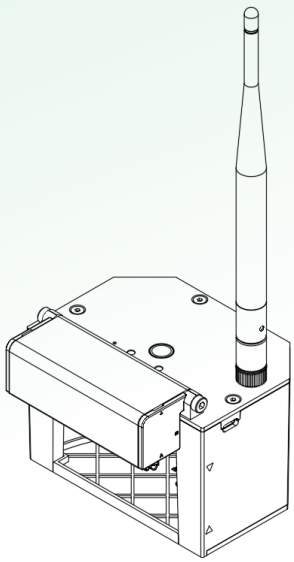
INTEROPERABLE ENERGY MONITORING DEVICE

EMONI® LPWAN EndNode

Reads the absolute counter value of gas, water and electricity meters: camera-based, recognised on the device, sent over LoRaWAN



Absolute reading
The meter's own counter value, no pulse counting

LoRaWAN EU868
Class A, OTAA, MAC 1.0.2

≈ 6 years
Battery life at the default 3 h interval

On-device OCR
Only validated readings are sent, never images

EMONI digitises existing gas, water and electricity meters with a mechanical counter or a digital display, without replacing the meter. Instead of counting pulses, it reads the counter itself: the device photographs the digits at a configurable interval, recognises them on the device with a custom-trained neural network and sends the plausibility-checked absolute reading, together with battery voltage, event code and motion data, as a compact LoRaWAN uplink to the customer's network server, the EMONI Cloud or any third-party application.

Advantages

- **Absolute meter reading:** every uplink carries the value shown on the meter. A lost uplink or a battery change never leaves a gap in the total
- Retrofit for existing meters: no meter replacement, no pulse output needed
- **≈ 6 years battery life** at the default 3 h interval, or permanent USB-C supply
- Recognition on the device: only validated values travel over the air, never images
- Vendor-neutral: The Things Stack, ChirpStack and other LoRaWAN network servers

Features

- Camera with LED illumination, 480 × 320, independent of ambient light
- One-time calibration via a local Wi-Fi menu
- Upload interval 1 min to 72 h, adjustable by downlink
- Firmware updates over LoRaWAN (FUOTA, delta updates)
- Secure Boot, flash encryption, AES-128 LoRaWAN encryption
- CE compliant under RED 2014/53/EU, RoHS · Made in Germany

WHY ABSOLUTE READING?

Reads the counter, not pulses.

The transmitted total always matches the meter.

	Pulse-based	EMONI
Sends the meter's actual reading	✗	✓
No drift after outages or missed pulses	✗	✓
Works without a pulse output	✗	✓
Plausibility check of every reading	✗	✓

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Product overview

Meter reading without meter replacement

EMONI is mounted above or in front of the counter of the meter using the included hinged holder and 3M adhesive tape. After a one-time calibration the device reads only inside the reading area drawn around the digits. Suitable for gas and water meters with a roller counter and for electricity meters with a rotating disc (Ferraris) or a digital display, in indoor environments.

Recognition and validation on the device

At every wake-up (by timer, button or motion), the device captures a picture, recognises the digits and validates the result: a reading must not be lower than the last accepted value and must not rise faster than the configured Q_{max} (or maximum power) allows. Only then is one uplink sent; between cycles the device stays in deep sleep.

