CPN01- NB-IoT Outdoor Open/Close Dry Contact Sensor User Manual

Last modified by Xiaoling (/xwiki/bin/view/XWiki/Xiaoling) on 2023/06/15 09:36

Table of Contents:

1. Introduction

1.1 What is CPN01 NB-IoT Pulse/Contact Sensor

The Dragino CPN01 is an **NB-IoT Dry Contact Sensor**. It detects open/close status and uplinks the info to IoT server via NB-IoT network. User can see the **dry contact** the IoT Server.

The CPN01 will send periodically data every day as well as for each dry contact action. It also counts the contact open times and calculates the last open duration. Users Open/Close event, instead, device can count each open event and uplink periodically.

CPN01 has **Open-Alarm feature**, user can set this feature so CPN01 will send an alarm if the contact has been open exceeds a certain time.

CPN01 is designed for outdoor use. It has a weatherproof enclosure and industrial-level battery to work in low to high temperatures.

NarrowBand-Internet of Things (NB-IoT) is a standards-based low power wide area (LPWA) technology developed to enable a wide range of new IoT devices and service consumption of user devices, system capacity, and spectrum efficiency, especially in deep coverage.

CPN01 supports different uplink methods including **TCP, MQTT, UDP, and CoAP** for different application requirements.

CPN01 is powered by **8500mAh Li-SOCI2 battery**, It is designed for long-term use of up to 5 years. (Actually Battery life depends on the use environment, update period

To use CPN01, user needs to check if there is NB-IoT coverage in the field and with the Nb-IoT bands that CPN01 supports. If local operator support it, user needs to get install into CPN01 to get NB-IoT network connection.

1.2 Features

- NB-IoT Bands: B1/B3/B8/B5/B20/B28 @H-FDD
- Open/Close detect
- Open/Close statistics
- Monitor Battery Level
- Uplink on periodically and open/close event
- Datalog feature
- Uplink periodically
- Downlink to change configure
- Wall Mountable
- Outdoor Use
- Ultra-Low Power consumption
- AT Commands to change parameters
- Micro SIM card slot for NB-IoT SIM
- 8500mAh Battery for long-term use

1.3 Specification

Common DC Characteristics:

- Supply Voltage: 2.1v ~ 3.6v
- Operating Temperature: -40 ~ 85°C

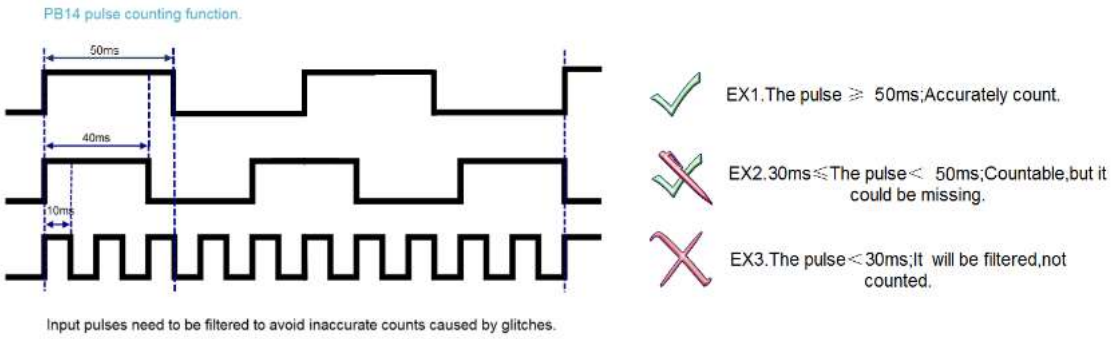
NB-IoT Spec:

- B1 @H-FDD: 2100MHz
- B3 @H-FDD: 1800MHz
- B8 @H-FDD: 900MHz
- B5 @H-FDD: 850MHz
- B20 @H-FDD: 800MHz
- B28 @H-FDD: 700MHz

1.4 Installation

Connect CPN01 to an Open Close sensor like below. So it can detect the Open/Close event.

EX1.The pulse ≥ 50ms;Accurately count.

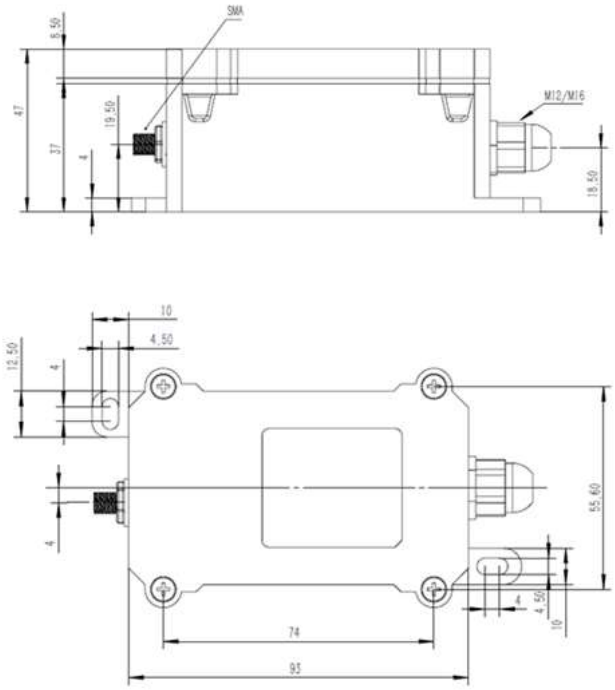


Input pulses need to be filtered to avoid inaccurate counts caused by glitches.

