SPH01-NB -- NB-IoT Soil pH Sensor User Manual

Version 167.1 authored by Mengting Qiu on 2025/12/22 10:26

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1. Introduction

1.1 What is NB-IoT Soil pH Sensor

The Dragino SPH01-NB is a **NB-IoT Soil pH Sensor** for IoT of Agriculture. It is designed to measure the **soil PH and soil temperature**, so to send to the platform to analyze the soil acid or alkali level. The probe is IP68 waterproof.

SPH01-NB probe is made by Solid AgCl reference electrode and Pure metal pH sensitive electrode. It can detect **soil's pH** with high accuracy and stable value. The SPH01-NB probe can be buried into soil for long time use.

SPH01-NB supports different uplink methods including **MQTT, MQTTs, UDP, TCP or CoAP** for different application requirement, and support uplinks to various IoT Servers.

SPH01-NB **supports BLE configure and OTA update** which make user easy to use.

SPH01-NB is powered by **8500mAh Li-SOCI2 battery**, it is designed for long-term use up to several years.

SPH01-NB has optional built-in SIM card and default IoT server connection version. Which makes it works with simple configuration.

1.2 Features

- NB-IoT Bands: B1/B2/B3/B4/B5/B8/B12/B13/B17/B18/B19/B20/B25/B28/B66/B70/B85 @H-FDD
- Ultra-low power consumption
- Monitor soil pH with temperature compensation.
- Monitor soil temperature
- Support pH calibration by end user
- Multiply Sampling and one uplink
- Support Bluetooth v5.1 remote configure and update firmware
- Uplink on periodically
- Downlink to change configure
- 8500mAh Battery for long term use
- Nano SIM card slot for NB-IoT SIM

1.3 Specification

Common DC Characteristics:

- Supply Voltage: 2.5v ~ 3.6v
- Operating Temperature: -40 ~ 85°C

Soil pH:

- Range: 3 ~ 10 pH
- Resolution: 0.01 pH
- Accuracy: ±2% under (0~50 °C, Accuracy will poor under 0 due to frozen)
- Temperature Compensation Range: 0 ~ 50°C
- IP68 Protection
- Length: 3.5 meters

Soil Temperature:

- Range -40°C ~ 85°C
- Resolution: 0.1°C
- Accuracy: <±0.5°C(-10°C ~ 40°C), <±0.8°C (others)

- IP68 Protection
- Length: 3.5 meters

NB-IoT Spec:

NB-IoT Module: BC660K-GL

Support Bands:

- B1 @H-FDD: 2100MHz
- B2 @H-FDD: 1900MHz
- B3 @H-FDD: 1800MHz
- B4 @H-FDD: 2100MHz
- B5 @H-FDD: 860MHz
- B8 @H-FDD: 900MHz
- B12 @H-FDD: 720MHz
- B13 @H-FDD: 740MHz
- B17 @H-FDD: 730MHz
- B18 @H-FDD: 870MHz
- B19 @H-FDD: 870MHz
- B20 @H-FDD: 790MHz
- B25 @H-FDD: 1900MHz
- B28 @H-FDD: 750MHz
- B66 @H-FDD: 2000MHz
- B70 @H-FDD: 2000MHz
- B85 @H-FDD: 700MHz

Battery:

- Li/SOCI2 un-chargeable battery
- Capacity: 8500mAh
- Self Discharge: <1% / Year @ 25°C
- Max continuously current: 130mA
- Max boost current: 2A, 1 second

Power Consumption

- STOP Mode: 10uA @ 3.3v
- Max transmit power: 350mA@3.3v

1.4 Applications

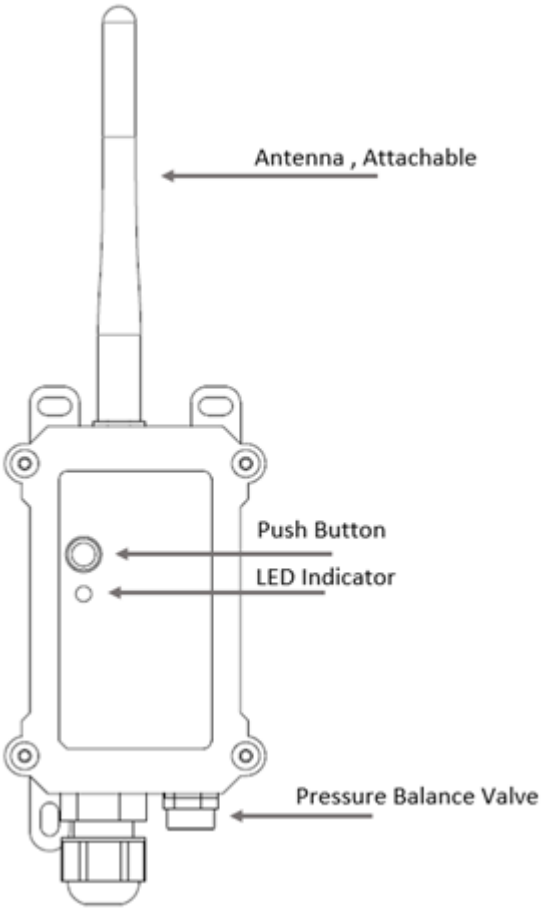
- Smart Agriculture

1.5 Sleep mode and working mode

Deep Sleep Mode: Sensor doesn't have any NB-IoT activate. This mode is used for storage and shipping to save battery life.

Working Mode: In this mode, Sensor will work as NB-IoT Sensor to Join NB-IoT network and send out sensor data to server. Between each sampling/tx/rx periodically, sensor will be in IDLE mode), in IDLE mode, sensor has the same power consumption as Deep Sleep mode.

1.6 Button & LEDs



Behavior on ACT	Function	Action
1~3s	Send an uplink	If sensor has already attached to NB-IoT network, sensor will send an uplink packet, **blue led** will blink once. Meanwhile, BLE module will be active and user can connect via BLE to configure device.
>3s	Active Device	**Green led** will fast blink 5 times, device will enter **OTA mode** for 3 seconds. And then start to attach NB-IoT network. Once sensor is active, BLE module will be active and user can connect via BLE to configure device, no matter if device attach NB-IoT network or not.

x5	Deactivate Device	**Red led** will solid on for 5 seconds. Means device is in Deep Sleep Mode.

Note: When the device is executing a program, the buttons may become invalid. It is best to press the buttons after the device has completed the program execution.

1.7 BLE connection

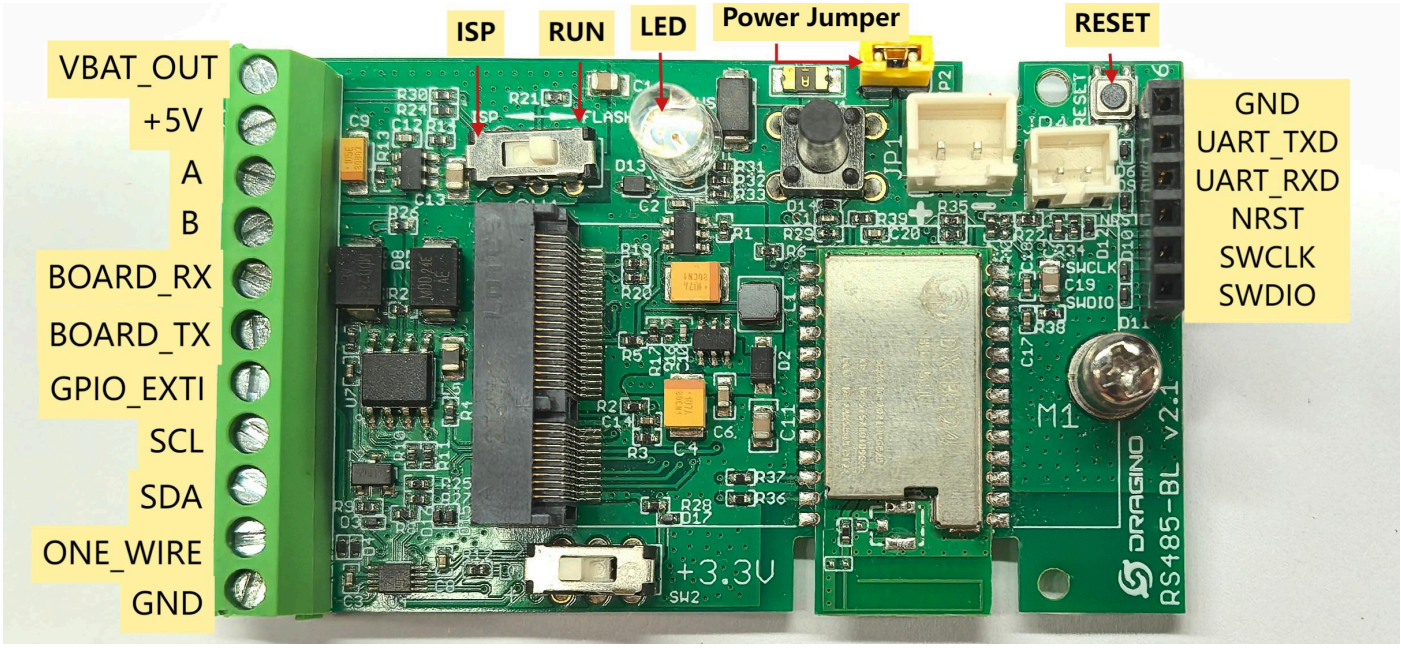
SPH01-NB support BLE remote configure and firmware update.

BLE can be used to configure the parameter of sensor or see the console output from sensor. BLE will be only activate on below case:

- Press button to send an uplink
- Press button to active device.
- Device Power on or reset.

If there is no activity connection on BLE in 60 seconds, sensor will shut down BLE module to enter low power mode.

1.8 Pin Definitions , Switch & SIM Direction



1.8.1 Jumper JP2

Power on Device when put this jumper.

1.8.2 BOOT MODE / SW1

1) ISP: upgrade mode, device won't have any signal in this mode. but ready for upgrade firmware. LED won't work. Firmware won't run.

2) Flash: work mode, device starts to work and send out console output for further debug

1.8.3 Reset Button

Press to reboot the device.

