IOT Device Series Product

Software Function

This document is applicable for the following products.

	Protoss Series: PW21, PW11, PE11, PG46
	Elfin Series: EW10, EW11, EE10, EE11, EE21, EG46
	Eport Series: E10, E20, E20-PIN, E30 Eport Pro Series: EP10, EP20, EP20-PIN, EP40
	Ethernet Serial Server: HF5111S, HF5111A, HF5111B, HF5122, HF5142A, HF5142B,

	Wi-Fi Serial Server: HF2211S, HF2211A, HF2211, HF2221, HF9610A, HF9610A, HF9610C, W10, W20,
	IO Series: HF6208, HF6508
	4G Router Series: HF2421, HF2421G, HF8102, HF9624, HF9606, HF9606W

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1. FUNCTIONAL DESCRIPTION

The IOT device series products has the following appllication，The following just take Elfin-EE10 for example. See test manual of specific product for detail usage:

- Connect customer's device with PC or server via TCP/UDP/Telnet.
- Contain a HTTP web server allow user to configure through browser with PC or phone.

1.1. Basic Network Protocol

The IOT device series products uses the IP address for network communications. If uses the TCP to ensure that no data is lost or duplicated. If use UDP to assure that data can be fast and effective to DES3tination address.

Supported protocols include:

- ARP, UDP, TCP, ICMP, DHCP, Telnet, DHCP, HTTP Server/Client
- Telnet command configuration. Webpage configuration
- Security Protocol: TLS, AES, DES3 encryption

<table>
<tr><td colspan="5">IOT Device Series Products</td></tr>
<tr><td rowspan="5">Application Programming Interface</td><td colspan="2">Protocols</td><td>Security</td><td>Configuration</td></tr>
<tr><td>DHCP
IGMP</td><td>DNS/DDNS
TCP/IP
HTTP</td><td>TLS
AES
DES</td><td>Web
IOTService
CLI
Telnet</td></tr>
<tr><td colspan="4">TCP/UDP</td></tr>
<tr><td colspan="4">IP/ICMP</td></tr>
<tr><td colspan="4">Ethernet/Wi-Fi</td></tr>
<tr><td colspan="2">FreeRTOS/mbed/Linux OS</td><td colspan="3">Drivers</td></tr>
<tr><td colspan="5">MCU</td></tr>
</table>

Figure 1. Software Protocol Structure

1.2. Ethernet Interface Function

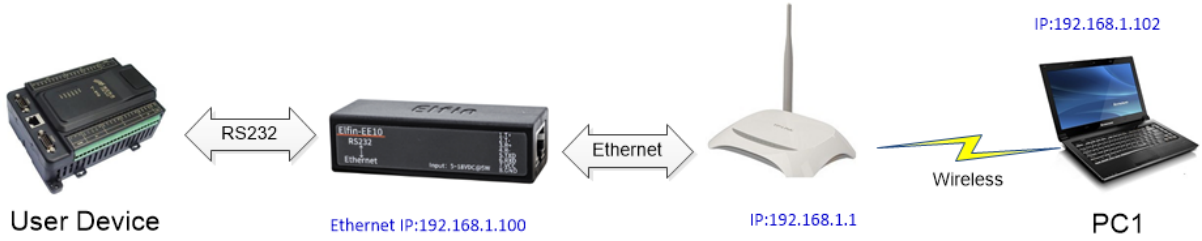


Figure 2. Ethernet Interface Function

The product Ethernet interface work in WAN functioin by default. When connect to router, it will get IP address from router(as picture 192.168.1.100). Then the procut and the PC1 are in the same local area network(LAN) for network communication, The data of communication finally pass from RS232 to network to control or collect PLC device.

Notes:

Different procut support UART of RS232/RS422/RS485/TTL interface. See product user manual.

1.3. Typical Network Architecture

As the following picture, Products and mobile device all connect to the same Router AP. At the same time, Products connect to user equipment by RS232 interface(RS485 function can be customized to support, still need additional 485 chip). The whole wireless network is easily to extend in this kind of network structure.

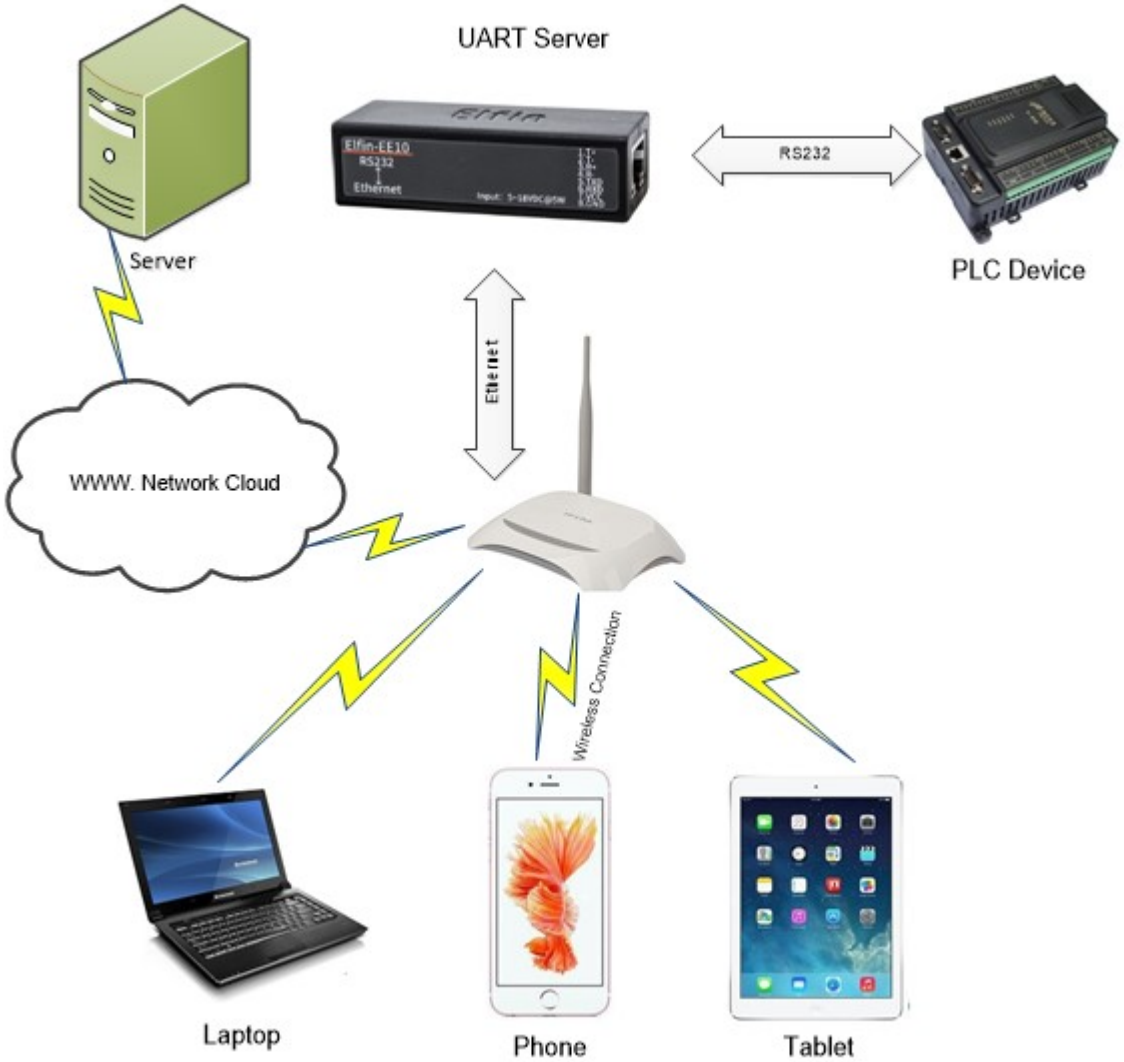


Figure 3. Network Application

1.4. Working Mode

1.4.1. Transparent Transmission Mode

Product support transparent transmission mode for UART to netowork. In this mode, User only need to set some necessary parameter (Network communication parameter). After power on, the device can auto connect to default destination address (TCP/UDP). Use web page or PC IOTService software to set commucation parameter.

