

LoRa Gateway

--User Manual V1.3



1 Product overview

The LoRa Gateway is an ultra-long-range wireless data acquisition gateway dedicated to receiving our temperature and humidity LoRa sensor. Support GPRS (850,900,1800,1900MHz), RS485, MODBUS-RTU interface. LoRa Gateway uses high-performance 32-bit industrial processor and industrial-grade wireless module, with high reliability, stability and data security. LoRa Gateway support the local sound and light alarm, SMS alarm, GPRS alarm and other alarm methods. Different from the previous ASK, FSK,GFSK, this gateway use a special spread spectrum modulation technology LoRa greatly improved the sensitivity of the received, up to 157db link budget so that the wireless communication distance has improved significantly. The distance can up to 5km in open area.

2 Product feature

- Four band(850、 900、 1800、 1900MHz)
- RS-485;
- 1 digital output ,can be used to alert,
- Kinds of alarm method;
- External special USB configure interface, user can configure LoRa Gateway operating module;
- Prevent collision: advanced technology to prevent the collision;
- Security: encryption algorithm and certification to ensure data security, to prevent the data link eavesdropping and data to be cracked
- Metal shell, resistance to high pressure;

3 Technical Parameters

RF frequency	433MHZ
RF Receiving Sensitivity	-148dBm
RF Modulation	LoRa
LoRa sensor identification Angle	3D
Interface	GPRS\RS485\MODBUS-RTU
GSM	Support 4 band (850/ 900/1800 /1900MHZ)
LED	3 LED (RF、 GSM、 power)
Firmware update	Support
RF protocol	Private protocol
Flash Memory	32Mb

Supply power	DC12V
Net weight	0.27kg
Operating temperature.	-20°C~+60°C
Operating humidity.	5% ~ 95% (non-condensing)
Built-in battery	3.7V/850mAh
Dimension	112mm*105mm*27mm

4 Definition of interfaces

4.1 Appearance



4.2 All interfaces

Interfaces	Functions
A.LED light	RF、GSM、Power
B.Expansion interface	Expand functions (Pls check explanation following)
C.USB	Configure device and save log
D.Switch of power	Turn on/off
E.Charge interface	Connect power plug
F.SIM card slot	Insert SIM card
G.RF antenna interface	Connect RF antenna
H.GSM antenna interface	Connect GSM antenna

4.3 Expand interfaces

Interfaces	Functions
1- RS-485B	RS-485B
2- RS-485A	RS-485A
3- GND	GND
4- OUT	Output
5-GND	GND
6-12V	12V output

5 LED light indicating status

Blue light - RF	
RF light status	Explanations
Keep on always	OTA、Read or write configure
Sparkling 0.1 second	Receive LoRa sensor

Green light - GSM	
GSM light status	Explanations
Keep on always	OTA 、Read or write configure、In communicating
On 0.1second,off 0.1second	Can't read IMEI、Wait for picking up
On 0.1second,off 0.2second	Receive SMS
On 0.1second,off 0.9second	Connect with GPRS network
On 0.1second,off 2.9second	Connect with GSM network

On 1second,off 2second	Can't connect with GSM network
On 0.5second,off 0.5second	Can't connect with SIM card

Red light - Charging	
Charging light status	Explanations
Keep on always	OTA、 Read or write configure、 connect power
Sparkling each 2seconds	not connect power

6 GPRS data format

LoRa Gateway GPRS data is hex.

The format of hex code:

Format: Start symbol(2byte) + Packet length(2byte) + Protocol type(2byte) + Hardware type(2byte) + Firmware version(4byte) + IMEI(8byte) + RTC time(6byte) + LBS data length(2byte) + LAC(2byte) + CELLID(2byte) + Extension(A) + State data length(2byte) + Alarm type(1byte) + Terminal information(1byte) + CSQ(1byte) + GSM state(1byte) + Battery voltage(2byte) + Power voltage(2byte) + Extension(B) + Sensor information data length (2byte) + Sensor type(1byte) + Number of the Sensor (1byte) + length of per Sensor (1byte) + Sensor information(X byte) + Extension(C) + Extension(D) + packet index(2byte) + Check code(2byte) + Stop symbol (2byte)

Here below is a table which informs more detailed information about the protocol.

