User Guide | PULSE ARF8428AAA MQTT | NB-IoT / LTE-M

Document version	V1.0
Product/Service	PULSE NB-IOT / LTE
Area	
Etat	Terminé

User_Guide__PULSE_ARF8428AAA_MQTT__NB-IoT__LTE-M.pdf

PRODUCT INFORMATION AND REGULATORY INFORMATION

This User Guide applies to the following product:
PULSE
Reference: ARF8428AA
APP Version: V2.0.X

DOCUMENT INFORMATION	
Title	PULSE MQTT - User Guide
Type	User Guide
Version	1.0

DECLARATIONS OF CONFORMITY

EU declaration of conformity for PULSE NB-IoT & LTE-M ARF8428AA.pdf

UK declaration of conformity for PULSE NB-IoT & LTE-M ARF8428AA.pdf

UK ADEU02NB-PSTI.docx

Compliance to FCC/ISED

TABLE OF CONTENTS

1. INTRODUCTION

1.1. General overview of the PULSE sensor

The PULSE is a **pulse sensor** designed for multi-energy remote metering (water, electricity, heat) and for the measurement of technical events (rain gauges, odometers, machine cycles).

It features two pulse inputs compatible with **dry contact, REED, open collector and S0** signals, and supports **2-wire, 3-wire, 4-wire and 5-wire** meters.

The PULSE is capable of **fraud detection** (tamper wire disconnection) with an adjustable threshold and a configurable sampling frequency, as well as **flow direction detection** for 4-wire or 5-wire meters.

The product integrates three levels of data historization (RAM, daily history exportable via NFC, and periodic EEPROM backup), ensuring index consistency even in the event of prolonged network outages. It can historize and store locally up to **800 successive index values**, ensuring data preservation in difficult or unavailable network conditions.

The PULSE communicates directly with a server through its **NB-IoT or LTE-Cat-M1 cellular connectivity**, without requiring any gateway, router or additional intermediate equipment.

It uses the **MQTT** protocol, ensuring reliable and energy-efficient remote metering.

The **secure NFC interface** enables local configuration, index reading, history export, log retrieval and firmware updates.

Its security mechanisms, compliant with **EN 18031-1**, ensure access protection, data integrity and controlled identity management.

Thanks to its **IP68 watertight enclosure**, optimized operation (PSM, TAU and Active Time management), **battery-powered operation for up to more than 15 years**, and its update mechanisms (FOTA and NFC), the PULSE provides a durable and secure remote metering solution for tertiary, industrial and public-sector environments.

1.2. Main features of the PULSE sensor

- **2 configurable pulse inputs:**

  Allowing one or two pulse-output meters or devices (dry contact, REED, S0 or open collector) to be connected.

- **Flow direction detection:**

  Measurement of consumed volume in both directions (forward / backward) for water meters equipped with a 4-wire or 5-wire signal.

- **Configurable fraud detection (wire cut):**

  Detection of a state change on the tamper input of each channel, with an **adjustable detection threshold** and a **configurable sampling frequency**.

- **Acquisition time programming:**

  Ability to define the exact time at which the product performs the first index acquisition and stores it.

- **Configurable transmission modes:** With adjustable transmission interval

- **Advanced historization:**

  - 2-wire or 3-wire meter: up to **800 historized index values** (**400 values** if two meters are connected),
  - 5-wire meter: up to **400 successive historized index values**,
  - 4-wire meter: up to **300 successive historized index values**,
  - Daily history exportable via NFC (last 100 values),
  - EEPROM backup every 10 minutes to secure index data.

  This historization capability limits data loss during prolonged network outages and optimizes energy consumption.

- **Worldwide cellular connectivity:**

  Direct connection to NB-IoT networks (B1-B5, B8, B12, B13, B17, B19, B20, B25, B26, B28, B65, B66, B85, B106) or LTE-Cat-M1 networks (B1-B5, B8, B12, B13, B18, B19, B20, B25, B26, B28, B66, B85, B106), **without any gateway or router**.

- **Fast local configuration via NFC:**

  The *IoT Configurator NB-IoT/LTE-M* application, available on iOS and Android, allows product configuration in less than 10 minutes.

- **Operational maintenance:**

  Application firmware and modem firmware updates, locally via NFC.

- **More than 15 years of autonomy:**

Thanks to its low-power architecture, advanced PSM and TAU management, and **Virtual PSM**, the product can operate for more than 15 years on a dual-battery pack (depending on network and application configuration).

- **Low battery alert:**

  Local alert (LED or NFC application) and remote notification via MQTT.

- **Integrated mounting system:**

  DIN rail, pipe, wall, clamp.

- **IP68 protection rating:**

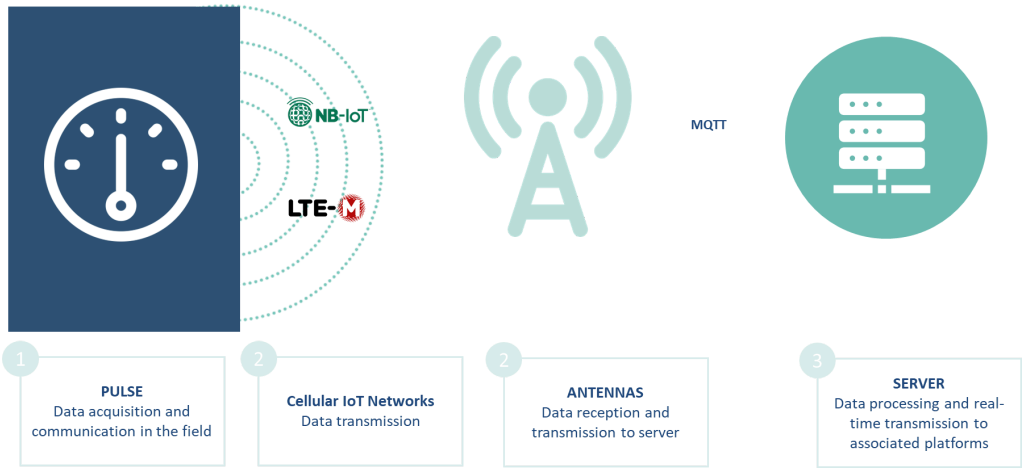
  Allowing installation in exposed or buried environments.

- **Made in France:**

  Product designed and manufactured in France.

> 📌 **NOTE**
> To address different use cases, the PULSE product also supports the LwM2M (Lightweight M2M) communication protocol.
> **To use the product with the LwM2M protocol, please refer to the dedicated User Guide.**

1.3. Operating principle of the PULSE sensor



2. SPECIFICATIONS

2.1. Technical specifications of the PULSE sensor

2.1.1. General characteristics

Mechanical characteristics	
Dimensions	200 × 63.5 × 34 mm
Weight	175 g (battery included)
Enclosure	IP68, EMERGE™ PC 8731HH grey resin (housing) EMERGE™ PC 8430-15 transparent resin (base) Indoor / outdoor use
Mounting system	DIN rail, pipe, wall, clamp

Battery	
Supply voltage	3.6 V nominal
Power supply	Replaceable FANSO Li-$SOCl_2$ dual battery pack – Adeunis ref. ER18505H-2 + SPC1520A
Battery capacity	8000 mAh + 38 mAh

Operating conditions	
Operating temperature range	–25°C / +70°C
Relative humidity	0 to 85% RH (non-condensing)
Operating altitude	2000 m or less

Recommendations related to the use of internal batteries in the product are detailed here.

📌 Although the PULSE is designed to operate over a temperature range of **–25°C to +70°C**, it is important to note that **standby power consumption increases significantly above 50°C**.
This increased consumption may impact battery life in hot environments or exposed installations.

2.1.2. Cellular network characteristics and supported protocols

Connectivity	
SIM card	Nano SIM 4FF Class C (1.8 V)
Antenna	Internal PCB antenna
Module	Nordic nRF9151
Cellular standard	3GPP LTE Release 14
Cellular IoT networks	NB-IoT, LTE-Cat-M1
NB-IoT frequency bands	B1–B5, B8, B12, B13, B17, B19, B20, B25, B26, B28, B65, B66, B85, B106
LTE-Cat-M1 frequency bands	B1–B5, B8, B12, B13, B18, B19, B20, B25, B26, B28, B66, B85, B106
Data transfer protocol	MQTT / MQTTS, LwM2M (To use the product with the LwM2M protocol, refer to the dedicated User Guide)

2.1.3. RF characteristics

RF characteristics	NB-IoT	LTE-Cat-M1
Max transmit power	+23 dBm	+23 dBm
Tx bandwidth	200 kHz	1.4 MHz
Theoretical data rate	65 kbps (UL) 30 kbps (DL)	375 kbps (UL) 300 kbps (DL)
Sensitivity	> –108 dBm –113 dBm typ.	> –103 dBm -107 dBm typ.

2.1.4. Data consumption

This section provides estimates of the PULSE data consumption with both channels enabled, depending on the selected communication mode and data transmission periodicity.

📌 **NOTE 1**
Product/broker communications such as keep-alives, time updates, and server registration are not included in the data consumption estimate below.

NOTE 2
Data consumption is the same regardless of the technology (NB-IoT or LTE Cat-M1) used by the product to connect to the cellular network.

Product / server communication mode	Monthly data consumption with 1 transmission/hour	Monthly data consumption with 1 transmission/day
Without historization 2 channels enabled, fraud detection disabled, lifetime set to 12 hours	4464 KB	186 KB
With historization 2 channels enabled, fraud detection disabled, lifetime set to 12 hours	4910 KB If index saved every 15 minutes	248 KB If index saved every 60 minutes

2.2. NFC interface

The PULSE features an **integrated NFC interface** allowing all local configuration and diagnostic operations.

NFC communication is available in **PARK mode**, **PRODUCTION mode**, and **even in the absence of a SIM card**.

2.2.1. Functions accessible via NFC

The NFC interface allows you to:

- Read the current status of the product (index value, network coverage, server connection, battery level),
- Configure all application and network parameters,
- Export index histories in **.CSV** format,

- Retrieve operating logs and network logs,
- Perform firmware updates (application and modem).

2.2.2. Secured access via NFC token

NFC access is protected by a **unique token** (8 alphanumeric characters), in accordance with **EN 18031-1**.

The **IoT Configurator NB-IoT/LTE-M** application uses this token to determine user access rights:

- **Without token:** access to diagnostics and non-protected product parameters (application parameters),
- **With token:** full access to protected parameters (network, security), firmware updates, and access to secrets and logs.

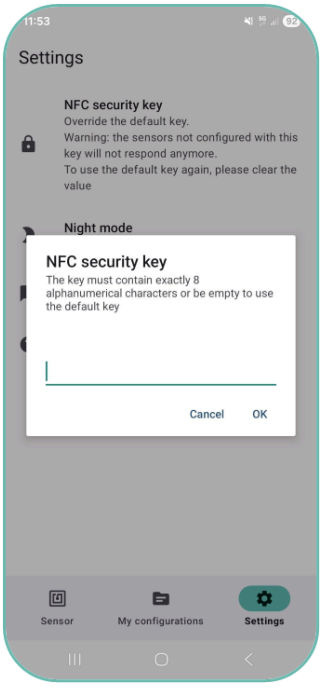
The NFC token can be:

- **Entered in the application** before the first connection to the sensor,
- **Modified by the user** (provided the current value is known),
- Restored using a **backup token** stored in internal memory and not modifiable.

2.2.3. Procedure for configuring the NFC token in the mobile application

To allow access to the configuration of a specific sensor from the mobile application, the NFC security key of this sensor must be configured in the application.

This key is available on the **KMS platform.**



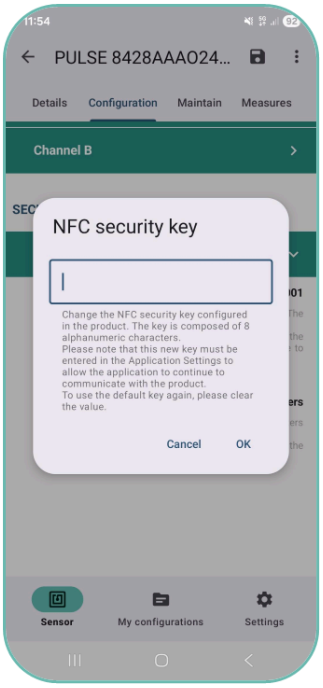
Open the **IoT Configurator NB-IoT/LTE-M** application.

📱 Go to the **“SETTINGS”** menu of the application
⇒ Select the **“NFC Security Key”**section
⇒ Configure the security key
⇒ Apply the configured token to the product via NFC

If the configured token is incorrect, **no sensor parameters will be accessible via NFC**.

This NFC security key can be modified after the first connection.

⚠️ In this case, it is mandatory to also update the NFC security key in the product in order to be able to reconnect to it.



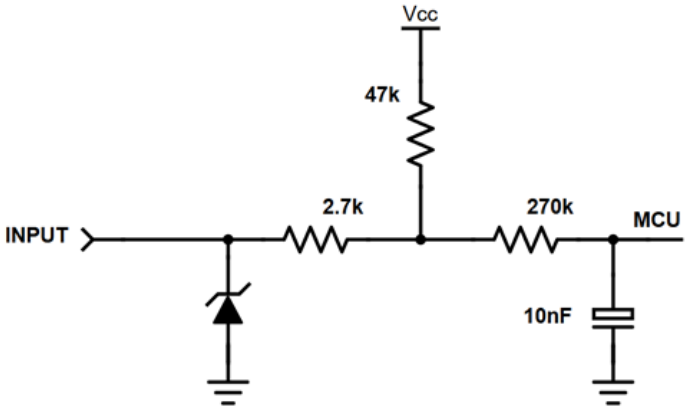
MODIFYING THE NFC SECURITY KEY IN THE PRODUCT:

📱 Go to the **“CONFIGURATION”** section of the sensor
⇒ Select the **“SECURITY”** section
⇒ Configure the **“NFC Security Key”** parameter
⇒ Apply the configured token to the product via NFC

2.3. PULSE signal input interface

The PULSE product features **2 configurable pulse inputs**, allowing one or two meters or pulse-output devices (dry contact, REED, S0, or open collector) to be connected.

THE OPERATING PRINCIPLE DIAGRAM IS AS FOLLOWS



Absolute maximum values	Unit
Minimum input voltage	−0.3 V
Maximum input voltage	+3.6 V

Electrical characteristics	
Minimum input voltage	0 V
Maximum input voltage	+3.6 V
Equivalent input resistance	47 kΩ
Input frequency	< 100 Hz
Input current consumption – HIGH level	0 µA
Input current consumption – LOW level	60 µA

Values exceeding the absolute maximum ratings will damage the product.

2.4. Compatible meters

EXAMPLES OF METERS TESTED BY ADEUNIS

Manufacturer	Meter / pulse transmitter reference	Meter type
ITRON	CF Echo II	Thermal
FLUDIA	FM230	Electrical
SOCOMEC	Countis E00	Electrical
MCI	DDS-1Y	Electrical
HAGER	ECP140D	Electrical
SCHNEIDER	IEM3210	Electrical
GAVAZZI	EM110DINAV81XO1X	Electrical
LEGRAND	EMDX³	Electrical
KAMPSTRUP	Pulse Adapter	Water
ITRON	Cyble Sensor V2	Water
SAPPEL-DIEHL	Izar Pulse	Water
ELSTER	PR6	Water
MADDALENA	Flow Pulse	Water
SENSUS	MS8100	Water
ELSTER	Reed PSMT T-Probe	Water
B-Meter	IWM-PL3	Water
WEHRLE MODULARIS	TRK-HYX / ETK-EAX	Water
DIEHL	REED SWITCH 570 REF: 630-061	Water
MADDALENA	Reed Switch WMAP	Water
MADDALENA	Reed Switch ONE	Water
MADDALENA	Flow Pulse WMAP	Water
ZENNER	Zenner – ZNREED 133802	Water
SENSUS	Capteur Reed RD	Water

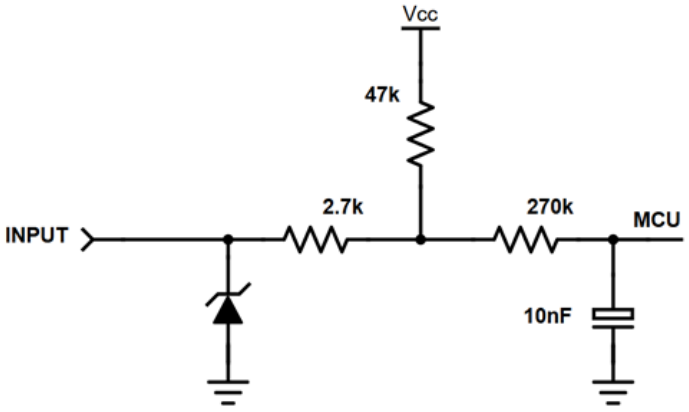
The list above is not exhaustive.

Please contact Adeunis to verify the compatibility of the PULSE sensor with any other meter or pulse transmitter reference.

2.5. Fraud signal input interface

The PULSE product allows detection of a state change on the fraud input of each channel (rising edge detected on an input normally held to ground).

