WINEXT
TECHNOLOGY

AN-201A Sensor Box

User Manual

LoRa

END-TO-END LORAWAN NETWORK SOLUTION

Content

1. Description

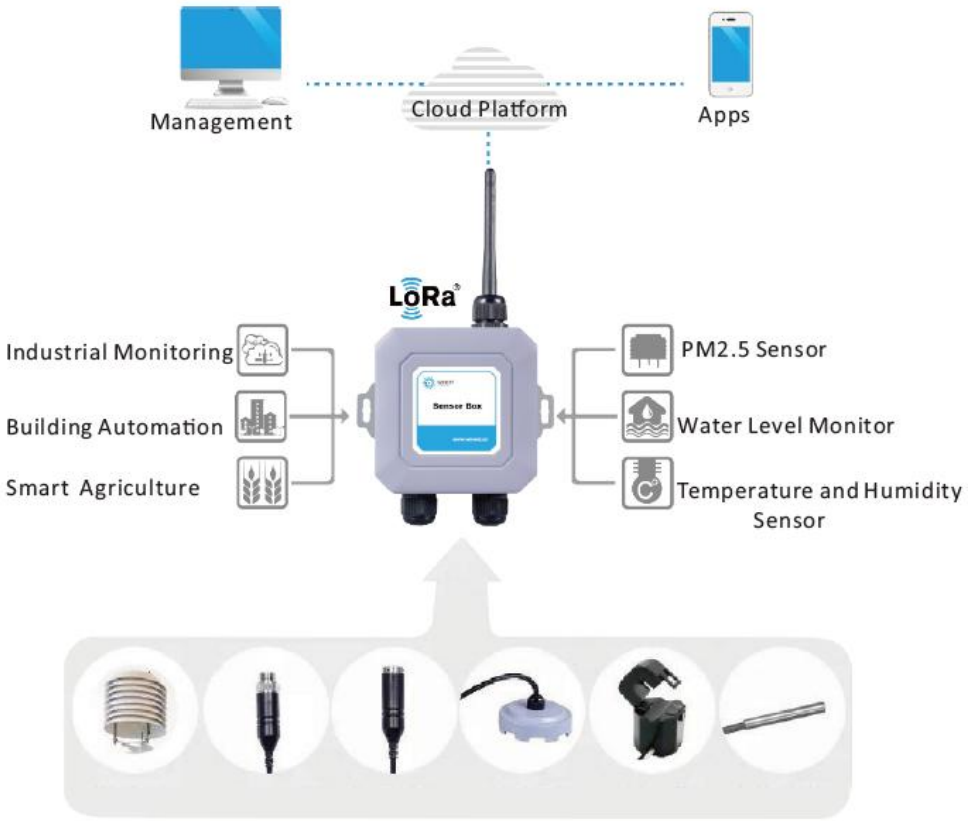
1.1 Product Description

AN-201A Sensor Box is a wireless data gathering device, compliant with LoRaWAN. It has been integrated with multiple communication ports for a variety of sensors. Its high-gain omni-directional external antenna expands the communication distance. External power supply and battery power supply are optional. With battery capacity Up to 19000mAh, it enables a long lifespan, reduces cost of battery replacement. It has a rugged enclosure with IP65 ingress protection rate. It can be fixed by pole-mounted and wall-mounted method, installed on pole, walls of the building, roof and etc.

1.2 Application

Suitable for workshop, warehouse, agricultural greenhouse, docking within scenarios such as rooms, hydrological monitoring sensors, e.g.: hydraulic pressure sensors, liquid level sensor, liquid flow sensor, water sensor, temperature sensor, humidity sensor, light sensor, PM2.5, angle sensor, wind speed sensor, etc.

Typical applications scenario:
Industrial monitoring, building automation, smart agriculture



1.3 Features

- Support Standard LoRaWAN Protocol
- Frequency Bands: CN470-510/EU863-870/US902-928/AS923~925/AU915~928/CT850 etc.
- Integrates multiple communication interfaces: SPI, UART, ADC, GPIO, I2C,etc.
- Ingress Protection Rate:IP65
- Low power consumption,external power supply and built-in battery optional
- Battery power supply mode uses a large capacity battery of 19000mAh
- Supports multiple voltage outputs:3.3V, 5V, 9V, 12V, etc.
- supports wired and wireless parameter configuration and firmware upgrades; supports remote configuration
- Supports low battery alarm
- Supports heartbeat package reporting, heartbeat interval is configurable
- Operating temperature: -20℃～+70℃

1.4 Specification

Item		Specification
Wireless Performance	Data Transmission Rate	300bps~5.4Kbps
	Frequency	CN470MHz~510MHz
		EU863MHz~870MHz
		US 902MHz~928MHz
		AS923~925MHz
		AU915~928MHz
		CT850MHz
	Max Tx Power	19dBm
	Max Link Budget	160dB
	Max Rx Sensitivity	-140dBm(SF=12)
	LoRa Antenna	Omnidirectional external antenna
	Communication Port	UART, SPI, I2C, GPIO, ADC, RS485
Operating Condition	Temperature	-20℃～+70℃
	Humidity	10%~95%RH non condensing
Power Supply	Power Supply	DC5-24V input; built-in battery optional
	Battery Capacity	3.6 V/19000mAH
Power	Sleep Current	≤6uA
	Tx Current	≤125mA
	Rx Current	≤16mA
Others	External Sensors Suitable	RS485 port: suitable for wind speed sensor, wind direction sensor, GPS, water meter, electricity meter and gas meter, etc…
		PT1000 port: temperature sensor

Item		Specification
		I2C port: gravity sensor, temperature and humidity sensor, etc.
		GPIO port: suitable for immersion sensor, angle sensor, smoke detector (software not support temporary)
		ADC port: pressure sensors, liquid level sensors, temperature and humidity sensors, light sensors, flow sensors, carbon dioxide sensors, etc.
	Ingress Protection Rate	IP65
	Dimension	110*110*45mm(antenna excluded)