Data block	Number of bytes	Data Content	Meaning
Start symbol	2	'TZ'	Header of every packet
Packet length	2	Variable	The packet length range from the protocol type to the Check code (include the protocol type and the Check code)
Protocol number	2	'\$\$'	
Hardware type	2	04H 06H	
Firmware version	4	Variable	i.e. 01H 06H 00H 00H means Firmware version is 1.06
IMEI	8	Variable	BCD format, i.e. 08H 66H 10H 40H 26H 49H 19H 96H means IMEI is

			866104026491996
RCT time	6	Variable	The RTC time when packet The sequence is Year Month Day Hour Minute Second i.e. 11H 07H 12H 06H 34H 2AH means 2017/07/18/ 06: 52: 42
LBS data length	2	Variable	LBS's data length, if the value is 00H 00H, means no LBS data.
LAC	2	Variable	i.e. 27H 93H means LAC is 2793
CELL ID	2	Variable	i.e. 0FH A1H means CELL ID is 0FA1
Extension	A=0		For future extending the protocol use, currently, has nothing, do not possess any byte
Status data length	2	Variable	The status data length, if this part is 00H 00H means no status data.
Alarm type	1	Variable	AAH Interval GPRS data 10H Low battery Alarm 60H Begin Charge 61H End charge
Terminal information	1	Variable	Bit7: 1-connect to power 0-not connect to power Bit6: 1-This packet is the last packet of this packet index 0- This packet is not the last packet of this packet index Bit 5-0 :reserved
CSQ	1	Variable	GSM signal strength
GSM status	1	Variable	Bit 7-6 :reserved Bit 5: 1-TCP\UDP connected 0-TCP\UDP not connected Bit4: 1-GPRS network connected 0-GPRS network not connected Bit3: 1-roaming 0-not roaming Bit2: 1-GSM network connected 0-GSM network not connected Bit1: 1-Detected SIM card 0-no SIM card Bit0: 1-GSM module is on 0-GSM module is off
Battery voltage	2	Variable	Unit:10mv, MSB first i.e. 01H 95H=405, 405*10=4.05V
Power voltage	2	Variable	Unit:10mv, MSB first i.e. 04H D2H=1234, 1234*10=12.34V
Extension	B=0		For future use, currently, this part has nothing, does not have any byte

Sensor information data length	2	Variable	The length of sensor data area, 00H 00H means no sensor data
Sensor type	1	01H	01H-LoRa sensor
Number of the Sensor	1	Variable	The number of sensor in this packet
length of per Sensor	1	0BH	The length of per sensor
Sensor information	X	Variable	per sensor data format: ID + status + battery voltage + temperature + humidity + RSSI ID(4byte): Status(1byte): bit7: Battery voltage status, 1-low Voltage, 0- Voltage normal; bit6: Temperature alert status, 1-Temperature alert, 0- Temperature normal, bit5-0:reserved; battery voltage(2byte):unit: 1mv, MSB first, i.e. 0EH 08H means voltage is 3.592V; temperature(2byte):unit:0.1℃, MSB first, bit15:sensor is normal or abnormal 1- abnormal 0- normal bit14:temperature is positive(+) or negative(-), 0-positive, 1-negative, Bit13-0: temperature value i.e. 01H 1FH means temperature is 28.7℃, 41H 1FH means temperature is -28.7℃, 80H 00H means sensor is abnormal; Humidity(1byte):unit:%, if it is FFH means no humidity, i.e. 42H means humidity is 66%. RSSI(1byte):unit: -dBm
Extension	C=0		For future use, currently, this part has nothing, do not have any byte
Extension	D=0		For future use, currently, this part has nothing, do not

			have any byte
Packet index	2	Variable	The value range of this part is between 1 and 9999
Check code	2	Variable	The range is from Protocol type to Packet index(include Protocol type and Packet index),MSB first, can see the Check code calculate function CRC16 at document RS485 modbus protocol v1.1
Stop bits	2	0DH 0AH	Indicate this packet is finished

7 RS485 data protocol

7.1 Report automatically

Start symbol(1byte) + Data length(1byte) + Address(1byte) +
Sensor type(1byte) + Sensor data(X byte) + Check code(2byte) +
Stop symbol (1byte)

- **Start symbol:** 7FH;
- **Data length:** 1byte ,the range is from **Address** to **Check code**(include **Address**, not include **Check code**) ;
- **Address:** LoRa gateway's RS485 address,depends on the command 042;
- **Sensor type:** received Sensor type,01H-LoRa Sensor
- **Sensor data:** Sensor ID + Status + Battery voltage + Temperature + Humidity + RSSI
Sensor ID:4 byte,
Status:1 byte;
bit7: Battery voltage status, 1-low Voltage, 0- Voltage normal;
bit6: Temperature alert status,1- Temperature alert, 0- Temperature normal.
bit5-0: reserved;

Battery voltage: 2 byte, unit: 1mv, MSB first,
i.e. 0C 50 means voltage is 3.152V;

Temperature:2byte,unit:0.1℃, MSB first,
bit15: Sensor is normal or abnormal`
1- abnormal
0- normal
bit14:temperature is positive(+) or negative(-),
0-positive,
1-negative,
bit13-0: temperature value
i.e. 01H 1FH means temperature is 28.7℃,
41H 1FH means temperature is -28.7℃,

80H 00H means Sensor abnormal;

Humidity: 1 byte, unit: %, if it is FF means no humidity.

RSSI: 1 byte, unit: -dBm;

- **Check code:** 2 byte, LSB first, can see the **Check code** calculate function CRC16 at document RS485 modbus protocol v1.1
- **Stop symbol:** 03H.

