

# SENSO8 Temperature Humidity Sensor API Document

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The API document describes the format of downlink and uplink JSON data for the following models:

- SEN20100-0000
- SEN21100-0000



Payload templates use unquoted placeholder names to describe field values. Replace each placeholder with a value of the type specified in the field table before sending JSON.

## 1. Uplink Data

### 1.1. Data Reporting

The sensor sends a data uplink data report in the following cases:

- There is a trigger event
- Periodic heartbeat
- Button press

#### 1.1.1. MQTT Topic Format

SENSO8/nbiot/data/<IMEI>

#### 1.1.2. MQTT Message Payload Format

```
{
  "ver": protocol_version,
  "msg": msg_seq_no,
  "time": epoch_time,
  "sn": sensor_imei,
  "temp": temperature,
  "RH": relative_humidity,
  "bat": battery,
  "RAT": radio_type,
  "rssi": radio_rssi,
  "rsrp": radio_rsrp,
  "rsrq": radio_rsrq,
  "ci": radio_ci,
  "tac": radio_tac,
```

```

"low_batt": low_batt,
"low_temp": low_temp_alert,
"high_temp": high_temp_alert,
"low_RH": low_humi_alert,
"high_RH": high_humi_alert,
"debug": debug_info
}

```

| <i><b>Field</b></i> | <i><b>Description</b></i>                                       |
|---------------------|-----------------------------------------------------------------|
| protocol_version    | Protocol version (int)                                          |
| msg_seq_no          | Message sequence number (uint32)                                |
| epoch_time          | Unix epoch time in ms                                           |
| sensor_imei         | IMEI of the sensor (string)                                     |
| temperature         | Temperature reading (°C) (one decimal place)                    |
| relative_humidity   | Relative humidity (%) (one decimal place)                       |
| battery             | Battery voltage (mV) (invalid when using AC adaptor)            |
| radio_type          | Radio Type, e.g. LTE, 3G, ...                                   |
| radio_rssi          | Radio RSSI (int)                                                |
| radio_rsrp          | Radio RSRP (int)                                                |
| radio_rsrq          | Radio RSRQ (int)                                                |
| radio_ci            | Radio cell information (8-digit hex string)                     |
| radio_tac           | Radio tracking area code (4-digit hex string)                   |
| low_batt            | 0 – battery normal; 1- battery low                              |
| low_temp_alert      | 0 – normal; 1 – temperature below low temperature threshold     |
| high_temp_alert     | 0 – normal; 1 – temperature above high temperature threshold    |
| low_humi_alert      | 0 – normal; 1 – relative humidity below low humidity threshold  |
| high_humi_alert     | 0 – normal; 1 – relative humidity above high humidity threshold |
| debug_info          | Reserved                                                        |

## 1.2. Device Configuration Reporting

The sensor uploads the device information (like IMEI, firmware version, etc) and settings (like data upload period, temperature threshold, etc) on start-up. By default, the sensor also reports these data every 24 hours by default. It is strongly suggested to keep a log of it for keep tracking

of the sensor status.

### 1.2.1. MQTT Topic Format

SENSO8/nbiot/sys/<IMEI>

### 1.2.2. MQTT Message Payload Format

```
{
  "ver": protocol_version,
  "sn": sensor_imei,
  "iccid": sim_iccid,
  "sampling": [sampling_batt, sampling_ac],
  "upload": [upload_batt, upload_ac],
  "low_temp": [low_temp_threshold, 0, 1],
  "high_temp": [high_temp_threshold, 0, 1],
  "low_RH": [low_humi_threshold, 0, 5],
  "high_RH": [high_humi_threshold, 0, 5],
  "cal_temp": cal_temp,
  "cal_RH": cal_RH,
  "low_batt": low_batt_alert_lvl,
  "batt_pwr_alert": batt_alert_en,
  "reg_timeout": registration_timeout,
  "band": [band_1, band_2, ..., band_n],
  "repeat": [0, 60],
  "local_port": 0,
  "en_shutdown": 0,
  "firmware": fw_version,
  "client_prefix": client_id_prefix,
  "topic_prefix": topic_prefix,
  "stat": stat_info
}
```

