LW503 LoRaWAN Soil NPK Sensor User Manual

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1. Overview

LoRaWAN soil nitrogen phosphorus potassium (NPK) sensor, specially designed for precision agriculture. It can penetrate deep into the soil and detect nitrogen, phosphorus, and potassium content in real-time and accurately, with minimal measurement errors. With LoRaWAN long-distance low-power communication technology, stable data transmission can be achieved in remote farmland without frequent battery replacement. Farmers can grasp the soil nutrient status at any time and apply fertilizers reasonably through supporting software, which not only reduces costs but also improves crop yield and quality, helping agriculture move towards intelligence and efficiency.

2. Technical Parameters

Power Supply	5-28 VDC
Weight	150g
Operating Emperature	0℃~55℃
Measuring Range	0-1999 mg/kg(mg/L) 0-2999 mg/kg(mg/L)
Measurement Error	≤5%
Resolution Ratio	1 mg/kg(mg/L)
Sensor External Dimensions	45*15*123mm
Steel Needle Material	Stainless Steel
Sealing Material	Black flame retardant epoxy resin
Transmitter Line length	Default 2m (other lengths can be customized)
Frequency	CN470/IN865/EU868/RU864/US915/AU915/ KR920/AS923-1&2&3&4
Mode	OTAA Class C

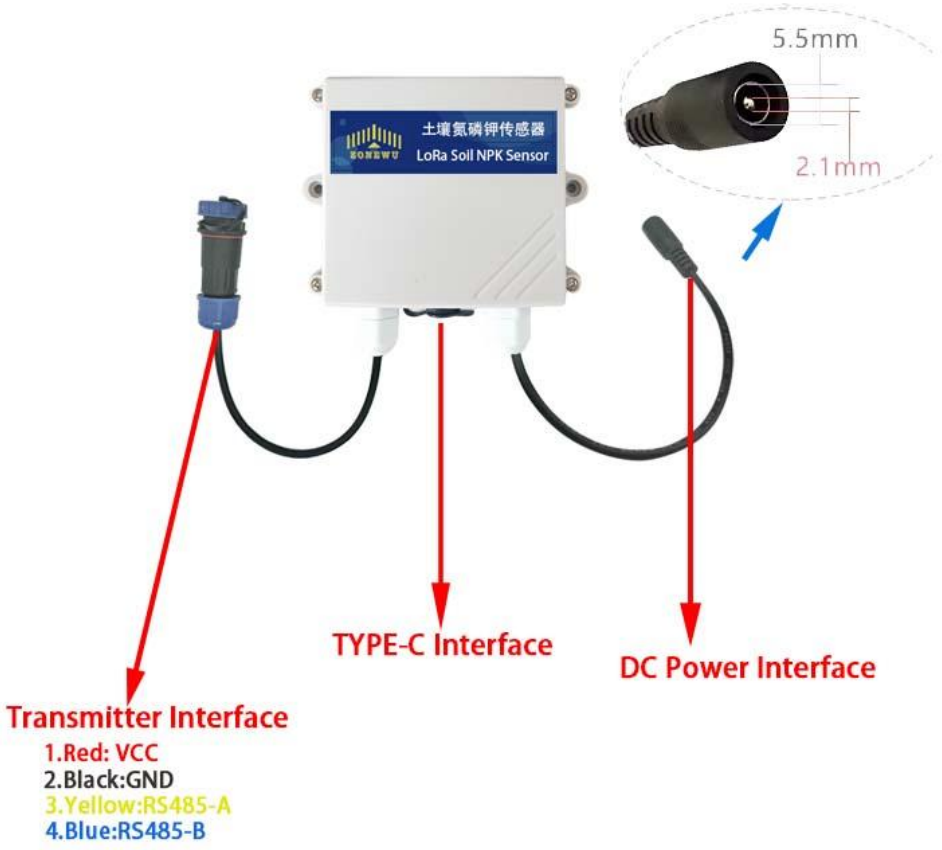
Reporting cycle	5min(Default)
Communication Protocol	LoRaWAN
Equipment information (Reference)	AppEUI：0000000000000001 DevEUI：aaaa202404150001 AppKey：00001111222233334444555566667777 MAC Version：LoRaWAN 1.0.3

2.1 Product List

- LW503 LoRaWAN Terminal 1 piece
- TYPE-C data cable 1 piece
- Soil NPK Transmitter 1piece(individual packing)

3. Configuration and Installation

3.1 LW503 Interface Description



1. **DC Power Interface:**DC5.5 * 2.1 female socket, power supply interface, 5-28VDC.