THE OPERATING PRINCIPLE DIAGRAM IS AS FOLLOWS

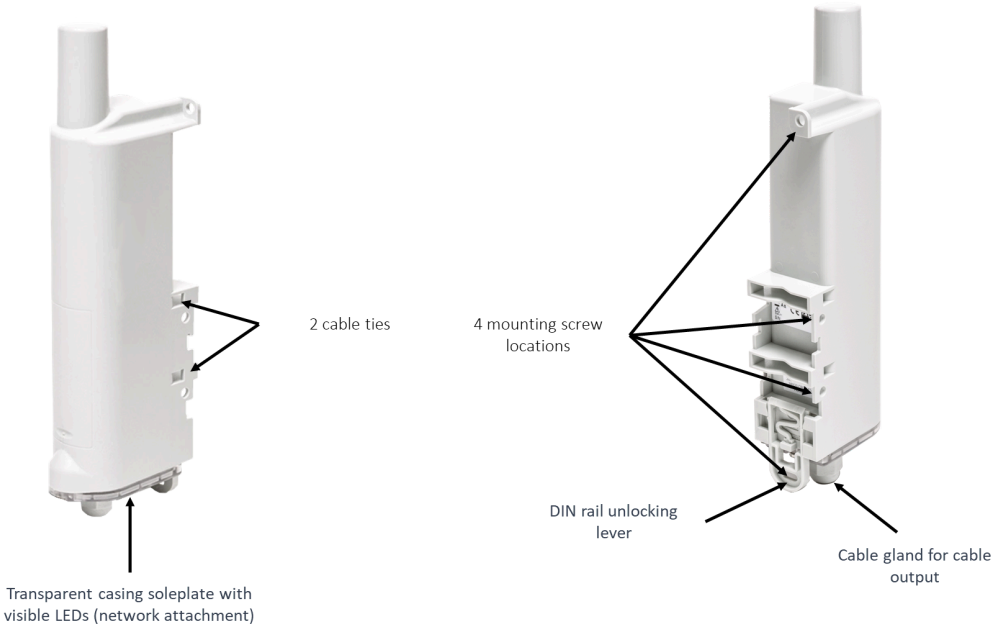


Absolute maximum values	Unit
Minimum input voltage	−0.3 V
Maximum input voltage	+3.6 V

Electrical characteristics	
Minimum input voltage	0 V
Maximum input voltage	+3.6 V
Equivalent input resistance	47 kΩ

Values exceeding the absolute maximum ratings will damage the product.

2.6. PULSE sensor enclosure



2.6.1. Environmental conditions and protection rating

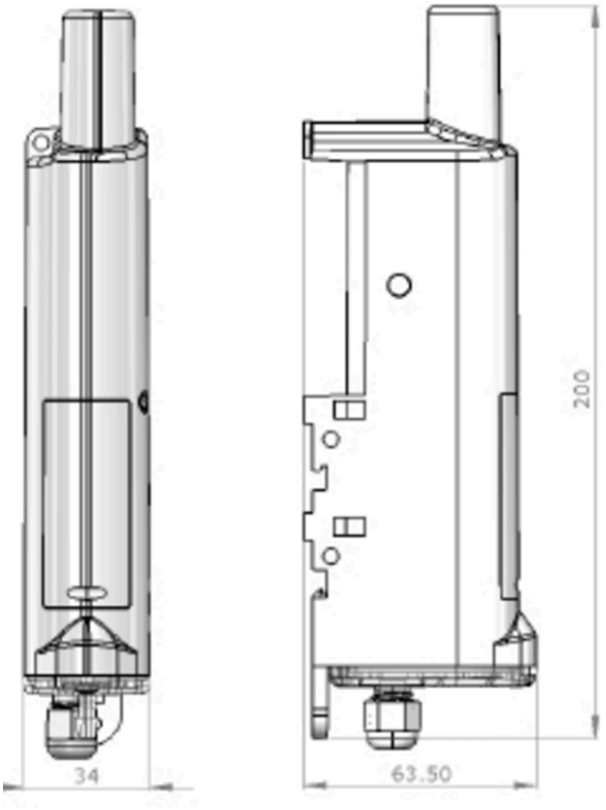
The product enclosure has been tested to ensure a certain level of dust and water resistance.

- For dust: Level 6 guarantees complete dust tightness.
- For water: Level 8 guarantees at least water resistance up to one meter for 1 hour.

Therefore, we can guarantee the water resistance of our IP68 enclosure for immersions less than or equal to this duration. Any use of our sensor outside the criteria mentioned above cannot be guaranteed by Adeunis.

📌 **NOTE**
The IP68 protection rating does not guarantee protection against condensation due to ambient humidity and temperature variations. Prolonged exposure to high-temperature variations and/or high relative humidity can lead to premature product failure.

2.7. Dimensions of the PULSE sensor



Dimensions in millimeters.

3. DELIVERY PACKAGE

The product is delivered in a cardboard package containing the following items:

- Upper housing, electronic board, enclosure base and 2 Torx 10 screws for the base
- Cable gland nut and 2 cable gland inserts (5.4 mm and 4.2 mm)
- Replaceable FANSO Li-$SOCl_2$ dual battery pack – Adeunis ref. ER18505H-2 + SPC1520A

4. PREPARATION FOR FIRST USE

4.1. Downloading the IoT Configurator NB-IoT/LTE-M application

IoT Configurator NB-IoT/LTE-M is an Android/iOS mobile and tablet application used to configure the network, server and application parameters of the PULSE product via an NFC interface.

The application also allows application configurations to be saved, exported and imported, making it possible to quickly duplicate a configuration across multiple products.

1. Download the application free of charge from:

Google Play Store https://play.google.com/store/apps/details?id=com.adeunis.nfcconfigurator

ou sur App Store https://apps.apple.com/fr/app/nb-iot-lte-m-iot-configurator/id6467626857

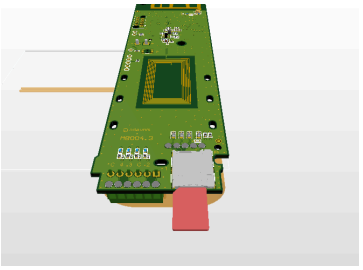
📌 **NOTE 1**
Using the NFC antenna has an impact on the product's battery life. To preserve autonomy, it is recommended to bring the smartphone close to the PULSE NFC antenna **only when performing a read/write operation**.
Once the operation is completed, remember to move the smartphone away from the product's NFC antenna.

4.2. SIM card installation

SIM CARD INSTALLATION PROCEDURE

The PULSE uses a **nano-SIM format** SIM card with a **push-push** connector.

Follow the procedure below to ensure correct installation and avoid mechanical damage.



1. Verify that the product is in **PARK mode** using the **IoT Configurator NB-IoT/LTE-M** application.
2. Remove the two screws from the enclosure base.
3. Pull on the cable gland to separate the base from the enclosure.
4. The push-push connector is located on the lower part of the electronic board.
5. Insert the nano-SIM into the connector with:
   - the gold contacts facing downwards,
   - the chamfered corner oriented towards the upper left.
6. Gently push the SIM card until a locking click is felt. The SIM card must remain locked in the connector.
7. To eject the SIM card: push it again until the unlocking click is felt, then remove it.
8. Reinsert the electronic board by following the guide rails inside the enclosure.
9. Tighten the two screws on the enclosure base to ensure watertightness (tightening torque: **0.6 Nm ± 0.05**).

WARNING

- The product **does not detect** SIM card insertion or removal in real time.
- As a result, **a newly inserted SIM card will only be detected after:**
  - switching the product to **PRODUCTION mode**, or
  - a **full product restart** (reboot, NFC → "Restart", or power-up).
- Never insert or replace the SIM card while the product is operating normally in **PRODUCTION mode**.
- If the SIM card is changed in PRODUCTION mode (not recommended), an **NFC reboot is mandatory** to synchronize the actual modem state (ICCID, SIM status).
- Then verify proper operation via the NFC application (ICCID reading, radio status).

> 📌 **NOTE**
> PIN code configuration is not supported by the PULSE product.

4.3. LED meanings (visual diagnostics)

PRODUCT STATUS	**Red LED status**	**Green LED status**
Product in PARK mode (i.e. powered off)	OFF	OFF
Product startup	OFF	Flashing 5 cycles: 100 ms ON / 100 ms OFF
Product startup failure	ON for 15 s	OFF
Network attachment in progress	Flashing 50 ms ON / 1 s OFF	Flashing 50 ms ON / 1 s OFF
Network attachment successful	OFF	ON for 5 s
Network attachment failure	ON for 5 s	OFF
Low battery level	Flashing 500 ms ON every 60 seconds	OFF

4.4. Power supply

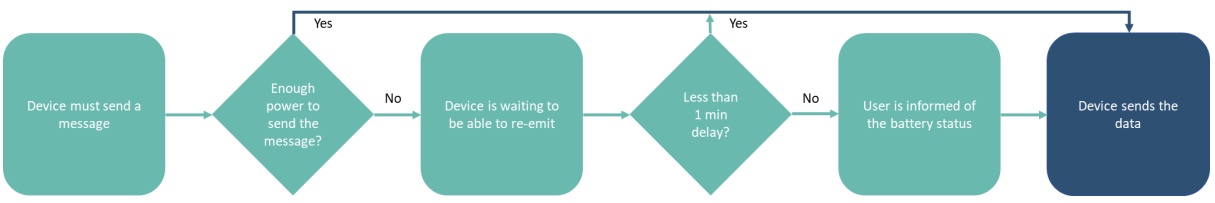
4.4.1. Power supply type

The PULSE is powered by a **dual lithium battery pack** (Adeunis ref. **ER18505H-2 + SPC1520A**), specifically designed to provide a service life that can exceed **15 years**, depending on usage and network configuration.

4.4.2. Low battery management

The product continuously monitors its battery level.

When the product detects that the battery is no longer able to deliver the energy required for a transmission (extreme temperatures or end-of-life battery), it waits until it is able to transmit.
If the resulting delay exceeds one minute, the product informs the user that the battery level is low.



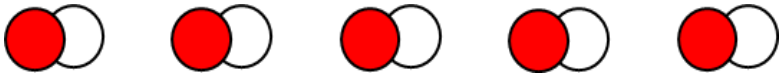
In case of low battery:

- **Red LED:** flashes every 60 seconds for 500 ms.
- **Low bat flag** reported on the MQTT broker.
- **NFC notification** visible in the application.

It is recommended to replace the battery pack as soon as this alert appears.

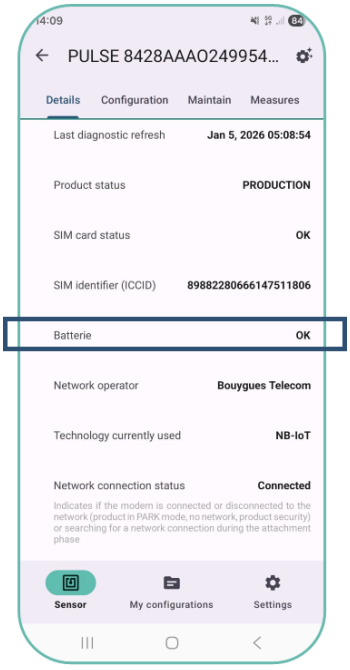
The low battery indication is automatically cleared when the battery is replaced or when temperature conditions become favorable for proper battery operation.

USER INFORMATION VIA THE PRODUCT LED INDICATORS



The red LED flashes every 60 seconds for 500 ms when the product battery level is low.

USER INFORMATION VIA THE IoT Configurator NB-IoT/LTE-M APPLICATION



📱 Go to the **“DIAGNOSTIC”** section of the sensor to check the battery status: **“OK”** or **“LOW”**

USER INFORMATION VIA A MQTT BROKER

```
{
  "sn": "8428AAA0249954190",
  "lowbat": false,
  "CHA": [
    {
      "v": 146,
      "t": 1766482927
    }
  ],
  "CHB": [
    {
      "v": 66,
      "t": 1766482927
    }
  ],
  "WA": [
    {
      "v": 1,
      "t": 10
    },
    {
      "v": 1,
      "t": 8
    }
  ],
  "txInfo": {
    "snr": 12,
    "rsrp": -78,
    "rsrq": -6,
    "txPower": 7,
    "nbReboot": 37,
    "t3324": 32
  }
}
```


The PULSE product reports the battery status in every message sent to the MQTT broker.

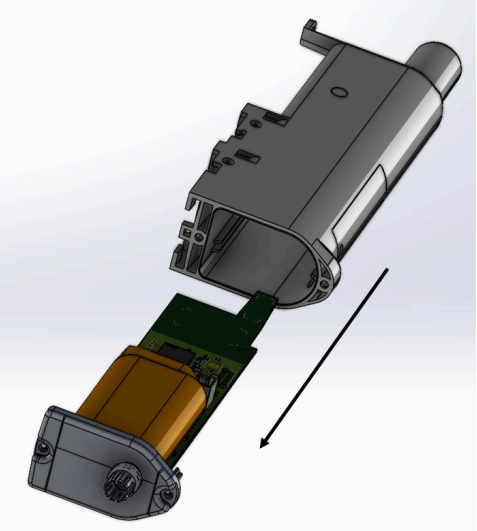
4.4.3. Dual battery pack replacement

When the low battery indicator is activated, it is recommended to replace the internal battery pack.

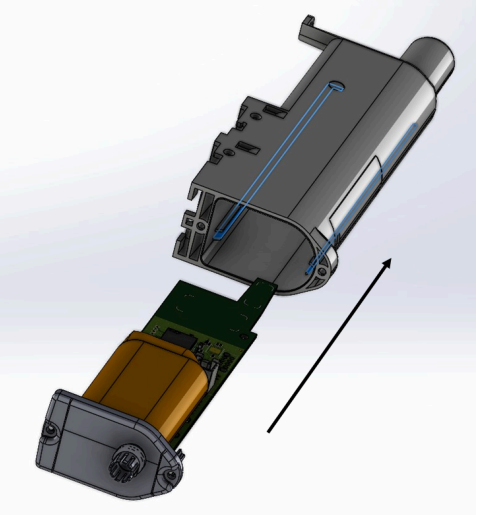
It is important to use the same battery reference, namely **Adeunis ER18505H-2 + SPC1520A**.

DUAL BATTERY PACK REPLACEMENT PROCEDURE

1. Remove the two screws from the enclosure base.
2. Pull on the cable gland to separate the base.
3. Slide the electronic board out of the guide rails.
4. Slide the cable tie.
5. Disconnect the battery cable and remove the battery.
6. Replace it with a new battery and reconnect the cable.
7. Reposition the cable tie.
8. Reinsert the electronic board by following the guide rails inside the enclosure.
9. Tighten the two screws on the enclosure base to ensure watertightness (tightening torque: **0.6 Nm ± 0.05**).



Pull on the cable gland to separate the base.



Reinsert the electronic board by following the guide rails inside the enclosure and tighten the two screws

After this battery replacement procedure, the product will automatically resume normal operation and clear the low battery indicators (status and LED).

5. COMMISSIONING

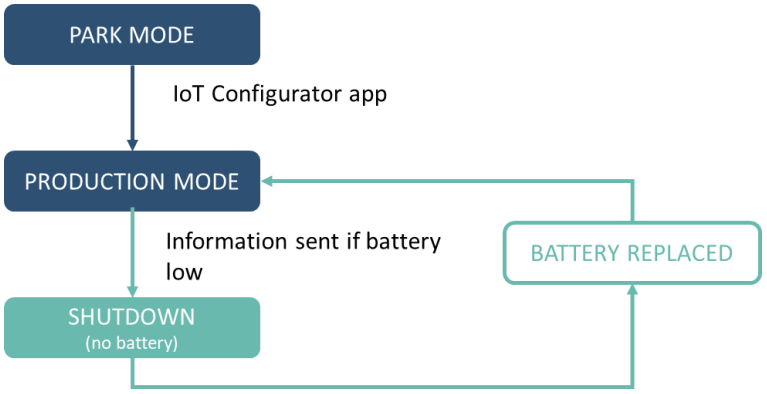
This chapter describes in detail the behavior of the PULSE during commissioning, as well as the product startup sequence.

This information helps you understand:

- How the product starts up,
- How network attachment is performed,
- How to interpret the LED indications,
- And how to respond in specific cases (no SIM card, no network coverage, etc.).

5.1. Operating modes

The PULSE has two operating modes: **PARK** and **PRODUCTION**.



5.1.1. PARK mode

The product is delivered in **PARK mode**.

This mode is intended for:

- long-term storage,
- transportation,
- product preparation in a workshop,
- and configuration operations **via NFC**, without any network transmission.

In PARK mode:

- No network communication is initiated.
- Power consumption is minimal.
- All NFC operations remain available (reading, configuration, diagnostics, update).

The product will only start transmitting after switching to **PRODUCTION mode**.

5.1.2. PRODUCTION mode

This mode enables the product to operate in its final use.

Switching to PRODUCTION mode automatically triggers:

- A full product startup.
- The start of pulse input sampling, tamper detection (if enabled) and flow direction monitoring (if configured).
- The startup of the MQTT transmission cycle according to the selected configuration.

5.2. Product startup

Switching to PRODUCTION mode is performed using the **IoT Configurator NB-IoT/LTE-M** application.

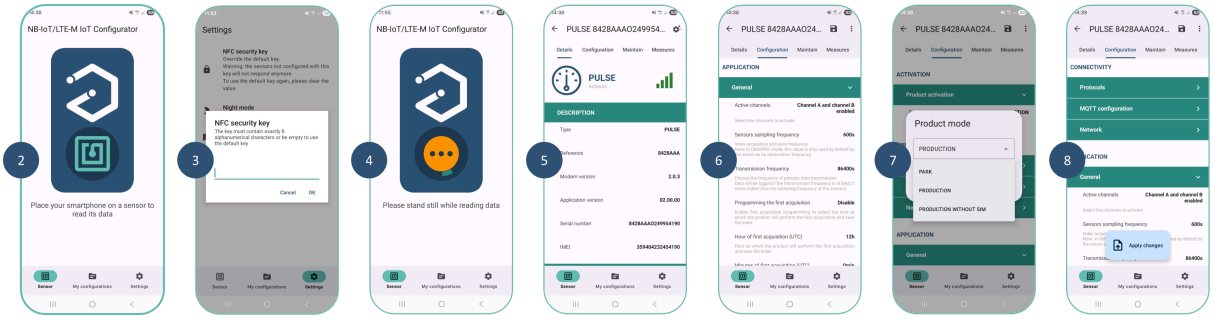
1. Make sure the product contains a **SIM card**.

