YOSENSI.IO

Payload description

Payload ver. V2

Release notes

Released	Version	Key changes
29.06.2021	1.0.0	Initial version.

Content

Introduction

This datasheet describes the payload protocol developed by Yosensi for communicating with our devices.

Payload structure

Payload header – 4 bytes				**Measurements – *N* bytes**		
byte[0]	byte[1]	byte[2]	byte[3]	byte[4]	...	byte[*N*]

Payload header

Payload header – 4 bytes			
byte[0]	byte[1]	byte[2]	byte[3]
payload version = 2	payload counter	payload creation time	

The payload header has a constant length of 4 bytes, and contains the following data:

- payload version – byte[0] (constant unsigned int = 2);
- payload counter – byte[1] (unsigned int 0–255; after overflow it resets to 0).;
- payload creation time – bytes[2–3] (unsigned int value [seconds]); defines time difference between constructing the payload and sending it.

Measurements

Measurements – *N* bytes			
1ML	2ML	...	NML

Data with measurements are placed in the payload in the order they occur. The length of the measurement data varies depending on the type of measurement.

1ML – data length of the first measurement
2ML – data length of the second measurement
NML – data length of the N measurement

Measurement structure

First measurement					**Nth measurement**				
byte[0]	byte[1]	byte[2]	byte[*n*]*	byte[*n*]**	byte[0]	byte[1]	byte[2]	byte[*n*]*	byte[*n*]**
6 upper bits meas_type, 2 lower bits precision	meas. delay in seconds	4 upper bits addr_len, 4 lower bits meas_len	address	measured value	6 upper bits meas_type, 2 lower bits precision	meas. delay in seconds	4 upper bits addr_len, 4 lower bits meas_len	address	measured value

Individual measurements can differ in length, according to the device, and contain the following data:

- byte[0] – upper 6 bits: measurement type, lower 2 bits: precision,
- byte[1] – time difference between payload construction and when measurement is taken (unsigned int value [seconds]),
- byte[2] – upper nibble: address length (0–15), lower nibble (+1): measurement length (1–16),
- byte[3] to byte[2 + address length] – address (can be empty if address length is 0)*,
- byte[3 + address length] to byte[3 + address length + measurement length] – measured value with sign without precision applied**.

The first three bytes [0-2] in a measurement have a fixed position, while the subsequent values address and measurement value can have different lengths (not fixed).

There are no *start* or *stop* bytes in the measurement frame, the measurements are located immediately after each other in the payload and their position is not fixed.

Measurement types

The measurement type is coded in the upper 6 bits of the first byte of the measurement part, and differs according to the device in use. The categories are:

- 1 – state
- 2 – battery level [mV]
- 3 – temperature [°C]
- 4 – relative humidity [%]
- 5 – pressure [hPa]
- 6 – illuminance [lux]
- 7 – CO_2 equivalent [ppm]
- 8 – TVOC concentration [ppb]
- 9 – dust concentration [µg/m3]
- 10 – distance [mm]
- 11 – current [mA or A, depending on device type]
- 12 – voltage [mV]
- 13 – power [W]
- 14 – accelerometer
- 15, 16 – three-value custom [custom]
- 17, 18 – four-value custom [custom]
- 21, 22, 23 – two-value custom [custom]
- 24 – pulse meter [custom]
- 25 – custom [custom]
- 26 – CO concentration [ppm]
- 27 – CO_2 concentration [ppm]
- 28 – sound pressure level [dB]

Measurement types 1 - 14 and 24 - 28 are single-valued.
Measurement type customer is a pre-defined type, it is used to assign measurement types that have not been defined yet.

Sensor identifier (sensor address)

The sensor identifier (ID) combines the sensor type and its address. If the type value is lower than 10, a prefix of 0 is added.

Examples:

1. type = 1, addr = 680A → sensor_id = 01680A
2. type = 11, addr = 680A → sensor_id = 11680A
3. type = 1, addr = NULL → sensor_id = 01
4. type = 11, addr = NULL → sensor_id = 11

When sensor IDs (sensor address) are assigned:

1. If a device is equipped with e.g. 3 sensors taking measurements of different types e.g. temperature, humidity and pressure. In this case we can avoid adding the sensor address to each measurement because we are able to clearly associate the measurement with a particular sensor and its location. However, if necessary the sensor address can be used to determine whether the sensor is internal or external.
2. If the device is equipped with more sensors of the same type e.g. two temperature sensors and one humidity and pressure sensor each. In this case you should consider assigning an

address for the sensors in order to easily identify which measurement applies to which sensor in the following way:

a. the sensor address is not required if the sensor is internal (inside the device enclosure) - its location is known to us;

b. the sensor address should be added to the measurement from external sensors (sensors that can be connected to the device) or the device has multiple inputs of the same type, then we have information from which sensor (input) the measurement comes from.

