move
SOLUTIONS

Environmental Sensor

Instruction Manual

Quick installation guide and system operation
Important safety, compliance and warranty information

Environmental Sensor

Instruction Manual - English

This document applies to:
ENV-STD-LR-1, version 1.0

Index

Warnings

<div style="text-align: right; font-size: 3em;">1</div>

For the correct and safe operation of the product, it is recommended to read and follow the instructions in this manual.

Great attention should be paid to the following warnings. Move Solutions shall not be held responsible for inconveniences, damage or malfunctions due to lack of compliance to the prescriptions and suggested use in this manual.

- The declared IP rating is intended with either the protective cap on or a compatible cable connected to each connector of the sensor. Do not expose the product to humidity or dust in any other condition.

- Do not remove the windscreen from the microphone unless when instructed to do so

- Do not in any circumstance unscrew or loosen the microphone's cap

- Do not connect the product to an external power supply that exceeds the limits in this document.

- Before use, make sure that the product conforms to the description in this manual and that no damage is present.

- Do not use batteries other than those specified by Move Solutions without express approval from a Move Solutions representative.

- The product is not intended for use in applications where safety is extremely critical, such as medical-related applications or life-security systems.

- On top of the prescriptions in this manual, the user should operate in compliance with local standards for security and health, and according to the best engineering practices for a safe installation.

- The product must be kept clear of children, animals, and any unauthorized personnel.

- Do not disassemble the product except when explicitly instructed in this manual, as this could cause malfunctions and damage the product.

- Do not attempt to repair or modify the product.

- If the product releases smoke or heat during operation, immediately disconnect the batteries.

- Do not expose the product to temperatures outside the specified range or heat sources.

- Do not expose the product to liquids of any kind and do not operate on it with wet hands. The product can only be exposed to water when the conditions to guarantee the IP rating are satisfied.
- Do not operate on the product in extreme weather conditions that may damage the device or the user, such as thunderstorms or snowstorms.
- Do not disperse the product or part of it in the environment.
- Correct functioning of the product in environments with high radio activity is not guaranteed.
- The product is compliant to all regulations concerning the fair use of ISM radio bands. However, given the free nature of these bands, occasional conflict with nearby devices operating on the same bands cannot be fully prevented.

This product contains electronic components and batteries that must be disposed of separately from common household waste, according to local regulations. To ensure correct disposal of the product at the end of its lifecycle, please refer to your local authority. Failure to comply to the regulations could lead to penalties.

NOTE

- In case of deterioration or loss of this manual, a compliant copy may be requested by the customer from the manufacturer. For increased security, we suggest that you keep a copy of this manual in a place where it cannot be damaged or lost.

FC FCC Compliance

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

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

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

ISED Compliance

This device complies with Industry Canada licence-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 Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

(1) l'appareil ne doit pas produire de brouillage, e

(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This equipment complies with Industry Canada radiation exposure limits set forth for an uncontrolled environment.

Cet équipement est conforme à l'exposition aux rayonnements Industry Canada limites établies pour un environnement non contrôlé.

Symbols and provisions used in the documentation

The following symbols and conventions are used throughout the documentation. Please follow all warnings and instructions marked on the product.

⚠️ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, can result in minor or moderate injury.

❗ IMPORTANT

IMPORTANT indicates a potentially hazardous situation which, if not avoided, can result in property damage or loss of product functionality.

NOTE

NOTE specifies the operating environment, installation conditions, or special conditions of use.

Bold
Bold text highlights an important point or keywords for understanding the context.

Italic
Text in italics is used for specific names for sensors, options of the Move Cloud Platform, or chapters of this manual.

Fire Danger icons warn of the possibility of fire.

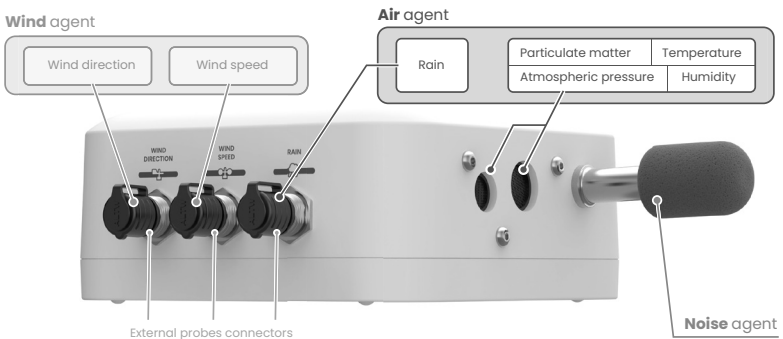Electrical Danger icons warn of the risk of electric shock.

Prohibition icons indicate actions that must not be performed.

General description

<div style="text-align: right; font-size: large;">2</div>

The Environmental Sensor is a wireless sensor that can measure a variety of parameters such as particulate matter, environmental noise, and a wide range of weather-related parameters for an all-round understanding of the environment around it.

Wind agent

| Wind direction | Wind speed |

Air agent

| Rain |

| Particulate matter | Temperature |
| Atmospheric pressure | Humidity |

External probes connectors

Noise agent

KEY FEATURES

- Affordable 3-in-1 particulate, weather, and noise station
- For indoor and outdoor operation
- Compatible with external 12-24V power supplies for extended operation
- Battery operation for fast deployment
- Wireless LoRaWAN connection
- Fully remote configuration and management
- *Low Power* and *Always On* modes for optimal battery life management
- Noise parameters calculated according to definitions in the IEC 61672 regulation
- PM_1, $PM_{2.5}$, PM_4 and PM_{10} measurements with instantaneous, average, and maximum values and trigger mode

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- Wind direction and speed measurement with instantaneous, average, and maximum values and trigger mode (external probes required)

- Rainfall measurement with instant and total values and trigger mode for geohazard applications (external probe required)

- Data management and processing through the MyMove IoT Platform

Its wireless design ensures seamless integration with other Move Solutions and IoT Platform.