2. **TYPE-C Interface:**Used for device serial port configuration.

3. **Transmitter Interface:**Used for connecting integrated NPK Transmitter
   1.RD：VCC **2.BK**：GND **3.YL**：RS485A **4.BLU**：RS485B

3.2 LW503 Parameter Configuration Instructions

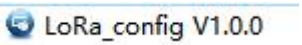
Configuration preparation:

- USB Type-C data cable
- Computer (Windows system)
- Configuration Tool Toolbox

Download:http://www.zonewu.com/en/Configuration-Tools.html

1. Install serial port driver program.CH340 USB to serial port .

2. Connect the LW50X to the PC using a USB cable and check if there is a COM port. If not, please recheck the equipment wiring and driver installation.

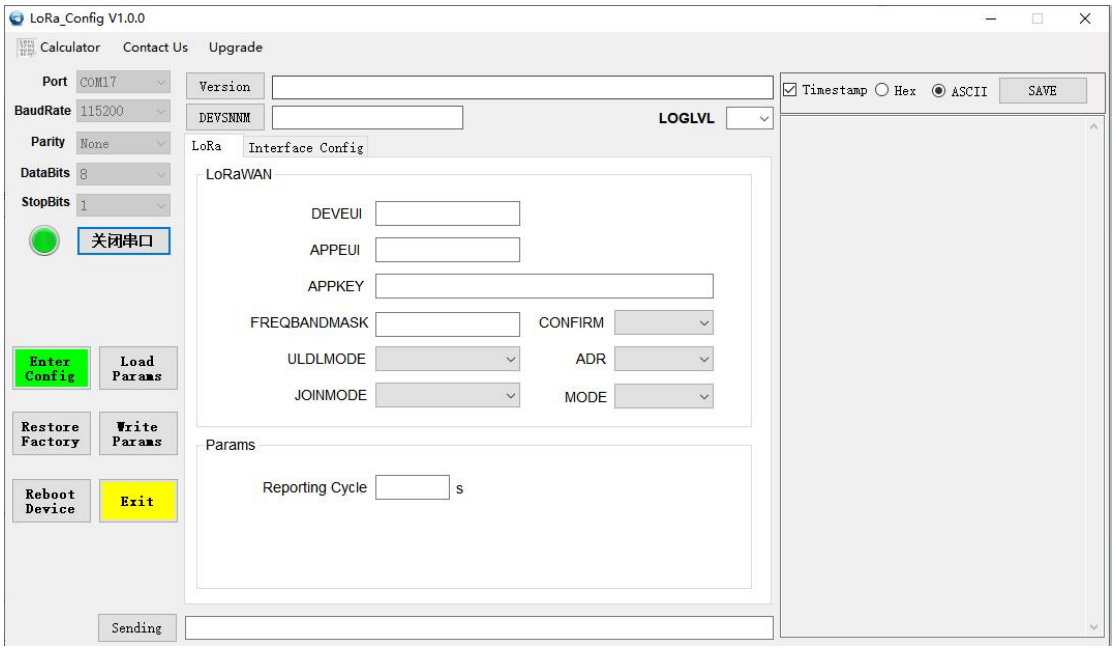
3. Open the configuration tool LoRa_config 

.open the corresponding COM port .

