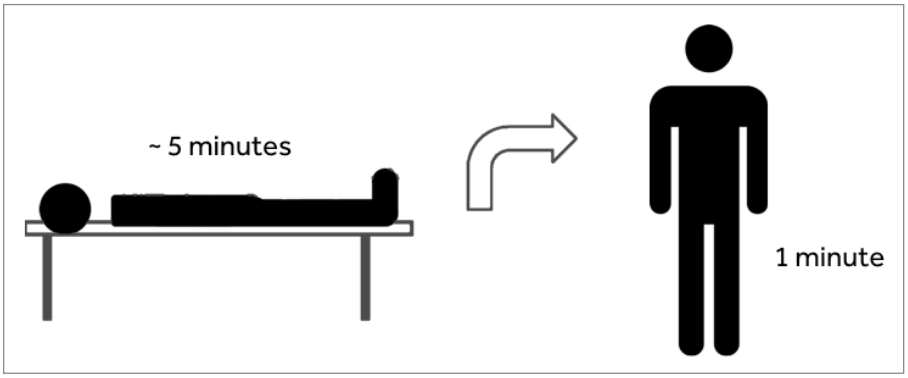
Cycle Iteration	# Shuttles at this level	Running Speed (kph)
1	7	8.0
2	8	9.0
3	8	9.5
4	9	10.0
5	9	10.5
6	10	11.0
7	10	11.5
8	11	12.0
9	11	12.5
10	11	13.0
11	12	13.5
12	12	14.0
13	13	14.5
14	13	15.0
15	14	15.5
16	14	16.0
17	15	16.5
18	15	17.0
19	15	17.5
20	16	18.0
21	16	18.5

Note

Beep test protocols vary internationally, with markers 20 meters or 20 yards apart. 20-meter spacing represents a 9.3% increase in distance over 20-yard spacing. Thus subjects using metric spacing must use 9.3% more effort for a given level in the test.. If different distance and timing criteria are used, the VO_2max value calculated during test analysis will be less accurate.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
> Overview/Test Protocols
> Treadmill/Beep Test Analysis
> Orthostatic Hypotension Readiness Test Analysis
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Orthostatic Hypotension Readiness Test Protocol



1. Lie down in a quiet, warm, comfortable setting for at least five minutes - the time taken to establish heart rate variability. If OmniSense™ Live is used, and HRV is one of the configured fields in the BioGauge, then HRV will display when a valid calculation has been made.
2. If conducted using the OmniSense™ Mobile application, and audio prompt will inform when the test is complete.
3. Stand up and remain stationary for one minute.

Note

The subject status should remain green throughout the test. If status shows grey for 5 sec at any point, indicating poor conductivity (dry skin or strap), then the HRV calculation may restart when status returns to green.

Note

In the OmniSense™ Mobile application, this test is referred to in the Fitness Assessments screen as a **Readiness Assessment**.

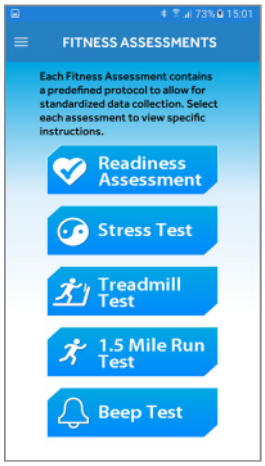
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
> Overview/Test Protocols
> Treadmill/Beep Test Analysis
> Orthostatic Hypotension Readiness Test Analysis
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

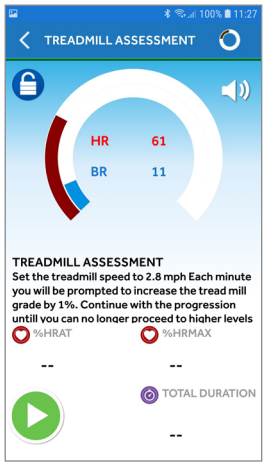
BASELINE FITNESS TESTING
Overview/Test Protocols (5/5)

OmniSense™ Mobile

All baseline fitness tests can also be carried out using the OmniSense™ Mobile application. Test data, analysis and survey results are uploaded to the cloud database.

See the **OmniSense™ Mobile** section for details.





CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
> Overview/Test Protocols
> Treadmill/Beep Test Analysis
> Orthostatic Hypotension Readiness Test Analysis
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

BASELINE FITNESS TESTING
Treadmill/Beep Test Analysis (1/5)

OmniSense™ Live



#	Description
1	Recording is ON by default; turn OFF if you do not want to record warm-up data, or exclude the warm up data later by creating a subsession in Analysis.
2	Create session names Treadmill Test/Beep Test in Live **Preferences** for current and future use; click the tick button to assign the session name.
3	Use markers to note any events you may want to refer to later in Analysis. The start and end of the test are easy to identify due to obvious changes in activity level.

- Perform the test according to the protocol.
- Make sure recording in ON.

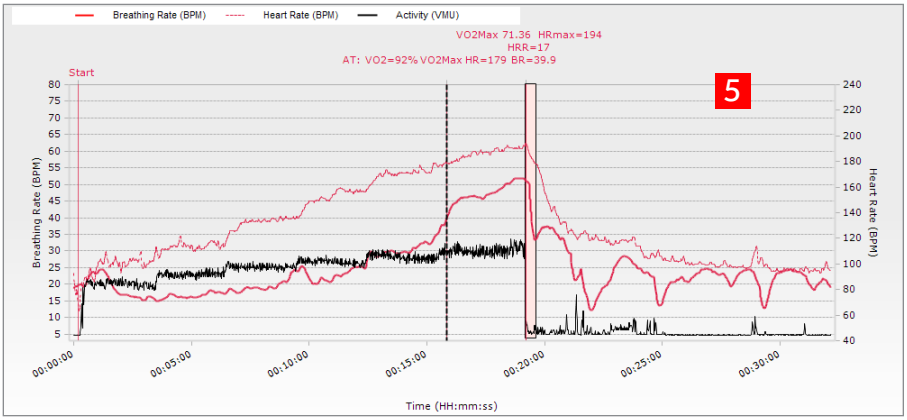
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
> Overview/Test Protocols
> Treadmill/Beep Test Analysis
> Orthostatic Hypotension Readiness Test Analysis
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

BASELINE FITNESS TESTING
Treadmill/Beep Test Analysis (2/5)

Automatic Test Analysis



#	Description
1	Use the filter pull downs to locate the relevant treadmill or beep test session.
2	Double-click the session to move it to the Legend.
3	Select **Treadmill Test** or **Beep Test** from the Time Variables list as appropriate. Heart rate, breathing rate and activity level will be displayed on the graph. No other parameters can be selected.
4	Select the Detect button to implement automatic analysis of the test.
5	If successful, the anaerobic threshold will be detected, as well as HR max and heart rate recovery values. VO_2max will be calculated according to an ACSM formula. They are shown in red text and graphics on the graph.



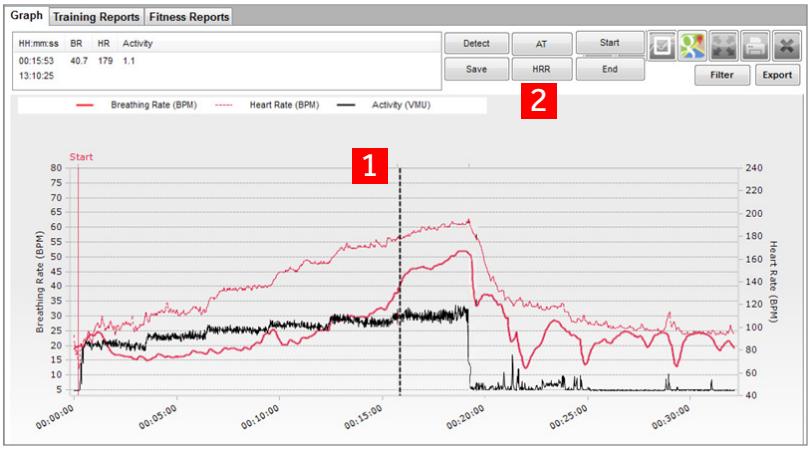
Note

If automatic analysis is not successful, or the AT threshold detected automatically appears to be wrong, a message will display, it must be made manually.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
> Overview/Test Protocols
> Treadmill/Beep Test Analysis
> Orthostatic Hypotension Readiness Test Analysis
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Manual Test Analysis

Place the vertical graph cursor at the relevant points on the graph traces and use the manual detect buttons as indicated.



#	Description
1	Vertical Graph cursor
2	Automatic & manual detect buttons

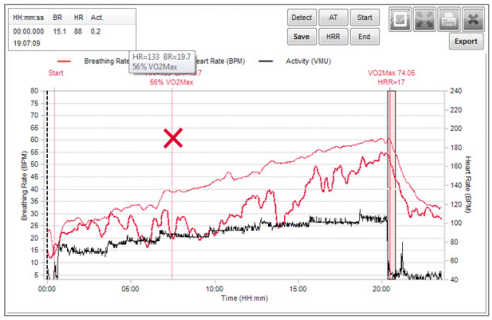
- Use the buttons in the order below, placing the vertical graph cursor appropriately.
- The cursor can be relocated and any button re-used to correct errors.

Button	Description
Detect	Use for automatic detection. A message will display if the detection algorithm criteria are not satisfied.
Start	Set at the start of the active part of the test, for a valid VO_2 max estimate.
End	Set at the end of the active part of the test, for a valid VO_2 max estimate.
AT	Set at the **Anaerobic Threshold** (see next page)
HRR	Set at peak heart rate value at end of test, to establish heart rate recovery. A rectangle will show the 30-second HRR interval.
Save	Use to save the physiological parameters to the database after all parameters have been established. A dialog will display.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
> Overview/Test Protocols
> Treadmill/Beep Test Analysis
> Orthostatic Hypotension Readiness Test Analysis
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

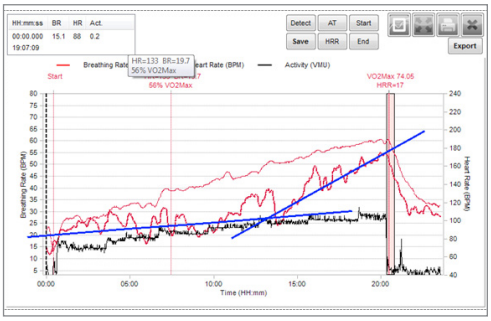
Manual AT Threshold Selection

In the example below, the automatic detection algorithm has failed, and set the AT Threshold at 56% of VO_2max, indicated by the red cross.



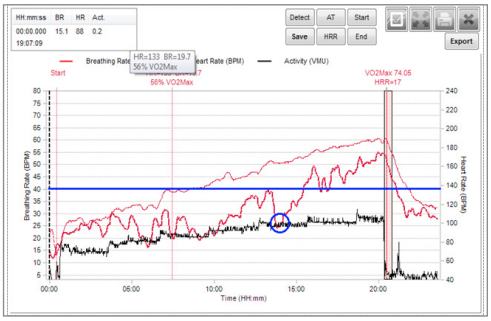
There are two alternative approaches to manual selection.

Method 1



- Look for a trend of more-rapidly-increasing breathing rate amongst the artefacts in the respiration rate. This is indicated where the blue lines intersect – a better estimation of AT than the automatically-determined value.

Method 2



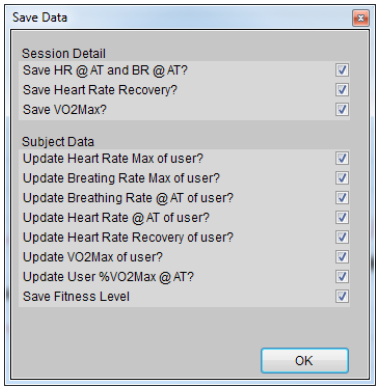
- Locate the last **major** inflection (upswing) in the respiration rate before the 40 breaths/min level (horizontal blue line) is passed. Minor inflections should be ignored. The blue circle indicates this location.

Using whichever method is best suited, relocate the graph cursor and click the **AT** button.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
> Overview/Test Protocols
> Treadmill/Beep Test Analysis
> Orthostatic Hypotension Readiness Test Analysis
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Save Fitness Test Parameters

Use the **Save** button once all fitness parameters have been satisfactorily established. A dialog will display.

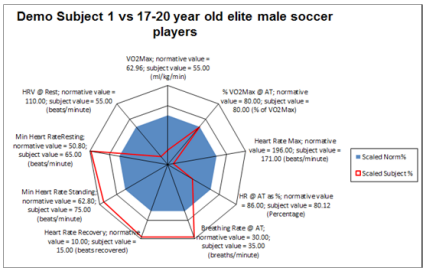


Session Detail

- If the Session detail parameters AT, HRmax , HRR and VO_2 are checked, then they will be saved with the session and will always re-display on the graph.

Subject Data

- Details will be saved into the OmniSense™ Database.
- Max values saved will be reflected in 100% deflection on subject BioGauge in Live.
- VO_2max will be displayed in Fitness Reports.



- Note that only three of these parameters are visible directly, in OmniSense™ **Live > Setup > Subject.**

HR max BPM	HR @ AT BPM	BR @ AT BPM
164	144	40
185	152	40

Note

Fitness test parameters saved to the database are synchronized between the local PC and the cloud database, when a PC session is connected to the cloud.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
> Overview/Test Protocols
> Treadmill/Beep Test Analysis
> Orthostatic Hypotension Readiness Test Analysis
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

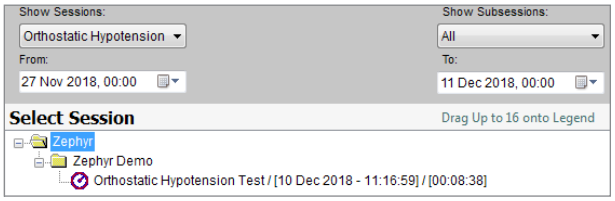
Orthostatic Hypotension Readiness Test Analysis

1. Conduct an orthostatic hypotension readiness test (called a Readiness Assessment in the OmniSense™ Mobile application) in OmniSense™ Live, ideally naming the session as such - though it can be renamed later in OmniSense™ Analysis.

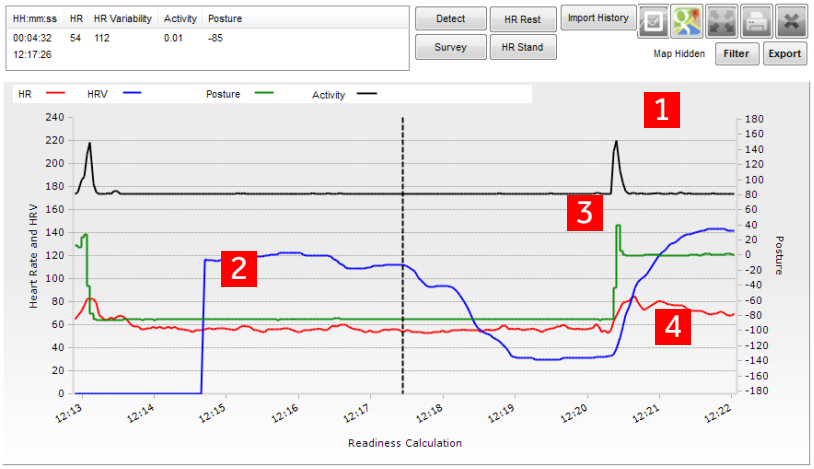


2. In OmniSense™ Analysis, select the **Readiness** button from the toolbar, and populate the legend with the appropriate session.





3. The Readiness graph shows four parameters, and will display a number of features.



#	Description
1	Activity (black) is ~ zero and spikes when the subject stands.
2	HRV (blue) is zero until a valid value is determined.
3	Posture (green) is ~ -90° while lying, ~0° while standing.
4	Heart rate (red) stabilizes while lying, rises then falls as the subject stands.

Note

When **Readiness** is initially selected from the toolbar, the parameter panel automatically shows the **Readiness Calculation** parameter as selected.



This selection is used when a Readiness analysis is intended. All other parameters are used when displaying historical results.

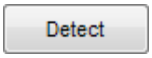
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
> Overview/Test Protocols
> Treadmill/Beep Test Analysis
> Orthostatic Hypotension Readiness Test Analysis
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

BASELINE FITNESS TESTING

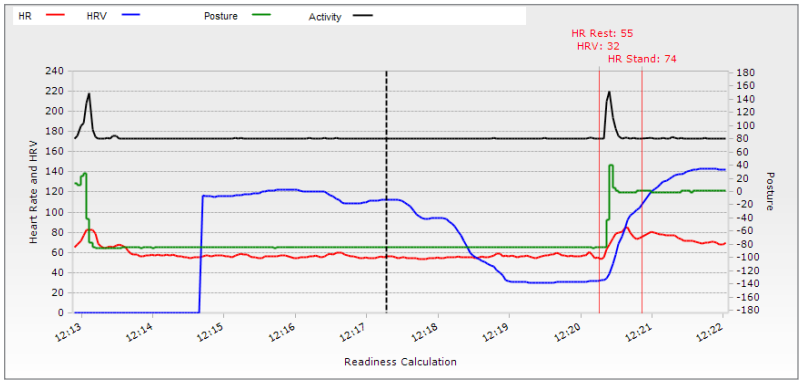
Orthostatic Hypotension Readiness Test Analysis (2/8)

Automated Test Analysis

1. With **Readiness** selected in the toolbar, and an orthostatic test loaded into the legend, select the **Detect** button.



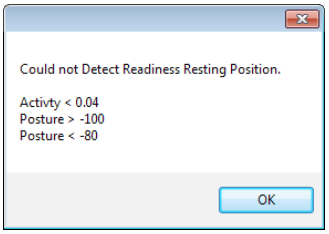
2. The detection algorithm will determine the point at which the subject went from lying to standing posture, and indicate **Resting Heart Rate** and **Resting Heart Rate Variability** approximately 10 seconds before the change, and **Standing Heart Rate** approximately 30 seconds after this point.



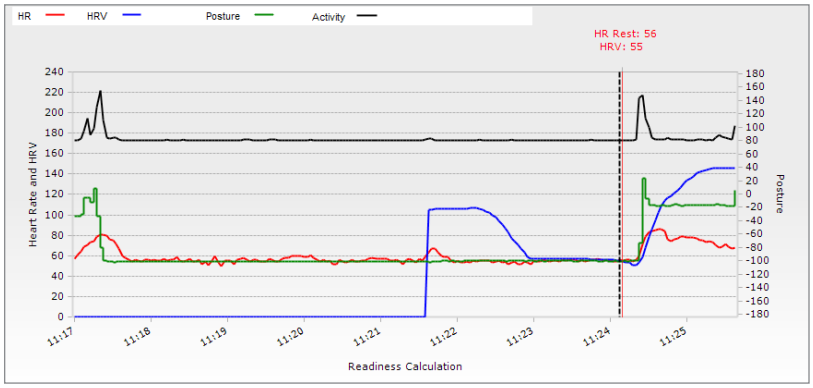
3. If the test criteria are met, then the parameters will indicate in red on the graph.

Manual Test Analysis

It may be that posture criteria are not met sufficiently. In this case, when the **Detect** button is selected, a dialog appears.



1. In this instance, manually set the vertical cursor approximately 10 seconds before the posture change/activity spike, and select the **HR Rest** button.



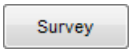
2. The **Resting HR** and **HRV** values will be shown.
3. Repeat for **Standing HR**, placing the cursor ~30 seconds after the subject is standing, using the **HR Stand** button.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
> Overview/Test Protocols
> Treadmill/Beep Test Analysis
> Orthostatic Hypotension Readiness Test Analysis
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

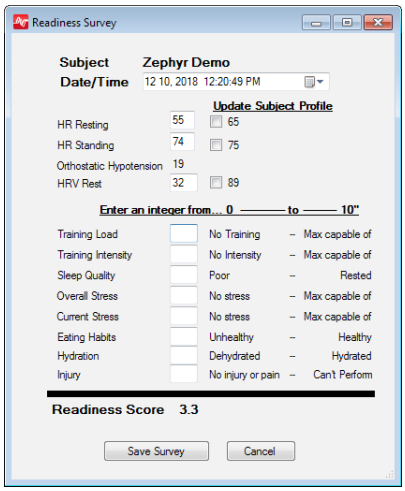
Orthostatic Hypotension Readiness Test Analysis (3/8)

Readiness Survey

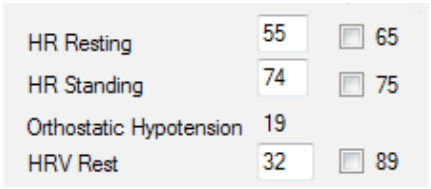
1. When the orthostatic readiness test analysis has been performed, select the **Survey** button.



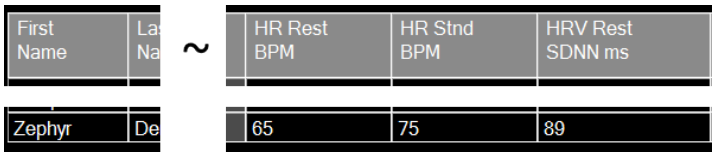
2. A survey dialog will display.



3. The dialog will contain the **Date/Time** of the currently analyzed test, and the parameters derived from it in editable fields.



4. The non-editable fields show the values for that subject currently stored in the OmniSense™ database. Check the appropriate boxes to update the subject's stored values when the survey is saved.



Orthostatic Hypotension is the difference in beats/minute between Resting and Standing heart rate.

These parameters comprise the objective components of the **Readiness Score** on a 1-10 scale. The subject must now complete a survey to allow the Readiness algorithm to factor in the subjective components.

As seen above, the **Readiness Score** for the example currently stands at 3.3 with no survey responses added.

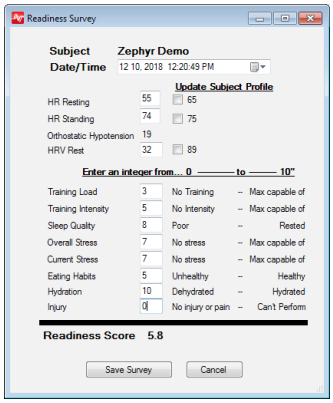
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
> Overview/Test Protocols
> Treadmill/Beep Test Analysis
> Orthostatic Hypotension Readiness Test Analysis
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Orthostatic Hypotension Readiness Test Analysis (4/8)

5. The subject should now complete the survey. The answers are entirely subjective, and may only show value if trends are established after a number of tests and surveys have been recorded. The history of results can be retrieved in Analysis.

