MOBILITY LAB BY APDM

USER GUIDE

WELCOME

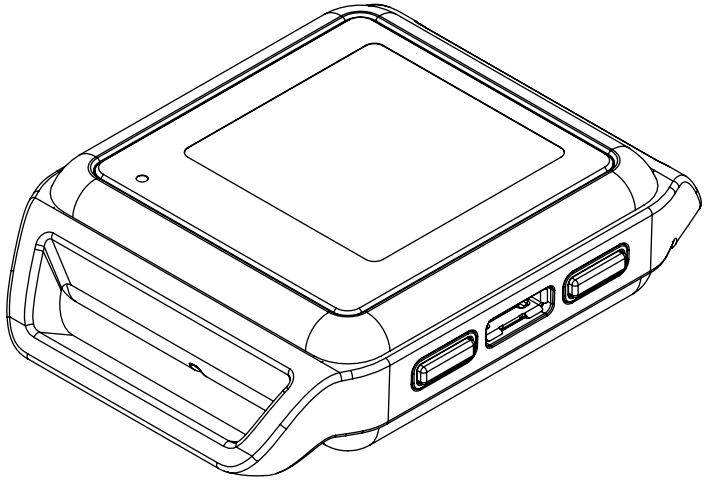
to Mobility Lab

Using APDM's advanced wearable sensors, Mobility Lab makes it easy to collect, analyze, and store outcome measures. Attach sensors to your subject, and instruct them to perform a standardized test. A report is then automatically generated to compare against normative values.

web: www.apdm.com
email: info@apdm.com
phone: 888-988-APDM (2736)

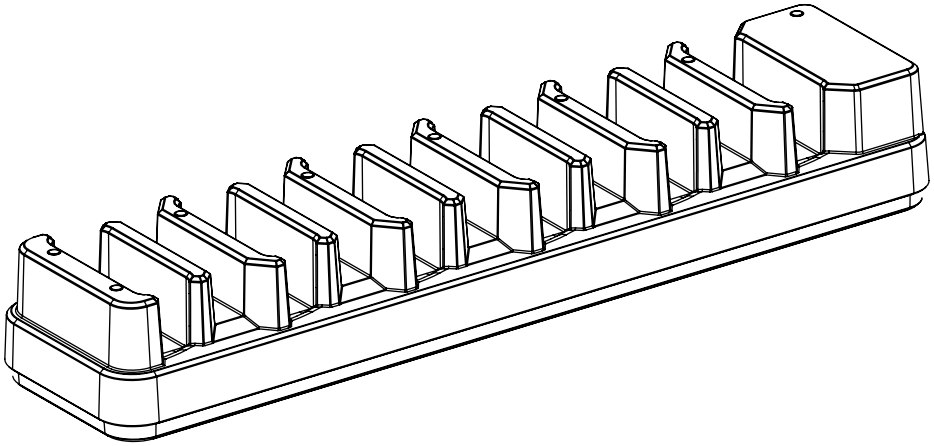
CONTENTS

PARTS



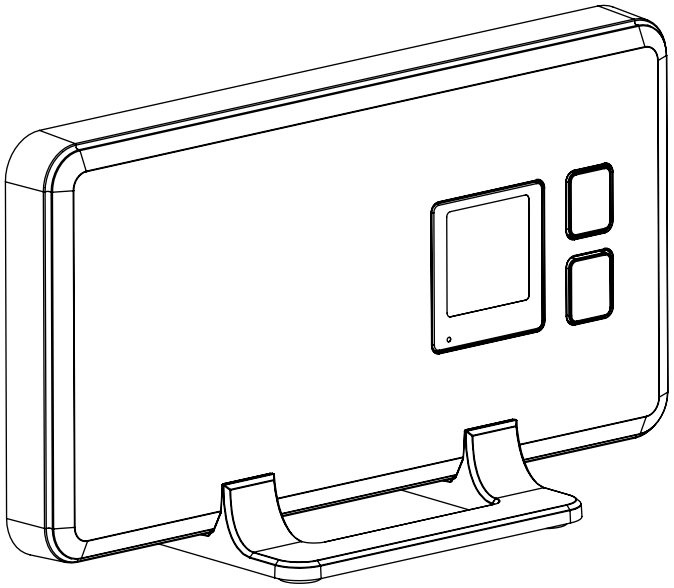
OPALS

The Opal movement sensors precisely record movement with triaxial accelerometers, gyroscopes, and magnetometers.



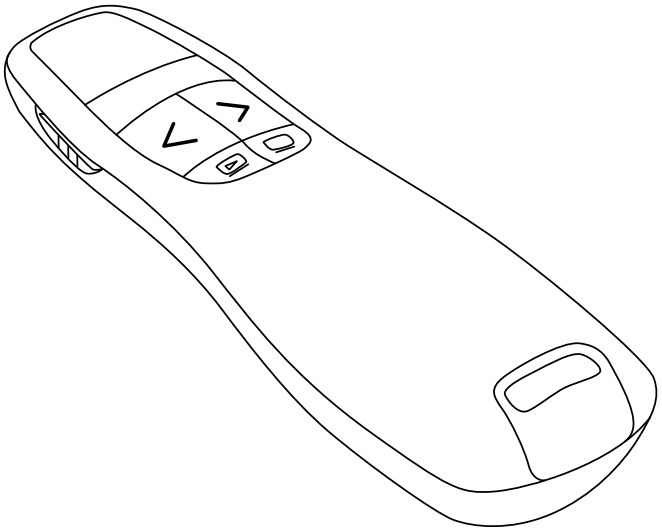
DOCKING STATION

The Docking Station is used to charge and configure the Opal movement sensors.



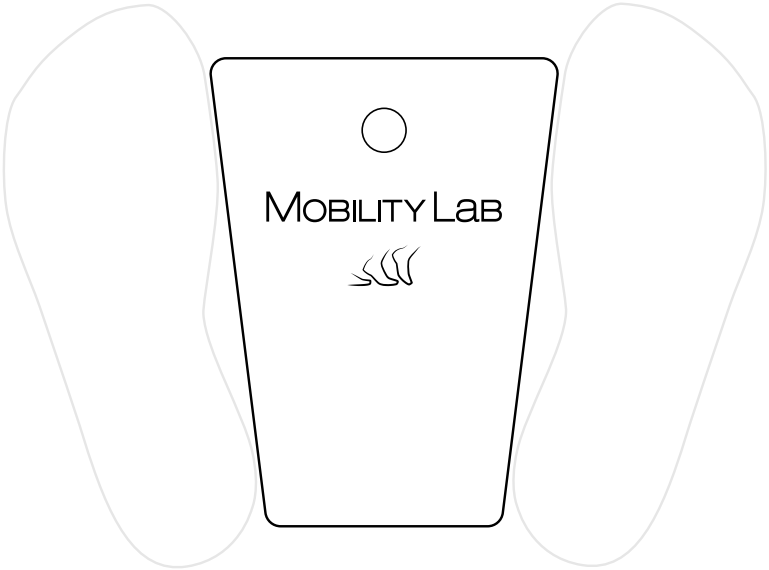
ACCESS POINT

The wireless Access Control Point allows for wireless communication between the host computer and Opal movement sensors. A single Access Point can support up to 6 Opals.