2. Structure

2.1 Dimension

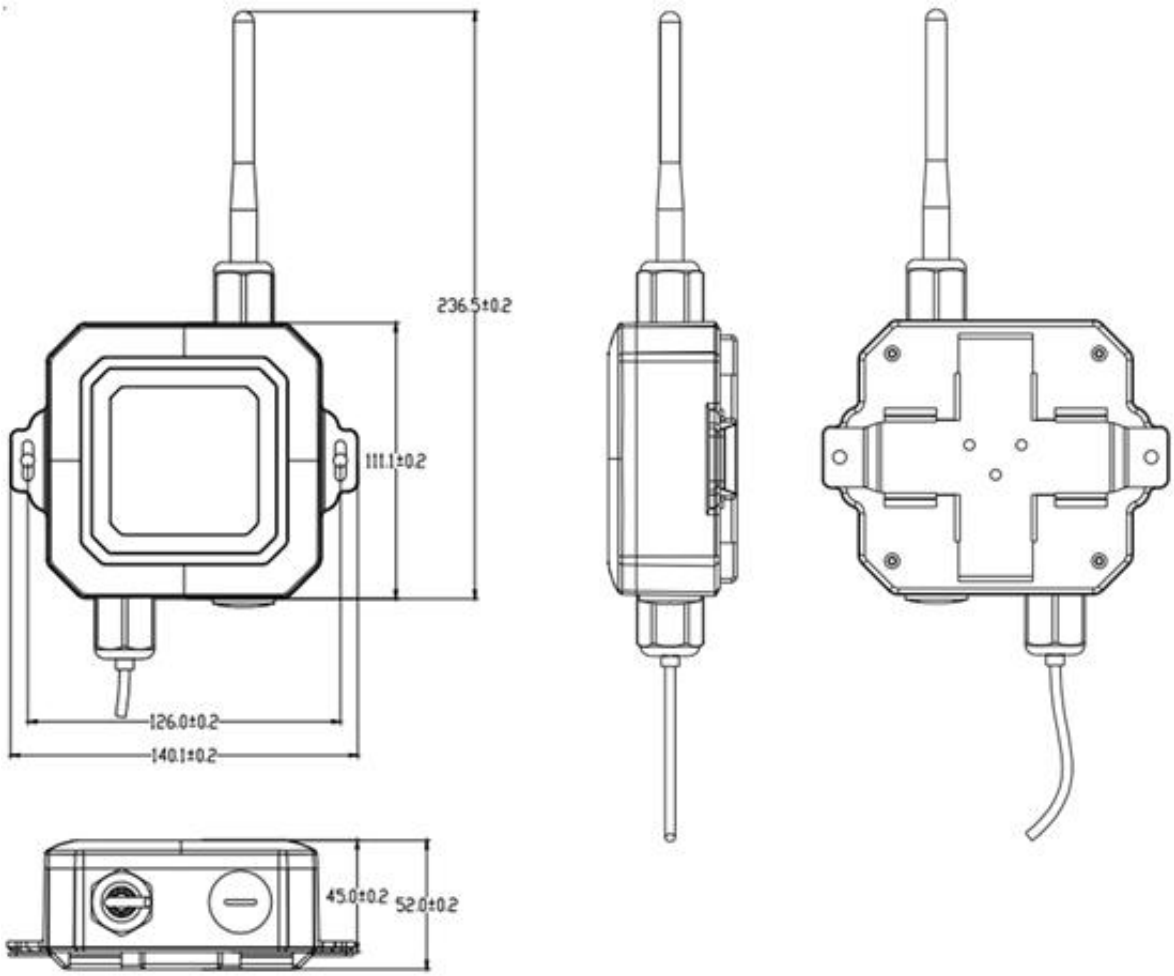


Figure: AN-201 Sensor Box Dimension (mm)

2.2 Device type and structure

1. Built-in Battery with Standard Connectors

2. Built-in Battery with Aviation Connectors

3.External Power Supply with Standard Connectors

4.External Power Supply with Aviation Connectors

There are 4 types with different power supply versions available

No.	Description	Use	Remark
1	Built-in Battery with Standard Connectors	Users open the cover and connect the sensor wiring inside the box themselves	Users can finish wire connection by themselves.
2	Built-in Battery with Aviation Connectors	Based on the pin definition of the aviation connectors, users only need to connect sensors or wiring outside the box.	Suitable for upgrading existing sensors and for rapid on-site construction scenarios.
3	External Power Supply with Standard Connectors	Users open the cover and connect the sensor wiring inside the box themselves.	Users can finish wire connection by themselves.
4	External Power Supply with Aviation Connectors	Based on the pin definition of the aviation connectors, users only need to connect sensors or wiring outside the box.	Suitable for upgrading existing sensors and for rapid on-site construction scenarios

