F2910-E Embeded NB-IoT Terminal User Manual

The user manual is suitable for the following model:

Model	Product Type
F2910-E-B5	B5 embedded NB-IoT Terminal
F2910-E-B8	B8 embedded NB-IoT Terminal
F2910-E-B20	B20 embedded NB-IoT Terminal

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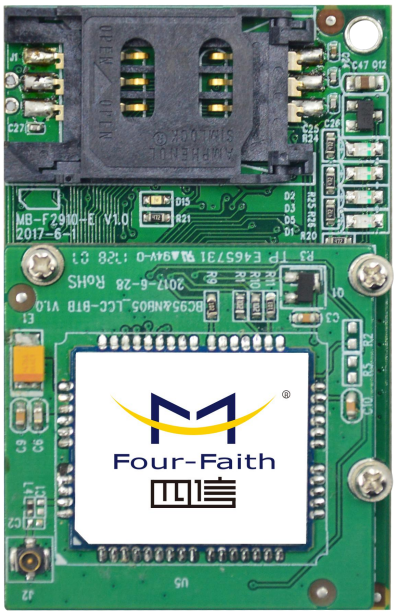
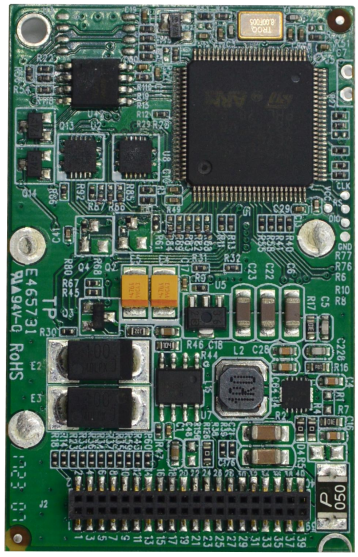
Product shape



TOP



BOTTOM

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Chapter 1 Brief Introduction of Product

1.1 General

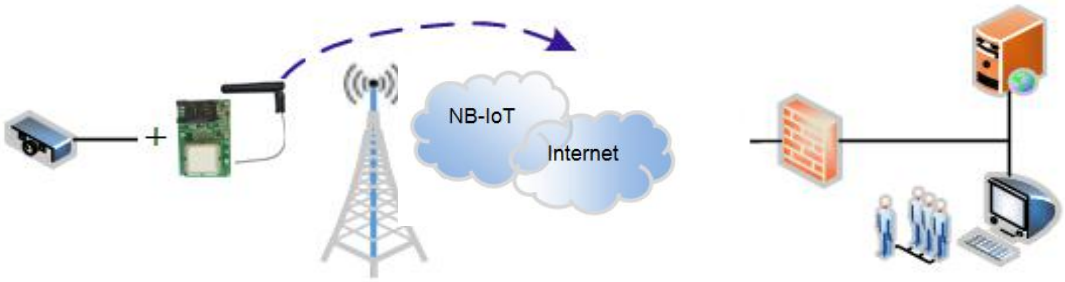
F2910-E series NB-IoT terminal is a kind of Internet of things device that provides data transfer by public NB-IoT network.

It adopts high-powered industrial 32 bits CPU and embedded real time operating system.3-way serial port design, support TTL interface which can be directly embedded into the equipment to realize the transparent transmission of data and low power design.

It has been widely used on M2M fields, such as wireless meter reading, smart city, smart grid, intelligent transportation, fire protection, asset tracking, mobile terminal POS, logistics, industrial automation, digital medical, military, agriculture, forestry, water, coal, petrochemical and other fields of data transmission.

Application system

F2910-E embedded NB-IoT terminal is based on the terminal products of the NB-IoT data communication network.F2910-E data terminal embedded in the device connects the field devices to the network,The implementation of remote transparent data communication from user equipment to data center provides an efficient and reliable transmission channel.Network schematic as follows ,and we can accept the customized development requirements.



1.2 Features and Benefits

Design for Industrial Application

- High-powered industrial NB-IoT module
- High-powered industrial 32 bits CPU
- Low power consumption design, reduce the power dissipation farthest
- Power range: DC 3.6~9V
- Industrial level working temperature range:-40~75℃

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Stability and Reliability

- Support hardware and software WDT
- Support auto recovery mechanism, including online detect, auto redial when offline to make it always online
- SIM/UIM port: 15KV ESD protection
- Power port: reverse-voltage ,Overcurrent protection and overvoltage protection
- Fewer connectors and good seismic performance

Standard and Convenience

- Providing a standard TTL interface,Can be directly embedded into the device
- Support intellectual mode, enter into communication state automatically when powered
- Provide management software for remote management
- Support several work modes
- Convenient system configuration and maintenance interface
- Support serial port upgrade, remote maintenance, device log expor
- The embedded installation is convenient, fast and convenient fixation

High-performance

- Support multi data centers and it can support 5 data centers at the same time
- Design with standard UDP/COAP protocol stack,Support transparent data transmission
- A multi indicator light that can indicate a variety of system states
- The support of real-time serial read device, such as IMEI, SIM card, IP address, signal value etc