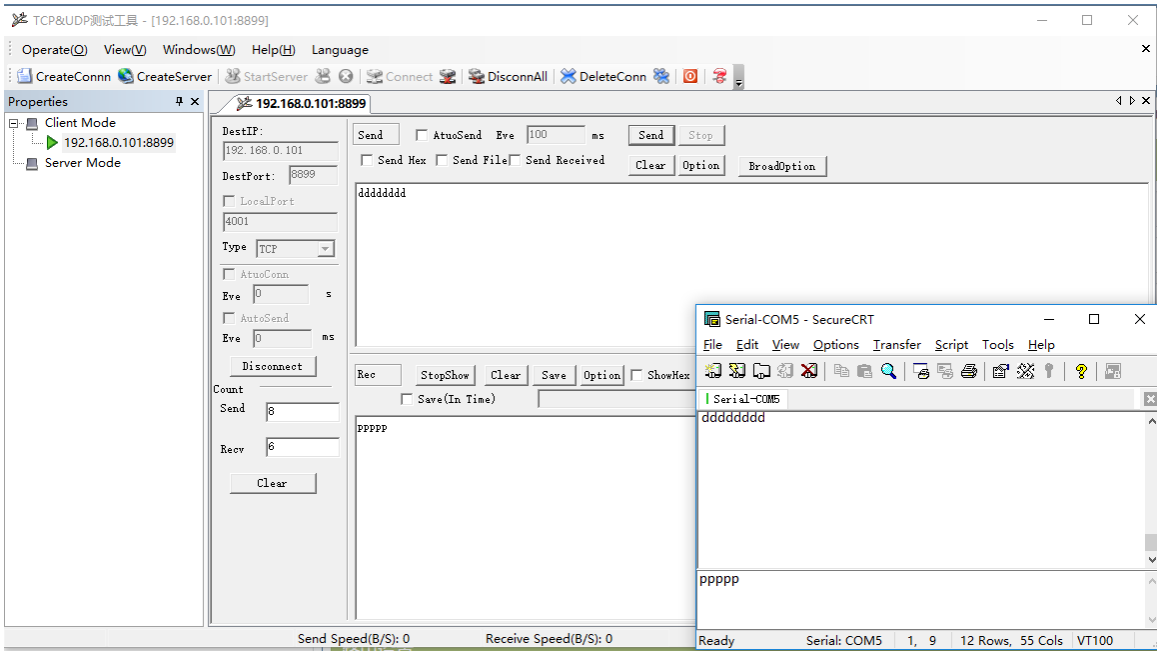


Figure 4. Transparent Data Transmission Example

1.4.2. TCP Server

Transparent transmission mode support TCP Server、TCP Client、UDP Server、UDP Client communication application. UDP Server is special function which will be described in Cli command. There is a default tcp server socket(netp) created. The Socket can be modified to work at one of the above working mode. When Socket works as TCP server. It will allow multiple TCP client connection (max 5). Multiple TCP connection will work in below structure:

Upload data flow: All the different TCP connection or the Client's data will be continuously transmitter to UART.

Download data flow: All data received from UART will be copied and broadcast to every TCP client.

Detailed multiple TCP connection structure drawn as below:

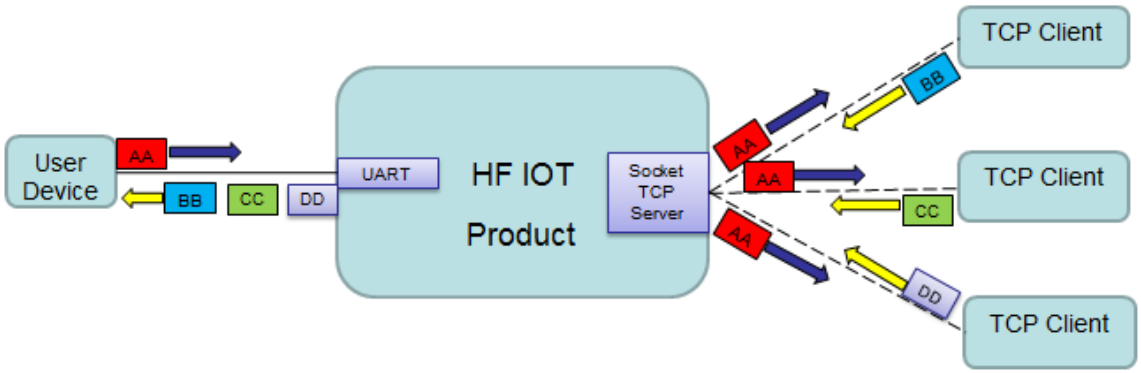


Figure 5. TCP Server Data Transmission Example

1.4.3. Multiple Socket

The device support max 5 Socket channel, each socket can work individually at TCP/UDP. Multi Socket simultaneous communication of data stream is as following.

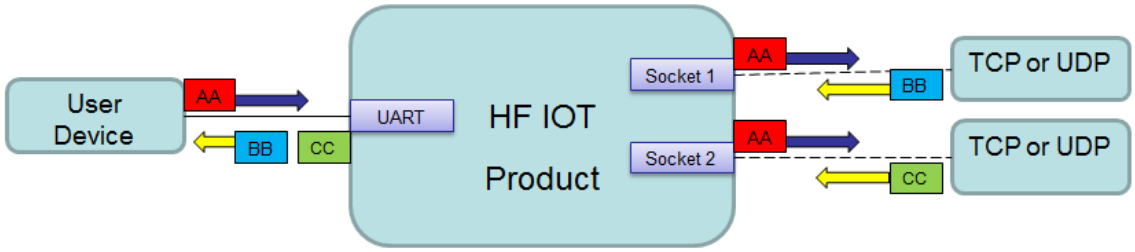


Figure 6. Multi Socket Data Transmission Example

Multi Socket can be created through software configure or webpage configure. The below set up 3 socket channel.

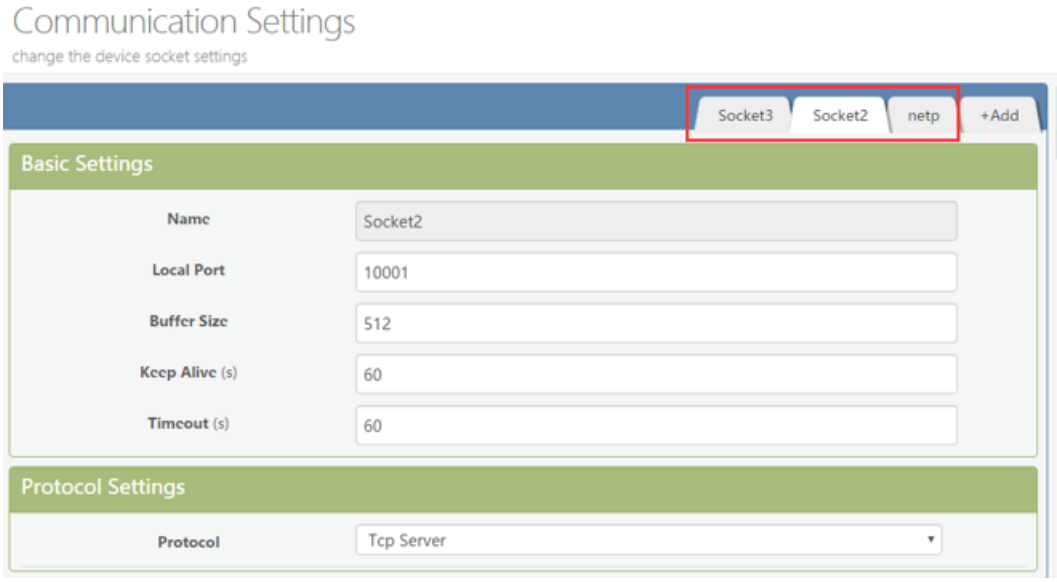


Figure 7. Webpage Set Multi Socket

1.4.4. HTTP Mode

Sending data in HTTP format to HTTP server (Set product socket to HTTP by IOTService software or webpage). When device socket works in HTTP mode. All received UART data will automaticly

transform to HTTP format (add HTTP header) and send to HTTP server. For the received HTTP data from HTTP server, it will automatically remove HTTP header and only output the data packet to UART.

