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USER GUIDE

EMS

Produal

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Operating Manual
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ELSYS.se

LoRaWAN Wireless sensor

Operating Manual
EMS Series



Elektroniksystem i Umeå AB Tvistevägen 48C, 907 36 Umeå, Sweden
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Specifications in this document are subject to change without notice.
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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 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. The sensors contain a lithium battery, which must be disposed of separately.

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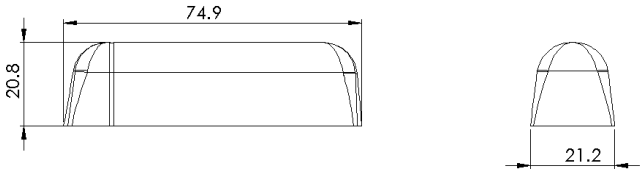
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1. Description

The EMS series consists of subtle indoor sensors with different features and LoRaWAN® wireless connectivity. The sensor measures, depending on model, temperature, humidity, acceleration, door activity, occupancy and can also be used as a water leak detector. The EMS series sensors are designed to be mounted on door frames, under desks, under dishwashers or in any other limited surface area. The sensors are equipped with NFC (Near Field Communication) for easy configuration with an NFC-enabled smartphone.

1.1 Dimensions (mm)



1.2 Label

At the back of your device there is a label with an Aztec barcode containing DevEUI and sensor type.



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1.3 Main features of the EMS series

- Compatible with LoRaWAN® specification 1.0.3 and 1.0.4, depending on firmware version
- Measures ambient temperature
- Measures ambient humidity
- Detects acceleration
- Detects water leak
- Detects opening activity (reed switch)
- Monitors desk occupancy
- Easy installation
- Easy configuration
- Install on flat surfaces*
- Battery-powered
- Long-range communication
- Configurable over NFC
- Configurable over the air
- Ten years of battery life**
- Supported channel plans: EU863-870, IN865, US902-928, AU915-928, AS923, KR920-923, HK923
- CE Approved and RoHS compliant

**Do not mount on any metal surfaces*

***Depending on settings and environmental factors*

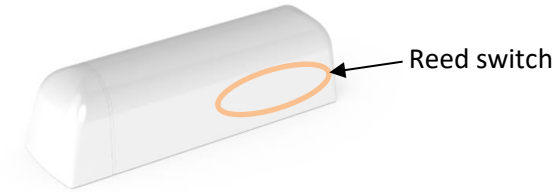
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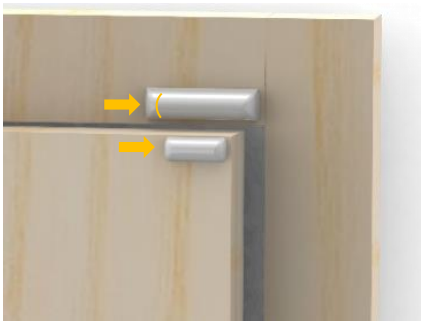
2. Mounting guidelines

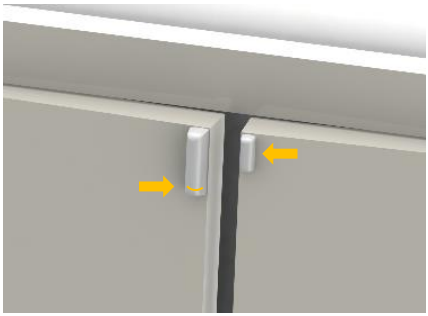
Below follows mounting guidelines for door activity, water leak, temperature/humidity, and desk occupancy sensors.

2.1 Door activity sensor

Make sure that the magnet part is mounted on the door blade (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 10 mm. 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 images).







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2.2 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.

2.3 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 in direct sunlight, close to a radiator or placed near air vents where it may measure values that is not representative for the rest of the room.

2.4 Desk occupancy sensor

The device should be mounted underneath the desk, 10-20 centimeters from the front edge of the desk. Make sure that the hole is pointing towards the person sitting or standing by the desk. The sensor can detect occupancy up to 50 centimeters with a field of view of 60 degrees both in the horizontal and vertical direction. After mounting the sensor at its intended location, the sensor will need time to calibrate to the new environment (to set the correct baseline for occupancy detection). Leave the sensor to calibrate over the night and make sure that the sensor is not close to or looking at a hot object (like a radiator) or placed near air vents as it may disturb the occupancy detection.



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3. Installation

1. Remove the back panel of the sensor with a small screwdriver. Take care not to damage any internal components.



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.

4. Service and maintenance

No serviceable parts inside. If service is needed other than battery replacement, please contact your distributor.

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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 EMS sensor to connect with the NFC antenna. Keep the two devices close to each other and don't move them to get as good connectivity as possible. *You may need to remove the top cover and battery to get connection.*
4. Current settings will be displayed in the application.
5. Use the application to change any settings if needed.
6. Tap the device on top of the EMS to send the new settings to the sensor. Make sure that the application confirms your new settings.
7. Wait for the sensor to reboot (1-5 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.

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

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.

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6. Sensor behavior

6.1 Sensor startup

1. When the sensor starts up it loads any configuration parameters stored in the NFC chip. The sensor will then write all configuration parameters back to the NFC chip.

