

# SENSO8 NB-IoT IAQ User Guide

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## 1. Introduction

SENSO8 NB-IoT IAQ Sensor is an LPWAN wireless indoor air quality sensor which can detect indoor temperature, humidity, and a wide range of gases like carbon dioxide, ammonia and hydrogen sulfide. The sensor reads the environment data and uploads the data to the MQTT broker with a simple, open API.

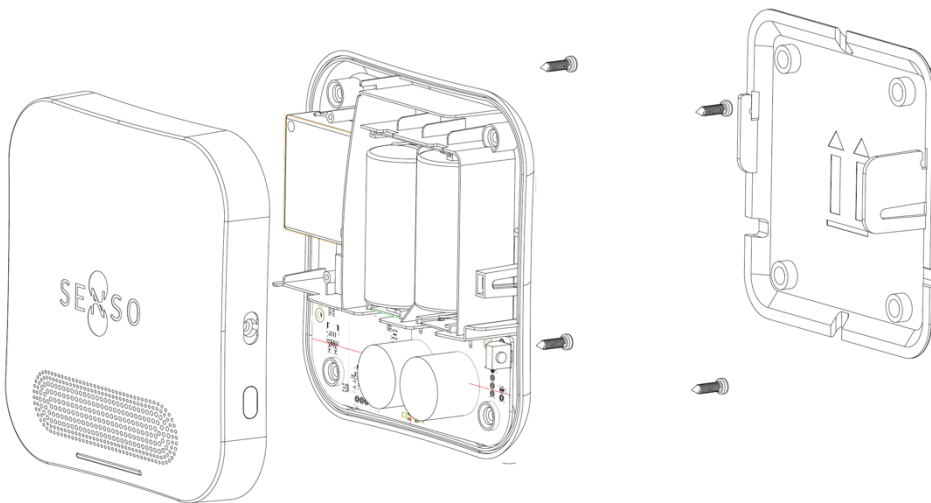
The user guide is applicable for the SENSO8 NB-IoT IAQ Sensor models:

- SEN1070x

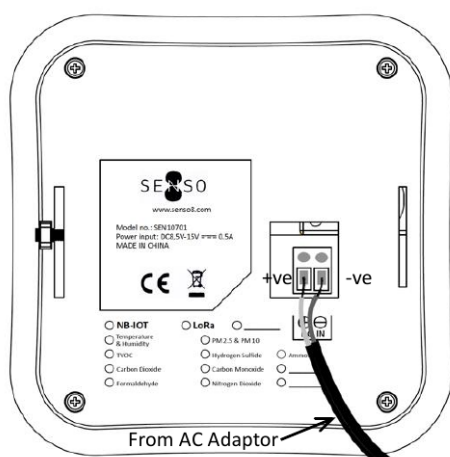


## 2. Sensor Setup

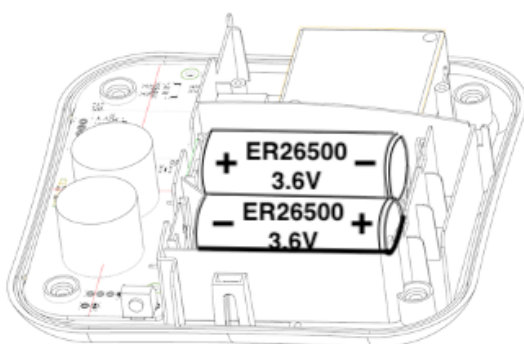
1. Make sure the sensor is not connected to any DC power supply.
2. Unfasten the screws and open the sensor's cover.



