

SIGLINK

TEMPERATURE
& HUMIDITY
SENSOR



Device operation and message format

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Revision History

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1 Introduction

This document intends to describe the device operation as well as the structure and the content of packets sent to/from the SIGLINK – temperature and humidity sensor via the Sigfox network. It is mainly for developers who want to integrate the device into their own application.

2 Sigfox network and operation modes

The Sigfox is one of the LPWAN networks. It is used for transferring data from IoT devices to Sigfox backend servers and vice versa.

The devices connected to the network can transmit (uplink) as well as receive (downlink) a message to/from the Sigfox backend portal.

The length of the **uplink** message is: **1 - 12 bytes**.

The length of the **downlink** message is **8 bytes**.

The Sigfox network offers two main operation modes:

- ***Uplink and downlink***
Each uplink event is followed by a downlink event. This is often used to configure a device (downlink message contains the configuration data). However, the maximum number of downlink messages is restricted to 4 per day by the Sigfox organization.
- ***Uplink only***
Only the uplink event is initiated. Downlink event does not exist in this case. The maximum number of uplinks is restricted to 140 per day.

The SIGLINK uses both modes as described in the next section.

3 Siglink message format

3.1 Uplink message

This message is periodically sent by the SIGLINK to the Sigfox backend portal based on the configured transmission period.

The message consists of 11 bytes and the content is following:

Device Type	Message Type	Battery IDLE High Byte	Battery IDLE Low Byte	Temp High Byte	Temp Low Byte	Hum High Byte	Hum Low Byte	Battery TX High Byte	Battery TX Low Byte	Sensor Status Byte
0x03	0x00	0x0C	0x4E	0xFE	0x70	0x03	0x56	0x0B	0x5E	0x00

- **Device Type** – It is always **0x03** for the data from SIGLINK Temperature and Humidity sensor.
- **Message Type** – It is always **0x00** for the periodic data messages.
- **Battery IDLE High Byte and Low Byte** – It forms an unsigned word for measured battery voltage in mV (in idle mode). In the example the reported voltage is 3.15 V ($0x0C4E = 3150 \text{ mV} = 3.15\text{V}$).
- **Temp High Byte and Low byte** – It forms a signed word for temperature value. It is represented as two's complement number divided by 10:
 - For Positive Temperatures, the most significant bit will be clear and the calculation to get actual temperature is: $\text{value} / 10$.
 - If the most significant bit is set, then the temperature is negative and the calculation to get actual temperature is $(\text{value} - 65536) / 10$.
 - In the given example it becomes $0xFE70$ which denotes the Temp -40.0°C ($0xFE70 = 65136$, then $(65136 - 65536)/10 = -40.0$).
- **Humidity High and Low Byte** – It forms unsigned word for humidity value.
 - The calculation is: $\text{value} / 10$ to get the actual relative humidity in percent.
 - In the given example it becomes $0x0356$ (854) which denote the humidity 85.4 %RH.
- **Battery TX High Byte and Low Byte** – It forms an unsigned word for battery voltage measured during the last transmission in mV. If the value is zero, the information is not available. In the example the reported voltage is 2.91 V ($0x0B5E = 2910 \text{ mV} = 2.91\text{V}$).
- **Sensor Status Byte** – Reserved.

3.2 Downlink message

This message is used to configure parameters of the SIGLINK device. Once the configuration update is required, the periodic message sent by the SIGLINK is responded with a downlink message initiated by the Sigfox backend portal.

The message length is always 8 bytes and the content is following:

Device Type	Transmission Interval (Hours)	Transmission Interval (Minutes)	Config Update Period	Byte 4	Byte 5	Byte 6	Byte 7
0x03	0x00	0x1E	0x02	0x00	0x00	0x00	0x00

- **Device Type** – The type of the device to which is the message directed. For SIGLINK temperature and humidity sensor it always is **0x03**. If the message type does not match the device which is being addressed, the message is ignored by the device.
- **Transmission Interval** – Periodic transmission interval to be configured. Based on this interval, the device will periodically transmit measured data. The interval must be set within a range of **10 minutes to 72 hours (3 days)**. Messages with incorrect interval will be ignored. It is important to enter these values in **hexadecimal format** (for instance for interval 30 minutes put value “1E”).
- **Config Update Period** – This period denotes time interval between two configuration (downlink) messages responding to a standard periodic data message. It is calculated as: value × 6 hours. Value **0x00** disables the periodic configuration update.
In the given example $2 \times 6 = 12$ hours. It means that after each 12 hours a configuration message is initiated (as a response to a standard periodic message).
- **Byte4 – Byte7** – Reserved, set as 0x00

4 Device operation

4.1 Initial configuration

After switching the SIGLINK ON, the initial configuration is started. It is signaled by the red **LED flashing every 2 seconds**. In this mode the device sends an uplink message and waits for a downlink message to get configuration data (uplink and downlink mode). Thus, before switching the device ON, the user should make sure there is a correct downlink message set on the Sigfox backend portal.

If the procedure succeeds and the downlink message is correctly received, the device will signalize success by lighting the red **LED ON for 5 seconds** and the newly downloaded configuration data (transmission interval, periodic update interval) are set.

If the procedure fails, the transmission is initiated again up to 3 times. If all 3 attempts fail, the configuration failure is signaled by **toggling the red LED ON/OFF with 0.5s interval** for a period of 5 seconds. The device then uses the last successfully set configuration data or if no configuration has been downloaded yet, the default values are used.

Default configuration values:

- Transmission interval: 30 minutes
- Periodic update interval: 6 hours

The possible reasons for configuration procedure failure:

- Low Sigfox signal coverage so the uplink/downlink messages are not received correctly.
- The downlink message is successfully received, but the content (the configuration data) are invalid (for example, attempting to set too low transmission interval).

The whole initial configuration can last up to 3 minutes.

After the initial configuration, the device enters the normal operation mode.

4.2 Normal operation mode

This mode is entered after the initial configuration and is signaled by the **red LED flashing every minute**. It is a low power mode where most of the time the device is hibernating (low current consumption) and wakes up only when the periodic data transmission is required.

When the **periodic data** transmission is required, the device wakes up and checks if the **periodic configuration update** is required too. If it is not, the device sends only the periodic data (uplink mode), which takes up to 10 seconds, and then will hibernate again. If the **configuration update** is required, the device sends the periodic data and then waits for a downlink message (uplink and downlink mode). The procedure can take up to 1 minute. The periodic configuration update is described in the next section 4.3.

4.3 Periodic configuration update

This mode is used for **periodical updates of configuration settings** of the SIGLINK. The update period is configurable.

The mode is signaled by the red **LED flashing every 2 seconds**. In this mode, the device sends an uplink message with the periodic data (temperature, humidity, battery) and waits for a downlink message to get configuration data (uplink and downlink mode).

The success of the procedure is signaled by lighting the red **LED ON for 5 seconds** and the newly downloaded configuration data (transmission interval, periodic update interval) is set.

If the procedure fails, the configuration failure is signaled by **toggleing the red LED ON/OFF with 0.5s interval** for a period of 5 seconds and the configuration data remains unchanged.

This mode is almost the same as the Initial configuration mode described in the section 4.1. The only difference is that transmission is initiated only once and in case of a failure, the retransmission is not attempted again.

The whole periodic configuration can last up to 1 minute.

After the configuration update, the device hibernates and continues in the normal operation mode.