

SEN22600 API Document

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This API document describes the format of the downlink and uplink JSON data for the following models: SEN22600



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. Revision History

Version	Date	Changes
1.0	May 2026	Initial version
2.0	Oct 2026	First release on docs.senso8.com

2. MQTT Topic

There is a topic for sensor activation during the initial device setup

Topic Type	Retained Message	Description	Format (Default)
Device Activation	Yes	Used by the sensor to subscribe the activation topic to the MQTT broker during the initial device setup.	SENSO8/SEN22600/activation/<IMEI>

There are three uplink data MQTT topics used for the SEN22600 sensor to publish meter readings, device configuration and time synchronization data to the MQTT broker:

Topic Type	Retained Message	Description	Format (Default)
Data Reporting	No	Used by the sensor to publish data uplink messages to the MQTT broker.	SENSO8/SEN22600/data/<IMEI>
Device Status Reporting	No	Used by the sensor to publish device status messages to the MQTT broker.	SENSO8/SEN22600/sys/<IMEI> with JSON start with "msg_type":"status"
Device Configuration Reporting	No	Used by the sensor to publish device configuration messages to the MQTT broker.	SENSO8/SEN22600/sys/<IMEI> with JSON start with "msg_type":"setting"

Topic Type	Retained Message	Description	Format (Default)
Time Synchronization	No	Used by the sensor to publish time synchronization messages to the MQTT broker.	SENSO8/SEN22600/timesync/<IMEI> with JSON start with "msg_type":"timesync"

In addition, there is one downlink data MQTT topic used by the MQTT broker to send configuration commands to the sensor:

Topic Type	Retained Message	Description	Format
Device Configuration	Yes	Used by the MQTT broker to send device configuration commands to the sensor.	SENSO8/SEN22600/ctrl/<IMEI>

3. Device Configurations For Activation

The following device configurations must be set correctly before the sensor can operate normally. It is suggested to set these configurations via downlink commands after the device is powered on for the first time. Any missing configuration settings or invalid parameters will fail to activate the sensor.

Retained Message for application publish activation downlink must be enabled (set to 1). QoS for application publish activation downlink must be set to 1.

The application must set the initial metering reading value via downlink command after the device is powered on for the first time. The valid range of the initial metering reading depends on **digits** (number of meter display digits), which is configured in section [MIU Settings](#).

Key	Value	Type	Range	Default
init_val	Initial metering reading (L)	number	0-(10 ^{digits} -1)	0

Example:

```
Initial metering reading: 12345 L
```

```
{
  "init_val": 12345
}
```

4. Uplink Data

The sensor sends a sequence of uplinks in the following cases:

- There is an alert event (e.g., low battery, backflow, leakage, etc.)
- Periodic data report

The sequence of uplink messages is as follows:

1. Data Log Reporting (DATA message)
2. Device Status Reporting (SYS message)
3. Time Synchronization (TIMESYNC message)

After the uplink, the device will wait for a downlink configuration command from the MQTT broker (if any) and uplink the Device Configuration Reporting (SYS message) after receiving a downlink configuration command (if any).

4.1. Data Log Reporting

4.1.1. MQTT Topic Format

SENSO8/SEN22600/data/<IMEI>

4.1.2. MQTT Message Payload Format

The data is stored in binary format in 4-byte little endian with the following structure:

Byte	Content
0 - 3	Message Header, 0xFFFF0142 [0xFFFF (reserved)] [0x01 (uncompressed)] [0x42 ('B' = binary)]
4 - 7	Message ID
8 - 23	MIU ID (IMEI), null-padded ASCII
24 - 27	Data Type (1)
28 - 31	Number of records (N)
32 - 35	UTC Unix time of first record (sec)
36 - 39	Meter reading of first record (L)
40 - 43	UTC Unix time of second record (sec)
44 - 47	Meter reading of second record (L)
...	...

Byte	Content
...	...
...	UTC Unix time of N-th record (sec)
...	Meter reading of N-th record (L)

Maximum records per publish: 1500

4.2. Device Status Reporting

The sensor uploads the device status after each data upload.

