Bivocom

Industrial NB-IoT Cellular Modem
TW810 Series User Guide

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About This Guide

Thank you for choosing BIVOCOM Industrial Cellular NB-IoT Modem TW810 Series. Please thoroughly read this user guide before you configure and install the device.

This manual is compatible with below models

Model	Description
TW810-B5	Industrial NB-IoT Modem(850MHz)
TW810-B8	Industrial NB-IoT Modem(900MHz)
TW810-B20	Industrial NB-IoT Modem(800MHz)
TW810-GL	Industrial NB-IoT Modem(B1/B3/B8/B5/B20/B28)
TW810-MS7C	Industrial LTE-M Modem(Quad-Band FDD-LTE B1/B3/B5/B8 GPRS/EDGE 900/1800 MHz)

Summary of Changes

Date	Version	Notes	Editor
10-01-2017	V1.0	Initial new version	Wei Liu
09-01-2018	V1.1.1	Adding guide for LTE-M version modem	Harry

Table of Contents

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1. Definitions

1.1 LTE CAT M1/NB-IoT Modem

LTE CAT M1/NB-IoT modem, a wireless Data Transfer Unit(DTU) used for converting the data from serial port data packet to IP data packet, or from IP data packet to serial port data packet, then transfer the data packet through LTE CAT M1/NB-IoT cellular network.

1.2 Center/Server

A computer for receiving data sent from NB-IoT Modem through NB-IoT network, and sending data to NB-IoT Modem through NB-IoT network.

1.3 TW810

An industrial LTE-M/NB-IoT Modem series manufactured by Bivocom.

2. Introduction

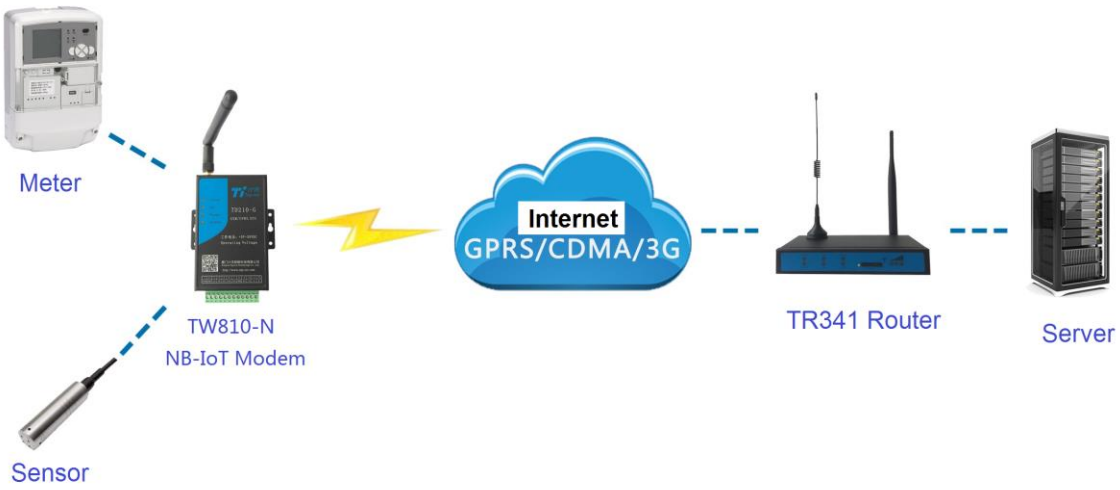
2.1 Overview

TW810 Series LTE CAT M1/NB-IoT Modem is a type of industrial wireless LTE CAT M1/NB-IoT Modem (Also called DTU, Data Transfer Unit, or IP modem), designed to fully meet the needs of industrial standards and industrial users. It adopts high-powered industrial 32-bits CPU, multi-layer software detection and hardware protection mechanism to ensure reliability and stability of the device. It supports LTE CAT M1/NB-IoT network, with rich and flexible interfaces, such as RS232, RS485 and RS422, and TTL GPIOs is also customizable.

TW810 Series LTE CAT M1/NB-IoT Modem can help users to quickly access the Internet, to ensure secure and reliable data transmission. It's ideal for IOT (Internet of Things) and M2M (Machine to Machine) applications, and has been widely used in many applications, such as Intelligent Transportation, Smart Grid, Vending Machine, Agricultural Irrigation, Environmental Protection, Industrial Automation, Energy Saving, Smart Home, etc.

2.2 Applications

TW810 Series LTE CAT M1/NB-IoT Modem utilizes NB-IoT cellular network for remote data acquisition and transmission, and has been used for industrial remote monitor and control.
Typical application as below.



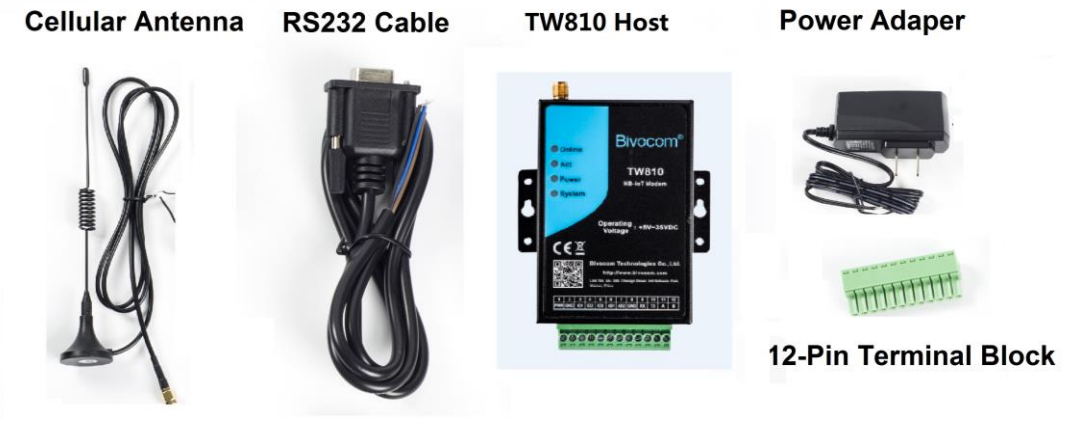
3. Getting Started

WARNING: Please make sure the device is powered off before you install and configure it.

3.1 Package Checklist

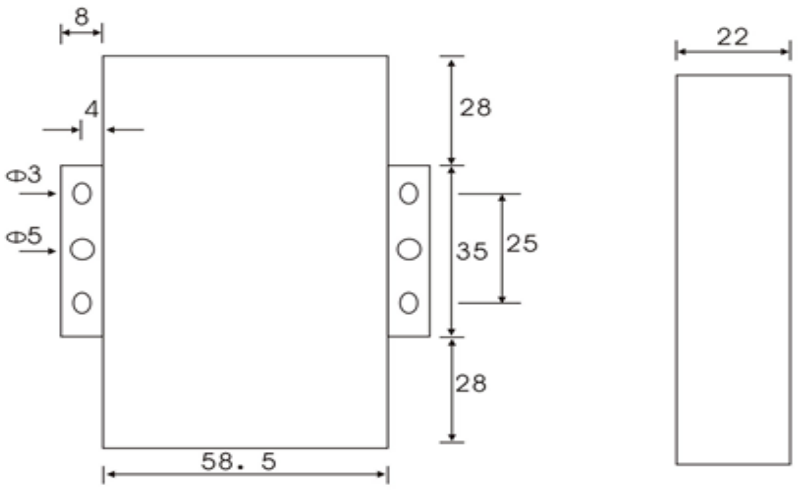
Check the package before you configure and install the device.

- TW810 NB-IoT Modem Host
- Cellular antenna(SMA Male)
- Power Adapter(12VDC/0.5A)
- 3- Pin RS232 cable with DB9 connector(female)
- 12-Pin Terminal Block



3.2 Dimensions

There are 3 holes for installation at each side of TW810 (Unit: mm)



3.3 Installation

3.3.1 SIM/UIM Card

Insert the SIM/UIM card.

TW810 supports normal SIM/UIM only, so if you're using a Micro SIM or Nano SIM card, you may need to use a Micro SIM or Nano SIM to Normal SIM card adapter.