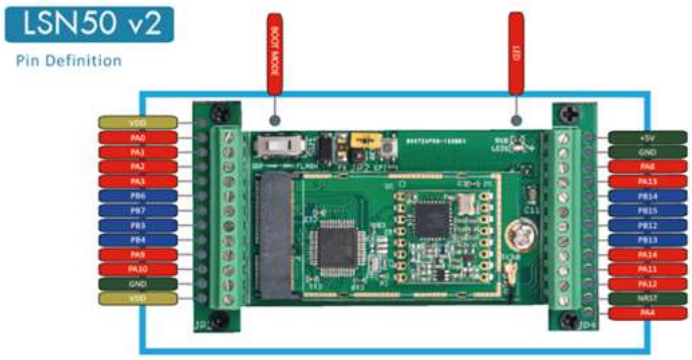
1.5 Applications

- Open/Close Detection
- Pulse meter application
- Dry Contact Detection

1.6 Mechanical



1.7 Pin Definitions and Switch



1.7.1 Pin Definition

CPN01 is pre-configured to connect to two external wires. The other pins are not used. If user wants to know more about other pins, please refer to the **LSN50v2 User M**
(/xwiki/bin/view/Main/User%20Manual%20for%20LoRaWAN%20End%20Nodes/LSN50%20%26%20LSN50-V2%20-%20LoRaWAN%20Sensor%20Node%20User%

1.7.2 Jumper JP2(Power ON/OFF)

Power on Device when putting this jumper.

1.7.3 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. The firmware won't run.
2) Flash: working mode, the device starts to work for NB-IoT connection and sends out console output for further debugging.

1.7.4 Reset Button

Press to reboot the device.

1.7.5 LED

The LED will blink when :

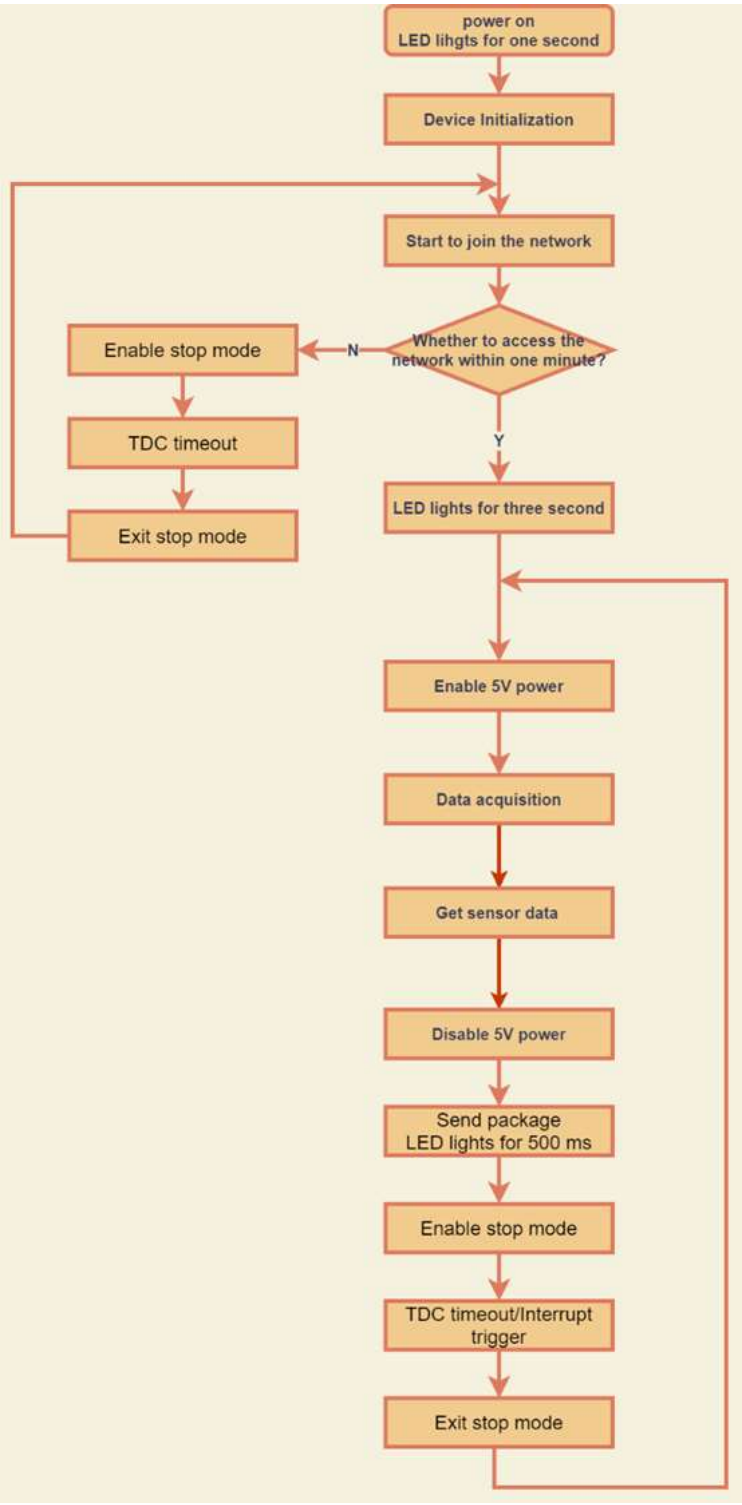
1. Boot the device in flash mode
2. Send an uplink packet

2. Use CPN01 to communicate with IoT Server

2.1 How it works

The CPN01 is equipped with an NB-IoT module, the pre-loaded firmware in CPN01 will get **Open/Close Event or Count** from sensor and send the value to the NB-IoT n this value to IoT server via the protocol defined by CPN01.