1.8.4 SIM Card Direction

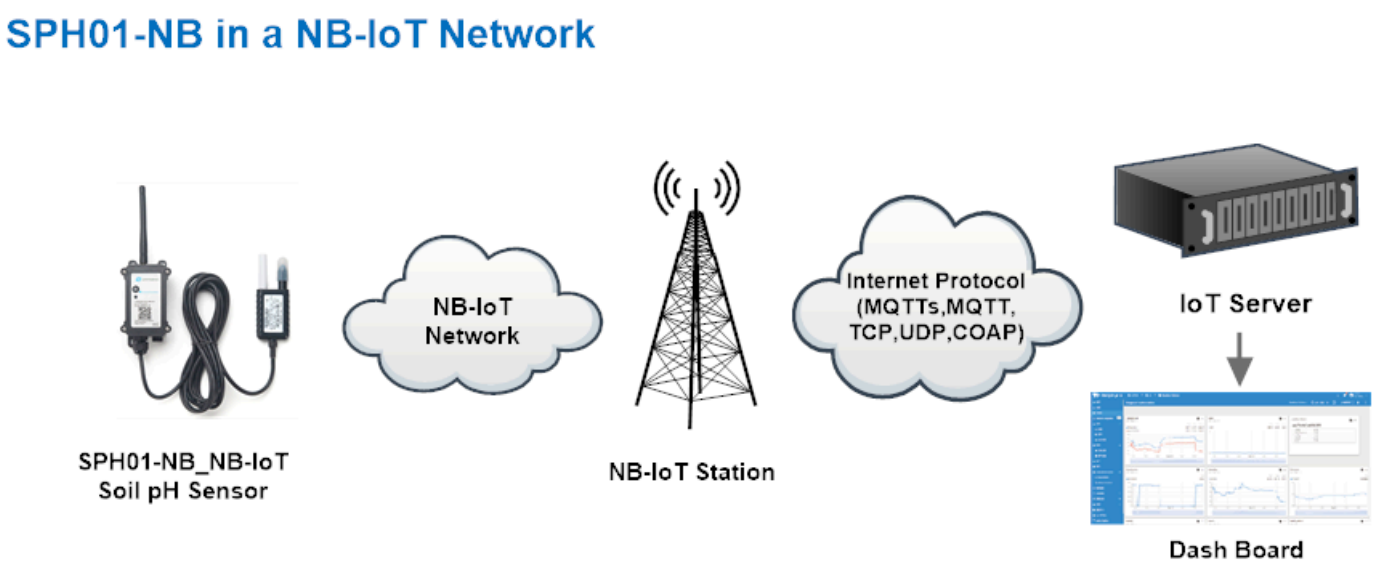
See this link. How to insert SIM Card.

2. Use SPH01-NB to communicate with IoT Server

2.1 Send data to IoT server via NB-IoT network

The SPH01-NB is equipped with a NB-IoT module, the pre-loaded firmware in SPH01-NB will get environment data from sensors and send the value to local NB-IoT network via the NB-IoT module. The NB-IoT network will forward this value to IoT server via the protocol defined by SPH01-NB.

Below shows the network structure:

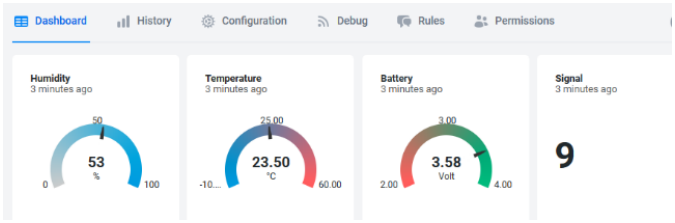
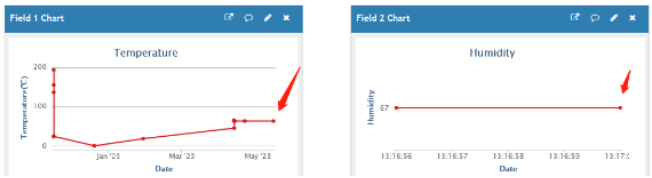
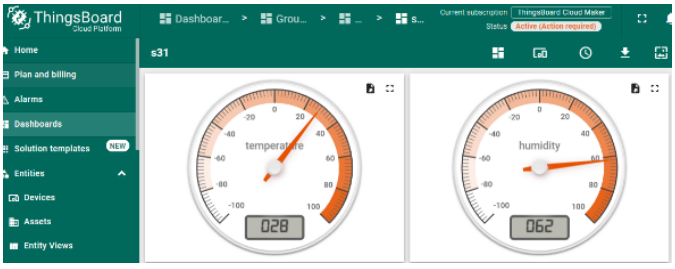


There are two version: **-GE** and **-1T** version of SPH01-NB.

GE Version: This version doesn't include SIM card or point to any IoT server. User needs to use AT Commands to configure below two steps to set SPH01-NB send data to IoT server.

- Install NB-IoT SIM card and configure APN. See instruction of Attach Network.
- Set up sensor to point to IoT Server. See instruction of Configure to Connect Different Servers.

Below shows result of different server as a glance.

Servers	Dash Board	Comments
Node-Red		
DataCake		
Tago.IO		
General UDP	Raw Payload. Need Developer to design Dash Board	
General MQTT	Raw Payload. Need Developer to design Dash Board	
ThingSpeak		
ThingsBoard		

1T Version: This version has 1NCE SIM card pre-installed and configure to send value to ThingsEye. User Just need to select the sensor type in ThingsEyeand Activate SPH01-NB and user will be able to see data in ThingsEye. See here for ThingsEye Config Instruction.

2.2 Payload Types

To meet different server requirement, SPH01-NB supports different payload type.

Includes:

- General JSON format payload. (Type=5)
- HEX format Payload. (Type=0)
- ThingSpeak Format. (Type=1)
- ThingsBoard Format. (Type=3)

User can specify the payload type when choose the connection protocol. Example:

AT+PRO=1,0 // Use COAP Connection & hex Payload

AT+PRO=1,5 // Use COAP Connection & Json Payload

AT+PRO=2,0 // Use UDP Connection & hex Payload

AT+PRO=2,5 // Use UDP Connection & Json Payload

AT+PRO=3,0 // Use MQTT Connection & hex Payload

AT+PRO=3,5 // Use MQTT Connection & Json Payload

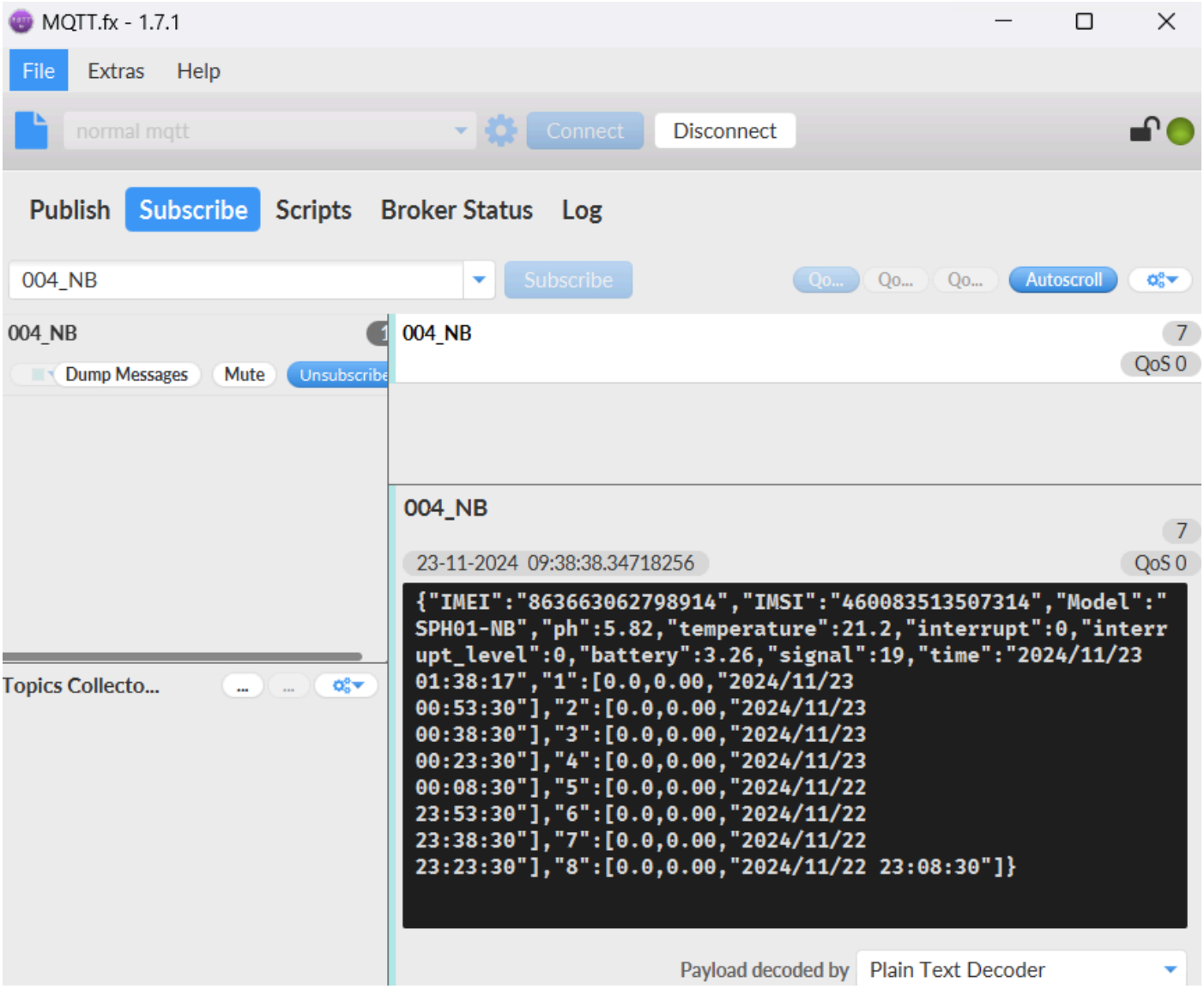
AT+PRO=4,0 // Use TCP Connection & hex Payload

AT+PRO=4,5 // Use TCP Connection & Json Payload

2.2.1 General Json Format(Type=5)

This is the General Json Format. As below:

{"IMEI":"863663062798914","IMSI":"460083513507314","Model":"SPH01-NB","ph":5.82,"temperature":21.2,"interrupt":0,"interrupt_level":0,"battery":3.26,"signal":19,"time":"2024/11/23 01:38:17","1":[0.0,0.00,"2024/11/23 00:53:30"],"2":[0.0,0.00,"2024/11/23 00:38:30"],"3":[0.0,0.00,"2024/11/23 00:23:30"],"4":[0.0,0.00,"2024/11/23 00:08:30"],"5":[0.0,0.00,"2024/11/22 23:53:30"],"6":[0.0,0.00,"2024/11/22 23:38:30"],"7":[0.0,0.00,"2024/11/22 23:23:30"],"8":[0.0,0.00,"2024/11/22 23:08:30"]}



Notice, from above payload:

- PH, Temperature, Interrupt, Interrupt_level, Battery, Signal & time are the value at uplink time.
- Json entry 1 ~ 8 are the last 1 ~ 8 sampling data as specify by **AT+CLOCKLOG=1,65535,15,8** Command. Each entry includes (from left to right): PH, Temperature, Sampling time.