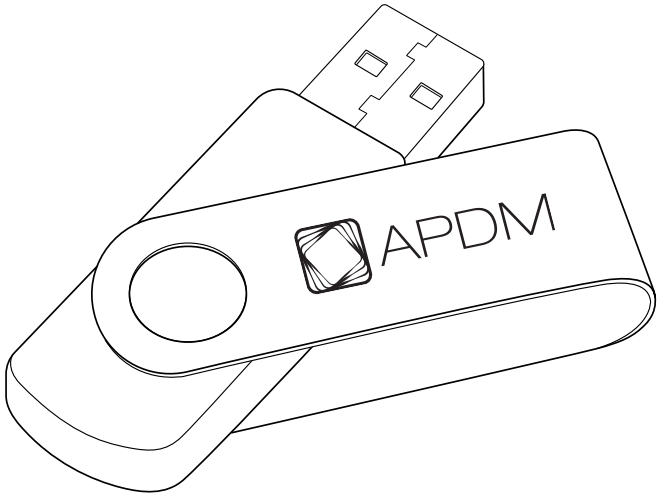
WIRELESS REMOTE

The Mobility Lab software supports the use of a remote control to aid while collecting data. This functionality makes it possible for a single attendant to collect data while following or assisting the subject.



FOOTPLATE

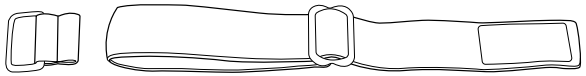
The Mobility Lab Footplate is designed to standardize stance width before each Mobility Lab test, unless otherwise noted.



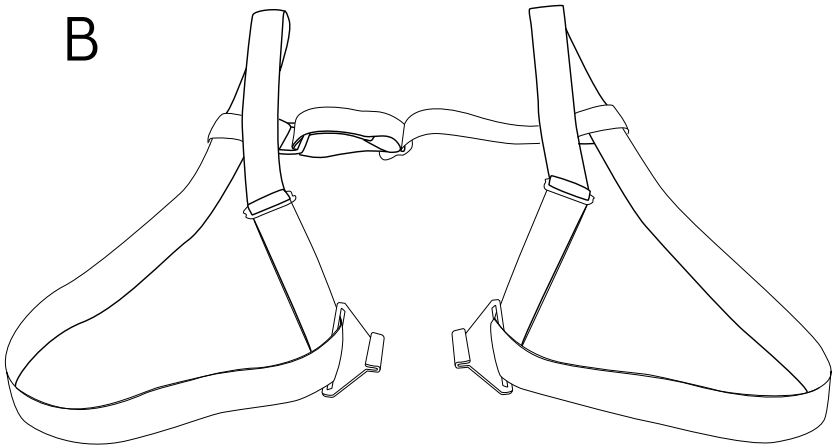
USB DRIVE

The USB drive contains the Mobility Lab software for automated analysis and reporting.

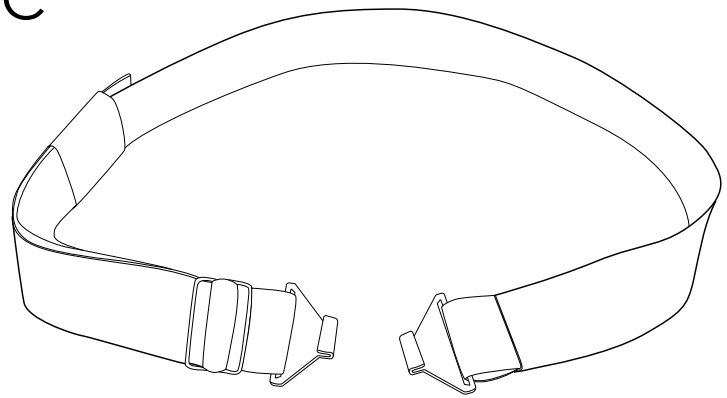
A



B



C



STRAPS

There are a number of options for securing the sensors on subjects using a selection of straps.*