| <b>Field</b>     | <b>Description</b>                                    |
|------------------|-------------------------------------------------------|
| protocol_version | Protocol version (int)                                |
| sensor_imei      | IMEI of the sensor (string)                           |
| sim_iccid        | ICCID of the SIM card (string)                        |
| sampling_batt    | Data sampling period when running on battery (sec)    |
| sampling_ac      | Data sampling period when running on AC adaptor (sec) |
| upload_batt      | Data upload period when running on battery (sec)      |
| upload_ac        | Data upload period when running on AC adaptor (sec)   |

| <i>Field</i>         | <i>Description</i>                                                                                                            |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------|
| low_temp_threshold   | Low temperature alert threshold (°C)                                                                                          |
| high_temp_threshold  | High temperature alert threshold (°C)                                                                                         |
| low_humi_threshold   | Low relative humidity alert threshold (%)                                                                                     |
| high_humi_threshold  | High relative humidity alert threshold (%)                                                                                    |
| cal_temp             | Temperature offset for calibration (°C)                                                                                       |
| cal_RH               | Relative humidity offset for calibration (%)                                                                                  |
| low_batt_alert_lvl   | Battery low alert threshold (mV)                                                                                              |
| batt_alert_en        | Reserved                                                                                                                      |
| registration_timeout | Mobile network registration timeout (sec)                                                                                     |
| band_x               | NB-IoT frequency band supported (int)<br><br>0 – Auto<br><br>1 – B1<br><br>3 – B3<br><br>5 – B5<br><br>8 – B8<br><br>20 - B20 |
| fw_version           | Firmware version                                                                                                              |
| client_prefix        | MQTT client prefix (string)                                                                                                   |
| topic_prefix         | MQTT topic prefix (string) (apply to data, sys, ctrl topics)                                                                  |
| stat_info            | Reserved                                                                                                                      |

## 2. Downlink Data

The downlink data is used for updating the gateway settings online. It is published to the gateway via the MQTT broker. The format of the downlink commands is described in [Downlink Data Format](#). **After issuing a downlink configuration command, the device will publish a Device Configuration Report (SYS message) acknowledging the command and showing the latest device configuration.**

## 2.1. MQTT Settings

The sensor is using MQTT persistent connection to receive downlink commands.

In order to support downlink command, the **MQTT broker** needs to support **MQTT 3.1.1**. And, the following setting is required for MQTT client posting downlink data to SENSO8 sensor.

