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Description of Lorawan protocol

In this document, it describes the protocol of Lorawan ultrasonic water meter.

1. The water meter must receive the downlink frame to configure the **RTC**.

   The frame contains 8 bytes with the following information: 01 is the first byte that identifies the frame, the second byte is the year, the third byte is month, the four byte is day, the five byte is the hours, the six byte is minutes, the seven byte are the hours of **fisrt transmission** and the eight byte are minutes of first transmissions.

   Example: The next frame 0121063020450615
   01: Identifies the frame
   21: Year 2021. The value is string hexadecimal is not a int value.
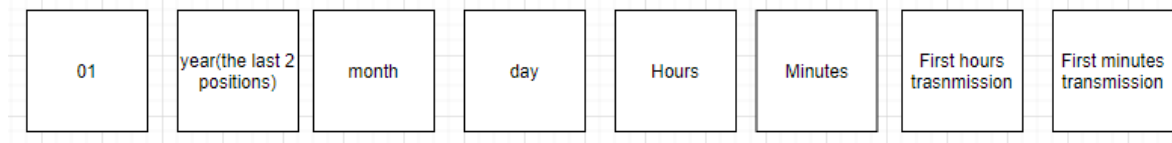   06: Month 06(June). The value is string hexadecimal is not a int value.
   30: Day 30. The value is string hexadecimal is not a int value.
   20: Hour 20. The value is string hexadeciamal is not a int value.
   45: Minutes 45. The value is string hexadeciamal is not a int value.
   06: Hour first trasnmission 06. The value is string hexadeciamal is not a int value.
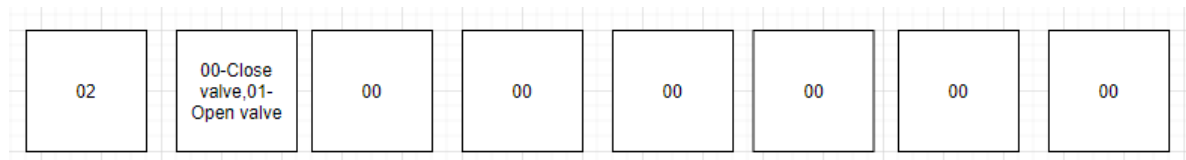   15: Minutes first trasnmission 15. The value is string hexadeciamal is not a int value.

2. The water meter must receive the downlink frame to open/close valve.

   The frame contains 8 bytes with the following information: 02 is the first byte that identifies the frame, the second byte contain the value to Open/Closet the valve(hexadecimal). 00 value close the valve and 01 value open the valve. The rest of the bytes are with 00 hexadecimal value.

   Example: the next frame open the valve 0201000000000000, the next frame close the valve 0200000000000000.

3. The water meter must receive the downlink frame to configure how many transmissions will take place each day.

   The frame contains 8 bytes with the following information: 03 is the first byte that identifies the frame, the second byte contain the value of the number of transmissions(hexadecimal). The rest of the bytes are with 00 hexadecimal value.

   Example: the next frame 03FF000000000000
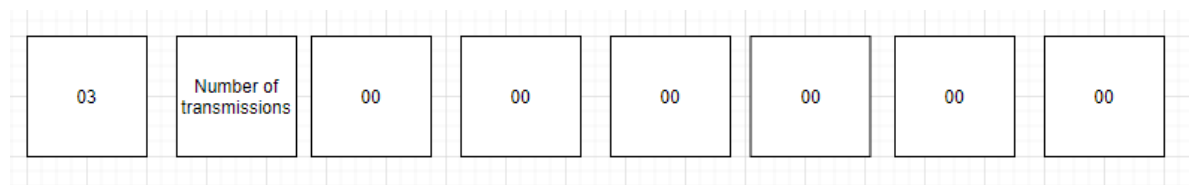
   03: Identifies the frame

   FF: The int value is 255. The module Will transmit 255 times. 1440 minutes/ 255 times = 5.6 Minutes every trasnsmission

   The next frame 0304000000000000

   03: Identifies the frame

   04: The int value is 4. The module Will transmit 4 times at day. 1440 minutes/ 4 times = 360 Minutes every trasnsmission

   Note: Each transmission must validate the hour and minutes of the first transmisión(frame identifies 01). For example, if the number of transmissions is 4 times a day and the transmission time is at 06:30, the module must transmit at 06:30, 12:30, 18:30, 00:30. And so on with any number of transmissions per day

03	Number of transmissions	00	00	00	00	00	00

4. The water meter must receive the downlink frame to sampling the water consumption at each time determined by the frame.

   The frame contains 8 bytes with the following information: 05 is the first byte that identifies the frame, the second and third bytes contain the value of the number of **minutes** to sample consumption. The rest of bytes are with 00 hexadecimal value.

   Example: the next frame 05003C0000000000
   05: Identifies the frame
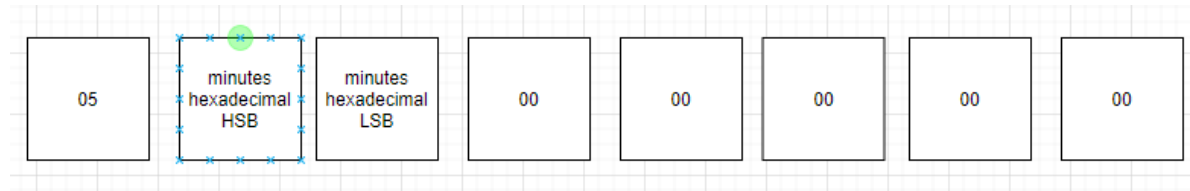   003C: The int value is 60. The sampling consumption will be every 60 minutes.