Item	Description
Training Load	Average in previous 10 days. 10 = maximum capability.
Training Intensity	Average in previous 10 days. 10 = maximum capability.
Sleep Quality	Subjective or scaled based on external 3rd party system. 0 = poor quality.
Overall Stress	0 = stress-free, 10 = very stressed.
Current Stress	0 = stress-free, 10 = very stressed.
Eating Habits	0 = poor, 10 = optimal, in consultation with coach/ nutritionist.
Hydration	0 = dehydrated, 10 = hydrated.
Injury	0 = unable to train/perform, 10 = no injury.

6. Once the survey is complete, use the **Save Survey** button to save the results into the OmniSense™ database. The **Readiness Score** is recalculated as each entry is made.



Note

Subjective Readiness Survey responses are always on a scale 1-10, but each response can be given a weighting in Analysis **Preferences**, to increase or reduce its importance in the Readiness Score calculation.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
> Overview/Test Protocols
> Treadmill/Beep Test Analysis
> Orthostatic Hypotension Readiness Test Analysis
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

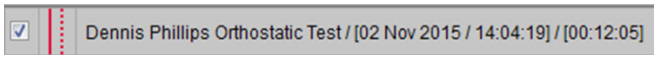
Orthostatic Hypotension Readiness Test Analysis (5/8)

Display Readiness History

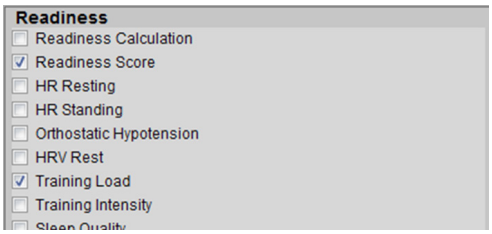
1. Select a date range in the **Filter Session List**. (This can be adjusted later).



2. Populate the legend with a session from the desired subject - this can be any session, it is merely to establish the subject of interest. The details of this session will not be used.



3. Select the desired Readiness parameters.



4. The Readiness history will display in the graph area.

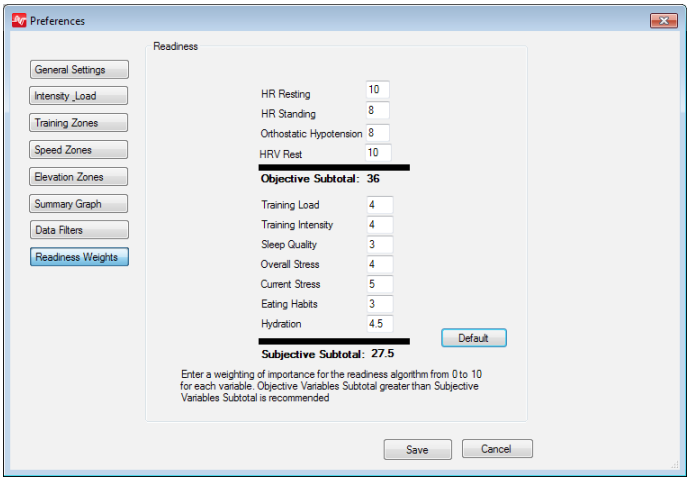


CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
> Overview/Test Protocols
> Treadmill/Beep Test Analysis
> Orthostatic Hypotension Readiness Test Analysis
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Configure Readiness Survey Weightings

The components of the Readiness survey are each given a weighting which can be configured in **Analysis > Preferences**. This allows a coach to add more or less relevance to a particular survey response, as they see fit.

1. Select **Readiness Weights** from the **Preferences** dialog.



2. The default weightings are shown - reset to these using the **Default** button at any time.

3. Edit the weightings to suit. As the text below the fields indicates, it is recommended that the objective factors subtotal should always exceed that of the subjective factors.

4. Select **Save** to make the changes permanent.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
> Overview/Test Protocols
> Treadmill/Beep Test Analysis
> Orthostatic Hypotension Readiness Test Analysis
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Orthostatic Hypotension Readiness Test Analysis (7/8)

Import Readiness History

Recording the results of a Readiness survey taken remotely, and sent in a file to a coach or manager is largely now a legacy task.

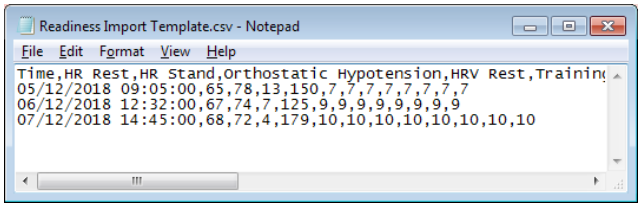
OmniSense™ Mobile now allows a registered user to perform the hypotension test remotely, and complete a survey.

The results uploaded automatically to the OmniSense™ cloud server, and submitting results in a file is no longer necessary.

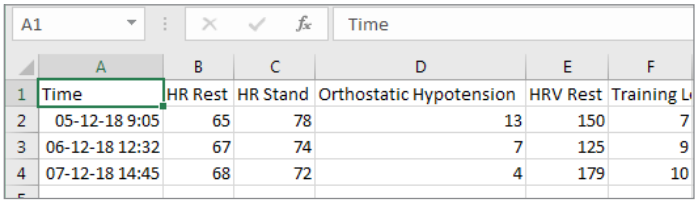
Create Readiness History File

The documentation folder accompanying each OmniSense™ installation should contain a file titled Readiness Import Template.csv.

1. Make a copy for any individual subject, Data must be entered in exactly the format contained in the file. When opened in Microsoft™* Notepad™*, the raw data and formatting can be seen.



2. By default, this file will open in Microsoft™* Excel™*. Note in particular the time entry format, and replicate this when completing. Delete any existing records.

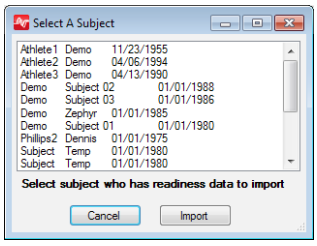


	A	B	C	D	E	F
1	Time	HR Rest	HR Stand	Orthostatic Hypotension	HRV Rest	Training L
2	05-12-18 9:05	65	78	13	150	7
3	06-12-18 12:32	67	74	7	125	9
4	07-12-18 14:45	68	72	4	179	10

3. The subject must enter their survey responses in the columns as shown.

Import Readiness History

1. In the **Readiness** pane, with **Readiness Calculation** as the checked parameter, select the **Import History** button. A list of all subjects will display. Select the subject for whom the history will apply.



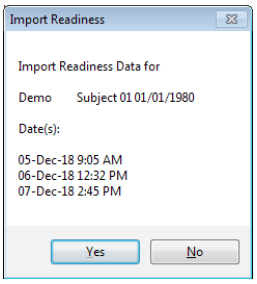
The format of the entries is Lastname | Firstname | Date of Birth.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
> Overview/Test Protocols
> Treadmill/Beep Test Analysis
> Orthostatic Hypotension Readiness Test Analysis
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

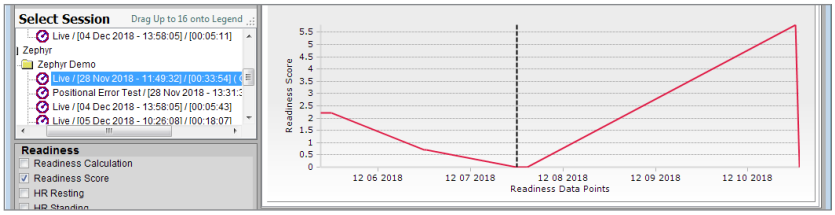
Orthostatic Hypotension Readiness Test Analysis (8/8)

2. Select the appropriate subject, and when prompted, browse to the location of the external history file.

3. When the file is selected, you will be prompted to confirm import of the results.



4. Once imported, these results will be displayed for the subject whenever any of the Readiness parameters are checked.



Caution

When external survey results are imported, they are permanently added to the OmniSense™ database against the selected subject. They cannot be deleted. Confirm the results are correct and assigned to the appropriate subject before importing.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
> Intensity & Load
> Interpreting Graphs
APPENDICES
EULA
SUPPORT
INDEX

FITNESS PARAMETERS
Intensity & Load (1/3)

Overview

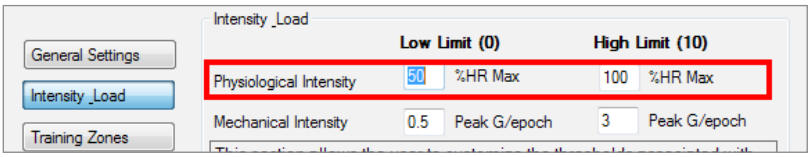
The following sections describe in more detail some of the physiological parameters and how they are calculated.

Category	Intensity	Load
Physiological	An index of cardiovascular output.	Cumulative effort of the cardiovascular system.
Mechanical	An index of musculoskeletal output.	Cumulative effort of the musculoskeletal system.
Training	Average of Physiological + Mechanical Intensities. An index of combined output .	Average of Physiological + Mechanical Loads. Total cumulative effort of the body.

- Aerobic, plyometric and similar training activities will have a high physiological intensity.
- Weight and other relatively static training methods will have a lower mechanical intensity, as measured by the BioModule, whose accelerometer is measuring whole body movement.

Physiological Load & Intensity

These are heart rate-related metrics. Intensity/effort is divided into 10 zones. The thresholds are configured in Live & Analysis Preferences.



Physiological Intensity Threshold default settings

- 50-54.9% of maximum heart rate is an intensity of 1
- 100% or greater of maximum heart rate is an intensity of 10
- Less than 50% of HRmax has no value ('null' - a zero would affect calculations)

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
> Intensity & Load
> Interpreting Graphs
APPENDICES
EULA
SUPPORT
INDEX

FITNESS PARAMETERS
Intensity & Load (2/3)

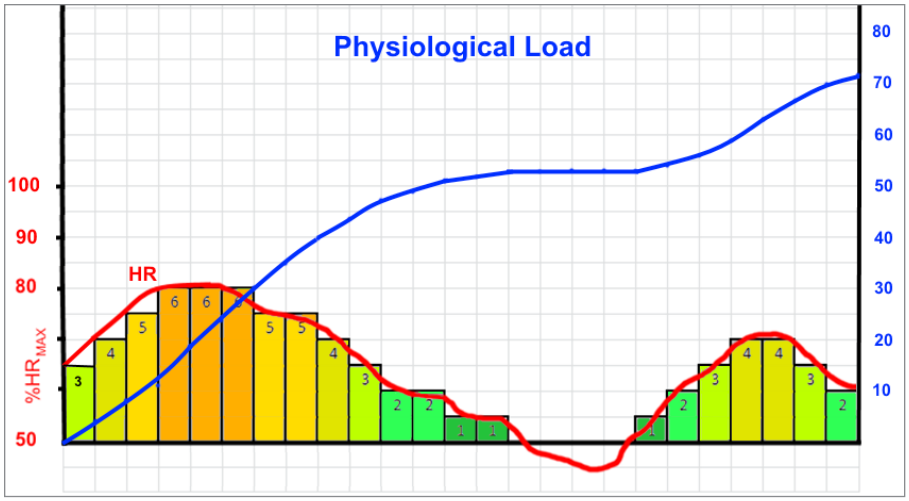
Physiological Intensity



Intensity Level	Heart Rate Range % HR maximum
Null	Less than 50
1	50.0 - 54.9
10	95.0 - 100.0

- Calculated once per second, over 1 second epoch.
- Scaled linearly within zone (e.g. 52.5% HRmax = Physiological Intensity Level 0.5)

Physiological Load

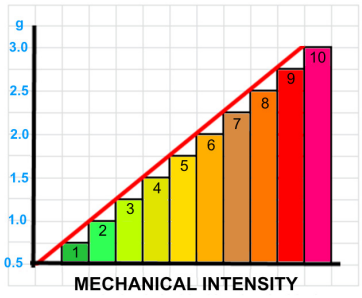


- Physiological Load = (Sum of physiological intensities)/60
  [Divide by 60 as intensity is measured in 1/60 minute epochs]
- Average Physiological Intensity per session
  = Physiological Load/Session Time in minutes.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
> Intensity & Load
> Interpreting Graphs
APPENDICES
EULA
SUPPORT
INDEX

FITNESS PARAMETERS
Intensity & Load (3/3)

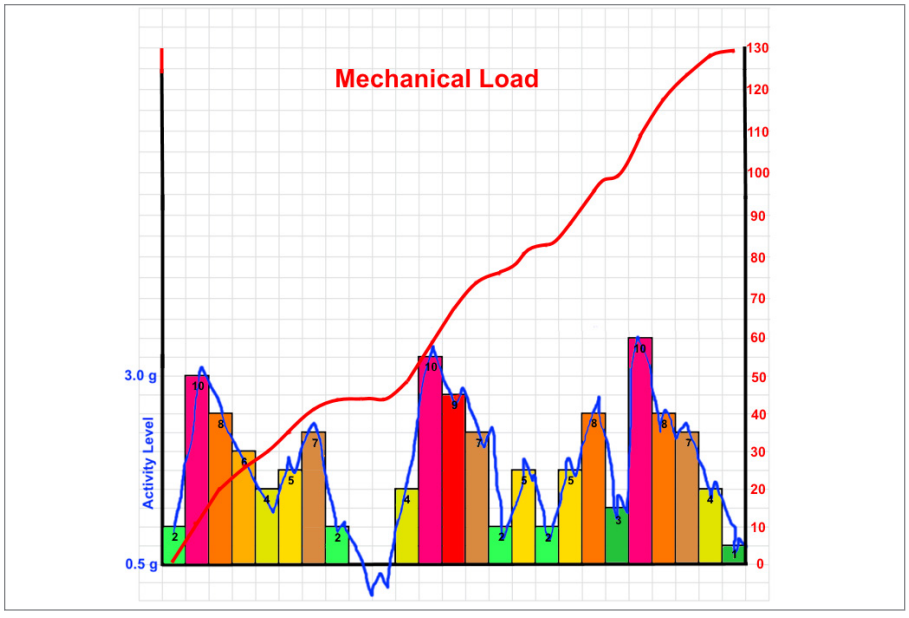
Mechanical Intensity



Intensity Level	Activity Level (g)
Null	Less than 0.5
1	0.5 - 0.75
10	3.0 or greater

- Calculated once per second, over 1 second epoch.
- Scaled linearly within Zone (e.g. 0.6g = Mechanical Intensity Level 0.4)

Mechanical Load

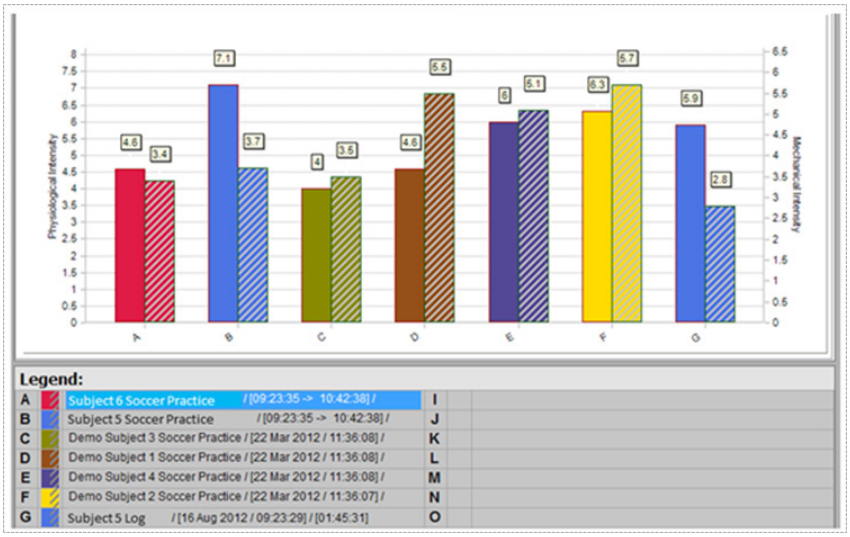


- Mechanical Load = (Sum of mechanical intensities)/60
  [Divide by 60 as intensity is measured in 1/60 minute epochs]
- Average Mechanical Intensity per session
  = Mechanical Load/Session Time in minutes.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
> Intensity & Load
> Interpreting Graphs
APPENDICES
EULA
SUPPORT
INDEX

FITNESS PARAMETERS
Interpreting Graphs (1/9)

Average Physiological vs. Average Mechanical Intensity



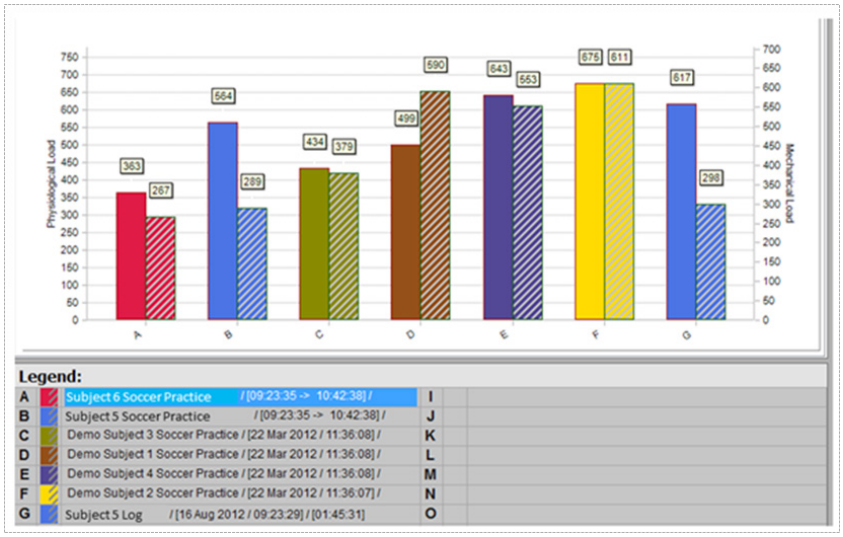
Left Axis	Right Axis
Average Physiological Intensity	Average Mechanical Intensity

- Average summary values (as opposed to Maximum or Minimum) give some indication of whole-session performance.
- High Average Mechanical Intensity with low Average Physiological Intensity is a good indicator of efficiency and useful when comparing multiple people doing similar activities.
- For example, Subject D (brown) has Average Physiological Intensity 4.6 and Average Mechanical Intensity 5.5 for the session. This subject is more efficient than subject B (blue, left) whose Average Physiological Intensity is 7.1 and Average Mechanical Intensity of 3.7.
- Subject D's heart is working less hard, for more mechanical results, than subject B's (or A or G) is.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
> Intensity & Load
> Interpreting Graphs
APPENDICES
EULA
SUPPORT
INDEX

FITNESS PARAMETERS
Interpreting Graphs (2/9)

Physiological vs. Mechanical Load



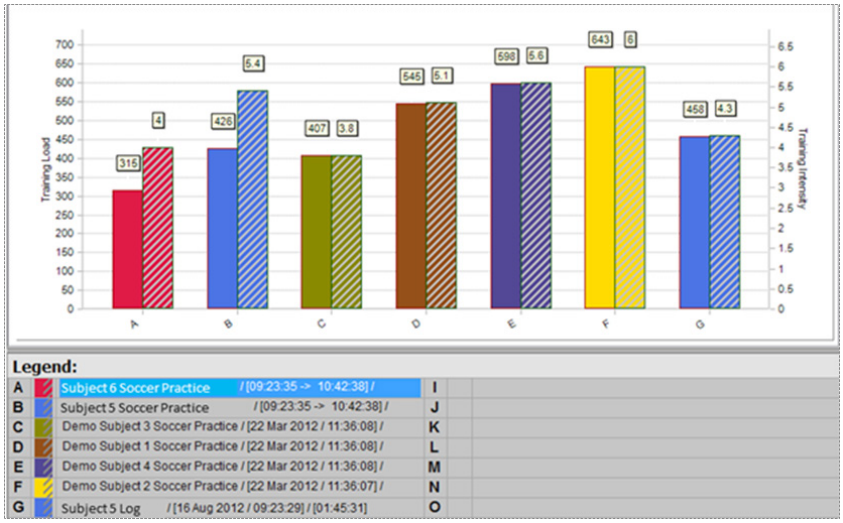
Left Axis	Right Axis
Physiological Load	Mechanical Load

- Load is the summation (or area under the curve) of the corresponding intensity value plotted over time.
- It provides a measure of the overall conditioning value or impact of the session.
- High physiological load with low mechanical load can be an indicator of anxiety or inefficiency – assuming the session involves running or movement. Subjects B and G (both blue) show this possible indication.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
> Intensity & Load
> Interpreting Graphs
APPENDICES
EULA
SUPPORT
INDEX

FITNESS PARAMETERS
Interpreting Graphs (3/9)

Training Load & Intensity



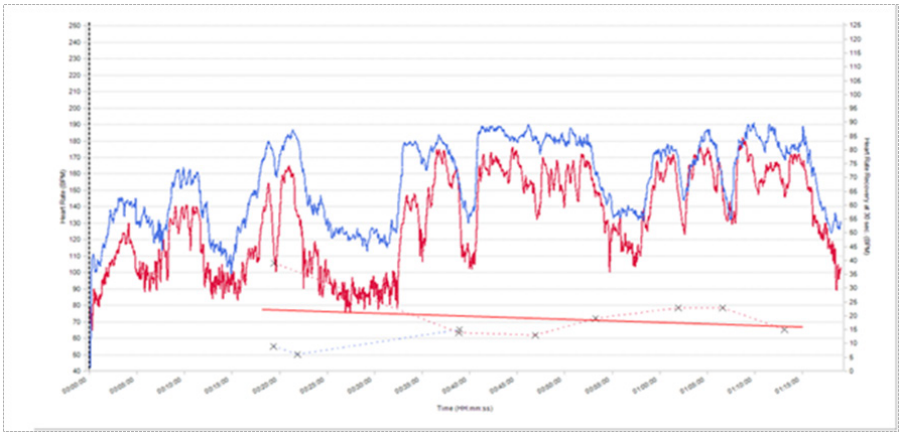
Left Axis	Right Axis
Training Load	Training Intensity

- Training Load & Intensity provide a metric that is a combination of the physiological and mechanical components for the most simplified summary of overall training value & impact of the workout session.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
> Intensity & Load
> Interpreting Graphs
APPENDICES
EULA
SUPPORT
INDEX

FITNESS PARAMETERS
Interpreting Graphs (4/9)

Recovery & Fatigue

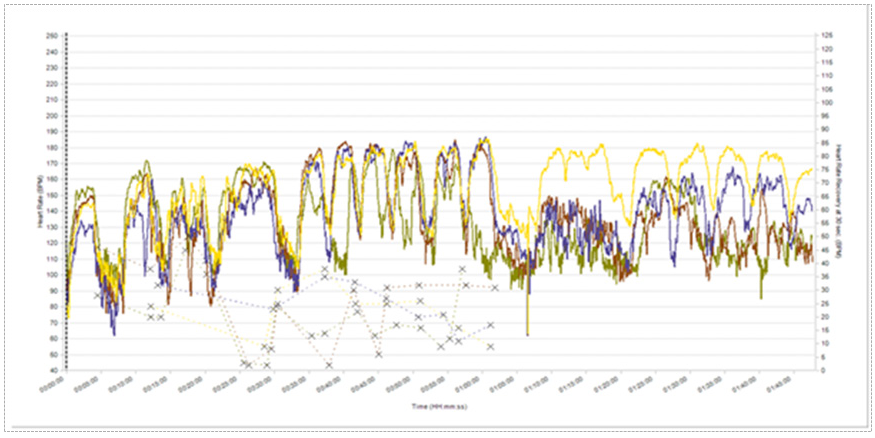


Left Axis	Right Axis
Heart Rate	Heart Rate Recovery @ 30 sec

- HRR 30 recordings are triggered when an athlete has exceeded an activity threshold and HR threshold for a set period of time, and then become inactive for 30 seconds to take a recovery measurement.

