LoRa Sensor Terminal

FST200

User Manual

V1.0.0

This manual is applicable to the following products: FST200-00HA, FST200-00HC, FST200-00HC, FST200-00LC

Xiamen Four-Faith Communication Technology Co., Ltd.
https://www.fourfaith.com

Document Revision History

Date	Version	Note	Author
2022-10-27	V1.0.0	Initial Version	Jonas

Note: There may be differences between models of accessories and interfaces, actual products shall prevail.

Copyright Notice

Trademark Notice

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CE Warning

1. The product shall only be connected to a USB interface of version USB2.0 or higher.
2. Adapter shall be installed near the equipment and shall be easily accessible.
3. Supply by specified adapter the operating temperature of the device.can't exceed 60℃ and shouldn't be lower than -20℃. Supply by other power supply the operating temperature of the device.can't exceed 75℃ and shouldn't be lower than -35℃.
4. The plug considered as disconnect device of adapter.
5. The device complies with RF specifications when the device used at 20cm from the body.

Hereby, Xiamen Four-Faith Communication Technology Co.,Ltd declares that this product is in compliance with essential requirements and other relevant provisions of Directive 2014/53/EU. This product is allowed to be used in all EU member states.

FCC Statements:

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications or changes to this equipment. Such modifications or changes could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Federal Communication Commission (FCC) Radiation Exposure Statement

When using the product, maintain a distance of 20cm from the body to ensure compliance with RF exposure requirements.

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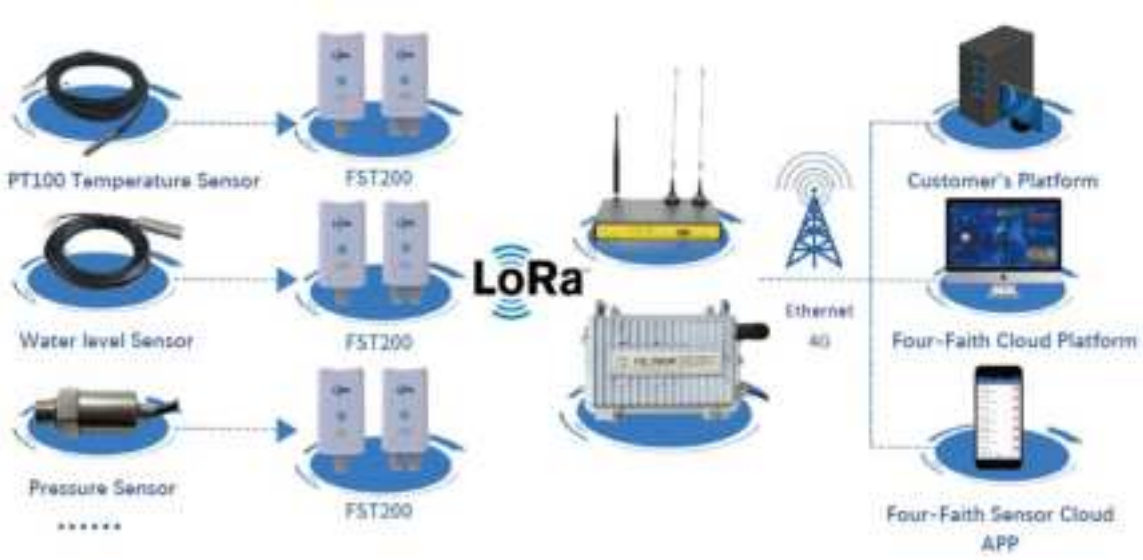
Chapter 1 Product Introduction

1.1 Overview

FST200-00 series LoRa humidity and temperature sensor terminal adopts an industrial-grade 32-bit communication processor, integrated with Four-Faith's self-developed LoRa module, equipped with temperature and humidity collection, threshold alarm, NFC configuration, and other sensors, combined with IP67 high protection grade waterproof and dustproof housing, suitable for all kinds of the harsh external environment.

The products support LoRaWAN* and Four-Faith private protocols, adopt ultra-low power design, built-in large capacity lithium battery, and portable battery replacement bin to ensure long-term stable operation of the products. The product adopts a variety of configuration modes to facilitate rapid and flexible deployment. It can also be combined with the Four-Faith sensor cloud platform and APP to realize remote real-time data monitoring.