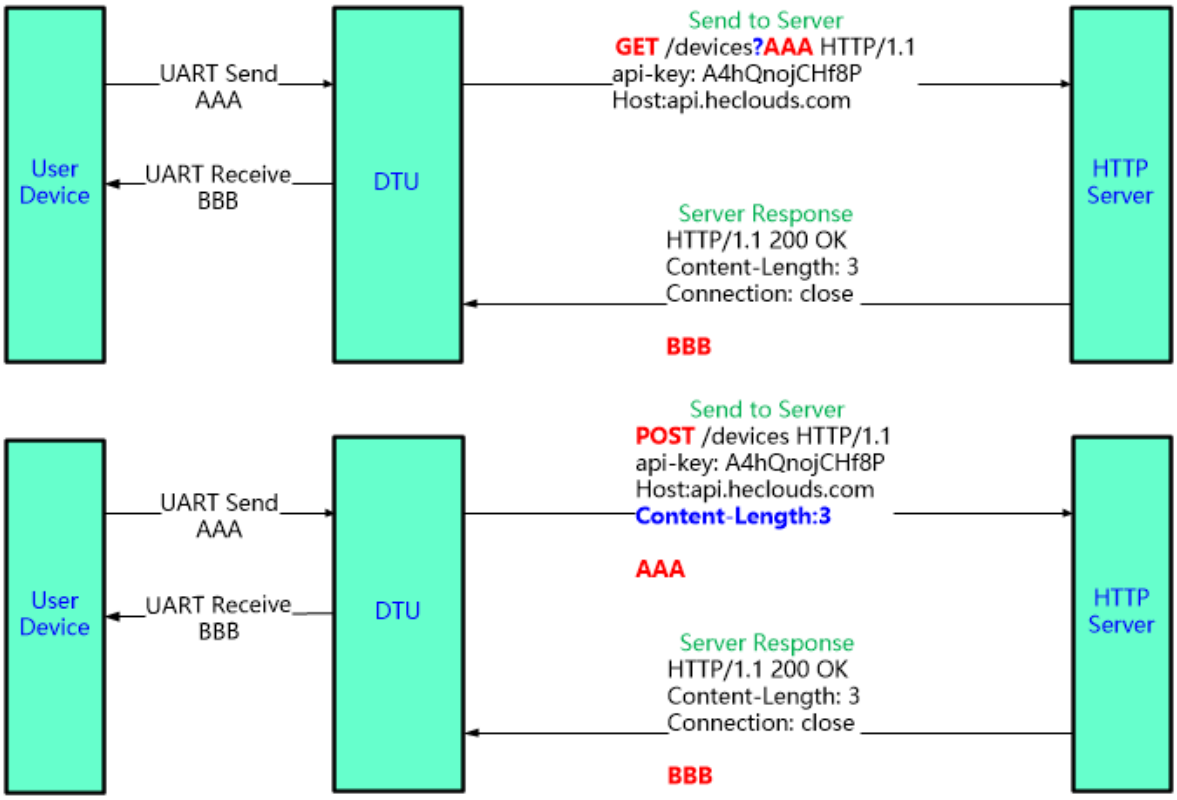


Figure 8. HTTP Request

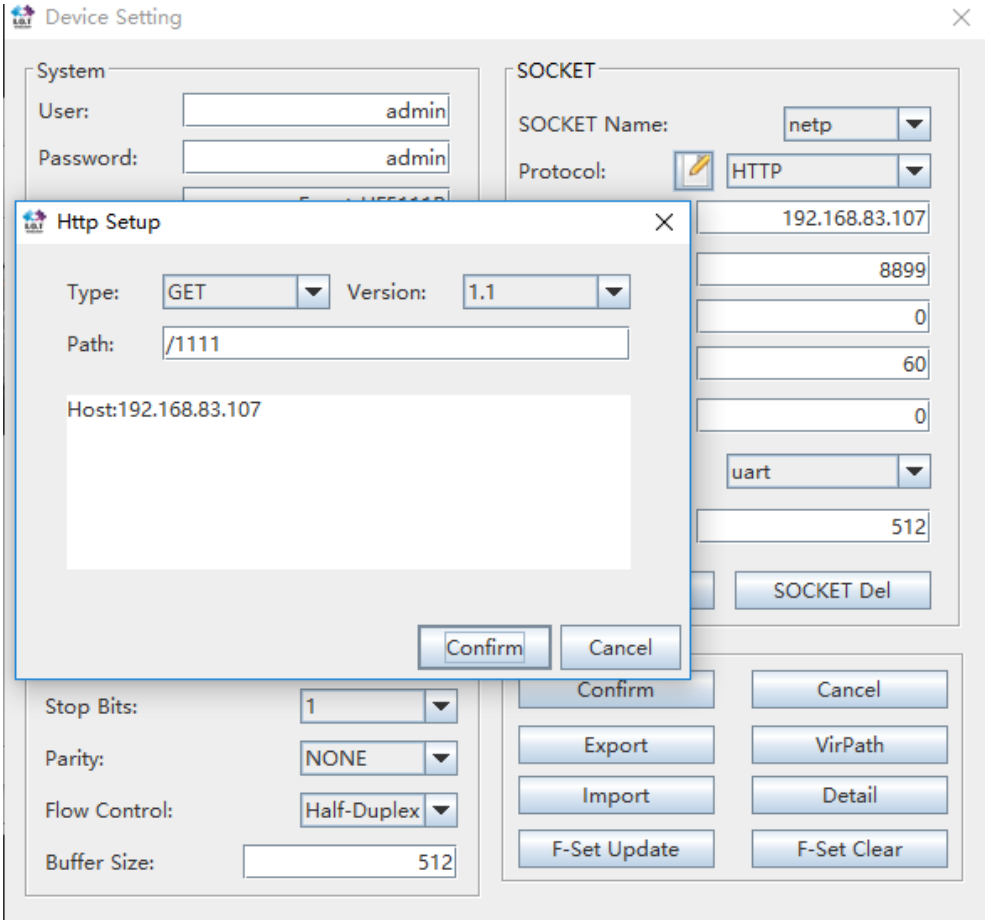


Figure 9. IOTService Configure

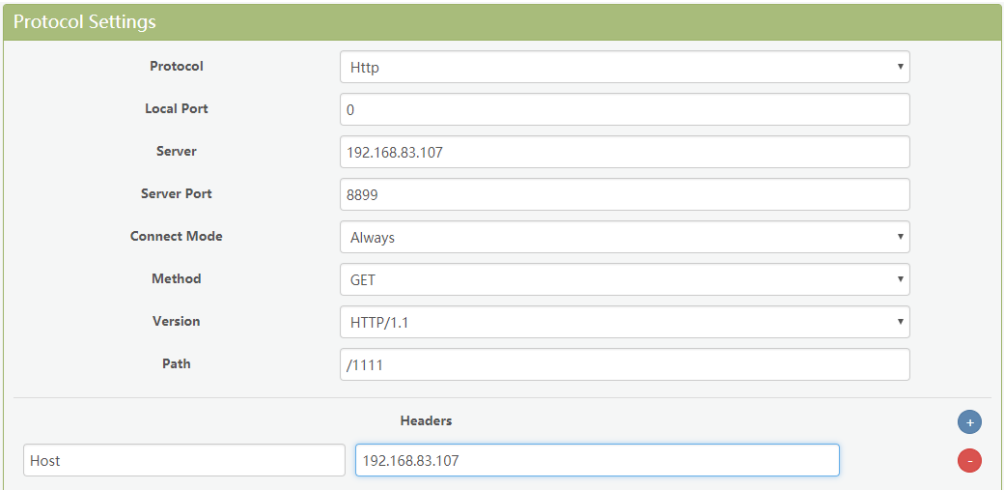


Figure 10. Webpage Configure

For GET request, the received UART packet AAA will put after the HTTP path (auto add “?” between path and parameters), for POST request, packet is put in the content (auto add Content-Length header information).