4.2.1. MQTT Topic Format

SENSO8/SEN22600/sys/<IMEI>

4.2.2. MQTT Message Payload Format

```
{
  "msg_type": message type,
  "msg": message sequence no,
  "time": unix time,
  "miu_id": miu s/n,
  "wtm_id": water meter s/n,
  "fw_ver": firmware version,
  "hw_ver": hardware version,
  "meter": meter reading,
  "mode": operation mode,
  "temp": temperature,
  "lf_bf": lifetime backflow volume,
  "bat": battery percentage,
  "mV": battery voltage,
  "bf": backflow status,
  "lk": leak status,
  "zc": zero consumption status,
  "hf": high flow rate status,
  "trim": data trim count,
  "rssi": radio rssi,
  "rsrp": radio rsrp,
  "rsrq": radio rsrq,
  "sinr": radio sinr,
  "ci": radio cid,
  "tac": radio tac,
  "imei": sensor imei,
  "iccid": iccid [nanoSIM, eSIM],
  "mcc": mobile country code [nanoSIM, eSIM],
  "mnc": mobile network code [nanoSIM, eSIM],
  "sim": active sim slot,
  "fota": firmware update status,
  "debug": [debug info]
}
```

Field	Description	Type
msg_type	Message type - "status"	string
msg	Message sequence number	number
time	Uplink Time - UTC Unix time (sec)	number
miu_id	MIU serial number	string
wtm_id	Water meter serial number	string
fw_ver	Firmware version	string
hw_ver	Hardware version	string
meter	Water meter reading (L)	number
mode	Operation mode 0: waiting for activation 1: normal 2: low battery (15%) 3: critical low battery (8%)	number
temp	Internal temperature (°C, one decimal place)	number
lf_bf	Lifetime accumulated reverse-flow volume (L)	number
bat	Battery percentage (0-100%)	number
mV	Battery voltage (mV)	number
bf	Backflow (reverse flow) alert status (0: normal, 1: backflow detected)	number
lk	Leak alert status (0: normal, 1: leak detected)	number
zc	Zero consumption alert status (0: normal, 1: zero consumption detected)	number
hf	High flow rate alert status 0: normal 1: above threshold 1 2: above threshold 2 3: above threshold 3	number
trim	Data trim status (0: normal, 1: data trim detected)	number
rssi	Radio RSSI	number
rsrp	Radio RSRP	number
rsrq	Radio RSRQ	number
sinr	Radio SINR (Signal to Interference & Noise Ratio)	number

Field	Description	Type
ci	Radio cell information (8-digit hex string)	string
tac	Radio tracking area code (4-digit hex string)	string
imei	Sensor IMEI	string
iccid	ICCID [nanoSIM, eSIM] (null if SIM not present)	string array
mcc	mobile country code [nanoSIM, eSIM] (-1 if SIM not present)	number array
mnc	mobile network code [nanoSIM, eSIM] (-1 if SIM not present)	number array
sim	Currently active SIM slot index (0: nanoSIM, 1: eSIM)	number
fota	Last OTA firmware update result code 255: no firmware update activity 0: success 1 - 254: fail with an error code	number
debug	Reserved	array

4.3. Time Synchronization

The sensor uploads the time synchronization information after each data upload.

4.3.1. MQTT Topic Format

SENSO8/SEN22600/timesync/<IMEI>

4.3.2. MQTT Message Payload Format

```
{
  "msg_type": message type,
  "msg": message sequence no,
  "time": unix time,
  "miu_id": miu s/n,
  "oldtime": original unix time,
  "newtime": adjusted new unix time,
  "nextuptime": next upload unix time
}
```

Field	Description	Type
msg_type	Message Type - "timesync"	string
msg	Message sequence number	number
time	Uplink Time - UTC Unix time (sec)	number
miu_id	MIU serial number	string
oldtime	Original UTC Unix time before time sync (sec)	number
newtime	Adjusted new UTC Unix time after time sync (sec)	number
nextuptime	Next scheduled upload UTC Unix time (sec)	number

4.4. Device Configuration Reporting

The sensor uploads the device configuration after control parameter download.

