Operating Manual

ELSYS | PART OF BEMSIQ GROUP

ERS Eco Series LoRa

LoRaWAN Wireless sensor

Important safety information

Read this manual before attempting to install the device!

Failure to observe recommendations included in this manual may be dangerous or cause a violation of the law. The manufacturer, ElektronikSystem i Umeå AB will not be held responsible for any loss or damage resulting from not following the instructions of this operating manual.

- The device must not be dismantled or modified in any way.
- The device is only intended for indoor use. Do not expose it to moisture.
- The device is not intended to be used as a reference sensor, and ElektronikSystem i Umeå AB will not be held liable for any damage which may result from inaccurate readings.
- The device must never be subjected to shocks or impacts.
- To clean the device, wipe with a soft moistened cloth. Use another soft, dry cloth to wipe dry. Do not use any detergent or alcohol to clean the device.

Disposal note in accordance with Waste from Electrical and Electronic Equipment (WEEE) Directive 2012/19/EU

The device, as well as all the individual parts, must not be disposed of with household waste or industrial waste. You are obliged to dispose of the device at the end of its service life in accordance with the requirements of Directive 2012/19/EU to protect the environment and to reduce waste through recycling. For additional information and how to carry out disposal, please contact the certified disposal service providers.

Contents

1.   Description

The ERS Eco series LoRa of sensors are batteryless LoRaWAN® indoor climate sensors powered by indoor light. The sensor measures, depending on model, temperature, humidity, light intensity, and CO2 level. It is equipped with NFC (Near Field Communication) for easy configuration with an NFC-enabled smartphone.

1.1   Dimensions (mm)

Solar cell surface

1
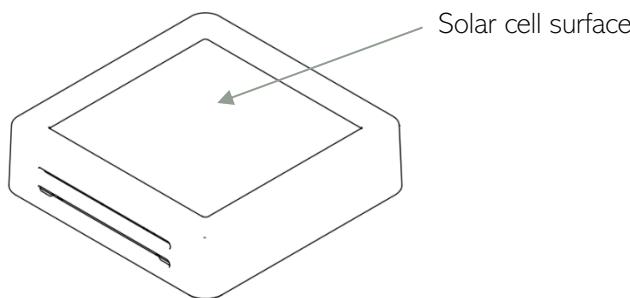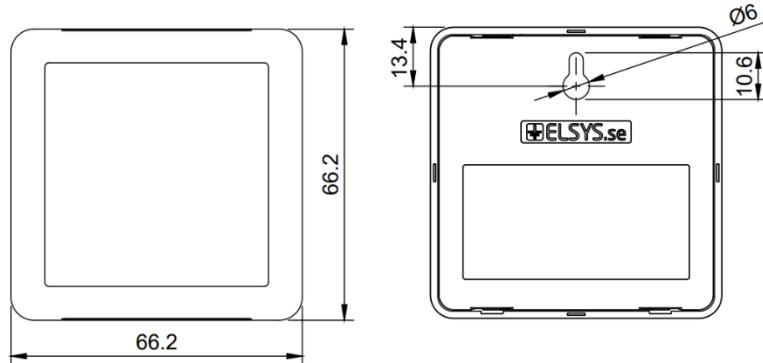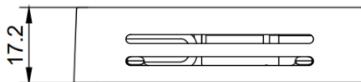
1.2   Label

At the back of your device there is a label with an Aztec barcode containing DevEUI and sensor type.
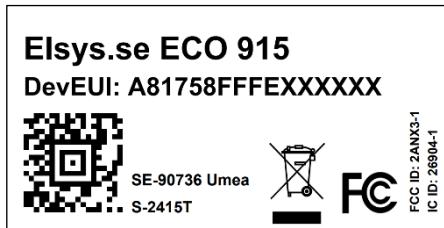
1.3   Main features of the ERS Eco series LoRa