7.2 Modbus Protocols

LoRa gateway support standard RS485 Modbus protocol, pls read the document RS485 modbus protocol v1.1

8 Command List

Note: \$\$\$\$\$\$ is LoRa Gateway `s password, and the initial password is 000000

NO.	Instruction	Format	Note
001	Modify user password	*\$\$\$\$\$\$,001,@@@@#@#	\$\$\$\$\$\$: old password @@@@#@ : new Password (default:000000)
003	Set a preset SMS number	*\$\$\$\$\$\$,003,SMS Number#	SMS Number: must less than 25 digits
004	Set low power alarm	*\$\$\$\$\$\$,004,XXX#	XXX is the low power alarm voltage, eg: 3.8v,XXX=380 (default:360) For example: *\$\$\$\$\$\$,004,380# When the voltage is lower than the preset value, LoRa Gateway will send one lower power alarm GPRS data to the Preset Server.
008	Extend setting	*\$\$\$\$\$\$,008,ABCDEFGH#	A=0, B=0,

			C=0, D=0, default, D=1, Close all SMS function' E=0, F=0, G=0, disable ACK function, default, G=1, enable ACK function
009	Change band	*\$00000\$,009,S#	S=0, work in 900/1800 S=1, work in 850/1900 S=2, Automatic selection S=3, not set(default) *note: the default of parameter is S=3, not set the frequency band, if the unit of GSM module support three frequency(900/1800/1900), then you could set the parameter to S=0, if the unit of GSM module support the four frequency(850/900/1800/1900), then you could set the parameter to S=1.
011	Set APN,Username,Password	*\$00000\$,011,APN,Username,Password#	APN : must < 28 character; Username: must<28character ; Password: must<28 character; * If haven't username or password, then left it blank. For example: *000000,011,CMNET,,#
014	Set DNS	*\$00000\$,014, X,DNS1,DNS2# Disable the DNS	X=0 Disable the DN(default) X=1 Enable the DNS DNS is the domain name server , xxx.xxx.xxx.xxx
015	Set IP Address & port number	*\$00000\$,015,0,IP,PORT#	IP : xxx.xxx.xxx.xxx PORT : [1,65535]
016	Enable/Disable GPRS function	*\$00000\$,016,X#	X=0 Disable GPRS unction X=1 Enable GPRS Function This is the last step of GPRS setting.(default)
018	Set the time intervals of GPRS Data	*\$00000\$,018,X#	X=0 stop send time interval GPRS =[10,999] Time interval (unit:

			sec) (default:300)
019	Set the GPRS mode	*\$019,X#	X=0, Use the UDP mode X=1, Use the TCP mode (default)
020	Local digital OUTPUT alarm function	*\$020,X#	X=0, disable X=1, enable,(default)
030	Set SMS alarm function	*\$030, ABCDEFG#	A=1,Enable SMS alarm for temperature and humidity alert, (default); B=1,Enable SMS alarm for power off (default); C=1,Enable SMS alarm for low voltage alert, (default); D=0; E=0; F=0; G=0;
040	RS485 setting	*\$040, A,B,C,D #	A:Baud rate[1200,115200], 9600 (default); B:Data bit, 0-8bit(default), 1-9bit; C:Stop bit, 0-0.5bit, 1-1bit(default) 2-1.5bit, 3-2bit D:Parity 0-null(default), 1-Even parity, 2-Odd parity
041	RS485 working mode	*\$041, X#	X:0-Report automatically; X:1-modbus, Should add Sensor to channels(command 144) ,default;
042	RS485 address	*\$042, AB#	AB:[0-F], Can't be 00, default:01
043	RS485 Anti-Reread	*\$043, X#	X:[0-3600],unit:s,default:0 RS485 send once sensor data within this time period, no matter LoRa Gateway receive this sensor many times.

			Only use in RS485 Report automatically mode
044		*\$,\$,\$,\$,\$,\$,044,X#	X:[0-86400],unit:s,default:300 LoRa Gateway will think sensor is offline if it do not receive this sensor within this time period Only use in RS485 modbus mode
127	GPRS sending interval when no power	*\$,\$,\$,\$,\$,\$,127,X#	X=0,Disable this function (default) X: GPRS interval ,[10,6000], unit: s;
136	Enable RF function	*\$,\$,\$,\$,\$,\$,136,X#	X:0:disable RF function 1:enable RF function (default)
142	Set Sensor temperature and humidity alert function	*\$,\$,\$,\$,\$,\$,142,X,Temp_H,Temp_L,RH_H,RH_L#	X=0:disable (default) X=1: If sensor's temperature exceed Temp_H、 under Temp_L、 humidity exceed RH_H、 under RH_L, gateway alert; X=2: If sensor's status means alert gateway alert; X=3: If sensor's temperature exceed Temp_H gateway alert, when temperature under