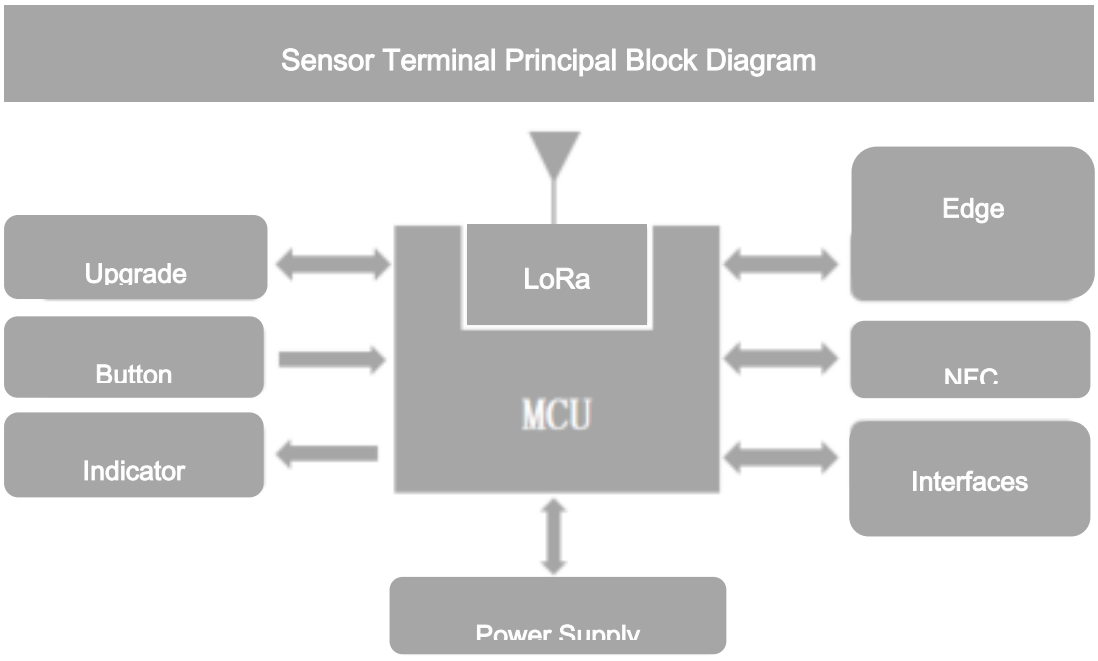
The products are widely used in the M2M industry in the industrial chain of the Internet of Things, such as the tobacco industry, computer room monitoring, factory monitoring, drug monitoring, venue monitoring, warehouse monitoring, agricultural greenhouses, smart buildings, and other fields. Typical applications of temperature and humidity sensors are shown as below.



1.2 Product Features

- Industrial design: using high precision sensor chip and industrial high performance wireless LoRa module.
- Battery life:
  Battery power supply (FST200-00HA): Adopted by Four-Faith LoRa module, ultra-low power design, built-in 19000mA ultra-large capacity lithium sub-battery
  DC power supply (FST200-00HC): Supports 5 to 36V, 12V/0.5A by default
- Shell: ABS+PC, anti-UV, flame retardant materials and other exquisite integrated appearance design.
- Protection level: IP67 protection level.
- Communication distance: kilometer-level transmission distance, good penetration.
- Configuration mode: The NFC APP, configuration tool, and sensor cloud platform can be configured in various modes to facilitate rapid and flexible deployment.
- Protocol: support Four-Faith private protocol and standard LoRaWAN protocol *.
- Upgrade mode: NFC upgrade, local serial port upgrade, and remote upgrade.
- Installation: support wall mounted installation, pole-mounted, and din-rail. The default installation is wall mounted.
- All-in-one solution: supporting sensor cloud platform and APP, remote real-time data monitoring.

