POWERFLEET®

Product Overview

Enviormental Sensor

Proprietary and Confidential

Version 1.3

Revised and Updated: April 04, 2024

by PowerFleet Inc.

Legal Notices

IMPORTANT

1. All legal terms and safety and operating instructions should be read thoroughly before the product accompanying this document is installed and operated.
2. This document should be retained for future reference.
3. Attachments, accessories or peripheral devices not supplied or recommended in writing by PowerFleet Inc. May be hazardous and/or may cause damage to the product and should not, in any circumstances, be used or combined with the product.

General

The product accompanying this document is not designated for and should not be used in life support appliances, devices, machines or other systems of any sort where any malfunction of the product can reasonably be expected to result in injury or death. Customers of PowerFleet Inc. Using, integrating, and/or selling the product for use in such applications do so at their own risk and agree to fully indemnify PowerFleet Inc. For any resulting loss or damages.

Warranty Exceptions and Disclaimers

PowerFleet Inc. Shall bear no responsibility and shall have no obligation under the foregoing limited warranty for any damages resulting from normal wear and tear, the cost of obtaining substitute products, or any defect that is (i) discovered by purchaser during the warranty period but purchaser does not notify PowerFleet Inc. Until after the end of the warranty period, (ii) caused by any accident, force majeure, misuse, abuse, handling or testing, improper installation or unauthorized repair or modification of the product, (iii) caused by use of any software not supplied by PowerFleet Inc., or by use of the product other than in accordance with its documentation, or (iv) the result of electrostatic discharge, electrical surge, fire, flood or similar causes. Unless otherwise provided in a written agreement between the purchaser and PowerFleet Inc., the purchaser shall be solely responsible for the proper configuration, testing and verification of the product prior to deployment in the field.

POWERFLEET INC.'S SOLE RESPONSIBILITY AND PURCHASER'S SOLE REMEDY UNDER THIS LIMITED WARRANTY SHALL BE TO REPAIR OR REPLACE THE PRODUCT HARDWARE, SOFTWARE OR SOFTWARE MEDIA (OR IF REPAIR OR REPLACEMENT IS NOT POSSIBLE, OBTAIN A REFUND OF THE PURCHASE PRICE) AS PROVIDED ABOVE. POWERFLEET INC. EXPRESSLY DISCLAIMS ALL OTHER WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY, SATISFACTORY PERFORMANCE AND FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL POWERFLEET INC. BE LIABLE FOR ANY INDIRECT, SPECIAL, EXEMPLARY, INCIDENTAL OR CONSEQUENTIAL DAMAGES (INCLUDING WITHOUT LIMITATION LOSS OR INTERRUPTION OF USE, DATA, REVENUES OR PROFITS) RESULTING FROM A BREACH OF THIS WARRANTY OR BASED ON ANY OTHER LEGAL THEORY, EVEN IF POWERFLEET INC. HAS BEEN ADVISED OF THE POSSIBILITY OR LIKELIHOOD OF SUCH DAMAGES.

Intellectual Property

FCC & IC Compliance Statement

The FCC Wants You to Know

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

a) Reorient or relocate the receiving antenna.
b) Increase the separation between the equipment and receiver.
c) Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
d) Consult the dealer or an experienced radio/TV technician.

CAN ICES-3 (B) / NMB-3 (B)

This Class B digital apparatus complies with Canadian ICES-003.
Cet appareil numérique de classe B est conforme à la norme canadienne ICES-003.

If shielded cables were used for testing include:
“

<<< In order to maintain compliance with FCC regulations, shielded cables must be used with this equipment. Operation with non-approved equipment or unshielded cables is likely to result in interference to radio and TV reception. >>>>

FCC Warning (Modification statement)

Modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment under FCC Rules.

Powerfleet has not approved any changes or modifications to this device by the user. Any changes or modifications could void the user’s authority to operate the equipment.

ISED Warning (Modification statement)

Augury n’approuve aucune modification apportée à l’appareil par l’utilisateur, quelle qu’en soit la nature. Tout changement ou modification peuvent annuler le droit d’utilisation de l’appareil par l’utilisateur.