Open LoRaWAN integration

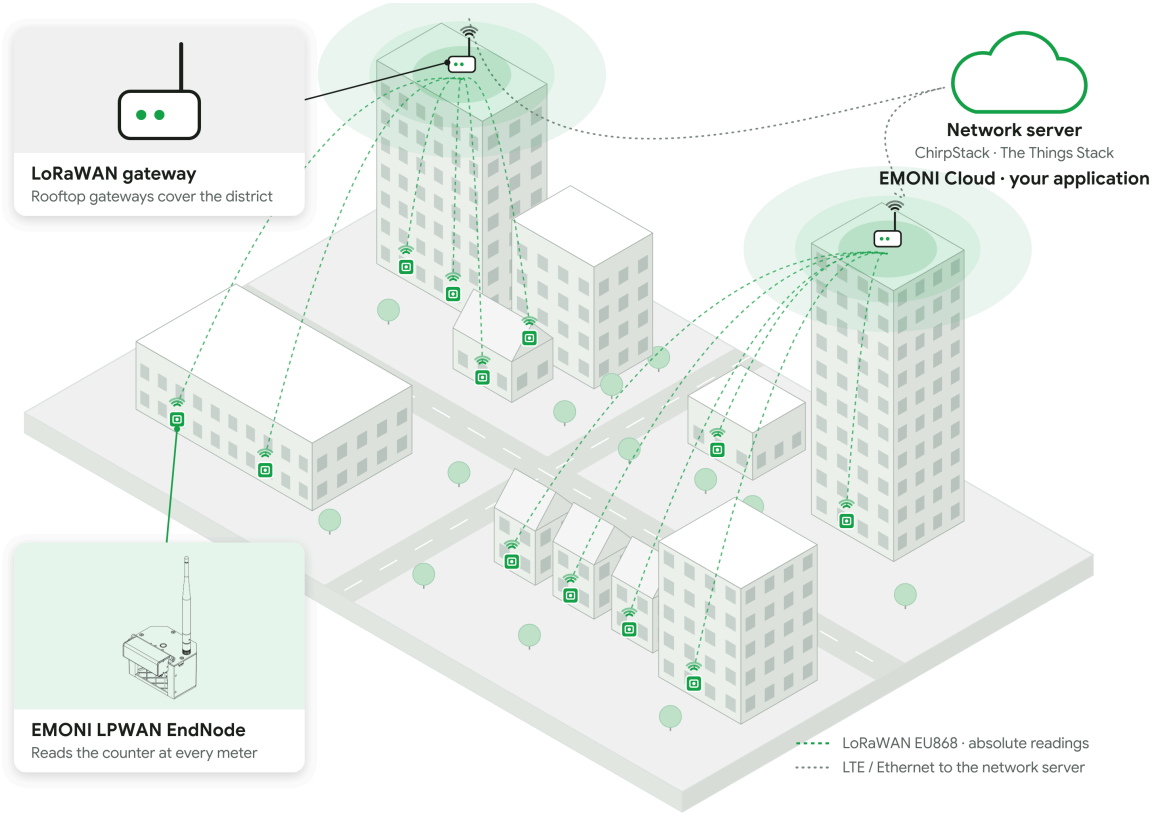
The device joins the customer's network by OTAA and sends a 16-byte binary frame on FPort 8. The EMONI codec decodes it on The Things Stack or ChirpStack. Data can be forwarded by webhook to the EMONI Cloud or to the customer's own application. EMONI needs no access to the network server for normal operation.

Maintainable in the field

Configuration downlinks set the upload interval, the confirmed-uplink period and a re-baseline of the stored reading. Firmware updates are delivered as small delta patches over LoRaWAN (FUOTA, FPort 150) by the EMONI OTA cloud through the customer's network server; readings continue during the update and a failed update rolls back automatically.

LoRaWAN across the city

EMONI devices in basements and meter rooms send their absolute readings to rooftop LoRaWAN gateways. The gateways forward them to the network server and on to the EMONI Cloud or your own application.



Deployment models

Model	Connectivity	Typical customers
Customer-managed LoRaWAN	LoRaWAN to the customer's own network server, application and data storage	Utilities, municipalities, grid operators, industry
EMONI Cloud integration	Decoded uplinks forwarded by webhook to app.emoni.cloud (readings, consumption, device status)	Managed service deployments

Technical data

Application: digital reading of gas, water and electricity meters with a mechanical counter or a digital display, indoors.

LORAWAN	
Frequency band	863–870 MHz (EU868)
LoRaWAN version	MAC 1.0.2, RP001 Regional Parameters 1.0.2 rev. B
Device class / activation	Class A, OTAA (per-device 128-bit AppKey)
TX power	≤ 14 dBm
Channels	868.1 / 868.3 / 868.5 MHz plus network-defined channels
RX2	869.525 MHz, data rate set by the network
Join data rate / ADR	DR0 (SF12) / ADR on
Ports	FPort 8 (readings, downlinks), FPort 150 (FUOTA)
Uplink payload	Binary, 16 bytes for 8–9 digits: reading, comma position, battery (mV), event code, motion x/y/z, Q_{max}
Confirmed uplinks	Yes, period adjustable by downlink
Firmware updates	FUOTA (Class A, delta updates) on self-hosted The Things Stack or ChirpStack v4; Wi-Fi on site
WI-FI (CALIBRATION AND SERVICE ONLY)	
Standard / band	IEEE 802.11 b/g/n, 2400–2483.5 MHz
Output power	13 ± 2 dBm (HT20, MCS7)
Security	WPA2; access point only while uncalibrated, closes after 10 min
SECURITY	
Firmware	Secure Boot (signed by ISIS IC), flash encryption, automatic rollback
Radio	AES-128 encryption and message integrity code (LoRaWAN)
Calibration menu	Login protected, lock-out after 5 wrong passwords