The diagram below shows the working flow in the default firmware of CPN01:



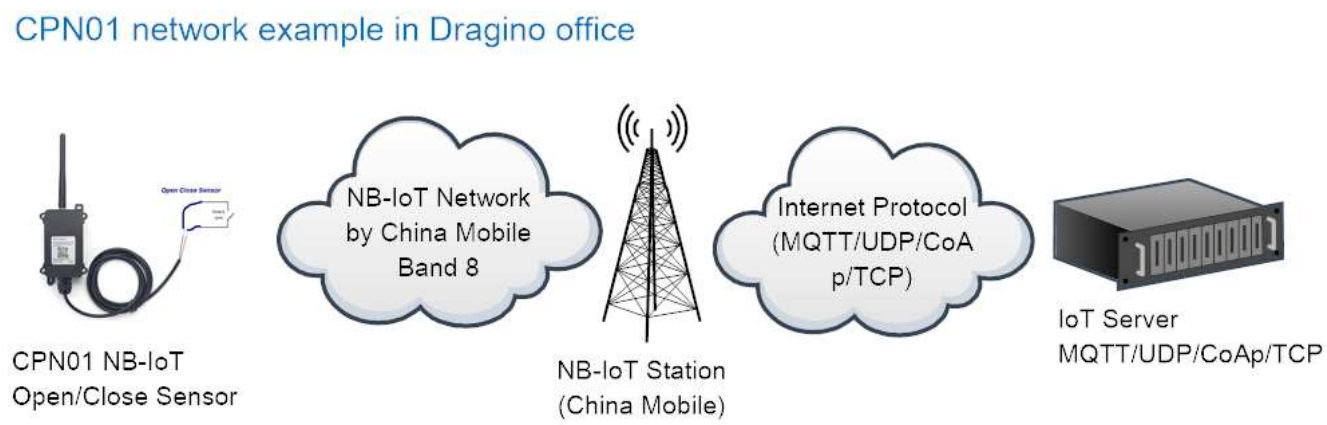
2.2 Configure CPN01

2.2.1 Test Requirement

To use CPN01 in your city, make sure to meet below requirements:

- Your local operator has already distributed an NB-IoT Network.
- The local NB-IoT network used the band that CPN01 supports.
- Your operator is able to distribute the data received in their NB-IoT network to your IoT server.

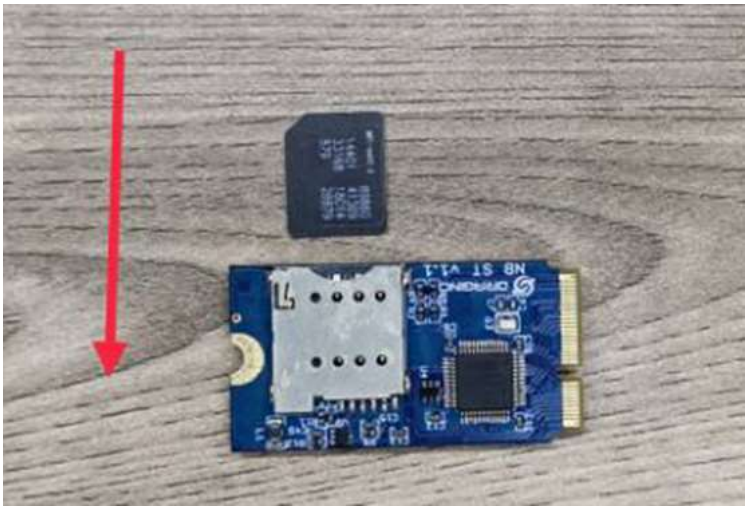
Below figure shows our testing structure. Here we have NB-IoT network coverage by China Mobile, the band they use is B8. The CPN01 will use **CoAP(120.24.4.116:56 MQTT(120.24.4.116:1883)** or **TCP(120.24.4.116:5600)protocol** to send data to the test server.



2.2.2 Insert NB-IoT SIM card

Insert the NB-IoT Card get from your provider.

User needs to take out the NB-IoT module and insert the SIM card like below:



2.2.3 Connect USB – TTL to CPN01 and configure it

User need to configure CPN01 via serial port to set the **Server Address** / **Uplink Topic** to define where and how-to uplink packets. CPN01 support AT Commands, user c to CPN01 and use AT Commands to configure it, as below.

Connection:

USB TTL GND <----> GND

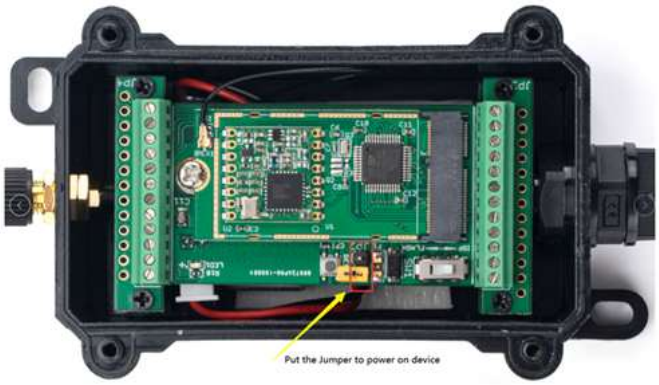
USB TTL TXD <----> UART_RXD

USB TTL RXD <----> UART_TXD

In the PC, use below serial tool settings:

- Baud: **9600**
- Data bits: **8**
- Stop bits: **1**
- Parity: **None**
- Flow Control: **None**

Make sure the switch is in FLASH position, then power on CPN01 by connecting the **Yellow Jumper**.



CPN01 will output system info once powered on as below, we can enter the **password: 12345678** to access AT Command input.

