AXIOMA METERING UAB

ULTRASONIC WATER METER QALCOSONIC W1/F1

Lora Payload (Long) “Extended”

1. Decoding the payload

The size of the *Axioma* device's payload can vary depending on the type of measuring device. All VIF data are sending through Port 100.

By default information of the *Flow metering device* will always be shown in the order indicated in the following table.

Order	Number of bytes	Description
1	4	Current date and time
2	1	Status code
3	4	Current volume
4	4	Log date and time
5	4	Volume at log date and time
6	2	Delta volume 1
7	2	Delta volume 2
8	2	Delta volume 3
9	2	Delta volume 4
10	2	Delta volume 5
11	2	Delta volume 6
12	2	Delta volume 7
13	2	Delta volume 8
14	2	Delta volume 9
15	2	Delta volume 10
16	2	Delta volume 11
17	2	Delta volume 12
18	2	Delta volume 13
19	2	Delta volume 14
20	2	Delta volume 15
21	1	Padding byte 0x2F

By default 15 volume values are transmitted in one telegram. First of all, there is log time and log volume value at the beginning, after these differences only differences are transmitted. Log values are always equal to beginning of an hour or a day. For example: log time is 2019-02-01 23:00, log value is 100 liters, log period is 3600s. Log value + delta volume 1 is the volume value at the time of 2019-02-02 00:00, Log value + delta volume 1 + delta volume 2 is the volume value at the time of 2019-02-02 01:00 and so on until all values are parsed.

2. Explanation of the payload

1. UNIX hexadecimal timestamp, when data was updated from the meter. Example: 0x5AE46015 means Saturday, April 28, 2018 11:50:45 AM (GTM).
2. Status of the metering device indicated in following table.

Bit No. / Status	0	1	2	3	4	5	6	7
Low battery			X					
Permanent				X				
Manipulation (only W1)					X		X	X
Dry					X			
Backflow					X	X	X	
Manipulation (only F1)					X		X	X
Burst					X	X		X
Leakage					X	X		
Low temperature					X			X

All alarm messages are listed in priority order, where priority goes according to the arrow. For instance, if status byte is equal to 0x90, then this would mean that the temperature is low, but if the status byte has only 0x10, then it would mean that the device's pipe is dry.

3. Volume is multiplied by 0.001 m³. Example: 0xB0620100 means 90.8 m³. Byte sequence is little-endian.

4. The next values in the payload are historical. They are presented in the same dimensions as actual values in previous registers. Historical data is updated whenever relevant values are recorded to the payload. For example actual values of *Flow metering device* updating every hour so at that moment all registers is rolled to the right by four bytes and the last four bytes are consumed. Historical values are always saved depending on storing period. If storing period is more than one hour it will be equal to the beginning of an hour (01:00:00h; 02:00:00h etc.). If storing period is more than one day, it will be equal to the beginning of a day (00:00:00h).
5. Period between past values indicates time offset between present values and values given in past periods. By default this period is provided in seconds.

3. Configuration parameters

Through Port number 101 configurations of parameters are transmitted in the form of extended payload. Configuration is transmitted every tenth telegrams. These telegrams are extended by DIF values and every DIF value is inserted before every VIF value.

1. DIF values means length of data (code of data format) transited in the payload.
    a. 32 bits integer, i.e. 0x04,
    b. 16 bits integer, i.e. 0x02,
    c. 8 bits / 1 byte, i.e. 0x31.
2. VIF values mean type of data (code of data units) in the payload.
    a. Date and time, unix time, i.e. 0xFF8913,
    b. Status code, i.e. 0xFD17,
    c. Volume, liters or 0.001 m³, i.e. 0x13,
    d. Period between past values, sec., i.e. 0xFD2C.

Example of payload through port number 101 explained in the following table.