1.3 Operating Principal Block Diagram



1.4 Product Specification

Characteristics	
Items	**Contents**
Frequency	433/470/868/915MHz
Protocol	Private protocol, LoRaWAN® protocol *
Indoor Communication Distance	Penetrates 10 floors
Outdoor Communication Distance	5 Km
Operating Temperature	FST200-00HA: -20~+60℃（-4~+140℉）
	FST200-00HC :-35~+75℃（-31～+167℉）
Power Supply Method	FST200-00HA: Built-in 3.6V/19000mAh lithium battery (Disposable)
	FST200-00HC: Supplies power from the DC power adapter. The default value is 12V/1.5A
Receiving Current	≤10.5mA, (SF=9@20dBm)
Note: FST200-00HA/FST200-00HC, FST200-00HA low-power consumption product, FST200-00HC normal power consumption product; * means under development	

Power Consumption	
Items	**Contents**
Transmitting Current	FST200-00HA:<142mA@3.6V
	FST200-00HC:<69mA@12V
Receiving Current	FST200-00HA:<14.9mA@3.6V
	FST200-00HC:<7.2mA@12V
Sleep Mode Current	FST200-00HA:<14uA@3.6V
3.3V Output Load	FST200-00HA:<100mA@3.6V
12V Output Load	FST200-00HA:<80mA@3.6V

Note:
1, FST200-00 HA/FST200-00HC, FST200-00HA is low-power consumption product, FST200-00HC normal power consumption product.
2, 3.3V and 12V output load is single channel output load
3, Power test is without sensor test power consumption

Interfaces

No.	Content	Description
1	RX	RS232 Input
2	TX	RS232 Output
3	GND	Ground
4	B	RS485 Native
5	A	RS485 Positive
6	D2	Digital signal input and output (0-3.3V)
7	D1	Digital signal input and output (0-3.3V)
8	A2	Current acquisition analog signal input (0-20mA), maximum 5V input
9	A1	Voltage acquisition analog signal input (0-5V)
10	V3.3	Output DC is 3.3V and the maximum current is 100mA
11	GND	Ground
12	V12	Output DC 12V, maximum current 80mA
13	GND	Ground
14	CHARGE	The positive terminal of the adapter connects to this pin. The voltage range is 5 to 36V, 12V is recommended. Only applicable to FST200-00HC series product

Note: PT100 interface is optional

Hardware

Item	Content
CPU	Industrial grade 32-bit communication processor
Flash	128KB
SRAM	16KB

Other

Item	Content
Shell	PC+ABS material, anti-exposure, anti UV, anti-aging, impact resistance, protection grade IP67
Dimension	130x64x64mm (Excluding antenna and mounting parts)
Installation	Wall mount (Default), din-rail and pole-mount (Optional)
Flame Resistance	UL94V-0
Weight	FST200-00HA：280g FST200-00HC：180g

Chapter 2 Installation

2.1 Packing Lists

When you unpack, please keep the packing materials in good condition for future transportation. If the following items are damaged or lost, please contact your agent or sales representative in time. The list is as follows:

FST200-00HA

- 1 x Four-Faith LoRa sensor terminal FST200
- 1 x wall mounting kit (default), pole-mount kit or Din-rail kit (optional)
  Wall mounting kit: Wall mounting bracket + wall mounting bracket + screw pack +2 screws.
  Pole-mount kit: Clamp bracket + stainless steel hoop +2 screws.
  Din-rail kit: Snap bracket +2 screws
- Product qualification certificate
- 1x Waterproof silicone cover
- Product warranty card