- Publish QoS = 1
- Retain Flag = False

## 2.2. Downlink Data Format

### 2.2.1. High Temperature Threshold Configuration

#### 2.2.1.1. MQTT Topic Format

SENSO8/nbiot/ctrl/<IMEI>

#### 2.2.1.2. MQTT Message Payload Format

```
{
  "sn": sensor_imei,
  "high_temp": [high_temp_threshold, 0, 1]
}
```

### 2.2.2. Low Temperature Threshold Configuration

#### 2.2.2.1. MQTT Topic Format

SENSO8/nbiot/ctrl/<IMEI>

#### 2.2.2.2. MQTT Message Payload Format

```
{
  "sn": sensor_imei,
  "low_temp": [low_temp_threshold, 0, 1]
}
```

### 2.2.3. High Relative Humidity Threshold Configuration

### 2.2.3.1. MQTT Topic Format

SENSO8/nbiot/ctrl/<IMEI>

### 2.2.3.2. MQTT Message Payload Format

```
{
  "sn": sensor_imei,
  "high_RH": [high_humi_threshold, 0, 5]
}
```

## 2.2.4. Low Relative Humidity Threshold Configuration

### 2.2.4.1. MQTT Topic Format

SENSO8/nbiot/ctrl/<IMEI>

### 2.2.4.2. MQTT Message Payload Format

```
{
  "sn": sensor_imei,
  "low_RH": [low_humi_threshold, 0, 5]
}
```

## 2.2.5. Data Sampling Period Configuration

### 2.2.5.1. MQTT Topic Format

SENSO8/nbiot/ctrl/<IMEI>

### 2.2.5.2. MQTT Message Payload Format

```
{
  "sn": sensor_imei,
  "sampling": [sampling_batt, sampling_ac]
}
```

## 2.2.6. Data Upload Period Configuration

### 2.2.6.1. MQTT Topic Format

SENSO8/nbiot/ctrl/<IMEI>

### 2.2.6.2. MQTT Message Payload Format

```
{
  "sn": sensor_imei,
  "upload": [upload_batt, upload_ac]
}
```

## 2.2.7. Frequency Band Configuration

### 2.2.7.1. MQTT Topic Format

SENSO8/nbiot/ctrl/<IMEI>

### 2.2.7.2. MQTT Message Payload Format

```
{
  "sn": sensor_imei,
  "band": [band_1, band_2, ..., band_n]
}
```

| <i>Field</i>        | <i>Description</i>                                                                      | <i>Type</i> | <i>Default</i> |
|---------------------|-----------------------------------------------------------------------------------------|-------------|----------------|
| sensor_imei         | IMEI of the sensor (string)                                                             | string      |                |
| sampling_batt       | Data sampling period when running on battery (sec) (min: 10 sec)                        | number      | 900 sec        |
| sampling_ac         | Data sampling period when running on AC adaptor (sec) (min: 10 sec)                     | number      | 900 sec        |
| upload_batt         | Data upload period when running on battery (sec) (min: 180, max: 43200) <sup>1</sup>    | number      | 3600 sec       |
| upload_ac           | Data upload period when running on AC adaptor (sec) (min: 180, max: 43200) <sup>1</sup> | number      | 900 sec        |
| low_temp_threshold  | Low temperature alert threshold (°C) (integer only)                                     | number      | 18°C           |
| high_temp_threshold | High temperature alert threshold (°C) (integer only)                                    | number      | 30°C           |
| low_humi_threshold  | Low relative humidity alert threshold (%) (integer only)                                | number      | 40%            |
| high_humi_threshold | High relative humidity alert threshold (%) (integer only)                               | number      | 70%            |

| <i><b>Field</b></i> | <i><b>Description</b></i>                                                                                                                 | <i><b>Type</b></i> | <i><b>Default</b></i> |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------------|
| band_x              | NBIoT frequency band supported (int) <sup>2</sup><br><br>0 – Auto<br><br>1 – B1<br><br>3 – B3<br><br>5 – B5<br><br>8 – B8<br><br>20 - B20 | number             | 0                     |

1. Data upload period must be longer than data sampling period. The sensor can store up to 20 samples between each data upload period.
2. For automatic frequency selection, set “band”: [ 0 ] on the command. Otherwise, put the desired frequency bands in the JSON array. For example, to support B3 and B8, set “band”: [ 3 , 8 ] on the command.

### 3. Revision History

| <i><b>Revision</b></i> | <i><b>Date</b></i> | <i><b>Description</b></i>                              |
|------------------------|--------------------|--------------------------------------------------------|
| 1.0                    | Mar 2020           | Initial Release.                                       |
| 1.1                    | Jul 2020           | Added new JSON data keys on firmware version 2.01.000. |
| 1.2                    | Jul 2022           | Minor Correction (from serial_no to sensor_imei).      |
| 1.21                   | Jun 2023           | Corrected the minimum data sampling period.            |
| 1.22                   | May 2024           | Added SEN21100 to supported models.                    |
| 2.0                    | Oct 2026           | First release on docs.senso8.com                       |