1.3 Specifications

Specification

ITEM	CONTENT
F2910-E Embedded NB-IoT Terminal	
Standard and Band	B5:850MHz B8:900MHz B20:800MHz
Bandwidth	100bps-100Kbps
TX power	23±1dBm
RX sensitivity	<-129dBm

Interface Type

ITEM	CONTENT
Serial data interface	Port number:3 uart uart1:TTL uart2:TTL uart3:TTL Serial port form:2×20PIN 1.27 interval Female Header Connector Stop bits:1、2 Parity: none, even, odd, space

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	Baud rate: 110~230400 bps
Antenna interface	Standard PIEX interface, 50 ohm
SIM/UIM	Standard user card interface, support 3V SIM/UIM card
Indicator	“power”、“USIM card”、“run”、“Network status indication”

Power Input

ITEM	CONTENT
Standard Power	DC 5V
Power Range	DC 3.6~9V

Consumption

ITEM	CONTENT
Communication	25-30mA@5V 40-45mA@3.6V
Standby	7-9mA@5V 12-14mA@3.6V

Physical Characteristics

ITEM	CONTENT
Installation	Embedded
Dimensions	60x38x12mm
Weight	8.0g

Environmental Limits

ITEM	CONTENT
Operating Temperature	-40~+75ºC（-40~+167℉）
Storage Temperature	-40~+85ºC（-40~+185℉）
Operating Humidity	95% (Non-condensing)

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Chapter 2 Installation Introduction

2.1 General

The NB-IoT Terminal must be installed correctly to make it work properly.

Warning: Forbid to install the NB-IoT Terminal when powered!

2. 2 Encasement List

In order to secure transport, NB-IoT terminal usually requires reasonable packing, please take care of the packing material box when you open it, so that you can use it to transfer in the future.

NB-IoT terminal including following components:

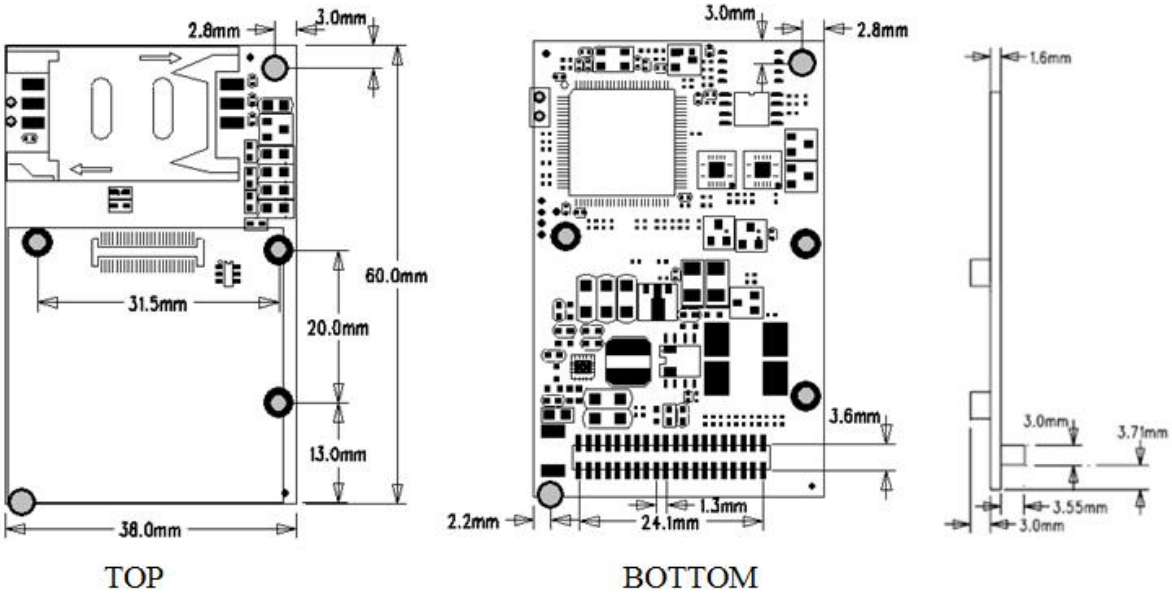
- ✧ NB-IoT terminal host: 1 (according to the user order packaging)
- ✧ CD for use manual:1
- ✧ Rod antenna (IPEX connector) :1

Note: The antenna may have been assembled to the host during packaging, please check!

2. 3 Installation and Cable Connection

There are one 2.7mm diameter mounting holes on the main board,It is easy to be fixed to the user's equipment.