The sensor offers a variety of working modes to accommodate different scenarios, all manageable through the MyMove IoT Platform. To operate, the sensor requires a Move Solutions gateway installed nearby.
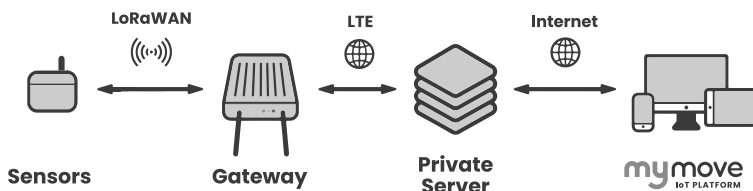
AGENTS

The Environmental Sensor is made up of three **Agents** that behave as three independent sensors.

The **Noise agent** measures environmental noise through a microphone designed specifically for this product and allows the user to measure Leq over a selection of different time windows, as well as L_{max}, L_{pk}, L_{10}, L_{50} and L_{90}, all with both **A and C frequency weightings and F and S time-weightings** as defined in IEC 61672-1. The power efficient microphone allows for up to 5 weeks of continuous monitoring on batteries alone, or an external power supply can be connected for long term monitoring.

The **Air agent** outputs data on particulate matter in the air: instantaneous mass concentration of PM_1, $PM_{2.5}$, PM_4 and PM_{10} can be measured in *Low Power* mode, while *Always On* mode allows the user to collect data on the maximum and average mass concentration of particulates in the air and set acquisitions to trigger when the instantaneous mass concentration exceeds a threshold. To maximize insight on these

parameters the agent collects data on atmospheric pressure, ambient temperature and relative humidity, and an external tipping bucket rain probe can be connected to measure instantaneous and cumulative rainfall. A threshold can be set to trigger an acquisition when the total rainfall over a specified time exceeds a user defined threshold.

The **Wind** agent takes measurements from two external **Wind speed** and **Wind direction** probes. The *Low Power* mode consists of programmed reading of instantaneous speed and direction, with cadence ranging between 2 minutes and 24 hours. A more power-hungry *Always On* mode enables the user to also measure average and maximum wind speeds, as well as enabling a trigger mode on instantaneous wind speed.

Technical Data

Noise agent		
Technology	MEMS	
Resolution	0.01 dB$_{SPL}$	L_{Aeq}, L_{Ceq}, L_{AFmax}, L_{CFmax}, L_{ASmax}, L_{CSmax}, L_{Apk}, L_{Cpk}
	1.0 dB$_{SPL}$	L_{AF10}, L_{AF50}, L_{AF90}, L_{CF10}, L_{CF50}, L_{CF90}
Accuracy (1 kHz, 94 dB$_{SPL}$)	± 0.5 dB$_{SPL}$	
Sampling frequency	48 kHz	
Output parameters	• L_{Aeq} over the selected averaging time • L_{Ceq} over the selected averaging time • L_{AFmax} since last communication • L_{CFmax} since last communication • L_{ASmax} since last communication • L_{AFmax} since last communication • L_{Apk} since last communication • L_{Cpk} since last communication • L_{AF10} since last communication • L_{AF50} since last communication • L_{AF90} since last communication • L_{CF10} since last communication • L_{CF50} since last communication • L_{CF90} since last communication	
Cadence (communication period)	2 minutes, 5 minutes, 10 minutes, 15 minutes, 30 minutes, 1 hour, 2 hours, 4 hours, 6 hours, 8 hours, 10 hours, 12 hours, 14 hours, 16 hours, 18 hours, 24 hours.	
Evaluation window	2 minutes, 5 minutes, 10 minutes, 15 minutes, 30 minutes, 1 hour, 2 hours, 4 hours, 6 hours, 8 hours, 10 hours, 12 hours, 14 hours, 16 hours, 18 hours, 24 hours.	

Air agent		
Cadence (communication period)	2 minutes, 5 minutes, 10 minutes, 15 minutes, 30 minutes, 1 hour, 2 hours, 4 hours, 6 hours, 8 hours, 10 hours, 12 hours, 14 hours, 16 hours, 18 hours, 24 hours.	
Particulate matter		
Technology	Laser scattering	
Range	0 - 1000 µg/m3	
Size range	**PM$_1$**	0.3 – 1.0 µm
	PM$_{2.5}$	0.3 – 2.5 µm
	PM$_4$	0.3 – 4.0 µm
	PM$_{10}$	0.3 – 10.0 µm
Accuracy (**PM$_1$** and **PM$_{2.5}$**)	Reading < 100 µg/m^3	±5 µg/m^3 and 5% of reading
	Reading > 100 µg/m^3	± 10% of reading
Accuracy (**PM$_4$** and **PM$_{10}$**)	Reading < 100 µg/m^3	±25 µg/m^3
	Reading > 100 µg/m^3	± 25% of reading
Resolution	0.1 µg/m^3	
Output parameters (***Low Power*** mode)	Instantaneous **PM$_1$**, **PM$_{2.5}$**, **PM$_4$** and **PM$_{10}$**	
Output parameters (***Always On*** mode)	• Instantaneous **PM$_1$**, **PM$_{2.5}$**, **PM$_4$** and **PM$_{10}$** • Maximum **PM$_1$**, **PM$_{2.5}$**, **PM$_4$** and **PM$_{10}$** since last communication • Average **PM$_1$**, **PM$_{2.5}$**, **PM$_4$** and **PM$_{10}$** over the selected evaluation window	
Threshold resolution (***Always On*** mode only)	10 µg/m^3	
Evaluation window	2 minutes, 5 minutes, 10 minutes, 15 minutes, 30 minutes, 1 hour, 2 hours, 4 hours, 6 hours, 8 hours, 10 hours, 12 hours, 14 hours, 16 hours, 18 hours, 24 hours.	