2.2.1 Device Description

Figure: AN-201A Sensor Box Description

2.2.2 Aviation joint

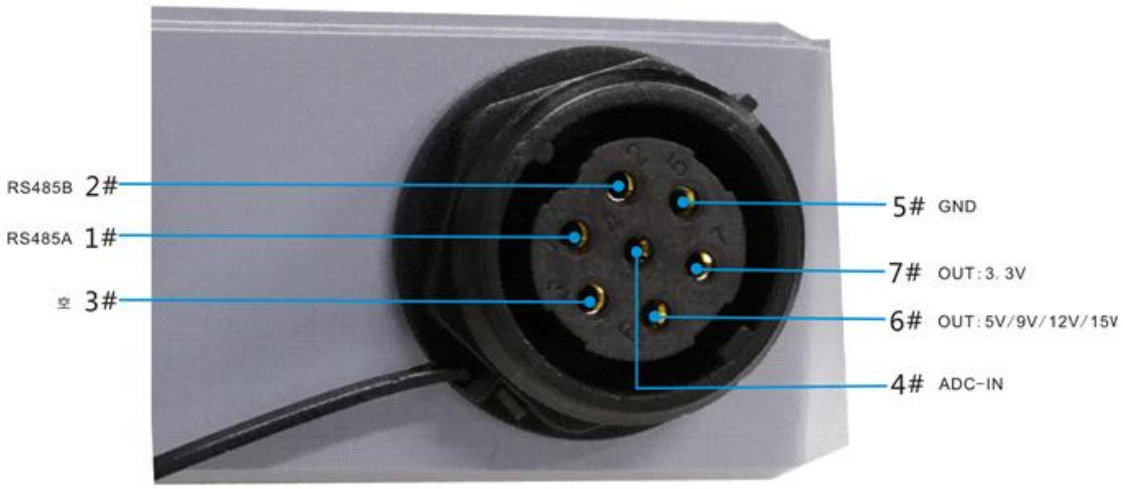


Figure: AN-201A Aviation Connector

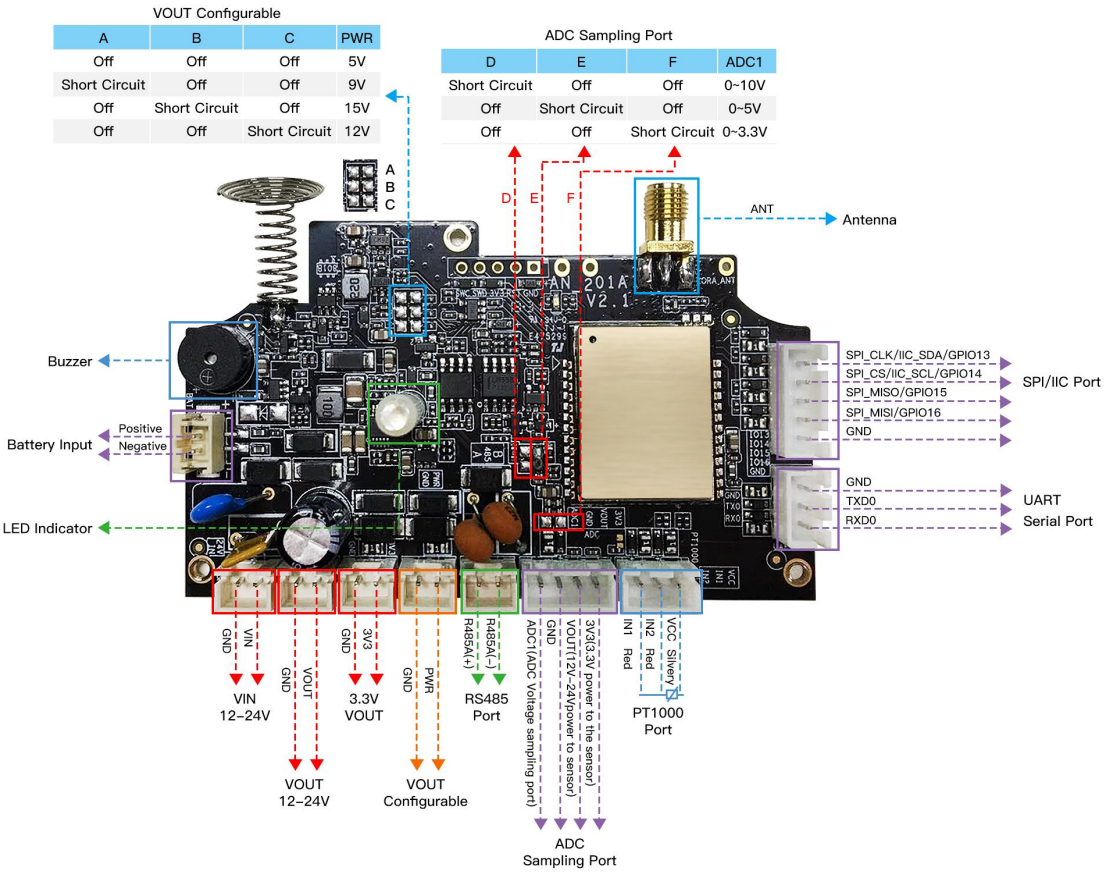


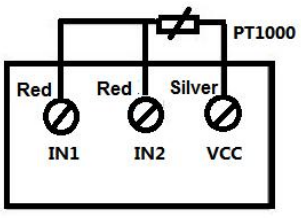
Figure: PCBA Diagram

2.2.3 Interface Description

Description	Function
Buzzer	Alerts for device status
Capacitive Touch Sensing Switch	Gently touch the spring power-on position for about 5 seconds, then the buzzer will sound continuously, remove your finger after about 1 second, and then touch twice consecutively to hear two beeps, indicating the device is powered on and ready to operate. To reset, touch for about 5 seconds after powering on.
Operation Indicator	Light on when the device working Light off when the device sleeping
Antenna Interface	LoRa antenna interface
12V-24V Power Supply Output Interface	Support 12V-14V output VOUT: for positive of 12-24V output GND: for negative of 12-24V output
Battery Interface	3.6V Battery supply port +: 3.6V Battery positive -: 3.6V Battery negative
3.3V VOUT Port	Support 3.3V VOUT 3V3：for positive of 3.3V VOUT GND: for negative of 3.3V VOUT
VOUT Configurable	Function: for 5V/9V/12V/15V VOUT A/B/C resistor are in Off state, 5V VOUT via PWR connector Connect the two ends of the A resistor by wires, 9V VOUT via PWR connector Connect the two ends of the C resistor by wires,, 12V VOUT via PWR connector Connect the two ends of the B resistor by wires,, 15V VOUT via PWR connector PWR: for positive of VOUT
RS485 Port	Interface Description: 485A: RS485A line interface. 485B: RS485B line interface.

Description	Function
ADC Sampling Port	Support 0-3.3V, 0-5V, 0-10V voltage sampling. 0-3.3V sampling: Connect the two ends of the F resistor by wires, voltage sampling via ADC1 port. 0-5V sampling: Connect the two ends of the E resistor by wires, voltage sampling via ADC1 port. 0-10V sampling: Connect the two ends of the D resistor by wires, voltage sampling via ADC1 port. 3V3: 3.3V sensor power supply VOUT: 12V to 24V sensor power supply. GND: Negative terminal for sensor power supply. ADC1: Voltage sampling port Note: Connect the two ends of the anyone of D/E/F resistor by wires, the other 2 resistors are in Off state.
PT1000 Port	Function: for temperature detection, supports three-wire PT1000 sensors. Please refer to its diagram for details.
Serial Port Debugging Interface	Function: Connect to a computer to communicate with the device using a host machine, configure parameters, and perform AT command debugging, among other functions. Description: RXD0 connects to serial RXD. TXD0 connects to serial TXD. GND connects to serial GND.
SPI Port	Function:SPI port or IIC port Description: IOI3: SPI-CLK port or IIC-SCL port IOI4: SPI-CS port or IIC-SDA port IOI5: SPI_MISO port IOI6: SPI_MOSI port
Power-On Indicator	Light on when powered by a battery or an adapter