Dimension: (unit: mm)



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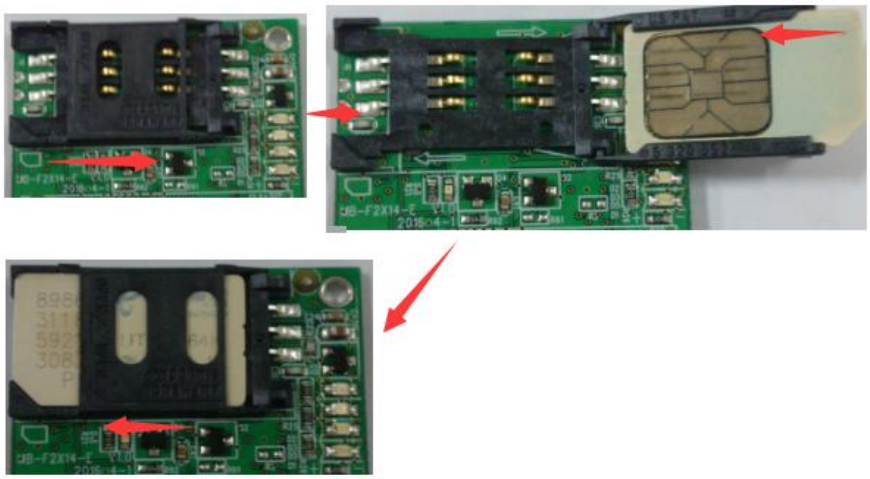
（Note:The components and position on the PCB board may be changed slightly with the version upgrade. Please take the object as the object!）

Installation of SIM card:

The NB-IoT terminal antenna interface is a IPEX connection seat.Buckle the IPEX male head of antenna to the antenna interface and ensure a good connection so as not to affect the signal quality.

When installing or removing the USIM card, please install it follow the icons on the device,ensure the metal contact surface of the USIM card is fully in contact with the socket and fastened.



2. 4 Power

NB-IoT terminal usually embedded in the device PCB board .In order to adapt to complex application environment and improve working stability of system,NB-IoT terminal adopts advanced power supply technology, it can support 3.6VDC~9VDC power supply, so we recommend users to use 5VDC/200mA to power the terminal.When powering the terminal, the stability of power supply must be guaranteed(the ripple less than 100mv and ensure instantaneous voltage does not exceed 12V) ,and ensure that the power supply is higher more than 1W.

2. 5 Indicator Lights Introduction

NB-IoT four indicator lights：Power、Module、Status、SIM.

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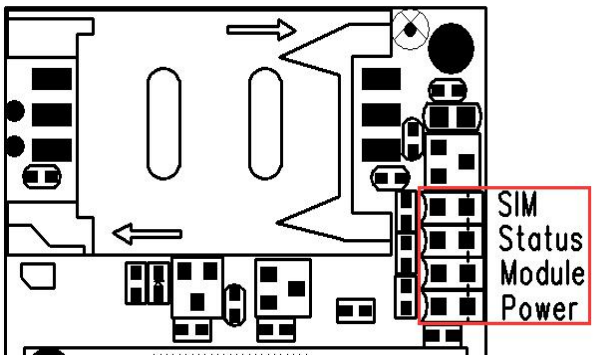

Number	Power	SIM	Status	Module	Meaning
1	bright	X	Slow flashing	X	Module initialization
2	bright	X	Slow flashing	Quick flashing	The system is dialing
3	bright	Alternately Slow flashing		X	The device dialing succeed
4	bright	Synchronous slow flashing		X	The device dialing succeed and the center connect succeed

Notes:
1.Bright means always on, that’s keep no flash for 3 seconds at least;
2.Extinguishing means constant, that’s keep no flash for 3 seconds at least;
3.Slow flashing means that the flashing frequency is about 1 time / s;
4.Quick flashing means that the flashing frequency is about 1 time/ 200ms;
5."X" means any state.

2.6 Pin definition

Each pin of the terminal is defined as the following table:

Pin	Name	Desribe	Note
1	TXD3	Uart3 send data	3.3V TTL level VOH>=2.5 VOL<=0.5
2	RXD3	Uart3 receive data	3.3V TTL level VIH>=2.0 VIL<=0.8
3	WDI	WDI	
4	GPIO0	Analog signal input	Input voltage:0V~3.3V
5	GPIO1	Input	Internal pullup VIH>=2.0 VIL<=0.8
6	GPIO2		
7	GPIO3	Output	VOH>=2.5 VOL<=0.5
8	GPIO4		
9	CSQ1	Output,Signal	(1)CSQ<10:

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10	CSQ3	intensity indication	CSQ1=1,CSQ2=0,CSQ3=0, (2)10<=CSQ<20: CSQ1=1,CSQ2=1,CSQ3=0, (3)CSQ>=20: CSQ1=1,CSQ2=1,CSQ3=1
11	CSQ2		
12	RST	MCU rst	Low level effective time>=100ms VIH>=2.0 VIL<=0.8
13,14	GND	GND	
15	SIMDATA	SIMDATA	SIMcard interface,compatible,1.8V/3.0V SIM card
16	SIMRST	SIMRST	
17	SIMVCC	SIMVCC	
18	SIMCLK	SIMCLK	
19,20	GND	GND	
21	SLC	IICCLK	IIC interface VIH>=2.0 VIL<=0.8 VOH>=2.5 VOL<=0.5
22	SDA	IICDATA	
23	GND	GND	
24	AIO	AIO	Input voltage:0V~3.3V
25	TXD2	Uart2 send data	3.3V TTL level VOH>=2.5 VOL<=0.5
26	Online	Output,module online status indication	Default low level, high level after device on-line VOH>=2.5 VOL<=0.5
27	LED_MODULE	Output,Module status indication	See the 2.7 section in detail
28	RXD2	Uart 2 receive data	3.3V TTL level VIH>=2.0 VIL<=0.8
29	LED_SIM	Output,SIM card status indication	See the 2.7 section in detail
30	LED_STATUS	Output,Modem running status indication	See the 2.7 section in detail
31	TXD1	Uart 1 send data	3.3V TTL level