Note: the valid AT Commands can be found at: https://www.dropbox.com/sh/351dwor6joz8nwh/AADn1BQaAAxLF_QMyU8NkW47a?dl=0 (https://www.dropbox.com/sh/351dwor6joz8nwh/AADn1BQaAAxLF_QMyU8NkW47a?dl=0)

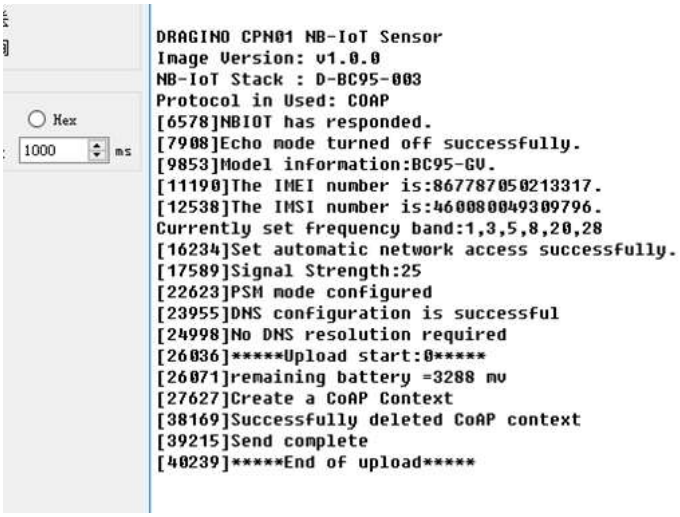
2.2.4 Use CoAP protocol to uplink data

Note: if you don't have a CoAP server, you can refer this link to set up a CoAP server: http://wiki.dragino.com/xwiki/bin/view/Main/Set%20up%20CoAP%20Ser (http://wiki.dragino.com/xwiki/bin/view/Main/Set%20up%20CoAP%20Server/)

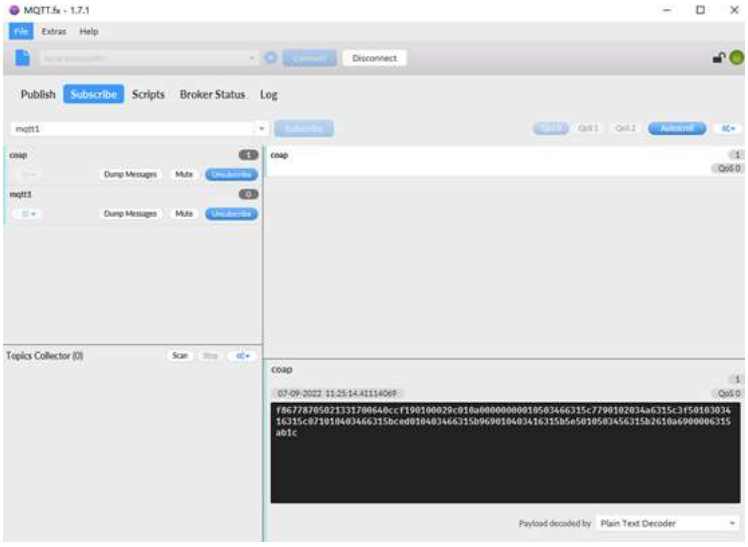
Use below commands in CPN01:

- **AT+PRO=1** // Set to use CoAP protocol to uplink
- **AT+SERVADDR=120.24.4.116,5683** // Set CoAP server address and port
- **AT+URI=0,0,11,2,"mqtt"** // Set CoAP resource path

For parameter description, please refer to AT command set



After configuring the server address and **reset CPN01** (via AT+ATZ), CPN01 will start to uplink sensor values to the CoAP server.



2.2.5 Use UDP protocol to uplink data(Default protocol)

AT Commands:

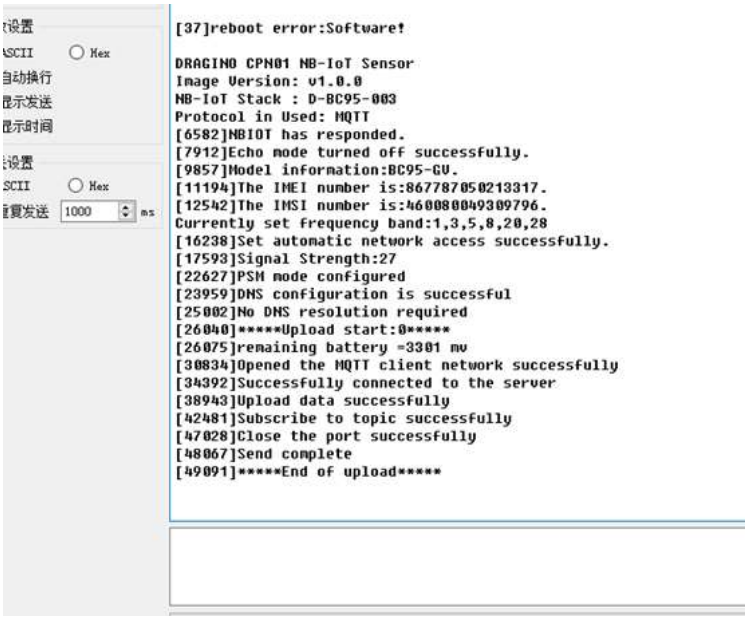
- **AT+PRO=2** // Set to use UDP protocol to uplink
- **AT+SERVADDR=120.24.4.116,5601** // Set UDP server address and port
- **AT+CFM=1** // If the server does not respond, this command is unnecessary