Make sure your Modem is powered off, then use a needle object(such as a pen) to push the button near the SIM/UIM card holder, it will flick out immediately. Put the SIM/UIM card to card holder with chipset upside, insert it to NB-IoT Modem and make sure it's tightly matched.

Warning: Never install SIM/UIM card when NB-IoT Modem is powered on.

3.2.2 Cellular Antenna

Fasten the cellular antenna.

Screw the SMA male cellular antenna to TW810 (SMA female interface), make sure it is screwed tightly to ensure the strength of signal.

3.2.3 Terminal Block, Power Cable and Console Cable

Insert the terminal block to modem correctly.

1) Definition of Terminal Block Interface

PIN No.	Signal Name	Default Function	Extended Function
1	PWR	Power input anode	NA
2	GND	Power Ground	NA
3	IO1	GPIO, able to check dry contact signal and 3.3 V switch signal, output 3.3V switch signal	Reserved RS232 RTS and TTL RX
4	IO2	GPIO, able to check dry contact signal and 3.3 V switch signal, output 3.3V switch signal	Reserved RS232 CTS and TTL TX
5	IO3	GPIO, able to check dry contact signal and 3.3 V switch signal, output 3.3V switch signal	Reserved RS232 DCD

6	IO4	GPIO, able to check dry contact signal and 3.3 V switch signal, output 3.3V switch signal	Customized pulse output, pulse counter, analog quantity input, Reserved RS232 RI
7	IO5	GPIO, able to check dry contact signal and 3.3 V switch signal, output 3.3V switch signal	Customized pulse output, pulse counter, analog quantity input
8	GND	Power Ground	NA
9	RX	RS232 Receive Data	NA
10	TX	RS232 Transfer Data	NA
11	A	RS485 anode	Reserved RS232 DTR
12	B	RS485 cathode	Reserved RS232 DSR

2) Connect Power Cable and Console Cable

Connect the power supply cable and console cable to terminal block.

The interface of TW810 is industrial terminal block, we suggest you use 28-16AWG power cable and console cable.

Definition of power cable and console cable in this package are as below

Power Cable (Output 12VDC/0.5A)

Color of cable	Power Output Polarity
Black & White Alternate	Anode
Black	Cathode

RS232 Cable (with DB9 female interface)

Color of Cable	Corresponding DB9-M Pin Number
Blue	3
Brown	2
Black	5

WARNING: make sure you connect the terminal block to TW810 modem correctly before power on, or it may cause the damage of device.

3.3 Power Supply

After all the accessories and cables mentioned above are installed very well and correctly, then plug the power supply to power outlet.

TW810 adopts advanced power technology to improve the stability and adapt to complex external environment. You can use Bivocom standard power adapter(12VDC/500mA), or use DC power ranging at 5-35VDC, please make sure the power supply is stable enough(Ripple shall be less than 300mA, and

Instantaneous voltage shall not larger than 35V), meanwhile, power shall over 4W.
Note: We suggest you use Bivocom standard power adapter (500mA/12VDC).

3.4 LED Indicators

TW810 has 4 LED indicators, 'Online', 'ACT', 'Power', 'System', as follows.

LED Indicators	Status	Content
Online	Off	TW810 isn't connected to server
	On	TW810 is connected to server
ACT	Off	No data transfer
	Blink	Sending or receiving data
Power	Off	Power Off
	On	Power On
System	Off	System error
	Blink	System works

4. Configuration

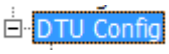
4.1 Getting started

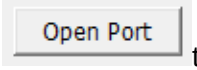
To start to configure the modem, you'll need below materials

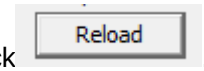
1) A laptop or computer that has DB9 serial port(male)
Note: if your laptop or computer doesn't have a serial port, an USB to Serial port(male) adapter would be required.

2) BIVOCOM TW810 config tool.
The TW810 config tool integrated with configuration, debug and firmware upgrade functions.
You can go to BIVOCOM website to download the config tool, like below.
http://www.bivocom.com/index.php?m=content&c=index&a=show&catid=12&id=30
Note: The config tool only support Windows OS, IOS is not supported yet.

4.2 Serial port configuration

Connect TW810 to your laptop or computer through RS232, then open Bivocom configuration tool (TW810.exe), Click 

on the left side, and click 

to open the serial port, and choose your COM port of laptop or computer. Then Click 

, and a window will be open tell

you to restart the device(Figure 2), unplug the power adapter, and power on TW810 again, then waiting for entering into configuration status, when it shows loading DTU parameters successfully(Figure 3), then you can go to next step to configure the modem, including Basic Setting(4.3), Network Setting(4.4).