Product will send the below data to HTTP Server when UART receive “pppp” data for GET request.
GET /1111?pppp HTTP/1.1

Host: 192.168.83.107

Product will output “DDDDD” when get response from the HTTP server.

HTTP/1.1 200 OK

Server: nginx

Content-Length: 5

DDDDD

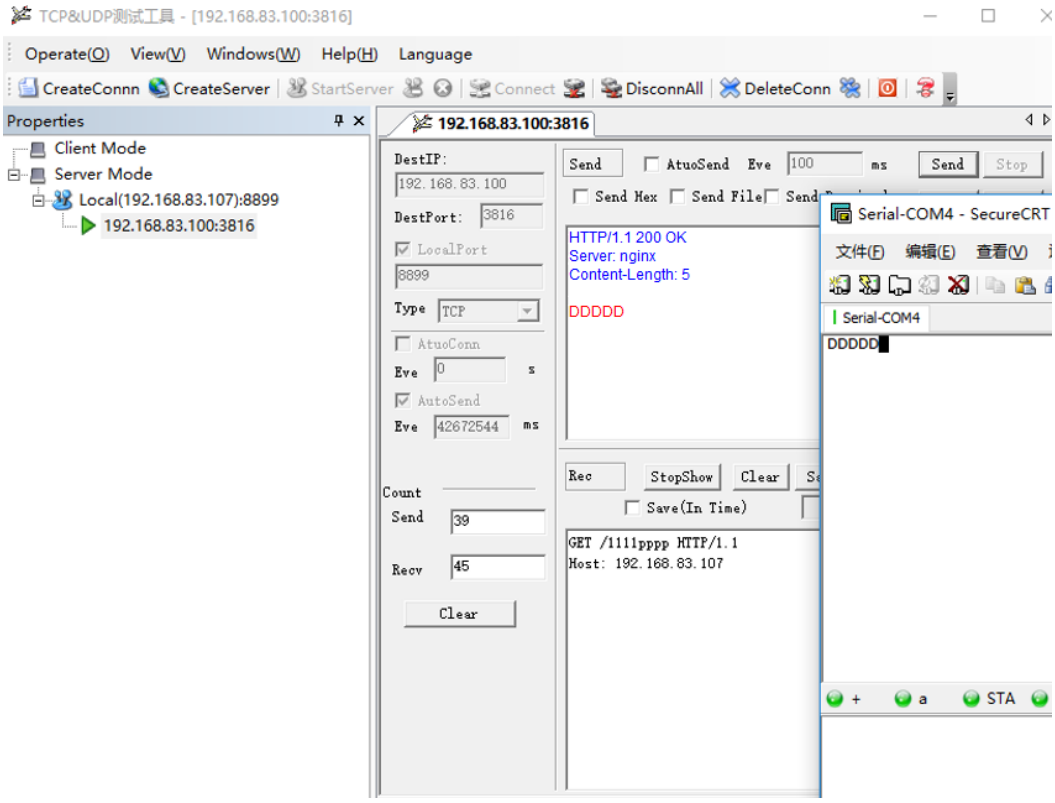


Figure 11. HTTP GET Request Example

Product will send the below data to HTTP Server when UART receive “pppp” data for POST request.

POST /1111 HTTP/1.1

Host: 192.168.83.107

Content-Length:4

pppp

Product will output “DDDD” when get response from the HTTP server.

HTTP/1.1 200 OK

Content-Length: 4

Connection: close

DDDD

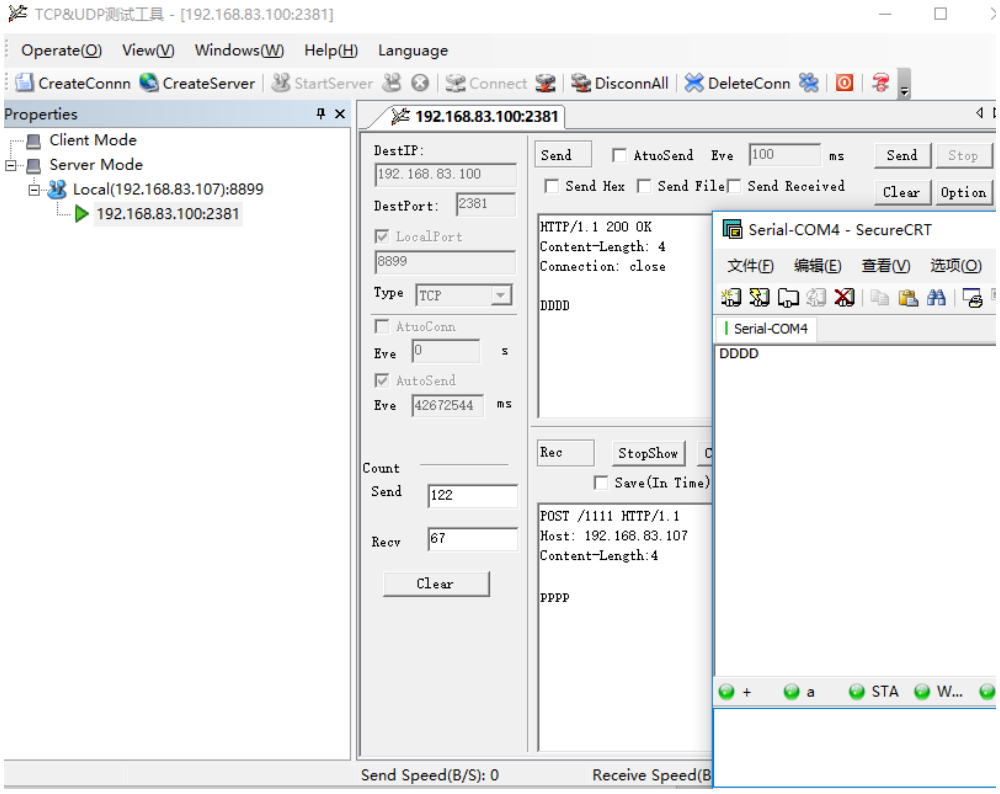


Figure 12. HTTP POST Request Example

1.4.5. Telnetd Mode

When device work in Telnetd mode, UART port can connect to user device console port(some gateway and switch device may have this console port to set parameters of its working mode). May use Products to config user device via Telnetd mode.

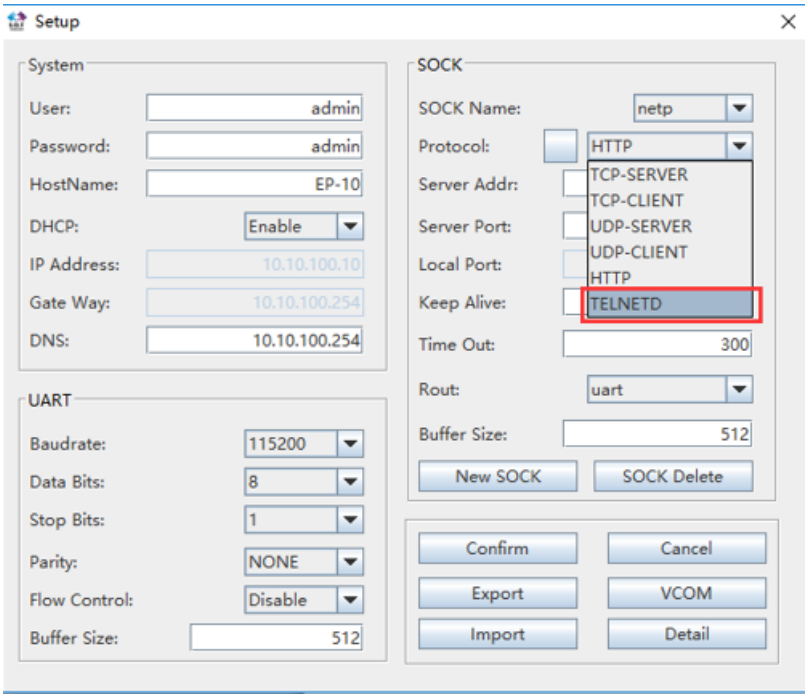


Figure 13. IOTService Software Configure Protocol

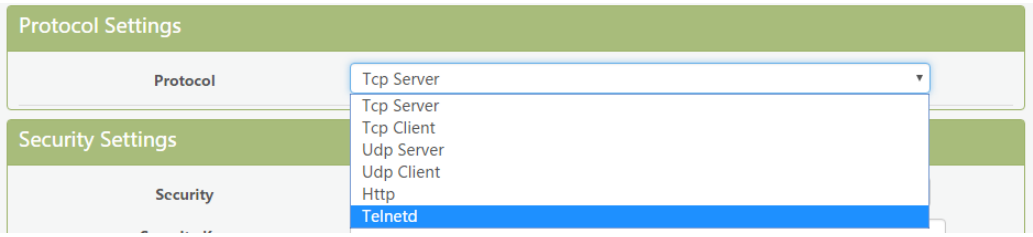


Figure 14. Web page configure protocol

Connect device UART to user device console port(The example use NC916) and create Telnet connection. Then It can directly configure user device.