Rain (external probe require, see *Ordering information*)	
Technology	Tipping bucket
Resolution[1]	0.2 mm
Accuracy	± 4% (at 2 mm/min)
Output parameters	• Rainfall since last communication • Total rainfall over the selected evaluation window
Evaluation window	2 minutes, 5 minutes, 10 minutes, 15 minutes, 30 minutes, 1 hour, 2 hours, 4 hours, 6 hours, 8 hours, 10 hours, 12 hours, 14 hours, 16 hours, 18 hours, 24 hours.
Threshold resolution	Same as Resolution. Threshold is applied to the total rainfall over the selected evaluation window.
Atmospheric pressure	
Resolution	0.01 hPa
Accuracy	±0.5 hPa
Range	0 – 1250 hPa
Output parameters	Instantaneous atmospheric pressure
Temperature	
Resolution	0.01 °C
Accuracy	±0.7 °C
Output parameters	Instantaneous ambient temperature
Relative Humidity	
Resolution	0.01 %RH
Accuracy	±6 %RH (30-70 %RH)
Output parameters	Instantaneous relative humidity

[1] These values are based on the rain probe provided by Move Solutions as an accessory. Other rain probes may differ.

Wind agent (external probe require, see *Ordering information*)	
Technology	External 4-20 mA wind direction and wind speed sensors
External sensor supply voltage	12.3 VDC ±2% (70 mA)
Supported analog interface	4-20 mA (3 wires)
Range	0.4-25 mA
Resolution	0.001 mA
Accuracy of readout	±0.03 mA
Accuracy of wind speed sensor	±0.3 m/s
Accuracy of wind direction sensor	±3°
Output parameters (**Low Power** mode)	• Instantaneous wind speed (3 seconds average) • Instantaneous wind direction
Output parameters (**Always On** mode)	• Instantaneous wind speed (3 seconds average) • Instantaneous wind direction • Average wind speed over the selected cadence time • Maximum wind speed since last communication
Cadence (communication period)	2 minutes, 5 minutes, 10 minutes, 15 minutes, 30 minutes, 1 hour, 2 hours, 4 hours, 6 hours, 8 hours, 10 hours, 12 hours, 14 hours, 16 hours, 18 hours, 24 hours.
Threshold resolution (**Always On** mode only)	0.1 mA

General data	
Wireless connection technology	Sub-GHz LoRaWAN protocol[1] (gateway required)
Supported LoRaWAN regions	EU868, US915, AU915

Wireless coverage[2]	1 km line of sight from the nearest gateway
Internal storage	• Up to 10000 air agent events *or* • Up to 14000 noise agent events *or* • Up to 24000 wind agent events
Cable connection	Move Solutions 8-pole connector (***Move Link***). For compatible accessories visit Move Solutions' website or contact us directly.
Battery	2x 19Ah 3.6V replaceable lithium battery (Suggested: EVE ER34615PHR4).
External Power	12 – 24 VDC (nominal) Minimum voltage: 11 VDC Maximum voltage: 28 VDC
Maximum required power from external power supply	900 mW
Operating range	0 ~ 90 (non-condensing) %RH -10 ~ 50 °C
Storage conditions	0 ~ 80 (non-condensing) %RH -40 ~ 70 °C
Dimensions	220.2 x 206.6 x 70 mm
Weight[3]	1.5 kg
Case material	Polycarbonate
Microphone material	Anodized aluminum
Installation options	Wall or pole mount

[1] The sensor's LoRaWAN connection operates on a best-effort basis, which means that while most data packets are delivered, there is a slight possibility of occasional packet loss.

[2] Wireless coverage may vary based on the actual deployment scenario.

[3] Refers to the sensor unit itself. External accessories, such as mounting plate, external connectors and probes are not included since they are optional and/or can be replaced with alternative parts to fit specific applications.

What's in the box

Each Environmental Sensor is shipped inside its own cardboard box. On the box, a label is affixed with the EUI and Serial Number of the product. The EUI is very important as it identifies the sensor on the MyMove IoT Platform.
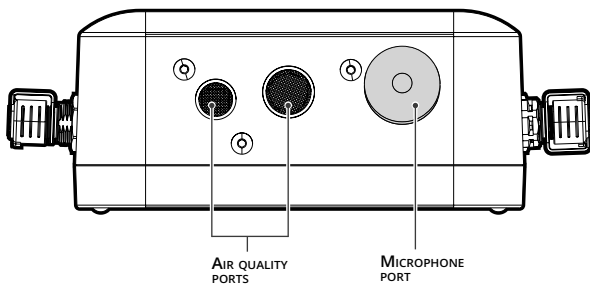
WARNING

- **DO NOT** use the Environmental Sensor if any of the components looks broken or tampered with.