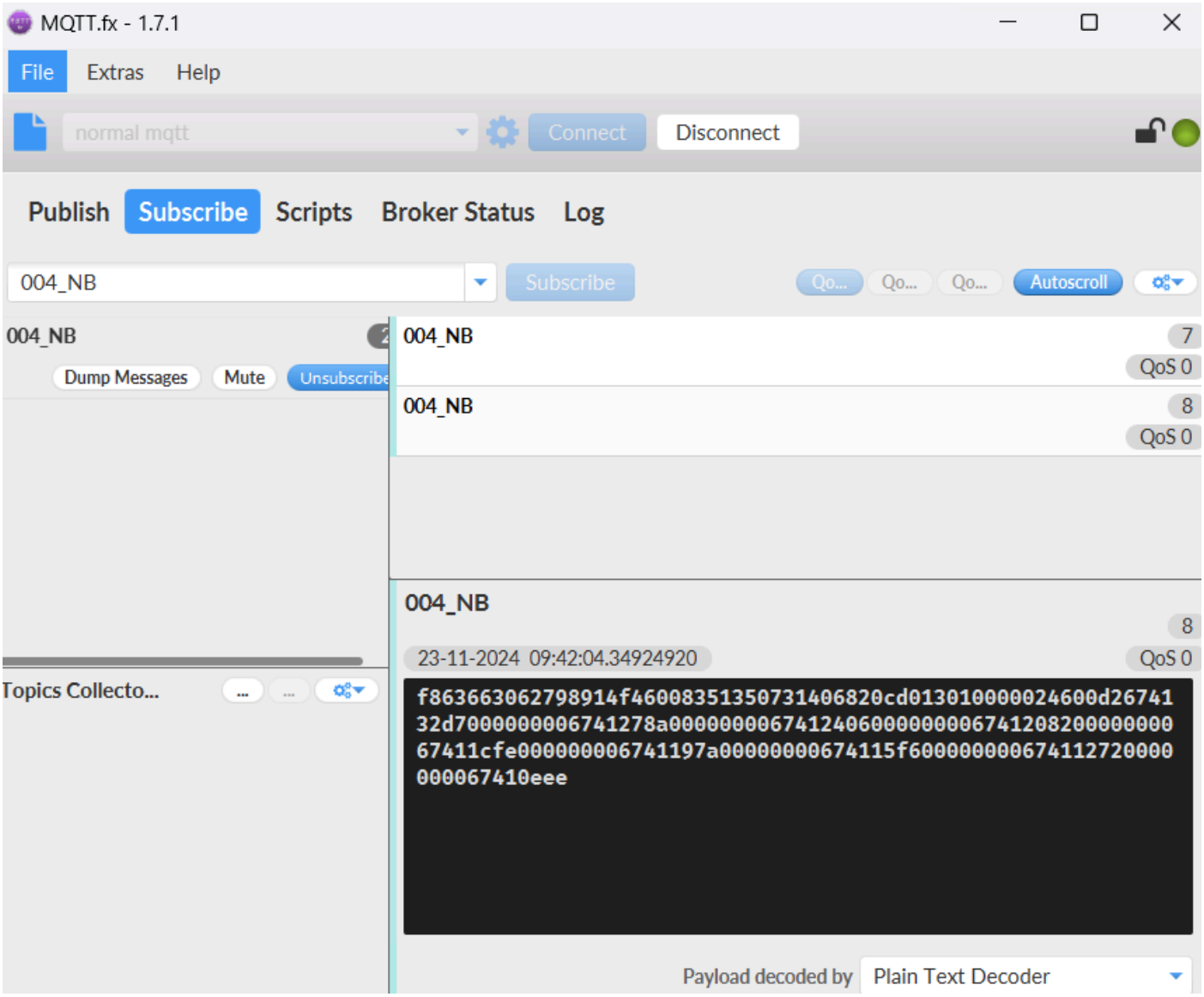
2.2.2 HEX format Payload(Type=0)

This is the HEX Format. As below:

f863663062798914f460083513507314068 20cd013010000024600d2674132d70000000067412 78a0000000067412406

HEX Format for SPH01-NB(AT+CLOCKLOG=1,65535,15,8)															
f863663062798914			f460083513507314	0682	0cd0	13	01	00	00	0246	00d2	674132d7			
f+IMEI			f+IMSI	Version	BAT	signal	Mod	Interrupt	Interrupt_level	Soil PH	Soil Temperature	Timestamp			
8 Bytes			8 Bytes	16 Bytes											
0000	0000	6741278a	0000000067412406	0000000067412082							0000000067411cfe				
Soil PH	Soil Temperature	Timestamp	last 2nd data	last 3rd data							last 4th data				
8 Bytes			8 Bytes	8 Bytes							8 Bytes				
000000006741197a			00000000674115f6	0000000067411272							0000000067410eee				
last 5th data			last 6th data	last 7th data							last 8th data				
8 Bytes			8 Bytes	8 Bytes							8 Bytes				

If we use the MQTT client to subscribe to this MQTT topic, we can see the following information when the NB sensor uplink data.



Version:

These bytes include the hardware and software version.

Higher byte: Specify Sensor Model: 0x06 for SPH01-NB

Lower byte: Specify the software version: 0x82=130, means firmware version 1.3.0

BAT (Battery Info):

Ex1: 0x0CC6 = 3270mV

Signal Strength:

NB-IoT Network signal Strength.

Ex1: 0x18 = 24

0 -113dBm or less

1 -111dBm

2...30 -109dBm... -53dBm

31 -51dBm or greater

99 Not known or not detectable

Soil pH

Range: 0 ~ 14 pH

Example:

0x02B7(H) = 695(D) = 6.95pH

Soil Temperature

Get Soil Temperature

Example:

If payload is: **0105H**: (0105 & FC00 == 0), temp = 0105H /10 = 26.1 degree

If payload is: **FF3FH** : (FF3F & FC00 == 1) , temp = (FF3FH - 65536)/10 = -19.3 degrees.

Interrupt:

This data field shows if this packet is generated by interrupt or not.

Example:

0x00: Normal uplink packet.

0x01: Interrupt Uplink Packet.

Interrupt_level:

This byte shows whether the interrupt is triggered by a high or low level.

Ex1: 0x00 Interrupt triggered by falling edge (low level)

Ex2: 0x01 Interrupt triggered by rising edge (high level)

TimeStamp:

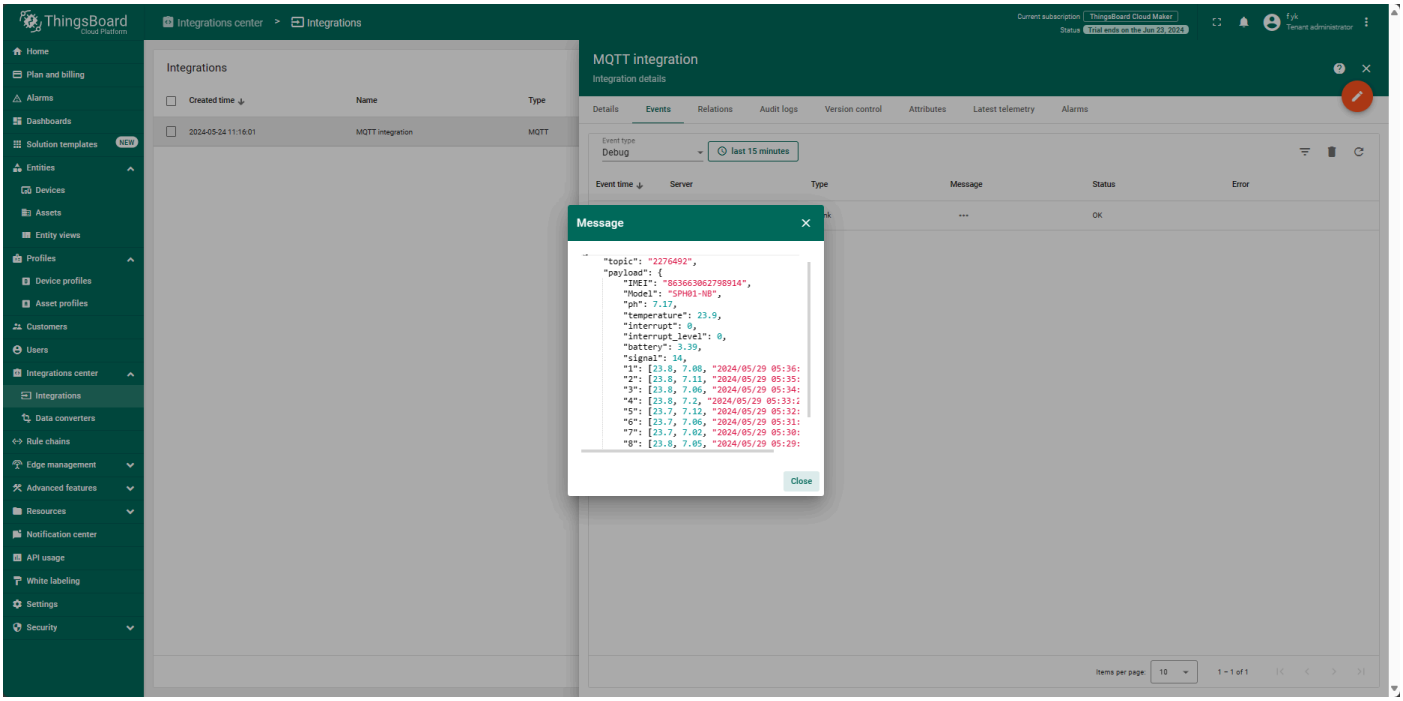
Unit TimeStamp Example: 64d49439(H) = 1691653177(D)

Put the decimal value into this link(https://www.epochconverter.com) to get the time.

2.2.3 ThingsBoard Payload(Type=3)

Type3 payload special design for ThingsBoard, it will also configure other default server to ThingsBoard.

```
{
  "topic": "2276492",
  "payload": {
    "IMEI": "863663062798914",
    "Model": "SPH01-NB",
    "ph": 7.17,
    "temperature": 23.9,
    "interrupt": 0,
    "interrupt_level": 0,
    "battery": 3.39,
    "signal": 14,
    "1": [23.8, 7.08, "2024/05/29 05:36:25"],
    "2": [23.8, 7.11, "2024/05/29 05:35:50"],
    "3": [23.8, 7.06, "2024/05/29 05:34:25"],
    "4": [23.8, 7.2, "2024/05/29 05:33:25"],
    "5": [23.7, 7.12, "2024/05/29 05:32:25"],
    "6": [23.7, 7.06, "2024/05/29 05:31:25"],
    "7": [23.7, 7.02, "2024/05/29 05:30:25"],
    "8": [23.8, 7.05, "2024/05/29 05:29:25"]
  }
}
```