4.4.1. MQTT Topic Format

SENSO8/SEN22600/sys/<IMEI>

4.4.2. MQTT Message Payload Format

```
{
  "msg_type": message type,
  "msg": message sequence no,
  "time": unix time,
  "miu_id": miu s/n,
  "wtm_id": water meter s/n,
  "batt_th": [battery low threshold, battery critical low threshold],
  "btn_reset": enable button reset,
  "sim_sel": sim selection policy,
  "reg_time": registration timeout,
  "dns1": dns1 address,
  "dns2": dns2 address,
  "band": [band1, band2, ....., band8],
  "broker1": {
    "url": broker1 address,
    "port": broker1 port,
    "c_session": broker1 clean session,
    "tls": broker1 tls
  },
  "broker2": {
    "url": broker2 address,
    "port": broker2 port,
    "c_session": broker2 clean session,
    "tls": broker2 tls
  },
  "top_data": data uplink topic,
  "top_sys": sys uplink topic,
  "top_ctrl": ctrl downlink topic,
  "top_ts": timesync uplink topic,
  "wait2off": wait for downlink time,
  "meter": meter reading,
  "window": random uplink window,
  "up_int": data uplink interval,
  "manu_up": manual uplink limit,
  "log_base": time/volume based logging,
```

```

"fwd1_th": fwd1 threshold,
"fwd1_dur": fwd1 duration,
"fwd2_th": fwd2 threshold,
"fwd2_dur": fwd2 duration,
"fwd3_th": fwd3 threshold,
"fwd3_dur": fwd3 duration,
"back_th": backflow threshold,
"leak_th": leak threshold,
"leak_dur": leak duration,
"zero_dur": zero consumption duration,
"time_int": time based sampling interval,
"voln_sz": volume based sampling size,
"pulse_sz": litres per pulse,
"digit_sz": litres per meter digit,
"digits": number of meter display digits
}

```

Field	Description	Type															
msg_type	Message Type - "setting"	string															
msg	Message sequence number	number															
time	Uplink Time - UTC Unix time (sec)	number															
miu_id	MIU serial number	string															
wtm_id	Water meter serial number	string															
batt_th	<p>[low_threshold_%, critical_threshold_%] Battery low threshold: device enters reduced uplink mode Battery critical threshold: device triggers final upload and ceases automatic uploads (low threshold must be $\geq$ critical threshold)</p> <table> <tr> <th></th><th>Low</th><th>Critical Low</th></tr> <tr> <td>Uplink Interval</td><td>once per 14 days</td><td>no</td></tr> <tr> <td>Sampling Frequency</td><td>once per day at 23:59:55</td><td>once per day at 23:59:55</td></tr> <tr> <td>Alert Message</td><td>yes</td><td>no</td></tr> <tr> <td>Manual Trigger Uplink</td><td>yes</td><td>yes</td></tr> </table>		Low	Critical Low	Uplink Interval	once per 14 days	no	Sampling Frequency	once per day at 23:59:55	once per day at 23:59:55	Alert Message	yes	no	Manual Trigger Uplink	yes	yes	array [number, number]
	Low	Critical Low															
Uplink Interval	once per 14 days	no															
Sampling Frequency	once per day at 23:59:55	once per day at 23:59:55															
Alert Message	yes	no															
Manual Trigger Uplink	yes	yes															
btn_reset	Hold button for 30 sec then release to factory default (0: disable, 1: enable)	number															

Field	Description	Type
sim_sel	SIM selection policy 0: nano SIM only 1: eSIM only 2: nano SIM preferred 3: eSIM preferred 4: toggle between nano SIM and eSIM	number
reg_time	LTE registration timeout (sec)	number
dns1	Primary DNS server address	string
dns2	Secondary DNS server address	string
band	Frequency band used (0: Auto Select)	number array
broker1	Broker 1 settings	object
broker2	Broker 2 settings	object
url	MQTT broker address	string
port	MQTT broker port	number
c_session	MQTT broker clean session (0: disabled, 1: enabled)	number
tls	MQTT broker TLS enabled (0: disabled, 1: enabled)	number
top_data	Data uplink MQTT topic	string
top_sys	Device status/configuration report uplink MQTT topic	string
top_ctrl	Device configuration downlink MQTT topic	string
top_ts	Time sync uplink MQTT topic	string
wait2off	Wait for downlink time (sec)	number
meter	Water meter reading (L)	number
window	Random uplink window time (sec)	number
up_int	Data uplink interval (min)	number
manu_up	Manual uplink limit per day (0: unlimited)	number
log_base	Data logging base (0: time based, 1: volume based)	number
fwd1_th	High flow rate 1 threshold (L/min)	number
fwd1_dur	High flow rate 1 duration (min)	number
fwd2_th	High flow rate 2 threshold (L/min)	number
fwd2_dur	High flow rate 2 duration (min)	number