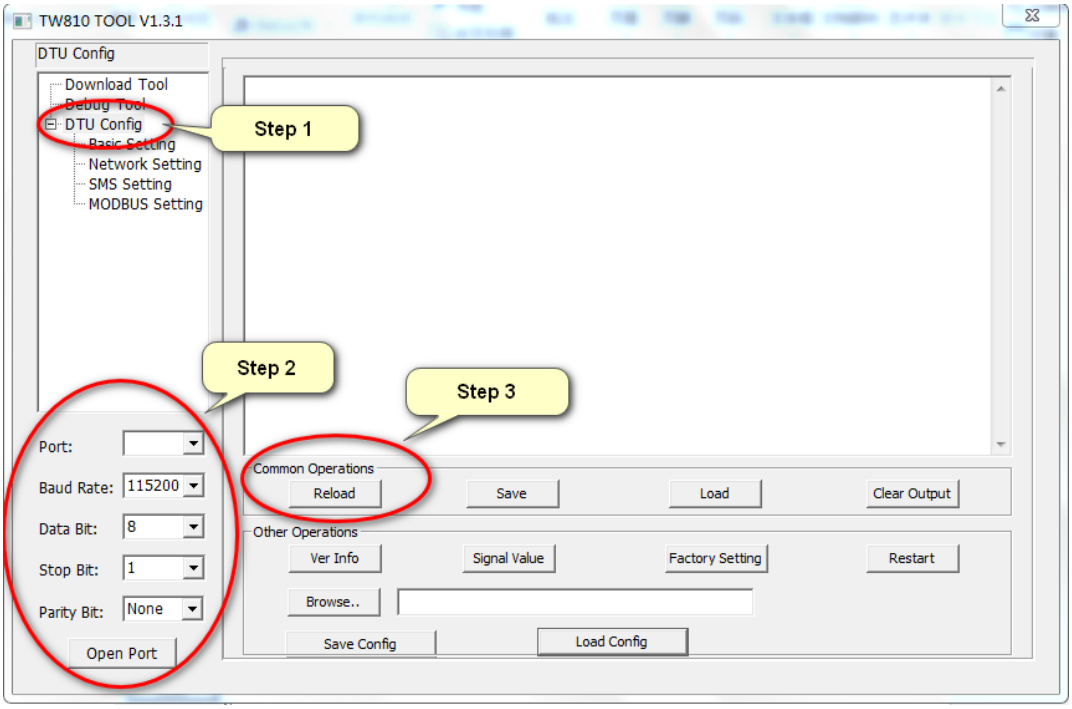


Figure 1

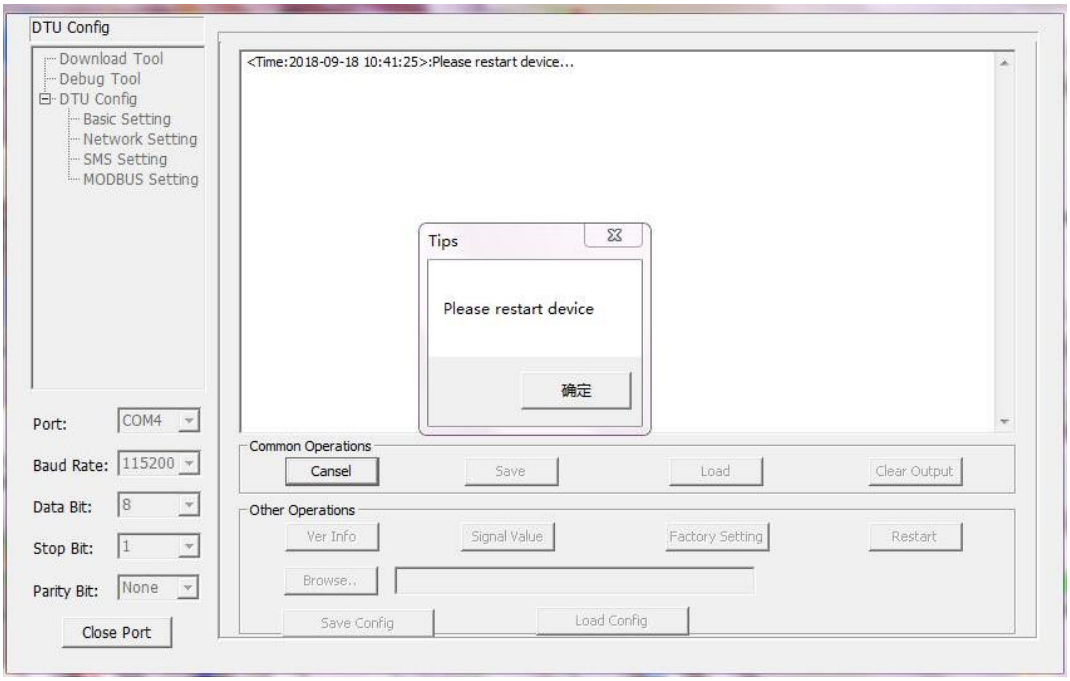


Figure 2

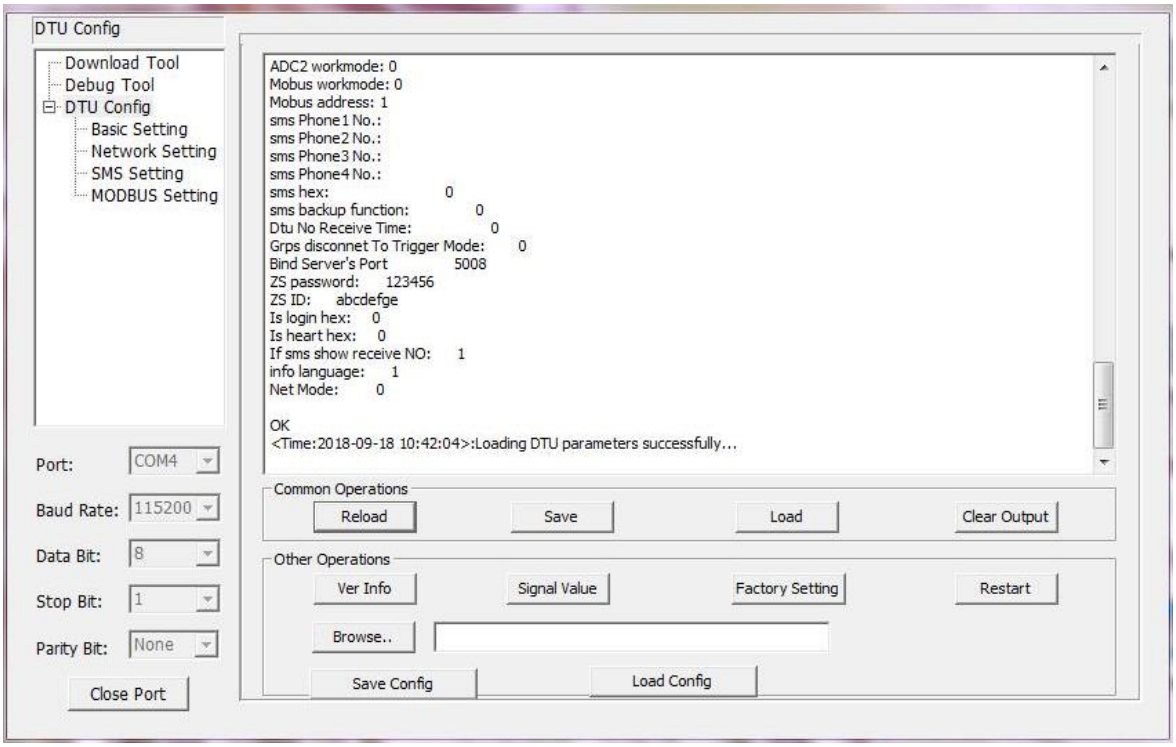
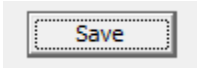


Figure 3

Below are quick instructions of Operations on the config tool, but you can go to next step.(4.3 Basic setting), if you're familiar with those parameters.

4.2.1 Save



Click to save the parameters you've configured.

4.2.2 Load

Load the parameters of TW810 to config tool and display.

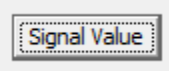
4.2.3 Clear Output

Clear log of config tool.

4.2.4 Version Info

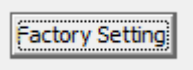
Check the version info of TW810.

4.2.5 Signal Value



Check the signal strength of TW810.

4.2.6 Factory Setting

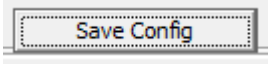


TW810 returns to factory setting.

4.2.7 Restart

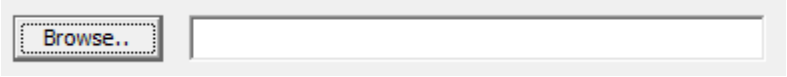
Restart TW810

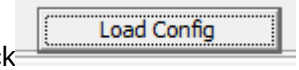
4.2.8 Save Config



Save configuration of TW810 in file format, which you can use it recover the config.

4.2.9 Configure via Saved Config File

Click 

, and choose the saved config file, then click 

to configure TW810.

4.3 Basic Setting

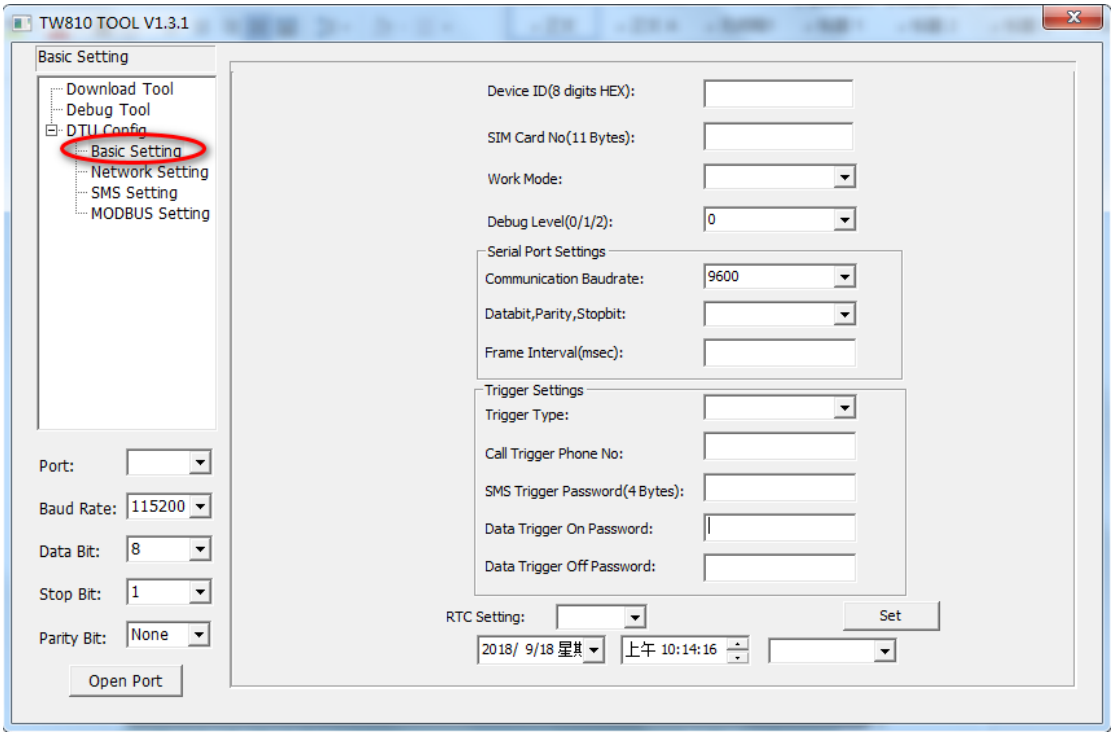
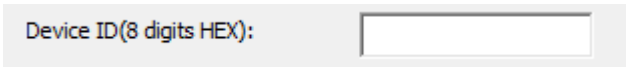


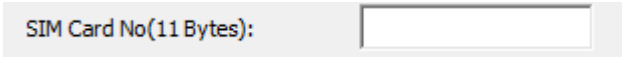
Figure 4

4.3.1 Device ID



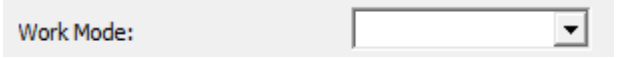
To identify the TW810 and for device management, if you have many TW810 connected to server, please make sure all the ID are different.