- Batteryless
- Powered by a printed, organic solar cell optimized for indoor light
- Energy storage that lasts up to 50 days in the dark*
- Maintenance free and low total cost of ownership
- Enclosure made from biodegradable material
- Compatible with LoRaWAN® specification 1.0.4
- Measures ambient temperature
- Measures ambient humidity
- Measures light intensity
- Measures CO_2 level**
- Easy installation
- Easy configuration
- May be installed on a wall or any (non-metallic) surface
- Long-range communication
- Configurable over NFC
- Configurable over the air
- Supported channel plans: EU868, IN865, US915, AU915, AS923, HK923, KR923**
- CE Approved and RoHS compliant

Depending on settings and environmental factors

** Depending on model

2.   Mounting guidelines

2.1   Storage of the product

When delivered, the Eco sensors are in a deep sleep mode. They are activated and start their LoRaWAN® join procedure when exposed to light intensity above 100 lux. Estimated run-time in deep sleep mode is two months. It is therefore not recommended to store the sensors for longer than two months since the energy storage will be discharged and the sensors will power themselves off.

For sensors in storage that have powered off, it will be possible to re-charge them by placing them in a well-lit area. Charging time depends on light intensity but as a guideline it takes ~12 hours to fully charge at 1000 lux. This re-charge procedure must take place within four months after the sensors have powered themselves off (six months after production date). Failure to do so may cause irreversible damage to the energy storage.

2.2   Before installation

Before installation, the light conditions in the intended installation location should be known. As a guideline, with default settings and at Spreading Factor 7 an average illuminance of at least 60 lux is needed for the solar cell to be able to harvest enough energy and keep the sensor running. During a whole week this corresponds to 250 lux for eight hours followed by 16 hours of darkness and darkness during the weekend. Please note that this is an average value. A minimum of 90 lux is needed for the sensor to charge its energy storage.

Avoid placing the sensor where it is constantly exposed to incident sunlight through window glass as this may degrade the performance of the indoor solar panel over time. Occasional exposure to high light intensities such as a few hours of sunlight each day is fine and will not affect the performance of the panel.

3.   Installation

1. Place double sided adhesive tape on the back side of the sensor or mount a screw in the intended sensor location.
2. Place the sensor in its intended location by gently applying pressure to it for the tape to adhere to the surface. Or, in the case of using a screw, hang the sensor onto the screw using the back side mounting hole.

Caution: When using a screw for mounting, please make sure that the total length protruding from the wall does NOT exceed 6 mm. Not adhering to this advice might result in physical contact between the screw and internal parts of the sensor causing a loss in range or malfunctioning of the sensor.

4.   Service and maintenance

No serviceable parts inside. If service is needed, please contact your distributor.

5.   Sensor configuration

All sensor settings can be configured via a smartphone application with NFC (Near Field Communication) or over the air via the network server and downlink data to the sensor. The sampling rate, spreading factor, encryption keys, port, and modes can be changed. All sensor settings can be locked from the server or NFC to make end-users unable to read or change settings on the sensor.

5.1   NFC configuration

1.   Download ELSYS "Sensor Settings" application from Google Play or App Store and install it on a smartphone or tablet. The device must support NFC.
2.   Enable NFC on the device and start the application.
3.   Place your device on top of the NFC antenna on the sensor. Keep the two devices close to each other and don't move them to get as good connectivity as possible.
4.   Remove the device. Current settings will be displayed in the application.
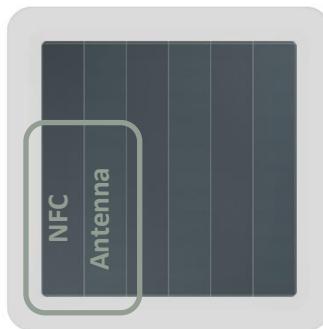
5.   Use the application to change any settings if needed.
6.   Quickly tap the device on top of the NFC antenna to transfer the new settings to the sensor. Make sure that the application confirms your new settings.
7.   Wait for the sensor to reboot (1 sec), indicated by the LED flashing. Sensor settings have been updated. Always validate your settings by reading the NFC data after the sensor has restarted.

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5.2 Over the air configuration

All settings may be configured over the air via your LoRaWAN® infrastructure. Please visit the support section on our webpage for more information regarding downlink protocol.