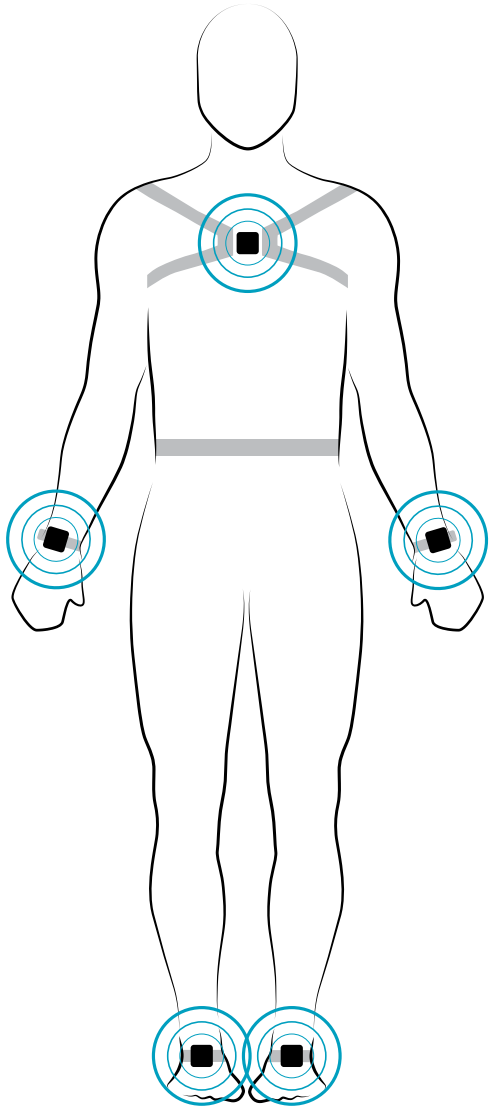
A. Wrist and Foot strap

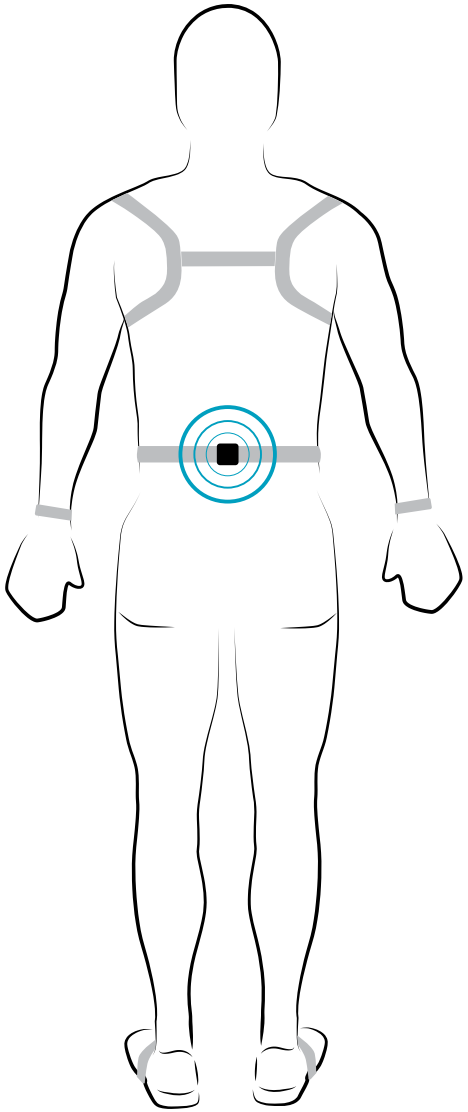
B. Sternum strap

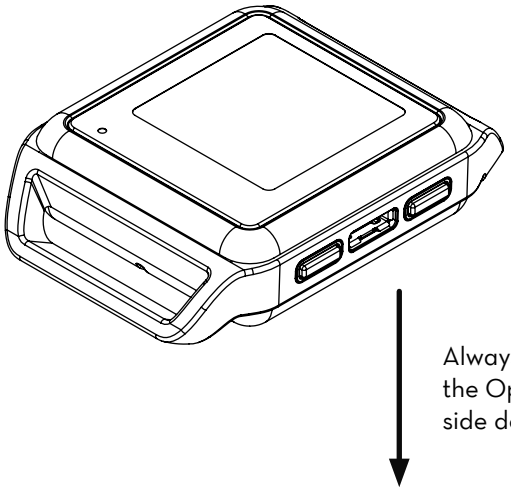
C. Lumbar strap

*All straps are latex-free.

Sensor Placement



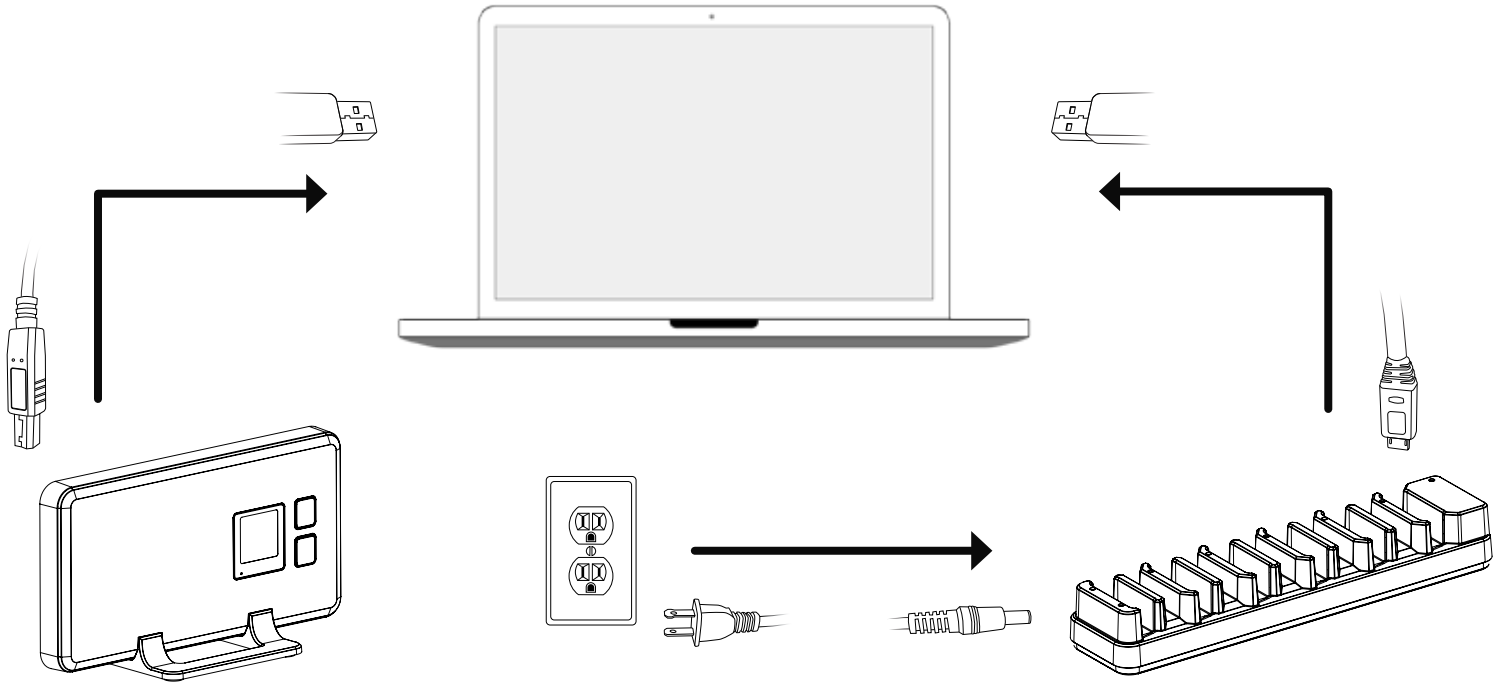




Your Mobility Lab system comes with all or some of the sensors shown.

To upgrade your system, contact us at 888-988-APDM (2736) or info@apdm.com.

SETUP



SETUP

1. Connect the Access Point to your computer using the Type-B USB cable provided.
2. Connect the external power adapter to the Docking Station, and plug it in.
3. Connect the Docking Station to your computer using the Micro USB cable provided.
4. Plug the Opal(s) into the Docking Station.

It is the responsibility of the user to use the needed accessories supplied with the equipment. Changes or modifications not expressly approved by APDM could void user authority to operate the equipment.

SOFTWARE INSTALLATION

Requirements

Operating System

Windows 7 (64-bit) or later.

(Make sure you have Internet Explorer 10 or later installed.)

OSX Mountain Lion or later.

RAM

4GB+

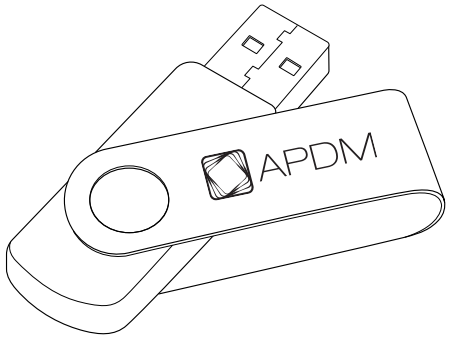
Processor

Intel Core i3 or better.
Recommended Intel Core i5 or i7.