4.3.2 SIM Card No.

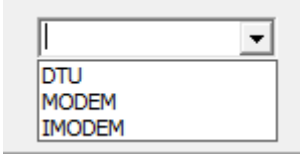


The Number of SIM inserted in this modem.

4.3.3 Work Mode



Keep the default settings-DTU, as work mode MODEM and IMODEM are not supported on TW810.

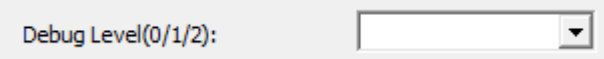


DTU (Transfer the data to server through LTE CAT M1/NB-IoT Modem)

Note: the MODEM and IMODEM work mode are only available on TD210 series IP Modem.

4.3.4 Debug Level

If you're going to diagnose the modem, we suggest you choose 2, otherwise, you can choose 0 or 1.



There are 3 levels to choose from the drop-down menu, as below

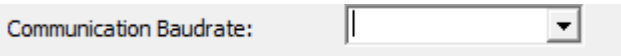
2: All logs output through RS232/RS485

1: Part of important logs output through RS232/RS485

0: No logs output

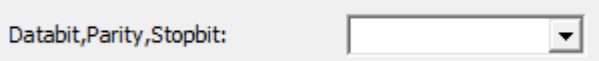
4.3.5 Communication Baud Rate

This is to configure the baud rate that to match your front sensors or meters' baud rate.

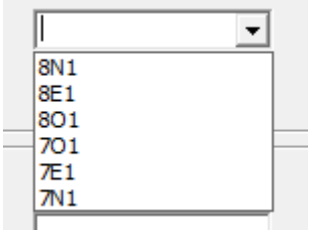


Supported baud rate: 300, 600, 1200, 2400, 4800, 9600, 14400, 19200, 38400, 56000, 57600 and 115200.

4.3.6 Databit, Parity and Stopbit



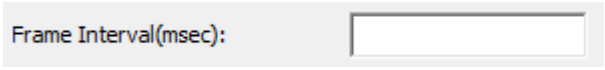
You can choose below from drop-down menu.



8N1 (8 Databit, No Parity, 1 Stopbit)

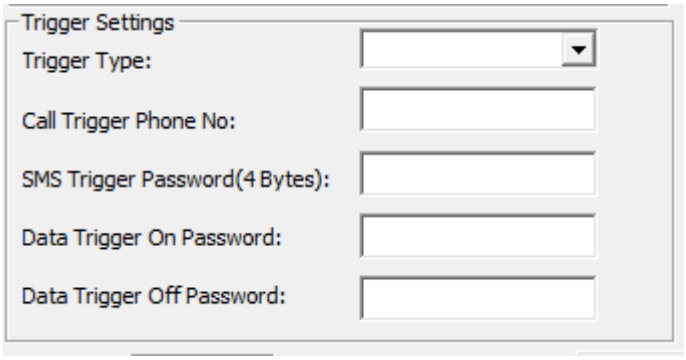
8E1 (8 Databit, Even Parity, 1 Stopbit)
8O1 (8 Databit, Odd Parity, 1 Stopbit)
7O1 (7 Databit, Odd Parity, 1 Stopbit)
7E1 (8 Databit, Even Parity, 1 Stopbit)
7N1 (7 Databit, No Parity, 1 Stopbit)

4.3.7 Frame Interval (Unit: Millisecond)

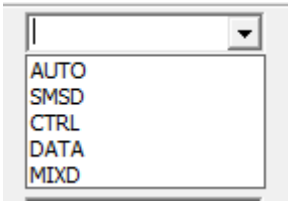


When Modem receives packet slicing, increase the value, while for packet merging, lower the value, 20ms for 115200 baud rate, 50ms for 9600 baud rate and 200ms for 1200 baud rate.

4.3.8 Trigger Settings

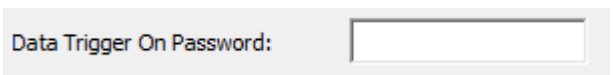


1) Trigger Type



There are 2 trigger types for TW810 only, AUTO and DATA.
AUTO: Always online
DATA:Sending specific data to trigger TW810 online or offline.
Note: SMSD, CTRL, MIXED are not applicable to TW810, only available on TD210 Cellular modem.
http://www.bivocom.com/index.php?m=content&c=index&a=show&catid=12&id=22

2) Data Trigger On Password

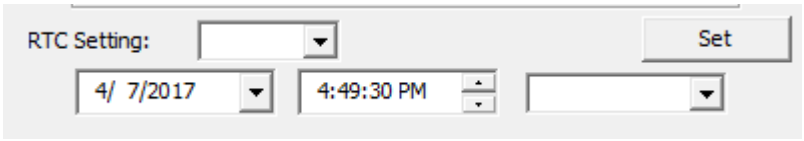


You can set up trigger data in the blank, once the trigger mode is DATA and MIXD, and TW810 receives the trigger data through RS232/RS485 serial port, it will get online.

3) Data Trigger Off Password

You can set up trigger data in the blank, once the trigger mode is DATA, and TW810 receives the trigger data through RS232/RS485 port, it will get offline.

4) RTC Setting



You can set up the system time for your TW810.

4.4 Networking Setting

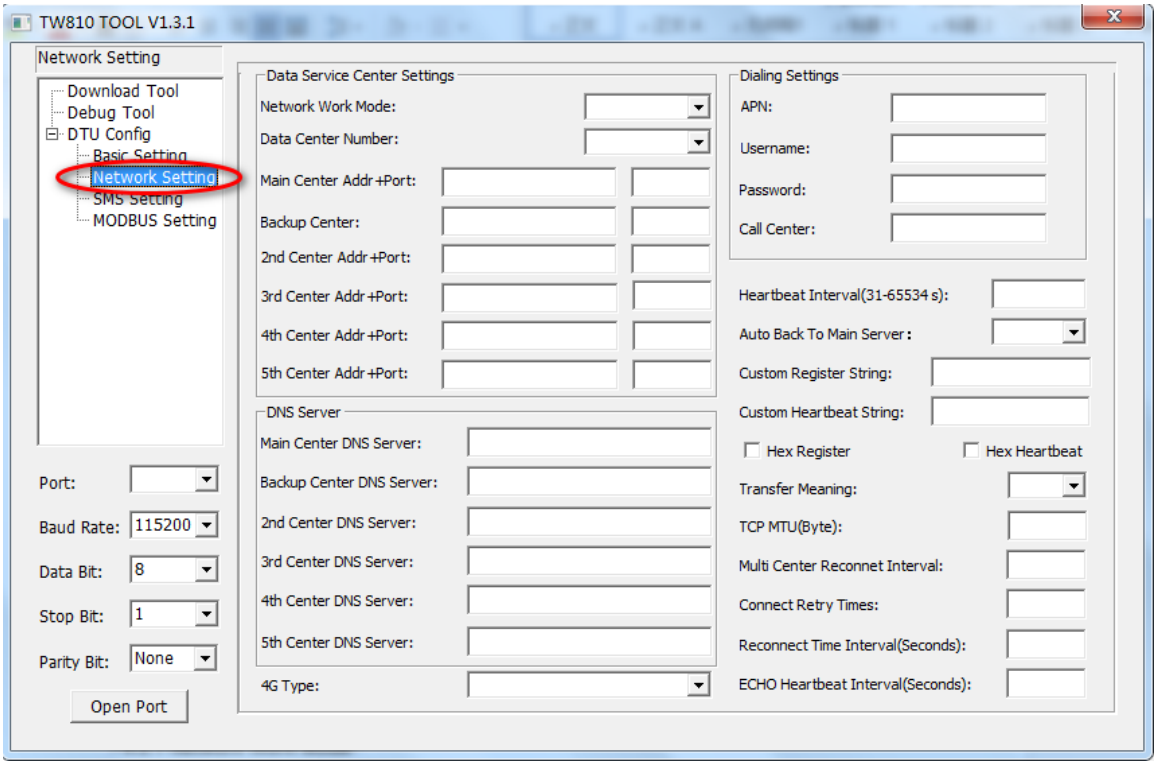


Figure 5

4.4.1 Network Work Mode

1) NB-IoT Modem(TW810-B5, TW810-B8, TW810-B20, TW810-GL)