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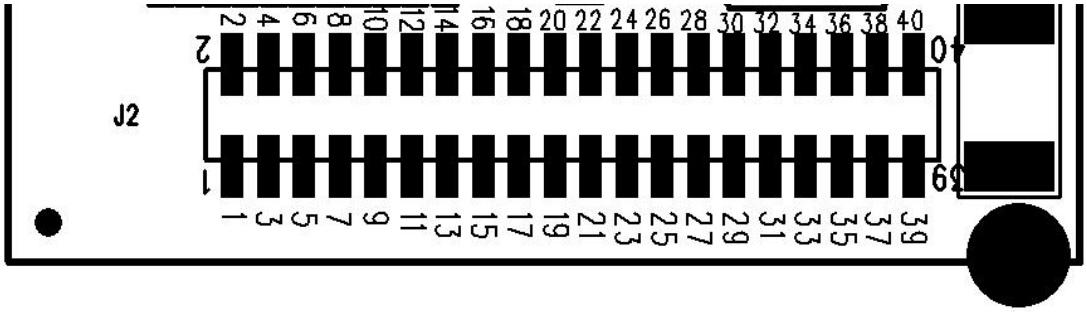
			VOH>=2.5 VOL<=0.5
32	RXD1	Uart 1 receive data	3.3V TTL level VIH>=2.0 VIL<=0.8
33, 34, 35, 36	GND	GND	
37, 38, 39, 40	VCC	POWER	DC 3.6~9V

NB-IoT terminal 2×20PIN （bottom）:



2.7 LED state output pin level description

In addition to providing four indicator , NB-IOT terminal also makes its network, running state and USIM instructions through pins out, which can be selected by customers according to their own needs.The output level in any stage is in the following table:

Number	LED_SIM	LED_Status	LED_Module	Meaning
	SIM card	Running	Network	
1	X	Slow alternating high and low	X	Module initialization
2	X	Slow alternating high and low	Quick alternating high and low	The system is dialing
3	LED_SIM/LED_Status Alternating output level		X	The device dialing succeed but the center connect unsuccessful.
4	LED_SIM/LED_Status Synchronous output electrical level		X	The device dialing succeed and the center connect successful
Notes: 1.High output means keep high electrical level for 3 seconds at least; 2.Low output means keep low electrical level for 3 seconds at least; 3.Slow alternating means the high and low alternating frequency is about 1 time / s; 4.Quick alternating means the high and low alternating frequency is about 1 time /200				

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ms;

5."X" means any electrical level.

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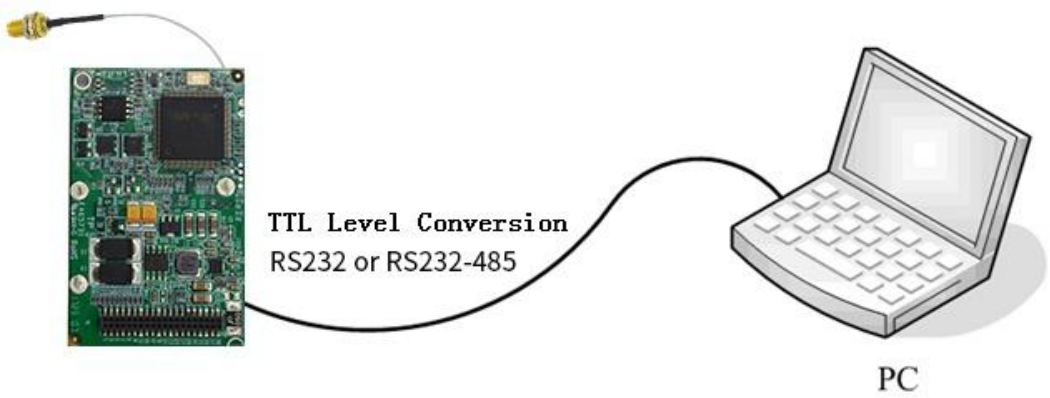
Chapter 3 Configuration

3.1 Configuration Connection

Before configuration, it's necessary to connect the NB-IoT Terminal with the configure PC by the shipped RS232 or RS232-485 conversion cable as following.



3.2 Configuration Introduction

There are two ways to configure the NB-IoT:

Configuration software tool: All the settings are configured through the shipped software tool. It's necessary to have one PC to run this tool.