Field	Description	Type
fwd3_th	High flow rate 3 threshold (L/min)	number
fwd3_dur	High flow rate 3 duration (min)	number
back_th	Backflow alert threshold (L)	number
leak_th	Leak alert flow rate threshold (ml/hr, multiples of 100)	number
leak_dur	Leak alert duration (min)	number
zero_dur	Zero consumption alert duration (min)	number
time_int_s	Time based sampling interval (sec)	number
voln_sz	Volume based sampling size (L)	number
pulse_sz	Litres per pulse	number
digit_sz	Litres per meter digit	number
digits	Number of meter display digits (0-9)	number

5. Downlink Data

The downlink data is used for updating the sensor settings online. It is published to the sensor via the MQTT broker. **After receiving a downlink configuration command, the device will publish a Device Configuration Reporting (SYS message) acknowledging the command and showing the latest device configuration.** This does not apply to the **default** commands.

5.1. MQTT Settings

The sensor is using MQTT persistent connection to receive downlink commands. In order to support downlink commands, the **MQTT broker** needs to support **MQTT 3.1.1**. The following settings are required for the MQTT client posting downlink data to the SENSO8 sensor.

- Publish QoS = 1
- Retain Flag = Yes

5.2. MQTT Topic Format

SENSO8/SEN22600/ctrl/<IMEI>

5.3. MQTT Message Payload Format

5.3.1. Network Settings

Key	Value	Type	Range	Default
sim_sel	Select the SIM selection policy 0: nano SIM only 1: eSIM only 2: nano SIM preferred 3: eSIM preferred 4: toggle between nano SIM and eSIM	number	0-4	0
reg_time	LTE registration timeout (sec)	number	0-600	60

Key	Value	Type	Range	Default
band	<p>Frequency band selection [band1, band2, ... band8] (max 8) 0: Auto Select e.g. manual select band 1, 3, 7, 8, 28</p> <pre>{"band": [1, 3, 7, 8, 28]}</pre> <p>e.g. auto select</p> <pre>{"band": [0]}</pre>	array	n/a	[0]
dns1	<p>Primary DNS server address (URL or IP) format: x.x.x.x send "0.0.0.0" to clear</p>	string	n/a	8.8.8.8
dns2	<p>Secondary DNS server address (URL or IP) format: x.x.x.x send "0.0.0.0" to clear</p>	string	n/a	8.8.4.4

Example:

```
SIM slot 1 only
Registration timeout: 60 sec
dns1: 1.1.1.1
dns2: 8.8.8.8
```

```
{
  "sim_sel": 0,
  "reg_time": 60,
  "dns1": "1.1.1.1",
  "dns2": "8.8.8.8"
}
```

5.3.2. MQTT Broker Settings

Key	Value	Type	Range	Default
broker1	{"url", "port", "user", "password", "c_session", "tls", "sni", "cert_url"}	object	n/a	n/a
broker2	{"url", "port", "user", "password", "c_session", "tls", "sni", "cert_url"}	object	n/a	n/a
url	Broker address (URL or IP)	string	max. len 128	n/a
port	MQTT broker port number	number	0-65535	n/a
user	MQTT broker username use macro <IMEI> to use the device IMEI as username	string	max. len 50	n/a
password	MQTT broker password use macro <AUTO> (only when user is <IMEI>) to auto-derive password	string	max. len 50	n/a
c_session	MQTT clean session (0: disable, 1: enable)	number	0/1	n/a
tls	TLS for MQTT (0: disable, 1: enable)	number	0/1	n/a
cert_url	CA cert file address (URL or IP)	string	max. len 128	n/a