- Blue Subject 5 rarely stopped long enough for an HRR 30 recovery measurement to be taken.

- Red subject 6 HRR30 trend line(red) shows only a very slight fatigue slope (recovery becomes slightly less as the session proceeds), which indicates that the subject is well conditioned and not pushed to fatigue. A steeper downward trend line may indicate the onset of fatigue.

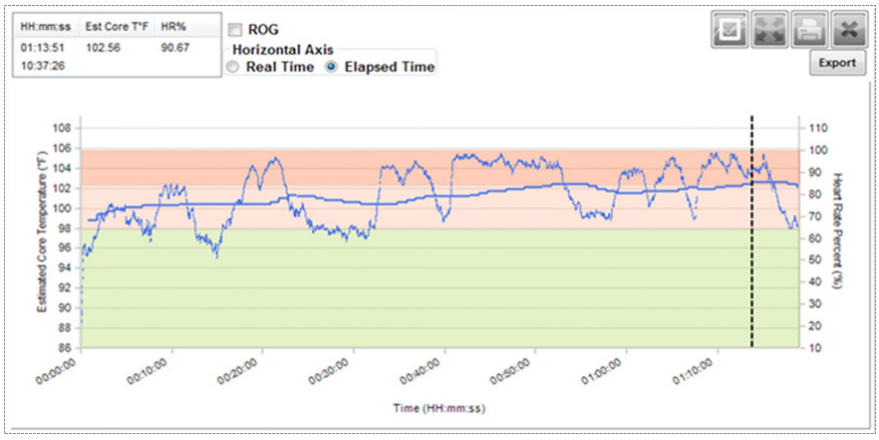


- In the second half of this session, less recovery time was allowed, so automatic HRR 30 calculations are less frequent.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
> Intensity & Load
> Interpreting Graphs
APPENDICES
EULA
SUPPORT
INDEX

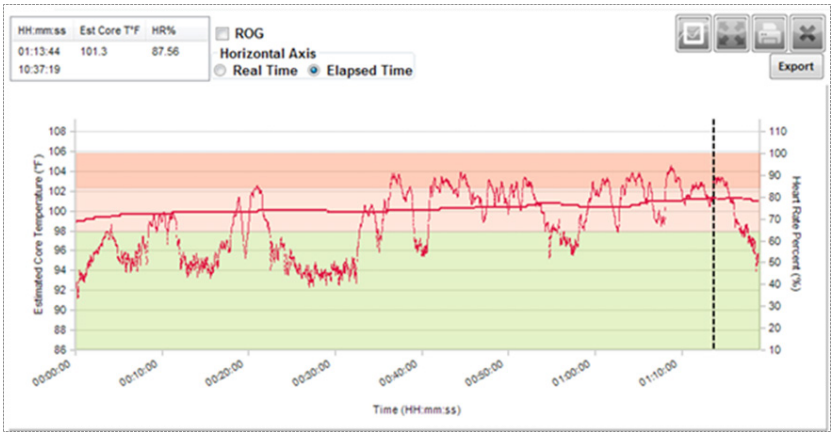
FITNESS PARAMETERS
Interpreting Graphs (5/9)

Safety & Core Temperature



Left Axis	Right Axis
Estimated Core Temperature	Heart Rate Percent

- This plot shows the subject Heart Rate % (% of Maximum Heart Rate) and Estimated Core Temperature over time.
- At the end of the session the vertical cursor location shows his core temperature reached a max of 102.56° F which is at the low end of potential heat stress.
- Beyond 103° to 104° F, there would be safety concerns.

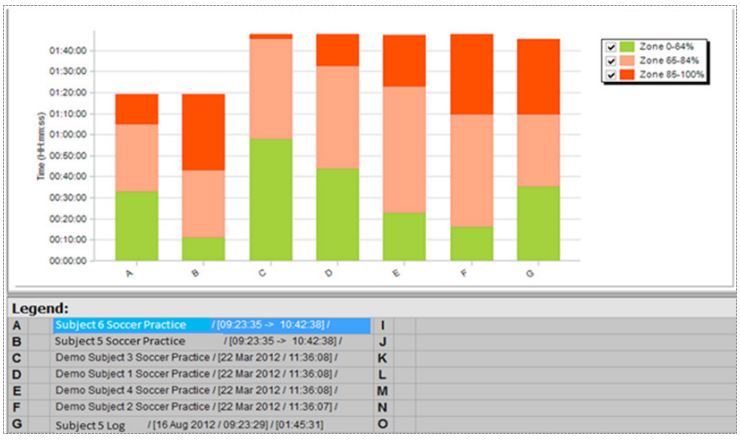


- In the graph above the subject's temperature never reached an Alarm level (Max 101.3°F) because he was able to recover periodically.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
> Intensity & Load
> Interpreting Graphs
APPENDICES
EULA
SUPPORT
INDEX

FITNESS PARAMETERS
Interpreting Graphs (6/9)

Time in HR Zones



Left Axis	Right Axis
Time	N/A - only one summary parameter can display if the graph is a stacked bar chart

- This summary variable shows the time spent from 0 – 64.9% HRmax (green), 65 – 84.9% (orange) and 85 – 100% (red). These zones are fixed, and do not correspond to heart rate Training Zones.
- Maximum heart rate should be measured along with other fitness parameters and calibrated in the software by running through a fitness test as described in the **Baseline Fitness Testing** section.
- Subject 5 is included twice (bar B and bar G). Bar G is the log data imported later from his BioModule, with post session recovery data removed. You can do this by creating a subsession, described in the **Analysis Operations** section.

Note

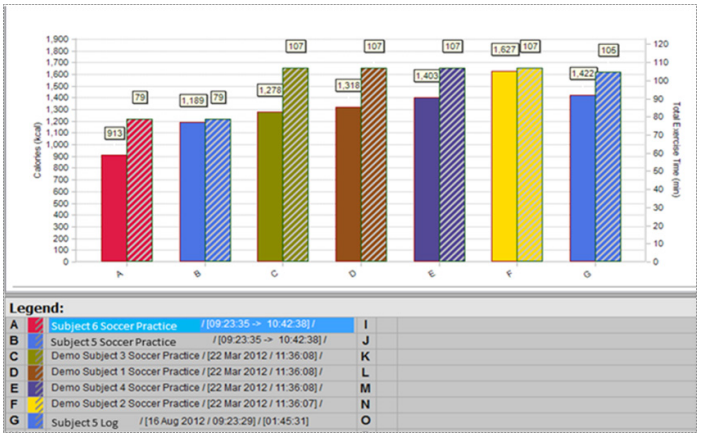
The HR zones here are defined by the fixed thresholds 65% and 85% of subject maximum heart rate.

These should not be confused with the five Training zones, which are also heart rate zones, used in conjunction with workouts. Training Zone thresholds are configurable in Live **Preferences.**

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
> Intensity & Load
> Interpreting Graphs
APPENDICES
EULA
SUPPORT
INDEX

FITNESS PARAMETERS
Interpreting Graphs (7/9)

Caloric Expenditure



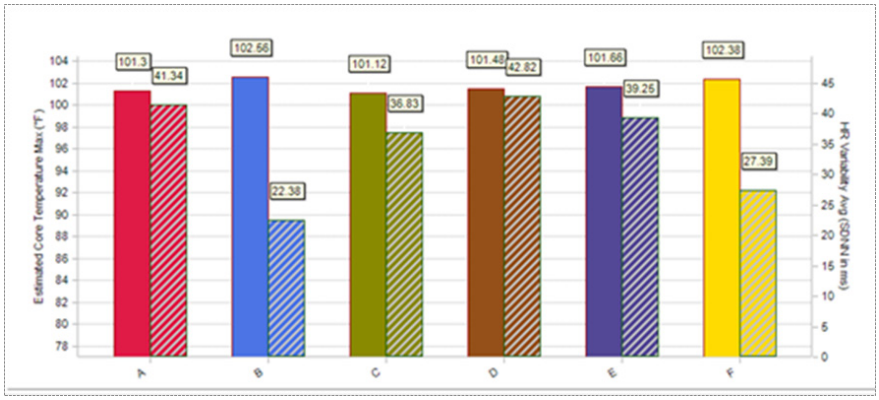
Left Axis	Right Axis
Calories	Exercise Time

- This graph shows a measure of calories burned and total session duration, which can be useful in estimating dietary replenishment needs.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
> Intensity & Load
> Interpreting Graphs
APPENDICES
EULA
SUPPORT
INDEX

FITNESS PARAMETERS
Interpreting Graphs (8/9)

Physiological Strain & Stress Indicators



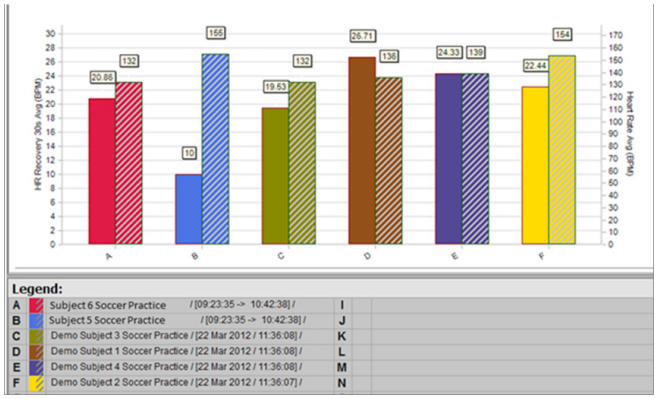
Left Axis	Right Axis
Estimated Core Temperature	Average Heart Rate Variability

- Estimated Core Temperature (Max) and Heart Rate Variability (Avg) can both be interpreted as measures of physiological strain.
- A low HRV is an indication of stress, fatigue and dehydration, and also relates to heat stress.
- Elevated Estimated Core Temperature is also an indication of heat stress and should be monitored carefully, particularly on a hot intense training session.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
> Intensity & Load
> Interpreting Graphs
APPENDICES
EULA
SUPPORT
INDEX

FITNESS PARAMETERS
Interpreting Graphs (9/9)

HR_{avg} & HRR Indicating Stress & Anxiety



Left Axis	Right Axis
HR Recovery 30s	Average Heart Rate

- Summary graph of average heart rate recovery in 30 seconds (drop in beats per minute after stopping an interval of high intensity activity), against average heart rate for the session.

- A low average recovery value indicates either a high level of anxiety, as in for bar B, and could also indicate a lower level of fitness .

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 1
BioModule Firmware Upgrade (1/4)

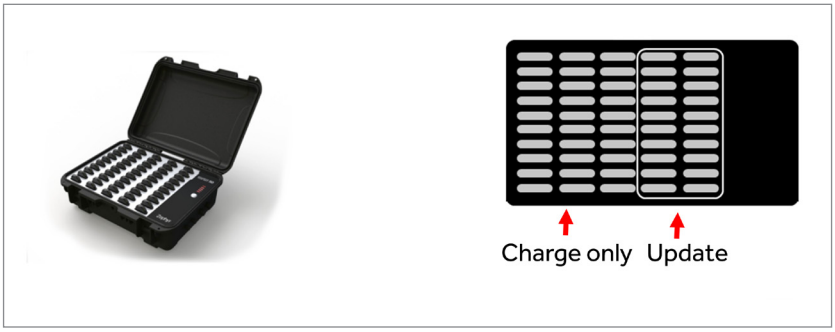
BioModules supplied with a new installation are configured with the latest firmware.

Should your OmniSense™ version be upgraded, or if you have existing BioModules, it may be necessary to upgrade the firmware in the devices.

OmniSense™ will generally support earlier versions of device firmware, but it is good practice to have the latest version of firmware in your device.

Refer to the next Appendix for more information on BioModule firmware versions.

1. Connect the BioModule(s) to your PC platform using the single or multi device cradle. In earlier system cases, the right hand 20 slots (two vertical rows) are marked as available for USB connection. The left hand 30 slots are for charging devices only.



In later PSM50 system cases, all 50 slots are available for USB connection, but can only be connected to the PC 10 at a time, via 5 USB connectors on the side of the case. This is a Microsoft™* Windows™* limitation - more than 10 devices connected may affect device handling.



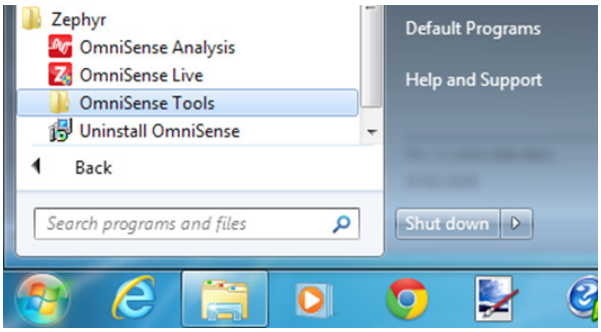
2. The 10 BioModules connected at any point are visible to the firmware update tool over USB. The remaining BioModules must be connected in turn.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 1
BioModule Firmware Upgrade (2/4)

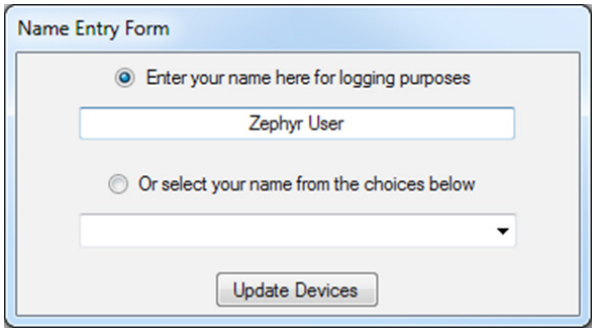
3. Locate the **ZUSBUPDATER.exe** utility, which is in the Firmware Upgrade directory of every OmniSense™ thumb drive, and double-click to start.

   It can also be found at C:\Program Files (x86)\Zephyr\OmniSense\Tools, or from the **Start > All Programs > Zephyr > OmniSense Tools**



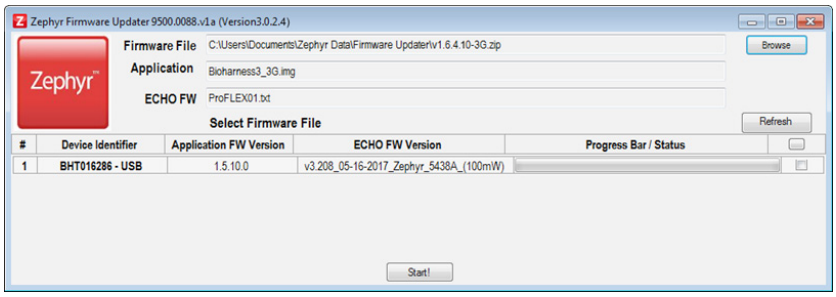
4. A dialog will display asking you to enter your name. This is **not** a security check – it merely records your name against device re-configurations made in a log file at

   C:\Program Data\Zephyr\ZephyrDeviceUpdateLog.csv.



   This will let system owners track configuration changes historically. Once entered, a name is saved and can be selected from the pull-down list.

5. Select **Update Devices** to display the updater tool. As of OmniSense™ 5.0, the updater tool can update the firmware for the ECHO module as well as the BioModule firmware. The firmware update file will be a .zip file if this is the case.



6. All detected devices will be displayed.

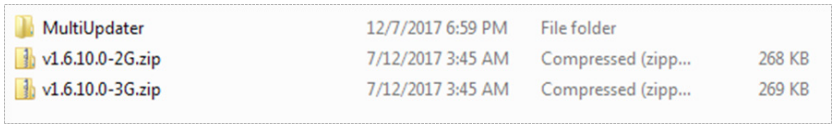
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 1
BioModule Firmware Upgrade (3/4)

7. Click **Browse** to locate the desired firmware image file. Firmware image files are included in firmware upgrade directories.

   Prior to firmware version 1.6.10.0, released with OmniSense™ 5.0, firmware images will be a single *.img file, such as Bioharness3_3G-1.5.10.0.img.

   From firmware version 1.6.10.0 and later, some firmware images may be supplied in the form of a .zip file, such as Bioharness3_3G-1.6.10.0.zip. This directory **does not need to be unzipped** – the firmware updater will do this automatically. Subsequent firmware versions may still consist only of a single .img file.



Caution

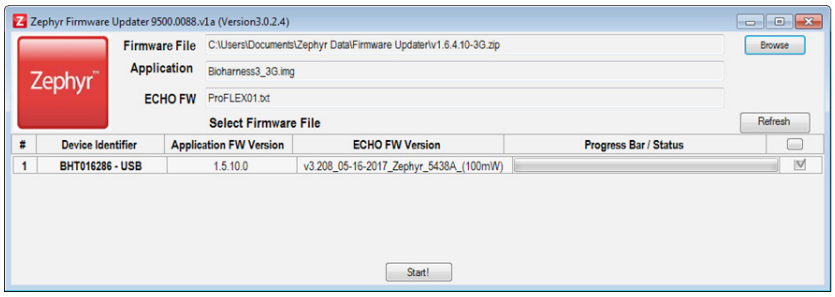
There are three variants of the BioModule 3.0, which are updated with different firmware images:

Generation	Description
1G	Bluetooth™* 2.1 only
2G	Bluetooth™* 2.1 + ECHO
3G	Bluetooth™* 2.1 + ECHO + Bluetooth™* 4.0 (BLE)

The devices are identical externally. If you are uncertain of the generation of your BioModule, use the Zephyr™ Config Tool to read its hardware part number.

Generation	Hardware Part #	Firmware Image Example
1G	9800.0153	BioHarness3_1G_v1.7.8.0.img
2G	9800.0189v6-v9g	BioHarness3_2G_v1.7.8.0.img
3G	9800.0189.v9k	BioHarness3_3G_v1.7.8.0.img

8. When the .zip or .img file is loaded into the updater, the component file(s) will be displayed individually in the **Application** and **ECHO FW** fields.

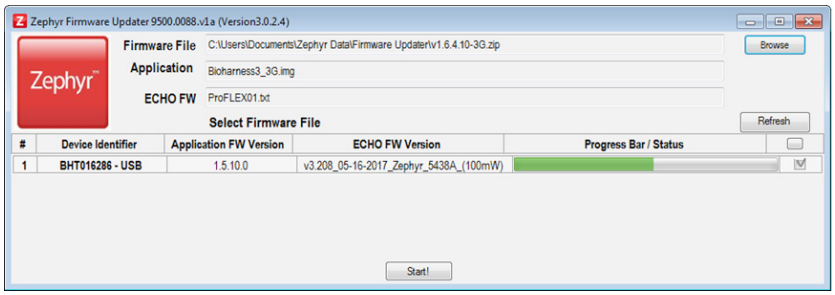


Check the right-most boxes of those devices to be updated, and select **Start!** To update

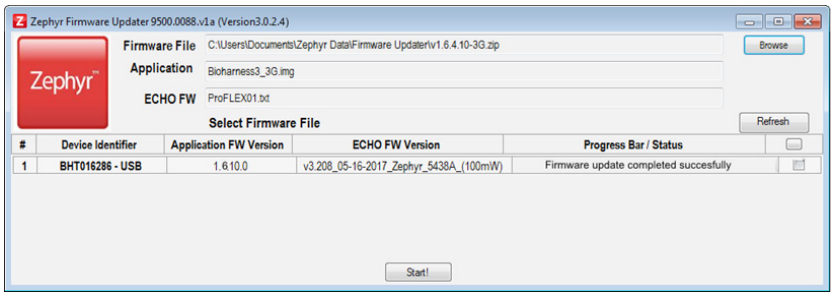
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 1
BioModule Firmware Upgrade (4/4)

9. The green and red LEDs will flash while the firmware image is being reprogrammed, blue and orange while the ECHO firmware is programmed. The progress bar will indicate the update is taking place.



10. A '**Firmware update completed successfully**' message will display on successful update of the firmware, or a diagnostic message if the update has failed.