A label bearing the same information as the one on the packaging is affixed on the side of the of the Environmental Sensor:

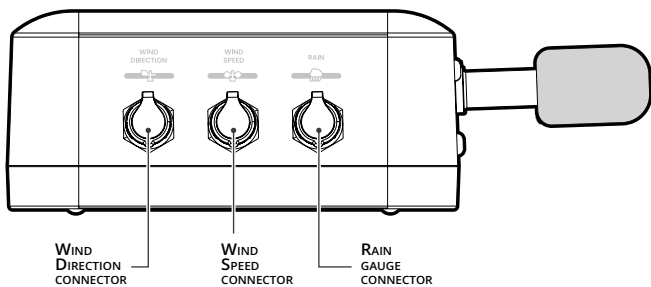Looking at the product you'll see:

AIR QUALITY
PORTS

MICROPHONE
PORT

LEFT VIEW

WIND
DIRECTION
CONNECTOR

WIND
SPEED
CONNECTOR

RAIN
GAUGE
CONNECTOR

RIGHT VIEW

MOVE LINK
CONNECTOR

EXTERNAL POWER
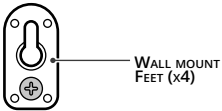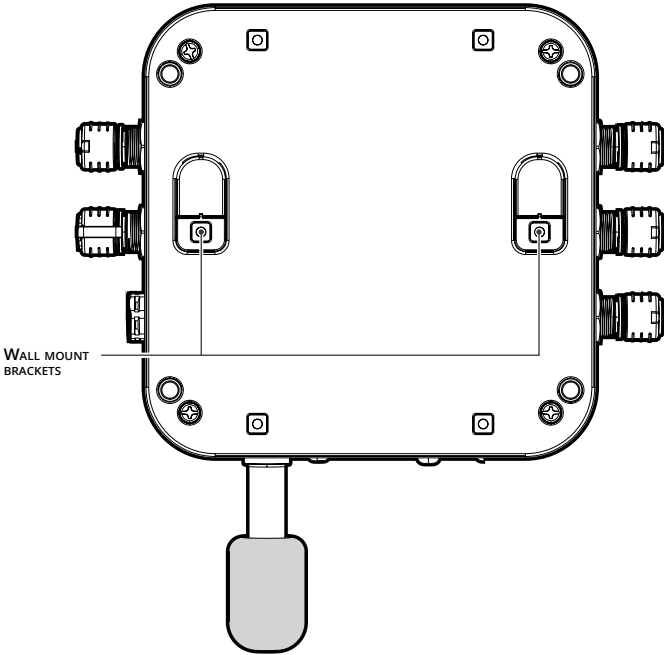CONNECTOR

WALL MOUNT
BRACKETS

WALL MOUNT
FEET (x4)

Installation

5
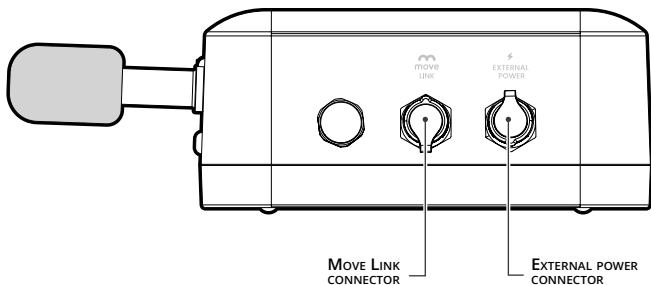
⚠️ ⚡ **WARNING**

- **DO NOT** use an electric screwdriver during installation to avoid damage to the device, especially when screwing in the self-tapping screws.

Before the installation check that you have the right tools for the operation

- Screwdrivers and wrenches of suitable size
- A drill of suitable size (for mounting to a wall)

5.1 Positioning of the system

Follow these rules to make sure the system works to the best of its performance:

1. When mounting the wind direction sensor, make sure the arrow on the base of the sensor points North.
2. To optimize the noise monitoring performance, place the Environmental Sensor higher than the environment to be monitored. Keep the area surrounding the microphone clear from hanging cables and other obstacles to minimize reflections.
3. To optimize the air monitoring performance, avoid exposition to direct sunlight as much as possible. When a solar panel is mounted on the same pole, it is advised to place the Environmental Sensor under the shade of the panel.
4. To optimize the air monitoring performance, avoid restricting the airflow to the air ports of the Environmental Sensor by placing it in a niche, or by placing obstacles around it.
5. To optimize the wind monitoring performance, place the wind sensors atop the pole and free from any obstacle.
6. When mounting the rain sensor to a pole, make sure it's not directly over the Environmental Sensor to avoid channeling water on the unit. Avoid placing the rain sensor directly under the wind sensors to avoid "shadow effect" from the wind sensors. See picture for optimal installation of the sensors.

5.2 Wall mounting

(!) IMPORTANT

⊘

- Wall mounting may alter the reading of the noise agent by creating unwanted reflections. It can also affect the air agent by restricting the air flow to the ports, and can lead to false positive if the wall is in itself a source of dust.

FASTENED TO THE WALL (PREFERRED)

1. Screw the four wall mount feet to the box as shown in the picture, with the foot closest to the microphone facing the inside of the box instead of the outside.
2. Drill 3 holes in the wall and insert the 3 anchors.
3. Fix the Environmental Sensor to the wall with the 3 screws.