MobileDeviceRF Exposure Statement

Portable:(§2.1093) — A portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is / are within 20 centimeters of the body of .the use

Interference statement (if it is not placed in the device)

This device complies with Part 15 of the FCC Rules and 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, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Wireless notice

This device complies with FCC/ISED radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines and RSS-102 of the ISED radio frequency (RF) Exposure rules. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Le présent appareil est conforme à l'exposition aux radiations FCC / ISED définies pour un environnement non contrôlé et répond aux directives d'exposition de la fréquence de la FCC radiofréquence (RF) et RSS-102 de la fréquence radio (RF) ISED règles d'exposition. L'émetteur ne doit pas être colocalisé ni fonctionner conjointement avec à autre antenne ou autre émetteur.

RF SPECS:

:. Operation Frequency: 2402MHz~2480MHz Maximum E.I.R.P
6.10dBm
Here by, we Powerfleet Inc. declares that this device is in compliance with the essential requirements and other relevant provisions of Directive 2014/53/EU.
This product can be used across EU member states.
Manufacturer: Powerfleet Inc.
Address of Manufacturer: 123 Tice Boulevard,Suite 101,Woodcliff Lake, NJ 07677, United States

CE

Table of Contents

Figures List

Tables List

1 Introduction

The purpose of this document is to provide high-level information required by service providers and enterprises wishing to utilize the Enviormental Sensor device as part of a wireless sensor network (WSN) solution. The solution offers a rugged and long-life battery for real- time visibility, security and awareness of cargo and asset location, in addition to the monitoring of condition, problems and delays throughout the supply chain.

1.1 Document Scope

This document describes the high-level system features and capabilities of the Enviormental Sensor device.

This document does not deal with the protocols and interfaces between the Enviormental Sensor and the backend, nor with the algorithms and logic engine implemented in order to deliver a complete remote monitoring and tracking system. These protocols, APIs, and algorithms are described in separate documentation, as listed in the following sections.

1.2 Definitions, Acronyms and Abbreviations

Name	Description
WSN	Wireless Sensor Network
Hub (CelloTrack Nano 20 – from FW version 34n)	Asset & Cargo Management IoT solution using internal sensors and also functioning as a hub for a Wireless Sensor Network (WSN)
Enviormental Sensor\LV-760	Cellocator's long-life, low maintenance sensor, industrial device
BLE	Bluetooth Low Energy (BT Smart)

PCB	Printed Circuit Board
OTA	Over The Air
FOTA	Firmware Update Over The Air

Table 1: Definitions, Acronyms and Abbreviations

1.3 References and Bibliography

No.	Document Name
1	Enviormental Sensor Release Notes
2	Enviormental Sensor Installation Guide

Table 2: References and Bibliography

1.4 List of Changes

Version	Change	Remarks	Date Approved
1.2	1st version		May 30, 2022

Table 3: List of Changes

2 Enviormental Sensor at a Glance

2.1 General

With the ever-increasing growth in global supply chains, maintaining an accurate picture of what is happening across your business at any given time is practically impossible. Enviormental Sensor, as part of a sensor network, can greatly enhance your supply chain management and costs, especially within high impact environments.

Based on IoT technology that incorporates a WSN, Enviormental Sensor with its BLE communication is an innovative, rugged, and smart monitoring system that requires low maintenance while ensuring a wide range of businesses in an ever-increasing array of industries can monitor their global cargos and assets.

Using renowned Cellocator firmware and technology, the Enviormental Sensor utilizes additional BLE cutting edge technology and extensive sensing capabilities to provide a solution that not only tracks assets but also monitors the environment and conditions in which the asset is currently located or handled, via temperature, accelerometer, and magnetic (doors closing/opening) internal sensors.

