OY1310

LoRaWAN Water meter AMR

User manual

Version 2.0

June 2020

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1 Disclaimer

This document represents information on products at the time of publication and is subject to change without prior notice due to product improvements or other reasons. Talkpool makes

no warranties based on the accuracy or completeness of the contents of this document and reserves the right to make changes to specifications and product descriptions at any time without notice. Talkpool reserves all rights to this document and the information contained herein.

1.1 Technical support

Please visit www.talkpool.io for additional information, or contact IoT.support@talkpool.com

1.2 EU Declaration of conformity

EC DECLARATION OF CONFORMITY

certify that the design and manufacturing of this product
WIRELESS WATER METER /
OY1310 868
conforms to the following directives and standards
The Radio Equipment Directive (2014/53/EU),
EN 300 220-1 V2.4.1, EN 300220-2 V2.4.1,
EN 301 489-1 V1.9.2, EN 301 489-3 V2.1.1,
EN 60950-1:2006+A11+A1+A12+A2
EN 62479:2010
RoHS Directive 2011/65/EU
This product was CE marked in year -19

2019-09-10   _____
Managing Director   **Stefan Lindgren**

2 Warnings

The following safety precautions must be observed during all phases of the operation, usage, service or repair of this Talkpool product.

- Read the product manual.
- Do not modify the product.
- The product should not be exposed to extreme heat or open flame.
- The device must not be exposed to harsh chemical agents or solvents.
- The labelling of the product may not be changed, removed or made unrecognizable.

3 Environmental

This symbol on the product or on its packaging indicates that this product must not be disposed of with your other household waste. Instead, it is your responsibility to dispose of your waste by taking it to a collection point designated for the recycling of electrical and electronic appliances. Separate collection and recycling of your waste at the time of disposal will contribute to conserving natural resources and guarantee recycling that respects the environment and human health. For further information concerning your nearest recycling center, please contact your nearest local authority/town hall offices, your household waste collection company or the shop where you bought the product.

4 Product Description

The OY1310 LoRaWAN Water meter AMR is designed to measure water flow through water pipes. It is optimized for reliable and secure measurements with more than 10 years life length.

The standard measurement and reporting interval is every 3 hour, other reporting intervals can be configured over the air.

5 Installation and activation

The unit is shipped in sleep mode, i.e. with all functions, including radio, deactivated. The device activates when the red button is pressed for more than 8 seconds. This happens automatically when the unit is mounted on to a GSD8-RFM mechanical water meter. The installer mounts the LoRaWAN AMR unit on the GSD8-RFM mechanical water meter from B Meters and mounts the locking pin and seal.

5.1 LoRaWAN Configuration

Configuration on the network server is done with
AppEUI: 70-B3-D5-D7-2F-F8-13-00 (a.k.a. JoinEUI)
It is possible to order a batch of devices configured with a customer unique AppEUI from the Talkpool OUI range.

The device is configured with device unique DevEUI and AppKey. The device is default configured for OTA provisioning. Contact the Talkpool team for ABP configuration. The device follows the LoRaWAN standard related Join configuration parameters, such as RX1 and RX2 windows, RX2 downlink frequency etc.
The default setting is ADR enabled.