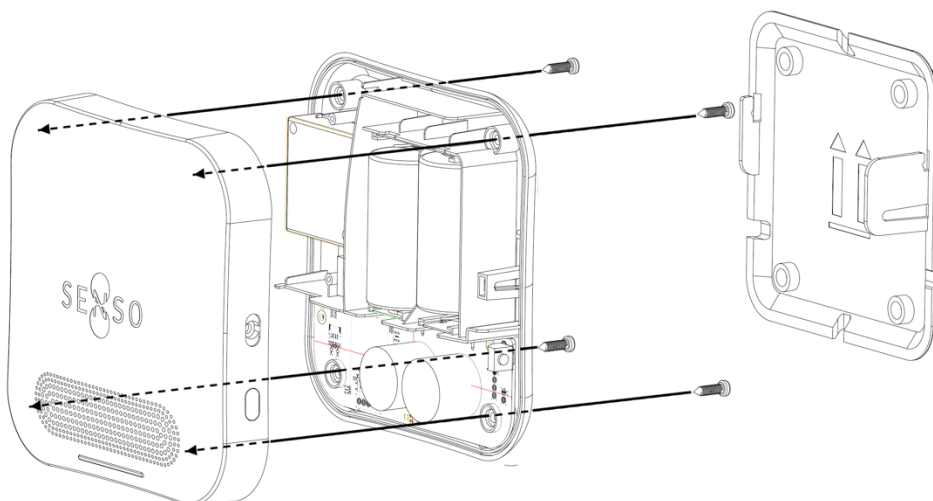
3. Insert a nano-SIM to the SIM card socket. **Make sure the direction of the nano-SIM is correct.**
4. Connect the wires connecting to the AC adaptor (DC powered) to the terminal block on the bottom of the sensor.



Or, insert two ER26500 Li-SOCl<sub>2</sub> batteries into the battery compartment.



5. Put on the cover and fasten the screws on the corners.



6. For the DC powered models (using the AC adaptor), the LED indicator on the top cover will light up once the adaptor is powered up.

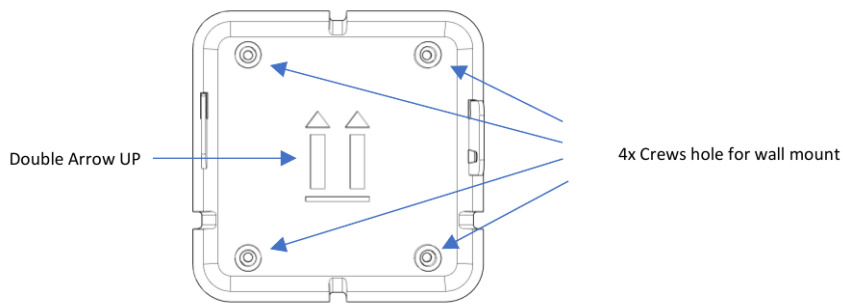
For the battery powered models, press and hold the button on the side for 3 seconds to power on the sensor.

7. On power on, the sensor will send a data report. The sensor will also publish a device configuration report to the MQTT broker. Check the server backend or dashboard to make

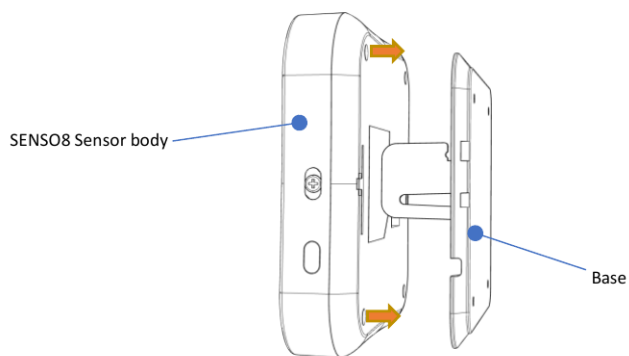
sure the connection has been established and data can be successfully uploaded.

### 3. Installation

1. Perform a site survey and make sure the SENSO8 IAQ sensor has a good NB-IoT network coverage.
2. Mount the base of the sensor to the wall with the double arrows pointing upwards, and fix it with 4 screws.