11. Retry if necessary.

12. Contact zephyrperformancesupport@medtronic.com if any problems persist.

Note

If you are experiencing problems with firmware updates and your BioModules are connected to the PC via a USB hub, then bypass the hub and connect the charge cradle or case direct to a USB port. Also consider replacing the USB connector.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 2
BioModule Firmware Versions (1/3)

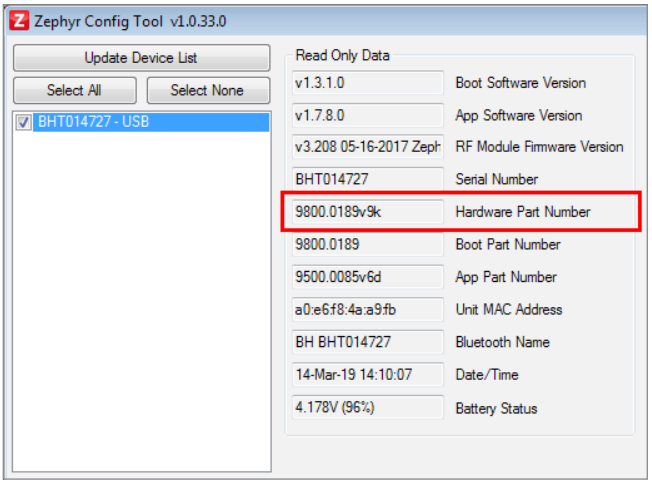
The following refers to the BioModule 3.0 only, which is currently in its 3rd generation (3G).

- Hardware and firmware part numbers referred to below can be read from a BioModule using the Zephyr™ Config Tool.

Hardware

Generation	Part No.	Radio Protocols
3G	9800.0189.v9k and later.	Bluetooth™* + ECHO + BLE
2G	9800.0189.v6-v9g	Bluetooth™* + ECHO
1G	9800.0153	Bluetooth™* only

- Bluetooth™*: 'Classic' Bluetooth™* 2.1 + ED
- ECHO: Proprietary Zephyr™ 802.15.4 radio solution
- BLE: Bluetooth™* Low Energy, also known as Bluetooth™* Smart



Hardware Part # indicating ....v9k, a 3G BioModule

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 2
BioModule Firmware Versions (2/3)

The table of firmware version information can be used when updating BioModule firmware.

Caution

A firmware image file appropriate to the generation of BioModule (1G/2G/3G) must be used when updating firmware, using the ZUSBUpdater Tool. Refer to the previous Appendix for details.

Date	Version	Part No.	Description
Jun 2011	1.0.6.0	9500.0085.v1a	
Oct 2011	1.1.3.0	9500.0085.v1b	
Oct 2011	1.1.4.0	9500.0085.v1c	
Oct 2011	1.1.7.0	9500.0085.v1d	
Oct 2011	1.1.8.0	9500.0085.v1e	
Oct 2011	1.1.9.0	9500.0085.v1f	
Nov 2011	1.1.10.0	9500.0085.v1g	
Dec 2011	1.1.14.0	9500.0085.v1h	
Dec 2011	1.1.15.0	9500.0085.v1i	Bug fixes this version and prior.
Apr 2012	1.1.19.0	9500.0085.v1j	Bluetooth™* only this version and prior.
May 2012	1.3.5.0	9500.0085.v2a	Separate image files for BT only, BT +ECHO.
May 2012	1.3.12.0	9500.0085.v2b	
Jul 2012	1.3.13.0	9500.0085.v2c	
Aug 2012	1.3.14.0	9500.0085.v2d	GPS Support.
Dec 2012	1.3.15.0	9500.0085.v2e	ECG buffering.
Dec 2012	1.3.16.0	9500.0085.v3a	BT/ECHO version only.
May 2013	1.3.5.116	9500.0085.v3b	Impdence breathing for trial units.
Jun 2013	1.3.18.0	9500.0085.v3c	GPS logging bug fix. Capacitive breathing version.
Jun 2013	3.0.7.0	9500.0085.v4a	Impedence breathing. Limited beta release.
Jun 2013	3.0.8.104	9500.0085.v4b	Impedence breathing. Limited beta release.
Jul 2013	1.3.19.0	9500.0085.v5a	Clock timing bug fix. Capacitive breathing version.
Oct 2013	1.3.23.0	9500.0085.v6a	GPS data in Summary format. GPS switched to enhanced DGPS automatically on connection to BioModule.
Apr 2014	1.3.25.0	9500.0085.v6b	
Apr 2014	1.3.27.0	9500.0085.v6c	Improvements to calibration of RTC clock
May 2014	3.0.35.0	9501.0002.v2q	For use with ZephyrLIFE™ Home Android™* app & BioPatch™

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 2
BioModule Firmware Versions (3/3)

Date	Version	Part No.	Description
May 2014	3.0.8.111	9501.0002.v1r	For use with ZephyrLIFE™ Hospital ECHO System & BioPatch™.
Jul 2014	1.3.20.106		PSM Systems using ATX radio network.
Nov 2014	1.4.5.0	9500.0085.v7a	GPS with ECHO. BLE support. Initially strap only.
Jul 2015	1.4.5.300	9500.0085.v7b	QStarz BT-Q1300ST support added.
Nov 2015	1.4.12.0	9500.0085.v8a	Support 3 ECHO modes, additional accelerometry variables and Enhanced log formats. Faster USB log download.
Apr 2016	1.5.0.0	9500.0085.v9a	Further improved USB log download speed. Fix accelerometer data bug in log data.
Nov 2016	1.4.5.400	9500.0133.v1a	BioPatch™ HP support for use with OmniSense™ 3.9.7 _3G BioModules only.
Nov 2016	1.5.0.201	9500.0134.v1a	BioPatch™ HP support for use with OmniSense™ 4.1.6 _3G BioModules only.
Mar 2017	1.5.10.0	9500.0085.v9a	Strap & BioPatch™ HP support with auto-detection.
Dec 2017	1.6.10.0	9500.0085.v10b	Final release version OmniSense™ 5.0.
Mar 2018	1.6.10.100	9500.0085.v10c	Minor bug fix.
Mar 2019	1.7.8.0	9500.0085.v11a	Configurable HRV SDNN/RMSDD OmniSense™ 5.0.6

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 3
BioModule Log Data Descriptions (1/8)

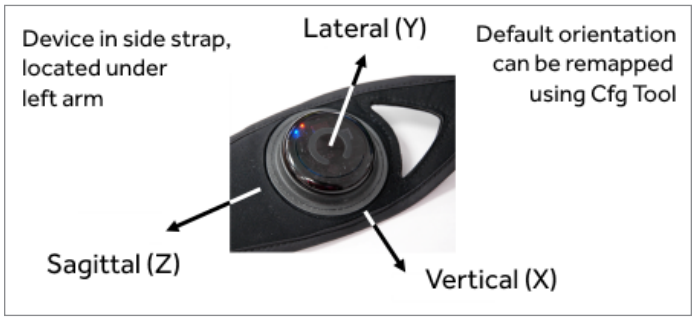
Log Data

BioModule log data can be imported into OmniSense™ Analysis using the Zephyr™ Downloader tool, This tool can also be used to generate external csv (and other formats) of log data.

The data descriptions here, and file names, refer to these external files.

Note
Not all BioModule log data is imported into OmniSense™ Analysis - logs - ECG and Accelerometer waveform data are not as they contain very large amounts of data which could not be usefully viewed in Analysis.

Accelerometer Axis Mapping



A BioModule should be configured for the appropriate garment. When setting

Garment type in OmniSense™ Live, the appropriate axis mappings will be made automatically.

Session Info

The Zephyr™ Downloader will generate a SessionInfo text file in addition to the csv log output files. The data in this file is not stored on the BioModule - it is generated by the downloader itself.

```
Sample Data:
Subject Information
~~~~~~~~~~~~~~~~~~~
Name: UNKNOWN
Gender: UNKNOWN
Birth Year: UNKNOWN
ROG Act Min/Max : UNKNOWN
ROG Resp Min/Max : UNKNOWN
ROG HR Min/Max : UNKNOWN
ROG O2R sec / sec : UNKNOWN