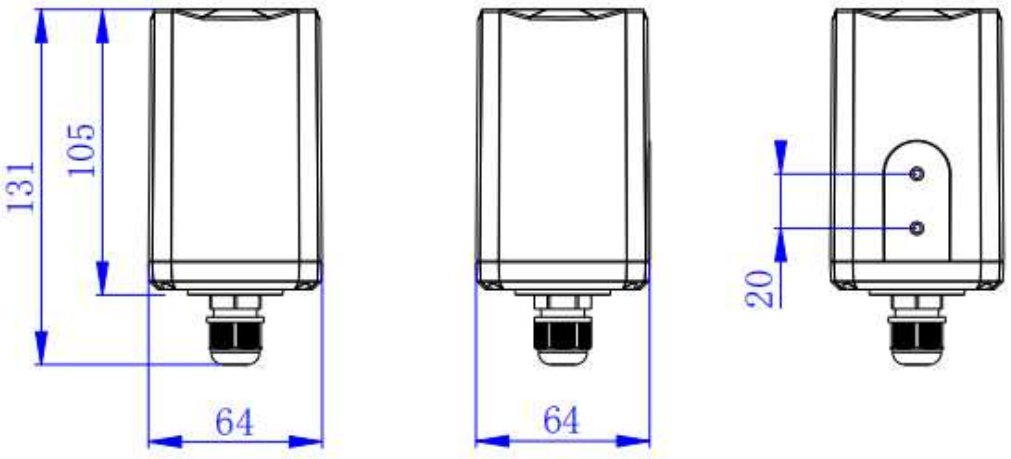
FST200-00HC

- 1 x Four-Faith LoRa sensor terminal FST200
- 1 x standard 12VDC/0.5A power supply
- 1 x wall mounting kit (default), pole-mount kit or Din-rail kit (optional)
  Wall mounting kit: Wall mounting bracket + wall mounting bracket + screw pack +2 screws.
  Pole-mount kit: Clamp bracket + stainless steel hoop +2 screws.
  Din-rail kit: Snap bracket +2 screws
- Product qualification certificate
- 2 x Waterproof silicone cover
- Product warranty card

2.2 Appearance

Bottom: ① FST200-00HA, battery-power version with one PG9-8 cable waterproof connector
Bottom: ② FST200-00HC, DC power version with two PG9-8 cable waterproof connector
Front side: ③ NFC induction zone
Rear side: ④ Wall mounting bracket, ⑤ Pole mounting bracket, ⑥ Din-rail bracket

2.3 Dimension (mm)



2.4 Button Instruction

Function	Operation	LED Status	Device Status
Power on	Long press ACT button over 3 seconds	Off ➡ Green light flashing	activated
Power off	Long press ACT button over 3 seconds	Green light flashing ➡ Off	not activated
Restart	Long press RESET over 1 second and release	Green light flashing	Does not change the activation status of the device before the restart
Confirm On/Off status	Short press ACT button	Light flashing: device turn on Light off: device shut down	

Note: Buttons are provided to facilitate debugging and emergency power-off restart. Under normal circumstances, NFC APP or PC configuration tool can be used to switch on and off the machine and restore factory settings.

2.5 Product Installation

Select the sensor device to be collected, connect it to the reserved port on the sensor terminal based on the sensor specifications, and secure the sensor device through the PG9-8 cable waterproof connector and waterproof silicone sleeve.

Liquid level transmitter

Air quality transmitter

Pressure transmitter

PT100 Sensor

- **Wall-mounted installation:**

1. Attach the 2 screws to the sensor terminal through the wall mount
2. Use an electric drill to drill two holes in the wall marked according to the wall mounting brackets
3. Insert the two expansion bolts into the two holes
4. Insert two screws into the expansion bolt through the wall mounting hole of the wall

mounting bracket

5. Attach the sensor terminal to the wall mounting mount

- **Pole-mounted installation:**

1. Fix the 2 screws on the sensor terminal through the hoop support
2. Unscrew the lock of the hoop counterclockwise
3. Straighten the hoop through the rectangular hole in the hoop support, then wrap the hoop around the target rod
4. Tighten the lock on the hoop clockwise with a screwdriver

- **Din-rail installation:**

1. Fix the 2 screws through the din-rail bracket to the sensor terminal
2. Attach the guide rail to the din-rail bracket

Chapter 3 Parameter Configuration

3.1 Configuration Tool

The FST200-00 series supports Type-C configuration tool (Sensor Terminal Tools) and NFC configuration (Sensor Cloud APP), as shown in Figures 3.1 and 3.2. The following chapters mainly describe the parameter configuration of the sensor cloud APP NFC configuration, except for the configuration procedure.

Note: The Four-Faith sensor cloud platform described in Chapter 4 can also be configured with the following parameters. For details, refer to the instruction manual of the Four-Faith sensor cloud

