## nemi Log (+ cellular)

Battery powered wireless data logger with integrated sensors and cellular option

## Description

nemi Log is a stand-alone wireless data logger whose battery life is maximized using the highly efficient nemi Link 2400 wireless technology. It receives data from up to eight wireless sensor nodes. With the integrated 9 DoF IMU and GPS, nemi Log can also be used independently to measure accelerations, rotation rates, rotation angles and magnetic fields and determine the position.

In the nemi Log basic version, all data is stored on a micro SD card. The nemi Log + cellular version offers the option of sending status messages (via MQTT) and uploading all data to an FTP server via mobile radio.

## Key Features

- **Receiver for up to 8 sensor nodes** in the radio network nemi Link 2400
- **Data logging** on **micro SD card**
- **Data provision** via **cellular connection**
- Integrated **accelerometer, gyroscope and magnetometer** (3 axes each)
- Completely wireless and **maximized battery life** due to **nemi Link 2400 radio technology**
- Provision of data as CSV files with time stamps from integrated clock (RTC), GPS Timestamp or NTP
- Robust, weatherproof **IP 65 housing**



| | |
|---|---|
| **IMU sensor module** for measuring accelerations and rotation rates in and around all 3 axes; ACC up to 16 g; GYR up to 4000 °/s | **nemi Link 2400** - i4M's own robust and **flexible radio technology** in the 2.4 GHz frequency band |
| Triaxial **magnetometer**; measuring range up to 16 Gauss | **4G cellular connection;** energy-efficient NB-IoT or LTE-M protocol (only + cellular version) |
| **GPS module** for localization with an accuracy of 2 m CEP | **Data logging** on **micro SD card** |
| **Internal rechargeable battery;** runtime of several weeks depending on configuration | Continuous operation with **voltage input 7 - 30 V DC** |

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## Specifications

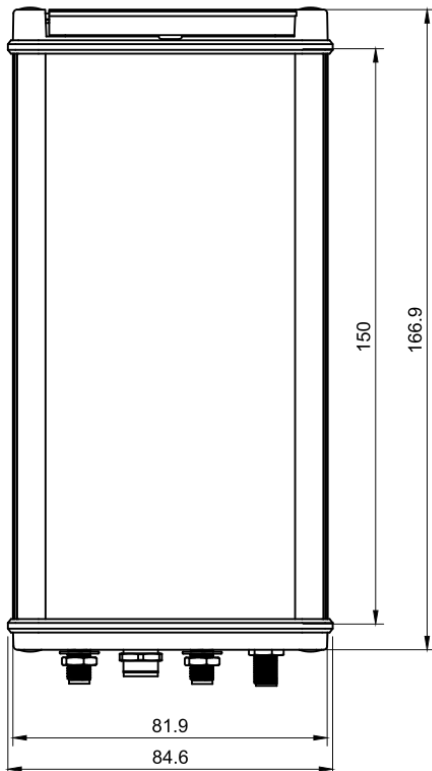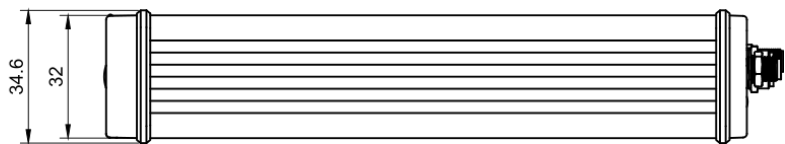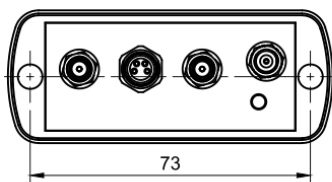| General information | | |
|---|---|---|
| Dimensions<br>(without antenna and connectors) | 178 x 85 x 35 | mm |
| Weight | 446 | grams |
| Internal power supply | Lithium-ion battery | - |
| Running time with full battery | Depending on application<br><br>Example:<br>Continuous, permanent logging (duty cycle 100 %) of data from 3 x nemi G+ at 4000 Hz (three axis each) and data from internal IMU at 208 Hz without GPS: runtime 10 days | weeks |
| Charging time (0 - 100 %) | 3<br>(at 15 W charging power) | hours |
| External power supply (USB-C) | 5 | V |
| External power supply (EXT M8) | 7 – 30 | V DC |
| Data logging | on micro SD card (max. 32GB)<br>(in binary format, software for decoding to CSV format is supplied free of charge). | - |
| Operating temperature range | -20 to 60 | °C |
| Housing protection rating | IP 65 | - |
| **Additional integrated 9-DoF IMU**<br>**per 3-axis MEMS accelerometer (ACC) / gyrometer (GYR) / magnetometer (MAG)** | | |
| Sampling rate | 208 / 104 / 52 | Hz |
| Selectable measuring ranges ACC | ± 16 / 8 / 4 / 2 | g |
| Selectable measuring ranges GYR | ± 4,000 / 2,000 / 1,000 / 500 / 250 / 125 | °/s |
| Selectable measuring ranges MAG | ± 16 / 12 / 8 / 4 | Gauss |
| Signal resolution | 16 | bit |
| **Satellite navigation** | | |
| GPS module | GPS/GLONASS/BeiDou/Galileo | - |
| Sampling rate | max. 10 | Hz |
| Accuracy | 1.5 | m CEP |
| **Cellular Connection (only + cellular version)** | | |
| Data transmission | FTP server,<br>MQTT data streams | - |
| Cellular connection | LTE-M/NB-IoT modem | - |
| Frequency range | 700-2200 | MHz |
| LTE-M throughput<br>Downstream<br>upstream | <br>300<br>375 | kb/s |
| NB-IoT throughput<br>Downstream<br>upstream | <br>30<br>60 | kb/s |