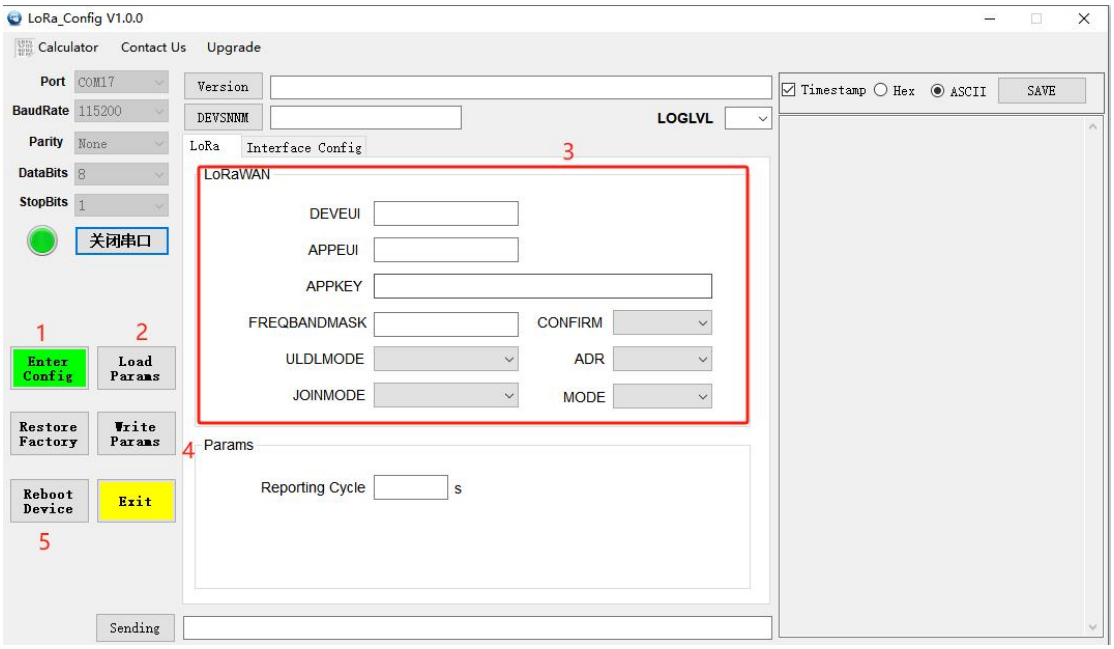
Port default parameters:

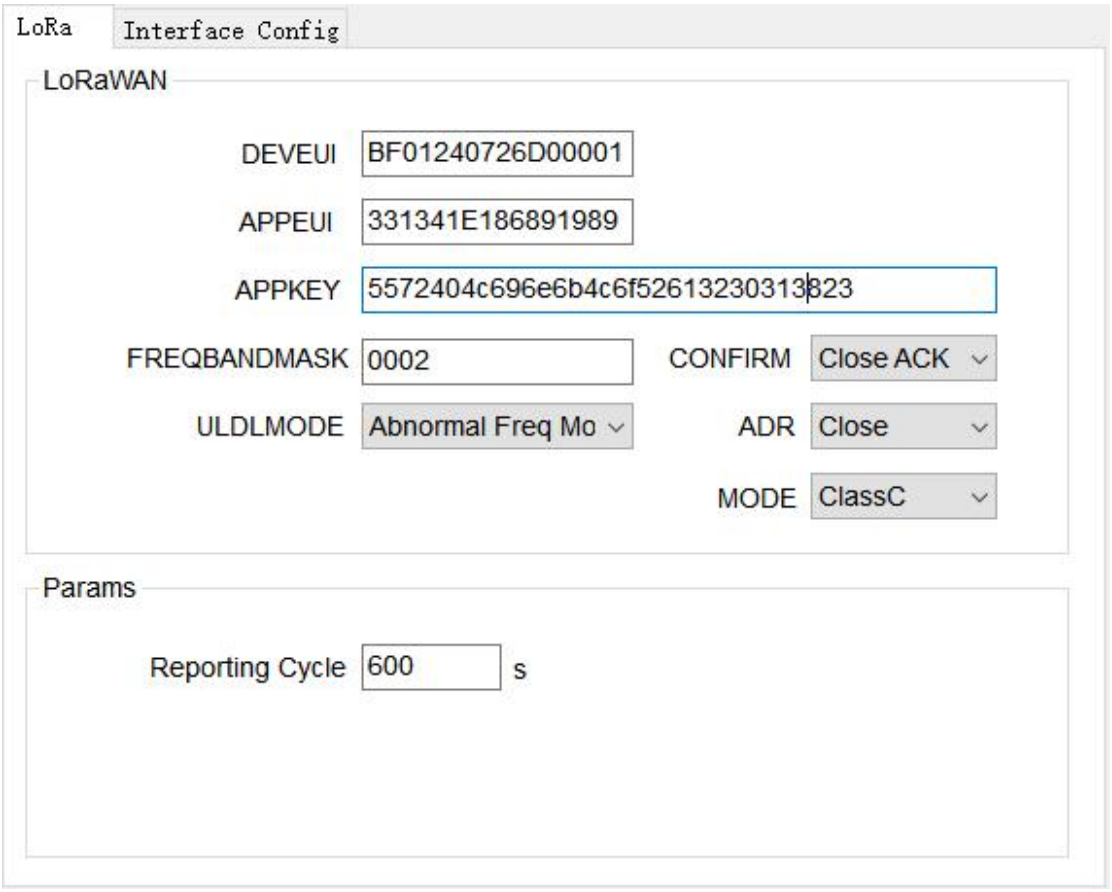
BaudRate	115200bit/s
Parity	None
DataBits	8
StopBits	1