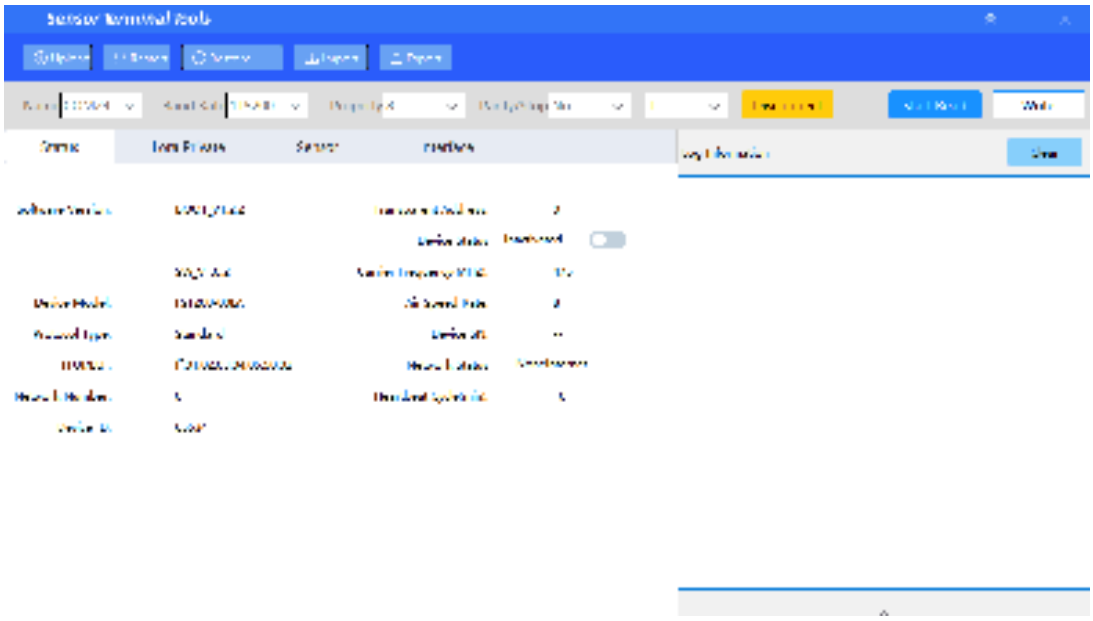


Figure 3.1 Sensor Could APP

Figure 3.2 Sensor Could APP

3.2 Configuration Steps

1. Download and install PC configuration tools corresponding to FST200-00 series and Android APP from Four-Faith official website.

2. Connect and loading

- Sensor Terminal Tool

Use type-C to connect the computer to the device. Open the serial port and click Start to Read to obtain the device parameter information.

- Sensor Could APP

After enabling the NFC function of the mobile phone, open the sensor cloud APP,

enter the registered account and password (the same as the account information of the sensor cloud in Chapter 4), select the 'NFC Configuration' TAB, paste the NFC area of the mobile phone on the NFC sensing area on the front of the device for a few seconds, and keep the device parameter information synchronized to the sensor cloud APP until it is read successfully.

3. Parameter write update

- Sensor Terminal Tools

  Use the configuration tool to modify and obtain device parameters, such as powering on or off the device and parameter values. Click the "Start Write" button. After the data is successfully written, click the "Restart" button to immediately take effect.

- Sensor Could APP

  Modify the acquired parameter information through the sensor cloud APP, such as switch on and off, parameter values, etc. Click the "Start writing" button and stick it in the NFC sensing area of the device until the configuration is complete. Then update and obtain the real-time parameter information of the device through the "Re-read" button.

Note:

1. **There are model differences in the NFC area of Android phones, which are generally located near the back camera. For details, please refer to the manual of the phone.**
2. **After the NFC read/write succeeds or fails, keep the mobile phone away from the device temporarily and attach it to the NFC sensing area of the device for the next operation.**

3.3 LoRa Configuration

FST200-00 series devices support LoRaWAN configuration * and LoRa private configuration (Four-Faith private protocol). The PC configuration tool and sensor cloud APP are used to automatically distinguish the protocol types supported by the device.

- LoRa private protocol configuration

Open the "NFC Configuration --> LoRa Private Configuration" menu in the Sensor Cloud APP, and set the network mode, network number, device ID, pass-through address, carrier frequency, data rate, and transmit power of the device.