2. Launch the **IoT Configurator NB-IoT/LTE-M** application and enable NFC on your smartphone.
3. In the **IoT Configurator NB-IoT/LTE-M** application, configure the product NFC token.
4. Place your smartphone against the product.
5. The product information and its current configuration are automatically displayed in the **IoT Configurator NB-IoT/LTE-M** application.
6. Configure the server, network and application parameters of the product using the **IoT Configurator NB-IoT/LTE-M** application.

Refer to the following sections of this User Guide:

- **Section 6.2 "Server parameter configuration"**
- **Section 6.3 "Cellular network parameter configuration"**
- **Section 6.4 "Application parameter configuration"**

7. Go to the sensor **"CONFIGURATION"** menu and select the **"PRODUCT ACTIVATION"** section. Enable **"PRODUCTION"** mode.
8. Apply the new configuration to the product by pressing **"Apply changes"** in the **IoT Configurator NB-IoT/LTE-M** application.



During this startup phase, the **green LED flashes rapidly** (5 fast cycles: 100 ms ON / 100 ms OFF).

If the product is faulty, the red LED will turn on for 15 seconds and the product will then reboot.

5.3. Network attachment (NB-IoT / LTE-M)

5.3.1. Network attachment at startup and configuration

After product startup:

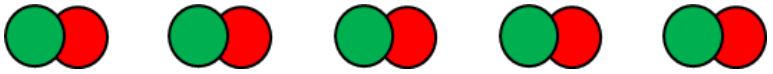
- The modem attempts a **network attachment** using the available technology,
- The duration can range from a few seconds to several tens of seconds,
- In case of failure, the sensor retries according to a defined attachment cycle (operator parameters).

AUTOMATIC NETWORK ATTACHMENT

If a single-operator Nano SIM card is inserted, the product attaches to the network automatically.

If a multi-operator or multi-technology Nano SIM card is inserted, the product automatically searches for and selects the best operator or the best technology at product startup (depending on the list of operators supported by the SIM card).

During the network attachment process, the green and red LEDs flash alternately for 50 ms every second.



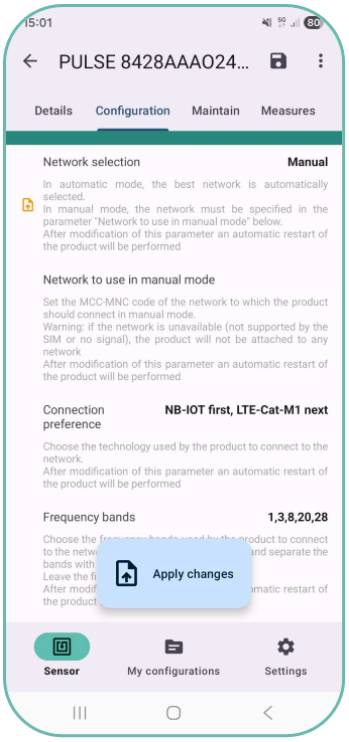
If network attachment fails, the red LED turns on for 5 seconds.

By default, the product will attempt two network attachments every 12 hours. This mechanism helps protect battery life in poor network conditions. These two parameters (number of attachment attempts and waiting time between two attempts) can be configured using the **IoT Configurator NB-IoT/LTE-M** application.

As long as the product has not attached to the network at least once, the red LED will turn on for 5 seconds for each failed attachment attempt.

MANUAL NETWORK ATTACHMENT

Once network attachment has been completed, the user can choose to manually attach to a specific operator using the **IoT Configurator NB-IoT/LTE-M** application.



Go to the sensor **“CONFIGURATION”** menu
Select the **“NETWORK”** section
⇒ Set the **“Network selection”** parameter to manual mode
⇒ Then enter the MCC-MNC code corresponding to the network the product must connect to in manual mode using the **“Network to use in manual mode”** parameter
⇒ Apply the new configuration to the product via NFC.
It is also possible to select the technology used by the product to connect to the network (NB-IoT or LTE-Cat-M1) using the **“Connection preference”** parameter.

Once the operator is selected, the product will restart automatically and will then operate on this operator, even after subsequent power cycles.

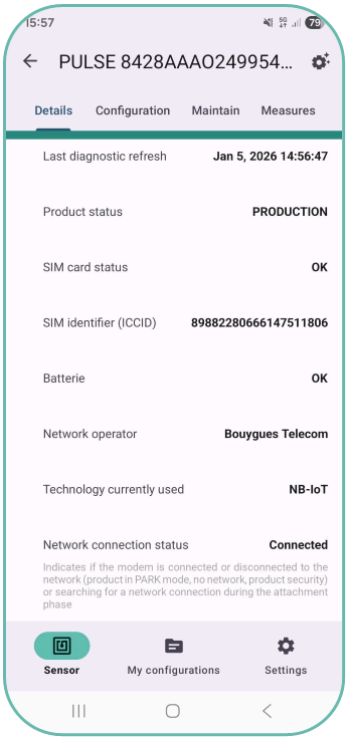
WARNING

If the network selected in manual mode is not accessible (not supported by the SIM card or no coverage), the product will not attach to any network.

📌 **NOTE**
If no network activity is detected for 48 hours (such as lifetime or data transmission), the product will automatically restart a network attachment procedure.

5.3.2. Monitoring the network attachment status

At any time, the user can check the network connection status in the **IoT Configurator NB-IoT/LTE-M** application.



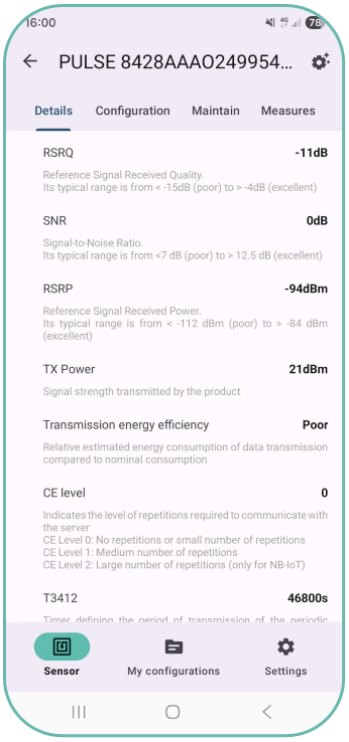
📱 Go to the sensor **“DETAILS”** menu
Select the **“DIAGNOSTIC”** section
⇒ Monitor the network attachment status using the **“Network connection status”** parameter.

Network attachment status	Description
Not connected	Product in PARK mode or no network coverage at the installation location
Disconnected (timeout)	Network attachment time exceeds the configured timeout in the product (120 seconds by default)
Searching	Product searching for a network connection
Connected	Product connected to the network

5.4. Checking network quality

Adeunis recommends that the installer checks the network coverage level before installing the product in its final location.

5.4.1. Check via the IoT Configurator NB-IoT/LTE-M application



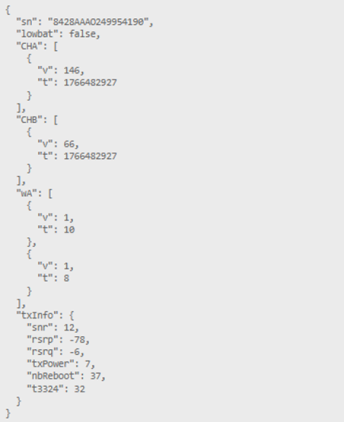
Go to the sensor **"DETAILS"** menu
Select the **"DIAGNOSTIC"** section
⇒ View the values of the following parameters: RSRQ, SNR, RSRP, Tx power

To facilitate evaluation of product operation, an icon displayed at the top of the "DIAGNOSTIC" section also provides a visual indication of signal quality.

5.4.2. Check via a MQTT broker

The user can choose to automatically add network performance data to the MQTT message. This data includes RSRP, RSRQ, SNR, transmit power, the T3324 value, and the number of product restarts.

This option is disabled by default.



📱 Go to the sensor “CONFIGURATION” menu
⇒ Select the “MQTT CONFIGURATION” section
⇒ Disable or enable the “Enable transmission of network data” parameter
⇒ Apply the new configuration to the product via NFC

Once the product is installed and connected to the network, it automatically performs a network quality diagnostic each time it wakes up from sleep mode.

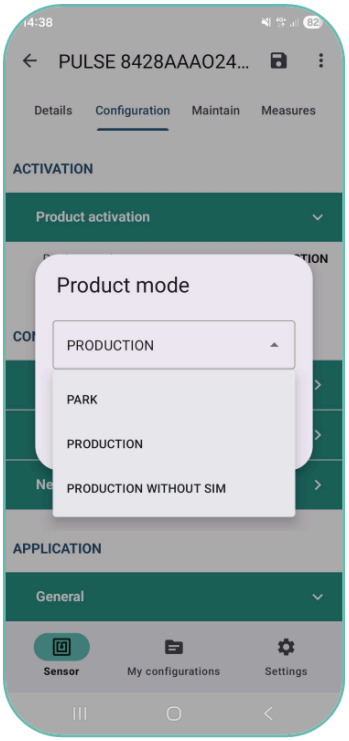
At any time, the installer/user can view this network quality information via the **IoT Configurator NFC application** or via the MQTT broker, and potentially move the product to a location with better network quality.

5.5. Specific case: startup without a Nano SIM

It is possible to use the PULSE in “non-connected” mode, i.e. without inserting a Nano SIM card. When this mode is enabled, the product will not connect to a cellular network and will not transmit its data to a remote server. Remote meter readings will therefore be accessible locally only via the **IoT Configurator NB-IoT/LTE-M** application.

📌 **Features available in “non-connected” mode**

- Configuration via the **IoT Configurator NB-IoT/LTE-M** application.
- **Reading of index values** for each pulse input.
- Viewing of these two data points in the **IoT Configurator NB-IoT/LTE-M** application.
- Local **export** of the history of the **last 100 index values** for each channel.



Activating operation without a Nano SIM using the IoT Configurator NB-IoT/LTE-M application
Go to the sensor **“CONFIGURATION”** menu
Select the **“PRODUCT ACTIVATION”**section
⇒ Enable **“PRODUCTION WITHOUT SIM”** mode
⇒ Apply the new configuration to the product via NFC

6. CONFIGURATION

This chapter describes the **general configuration principles of the PULSE**, the different available parameters, and their impact on product behavior.

Concrete configuration examples (depending on the meter type or the use case) are detailed in the **appendices**.

6.1. General configuration principles

PULSE can be configured locally via the **NFC** interface, both before and after deployment.

Local NFC configuration is particularly well suited for on-site installation, maintenance, or troubleshooting phases.

6.2. Server parameter configuration

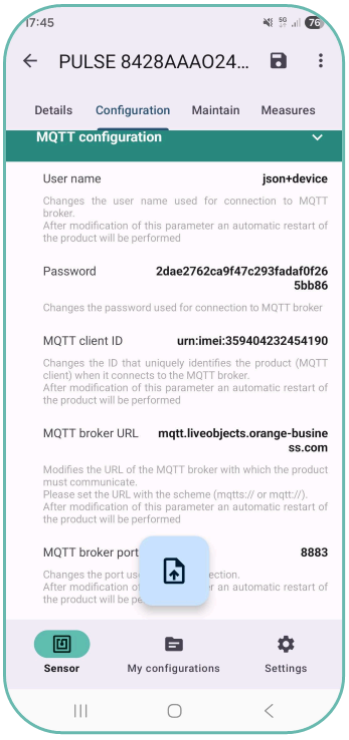
The connection to the MQTT broker is based on:

- a **username**,
- a **client ID**,
- a **broker URI**,
- a **publish topic**,
- a **server certificate**.

The table below lists the parameters to configure on the product to connect to an MQTT broker.

Parameters	Description	Default configuration
Username	Username configured in the product and used to connect to the MQTT broker. To register the product on a broker, the username can be viewed on the **KMS platform**. The username can be modified by the user.	A unique username is preconfigured in the product before shipment.
Password	Password configured in the product to authenticate the connection to the MQTT broker. For the product to be recognized, this password must also be configured on the MQTT broker side. The password can be viewed on the **KMS platform** and can be modified by the user.	A unique alphanumeric password is preconfigured in the product before shipment.
MQTT Client ID	ID used to uniquely identify the product (MQTT client) when connecting to the MQTT broker. Format: `urn:imei:xxx`. To register the product on a broker, the Client ID can be viewed on the **KMS platform**. The Client ID can be modified by the user.	A unique Client ID is preconfigured in the product before shipment.
Server certificate validation	The MQTT client verifies the validity of the server certificate presented when establishing the TLS connection. If using a self-signed certificate, this validation must be disabled.	Disabled
MQTT server certificate	If server certificate validation is enabled, this certificate allows the product to authenticate the MQTT broker (requires uploading a `.pem` file). This certificate must be obtained from the MQTT broker provider.	-
MQTT broker URL	URL of the MQTT broker the product must communicate with. The **"MQTT Server"** field accepts URLs in the following forms: • `mqtts://` → Secure TLS connection • `mqtt://` → Non-secure connection (no encryption) • No prefix → the connection will automatically be	-

Parameters	Description	Default configuration
	established in secure mode (MQTTS). The URL field can contain up to 100 characters, including the IP address or DNS name.	
MQTT broker port	Port used for the connection.	-
Publish topic	Topic used to publish product data.	`dev/data`



To configure the MQTT broker via the IoT Configurator NB-IoT/LTE-M application
Go to the sensor “CONFIGURATION” menu
⇒ Then select the “MQTT CONFIGURATION” section
⇒ Apply the new configuration to the product via NFC.

Once the MQTT broker connection parameters have been configured in the product, it is ready to be registered on a server.

6.3. Cellular network parameter configuration

The PULSE product must be connected to a network in order to transmit its data to a MQTT broker.

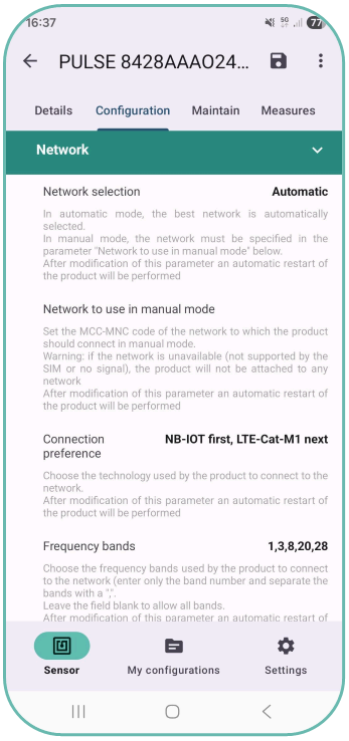
Some radio parameters directly impact battery life:

- PSM and TAU management,
- enabling **Virtual PSM** when network PSM is not available,
- selecting the network the product connects to, etc.

These parameters are generally preconfigured and can be adjusted depending on the deployment context.

The following table lists all the PULSE network parameters and their default values.

Parameters	Description	Default configuration
Network selection	Automatic or manual selection of the cellular network used by the product at startup	Automatic
Connection preference	Technology used by the product to connect to the network	NB-IoT then LTE-Cat-M1
Frequency bands	Frequency bands used by the product to connect to the network. Default bands are European bands. Bands can be limited to reduce attachment time (e.g., in France only band 20 is used by operators).	1, 3, 8, 20, 28
Maximum network attachment duration	Maximum duration allowed for modem network attachment. If exceeded without attachment, the attempt is aborted.	120 seconds
Number of network attachment attempts	Number of successive network attachment attempts	2
Waiting time between two attachment attempts	Delay between two successive attachment attempts	12 hours
APN	Forces the Access Point Name defining the Internet connection parameters (network and operator)	–
T3412 value	Timer defining the period for sending periodic Tracking Area Update (TAU) signals to the network. When T3412 expires, the product exits deep sleep with no radio activity (PSM cycle). The T3412 value is multiplied by its multiplier to obtain the keep-alive duration.	1
T3412 multiplier	Multiplier for the T3412 timer	31 hours
T3324 value	Timer indicating how long the sensor remains reachable by the network after a transmission. When T3324 expires, the product enters PSM while staying registered. The T3324 value is multiplied by its multiplier to obtain the Active-time duration.	5
T3324 multiplier	Multiplier for the T3324 timer	2 seconds
Virtual PSM mode	The product behaves as if in PSM sleep when the network does not allow normal PSM	Enabled



📱 **If needed, the user can modify the default cellular network connection parameters via the IoT Configurator NB-IoT/LTE-M application:**

Go to the sensor “CONFIGURATION” menu
⇒ Select the “NETWORK” section
⇒ Configure the product
⇒ Apply the new configuration to the product via NFC

6.4. Application parameter configuration

6.4.1. Selecting the connected meter type

The PULSE product can be connected to most pulse meters on the market.

Depending on the number of wires available on the meter output, certain functions (tamper, flow direction) are supported.

The paragraphs below describe what the PULSE supports depending on the connected meter type, to help the installer choose the wiring and sensor configuration.

Connected to a 2-wire meter

The PULSE allows **reading the consumption index** by counting the pulses emitted by the meter.

This is the simplest wiring (signal + ground) and is suitable for standard pulse outputs (dry contact, REED, or open collector).

📌 **Two 2-wire meters can be connected simultaneously**, one on each pulse input (Channel A and Channel B).

A configuration example for a 2-wire meter is provided in APPENDIX 3 of this User Guide.

Connected to a 3-wire meter

The PULSE allows:

- **reading the consumption index** by counting the pulses emitted by the meter,
- **detecting a wire cut** on the tamper detection wire (fraud attempt or accidental break),
- **reporting a tamper status** to the server.

If the tamper wire is cut, the product detects the anomaly and reports it at the next index transmission. This mode helps secure the installation against wiring faults or fraud attempts.