## Nemi Log basic vs. nemi Log + cellular

In the nemi Log basic version, the data is stored on a micro SD card which can be removed and read (on any PC).

In the nemi Log + cellular version, the data recorded and temporarily stored on the SD card can be automatically uploaded to an FTP server by the system via the integrated NB-IoT/LTE-M modem. The logger settings (e.g. sampling rate, active channels, gain,…) can be changed via a config file on the FTP server without having direct physical access to the logger.
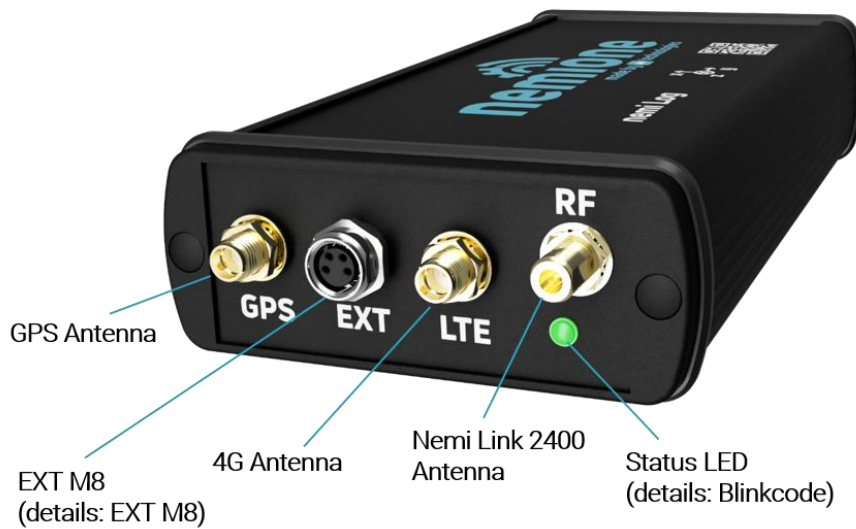
## Dimensions

(All dimensions in mm)

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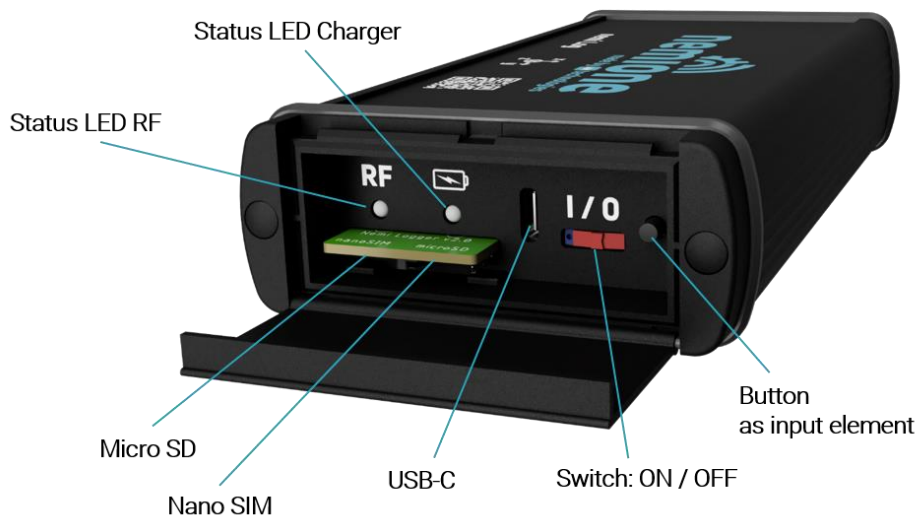
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## Connections

nemi Log has several connection that are split into exposed connectors on the front panel and hidden elements on the back. The connections that are used for the setup of the nemi Log are protected from the elements behind a flap. For full IP65 protection, the flap must be closed

