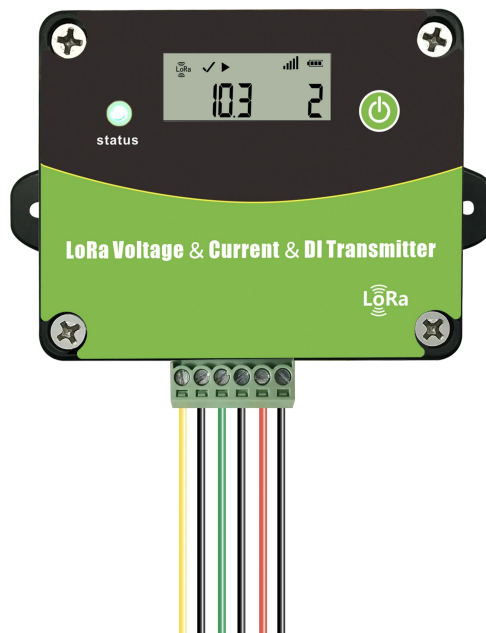


# TZ-Tag11 LoRaWAN

---User Manual V1.1



# 1 Product Overview

TZ-Tag11LoRaWAN is a high quality wireless voltage and current transmitter developed by our company. This product fully considers the harsh field environment and the field implementation situation, and successfully solves many deficiencies of similar products. It achieves ultra-long range (5km), small size (109mm\*69mm\*40mm), and ultra-long endurance. The product has been verified in many key projects, with stable and reliable characteristics. The product send out data by LoRaWAN protocol. The transmitter collects data periodically and sends it out through the embedded LoRa communication module. After receiving the signal, the receiver can parse the voltage value, current value, digital input and other information, and realize real-time transmission and data storage functions at the same time. In addition, the product is also equipped with LCD, LED and buzzer to make you view the voltage value, current value, digital input, RSSI signal strength, battery level, and other information in a more intuitive way, with sound and light alarm functions. This product, in conjunction with LoRaWAN Gateway, can be widely used in all kinds of testing occasions.

Tag11 transmits the data collected by the external user equipment to the server through LoRaWAN Gateway, so as to realize remote data transmission.

Tag11 can be connected to all kinds of sensors whose output is voltage and current, such as voltage and current, temperature and humidity, pressure, gas, door contact and water immersion sensors.

## 2 Product Application

1. Industries for monitoring gas, such as air quality;
2. Industries for using digital input, such as door contact and water immersion;
3. Industries for monitoring liquid, such as water quality testing and oil extraction plant;
4. Industries for monitoring temperature and humidity, such as cold chain, agricultural shed, pharmaceutical warehouse and biochemical laboratory;

## 3 Product Features

1. The transmitter can be compatible with user equipment in three output modes, namely 0-10V, 0-20mA and digital input, with a wide range of application;

2. The transmitter adopts the new-generation LoRa chip from Semtech, with strong transmitting power, strong penetrating diffraction and weak attenuation.
3. The transmitter has an user-defined sending interval from 1min to 1440min, which meets most application scenarios.
4. The transmitter supports three working modes, namely normal mode, low voltage mode, and voltage and current alarm mode, to complete monitoring in a more effective and intelligent way;
5. The transmitter is equipped with high-performance lithium battery, with current less than 5uA in sleep mode, long standby time and stable performance. In addition, it is equipped with super capacitor to effectively realize the full use of the battery, thus solving the problem of battery instability under high and low temperature;
6. All the data collected by the transmitter can be stored in memory, which can be read by USB;
7. The transmitter adopts FDMA, TDMA and other technologies to effectively avoid wireless conflict;
8. The transmitter has the ACK function to ensure that data is not lost;
9. The transmitter supports setting parameters by sending commands through gateway;
10. The transmitter is equipped with LCD display to enable users to view the voltage value, current value, digital input, RSSI signal strength, battery level, and other information in an intuitive way;
11. The transmitter is equipped with buzzer to sound an alarm when the current and voltage exceed the limit;

## **4 Feature Advantages of LoRaWAN over LoRa proprietary protocols**

LoRaWAN is a set protocol standards mainly rely on MAC based on the LoRa physical layer transmission technology .With the standard, LoRaWAN has been a network technology. The technology contains LoRaWAN node, LoRaWAN gateway and LoRaWAN protocol ,data cloud platform. When using the LoRaWAN network products, there are two interface for user:One is a data interface between the underlying sensor and the LoRaWAN node, through which sensor data is passed to the network;the other is LoRaWAN protocol and data cloud platform and the user's application has a data interface between the network data transfer application.