For NB-IoT only version modem(like TW810-GL), there are 2 works modes you can choose, NUDP(Pure

UDP) and COAP.(Figure 6 and 7)

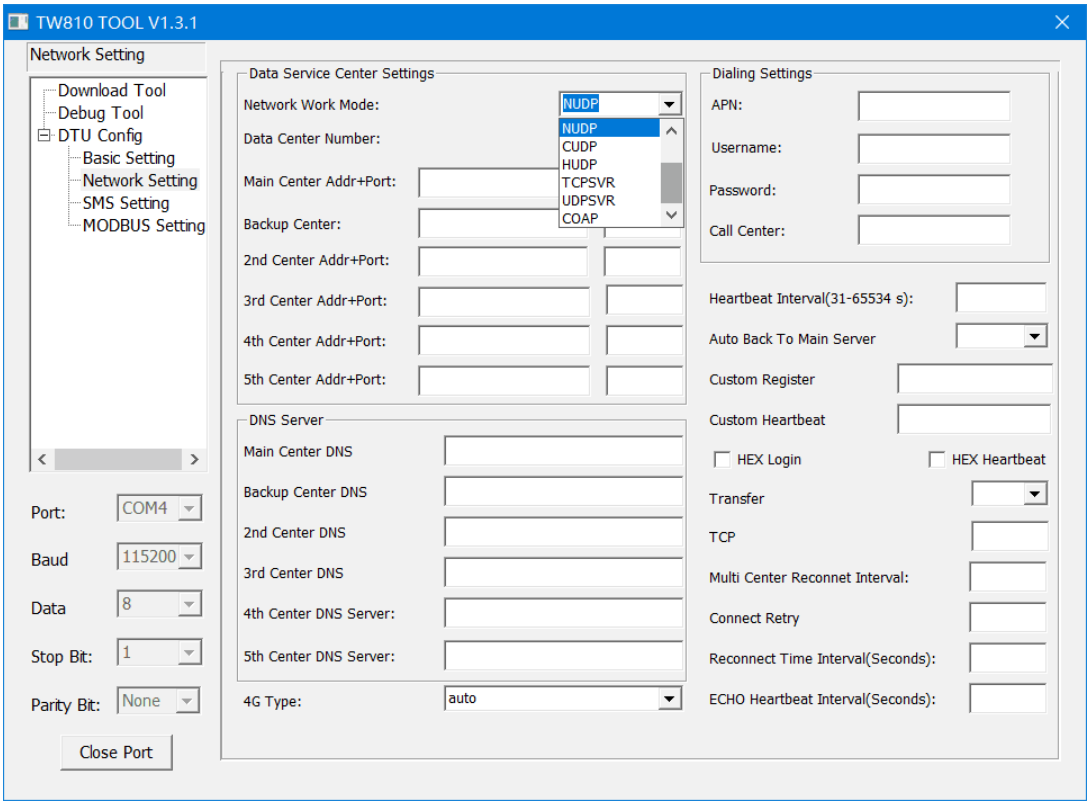


Figure 6

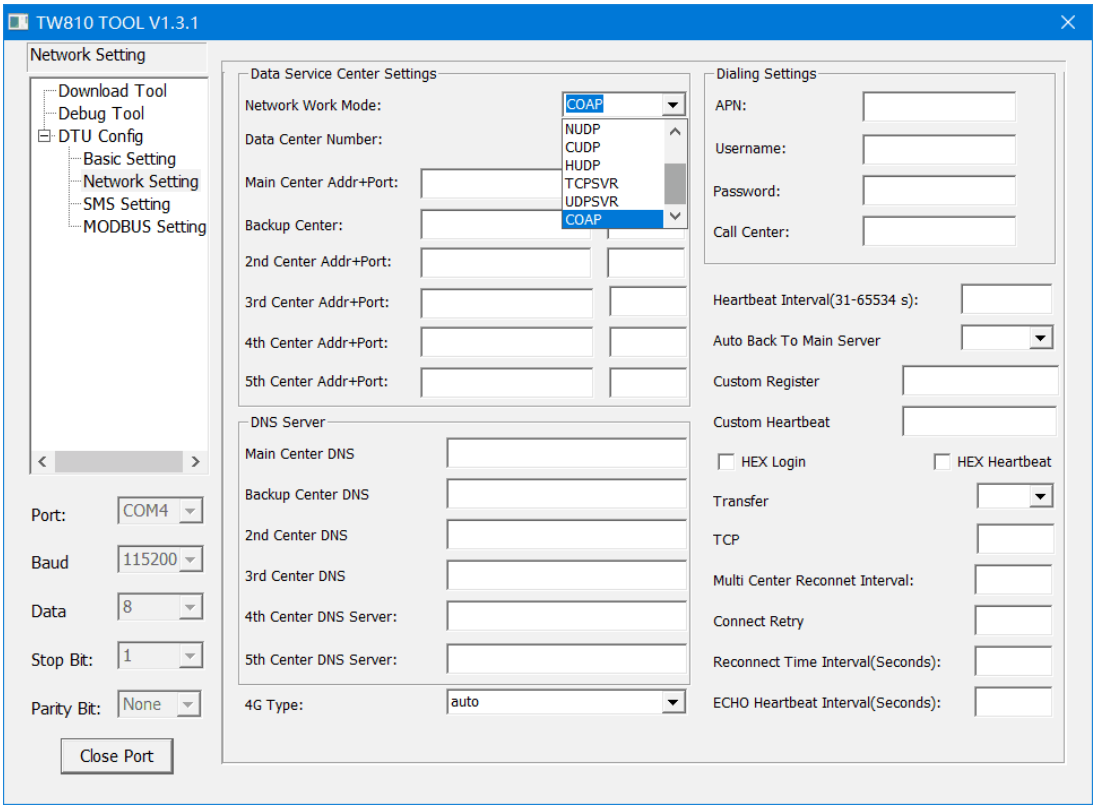


Figure 7

CUDP(Custom UDP) and HUDP(DCUDP) are unavailable now.

- TW810 will act as a UDP client when choose NUDP.

Note: NB-IoT Modem TW810 only supports UDP and COAP.

2) LTE-CAT M1/NB1 Modem(TW810-MS7C)

While for LTE CAT M1 version modem (like TW810-MS7C), you can choose both CTCP and NUDP work modes.