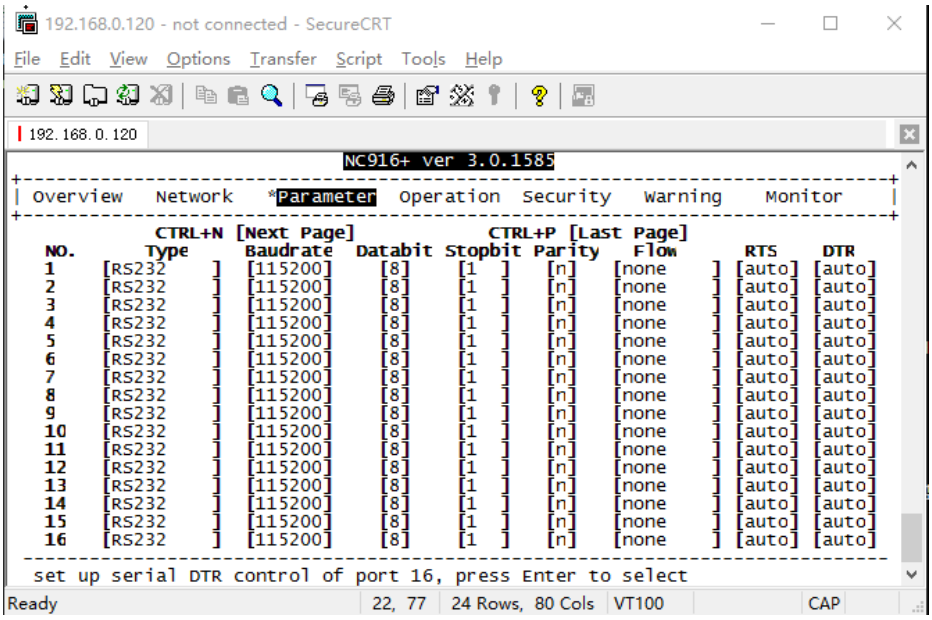


Figure 15. Telnet details example

1.4.6. WebSocket Mode

Device support WebSocket Client send data to WebSocket Server. (Use IOTService or Webpage to config). When in WebSocket Mode, device side will auto add WebSocket protocol header to server when receive UART data. And remove the protocol header and send the content to UART.

More WebSocket Case refer to following link.

http://www.hi-flying.com/download-center-1/application-notes-1/download-item-industry-products-application-manual-20180415