LoRaWAN provides multi-channel access, frequency switching, adaptive rate, channel management, timing send and receive, node access authentication and data encryption, roaming and other features. In addition to the advantages of long distance transmission and low power consumption in the physical layer, the following advantages are obtained compared to the

transmission method using only the physical layer of the LoRa:

1. Compatible. Different sensor nodes from different manufacturers can access the same LoRaWAN network, and the interface between the LoRaWAN protocol and the data cloud platform is unified. For application developers in terms of custom development without the development of all sensors, shorten the development cycle, reduce R & D costs, to deliver quickly.

2. Large network capacity. Through multi-channel access, frequency switching, adaptive rate LoRaWAN network relative to the physical layer based on the LoRa point-to-point or multi-point application of data capacity, access nodes can be more scalability. It is good for application developers to develop large-scale applications and continuous upgrade applications.

3. Good safety. LoRaWAN network design nodes access authentication, data encryption and other security mechanisms. These mechanisms, reviewed by industry experts and validated by multiple applications by various technology companies worldwide, are much more secure than ad hoc agreements with application developers. For the application of continuous security protection.

## 5 Product Specifications

**Table 5.1 Product Specifications of TZ-Tag11**

<b>Items</b>	<b>Features</b>
Power supply	Built-in 4000mAh/3.6V battery
Working environment	-30°C~+60°C; 0%RH ~ 85%RH (with no condensation)
Frequency band	470/868/915 (optional)
Wireless modulation mode	LoRa modulation
Communication protocol	LoRaWAN v1.02
Voltage range	0-10V
Voltage resolution	1mV
Current range	0-20mA
Current resolution	1uA
Max open air transmission distance	5000m
Transmission power	20dbm (adjustable)
Acquisition interval	1min-1440min, user-definable,default 15 minutes
Low voltage alarm	Support, user-definable
Voltage and current alarm	Support, user-definable
Standby current	<5uA
Data storage capacity	50000
Battery life	3 years (15min sending interval)
Net weight	135g

Dimensions	109mm*69mm*40mm
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## 6 Working Mode

Working mode	Working status
Normal mode	The transmitter collects the voltage and current data at preset acquisition interval and then starts the LoRa module to send it out
Low voltage alarm mode	When the transmitter voltage is lower than 2.2V (settable), data will be collected and sent at an interval of 30min (settable). At this time, the power supply of transmitter is nearly exhausted, and the customer should replace battery in time
Voltage and current alarm mode	When the ambient voltage and current exceed the range set by the user, the transmitter can collect and send data at a relatively fast interval to facilitate the customer to record the changes of the ambient voltage and current

Note: Priority: Voltage and current alarm mode>Low voltage alarm mode>Normal mode

## 7 Device Status When Sending Data

When the device sends a packet of data, the LED flashes once, and the corresponding sending icon of the LCD will also be displayed;

LED flashing includes green flashing and red flashing, which is red flashing when the device is abnormal (voltage and current exceeding limit, low voltage of battery), and green flashing when the device is normal;

See the LCD commands below for LCD indicator.

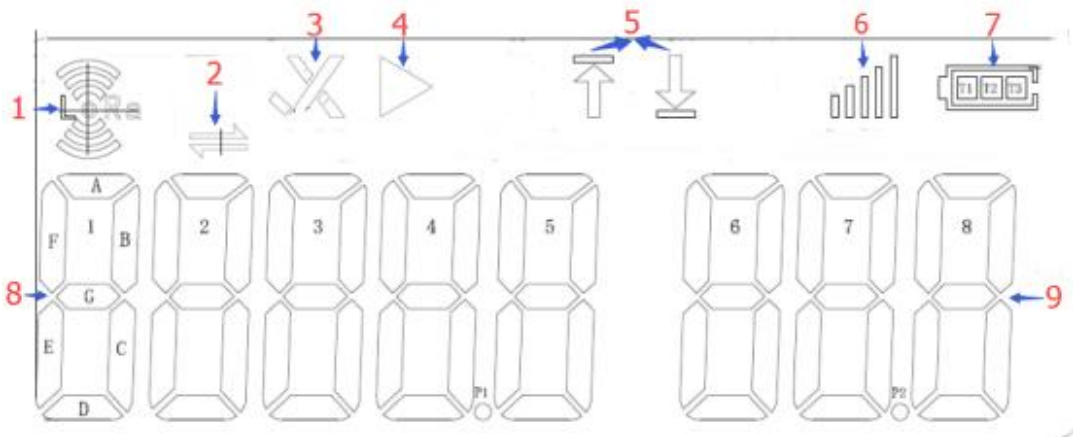
## 8 Key Functions

Mode	Operation method	Indicator status	Command
On	Long press for 3s	1. Green LED is on for 5s 2. LCD display is disabled	The device starts sending data