Parameter	Description	Factory Default Value
Add Network Model	It is divided into automatic add network mode and manual add network mode. Automatic add network mode： ◆ The network ID, device ID, and transparent transmission address are assigned by the gateway, and the device cannot be changed. The carrier frequency and air rate must be consistent with the LoRa gateway. ◆ After the device is powered on, it determines whether the network has been added. If the network has been added, the network request is not executed. If the network has not been added, the network request is executed. ◆ After the network is added successfully, the network will be displayed in the "network status" of "device status". ◆ If the device does not receive a response from the gateway and reaches a certain number, it will reconnect to the network. Manual add network mode： ◆ The network number, device ID, transparent transmission address, carrier frequency, and air rate must be consistent with the LoRa gateway. ◆ After the device is powered on, the network	Automatic add network mode

	adding request is not executed ◆ No network access status notice ◆ No disconnection detection and reconnection mechanism	
Network ID	The network ID is used to distinguish different LoRa networks. LoRa devices using the same network number are allowed to communicate with each other.	0
Device ID	Device address, use for distinguishing different devices	65534
Transparent Transmission Address	Gateway address, use for distinguishing different gateways	0
Carrier Frequency	The LoRa frequency band used by the device for sending and receiving data must match that used by the gateway	475.000
Data Rate	The data transmission rate in the air can be divided into eight levels. The higher the level, the higher the rate, and the closer the transmission distance, and vice versa. Therefore, you need to adjust the value according to the actual application environment	3
Transmitted Power	Range: 5 to 22dBm. The higher the transmission power, the higher the power consumption and the longer the transmission distance.	20

Note:

1. **If you use the Four-Faith sensor cloud platform to manage FST200-00 series devices, please use the automatic network adding mode.**
2. **In the add network mode, modify the carrier frequency, and data rate, and restore factory Settings to execute the network request again.**
3. **If a large amount of equipment is to be purchased, please contact Four-Faith to obtain FFUI/EUI and other parameters of the equipment.**

◆ LoRaWAN configuration*

Under developing.

3.4 Basic Setting

Open the "NFC Configuration > Sensing Configuration" menu in the Sensor Cloud APP, set the common device parameters, calibrate the device, and set the threshold.

◆ **General Parameters**

Parameter	Description	Factory Default Value
Reporting Interval	The value ranges from 1 to 65535 minutes. For details, please refer to the section "Data Communication Protocols" below.	10min
Work Mode	1. FT mode: according to the " chapter 5 data communication protocol" FT mode agreement format to report 2. Passthrough mode: according to the " chapter 5 data communication protocol" passthrough mode protocol format to report	FT Mode
Sleep Mode	1. Deep sleep: ● When no service processing is performed, the module enters the deep sleep state. ● Wake-up is triggered at the reporting interval. Data is collected based on the edge acquisition configuration, and data is processed and reported based on the working mode. 2. Sleep Regularly: ● Regularly sleep, also known as air awakening.	Deep sleep

	● In regular sleep mode, you need to set sleep time, wake time, and collection command. ● In regular sleep mode, the system wakes up only after receiving the "collection instruction" (no active report), collects data according to the edge acquisition configuration, and completes data processing and reporting according to the working mode	
Sleep Time	In regular sleep mode, the value is a hibernation period (unit: s). When the hibernation period exceeds this period, the device wakes up and enters the working state.	0
Wake-up Time	In regular sleep mode, the device needs to keep the wake-up time after receiving or not receiving data to facilitate data processing at the customer application layer. The unit is ms. If the device is woken up for more than this time, it enters the sleep state.	0
Acquisition Instruction	In regular sleep mode, a matching data collection command must be delivered to start data collection.	00:00:00:00:00:00:00:00

Note: Four-Faith sense cloud platform, such as using the management FST200-00 series equipment, please use the deep sleep mode, regular sleep mode, the gateway leading code time should be the same as the device sleep time