Order	Number of bytes	Description	Example
1	1	DIF – 32 bits integer	0x04
2	3	VIF – Current date and time, unix time	0xFF8913
3	1	DIF – 8 bits / 1 byte	0x31
4	2	VIF – Status code	0xFD17
5	1	DIF – 32 bits integer with storage	0x04
6	3	VIF – Log date and time	0xFF8915
7	1	DIF – 32 bits integer with storage	0x44
8	1	VIF – Volume at the log time, l	0x13
9	1	DIF – variable length with storage	0x4D
10	1	VIF – Delta volume in liters with extension bit selected.	0x93
11	1	VIFE – compact profile	0x1E
12	1	Length – real data length is (value – 2), so the real data is 30 bytes.	0x20
13	1	Spacing control – Bit7..bit6 – 01 which mean that values are incrementing Bit5 .. bit4 – 10 period between two values are in hours. Bit3 .. bit0 – 0010 which means that delta value is in two bytes.	0x62
14	1	Spacing value – period between two delta values	0x01

4. Device alarms

Device is sending its status through Port number 103 when the critical alarm occurs. The payload in the telegram has timestamp and status / alarm code only (see the table below).

Order	Number of bytes	Description
1	4	Date and time
2	1	Status / alarm code

Data types are the same as in the default payload (see Chapter above) and shortly explained below:

1. UNIX hexadecimal timestamp, when data was updated from the meter.
2. Alarms of the metering device indicated in following table.

Bit No. / Status	0	1	2	3	4	5	6	7
Backflow (only W1)					X	X	X	
Burst					X	X		X
Leakage					X	X		
Low temperature					X			X

Device is sending status telegram only when new alarm occurs. These telegrams need to be confirmed (are sending with confirmation). If there is no confirmation device is sending same message repeatedly three times.

Status of the device are sending periodically (even equal to 0x00) through Port 100 with default payload and this period is configurable.

Alarm messages are sending through Port 103 once status code of this alarm is changed / new alarms occurred. To reduce the amount of duplicate messages, alarm should last for the minimum threshold interval in order alarm message could be sent.

5. Configurable settings through downlink commands

There are possibilities to modify read and send periods of the module through Port 102. The command to set period when data should be transmitted from the module described below:

Order	Number of bytes	Description and meaning	Example
1	1	DIF value – 32 bit signed integer	0x04
2	4	VIF value – exact command	0xFF898500
3	4	Data send period (LSB), i.e. 116 sec.	0x74000000

The reset command of the send period to default is explained below:

Order	Number of bytes	Description	Example
1	1	DIF value – no data to send	0x00
2	4	VIF value – exact command	0xFF898507

The command to set period when data should be collected from the measurement device described below:

Order	Number of bytes	Description	Example
1	1	DIF value – 32 bit signed integer	0x04
2	4	VIF value – exact command	0xFF898C00
3	4	Data read period (LSB), i.e. 116 sec.	0x74000000

The reset command of the read period to default is in the table below:

Order	Number of bytes	Description	Example
1	1	DIF value – no data to send	0x00
2	4	VIF value – exact command	0xFF898C07

Additional commands can be applied to the device through port 102. Number of historical data can be changed according to the command below:

Order	Number of bytes	Description	Example
1	1	DIF value – 8 bit unsigned integer	0x01
2	4	VIF value – exact command	0xFF899200
3	1	Number of historical data, i.e. 4.	0x04

Low temperature level when the low temperature alarm occurs can be changed according to the command below (only Qalcosonic F1):

Order	Number of bytes	Description	Example
1	1	DIF value – 8 bit signed integer	0x01
2	4	VIF value – exact command	0xFF899700
3	1	Low temperature level, i.e. 5°C.	0x05

The reset command of the low temperature level to default is in the table below:

Order	Number of bytes	Description	Example
1	1	DIF value – no data to send	0x00
2	4	VIF value – exact command	0xFF899707

Alarm mask which errors send the immediate alarm message can be changed according to the command below:

