OpenGo by MOTICON

Sensor Insole

Specification

Effective September 1st, 2023

Content

Overview

Model
Insole3

Moticon's OpenGo Sensor Insole is a versatile tool for sensing human foot dynamics.

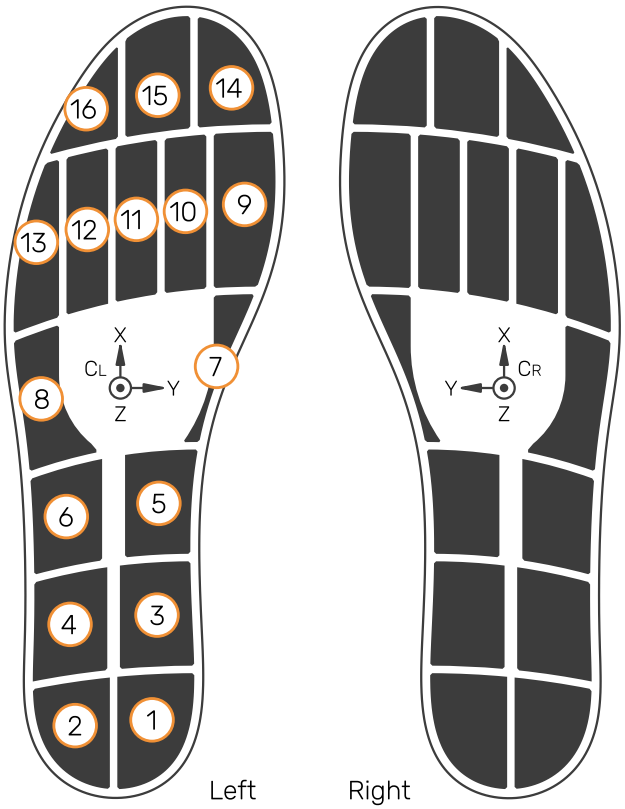
The sensor insole is fully integrated and highly flexible. It incoporates all technological components to execute standalone measurements. No external devices are required for data acquisition.

The following table depicts the basic specifications. For more detailed information, refer to the corresponding chapters of this document.

Feature	Specification
Sensors	16 pressure 3 acceleration 3 angular rate per side
Wireless	Bluetooth Low Energy 5.0
Power Supply	PD2032 con cell battery, rechargeable
Sizes	9 double sizes EU 32/33 - 48/49 US 1/2 - 12½/13½
Data Storage	Onboard memory & live data transmission to mobile device/ endpoint

Pressure Sensors

Quantity	Type	Axis	Range	Resolution	Hysteresis	Calibration
16 per side	capacitive plantar	Z	0-50 N/cm²	0.25 N/cm²	≤ 1 %	in-production lifetime



Notes

The sensor insole outline and the sensor positions are given in a common coordinate system.
The orientation of the coordinate systems is different for left and right sides.

Legend

(1) Sensor numbering
X/Y/Z Directions of coordinate system
CL/R Center of coordinate system

	Size 1	Size 2	Size 3	Size 4	Size 5	Size 6	Size 7	Size 8	Size 9	
TAI	12,129	13,240	14,462	15,787	17,237	18,824	20,572	22,456	24,524	mm²
TAS	7,578	8,330	9,179	10,109	11,129	12,241	13,696	15,042	16,525	mm²
SC [1]	62.5	62.9	63.5	64.0	64.6	65.0	66.6	67.0	67.4	%

Notes

[1] Sensor coverage varies over size due to keepout areas for wiring, electronics, antenna and borders which do not scale with size.

Legend

TAI: Total area of sensor insole.
TAS: Total area covered by pressure sensors.
SC: Sensor coverage. Area covered by pressure sensors in relation to total area of sensor insole.