Drive Space

500MB for installation.
Recommended 100GB+ for ample recording storage.

Installation



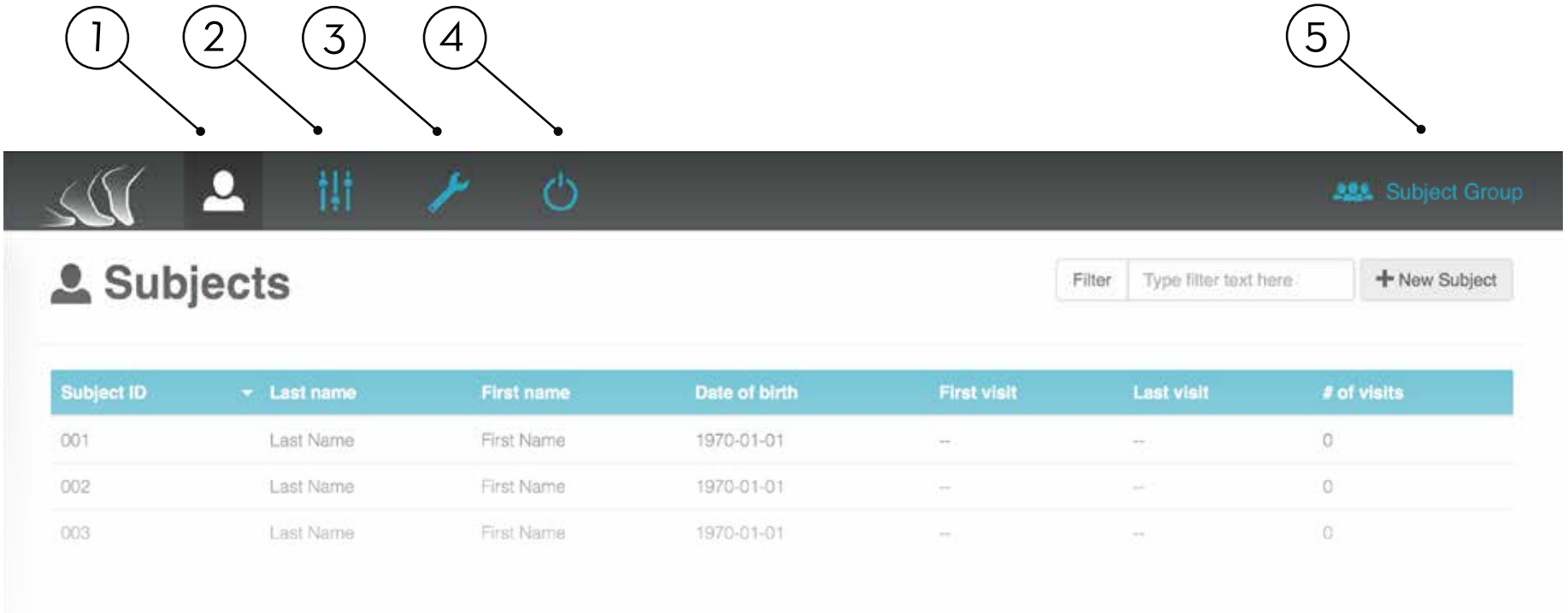
Macintosh OSX

• Insert the provided USB drive into your computer. Drag the Mobility Lab icon into the Applications folder to install.

Windows

• Insert the provided USB drive into your computer. Double click on the setup file. This will guide you through the installation process.

USING YOUR SOFTWARE



MENU

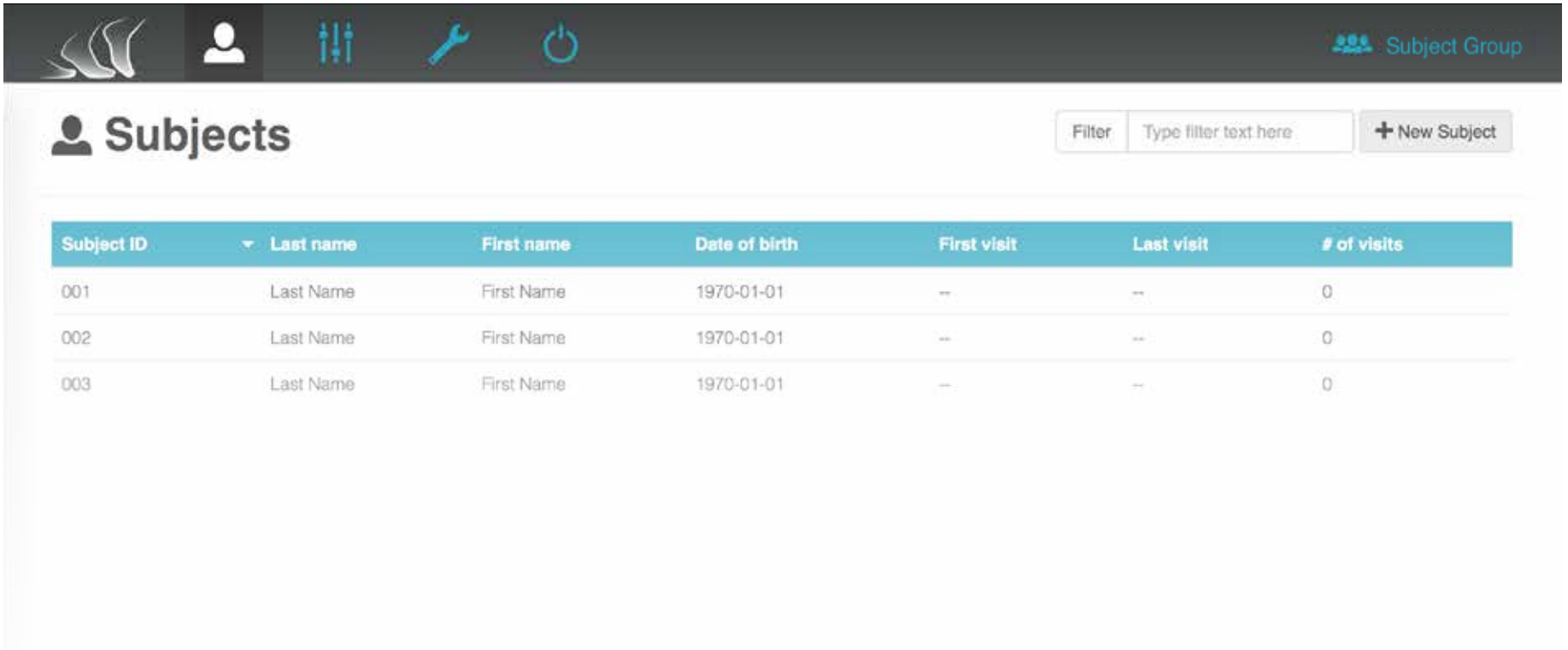
1. ***Subjects***
   The Subjects tab shows all of the subjects in your Mobility Lab system for a selected subject group.