📌 **Two 3-wire meters can be connected simultaneously**, one per channel, with independent supervision of each tamper wire.

Connected to a 4-wire water meter

The PULSE allows:

- **measuring forward flow consumption**,
- detecting **reverse flow**,
- **measuring reverse flow consumption**,
- computing **net consumption** (forward flow – reverse flow),
- **detecting a wire cut** on the tamper detection wire (fraud attempt or accidental break).

It automatically distinguishes normal consumption from reverse flow while ensuring tamper detection. This wiring is particularly suitable for bidirectional water meters.

A configuration example for a 4-wire meter is provided in APPENDIX 4 of this User Guide.

Connected to a 5-wire water meter

The PULSE allows:

- **measuring total consumption** (forward flow + reverse flow),
- **measuring compensated consumption** (forward flow only),
- **detecting flow direction**,
- **detecting a wire cut** on the tamper detection wire (fraud attempt or accidental break).

The PULSE provides **complete and accurate measurement** through the management of high- and low-frequency pulse signals, **flow direction detection**, and **tamper supervision**.

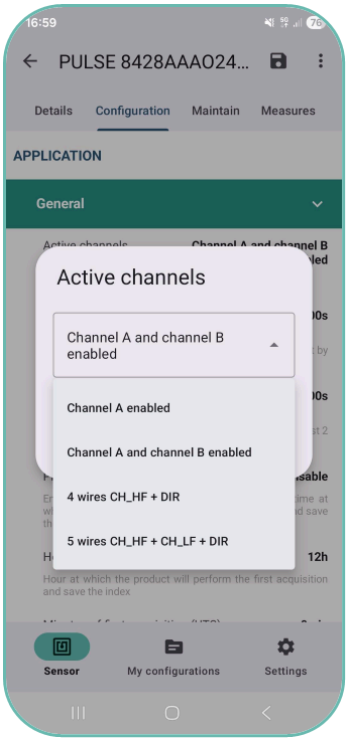
This mode is recommended for advanced meters requiring fine resolution and enhanced supervision.

A configuration example for a 5-wire meter is provided in APPENDIX 5 of this User Guide.

Meter type	Pulses	Direction	Tamper	Specific feature
2-wire	✔️	✖️	✖️	Basic counting

Meter type	Pulses	Direction	Tamper	Specific feature
3-wire	✔	✖	✔	Counting + tamper detection
4-wire	✔ (HF)	✔	✔	Forward counting + reverse flow detection + reverse counting + net consumption + tamper detection
5-wire	✔ (HF & LF)	✔	✔	Total consumption counting + forward flow counting + direction detection + tamper detection

The wiring diagrams for connecting meters to the screw terminals are available in a dedicated section of this user guide.



📱 Setting the meter type via the IoT Configurator NB-IoT/LTE-M application:
Go to the sensor “CONFIGURATION” menu
⇒ Select the “APPLICATION” section
⇒ Select the “GENERAL” subsection
⇒ Set the “Active channels” parameter
⇒ Apply the new configuration to the product via NFC.

6.4.2. Pulse input configuration

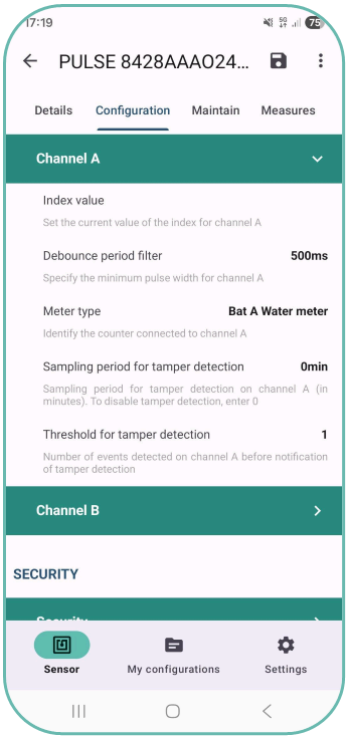
Each pulse input (Channel A and Channel B) can be configured independently.

Main parameters allow you to:

- set the index value at startup,
- adjust pulse filtering depending on the connected meter,
- identify the meter type.

If the PULSE is connected to **one 2-wire, 3-wire, 4-wire or 5-wire meter**, only **Channel A** must be configured.

If the PULSE is connected to **two 2-wire meters or two 3-wire meters**, both **Channel A and Channel B** must be configured.



Configuring pulse inputs via the IoT Configurator NB-IoT/LTE-M application:
Go to the sensor “CONFIGURATION” menu
⇒ Select the “APPLICATION” section ⇒ Select the “CHANNEL A” subsection
⇒ Set the “Index value”, “debounce period filter” and “meter type” parameters
⇒ Configure Channel B parameters if needed
⇒ Apply the new configuration to the product via NFC.

6.4.3. Tamper detection configuration

When the meter includes a tamper wire, the tamper wire-cut detection function can be enabled for each channel.

The PULSE product then checks at a regular interval (configurable period) the tamper input state for each channel where tamper detection is enabled. A tamper event is detected if a rising edge is detected on the tamper input normally held to ground.

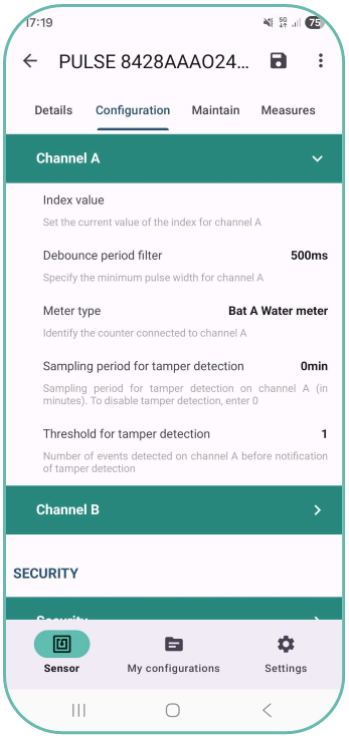
The product counts the number of detected rising edges (configurable threshold). When the tamper detection threshold is reached, the user is informed at the next periodic transmission.

The product continues to operate and transmit its data even when a tamper wire cut is detected.

Associated parameters allow you to:

- enable/disable tamper detection,
- set the **tamper sampling period**,
- set a **detection threshold** (number of events before reporting),
- include the **tamper status** in periodic transmissions.

📌 Tamper detection does not trigger an immediate alarm transmission, but an information report (associated with the tamper detection timestamp) during configured transmissions.



📱 **Configuring tamper detection via the IoT Configurator NB-IoT/LTE-M application:**
Go to the sensor “CONFIGURATION” menu
⇒ Select the “APPLICATION” section
⇒ Select the “CHANNEL A” subsection
⇒ Set the “Tamper detection sampling period” and “Tamper detection threshold” parameters
⇒ Configure Channel B parameters if needed
⇒ Apply the new configuration to the product via NFC.

6.4.4. Sampling period configuration

The PULSE allows **reading the consumption index** by counting the pulses emitted by the meter.

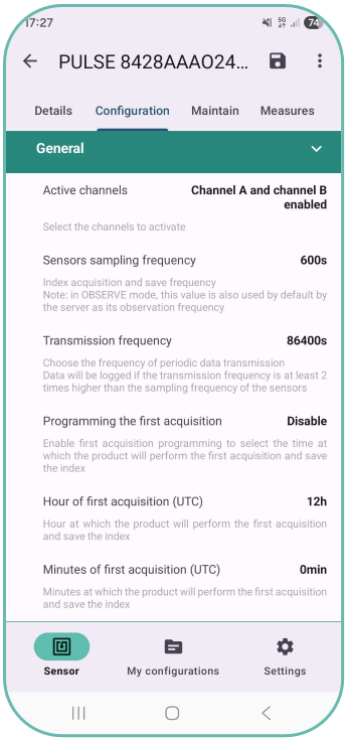
The sampling period defines how often the PULSE saves the meter index value.

- Default sampling period is 24 hours.
- The user can choose any sampling period between 60 and 604800 seconds (7 days).
- The minimum interval between two samplings is 1 minute.
- Sampling granularity is one minute, rounded down to the nearest value (e.g., 90 s = 1 min).

📌 **NOTE 1**
If two meters are connected simultaneously to the PULSE, the sampling period is necessarily common to both pulse inputs to prevent transmission desynchronization that would impact battery life.

NOTE 2
In OBSERVE mode, any server-side configuration of the attributes “evaluation minimum period (epmin)” and “evaluation maximum period (epmax)” in an observation operation will not be taken into account by the product.

NOTE 3
Pulse detection and counting remain operational even when the cellular network is not available.



Configuring the sampling period via the IoT Configurator NB-IoT/LTE-M application:
Go to the sensor “CONFIGURATION” menu
⇒ Select the “APPLICATION” section
⇒ Set the “Sampling period” parameter
⇒ Apply the new configuration to the product via NFC.

6.4.5. Configuring application data transmission

DATA TRANSMISSION MODE

The PULSE product enables **consumption index measurement** by counting the pulses emitted by the meter. Depending on the number of wires available at the meter output, certain functions (tamper detection, flow direction) are supported.

Consumption values are transmitted using two transmission modes:

- Periodic transmission without history
- Periodic transmission with history

Concrete use cases and the associated configuration examples are provided in the **appendices** of the User Guide.

Transmission mode	Definition	Typical use case
Periodic transmission without history	With this transmission mode, the PULSE continuously detects and counts pulses on each of its two inputs. For each input, the product stores the index value according to the configured sampling frequency. The product transmits only the **latest stored index value** (no history)	**APPENDIX 3** **APPENDIX 4** **APPENDIX 5**

Transmission mode	Definition	Typical use case
Periodic transmission with history	With this transmission mode, the PULSE continuously detects and counts pulses on each of its two inputs. For each input, the product stores the index value according to the configured sampling frequency. With the history mechanism enabled, if the sampling frequency is lower than the transmission frequency, the product stores successive index values in local memory and then transmits them in a **single message** at the end of the transmission period.	**APPENDIX 3** **APPENDIX 4** **APPENDIX 5**

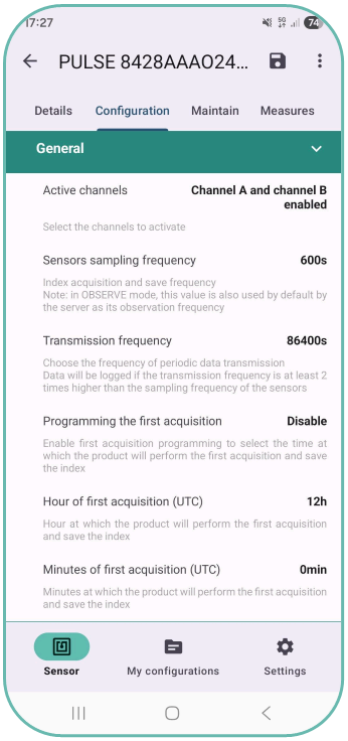
📌 **NOTE 1**
The granularity of periodic transmissions is **one minute**, rounded down to the nearest lower value (e.g. 90 s = 1 min).

CONFIGURING DATA HISTORY

With the history mechanism enabled, if the sampling frequency is lower than the transmission frequency, the product stores successive index values in local memory and then transmits them in a single message at the end of the transmission period.

The PULSE product can store up to **400 successive consumption index values when two inputs are active**, or up to **800 values when only one input is used** (depending on the configuration).

Meter type	Maximum number of stored values
1 × 2-wire or 3-wire meter	800
2 × 2-wire or 3-wire meters	400
4-wire meter	300
5-wire meter	400



Configuring history via the IoT Configurator NB-IoT/LTE-M application:
Go to the sensor **“CONFIGURATION”** menu
⇒ Configure the **“Transmission frequency”** parameter
⇒ Apply the configuration to the product via NFC

6.4.6. Retransmission of data in case of server connection issues

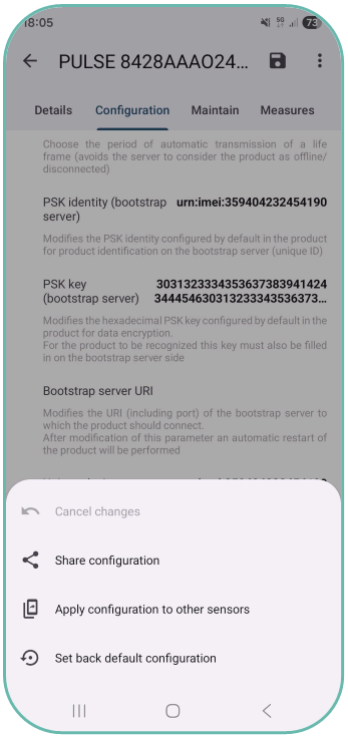
To prevent data loss in the event of an MQTT broker connection issue, an acknowledgement check is automatically performed by the product after each transmission.

If the message sent by the product is not acknowledged by the broker, the unsent data is stored by the product and transmitted during the next periodic report, up to **400 values when two inputs are active**, or **800 values when only one input is used** (depending on the configuration).

If this limit is exceeded, the oldest values will be automatically deleted by the product.

6.5. Restoring factory settings

The PULSE product can be reset to the default factory settings using the **IoT Configurator NB-IoT/LTE-M application**.



To restore factory settings via the IoT Configurator NB-IoT/LTE-M application, go to the secondary menu at the top of the **"CONFIGURATION"** screen
⇒ Then select the action **"Restore default configuration"**
⇒ Apply the new configuration to the product via NFC.

6.6. Data timestamping

Each index value reported by the PULSE product is automatically associated with a timestamp in UTC.

The internal clock is synchronized remotely via the network.

Timestamps are provided in **EPOCH** format.

6.7. Programming the acquisition time

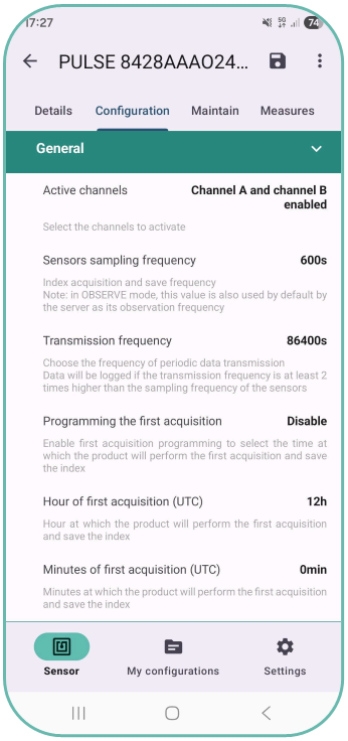
By default, the PULSE product starts its sampling period when it switches from **PARK mode** to **PRODUCTION mode**.

It is possible to program the time at which the product will perform its first acquisition, independently of the time at which it was started. The message transmission frequency will then be aligned with this first acquisition time.

The acquisition time can be configured using the **IoT Configurator NB-IoT/LTE-M application**.

The table below lists the parameters required to program the acquisition time:

Parameters	Description	Possible configuration	Default configuration
First acquisition scheduling	Enables/disables acquisition scheduling in order to select the time at which the product performs the first acquisition and stores the index value	Enabled / Disabled	Disabled
First acquisition hour	Hour (UTC) at which the product performs the first acquisition and stores the index value	Between 0 and 23 hours	12
First acquisition minutes	Minutes at which the product performs the first acquisition and stores the index value	Between 0 and 59 minutes	00 minutes



To program the acquisition time via the IoT Configurator NB-IoT/LTE-M application:
⇒ Go to the sensor **"CONFIGURATION"** menu
⇒ Go to the **"APPLICATION"** section ⇒ Go to the **"General"** sub-section
⇒ Configure the **"Programming the first acquisition"** parameter
⇒ Then configure the **first acquisition hour**
⇒ Finally, configure the **first acquisition minutes** ⇒ Apply the new configuration to the product via NFC

NOTE 1
If first acquisition scheduling is enabled and the user changes the sampling frequency or the transmission frequency, the product will force the transmission of stored data during the next transmission and will resynchronize to the new start time at the following data transmission.

An example of acquisition time programming is provided in **APPENDIX 12** of the User Guide

7. PREPARATION AND MOUNTING

To install the product please refer to the Adeunis INSTALLATION GUIDE (NB-IoT / LTE-M IP68 Industrial Box)

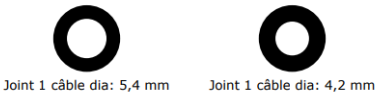
7.1. Enclosure disassembly

The product is delivered fully assembled. The base must be removed to allow connection of one or more meters to the screw terminals. Once wiring is completed, the enclosure can be closed again.

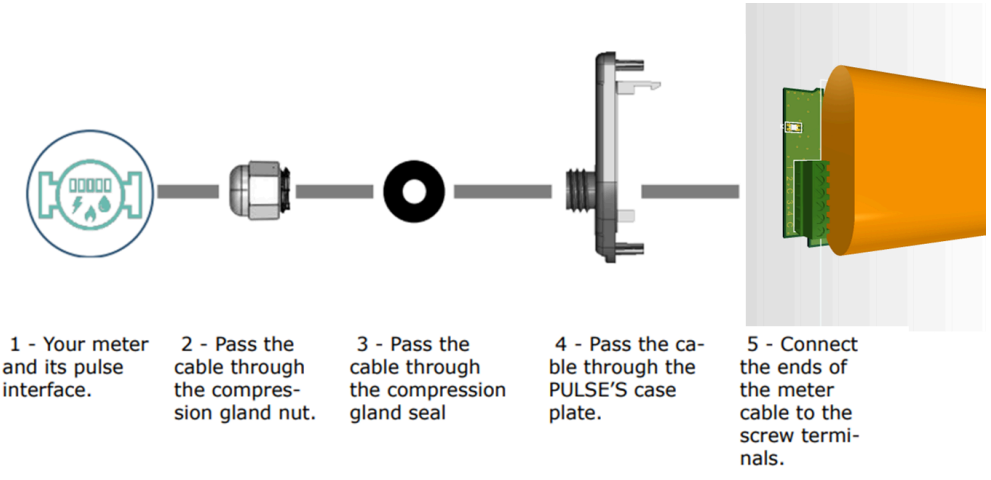
7.2. Installation of the cable gland seal

Before connecting the meter cable strands to the product's screw terminals, you must insert the cable gland nut and the seal suited to your configuration.