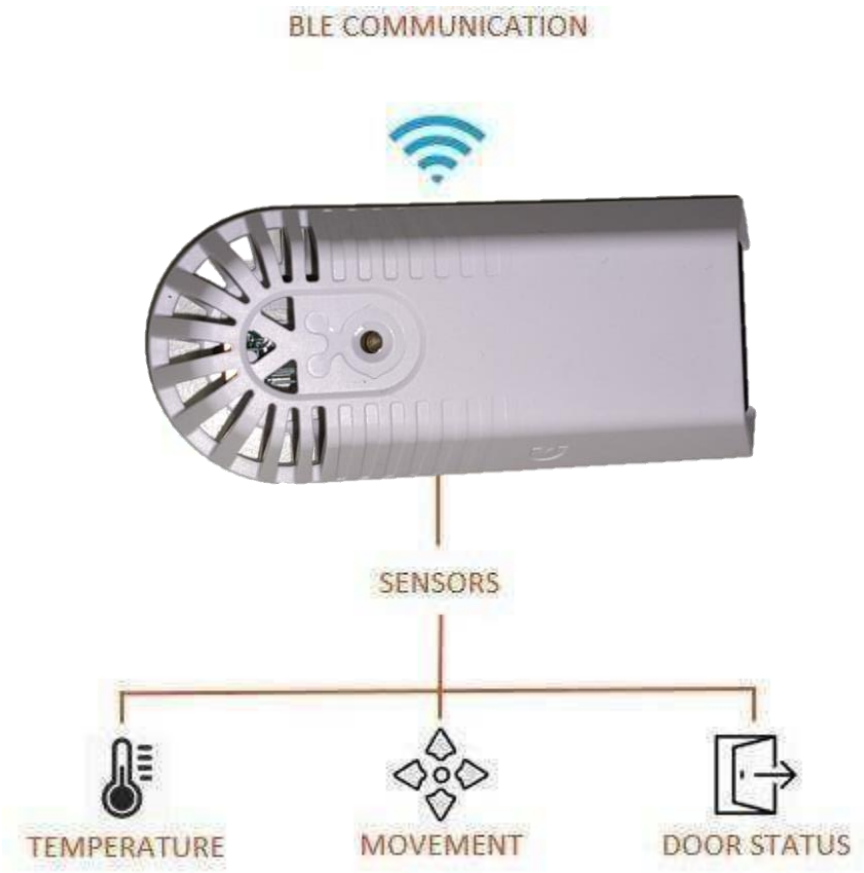

Figure 1: Enviormental Sensor Sensors

The Enviormental Sensor device provides a robust Multi-Sensor for Real-Time Monitoring & Event Triggering in various IoT applications:

- Enables **real-time** awareness of a variety of objects using the Enviormental Sensor as a short range of Wireless Sensor Network (WSN).
- Providing on-the-fly alert notifications enabling you to take **proactive actions whenever required**.
- **Many** different environment sensing capabilities.
- **Easy integration** with hub.
- High **ROI** (competitive pricing).
- **BLE** based – the common protocol used in the IoT industry.

- **Robust** and **rugged** design for high impact environments and IP69K compliance.
- **Long-life**, seven years of battery operation (defined scenario).

2.2 Main Features and Benefits

This section lists the main features of the Enviormental Sensor system and the benefits they provide. For a full list of the available features and further explanations on each feature, refer to the *Feature List* section.

- A range of **internal embedded sensors** that can sense temperature, movement, and door status. These sensors play a big role in reducing risk and exposure to losses, in turn bringing peace of mind to customers.
- Can be used as a **Wireless Sensor Network** via BLE communication to the hub (CelloTrack Nano 20).
- Keep alive messages ensure parts can be tracked within large warehouses.
- Install and forget, no maintenance, no battery replacement.
- Long-life batteries (about seven-year lifespan) do not need replacing or recharging.
- Inherent **Data Logger** with the ability to store around 3,000 logged data samples and events.
- **Rugged plastic enclosure**, protecting against sunlight and chemicals.
- Easy to install within harsh environments via two metal tie-wraps or two supplied screws.
- **IP69K** Certified (protected against close-range high pressure, high temperature spray downs).
- Designed to meet **ISO 16750** standard (environmental conditions).
- Compliance with **GDP – Good Distribution Practice** (Europe, US).

