

# Operating Manual

## EMS



## 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 battery should be removed from the device if it is not to be used for an extended period. Otherwise, the battery might leak and damage the device. Never leave a discharged battery in the battery compartment.
- 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 ElektroG and WEEE Directive 2012/19/EU

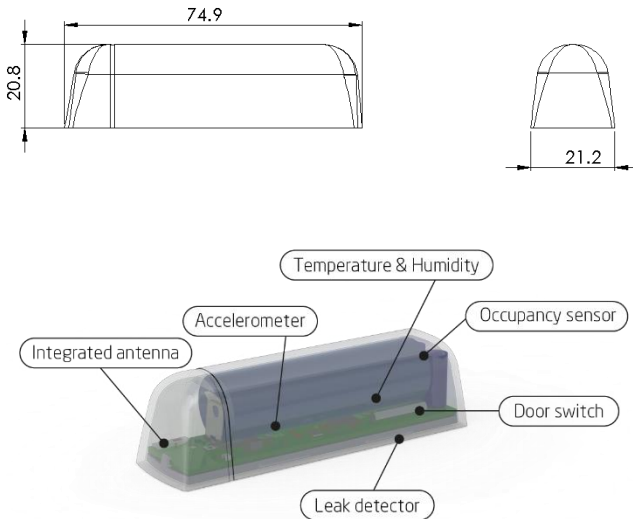
The device, as well as all the individual parts, must not be disposed of with household waste or industrial waste. You are obliged to dispose of the device at the end of its service life in accordance with the requirements of ElektroG in order to protect the environment and to reduce waste through recycling. For additional information and how to carry out disposal, please contact the certified disposal service providers. The sensors contain a lithium battery, which must be disposed of separately.

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## Description

EMS is a subtle indoor sensor with multiple purposes for LoRaWAN® wireless network. It measures temperature and humidity but can also be used as water leak detector, door activity sensor or acceleration detector. EMS is designed to be mounted on door frames, under desks, under dishwashers or in any other limited surface area. EMS is equipped with NFC (Near Field Communication) and can easily be configured from a smartphone.



The barcode contains DevEUI and sensor type. This label is located at the back of your device.



## Main features of EMS

- Compatible with LoRaWAN® specification 1.0.3
- Measures ambient temperature
- Measures ambient humidity
- Detects acceleration
- Detects water leak
- Detects opening activity (Reed Switch)
- Easy installation
- Easy configuration
- May be installed on any flat surface
- Battery-powered
- Long-range communication
- Configurable over NFC
- Configurable over the air
- Ten years of battery life\*
- Supported channel plans: US902-928, EU863-870, AS923, AU915-928, KR920-923, RU864, IN865 & HK923
- CE Approved and RoHS compliant

*\*Depending on settings and environmental factors*

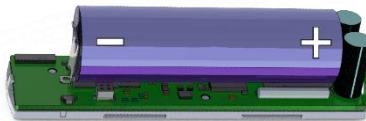
## Installation

1. Remove the back panel of the sensor with a small screwdriver.



2. Install the battery. The EMS requires one AA battery. The battery type is 3.6V Lithium Battery (ER14505).

*Caution: Using batteries other than the ones provided may result in loss of performance and battery life, and also damage to the device. Dispose of properly, observing environmental protection rules.*



3. Mount the back panel on the surface using the adhesive tape.
4. Attach the cover to the back panel.

## Door activity sensor

Make sure that the magnet part is mounted on the “door” (the part that is going to open) and the sensor part is mounted on the frame. For double doors, put one part on each door.

The distance between magnet and sensor should, if possible, not exceed 10mm. Make sure that the magnet and reed switch are mounted next to each other. Detection range will be affected by the materials of the door and frame, different materials result in different ranges. The reed switch is on the end of the sensor without the stripe. The magnet needs to face this side of the sensor (see image).



## Water leak sensor

Make sure that the back panel is mounted on the surface where the water may leak. The sensor element that detects the leak is placed on the back panel. For example, if EMS is going to monitor water leak from a dishwasher, place the back panel onto the floor under the machine.

## Temperature/humidity sensor

Place the device in an open space on a wall, under a desk or on any other flat surface. Make sure that the sensor is not faced by direct sunlight or placed near air vents or other places where it may measure values that is not representative for the rest of the room.

## 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.

### NFC Configuration

1. Download ELSYS "Sensor Settings" application from Google Play 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 EMS sensor to connect with the NFC antenna. *You may need to remove the top cover and battery to get connection.*
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 EMS to give the new settings to the sensor. Make sure that the application confirms your new settings.
7. Wait for the sensor to reboot (5 sec), indicated by the LED flashing. Sensor settings have been updated.