WALL MOUNT FEET (x4)

The mount foot over the microphone has to be intended only for a proper leveling the device over the wall.
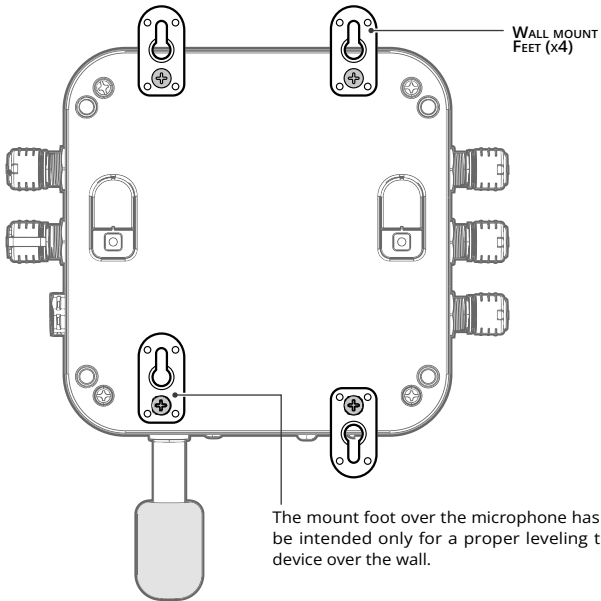
HANGING

1. Screw two wall mount feet to the back of the box as shown in the picture.
2. Drill 2 holes in the wall and insert 2 anchors.
3. Insert 2 screws in the holes.
4. Hang the environmental sensor to the two screws.

WALL MOUNT
FEET (x2)
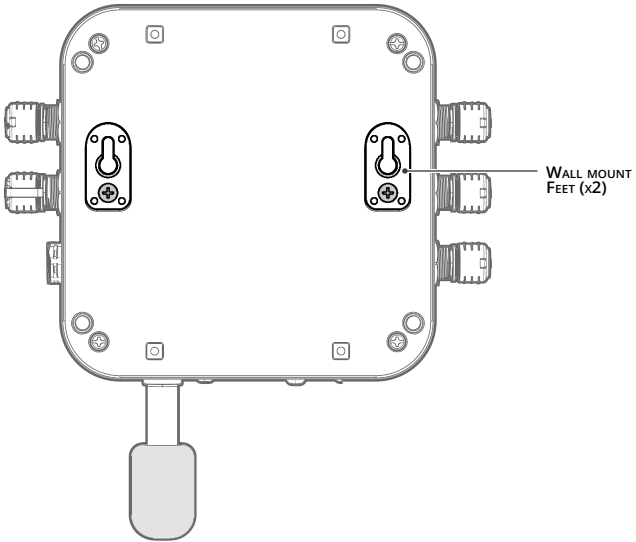
5.3 Connecting an external power source

⚠️ **WARNING**

- When connecting an external power source make sure the power source is within the limits prescribed in this manual. Failure to comply with this warning could result in damage to the device.
- The cable used should be no longer than 3 meters.

Use the connector that's shipped with the product. The cable used should be no longer than 3 meters, have a diameter between 4 and 8 mm, and the nut of the connector should be tightened between 0.4 and 0.6 Nm to ensure that the connector is watertight.

1. Using a small flat-head screwdriver, loosen the screws on the terminal
2. Strip the cable's external jacket about 15 mm from the end. Expose the wires about 5 mm from the end.
3. Pass the cable through the rubber sealing ring, the plastic nut and the plastic cylinder.
4. Locate the small numbers embossed next to each terminal of the connector head.
5. Wire the two cables from the power source to the connector head as per the table below.
6. Screw the cylinder to the connector head.
7. Slip the rubber sealing ring into the cylinder and tighten the nut, taking care not to twist the cable.

The table shows how to wire the cable to the connector.

M12 Connector	Power source
1	V-
2	Not connected
3	Not connected
4	V+

MyMove IoT Platform

6

6.1 General settings

To access MyMove IoT Platform, connect to the URL that you have been supplied with by Move Solutions and log in with your credentials.

Through the MyMove IoT Platform you'll be able to:

- check the data of the last 24 hours and the current state of all your devices
- explore all the data that has been gathered by your sensors since day one
- set alarms and email notifications for each sensor
- manage settings for each sensor
- ...and more!

NOTES

- The MyMove IoT Platform is frequently updated with new features, fixes, and reviews. Refer to its documentation for more detailed information.
- Settings that alter the Environmental Sensor behavior (settings that don't concern email alarms and sensor naming) can require up to 1 hour to be synchronized with the sensor.

Aquired data

<div style="text-align:right">**7**</div>

The Environmental Sensor is divided in three "agents" which essentially behave as three independent sensors. Each agent is also divided in "channels" that act as a group of outputs that can be thought as linked together.

- Noise agent: handles all measurements from the microphone. This agent is made of a single channel.
- The Air agent is made up of two channels:
  - The Air quality channel centers around PM measurements, and integrates temperature, humidity and pressure.
  - The Rain channel is unlocked by connecting an optional rain probe to the sensor.
- The Wind agent is also made up of two channels:
  - The Wind speed channel requires an external wind speed probe and can output data on instant, average and maximum wind speed.
  - The Wind direction channel also requires an external wind direction probe.

Data from any channel can be divided into 3 categories

- Instant data
- Cadence-based data
- Average data

Instant data refers to data that is acquired at the time of transmission. For example, the instant pressure output from the air quality channel is the atmospheric pressure when the sensor transmits this data to the cloud platform, without any sort of filtering or averaging.

Cadence-based data is data that is calculated during the time between one transmission and the next. For example the total rain output from the rain channel of the air agent is the amount of rainfall since the last transmission. Similarly, maximum PM_1 from the air quality channel is the maximum PM_1 registered since the last transmission.