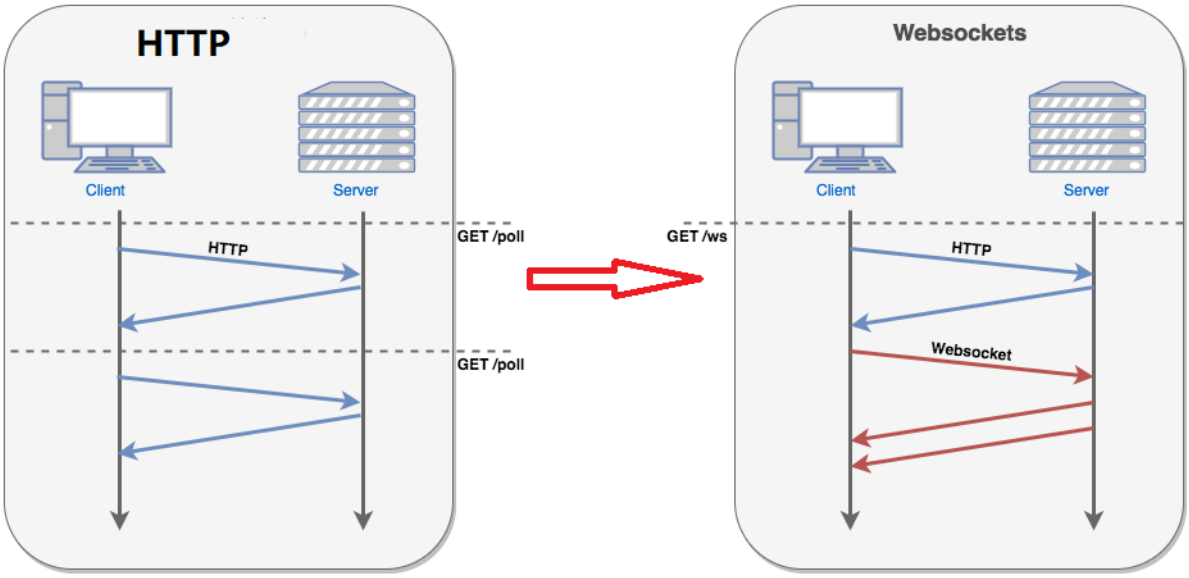


Figure 16. Websocket Basic Concept

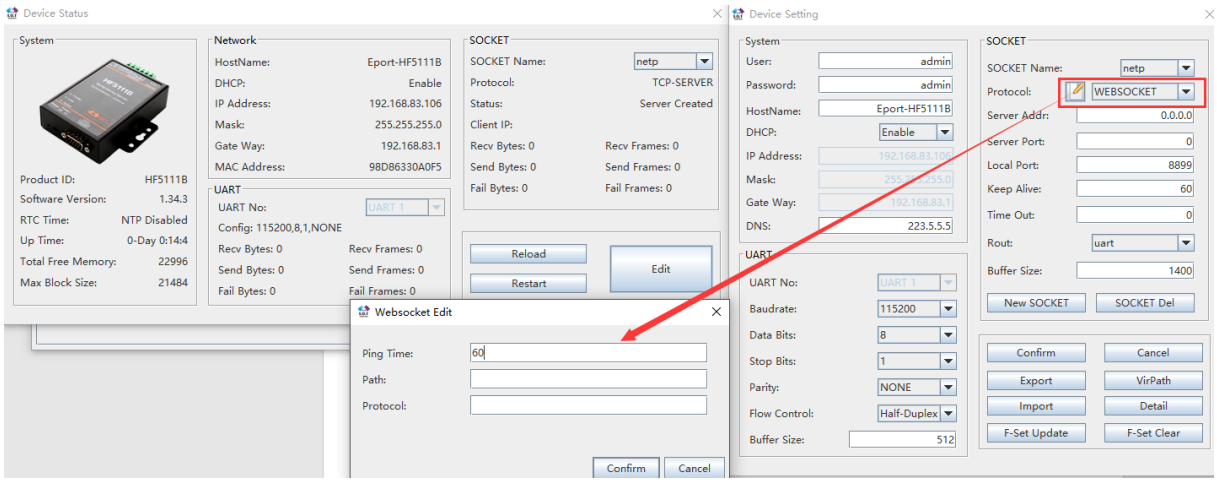


Figure 17. IOTService Tools Config

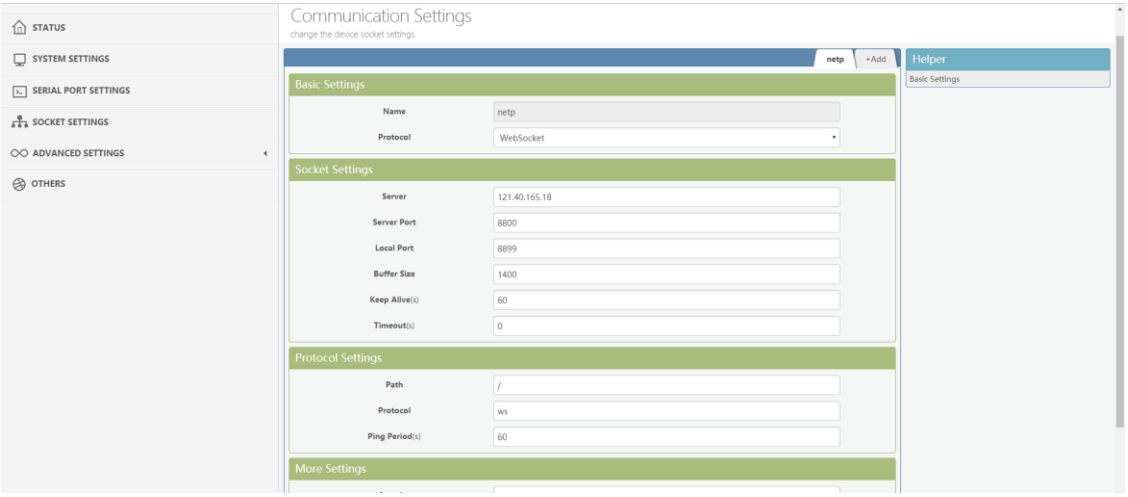


Figure 18. Webpage Config

1.4.7. MQTT Mode

Device support MQTT Client send data to MQTT Server. (Use IOTService or Webpage to config).

More MQTT Case refer to following link.

http://www.hi-flying.com/download-center-1/application-notes-1/download-item-industry-products-application-manual-20180415