PT1000 Wiring Diagram



2.3 Packaging kits

Item	Qty(pc)	Remark
AN-201A Sensor Box	1	/
Power Adaptor	1	Optional
Aviator connector	1	Optional
Backboard	1	Optional
Wedge Shaped Silicone Plug	4	Size:3x7x15mm, White
Screw	2	M5x12, with gasket and plastic cover. It is a screw head sketch below. 
Tapping screw	2	M5X30, cross round head with gasket and plastic cover
Holding Bracket	2	Φ50-110, stainless steel

3. How to Work

3.1 Operation principle

AN-201A Sensor Box is integrated with SPI, UART, ADC, GPIO, IIC, RS485 ports. It can communicate with variable sensors via its ports, with configuration under AT command. It supports power supply and battery supply. Built-in battery capacity up to 19000mAh, enables a long working life. It supports a variety of output voltage, 3.3V, 5V, 9V, 12V, 15V, etc. Use DIP switch to change output voltage on hardware circuit. You can also configure the output voltage under the AT command in 3 modes as constant on, constant off and sampling gathering mode. It can supply power to variety kinds of sensors.

3.2 Port

Note: Pictures for the ports are for reference.

3.2.1 ADC port

ADC port is mainly used to collect analog input. It can be configured to collect sampling voltage range, sampling times, sampling interval and sensor response time.

Sampling Voltage Range: Output voltage ranges include 0~2.5v and 0~5V, configured via host computer and hardware connection.

Sampling Time: The amount of each sampling times needed for sending data once. It outputs the

average of several sampling values collected.

Sampling Interval Time: It takes 10 seconds at least for a data sampling gathering.

Response Time: The time to output parameters stably for a sensor.

Hardware Connection:

Figure: 3-1 ADC Interface Connection

ADC: Signal wire converting analog signal to digital signal

GND: Ground wire.

VOUT: Sensor voltage wire, with output voltage of 5V, 9V, 12V, 15V corresponding to different sensors voltage input. Please refer to the details in the *Figrue: PCBA Structure (select appropriate voltage based on sensor power input)*.

3.3V: Sensor voltage wire, with output voltage of 3.3V only(select appropriate voltage based on sensor power input).

3.2.2 IIC port

AN-201A is the IIC host. Via address configuration, it can initialize the IIC port sensor register to write and read the register address data at intervals.

Sensor Address: IIC slave address, please look it up in its data manual.

Sampling Interval Time: The interval of data sampling collections, it takes 10 seconds at least for data sampling collection.

Response Time: the time that it takes to output parameters stably for a sensor.

Write Register Data: it needs to initialize the IIC sensor register address data to complete corresponding sensor configuration when power applied. It is executed on power once only.

Read Register Data: read IIC register address data.

Hardware Connection:

Figure: 3-2 IIC Port Connection

- **IO3**: Sensor SCL signal line
- **IO4**: Sensor SDA signal line
- **GND**: Sensor ground wire
- **VOUT**: Sensor voltage wire, with output voltage of 5V, 9V, 12V, 15V corresponding to different sensors input voltage. Please refer to the details on the 2-4 Internal Structure Diagram.
- 3.3V: sensor voltage wire, with output voltage of 3.3V only.

3.2.3 RS485 port

It has transparent transmission mode and polling mode.
Transparent Transmission mode: AN-201A accepts sensor data passively and sends it to the platform.
Polling mode: AN-201A actively queries sensor data regularly and sends it to the platform. It needs to configure the timing time to query data, the sensor protocol and the sensor response time.

- **Data Sampling Period**: The interval of data query. It takes 10 seconds at least.
- **Protocol**: Configure the command of AN-201A to receive sensor data according to the sensor protocol. It supports to read a piece of data only. After configuration done, data can be saved.
- **Response time**: The time to output parameters stably for a sensor once it powered up.
- **Hardware Connection**:

Figure:3-3 RS485 Interface Connection

- **485A**: Sensor wire A
- **485B**: Sensor wire B
- **GND**: Sensor ground wire(If not powered by AN-201A, it does not need to connect)
- **VOUT**: sensor voltage wire, with output voltage of 5V, 9V, 12V, 15V. Please refer to the details in the PCBA Structure.
- **3.3V**: Sensor voltage wire, with output voltage of 3.3V only. If not powered by AN-201A, it does not need to connect.

3.3 Turn on

- **Turn on**: Gently touch inductive switch for 5s with your fingers, the buzzer will keep ringing. Leave it for about 1s later. Then touch it twice with your fingers until two Di sounds heard. At this time, the device boots up and can work normally.

- **Reset**: Touch the inductive switch with fingers for 5s to reset after it boots up.

- **Join network**: The buzzer beeps 3 times indicating it joins network.

4. Configuration

4.1 Precaution

For device normal operation and detection accuracy, please pay attention to the following matters before configuration:

- Before configuration, please contact our technical staff for the relevant software and manual.
- For wireless configuration, it should be done within the signal coverage area of the wireless serial port module.

4.2 Tool list

Item	Description
Laptop	Installation
USB to TTL Serial Port Cable	The laptop communicates with AN-201A via serial port module.
Wireless Configuration Module	Support communication between the laptop with AN-201A
Host Configuration Tool	Configure AN-201A via its host computer graphical interface.
User Manual	For configuration docs, please contact our technical staff.

Figure: Tool List

Note: For configuration, you can use wireless configuration module or USB to TTL cable.

4.3 Web configuration tool

Before configuration, prepare the following tools and docs (select either wireless configuration module or USB to TTL serial port cable).

Figure: Configuration Tool

Note: please contact our technical staff for Web configuration tool docs (master configuration tool).