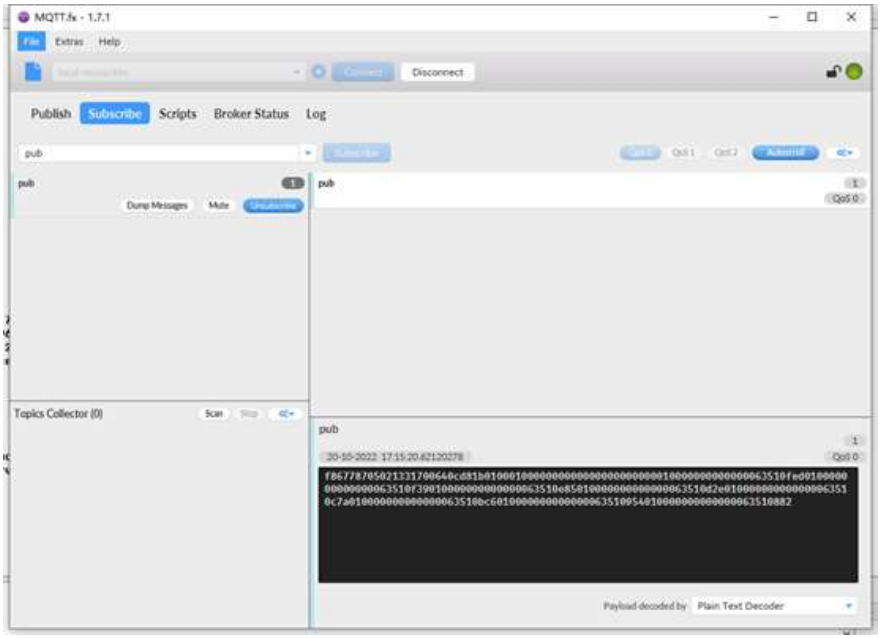
```
[37]reboot error:Software!

DRAGINO CPN01 NB-IoT Sensor
Image Version: v1.0.0
NB-IoT Stack : D-BC95-003
Protocol in Used: UDP
[6581]NBIOT has responded.
[7911]Echo mode turned off successfully.
[9856]Model information:BC95-GV.
[11193]The IMEI number is:867787050213317.
[12541]The IMSI number is:460080049309796.
Currently set frequency band:1,3,5,8,20,28
[16237]Set automatic network access successfully.
[17592]Signal Strength:28
[22626]PSM mode configured
[23958]DNS configuration is successful
[25001]No DNS resolution required
[26039]*****Upload start:0*****
[26074]remaining battery =3258 mv
[31633]Open UDP port successfully
[35673]Datagram is sent by RF
[36707]Send complete
[37731]*****End of upload*****
```

2.2.6 Use MQTT protocol to uplink data

AT Commands:

- **AT+PRO=3** // Set to use MQTT protocol to uplink
- **AT+SERVADDR=120.24.4.116,1883** // Set MQTT server address and port
- **AT+CLIENT=CLIENT** // Set up the CLIENT of MQTT
- **AT+UNAME=UNAME** // Set the username of MQTT
- **AT+PWD=PWD** // Set the password of MQTT
- **AT+PUBTOPIC=NSE01_PUB** // Set the sending topic of MQTT
- **AT+SUBTOPIC=NSE01_SUB** // Set the subscription topic of MQTT



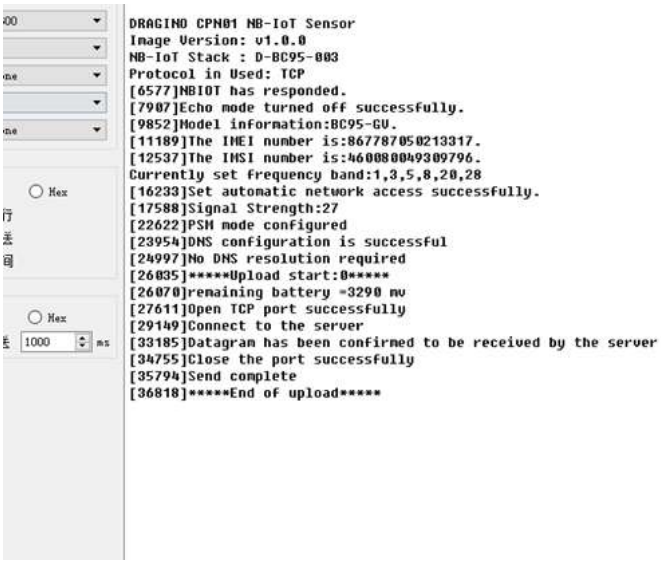


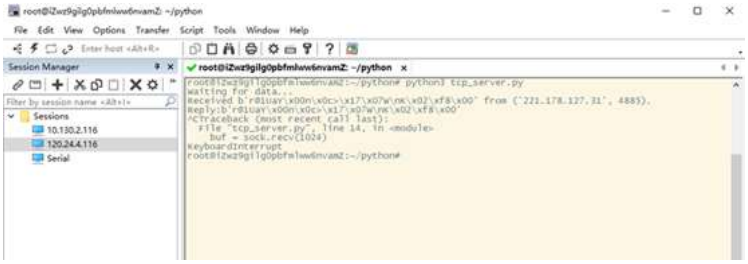
MQTT protocol has a much higher power consumption compare with UDP / CoAP protocol. Please check the power analyze document and adjust the uplink period to a s

2.2.7 Use TCP protocol to uplink data

AT Commands:

- **AT+PRO=4** // Set to use TCP protocol to uplink
- **AT+SERVADDR=120.24.4.116,5600** // Set TCP server address and port





2.2.8 Change Update Interval

User can use below command to change the **uplink interval**.