2.3 Intended Markets

The Enviormental Sensor is intended for a wide-range of vertical markets within the MRM industry, many of which can greatly benefit from Cellocator's long-standing expertise in logistics and tracking.

The example vertical markets in the following sections are just a sample of the capabilities of the Enviormental Sensor.

2.3.1 Cold Chain Compliance

With Enviormental Sensor devices installed inside a temperature-controlled container / trailer (together with a hub), or attached to a pallet, box or other type of package loaded with pharmaceutical or perishables, stakeholders in the cold chain process can easily and reliably monitor in real-time the microclimate of the pallet / box, rather than the container environment only.

This helps to ensure adequate shelf-life time, guarantee compliance with shipment regulations, and even enables a real-time response in exceptional cases.

Figure 2: Cold Chain Solution

2.4 BLE (Enviormental Sensor) vs. Active/Passive RFID

The following table presents a matrix of parameters comparing the BLE communication adopted by the Enviormental Sensor and commonly used in IoT devices, versus old RFID technology in use in various existing logistic and warehouse solutions.

Feature / Technology	BLE	Passive RFID	Active RFID
Power source	Internal (<15mA)	Energy transferred using RF from reader	Internal to tag
Battery	Yes	No	Yes

Required signal strength to unit	Medium	Very low	Very high
Range	Up to 100m	Up to 3-5 meters	Up to 100m

Feature / Technology	**BLE**	**Passive RFID**	**Active RFID**
Cost	Expensive (~10$)	Cheap (<1$)	Expensive (~10$)
Support internal sensors	Yes	No	Yes
Security	Strong	Weak	Strong
Smartphone/Tablet communications	Yes	No	No
Applications	App, logistic, inventory, asset tracking (WSN)	Inventory, logistic, security (restricted area), user identification, vending machine	Tracking person/asset
Frequency	2.4G	Various: LF, HF, UHF, SHF	
Bit rate	~200 kbit/s		

Table 4: BLE (Enviormental Sensor) vs. Active/Passive RFID

3 Enviormental Sensor Features and Capabilities

3.1 Feature List and capabilities of Enviormental Sensor

Feature	**Enviormental Sensor**
Orientation and Absolute Orientation	√

Impact	√ (or free-fall)
Free-fall	√ (or impact)
Temperature Sensor	√
Door Open/Close	√
Light Sensor	-
Humidity Sensor	-
Short Range Low Energy Wireless Communication	√
Long life battery	**~7 years**
Maintenance (battery replacement)	-
Power on/off button	**Always on**
IP	**IP69K**

Table 5: Applicability Table

3.1.1 Internal Sensors

The internal sensors are the main elements of the Enviormental Sensor, and provide the monitoring abilities that ensure your assets stay secure. The following sections describe each of the sensors and their capabilities.

3.1.1.1 Accelerometer

The legacy CelloTrack accelerometer is used to detect movement, vibrations or impact of assets and enables different transmission rates for a moving asset and a standing asset. It is based on the interrupt mechanism (of the accelerometer chip) for acceleration incidents that pass a certain (configurable) threshold. When the acceleration reading crosses the configured threshold for longer than the configured time, an Impact event is generated.

Orientation Change and Absolute Orientation

When the Earth-gravity vector of the Enviormental Sensor exceeds the configured threshold (degrees measured), an Orientation event can also be generated and logged. This feature can be used to detect rollover situations, where the tracked asset is rolled on one of its sides or is placed upside down. The Absolute Orientation (x,y,z vectors) is reported via all transmissions of data regarding the asset(s) orientation.

Movement/Freefall/Impact

The legacy accelerometer user can configure it to work with one of three modes, impact, freefall and ordinary movement events. Impact events detect harsh and dangerous incidents such as a crash, and are easily distinguished from freefall, load/unloading movements and breaching attempts.

3.1.1.2 Temperature Sensor

The readings collected by the sensor ensure *data logging capabilities* that are smart and adaptive in that they help reserve battery life and save energy.

Getting real time temperature measurements dramatically improves the control of the shipment and gives the ability to react accordingly.