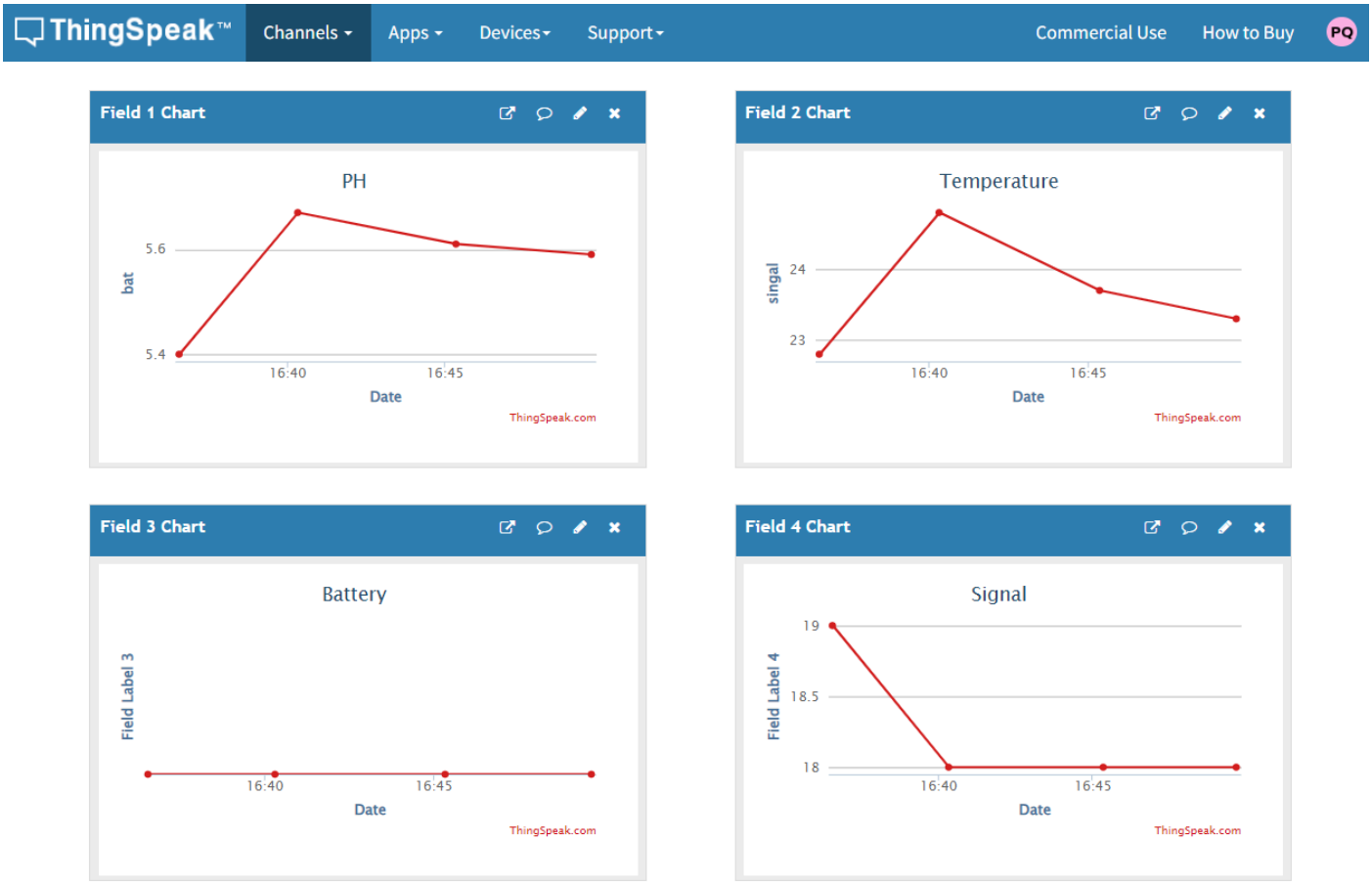
2.2.4 ThingSpeak Payload(Type=1)

This payload meets ThingSpeak platform requirement. It includes only four fields. Form 1~4 are:

PH, Temperature, Battery & Signa. This payload type only valid for ThingsSpeak Platform.

As below:

field1=PH value&field2=Temperature value&&field3=Battery value&field4=Signal value



2.3 Test Uplink and Change Update Interval

By default, Sensor will send uplinks **every 2 hours**

User can use below commands to change the uplink interval.

AT Command: AT+TDC

Example: AT+TDC=7200 // Set Update Interval to 7200 seconds

Downlink Command: 0x01

Format: Command Code (0x01) followed by 3 bytes.

Example: 12 hours= 43200 seconds 43200(D)=0xA8C0(H)

Downlink Payload: **01 00 A8 C0** // AT+TDC=43200, Set Update Interval to 12 hours.

Note: User can also push the button for more than 1 second to activate an uplink.

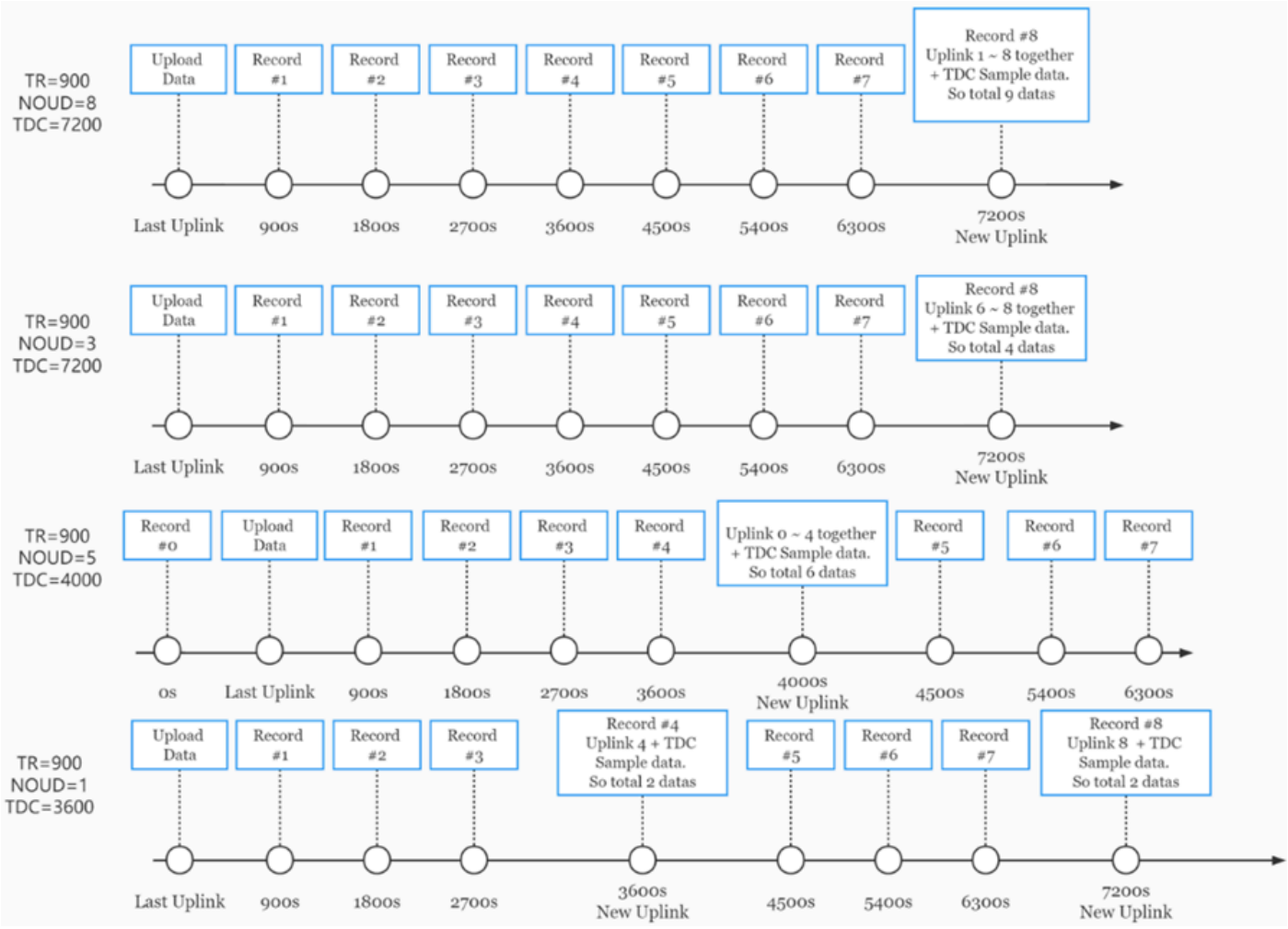
2.4 Multi-Samplings and One uplink

Notice: The AT+NOUD feature is upgraded to Clock Logging, please refer Clock Logging Feature

To save battery life, SPH01-NB will sample temperature & humidity data every 15 minutes and send one uplink every 2 hours. So each uplink it will include 8 stored data + 1 real-time data. They are defined by:

- **AT+TR=900** // The unit is seconds, and the default is to record data once every 900 seconds (15 minutes, the minimum can be set to 180 seconds)
- **AT+NOUD=8** // The device uploads 8 sets of recorded data by default. Up to 32 sets of record data can be uploaded.

The diagram below explains the relationship between TR, NOUD, and TDC more clearly:



2.5 Trggier an uplink by external interrupt

SPH01-NB has an external trigger interrupt function. Users can use the GPIO_EXTI pin to trigger the upload of data packets.

AT command:

- **AT+INTMOD** // Set the trigger interrupt mode
- **AT+INTMOD=0** // Disable Interrupt
- **AT+INTMOD=1** // Trigger by rising and falling edge
- **AT+INTMOD=2** // Trigger by falling edge
- **AT+INTMOD=3** // Trigger by rising edge

2.6 Installation and Maintain

2.6.1 Before measurement

If the SPH01-NB has more than 7 days not use or just clean the pH probe. User should put the probe inside pure water for more than 24 hours for activation. If no put in water, user need to put inside soil for more than 24 hours to ensure the measurement accuracy.

2.6.2 Measurement

Measurement the soil surface:

Choose the proper measuring position. Split the surface soil according to the measured deep.

Put pure water, or rainwater to make the soil of measurement point to moist mud. Remove rocks or hard things.

Slowly insert the probe to the measure point. Don't use large force which will break the probe. Make sure not shake when inserting.

Put soil over the probe after insert. And start to measure.

Measurement inside soil:

Dig a hole with diameter > 20CM.

Insert the probe inside, method like measure the surface.

2.6.3 Maintain Probe

1. pH probe electrode is fragile and no strong. User must avoid strong force or hitting it.

2. After long time use (3~ 6 months). The probe electrode needs to be clean; user can use high grade sandpaper to polish it or put in 5% hydrochloric acid for several minutes. After the metal probe looks like new, user can use pure water to wash it.

3. Probe reference electrode is also no strong, need to avoid strong force or hitting.

4. User should keep reference electrode wet while not use.

5. Avoid the probes to touch oily matter. Which will cause issue in accuracy.

6. The probe is IP68 can be put in water.

2.7 Calibration

User can do calibration for the probe. It is limited to use below pH buffer solution to calibrate: 4.00, 6.86, 9.18. When calibration, user need to clean the electrode and put the probe in the pH buffer solution to wait the value stable (a new clean electrode might need max 24 hours to be stable).

After stable, user can use below command to calibrate.

pH buffer solution	AT Command to calibrate	Downlink Command	Read Cal Value
4.00	AT+PHCAL=4	0x09 04 Reply with Calibrate payload	AT+PHCAL=? Example 41,61,91
6.86	AT+PHCAL=6	0x09 06 Reply with Calibrate payload	AT+PHCAL=?
9.18	AT+PHCAL=9	0x09 09 Reply with Calibrate payload	AT+PHCAL=?
Factory Default	AT+PHCAL=15	0x09 15 Reply with Calibrate payload	AT+PHCAL=? Example 151

Calibration Payload

Size(bytes)	1	1	1	7	1
Value	PH4 Calibrate value	PH6.86 Calibrate value	PH9.18 Calibrate value	Reserve	Message Type Always 0x03

User can also send 0x14 downlink command to poll the current calibration payload.

Downlink Control Type	FPort	Type Code	Downlink payload size(bytes)
Get Calibration Version Info	Any	14	2

- Reply to the confirmation package: 14 01
- Reply to non-confirmed packet: 14 00

2.8 Set alarm of Temp/PH

On each sampling define by AT+CLOCKLOG=1,65535,**15**,8 (default 15 minutes), when the value exceed the range, it will trigger an Alarm and immediately sends a uplink.

AT Command:

AT+TEMPALARM=min,max

Example: AT+TEMPALARM=20,30 // Alarm when temperature lower than 20 or higher than 30

AT+PHALARM=min,max

Example: AT+PHALARM=5,8 // Alarm when PH lower than 5 or higher than 8.

Downlink Command: 0x08

Format: Command Code (0x08) followed by 4 bytes.