Two types of seals are supplied with the PULSE: one for a **5 mm diameter cable** and one for a **4 mm diameter cable**.



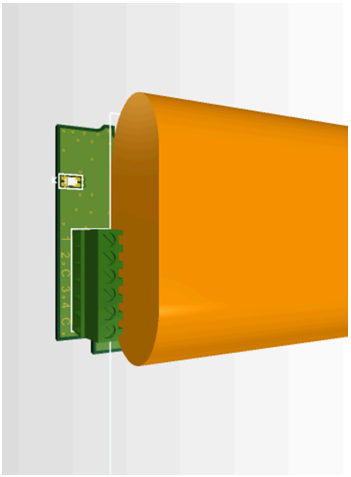
Assembly procedure:



7.3. Connecting meters to the screw terminals

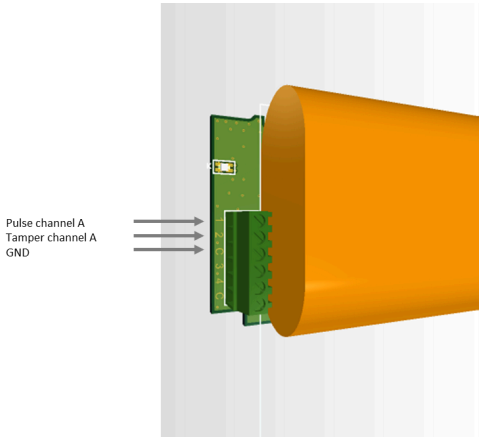
Once the cable gland nut and seal are installed, the meter cable strands can be connected to the product's screw terminals.

Terminal block description:

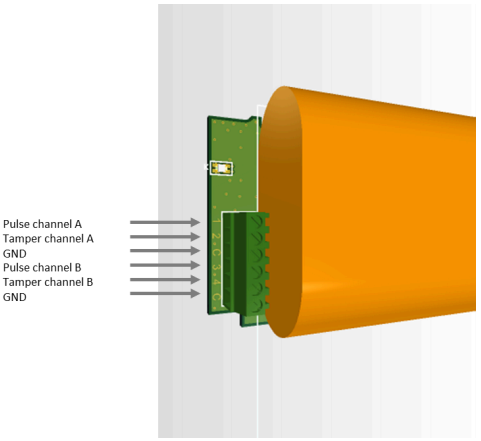


Mode / PIN	1	2	C	3	4	C
1 meter 2 or 3 wires	CHA	(Tamper A)	GND	-	-	-
2 meters 2 or 3 wires	CHA	(Tamper A)	GND	CHB	(Tamper B)	GND
1 meter 4 wires	CH_HF	Tamper	GND	-	DIR_HF	-
1 meter 5 wires	CH_HF	Tamper	GND	CH_LF	DIR_HF	-

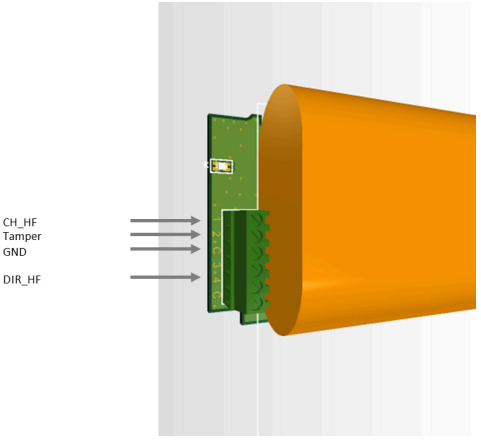
Wiring for 1 meter (2/3 wires)



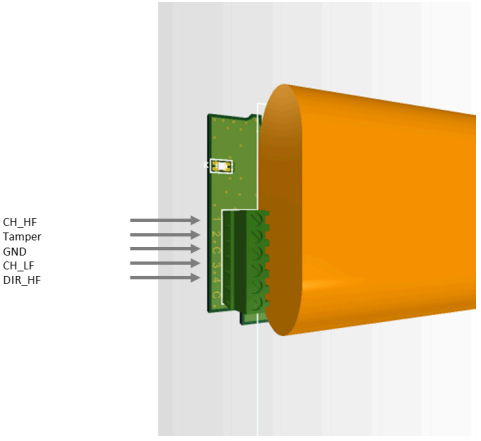
Wiring for 2 meters (2/3 wires)



Wiring for 1 meter (4 wires)



Wiring for 1 meter (5 wires)



7.4. Product positioning

Two rules are essential to optimize radio range:

- Position the product as high as possible.
- Minimize the number of obstacles to reduce radio wave attenuation.

Position

Whenever possible, install the product at a minimum height of **1.5 m** and avoid mounting it directly against a wall.

Obstacles

Ideally, the product should be positioned **20 cm away from any obstacle**, and if possible near an opening (the closer the obstacle, the more emitted power will be absorbed). All materials encountered by a radio wave will attenuate it.

Remember that **metal** (metal cabinets, beams, etc.) and **concrete** (reinforced concrete, partitions, walls, etc.) are the most critical materials for radio wave propagation.

7.5. Product mounting

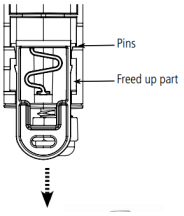
The PULSE offers 3 mounting options, allowing for various setups depending on the environment where it needs to be deployed.

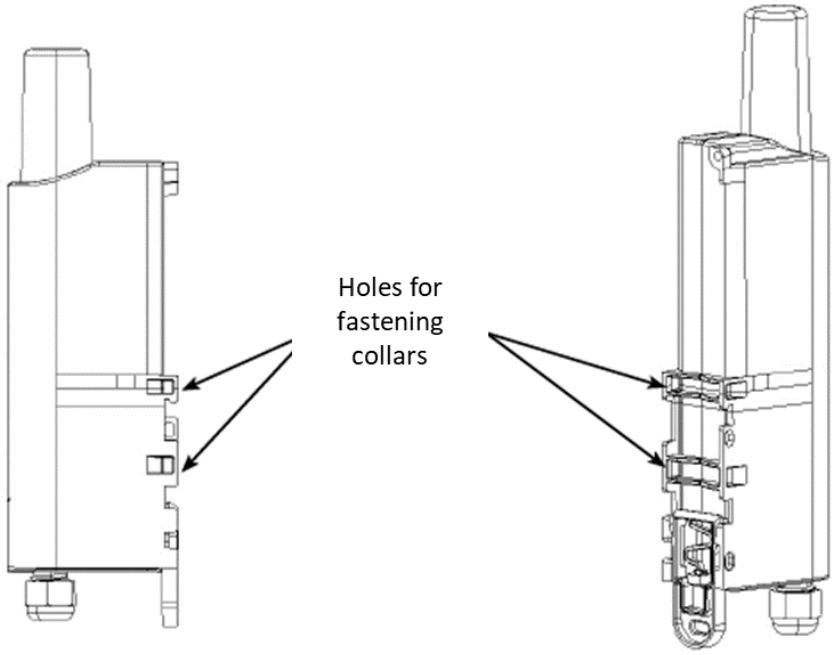
FIXING ON TUBE OR MAST

The fastening collar fastenings enable the product to be fastened on a mast or tube under completely safe conditions.

To optimize fastening onto a tube or mast, we recommend you remove the Rail-DIN locking/unlocking lever.

To remove it, pull the lever down until the locking pins are opposite a freed-up part and then remove the lever.





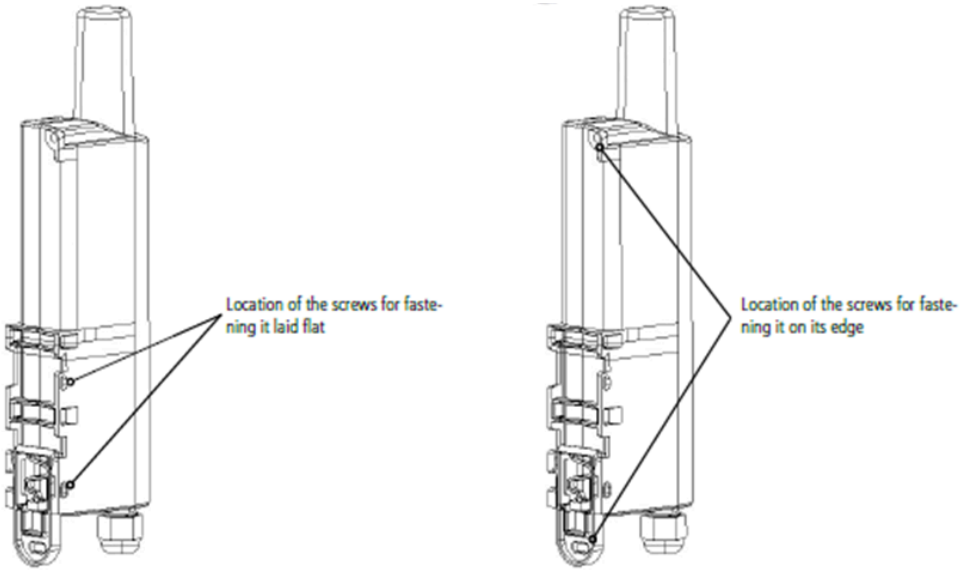
FIXING WITH SCREWS

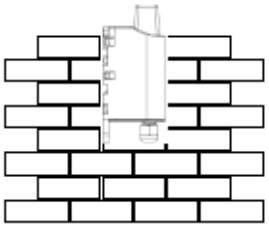
The product comes with 2 CBLZ 2.2 × 19mm screws and 2 SX4 plugs.

Use these products or equivalent products to attach your product to a flat surface.

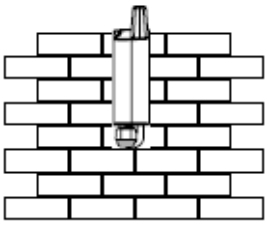
Two positions can be chosen, flat or on the edge

- The position on the edge keeps the product away from its support and contributes to better radio wave propagation.
- If you choose the flat position, please remove the Rail-DIN locking/unlocking lever as explained above.





Fastening laid flat

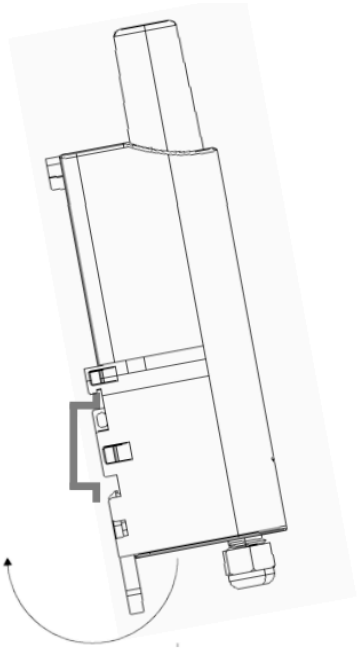


Fastening on its edge

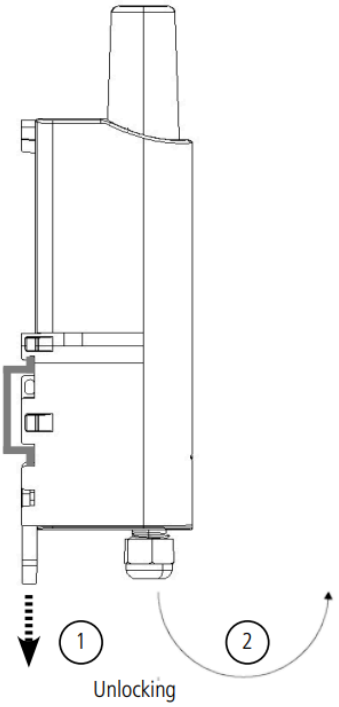
Rail-DIN FIXATION

This system, integrated into the casing, enables the product to be fastened onto a standard 35 mm rail.

- To fit the casing, place the upper inserts on the rail and lower the product to clip it into position.
- To remove the product, pull the unlocking lever down and disengage the product from the rail.



Locking onto the DIN-Rail



Unlocking

8. BATTERY LIFE

This chapter presents **battery life estimates** for the PULSE, depending on the number of active channels, the selected network type, the data transmission periodicity, and network quality.

To ensure proper product operation and maximize battery life, Adeunis strongly recommends:

- Selecting an operator that supports **PSM mode** on its own network.

⚠️ In the case of roaming connections, Adeunis recommends verifying that PSM is also supported on partner operator networks. For more information on PSM mode, refer to the dedicated section.

- Selecting the technology (**NB-IoT or LTE-Cat-M1**) used by the product to connect to the cellular network.
- Limiting the number of frequency bands used by the product to connect to the cellular network (for example, in France only band 20 is used by operators).

⚠️ If the SIM is suspended or the network is unavailable, the product will automatically and periodically attempt to reattach to the network, which may impact battery life.

8.1. Battery life estimates with NB-IoT network connectivity

The battery life table below is estimated based on a product connected to an NB-IoT network supporting PSM mode.

Battery life may vary depending on the selected operator.

Battery life with lifetime configured to 12 hours

Transmission frequency	Number of active channels	Battery life – good network (years)	Battery life – poor network (years)
48 messages/day	2	6.7	0.3
24 messages/day	2	11.7	0.6
12 messages/day	2	> 15	1.1
6 messages/day	2	> 15	2
4 messages/day	2	> 15	2.6
2 messages/day	2	> 15	3.8
1 message/day	2	> 15	5

8.2. Battery life estimates with LTE-Cat-M1 network connectivity

The battery life table below is estimated based on a product connected to an LTE-Cat-M1 network supporting PSM mode.

Battery life may vary depending on the selected operator.

Battery life with lifetime configured to 12 hours

Transmission frequency	Number of active channels	Battery life – good network (years)	Battery life – poor network (years)
48 messages/day	2	14	2.6
24 messages/day	2	> 15	4.8
12 messages/day	2	> 15	8.3

Transmission frequency	Number of active channels	Battery life – good network (years)	Battery life – poor network (years)
6 messages/day	2	> 15	13.2
4 messages/day	2	> 15	> 15
2 messages/day	2	> 15	> 15
1 message/day	2	> 15	> 15

📌 **NOTE**
The battery life values above are estimates based on specific usage and environmental conditions (maximum 1 year of storage before use, calculations performed at 20 °C indoors) and on a basis of **500 pulses/day/channel**.
They do not constitute a commitment from Adeunis.

Battery life depends on many non-predictable network parameters, including:

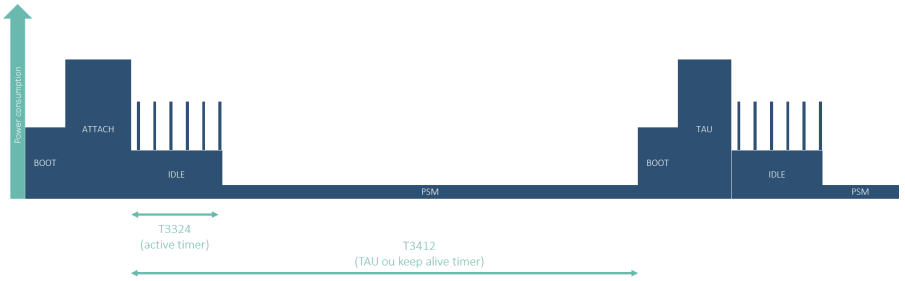
- signal quality,
- transmission power.

8.3. PSM mode support

8.3.1. Network PSM

Power Saving Mode (PSM) is a deep sleep state defined by 3GPP, in which the module remains attached to the cellular network while disabling its radio functions, drastically reducing power consumption between transmissions.

The PULSE product, based on the **Nordic nRF9151** radio module, supports PSM.

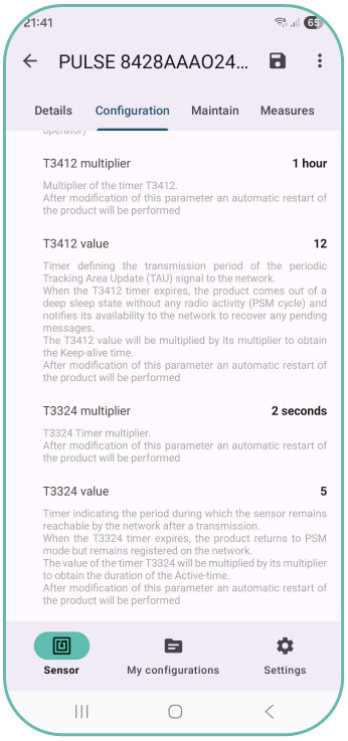


Phase	Behavior
Active (TX/RX)	Radio active, high power consumption
RRC Idle (T3324)	Radio partially active (paging listening), reduced consumption
PSM	Radio fully disabled
Wake-up (TAU or trigger)	Radio reactivated, new connection, cycle resumes

PSM parameter configuration

The user can configure the following timers via the **IoT Configurator NB-IoT/LTE-M** application:

- **T3324**: Duration during which the product remains reachable after a transmission.
- **T3412**: Maximum period during which the product remains in PSM before reconnecting for a Tracking Area Update (TAU).

