

DOCUMENTATION

Telegram structure LoRa water meter

Rev. 2.0

INNOTAS GMBH



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2 List of revisions

REVISION	DATE	AMENDMENT
1.0	2018	First edition
1.1	2018	various additions (potter)
1.2	04.06.2019	Longer transmission intervals and monthly value transmission
1.3	18.09.2019	Status bits changed
1.4	12.11.2019	High power module integrated
1.5	09.03.2020	Filling protocols introduced on a (bi-)weekly basis
1.6	10.06.2021	Addition ReJoin command
1.7	01.04.2022	Change ReJoin, set addition ZS
1.8	02.06.2022	Installation logs only 30
1.9	28.04.2023	Examples supplemented
2.0	05.12.2023	Error correction protocol 3 and 4 (Töpfer)

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3 Upload protocols

In the standard module, 2 transmission modes can be selected, the normal mode and the mode with extended transmission intervals.

Normal mode enables the maximum number of transmission telegrams per day, taking the energy budget into account. The mode with extended transmission intervals allows the data volume to be reduced for reasons of data protection or network load.

In normal mode, 4 different protocols (no. 1 to no. 4) are sent cyclically. The identification of which protocol type is currently being sent is coded in the port number. The protocol no. is the same as the port no. In mode with extended transmission intervals, protocol 2 or protocol 10 is always transmitted.

A module with increased transmission power can also be supplied. This module is set to 1 protocol per day at the factory. It is also possible to set the normal mode here. However, the estimated service life of 12+ years will then not be achieved. We therefore strongly advise against this.

3.1 Protocol 1

4 bytes Current meter reading as a 4-byte number in liters.

Example payload : 0x00000003

→ 0.003m³ Current meter reading

3.2 Protocol 2

4 bytes Current meter reading as a 4-byte number in liters.

4-byte counter reading on the reporting date as a 4-byte number in liters. 2 byte error and status code

1 byte Key date month

The log is sent once a year (annual) or once a month (monthly), at the end of each month If the extended transmission intervals are set, log 2 is always sent.

Example payload : 0x0000000500000003000000C

- 0.005m³ Current meter reading,
- 0.003m³ Meter reading on the reference date,
- 0 STATUS,
- 12 Reporting date month for hiring annually

3.3 Protocol 3

4 bytes Current meter reading as a 4-byte number in liters.

2 Byte max. flow rate of the last day (0-24 h) in liters/h (measured and averaged over one minute)

1 byte Standstill time of the last day (0-24 h) as % in 0.5 % resolution (0 ...200)

2 bytes Number of starts of the last day (0-24 h)

2 Byte min. flow rate of the last day (0-24 h) in liters/h

Please note that the minimum flow rate is the smallest measured flow rate above the start-up flow rate.

On days with no flow at all, the maximum flow and minimum flow are zero!

Minimum flow values between zero and start-up flow are not possible, as this is a discontinuous flow.

Example payload : 0x0000000500B4C7000002D0

→ 0.005m ³	Current meter reading
180 l/h	Maximum flow rate
→ 99,5%	Standstill
→ 0	Start-up/day
720 l/day → 720 l/day	Flow rate

Protocol 4

4 bytes Current meter reading as a 4-byte number in liters.

2 bytes Flow rate of the last full hour

2 byte flow rate of the penultimate full hour

2 bytes Flow rate of the full hour at the time of transmission -3h 2

bytes Flow rate of the full hour at the time of transmission -4h

Attention, the internal clock is used to determine the time, which may differ from the server time. Example

payload: 0x0000000500010002000A000F

→ 0.005m ³	Current meter reading
→ 1 l/h(-1)	Flow rate of the last hour
→ 2 l/h(-2)	Flow rate 2 hours ago
→ 1 0 l/h(-3)	Flow rate 3 hours ago
→ 1 5 l/h(-4)	Flow rate 4 hours ago

3.5 *Protocol 9*

4 bytes Byte number of sent bytes in SF7 4

bytes Byte number of sent bytes in SF8 4

bytes Byte number of sent bytes in SF9 4

bytes Byte number of sent bytes in SF10 4

bytes Byte number of sent bytes in SF11 4

bytes Byte number of sent bytes in SF12 1

byte Number of JOIN attempts

Protocol 9 is only sent on request.