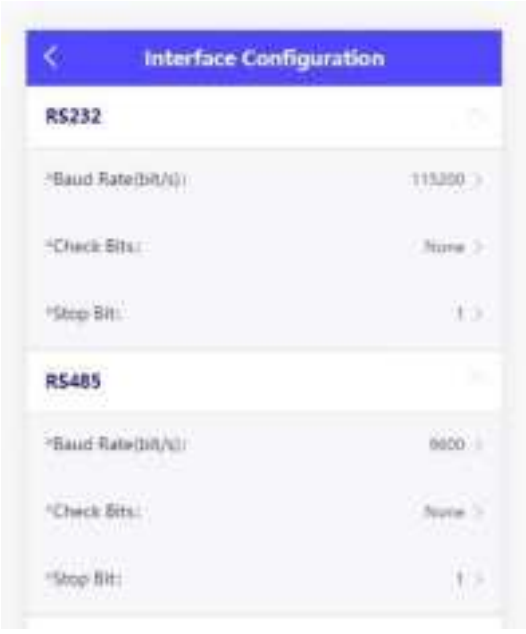
◆ **Edge Acquisition**

Parameter	Description	Factory Default Value
Output 3.3V	3.3V output switch	FST200-00HA (battery power supply): default off FST200-00HC (DC power supply): on
Output 12V	12V output switch	FST200-00HA (battery power supply): default off FST200-00HC (DC power supply): on
Output Power Supply Time(s)	Output 3.3V/12V duration	FST200-00HA (battery power supply): 5s FST200-00HC (DC power supply): Continuous output
485 Acquisition	485 acquisition switch	Off
485 Acquisition Command	10 Modbus acquisition commands can be configured. Modbus instructions are executed in sequence. If the command execution is abnormal and subsequent instructions are not executed, it is reported immediately (when data merging is enabled, only error codes are	When the acquisition command is not configured, By default, run 01:03:00.00:00:02:C4:0B to collect T/H sensors (HTS40L).

	reported).	
Time-out Period	When the 485 acquisition is enabled, abnormal timeout of Modbus command execution.	200ms
Data Merge	When the 485 acquisition is enabled, multiple modbus commands are executed, and the data merging switch is returned.	On
Merge Method	When the 485 acquisition is enabled, Whole packet merging: reported according to the FT mode protocol in Chapter 5 Data Communication Protocols. Modbus Merge: reported according to the FT mode protocol in Chapter 5 Data Communication Protocols	Whole packet merging
IO Acquisition	IO Acquisition switch	Off
D1 Interface	Digital signal input and output (0-3.3V)	Not used
D2 Interface	Digital signal input and output (0-3.3V)	Not used
A2 Interface	Current acquisition analog signal input (0-20mA), maximum 5V input	Not used
A1 Interface	Voltage acquisition analog signal input (0-5V)	Not used

3.5 Interfaces Setting

On the Sensor cloud APP, choose NFC Configuration > Interface Configuration and set the RS232, RS485 parameters.



Interfaces	Parameter	Description	Factory Default Value
RS232	Baud Rate	600-115200	115200
	Check Bit	NONE（No check bit） EVEN（even check） ODD（odd check）	No check bit
	Stop Bit	1，2	1
RS485	Baud Rate	600-115200	9600
	Check Bit	NONE（No check bit） EVEN（even check） ODD（odd check）	No check bit
	Stop Bit	1，2	1

3.6 Maintenance

◆ Upgrade

FST200-00 series support NFC upgrade of sensor cloud APP, remote upgrade of Four-Faith sensor cloud platform, and PC configuration tool upgrade. The detailed steps are as follows:

1. To obtain the latest software upgrade package from the official website of Four-Faith, it is required to clearly inform how to upgrade (NFC upgrade if the upgrade package name contains Modified information and remote upgrade of sensing cloud platform, PC configuration tool upgrade if the upgrade package name does not contain Modified information).
2. Import the upgrade package (the NFC upgrade package must be first imported to the Four-Faith sensor cloud platform) and start the upgrade.
3. A message is displayed indicating whether the upgrade is successful or not. If the upgrade fails, perform the upgrade again.

Note: During the upgrade, do not perform any other operations on the App or device.

◆ Backup (Batch configuration)

The FST200-00 series supports backing up device configuration information and importing it to other devices for quick batch configuration. The backup information does not include LORA-related parameters and is applicable to batch configuration of products of the same series.

Parameter	Description
Export	You can use NFC to read device data, obtain configuration information, and export it to a local PC or upload it to a platform.
Import	The configuration information saved locally or on the platform is written to the device in batches through the NFC.

◆ Debugging and resetting

Parameter	Description	Factory Default Value
Debug Level	0 = No log information is generated 1 = The key log information is displayed 2 = The detailed log information is displayed Log information is output through the type-c interface	0
Restart Device	Actively restart the device	
Reset to Factory Setting	The device parameters are reset to the factory setting	

Chapter 4 Four-Faith Sensor Cloud Platform

Four-Faith Sensor Cloud is a data management platform independently developed by Four-Faith. It provides unified data management, analysis, visualization, and other services for devices through data analysis and modeling, enabling efficient management of enterprises.