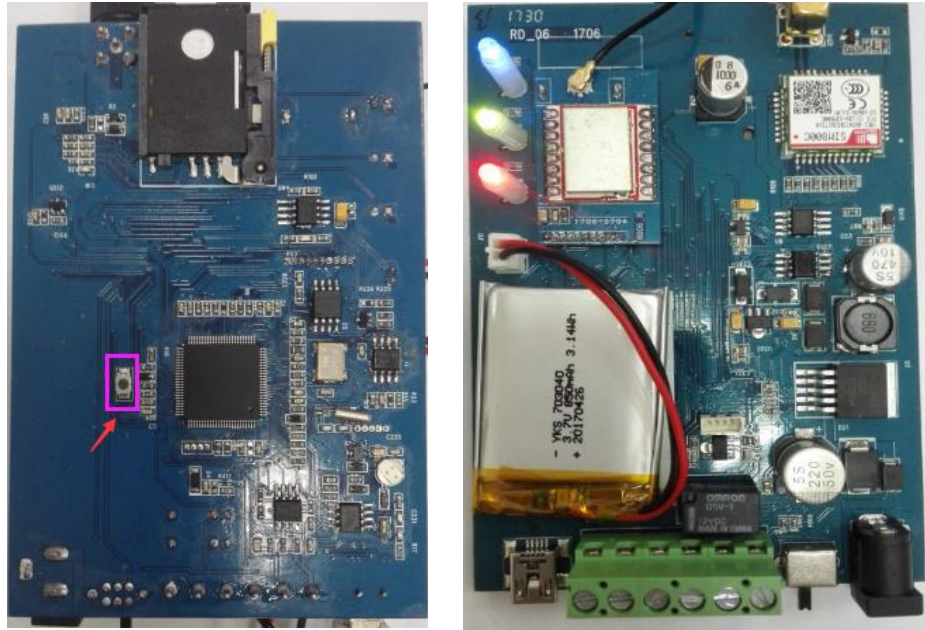
			Temp_L gateway relieve alert; If sensor's humidity exceed RH_H gateway alert, when humidity under RH_L gateway relieve alert; X=4: If sensor's temperature under Temp_L gateway alert, when temperature exceed Temp_H gateway relieve alert; If sensor's humidity under RH_L gateway alert, when humidity exceed RH_H gateway relieve alert; Temp_H: high temperature threshold, [-55~125],unit:°C, default: 100; Temp_L: low temperature threshold, [-55~125],unit:°C, default: 0 RH_H: high humidity threshold, [0~100],unit:%, default: 80 RH_L: low humidity threshold, [0~100],unit:%,
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			default: 0
144	Add a LoRa sensor	*\$\$\$\$\$\$,144,X,ID#	X:Channel,[1,50]; ID: LoRa sensor ID, 8 characters;
145	Delete a LoRa sensor	*\$\$\$\$\$\$,145,X#	X:Channel,[1,50];
146	Delete all LoRa sensor	*\$\$\$\$\$\$,146,1#	
147	Read all added LoRa sensor	*\$\$\$\$\$\$,147,1#	
148	RF reboot	*\$\$\$\$\$\$,148,X#	X:[1,1440],default:60,unit:min RF module will reboot if gateway cannot receive any sensor within this time period
500	Clear data flash	*\$\$\$\$\$\$,500#	Clear stored in the flash memory inside the machine
600	Auto Reboot	*\$\$\$\$\$\$,600,X,Y#	X=0,Disable his function X=1, Active this function. (Default) Y:Reboot time interval, [10,9999],unit: min, (default: 1440)
801	Reading the IMEI number	*\$\$\$\$\$\$,801#	LoRa Gateway reply the IMEI
990	Initialization Tracker	*\$\$\$\$\$\$,990,099#	It will set all parameter to factory default value (Excluding the Password).
991	Reboot now	*\$\$\$\$\$\$,991#	Reboot the LoRa Gateway

10 Upgrade LoRa Gateway firmware

Firstly, make LoRa Gateway into the upgrading mode. Method as bellowed:

1. Open device and take out the PCB board;
2. Press on the button of LoRa Gateway at back;
3. Power on gateway;
4. If three LED keep light, it means that it is in the upgrading mode. Please click here to check the method of upgrading as bellowed.