In order to be compatible with GDP (Good Distribution Practice), the internal temperature sensor guarantees an accuracy of ±1°C and a minimum resolution of 0.1°C.

3.1.1.3 Door Open/Close

The Door Open / Close sensor enables the placement of Enviormental Sensor devices on doors/windows together with a magnet device on door/window frames, so that if the door or window is opened/closed, events will be generated.

3.1.1.4 Proximity Alert

WSN-enabled to identify a "missing object" from the entire solution of the logistic supply chain.

For example, if a pallet embedded with a Enviormental Sensor device is being removed, is not in the right place, or appears to have been stolen, the Nano hub (or any other hub) can send an alert reporting the missing package/box.
For this feature, the RSSI signal strength can be configured according to your specific needs.

3.1.2 BLE Wireless Communication with CelloTrack Nano 20

The method of communication between the Enviormental Sensor devices and CelloTrack Nano 20 is *BLE* (Bluetooth Low Energy) *2.4 GHz short range low energy wireless communication*. This method of communication is intended to provide considerably reduced power consumption, footprint and cost, with these three parameters the most important values within the IoT world.

Using *BLE*, the Nano 20 can communicate with up to 16 Enviormental Sensor devices in a *Master* and *Slave* type setup. However, in order to function correctly as a WSN, the Nano unit and Enviormental Sensor devices must be paired.

Using Nano 20 and paired Enviormental Sensor devices as a local WSN enables you to leverage an environment, within which you can sense where different measurements are expected such as inside cooled cargo boxes, or in a long trailer where the environmental conditions inside the trailer may be different for objects closer to the door.

Another form of communication between the CelloTrack Nano 20 hub and Enviormental Sensor devices is via *transparent* (guest) mode. In this mode, no pairing process is required and thus the CelloTrack Nano 20 does not manage or save Enviormental Sensor device data or thresholds. As a result, in transparent mode the CelloTrack Nano 20 can be used as a gateway to unlimited Enviormental Sensor devices. In situations where only Enviormental Sensor MAC addresses are required, Tag mode (similar to iBeacon mode) can be activated.

3.1.3 Data Logger

The Enviormental Sensor can store around 3,000 logged data samples and events with enable/disable capability.

A combination of data logger with the "Tx-on-Violation-only" mode will store samples and events in the logger, while transmitting events and violations in real-time.

3.1.4 Long Life Battery

The long-life AA ER14505 Li-SOCI 2600mAh non-rechargeable battery should last for seven years in typical scenarios. The Enviormental Sensor is a disposable device with no maintenance required.

3.1.4.1 Battery Lifetime

The Enviormental Sensor battery is designed to last ~7 years under the following settings and conditions:

- +8dbM Tx power
- Magnetic sensor is active
- Temperature sensor is active
- Sampling rate: St Stationary - once every 360 minutes; At movement - once every 0.5 minute
- Transmission rate: St Stationary - once every 360 minutes; At movement - once every 0.5 minute
- Room temperature (25°C)

Note that where temperature is not mentioned, battery performance is valid at +20°C.

3.1.5 Support for iOS background scanning

The "Services" field and the added half of the MAC address to the "Complete local name" string ensures full functionality in an iOS environment, also when the app is running in the background.

3.1.6 Configurable parameters

The following transmission and connection parameters can be configured:

- Enviormental Sensor Tx power (+8 to -18 dBm)
- Tx duration (20-5100 ms)
- Timers multiplier: multiplier of 60 (seconds❼minutes) allows Relaxed / Violation / Proximity timers to go beyond the 24h limit (up to 60 days)
- Connection timeout: maximum allowed time a Enviormental Sensor connection session can last (1-2147 seconds)

3.2 Mounting

The Enviormental Sensor devices can be attached to a tracked object via two methods: using two screws, or with plastic/metal ties that can be weaved through the two holes on the side of the device.