ELECTRICAL	
Battery	4 × 1.5 V AA lithium (FR6), Energizer L91 recommended; alkaline cells not recommended
External supply	USB-C, 5 V, max. 1 A (takes over automatically)
Power consumption	≈ 0.20 mW (deep sleep) · ≈ 0.26 W (mean of a wake), both at 5 V
Charge per wake cycle	approx. 1.4 J, 5.4 s (good radio link)
Upload interval	1 min to 72 h, default 3 h; on site or by downlink
SENSORS	
Camera	480 × 320, 1/5" lens, LED illumination
Recognition	On-device OCR with plausibility check
Motion sensor	6D accelerometer: tilt, fall, movement; wake on motion (optional)
ENVIRONMENT	
Operating temperature	+5 °C to +45 °C
Storage temperature	–20 °C to +70 °C (max. 70 % RH)
Humidity	0–95 % RH, non-condensing
Protection class	IP20, indoor use only
MECHANICAL	
Dimensions (H × L × W)	80 × 72 × 107 mm
Weight	196 g without batteries
Housing	ABS, IK07, opened with tools only
Mounting	Hinged holder with 3M adhesive tape
CONFORMITY	
Directives	CE, RED 2014/53/EU, RoHS 2011/65/EU, WEEE
Warranty	2 years

Applied harmonised standards

RED article	Standards
3.1 a) Safety, health	EN IEC 62368-1:2024+A11:2024 · EN IEC 62311:2020
3.1 b) EMC	ETSI EN 301 489-1 V2.2.3 · ETSI EN 301 489-3 V2.3.2 · EN 55032:2015+A1:2020 · EN 55032:2015+A11:2020 · EN IEC 61000-3-2:2019+A2:2024 · EN IEC 61000-3-3:2013+A2:2021
3.2 Radio spectrum	ETSI EN 300 328 V2.2.2 · ETSI EN 300 220-1 V3.1.1 · ETSI EN 300 220-1 V3.3.1 Full EU Declaration of Conformity: emoni.cloud/downloads

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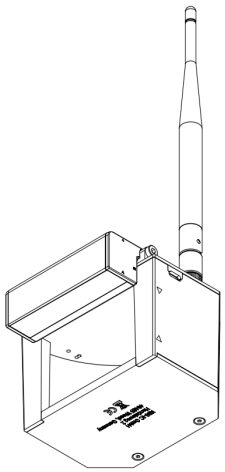
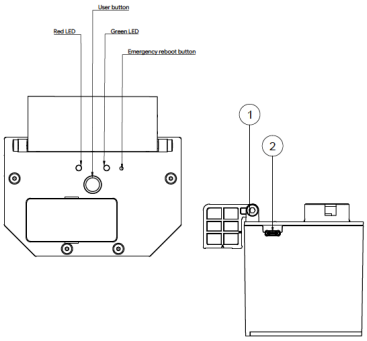
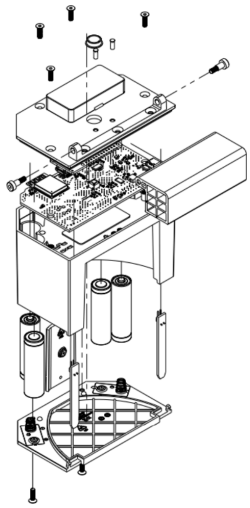
Dimensions and design



Device with antenna



Controls: status LEDs, user button, emergency reboot button



Exploded view: lid, electronics, housing, AA cells, base

Art.-No.	Description	H × L × W
AG-506	EMONI LPWAN EndNode, LoRaWAN EU868, with antenna and hinged holder	80 × 72 × 107 mm

Status LEDs

LED	Meaning
Green, blinking slowly	Device starting
Green, fading	Joining the LoRaWAN network
Green, on	Joined, device active
Red, on	Taking a picture
Red, short flash	Reading sent
Red + green, fading	Not calibrated, calibration Wi-Fi open
Red + green, blinking	Firmware update in progress
Red + green, fast	Factory reset, device restarts
Red, fast for 5 s	Battery too low for calibration Wi-Fi

Battery life (estimate)

Upload interval	Motion wake on	Default
1 min	1 month	1 month
15 min	1.0 year	1.2 years
1 h	2.3 years	3.5 years
3 h (default)	3.2 years	6.2 years
6 h	**3.5 years**	**> 7.5 years**
12 h	3.8 years	> 7.5 years
24 h	3.9 years	> 7.5 years

Basis: typical site, four Energizer L91 cells, 3000 mAh usable, 1 %/year self-discharge, field-measured wake energy (1.05 × bench); deep sleep 0.20 mW, 0.53 mW with motion wake. Above 7.5 years cell ageing and the installation limit the life, not the device.

Downlink commands (FPort 8)

Upload interval	1 min to 72 h
Confirmed-uplink period	every N min, every uplink or network default
Re-baseline reading	keeps the calibration

Payload codec and documentation: emoni.cloud/downloads. Further documents: User Manual AG-506, Technical Reference Manual AG-506, EMONI Calibration Guide.

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