Willow Sensors Indoor Temperature & Humidity Sensor User Manual

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Overview

The user manual explains the features of the WS-I-8-AE-TH-1 LoRaWAN Indoor Temperature & Humidity sensor. WS-I-8-AE-TH-1 uses the popular STM32WL55 Cortex-M4 microcontroller of STMicroelectronics. This microcontroller combines a computer unit and a LoRaWAN radio on a single chip. WS-I-8-AE-TH-1 is fully backed by a 3-year warranty, technical support, and application assistance by BiPOM Electronics, Inc.

CONTENTS

Indoor Temperature & Humidity Sensor Features

Dimensions

Top View:
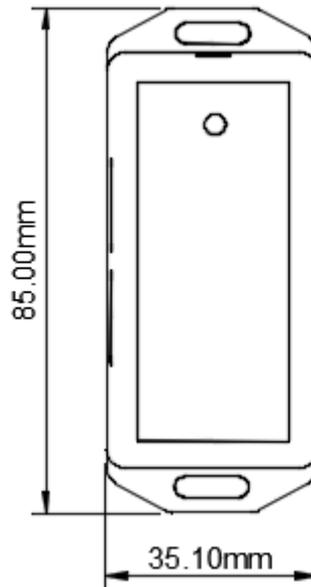
Front View:
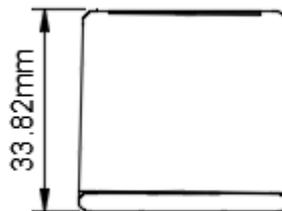
Sensor Accessories

The sensors consist of 3 parts; the main LoRaWAN sensor, an external antenna, and an activation/reset pin. As shown in below:

Specifications

LoRaWAN

• Ultra-Low Power

• Suitable for battery operation

• User-programmable

• Configurable power output

• Maximum output power: 22 dBm

• Frequency Bands: US915 /AS915/ AU915/ EU868/CN779/EU433/KR920/IN865/RU86

 (Supported but not officially certified in all regions)

• 64 KB of RAM and 256 KB of Flash available for user applications

Temperature & Humidity Sensor

• Temperature Measurement Range: -40 to 125 °C

• Humidity Measurement Range: 0 to 100 % RH

• Accuracy of $\pm$ 0.3 °C and $\pm$ 2 % RH

• 868/915 MHz LoRaWAN protocol

• Up to 10 km communication distance in the line of sight

Operating Modes

The sensor has two different modes as Deep Sleep Mode and Working Mode.

Idle Mode

In idle mode, the sensor does not have any measurement and LoRaWAN activity. This mode is used to increase battery life.

Working Mode

In this mode, the sensor operates as a LoRaWAN end node and sends out the sensor data to a LoRaWAN server. Between each measurement and transmitting period, the sensor will be in the idle mode.

Sensor Activation

For the sensor to be used, it must be activated after shipping. The user needs to wake up the sensor with a pin, which should be found in the product box, by pressing the button which is in the activation/deactivation hole of the sensor. The user should keep pressing the button until they see the blinking LED (Activation LED Pattern) on the front side of the sensor.

Attention: The user must plug in the antenna before activating the sensor otherwise, sensor might be damaged.

LED Pattern for Activation

🟢🔴🔴🟢

In activation LED should blink as Green, Red, Red, Green respectively.

LED Pattern for Join Success

🟢🟢🟢🟢🟢

If the LED blinks for five times that means join is successful.

LED Pattern for Join Failed

🔴🔴🔴🔴🔴

If user sees blinking RED LED for five times that means, sensor failed to join a LoRaWAN network.

To deactivate the sensor, user should use the pin and see the blinking LED again.

LED Pattern for Deactivation

🔴

User should see a blink LED for once in deactivation.

Note: Use the hole that is located on the right side of the sensor and a reset pin for this process. One can see a related image below.

Payload (Uplink Message) Structure

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
Battery Level	Internal Temp MSB	Internal Temp LSB	Temp MSB	Temp LSB	Humidity MSB	Humidity LSB

Uplink message consists of 7 bytes which are indicates Battery Level, MCU Temperature, Environment Temperature, and Humidity, respectively.

- Battery Level (1 byte / 8-bit)

- Internal (MCU) Temperature in Celsius (2 byte / 16-bit)

- Temperature in Celsius (2 byte / 16-bit)

- Humidity in RH% (2 byte / 16-bit)

Example Payload:

0x64   0x0023   0x0019   0x0027

Battery Level: 0x64 equals to 100 in decimal which indicates 100%

Internal Temperature: 0x0023 equals to 35 in decimal which indicates 35 Celsius

Temperature: 0x0019 equals to 25 in decimal which indicates 25 Celsius

Humidity: 0x0027 equals to 39 in decimal which indicates 39 RH%

Downlink Message Structure

The sensor supports downlink messages to perform software reset and to set data transmission interval. The sensor can receive downlink messages only after the sensor sends an uplink message to the LoRaWAN server.

Software Reset Downlink Command

By sending below command one can perform software reset.

Port	Payload
0x0A	0x11

Setting Data Transmission Interval

User can change data transmission interval with the following command to related port address. Payload indicates time interval in millisecond.

Port	Payload
0x08	0x012C *

* Example payload, means 300 seconds)

Battery Life

Data Rate	Payload Size (Byte)	Interval (minute)	Battery life (25 ºC)
DR_0 (SF-10 EU868)	7 Byte	1 minutes	1.5 Year
DR_0 (SF-12 EU868)	7 Byte	5 minutes	5 Years
DR_0 (SF-12 EU868)	7 Byte	10 minutes	10 Years