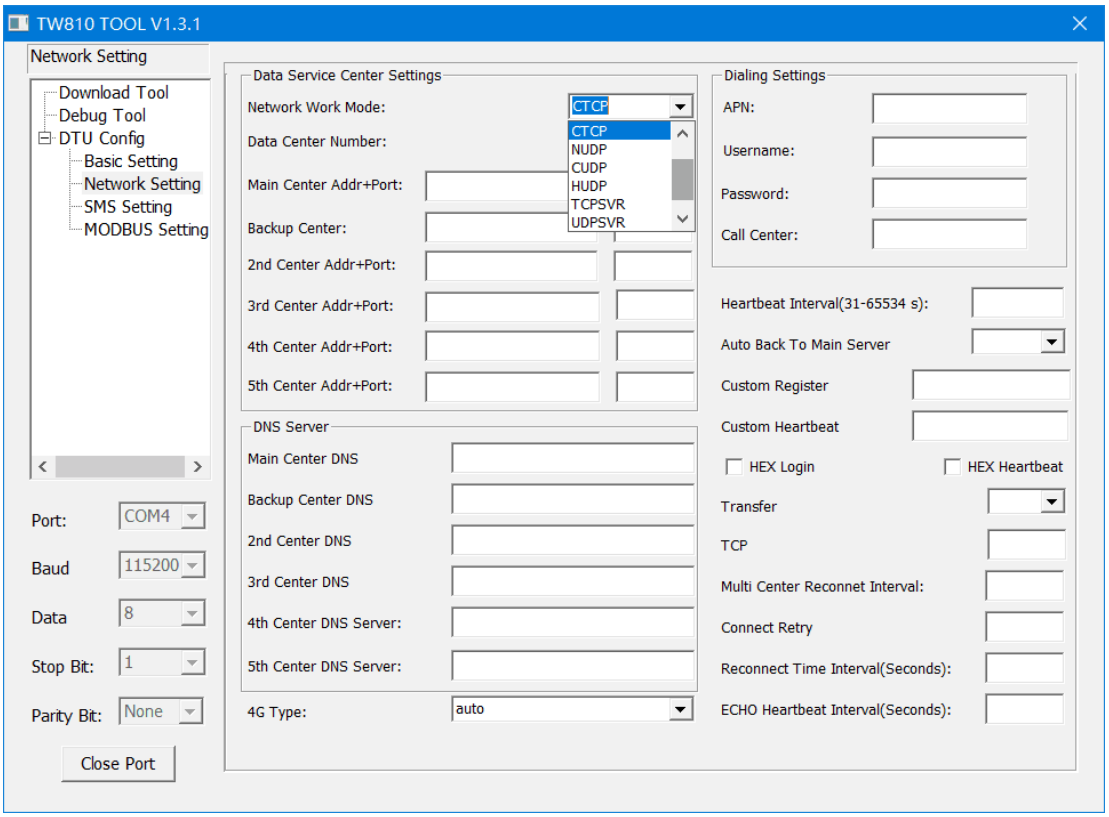
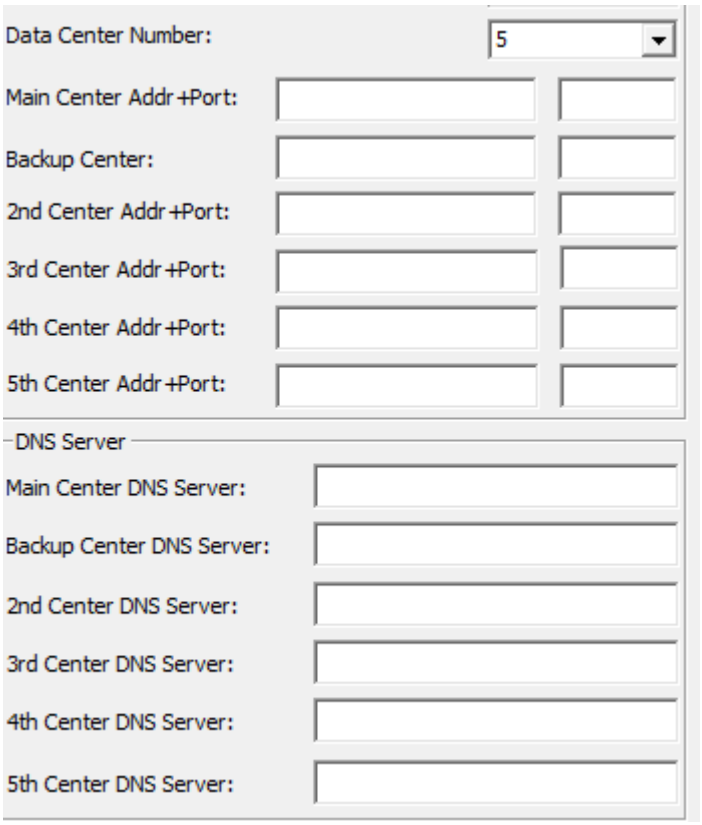


Figure 8

4.3.2 Data Center Number



1) You can configure up to 5 data centers.

- 0 means TW810 will not connect to LTE CAT M1 and NB-IoT network.
- 1 means TW810 only supports 1 data center, TW810 will connect to main center, once it couldn't connect to backup center, it will continue to connect to main center till it's connected.
- 2-5 means TW810 supports multi centers, and all the other centers will get sync data.

Note: if there is not backup center, please set up the same address and port for main center and backup center

2) Center Addr.+Port

This is to configure your server's IP address and port.

3) Center DNS Server

When you use DNS for center, a DNS server is required to analytic the corresponding IP address.
Note: DNS may be unavailable for NB-IoT modem, but it may work in different carriers.

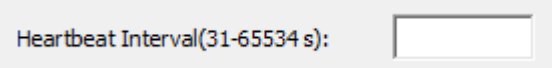
4.4.3 Dialing Settings

You may be required to configure the APN and related parameters below, or just keep it null, as different carriers may have different requirement for connecting LTE CAT M1 and NB-IOT devices to their network.

- APN: cellular network access code
- Username: authentication username of NB-IoT network
- Password: authentication password of NB-IoT network
- Call center: dial number of call center for NB-IoT network

Note: Different carriers may have different APN, Username, Password and Call Center, please ask your mobile carriers for those info if you have any questions.

4.4.4 Heartbeat Interval



Heartbeat time, we suggest you keep it as default settings.

4.4.5 Auto Back to Main Server

- Y

Auto back to main server.

- N

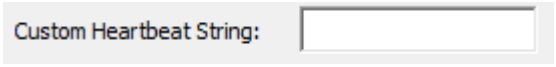
Don't auto back to main server.

This setting will only work when both main and backup center are enabled, under this work mode, if main center fails, TW810 will auto connect to backup center. If you choose 'Y', TW810 will check whether main center is recovery or not, if yes, it will switch to main center, and disconnect with backup center. While if choose 'N', TW810 will not check whether main center is recovery or not.

4.4.6 Custom Register String

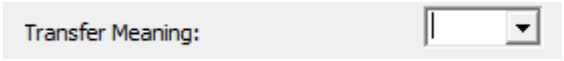
You can configure it when network work mode is configure as CUDP, but you can also choose not to configure it, which means register string won't be sent.
Note: the length of register string is up to 70 bytes.

4.4.7 Custom Heartbeat String



You can configure it when network word mode is configure as CUDP, but you can also choose not to configure it, which means register string won't be sent.
Note: the length of register string is up to 70 bytes.

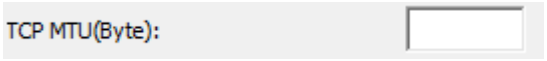
4.4.8 Transfer Meaning



- Y means Yes
- N means No

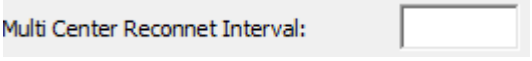
We suggest you keep it as default settings-Y

4.4.9 TCP MTU



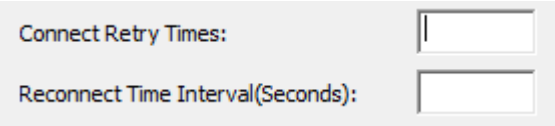
We suggest you keep it as default settings, as it is not supported by TW810.

4.4.10 Multi Center Reconnect Interval



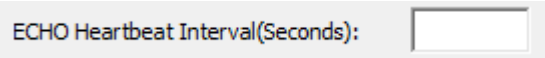
Only available when data center number is 2-5.

4.4.11 Reconnect



In real application, the data center may be shut down or have issue, and that will cause TW810 disconnects from data center, while in order to keep TW810 always online, it will try to reconnect the data center, and that will cause unnecessary data flow. So you can configure those 2 functions to save the data flow, when Reconnect Time Interval enabled, TW810 will try to reconnect data center, and if Connect Retry Times exceed the value you set, while TW810 is still unable to reconnect to data center, TW810 will do exception handling.

4.4.12 ECHO Heartbeat Interval



We suggest you keep it as default settings, as it is not supported by TW810 now.

4.4.13 TTL Heartbeat

It's a reserved feature, we suggest you keep it as default settings, as it is not supported by TW810 now.

4.5 MODBUS Setting

Modbus is a reserved feature, and not supported by TW810 now.