2. ***Options***
   The Options tab shows all of the display options in your Mobility Lab system for a selected subject group.

3. ***Hardware Configuration***
   The Hardware Configuration tab shows assigned sensor locations on the body.

4. ***Power Off Sensors***
   The Power Off Sensors tab turns off any docked sensors for storage.

5. ***Subject Group Selection***
   The Subject Group Selection dropdown allows you to select, add, edit, delete, and export data for a specific subject group.



SUBJECTS

The Subjects tab shows all of the test subjects in your Mobility Lab system for a selected subject group.

Adding a Subject

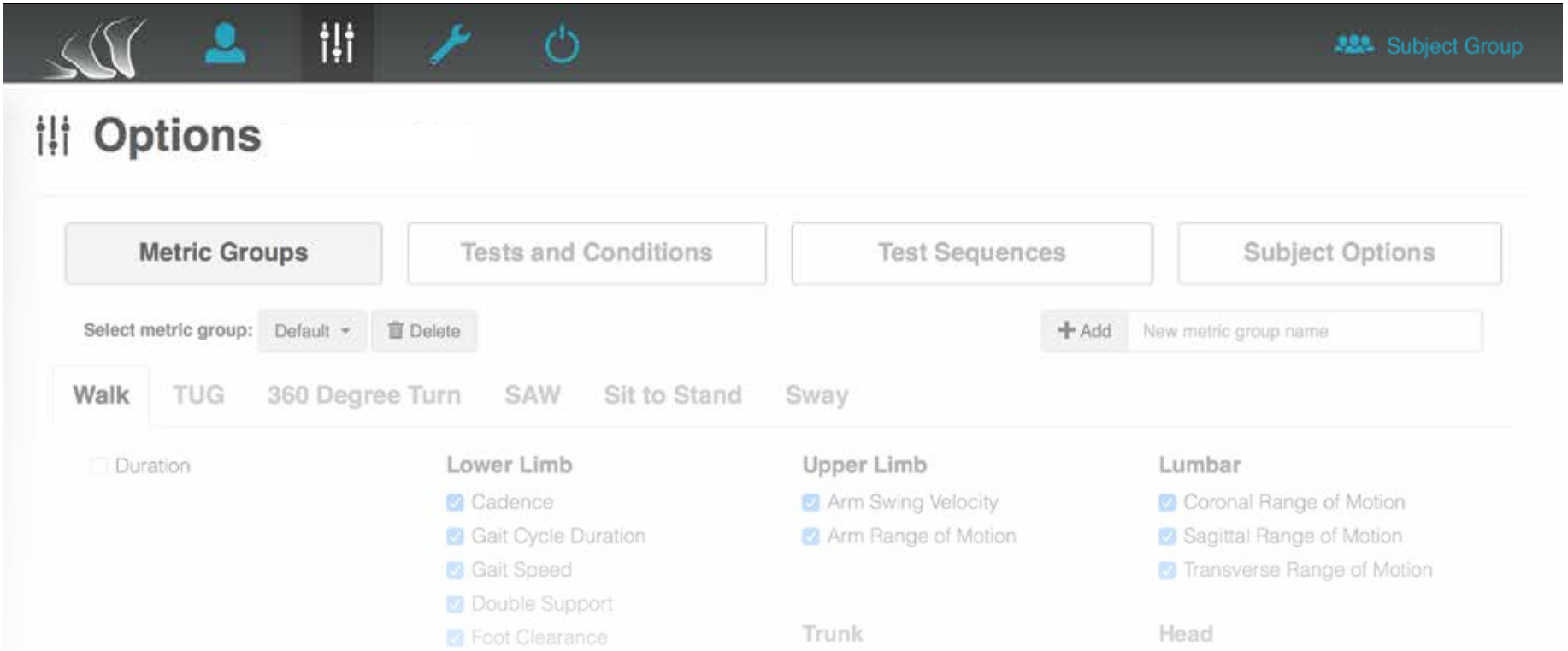
Click on the "New Subject" button on the top right of your screen. Fill in the required fields and click Save.

Running a Test

Click on the subject you wish to test. Click on the "New Test" button on the top right of your screen.

Finishing a Test Sequence

Click on the subject you wish to test. Click on the red "bell" icon to the right of an unfinished test sequence. This option will be active for 24 hours after the sequence is started.



OPTIONS

The Options tab shows all of the display options in your Mobility Lab system for a selected subject group.

Metric Groups

The "Metric Groups" page allows you to change which metrics are displayed in the test results window, and add custom metric groups for each test.

Tests and Conditions

The "Tests and Conditions" page allows you to add, edit, and delete custom tests and test conditions*.