5.2 Sensor states and state check

The sensor has four states: Initial, Joining, Configure and Operational state.
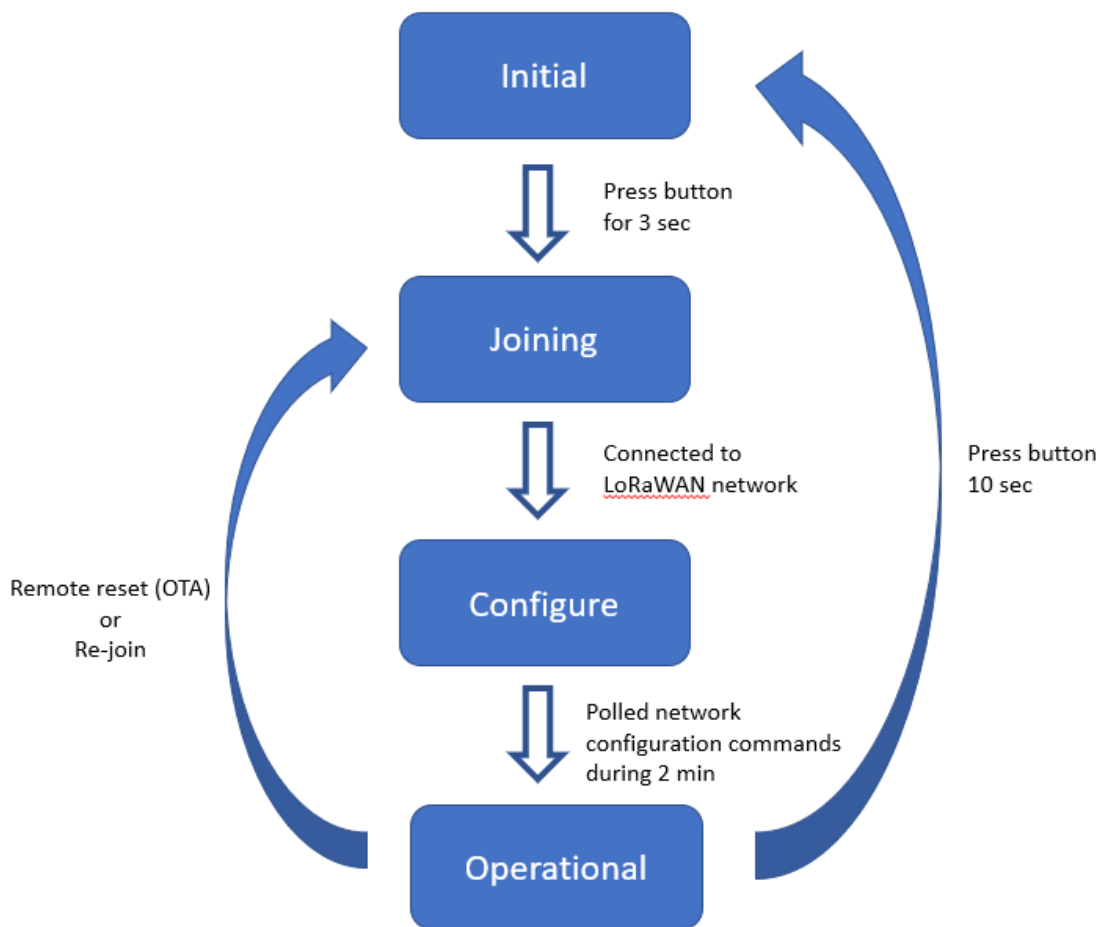
Figure 1 Device states

To check the device state during intial state, press the button for 0.5 sec and 1 short flash indicates that the device is in initial state. In all other states the LED is off.

5.2.1 Re-join functionality

The device supervises its connectivity to the network, by monitoring that periodic downlink messages are received.

The device tries to re-join the network if it has not heard anything from the network for 288 uplinks (36 days @ 3 hour message interval). The device requests and normally gets a downlink ever 64th uplink due to the ADRAckReq functionality.

5.2.2 Startup Sequence

When the device has joined the network, startup transmissions are performed in order to make it easier to configure the device using downlink commands. When the startup sequence is completed normal operation is started.

There are at least five startup transmissions. The Status command (index 0x20) is sent unless a reply to a downlink is sent. If no replies are sent the Status commands are sent with increasing intervals starting with 15 seconds and ending with two minutes. This startup sequence should be utilized to set the desired measurement interval and set the starting value of the water meter (if not equal to $0m^3$). For accurate calibration, the water meter should not be used during the calibration.