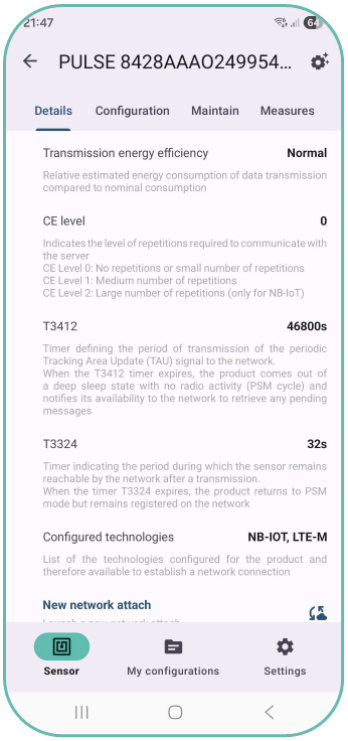


Go to the **“CONFIGURATION”** menu
⇒ Select the **“NETWORK”** section
⇒ Configure **T3412 multiplier**, **T3412 value**, **T3324 multiplier**, **T3324 value**
⇒ Apply the configuration via NFC

Remark

These values are **requested from the network**, but may be **dynamically modified by the operator** during network attachment or during a TAU procedure.

The user can view the values actually applied by the network at any time in the **IoT Configurator NB-IoT/LTE-M** application:



📱 Go to the **“DETAILS”** menu
⇒ Select the **“DIAGNOSTIC”** section
⇒ Monitor **T3412** and **T3324** values

📌 **NOTE**
If the T3324 value displayed in the application is **-1**, this means that the connected network does not support PSM mode.

8.3.2. Virtual PSM

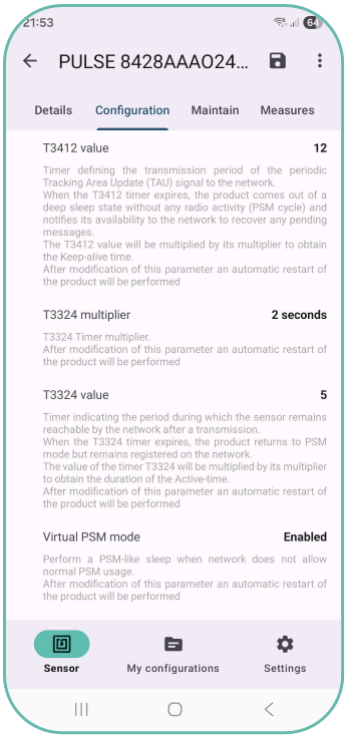
In addition to network PSM, the product integrates a **Virtual PSM** mode, an advanced feature enabled by the **Nordic nRF9151** module.

This mode allows the product to locally simulate behavior equivalent to network PSM even when the latter is not available (for example, when using roaming SIMs or in non-compatible environments).

This feature prevents abrupt modem shutdowns and ensures a smooth transition to a low-power state.

As soon as the network becomes compatible with standard PSM, the product **automatically switches** to it without any manual intervention, ensuring optimal energy performance under all conditions.

Virtual PSM is **enabled by default**. The user may disable it at any time.



Go to the **“CONFIGURATION”** menu
⇒ Select the **“NETWORK”** section
⇒ Configure the **“Virtual PSM mode”** parameter
⇒ Apply the configuration via NFC

9. UPDATE

The PULSE product supports application firmware and modem firmware updates via the NFC interface, using the **IoT Configurator NB-IoT / LTE-M** mobile application.

Adeunis periodically releases updates, including:

- **software fixes**,
- **performance optimizations**,
- **security patches**,
- and/or **new features**.

To receive update files adapted to your product, please contact Adeunis support.

Update procedure via NFC

1. Contact Adeunis support to obtain the update file(s).
2. Save the update file(s) on the smartphone.
3. Open the **IoT Configurator NB-IoT / LTE-M** mobile application.

4. Enable NFC on your smartphone.
5. Place the smartphone against the PULSE sensor to establish the connection.
6. Follow the instructions in the application to:
    - select the update file,
    - start the transfer,
    - verify successful update execution.
7. A confirmation message is displayed at the end of the procedure.

📌 **NOTE 1**
The update takes on average **1 to 2 minutes**, depending on the firmware type and the smartphone used.

NOTE 2
Firmware updates via NFC are **not supported on iOS**.

10. DOCUMENT HISTORY

Version	Content
V 1.0	Creation

APPENDIX 1: MQTT PROTOCOL

The PULSE product can be configured to use one of the following two protocols to exchange data with an IoT platform:

- MQTT / MQTTS (Message Queuing Telemetry Transport)
- LwM2M (Lightweight M2M)

MQTT protocol overview

MQTT (Message Queuing Telemetry Transport) is an open, lightweight, and standardized messaging protocol based on a **publish/subscribe** architecture.

It is widely adopted in IoT applications thanks to its ease of implementation and compatibility with many servers (*brokers*).

Authentication method

The **PULSE** product supports MQTT authentication using a **username/password**, which is compatible with most MQTT servers.

Secure connection via TLS (MQTTS)

The product supports **MQTTS V3.1.1** with **TLS 1.2 minimum** encryption.

By default, server authenticity verification is disabled to reduce data exchanges and optimize the product's power consumption.

If the user wants to further secure the server connection:

- Up to **two server CA certificates** can be imported in `.pem` format.
- Certificates can be imported using the **IoT Configurator NB-IoT / LTE-M** application after switching the product to **PARK mode**.

📌 **NOTE 1**
Adeunis recommends importing two certificates to ensure product operation in case a certificate expires. Once deployed, **certificates cannot be updated remotely**.

NOTE 2
PULSE does not support X.509 client certificate authentication. Therefore, the product is not compatible with AWS IoT and Azure IoT Hub.

Unsecured connection (MQTT)

PULSE also supports **unencrypted connections (without TLS)** for local or test environments.

This notably enables compatibility with internal brokers without encryption.

📌 **NOTE**
Unsecured mode is enabled **automatically** if the server URL starts with `mqtt://`. If the URL starts with `mqtts://`, a secure connection is established. If no prefix (`mqtt://` or `mqtts://`) is provided, the product uses a **secure connection by default

PULSE publish topic

Le **topic MQTT** est le canal par lequel le produit publie ses données.

- Ce paramètre est configurable via l'application **IoT Configurator NB-IoT / LTE-M**
- Tout système souhaitant recevoir les données du capteur doit s'abonner à ce topic

The **MQTT topic** is the channel on which the product publishes its data.

- This parameter can be configured using the **IoT Configurator NB-IoT / LTE-M** application.
- Any system that wants to receive sensor data must subscribe to this topic.

Go to the sensor "CONFIGURATION" menu
⇒ Go to the "PROTOCOLS" section
⇒ Select the transfer protocol "MQTT"
⇒ Then go to the "MQTT CONFIGURATION" section
⇒ Set the data publish topic using the "Product publish topic" parameter
⇒ Apply the new configuration to the product via NFC

Qualité de service (QoS)

Three QoS levels define how MQTT handles message delivery (publish messages from client to broker and messages from broker to the subscribed client). Subscribed clients can specify the maximum QoS level they want to receive.

PULSE supports **QoS level 1**:

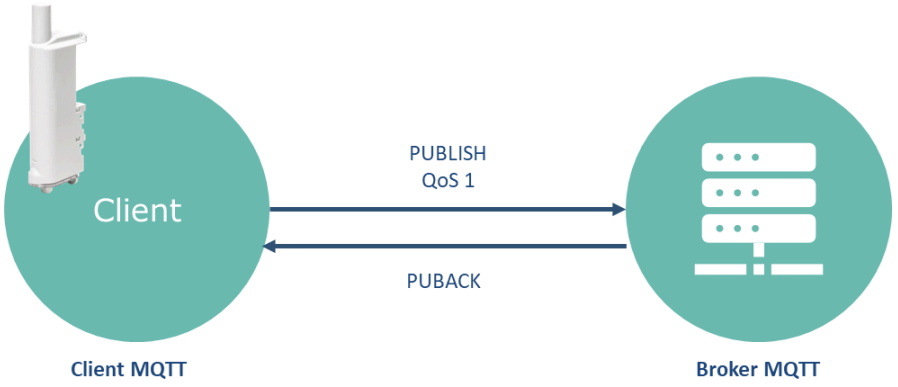
- **QoS 1 ("At least once")**

This level ensures that the PULSE "PUBLISH" message is received at least once. The sender keeps the message until it receives an acknowledgement (PUBACK).

After a certain time, if no acknowledgement with the corresponding message identifier is received, the sender retransmits the message. The message may be sent multiple times until a confirmation is received.

In addition, when the receiver gets a QoS 1 message, it can process it immediately before sending an acknowledgement. For example, when the broker receives a message, it forwards it to all subscribers and then acknowledges the message to the sender.

A message can therefore be sent and received multiple times. The duplicate will contain a DUP flag, which is not processed by the receiver. The receiver still sends an acknowledgement, regardless of the DUP flag.



MQTT functional limitations

MQTT does not provide:

- Advanced remote device monitoring,
- Remote reading of device status,
- Remote firmware updates,
- Optimized communication to reduce data usage and the product's power consumption.

For these functions, the **LwM2M** protocol is required.

APPENDIX 2: PULSE PRODUCT DATA MODEL

Messages sent by the PULSE product use the JSON data exchange format.

The JSON payload dynamically changes depending on the configuration applied to the PULSE product. To easily map each JSON field to an application data item, please refer to the tables below.

If measurement values contain data arrays, the first element corresponds to the first measurement performed.

Timestamps are in UTC EPOCH format.

Product configuration

- One 2- or 3-wire meter connected to input A
- Tamper detection disabled

Data	Description
“CHA”: [“v”]	Consumption index for input A
“CHA”: [“t”]	Timestamp

Product configuration

- 1 meter with 3 wires connected to input A
- Tamper detection enabled

Data	Description
“CHA”: [“v”]	Consumption index for input A
“CHA”: [“t”]	Timestamp
“wA”: [“v”]	Tamper detection status for input A
“wA”: [“t”]	Timestamp

Product configuration

- Two 2- or 3-wire meters connected (one on each pulse input)
- Tamper detection disabled for both meters

Data	Description
“CHA”: [“v”]	Consumption index for input A
“CHA”: [“t”]	Timestamp
“CHB”: [“v”]	Consumption index for input B
“CHB”: [“t”]	Timestamp

Product configuration

- Two 3-wire meters connected (one on each pulse input)
- Tamper detection enabled for Channel A meter

Data	Description
“CHA”: [“v”]	Consumption index for input A
“CHA”: [“t”]	Timestamp
“CHB”: [“v”]	Consumption index for input B
“CHB”: [“t”]	Timestamp
“wA”: [“v”]	Tamper detection status for input A
“wA”: [“t”]	Timestamp
“wB”: [“v”]	Tamper detection status for input B
“wB”: [“t”]	Timestamp

Product configuration

- One 4-wire meter connected
- Tamper detection disabled

Data	Description
“CHA”: [“v”]	Net consumption (forward flow – reverse flow)
“CHA”: [“f”]	Forward flow consumption
“CHA”: [“b”]	Reverse flow consumption
“CHA”: [“r”]	Reverse flow detection status
“CHA”: [“t”]	Timestamp

Product configuration

- One 4-wire meter connected
- Tamper detection enabled

Data	Description
“wA”: [“v”]	Tamper detection status
“wA”: [“t”]	Timestamp
“CHA”: [“v”]	Net consumption (forward flow – reverse flow)
“CHA”: [“f”]	Forward flow consumption
“CHA”: [“b”]	Reverse flow consumption
“CHA”: [“r”]	Reverse flow detection status
“CHA”: [“t”]	Timestamp

Product configuration

- One 5-wire meter connected
- Tamper detection disabled

Data	Description
“CHA”: [“v”]	Total consumption (forward flow + reverse flow)
“CHA”: [“vf”]	Compensated consumption (forward flow only)
“CHA”: [“d”]	Flow direction

Data	Description
“CHA”: [“t”]	Timestamp

Product configuration

- One 5-wire meter connected
- Tamper detection enabled

Data	Description
“wA”: [“v”]	Tamper detection status
“wA”: [“t”]	Timestamp
“CHA”: [“v”]	Total consumption (forward flow + reverse flow)
“CHA”: [“vf”]	Compensated consumption (forward flow only)
“CHA”: [“d”]	Flow direction
“CHA”: [“t”]	Timestamp

APPENDIX 3: PERIODIC TRANSMISSION OF A 2-WIRE METER CONSUMPTION INDEX, WITH OR WITHOUT HISTORY

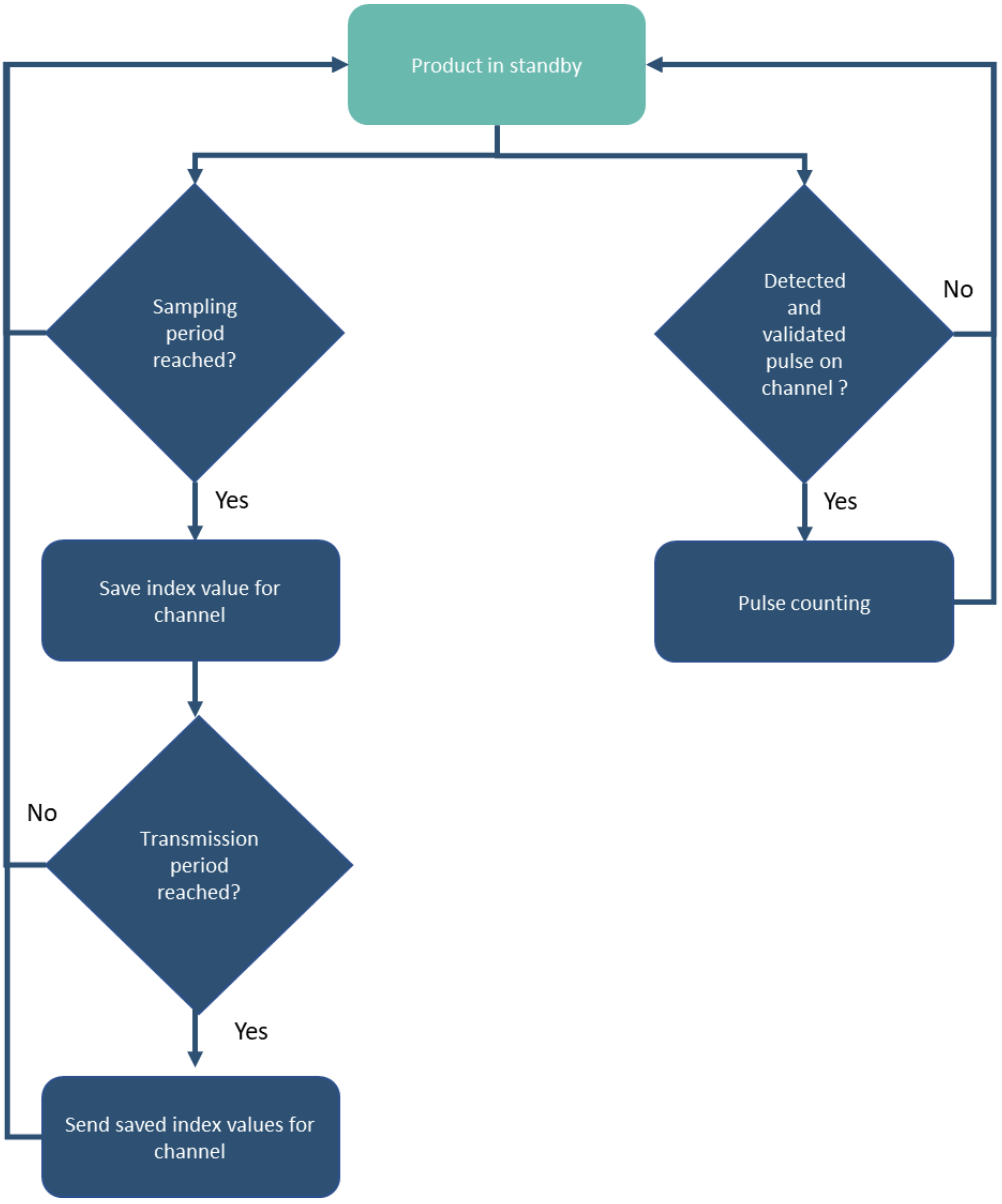
The PULSE product continuously detects and counts pulses on each of its two inputs, stores the consumption index for each pulse input according to the configured sampling rate, and transmits the latest stored value.

With the history mechanism enabled, if the sampling rate is higher than the reporting rate, the product stores successive index values in local memory and then transmits them in a single message sent at the end of the reporting period.

📌 **Maximum number of samples: up to 400 successive consumption index values when two inputs are active, or 800 values when only one input is used (depending on the configuration)**

Principle diagram

The periodic transmission of the consumption index of a 2-wire meter is performed according to the following diagram



The table below lists the parameters to configure to use this transmission mode

Parameters	Description	Possible configuration	Default configuration
Active channels	Select which channels to enable.	Channel A enabled Channels A and B enabled 4 wires CH_HF + DIR 5 wires CH_HF + CH_LF + DIR	Channels A and B enabled
Sampling rate	Index acquisition and storage frequency.	60 to 604800 seconds (7 days)	86400 seconds
Reporting interval	Select the periodic reporting interval. Data will be historized if the reporting interval is at least 2× higher than the sampling rate.	60 to 604800 seconds (7 days)	86400 seconds

Parameters	Description	Possible configuration	Default configuration
Schedule first acquisition	Enable acquisition scheduling to choose the time at which the product performs the first acquisition and index storage.	Enabled Disabled	Disabled
Time of first acquisition	Select the time (UTC) at which the product performs the first acquisition and index storage.	0:00 to 23:00	12:00
Minutes of first acquisition	Select the minutes at which the product performs the first acquisition and index storage.	0 to 59 minutes	00 minutes
Channel A index value	Overwrites the current index value of Channel A.	0 to 2147483648	-
Channel A debounce period	Minimum pulse width detected for Channel A.	10 ms to 10 s	10 ms
Channel A meter type	Identify the meter connected to Channel A.	Any alphanumeric string	Meter type on Channel A
Channel A tamper sampling period	Frequency at which the product checks the tamper input state on Channel A to detect a “tamper” wire cut.	0 to 1440 minutes (1 day) To disable tamper detection, set 0	0 (disabled)
Channel A tamper threshold	Number of tamper detections before notification.	1 to 10	1
Channel B index value	Overwrites the current index value of Channel B.	0 to 2147483648	-
Channel B debounce period	Minimum pulse width detected for Channel B.	10 ms to 10 s	10 ms
Channel B meter type	Identify the meter connected to Channel B.	Any alphanumeric string	Meter type on Channel B
Channel B tamper sampling period	Frequency at which the product checks the tamper input state on Channel B to detect a “tamper” wire cut.	0 to 1440 minutes (1 day) To disable tamper detection, set 0	0 (disabled)
Channel B tamper threshold	Number of tamper detections before notification.	1 to 10	1

These parameters can be configured using the **IoT Configurator NB-IoT/LTE-M** application.