Extended AT command: All the settings are configured through AT command, so any device with serial port can configure it. Before configuration with extended AT command, you should make NB-IoT enter configure state. Please refer to appendix about the steps how to make NB-IoT enter configure state .

Here introduce how to configure NB-IoT using configure software tool and corresponding AT command of each configuration item.

3.3 Run the configure Tool

NB-IoT Terminal F2910_V1.0.3.exe

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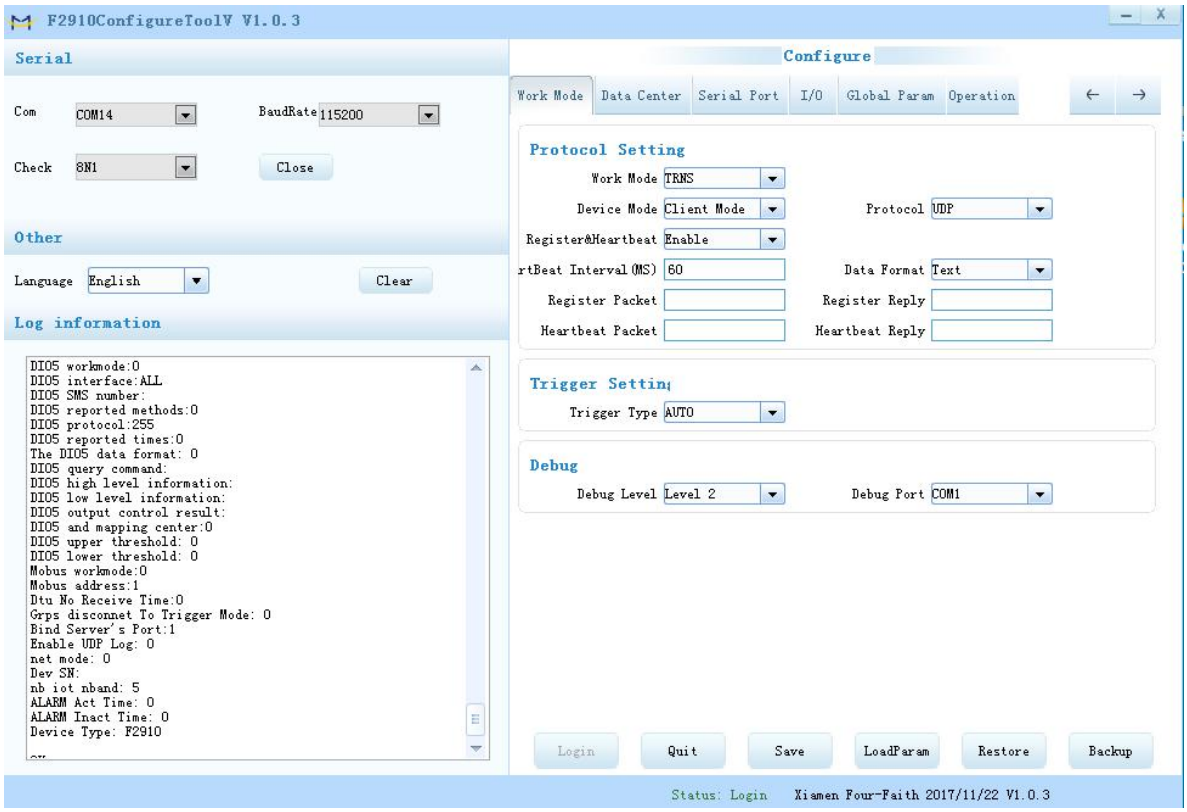

The “Serial Parameters” column shows the current serial port settings. To configure NB-IoT, please choose correct serial port which is connected to NB-IoT, and the baud-rate is 115200 with no parity, then open the serial port. The serial port has been opened if the button text is“Close”. If the text is “Open”, you should open the port first.

When the port opened, the “Output Info” column will display

“Port(COM1) Has Opened,Please Re-Power the NB-IoT,

Waiting NB-IoT Enter Configure State...”