Finally, average data is measured continuously, and the data's moving average is continuously calculated and used as output. For example, when the noise agent's average time is set to 1h the L_{Aeq} output is the average A-weighted sound pressure level over the last hour at the time of transmission. If the cadence is 5 minutes, this means that at 11:00 AM the user will receive L_{Aeq} averaged between 10:00 AM and 11:00 AM, and at 11:05 AM the user will receive L_{Aeq} averaged 10:05 AM and 11:05 AM. Notice how this data is independent from the cadence time, which only affects how often the data is presented to the user. Think of this as having an instrument on your desk that is continuously measuring the average of some input over the last hour (the evaluation window) and continuously updating the reading on the screen, and every 5 minutes (the cadence time) you are looking at the instrument's screen and writing down the reading.

7.1 Noise agent

The table below shows the output data of the agent.

Output	Category
L_{Aeq}	Average
L_{Ceq}	Average
L_{AFmax}	Cadence-based
L_{ASmax}	Cadence-based
L_{CFmax}	Cadence-based
L_{CSmax}	Cadence-based
L_{Apk}	Cadence-based
L_{Cpk}	Cadence-based
L_{AF10}	Cadence-based
L_{AF50}	Cadence-based
L_{AF90}	Cadence-based
L_{CF10}	Cadence-based
L_{CF50}	Cadence-based
L_{CF90}	Cadence-based

These parameters are defined in accordance with the IEC 61672-1 Standard. The letters A and C in the name of the outputs stand respectively for A-weighted and C-weighted sound pressure level, which are two different frequency weightings specified in the standard and used in most applications. The letters F and S in the name of the outputs stand respectively for fast and slow time-weighting and affect how much the parameter is sensitive to sudden changes in noise level; these two weightings as well are defined in the standard and used in many applications.

Every parameter output by this agent is expressed in dB_{SPL}.

L_{Aeq} and L_{Ceq} are defined in the standard as the "time-averaged sound level equivalent continuous sound level". Simply put, they measure the average noise level over a given evaluation window, respectively with A-weighting and C-weighting.

L_{AFmax}, L_{ASmax}, L_{CFmax}, L_{CSmax} represent the maximum sound pressure level over the cadence time, in all four combinations of frequency-weighting and time-weighting.

L_{Apk} and L_{Cpk} are similar to the L_{max} outputs, but without taking into account the time-weighting.

L_{AF10}, L_{AF50} and L_{AF90} represent respectively the 10th, 50th and 90th percentile of the sound level with fast time weighting and A-weighting. The same goes for L_{CF10}, L_{CF50} and L_{CF90}, but with C-weighting instead.

7.2 Wind agent

This agent is composed of two channels: the wind speed channel and the wind direction channel. The two channels share the cadence time, and each of them has additional settings.

WIND SPEED CHANNEL

The wind speed channel has two working modes.

In low power mode, the channel is turned on only at the time of transmission to read the instant wind speed. This allows for low power consumption, extending the battery life of the product.

In always on mode on the other hand, the probe is kept on and sampled at short intervals; this allows the channel to compute maximum and average values of wind speed at the expense of the battery life of the product. In always on mode the user can also enter a threshold that immediately triggers an acquisition when exceeded. Triggered acquisitions do not include average and maximum wind speed outputs, but also trigger the wind direction channel to give more complete data.

Output	Category	Low Power Mode	Always On Mode	Triggered Acquisition
Instant wind speed	Instant	Yes	Yes	Yes
Average wind speed	Cadence-based	No	Yes	No
Maximum wind speed	Cadence-based	No	Yes	No

NOTES

- Instant wind speed and instant wind direction are computed as the 3 seconds average of the signal from the probes.
- although being an "average" measurement, average wind speed has no evaluation window setting. Instead, it is always averaged over the cadence time.

WIND DIRECTION CHANNEL

The wind speed channel has two working modes.

In low power mode, the channel is turned on only at the time of transmission to read the instant wind speed. This allows for low power consumption, extending the battery life of the product.

In always on mode on the other hand, the probe is kept on and sampled at short intervals; this allows the channel to compute maximum and average values of wind speed at the expense of the battery life of the product. In always on mode the user can also enter a threshold that immediately triggers an acquisition when exceeded. Triggered acquisitions do not include average and maximum wind speed outputs, but also trigger the wind direction channel to give more complete data.

Output	Category
Instant wind direction	Instant

NOTE

- Instant wind speed and instant wind direction are computed as the 3 seconds average of the signal from the probes.

7.3 Air agent

The air agent is made up of two separate channels: the air quality channel and the rain channel. The two channels share the cadence, and each one has its own settings as well.

AIR QUALITY CHANNEL

The air quality channel has two working modes. In low power mode the particulate matter sensor is turned on only at the time of transmission to measure instantaneous particular matter concentrations, and is then turned back off to ensure a much longer battery life. In always on mode on the other hand the particulate matter sensor is kept running and its output are sampled at regular intervals, allowing the channel to track average and maximum values of particulate matter. In always on mode the user can also activate independent thresholds on each size of particulate matter to trigger an acquisition when instant values exceed the threshold value.

Output	Category	Low Power Mode	Always On Mode	On PM triggered acquisition
Instant pressure	Instant	Available	Available	Available
Instant temperature	Instant	Available	Available	Available
Instant humidity	Instant	Available	Available	Available
Instant PM_1	Instant	Available	Available	Available
Instant $PM_{2.5}$	Instant	Available	Available	Available
Instant PM_4	Instant	Available	Available	Available
Instant PM_{10}	Instant	Available	Available	Available
Average PM_1	Average	Not Available	Available	Not Available
Average $PM_{2.5}$	Average	Not Available	Available	Not Available
Average PM_4	Average	Not Available	Available	Not Available
Average PM_{10}	Average	Not Available	Available	Not Available

Output	Category	Low Power Mode	Always On Mode	On PM triggered acquisition
Maximum PM_1	Cadence-based	Not Available	Available	Not Available
Maximum $PM_{2.5}$	Cadence-based	Not Available	Available	Not Available
Maximum PM_4	Cadence-based	Not Available	Available	Not Available
Maximum PM_{10}	Cadence-based	Not Available	Available	Not Available

Instant pressure is the atmospheric pressure measured at the time of transmission.