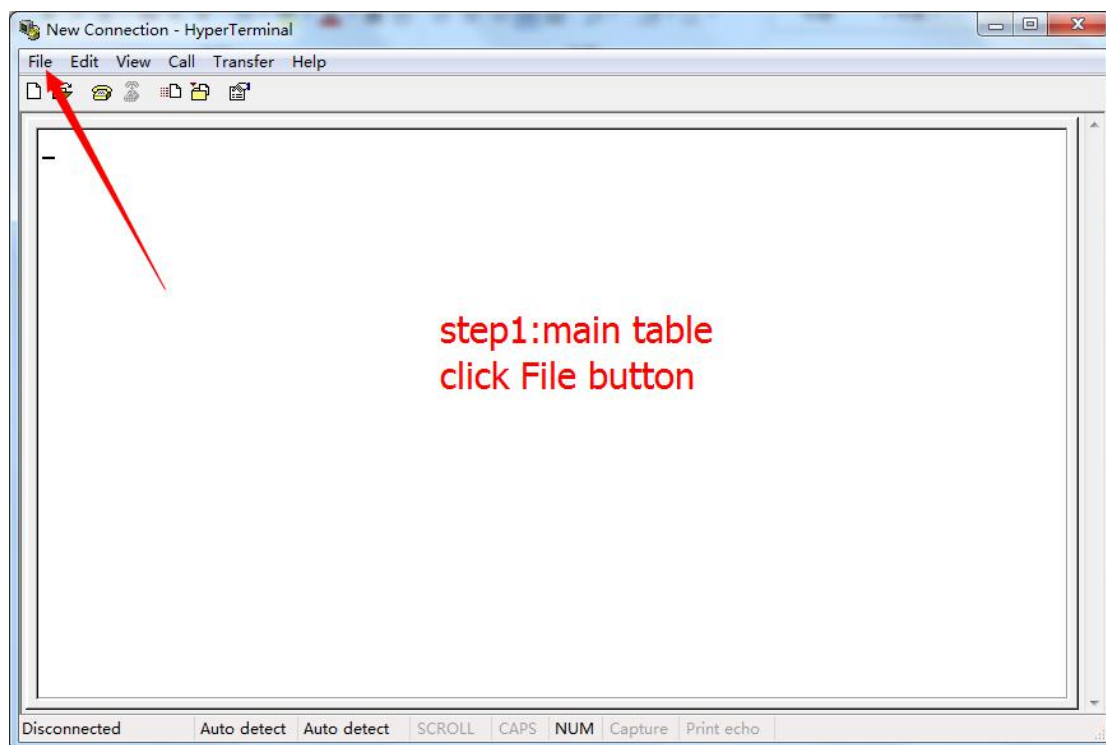


Method of upgrading firmware

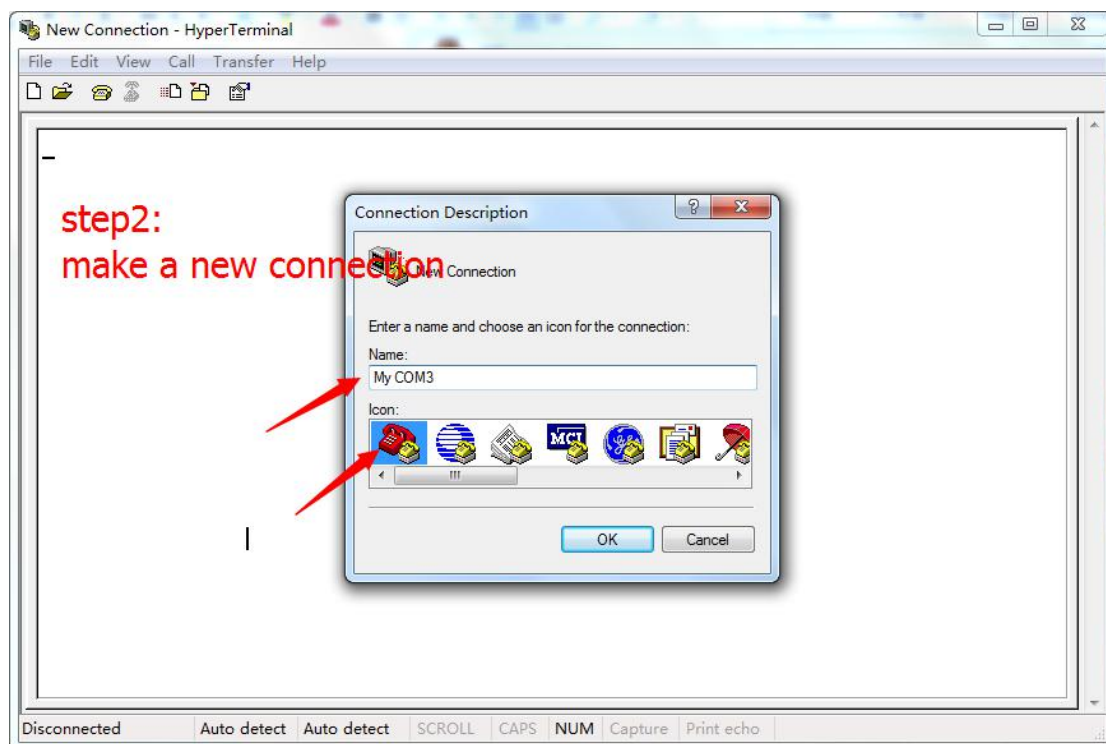
Please enter the upgrading mode as steps in user manual, if need upgrade the firmware. If you have entered the upgrading mode, please finish the firmware upgrading as steps as bellowed.