Device Information
~~~~~~~~~~~~~~~~~~
Serial number: UNKNOWN
MAC address: UNKNOWN
Device Friendly Name: UNKNOWN

Session Information
~~~~~~~~~~~~~~~~~~~
Log Format: 0011
Log Date: Tuesday, 24 July 2012
Log Time: 4:19:37 p.m.
Log Duration: 00:03:32
Page Period(ms): 1000
```

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 3
BioModule Log Data Descriptions (2/8)

Logging Formats

The logging format of a BioModule is configurable using the Zephyr™ Config Tool. The more comprehensive log formats use more device memory, which reduces the total hours of data which can be stored in the device.

Users should configure the device to suit their parameter configuration and total log duration needs.

Supported logging formats:

- Summary
- Summary + Waveform
- Summary + Development
- Enhanced Summary
- Enhanced Summary + Waveform
- Enhanced Summary + Development

The output from the Zephyr™ Downloader may generate more than one output file for a given log format, as individual parameters are reported at different frequencies.

The Zephyr™ Downloader can also export log files in varying file formats, selected from the menu in the downloader.

Note:

Some waveform log parameters such as ECG are only available via external files generated using the Zephyr™ Downloader. The waveforms cannot be displayed within OmniSense™ Analysis itself.

File Type	Description
.csv	Comma Separated Values which can be opened in Microsoft™* Excel™*, Notepad™* or similar, or imported into many data processing applications.
.dat/.hed file pairs	Designed for input of large data sets into 3rd party data processing applications such as DaDISP™*
.kml	For GPS data display using Google™* Earth™* - the BioModule must be used in conjunction with a supported GPS device.

Invalid Values

Variants on the Summary Log Formats may contain data values which indicate an invalid value – the data is not available, or the device does not support the parameter. Invalid values are provided where applicable.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 3
BioModule Log Data Descriptions (3/8)

Memory Capacity

The BioModule will continue to log until the memory capacity is full. When this happens, it will erase the oldest log in memory, and continue to write the current log in the space available. This process will repeat until the current logging session is terminated.

When an old log is overwritten by the current one – all of that log will be erased, even if only part of the freed space is used.

If the device is configured to log in Summary and Development mode, then the maximum possible log duration with new batteries (~35 hours) will exceed the maximum memory capacity of the device (~30 hours). In this situation, the saved part of the current log will be erased, freeing up all memory space. When the logging session is terminated, the only data saved and available for download will be that which was logged **after** the initial 30 hours.

Logging Format	Memory Capacity (Hrs)
Summary	450
Summary + Waveform	60
Summary + Development	30
Enhanced Summary	450
Enhanced Summary + Waveform	60
Enhanced Summary + Development	30

Timestamp Formats

A variety of time stamp formats are used in Zephyr™ csv files. Some are user-friendly, others less so. The latter are normally associated with data parameters which are likely to be of more use to an engineer who is integrating BioModule data into other software applications, who is less concerned with the data being human readable when processed internally.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 3
BioModule Log Data Descriptions (4/8)

General Log Format Output (Legacy)

This describes the actual external .csv files generated by the Zephyr™ Downloader tool.

Log Format	Reporting Frequency	Parameters	File Name
General	1 Hz	Heart Rate Breathing Rate Posture Activity Acceleration Battery BR Amplitude ECG Amplitude ECG Noise X Acc Min X Acc Peak Y Acc Min Y Acc Peak Z Acc Min Z Acc Peak	yyyy_mm_dd-hh_mm_ss_General
	18 Hz	Breathing Waveform Heart RR	yyyy_mm_dd-hh_mm_ss_BR_RR
	Per Event	Event Code Event Type Source Event ID Event Specific Data	yyyy_mm_dd-hh_mm_ss_Event_Data
	Per Download	Subject Information Device Information Session Information	yyyy_mm_dd-hh_mm_ss_SessionInfo.txt
General + ECG	250 Hz	ECG	yyyy_mm_dd-hh_mm_ss_ECG
General + Acc	100 Hz	Acceleration Magnitude (g)	yyyy_mm_dd-hh_mm_ss_Accelmag

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 3
BioModule Log Data Descriptions (5/8)

Summary Log Format Output

Descriptions for the external .csv files generated by the Zephyr™ Downloader tool.

Log Format	Reporting Frequency	Parameters	File Name
Summary	1 Hz	Heart Rate Breathing Rate Posture Activity Peak Acceleration Battery Voltage Battery % BR Amplitude BR Noise BR Confidence ECG Amplitude ECG Noise HR Confidence HRV System Confidence GSR Status ROG Time ROG Vert Acc Min Vert Acc peak Lateral Acc Min Lateral Acc Peak Sagittal Acc Min Sagittal Acc Peak Device Temperature Status Info Link Quality RSSI Tx Power Core Temperature Aux ADC1/2/3	yyyy_mm_dd-hh_mm_ss_Summary
	Per Event	Heart RR	yyyy_mm_dd-hh_mm_ss_RR
	Per Event	Breathing BB	yyyy_mm_dd-hh_mm_ss_BB
	Per Download	Subject Information Device Information Session Information	yyyy_mm_dd-hh_mm_ss_SessionInfo.txt
	Per Event	Event Code Event Type Source Event ID Event Specific Data	yyyy_mm_dd-hh_mm_ss_Event_Data

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 3
BioModule Log Data Descriptions (6/8)

Summary Log Format Output (Continued)

Descriptions for the external .csv files generated by the Zephyr™ Downloader tool.

Log Format	Reporting Frequency	Parameters	File Name
Summary + Waveform	250 Hz	ECG	yyyy_mm_dd-hh_mm_ss_ECG
	100 Hz	Vertical Acc Lateral Acc Sagittal Acc	yyyy_mm_dd-hh_mm_ss_Accel
	25 Hz	Breathing Waveform	yyyy_mm_dd-hh_mm_ss_Breathing
Summary + Development	1000 Hz	ECG Waveform	yyyy_mm_dd-hh_mm_ss_ECG
	100 Hz*	Vertical Acc Lateral Acc Sagittal Acc	yyyy_mm_dd-hh_mm_ss_Accel
	25 Hz	Breathing Waveform	yyyy_mm_dd-hh_mm_ss_Breathing
+ GPS	1 Hz	Location (Lat/Long) Altitude GPS fix Quality Speed Over Ground Track Angle HDOP	yyyy_mm_dd-hh_mm_ss_GPS

* Accelerometer data is reduced in resolution from 12 bit to 10 bit to accommodate the additional ECG data.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 3
BioModule Log Data Descriptions (7/8)

Enhanced Summary Log Format Output

The parameters below are contained in the Enhanced Summary log format in addition to all of the parameters previously described in the Summary log format.

Log Format	Reporting Frequency	Parameters	File Name
Enhanced Summary	1Hz	Impulse Load Walk Steps Run Steps Bounds Jumps Minor Impacts Major Impacts Average Rate Force Development Average Step Impulse Average Step Period Jump Flight Time Peak g Phi Angle Peak g Theta Angle	yyyy_mm_dd-hh_mm_ss_ SummaryEnhanced
	Per Event	Heart RR	yyyy_mm_dd-hh_mm_ss_RR
	Per Event	Breathing BB	yyyy_mm_dd-hh_mm_ss_BB
	Per Download	Subject Information Device Information Session Information	yyyy_mm_dd-hh_mm_ss_ SessionInfo.txt
	Per Event	Event Code Event Type Source Event ID Event Specific Data	yyyy_mm_dd-hh_mm_ss_Event_Data

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 3
BioModule Log Data Descriptions (8/8)

Enhanced Summary Log Format Output (Continued)

The parameters below are contained in the Enhanced Summary log format in addition to all of the parameters previously described in the Summary log format.

Log Format	Reporting Frequency	Parameters	File Name
Enhanced Summary + Waveform	25 Hz	ECG	yyyy_mm_dd-hh_mm_ss_ECG
	100 Hz	Vertical Acc Lateral Acc Sagittal Acc	yyyy_mm_dd-hh_mm_ss_Accel
	25 Hz	Breathing Waveform	yyyy_mm_dd-hh_mm_ss_Breathing
Enhanced Summary + Development	1000 Hz	ECG Waveform	yyyy_mm_dd-hh_mm_ss_ECG
	100 Hz*	Vertical Acc Lateral Acc Sagittal Acc	yyyy_mm_dd-hh_mm_ss_Accel
	25 Hz	Breathing Waveform	yyyy_mm_dd-hh_mm_ss_Breathing
+ GPS	1 Hz	Location (Lat/Long) Altitude GPS fix Quality Speed Over Ground Track Angle HDOP	yyyy_mm_dd-hh_mm_ss_GPS

* Accelerometer data is reduced in resolution from 12 bit to 10 bit to accommodate the additional ECG data.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (1/53)

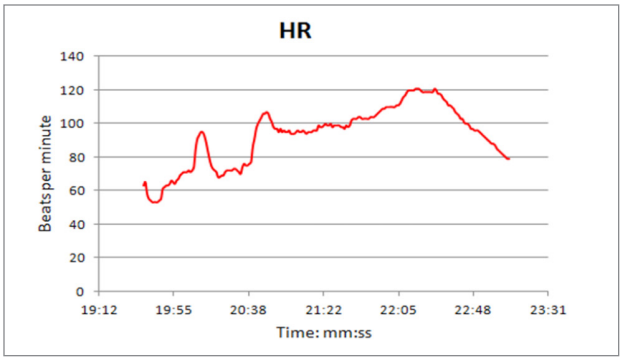
Index of Parameters

Heart Rate 362
Breathing Rate 363
Skin Temperature 364
Posture 364
Activity Level 365
Peak Acceleration 366
Battery Voltage 367
Breathing Wave Amplitude 368
ECG Amplitude 369
ECG Noise 370
X Acceleration Min/Peak 371
Y Acceleration Min / Peak 372
Z Acceleration Min/peak 373
Breathing Waveform | General Log 374
Heart R-R | General Log 375
ECG Waveform | General & ECG Log 376
Acceleration | General & Acceleration Log 377
Battery Level 378
Breathing Noise Level 378
Breathing Confidence 379
Heart Rate Confidence 379
Heart Rate Variability 380
System Confidence 381
Galvanic Skin Response 382
ROG Subject Status 382
ROG Time 383
Device Temperature 383
Status Info 384
Link Quality 385
Bluetooth™* RSSI 385
Bluetooth™* Tx Power 386
Estimated Core Temperature 386
Aux ADC 1/2/3 387
Event Data 388
GPS Location 389
GPS Altitude 390
GPS Fix Quality 391
GPS Speed Over Ground 392
GPS Track Angle 393
GPS HDOP 394
GPS Location ((KML) 395
Impulse Load 396
Walking Step Count 397
Run Step Count 398
Bound Count 398
Jump Count 399
Minor Impact Count 400
Major Impact Count 401
Average Force Development Rate 402
Average Step Impulse 403
Average Step Period 404
Jump Flight Time 404
Peak Acceleration Phi Angle 405
Peak Acceleration Theta Angle 406
Heart R-R | Summary Log 407
Breath B-B 408
Accel | Summary Log 409
Breathing Waveform | Summary Log 410
ECG | Waveform Log 411
Accel | Development Log 412
ECG | Development Log 413

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (2/53)

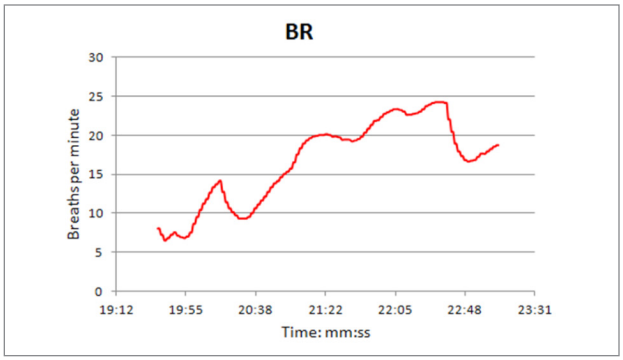
Heart Rate

Log Format	All formats
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	105, 106, 95, 89, 86...
Range	25 - 240
Units	Beats per minute
Invalid Value	
Sample Graph	
Notes	Values consistently above 200+ beats per minute may indicate a noisy ECG signal. Causes include: ▪ Dry sensor pads or skin ▪ Loose strap ▪ Poorly located strap ▪ Poor device/receptacle connection ▪ Device or strap fault Dropouts to 0 usually indicate a mechanical connection problem ▪ Check connection between device and receptacle – handle spring contacts carefully to avoid breaking them Raw ECG data is filtered to account for false or missed R detections, and some smoothing is applied. HR is determined mainly from the preceding 15 seconds of ECG data. The HR detection algorithm initializes at 65 beats per minute. This may show at the beginning of a log file for ~7 seconds, but will be flagged invalid, as the algorithm processes initial data. A flag in the **Status Info** channel of the **Summary** Log will indicate whether the HR data is valid.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (3/52)

Breathing Rate

Log Format	All formats
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	8.1, 8.1, 7.3, 7.3, 6.6, 6.6
Range	4 - 70
Units	Breaths per minute
Invalid Value	
Sample Graph	
Notes	Breathing is detected by a pressure sensor in the Zephyr™ Strap which detects torso expansion and contraction due to breathing. Several breath cycles are necessary for initial breathing rate indication to stabilize (15 – 45 seconds). Spontaneous adjustment of strap tension or location, or abrupt changes in posture, talking, coughing etc may cause changes in the range of pressure detected by the strap which produce temporary artefacts (peaks or troughs) in breathing rate indication. These should be anticipated and potentially ignored when analyzing data. The BioPatch™ uses impedance plethysmography to detect breathing cycles.

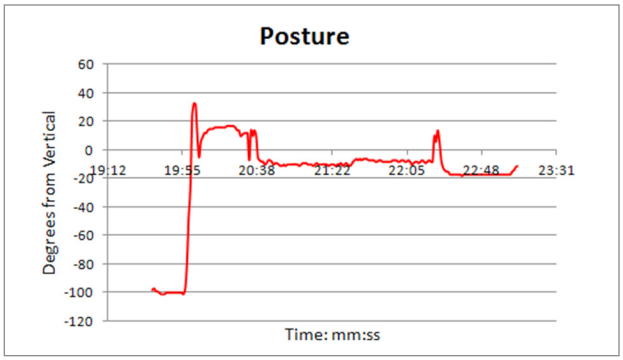
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (4/53)

Skin Temperature

Log Format	General log formats
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	-3276.8, -3276.8, -3276.8...
Range	10 - 60
Units	Deg C
Invalid Value	-3276.8
Sample Graph	Not supported by BioModule 3.0. BioModule 3.0 always reports the invalid value.
Notes	The BioModule 3.0 has replaced this parameter with Estimated Core Temperature in the Summary and Enhanced Summary log formats.

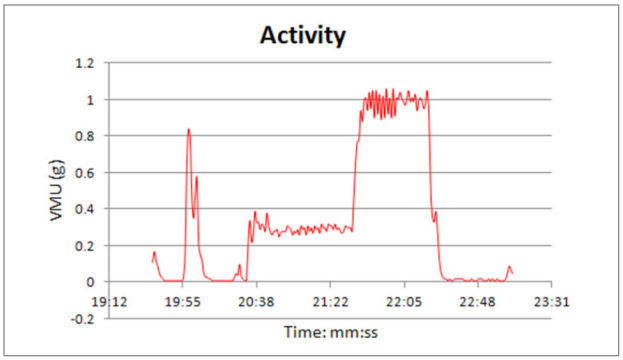
Posture

Log Format	All formats
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	-98, -97, -99...
Range	± 180
Units	Degrees from vertical
Invalid Value	
Sample Graph	
Notes	0 ° = subject vertical. 90 ° = subject prone (face down). -90 ° = subject supine (face up). ± 180 ° = subject inverted. There is likely to be an offset of 5-15 ° from 0 for a 'vertical' subject due to variations in torso shape and actual posture.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (5/53)

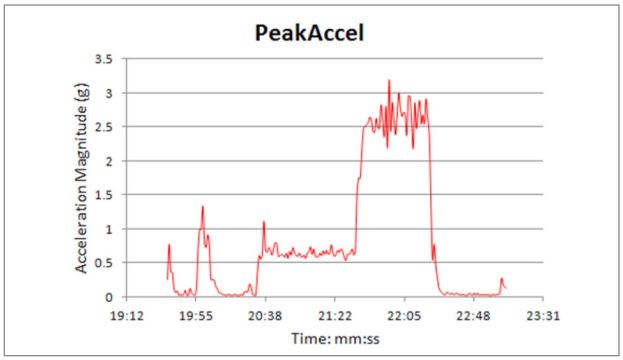
Activity Level

Log Format	All formats
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	0.11, 0.17, 0.12...
Range	0 - 16
Units	Vector Magnitude Units (VMU), measured in g
Invalid Value	
Sample Graph	
Notes	VMU = $\sqrt{(x^2+y^2+z^2)}$ where x, y and z are the average of the three axial acceleration magnitudes over the previous 1 second epoch, sampled at 100Hz. Walking ~ 0.2 VMU or greater Jogging ~ 0.8 VMU or greater Axial accelerometer output is band pass filtered, to remove non-human artefacts, and gravity.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (6/53)

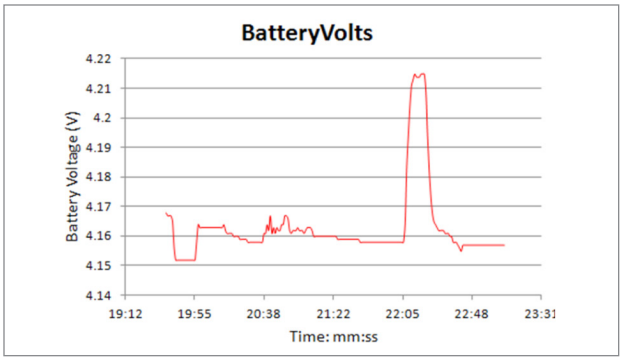
Peak Acceleration

Log Format	All formats
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	0.26, 0.78, 0.38...
Range	0 - 16
Units	g
Invalid Value	
Sample Graph	
Notes	The Peak Acceleration Magnitude is calculated for the previous second: Peak Accn = $(\sqrt{(x^2 + y^2 + z^2)})_{max}$ where x, y and z are the 3 axial acceleration values, sampled at 100 Hz. Raw accelerometer output is filtered to remove non-human artefacts, and gravity. The maximum value is capped at 16g.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (7/53)

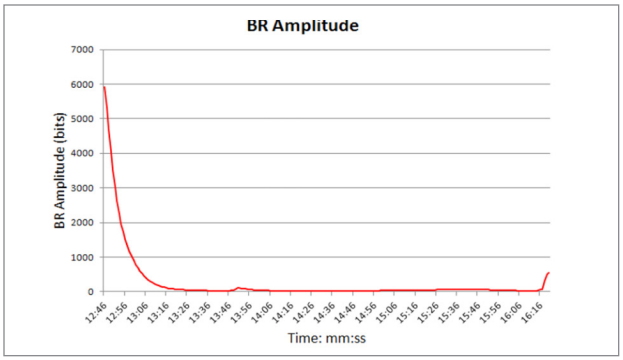
Battery Voltage

Log Format	All formats
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	4.168, 4.167, 4.167...
Range	~ 3.6 to ~ 4.2 for a functioning battery
Units	Volts
Invalid Value	
Sample Graph	
Notes	Fully charged ~ 4.2V, fully discharged ~ 3.6V The device processor will turn the device off when battery voltage < 3.6V, to prevent further discharge causing permanent damage to the battery.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (8/53)

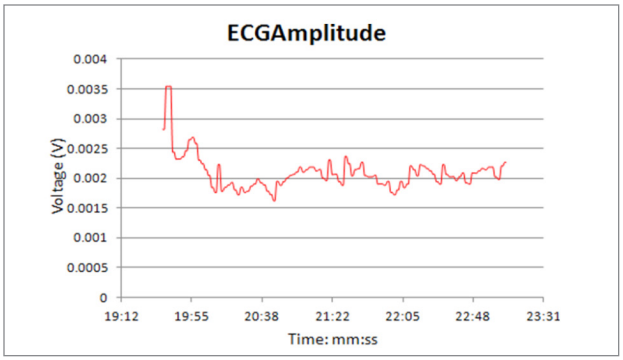
Breathing Wave Amplitude

Log Format	All formats
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	5864, 5307, 4698...
Range	0 - 65534
Units	N/A
Invalid Value	
Sample Graph	
Notes	This is a metric extracted from the breathing detection algorithm, and is used for internal development only. Initial value is large, but reduces rapidly as the algorithm has data to process.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (9/53)

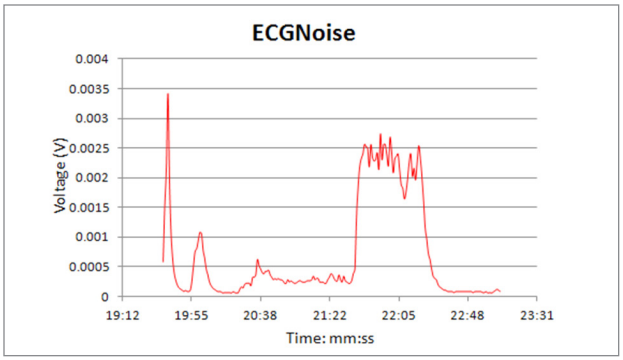
ECG Amplitude

Log Format	All formats
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	0.00282, 0.00282, 0.00354...
Range	0 – 0.05
Units	Volts
Invalid Value	
Sample Graph	
Notes	Indicative only – this parameter represents an un-calibrated amplitude (measured from peak of the R wave to peak of the S wave) of the QRS complex. This value is filtered to attempt to remove noise related variation, however will increase during periods of high noise.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (10/53)

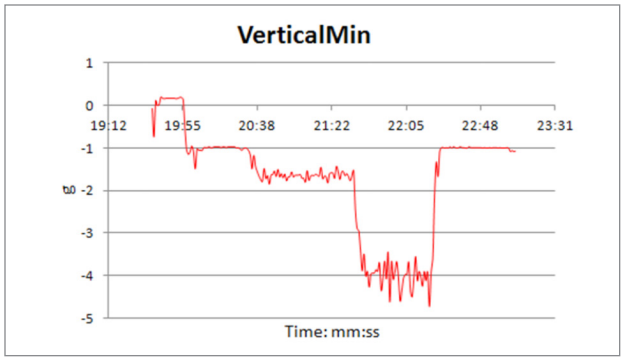
ECG Noise

Log Format	All formats
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	0.00058, 0.0015, 0.00216...
Range	0 – 0.05
Units	Volts
Invalid Value	
Sample Graph	