Example payload : 0x0000001F0000002F0000001F000000200000001F0000002105

→ 31 bytes in SF7

→ 47 bytes in SF8

→ 31 bytes in SF9

32 bytes in SF10

→ 31 bytes in SF11

→ 33 bytes in SF12

→ 5 join attempts

3.6 Protocol 10

2 byte error and status code

Protocol 10 does not contain any meter readings, only the status code. The protocol is used to maintain LoRa network operation without transmitting user-relevant data (data protection). In the mode with extended transmission intervals, a telegram is transmitted daily, but the amount of user data is further reduced. Protocol 2 is then only sent every 7 days (weekly) or every 14 days (fortnightly). In between, a protocol 10 is transmitted daily.

Example payload : 0x020C

0x02 Sabotage error,

0x0C Transmission interval normal, current transmission interval every 2 min (installation), monthly target date

3.7 Numerical value representation

Value	Representation
Current meter reading	Hex, MSB first, e.g. 0000012C = 300 liters
Meter reading on the reference date	Hex, MSB first, e.g. 001F 5C40 = 2055.232 liters = 2055,232m ³
Key date month	Hex, e.g. 0x01=January; 0x0C=December
max./min flow rate of the last day	Hex, MSB first, e.g. 04CD = 1229l/h
Downtime of the last day	Hex, MSB first, e.g. C1 = 193 /2 = 96.5%
Number of starts on the last day	Hex, MSB first, e.g. 0012 = 18 starts
Flow rate within a past Hour	Hex, MSB first, e.g. 01C2 = 450 liters
Number of bytes sent	Hex, LSB first , e.g. 2A01 0000 = 298 bytes
Number of JOIN attempts	Hex, one byte, e.g. 04 = 4 join attempts

3.8 Status bits

Byte	Bit no.	Meaning/function
MSB	7	Reflux
MSB	6	Standstill
MSB	5	RESET error
MSB	4	HF error
MSB	3	CS error
MSB	2	Battery low
MSB	1	Sabotage
MSB	0	Measurement error
LSB	7	Leakage
LSB	6	Reserve
LSB	5	Reserve
LSB	4	Reserve
LSB	3	Reporting date annually (0) / monthly (1)
LSB	2	Transmission interval according to bit 1+2 (0) Transmission interval 2 minutes (1)
LSB	1	Normal mode (0) Interval daily (1)
LSB	0	Interval weekly (2) Interval bi-weekly (3)

3.9 Transmission intervals

The transmission interval in normal mode is 2 hours, in SF12 all protocols are omitted 1. The device transmits 12 telegrams within 24 hours, in SF 12 only 8 telegrams. After starting the device (join), 30 telegrams with a cycle time of 2 minutes are sent for commissioning (possibly a slightly longer cycle time if the duty cycle is exceeded due to large spreading factors). The start of the cycles begins with the join time, it does not run synchronously with the full hour! The first telegram (cycle 0) is sent after a successful join. When evaluating consumption values, the possible time deviation between the device's internal time and the server time must be taken into account.

The normal cycle time can be reset to 2 minutes at any time using the optical interface or download protocol for a further 30 telegrams. The shortened cycle time starts after the next regular protocol has been sent. Attention, repeated use of the 2-minute mode shortens the battery life!

If the transmission interval is set to once a day, a telegram is sent every 24 hours.

Cycle	Protocol no	Protocol no. SF12
0	3	3
1	4	4
2	1	Not applicable
3	4	4
4	1	Not applicable
5	4	4
6	1	Not applicable
7	4	4
8	1	Not applicable
9	4	4
10	2	2
11	4	4

4 Download protocols

After receiving a telegram, the server can send data or commands to the device.

Set spreading factor

~~4.1~~ The command for setting the spreading factor is 0x55 followed by the spreading factor [0x00-SF12,...0x05-SF7]
e.g. 0x55 0x05 sets the spreading factor to SF7, 0x55 0x01 sets the SF11

Set device PIN

~~4.2~~ The command for setting the device PIN is 0x56 PIN0 PIN1
e.g. 0x56 0x12 0x34 sets the device PIN to 1234.
The factory default PIN is 0000 and is ignored by the PC program.

Query number of bytes sent

~~4.3~~ The command 0x57 causes the device to send the send byte statistics.