Off	Long press for 3s	1. Red LED is on for 5s 2. LCD display is disabled	The device no longer sends data
Sending data	Short press once	LED flashes once	Valid only in "On" mode  LED flashing is the same as that when sending data, that is, red flashing when it is abnormal and green flashing when it is normal

## 9 LCD Display Commands

LCD display is disabled when the device is in "Off" mode, and LCD display is enabled when the device is in "On" mode. It can display LoRa icon, sending icon, voltage and current alarm icon, running status, voltage and current overload icon, RSSI signal icon, battery status, voltage, current and digital input.



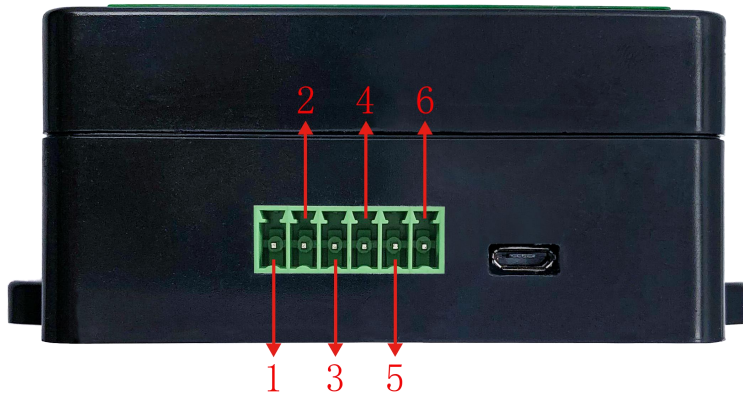
No.	Functions	Commands
1	LoRa icon	LoRa sensor
2	Sending icon	Only flash when the device sends data. It is not displayed when sending is completed
3	Voltage and current alarm icon	Normal: √ Alarm: ×
4	Running status	▷ Start running
5	Voltage and current overload icon	Exceed upper limit: ↑ Exceed lower limit: ↓ Exceed upper and lower limit: ↑↓

6	RSSI signal icon	 : [-80,0];  : [-100,-80];  : [-115,-100];  : [-125,-115];  : [-138,-125]; The RSSI value is updated each time the gateway response is received after sending data, so the RSSI value is not displayed if no ACK is enabled or no response is received
7	Battery status	 : [3.2,3.6];  : [3.0,3.2];  : [2.8,3.0];  : [2.5,2.8];
8	Voltage, current and digital input	Voltage: display voltage value, unit :V Current: display current value, unit:mA digital input: display ON when connected, display OFF when disconnected Display mode: display voltage value, current value and digital input in turn in 10s interval
9	Serial number	The serial number "1" means that the "8" position displays the voltage value The serial number "2" means the "8" position displays the current value The serial number "3" means that the "8" position displays the digital input

## 10 Electrical Connection

The interfaces of Tag11 consists of three parts: voltage part, current part and digital input part respectively from left to right. Each part has two interfaces: voltage positive, voltage negative,

current positive, current negative, and two interfaces of digital input respectively from left to right. The power supply range of voltage interface is 0-10V; The power supply range of current interface is 0-20mA; When the two interfaces of digital input are open, it is OFF; when the two interfaces are closed, it is ON. The following figure shows the interface part of Tag11:



**Interface Description:**

Serial number	Interface	Caption
1	Voltage positive	Connect to the positive pole of the voltage output
2	Voltage negative	Connect to the negative pole of the voltage output
3	Current positive	Connect to the positive pole of the current output
4	Current negative	Connect to the negative pole of the current output
5	digital input interface 1	Connect one end of the digital input
6	digital input interface 2	Connect one end of the digital input

## 11 Working Mode of Buzzer

When the voltage and current exceed the limit, the buzzer is enabled to work, with intermittent beeping;



- Commands need to be enabled:
1. Commands 03
  2. Commands 36

Way to disable the buzzer:

1. Voltage and current return to normal;
2. Short press the key;
3. The working time of buzzer is up.

Commands:

1. After a buzzer is completed, it will work again when the voltage and current are abnormal again (voltage and current are normal first and then abnormal again);
2. The buzzer function is disabled by default. The customer needs to enable the buzzer function;
3. The buzzer consumes a large amount of power, thus shortening the battery life. The customer should set this function based on actual requirements.