Windows XP has Hyper Terminal inside. Here we will use the English version, if you need Chinese version, you can go to download on channel, the steps will be same as shown as bellowed. For example as WIN7 Hyperterminal.exe.

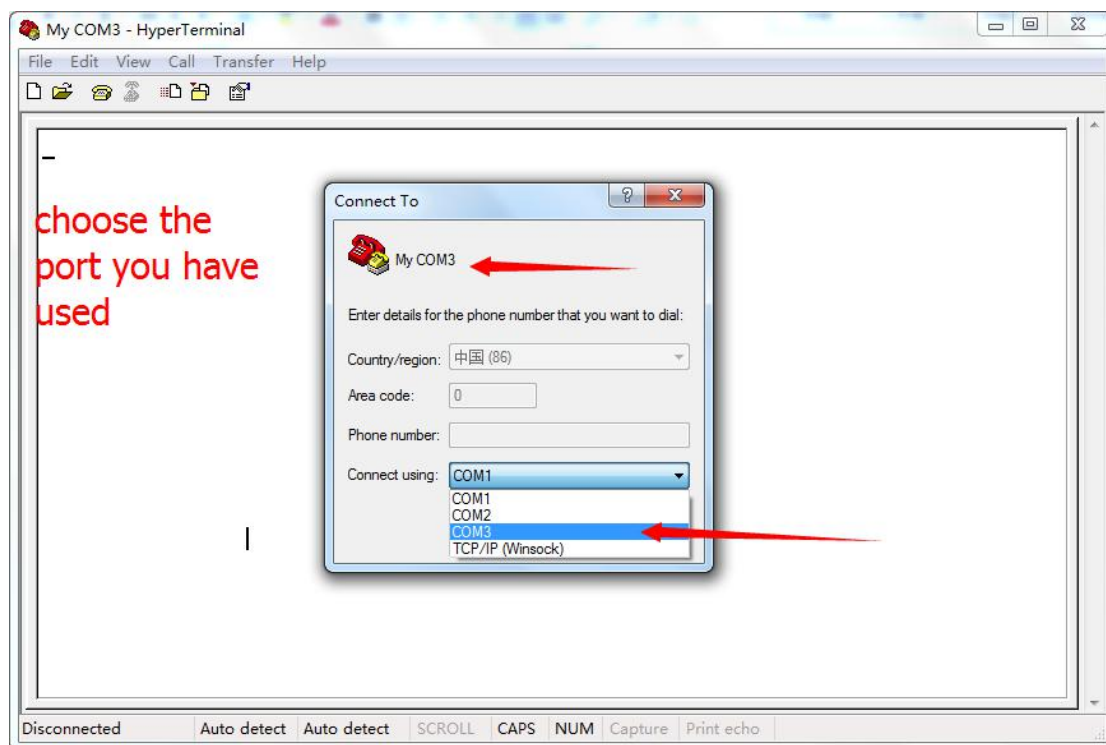
- 1) As picture 1-1 shown, which is home page of software.
- 2) As 1-2, file---new connection, start to create a new self-named connection.
- 3) As picture 1-3, please choose COM that you using, we are COM3.
- 4) As picture 1-4, select parameter as picture shown.
- 5) Finally File---Save save the connection that just created.
- 6) If need in next time, File---Open---open the created connections, like My COM3.
- 7) Hold the DFU, then connect the power supply, LED lights have been on;
- 8) Click the "1" key on keyboard, will see the page as picture 1-5;
- 9) As picture 1-6, proceed the firmware upgrading as steps 1-2-3-4.
- 10) If the page show "successfully" As picture 1-7, means the firmware is upgraded, you can click the "2" key on keyboard, and exit the upgrade mode.