As follows:



4. 1.Enter Config → 2.Load Params → 3.LoRaWAN → 4.Write Params → 5.Reboot Device





LoRaWAN Interface:

Item	Describe	Notes
DevEUI	Node's globally unique identifier code	64bit
AppEUI	Node's application identifier code	64bit
AppKey	Assigned to the terminal by the application owner.	128bit

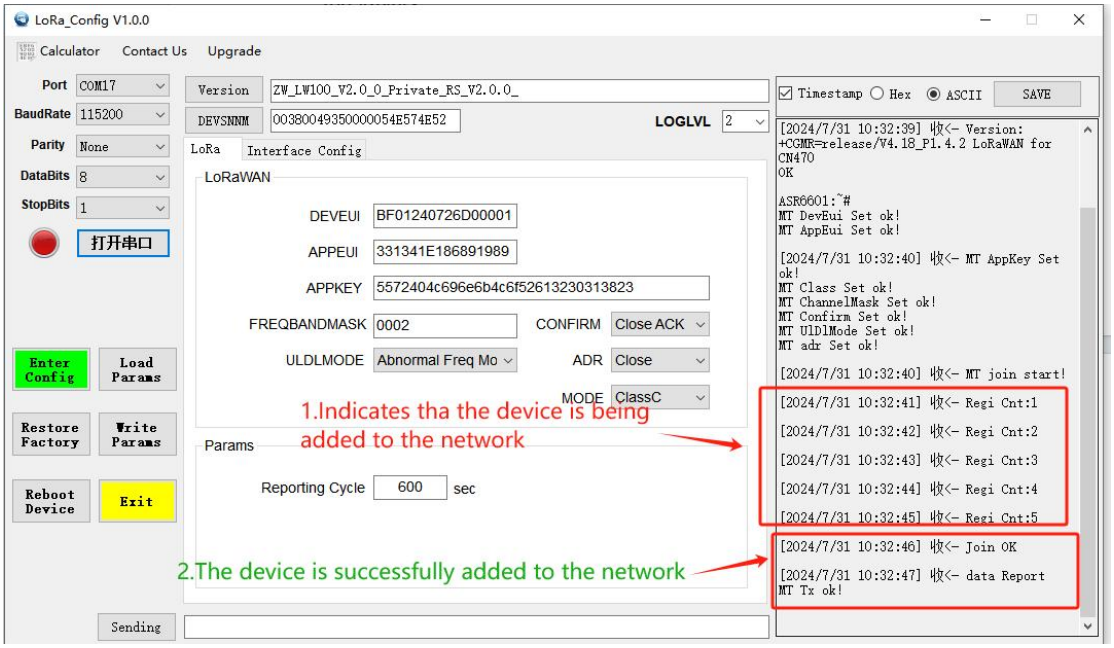
FREQBANDMASK	Set frequency group mask	
ULDLMODE	Set up uplink and downlink same frequency but different frequency	
CONFIRM	Set uplink transmission type	
ADR	Set adaptive speed	
MODE	Set device working mode	

The device will be configured with ternary parameters by default when it leaves the factory:
DevEUI: BF05240726D00001
AppEUI: 331341E186891989
AppKey: 5572404c696e6b4c6f52613230313823
NOTE:All sensors are shipped with AppEUI and AppKey default to **331341E186891989** and **5572404c696e6b4c6f526132330313823**.
Users can customize according to their own applications
FREQBANDMASK: The frequency group mask for LoRaWAN operation, with 16 bits corresponding to 16 frequency groups. Default is 0001.Users need to configure it according to the actual application region.