The first and second bytes following the function code are the minimum and maximum value of **TEMP**, and the third and fourth bytes are the minimum and maximum value of **PH**.

- **Example 1**: Downlink Payload: **08 14 1E 05 08** // AT+TEMPALARM=20,30 & AT+PHALARM=5,8
- **Example 2**: Downlink Payload: **08 00 00 00 00** // disable temperature and PH alarm.

Notice:

- To disable Alarm, user can set min and max to same value , such as **AT+TEMPALARM=0,0 and AT+PHALARM=5,5**
- If user only want to send only min or max, user can set the alarm to a value that device won't reach. For example: **AT+TEMPALARM=-80,0**(Alarm above 0 degrees Celsius).

2.9 Clock logging (Since firmware version v1.2.1)

Sometimes when we deploy lots of end nodes in field. We want all sensors sample data at the same time, and upload these data together for analyze. In such case, we can use clock loging feature.

We can use this command to set the start time of data recording and the time interval to meet the requirements of the specific collection time of data.

- **AT Command: AT+CLOCKLOG=a,b,c,d**

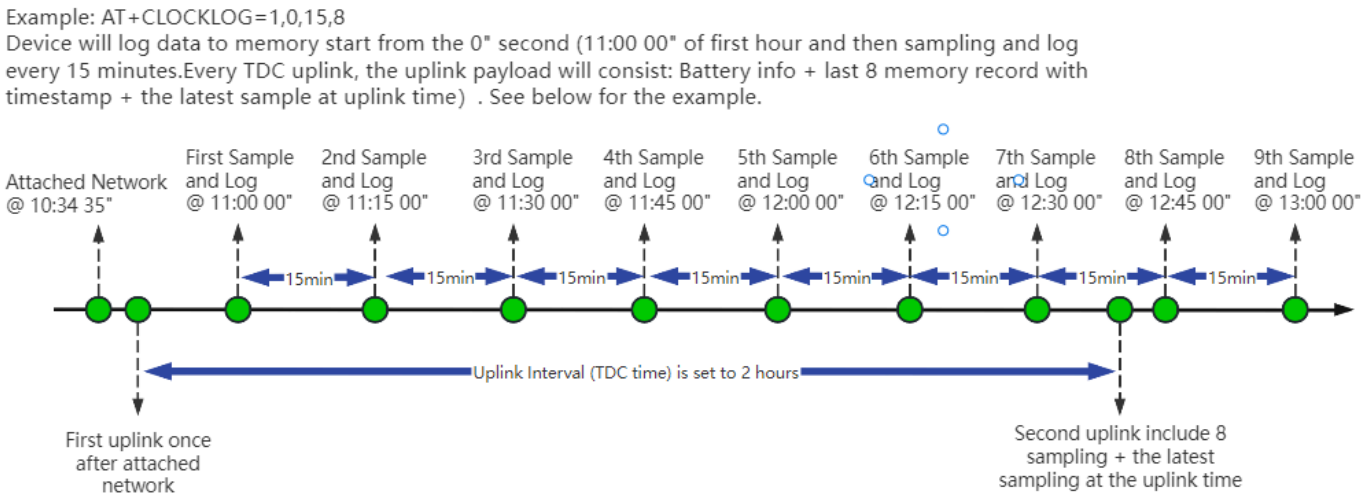
a: 0: Disable Clock logging. **1:** Enable Clock Logging

b: Specify First sampling start second: range **(0 ~ 3599, 65535)** // **Note:** If parameter b is set to 65535, the log period starts after the node accesses the network and sends packets.

c: Specify the sampling interval: range **(0 ~ 255 minutes)**

d: How many entries should be uplink on every TDC **(max 32)**

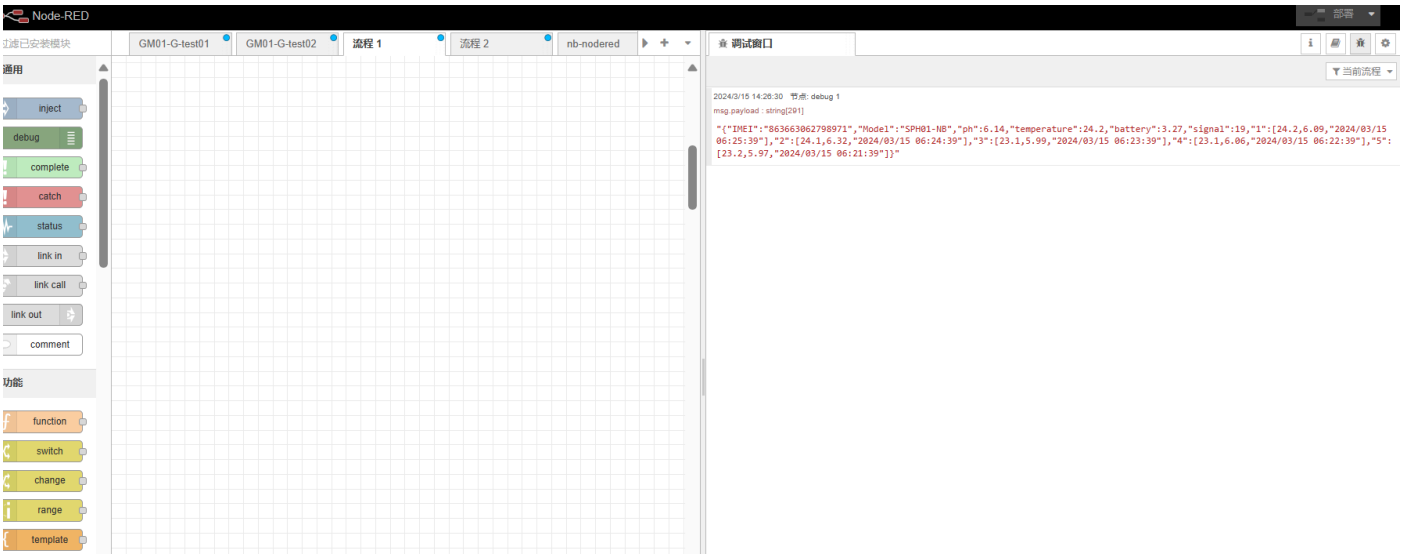
Note: To disable clock recording, set the following parameters: AT+CLOCKLOG=1,65535,0,0



Example:

AT+CLOCKLOG=1,65535,1,5

After the node sends the first packet, data is recorded to the memory at intervals of 1 minute. For each TDC uplink, the uplink load will include: battery information + the last 5 memory records (payload + timestamp).



Note: Users need to synchronize the server time before configuring this command. If the server time is not synchronized before this command is configured, the command takes effect only after the node is reset.

- **Downlink Command: 0x0A**

Format: Command Code (0x0A) followed by 5 bytes.

- **Example 1**: Downlink Payload: **0A01FFFF0F08** // Set SHT record time: AT+CLOCKLOG=1,65535,15,8

- **Example 1**: Downlink Payload: **0A0104B00F08** // Set SHT record time: AT+CLOCKLOG=1,1200,15,8

Note: When entering the downlink payload, there must be no Spaces between bytes.

2.10 Datalog Function(Since firmware version v1.3.4)

2.10.1 Unix TimeStamp

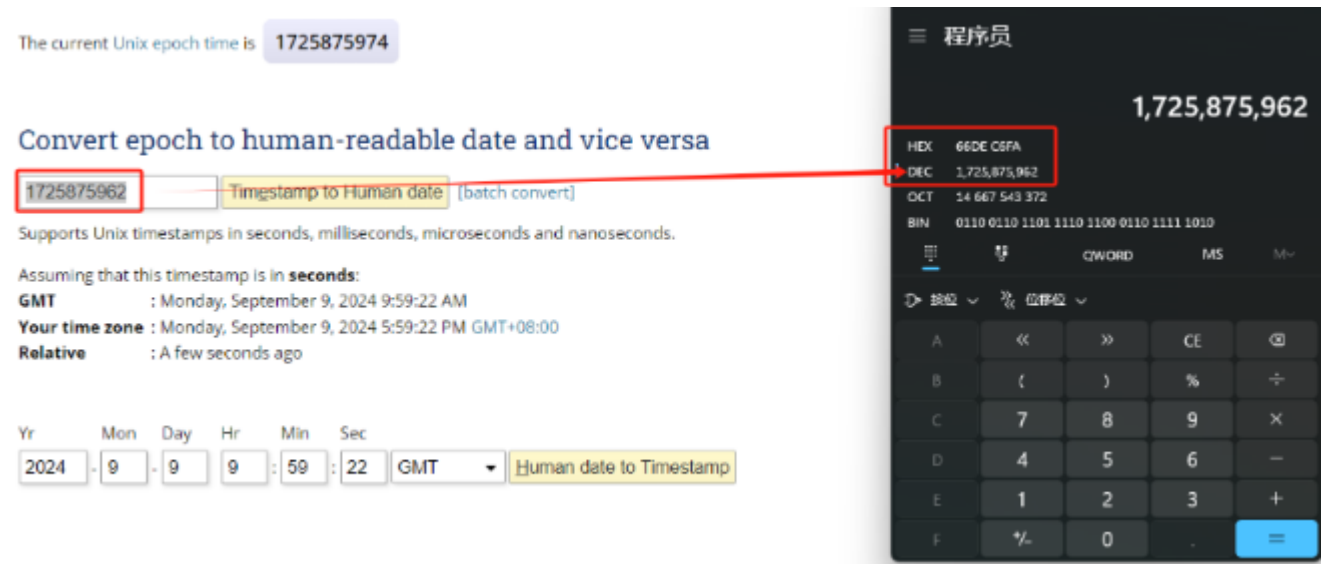
SPH01-NB uses Unix TimeStamp format based on

Size (bytes)	4	1
DeviceTimeAns Payload	32-bit unsigned integer : Seconds since epoch*	8bits unsigned integer: fractional-second in ½^8 second steps

Figure 10 : DeviceTimeAns payload format

User can get this time from link: https://www.epochconverter.com/ :

Below is the converter example



So, 1725875962 means that the current time is Monday, September 9, 2024 at 9:59 AM.

2.10.2 Poll sensor value

User can poll sensor value based on timestamps from the server. Below is the downlink command.

1 byte	4 bytes	4 bytes
31	Timestamp start	Timestamp end

Timestamp start and Timestamp end use Unix TimeStamp format as mentioned above. Devices will reply with all data log during this time period.

For example, downlink command **31 68A3 0F7C 68A3 114C**

Is to check 2025/8/18 11:33:00 to 2025/8/18 11:41:00's data

2.10.3 Datalog Uplink payload

The Datalog poll reply uplink will use below payload format.

Retrieval data payload:

Size(bytes)	2	2	4
value	PH1	temp	Timestamp

Function Description: This feature is only used when the clock logging feature is turned on. one uplink packet can send **64** groups of stored data totaling **512** bytes.