Pressure Sensor Calibration

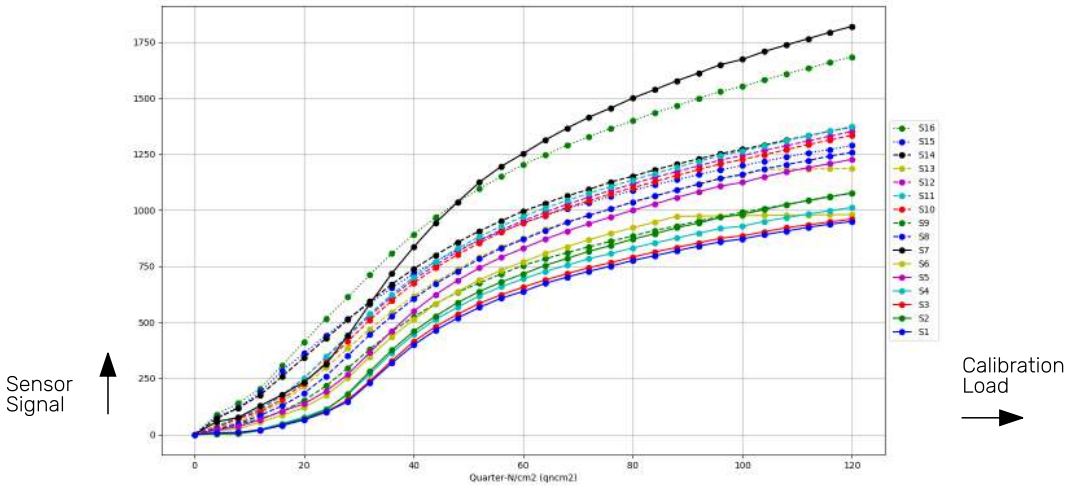
Type	Device	Procedure
in-production testing (IPT)	fluid cushion	each sensor insole is calibrated individually
user calibration	n/a	user to carry out motion sequence to calibrate sensor insole individually for highest accuracy [1]

Notes

[1] The calibration routine is carried out using the OpenGo App. Visit moticon.com/doc-opengo-calibration for more information.

Example

The figure shows a typical stack of calibration curves as generated in the in-production testing, representing the pressure sensor response function when loaded. Each calibration curve relates to one discrete pressure sensor.



Pressure Sensor Zeroing

Type	Description
automatic zeroing mode [1]	offsets and drifts in the pressure sensor readings are continuously compensated by automated firmware routines.
manual zeroing mode [2]	manual zeroing of pressure sensor readings.

Notes

[1] The automatic zeroing mode is always active. It is based on algorithms continuously checking sensor zero levels and compensates for sensor offsets and drifts which may occur due to lacing shoes and due to temperature changes.

[2] In addition, a manual zeroing routine can be carried out by means of a software function in the OpenGo App.
The routine does not disable the automatic zeroing, but overwrites current zero values. The routine should be applied in cases where no unloading cycles occur or are not feasible before measurement start.

Acceleration Sensors

Quantity	Type	Axis	Range	Resolution	Hysteresis	Calibration
1 per side	MEMS LSM6DSL	Y/Y/Z	± 16 g	0.488 mg/LSB 16 bit	n.a.	in-factory lifetime