5.3 Application parameters

All parameters for the "Sensor Settings" application can be found in our settings document. Please visit the support section on our webpage for more information.

6.   Sensor behavior

6.1   Sensor startup

When delivered, the ERS Eco is in a low power sleep mode. It will periodically sample the ambient light conditions and won't start its join procedure until it determines that there is sufficient incoming light. The recommended deployment procedure is to keep the sensor in the dark until it has been commissioned to the server and is ready to be deployed. When exposed to light the sensor will start running the LoRaWAN® join procedure, starting at Spreading Factor 7.

6.2   Energy storage

If the internal energy storage for some reason is depleted, for example from being started without any network server to connect to, the sensor needs to recharge. Place the sensor in a well-lit area (not direct sunlight) and it will harvest the energy from the light source to replenish its energy storage. Depending on light conditions this may take from a few hours up to a couple of days. In a fairly well-lit office with 1000 lux, it will take ~12 hours.

If the sensor is to be stored for a prolonged period of time, the energy storage will also eventually discharge. Approximate run-time in low power sleep mode is two months after production date. In the case that the sensor is stored longer than this, the above-mentioned recharging procedure must be done to wake up the sensor.

6.3   Sampling mode / Periodic measurement

The sensor makes periodic measurements according to the user configuration.

6.4   Scheduled transmission

The sensor transmits data according to the user configuration. However, the configured sending interval can be overridden by network limitations. Due to this, the spreading factor and sending interval settings might result in longer intervals than intended.

6.5   LED indication

The LED in the center of the sensor indicates different actions when the sensor is active.

| LED indication	Action
Red/green sequence	Sensor is starting up
Short orange blink	LoRa join request transmission
Short green blink	LoRa uplink transmission
Short red blink	Sensor failed to send an uplink Common cause is duty cycle limits

7.   Internal sensors

The populated internal sensors in the ERS Eco series LoRa differ between models according to the list below.

|	ERS Eco Lite LoRa	ERS Eco CO2 Lite LoRa
Temperature	✓	✓
Humidity	✓	✓
Light	✓	✓
CO2		✓
NFC	✓	✓

7.1 Temperature

Resolution: 0.1 °C

Accuracy: ±0.2 °C typical, see figure
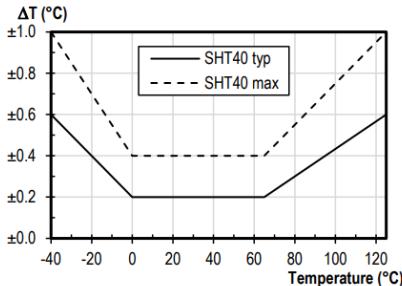
7.2 Humidity

Resolution: 1 % RH

Accuracy at 25 °C: ±2 % RH, see figure
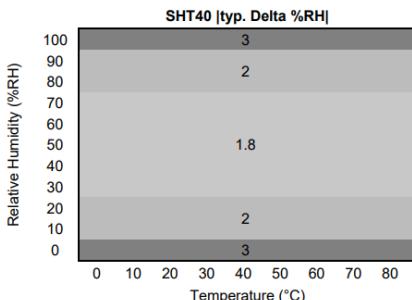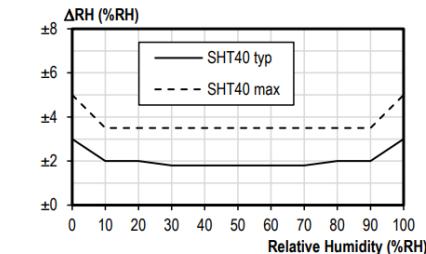
Accuracy of RH over temp.: See figure

7.3   Light

The sensor uses the solar cell to measure light intensity. For correct reading, make sure it isn't obstructed. The electrical characteristics of the solar cell as a function of light angle of incidence roughly equates to a cosine corrected measurement.