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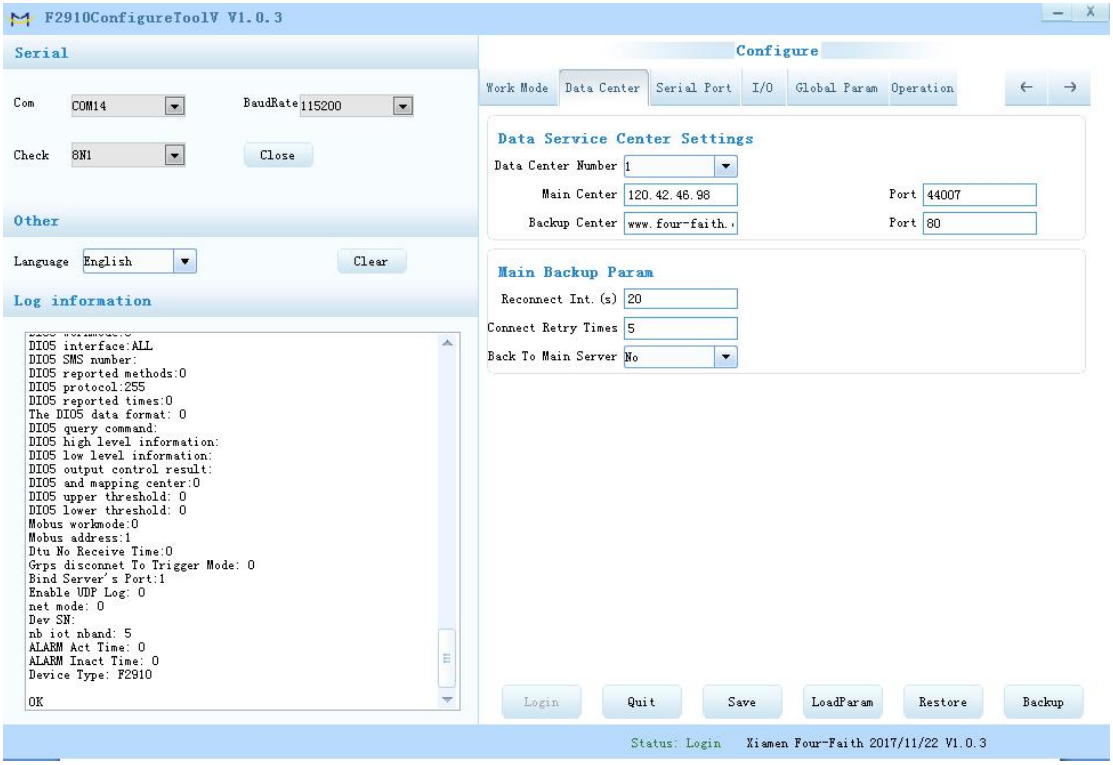
3.4 Re-power NB-IoT Terminal



After Re-power NB-IoT Terminal, The configure tool will make it enter configure state. The software will load current settings from NB-IoT Terminal and displays on the right configure columns at the same time. It's now ready to configure.

3.5 Configuration

3.5.1 Data Service Center Settings

There are the configurations of the data service center in the center server parameter page.

◆ Number of central servers

The NB-IoT terminal supports two ways of data center to receive data:

One is main and backup way. When the NB-IoT terminal is online, it will connect to main center first. If the connection is successful, NB-IoT terminal will communicate with main center, otherwise NB-IoT terminal will try to connect the backup center for data communication.

Note: please configure secondary center and main center to be the same value if there is no secondary center.

The other is multiple centers way. NB-IoT terminals can support data communication between 5 centers at the same time. NB-IoT terminals will try to connect to multiple data

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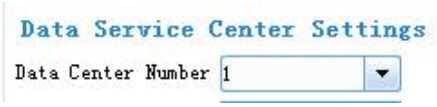
centers when they are online using this mode.



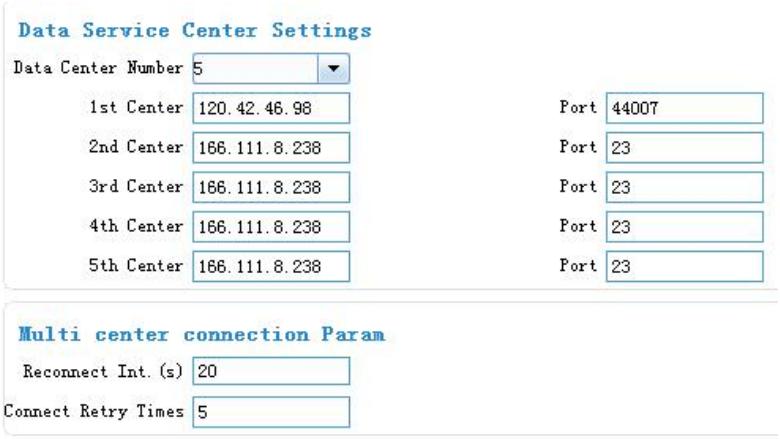
NB-IoT terminal will work in main and backup way when data center number is 1, and main and backup center configuration will be working.

NB-IoT terminal will work in a multiple center way when data center number is bigger than 1, so backup center will be invalid, and main center and center 1~4 will be valid.

◆ Main center address, port

The IP address or domain name of the main center server, and the port proposal is set above 1024.

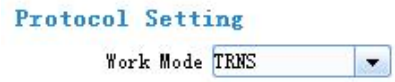
◆ Multi center server configuration



The multi center configurations will be working when the server number is bigger than 1. For example, main center will be 1st center and the number of servers is 5 when data center is 5, and center number 5 corresponds to 5 data service centers for communication.

3.5.2 NB-IoT Terminal Settings

◆ NB-IoT Terminal WorkMode



TRNS mode: heartbeat package adopts the UDP protocol, data communication adopts the UDP protocol , heartbeat packet and data communication are connected with the same UDP connection.