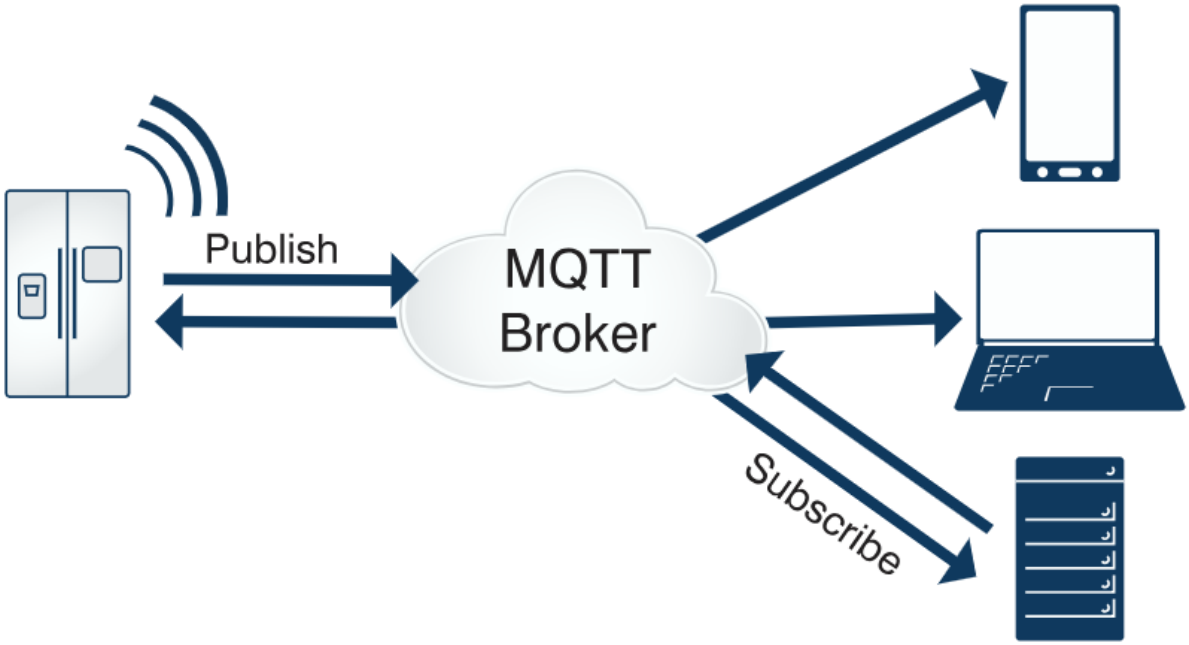


Figure 19. MQTT Concept

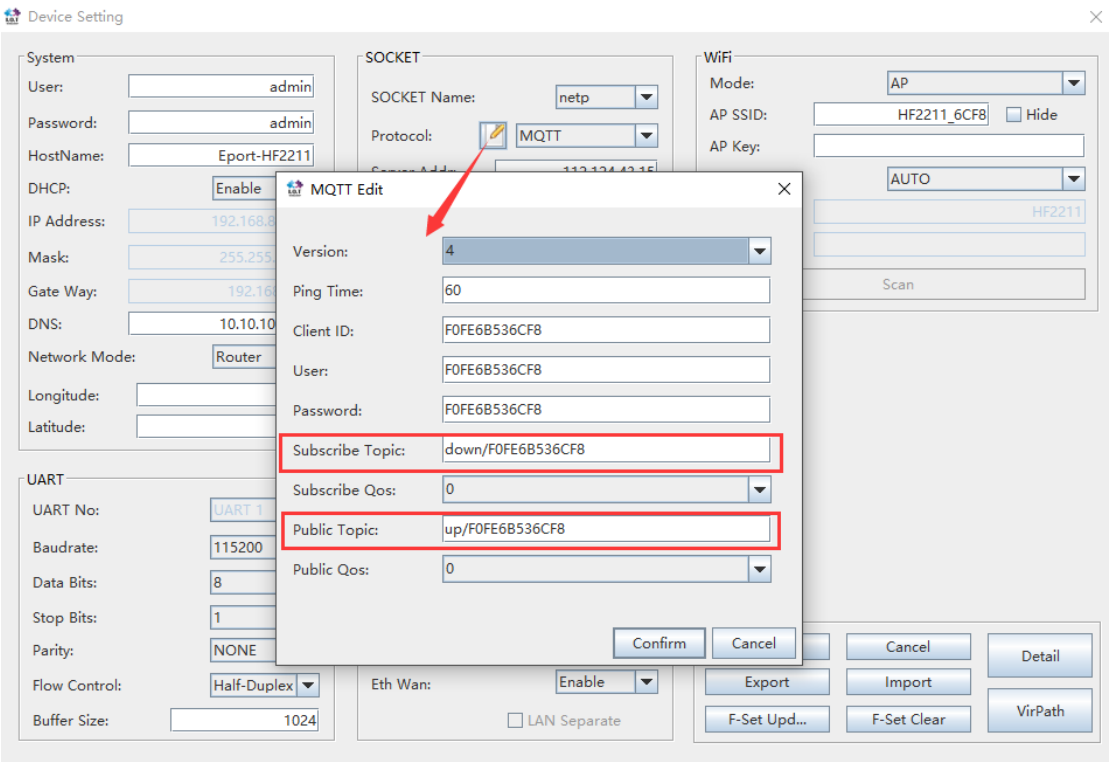


Figure 20. IOTService Tools Config

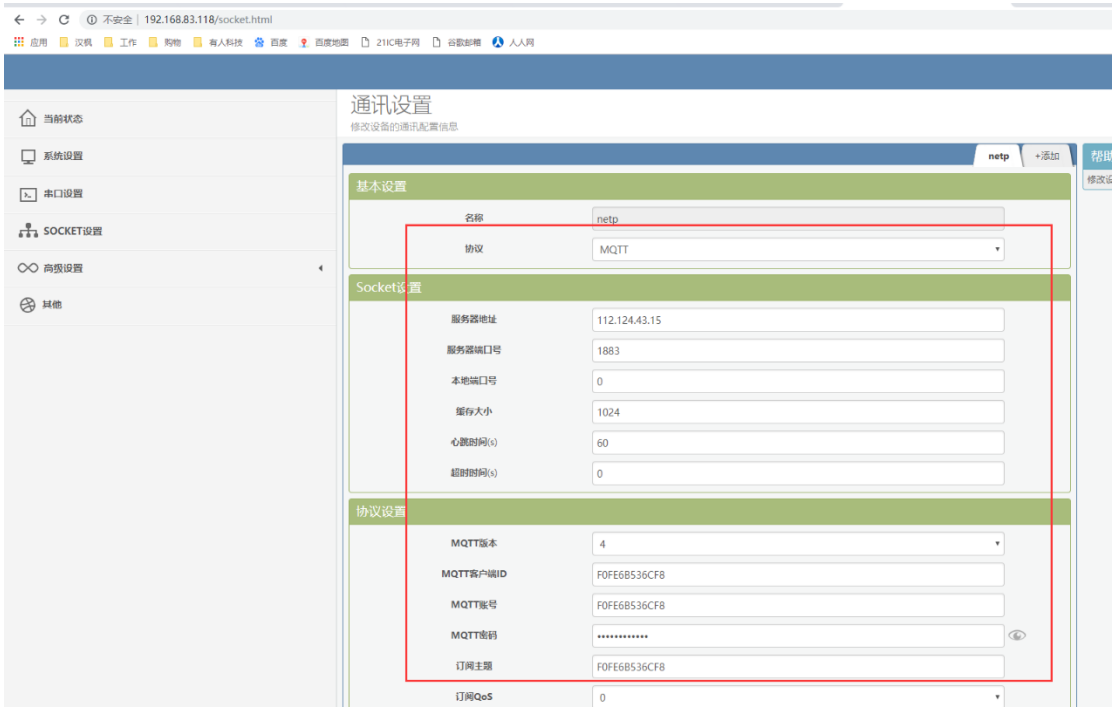


Figure 21. Webpage Config

1.5. AES/DES3 /TLS Data Encryption

To improve device security and ensure the data won't be cracked and illegal used. The Products device can do encryption to UART data before transmit to network.AES use CBC method and the key is 16 characters length. TLS use no certificate method. DES3 is 24 characters length.

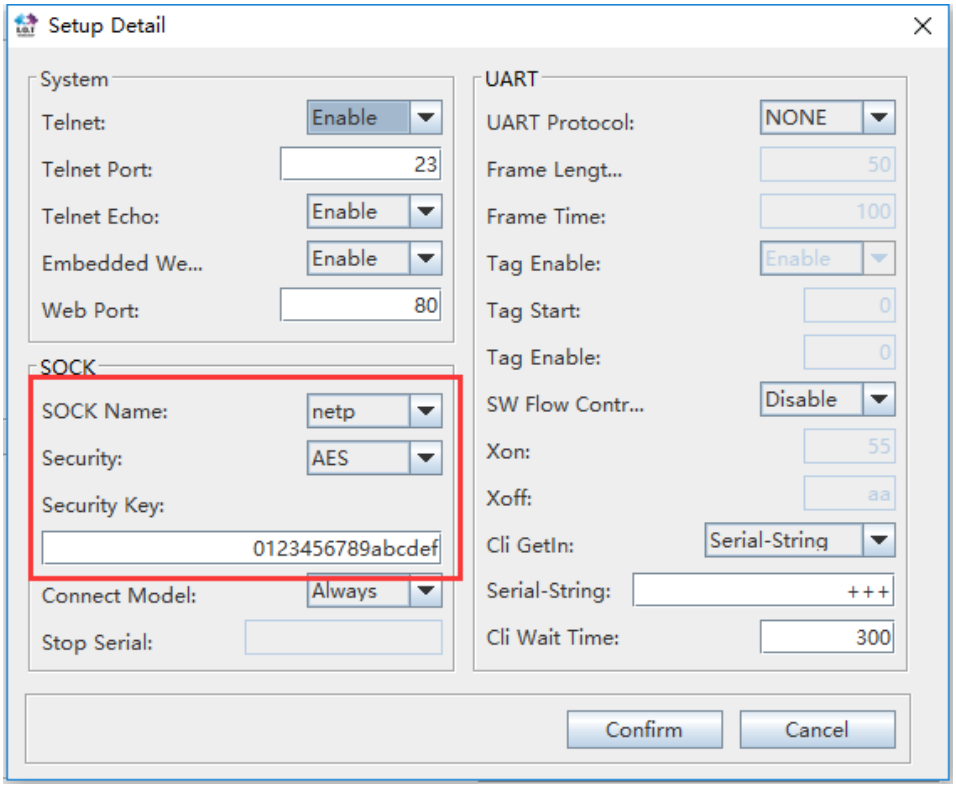


Figure 22. IOTService Software Configure Encryption

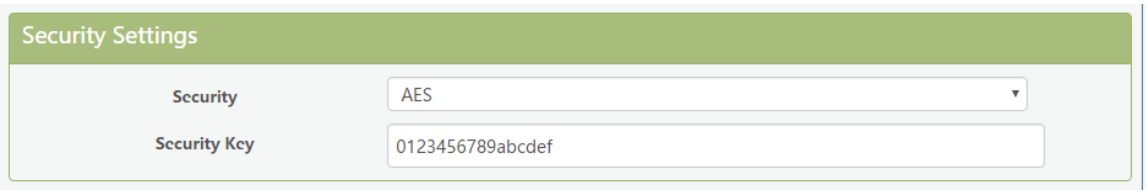


Figure 23. Webpage Configure Encryption

1.6. TCP Keepalive

When TCP connection between device and server became abnormal. The device will check the obnormal status and reconnect to server (When the device working in TCP Client Mode), When the device working in TCP Server, It will break the TCP client and wait for next connection.

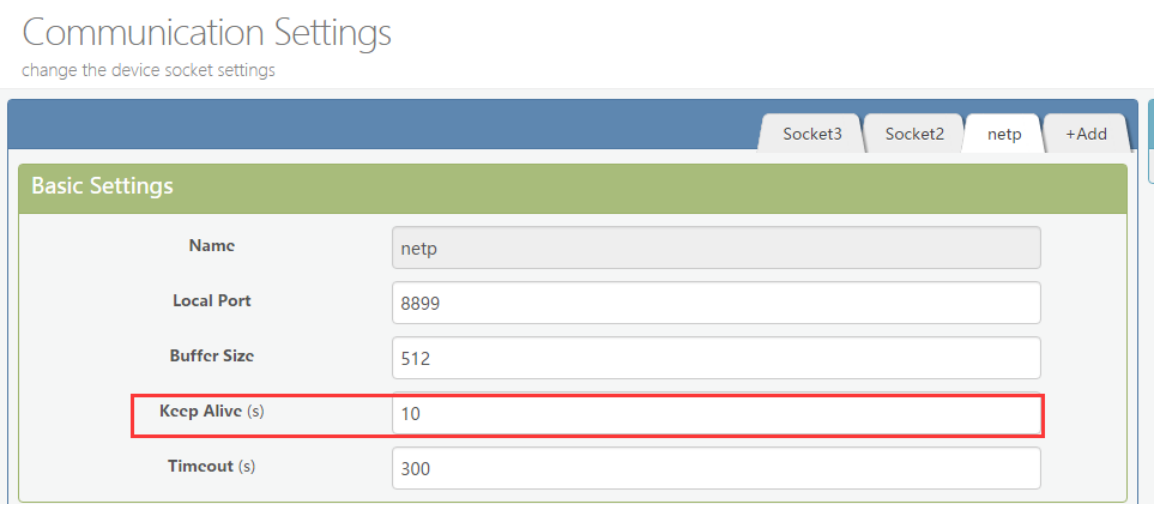


Figure 24. Webpage Config Keepalive

1.7. Timeout

The device will break the TCP connection after some time (default is 300 seconds and it can be modified to other value) if there is no data packet received from TCP target. It will reconnect to server (When device works in TCP Client mode). When device working in TCP Server, it will disconnect with TCP Client. This mechanism can effectively restore TCP abnormal connection. If set it to "0", this function will be disabled.