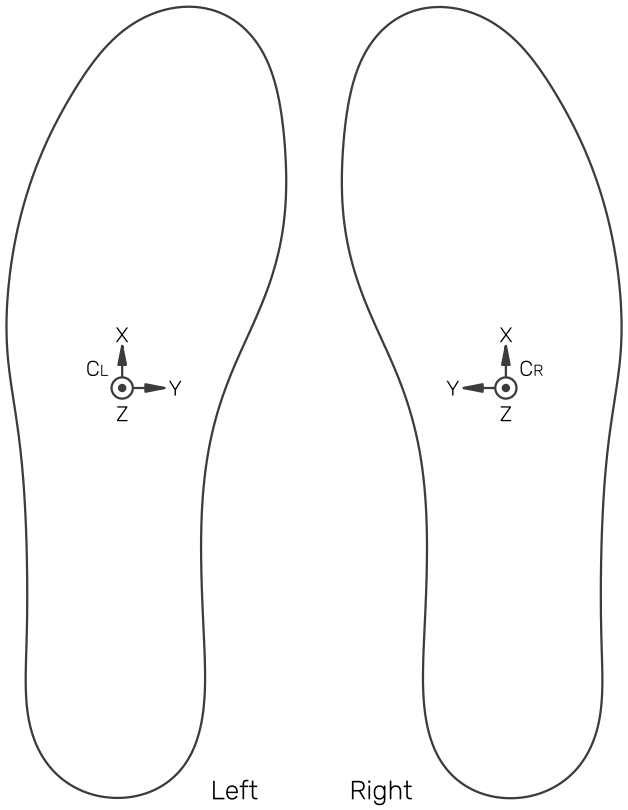
Notes

The position of the IMU sensor is at the origin of the coordinate system.
The orientation of the coordinate system is different for left and right sides.
Any coordinates to the sensor centers and outline coordinates of the data output are given in relation to the coordinate system.

Refer to the official LSM6DSL ST Microelectronics datasheet for further information.

Legend

①	Sensor numbering
X/Y/Z	Directions of coordinate system and acceleration
$C_{L/R}$	Center of coordinate system



Angular Rate Sensors

Quantity	Type	Axis	Range	Resolution	Hysteresis	Calibration
1 per side	MEMS LSM6DSL	$\Omega_X/\Omega_Y/\Omega_Z$	± 2000 dps	70 mdsp/LSB 16 bit	n.a.	in-factory lifetime

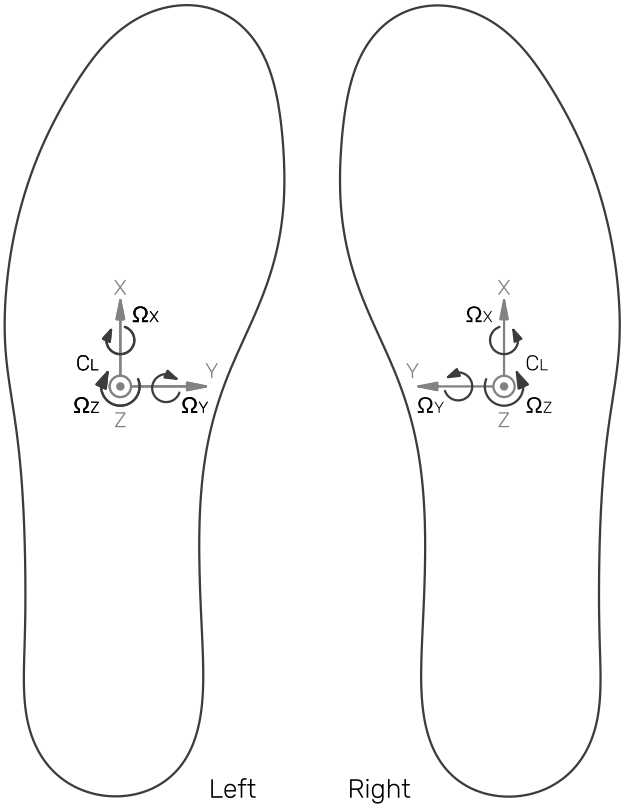
Notes

The position of the IMU sensor is at the origin of the coordinate system.
The orientation of the coordinate system is different for left and right sides.
Any coordinates to the sensor centers and outline coordinates of the data output are given in relation to the coordinate system.

Refer to the official LSM6DSL ST Microelectronics datasheet for further information.

Legend

(1) Sensor numbering
X/Y/Z Directions of coordinate system and acceleration
$C_{L/R}$ Center of coordinate system



Data Acquisition

Sample Rates [1]	Memory	Timer [2]	Primary Data Channels [1]	Computed Data Channels [1]
10 Hz 25 Hz 50 Hz 100 Hz	32 MB [3] FLASH non- extendable	drift ≤ 1 %	TS PR [1...16] ACC [X,Y,Z] ANG [X,Y,Z]	COP [X,Y] TF [Z]

Notes

[1] Sample rates and data channel combinations are software-selectable in the OpenGo App.
Each data channel can be activated/deactivated individually. The time stamp channel is always active.