5.3.3. MQTT Topic Settings

Key	Value	Type	Range	Default
top_prefix	Topic prefix shortcut — sets all four topics at once using the pattern "prefix"/data/<imei> "prefix"/sys/<imei> "prefix"/timesync/<imei> "prefix"/ctrl/<imei> (trailing "/" is stripped automatically)	string	max len. 30	n/a
top_data	Data uplink topic. Macros can be used to define the topic, please refer section MQTT Topic Macro	string	max len. 64	SENSO8/ SEN22600/ data/ <imei>
top_sys	Device status/configuration uplink topic. Macros can be used to define the topic, please refer section MQTT Topic Macro	string	max len. 64	SENSO8/ SEN22600/ sys/ <imei>

Key	Value	Type	Range	Default
top_ctrl	Device configuration downlink topic. Macros can be used to define the topic, please refer section MQTT Topic Macro	string	max len. 64	SENSO8/ SEN22600/ ctrl/ <imei>
top_ts	Time sync uplink topic. Macros can be used to define the topic, please refer section MQTT Topic Macro	string	max len. 64	SENSO8/ SEN22600/ timesync/ <imei>
top_act	Device activation topic. Macro can be used to define the topic, please refer section MQTT Topic Macro	string	max len. 64	SENSO8/ SEN22600/ activate/ <imei>
wait2off	Wait for downlink time after publishing (sec)	number	0-10	10

5.3.4. MQTT Topic Macro

Macro	Description
<brand>	SENSO8
<model>	SEN22600
<imei>	Device IMEI
<id>	MIU S/N

Example:

```
Device IMEI is 860000000000001
MQTT Broker 1
- Address: mqtt.senso8.com
- Port: 8883
- Username: 356789012345678
- Password: mypassword
- Clean Session: Yes
- Enable TLS with CA cert server: http://cert.senso8.com/ca.pem
MQTT Broker 2
- Address: backup.mqtt.senso8.com
- Port: 1883
- Username: IMEI of the sensor
- Password: self generated password
```

- Clean Session: No

- Disable TLS

Topic for data uplink: TEST/data/8600000000000001

Topic for status/configuration uplink: TEST/sys/8600000000000001

Topic for configuration downlink: TEST/ctrl/8600000000000001

Topic for time sync uplink: TEST/timesync/8600000000000001

```
{
  "broker1": {
    "url": "mqtt.senso8.com",
    "port": 8883,
    "user": "356789012345678",
    "password": "mypassword",
    "c_session": 1,
    "tls": 1,
    "cert_url": "http://cert.senso8.com/ca.pem"
  },
  "broker2": {
    "url": "backup.mqtt.senso8.com",
    "port": 1883,
    "user": "<IMEI>",
    "password": "<AUTO>",
    "c_session": 0,
    "tls": 0
  },
  "top_prefix": "TEST"
}
```

5.3.5. MIU Settings

Key	Value	Type	Range	Default															
miu_id	MIU ID	string	max len. 16	<imei>															
wtm_id	Water Meter ID	string	max len. 16	n/a															
btn_reset	Hold button for 30 sec then release to factory default 0: disable, 1: enable	number	0-1	1															
batt_th	[x, y] x - battery low threshold in percentage y - battery critical low threshold percentage (device triggers final upload and ceases automatic uploads) (where x >= y) <table><tr><td></td><td>Low (x)</td><td>Critical Low (y)</td></tr><tr><td>Uplink Interval</td><td>once per 14 days</td><td>no</td></tr><tr><td>Sampling Frequency</td><td>once per day at 23:59:55</td><td>once per day at 23:59:55</td></tr><tr><td>Alert Message</td><td>yes</td><td>no</td></tr><tr><td>Manual Trigger Uplink</td><td>yes</td><td>yes</td></tr></table>		Low (x)	Critical Low (y)	Uplink Interval	once per 14 days	no	Sampling Frequency	once per day at 23:59:55	once per day at 23:59:55	Alert Message	yes	no	Manual Trigger Uplink	yes	yes	array [number, number]	0-100	[15, 8]
	Low (x)	Critical Low (y)																	
Uplink Interval	once per 14 days	no																	
Sampling Frequency	once per day at 23:59:55	once per day at 23:59:55																	
Alert Message	yes	no																	
Manual Trigger Uplink	yes	yes																	
init_val	Initial metering reading (L). Triggers device activation if in waiting-for-activation mode.	number	refer to digits	n/a															
window	Random uplink window time (sec)	number	0-3600	0															
up_int	Data uplink interval (min) the uplink interval (up_int) must be greater than random uplink window (window/60) to avoid uplink conflict	number	1-44640	1440															
manu_up	Max. number of uplink by button after activation 0: disable	number	0-65535	0															
one_shot	One-shot uplink time (UTC Unix time in sec)	number	<31days	n/a															
log_base	Data logging base 0: time based, 1: volume based	number	0-1	1															
fwd1_th	High flow rate 1 threshold (L/min) 0: disable	number	0-32767	0															