4.4 Function configuration

1. Insert the wireless configuration module into the USB port of the laptop, as shown in the figure below:

Figure: Wireless Configuration

2. Operate the M100C_ATCMD_Demo configuration tool, as shown in the figure below:

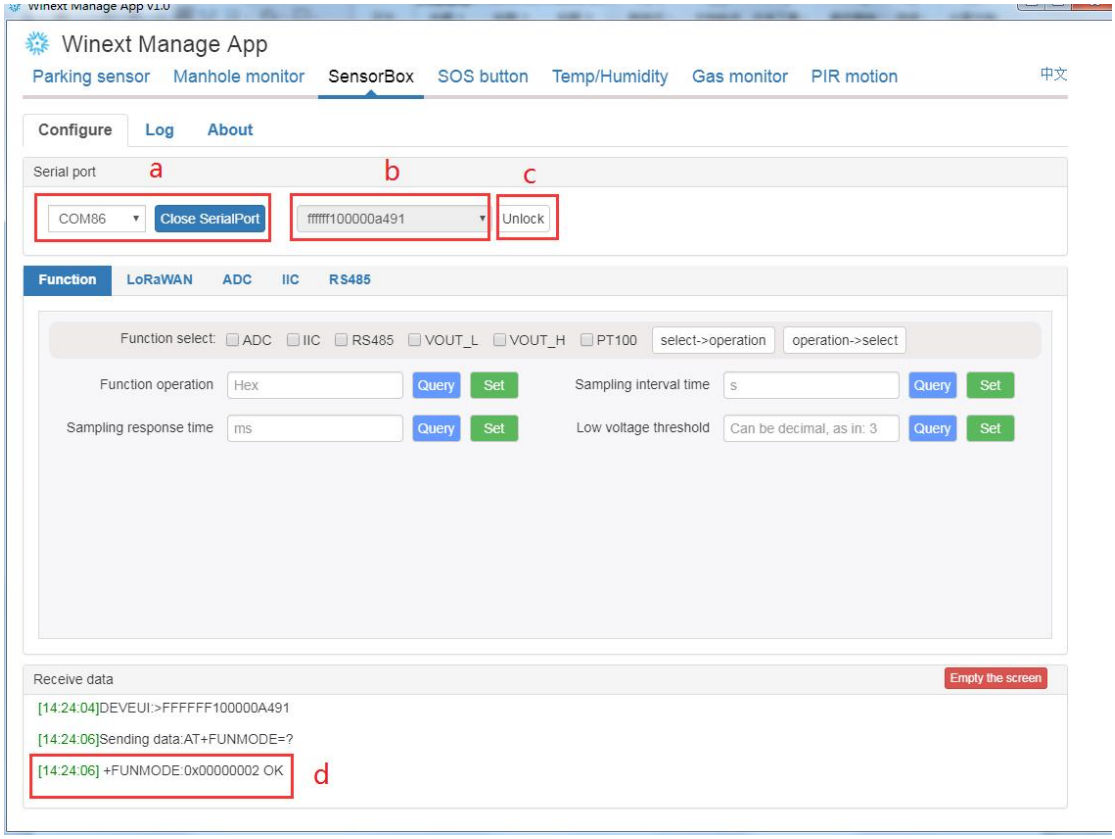


Figure: Demo Configuration

a. Select port, click on Open.

b. Reboot device and its DevEUI will be shown in the dropdown list.

c. Select the target device, click on Device Locked

d. Select the parameters to query or set. If it returns OK on the data receiving interface, it indicates configuration done.

Note: In wireless configuration mode, if there is no operation within 15s it will exit automatically.

3. Function selection:

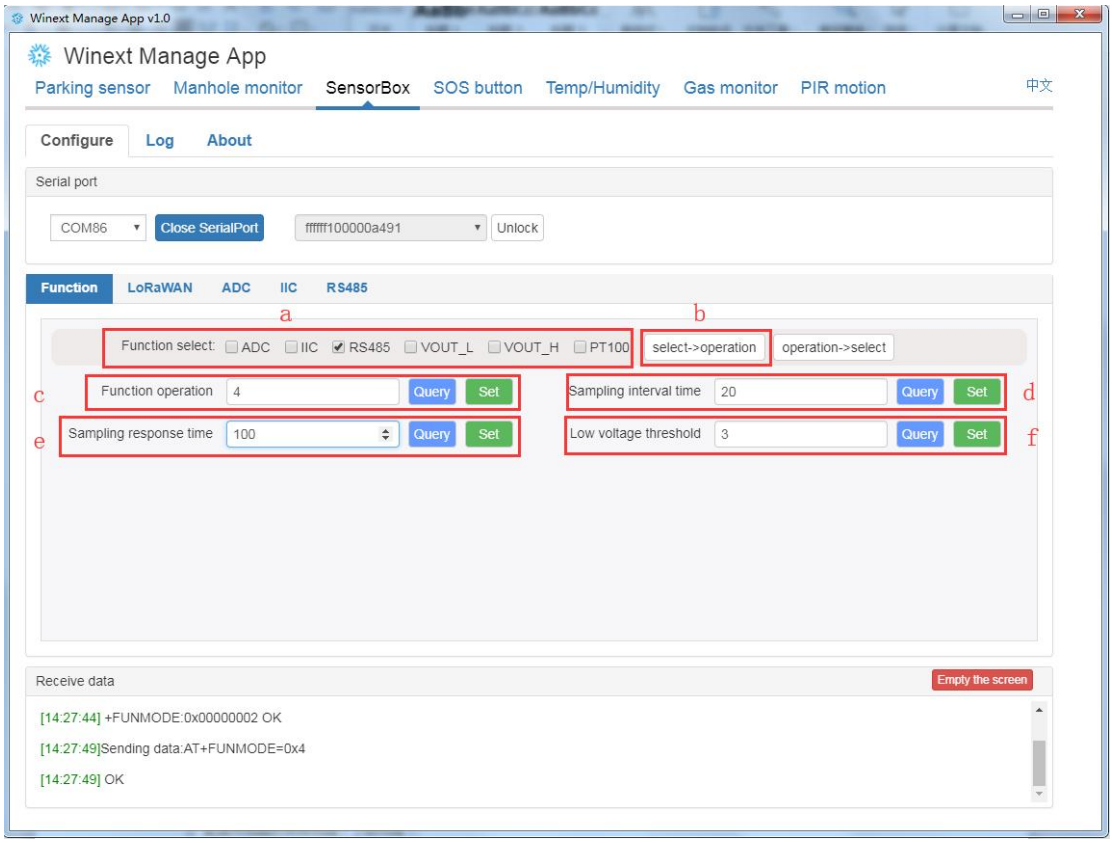


Figure: Web Configuration Operation

a. Select function options and power output mode according to requirements:

Function options: there are ADC, IIC, RS485 and other ports optional. Users can choose port depending on the device

Power output method:

Constant Off: not select VOUTL or VOUTH

Constant On: Select VOUTL and VOUTH

Data gathering working: Select either VOUTL or VOUTH

b. Click on Tab 3 to generate a function code.

c. Create a enable function

d. Set the device sampling interval time

e. Set the response time

f. Set the low voltage threshold

4.4.1 ADC function configuration

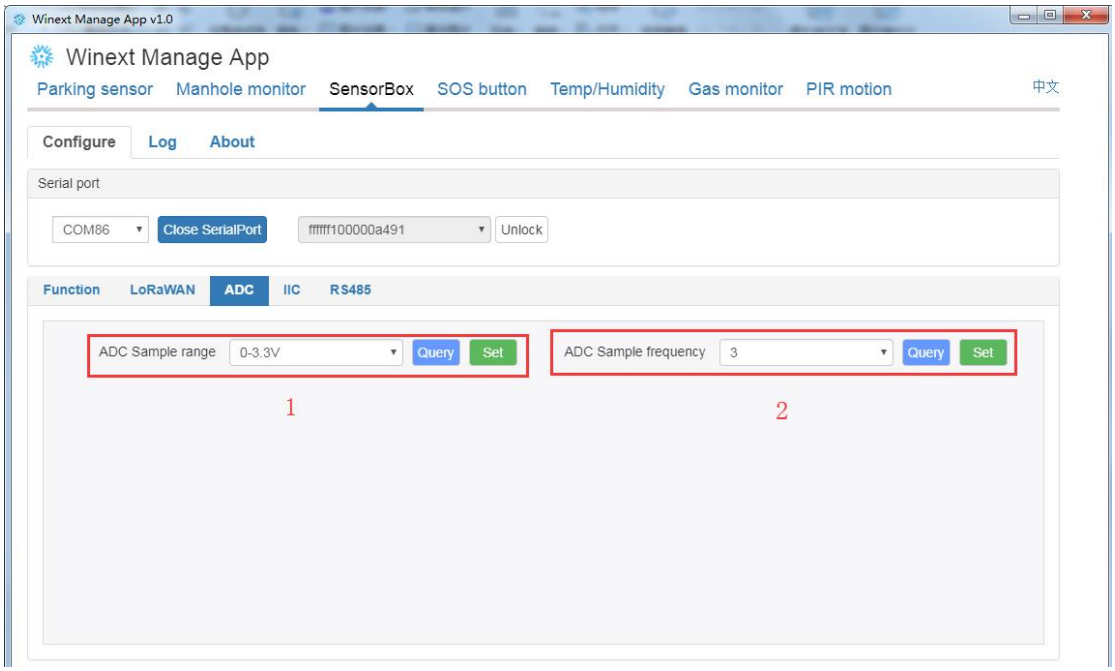


Figure: ADC Port Setting

ADC port setting:

1. Set ADC sample range.
2. Set ADC sample frequency
3. Click on **REBOOT**

4.4.2 IIC Configuration

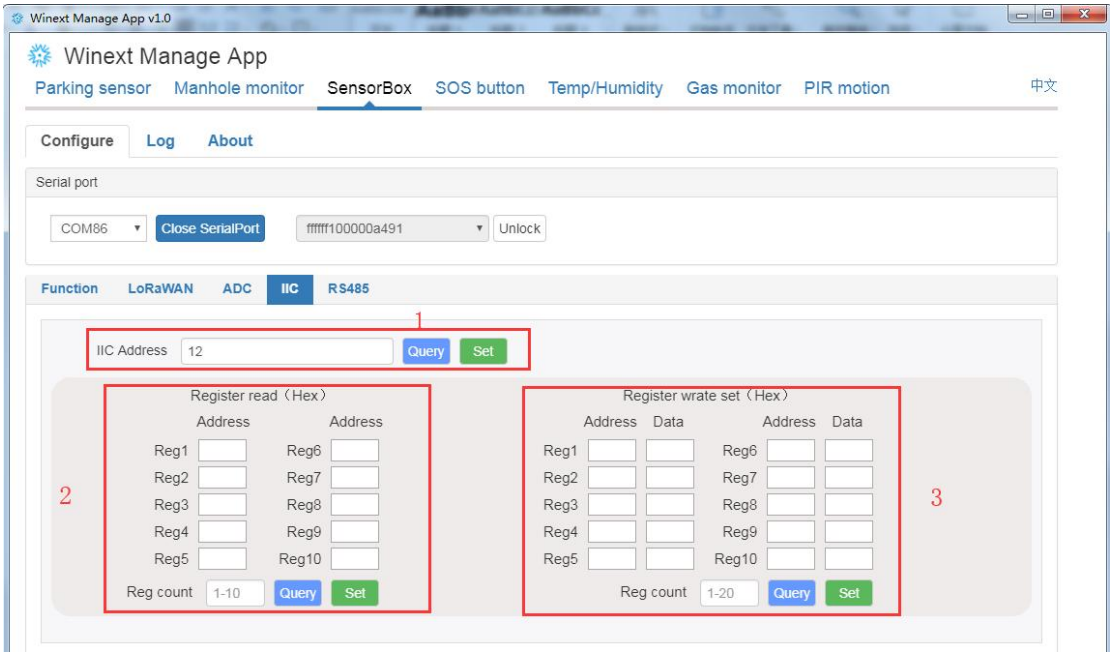


Figure: IIC Port Setting

IIC Port setting:

1. Set IIC address
2. Set the address of register needs to read.
3. Set the registers needed and the parameters
4. Reset.