6 Specification

Versions

OY1310 LoRaWAN Water meter   Compliant with B Meters' GSD8-RFM
Single jet water meter

Operations

Operating temperature   0°C to +55°C

Connectivity

Network   LoRaWAN
Frequency bands   868 MHz
Provisioning   Over the air & personalization

Security

Algorithms   AES-128
Hardware   Cryptographic co-processor
Features   Secure boot
Secure firmware upgrade
Hardware based ultra secure key storage

Battery life

Battery life length   > 10 years (at 3 hour intervals, at SF12)
Primary cell   Lithium-Manganese 3V
Capacity   2.2 Ah

Method

Optical readout   Using infrared diodes

Weight

Weight   85g

Configuration

Transmission intervals   3 hours, configurable over the air
Starting value   Configurable over the air
Unique App EUI available upon request

Alarm functions

1. Module removal
2. Flow exceeding threshold value continuously (configurable)
3. Magnetic fraud attempt
4. Leak detection (configurable)

Enclosure

IP68

Certifications

RoHS compliant
CE
LoRaWAN

7   Battery life

The battery life is designed to be more than 10 years with 3 hours measurement interval during worst condition (SF12 and on hot water pipe).

8   Security

The device has the following security features:

- Cryptographical coprocessor for ultra-secure hardware based key storage
- Secure boot
- Encrypted FW
- Message encryption (AES-128 bit)
- Message integrity (MIC AES-128 bit)
- No port access to device.

Further the device has tamper protection functionality

- Presence of strong magnet
- Removal from meter
- Back flow

9   Alarms

The OY1310 LoRaWAN Water meter AMR has several alarm functions built in. When an alarm is detected the corresponding alarm flag in the status data is set. When any alarm flag is set the status data is included in every report. The alarm flag must be reset manually using a Downlink command.

Module removed
If the module is removed from the water meter after activation this alarm flag is set.

Magnetic fraud attempt
The module has a detector that can sense if a magnet is used to manipulate the function of a dry dial water meter. If a magnet is sensed the alarm flag is set.

Flow exceeds Q3
If the flow exceeds Q3 for more than 10 minutes the alarm flag is set. Q3 depends on the water meter (based on pipe) and should be configured using a Downlink command. The default Q3 value is based on the largest Q3 for the specific series.

Leak detection
If a continuous flow has been detected for 24 hours the alarm flag is set. Two configuration parameters are used for this alarm, Leak window size and Leak zero tolerance, and these can be configured using Downlink commands. The leak window size defines how long it should

be between the detected water meter movements to consider no flow. Leak zero tolerance defines how many electric pulses that are required to consider a flow. The default values are 2 minutes and 2 pulses (0.25 liter for OY1310 and 2.5 liter for OY1320).

Alarm reset
The alarm flags are reset by setting the Status data with a Downlink command. The supplied data is used as a mask. Setting it to 0 resets all alarms. Setting it to 0xFE resets alarm flag 0.

10 Protocol

The protocol consists of different types of data

- LoRaWAN v.1.0.2 standard commands

- Unsolicited uplink status commands during configure state

- Periodic measurement reports

- Downlink commands and queries

- Uplink query response

Note 0x denotion means hexadecimal encoded.

10.1 LoRaWAN standard commands

All standard LoRaWAN v 1.0.2 are supported. Please refer to the LoRaWAN standard for the protocol definition.

10.2 Unsolicited uplink status commands

The sensor polls the server for configuration parameters the during the **Configure** state. This is done by sending unsolicited uplink status report (0x20). This is gives quick feedback to the installer that the installation has been successful and enables downlink configuration commands to be sent. After approximately 2 minutes the device changes to **Operational** state. See chapter 6.5 for details of the Status report.

Port: **Port 1**

Payload   0x01 20 00

        0x01: Data type

        0x20: Status command

        0x00: bit0 =0 => Normal startup

            bit1 =0 => No boot problem

            bit2-7 reserved

The expected behavior is 0x01 20 00. If not contact support.

10.3 Periodic measurement reports

The sensors transmit periodic unsolicited measurement reports. The default configuration is every 3 hour.