📌 **NOTE 1**
The sampling rate is mandatory and common to both pulse inputs to avoid desynchronization of data reporting, which would impact PULSE battery life.

NOTE 2
Pulse detection and counting remain functional even when the cellular network is unavailable.

NOTE 3
For transmission without history, simply configure a reporting interval equal to the sampling rate.

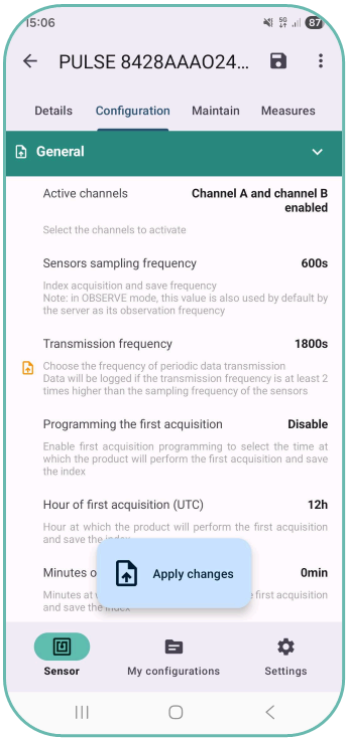
Example

PULSE product configured with:

- Channels A and B enabled
- Counting only pulses wider than 500 ms on Channel A and wider than 100 ms on Channel B
- Storing the consumption index on Channels A and B every 10 minutes
- Reporting index values every 30 minutes (i.e., after 3 stored values)
- Tamper detection disabled on both channels

Application parameters to configure

Parameters	Value	Description
Product–Server communication	PUSH	The product controls data transmissions to the server
Active channels	Channels A and B enabled	Enable both channels
Sampling rate	600 seconds	Store index on Channels A and B every 10 minutes
Reporting interval	1800 seconds	One report every 30 minutes containing the last 3 index values for each channel
Schedule first acquisition	Disabled	Acquisition scheduling disabled
Channel A tamper sampling period	0	Tamper detection disabled
Channel A debounce period	500 milliseconds	Only pulses with width > 500 ms are detected
Channel B tamper sampling period	0	Tamper detection disabled
Channel B debounce period	100 milliseconds	Only pulses with width > 100 ms are detected



Configuration via the IoT Configurator NB-IoT/LTE-M application

Go to the sensor “CONFIGURATION” menu.

1. Go to the “CONNECTIVITY” section
   ⇒ In the “Protocol” subsection
   ⇒ Set “Product–Server communication” to “PUSH”
2. Go to the “APPLICATION” section
   Go to the “General” subsection
   ⇒ Set “Active channels” to enable Channels A and B
   ⇒ Set the sampling rate to 600 seconds
   ⇒ Set the reporting interval to 1800 seconds
   ⇒ Disable “Schedule first acquisition”

   Go to the “Channel A” subsection
   ⇒ Disable tamper detection by setting “0”
   ⇒ Set the debounce period filter to 500 ms
   Go to the “Channel B” subsection
   ⇒ Disable tamper detection by setting “0”
   ⇒ Set the debounce period filter to 100 ms
3. Apply the new configuration to the product via NFC

MQTT message

Messages sent by the PULSE product use the JSON data exchange format.

```
{
  "sn": "8428AAAO249954190",
  "lowbat": false,
  "CHA": [
    {
      "v": 148,
      "t": 1766495120
    }
  ],
  "CHB": [
    {
      "v": 72,
      "t": 1766495120
    }
  ],
  "txInfo": {
    "snr": 13,
    "rsrp": -78,
    "rsrq": -7,
    "txPower": 7,
    "nbReboot": 41,
    "t3324": 32
  }
}
```

The PULSE JSON payload contains the following information:

- Product serial number: `"sn"`
- Battery status: `"lowbat"`
- Channel A index value(s) or number of counted pulses: `"CHA"` → `"v"`
- Channel A timestamp: `"CHA"` → `"t"`
- Channel B index value(s) or number of counted pulses: `"CHB"` → `"v"`
- Channel B timestamp: `"CHB"` → `"t"`

If measurement values contain data arrays, the first element corresponds to the first measurement performed.

Timestamps are in UTC EPOCH format.

APPENDIX 9: PERIODIC TRANSMISSION OF THE CONSUMPTION INDEX OF A 4-WIRE METER WITH REVERSE FLOW DETECTION

The PULSE product can be connected to a 4-wire water meter in order to:

- **Measure forward flow consumption,**
- **Detect reverse flow,**
- **Measure reverse flow consumption,**
- Calculate **net consumption** (forward flow – reverse flow),
- **Detect a wire cut** on the tamper detection line (fraud attempt or accidental break).

It automatically differentiates normal consumption from reverse flow while ensuring tamper detection. This wiring type is particularly suitable for bidirectional water meters.

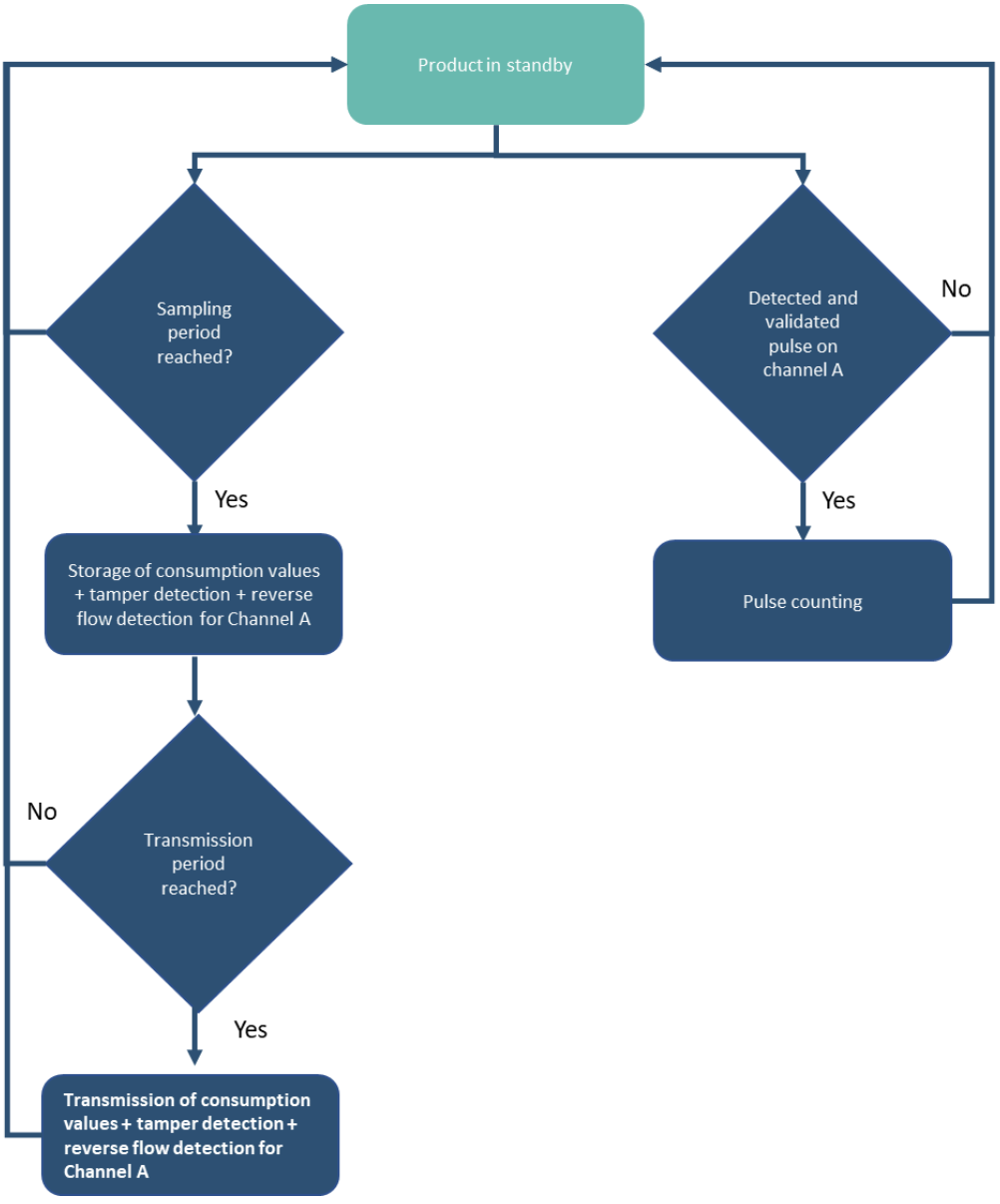
PULSE stores the consumption index according to the configured sampling rate and transmits the latest stored value.

With the history mechanism enabled, if the sampling rate is higher than the reporting interval, the product stores successive index values in local memory and then transmits them in a single message sent at the end of the reporting period.

📌 **Maximum number of samples:** up to **300 successive consumption index values** when a **4-wire meter** is connected to the PULSE product.

Principle diagram

The periodic transmission of the consumption index of a 4-wire meter with reverse flow detection is performed according to the following diagram



The table below lists the parameters to configure to use this transmission mode

Parameters	Description	Possible configuration	Default configuration
Active channels	Select which channels to enable.	Channel A enabled Channels A and B enabled 4 wires CH_HF + DIR 5 wires CH_HF + CH_LF + DIR	Channels A and B enabled
Sampling rate	Index acquisition and storage frequency.	60 to 604800 seconds (7 days)	86400 seconds
Reporting interval	Select the periodic reporting interval. Data will be historized if the reporting interval is at least 2× higher than the sampling rate.	60 to 604800 seconds (7 days)	86400 seconds
Schedule first acquisition	Enable acquisition scheduling to choose the time at which the product performs the first acquisition and index storage.	Enabled Disabled	Disabled
Time of first acquisition	Select the time (UTC) at which the product performs the first acquisition and index storage.	0:00 to 23:00	12:00
Minutes of first acquisition	Select the minutes at which the product performs the first acquisition and index storage.	0 to 59 minutes	00 minutes
Channel A index value	Overwrites the current index value of Channel A.	0 to 2147483648	-
Channel A debounce period	Minimum pulse width detected for Channel A.	10 ms to 10 s	10 ms
Channel A meter type	Identify the meter connected to Channel A.	Any alphanumeric string	Meter type on Channel A
Channel A tamper sampling period	Frequency at which the product checks the tamper input state on Channel A to detect a “tamper” wire cut.	0 to 1440 minutes (1 day) To disable tamper detection, set 0	0 (disabled)
Channel A tamper threshold	Number of tamper detections before notification.	1 to 10	1

These parameters can be configured using the **IoT Configurator NB-IoT/LTE-M** application.

📌 **NOTE 1**
The sampling period is necessarily shared by both pulse inputs to avoid data reporting desynchronization, which would impact the PULSE product's battery life.

NOTE 2
Pulse detection and counting remain operational even when the cellular network is not available.

NOTE 3
For transmission without historization, simply configure a reporting period equal to the sampling period.

NOTE 4
Tamper detection does not trigger an immediate alarm transmission. Instead, the information is reported (with the tamper detection timestamp) during the configured transmissions.

Example

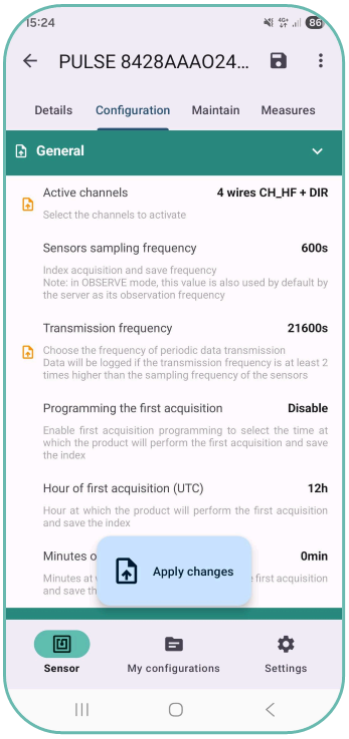
The PULSE product is connected to a 4-wire water meter equipped with a reverse flow detection signal.

Configuration:

- Channel A enabled with reverse flow detection
- Tamper detection enabled, with polling every 1 minute and a tamper threshold set to 1 event
- Counting only pulses wider than 500 ms
- Reading and storing the index value on Channel A every 10 minutes
- Transmitting the Channel A index value every 6 hours

Application parameters to configure

Parameters	Value	Description
Product–Server communication	PUSH	The product controls data transmissions to the server
Active channels	4 wires CH_HF + DIR	4-wire meter configuration
Sampling rate	600 seconds	Store the index every 10 minutes
Reporting interval	21600 seconds	One transmission every 6 hours containing the last 36 index values
Schedule first acquisition	Disabled	Acquisition scheduling disabled
Channel A debounce period	500 milliseconds	Only pulses wider than 500 ms are detected
Channel A tamper sampling period	1	Check tamper input every minute
Channel A tamper threshold	1	Notify after one tamper state change



Configuration via the IoT Configurator NB-IoT/LTE-M application

Go to the sensor “CONFIGURATION” menu.

1. Go to the “CONNECTIVITY” section
   ⇒ In the “Protocol” subsection
   ⇒ Set “Product–Server communication” to “PUSH”
2. Go to the “APPLICATION” section
   Go to the “General” subsection
   ⇒ Set “Active channels” to 4 wires CH_HF + DIR
   ⇒ Set the sampling rate to 600 seconds
   ⇒ Set the reporting interval to 21600 seconds
   ⇒ Disable “Schedule first acquisition”

Go to the “Channel A” subsection
⇒ Set the tamper sampling period to “1”
⇒ Set the tamper threshold to “1”
⇒ Set the debounce period filter to 500 ms

3. Apply the new configuration to the product via NFC

MQTT message

Messages sent by the PULSE product use the JSON data exchange format.


```
{
  "sn": "8428AAA0249954190",
  "lowbat": false,
  "WA": [
    {
      "v": 1,
      "t": 10
    }
  ],
  "CHA": [
    {
      "v": 149,
      "f": 149,
      "b": 0,
      "r": 0,
      "t": 1766495419
    }
  ],
  "txInfo": {
    "snr": 10,
    "rsrp": -80,
    "rsrq": -9,
    "txPower": 11,
    "nbReboot": 43,
    "t3324": 32
  }
}
```


The PULSE JSON payload contains the following information:

- Product serial number: `"sn"`
- Battery status: `"lowbat"`
- Tamper detection status: `"wA"` → `"v"`
- Tamper detection timestamp: `"wA"` → `"t"`
- Net consumption (forward flow – reverse flow): `"CHA"` → `"v"`
- Forward flow consumption: `"CHA"` → `"f"`
- Reverse flow consumption: `"CHA"` → `"b"`
- Reverse flow detection status: `"CHA"` → `"r"`
- Timestamp: `"CHA"` → `"t"`

If measurement values contain data arrays, the first element corresponds to the first measurement performed.

Timestamps are in UTC EPOCH format.

📌 Tamper detection does not trigger an immediate alarm transmission, but rather a status report (associated with the tamper detection timestamp) during the configured transmissions.

APPENDIX 5: PERIODIC TRANSMISSION OF THE CONSUMPTION INDEX OF A 5-WIRE METER WITH FLOW DIRECTION DETECTION

The PULSE product can be connected to a 5-wire water meter in order to:

- **Measure total consumption** (forward flow + reverse flow),
- **Measure compensated consumption** (forward flow only),
- **Detect flow direction**,
- **Detect a wire cut** on the tamper detection line (fraud attempt or accidental break).

PULSE provides a **complete and accurate measurement** thanks to the handling of high- and low-frequency pulse signals, **flow direction detection**, and **tamper monitoring**.

This mode is recommended for advanced meters requiring fine resolution and enhanced supervision.