4.4.3 RS485 port configuration

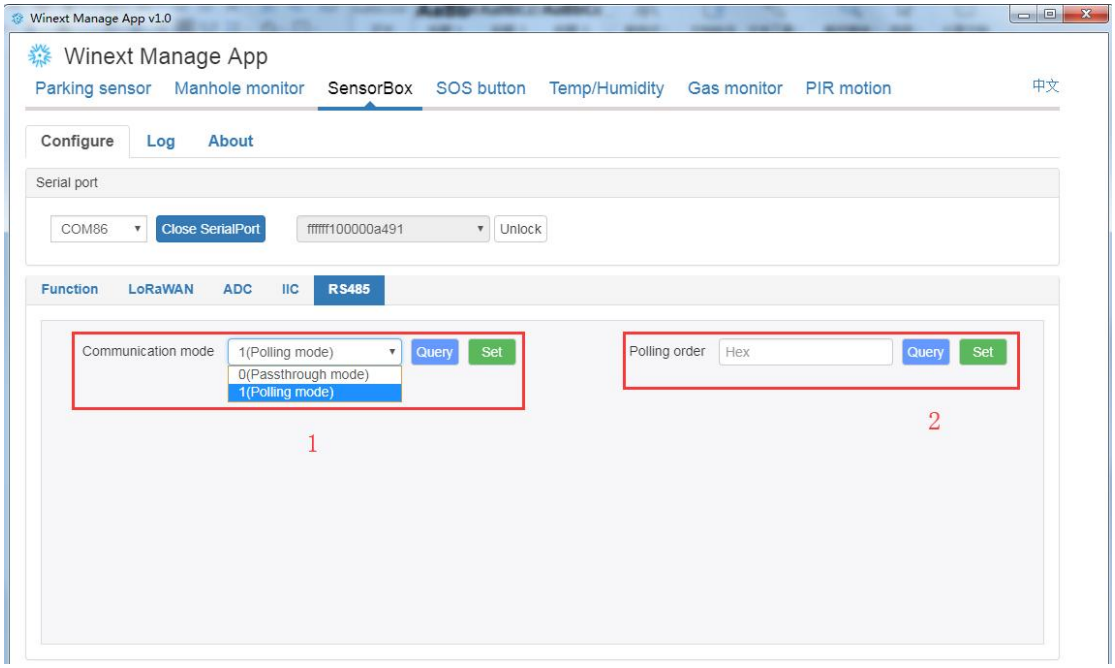
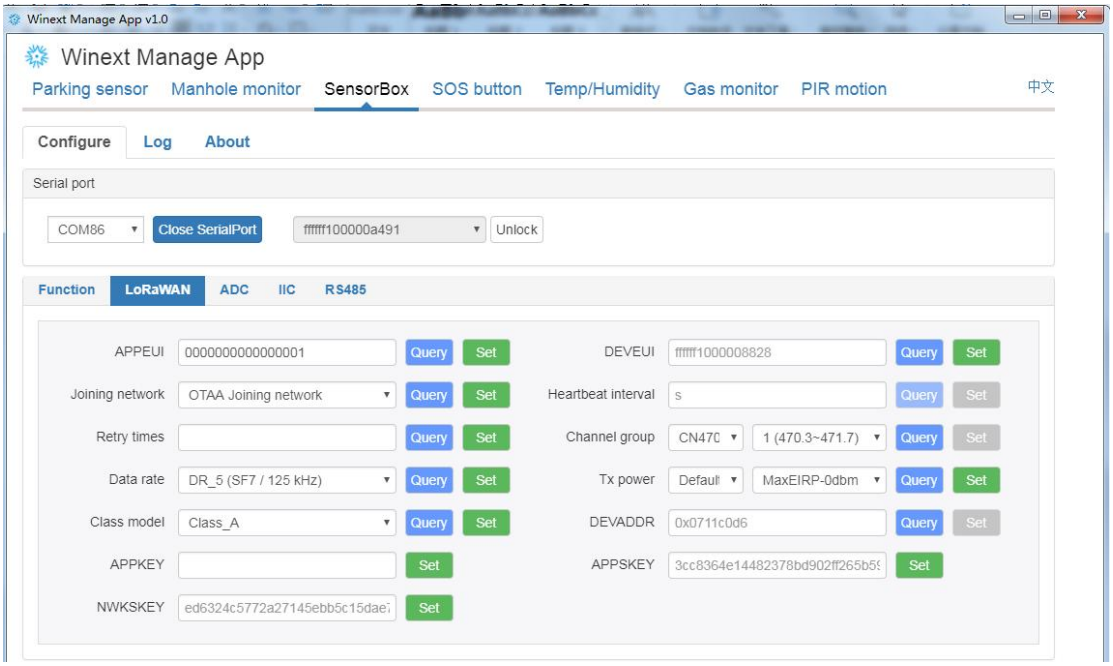


Figure: RS485 Port Setting

Configure RS485 port:

1. Set RS485 communication mode as polling mode or pass-through mode. In polling mode, AN-201A actively sends commands to query the sensor data. In pass-through mode, the sensor sends data actively to the device or the platform sends request to query data from the sensor. For pass-through mode, the platform port number is 220, the downlink data is prefixed with identification code FE.
2. For polling mode, it is to set polling mode command.
3. Reboot

4.4.4 Others



Item	Specification
APPEUI	LoRaWAN application EUI
DEVEUI	Device EUI
LoRaWAN Network Mode	OTAA or ABP
APPKEY	LoRaWAN application key
NWKSKEY	LoRaWAN network session key
DEVADDR	LoRaWAN device address

Figure: LoRaWAN configuration specification

Note:

1. **Channel combination**: CN470 includes 96 channels, divided into 12 combination groups as 8 channels in each group. Channel 0-7 is combination 1; channel 8-15 is combination 2, and so on; channel 88-95 is combination 12.
2. Parameters such as DEVEUI, APPEUI, APPKEY and NWKSKEY need to distinguish big endian and little endian. e.g.: configure DEVEUI parameters, it should enter "> FFFFFF1000000C8A", where '>' represents the big endian. And '<' is added before it, if the parameter is a little endian.
3. **DEVADDR**: enter in hexadecimal, such as "0x0711c0d6".