- **AT+TDC=7200** // Set Update Interval to 7200s (2 hours)

NOTE:

1. By default, the device will send an uplink message every 1 hour.

2.3 Uplink Payload

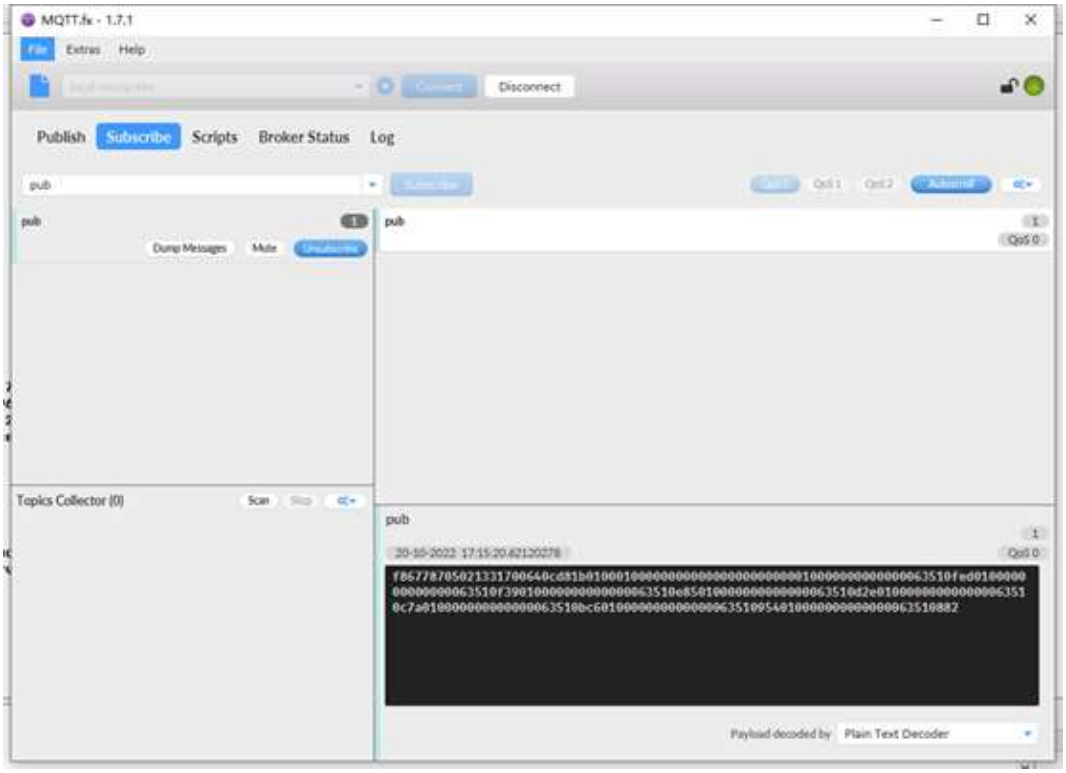
The uplink payload includes 123 bytes in total by default.

Each time the device uploads a data package, 8 sets of recorded data will be attached. Up to 32 sets of recorded data can be uploaded.

Size(bytes)	**8**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**3**
Value	Device ID	Ver	BAT	Signal Strength	MOD	Calculate Flag	Contact Status	Alarm	Total pulse

3	**4**	**1**	**3**	**3**	**4**	**8group**
The last open duration	Time stamp	Contact Status	Total pulse	The last open duration	Time stamp	...

If we use the MQTT client to subscribe to this MQTT topic, we can see the following information when the CPN01 uplink data.



The payload is ASCII string, representative same HEX:

0x f867787050213317 0064 0c78 17 01 00 00 00 000009 000002 6315537b 01 00000b 0000026 63510fed 0100000e00000263510f39 0100000000000063510e85 01 0100000000000063510c7a 0100000000000063510bc6 0100000000000063510954 0100000000000063510882

where:

- **Device ID:** 0x f867787050213317 = f867787050213317
- **Version:** 0x0064=100=1.0.0
- **BAT :** 0x0c78 = 3192 mV = 3.192V
- **Singal:** 0x17 = 23
- **Mod:** 0x01 = 1
- **Calculate Flag:** 0x00=0
- **Contact Status:** 0x00=0
- **Alarm:** 0x00 =0
- **Total pulse:** 0x000009 =9
- **The last open duration:** 0x000002 =2
- **Timestamp:** 0x6315537b =1662342011 (Unix Time)
- **Contact Status, Total pulse,The last open duration ,Time stamp :** 01 00000b 000026 63510fed
- **8 sets of recorded data: Contact Status, Total pulse, The last open duration ,Time stamp :** 0100000e00002663510f39,.....

2.4 Payload Explanation and Sensor Interface

2.4.1 Device ID

By default, the Device ID is equal to the last 15 bits of IMEI.

User can use **AT+DEUI** to set Device ID

Example:

AT+DEUI=868411056754138

The Device ID is stored in a non-erase area, Upgrade the firmware or run AT+FDR won't erase the Device ID.

2.4.2 Version Info

Specify the software version: 0x64=100, which means firmware version 1.00.

For example 0x00 64 : This device is CPN01 with firmware version 1.0.0.

2.4.3 Battery Info

Check the battery voltage for CPN01.

Ex1: 0x0B45 = 2885mV

Ex2: 0x0B49 = 2889mV

2.4.4 Signal Strength

NB-IoT Network signal Strength.

Ex1: 0x1d = 29

0 -113dBm or less

1 -111dBm

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

31 -51dBm or greater

99 Not known or not detectable

2.4.5 Calculate Flag

The calculate flag is a user defined field, IoT server can use this filed to handle different meters with different pulse factors. For example, if there are 100 water meters, m 100 has 1.5 liter/pulse.

User can set calculate flag to 1 for meter 1~50 and 2 for meter 51 ~ 100, So IoT Server can use this field for calculation.

Default value: 0.

