SENSO8 NB-IoT Temperature/Humidity Sensor API Document

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

- SEN20100-0000
- SEN21100-0000

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

MQTT Topic Format

SENSO8/nbiot/data/<IMEI>

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
}
```

Field	***Description***
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 (℃) (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.

MQTT Topic Format

SENSO8/nbiot/sys/<IMEI>

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,
}
```

Field	***Description***
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)
low_temp_threshold	Low temperature alert threshold (℃)
high_temp_threshold	High temperature alert threshold (℃)
low_humi_threshold	Low relative humidity alert threshold (%)
high_humi_threshold	High relative humidity alert threshold (%)
cal_temp	Temperature offset for calibration (℃)
cal_RH	Relative humidity offset for calibartion (%)
low_batt_alert_lvl	Battery low alert threshold (mV)
batt_alert_en	Reserved
registration_timeout	Mobile network registration timeout (sec)
band_x	NBIoT frequency band supported (int) 0 – Auto 1 – B1 3 – B3 5 – B5 8 – B8 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 Section 2.2 below. **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 Download Data Format

2.2.1 High Temperature Threshold Configuration

MQTT Topic Format

SENSO8/nbiot/ctrl/<IMEI>

MQTT Message Payload Format

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

2.2.2 Low Temperature Threshold Configuration

MQTT Topic Format

SENSO8/nbiot/ctrl/<IMEI>

MQTT Message Payload Format

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

2.2.3 High Relative Humidity Threshold Configuration

MQTT Topic Format

SENSO8/nbiot/ctrl/<IMEI>

MQTT Message Payload Format

```
{
  "sn": sensor_imei,
```

```
  "high_RH": [high_humi_threshold, 0, 5]
}
```

2.2.4 Low Relative Humidity Threshold Configuration

MQTT Topic Format

SENSO8/nbiot/ctrl/<IMEI>

MQTT Message Payload Format

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

2.2.5 Data Sampling Period Configuration

MQTT Topic Format

SENSO8/nbiot/ctrl/<IMEI>

MQTT Message Payload Format

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

2.2.6 Data Upoload Period Configuration

MQTT Topic Format

SENSO8/nbiot/ctrl/<IMEI>

MQTT Message Payload Format

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

2.2.7 Frequency Band Configuration

MQTT Topic Format

SENSO8/nbiot/ctrl/<IMEI>

MQTT Message Payload Format

```
{
```

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

Field	*Description*	*Type*	*Default*
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)[1]	number	3600 sec
upload_ac	Data upload period when running on AC adaptor (sec) (min: 180, max: 43200)[1]	number	900 sec
low_temp_threshold	Low temperature alert threshold (℃) (integer only)	number	18℃
high_temp_threshold	High temperature alert threshold (℃) (integer only)	number	30℃
low_humi_threshold	Low relative humidity alert threshold (%) (integer only)	number	40%
high_humi_threshold	High relative humidity alert threshold (%) (integer only)	number	70%
band_x	NBIoT frequency band supported (int)[2] 0 – Auto 1 – B1 3 – B3 5 – B5 8 – B8 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

Revision	*Date*	*Description*
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.