Notes	Indicative only – this parameter represents an un-calibrated amplitude of noise signals measured between QRS complexes. This is directly comparable to the ECG amplitude for SNR calculations.

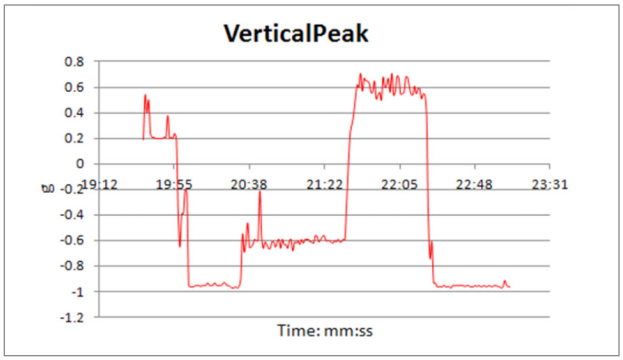
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (11/53)

X Acceleration Minimum (VerticalMin)

Log Format	All formats
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	-0.08, -0.75, 0.1...
Range	±16
Units	g
Sample Graph	
Notes	X axis = subject vertical. Minimum value during previous second, sampled at 100Hz. This is raw, unfiltered data.

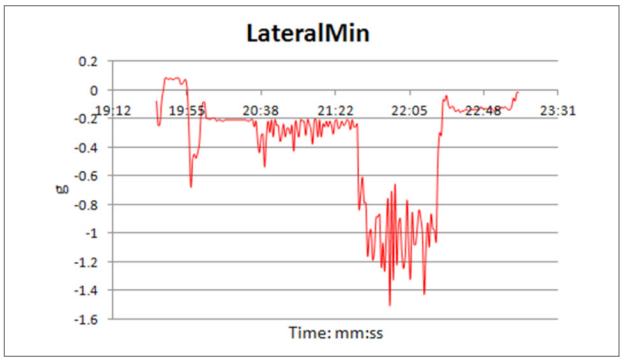
X Acceleration Peak (VerticalPeak)

Log Format	All formats
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	0.19, 0.54, 0.4...
Range	±16
Units	g
Sample Graph	
Notes	X axis = subject vertical. Maximum value during previous second, sampled at 100Hz. This is raw, unfiltered data.

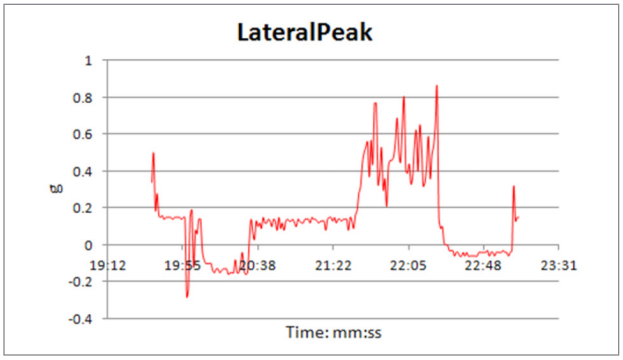
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (12/53)

Y Acceleration Minimum (LateralMin)

Log Format	All formats
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	0.19, 0.54, 0.4...
Range	±16
Units	g
Sample Graph	
Notes	Y axis = subject lateral. Minimum value during previous second, sampled at 100Hz. This is raw, unfiltered data.

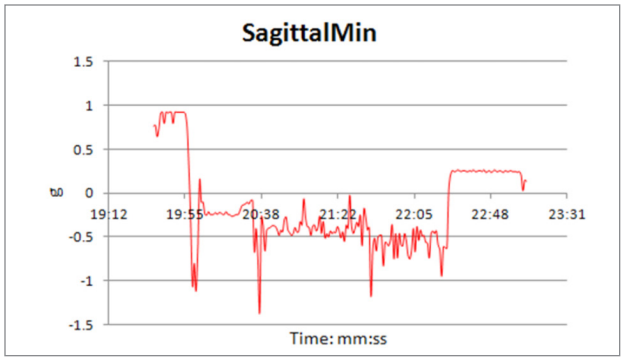
Y Acceleration Peak (LateralPeak)

Log Format	All formats
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	0.19, 0.54, 0.4...
Range	±16
Units	g
Sample Graph	
Notes	Y axis = subject lateral. Maximum value during previous second, sampled at 100Hz. This is raw, unfiltered data.

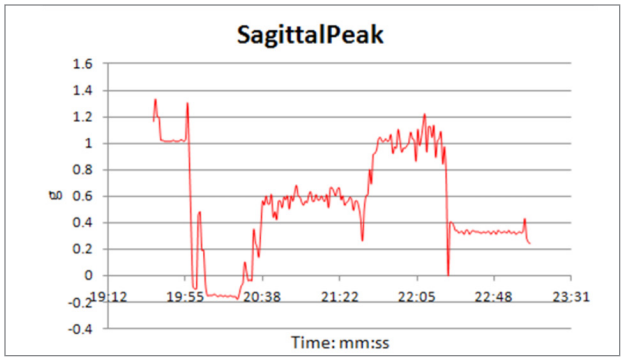
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (13/53)

Z Acceleration Minimum (SagittalMin)

Log Format	All formats
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	-0.08, -0.25, -0.24...
Range	±16
Units	g
Sample Graph	
Notes	Z axis = subject sagittal (front/rear). Minimum value during previous second, sampled at 100Hz. This is raw, unfiltered data.

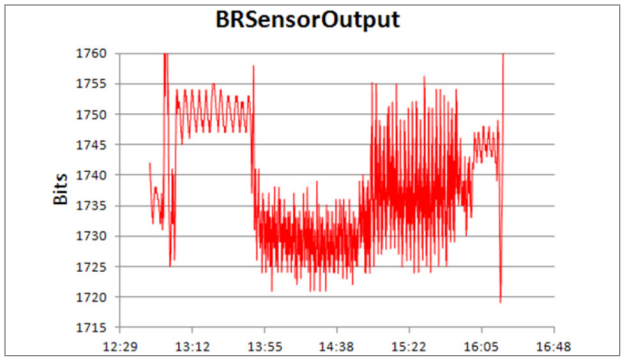
Z Acceleration Peak (SagittalPeak)

Log Format	All formats
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	0.34, 0.5, 0.19...
Range	±16
Units	g
Sample Graph	
Notes	Z axis = subject sagittal (front/rear). Maximum value during previous second, sampled at 100Hz. This is raw, unfiltered data.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (14/53)

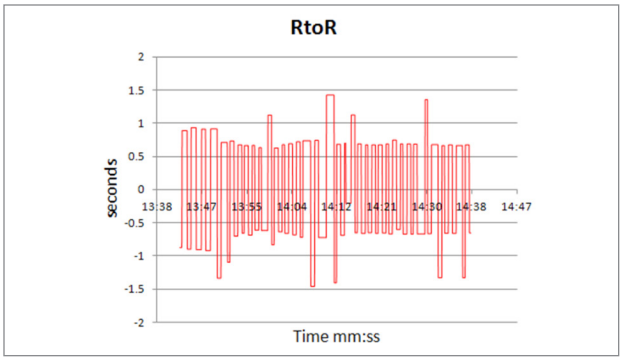
Breathing Waveform

Log Format	General - Breathing & RR
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	18 Hz
Sample Data	1741, 1742,1741...
Range	0 - 4096
Units	bits
Invalid Value	
Sample Graph	
Notes	Reported at 18Hz. This is the raw unfiltered breathing sensor output. Its main use is to determine whether there is sufficient dynamic range to indicate that the sensor is functioning correctly – this may be a few tens to a few hundreds of bits, depending on subject breathing mechanics. The data is then heavily filtered and processed in order to establish a respiration rate. The data is reflecting changes of pressure on the breathing sensor if used with a Zephyr™ strap. This will vary according to an individual's breathing mechanics, their body composition, and how tight the strap is fitted. As such **no inference** can be made on breathing depth or volume from this data.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (15/53)

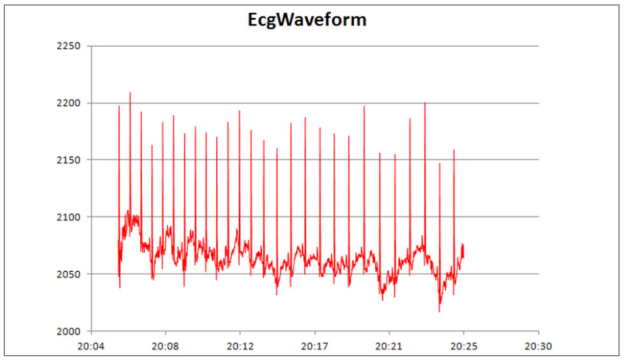
Heart R-R

Log Format	General - Breathing & RR
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	-0.702, -0.702, 0.857...
Range	0 – 32.767
Units	Seconds
Invalid Value	
Sample Graph	
Notes	Reported at 18Hz. The last detected R interval is repeated until a new R detection is calculated. Fresh detections are toggled positive/negative so that identical-magnitude detections in sequence can be distinguished. This method is used because the parameter must be reported at regular intervals, but changes irregularly.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (16/53)

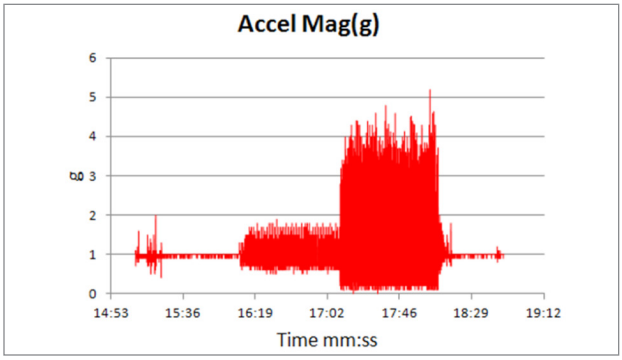
ECG Waveform

Log Format	Summary & Waveform Summary & Development Enhanced Summary & Waveform Enhanced Summary & Development
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	250 Hz (1000 Hz in Development formats)
Sample Data	2167, 2167, 2166...
Range	0 - 4095
Units	bits
Invalid Value	
Sample Graph	
Notes	Sampled at 1KHz Conversion to mV: 2048 bits = 0mV 1 bit = 0.00625mV

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (17/53)

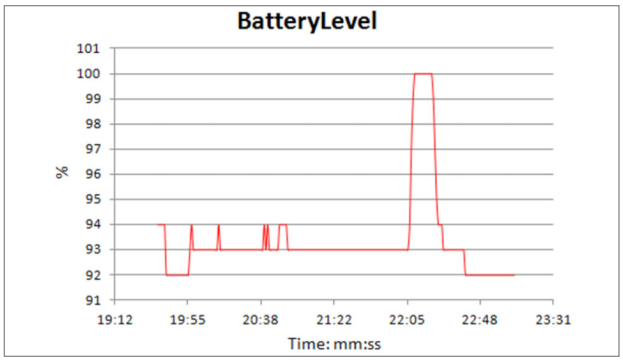
Acceleration Magnitude

Log Format	[Enhanced] Summary & Waveform
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	100 Hz
Sample Data	1.1, 1.1, 1...
Range	0 - 16
Units	g
Invalid Value	
Sample Graph	
Notes	Sampled and reported at 100Hz. Magnitude = ($\sqrt{(x^2 + y^2 + z^2)}$) where x,y & z are the three axial accelerometer values. This is raw, unfiltered data.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (18/53)

Battery Level

Log Format	Summary & Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	94,94,93
Range	0 - 100
Units	% Fully Charged
Sample Graph	
Notes	100% ~ 4.2V 0% ~ 3.6V If battery discharged curves are stored historically, battery health can be monitored.

Breathing Noise Level

Log Format	Summary & Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	
Range	0 - 65534
Units	Bits
Invalid Value	65535
Sample Graph	Invalid value of 65535 is always reported.
Notes	This parameter is not currently implemented – an invalid value is always reported.

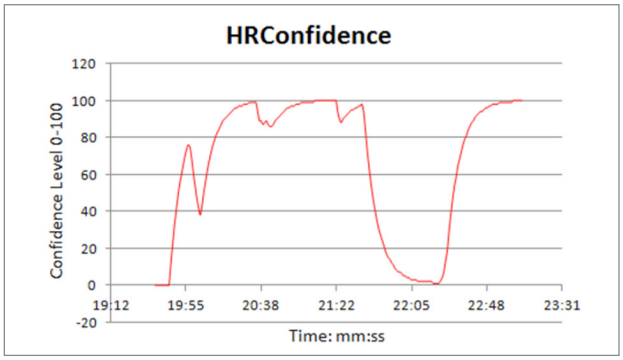
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (19/53)

Breathing Confidence

Log Format	Summary & Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	255, 255, 255...
Range	0 - 254
Units	Bits
Invalid Value	255
Sample Graph	Parameter not supported - a constant invalid value of 255 reported.
Notes	This parameter is not currently implemented – an invalid value is always reported.

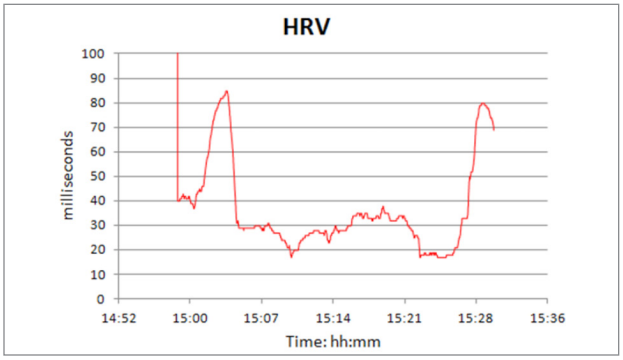
Heart Rate Confidence

Log Format	Summary & Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	0,23,75
Range	0 -100
Units	%
Sample Graph	
Notes	An algorithm which takes into account a worn detection indication, and the signal-to-noise ratio of the ECG signal is used to establish HR confidence. Above 20% indicates a reliable heart rate. 0% indicates not worn indication or an extremely noisy ECG signal.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (20/53)

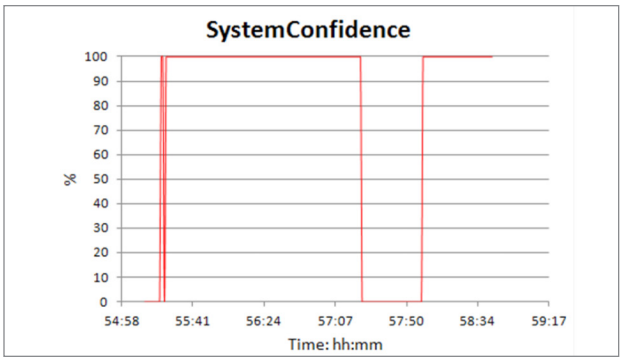
Heart Rate Variability

Log Format	Summary & Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	65535 initially, till calculated, then 50,52,54...
Range	0 - 65534
Units	Standard deviation in milliseconds
Invalid Value	65535
Sample Graph	
Notes	Two optional metrics can be configured using the Zephyr™ Config Tool. ▪ SDNN - an algorithm calculates a rolling 300 heartbeat value. This is updated once per second. For the first 300 beats of the log, the invalid value will be reported. ▪ RMSSD - an algorithm calculates a rolling 15-second value. The invalid value is reported prior to the first calculation. ▪ For both algorithms, if heart rate data becomes invalid, then the last valid HRV value will be reported for a maximum of 1 minute. After this, an invalid value will be reported, and the algorithm re-initialized when the heart rate becomes valid again. ▪ If heart rate is invalid for less than one minute, then the invalid values will be ignored and the algorithm will continue processing.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (21/53)

System Confidence

Log Format	Summary & Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	0, 100
Range	0 - 100
Units	%
Sample Graph	
Notes	System Confidence is a development parameter which will combine HR confidence with other parameters as they become available. At present System Confidence is identical to HR Confidence.

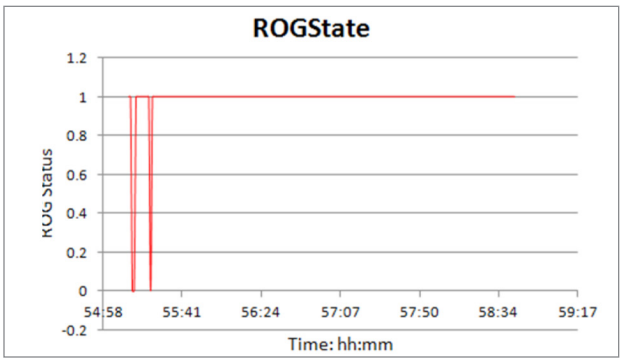
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (22/53)

Galvanic Skin Response (GSR)

Log Format	Summary & Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	65535, 65535, 65535
Range	0 - 65534
Units	Siemens
Invalid Value	65535
Sample Graph	A constant invalid value of 65535 is always returned.
Notes	GSR was originally implemented in the BioModule 2.0. It is not supported in the BioModule 3.0

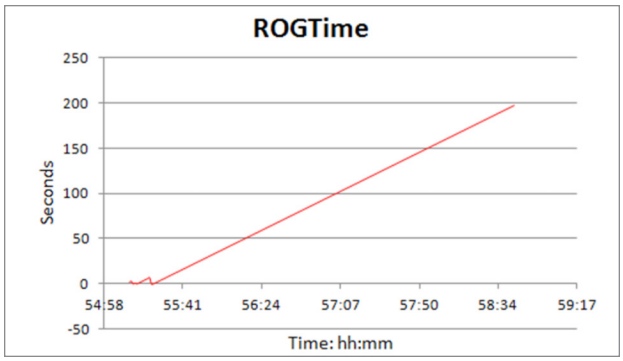
ROG Subject Status

Log Format	Summary & Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	1,1,0...
Range	0,1,2,3
Units	Status indication
Invalid Value	0
Sample Graph	
Notes	0=Invalid 1=Green, 2=Orange, 3=Red

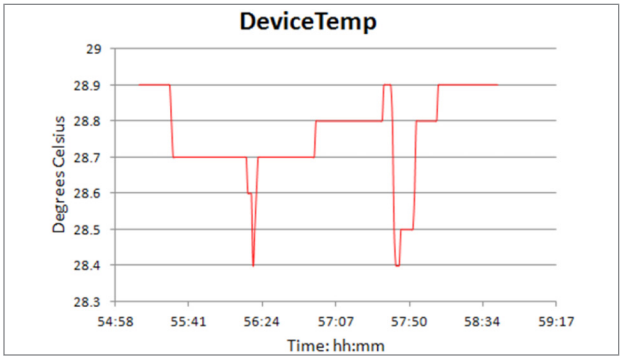
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (23/53)

ROG Time

Log Format	Summary & Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	0, 1, 2...
Range	0 - 8291
Units	Seconds
Sample Graph	
Notes	Time duration in current status. This value resets to 0 each time status changes, and increments for every second the status remains unchanged.

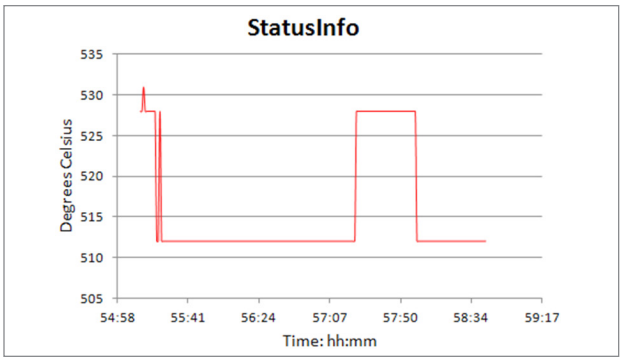
Device Temperature

Log Format	Summary & Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	28.9, 28.9, 28.9...
Range	10 - 60
Units	Degrees Celsius
Sample Graph	
Notes	Temperature as measured by a thermistor inside the BioModule. Some conductive heating from the subject will occur as time progresses, resulting in a slow increase of temperature, in the absence of other factors.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (24/53)

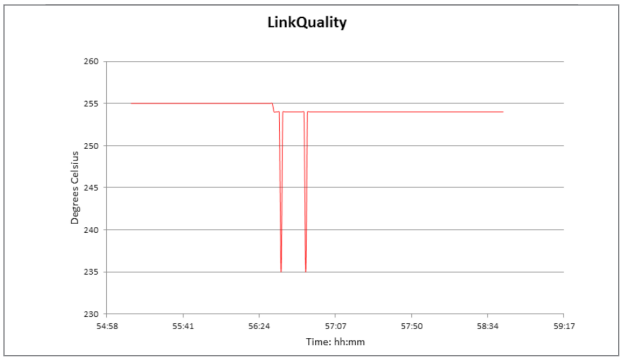
Status Info

Log Format	Summary & Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	528, 528, 531...
Range	
Units	Status Info code
Sample Graph	
Notes	Status codes are reported in hexadecimal format must be converted to binary for interpretation. Refer to the Bluetooth™* Comms Link document in the BioModule SDK for further interpretation. Details may determine: ▪ Worn detection confidence ▪ Button press detection ▪ Not fitted to garment indication ▪ Heart Rate reliability ▪ Respiration rate reliability ▪ Skin temperature reliability ▪ Posture reliability ▪ Activity reliability ▪ HRV reliability ▪ Estimated Core Temperature Reliability

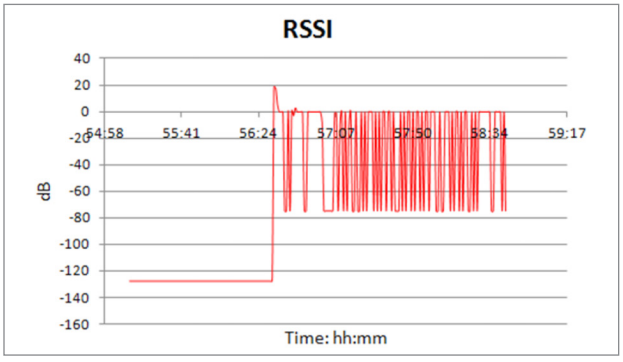
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (25/53)

Link Quality

Log Format	Summary & Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	255, 255, 255...
Range	0 - 255
Units	No units – 0=poor quality, 254=high quality
Invalid Value	255
Sample Graph	
Notes	A Bluetooth™* connection with an Android™* device was established during the session above.

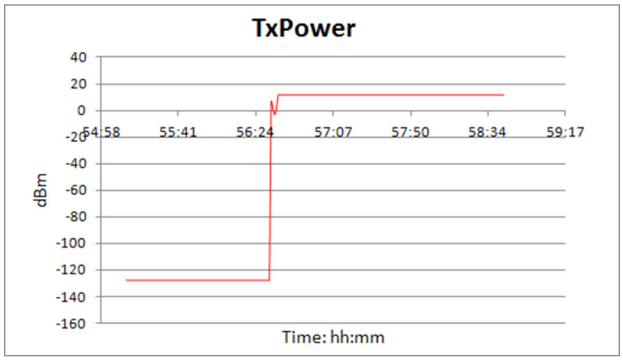
Bluetooth™* Received Signal Strength Indication - RSSI

Log Format	Summary & Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	-128, 13, 19...
Range	-127 to +127
Units	dB
Invalid Value	-128
Sample Graph	
Notes	A Bluetooth™* connection with an Android™* device was established during the session above.

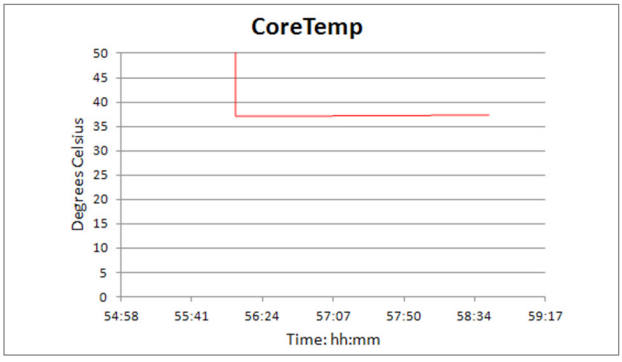
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (26/53)

Bluetooth™* Tx Power

Log Format	Summary & Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	-128, 13, 19...
Range	-30 to +20
Units	dbm
Invalid Value	-128
Sample Graph	
Notes	A Bluetooth™* connection with an Android™* device was established during the session above. 10=10dbm

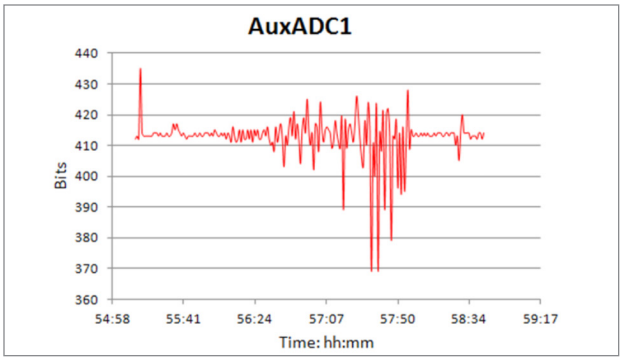
Estimated Core Temperature

Log Format	Summary & Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	6553.5, 37.1, 37.1
Range	33 - 41
Units	Degrees Celsius
Invalid Value	6553.5
Sample Graph	
Notes	The algorithm for calculating the Estimated Core Temperature from heart rate data will return an invalid value of 6553.5 for the first 60 seconds from power on.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (27/53)

Aux ADC 1/2/3

Log Format	Summary & Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	449, 442, 421...
Range	0-65534
Units	Bits
Invalid Value	65535
Sample Graph	
Notes	The BioModule circuit board has three output points for additional functionality. Unless otherwise specified, the data in all three ADC channels represents hardware circuit noise.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (28/53)

Event Data

For a full description of Event Message specifications, contact Zephyr™.

Log Format	Summary & Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	Per Event

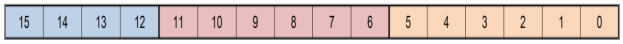
Sequence No.

Sample Data	0,1,2
Range	0 - 255

Time Stamp

Sample Data	2018 10 17 37070441
Notes	Comma separated, time in milliseconds since midnight

Event Code

Sample Data	192,4160, 4096
Range	0 – 4095
Units	Bits
Sample Diagram	
Notes	A 16 bit number. ▪ Bits 15-12 = Event Type ▪ Bits 11-6 = Event Source ▪ Bits 5-0 = Event ID

Type

Sample Data	System, Physiological, Error, Debug
Notes	No error or debug events are currently implemented

Source

Sample Data	Diagnosis, WornDetection, RogAlgorithm, HeartRateCalculation
Notes	Source of the event – source labels are self-evident

Event ID

Sample Data	0
Notes	Specific to the Event itself. Refer to Event Messaging System document

Event Specific Data

Sample Data	Worn status changed from 100% to 0%
Notes	Text description of the event. Self evident.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (29/53)

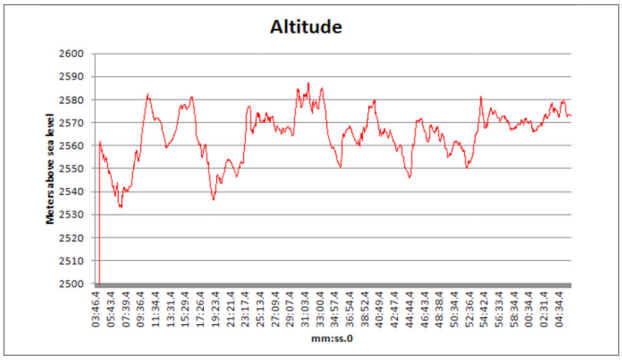
GPS Location

Log Format	Summary & Waveform Enhanced Summary & Waveform
Timestamp	hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	[Latitude] 4 38 40.314 North [Longitude] 74 5 25.386 West
Range	
Units	Latitude: Degrees Minutes Seconds North/South Longitude: Degrees Minutes Seconds East/West
Sample Graph	Location is displayed directly in Google Earth™*, using the exported kml file. See GPS Location (KML)
Notes	Accuracy of GPS data is subject to the number of satellites acquired by the GPS receiver. The BioModule enables DGPS automatically as soon as a Bluetooth™* connection is made to the GPS receiver. There will be some gaps in GPS data due to dropped packets between the BioModule and GPS receiver over the Bluetooth™* connection.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (30/53)

GPS Altitude

Log Format	Summary & Waveform Enhanced Summary & Waveform
Timestamp	hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	147.3, 149.2, 151.1
Range	
Units	Meters above mean sea level
Invalid Value	
Sample Graph	
Notes	Accuracy of GPS data is subject to the number of satellites acquired by the GPS receiver. The BioModule enables DGPS automatically as soon as a Bluetooth™* connection is made to the GPS receiver. There will be some gaps in GPS data due to dropped packets between the BioModule and GPS receiver over the Bluetooth™* connection.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (31/53)

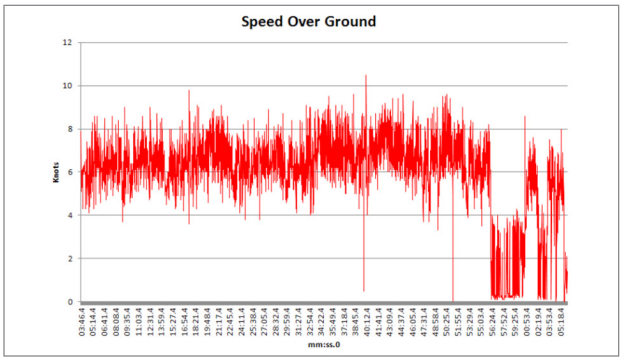
GPS Fix Quality

Log Format	Summary & Waveform Enhanced Summary & Waveform
Timestamp	hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	1,3,3,2,3
Range	1,2,3
Units	See below
Invalid Value	
Sample Graph	
Notes	This is dependent on the number of satellites acquired in order to be able to give an accurate calculation of location only (2D), or location + Altitude (3D) 1 = no fix 2 = 2D fix 3 = 3D fix

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (32/53)

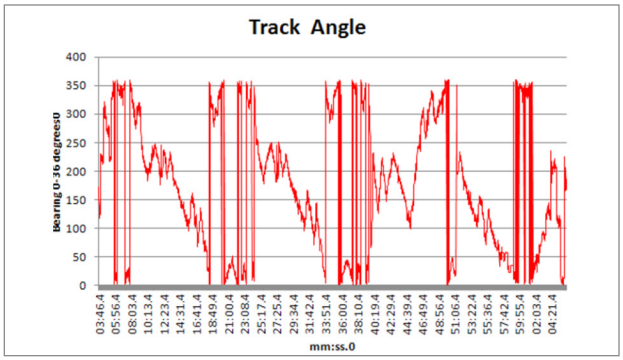
GPS Speed Over Ground

Log Format	Summary & Waveform Enhanced Summary & Waveform
Timestamp	hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	9.2, 7.9, 5.1
Range	0 -
Units	Knots (1 knot = 1.15 miles per hour)
Invalid Value	
Sample Graph	
Notes	Accuracy of GPS data is subject to the number of satellites acquired by the GPS receiver. The BioModule enables DGPS automatically as soon as a Bluetooth™* connection is made to the GPS receiver. There will be some gaps in GPS data due to dropped packets between the BioModule and GPS receiver over the Bluetooth™* connection.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (33/53)