4.1 Quick Adding Devices

◆ Adding Four-Faith Gateway

1. Choose F8926-L customize version
2. Check with F8926-L Series LoRa Gateway User Manual to ensure that the gateway network is online.
3. Enable the LORA application in the gateway application module. The default parameters match the factory parameters of FST200-00 series devices. If parameters need to be modified, the gateway and the device need to be updated simultaneously.
4. Add a gateway device on the Four-Faith sensor cloud platform.

Parameter	Description	Factory Default Value
Product Category	Add gateway product categories. (For details, check the Four-Faith Sensor Cloud User Manual.)	
Gateway Name	User defined	
Gateway Mac	Obtain the LAN MAC address from the gateway	

5. Wait for the heartbeat interval (1min by default). The Four-Faith sensor cloud platform displays that the gateway is online.

◆ Add Device

1. Add the device through the Four-Faith sensor cloud platform, and the device displays the inactive state (or scan the QR code of the device through the sensor cloud APP for quick input).

Parameter	Description	Factory Default Value
Product Category	FST200-00 series, select the FST200 default model	
Gateway Name	User defined	
Device ID	Specifies the character string of the FFUI/EUI identifier on the device	

2. Use the PC configuration tool, sensor cloud APP NFC configuration, or switch on and off to activate the device.
3. After the device is activated successfully and the online status is displayed, you can view the device data in real-time on the Four-Faith sensor cloud platform or sensor cloud App.

Chapter 5 Data Communication Protocol

The FST200-00 series supports the LoRaWAN* protocol and the Four-Faith private protocol.

5.1 Four-Faith Private Protocol

For details, please check the "FST200-00 Series API Command Manual".

1. Common format of the data frame (data are based on hexadecimal format, little endian mode).
   Frame start byte: fixed at 0xFE.
   Length field: The length of a data field.
   Command domain: see each command for details.
   Data field: data content corresponding to each command.
   XOR checksum: X or sum of length domain, command domain, and data domain.

Frame Start Byte	Length Field	Command Domain	Data Field	XOR Checksum
1 Byte	1 Byte	2 Bytes	xx Bytes (xx<82)	1 Byte

The uplink device data is contained in the data field in the following format

Package Type	Contents	Description
0x00 Business Data Package	Temperature (2), Humidity (2), Reporting interval (2), Battery power (1)	The device wakes up and reports at regular intervals
0x03 Temperature and Humidity Threshold Alarm Package	Temperature (2), Humidity (2), Temperature status (1), Humidity status (1), Battery power (1)	The device wakes up periodically at the threshold monitoring interval and reports immediately if the threshold is exceeded. Temperature and humidity condition: 1 high temperature/humidity 2 low temperature/humidity 0 normal

0x04 Device Status Package	Temperature (2), Humidity (2), Abnormal status (1), Warning status (1), Battery power (1)	The device wakes up for detection. If the device is abnormal, it reports the alarm immediately. Abnormal status: 1 Device abnormal 2 The measured value is abnormal 0 no abnormalities Notice status: 1 keep 2 keep 3. Anti-disassembly alarm package 0 no hint
0x05 Parameter Update Package	Reporting interval (2), Temperature calibration (1), humidity calibration (1), high temperature threshold (1), Low temperature threshold (1), high humidity threshold (1), Low humidity threshold (1), threshold detection interval (2), Transmit power (1), Add network mode (1)	In the case of network connection, restart, and related parameter modification, the RF parameter information must be obtained from the gateway. Net adding mode: 0 Add network manually 1. Automatic add network

Attention:

1. **When the temperature and humidity threshold alarm packet or device status packet is reported, the service data packet is reported in the next period.**
2. **When the temperature and humidity threshold alarm packet or device status packet recovers, the recovered temperature and humidity threshold alarm packet or device status packet is reported.**

Example:
Report business package: 00 00 00 ff 02 3d 03 00 03 32
Temperature (00 ff): 25.5 ℃
humidity (02 3d): 57.3%
Reported interval (00 03): 3 min
Battery power (32): jk50%