Params Interface:

Item	Describe	Notes
Reporting cycle	adjustable range 1-65535, default is 3600s (60min)	

Printing logs of device startup and network connection：

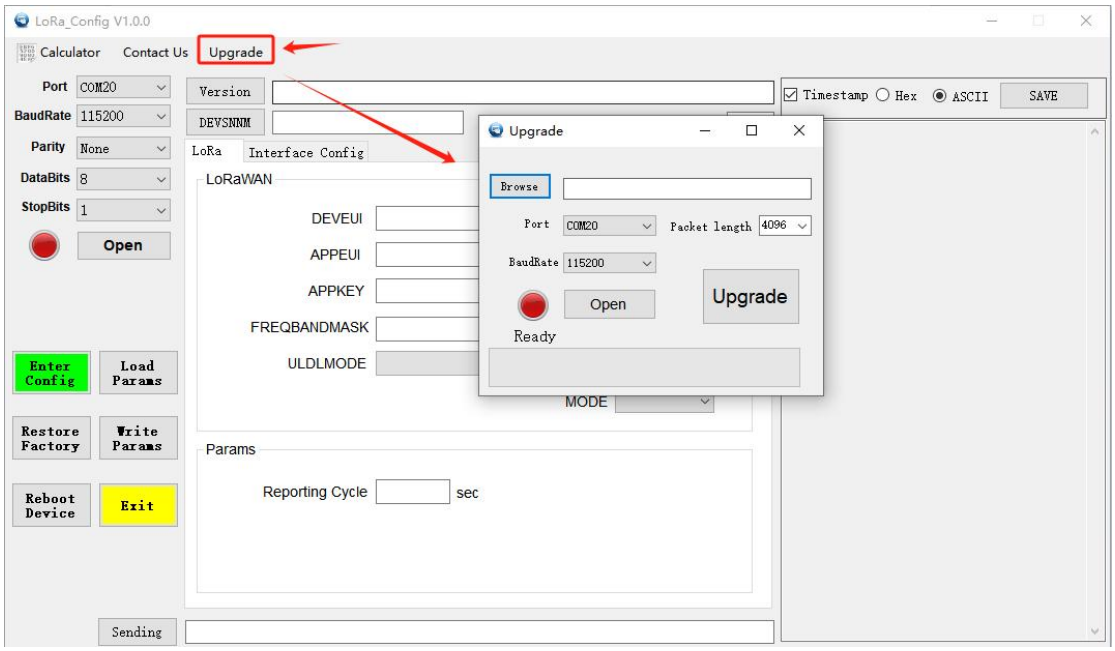


The device is equipped with a built-in LED indicator light, which is located next

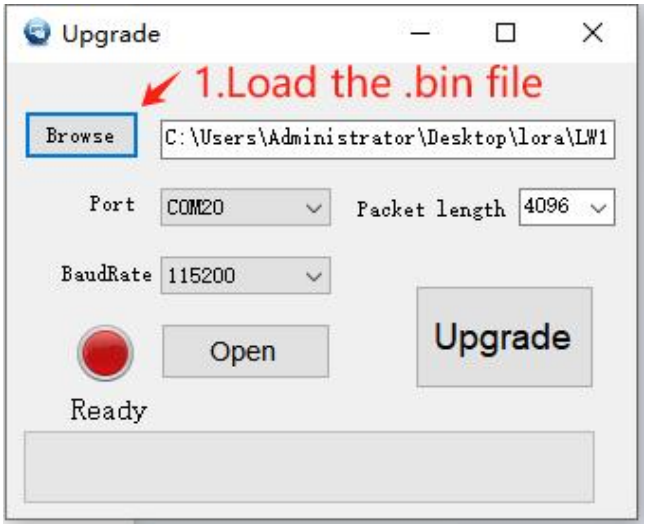
to the antenna interface and can be seen as a green light through the casing.