Range (6 bits): (b)000000 ~ (b) 111111

2.4.6 Alarm

See Alarm Base on Timeout

2.4.7 Contact Status

0: Open

1: Close

2.4.8 Total pulse

Total pulse/counting based on dry contact trigger event

Range (3 Bytes) : 0x000000 ~ 0xFFFFFF . Max: 16777215

2.4.9 The last open duration

Dry Contact last open duration.

Unit: min.

2.4.10 Timestamp

Timestamp : 0x6315537b =1662342011

Convert Unix timestamp to time 2022-9-5 9:40:11.

2.5 Downlink Payload

By default, CPN01 prints the downlink payload to console port.

Downlink Control Type	FPort	Type Code	Downlink payload size(bytes)
TDC(Transmit Time Interval)	Any	01	4
RESET	Any	04	2
INTMOD	Any	06	4

Examples:

- **Set TDC**

If the payload=0100003C, it means set the END Node's TDC to 0x00003C=60(S), while type code is 01.

Payload: 01 00 00 1E TDC=30S

Payload: 01 00 00 3C TDC=60S

- **Reset**

If payload = 0x04FF, it will reset the CPN01

- **INTMOD**

Downlink Payload: 06000003, Set AT+INTMOD=3

2.6 LED Indicator

The CPN01 has an internal LED which is to show the status of different states.

- When the device starts normally, the LED will light up for 1 second.
- After CPN01 join NB-IoT network. The LED will be ON for 3 seconds.
- For each uplink probe, LED will be on for 500ms.

2.7 Alarm Base on Timeout

CPN01 can monitor the timeout for a status change, this feature can be used to monitor some events such as door opening too long etc. Related Parameters are:

1. Keep Status: Status to be monitor

Keep Status = 1: Monitor Close to Open event

Keep Status = 0: Monitor Open to Close event

2. Keep Time: Timeout to send an Alarm

Range 0 ~ 65535(0xFFFF) seconds.

If keep time = 0, Disable Alarm Base on Timeout feature.

If keep time > 0, device will monitor the keep status event and send an alarm when status doesn't change after timeout.

AT Command to configure:

AT+TTRIG=1,30 --> When the **Keep Status** change from connected to disconnect, and device remains in disconnect status for more than 30 seconds. CPN01 will send
(http://wiki.dragino.com/xwiki/bin/view/Main/User%20Manual%20for%20LoRaWAN%20End%20Nodes/CPL01%20LoRaWAN%20Outdoor%20PulseContact%20%20Sen
TimeOpen2FCloseStatus2CUplinkFPORT3D2) (the second bit of 1st byte of payload) on this uplink packet is set to 1.

AT+TTRIG=0,0 --> Default Value, disable timeout Alarm.

2.8 Set debug mode

Feature: Enable or Disable debug mode

AT Command: AT+DEBUG

Command Example	Function	Response
AT+DEBUG=0	Disable debug mode to 0	OK
AT+DEBUG=1	Enable debug mode to 1	OK

2.9 Clear Flash Record

Feature: Clear flash storage for data log feature.

AT Command: AT+CLRDTA

Command Example	Function	Response
AT+CLRDTA	Clear flash storage for data log feature.	Clear all stored sensor data…OK

2.10 Set trigger mode

AT Command: AT+TTRMOD

Feature: Set the trigger interrupt mode.

Command Example	Function	Response
AT+TTRMOD=1	Count and trigger from open to close (rising edge)	OK
AT+TTRMOD=0	Count and trigger from close to open (falling edge)	OK

2.11 Set the calculate flag

Feature: Set the calculate flag

AT Command: AT+CALCFLAG

Command Example	Function	Response
AT+CALCFLAG=1	Set the calculate flag to 1	OK
AT+CALCFLAG=2	Set the calculate flag to 2	OK

2.12 Set count number

Feature: Manually set the count number

AT Command: AT+SETCNT

Command Example	Function	Response
AT+SETCNT=0	Set the count number to 0	OK
AT+SETCNT=100	Set the count number to 100	OK

2.13 Set the number of data to be uploaded and the recording time

AT Command:

AT+TR=900 // The unit is seconds, and the default is to record data once every 900 seconds.(The minimum can be set to 180 seconds)

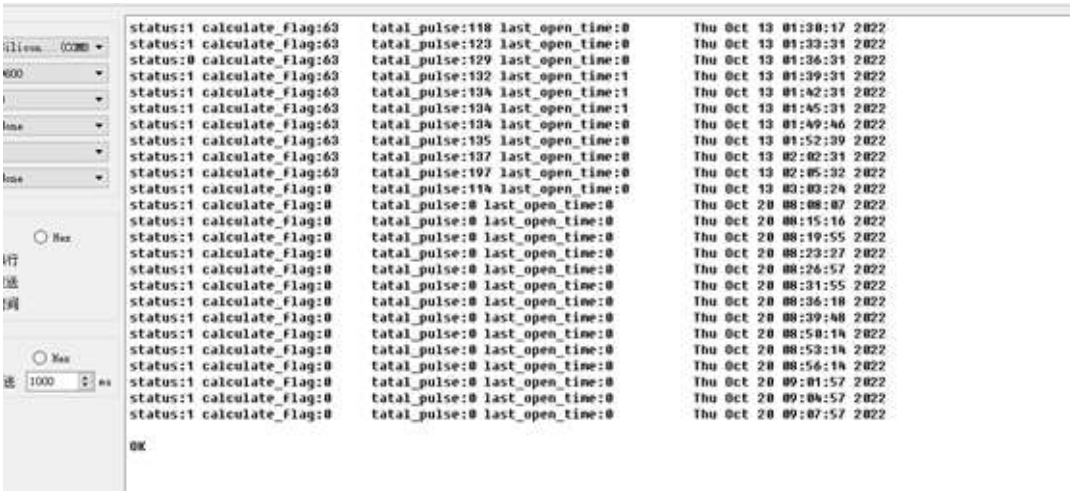
AT+NOUD=8 // The device uploads 8 sets of recorded data by default. Up to 32 sets of record data can be uploaded.

