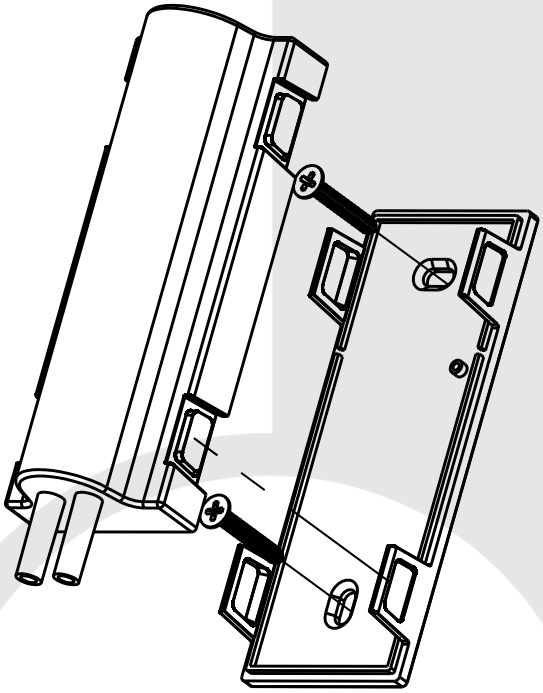
Installation and operating instructions



Pulse module with LoRa-WANTM radio interface

INNOTAS GMBH

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Written by: INNOTAS GmbH

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2 Revision Directory

Revision	Date	Amendment
2.0	04.01.2024	First edition (new version encapsulated)
2.1	15.07.2024	Changes, no counting without radio activation
2.2	06.11.2024	Notes on LoRa radio technology
2.3	28.04.2026	Update Pic's

3 Intended Use

The pulse LoRa module is used to record pulses and transmit them via radio. LoRa-WANTM is used as the radio standard. It has two pulse inputs. For example, the flow rate of a suitable pair of water meters (hot water and cold water) can be recorded with one module. If only one input is required, the second input can remain free. To avoid additional energy consumption, unoccupied inputs should be isolated. The module must be identified as a device in the LoRa network.

4 Installation instructions

The module is located in a special housing, the electronics are encapsulated. For installation, the supplied mounting plate must be attached with suitable means. For example, screws with a diameter of about 3mm are suitable for this. Then the module is locked onto the base plate. The cables are connected to the outputs of an external pulse source as follows:

brown →Ground

white → Module input, to be connected to the output of the pulse source

The assignment must be maintained for open collector/open drain outputs.
The ground cables are electrically connected internally. In the case of non-polarized, potential-free outputs such as mechanical switches, relays, etc., the assignment is arbitrary. To ensure that no pulses are counted during transport and connection, the counting function is only activated when the radio is activated. We therefore recommend that you only activate the radio after connecting the pulse inputs.

5 Activating the device

Before installation and activation, the devices should be announced to the LoRa server (commissioning). For this purpose, the DEVEUI, APPEUI and DEVKEY must be notified to the server. To simplify the process, you will receive an "electronic delivery note", a csv file with all the numbers of the delivered devices.

5.1 Activation of the radio

The pulse module is delivered in "stock mode", i.e. the radio is inactive. The factory-set connection is OTAA.Es there are 4 ways to activate the radio and start the JOIN process:

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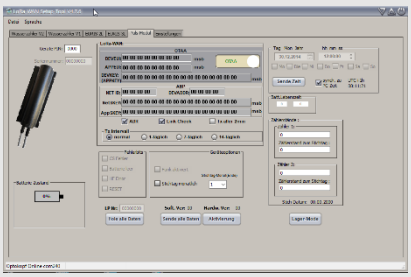
a) with an IrDa optohead and the free software LST (LoRa Setup Tool) from Innotas



b) with an IrDa optohead and the free Android APP to activate our LoRa products. Note: This only works with a deactivated PIN (factory setting)!

c) via activation head, obtained via InnotasNote: This only works with a deactivated PIN (factory setting)!

d) By means of a magnet The magnet must be guided to the magnetic sensor of the module three times every second and removed again. The approach of the magnet is acknowledged the first two times by a glow of the LED of the interface for about 0.8 seconds. At the third approach, the LED flickers very quickly for about one second.The module is activated, the join process begins immediately. Note: The magnetically active point of the module is located 10mm below the center on the underside (potting side). The magnet of the IRDA optohead can also be used for activation.

After a successful JOIN process, the device transmits every 2 minutes for about 8 hours. This enables the installer to promptly request a successful integration into the LoRa network from the server. After that, the device only transmits in the preset transmission interval. Due to the radio duty cycle, the 2 minute transmission interval may be slightly longer if the spread factors are high.

6 Settings

6.1 Setting ADR

The ADR (Automatic Data Rating) setting means that the data rate or spread factor of the radio transmission is controlled dynamically and automatically. The LoRa device sends a radio protocol with a confirmation request to the server. If the receipt is missing, the device will first repeat the protocol and then increase the spread factor. If the server receives the protocol correctly and with good quality, it sends a command to the device to reduce the spread factor. Large spread factors extend the protocol and thus the probability of a collision with another radio protocol and more energy is consumed. Therefore, the system always tries to work with the best possible spread factors.

6.2 Setting Link Check

Here, the device cyclically checks whether there is still a connection to the server.

6.3 JOIN Process

In the connection setting OTAA (factory setting), the device requests a connection from the network with its device ID of the DEVEUI and the application ID of the APPEUI. The protocol is encrypted with the DEVKEY. If the server knows the device, it responds to the device and now negotiates new private keys with the device. These are the NetSKey and the AppSKey. From this point on, the communication is privately encrypted. The device is now connected to the network.