Instant temperature and instant humidity are the temperature and relative humidity of the air outside the environmental sensor.

Instant PM_1, $PM_{2.5}$, PM_4 and PM_{10} are the mass-concentration of particulate matter (in µg/m3) at the time of transmission. PM_1 stands for particles with a diameter less than 1 micron; similarly, $PM_{2.5}$ refers to particles with diameter less than 2.5 microns: this means that $PM_{2.5}$ includes PM_1. The same definitions apply to the other kinds of particulate matter, with PM_4 including PM_1 and $PM_{2.5}$, and PM_{10} including all the other classes of particulate matter.

Average PM outputs measure the average mass-concentration of each kind of particulate matter over the selected evaluation window, while Maximum PM outputs keep track of the peaks in particulate matter concentration between one transmission and the next.

RAIN CHANNEL

The rain channel has an enable that allows the user to turn it on or off, but this doesn't affect the battery life of the product. The evaluation window setting decides what period of time is considered when computing the cumulative rainfall output.

The rain channel also has a trigger mode that can be enabled to trigger a transmission when the cumulative rainfall exceeds a user-defined threshold.

Output	Category	Low Power Mode
Rainfall	Cadence-based	Available
Cumulative Rainfall	Average	Available

The Rainfall output measures the total rain (in mm) that has fallen between one transmission and the next, while Cumulative Rainfall measures the total rain that has fallen in the selected evaluation window.

Maintenance

8

8.1 Microphone windscreen

If upon visual inspection the microphone's windscreen looks damaged, worn out or is missing, a spare part can be requested to Move Solutions. To replace it, simply pull it off the microphone and gently insert the new windscreen. When doing this make sure the microphone and the new windscreen are both dry to avoid trapping droplets of water between the windscreen and the microphone capsule.

IMPORTANT

- Do not, for any reason, unscrew or loosen the microphone capsule as this might permanently compromise its functionality.

8.2 Air filters

The two filters on the air ports prevent insects and bigger particles like pollen from obstructing the particulate matter sensor; as a result, the filters may need occasional cleaning. To clean them, you can use tweezers to remove obstacles, being careful not to damage the steel net.

If tweezers are not enough to clean the filters, they can be dismounted and cleaned with pressurized air or water before reinstalling them in the sensor.

To dismount the filter follow these steps:

1. Remove the Environmental Sensor from the installation and move it to a clean, dry environment. Disconnect anything that's connected to the Environmental Sensor's connectors.

2. Unscrew the four screws in the back of the product and remove the lid.

3. Disconnect the batteries.

4. Disconnect the cable of the air sensor by gently pressing the tab of the connector located on the PCB.

5. Unscrew the three screws on the front panel and dismount air sensor. Take care not to lose the screws and the nuts.

6. The two filters come off easily. Clean them with pressurized air or clean water, or take new ones if they need replacement (spare parts can be ordered from Move Solutions). Before mounting the filters, make sure they are dry.

7. Reassemble the air sensor, making sure the filters are correctly aligned to the holes. When tightening the three screws, make sure to distribute the pressure evenly. If after tightening the screws the wall of the box looks warped, loosen the screws in small steps until the wall is straight again.

8. Reconnect the batteries.

9. Put the lid back on and screw it in place. Make sure the gasket of the lid is in place and is not pinched between the box and the lid.

10. Reinstall the Environmental Sensor.

8.3 Replacing the batteries

Depending on the settings and operating conditions of the product, the batteries might eventually need to be changed. New batteries can be ordered from Move Solutions.

IMPORTANT
- Do not, for any reason, unscrew or loosen the microphone capsule as this might permanently compromise its functionality.

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1. Remove the Environmental Sensor from the installation and move it to a clean, dry environment. Disconnect anything that's connected to the Environmental Sensor's connectors.

2. Unscrew the four screws in the back of the product and remove the lid.

3. Disconnect the batteries and wait for a few seconds.

4. Connect the new batteries.

5. Put the lid back on and screw it in place. Make sure the gasket of the lid is in place and is not pinched between the box and the lid.

6. Reinstall the Environmental Sensor.

Overall dimensions

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Please note that the drawings provided in this manual are not drawn to scale.

The purpose of these illustrations is to assist you in understanding the various components and their relative positions. Therefore, it is essential to rely on the numerical measurements provided alongside the drawings for accurate dimensions.

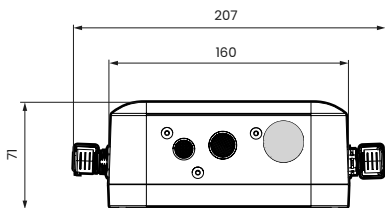The following measurements are expressed in millimeters (**mm**).