2. When the configuration is done the sensor tries to join the network if OTAA (Over the Air Activation) is enabled. Make sure that the sensor credentials (DevEUI, AppKey, JoinEUI) match the keys added in the server for activation of the device. The join procedure starts at spreading factor 7 with a join request every ~15 seconds. The sensor will gradually increase the time as well as the Spreading Factor between the following join requests until the join is successful. Every join request is indicated by an orange LED blink.

3. After successful connection to a network, the sensor sends an uplink containing the sensor settings and enters sampling mode.

6.2 Sampling mode / Periodic measurement

The sensor makes periodic measurements according to the user configuration.

6.3 Scheduled transmission

The sensor transmits the 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.

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6.4 LED indication

The LED indicates different actions when the sensor is active.

LED Indicator	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

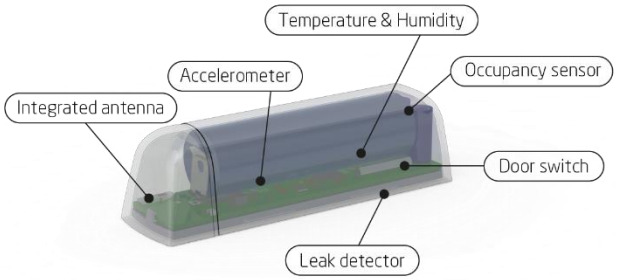
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7. Internal sensors

The populated internal sensors in the EMS series differ between models according to the list below.

EMS series internal sensors

Sensors	EMS	EMS Lite	EMS Door	EMS Desk
Temperature	✓	✓		✓
Humidity	✓	✓		✓
Acceleration	✓		✓	
Door activity	✓		✓	
Water leak	✓	✓		
Occupancy				✓

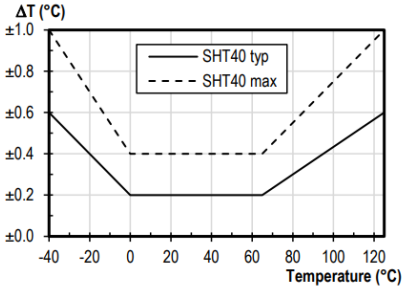


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7.1 Temperature

Resolution: 0.1 °C

Accuracy: 0.2 °C typical, see figure

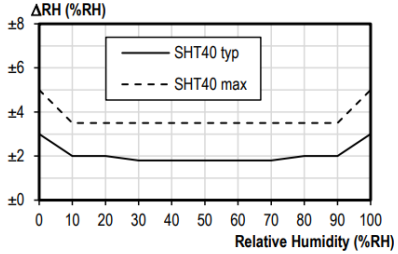


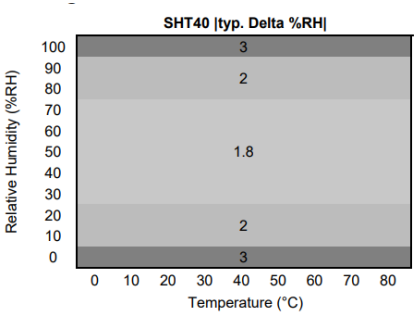
7.2 Humidity

Resolution: 1 % RH

Accuracy at 25 °C: ± 2 % RH, see figure

Accuracy of RH over temp. see figure





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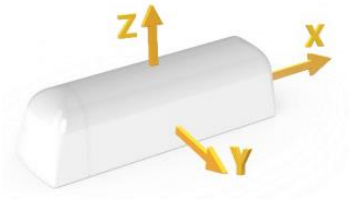
7.3 Accelerometer

The accelerometer sensor reports values of X, Y and Z direction, depending on the sensor orientation. In the picture the Z reference value is around 64 and the value for X, Y is 0.

Range: ± 2.0 g

Sensitivity: 16 mg/digit

Data rate: 10 Hz



7.4 Door activity (Reed switch)

The reed switch sensor is used to monitor door activity. When the magnet is near EMS and EMS Door in the area where the reed switch is located the reed switch closes and gives a value of 1. When the magnet is away from the reed switch the reed switch opens and gives a value of 0.

7.5 Water leak detection

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

7.6 Occupancy

The occupancy IR sensor measures differences in temperature to detect occupancy. The sensor will report value 0, 1 or 2. Value 0 meaning that no occupancy is detected. Value 1 is reported during pending (entering or leaving) and value 2 is reported when occupancy is detected.

Detection range: 50 cm

Field of view: 60° (horizontal/ vertical)

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8. Device specifications

Mechanical specifications	
Dimensions	21.2 x 74.9 x 20.8 mm
Weight	10 g excluding battery / 30 g including battery
Enclosure	Plastic, PC / ABS
IP rating	IP20
Mounting	Adhesive tape
Operating conditions	
Usage environment	Indoor
Temperature	0 to 50 °C
Humidity	0 to 85 % RH (non-condensing)
Power supply	
Operating voltage	3.6V DC
Battery type	AA 14505 (Li-SOCl2)
Battery life	Up to 10 years *(Depending on settings and environmental factors).*
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, KR923, HK923
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

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9. Sensor payload format

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

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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 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.

FCC ID: 2ANX3-EMS01 IC ID: 26904-EMS01

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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.

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

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11. Revision history

Revision	Description	Date
1.0	EMS series operating manual created	2023-01-26

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