2.14 Read or Clear cached data

AT Command:

AT+CDP // Read cached data

AT+CDP=0 // Clear cached data



2.15 Firmware Change Log

Download URL & Firmware Change log: https://www.dropbox.com/sh/8p5nuvo6gh7je4n/AAAMP7MMusgbXMz9Ik7Ls03Ga?dl=0 (https://www.dropbox.com/sh/8p5nuvo6gh7je4n/AAAMP7MMusgbXMz9Ik7Ls03Ga?dl=0)

Upgrade Instruction: Upgrade Firmware

2.16 Battery & Power Consumption

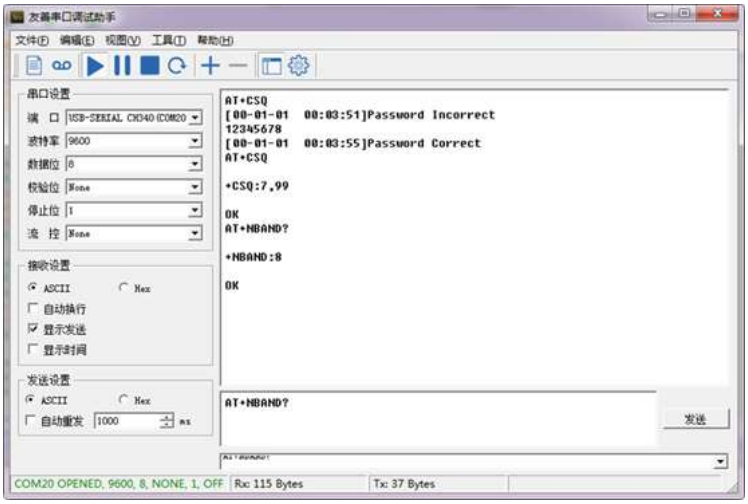
CPN01 uses ER26500 + SPC1520 battery pack. See below link for detail information about the battery info and how to replace.

Battery Info & Power Consumption Analyze (http://wiki.dragino.com/xwiki/bin/view/Main/How%20to%20calculate%20the%20battery%20life%20of%20Dragino%20sen

3. Access NB-IoT Module

Users can directly access the AT command set of the NB-IoT module.

The AT Command set can refer the BC35-G NB-IoT Module AT Command: https://www.dragino.com/downloads/index.php?dir=datasheet/other_vendors/BC35-G/ (https:/ dir=datasheet/other_vendors/BC35-G/)



4. Using the AT Commands

4.1 Access AT Commands

See this link for detail: https://www.dropbox.com/sh/351dwor6joz8nwh/AADn1BQaAAxLF_QMyU8NkW47a?dl=0 (https://www.dropbox.com/sh/351dwor6joz8nwh/AADn1

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+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+SERVADDR : Server Address

AT+TR : Get or Set record time

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

AT+CDP : Read or Clear cached data

AT+ DEBUG : Enable or Disable debug mode

AT+ TTRIG : Get or Set Alarm Base on Timeout

AT+ TTRMOD : Get or Set the trigger interrupt mode(0:falling,1:rising)

AT+ CALCFLAG : Get or Set the calculate flag

AT+ CLRC : Clear current door open count

COAP Management

AT+URI : Resource parameters

UDP Management

AT+CFM : Upload confirmation mode (only valid for UDP)

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

5. FAQ

5.1 How to Upgrade Firmware

User can upgrade the firmware for 1) bug fix, 2) new feature release.

Please see this link for how to upgrade: http://wiki.dragino.com/xwiki/bin/view/Main/Firmware%20Upgrade%20Instruction%20for%20STM32%20base%20products/#H2.H
(http://wiki.dragino.com/xwiki/bin/view/Main/Firmware%20Upgrade%20Instruction%20for%20STM32%20base%20products/#H2.HardwareUpgradeMethodSupportList)

Notice: CPN01 and CPL01 share the same mother board. They use the same connection and method to update.

6. Trouble Shooting

6.1 Connection problem when uploading firmware

Please see: http://wiki.dragino.com/xwiki/bin/view/Main/Firmware%20Upgrade%20Instruction%20for%20STM32%20base%20products/#H3.3Troubleshooting
(http://wiki.dragino.com/xwiki/bin/view/Main/Firmware%20Upgrade%20Instruction%20for%20STM32%20base%20products/#H3.3Troubleshooting)

6.2 AT Command input doesn't work

In the case if user can see the console output but can't type input to the device. Please check if you already include the **ENTER** while sending out the command. Some se the send key, user need to add ENTER in their string.

6.3 Not able to connect to NB-IoT network and keep showing "Signal Strength:99".

This means sensor is trying to join the NB-IoT network but fail. Please see this link for ***trouble shooting for signal strenght:99 (/xwiki/bin/view/Main/CSQ%3A99%2C***

7. Order Info

Part Number: CPN01

8. Packing Info

Package Includes:

- CPN01 Open/Close Sensor x 1
- External antenna x 1

Dimension and weight:

- Size: 195 x 125 x 55 mm
- Weight: 420g

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 answe 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 (http://../../../../../../D:%5C%E5%B8%82%E5%9C%BA%E8%B5%84%E6%96%99%5C%E8%AF%B4%E6%98%8E%E4%B9%A6%5CLoRa%5CLT%E7%B3%BB

0 Tags: Created by Xiaoling (/xwiki/bin/view/XWiki/Xiaoling) on 2022/10/19 16:29

No comments for this page