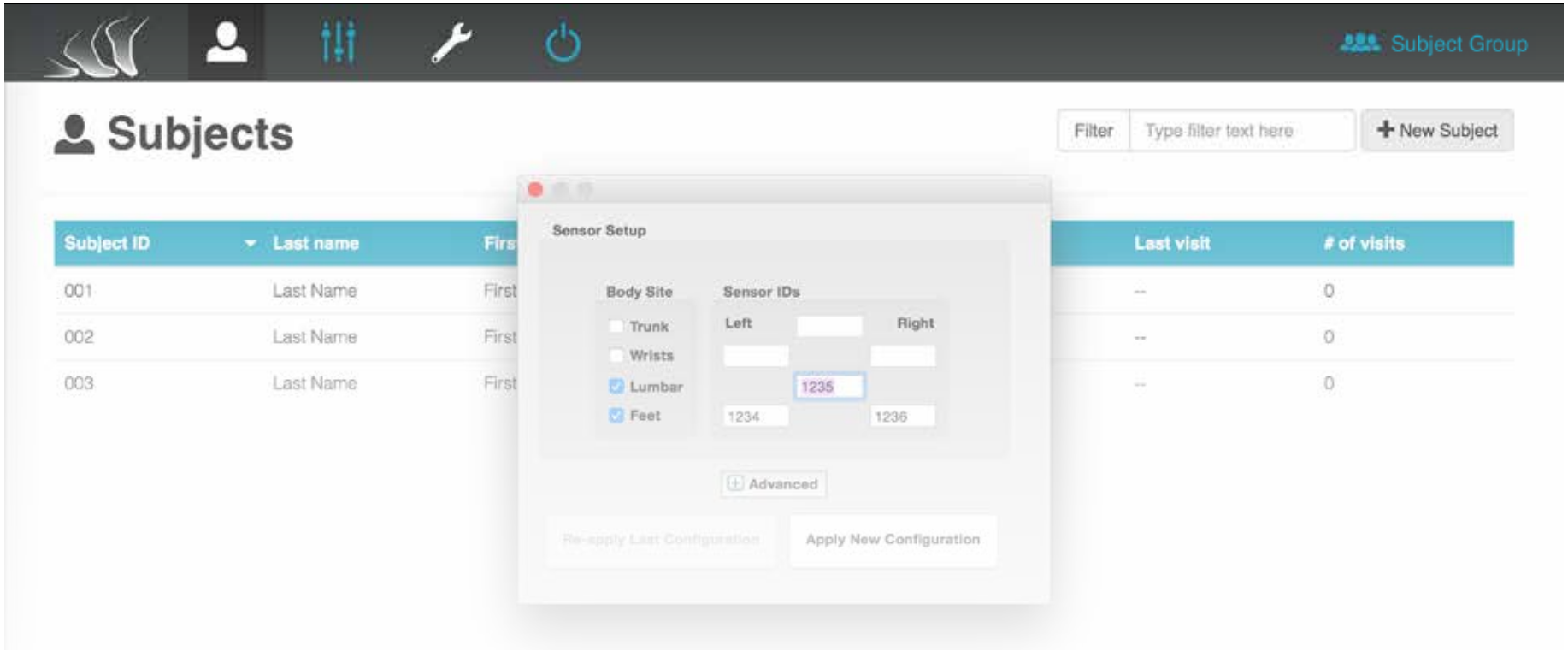
Test Sequences

The "Test Sequences" page allows you to add, edit, and delete custom test sequences.

Subject Options

The "Subject Options" page allows you to select the required and displayed fields on the subjects tab.

* Added feature



HARDWARE CONFIGURATION

The Hardware Configuration tab shows assigned sensor locations on the body.

Body Site

Check the boxes next to the body sites you wish to record from.

Sensor IDs

For each body site you record from, you must specify the ID of the Opal you will place on that location. The sensor ID is etched on the back of each Opal.

Advanced

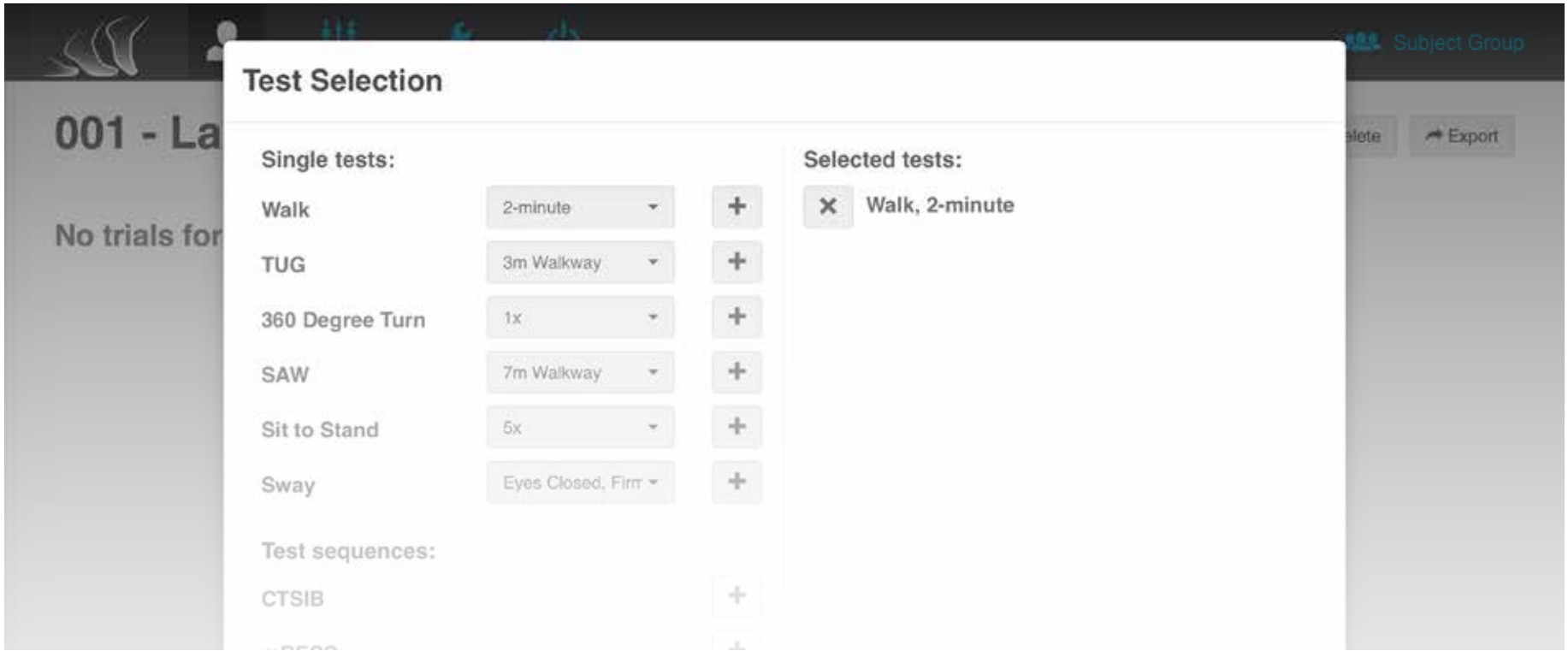
Click here for Custom Sensor Location Setup, Recording Options, and Wireless Remote settings.

Apply New Configuration

Click here when you are done choosing your configuration options.

Video, External Synchronization, and Continuous Monitoring settings can be accessed in the Tools dropdown of the menu bar.