3. Attach the sensor main body to the base in the proper orientation as shown below.

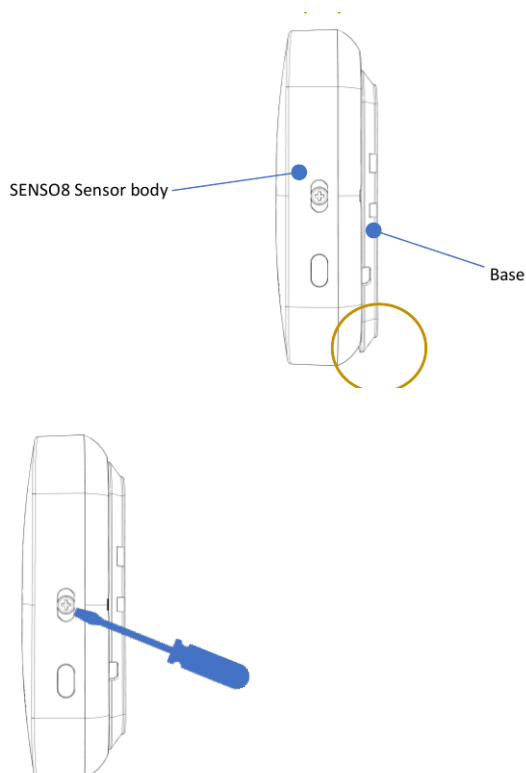


4. Slide the sensor main body down until it is locked to the base.

Base

SENSO8 Sensor body

5. Lock the sensor main body with a screw.



#### 6. Power on the sensor

- i. Plug the DC adaptor to the AC main, the sensor will power on automatically on DC supply (for DC supply models), OR
  - ii. Press the multi-function button for 3 seconds to power on the sensor (for battery operated models).
7. On power on, the sensor will publish a data report to the MQTT broker. Check the server backend or dashboard to make sure the connection has been established and data can be successfully uploaded.

## 4. Operating Instruction

### Power On

- For DC supply models, the sensor powers on automatically when connected to power supply.
- For battery powered models, press the multi-function button for 3 seconds to power on the sensor.
- The LED indicator will light up and the sensor will upload a data to the MQTT broker.

### Power Off

- Press and hold the multi-function button 5 seconds, the LED indicator will flash 3 times to indicate that it is shut down.

### Report Latest Data

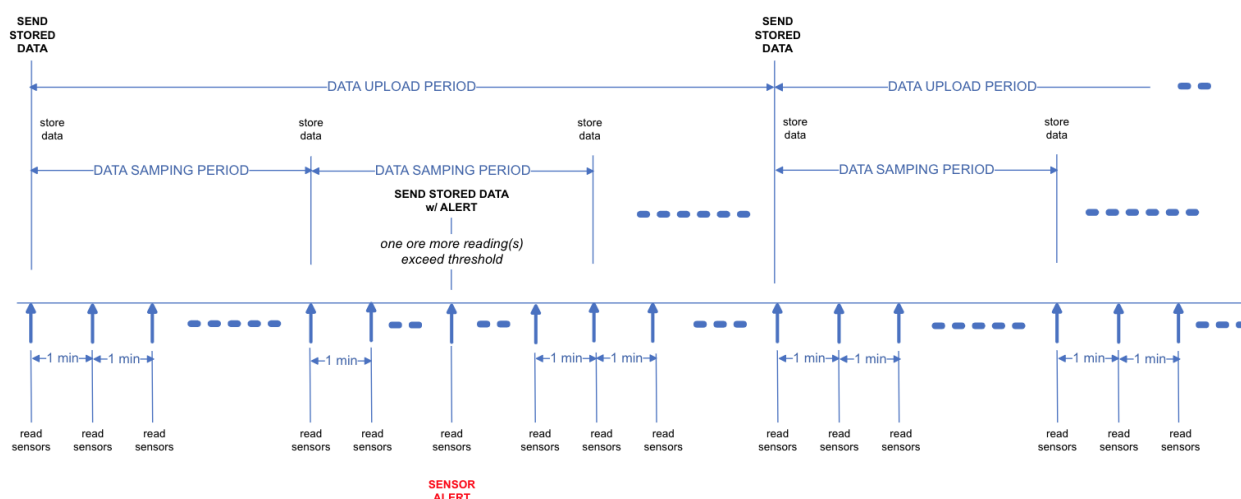
- Press the multi-function button briefly, the LED indicator will flash once. The sensor will upload the latest sensor data to the MQTT broker.

### SIM Card Insert/Remove

- The IAQ sensor detects the presence of the SIM card, the sensor will not operate if the SIM card is removed. The sensor will restart itself when the SIM card is inserted again.

## 5. Sensor Operation

The sensor performs a measurement every minute (except PM sensor) in the background. The PM sensor performs a measurement every 5 minutes when powered by DC supply and every 30 minutes when powered by batteries. If the reading exceeds either one of the thresholds, the sensor will publish send a data message with the stored data to the MQTT broker immediately with the corresponding alert. Otherwise, the sensor will go back to sleep mode. When the data sampling period is reached, the sensor will store the readings on the memory. When the data upload period is reached, the sensor will publish a data message to the MQTT broker with the stored data.