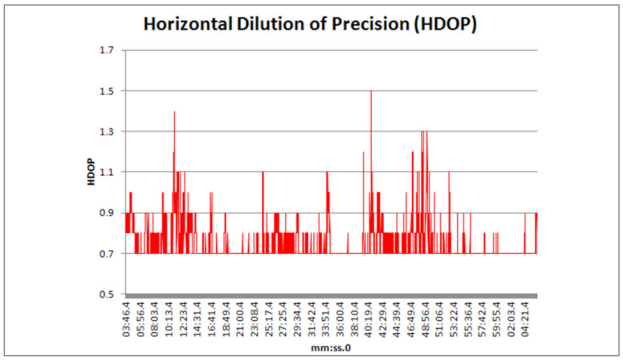
GPS Track angle

Log Format	Summary & Waveform Enhanced Summary & Waveform
Timestamp	hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	173.1, 158.8, 153.3
Range	0 - 360
Units	Compass bearing in degrees [0=North, 90= East, 180=South, 270=West]
Invalid Value	
Sample Graph	
Notes	Accuracy of GPS data is subject to the number of satellites acquired by the GPS receiver. The BioModule enables DGPS automatically as soon as a Bluetooth™* connection is made to the GPS receiver. There may be some gaps in GPS data due to dropped packets between the BioModule and GPS receiver over the Bluetooth™* connection.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (34/53)

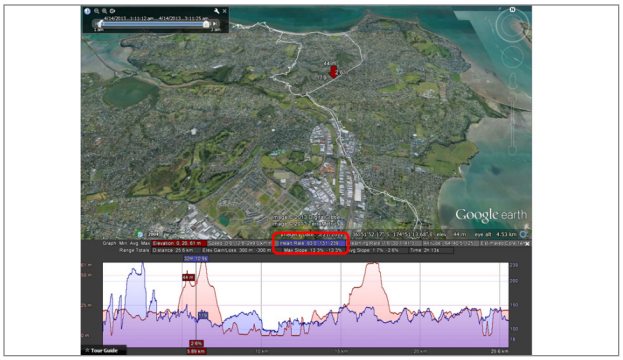
GPS HDOP (Horizontal Dilution of Precision)

Log Format	Summary & Waveform Enhanced Summary & Waveform
Timestamp	hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	0.8, 0.6, 0.5
Range	
Units	See below
Invalid Value	
Sample Graph	
Notes	A smaller value of HDOP indicates greater GPS location accuracy. Accuracy of GPS data is subject to the number of satellites acquired by the GPS receiver. The BioModule enables DGPS automatically as soon as a Bluetooth™* connection is made to the GPS receiver. There may be some gaps in GPS data due to dropped packets between the BioModule and GPS receiver over the Bluetooth™* connection.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (35/53)

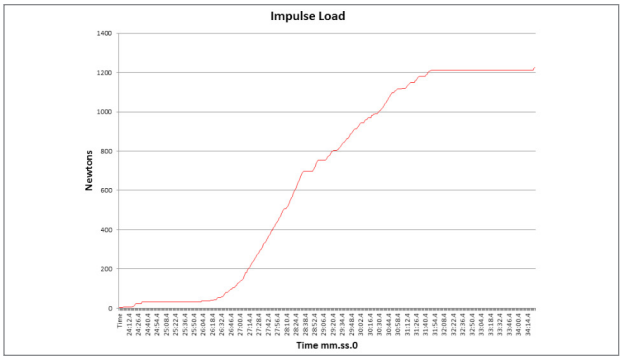
GPS Location (.kml)

Log Format	Summary & Waveform Enhanced Summary & Waveform
Timestamp	yyyy-mm-dd hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	Location: 174.852145 -36.9087683333333 40.0999984741211 for location – additional tags for physiological data
Range	
Units	Longitude Latitude Altitude
Invalid Value	
Sample Graph	
Notes	To access physiological data within the kml file (heart rate, estimated core temperature, activity level, peak acceleration) – right-click the file in the Google Earth™* Places navigation tree and select **Show Elevation Profile** from the context menu. Click on the various parameter links below the earth image to display in the graph below.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (36/53)

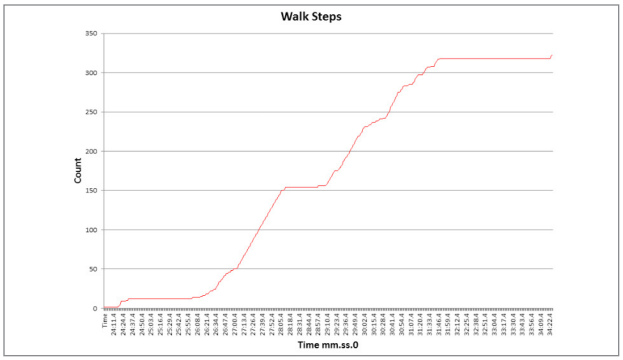
Impulse Load

Log Format	Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	3, 3, 9...
Range	Cumulative during session
Units	Newtons
Invalid Value	None specified
Sample Graph	
Notes	A cumulative measurement of mechanical load – the sum of the areas under the accelerometer magnitude curve for all impulses. Reset when the BioModule is power cycled.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (37/53)

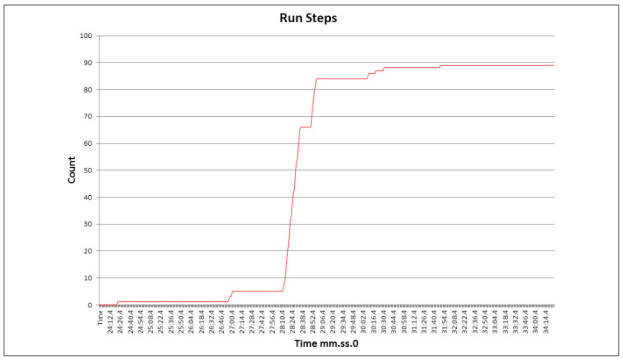
Walking Step Count

Log Format	Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	0, 1, 2...
Range	0 – 262143
Units	Number
Invalid Value	None specified
Sample Graph	
Notes	A cumulative count of detected walking steps. Impulse data is analyzed for magnitude, duration and angle as well as interval from preceding impulse, to determine whether the impulse is an impact or a step. Reset when the BioModule is power cycled.

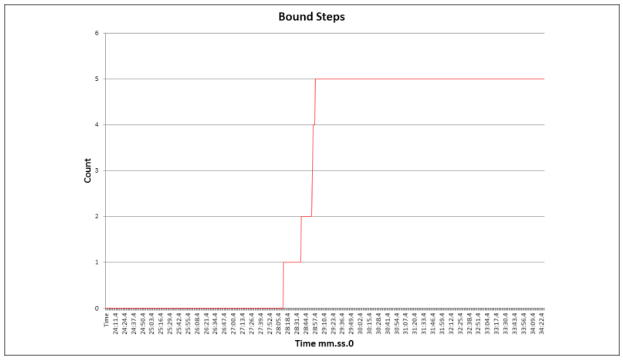
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (38/53)

Run Step Count

Log Format	Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	3, 3, 9...
Range	0 – 262143
Units	Number
Invalid Value	None specified
Sample Graph	
Notes	A cumulative count of detected running steps. Reset when the BioModule is power cycled.

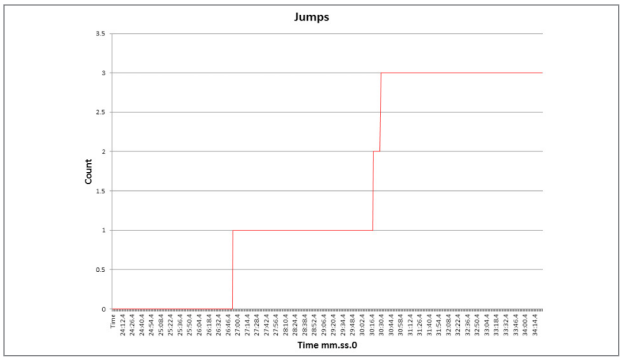
Bound Count

Log Format	Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	1,2,3
Range	0 – 1023
Units	Number
Invalid Value	None specified
Sample Graph	
Notes	A cumulative count of detected bounds. Bounds differ from running steps by the time in the air between steps. Reset when the BioModule is power cycled.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (39/53)

Jump Count

Log Format	Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	0, 1, 2...
Range	0 – 1023
Units	Number
Invalid Value	None specified
Sample Graph	
Notes	A cumulative count of detected jumps. Reset when BioModule power cycled.

Note:

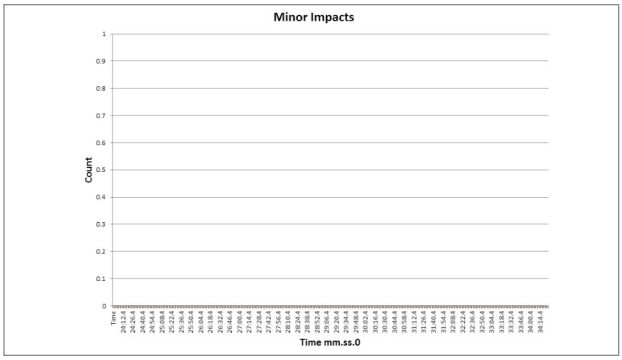
Walk, run, jump and bound step impulses are determined by analysis of the raw accelerometer data, taking into account the step frequency, time in the air and nature of adjacent impulses.

A jump event is specified as a static jump - the subject crouches, pauses and then jumps vertically. Basketball players are tested for jumping ability by this method. Dynamic jumps during heightened activity will not pass the jump event criteria.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (40/53)

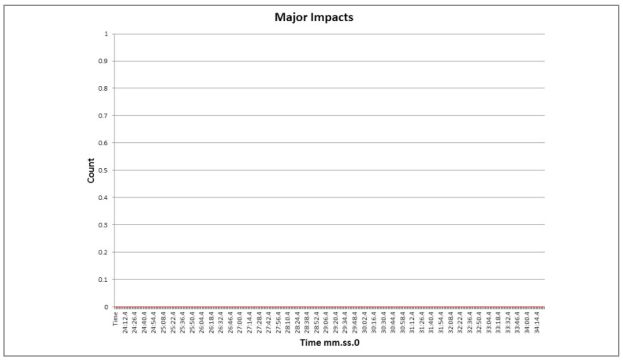
Minor Impact Count

Log Format	Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	0, 1, 2...
Range	0 – 1023
Units	Number
Invalid Value	None specified
Sample Graph	
Notes	A cumulative count of impulses classified as minor impacts – peak accelerometer magnitude during the impact is between 3 and 7g and angle of impact meets the criteria for an impact, as opposed to a step.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (41/53)

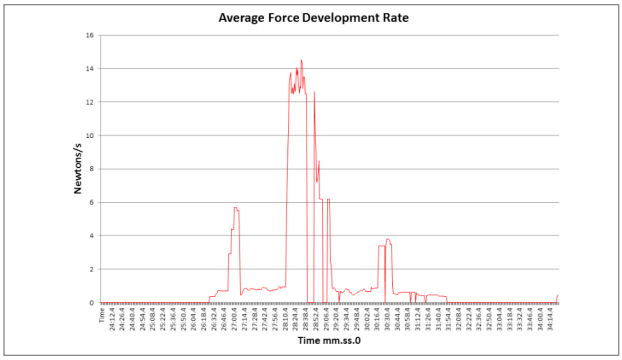
Major Impact Count

Log Format	Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	0, 1, 2...
Range	0 – 1023
Units	Number
Invalid Value	None specified
Sample Graph	
Notes	A cumulative count of impulses classified as minor impacts – peak accelerometer magnitude during the impact is greater than 7g and angle of impact meets the criteria for an impact, as opposed to a step.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (42/53)

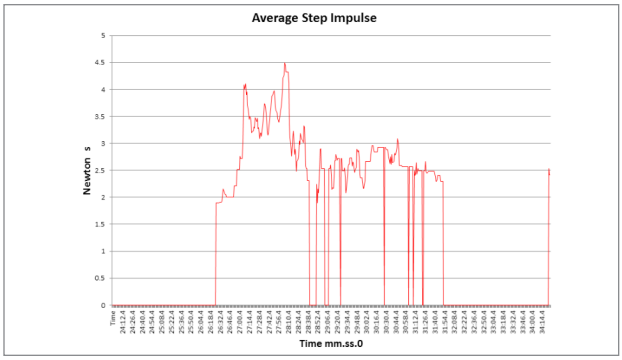
Average Force Development Rate

Log Format	Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	0.94, 3.21, 5.78...
Range	0 – 4095
Units	Newtons per second
Invalid Value	None specified
Sample Graph	
Notes	A measure of explosive power. The gradient of the accelerometer magnitude curve during initiation of the impulse. Averaged for the previous 10 steps. Zero if no steps detected for 5 seconds.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (43/53)

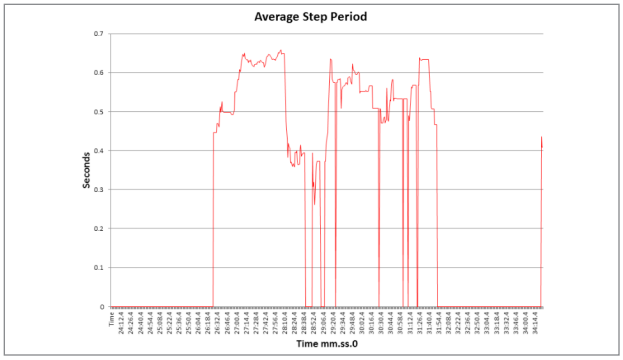
Average Step Impulse

Log Format	Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	2.75, 2.48, 2.67...
Range	0 – 1023
Units	Newton seconds
Invalid Value	None specified
Sample Graph	
Notes	Area under the accelerometer magnitude curve for a detected step. Averaged over previous 10 steps. A measure of the efficiency of steps, i.e. how much energy is expended during a step. Shorter (in duration) steps expend less energy. Zero if no steps detected for 5 seconds.

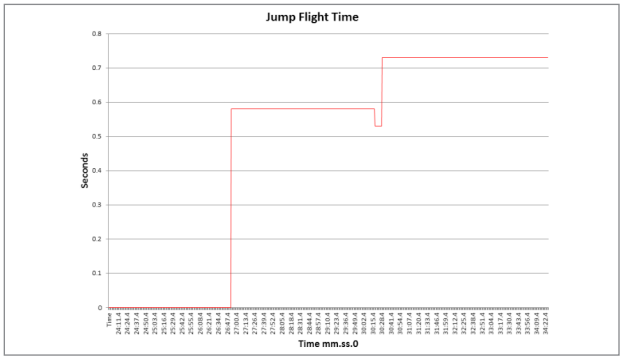
CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (44/53)

Average Step Period

Log Format	Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	0.655, 0.651, 0.647...
Range	0 - 1023
Units	Seconds
Invalid Value	None specified.
Sample Graph	
Notes	Time duration of a step, averaged over previous 10 steps. Zero if no steps detected for 5 seconds.

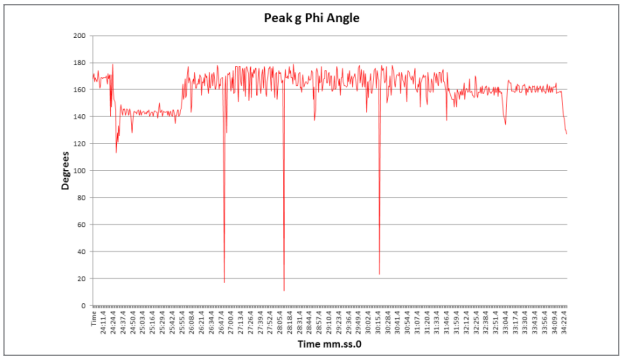
Jump Flight Time

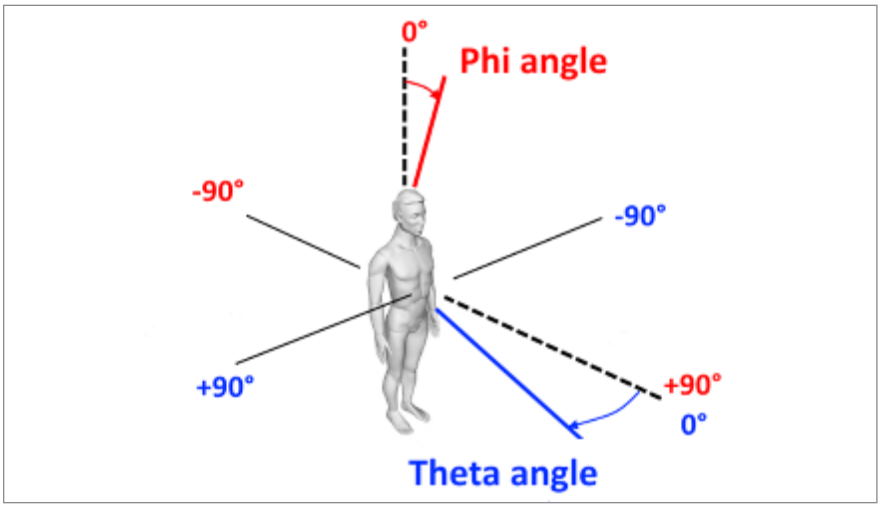
Log Format	Summary & Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	0, 0, 0.58
Range	0 - 255
Units	Seconds
Invalid Value	None specified
Sample Graph	
Notes	Last known value repeated until a new jump is detected.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (45/53)

Peak Acceleration Phi Angle

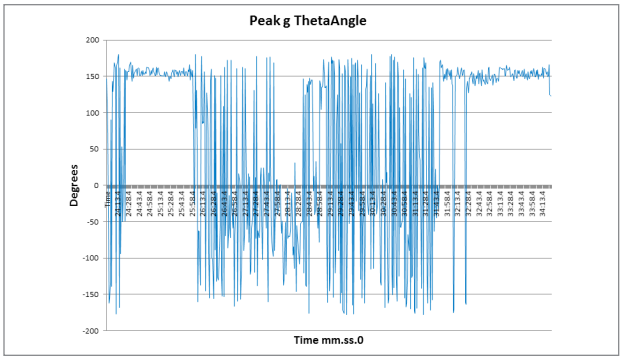
Log Format	Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	167, 154, 72
Range	0 – 180
Units	Degrees from vertical
Invalid Value	None specified
Sample Graph	
Notes	Direction of peak magnitude from vertical during previous epoch

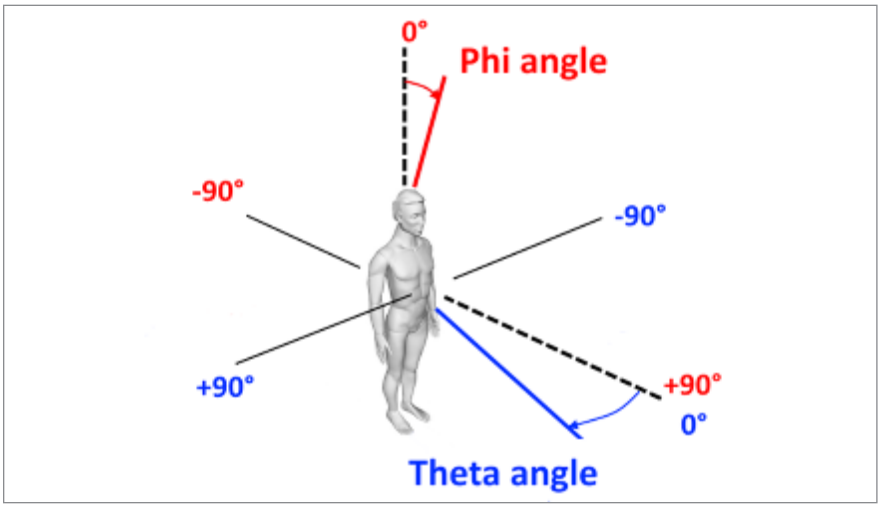


CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (46/53)

Peak Acceleration Theta Angle

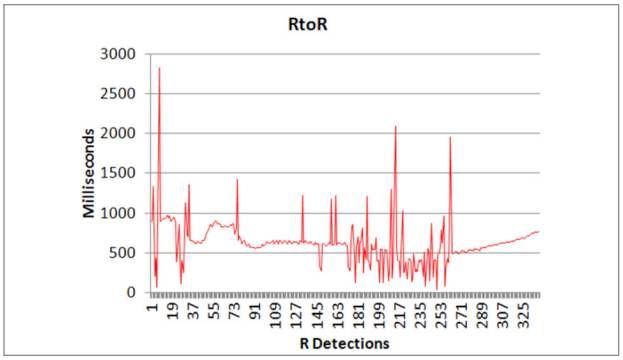
Log Format	Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1 Hz
Sample Data	167, 154, 72
Range	-180 to +180
Units	Degrees from subject heading
Invalid Value	None specified
Sample Graph	
Notes	Direction of peak magnitude from horizontal (zero as shown below) during previous epoch.



CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (47/53)

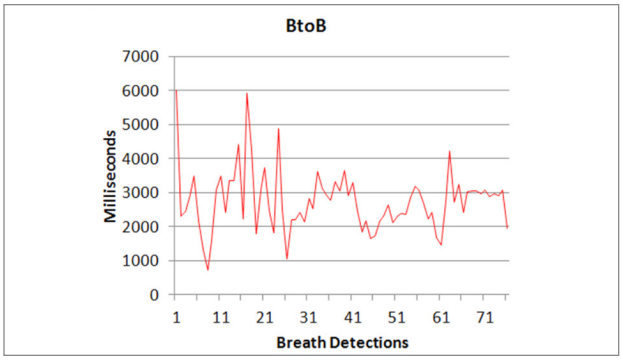
Heart R-R

Log Format	Summary & Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	Per R detection
Sample Data	891, 904, 1332...
Range	0 - 32767
Units	Milliseconds
Invalid Value	
Sample Graph	
Notes	R events are not timestamped. If necessary, a timestamp can be created by initializing the first detection at the time indicated by the file name, and accumulating RR values to this baseline.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (48/53)

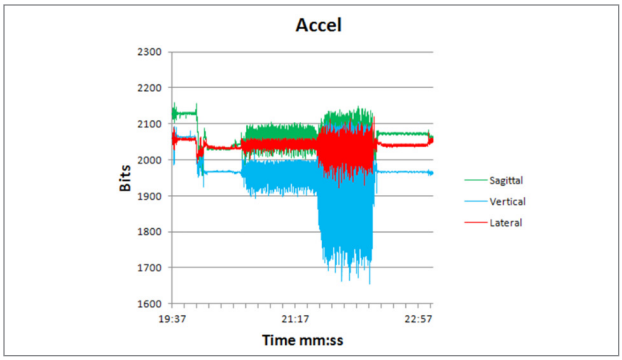
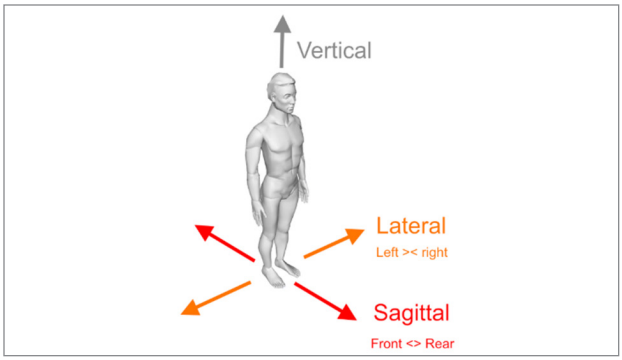
Breath B-B

Log Format	Summary & Enhanced Summary
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	Per breath detection
Sample Data	6000, 2300, 2460...
Range	
Units	Milliseconds
Invalid Value	
Sample Graph	
Notes	Breath events are not timestamped. If necessary, a timestamp can be created by initializing the first detection at the time indicated by the file name, and accumulating BB values to this. BB detections are unfiltered, so values outside the 850 – 15000 range generated by a breathing rate of 4 – 70 breaths/minute can be expected.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (49/53)

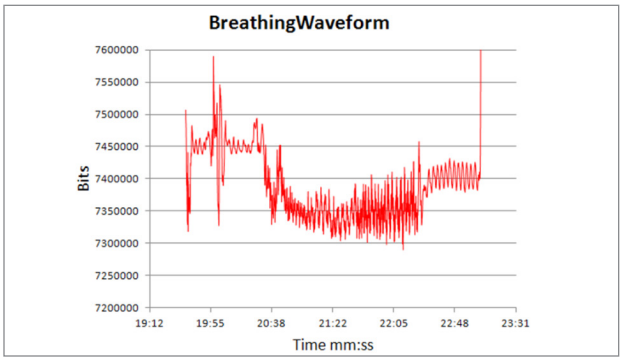
Accel

Log Format	Summary & Waveform Enhanced Summary & Waveform
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	100 Hz
Sample Data	2061, 2063, 2063...
Range	0 - 4095
Units	
Invalid Value	4095
Sample Graph	
Notes	Raw 12 bit unfiltered accelerometer output, a separate value for each axis. Axes refer to subject orientation, if device is configured for the appropriate garment type. Centered at 2048, 1 g = 83 bits 

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (50/53)

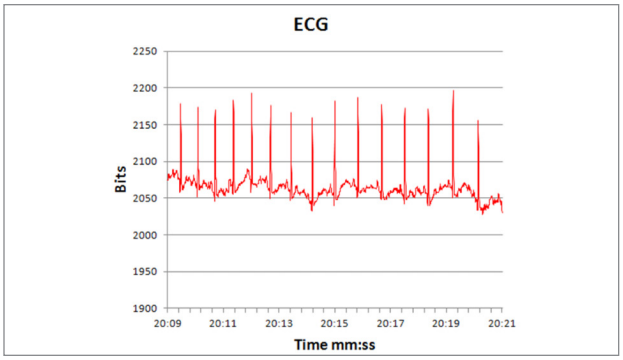
Breathing Waveform

Log Format	Summary & Waveform Enhanced Summary & Waveform
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	25 Hz
Sample Data	7506772, 7490787, 7490787...
Range	1 - 16777215
Units	Bits
Invalid Value	0, 16777216
Sample Graph	
Notes	A 24-bit un-calibrated representation of the breathing sensor output

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (51/53)

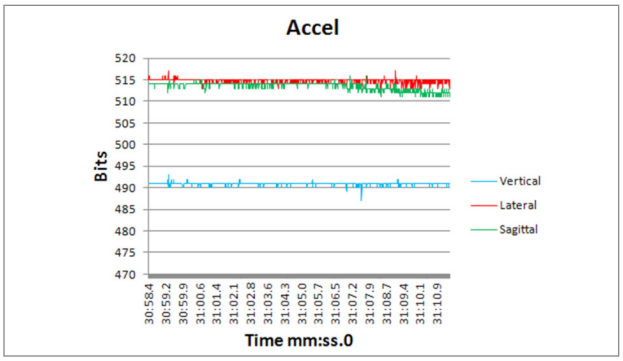
ECG

Log Format	Summary & Waveform Enhanced Summary & Waveform
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	250 Hz
Sample Data	2167, 2167, 2166...
Range	0 - 4095
Units	Bits
Invalid Value	4095
Sample Graph	
Notes	A 12-bit filtered ECG sensor output 1 bit = 0.0067025 mV (indicative)

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (52/53)

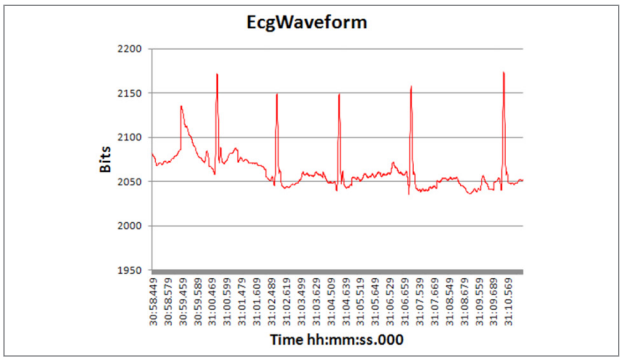
Accel

Log Format	Summary & Development Enhanced Summary & Development
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	100 Hz
Sample Data	491, 516, 514...
Range	0 - 1023
Units	Bits
Invalid Value	1023
Sample Graph	
Notes	Raw 10 bit unfiltered accelerometer output. Axes refer to subject orientation, if device is configured for the appropriate garment type. The 12-bit resolution of Accel in the Summary & Waveform log format is reduced to 10-bit to provide additional space. Values are centered on 512 bits, 1g = 20.75 bits

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 4
BioModule Log Data Parameters (53/53)

ECG

Log Format	Summary & Development Enhanced Summary & Development
Timestamp	DD/MM/YYYY hh:mm:ss.000
Reporting Frequency	1000 Hz
Sample Data	2167, 2167, 2166...
Range	0 - 4095
Units	Bits
Invalid Value	4095
Sample Graph	
Notes	A 12-bit filtered ECG sensor output 1 bit = 0.0067025 mV indicative

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 5
Security Advice (1/2)

Theft & Hacking

- Theft of and hacking into desktop PCs, laptop, tablets and mobile phones is a legitimate concern.
- There are a number of steps which can be taken to protect and prevent access to sensitive data held on any of these devices.

Desktop and Laptop Computers



- Lock your computer with a strong and unique password.
- Safeguard all passwords. Use a password manager. Change passwords regularly. Don't have them written down near your computer.
- Consistently lock your screen when you step away.
- Encrypt your hard drive - there are many 3rd party software options which can do this.
- Regularly back up your encrypted hard drive to another location.
- Keep your antivirus software, and operating system up to date.
- When online, don't open files or follow hyperlinks unless you are confident they are legitimate.
- When floating your mouse cursor over a hyperlink, its destination should appear in a tool tip at the bottom left of your browser window, showing the destination without you clicking on the link.



- Enable a firewall. All current Microsoft™* Windows™* versions - post XP - have a built-in firewall.
- Adjust the privacy and security settings of your chosen web browser. Browser Help will guide you through this. There are privacy-focussed browsers available as alternatives to the mainstream browsers in common use.
- Consider using a VPN (Virtual Private Network) internet connection. There are many free and low-cost options available. They will offer encrypted internet connections via intermediary servers.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
> BioModule Firmware Upgrade
> BioModule Firmware Versions
> BioModule Log Data Descriptions
> BioModule Log Data Parameters
> Security Advice
EULA
SUPPORT
INDEX

APPENDIX 5
Security Advice (2/2)

Mobile Devices



- Lock your phone with a PIN, password or fingerprint detection. Set the password lock to be short (i.e. 30 seconds)
- Encrypt your phone - only necessary for older phones. Current iOS™* and Android™* phones already employ data encryption, though this may not apply to the phone's SD Card by default. Check your phone's security settings.
- Set up remote wipe and phone location. These services are available from all major phone manufacturers and will be available in the phone's settings or a pre-installed application.
- Back up your phone data to its associated cloud service.
- Avoid 3rd-party apps stay with Google Play™* apps for Android™* phones, and if an app requests access to too much data, then reject it. Check app reviews for integrity.
- Beware of phishing texts and emails - most are obvious and can be deleted without opening, but remain alert to their possibility.
- Avoid jail breaking or rooting your phone - this bypasses the phone's intended security protection.
- Use public Wi-Fi carefully.
- Download anti-malware software for your device.

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

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CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

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CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

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CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

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CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

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CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

Eula (6/6)

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CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

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CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