Front Panel:



GPS Antenna

EXT M8
(details: EXT M8)

4G Antenna

Nemi Link 2400
Antenna

Status LED
(details: Blinkcode)

Back Panel:



Status LED Charger

Status LED RF

Micro SD

Nano SIM

USB-C

Switch: ON / OFF

Button
as input element

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## EXT M8

nemi Log offers various options to connect an external voltage source and two digital sensors at the same time.

### Wide-Range Voltage Input

Pin 1 and Pin 3 can be used as a wide-range voltage input (7 – 30 V) to offer the following options:

- Permanent installation with e.g. 24 V
- Runtime extension with external batteries (e.g. SAFT LS in series or 12 V car battery); The internal battery of the nemi Log is constantly recharged and acts as an energy buffer.

### Digital IO

Pin 2 and Pin 4 can be used to connect up to two digital sensors. The following options are available (both pins must be configured identically):

- Analog input 0 – 3.3 V
- Analog input 0 – 24 V
- Digital input up to 24 V; can be used as a trigger for data recording / transmission

It is also possible to connect various interfaces (UART, I2C). The implementation of associated drivers including downstream data transmission, for example via MQTT, in the firmware of the nemi Log is available upon request.

### Pinout

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## Status LED - Blink Codes

The nemione® nemi Log has an integrated status LEDs that are visible through the housing. This flashing indicates the various operating states of the receiver module.

| Operating Mode | Description |
|---|---|
| Constant green with short red flashes (0.5 s) | Wait for USB connection via COM port (only directly after switching on via switch and if USB is connected to a PC for max. 20 seconds) |
| Red flashing (0.5 s) | After switching on: Micro SD card missing or batteries are not charged enough to generate sufficient voltage for LTE modem and SD card |
| Purple flashing (1 s) | Wait for input via button<br>Mode 1: Wait for input<br>Mode 2 + 3 + 4: Waits 10 seconds for an input and then continues automatic mode |
| Yellow flashing (3 s) | The wireless sensors are woken up 30 seconds before the scheduled recording. |
| Green irregular flashing during SD logging | Data recording successful |
| Turquoise flashing (3 s) | The wireless sensors are sent to sleep for 20 seconds after recording |
| Blue flashing (5 s) | 4G login (can take 8 - 70 s depending on the network and provider) |
| Green irregular flashing during LTE data transmission | LTE data transmission, 5 kB packets successfully transmitted |

## Data transmission

nemi Log is a data logger for storing data locally on the micro SD card. It can be used to receive data from up to eight wireless sensor nodes in the nemi Link 2400 radio. nemi Log basic version stores the data on a micro SD card, which must be removed to read out the data. In addition to that, the nemi Log + cellular version offers the option of sending status messages (via MQTT) and uploading all data to an FTP server via mobile radio.
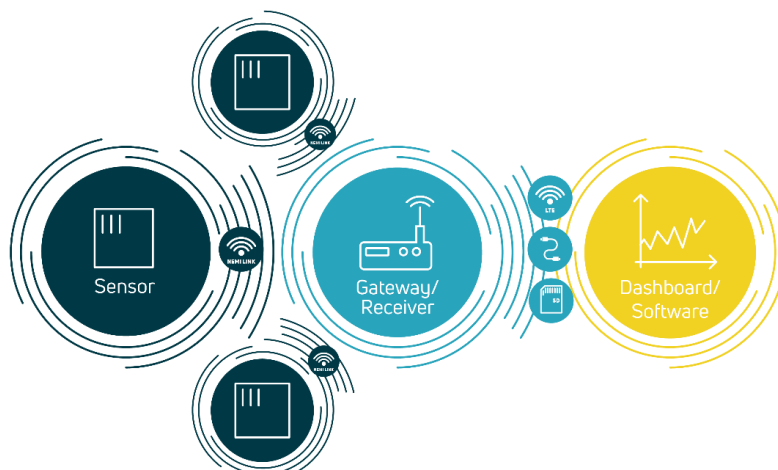
## Radio technology nemi Link 2400

Our own radio technology nemi Link 2400 is a wireless, battery-powered sensor network in the 2.4 GHz frequency band with star topology and one receiver module. This high-speed network enables the reliable transmission of data at high sampling rates. The high efficiency of our robust radio technology enables very long battery runtimes of our products. Our wireless sensors synchronize their internal clocks to the clock of the receiver module with extremely small deviations.

