AXIOMA METERING UAB

ULTRASONIC HEATING METER QALCOSONIC E1/E3

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 *Energy 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 energy
4	4	Current volume
5	4	Log date and time
6	4	Energy at log date and time
7	4	Volume at log date and time
8	2	Delta energy 1
9	2	Delta volume 1
10	2	Delta energy 2
11	2	Delta volume 2
12	2	Delta energy 3
13	2	Delta volume 3
14	2	Delta energy 4
15	2	Delta volume 4
16	2	Delta energy 5
17	2	Delta volume 5
21	3	Padding byte 0x2F

By default 6 energy and volume values are transmitted in one telegram. First of all, there are log time and log energy and volume values at the beginning, after these 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 are 0.011 MWh of energy and 100 liters, log period is 3600s. Log value + delta energy 1 is the energy value and log value + delta volume 1 is the volume value at the time of 2019-02-02 00:00, log value + delta energy 1 + delta energy 2 is the energy value and 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				
Temporary					X			

3. Energy for heating in kWh. Example: 0x240E0000 means 9230 kWh. Bytes in the payload are swapped (the sequence is little-endian) – least significant byte is on the left of the byte sequence.
4. Volume is multiplied by 0.001 m³. Example: 0xB0620100 means 90.8 m³. Byte sequence is little-endian.
5. 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).

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. Energy for heating, kWh, i.e. 0x863B,
    d. Volume, liters or 0.001 m³, i.e. 0x13.

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	0x04
6	2	VIF – Current energy	0x863B
7	1	DIF – 32 bits integer	0x04

8	1	VIF – Current volume	0x13
9	1	DIF – 32 bits integer with storage	0x44
10	3	VIF – Log date and time	0xFF8915
11	1	DIF – 32 bits integer with storage	0x44
12	2	VIF – Energy at the log time, l	0x863B
13	1	DIF – 32 bits integer with storage	0x44
14	1	VIF – Volume at the log time, l	0x13
15	1	DIF – variable length with storage	0x4D
16	1	VIF – Delta energy in kWh liters with extension bit selected.	0x86BB
17	1	VIFE – compact profile	0x1E
18	1	Length – real data length is (value – 2), so the real data is 10 bytes.	0x0C
19	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
20	1	Spacing value – period between two delta values	0x01
21	1	DIF – variable length with storage	0x4D
22	1	VIF – Delta volume in liters with extension bit selected.	0x93
23	1	VIFE – compact profile	0x1E
24	1	Length – real data length is (value – 2), so the real data is 10 bytes.	0x0C
25	1	Spacing control – Bit7..bit6 – 01 which mean that values are	0x62

		incrementing Bit5 .. bit4 – 10 period between two values are in hours. Bit3 .. bit0 – 0010 which means that delta value is in two bytes.	
26	1	Spacing value – period between two delta values	0x01

4. 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

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

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.):

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

5. Example of decoding payload

Decoding extended structure packet with 5 historical values. (Port 100)

Payload (Hex) LSB format:		
0ea0355d10ae7718002935000054c0345db2731800e7290000b800b900b800b800b800b900b800b800b800b800		
Payload length:		45 (bytes)
Data:		**Description:**
(5d35a00e)	2019-07-22	Date
(first 4 bytes of payload)	11:37:50	Time
TEMPORARY ERROR	**10** (payload)	Status code
(001877ae) 1603,502MWh		Energy (current)
(00003529) 13,609m3		Volume (current)
(5d34c054) 2019-07-21 19:00:00		First log date and time
(001873b2) 1602,482MWh		Energy at log date and time
(000029e7) 10,727m3		Volume at log date and time
(00b8) 1602,666MWh 20:00:00h		Energy and time of the past period 1
(00b9) 10,912m3 20:00:00h		Volume and time of the past period 1
(00b8) 1602,850MWh 21:00:00h		Energy and time of the past period 2
(00b8) 11,096m3 21:00:00h		Volume and time of the past period 2

(00b8) 1603,034MWh 22:00:00h	Energy and time of the past period 3
(00b9) 11,281m3 22:00:00h	Volume and time of the past period 3
(00b8) 1603,218MWh 23:00:00h	Energy and time of the past period 4
(00b8) 11,465m3 23:00:00h	Volume and time of the past period 4
(00b8) 1603,402MWh 00:00:00h	Energy and time of the past period 5
(00b8) 11,649m3 00:00:00h	Volume and time of the past period 5

6. 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.

7. 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.

8. 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 E1/E3 are able to send 6 telegrams per day on SF12. When the spreading factor is higher, for example SF11, so then Qalcosonic E1/E3 will be able to send 12 telegrams per day and so on.

9. 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.