3.3 Enviormental Sensor Hardware Components

The Enviormental Sensor hardware components are listed in the table below:

Name/Part Number	Description	Picture

Enviormental Sensor device **PN:** 715-50100	The Enviormental Sensor device.	
Enviormental Sensor – Magnet device PN: 71200010	Installed in locations to work opposite the Enviormental Sensor (such as on a door).	

Table 6: HW Components

4 Enviormental Sensor Devices

This section describes the Enviormental Sensor devices and their technical attributes. Note that the Enviormental Sensor device is sealed to conform to standard **IP69K** (protection against close-range high pressure, high temperature spray downs).

4.1 Communication with the CelloTrack Nano 20 Hub

Communication between the Enviormental Sensor device and Nano 20 is via *short range low energy wireless communication.* The actual rate of communication between the two can be configured.

There is also a special communication feature called Enviormental Sensor Provisioning: if five *keep alive* messages are not received (according to a configurable parameter) by the device, an event is created and the relevant device is considered "lost". If the device is subsequently communicative, a communication-restore event is sent.

4.2 Pairing Enviormental Sensor Devices with the Nano 20 Hub

In order to create the WSN, the CelloTrack Nano 20 and each Enviormental Sensor device must be paired.

The Nano 20 can pair with up to 16 devices, though it is also possible to report on “Guest” or "Tag " Enviormental Sensor devices, which are not actually paired with the Nano 20 hub (but part of a VLR (Visitor Location Register) database, meaning the Nano 20 can transparently transfer the Enviormental Sensor device data to the backend but the Nano 20 does not manage Enviormental Sensor devices, i.e. logs/thresholds).
The Nano 20 can work in parallel with paired Enviormental Sensor devices and “Guest” or "Tag" Enviormental Sensor devices. "Guest" or "Tag" Enviormental Sensor devices can be especially useful when many mobile cargo loads / assets need to be monitored.

The difference between "Guest" and "Tag" modes is that the CelloTrack Nano only reports on the existence (advertisements) of unpaired Enviormental Sensor units in Tag mode, while in Guest mode the sensor data is sent to the backend.

Pairing is performed via the Cellocator Programmer tool (shown in the following image) by entering the Enviormental Sensor MAC address.

For further information, download the *CelloTrack Nano Installation Guide* from the Cellocator Knowledge Base.

5 Technical Specifications

Communication	
Short Range RF	BLE 4.1 - 2.4GHz wireless communication
Power Output	8mW
Interfaces	
Accelerometer 3D,	±2g/±8g range, 12 Bit representation, 1mg / 4mg resolution • Vibration sensing with programmable threshold • Free-fall sensing with programmable threshold • Impact sensing with threshold up to 8g
Power	
Current Consumption	**Transmission pulse:** 23mA **Active connection with hub (Avg):** <250uA **All sensors active and logging:** <60uA **Hibernation:** <10uA
Internal Battery	ER14505 primary battery, 3.6V Lithium-Thionyl Chloride, AA size, 2500mAh
Sensors	
Temperature	**Typical accuracy:** 0°C to 85°C: ±0.2°C -25°C to 0°C: ±0.2 °C -40°C to -25°C: ±0.2 °C **Resolution:** 0.1°C
Open/Close door	10-20mm range from the defined permanent magnet
Free fall / Impact / Motion	Free fall detection with programmable threshold Impact with threshold up to 8g Motion detection with programmable threshold
Environment	
Temp, operation	-40°C to +65°C

Temp, storage	-40°C to +65°C
Ingress Protection	IP69K
Vibration, Impact	Shock resistance according to EN 60068-2-27, Vibration according to EN 12830
Mounting	Nylon/metal tie-wraps, 2 screws and/or double-sided adhesive.
Certifications	
CE	CE (EMC, Safety, R&TTE)
FCC	FCC part 15 subpart B&C
IC	ICES-3 (B)/NMB-3(B)
IEC 60529 – IP69K	Unit passes all relevant IEC 60529 – IP69K regulation tests
Environmental	Unit passes all relevant environmental regulation tests
Dimensions & Weight	
Dimensions	111 x 46.3 x 28.6 mm
Weight	90 gr

Table 7: Enviormental Sensor Specifications