[2] Left and right sensor insoles are time synchronized. Time drift refers to total drift of timing data over time from start of measurement.
Date information (yyyy/mm/dd) from control device, i.e. mobile device/ smartphone, is recorded upon start of measurement.
For the time stamp, the internal clock creates timing information at the resolution of the sample rate (hh:mm:ss.xyz).

[3] From production date 08-2020. Before that date: 16 MB.

Legend

TS: Time stamp in s (resolution in ms).
PR: Pressure channels 1 to 16 in N/cm².
ACC: Acceleration channels in X, Y and Z axis direction in g.
ANG: Angular rates about the X, Y and Z axes in dps.
COP: Center of pressure in X and Y axis direction in the range [-0.5...+0.5] related to corresponding sensor insole lenght or width.
TF: Total force (= ground reaction force) in Z axis direction in N.

Sensor Setup [1]	TR @ 10 Hz	TR @ 25 Hz	TR @ 50 Hz	TR @ 100 Hz	
Full Setup	11:20	04:32	02:16	01:08	hh:mm
Standard Setup	13:58	05:35	02:47	01:24	hh:mm
Monitoring Setup	32:15	12:54	06:27	03:13	hh:mm

Sensor Setup [1]	TS	PR	ACC	ANG	COP	TF
Full Setup	●	●	●	●	●	●
Standard Setup	●	●	●		●	●
Monitoring Setup	●		● [2]		●	●

Notes

Recording times refer to continuous data recording in Recording mode. Effective recording times can be higher when using SmartRecording mode for activity triggered data recording. For example, A measurement acquired with standard sensor setup in SmartRecording mode @50 Hz can take a up to 5 times of the duration of continuous recording if the wearer of the sensor insoles is only active 20 % of the time.

[1] The depicted sensor setups are setups which are pre-defined in the OpenGo App. Other Sample rates and data channel combinations are software-selectable in the OpenGo App. Each data channel can be activated/deactivated individually. The time stamp channel (TM) is always active. Indicated recording times apply for sensor insoles with 32 MB memory produced from 08/2020!

[2] Only Z axis.

Legend

TR: Maximum recording time for continuous on-board data recording.

Operation Modes

Standard Modes [1]	Description	Use Case
Preview	Transmits fixed basic sensor data wirelessly	Live showcasing and activity checks in the OpenGo App
Live	Transmits sensor data wirelessly to endpoint (desktop computer)	Direct data transmission for storage on endpoint
Record	Sensor data recording on onboard memory	Standalone data acquisition without mobile phone or tablet
Transmit	Wireless sensor data transmission from onboard memory to endpoint	Transfer of previously recorded sensor data to endpoint for storage on endpoint

Intelligence Modes [1]	Description	Use Case
Smart Recording [2]	Activity triggered recording mode. Recording is only resumed when user is active (load, motion)	Longterm gait monitoring
Smart Sleep	Automatic shutdown into power safe mode when sensor insole is not in use. No hardware switch.	No user interaction for turning on/off required

Notes

[1] The operation modes can be selected in the OpenGo App.
[2] Smart Recording is an activity triggered recording mode where internal firmware algorithms control the intermediate pausing and resuming in action. The mobile device (phone/tablet) is only required for starting and stopping, not for the recording itself.
For further details on the operation modes refer to the product pages on moticon.com/opengo/app.

System Functions

Function	Description
Firmware Update	The sensor insole firmware can be updated wirelessly using the OpenGo App. Firmware updates are delivery via updates of the OpenGo App.
File Management	The sensor insole firmware includes a file management system. Measurements can be selected, deleted and transmitted individually via OpenGo App.
System Status	The sensor insole firmware continuously checks the system status and transmits status information: 1. Restarts 2. Active Time 3. General (firmware version, serial number, size, side)
Battery Status	The sensor insole firmware detects the battery charge level and transmits the status to the OpenGo App.