See the section "Help" in the application for more information.

### 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.

### Application parameters

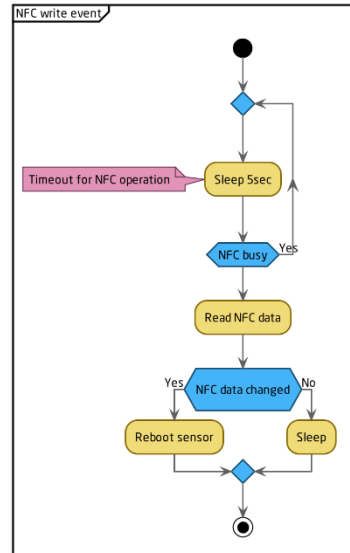
All parameters for the "Sensor settings" application can be found in our settings document. Please visit the support section on our webpage for more information.



# Sensor behavior

## NFC Read / Write

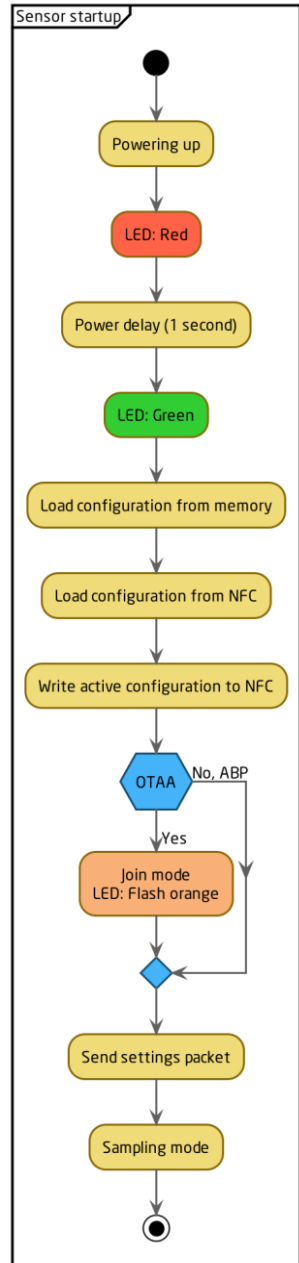
1. When reading or writing NFC configuration data to the sensor, it starts a timer and delays its action 5 seconds.
2. After the delay, the sensor determines if the NFC data has changed or not. If the data has changed, the sensor reboots and starts from power-up.
3. Write your settings in the application and then locate the NFC antenna of the phone and sensor. Keep the two devices close and don't move them to get the best connectivity as possible when writing or reading data to the sensor. Bad connection can be caused by long distance, wrong location, or rapid movement.
4. When you have written data to the sensor, let the sensor reboot and restart before trying to write again.



You should always validate your settings by reading the NFC data after the sensor has restarted.

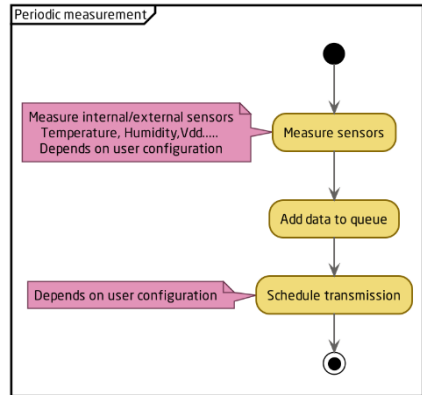
## Sensor startup

1. When the sensor starts up, it loads configuration from the internal memory and merges it with user configuration.
2. When the configuration is done, the sensor writes the new settings to the NFC chip. The sensor always writes new configurations to the NFC chip when something changes in the sensor or if NFC data is corrupted by an NFC writer or phone. The sensor always writes the new configuration to NFC chip at startup.
3. When the configuration is done, the sensor tries to join the network if OTAA (Over the Air Activation) is enabled.
4. The sensor LED flashes orange when it tries to join a network. It will try to join every 10 seconds initially. This interval will increase to save battery, at most up to one time per hour.
5. After successful connection to a network, the sensor sends a settings packet and enters sampling mode.



## Sampling mode / Periodic measurement

The sensor makes periodic measurements according to the user configurations.