INDEX
(1/8)

A

Accel
Log Data Description 409, 412

Acceleration Magnitude
Log Data Description 377

Accelerometer Axis Mapping 353

Accelerometer Magnitude 153

AccelPro Impact Report
Accelerometry Stream Parameters 167
Accelerometry Stream Tab 166
Anatomy of an Impulse 167
Impact Parameters 162
Impulse Data Lines 164
Summary Parameters 163
Summary Tab 162
Summary Tab Data Filters 165

Accel Waveform Data 155

ACSM 322

Activate 192

Activity Level
Log Data Description 365

Activity Type 262

ACWR 249

Add/Edit BioModules 46
from a Database .FDB File 49
from an XML File 48

Add GPS Devices 50

Add New Subject 42

Anaerobic Threshold (AT) 323

Analysis. See OmniSense™ Analysis

Android™* App. See also OmniSense™ Mobile

Anxiety 345

Archive data 112

Assign Devices to Subject 52

Athlete Status
Web portal 241

Aux ADC 1/2/3
Log Data Description 387

Average Force Development Rate 163
Log Data Description 402

Average Step Impulse
Log Data Description 403

Average Step Period
Log Data Description 404

B

Background Shading. See also Time Variables
Set 115
Speed Zone 138
Training Zone 137

Barcode Scanner 30

Barcode Scanner Operations 60
Print Pick Lists 60
Scanning Operations 61

Barcode Scanner Support. See also Software Installation

Baseline Fitness Testing
Beep Test Protocol 318
Orthostatic Hypotension Readiness Test Protocol 319
Treadmill/Beep Test Analysis 321
Automatic Test Analysis 322
Manual AT Threshold Selection 324
Manual Test Analysis 323
Save Fitness Test Parameters 325
Treadmill Test Protocol 317

Battery Care 34

Battery Level
Log Data Description 378

Battery Voltage
Log Data Description 367

BioGauge
PC 75
Settings 77
Web portal 216
Settings 217

BioModule 26
Assign Devices to Subject 52
Battery Duration 34
Charge Cradle 29
Configure. See Zephyr™ Config Tool
Deassign Devices from Subject 53
Default Configuration 32
ECHO Short Address 32
ECHO Transmit Power Level 33
Feature List 26
Firmware Updates 310, 346
Firmware Versions 351
Hardware generation 350
LED Indications 64
Log Enable 185
Log File Formats 353
Logging Capacity 184
Logging Formats 354
Log GPS Data 32
Memory Capacity 355
Power On/Off 63
Removal 66

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

INDEX
(2/8)

BioPatch™ HP 26

BLE 278

Bluetooth™* Link Quality
Log Data Description 385

Bluetooth™* Received Signal Strength Indication - RSSI
Log Data Description 385

Bluetooth™* Tx Power
Log Data Description 386

Bound Count
Log Data Description 398

Box and Whisker 149

BR @ AT 109

Breath B-B
Log Data Description 408

Breathing Confidence
Log Data Description 379

Breathing Noise Level
Log Data Description 378

Breathing Rate
Log Data Description 363

Breathing Wave Amplitude
Log Data Description 368

Breathing Waveform
Log Data Description 374, 410

BRmax 109

C

Calendar
Mobile Application 294

Calories 343

Clear all graph data 114

Comms Error Indications 82

Conconi test 317

Configure BioModule. See also Zephyr™ Config Tool

Core Temperature
Safe Limits 341
Safety 341

Cursor values. See also Time Variables

Cloud Portal. See Web portal

D

DaDISP™* 182

Dashboard 199

Database
Refresh 114

Data Plotter 312

Demo Mode 105
Demo Team Setup 106

Demonstration Data 111
Access (Analysis) 118

Deploy Team 58

Device Temperature
Log Data Description 383

Distance in Speed Zone 109, 132

E

ECG
ECG Amplitude
Log Data Description 369
ECG Noise
Log Data Description 370
ECG Waveform
Log Data Description 376
Log Data Description 411, 413

ECG electrode. See BioPatch™ HP

ECHO 28
BioModule Short Address 31
Gateway 28
Range 28
Repeater 28
Set ECHO Mode 37
Startup Time 69

Effectiveness Margin 272

Efficiency Settings 271

Elevation 109

Enhanced Summary 181

Enhanced Summary Data 154

Estimated Core Temperature
Log Data Description 386

Event Data
Log Data Description 388

Export
Export session to .zsf 120, 145
GPS data to external kml file 120, 149
Graph 115, 144

Exposure Index 157

External Load 271

INDEX
(3/8)

F

50 BioModule Charge Case 28

Filter Data 147
- Create a Data Filter 148
- Interpolate or Null? 147

Fitness Assessments. See also Baseline Fitness Testing
- OmniSense™ Mobile 295

Fitness Level 109

Fitness parameters 334

Flight Time 163

G

Galvanic Skin Response (GSR)
- Log Data Description 382

Garment Options 27
- Compression Shirt 27
- Loose Shirt 27
- Sports Bra 27

Goals 253
- Create a Goal 254

Google Earth™* 182

GPS 29
- MAC address 185
- Manually Pair a GPS 54
  - Get GPS MAC Address 54

GPS Altitude
- Log Data Description 390

GPS Fix Quality
- Log Data Description 391

GPS HDOP (Horizontal Dilution of Precision)
- Log Data Description 394

GPS Location
- Log Data Description 389

GPS Location (.kml)
- Log Data Description 395

GPS Speed Over Ground
- Log Data Description 392

GPS Track angle
- Log Data Description 393

Graph
- Clear 126
- Fullscreen 142
- Interpretation 337
- Remove Sessions 126
- Zoom and Pan 140

Graph Type
- Select 117
- Time & Summary 124

H

Heart Rate
- Log Data description 362

Heart Rate Confidence
- Log Data Description 379

Heart Rate Recovery 109

Heart Rate Variability
- Log Data Description 380

Heart R-R
- Log Data Description 375, 407

HR @ AT 109

HRmax 109

HRR 323

HR Zones
- Time in 342

HxM Smart 278
- Firmware Upgrade 284
- Store and Forward 285

I

Impact Angle 158

Impact Events 156

Impact Processing
- Accelerometer Magnitude 153
- Accelerometry Overview 152
- Accelerometry Stream 161
- AccelPro Impact Report 159
- Accel Waveform Data 155
- Impact Angle 158
- Impulse Data Lines 161
- Zones of Severity 157

Impact Processor
- Impact Processor Tool 160
  - File Options 160
- Start 114

Import
- Files 114

Import Session Data 146

Impulse
- Types of 156

Impulse Load
- Log Data Description 396

Intensity Thresholds 270

Internal Load 271

iOS™* App. See also OmniSense™ Mobile

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

INDEX
(4/8)

J

Jump Count
  Log Data Description 399

Jump Flight Time
  Log Data Description 404

Jump height 109

Jump time in air 109

K

KML 182

KML file 149
  Open Location Data 149
  View Physiological Data 150

Kubios 311

L

Legend 126

Live Screen
  Web portal 215

Loads for Periodization Planning 273

Lock Screen 291

Log Data 181
  BioModule Logging Capacity 184
  CSV 182
  DaDISP 182
  Default log format 181
  Download Data. See Zephyr™ Downloader
  Download Times 183
  External files 182
  Index of Parameters. See also Individual Parameters
  Log Data Descriptions 353
  Logging Formats 354
    Enhanced Summary 359
    General 356
    Summary 357
  Session Info 353

Log Data Descriptions 353

Log Data Parameters. See also Individual Parameters
  Index of 361

Log Format
  Enhanced Summary 359
  Enhanced Summary & Development 360
  Enhanced Summary & Waveform 360
  General 356
  Summary 357

Log GPS Data 32

M

Major Impact Count
  Log Data Description 401

Manage Users
  Web portal 245

Map
  Open in Analysis 114
  Web portal 219

Markers 115
  Add a marker 114
  OmniSense™ Mobile 292

Matlab™* 182

Max/Min/Avg 129

Mechanical Intensity 336

Mechanical Load 336

Minor Impact Count
  Log Data Description 400

Mobile Application 278
  Delete workout 287
  Fitness Assessments 295
  Free Workout 289
  Home 287
  Install 280
  Link Device 283
  Lock Screen 291
  Lock/unlock screen 296
  Log out 288
  Menu 288
  Notifications 279
  Overview 278
  Perform Fitness Assessment 296
  Screens 281
  Settings 282
  Store and Forward 285
  Workout history 297

N

Notification Area 98

O

OmniSense™ Analysis 107
  Database Rules 112
  Demonstration Data 111
  Features 108
  Overview 107
  Physiological Parameters 109
  Recording Logic 113
  Toolbar 114

OmniSense™ Cloud 191

OmniSense™ Live 68
  Accel Tab 80
  BioGauge Parameters 78

INDEX
(5/8)

Comms Tab 81
Configure BioGauge 77
Connection to Cloud Portal 104
Demo Mode 105
Details Tab 79
General Preferences 38
  Comms Counter retries 38
  General Application Settings 39
  Medic Tab Settings 39
GPS Tab 83
Live Screen Components 70
Live Toolbar 72
Map Window 93
  Heat Map 94
  Snail Trail 93
Medic Tab 91
Multiple Recordings 74
Notification Area 98
Preferences 99
  ECHO Mode 38
  General Application Settings 39
  Heart Rate Recovery Algorithm Settings 39
  Polling Cycle 38
  Sensor Tab Settings 39
  Slot Time 38
Recording Session 73
Safety Tab 90
Safety Thresholds 90
Send Team Workouts from Web Portal 89
Session Markers 96
Session Names 73, 95
Set Garment Type 55
Standard BioGauge 75
Startup Sequence 68
Training BioGauge 76
Training Tab 92
Workout Tab 84

OmniSense™ Local 191

OmniSense™ Mobile. See also Mobile Application

OmniSense™ Tools. See also Zephyr™ Config Tool

OmniSense™ Web Portal 24. See also Software Installation
  Cloud Account Definitions 25

Orthostatic Hypotension 328

Orthostatic Hypotension Readiness Test 151, 319
  Analysis 326
  Readiness History 330
    Import 332
  Readiness Score 328, 329
  Readiness Survey 328
    Weightings 331

P

Password. See Web portal

PC System Requirements 8
  Graphics Card 8
  Operating System 8
  Processor 8
  RAM 8
  Screen Resolution 8

Peak Acceleration
  Log Data Description 366

Peak Acceleration Phi Angle
  Log Data Description 405

Peak Acceleration Theta Angle
  Log Data Description 406

Peak Accelerometer Magnitude 156

Perform Fitness Assessment
  OmniSense™ Mobile 296

Periodization Plans 255. See also Goals

Phi 158

Physiological Intensity 335

Physiological Load 335

Physiological Load & Intensity 334

Physiological Parameters
  OmniSense™ Analysis 109

Portal. See Web portal

Posture
  Log Data Description 364

Preferences 99
  Intensity & Load 100
  OmniSense™ Live 99
  Physiological Intensity 100
  Speed Zones 103
  Training Thresholds 102

Print
  Graph 114, 135

PSM System 22
  Features 22, 23

R

Radar Chart
  Analysis Reports 168
  Athlete Status, portal 241
  Web portal 204

Radio Network Options 35

Rate of Force Development 154

Readiness
  History 330, 332

INDEX
(6/8)

Orthostatic Hypotension Readiness Test 151
Analysis 326, 327
Overview 151
Readiness Calculation 326
Readiness Score 328
Survey 151, 328
Weightings 331
Web portal 230

Readiness Assessment 319

Readiness Graph
Web portal 230

Readiness Survey 328

Readiness Test. See also Orthostatic Hypotension Readiness Test

Record data 113

Recording Logic 113

Recovery & Fatigue 340

Repeater Location 67

Reports
Create Report 173
Edit Report 175
Export Report 174
Fitness Overview 125
Fitness Reports 168
Group Consolidated Summary 176
Parameters 171
Periodization Report 177
Print Report 174
Radar Plot 168
Summary GPS 178
Summary Physiological 179
Table Coloring 172
Team Fitness Report 169
Training Monotony 177
Training Overview 125
Training Reports 170
Workout Compliance 180

ROG Subject Status
Background Shading 136
Log Data Description 382

ROG Time
Log Data Description 383

Run Step Count
Log Data Description 398

S

Safety Alarm Limits 45
Defaults 45

Session Info 353
Log Files 353

Session Markers 96
Create Marker 96

Session Names 95, 116
Create Session Name 95
OmniSense™ Live 95
Zephyr™ Downloader 116

Sessions (PC Analysis Application)
Archive All Filtered Sessions to ZSF 120, 145
Change Team 120
Change Time 120
Copy Sessions/Subsession 120
Delete 120
Filter 118
Filter Data 147
Import Session Data 146
Merge 120
Move to another person 120
Options 119
Permanently Delete 120
Populate Legend 119
Save Filtered Session 120

Set Garment Type 54

Setup
Add /Edit/Remove Team 56
Checklist 31
Database Setup 40
Repeater Location 67
Set ECHO Mode 37
Set Radio Network Type 36

Shuttle Run 318

Snail Trail
Web portal 227

Software Installation 8
Barcode Scanner Support 18
Hardware Installation 21
Installation Procedure 10
Installed Components 9
License Key 17
System Requirements 8
Troubleshooting 14

Speed 109

Stacked Total Charts 130
Distance in Speed Zone 132
Time in HR Zones 130
Time in Training Zone 131

Status Info
Log Data Description 384

Step Events 156

Step Period 156

Store and Forward 285

Strain & Stress 344

Strap. See also Zephyr™ Strap

INDEX
(7/8)

Subject Parameters 43

Subsession
- by Mouse 122
- by Wizard 123
- Create 114, 120
- OmniSense™ Mobile 292
- Overview 121

Summary Graph
- Web portal 228

Summary Graphs 128
- Box and Whisker 134
- Max/Min/Avg 129
- Negative Values 129
- Preferences 135
- Select Summary Variables 128
- Stacked Total Charts 130
- Summary 134
- Total 130

Synchronize Device Clocks 187

System Confidence
- Log Data Description 381

System Startup 68
- OmniSense™ Live 69
  - Startup Times 69

T

Team 56
- Add /Edit/Remove 56
- Deploy Team 58
- Populate Teams 57
- Remove Subject 57
- Undeploy a Team 59
- Web portal 239

Theft & Hacking 414

Theta 158

Threshold Settings (Web Portal) 270
- Efficiency Settings 271
- Intensity & Load 270
- Loads for Periodization Planning 273

Time
- Real/Elapsed 115, 141

Time in HR Zones 109

Time in Speed Zone 133

Time in Speed Zones 109

Time in Training Zone 131

Time in Training Zones 109

Timestamp
- vertical cursor 131

Time Variables
- Background Shading 136
- Cursor Values 139
- Select 127
- vertical cursor 139

Training Efficiency 271

Training Plans
- Overview 247
- Steps to Create a Periodization Plan 252
- Web portal 247, 248
- Workflow 250

Training Zone Thresholds 85
- %HR@AT 85
- %HR Max 86

Treadmill Test 127

U

Undefined User 197, 243

User Roles
- Web portal 243

V

View Devices
- Web portal 238

VO_2max 109, 317

W

Walking Step Count
- Log Data Description 397

Web portal 191
- Account Definitions 195
- Activate account 192
- Add/Configure Widget 202
- Additional Customer Account 214
- Analysis 218
  - Create a Report 220
  - Map 226
  - Workflow 221
- Athlete Status 206, 241
- Calendar 237
- Create New User 245
  - Physiological Parameters 246
- Custom Widget 211
  - Update/Delete 213
- Dashboard 199
  - Configure 201
- Forecast 203
- Goals 253
- Live Screen 215
- Login 193
- Manage Teams 239
- Manage Users 245
- Map 219, 226
  - Snail Trail 227
- My Profile 214
- My Status 204
- Navigation 200
- Over Time Graph 223

CONTENTS
ABOUT THIS MANUAL
GETTING STARTED
SYSTEM OVERVIEW
SYSTEM SETUP
LIVE OPERATIONS
ANALYSIS OPERATIONS
ANALYSIS IMPACT PROCESSING
ANALYSIS REPORTS
LOG DATA
OMNISENSE™ WEB PORTAL
OMNISENSE™ MOBILE
OMNISENSE™ TOOLS
BASELINE FITNESS TESTING
FITNESS PARAMETERS
APPENDICES
EULA
SUPPORT
INDEX

INDEX
(8/8)

Password 192
Lost Password 194
Periodization Plans 255
Periodization Report 232
Permissions 243
Permissions table 198
Portal Access 192
Send Team Assignments to PC Application 266
Subject BioGauge 216
Summary Graph Widget 210
Table Style Report 235
Team Status 205
Templates 218
Time Graph Widget 208
Graph Zoom 208
Select Sessions 209
Training Plans 247, 248
User Roles 243
User Roles and Permissions 197
View Devices 238
Web address 192
Workouts 260

Widget
Web portal 199

Workouts 85
Web portal 260
Workout Files 88

X

X Acceleration Minimum (VerticalMin)
Log Data Description 371

X Acceleration Peak (VerticalPeak)
Log Data Description 371

Y

Y Acceleration Minimum (LateralMin)
Log Data Description 372

Y Acceleration Peak (LateralPeak)
Log Data Description 372

Z

Z Acceleration Minimum (SagittalMin)
Log Data Description 373

Z Acceleration Peak (SagittalPeak)
Log Data Description 373

Zephyr™ Config Tool 301
Accelerometer 308
Audit File Location 301
Bluetooth™* 304
Configure From a Template 302
ECHO 309
Operation 301
Polling 305
Read-Only Data 303
Subject Info 305
Time 307
User Config 306

Zephyr™ Downloader 186. See also Log Data
Auto Download 190
Log Detail 189
Menu Options 187
Operation 188

Zephyr™ Strap 27
BioModule Removal 66
Fitting 65

Zones of Severity 156

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