◆Trigger Mode

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Normally NB-IoT terminal will be online all the time, to keep the data transmission and transfer application data timely. But in some occasion where is particularly sensitive to wireless communication data flow, can make NB-IoT terminal under the standby state in order to save traffic.When activated by inside trigger way once need to transfer application data, NB-IoT terminal will be triggered to be online and establish the data transmission channel, it will hang up the connection to return to the standby state after transmission.NB-IoT terminal support following activation ways.
Automatic: this way makes the NB-IoT terminal online forever.

Serial port: serial port activation.NB-IoT terminal will establish the connection or disconnect the communication link by sending specific data to the serial port of the NB-IoT terminal.

IO:IO activation. NB-IoT will be triggered to establish the connection when set Its IO port high level, and NB-IoT termnal will disconnect the connection and fall into sleep mode when set its IO port low level.
Timing: timing activation. NB-IoT will be triggered or fall into sleep by setting a specific time.

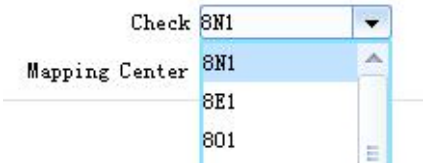
◆ Debug Level

Debug information is used to debug software when there is software problem.

0 --- no debug information output
1 --- simple prompt information output
2 --- detail debug information output

Note: it is necessary to set the debugging level to 2 only when the device can't work normally and need to debug the software, debug level 2 will affect the normal data communication.

◆ Databit, Parity, Stopbit



8N1 --- 8 Databit, No parity, 1 Stopbit
8E1 --- 8 Databit, Even parity, 1 Stopbit
8O1 --- 8 Databit, Odd parity, 1 Stopbit

◆ Communication Baudrate

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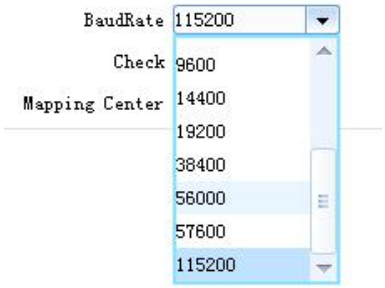
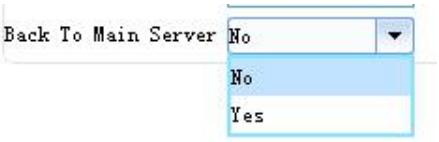


110	--- 110 bps
300	--- 300 bps
600	--- 600 bps
1200	--- 1200 bps
2400	--- 2400 bps
4800	--- 4800 bps
9600	--- 9600 bps
14400	--- 14400 bps
19200	--- 19200 bps
38400	--- 38400 bps
56000	--- 56000 bps
57600	--- 57600 bps
115200	--- 115200 bps

◆ Automatically return to the main center



No - do not automatically return to the main center
Yes - automatically return to the main center

This configuration only works when NB-IoT terminal in the main backup mode. NB-IoT terminal will connect to backup center automatically if the main center abnormal. NB-IoT terminal will regularly test the main center is working properly if you set this to 1. It will automatically switch back to main center disconnected from the backup center if main center is normal.NB-IoT terminal will not detect the main center whether to resume normal work if this is set to 0.

◆ Data frame interval time

It is used to determine whether the serial data frame is completed. If the time interval between two bytes is longer than the set value, the NB-IoT terminal will send the current received data to the data center immediately.

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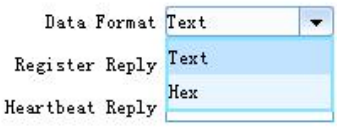
◆ Sixteen-band cardiac packs registration package



This configuration only works when the NB-IoT terminal is working in the TCST protocol mode and it is used to configure the content of a custom heartbeat package and a custom registration package.

TEXT: In the form of a string, the content of the input is the same as the content that is uploaded to the center.

HEX:16 binary string. For example, input: 313233, the reported value is: 123

note:1. The character input in the 16 band must be an even number and within the three sets of 0-9 or a-f or A-F.

2. When this parameter is modified, the custom heartbeat package and the custom registration package should be reconfigured once.

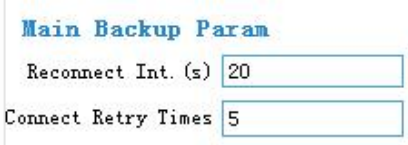
◆ Custom registration package

This configuration only takes effect when the NB-IoT terminal is working in the TCST protocol mode, and is used to configure a custom registration package.
Can also be empty（Indicating that no registration package is sent）.
The maximum length of the registered package is 70 bytes.

◆ Custom heartbeat package

This configuration only takes effect when the NB-IoT terminal is working in the TCST protocol mode, and is used to configure a custom heartbeat package.
Can also be empty（Indicating that no heartbeat package is sent）.
The maximum length of the heartbeat package is 70 bytes.