5 Firmware Upgrade

5.4 Please open the Bivocom Config Tool, as below,

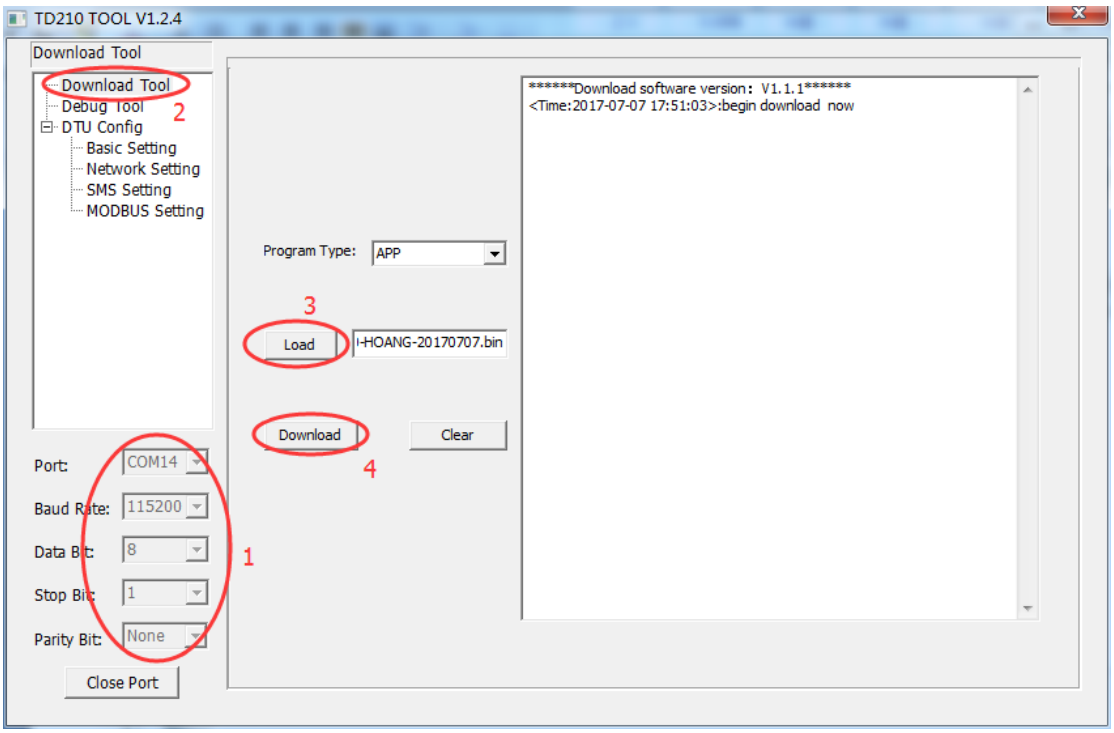
1) Configure Serial Port parameters

- Baud Rate: 115200
- Data Bit: 8
- Stop Bit: 1
- Parity Bit: None

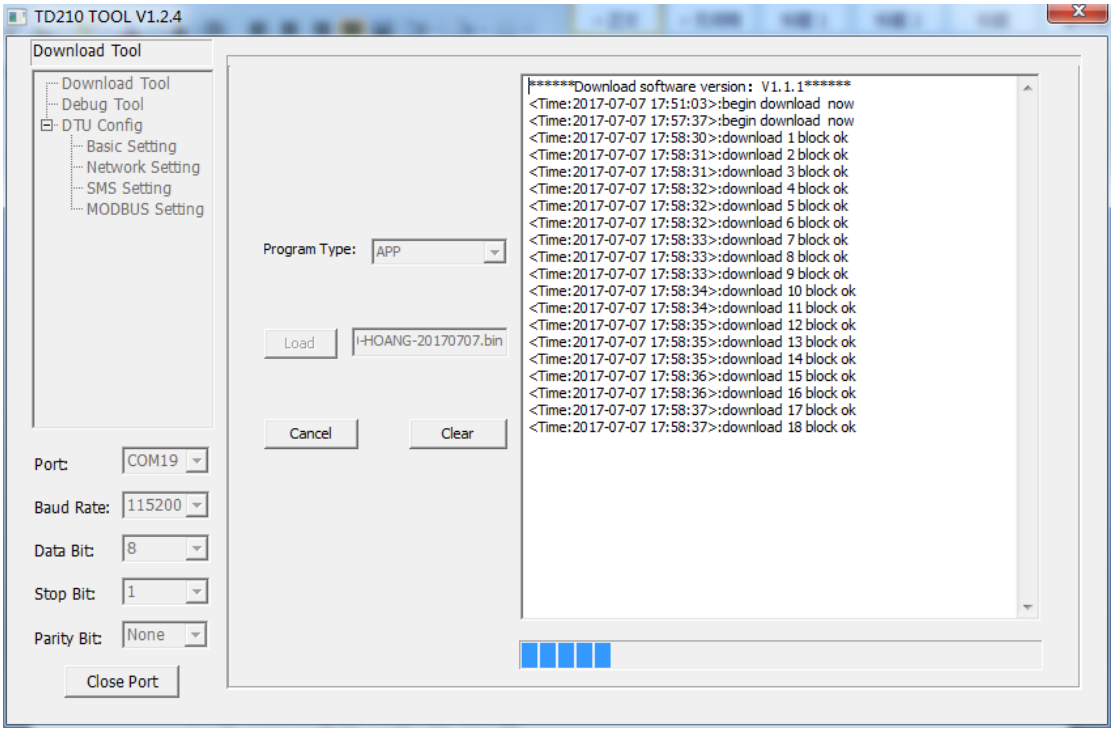
2) Click 'Download Tool'

3) Click 'Load', choose the firmware you want to upgrade

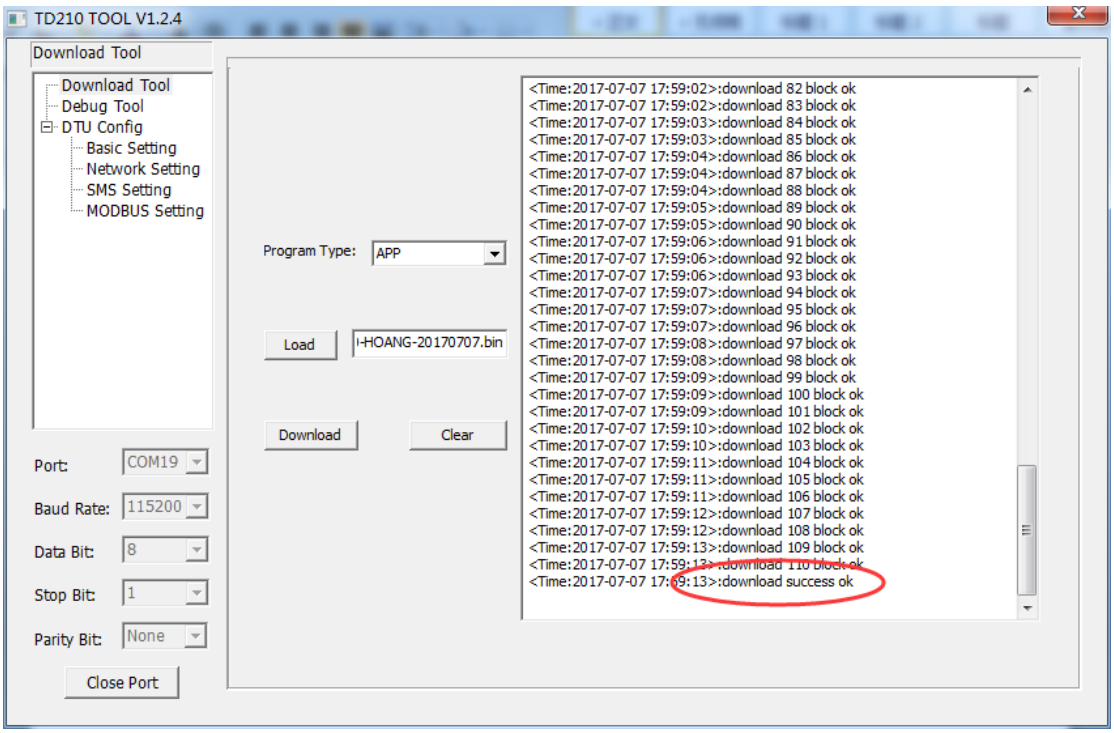
4) The click 'Download'