## 12 Command list

Note: After setting the command, must set #DS to take effect.

Command	Format	Note
Low voltage alarming function	*01,A,X,Y#	A:0 disable this function 1 enable this function (default) X:low voltage threshold , [2000-3600],unit: 1mV, default 2200 Y:transmit interval after low voltage alarming, [1-60],unit min,default 30
Set heartbeat package interval	*02,X#	X:[1-60],unit min, default 15
Set voltage and Current alarm	*03,A,X,Y,M,N,Z#	A=0: disable this function(default) A=1: enable this function X:high voltage threshold, [0.000-10.000], unit:v,default:10.000; Y:low voltage threshold,

		<p>[0.000-10.000], unit:v,default:0.000; M:high current threshold, [0.000-20.000], unit:mA,default:20.000 N:low current threshold, [0.000-20.000], unit:mA,default:0.000 Z:transmit interval after alarming [1-1440],unit:min,default:1 (support to three decimal point)</p>
Set the device time	*04,A,B,C,D,E,F#	<p>A:year, [1976-2099],unit: yer B:month, [1-12],unit: month C:day, [1-31],unit: day D:hour, [0-24],unit: hour E:minute, [0-59],unit: minute F:second, [0-59],unit: second</p>
Set up communication channel(868MHz)	*05,A,B,C,D#	<p>A:The default access channel 1 Default:868100000Hz B:The default access channel 2 Default:868300000Hz C:The default access channel 1 Default:868500000Hz D:The default RX2 receiving channel:869525000Hz A、B、C、D[86300000-870000000] unit:Hz</p>
Set up 8 continuous communication channel(915MHz)	*05,A1,A2,A3,A4,A5,A6,A7,A8,RX2#	<p>A1-A8:The number of the channels [0-95]default:0,1,2,3,4,5,6,7 Corresponding to the TX frequency:902.3+A*0.2 RX2: RX2 receiving frequency Default:923300000Hz unit:Hz</p>
Set up 8 continuous communication channel(470MHz)	*05,A1,A2,A3,A4,A5,A6,A7,A8,RX2#	<p>A1-A8:The number of the channels [0-95]default:0,1,2,3,4,5,6,7 Corresponding to the TX frequency:470.3+A*0.2 Corresponding to the RX frequency :500.3+A*0.2 RX2: RX2 receiving frequency Default:505300000Hz unit:Hz</p>
Set transmitting	*06,A,B#	<p>A:0 disable this function (default)</p>

power		1 enable this function B:power value, [0,3], default:0 0:20dbm 1:17dbm 2:14dbm 3:11dbm
Set the maximum data sending delay time	*07,X#	X: delay time, [0,300], unit: second, default: 180
Set the time interval for reading	*08,X#	X:[0,65535],unit:second, default:0 0 indicates that the data are taken at irregular intervals, and the data are not obtained until the transmission interval
Extend setting	*09,ABCDEFGH#	A=0, disable ACK function ; A=1, enable ACK function, it must be used with the gateway(default); B=0, C=0, D=0; E=0; F=0;
Set APPEUI	*11,X#	X: APPEUI 16 digital, default: 545A4C5208170101
Set APPKEY	*12,X#	X: APPKEY 32 digital; default: 2B7E151628AED2A6ABF7158809CF4F3A
Set work mode	*35,X#	X=0,turn off(default) X=1,turn on
Set buzzer beep time	*36,X#	X:beep time [0,65535],Unit:second,0 means the buzzer is not working(default); 65535 means the buzzer will work until the current return to normal
Turn off the buzzer	*37,0#	
Set the sending protocol	*40,X#	X=0,Not included RTC time, humidity unit is %; X=1,Including RTC time, humidity unit is % (default); X=2,,Not included RTC time, humidity unit is 0.1%;