Range: 0 – 4000 lux
Resolution: 1 lux
Accuracy: ±10 lux ±2% of reading

7.4   CO2

The CO2 sensor normally runs an automatic baseline correction algorithm (ABC), with a period of 8 days. For a fully corrected measurement, the ABC needs 3 consecutive 8-day periods where the sensor sees fresh air sometime during each ABC period. It can also be calibrated manually, and the ABC can be turned off. In this case it is recommended to do a manual calibration in fresh air once/year.

Range: 400-10000 ppm

Accuracy:
400-5000 ppm: ±30 ppm, ±3 % of reading (15-35 °C, 0-80 % RH)
5001-10000 ppm: ±10 % of reading (15-35 °C, 0-80 % RH)

8. Device specifications

Mechanical specifications	
Dimensions	66.2 x 66.2 x 17.2 mm
Weight	ERS Eco Lite LoRa: 33 g ERS Eco CO2 Lite LoRa: 38 g
Enclosure	Gaia Biomaterial Biodolomer®
IP rating	IP20
Mounting	Screw/Adhesive tape
Recommended installation height	1.6 m
Operating conditions	
Usage environment	Indoor
Illuminance	90 - 5000 lux
Temperature	0 to 50 °C
Humidity	0 to 85 % RH (non-condensing)
Power supply	
Operating voltage	2.8-3.6V DC
Power source	Epishine Light Energy Harvesting Module
Energy storage type	Lithium-ion capacitor (LIC)
Expected run-time	Up to 50 days in the dark (Depending on configuration and environment)
Radio / wireless	
Wireless technology	LoRaWAN® 1.0.4, Regional Parameters RP2 - 1.0.3
Wireless security	LoRaWAN® End-to-End encryption (AES-CTR), Data Integrity Protection (AES-CMAC)
LoRaWAN® Device Type	Class A End-device
Supported LoRaWAN® features	OTAA, ABP, ADR, Adaptive Channel Setup
Supported LoRaWAN® regions	EU868, IN865, US915, AU915, AS923, KR920
Link budget	137dB (SF7) to 151 dB (SF12)
RF Transmit Power	Max 14 dBm EIRP
EU directives compliance	RED 2014/53/EU RoHS 2011/65/EU WEEE 2012/19/EU

9.   Sensor payload format

The device uses the standard ELSYS payload format. Please see the specified document on our webpage.

10. Regulations

10.1 Legal notices

All information, including, but not limited to, information regarding the features, functionality, and/or other product specification, are subject to change without notice. ELSYS reserves all rights to revise or update its products, software, or documentation without any obligation to notify any individual or entity. ELSYS and ELSYS logo are trademarks of ElektronikSystem i Umeå AB. All other brands and product names referred to herein are trademarks of their respective holders.

10.2 Federal Communication Commission Interference Statement

NOTICE:

This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's license-exempt RSS(s) and complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

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

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique 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.
(2) L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

FCC ID: 2ANX3-ECO01   IC ID: 26904-ECO01

Note: Changes or modifications made to this equipment not expressly approved by ElektronikSystem i Umeå AB may void the FCC authorization to operate this equipment.

This device is tested for a minimum separation distance of 20 cm and the RF exposure requirement is fulfilled with this separation for FCC and ISED.

NOTICE:

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:

• Reorient or relocate the receiving antenna.

• Increase the separation between the equipment and receiver.

• Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

• Consult the dealer or an experienced radio/TV technician for help

10.3 Declaration of Conformity

Hereby, ElektronikSystem i Umeå AB declares that the radio equipment type Radio communication devices for low-speed data R&TTE Class 1 is in compliance with Directive 2014/53/EU, Directive 2011/65/EU and Directive 2012/19/EU.

The full text of the EU Declaration of Conformity is available at:
https://www.elsys.se/link/eu-doc

11. Revision History

Revision	Description	Date
1.0	ECO series operating manual created	2023-01-30
1.1	Fixed typos. Added FCC Interference statement. Added FCC label example.	2024-04-10
1.2	Updated FCC/ISED statement. Added separation distance requirement.	2024-06-05
1.3	Name update	2025-04-29