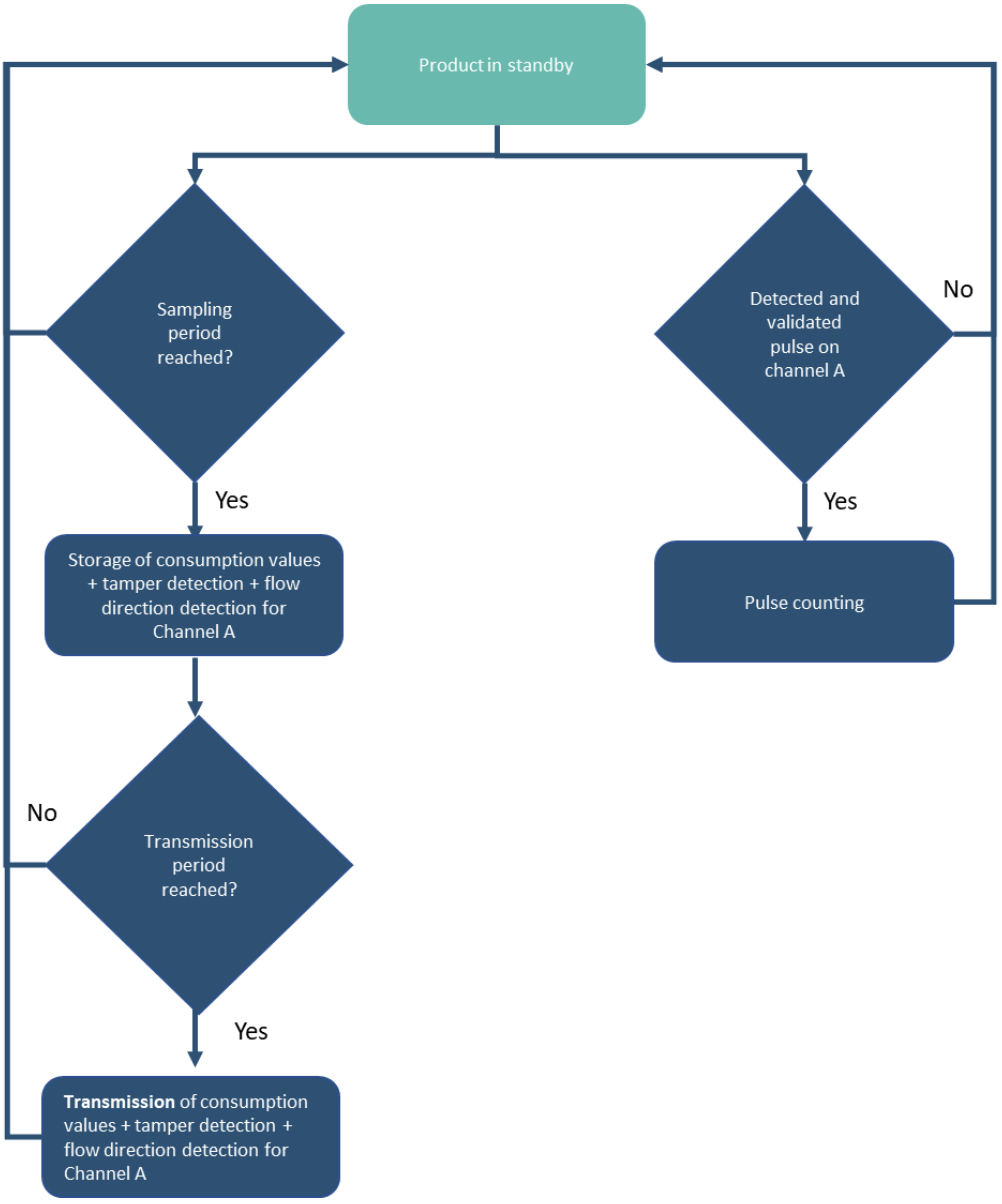
PULSE stores the consumption index according to the configured sampling rate and transmits the latest stored value.

With the history mechanism enabled, if the sampling rate is higher than the reporting interval, the product stores successive index values in local memory and then transmits them in a single message sent at the end of the reporting period.

📌 **Maximum number of samples:** up to **400 successive consumption index values** when a **5-wire meter** is connected to the PULSE product.

Principle diagram

The periodic transmission of the consumption index of a 5-wire meter with flow direction detection is performed according to the following diagram



The table below lists the parameters to configure to use this transmission mode

Parameters	Description	Possible configuration	Default configuration
Active channels	Select which channels to enable.	Channel A enabled Channels A and B enabled 4 wires CH_HF + DIR 5 wires CH_HF + CH_LF + DIR	Channels A and B enabled
Sampling rate	Index acquisition and storage frequency.	60 to 604800 seconds (7 days)	86400 seconds
Reporting interval	Select the periodic reporting interval. Data will be historized if the reporting interval is at	60 to 604800 seconds (7 days)	86400 seconds

Parameters	Description	Possible configuration	Default configuration
	least 2× higher than the sampling rate.		
Schedule first acquisition	Enable acquisition scheduling to choose the time at which the product performs the first acquisition and index storage.	Enabled Disabled	Disabled
Time of first acquisition	Select the time (UTC) at which the product performs the first acquisition and index storage.	0:00 to 23:00	12:00
Minutes of first acquisition	Select the minutes at which the product performs the first acquisition and index storage.	0 to 59 minutes	00 minutes
Channel A index value	Overwrites the current index value of Channel A.	0 to 2147483648	-
Channel A debounce period	Minimum pulse width detected for Channel A.	10 ms to 10 s	10 ms
Channel A meter type	Identify the meter connected to Channel A.	Any alphanumeric string	Meter type on Channel A
Channel A tamper sampling period	Frequency at which the product checks the tamper input state on Channel A to detect a “tamper” wire cut.	0 to 1440 minutes (1 day) To disable tamper detection, set 0	0 (disabled)
Channel A tamper threshold	Number of tamper detections before notification.	1 to 10	1

These parameters can be configured using the **IoT Configurator NB-IoT/LTE-M** application or via the LwM2M server.

📌 **NOTE 1**
The sampling rate is mandatory and common to both pulse inputs to avoid desynchronization of data reporting, which would impact PULSE battery life.

NOTE 2
Pulse detection and counting remain functional even when the cellular network is unavailable.

NOTE 3
For transmission without history, simply configure a reporting interval equal to the sampling rate.

NOTE 4
Tamper detection does not trigger an immediate alarm transmission, but rather a status report (associated with the tamper detection timestamp) during the configured transmissions.

Example

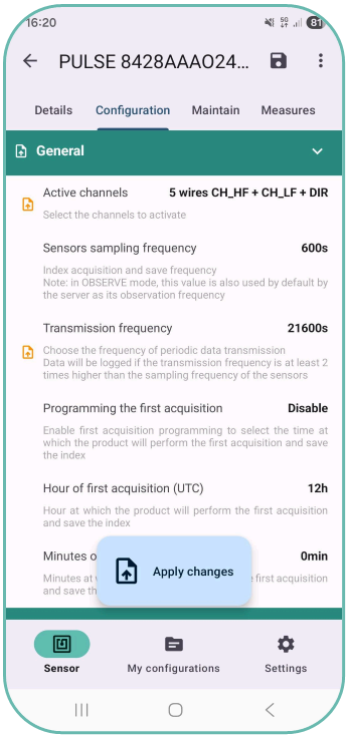
The PULSE product is connected to a 5-wire water meter equipped with a flow direction detection signal.

Configuration:

- Channel A enabled with flow direction detection
- Tamper detection enabled, with polling every 1 minute and a tamper threshold set to 1 event
- Counting only pulses wider than 500 ms
- Reading and storing the index value on Channel A every 10 minutes
- Transmitting the Channel A index value every 6 hours

Application parameters to configure

Parameters	Value	Description
Product–Server communication	PUSH	The product controls data transmissions to the server
Active channels	5 wires CH_HF + CH_LF + DIR	5-wire meter configuration
Sampling rate	600 seconds	Store the index every 10 minutes
Reporting interval	21600 seconds	One transmission every 6 hours containing the last 36 index values
Schedule first acquisition	Disabled	Acquisition scheduling disabled
Channel A debounce period	500 milliseconds	Only pulses wider than 500 ms are detected
Channel A tamper sampling period	1	Check tamper input every minute
Channel A tamper threshold	1	Notify after one tamper state change



Configuration via the IoT Configurator NB-IoT/LTE-M application

Go to the sensor “CONFIGURATION” menu.

1. Go to the “CONNECTIVITY” section
   ⇒ In the “Protocol” subsection
   ⇒ Set “Product–Server communication” to “PUSH”
2. Go to the “APPLICATION” section
   Go to the “General” subsection
   ⇒ Set “Active channels” to 5 wires CH_HF + CH_LF + DIR
   ⇒ Set the sampling rate to 600 seconds
   ⇒ Set the reporting interval to 21600 seconds
   ⇒ Disable “Schedule first acquisition”

Go to the “Channel A” subsection
⇒ Set the tamper sampling period to “1”
⇒ Set the tamper threshold to “1”
⇒ Set the debounce period filter to 500 ms

3. Apply the new configuration to the product via NFC

MQTT message

Messages sent by the PULSE product use the JSON data exchange format.


```
{
  "id": "6949701256f7ae35bcc4044a",
  "streamId": "urn:lo:nsid:imei:359404232454190",
  "timestamp": "2025-12-22T16:21:33Z",
  "model": "twin_json",
  "value": {
    "genericSensor": {
      "0": {
        "sensorValue": 145
      },
      "1": {
        "sensorValue": 62
      },
      "2": {
        "sensorValue": 1
      }
    }
  },
  "tags": [],
  "extra": {},
  "metadata": {
    "source": "urn:lo:nsid:imei:359404232454190",
    "group": {
      "id": "Vt15dX",
      "path": "/DEMO MKT"
    },
    "connector": "lwm2m",
    "network": {
      "lwm2m": {
        "ep": "urn:imei:359404232454190"
      }
    }
  },
  "created": "2025-12-22T16:21:38.653Z"
}
```


The PULSE JSON payload contains the following information:

- Product serial number: `"sn"`
- Battery status: `"lowbat"`
- Tamper detection status: `"wA"` → `"v"`
- Tamper detection timestamp: `"wA"` → `"t"`
- Total consumption (forward flow + reverse flow): `"CHA"` → `"v"`
- Compensated consumption (forward flow only): `"CHA"` → `"vf"`
- Flow direction: `"CHA"` → `"d"`
- Timestamp: `"CHA"` → `"t"`

If measurement values contain data arrays, the first element corresponds to the first measurement performed.

Timestamps are in UTC EPOCH format.

```
{
  "id": "6949701256f7ae35bcc4044c",
  "streamId": "urn:lo:nsid:imei:359404232454190",
  "timestamp": "2025-12-22T16:21:45.653Z",
  "model": "twin_json",
  "value": {
    "genericSensor": {
      "3": {
        "sensorValue": 1
      }
    }
  },
  "tags": [],
  "extra": {},
  "metadata": {
    "source": "urn:lo:nsid:imei:359404232454190",
    "group": {
      "id": "Vt15dX",
      "path": "/DEMO MKT"
    },
    "connector": "lwm2m",
    "network": {
      "lwm2m": {
        "ep": "urn:imei:359404232454190"
      }
    }
  },
  "created": "2025-12-22T16:21:38.653Z"
}
```


📌 Tamper detection does not trigger an immediate alarm transmission, but rather a status report (associated with the tamper detection timestamp) during the configured transmissions.

APPENDIX 6: INDEX

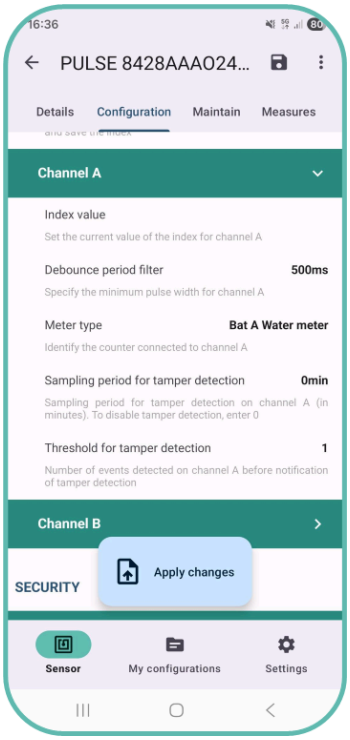
PULSE is designed to easily connect to up to two electricity, water, or heat meters—or any other equipment (rain gauge, odometer, etc.) featuring a pulse output (dry contact, REED relay, S0, open collector).

Once connected to a meter or piece of equipment, the product continuously detects and counts pulses, periodically stores meter values (indexes), and sends these index values to a server at a user-configurable interval.

Index configuration for each channel

By default, during the first commissioning of the PULSE product, the index is set to 0 for each of the two pulse inputs.

To reflect the current value of the meter(s) or equipment, the user can update the index value for each channel using the **IoT Configurator NB-IoT/LTE-M** application.



Configuration via the IoT Configurator NB-IoT/LTE-M application
Go to the sensor “CONFIGURATION” menu

1. Select the “APPLICATION” section
Select the “Channel A” subsection
⇒ **Enter the index value**
Then select the “Channel B” subsection
⇒ **Enter the index value**

2. Apply the new configuration to the product via NFC.

NOTE 1
The maximum index value when Channel A and/or Channel B is enabled is 4294967295; it will then roll over to 0.

NOTE 2
The maximum index value when Channel A + Direction is enabled is 2147483646; it will then roll over to 0.

Reading the index using the IoT Configurator application

The user can display the current index value for Channel A or for Channels A+B at any time using the **IoT Configurator NB-IoT/LTE-M** application.

To read the index via the IoT Configurator NB-IoT/LTE-M application, go to the "MEASUREMENTS" menu.

Local storage and export of the last 100 index values per channel

The index for each channel is automatically saved once per day in the PULSE product's local memory.

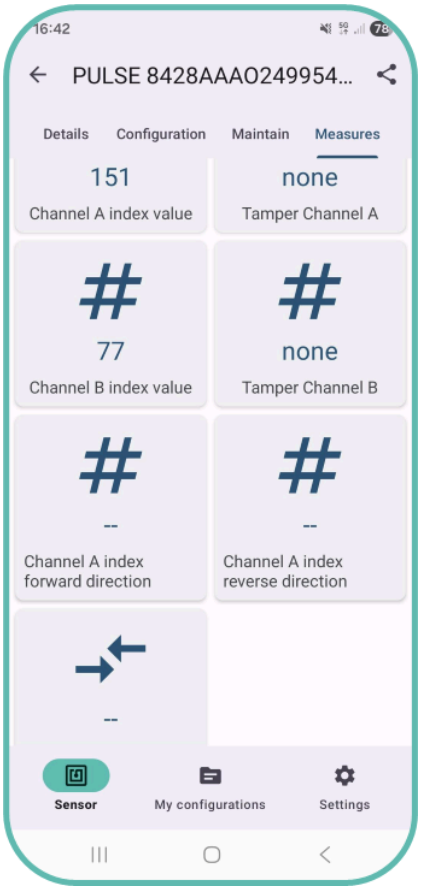
The first backup is performed at product startup, then every 24 hours.

The product stores the last 100 saved values for each channel. Once the memory is full, the oldest measurements are overwritten by the newest ones.

These index values will not be stored in the event of a power outage.

The user can export the last 100 saved values for each channel in .csv format using the **IoT Configurator NB-IoT/LTE-M** application.

T**o export the index history via the IoT Configurator NB-IoT/LTE-M application**, open the secondary menu at the top of the "MEASUREMENTS" screen



To avoid resetting the index to 0 in the event of a power outage, the latest stored index value is saved by the product every 10 minutes for each channel and is automatically restored at startup.

APPENDIX 7: ACQUISITION TIME SCHEDULING

It is possible to schedule the time from which the product will perform its first acquisition, independently of the time at which it was started. The message reporting frequency will be aligned with this first acquisition time.

Acquisition time configuration

By default, the PULSE product starts the sampling period when it switches from PARK mode to PRODUCTION mode.

Acquisition time scheduling can be configured using the **IoT Configurator NB-IoT/LTE-M application.**

The table below lists the parameters to configure for acquisition time scheduling

Parameters	Description	Possible configuration	Default configuration
Schedule first acquisition	Enable/disable acquisition scheduling to choose the time at which the product will perform the first acquisition and store the index	Enabled Disabled	Disabled
Time of first acquisition	Time (UTC) from which the product will perform the first acquisition and store the index	0 to 23 hours	12:00
Minutes of first acquisition	Minutes from which the product will perform the first acquisition and store the index	0 to 59 minutes	00 minutes

Example

- The installer connects the product to two water meters and applies the following configuration:
  - Channel A and Channel B enabled
  - Counting only pulses wider than 500 ms on Channel A and pulses wider than 100 ms on Channel B
  - PULSE communicates its data in PUSH mode
  - Storing the index value on Channel A and Channel B every 15 minutes
  - Reporting index values every hour (i.e., every 4 stored values)
  - Scheduling the first acquisition exactly at midnight

Application parameters to configure

Parameters	Unit	Value	Description
Active channels	-	Channels A and B enabled	Enable both channels
Sampling rate	Seconds	900	Store the index for Channels A and B every 15 minutes
Reporting interval	Seconds	3600	One report per hour containing the last 4 index values for each channel
Schedule first acquisition	-	Enabled	First acquisition scheduling enabled
Time of first acquisition	Hours	0	First acquisition and index storage at midnight
Minutes of first acquisition	Minutes	00	First acquisition and index storage at midnight
Channel A debounce period	Milliseconds	500	Only pulses wider than 500 ms are detected

Parameters	Unit	Value	Description
Channel B debounce period	Milliseconds	100	Only pulses wider than 100 ms are detected

📱 **Configuration via the IoT Configurator NB-IoT/LTE-M application**
Go to the sensor “CONFIGURATION” menu

1. Go to the “APPLICATION” section
Go to the “General” subsection
⇒ Set “Active channels” to enable Channels A and B
⇒ Set the sampling rate to 900 seconds
⇒ Set the reporting interval to 3600 seconds
⇒ Enable “Schedule first acquisition”
⇒ Set the first acquisition hour to 0:00
⇒ Set the first acquisition minutes to 00
Go to the “Channel A” subsection
⇒ Set the debounce period filter to 500 ms
Go to the “Channel B” subsection
⇒ Set the debounce period filter to 100 ms

3. Apply the new configuration to the product via NFC

- The installer starts the product (switch to PRODUCTION mode) at 09:30 UTC
- The product immediately starts detecting and continuously counting pulses on each of its two inputs
- The product attaches to the network and retrieves the time via the network
- At 00:00 UTC, the product stores the index for the first time
- The product stores the index every 15 minutes
- After 4 stored values, the product sends its first message containing the stored index values (according to the sampling rate) for Channel A and Channel B at 01:00 UTC
- Subsequent messages will be sent according to the configured reporting interval