Order	Number of bytes	Description	Example

1	1	DIF value – 8 bit unsigned integer	0x01
2	4	VIF value – exact command	0xFF899900
3	1	Alarm mask, i.e. 0x07.	0x07

Alarm mask can be configured according to the table below:

0 bit – Leakage	
1 bit – Burst	
2 bit – Freeze	
3 bit – Tamper	Only for Qalcosonic W1
4 bit – No consumption	Only for Qalcosonic W1

The reset command of the alarm mask to default is in the table below:

Order	Number of bytes	Description	Example
1	1	DIF value – no data to send	0x00
2	4	VIF value – exact command	0xFF899907

It is possible to make the reinitialization of the lora stack after the selected time. The following command should be applied:

Order	Number of bytes	Description	Example
1	1	DIF value – 32 bit unsigned integer	0x04
2	4	VIF value – exact command	0xFF899A00
3	1	Reinit lora after, i.e. 10s.	0x0A000000

Lora ACK limit, when the ADRAckReq bit is selected can be changed according to the command below:

Order	Number of bytes	Description	Example
1	1	DIF value – 8 bit unsigned integer	0x01
2	4	VIF value – exact command	0xFF899C00
3	1	ADRAckReq bit set period, i.e. 4 telegrams.	0x04

The reset command of the Lora ACK limit to default is in the table below:

Order	Number of bytes	Description	Example
1	1	DIF value – no data to send	0x00
2	4	VIF value – exact command	0xFF899C07

W-Mbus T1 mode can be enabled or disabled according to the command below (Only for Qalcosonic W1):

Order	Number of bytes	Description	Example
1	1	DIF value – 16 bit unsigned integer	0x02
2	4	VIF value – exact command	0xFF899B00
3	1	W-Mbus T1 enable, i.e. 1 means enabled.	0x0100

The reset command to default W-Mbus T1 working mode (disabled) is in the table below:

Order	Number of bytes	Description	Example
1	1	DIF value – no data to send	0x00
2	4	VIF value – exact command	0xFF899B07

Status check interval can be changed according to the command below (only for Qalcosonic F1):

Order	Number of	Description	Example

	bytes		
1	1	DIF value – 16 bit unsigned integer	0x02
2	4	VIF value – exact command	0xFF899800
3	1	Status check period, i.e. 600s.	0x5802

The reset command of the status check interval to default is in the table below:

Order	Number of bytes	Description	Example
1	1	DIF value – no data to send	0x00
2	4	VIF value – exact command	0xFF899807

Status check deadband interval, when the status will be checked if the error has occurred, can be changed according to the command below (only for Qalcosonic F1):

Order	Number of bytes	Description	Example
1	1	DIF value – 32 bit unsigned integer	0x04
2	4	VIF value – exact command	0xFF899600
3	1	Deadband interval, i.e. 3600s.	0x100E0000

The reset command of the status check deadband interval to default is in the table below:

Order	Number of bytes	Description	Example
1	1	DIF value – no data to send	0x00
2	4	VIF value – exact command	0xFF899607

Payload structure can be selected between compact and standard according to the command below (Only for Qalcosonic W1):

Order	Number of	Description	Example

	bytes		
1	1	DIF value – 16 bit unsigned integer	0x01
2	4	VIF value – exact command	0xFF899D00
3	1	Payload structure, i.e. 1 means standart. 0 means compact.	0x01

The reset command to default (compact) is in the table below:

Order	Number of bytes	Description	Example
1	1	DIF value – no data to send	0x00
2	4	VIF value – exact command	0xFF899D07

Additional element to communication telegram can be added according to the example command below:

Order	Number of bytes	Description	Example
1	1	DIF value – 32 bit unsigned integer	0x04
2	1	VIF value – date and time in uplink telegram	0xED
3	1	Command – add to telegram	0x0C

Additional element from communication telegram can be removed according to the example command below:

Order	Number of bytes	Description	Example
1	1	DIF value – no data to send	0x04
2	1	VIF value – date and time in uplink telegram	0xED
3	1	Command – remove from telegram	0x0D

This command is used to reset all parameters to default values (payload, read and send periods, number of archive data and etc.) (only for Qalcosonic F1):

Order	Number of bytes	Description	Example
1	1	DIF value – no data	0x00
2	4	VIF value – reset to default	0xFF898600

6. Example of decoding payload

Decoding extended structure packet with 15 historical values. (Port 100)

Payload (Hex) LSB format:		
0ea0355d302935000054c0345de7290000b800b900b800b800b800b900b800b800b800b800b800b800b900b900b900		
Payload length:		47 (bytes)
Data:		**Description:**
(5d35a00e)	2019-07-22	Date
(first 4 bytes of payload)	11:37:50	Time
LEAKAGE + TEMPORARY ERROR	**30** (payload)	Status code
(00003529) 14574,796m3		Volume (current)
(5d34c054) 2019-07-21 19:00:00		First log date and time
(000029e7) 10,727m3		Volume at log date and time
(00b8) 10,911m3 20:00:00h		Volume and time of the past period 1
(00b9) 11,096m3 21:00:00h		Volume and time of the past period 2
(00b8) 11,280m3 22:00:00h		Volume and time of the past period 3
(00b8) 11,464m3 23:00:00h		Volume and time of the past period 4

(00b8) 11,648m3 00:00:00h	Volume and time of the past period 5
(00b9) 11,833m3 01:00:00h	Volume and time of the past period 6
(00b8) 12,017m3 02:00:00h	Volume and time of the past period 7
(00b8) 12,201m3 03:00:00h	Volume and time of the past period 8
(00b8) 12,385m3 04:00:00h	Volume and time of the past period 9
(00b8) 12,569m3 05:00:00h	Volume and time of the past period 10
(00b8) 12,753m3 06:00:00h	Volume and time of the past period 11
(00b8) 12,937m3 07:00:00h	Volume and time of the past period 12
(00b9) 13,122m3 08:00:00h	Volume and time of the past period 13
(00b9) 13,307m3 09:00:00h	Volume and time of the past period 14
(00b9) 13,492m3 10:00:00h	Volume and time of the past period 15

Decoding alarm packet. (Port 103)

Payload:	43b1315d30
(5d31b143) 2019-07-19 12:02:11	Current date and time
(30) LEAKAGE + TEMPORARY ERROR	Status byte

7. Lora data read period synchronization

Both Qalcosonic W1 and Qalcosonic F1 synchronizes data read period at the midnight. It means that after midnight all data readings are done on the full hour. So if the read period is 1 hour, so after the midnight reading will be synchronized so data are read at 1 o'clock, 2 o'clock and so on.

8. Lora ACKAdrReq management

Default data transmission period on our devices are 6 hours, so it means that it is 4 times per day. In order to guarantee the connection with the server ACKAdrReq bit is set every 8th telegram, and the delay for the ACK to get is 4 telegrams. After this, SF is reduced by 1. It is possible to change after how many telegrams ACKAdrReq bit is selected using downlink command which is described in chapter 5.

9. Lora credits management

In order to save meter from the incorrect data send period change there is credit management algorithm in the devices. It is calculated that Qalcosonic W1 are able to send 8 telegrams per day on SF12 and Qalcosonic F1 are able to send 4 telegrams per day on SF12. When the spreding factor is higher, for example SF11, so then Qalcosonic W1 will be able to send 16 telegrams per day and Qalcosonic F1 will be able to send 8 telegrams per day and so on.

10. Lora activation method

It is possible to use both ABP or OTAA activation methods for both devices. It is preconfigured in production for which activation method is required.

11. Alarm messages processing

Meters sends alarm message when the error occurs which responsible for alarm message send. Qalcosonic W1 sends immediately when the error occurs and Qalcosonic F1 will send alarm message in 10 minutes period after error occurs.