* Added feature



RUNNING A TEST

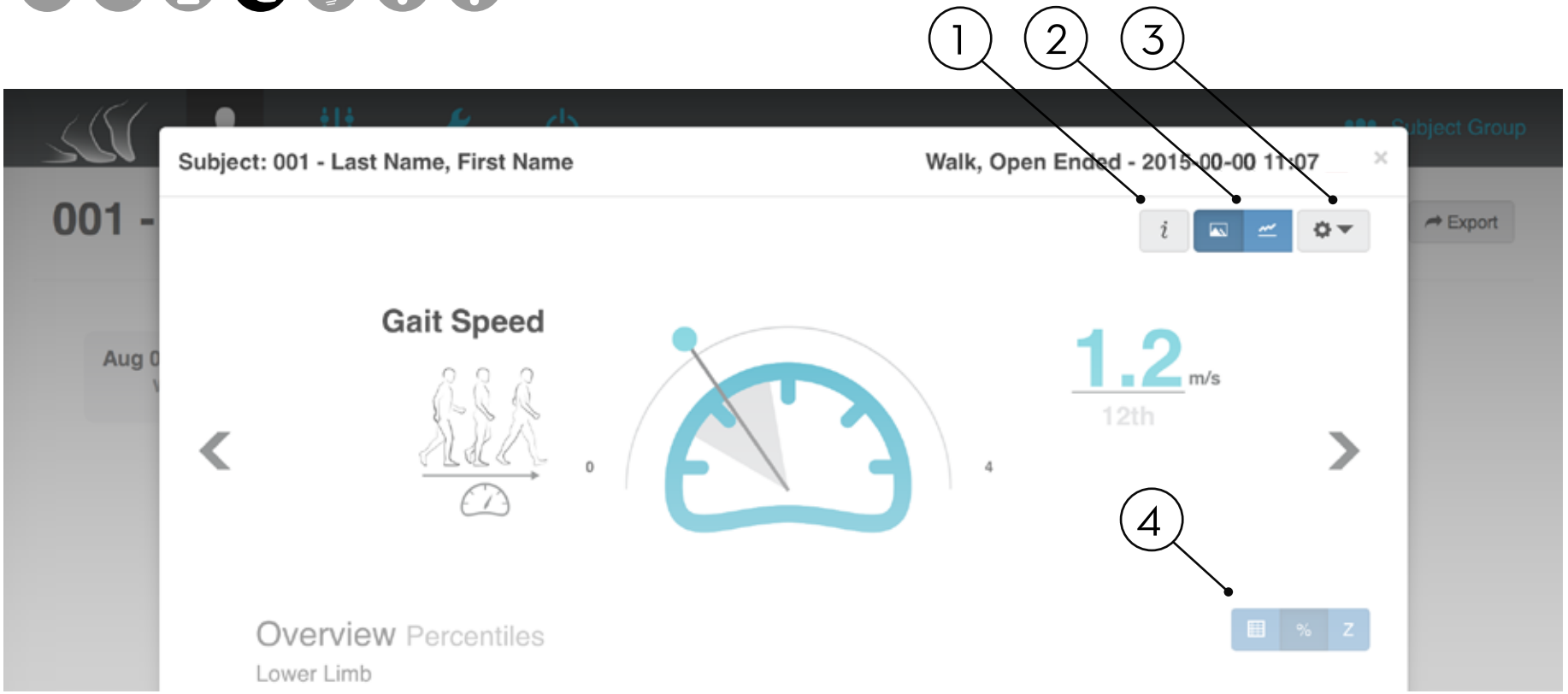
1. Click on the subject you wish to test. Click on the "New Test" button on the top right of your screen, and select the test(s) you wish to run.

2. Select the test(s) and condition(s) you would like to run. You may select multiple tests or one test sequence. Click Next to continue.

3. Make sure the necessary sensors are undocked and attached to the subject on the proper body sites. Click Next to continue.

4. Follow the instructions on each dialogue box to complete each test.

5. If using the wireless remote, press the forward button to start and stop each test.



TEST RESULTS WINDOW

1. ***Information Key***
   The Information Key shows definitions for each metric, and information on how to read each graph.

2. ***Visualization Options***
   The Visualization Options show the data graph in different formats for a selected test.

3. ***Tools Dropdown***
   The Tools Dropdown allows you to edit displayed metrics, access print view, export and upload trial data*, and delete a test.

4. ***Overview Options***
   The Overview Options show the data table in different formats for a selected test.

Norms are collected progressively from third party institutions. For more information, visit support.apdm.com.

* Added feature

Tests

W Walk T TUG S Sway C CTSIB mB mBES 360 360° Tu sS Sit to Stanc Sw SAW

The Mobility Lab system comes equipped with multiple tests. The table below indicates what each test can measure, and how many Opal sensors are necessary to run each test.

	Test Measures	Opals
W	Full body gait (legs, arms, and trunk), Asymmetry, Variability and Turning	3+
T	Postural transitions (sit, stand, and turning)	3+
S	Postural sway	1+
C	Postural sway, Visual dependence, Proprioceptive dependence, and Vestibular loss	1+
mB	Postural stability in varying conditions	1+
360	Turn velocity, Turn time, Number of steps	3+
sS	Trunk excursion, Stand time, Cadence, Total time	3+
Sw	Full body gait (legs, arms, and trunk), Asymmetry, Variability, Turning, and Postural Stability	3+

Each test within the Mobility Lab system is designed to capture data that may help improve the analysis of certain mobility and balance issues. The table below suggests which tests can be helpful to capture this data.

	PD	MS	CP	TBI	Stroke	Fall Risk	Dementia	Vestibular Disorders
W	X	X	X	X	X	X	X	X
T	X	X				X		
S	X	X				X		X
C	X	X		X		X	X	X
mB				X				X
360	X						X	X
sS	X	X			X	X		X
Sw	X	X		X	X	X	X	

Each test within the Mobility Lab system is designed to capture data for certain metrics. The table below indicates the metrics that each test captures, and how many Opal sensors are necessary to gather data for each metric.

Lower Limb	1 Opal sensor	3 Opal sensors	6 Opal sensors
Cadence		W Sw	W Sw
Gait Cycle Duration		W Sw	W Sw
Gait Speed		W Sw	W Sw
Elevation at Midswing		W Sw	W Sw
Double Support		W Sw	W Sw
Lateral Step Variability		W Sw	W Sw
Circumduction		W Sw	W Sw
Foot Strike Angle		W Sw	W Sw
Toe Off Angle		W Sw	W Sw
Stance		W Sw	W Sw
Step Duration		W Sw	W Sw
Stride Length		W Sw	W Sw
Swing		W Sw	W Sw
Toe Out Angle		W Sw	W Sw

Upper Limb	1 Opal sensor	3 Opal sensors	6 Opal sensors
Maximum Velocity			W Sw
Range of Motion			W Sw
Trunk Range of Motion			
Coronal			W Sw
Sagittal			W Sw
Transverse			W Sw
Lumbar Range of Motion			
Coronal		W Sw	W Sw
Sagittal		W Sw	W Sw
Transverse		W Sw	W Sw
Sit To Stand			
Duration	sS	T sS	T sS
Lean Angle			T sS
Stand To Sit			
Duration	sS	T sS	T sS
Lean Angle			T sS

Turning	1 Opal sensor	3 Opal sensors	6 Opal sensors
Angle	360	W T 360 Sw	W T 360 Sw
Duration	360	W T 360 Sw	W T 360 Sw
Velocity	360	W T 360 Sw	W T 360 Sw
Steps in Turn		W Sw	W Sw
Postural Sway			
95% Ellipse Sway Area	S C mB	S C mB Sw	S C mB Sw
RMS Sway	S C mB	S C mB Sw	S C mB Sw
Coronal RMS Sway	S C mB	S C mB Sw	S C mB Sw
Sagittal RMS Sway	S C mB	S C mB Sw	S C mB Sw
Anticipatory Postural Adjustment			
Duration		W Sw	W Sw
First Step Duration		W Sw	W Sw
First Step Range of Motion		W Sw	W Sw
Sagittal Max Acceleration		W Sw	W Sw
Coronal Max Acceleration		W Sw	W Sw

To upgrade your APDM sensor system, contact us at 888-988-APDM (2736) or info@apdm.com.