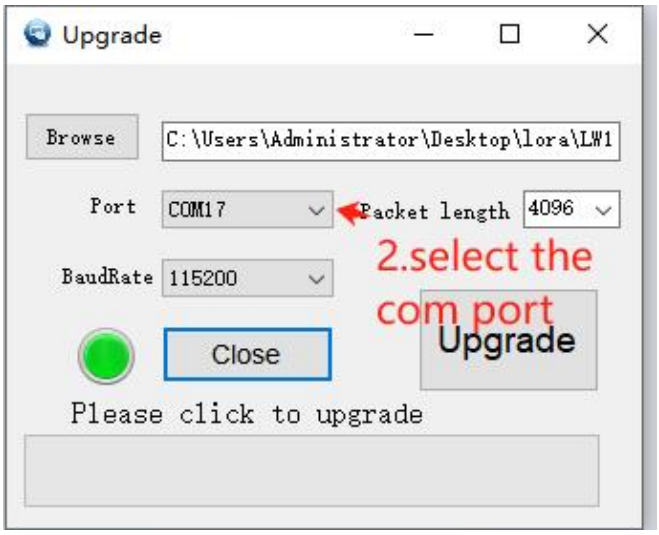
LED	Status	Describe
Green indicator light	Light	Wake up
	Extinguish	Enter sleep mode

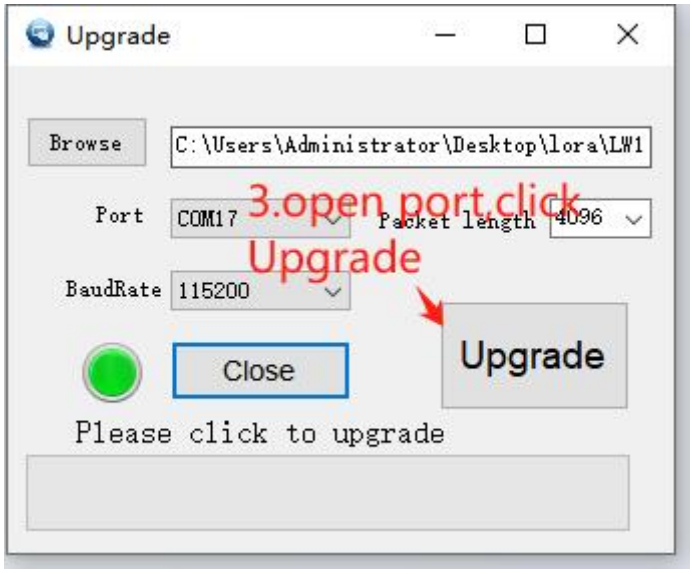
Firmware upgrade:

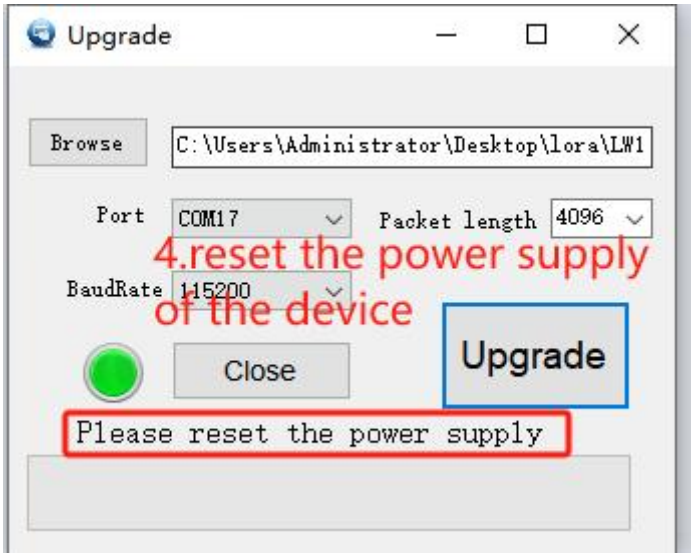


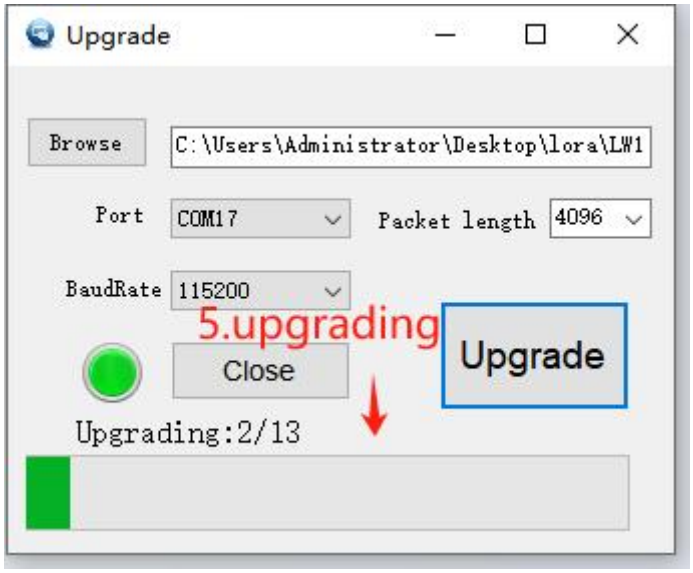
Click to upgrade → Pop up upgrade window

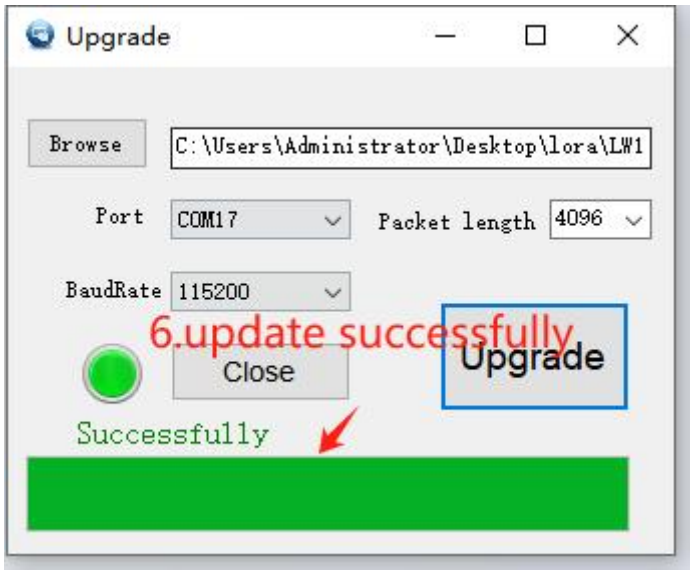



Upgrade
Browse
C:\Users\Administrator\Desktop\lora\LW1
Port
COM17
Packet length
4096
2.select the com port
BaudRate
115200
Close
Upgrade
Please click to upgrade


Upgrade
Browse
C:\Users\Administrator\Desktop\lora\LW1
3.open port,click Upgrade
Port
COM17
Packet length
4096
BaudRate
115200
Close
Upgrade
Please click to upgrade


Upgrade
Browse
C:\Users\Administrator\Desktop\lora\LW1
Port
COM17
Packet length
4096
4.reset the power supply of the device
BaudRate
115200
Close
Upgrade
Please reset the power supply

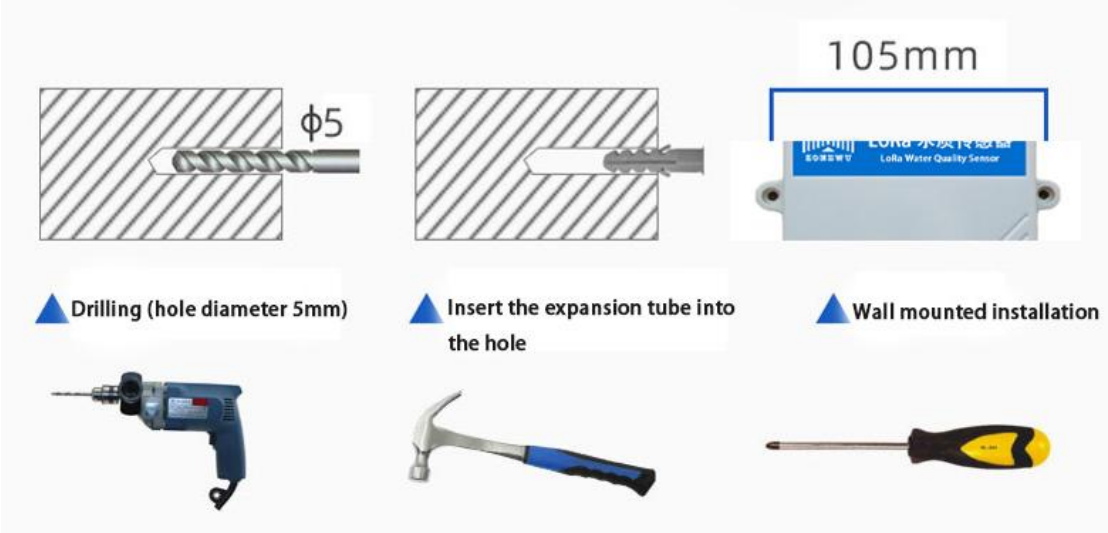




If there is an upgrade error during the upgrade process, you can close and reopen the upgrade window and follow the instructions to upgrade again.