5. Installation

5.1 Safety precautions

Please follow the below instructions for proper installation:

- Installation can only be authorized by the professional construction personnel or engineering representative.
- Please use the professional qualified installation tools to guarantee the safety of the construction personnel.
- Installation location must be far away from the fire source, strong electric field, magnetic field and similar environments, otherwise it may cause product damage.
- No installation under the high vibration environment.
- Winext reserves the interpretation of installation.

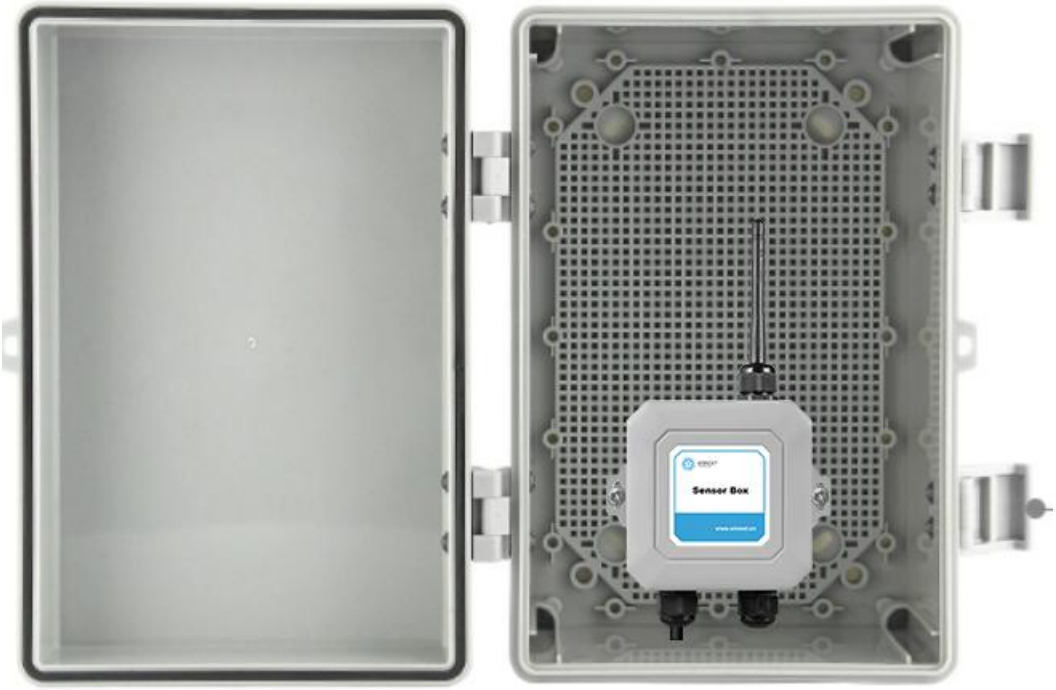
5.2 Tools

Please prepare the following installation tools, which not supplied in packaging accessories.

5.3 Installation

Figure: Wall-mounted and Pole- mounted Installation

5.4 Outdoor Installation



Note: The overall size of SensorBox is 290x140x45mm. For outdoor installation, it is recommended to equip a plastic waterproof case with IP66 or higher protection level.

6. Data Communication Format

Fport	Uplink /Downlink	Payload			Description
		Sensor type	Frame type	Data format	
43	Uplink	0x01	0x01	ADC	It takes 3 bytes. **1st byte represents battery volume**, for its highest bit:0: normal; 1: low battery volume; its low 7th bit represents battery volume value which needs to be converted and divided by 10. e.g.: 0x21 represents 3.3V, normal;0x9F represents 3.1V, low battery volume **2nd and 3rd byte**, these 2 bytes are for ADC data which needs to be converted and divided by 1000. e.g.: 0xce4 represents 3.3V.

Fport	Uplink /Downlink	Payload			Description
		Sensor type	Frame type	Data format	
43	Uplink	0x01	0x02	IIC	It takes N+1 bytes. **1st byte represents battery volume**, for its highest bit:0: normal; 1: low battery volume; its low 7th bit represents battery volume value which needs to be converted and divided by 10. e.g.: 0x21 represents 3.3V, normal;0x9F represents 3.1V, low battery volume **2nd--N+1byte,** these are for IIC data. N represents the number consistent with the number of read register configured.
43	Uplink	0x01	0x03	RS485	It takes N+1 bytes **1st byte represents battery volume**, for its highest bit:0: normal; 1: low battery volume; its low 7th bit represents battery volume value which needs to be converted and divided by 10. e.g.: 0x21 represents 3.3V, normal;0x9F represents 3.1V, low battery volume **2nd--N+1byte,** these are for RS485 data. N represents the number consistent with the number of read register.
43	Uplink	0x02	0x04	Temperature	It takes 3 bytes. **1st byte represents battery volume**, for its highest bit:0: normal; 1: low battery volume; its low 7th bit represents battery volume value which needs to be converted and divided by 10. e.g.: 0x21 represents 3.3V, normal;0x9F represents 3.1V, low battery volume **2nd and 3rd byte**, these 2 bytes are

Fport	Uplink /Downlink	Payload			Description
		Sensor type	Frame type	Data format	
					for temperature. The higher level of the 2 bytes, 0: normal; 1: alarm; low 15 signed integers, the high byte comes first. The data needs to be converted and divided by 100.e.g.: 97E6 means temperature is 66.18℃, there is an alarm. 6FED means temperature is -41.15℃, there is no alarm.

Figure: Data Communication Format Instruction

Note: Data of different frame types needs to be sent separately.

7. Trouble-shooting

1. After the device is powered on, its indicator led on the panel is not on.
A: There are two types sensor box available. For sensor box powered by battery, its indicator led is normally off; for external power supply sensor box, please check whether there is bad contact between power adapter and the device connector.

2.There is no network join notification sound for a long time after the device is normally started up
A: Check whether the device management platform gateway is online first; check whether the its parameters added on the management platform are correct.

3. The data sent from the sensor box connected with a transducer is abnormal or inconsistent with the communication format.
A: When the platform receives an error code(0E), please check whether the wire between the transducer and the sensor box is well connected at first. Replace another transducer and test if the uplink data is normal.

4. No data shows after a period of operation.
A: It may be caused by gateway connection status or power supply. Check whether the management gateway is online, check whether the battery capacity is low or the mains power is cut off.