Connectivity

Wireless Standard	Profile	Wireless Range	Bandwidth
BLE 5.0 [1]	proprietary [2]	≥ 10.0 m [3]	54 kB/s [4]

Data Volume	Download Time [5]	Recording Equivalent [5]
28.80 MB [6]	00:08:54 hh:mm:ss	68 min @ 100 Hz Full Setup
4.30 MB	00:01:20 hh:mm:ss	10 min @ 100 Hz Full Setup
0.43 MB	00:00:08 hh:mm:ss	1 min @ 100 Hz Full Setup

Notes

1 Version refers to integrated wireless chip. BLE connection to smartphones can be established from version 5.0.
2 No standard BLE profile is used.
3 Depends on environmental conditions and other active wireless devices.
4 Maximum data transmission bandwidth. Depends on smartphone performance.
5 Given times and setups are estimates and shall illustrate expectable download times of previously on-board recorded sensor data to a smartphone using the OpenGo App.
6 Includes 10 % overhead for auxiliary data.

Notes

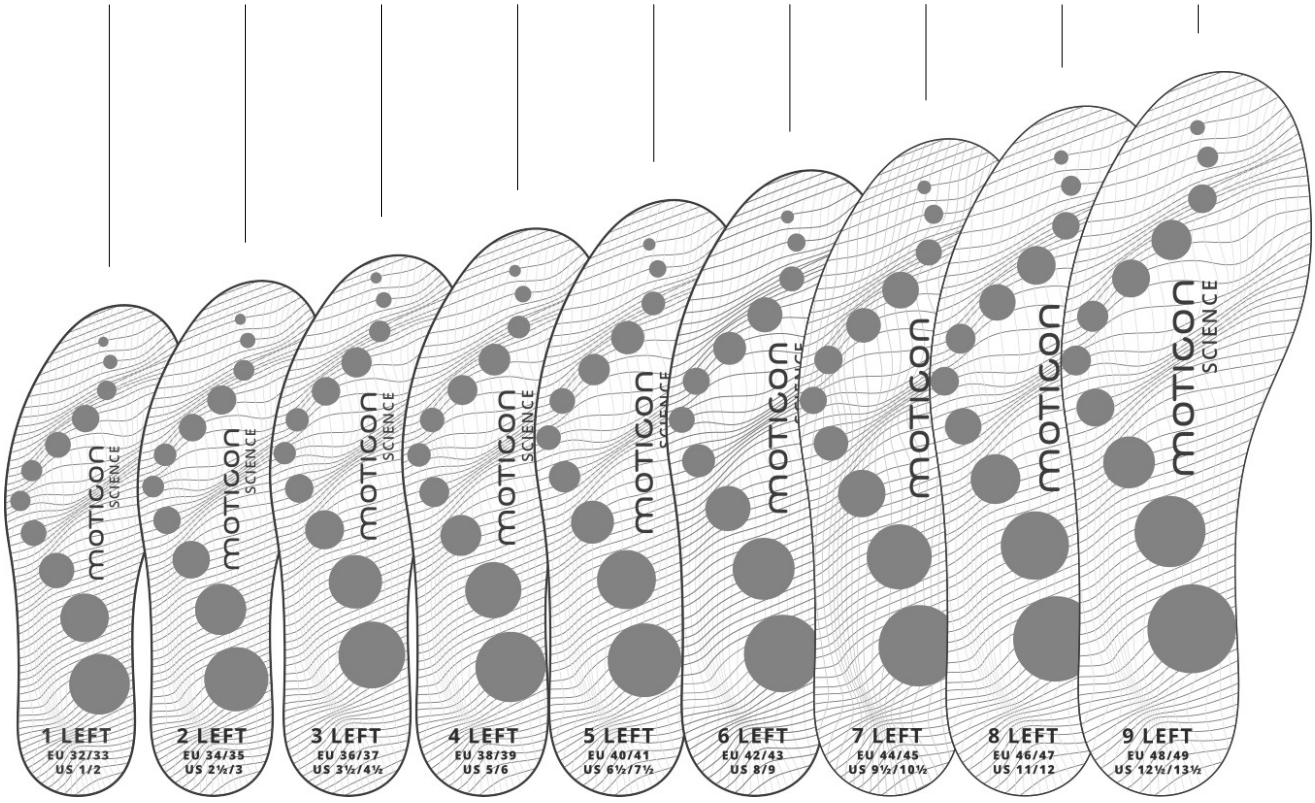
OpenGo Sensor Insoles transmit sensor data via BLE to the mobile device (OpenGo App). Sensor data is not stored on the mobile device. The OpenGo App transmits sensor data directly to the endpoint (OpenGo Software).
For instructions of use refer to the tutorials on account.moticon.com.