TIPS

Storage

In most situations, it is sufficient to simply dock your sensors when not in use. When docked, sensors stop recording, stop broadcasting, and charge batteries. ***Do not leave sensors docked in a docking station that is not plugged into a power outlet.***

For transport and storage, it is best to power off all system components. This can be done by docking the sensors and clicking the “Power Off” button in the Mobility Lab menu. The sensors will power down the next time they are undocked.

Cleaning

Clean the Opal sensors with a rubbing alcohol or other cleaning wipe. Do not use methyl alcohol, as it will cause degradation of the plastic over time.

The sensors and other system components should not be submerged in any liquids or subjected to any high temperatures.

The sensor straps can be removed and washed separately using mild soap and water.

Subject Attire

The subject should wear clothing that does not bind their movement in any significant way.
Walking shoes should be worn (i.e. no heels or flip-flops).

TROUBLESHOOTING

APDM is pleased to assist you with any questions you may have about your hardware, software, or the use of the technology for your application.

Please contact us at:

web: support.apdm.com

email: support@apdm.com

LED Colors

White Red Yellow Green Cyan Blue Magenta

LED Patterns and Error Messages

The LED on the Access Point and sensors provides important information about the operating state of the hardware. The table below lists the LED flashing patterns associated with these states, which can be useful in troubleshooting issues encountered with the hardware.

	Pattern	State
Startup Mode	Yellow	Startup wait (5 sec) v1.0, bootloader v1
	Magenta	Startup wait (5 sec) v1.1, bootloader v2
	Red	Failed to load firmware
	White	Bootloader Mode
Firmware Mode	Blue Yellow	Docked Mode (pre-charging - very low battery)
	Blue Green fast	Docked Mode (bulk charging - low battery)
	Blue Green slow	Docked Mode (trickle charging - 80-100% charge)
	Blue	Docked Mode (full charge)
	Red Blue	Docked Mode (battery error)

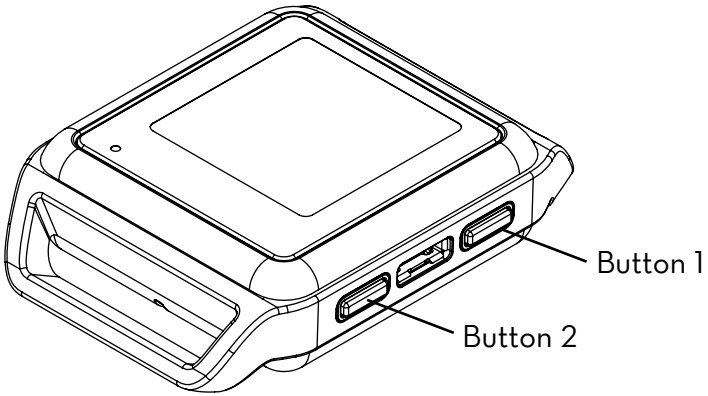
Firmware Mode

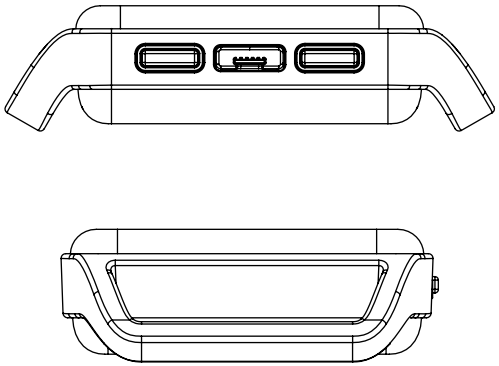
	Docked Mode (wait)
	Docked Mode (error)
	Reset Mode
	Transitioning into standby or powering off
	Hold Mode
	Run Mode (battery level 4, full)
	Run Mode (battery level 3)
	Run Mode (battery level 2)
	Run Mode (battery level 1, low)
	Run Mode (battery very low)
	Run Mode (clock unset, battery level 4, full)
	Run Mode (clock unset, battery level 3)
	Run Mode (clock unset, battery level 2)
	Run Mode (clock unset, battery level 1, low)
	Run Mode (clock unset, battery very low)
	Run Mode (no sync-lock, battery level 4, full)
	Run Mode (no sync-lock, battery level 3)
	Run Mode (no sync-lock, battery level 2)
	Run Mode (no sync-lock, battery level 1, low)
	Run Mode (no sync-lock, battery very low)

Firmware Mode		Run Mode (clock unset, no sync-lock, battery level 4, full)
		Run Mode (clock unset, no sync-lock, battery level 3)
		Run Mode (clock unset, no sync-lock, battery level 2)
		Run Mode (clock unset, no sync-lock, battery level 1, low)
		Run Mode (clock unset, no sync-lock, battery very low)
Error Mode		Error Mode (default)
		Error Mode (configuration)
		Error Mode (system)
		Error Mode (data buffer)
		Error Mode (SD buffer)
		Error Mode (SD I/O)
		Card is full
Wireless Streaming Debug Mode		Normal
		CPU limited
		Sync bad
		CPU limited, Sync bad
		Missed sync > O
		Missed sync > O, CPU limited
		Missed sync > O, Sync bad
		Missed sync > O, CPU limited, Sync bad

INFORMATION

For complete sensor information, please visit www.apdm.com





Dimensions	55mm x 40.2mm x 12.5mm
Material	PC-ABS plastic, glass
Weight	<25 grams (with battery)
Battery Life	Wireless Streaming (8h), Synchronous Logging (12h), Asynchronous Logging (16h)
Wireless Radio	Nordic Semiconductor nRF51822
Frequency Band	2.40-2.48GHz ISM band, adjustable
Data Rate	2Mbps on-air data-rate
Latency	300ms (typical) with data buffer, 30ms (typical) without data buffer
Transmission Range	30m line of sight, 10m indoors
Data Buffer	8Gb (~720 hours)
Synchronization	≤1ms difference, up to 24 Opals
Screen Resolution	128px x 128px

Compliance Information

FCC

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by APDM could void the user's authority to operate the equipment.

To access FCC and IC information on the APDM Opal and Access Point - Press Button 2 twice from the home screen.

Industry Canada (IC)

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canadienne applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire d'interférence, et (2) l'utilisateur de l'appareil doit accepter toute interférence subie, même si l'interférence est susceptible d'en compromettre le fonctionnement.

WEEE Directive Statement for the European Union

In common with all Electronic and Electrical products, APDM equipment should not be disposed of in household waste. Alternative arrangements may apply in other juristictions.

FCC ID: 2AHZD-OPAL
IC: 21349-OPAL
Model: Opal

FCC ID: 2AHZD-AP
IC: 21349-AP
Model: AP

CONTACT US

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