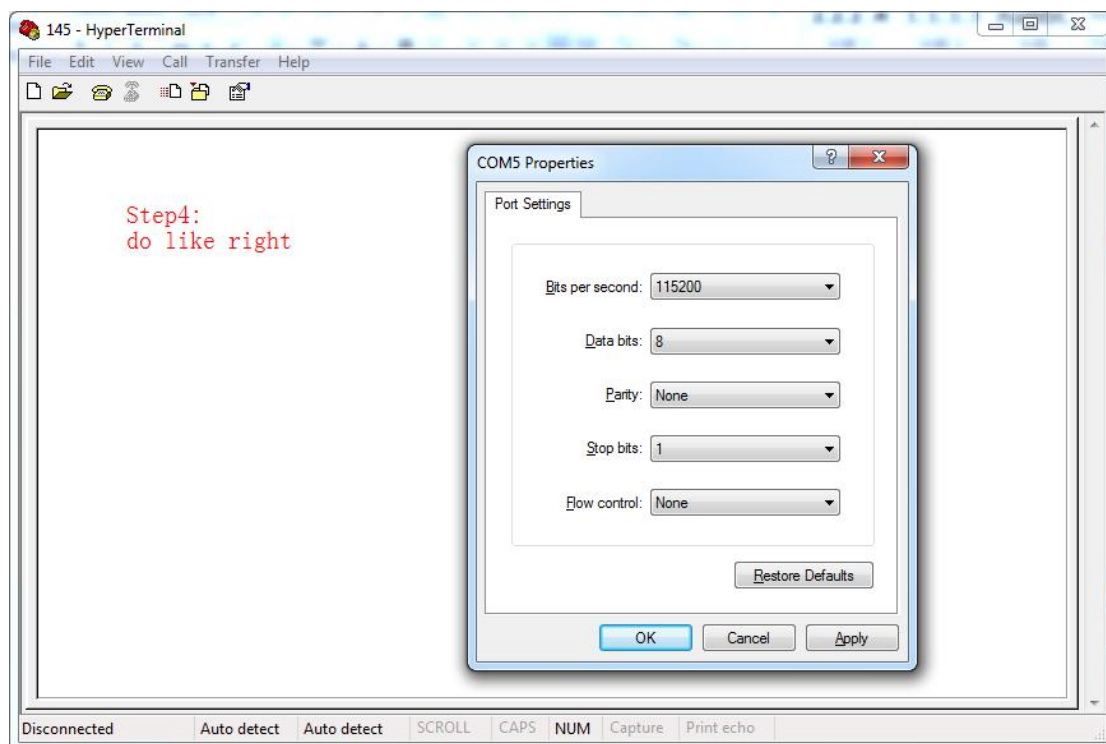
Picture 1-1 HyperTerminal software main interface



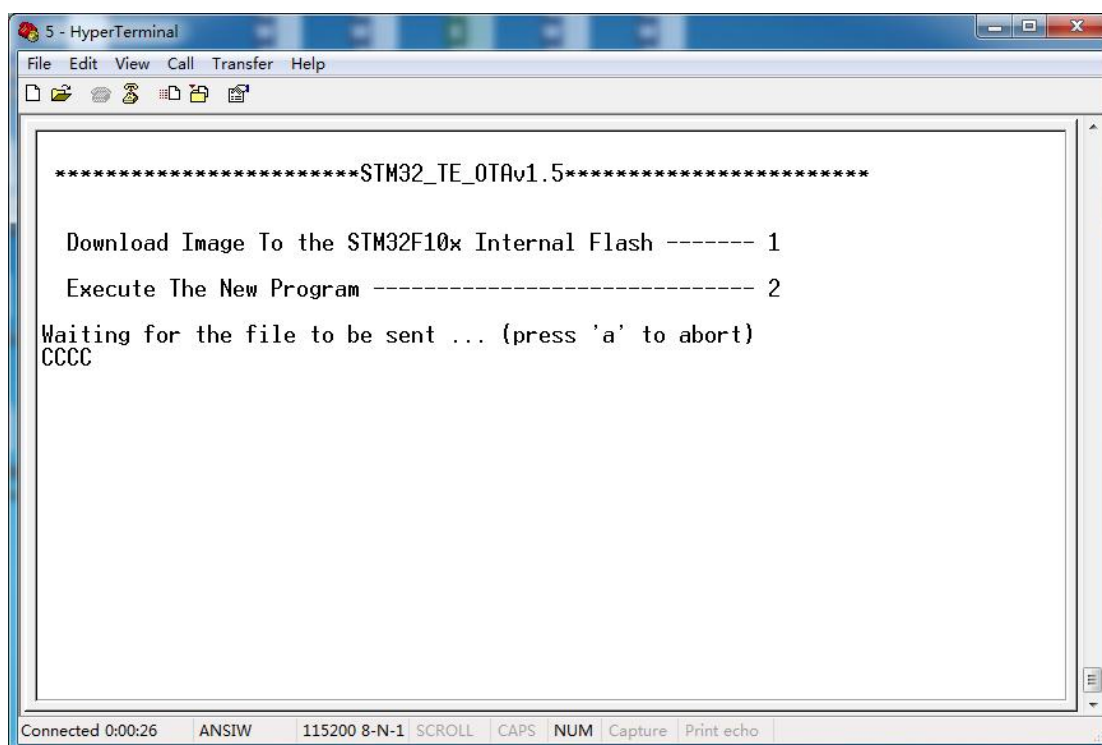
Picture 1-2 create a self-named connection diagram