To optimize the measurements of a use case, nemi Link 2400 offers the possibility to adjust the number of sensor nodes per radio channel and the radio speed to achieve the perfect balance between range, data rate and runtimes for each application.

Please find detailed information in the nemi Link 2400 info sheet.

## Compatible sensor nodes in the nemi Link 2400 wireless network

The nemi Log can serve as receiver for all nemione® sensor nodes working with i4M's proprietary nemi Link 2400 radio technology, as listed below:



| nemi G+ | nemi G+ nano | nemi DAQ | nemi DAQ nano |

## Application

nemi Log basic version is particularly suitable for temporary offline applications, where the data can be read out from an SD card. GPS offers position tracking and an exact Timestamp. Since it can be mounted very easily and flexibly, it is also often used in rotating and moving applications.

In addition to that, nemi Log + cellular version offers a wide range of other applications such as long-term monitoring with low data rates. One Example is the monitoring of structures.

## Coming Soon: Transmission of low-frequency data via MQTT

Only a small amount of data is required over long periods of time, particularly for the long-term monitoring of structures. When monitoring expansions or cracks, for example, damage progress can be stable or only slightly progressive over long periods of time. During this time, for example, one measured value every 20 minutes is sufficient for monitoring. As soon as progress accelerates, however, data with a significantly higher temporal resolution must be obtained, e.g. 100 measured values per second or more.

nemi Log can cover both fields of application and receives an additional MQTT mode for long-term monitoring:

In this mode, all paired nemione wireless sensor nodes can be switched to sleep mode for 10 minutes at a time, for example, with very low energy consumption. nemi Log also sleeps and saves power. After 10 minutes, nemi Log and all wireless sensor nodes wake up and briefly transmit samples from all wireless sensor nodes, e.g. for 10 seconds. nemi Log then calculates minimum, maximum and average values across all incoming data channels and sends these values to a server via MQTT. The data can then be stored in a database and displayed on dashboards. For this purpose, i4M technologies can offer complete packages consisting of server infrastructure, database and dashboard or the customer can use their own solution.

The MQTT mode can be combined with the normal transmission mode of nemi Log at any time, so that high-frequency raw time data can also be transmitted as the damage progresses.
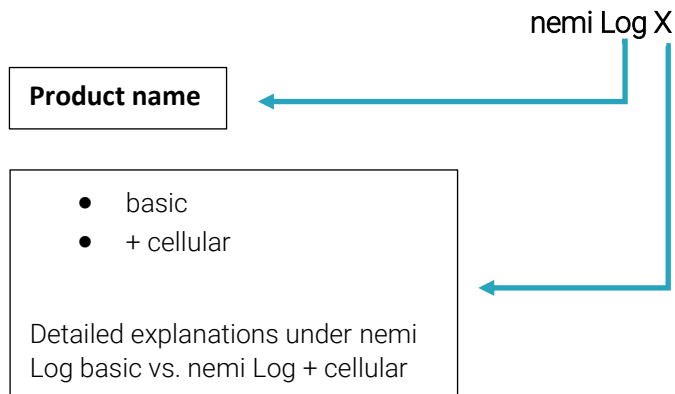
Download use case:



## Data Analysis

Upon request, we will be happy to support you with data analysis. The data analyses can be performed directly in the sensor or in the gateway by edge analytics as well as on the server or measuring computer. A great advantage of edge analytics is the **reduction of the transmitted data to the essentials** ("smart data"). This **reduces storage space** and **increases battery runtimes**.

Based on our knowledge from a multitude of previous projects, we have developed **algorithms for data evaluation** to generate **maximum added value** for our customers. We will gladly advise you on this. In addition to our existing algorithms we create **individualized scripts** upon request.

At the same time, the **data remains your capital**: We do not rely on big cloud providers but **keep the data in your IT ecosystem**. Alternatively, you can rely on our nemione® cloud solutions - hosted in the European Union.

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## Order options

nemi Log X

| Product name |
| --- |

- basic
- + cellular

Detailed explanations under nemi Log basic vs. nemi Log + cellular

## Contact

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