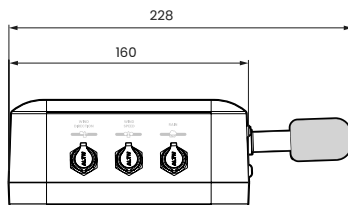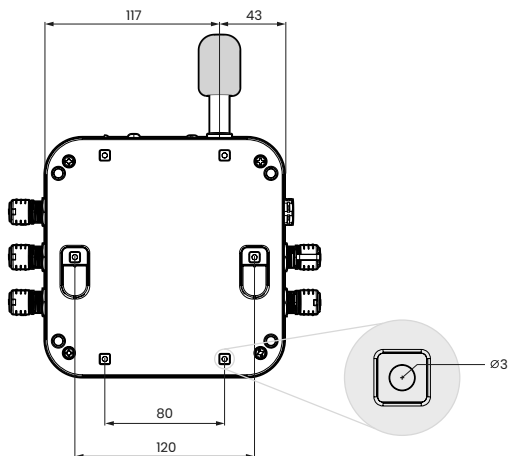*Maximum width with connectors*

Upper view
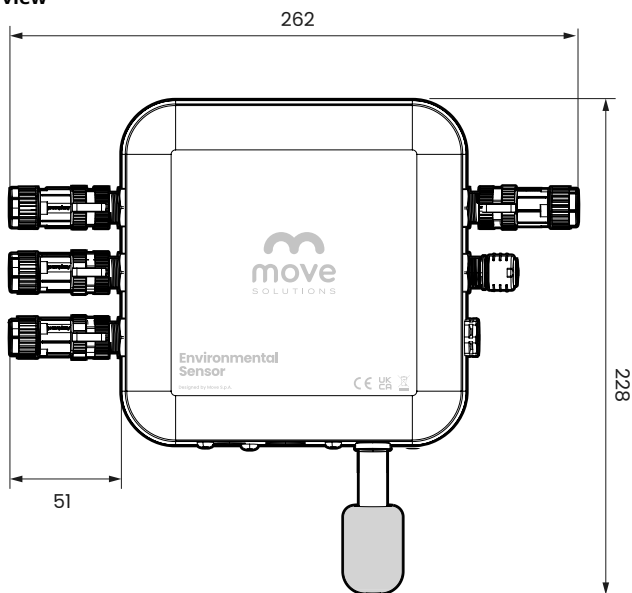
Without connectors

Front view

207

160

71

Right view

228

160

Lower view

117   43

Ø3

80

120

Annex A
Optimizing battery Life

The Environmental Sensor has many functioning modes and the effect of their combination on battery life is remarkable. Depending on the use you are planning to make of this product, the battery life might go from a few days to years, making it very important to choose the settings wisely.

In the tables below is a reference of the expected battery life considering only one agent at a time. To compute the expected battery life of the three agents combined, you can use this formula:

$$D = \frac{1}{\frac{1}{D_N} + \frac{1}{D_W} + \frac{1}{D_A}}$$

Where:

- D is the total expected battery life, in days.
- D_N is the expected battery life of the noise agent alone, in days.
- D_W is the expected battery life of the wind agent alone, in days.
- D_A is the expected battery life of the air agent alone, in days.

For example, let's say the Noise agent is on, the Wind agent is in **Low Power** mode with 2 minutes cadence and the Air agent is off. According to the tables, D_N equals 45 days, D_W equals 90 days and since the Air agent is off, we're simply not going to include D_A in the calculation.

This gives us:

$$D = \frac{1}{\frac{1}{D_N} + \frac{1}{D_W}} = \frac{1}{\frac{1}{45\text{days}} + \frac{1}{90\text{days}}} = 30\text{days}$$

of expected battery life.

EXPECTED BATTERY DURATION

This table lists the expected battery durations based on various possible combination of usage of the three agents of the Environmental Sensor. Parameters not mentioned in the table have little or no effect on overall battery duration.

Noise agent Noise channel	Wind agent Wind speed and direction channels	Air agent Air quality channel	Expected duration[1]
ON Any cadence	OFF	OFF	6 weeks
OFF	*Low Power* Mode[2] Cadence 30 minutes	OFF	3.3 years
OFF	*Low Power* Mode[2] Cadence 2 minutes	OFF	3 months
OFF	*Always On* Mode[2] Any cadence	OFF	12 days
OFF	OFF	*Low Power* Mode Cadence 30 minutes	1.5 years
OFF	OFF	*Low Power* Mode Cadence 10 minutes	6 months
OFF	OFF	*Always On* Mode Any cadence	11 days
ON Any cadence	*Low Power* Mode[2] Cadence 30 minutes	*Low Power* Mode Cadence 30 minutes	5 weeks
OFF	*Low Power* Mode[2] Cadence 30 minutes	*Low Power* Mode Cadence 30 minutes	1 year
ON Any cadence	OFF	*Always On* Mode Any cadence	8 days
ON Any cadence	*Always On* Mode[2] Any cadence	OFF	9 days
ON Any cadence	*Always On* Mode[2] Any cadence	*Always On* Mode Any cadence	5 days

[1] The expected battery life is only an estimate and can vary depending on a variety of environmental factors.

[2] Power consumption of Wind agent is directly affected by the output of the wind probes. Estimates in this table are based on an above-average use case, but in extreme cases the battery duration might be reduced.

Annex B
Wiring of the probes

B

The connector must be the **Amphenol LTW M12A-04BFFB-SL7001** or an equivalent connector (in which case the customer should check the compatibility on their own responsibility).

The connector should be wired with a cable of suitable diameter (according to the connector's datasheet) and the lock nut must be tightened sufficiently to ensure proper waterproof rating and avoid malfunctions when the cable is pulled.

The table shows the proper wiring of the wind direction and wind speed sensors.

M12 Connector	4-20 mA sensor
1	Ground
2	4-20 signal
3	Power (12V)
4	Not connected

The table shows the proper wiring of the rain gauge.

M12 Connector	Pulse output sensor
1	Ground
2	Signal (Normally Open Contact)
3	Not connected
4	Not connected

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Visit the website at www.movesolutions.it for contact information
relating to office addresses and telephone numbers.

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