**Note:** PM sensor measurement interval is 5 mins for DC supply and 30 mins for battery.

## 6. Configurable Sensor Settings

The following sensor settings are configurable via downlink command. The details of the data payload format can be found on the SENS08 NB-IoT IAQ Sensor API Document.

| Setting                           | Default Value | Unit   |
|-----------------------------------|---------------|--------|
| Data Sampling Period (battery)    | 900           | second |
| Data Sampling Period (DC adaptor) | 300           | second |
| Data Upload Period (battery)      | 3600          | second |
| Data Upload Period (DC adaptor)   | 900           | second |

| Setting                                  | Default Value | Unit   |
|------------------------------------------|---------------|--------|
| High Temperature Threshold               | 30            | °C     |
| Low Temperature Threshold                | 18            | °C     |
| High Humidity Threshold                  | 80            | %      |
| Low Humidity Threshold                   | 40            | %      |
| Carbon Dioxide Concentration Threshold   | 1500          | ppm    |
| TVOC Concentration Threshold             | 435           | ppb    |
| Formaldehyde Concentration Threshold     | 200           | ppb    |
| Ammonia Concentration Threshold          | 2000          | ppb    |
| Hydrogen Sulfide Concentration Threshold | 2000          | ppb    |
| Carbon Monoxide Concentration Threshold  | 12400         | ppb    |
| Nitrogen Dioxide Concentration Threshold | 360           | ppb    |
| PM2.5 Concentration Threshold            | 56            | ug/m3  |
| PM10 Concentration Threshold             | 254           | ug/m3  |
| LED schedule ON time from 00:00          | 420           | minute |
| LED schedule OFF time from 00:00         | 1380          | minute |

Note:

The sensor does not support PM1.0 alert. Therefore, there is no threshold for PM1.0.

## 7. LED Indicator

### 7.1. Device Status

| Event              | LED Pattern | Description                                                                                                                            |
|--------------------|-------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Powered On         | Blue LED on | Device powered on, and uploading the first data.                                                                                       |
| Report Latest Data | Blue LED on | The IAQ sensor is uploading the data when the function button is pressed.<br><br>(During the data upload, new button press is ignored) |

### 7.2. Error Status

On power on, the IAQ sensor will initialize the radio and perform a data and device configuration upload to the MQTT broker. If an error occurs (around one minute after the gateway powered

on), the LED indicator will flash in five seconds period to indicate the type of the error.

| Event                  | LED Pattern           | Description                                             | Possible Problem/Fix                                                                                                                                                                                    |
|------------------------|-----------------------|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SIM Error              | Single flash in Blue  | Error reading SIM card.                                 | <ul style="list-style-type: none"> <li>• SIM card not inserted.</li> <li>• Incorrect SIM card direction.</li> </ul>                                                                                     |
| Radio Module Error     | Two flashed in Blue   | Error initializing the NB-IoT module.                   | <ul style="list-style-type: none"> <li>• Remove the battery, press and hold the multi-function button for a few seconds and power on the device again.</li> <li>• Check the battery voltage.</li> </ul> |
| Radio Connection Error | Three flashes in Blue | Cannot establish the radio connection.                  | <ul style="list-style-type: none"> <li>• SIM card not valid.</li> <li>• Incorrect APN setting.</li> <li>• Antenna connection problem.</li> <li>• Poor radio coverage.</li> </ul>                        |
| TCP Connection Error   | Four flashes in Blue  | Cannot establish the TCP connection to the MQTT broker. | <ul style="list-style-type: none"> <li>• Incorrect MQTT broker IP/URL or port number.</li> <li>• MQTT broker is not running.</li> </ul>                                                                 |
| MQTT Connection Broker | Five flashes in Blue  | Cannot establish the MQTT connection to the broker.     | <ul style="list-style-type: none"> <li>• Incorrect username or password.</li> <li>• Poor radio signal quality</li> </ul>                                                                                |

| Event                   | LED Pattern           | Description                                                          | Possible Problem/Fix                                                                                                                                       |
|-------------------------|-----------------------|----------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MQTT Subscription Error | Six flashes in Blue   | Cannot subscribe to the topic for download control command.          | <ul style="list-style-type: none"> <li>• Incorrect ACL setting.</li> <li>• Incorrect username or password.</li> <li>• Poor radio signal quality</li> </ul> |
| MQTT Publish Error      | Seven flashes in Blue | Cannot publish to the topic for data or device configuration upload. | <ul style="list-style-type: none"> <li>• Incorrect ACL setting</li> <li>• Incorrect username or password.</li> <li>• Poor radio signal quality</li> </ul>  |

## 7.3. Air Quality Index Indicator

The LED indicator reports Air Quality Index during normal operation. The Air Quality Index (AQI) provides an indicator of the quality of the air and its health effects with a range of 0 to 500. The table below LED indicator colour and the corresponding AQI.