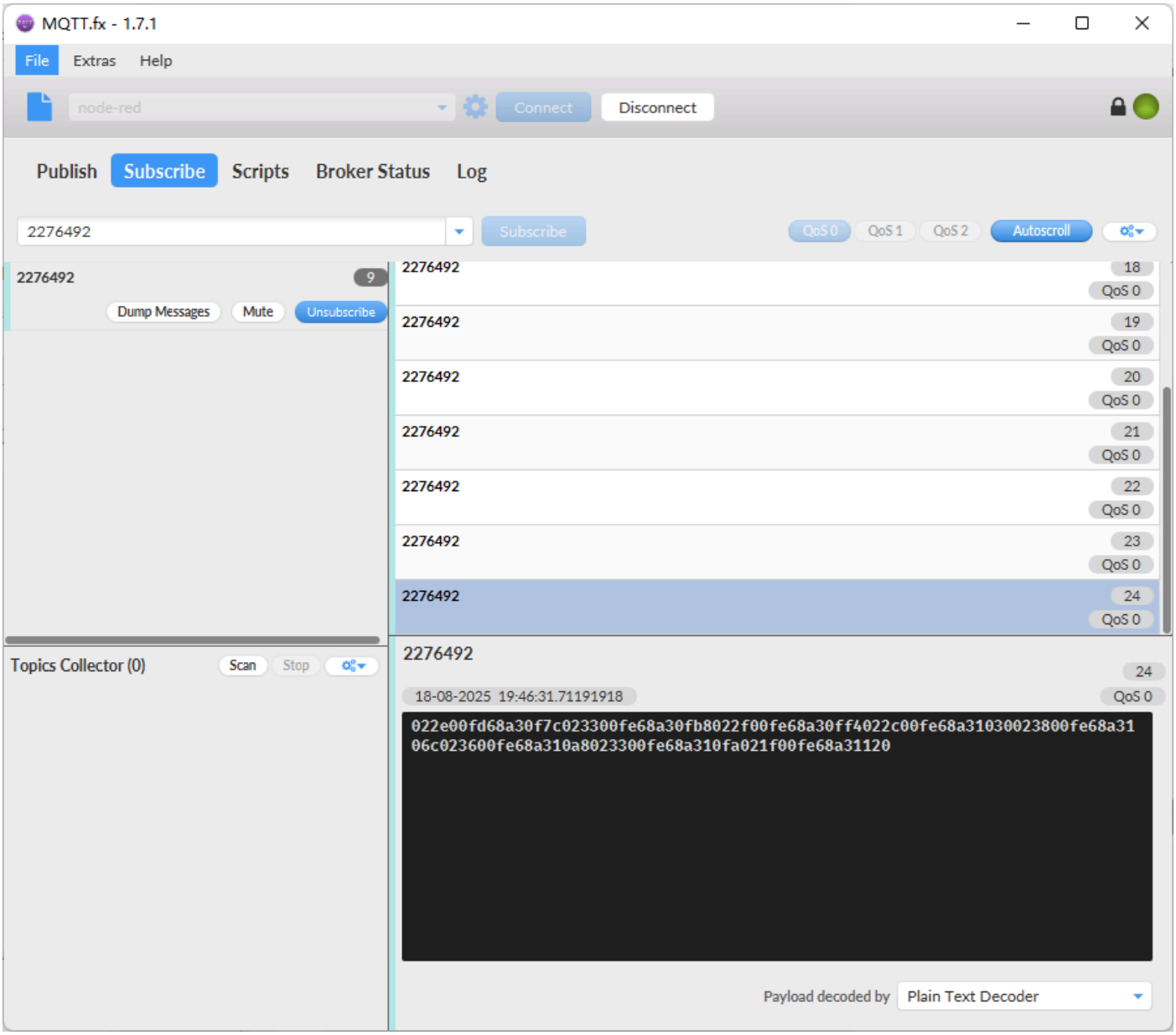
Example(For MQTT.fx):

If user sends below downlink command:

Where : Start time: 68A30F7C= time 25/8/18 11:33:00

Stop time: 68A3114C= time 25/8/18 11:41:00

SPH01-NB will uplink this payload.



0x022e00fd68a30f7c023300fe68a30fb8022f00fe68a30ff4022c00fe68a31030023800fe68a3106c023600fe68a310a80233

SPH01-NB(8 groups for example)			
022e 00fd 68a30f7c	**023300fe68a30fb8**	**022f00fe68a30ff4**	**022c00fe68a31030**
PH1 Temp Timestamp	**2nd data**	**3rd data**	**4th data**
8 Bytes	8 Bytes	8 Bytes	8 Bytes
023800fe68a3106c	**023600fe68a310a8**	**023300fe68a310fa**	**021f00fe68a31120**
5th data	**6th data**	**7th data**	**8th data**
8 Bytes	8 Bytes	8 Bytes	8 Bytes

PH1= 0x022e/10=55.8

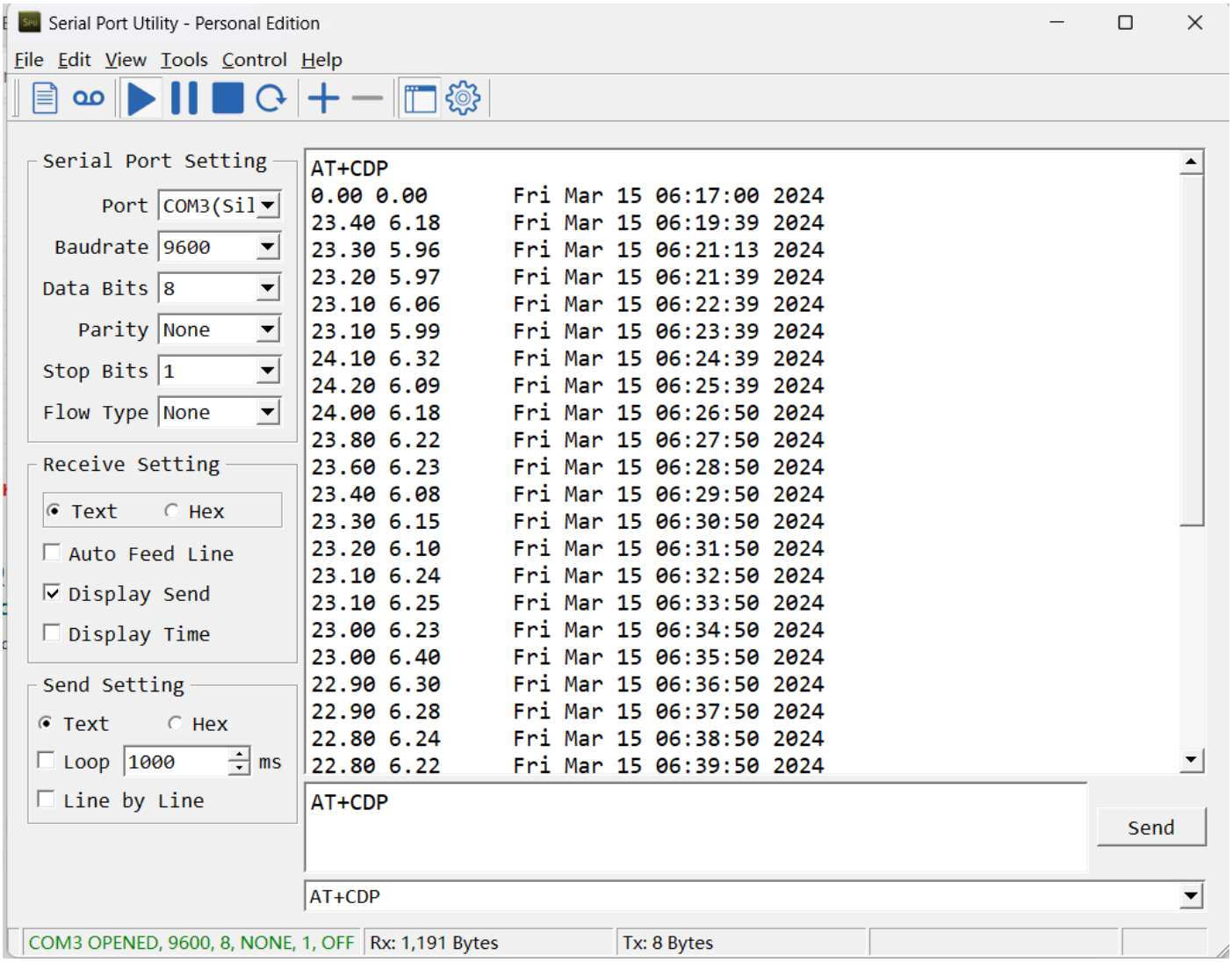
Temp=0x00fd/10=25.3℃

Unix time is 0x68a30f7c = 1755516796s = 25/8/18 11:33:00

2.11 Example Query saved historical records

- **AT Command: AT+CDP**

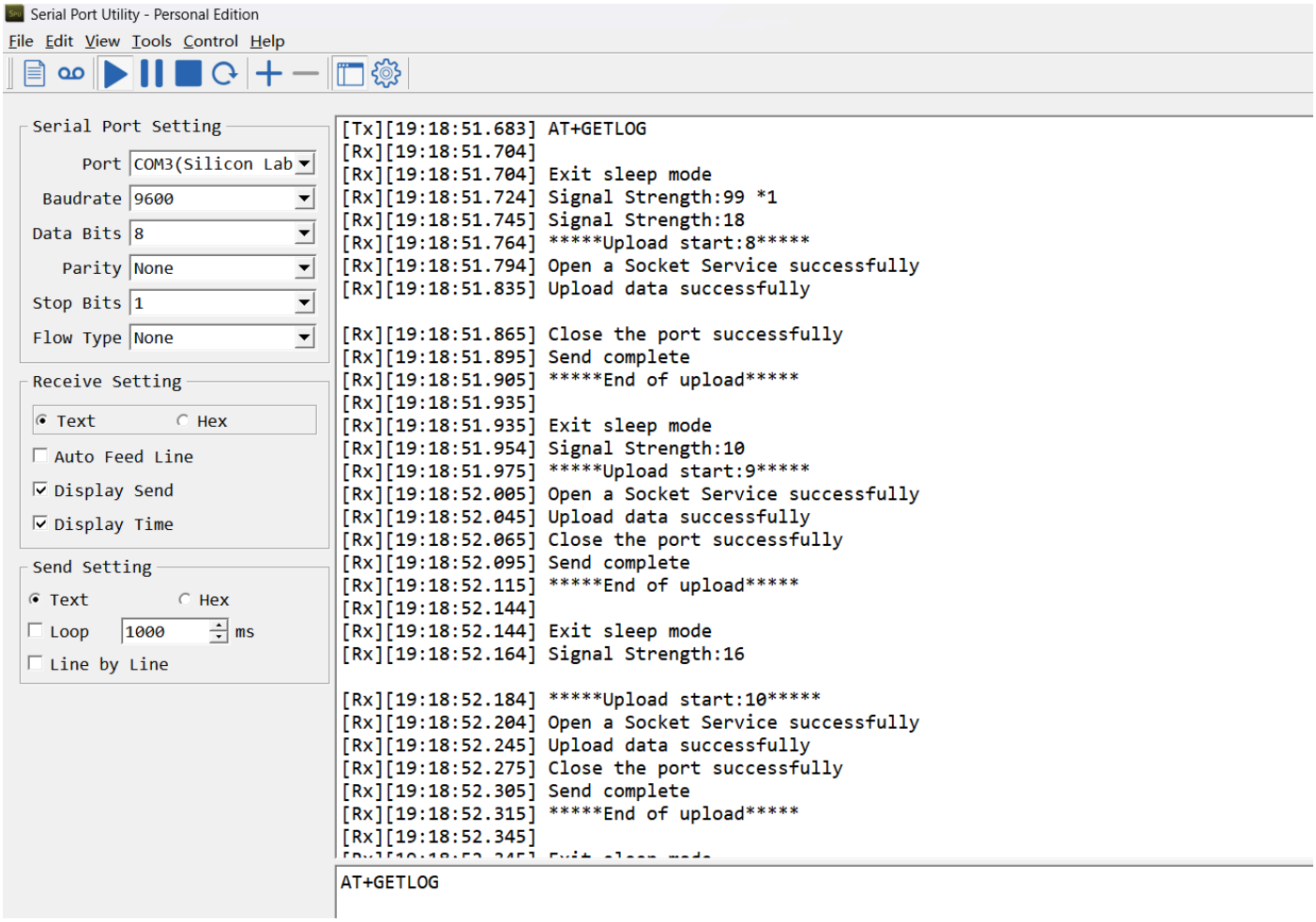
This command can be used to search the saved history, recording up to 32 groups of data, each group of historical data contains a maximum of 100 bytes.



