

## How to interpret GPS coordinates from Oyster's payload

Offset	Description
0.0-0.3	Message type
0.4	In-trip
0.5	Last fix failed
0.6-0.7	Reserved, set to 0
1 (INT32)	32 bits latitude, signed, value is scaled 1E7 to form an integer
5 (INT32)	32 bits longitude, as per latitude value
9 (BYTE)	Heading (estimated direction of travel, measured clockwise from North, unit of 2 degrees)
10 (BYTE)	Speed (kmph)
11 (BYTE)	Battery voltage (max value is 6.4V)

We will use an example to explain how to interpret the data:

Payload received on the Sigfox backend: 0076b67ae966c778680000b4

Offset	Description
0.0-0.3	0b0000 <b>0000</b> – GPS Data Record
0.4	0b000 <b>0</b> 0000 – Not moving
0.5	0b00 <b>0</b> 00000 – Last trip succeeded
0.6-0.7	0b <b>00</b> 000000 – Reserved
1 (INT32)	0x76b67ae9 – Latitude
5 (INT32)	0x66c77868 – Longitude
9 (BYTE)	0x00 – Heading North
10 (BYTE)	0x00 – Speed null
11 (BYTE)	0xb4 – 4,5V ( $180 * 6.4 / 256 = 4.5V$ )

For the latitude and the longitude, the values are in "little-endian", so you need to inverse it:

Latitude: 0x76b67ae9 -> 0xe97ab676

Longitude: 0x66c77868 -> 0x6878c766

The most significant bit of the first byte gives you the sign of the latitude and longitude.

Latitude Sign: First Byte: 0xe9 (0b1110 1001). Most significant bit = 1 (negative value)

Longitude Sign: First Byte: 0x68 (0b0110 1000). Most significant bit = 0 (positive value)

You need to perform a two's complement on the number to obtain the decimal value.

Note: Online calculator - <https://www.mathsisfun.com/binary-decimal-hexadecimal-flash.html>

Latitude decimal value: 0xe97ab676 -> -377833866

Longitude decimal value: 0x6878c766 -> 1752745830

The values need to be divided by 100 000.

Final latitude:  $-377833866/100000 = -37,7833866$

Final longitude:  $1752745830/100000 = 175,2745830$