On battery powered sensors, the LED indicator flashes every 5 seconds. On DC powered sensors, the LED indicator has a breathing effect.

| AQI     | Category                      | LED Colour |
|---------|-------------------------------|------------|
| <=50    | Good                          |            |
| 51-100  | Moderate                      |            |
| 101-150 | Unhealthy for Sensitive Group |            |
| 151-200 | Unhealthy                     |            |
| 201-300 | Very Unhealthy                |            |
| 301-500 | Hazardous                     | Flashing   |

## 8. Recommended Sensor Operating Lifetime

| NH3     | H2S     | CO      | NO2     | HCHO    | O3      | TVOC | CO2     | PM1.0/P<br>M2.5/P<br>M10 | T/H |
|---------|---------|---------|---------|---------|---------|------|---------|--------------------------|-----|
| 2 years | 2 years | 2 years | 2 years | 2 years | 2 years | -    | 5 years | -                        | -   |

## 9. Troubleshooting Guide

| Symptom                                                                                                         | Fix                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The sensor does not power on even if the DC power supply is connected or the batteries are inserted.            | <ul style="list-style-type: none"><li>• For SEN1070x models, check whether the SIM card is properly inserted. The gateway will not power on if it cannot detect the SIM card.</li><li>• For battery operated models, the sensor must use ER26500 Li-SOCl<sub>2</sub> battery. It cannot operate on 1.5V C-Size alkaline battery.</li><li>• Make sure the +ve and -ve terminals on the terminal block are connected properly to the DC power supply. The sensor cannot operate if the polarity is reversed.</li></ul> |
| The LED indicator shows that the sensor is operating but the server cannot receive any data.                    | <ul style="list-style-type: none"><li>• Make sure the sensor is installed in a place with good network coverage.</li><li>• Make sure the uFL antenna on the PCB is not loosened.</li><li>• Make sure the channel frequencies of the gateway and the sensor are the same.</li></ul>                                                                                                                                                                                                                                   |
| The signal strength (RSSI) of the received signal is weak even though the network coverage is good in the area. | <ul style="list-style-type: none"><li>• Make sure the sensor is not installed near any metallic objects. Metallic objects near the sensor would seriously affect the radio reception.</li></ul>                                                                                                                                                                                                                                                                                                                      |

## 10. Warning and Personal Injury

Do not apply this product to safety protection devices or emergency shutdown devices, nor in any other applications that may result in personal injury due to product malfunction, unless explicitly authorized. Please refer to the product datasheet and user guide before installation, processing, use or maintenance of the product. Failure to comply with the recommendations may result in death and serious bodily harm. The company shall not be held liable for any damages resulting in personal injury or death. All the claims against the company managers and employees, agents, distributor and subsidiaries are hereby disclaimed, including all the costs and compensation costs, legal fees etc.

## 11. Revision History

| Revision | Description      | Date        |
|----------|------------------|-------------|
| 1.0      | Initial release. | 10 Dec 2021 |

| Revision | Description                                                                                                                                                                                | Date        |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| 1.01     | Added AQI indictor colour table.                                                                                                                                                           | 28 Jan 2022 |
| 1.1      | Separate the user guide into NB-IoT and LoRaWAN versions.<br><br>Add sensor operations and configurable sensor settings.                                                                   | 28 Apr 2022 |
| 1.11     | Insert information and drawings for installation                                                                                                                                           | 15 Mar 2023 |
| 1.12     | Updated sensor setup drawing.<br><br>Updated PM1.0 alert threshold.<br><br>Added recommended sensor operating lifetime.<br><br>Revised the default High Humidity Threshold from 70% to 80% | 25 Apr 2023 |
| 1.13     | Added diagram for DC power connection and batteries insertion.                                                                                                                             | 22 Aug 2023 |
| 1.14     | Added “Warning and Personal Injury” Section.<br><br>Added note on PM sensor measurement interval.                                                                                          | 20 Mar 2024 |
| 2.0      | First release on docs.senso8.com                                                                                                                                                           | Oct 2026    |