7 What to do in the event of a connection failure

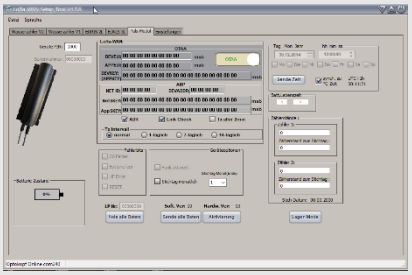
After activation, the device tries a JOIN process with the LoRa-WAN network. If this does not succeed, this is repeated after some time with a higher spread factor. If no connection is

established, the radio goes into sleep mode for 24 hours. After that, the JOIN sequence is run through again. In case of another failed attempt, the device pauses again for 24 hours, and so on. The 24-hour rhythm is independent of the time.If the device is already connected but the server does not answer the receipt requests, e.g. because the telegrams do not arrive at the server, the receipt does not arrive at the device or the server is switched off, then the device first increases the spread factor. Having arrived at SF12 and a few unsuccessful repetitions, the device falls back into the JOIN process and tries to establish a new connection to the LoRa network every 24 hours from then on.

8 Pulse Module Configuration

8.1 Parameterization via IrDa Optokopf

The pulse counter can be parameterized using a standard IrDa optohead. The optohead must be placed at a distance of about 3mm in the middle of the viewing window on the underside of the module on the left. The cable of the optohead preferably points to the right. If the optohead has a magnet, the interface is activated automatically, otherwise it must be activated by means of a magnet (about the middle of the module). The interface remains active for 2 minutes after activation. In conjunction with the LST (LoRa Setup Tool) software, the following parameters can be changed:



- Date and Time
- Meter readings
- Deadline (monthly, yearly)
- Cut-off month (yearly for cut-off dates)
- Set or change device PIN
- LoRa Settings:
    - Connection type OTAA / ABP
    - APPEUI, DEVKEY, NETID, NetSKEY, AppSKEY
    - ADR, Link Check
    - Transmission interval

For more information, please refer to the description of the LoRa Setup Tool (LST).

8.2 Factory configuration

The impulse module is delivered with a customer-specific configuration. For this purpose, the customer fills out an order form. The following settings can be specified:

- Time zone
- Connection setting OTAA
- Cut-off date, monthly or yearly
- Reference date month, if annually
- APPEUI, DEVKEY
- Device PIN "0000" (disabled) or customized

9 Monitoring features

The radio attachment module monitors the most important basic functions and settings during operation to ensure proper operation and to signal possible faults in good time.

9.1 Battery monitoring

The battery of the pulse module has a service life of 6-12 years in normal operation. The service life is strongly determined by the amount of pulses registered and the protocols sent. A "batt low" error is set after 10 years of operation since production or a battery voltage fall below during radio operation. The pulse counter still has a power reserve from the time the battery voltage falls below the voltage, which can vary between weeks and months depending on the battery load (due to radio, low or high ambient temperature and pulse frequency). The calculated service life of the battery is strongly dependent on the number of LoRa protocols sent. This number is determined not only by the set transmission interval, but also by protocol repetitions and special requirements caused by the server. For optimal use of the battery lifetime, in addition to the correct transmission interval, it is also important to ensure clean LoRa communication with the server. The error bit is transmitted via LoRa and can be read out via interface. The fault can be reset via the optical interface. Battery monitoring is factory-enabled.

IMPORTANT NOTE ABOUT LORA-WAN WIRELESS TECHNOLOGY

The LoRa-WAN radio technology is designed to manage the load on the radio frequency bands, the transmission power and the connection stability by the LoRa network server (LNS). This management is carried out by means of special control commands within the LoRa protocols, which allow optimal use of resources.

The calculation of battery life for our endpoints is based on a precise and optimized interaction between the end device and the server. Changes in the system that generate additional traffic can exceed the originally planned battery budget and lead to a shorter battery life. For this reason, it is crucial to actively monitor the actual communication taking place and not just check the arrival of the expected payload.

INNOTAS GmbH disclaims any liability for premature battery discharges caused by excessive communication volume.

9.2 RESET Monitoring

The pulse module registers a restart of the software in the event of an error. The error is communicated via radio and the interface.

9.3 Storage Monitoring

The pulse module monitors the consistency of the set parameters. If it detects an error, a checksum error is set. The error is communicated via radio and the interface.

9.4 RF Error

This is an internal diagnostic function.
The controller monitors the proper functioning of the radio chip. If interference is detected, an error bit is set, which can be read out via the optical interface.

10 Technical data

Min. Pulse ON/OFF Time	>10ms
max. Pulse frequency	50 Hz
Operation	Magnet / optical interface
Power supply	3 V DC Lithium Battery
Delivery	Stock mode (radio not active)
Operating time with one battery	6-12 years
Storage	Meter readings / key values / error conditions
Radio interface	LoRa-WANTM 868-870MHz Frequency Band
Specification LoRa-WANTM	V1.0.2
radiated power	up to 14dBm
Number of telegrams per day	<= 12, depending on setting and spread factor
Data security	Wireless 2-way AES 128, optics via PIN
Activation radio	Optohead / Activation Head / Magnet
Storage Temperature	-20°C – 60°C
Operating Temperature	-10°C – 60°C
Dimensions	Approx. 107x43x34mm³ without cable
Test mark	CE according to Directive 2014/53/EU (RED)
Protection class	IP 67
Weight	Approx. 135g

11 Warnings and safety instructions

The pulse module is intended exclusively for the recording and transmission of consumption values. The specified environmental conditions must be observed. The product must be installed professionally and in accordance with the installation guidelines and may therefore only be installed by trained specialists.

The pulse module contains a battery and must be disposed of properly.