		X=3,Including RTC time, humidity unit is 0.1%;
Set the voltage and Current calibration value	*42,A,X,Y#	A=0, Disable calibration;(default) A=1, Enable calibration; X:Voltage calibration value; If the calibration value is added to the voltage, it begins with +; If the calibration value is reduction to the voltage, it begins with -; unit: v Y:Current calibration value; If the calibration value is added to the Current, it begins with +; If the calibration value is reduction to the Current, it begins with -; unit: mA Note:support to three decimal point
Save command	#DS	
Search single command	#D5X	X:command
Search all commands	#DE	
Quit configuration	#DQ	
Into firmware upgrade mode	#DU	
Query current voltage /Current/switching value	#DT	
Print the stored readings	#DP	Automatically delete log data after reading
Delete all the stored readings	#DA	
Query current time	#DB	
Query Device EUI	#DC	
Query firmware version	#DV	
Default setting	#DO	All commands except 04 05 21 are restored to default Settings
Reboot device	#DR	

# 13 How to use the device

The sensor is in OTA mode, please register the device in the sever of LoRaWAN after getting it.DEVEUI can be seen in the label of the sensor,APPEUI is 545A4C5208170101,and APPKEY is 2B 7E151628AED2A6ABF7158809CF4F3A,

also can be set by yourself,The sensor needs to be configured with the same APPKEY and APPEUU (commands 11 and 12) as on the server.It can be normally used when the sensor successfully connect to the Internet. Please use 04 command to set RTC time if customer need the correct stored history readings.

The factory setting of the sensor is off mode by default,Please refer to the button function after you get it,press and hold the button for 3s to start up,and the sensor will automatically send data to the gateway,The data transmission interval is 15 minutes by default, if you want to send data quickly,please press the button shortly.TZ-Tag11 is a data sender,which should work with LoRaWAN Gateway.If the sensor is successfully connected to the network, it can be used normally.

If you want configure parameters , Please open the upper cover of device,and insert our configure line,at this time the green LED is bright which indicating the device has entered the configuration mode.For detailed configuration instructions and configuration methods,please refer to”TAG11” Configure Software Manual.

# 14 Data format

1. The standard data protocol (default)

**Start+State + battery voltage + voltage value + current value + switching value +RTC time**

- Start: 1 byte , 0x14
- TAG status: 1 byte (convert to binary)  
bit7: Battery voltage status, 1-low Voltage, 0- Voltage normal;  
bit6: the voltage and current status,1- alarm, 0- normal;  
bit5:The key status,1-Press button,0-don't have press button;  
bit4:Whether an ACK reply is required,1-need,0-need't;  
bit3:Whether RTC time is included,1-contains,0-ontains,doesn't contains;  
bit2:This packet is the first packet of data on boot,1-yes,0-no;  
bit1:Whether the switching status changes,1-yes,0-no;  
bit0: reserved;
- Battery voltage: 1 byte, unit:10mv, this value=actual value-150,  
For example:0xce means 3.56v(convert to decimal).
- Voltage value:2byte,unit:mv,High in front.
- Current value:2byt,unit:uA,High in front.

- Switching:1byte,00H-connect,01H-sidconnect.
- RTC time:6 byte, format is year+month+day+hour+minute+seconds,this data is optional, set by command 40;

## 2. The simple data protocol

### State + battery voltage + voltage value + current value + switching value

- TAG status: 1 byte (convert to binary)
  - bit7: Battery voltage status, 1-low Voltage, 0- Voltage normal;
  - bit6: the voltage and current status,1- alarm, 0- normal;
  - bit5:The key status,1-Press button,0-don't have press button;
  - bit3:Whether RTC time is included,1-contains,0-ontains,doesn't contains;
  - bit2:This packet is the first packet of data on boot,1-yes,0-no;
  - bit1:Whether the switching status changes,1-yes,0-no;
  - bit0: reserved;
- Battery voltage: 1 byte, unit:10mv, this value=actual value-150,  
For example:0xce means 3.56v(convert to decimal).
- Voltage value:2byte,unit:mv,High in front.
- Current value:2byt,unit:uA,High in front.
- Switching:1byte,00H-connect,01H-sidconnect.

# 15 LORAWAN Gateway downward command

LORAWAN Gateway downward command

Start+ downward command +command content+Check code

Start:0xF0;

downward command:1 byte;

Command content:X byte;

Check code:1 byte, the previous data sum

Please refer to the following table for the specific format. If there is no special indication, the following table adopts hex format, MSB First.