   The next frame 0501680000000000
   05: Identifies the frame
   0168: The int value is 360. The sampling consumption will be every 360 minutes.

Note: The default sampling value is 60 minutes. So the sampling Will be every 60 minutes.

5. The water meter must trasmit the uplink frame with the last 24 consumptions.

The frame could contain 12 bytes, 24 bytes, 36 bytes or 48 bytes. It depends of how many consumptions have value. The frame structure is the next:

34: First byte has the number of the hexadecimal value is 3 and the second value is the quantity of frames of 12 bytes Will be transmitted.

XX:The second byte is the percentage value of the battery(value between 0 and 100). This value can be from 00 to 64(hex value)

YY: The third byte has the next structure: the first bit is low meter battery level(1 is low battery 0 is high battery), the second bit is low module battery level(1 is low battery 0 is high battery), the third bit is valve state 1 open 0 close, the four bit is the pipe leakage fault, the five bit is pipe burst, the six bit is reverses pipe, the seve bit is forced open valve and the eight bit is forced close valve.

00: Not used

ZZZZZZZZ: these four bytes are the measurement of the meter.

The next bytes are the consumptions will be generated as follow: the 24 consumptions Will be sent with a bit control and 12 bits(consumption value) in descending date. If the consumption value is 0 the bit control is 0. If the consumption value is higher than 0 the bit control is 1.

Example: the consumption is 250(liters) the value in 12 bits is 000011111010, the bit control is 1 because the values is greater than 0 so the result is 1000011111010

Example with 24 consumtpions: the 24 consumtpions are in decsending date:

300, 400, 20, 30, 0, 0, 0, 0, 0, 0, 0, 12, 50, 55, 0, 0, 0, 0, 0, 0, 0, 100, 150, 220

300: 1000100101100
400: 1000110010000
20: 1000000010100
30: 1000000011110
0: 0
0: 0
0: 0
0: 0
0: 0
0: 0
0: 0
12: 1000000001100
50: 1000000110010
55: 1000000110111
0: 0
0: 0
0: 0
0: 0
0: 0
0: 0
0: 0
100: 1000001100100
150: 1000010010110
220: 1000011011100

Then join all the data

1000100101100100011001000010000000010100100000001111000000001000000
0011001000000110010100000011011100000001000011001001000100101101
000011011100

Data less than or equal to 32 bits
If the lenght of the data is less than or equal to 32 must be completed zeros to the right until complete 32 bits. Tthe complete frame be 12 bytes.

Data greater than 32 bits and less than or equal to 128 bits
If the lenght of the data is greater than 32 and less or equal to 128 must be completed zeros to the right until complete 128 bits. Tthe complete frame be 24 bytes

Data greater than 128 bits and less than or equal to 224 bits
If the lenght of the data is greater than 128 and less or equal to 224 must be completed zeros to the right until complete 224 bits. Tthe complete frame be 36 bytes

Data greater than 128 bits and less than or equal to 224 bits

If the lenght of the data is greater than 128 and less or equal to 224 must be completed zeros to the right until complete 224 bits. Tthe complete frame be 48 bytes

Data greater than 224

If the lenght of the data is greater than 224 must be completed zeros to the right until complete 320 bits. Tthe complete frame be 48 bytes

Then new data is:
1000100101100100011001000010000000101001000000011110000000001000000
0011001000000011001010000001101110000000010000011001001000010010110 1
0000110111000000000000000000000000000000000000000000000000000000000
00000000000000000000000000000

Then convert the binary data to hexadecimal data:
896464202901E0100C81940DC0419212D0DC00000000000000000000

The complete frame Will have 36 bytes and the result is:
33XXYY00ZZZZZZZZ896464202901E0100C81940DC0419212D0DC0000000000 0000000000

6. The water meter must trasmit the uplink and must request a downlink 5 minutes after of send the frame with the last 24 consumptions

The frame contains 12 bytes.
FF: First byte is the identifies of the frame.
FF: Second byte is the identifies of the frame
FF: Third byte is the identifies of the frame
XX:The fourth byte is the percentage value of the battery(value between 0 and 100). This value can be from 00 to 64(hex value)
YY: The fifth byte has the next structure: the first bit is low meter battery level(1 is low battery 0 is high battery), the second bit is low module battery level(1 is low battery 0 is high battery), the third bit is valve state 1 open 0 close, the four bit is the pipe leakage fault, the five bit is pipe burst, the six bit is reverses pipe, the seve bit is forced open valve and the eight bit is forced close valve.
ZZZZZZZZ: these four bytes are the measurement of the meter.
000000: 3 bytes with that value

The complete uplink frame is:
FFFFFFXXYYZZZZZZZZ000000

The request donwlink be interpreted with the ítems 1, 2, 3 and 4 of this document.

7. Store in non volatile memory the number of transmisión and the hour and minutes to transmit the frames.

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When water meter is reset or hasn't power supply sholud read of the non volatile memory these two parameters(number of transmission adn hour and minute of firts transmission)