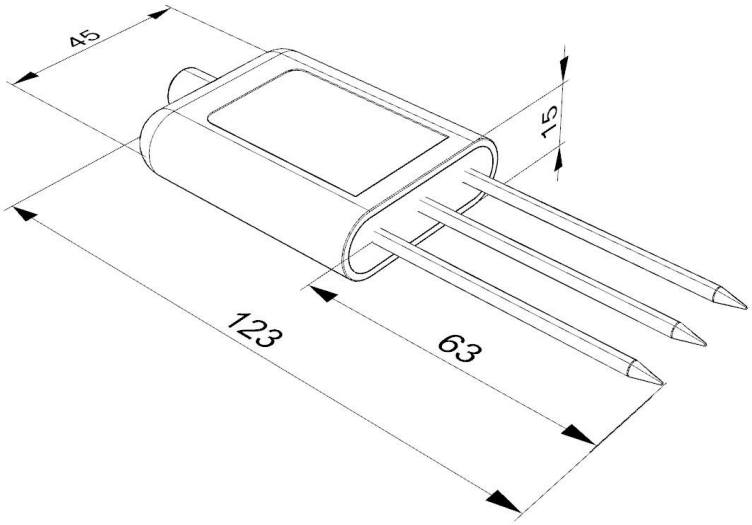
3.3 LW503 Size and Installation

Product size



Installation instructions

3.4 Soil NPK Transmitter Size



3.4.1 Precautions

1. The steel needle must be fully inserted into the soil during measurement.
2. Avoid direct exposure of strong sunlight to the equipment, which may cause excessive temperature. Pay attention to lightning protection when using outdoors.
3. Do not forcefully bend the steel needle, do not forcefully pull or pull the equipment lead wire, and do not hit or violently impact the equipment.
4. The device has a protection level of IP68 and can be fully submerged in water.
5. Due to the presence of radio frequency electromagnetic radiation in the air, it is not advisable to be in an electrified state for a long time.

4. Protocol Description

4.1 Data Format

The up/down data of the device is based on hexadecimal format. High position in front, low position in back.

address	code	length	data		
1 byte	1 byte	1 byte	2 byte	2 byte	2 byte

4.2 Upward Data

The device information is reported once during network access or restart.

050306002000250030					
Sensor address	**Instruction type**	**Data Length**	**DATA**		
			N	**P**	**K**
05	03	06	0020	0025	0030
5	3	6	32	37	48

Note: If the received data is FFFF FFFF, it indicates that the sensor is not connected or the sensor is abnormal.

4.2.1 Register Address Description

Register address	**0001H**	**0002H**	**0003H**
Parameter	N	P	K
Unit	mg/kg	mg/kg	mg/kg
Range	0-2999	0-2999	0-2999
Data Type	uint16	uint16	uint16
Sample Value	-	-	-
Operate	Read/Write	Read/Write	Read/Write

4.3 Downward data

Support configuring devices through downstream commands. When the

downlink command is in confirmation packet mode, the device will immediately send a reply packet after executing the command.

4.3.1 Restart the device

Starting byte（1byte）	Instruction type（1byte）	Trail byte（1byte）
0xFE	01	0xEF

Response：

Starting byte（1byte）	Instruction type（1byte）	Trail byte（1byte）
0xEF	01	0xFE

4.3.2 Set Reporting cycle

Starting byte（1byte）	Instruction type（1byte）	Reporting cycle（2byte）	Trail byte（1byte）
0xFE	02	X	0xEF

Response：

Starting byte（1byte）	Instruction type（1byte）	Reporting cycle（2byte）	Trail byte（1byte）
0xEF	02	X	0xFE