Port: **Port 1**

Payload header (Hex): 0121

Volume in liters (Hex): 00000000

Size: 6 Bytes

10.4 Downlink commands and queries

To control the sensor application, in-band commands and queries can be sent from the server application. Contact your LoRaWAN network provider for in-band application API.

All downlink application communication is done on LoRaWAN **port 1.**

Downlink command network => device				
Field	Bytes	Value	Description	Note
Type	1	xx	0x01: Set 0x02: Query 0x03: Action	
Index	1	xx	Command Index	
Data			As defined for Command Index only applicable for set-commands	

10.5 Commands

Index	Description	Datatype	Encoding	Valid range	Access	Unsolicited	Description	Note
0x03	FW build hash	6 x Uint8			Query	No	Unique number that identifies the firmware version	
0x05	Device reset				Action	No	Reset of device	
0x06	CPU voltage	Uint8	25mV/ LSB	0-3.6V	Query	No	Read CPU voltage. Max/min ranges depend on battery chemistry.	
0x0A	CPU temperature	Uint16 Big endian	0.01C / LSB	-50- +125 C	Query	No	Temperature from CPU sensor with 50 °C offset. Approximately 5 °C accuracy.	
0x20	Status	Uint8	Bitfield		Query Set	Yes	Bit 7: Flow exceeds Q3 at least for 10 min Bit 6: - Bit 5: Magnetic fraud attempt Bit 4: - Bit 3: Module removed Bit 2: - Bit 1: - Bit 0: Leakage during last 24 hours	To clear alarms: 0xFF clears no alarms, 0x00 clears all alarms, 0x80 clears all alarms except 'module removed' etc.
0x21	Volume	Uint32 Big endian	Liter			Yes	Volume as indicated on meter x 0.001 m3	
0x22	Reporting interval	Uint16 Big endian	Minutes	1-10080	Set Query	No	Reporting interval in minutes	
0x25	Starting value	Uint32 Big endian	Liter		Set Query	No	Volume as indicated on meter x 0.001 m3	
0x27	Back flow volume	Uint32 Big endian	Liter		Query	No	Volume as indicated on meter x 0.001 m3	
0x2B	Q3MaxFlow	Uint16 Big endian	Liters per hour	0-65535	Query Set	No	Corresponds to mechanical meter Q3 (based on pipe)	
0x2C	Leak Window size	Uint8	Number of 15 seconds samples	1-255	Query Set	No	The size, in units of 15 seconds sample windows, in which we expect flow below "zero tolerance" to reset leak detection	
0x2D	Leak Zero tolerance	UInt8	Opto phase changes	0-255	Query Set	No	Zero tolerance, max number of shaft phase changes considered "not moving".	

Alarm reset

The alarm flags are reset by setting the Status data with a Downlink command. The supplied data is used as a mask. Setting it to 0 resets all alarms. Setting it to 0xFE resets alarm flag 0.

10.5.1 Measurement interval

The measurements are done periodically. The interval time is controlled by the configuration parameter Measurement Interval. The default setting is 3 hours.

The measurement interval can be set between 1 and 65534 minutes (~1.5 months).

It is also possible to order a batch of OY1310 with a different default setting.

Example

Set measurement interval to 5 minutes:	Port 1: 01230005
Set measurement interval to 3 hours (180 min):	Port 1: 012300B4

10.5.2 Reset device

The device can be remotely reset and forced into **Joining** state. All settings are back to factory default.

Example: Remote device reset: Port 1: 0305

10.6 Uplink query response

When communication on LoRaWAN port 1 the following header is used:

Uplink command device => network				
Field	Bytes	Value	Description	Note
Type	1	xx	0x01: Data 0x02: Command NACK	
Index	1	xx	Command Index	
Data			As defined for Command Index (only for Type: Data)	

10.6.1 Uplink status report

The uplink status report is sent unsolicited during **Configure** state and queried in **Operational** state.

Example: Port 1: 01 20 00

　　01: Data type

　　20: Status command

　　00: bit0 =0 => Normal startup

　　　　bit1 =0 => No boot problem

　　　　bit2-7 reserved