



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)

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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. Depending on your configuration, up to 6 Docking Stations may be chained together into a single unit.





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.

USB DRIVE

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



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.



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.

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.
Double click the MobilityLab_Mac64.dmg file.
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

001

002

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.

Type filter text here

Filter

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.

 Last name 	First name	Date of birth	First visit	Last visit	# of visits
Last Name	First Name	1970-01-01		70	0
Last Name	First Name	1970-01-01			0
Last Name	First Name	1970-01-01		-77.0	0

Subjects

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4

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2

Subject Gro

+ New Subject



L Subjects

Subject Group

Filter	Type filter text here	1.4

+ New S	Subjec
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Subject ID	✓ Last name	First name	Date of birth	First visit	Last visit	# of visits
001	Last Name	First Name	1970-01-01		27.))	0
002	Last Name	First Name	1970-01-01			0
003	Last Name	First Name	1970-01-01	2 ⁷⁷ -1	17 N	0

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

Člick 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.

†**!**†

tit Options

Metric Groups		lests and Conditions		Test Sequence	es	Subject Options		
Select m	netric group:	Default *	1 Delete				+ Add	New metric group name
Walk	TUG	360 Degr	ee Turn	SAW	Sit to Stand	Sway		
Dura	Duration		Lower Limb		Upper Limb		Lumbar	
			0	adence		Arm Swing Velocity		💋 Coronal Range of Motion
			Gait Cycle Duration		Arm Range of Motion		🕺 Sagittal Range of Motion	
			🗾 Gait Speed				🛛 Transverse Range of Motion	
			🛛 Double Support		port			
		Foot Clearance		Trunk		Head		

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.

🚨 Subj	ects					Filter	Type filter text h	iere	+ New Subject
		12	0.0						
Subject ID		Firs	Sensor Setup				Last visit	# of	f visits
001	Last Name	First	Body Site	Sensor	IDs		2	0	
002	Last Name	First	Trunk	Left	Right			0	
003	Last Name	First	🖸 Lumbar 🕑 Feet	1234	1235		-	0	
				🕀 Advi	anced				
					Apply New Configuration				

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.

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04 1	lest selection					
001 - La	Single tests:				Selected tests:	alete 🛹 Export
in the last of the second	Walk	2-minute		+	× Walk, 2-minute	
o mais ior	TUG	3m Walkway	¥	+		
	360 Degree Turn	tx	*	+		
	SAW	7m Walkway		+		
	Sit to Stand	5x	*	+		
	Sway	Eyes Closed, F	im *	+		
	Test sequences:					
	CTSIB			+		
	DEAD					

RUNNING A TEST

- 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.

Walk TUG Sway CTSIB MBESS 360° Turn Sit to Stand 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]+
С	Postural sway, Visual dependence, Proprioceptive dependence, and Vestibular loss]+
mB	Postural stability in varying conditions]+
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	СР	TBI	Stroke	Fall Risk	Dementia	Vestibular Disorders
W	X	X	\times	\times	\times	\times	×	×
T	\times	\times				\times		
S	X	\times				\times		×
С	X	\times		\times		\times	\times	×
mB				\times				×
360	X						\times	×
sS	X	X			X	\times		\times
Sw	\times	X		X	X	\times	\times	

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.

ower 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	TSS
Lean Angle			TS
Stand To Sit			
Duration	SS	T SS	TSS
Lean Angle			TSS

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		
Coronal RMS Sway	S C mB		
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

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	•	Startup wait (5 sec) v1.O, bootloader v1
	•	Startup wait (5 sec) v1.1, bootloader v2
	•	Failed to load firmware
	0	Bootloader Mode
Firmware Mode		Docked Mode (pre-charging - very low battery)
	🔵 🔵 fast	Docked Mode (bulk charging - low battery)
	🔵 😑 slow	Docked Mode (trickle charging - 80-100% charge)
		Docked Mode (full charge)
		Docked Mode (battery error)

•	Docked Mode (wait)
	Docked Mode (error)
0	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)
	$\bullet \bullet \bullet$	Error Mode (system)
	$\bullet \bullet \bullet \bullet \bullet$	Error Mode (data buffer)
	$\bullet \bullet \bullet \bullet \bullet$	Error Mode (SD buffer)
	$\bullet \bullet \bullet \bullet \bullet \bullet \bullet$	Error Mode (SD I/O)
	•	Card is full
eless 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
Wir	•	Missed sync > O, CPU limited, Sync bad

Error Mode

INFORMATION



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



Material	6061 anodized Aluminum, ABS plastic	
Weight	<22 grams (with battery)	
Battery Life	Wireless Streaming (8h), Synchronous Logging (12h), Asynchronous Logging (16h)	
Wireless Radio	Nordic Semiconductor nRFLO1+ radio, ultra-low power	
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	

CONTACT US

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