◆ Reconnection setting



If the central server is abnormal or close to the server in practical applications, NB-IoT terminal is always unable to establish a connection. NB-IoT terminal will try to build connections constantly to ensure that it is always online, so that unnecessary traffic is generated.Those two configurations can prevent unnecessary waste of traffic.
NB-IoT terminal will enter sleep state after it tries to connect many times(times will be the

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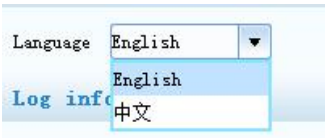
setting number)and connection is still not established.Sleep time will be the set Reconnect Int. Nb-IoT will try to reconnect again after the sleep time.

3.6 Functions

◆ Language setting

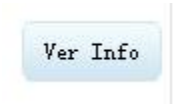


Used to set up the use language

◆ clear window

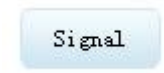
Used to clear window output Information

◆ Detection version



Used to detect software and hardware versions

◆ signal intensity

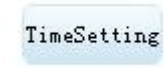


used to detect the signal intensity of the current network

◆ Factory configuration

recovery NB-IoT terminal to Factory configuration

◆ RTC Timing



Set the PC current time for NB-IoT terminal

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Appendix

The following steps describe how to make NB-IoT Terminal enter configure state with the Windows XP Hyper Terminal.

1. Press “Start”→”Programs”→”Accessories”→”Communications”→”Hyper Terminal”

2. Input connection name, choose “OK”
3. Choose the correct COM port which connect to NB-IoT Terminal , choose “OK”

4. Configure the serial port parameters as following, choose “OK”

   Bits per second: 115200

   Data bits: 8

   Parity: None

   Stop bits: 1

   Flow control: None

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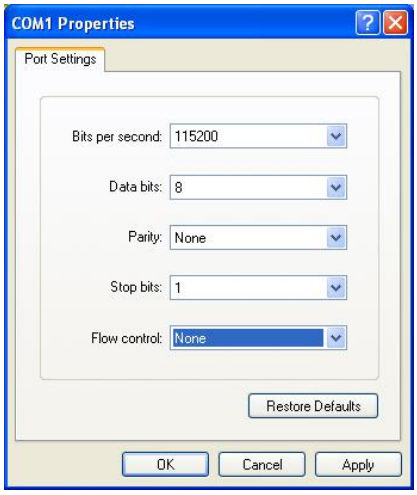
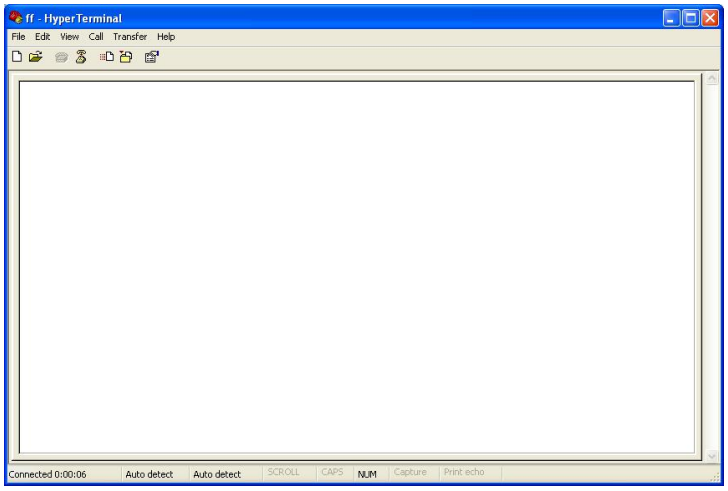
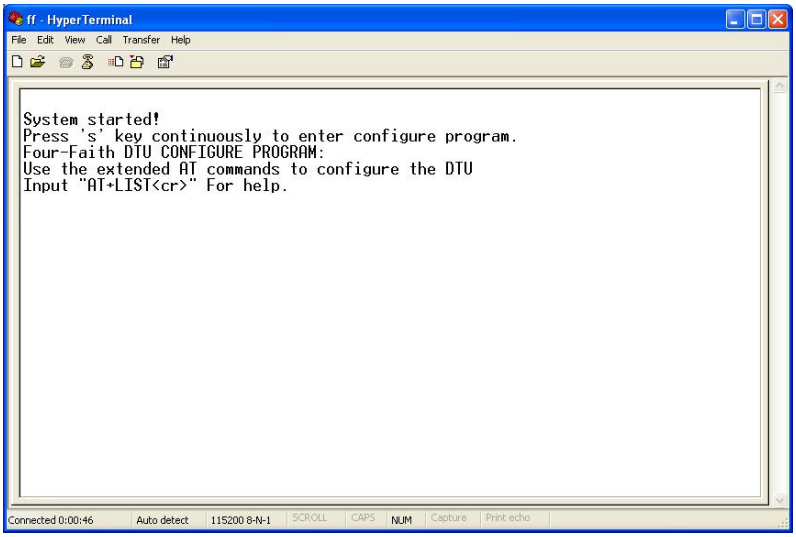


5. Complete Hyper Terminal operation, It runs as following.



6. Re-power NB-IoT Terminal, put mouse focus on the Hyper Terminal and press “s” key continuously until NB-IoT Terminal enter configure state as following.



7. NB-IoT Terminal has entered configure state, you can configure the parameters through AT command.

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