Legend

--- Wireless data transmission.

Sizes

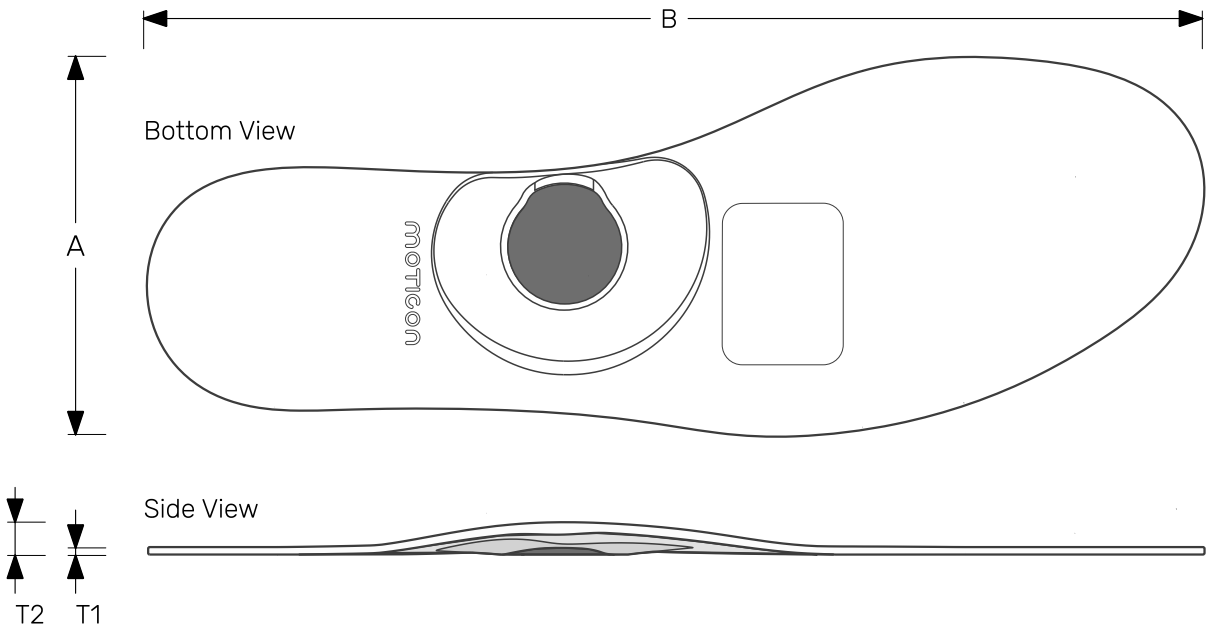
	Size 1	Size 2	Size 3	Size 4	Size 5	Size 6	Size 7	Size 8	Size 9
EU	32/33	34/35	36/37	38/39	40/41	42/43	44/45	46/47	48/49
US	1/2	2½/3	3½/4½	5/6	6½/7½	8/9	9½/10½	11/12	12½/13½



Notes
Refer to the OpenGo Sensor Insole fitting guide for more detailed information moticon.com/opengo/sensor-insole-sizes.