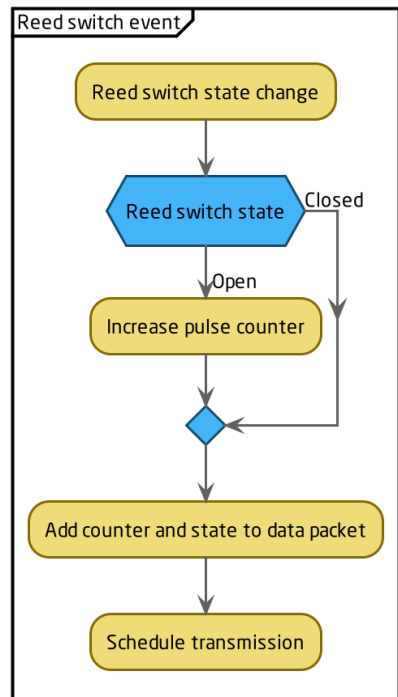


## Opening activity (Reed switch)

When the reed switch changes state from closed to open, the activity is added to a pulse counter that keeps track of the number of opening events. The number of the pulse counter and the current state is added to the data packet.

If the state is changed from closed to open, the pulse counter remains unchanged and only the state and current number of counts is added to the data packet.

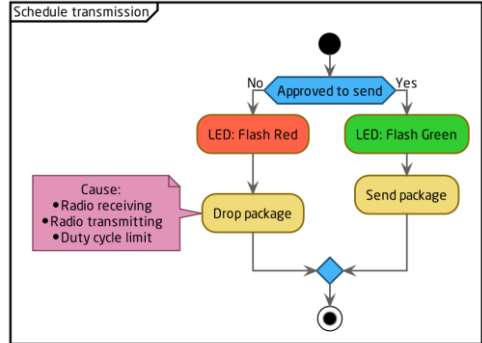
After values has been added to the packet, the EMS schedules a transmission.



## Schedule Transmission

The sensor transmits the data according to the user configurations.

*Note: 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.*



## Water leak detector

The EMS has probes mounted through the back panel which are constantly monitored by the sensor. The sensor can be configured to send alarm immediately when water is detected. Detection is sent periodically. Value is 0 for dry conditions and 1 when water is detected.

## Specifications

### Sensor payload format

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

Power supply:	3.6V DC
Battery type:	AA 14505 (Li-SOCl <sub>2</sub> )
EU directives compliance:	RoHS 2011/65/EU WEEE 2012/19/EU
Radio protocol:	LoRaWAN®
Radio frequency band:	US902-928, EU863-870, AS923, AU915-928, KR920-923, RU864, IN865 & HK923
Range:	8 km*
Operating conditions	0 to 50 °C 0 to 85 % RH (non-condensing)
Temperature range	0 – 40 °C
Temperature resolution	0.1 °C
Temperature accuracy	± 0.2 °C
Humidity range	0 – 100 %
Humidity resolution	0.1 % RH
Humidity accuracy	± 2 % RH
Accelerometer detection level	Configurable via NFC and downlink conf.
Water leak detector range	0 – 100 % (Represented by numbers 0 – 254)
Dimensions	21.2 x 74.9 x 21.8 mm
Battery life	Up to 10 years**

*\*Measured with settings: SF10, 868 Mhz. The range can be greater or less, depending on terrain and building structure.*

*\*\*Depending on settings and environmental factors.*

## Regulations

### 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.

### Federal Communication Commission Interference Statement

#### NOTICE:

This device complies with Part 15 of the FCC Rules and with Industry Canada licence-exempt RSS standard(s).

Operation is subject to the following two conditions:

- (1) this device may not cause harmful interference, and
- (2) this device must accept any interference received, including interference that may cause undesired operation.

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'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

**Radiofrequency radiation exposure Information:**

This equipment complies with FCC and Innovation, Science and Economic Development radiation exposure limits set forth for an uncontrolled environment.

This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

**Informations sur l'exposition aux rayonnements radiofréquences:**

Cet équipement est conforme à la réglementation de la FCC et aux limites d'exposition aux rayonnements définies par Innovation, Sciences et Développement économique pour un environnement non contrôlé.

Cet équipement doit être installé et utilisé à une distance minimale de 20 cm entre le radiateur et votre corps.

Cet émetteur ne doit pas être co-localisé ou fonctionner en conjonction avec une autre antenne ou un autre émetteur.

FCC ID: 2ANX3-EMS01

IC ID: 26904-EMS01

**NOTICE:**

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

**NOTE:** 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.

### Declaration of conformity

Hereby, Elektroniksystem i Umeå AB declares that EMS complies with the essential requirements and other relevant provisions of Directive 2014/30/EU and 2014/53/EU.