Calculation of measurement time

The payload's measurement timestamp (*mt*) is calculated as follows:

$$mt = sat - pct + md$$

where:

- *mt* [datetime] – measurement timestamp ,
- *sat* [datetime] – server arrival time,
- *pct* [seconds] – payload creation time,
- *md* [seconds] – measurement delay.

Example:

The device sends a payload with a payload creation time (*pct*) of 19 s and the measurement has a delay (*md*) of 5 seconds. Server received this frame at 12:00:00 (*sat*). The measurement was hence taken at approximately 12:00:00 – 00:00:19 + 00:00:05 = 11:59:46.

Payload examples

Single measurement without address

02:FE:F0:01:0D:03:01:00:FD

Payload header				Measurement				
0x02	0xFE	0xF0	0x01	0x0D	0x03	0x01	0x00	0xFD
ver = 2	cnt = 254	pct [s] = 61441		type = 3, prec = 1	md [s] = 3	addr_len = 0, meas_len = 2	val = 253 (25,3)	

Payload description:

Version	2
Counter value	254
Payload creation time	Sent 61441 seconds after payload construction
Measurement type	3 (temperature)
Measurement precision	1 decimal place
Measurement delay	3 seconds after payload construction
Sensor ID	03
Measurement length	2 bytes
Measurement value	25,3°C

Single measurement with address

02:01:00:09:10:00:20:68:0A:3E

Payload header				Measurement					
0x02	0x01	0x00	0x09	0x10	0x00	0x20	0x68	0x0A	0x3E
ver = 2	cnt = 1	pct [s] = 9		type = 4, prec = 0	md [s] = 0	addr_len = 2, meas_len = 1	addr = 680A		val = 62 (62)

Payload description:

Version	2
Counter value	1
Payload creation time	Sent 9 seconds after payload construction
Measurement type	4 (relative humidity)
Measurement precision	0 decimal place
Measurement delay	0 seconds after payload construction
Sensor ID	04680A
Measurement length	1 byte
Measurement value	62% (unit and decimal position inferred from type and precision)

Three-value measurement (type 16)

02:01:00:00:42:00:15:6A:00:CC:00:16:00:08

Payload header				Measurement									
0x02	0x01	0x00	0x00	0x42	0x00	0x15	0x6A	0x00	0xCC	0x00	0x16	0x00	0x08
ver = 2	cnt= 1	pct [s] = 0		type = 16, prec = 2	md [s] = 0	addr_len = 1, meas_len = 6*	addr = 6A	val 1 = 204 (2,04)		val 2 = 22 (0,22)		val 3 = 8 (0,08)	

*In this type, the total measurement length must be a multiple of 3, e.g. 3 (three 1-byte values), 6 (three 2-byte values), 9 (three 3-byte values), ...

Payload description:

Version	2
Counter value	1
Payload creation time	Sent 0 seconds after payload construction
Measurement type	16 (custom)
Measurement precision	2 decimal place
Measurement delay	0 seconds after payload construction
Sensor ID	166A
Measurement length	6 byte
Measurement value	2,04; 0,22; 0,08

Two measurements

02:FE:F0:01:0D:03:01:00:FD:10:00:20:68:0A:3E

Payload header				First measurement				
0x02	0xFE	0xF0	0x01	0x0D	0x03	0x01	0x00	0xFD
ver= 2	cnt= 254	pct [s] = 61441		type = 3, prec = 1	md [s] = 3	addr_len = 0, meas_len = 2	val = 253 (25,3)	

Second measurement					
0x10	0x00	0x20	0x68	0x0A	0x3E
type = 4, prec = 0	md [s] = 0	addr_len = 2, meas_len = 1	addr = '680A'		val = 62 (62)

Payload description:

Version	2
Counter value	254
Payload creation time	Sent 61441 seconds after payload construction

Measurement type	3 (temperature)
Measurement precision	1 decimal place
Measurement delay	3 seconds after payload construction
Sensor ID	03
Measurement length	2 byte
Measurement value	25,3°C

Measurement type	4 (relative humidity)
Measurement precision	1 decimal place
Measurement delay	3 seconds after payload construction
Sensor ID	0480A
Measurement length	2 byte
Measurement value	62%

Revision history

Date	Version	Changes
29.06.2021	1.0.0	Initial version
03.03.2022	1.1.0	1. Added description in the sections: a. "measurement structure"; b. "measurement types"; 2. Added description of how to assign the sensor ID (sensor address). 3. Corrected data of measurement in the "payload example, two measurements" section, which relates to a type of measurement (change from 0x01 to 0x10 in a frame). 4. Corrected error in calculation of measurement time.