Dimensions & Weight

	Size 1	Size 2	Size 3	Size 4	Size 5	Size 6	Size 7	Size 8	Size 9	
A	80.2	83.4	86.7	90.2	93.8	97.5	101.4	105.5	109.7	mm
B	214.9	225.6	236.8	248.6	261.1	274.2	288.0	302.4	317.5	mm
T_1	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	mm
T_2	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	mm
W[1]	63	68	72	77	81	87	92	96	102	g



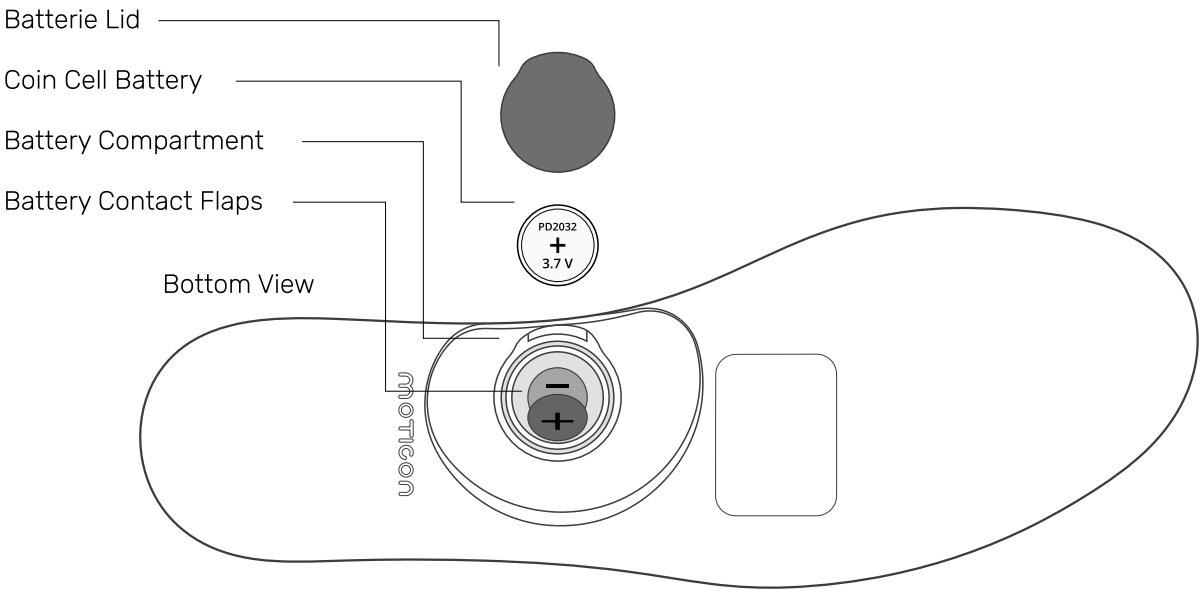
Notes

Dimensions may vary ± 1.5 mm due to production tolerances.

[1] Weight is per sensor insole, includes coin cell battery and the battery lid.

Power Supply

Supply Voltage	Power Consumption	Battery Type [1]	Battery Form Factor	Battery Technology
3.7 V ± 0.4 V	varies based on operation mode	1 coin cell rechargeable	2032	Lithium Ion



Caution:

[1] Recommended coin cell battery type is PD2032 (Route Jade, South Korea), available from Moticon.
DO NOT USE primary coin cell batteries type CR2032 or mangan based rechargeable coin cell batteries type ML2032.
These batteries have a nominal voltage of 3.0 V and continuous voltage drop in use.
Moticon SCIENCE Sensor Insoles require a minimum operation voltage of 3.2 V. A lower operating voltage causes malfunction.

Notes

Refer to the tutorials for coin cell battery handling and charging recommendations on account.moticon.com.

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