Command	Command function	downward command	Note
1	Low voltage alarming function	F0 01 A X Y CHECKSUM	A:0 disable this function 1 enable this function X:low voltage threshold, [2000-3600],unit: 1mV,2 byte Y:transmit interval after low

			voltage alarming, [1-60],unit min,2 byte
2	Set heartbeat package interval	F0 02 X CHECKSUM	X:[1-60],unit min,2byte
3	Set voltage and Current alarm	F0 03 A X Y M N Z CHECKSUM	A=0: disable this function(default) A=1: enable this function X:high voltage threshold, [0.000-10.000], unit:v,default:10.000; Y:low voltage threshold, [0.000-10.000], unit:v,default:0.000; M:high current threshold, [0.000-20.000], unit:mA,default:20.000 N:low current threshold, [0.000-20.000], unit:mA,default:0.000 Z:transmit interval after alarming [1-1440],unit:min,default:1 (support to three decimal point)
4	Set the device time	F0 04 Y M D H M S CHECKSUM	A:year,unit:yer,1 byte B:month,unit:month,1 byte C:day,unit:day,1 byte D:hour],unit:hour,1 byte E:minute,unit:minute,1 byte F:second,unit:second,1 byte
5	Set up communication channel(868M Hz)	F0 05 A B C D CHECKSUM	A:The default access channel 1 B:The default access channel 2 C:The default access channel 3 D:The default RX2 receiving A、 B、 C、 D[86300000-870000000] 4 byte,unit:Hz
5	Set up 8 continuous communication channel(915M Hz)	F0 05 A1 A2 A3 A4 A5 A6 A7 A8 RX2 CHECKSUM	A1-A8:The number of the channels [0-95], 1 byte Corresponding to the TX frequency:902.3+A*0.2 RX2: RX2 receiving frequency

			4 byte,unit:Hz
5	Set up 8 continuous communication channel(470M Hz)	F0 05 A B C D CHECKSUM	A1-A8:The number of the channels [0-95], 1 byte Corresponding to the TX frequency:470.3+A*0.2 Corresponding to the RX frequency :500.3+A*0.2 RX2: RX2 receiving frequency 4 byte,unit:Hz
6	Set transmitting power	F0 06 A B CHECKSUM	A:0 disable this function 1 enable this function B:power value, [0,3], 0:20dbm 1:17dbm 2:14dbm 3:11dbm
7	Set the maximum data sending delay time	F0 07 X CHECKSUM	X: delay time, [0,300], unit: second, 2 byte
8	Set the time interval for reading	F0 08 X CHECKSUM	X:[0,65535],unit:second, default:0 0 indicates that the data are taken at irregular intervals, and the data are not obtained until the transmission interval
11	Set APPEUI	F0 0B X CHECKSUM	X:8byte
12	Set APPKEY	F0 0C X CHECKSUM	X:16byte
40	Set LORA data protocol	F0 28 X CHECKSUM	X=0,simple data protocol; X=1,included RTC time, (default); X=2,not including RTC time,
42	Set the voltage and Current calibration value	F0 2A A X Y CHECKSUM	A=0,Disable calibration; (default) A=1, Enable calibration; X:Voltage calibration value; If the calibration value is added to the voltage, it begins with +; If the calibration value is reduction to the voltage, it begins with -;unit: v Y:Current calibration value; If the calibration value is added



			to the Current, it begins with +; If the calibration value is reduction to the Current, it begins with -;unit: mA Note:support to three decimal point
253	Search command	F0 FD X CHECKSUM	X:The command to query,1byte
255	Restart the LORA module	F0 FF 00 CHECKSUM	After setting the LoRa parameters (such as command 05,11,12), send this command to restart the LoRa module

Reply to the LORAWAN Gateway downward command

Start+ downward command +command content+Check code

Start:0x30;

downward command:1 byte;

Command content:X byte;

Implementation results:

If the command is set, then 1 byte, 0x00 means successful setting, 0x05 means no command, 0x08 means wrong parameter;

If it is query command, it is the query command+the query result+the contents of the command

Command content: if the query result is 0x05 or 0x08, there is no such data

Check code:1 byte, the previous data sum

## 16 Precautions

1. When the product is close to the metal object, the signal will be interfered, resulting in signal attenuation;
2. The product should be kept away from water and corrosive objects;
3. Please inform us of the use environment and standby requirements before ordering, and we will configure the device and guide the installation accordingly.