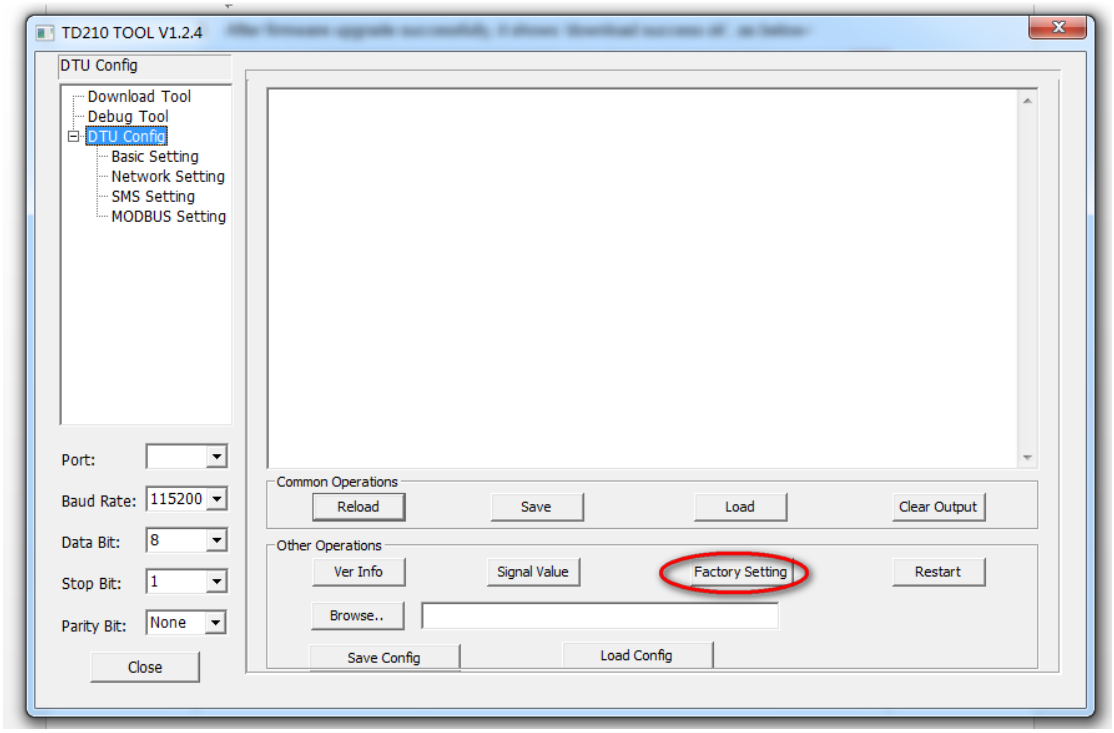
5.5 Power on the TW810, then device will start to upgrade the firmware, as below



5.6 After firmware upgrading successfully, it shows ‘download success ok’, as below



5.7 Then use the Config Tool to enter into the configuration status, set up the device to factory setting, and restart to configure the parameters.



Appendix 1: AT Command

Note: XX means parameter you'd like to set only, not command.

There are some AT Commands not supported by TW810

Description	AT Command	Parameter
Debug Level	AT+DEBUG=XX	XX: 0 (No logs) 1 (Simple logs) 2 (Detailed logs)
Baud Rate	AT+IPR=XX	XX: from 300 to 115200
Data bit, stop bit and Parity	AT+SERMODE=XX	XX: 8N1,8E1,8O1,7N1,7E1, 7O1
Frame Interval (ms)	AT+BYTEINT=XX	XX: unit(millisecond)
Trigger Type	AT+ACTI=XX	XX: AUTO (Always Online) SMSD (SMS Trigger) CTRL (Call Trigger) DATA (Data Trigger) MIXD (Mixed Trigger)
Data Trigger On Password	AT+DONPSWD=XX	XX: Trigger on data
Data Trigger Off Password	AT+DOFFPSWD=XX	XX: Trigger off data
Network Word Mode	AT+MODE=XX	XX: FTCP,HTCP,CTCP, NUDP,CUDP,HUDP
Data Center Number	AT+SVRCNT=XX	XX: number of data center
Main Center Addr.	AT+IPAD=XX	XX: Main center IP address or DNS
Main Center Port	AT+PORT=XX	XX: Main center port
Backup Center Addr.	AT+IPSEC=XX	XX: Backup center IP address or DNS
Backup Center Port	AT+PTSEC=XX	XX: Backup center port
2nd Center Addr.	AT+IPAD1=XX	XX: 2nd center IP address or DNS
2nd Center Port	AT+PORT1=XX	XX: 2nd Center Port
3rd Center Addr.	AT+IPAD2=XX	XX: 3rd center IP address or DNS
3rd Center Port	AT+PORT2=XX	XX: 3rd Center Port
4th Center Addr.	AT+IPAD3=XX	XX: 4th center IP address or DNS
4th Center Port	AT+PORT3=XX	XX: 4th Center Port

5th Center Addr.	AT+IPAD4=XX	XX: 5th center IP address or DNS
5th Center Port	AT+PORT4=XX	XX: 5th Center Port
Main Center DNS Server	AT+DNSSVR=XX	XX: Main Center DNS Server
Backup Center DNS Server	AT+DNSSV2=XX	XX: Backup Center DNS Server
2nd Center DNS Server	AT+DNSSVR1=XX	XX: 2nd Center DNS Server
3rd Center DNS Server	AT+DNSSVR2=XX	XX: 3rd Center DNS Server
4th Center DNS Server	AT+DNSSVR3=XX	XX: 4th Center DNS Server
5th Center DNS Server	AT+DNSSVR4=XX	XX: 5th Center DNS Server
APN	AT+APN=XX	XX: APN
APN Username	AT+USERNAME=XX	XX: APN Username
APN Password	AT+PASSWORD=XX	XX: APN Password
APN Call Center	AT+CENT=XX	XX: APN Call Center
Heartbeat Interval	AT+POLLTIME=XX	XX: Heartbeat Interval
Auto Back to Main Server	AT+RETMAIN=XX	XX: 1, Yes 0, No
Custom Register String	AT+CONNRGST=XX	XX: Custom Register String
Custom Heartbeat String	AT+LINKRGST=XX	XX: Custom Heartbeat String
Transfer Meaning	AT+STRAIGHT=XX	XX：0, Transfer meaning 1, No transfer meaning
TCP MTU	AT+TCPMTU=XX	XX: TCP Data Maximum Transmission Unit
Multi Center Reconnect Interval	AT+MCONTIME=XX	XX: Second(Unit)
Connect Retry Times	AT+RETR=XX	XX: Connect Retry Times
Reconnect Time Interval	AT+RDLWT=XX	XX: Reconnect Time Interval
TTL Heartbeat	AT+EXFUN=XX	XX: 0, Disable 1, Enable, 1 time per 60 seconds
ECHO Heartbeat Interval	AT+ECHOINT=XX	XX: 0, Disable Other value means seconds you set
MODBUS Work Mode	AT+MBMODE=XX	XX: 0, Disable 1, Network MODBUS 2, Serial Port MODBUS
MODBUS Device Address	AT+MBADDRESS=XX	XX: Address ranging from 1-247
1st Analog Work Mode	AT+ADCMODE1=XX	XX: 0, Disable 1, Collect Once

2nd Analog Work Mode	AT+ADCMODE2=XX	XX: 0, Disable 1, Collect Once
1st Digital Work Mode	AT+DIOWORKMODE1=XX	XX: 0, Disable 1, Input 2, Output
2nd Digital Work Mode	AT+DIOWORKMODE2=XX	XX: 0, Disable 1, Input 2, Output
3rd Digital Work Mode	AT+DIOWORKMODE3=XX	XX: 0, Disable 1, Input 2, Output

Appendix 2: FAQ

1. Power light is off

Check if the power supply range is 5~35V, and make sure the polarity is correct.

2. Online light is off

1) Make sure SIM card is the card holder and locked correctly, and antenna is fasten.
2) Check the IP address and port of server in the configuration tool is correct.
3) Check whether the server is working.
4) Check if the SIM is out of service (charges owed) and function of data is on.

3. The device couldn't enter into configuration mode.

1) Check the connection of RS232/RS485 is correct.
2) Is the RS232/RS485 connected to your computer or laptop and serial port of computer or laptop is working.
3) Check whether the baud rate of computer or laptop is the same as NB-IoT Modem.

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