2.12 Uplink log query

- **AT Command: AT+GETLOG**

This command can be used to query upstream logs of data packets.



2.13 Scheduled domain name resolution

This command is used to set up scheduled domain name resolution

AT Command:

- **AT+DNSTIMER=XX** // Unit: hour

After setting this command, domain name resolution will be performed regularly.

2.14 Set the QoS level

This command is used to set the QoS level of **MQTT**.

AT Command:

- **AT+MQOS=xx** // 0~2

Downlink Command: 0x07

Format: Command Code (0x07) followed by 1 byte.

Ex1: Downlink payload: **0x0700** // AT+MQOS=0

Ex2: Downlink payload: **0x0701** // AT+MQOS=1

2.15 Set the downlink debugging mode(Since firmware v1.3.0)

Feature: Enable or disable downlink debugging mode. (Since TE platform update, the platform version selection is no longer needed; only downlink debugging can be toggled.)

AT command: AT+DOWNTE

Command Example	Function/Parameters	Response/Explanation
AT+DOWNTE=?	Get current Settings	0,0 (default) OK
AT+DOWNTE=0,a	a: Enable/Disable downlink debugging	0: Disable downlink debugging mode. 1: Enable downlink debugging mode (users can view original downlink messages).

(Note: The first parameter is fixed to 0 and only the second parameter is configurable.)

Example:

- AT+DOWNTE=0,1 → Enable downlink debugging mode.
- AT+DOWNTE=0,0 → Disable downlink debugging mode.

Downlink Command:

No downlink commands for feature

2.16 Domain name resolution settings(Since firmware v1.3.0)

Feature: Set dynamic domain name resolution IP.

AT command: AT+BKDNS

Command Example	Function/Parameters	Response/Explanation

AT+BKDNS=?	Get current Settings	0,0,NULL (default) OK
AT+BKDNS=a,b,c	**a**: Enable/Disable dynamic domain name resolution.	**1**: Disable dynamic domain name update. The ip address will be saved after the domain name is resolved, if the next domain name resolution fails, the last saved ip address will be used. **2**: Enable dynamic domain name update. The ip address will be saved after domain name resolution, if the next domain name resolution fails, the last saved ip address will be used, and the domain name resolution will be updated regularly according to the time set by the customer.
	b: Set the time to update the domain name resolution at regular intervals.	Unit: hour
	c: Set the IP address manually.	The format is the same as AT+SERVADDR. If domain name resolution fails, this ip address will be used directly, if domain name resolution succeeds, parameter c will be updated to the successfully resolved IP address.

Example:

- AT+BKDNS=1,0 // Dynamic domain name resolution is disabled.
- AT+BKDNS=2,1 // The dynamic domain name resolution function is enabled and the automatic update time is set to 1 hour.
- AT+BKDNS=2,4,3.69.98.183,1883 // The dynamic domain name resolution function is enabled and the automatic update time is set to 4 hour, and manually set the ip address, if the domain name failed to resolve, it will directly use this ip to communicate. When the next domain name resolution is successful, it will be updated to the ip address of the successful resolution.

Downlink Command:

No downlink commands for feature

2.17 Set CoAP option

This command sets the connection parameters of the COAP.

AT command:

- AT+URI1 // CoAP option name, CoAP option length, "CoAP option value"
- AT+URI2 // CoAP option name, CoAP option length, "CoAP option value"

- AT+URI3 // CoAP option name, CoAP option length, "CoAP option value"
- AT+URI4 // CoAP option name, CoAP option length, "CoAP option value"

Example:

- AT+URI1=11,38,"i/faaa241f-af4a-b780-4468-c671bb574858"

2.23 Print last few data entries(Since firmware v1.3.4)

Feature: Print the last few data entries

AT command: AT+PLDTA

Command Example	Response
AT+PLDTA=8 Print last 8 entries	Stop Tx events when read sensor data 1 25/8/18 11:33:16 ph=5.58 temp=25.3 2 25/8/18 11:34:16 ph=5.63 temp=25.4 3 25/8/18 11:35:16 ph=5.59 temp=25.4 4 25/8/18 11:36:16 ph=5.56 temp=25.4 5 25/8/18 11:37:16 ph=5.68 temp=25.4 6 25/8/18 11:38:16 ph=5.66 temp=25.4 7 25/8/18 11:39:38 ph=5.63 temp=25.4 8 25/8/18 11:40:16 ph=5.43 temp=25.4 Start Tx events OK

Downlink Command:

No downlink commands for feature

2.24 Print data entries base on page(Since firmware v1.3.4)

Feature: Print the sector data from start page to stop page.

AT command: AT+PDTA

Command Example	Response

AT+PDTA=1,1 Print page 1 to 1	Stop Tx events when read sensor data 8028A00 25/8/2 07:08:33 ph=2.70 temp=27.2 8028A08 -30/1/1 00:04:29 ph=0.00 temp=0.0 8028A10 25/8/2 07:09:33 ph=2.70 temp=27.2 8028A18 -30/1/1 00:04:29 ph=0.00 temp=0.0 8028A20 25/8/2 07:10:33 ph=2.70 temp=27.3 8028A28 -30/1/1 00:04:29 ph=0.00 temp=0.0 8028A30 25/8/2 07:11:33 ph=2.70 temp=27.3 8028A38 -30/1/1 00:04:30 ph=0.00 temp=0.0 8028A40 25/8/2 07:12:33 ph=2.70 temp=27.3 8028A48 -30/1/1 00:04:30 ph=0.00 temp=0.0 8028A50 25/8/2 07:13:33 ph=2.71 temp=27.3 8028A58 -30/1/1 00:04:30 ph=0.00 temp=0.0 8028A60 25/8/2 07:14:33 ph=2.71 temp=27.3 8028A68 -30/1/1 00:04:30 ph=0.00 temp=0.0 8028A70 25/8/2 07:15:33 ph=2.71 temp=27.3 8028A78 -30/1/1 00:04:30 ph=0.00 temp=0.0 Start Tx events OK

Downlink Command:

No downlink commands for feature

2.25 Clear Flash Record(Since firmware v1.3.4)

Feature: Clear flash storage for data log feature.

AT command: AT+CLRDTA

Command Example	Function	Response

AT+CLRDTA	Clear date record	Stop Tx events,Please wait for the erase to complete Clear all stored sensor data... Start Tx events OK

Downlink Command: 0x32

- Example: 0x32 00 // Same as AT+CLRDTA

3. Configure SPH01-NB

3.1 Configure Methods

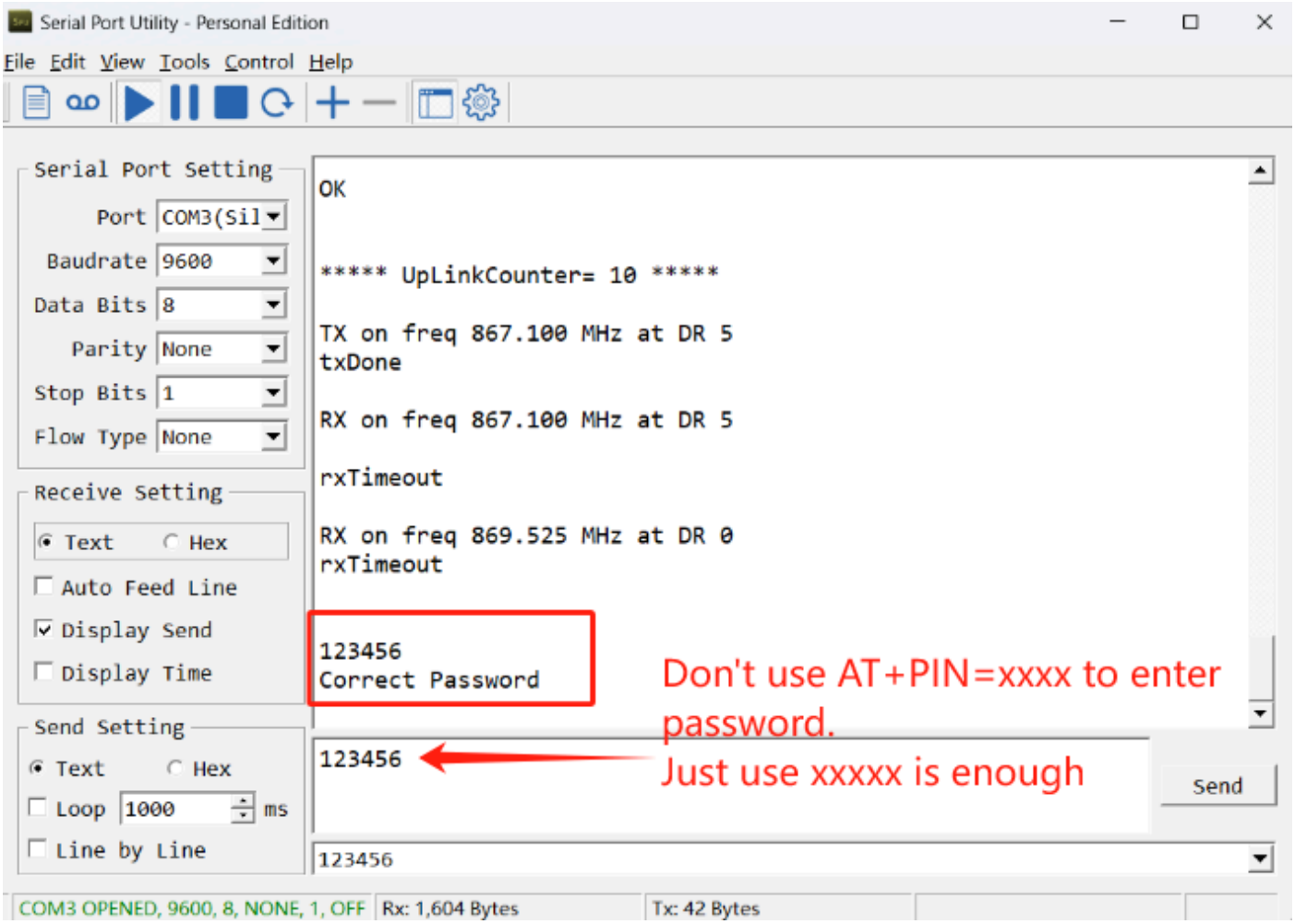
SPH01-NB supports below configure method:

- AT Command via Bluetooth Connection (**Recommended**): BLE Configure Instruction.
- AT Command via UART Connection : See UART Connection.