Key	Value	Type	Range	Default
fwd1_dur	High flow rate 1 duration (min)	number	1-1440	1
fwd2_th	High flow rate 2 threshold (L/min) 0: disable	number	0-32767	0
fwd2_dur	High flow rate 2 duration (min)	number	1-1440	1
fwd3_th	High flow rate 3 threshold (L/min) 0: disable	number	0-32767	0
fwd3_dur	High flow rate 3 duration (min)	number	1-1440	1
back_th	Backflow (lifetime reverse-flow) alert threshold (L) 0: disable	number	0-1000	10
leak_th	Leak alert flow rate threshold (ml/hr) value should be translated into multiples of 100 ml/h e.g. when a downlink value is 23456, device will convert to 23400	number	1- 1000000	15600 (DN15 Q1)
leak_dur	Leak alert duration (min) 0: disable	number	0-64800	0
zero_dur	Zero consumption duration (min) 0: disable	number	0-64800	0
time_int	Time based sampling interval (min) applies when log_base=0	number	1-4320	15
time_int_s	Time based sampling interval (sec) applies when log_base=0	number	1-4320	900
voln_sz	Volume based sampling size (L) applies when log_base=1	number	1-1000	1
pulse_sz	Litres per pulse	number	1-10000	1
digit_sz	Litres per meter digit (must be 1 or a multiple of 10)	number	1-10000	1
digits	Number or Range of meter digits (1-9): represent number of digits 0: range 32 bits e.g. 9: range 0 - 999,999,999 e.g. 0: range 0 - 4,294,967,295 The reading rolls over after the maximum.	number	0-9	8

Example:

Enable hold button to reset feature

Initial metering reading: 12345 L
Random uplink window time: 1800 sec
Uplink interval: 60 min
Volume based logging with 100 L step
Pulse size: 1 L/pulse

```
{  
  "btn_reset": 1,  
  "init_val": 12345,  
  "window": 1800,  
  "up_int": 60,  
  "log_base": 1,  
  "voln_sz": 100,  
  "pulse_sz": 1  
}
```

5.3.6. OTA Firmware Update Settings

Key	Value	Type	Range	Default
fota_svr	{"url", "tls", "cert_url"} refer to table below	object	n/a	n/a
fota_req	OTA firmware update request 0: no action required 1: request update application firmware 2: request update bootloader	number	0/1/2	0

Key	Value	Type	Range	Default
url	Firmware image address (HTTP/HTTPS URL)	string	max. len 128	n/a
tls	Enable TLS for firmware download 0: disable 1: enable	number	0/1	0
cert_url	CA cert file address (URL or IP)	string	max. len 128	n/a

Example:

Update application firmware with TLS and cert server

```
{
  "fota_svr": {
    "url": "https://fota.senso8.com/firmware.bin",
    "tls": 1,
    "cert_url": "http://cert.senso8.com/cert.pem"
  },
  "fota_req": 1
}
```

Example:

Update bootloader without TLS

```
{
```

```
"fota_svr": {  
  "url": "http://fota.senso8.com/bootloader.bin",  
  "tls": 0  
},  
"fota_req": 2  
}
```

5.3.7. Other Settings

Key	Description	Type	Value
default	Reset the device to factory default settings and reboot 8888: trigger factory reset	number	8888
setting	Request the device to immediately publish a settings report 1: request uplink device setting	number	1

Example:

```
Reset to factory default settings
```

```
{  
  "default": 8888  
}
```

Example:

```
Get current device settings summary
```

```
{  
  "setting": 1  
}
```