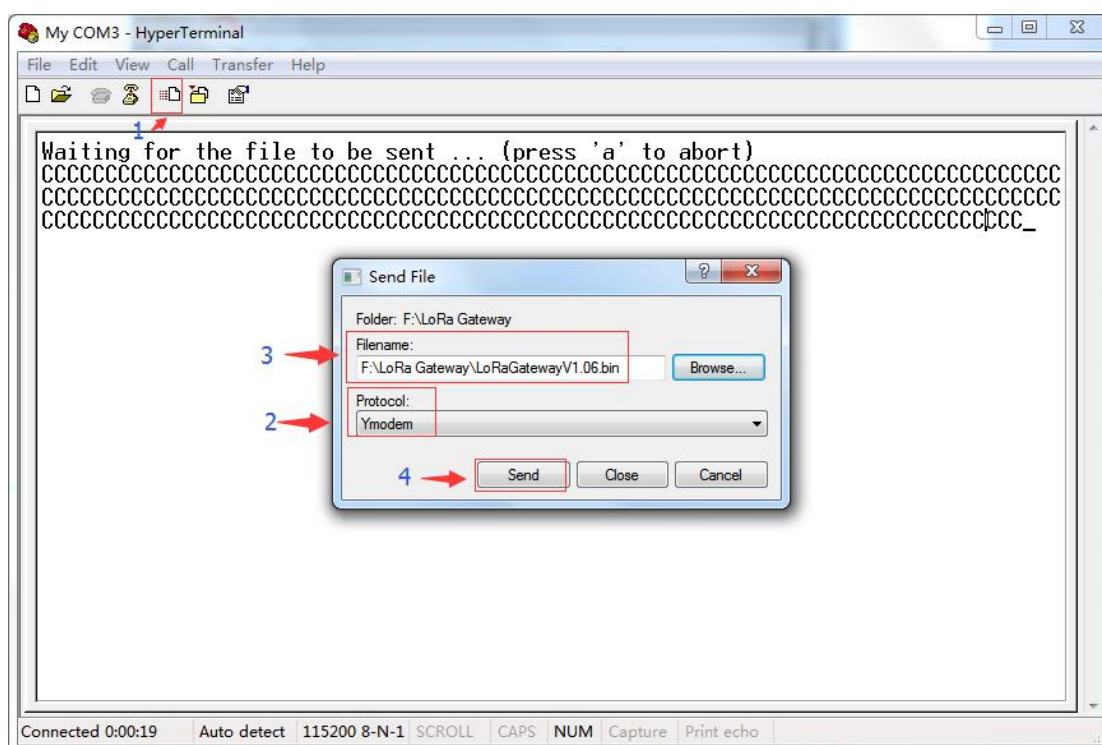
Picture 1-3 Select the port you are using



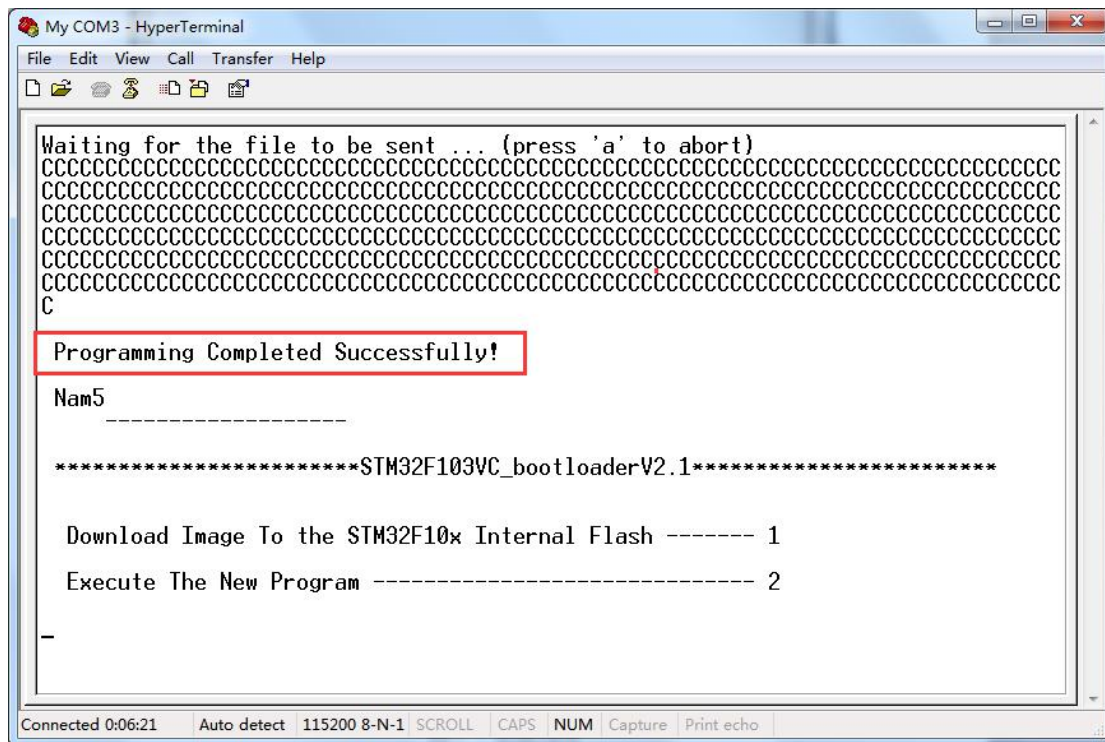
Picture 1-4 Set up relevant parameters



Picture 1-5 wait for firmware downloading



Picture 1-6 select firmware, download and upgrade



Picture 1-7 update is finished