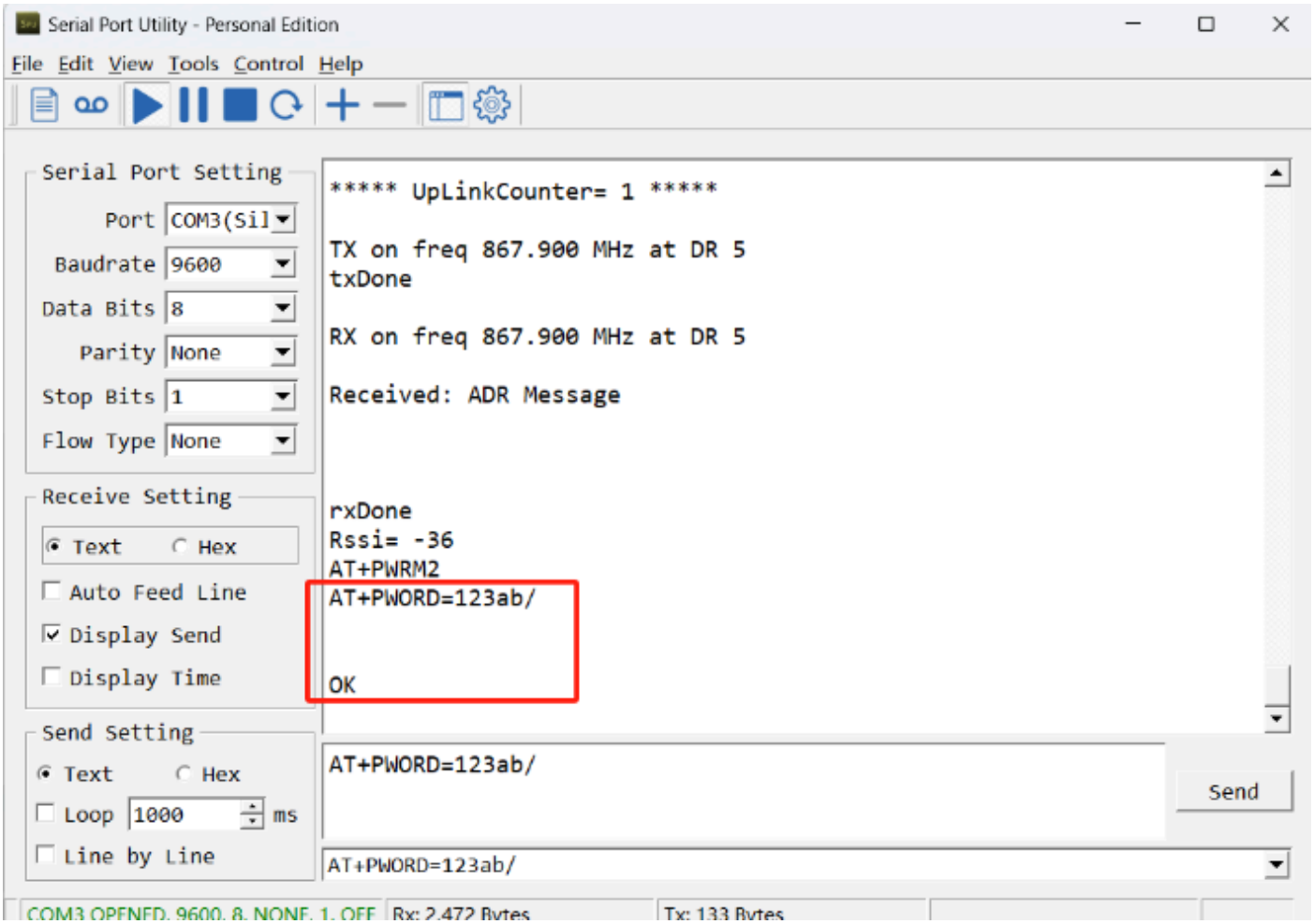
3.2 Serial Access Password

After the Bluetooth or UART connection is successful, use the Serial Access Password to enter the AT command window.

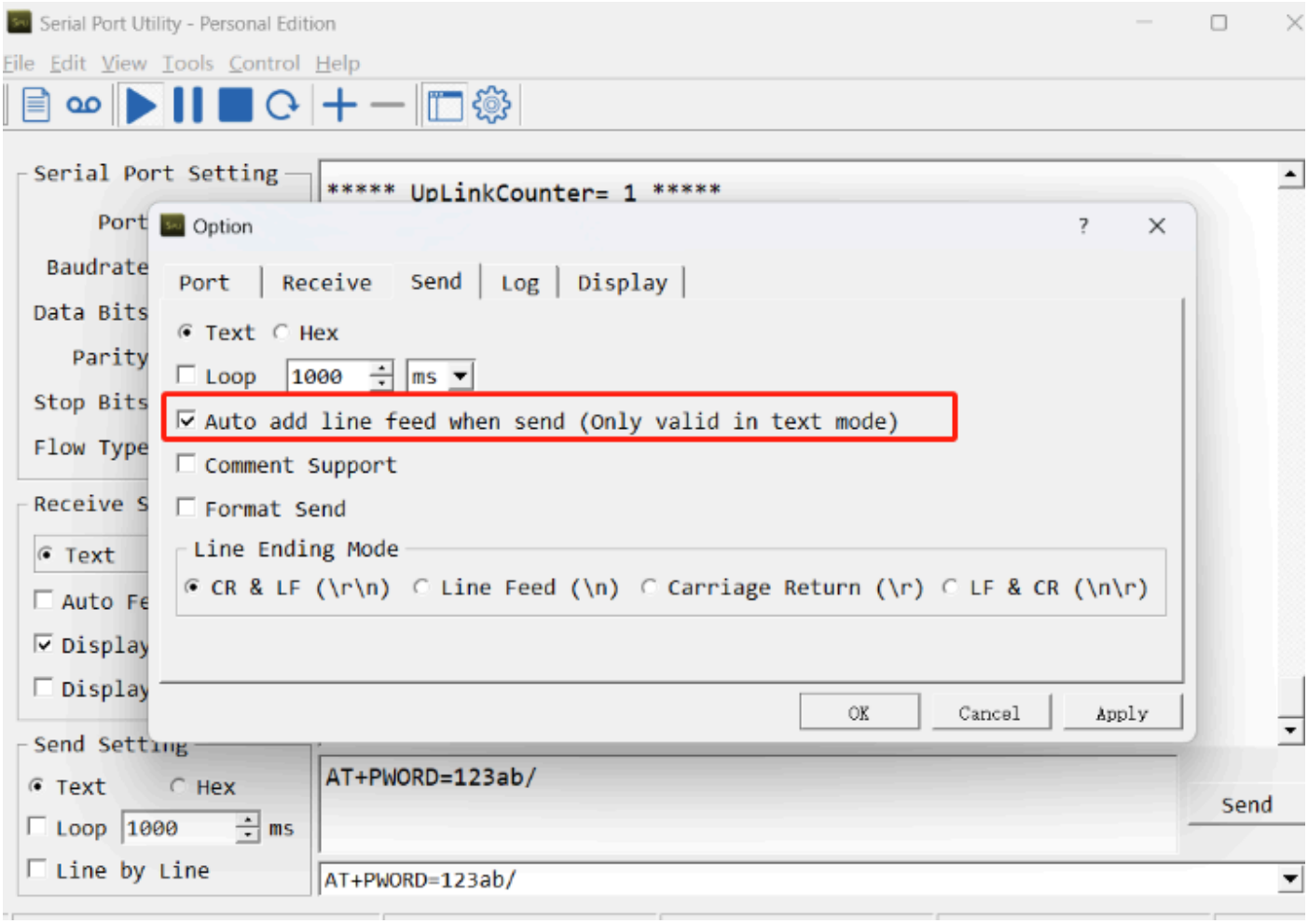
The label on the box of the node will print the initial password: AT+PIN=**xxxxxx**, and directly use the six-digit password to access the AT instruction window.



If you need to change the password, use **AT+PWORD=**xxxxxx (6 characters), NB nodes only support lowercase letters.



Note: After entering the command, you need to add a line break, and you can also set automatic line breaks in the Bluetooth tool or UART connection tool.



3.3 AT Commands Set

AT+<CMD>? : Help on <CMD>

AT+<CMD> : Run <CMD>

AT+<CMD>=<value> : Set the value

AT+<CMD>=? : Get the value

General Commands

AT : Attention

AT? : Short Help

ATZ : MCU Reset

AT+TDC : Application Data Transmission Interval

AT+CFG : Print all configurations

AT+CFGMOD : Working mode selection

AT+DEUI : Get or set the Device ID

AT+INTMOD : Set the trigger interrupt mode

AT+5VT : Set extend the time of 5V power

AT+PRO : Choose agreement

AT+RXDL : Extend the sending and receiving time

AT+DNSCFG : Get or Set DNS Server

AT+GETSENSORVALUE : Returns the current sensor measurement

AT+NOUD : Get or Set the number of data to be uploaded

AT+CDP : Read or Clear cached data

AT+TEMPALARM : Get or Set alarm of temp

AT+PHALARM : Get or Set alarm of PH

AT+SERVADDR : Server Address

MQTT Management

AT+CLIENT : Get or Set MQTT client

AT+UNAME : Get or Set MQTT Username

AT+PWD : Get or Set MQTT password

AT+PUBTOPIC : Get or Set MQTT publish topic

AT+SUBTOPIC : Get or Set MQTT subscription topic

Information

AT+FDR : Factory Data Reset

AT+PWORD : Serial Access Password

AT+LDATA : Get the last upload data

AT+CDP : Read or Clear cached data

4. Battery & Power Consumption

SPH01-NB use ER26500 + SPC1520 battery pack. See below link for detail information about the battery info and how to replace.

Battery Info & Power Consumption Analyze .

5. Firmware update

User can change device firmware to:

- Update with new features.

- Fix bugs.

Firmware and changelog can be downloaded from : **Firmware download link**

Methods to Update Firmware:

- (Recommended way) OTA firmware update via BLE: **Instruction**.
- Update through UART TTL interface : **Instruction**.

6. FAQ

6.1 How can I access the BC660K-GL AT Commands?

User can access to BC660K-GL directly and send AT Commands.

See BC660K-GL AT Command set

6.2 Why is there no LED response when I press the button on the solar panel model?

If the LED does not light up when you press the button, it may be because the battery has entered protection mode.

Solution: To reactivate the battery, simply expose the solar panel to direct sunlight.
For more details, please refer to: Battery Protection State (Apply to Solar Panel + Li-ion battery)

7. Order Info

Part Number: **SPH01-NB-XX**

XX:

- **GE**: General version (Exclude SIM card)
- **1T**: with 1NCE * 10 years 500MB SIM card and Pre-configure to ThingsEye server

8. Packing Info

Package Includes:

- SPH01-NB NB-IoT Soil pH Sensor x 1
- External antenna x 1

Dimension and weight:

- Device Size: cm
- Device Weight: g

- Package Size / pcs : cm
- Weight / pcs : g

9. Support

- Support is provided Monday to Friday, from 09:00 to 18:00 GMT+8. Due to different timezones we cannot offer live support. However, your questions will be answered as soon as possible in the before-mentioned schedule.
- Provide as much information as possible regarding your enquiry (product models, accurately describe your problem and steps to replicate it etc) and send a mail to Support@dragino.cc.