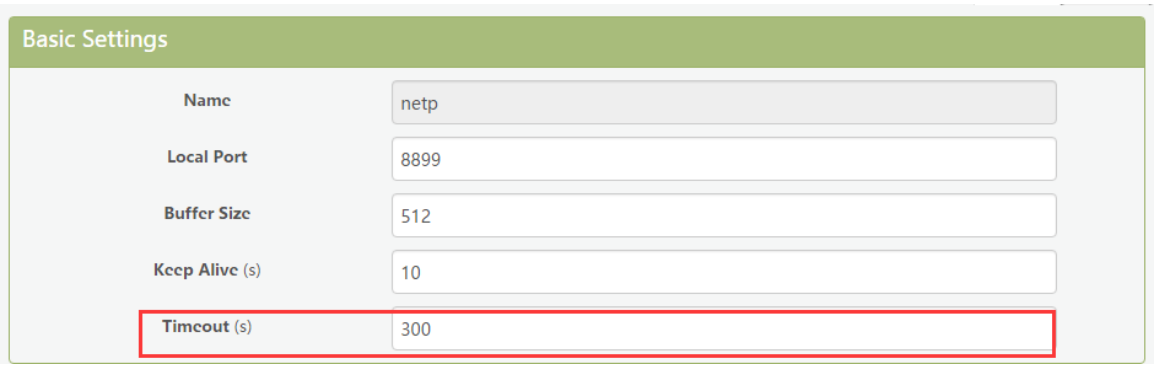


Figure 25. Webpage Configure Timeout

1.8. Route Setup

The data received from Socket channel can be set to another socket channel. (Default: socket DES3tination channel is UART. It also can be other Socket channel, or take the Socket as log print usage)

The below example shows the default netp Socket channel route setting to Socket1, Socket1 configure as TCP Server mode and route setting to UART. After these setting the netp Socket channel received UART data will output to Socket1, and Socket1 channel will output to serial output.

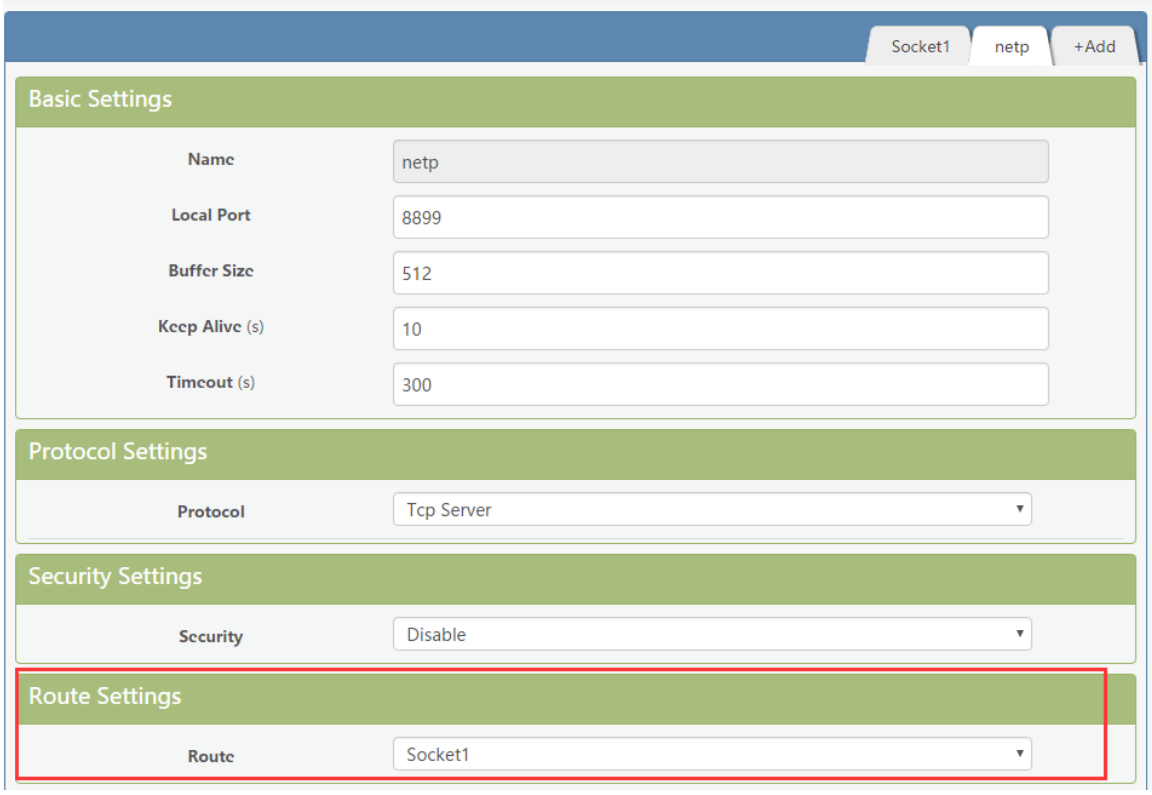


Figure 26. Route function setup example

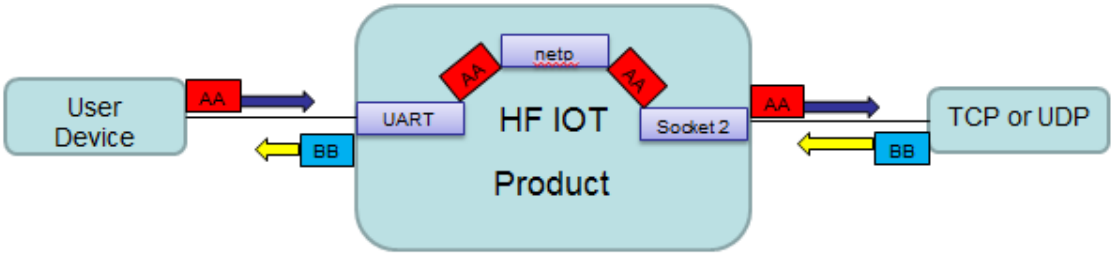


Figure 27. Route Function Data Flow Example

1.9. UART Frame Scheme

1.9.1. UART Free-Frame

Product support UART Free-Frame function, it will check the intervals between any two bytes when receiving UART data, If the interval time exceed the setting value, It will think it as the end of one frame, or it will receive data utill greater than internal buffer bytes(Default: 512, the largest 1400 bytes), then transfer to Socket Channel.

Module default UART Free-Frame interval time is 50ms, it will package into another frame if received UART data interval time is greater than 50ms. User also can set this interval time to minimum 10ms through Cli command and webpage.

If interval time is set to 10ms and customer MCU cann't send next byte within 10ms, the serial data will be break into two frame.

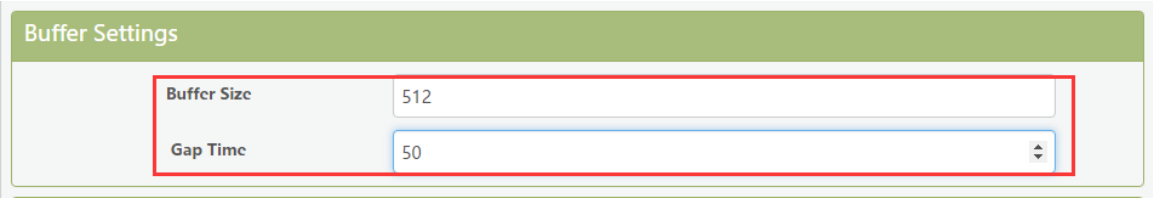


Figure 28. UART free-frame function

1.9.2. UART Auto-Frame

Products support UART Auto-Frame function, If user select to open this function,setting frame tigger length and auto frame trigger time parameters, Then the product will auto framing the data which received from UART port and transmitting to the network as pre-defined data structure.

Auto-Frame trigger length: The fixed data length that product used to transmitting to the network.

Auto-Frame trigger time: After the trigger time, If UART port received data cann't reach auto-frame trigger length, Then product will transmitting available data to network and bypass the auto-frame trigger length condition.

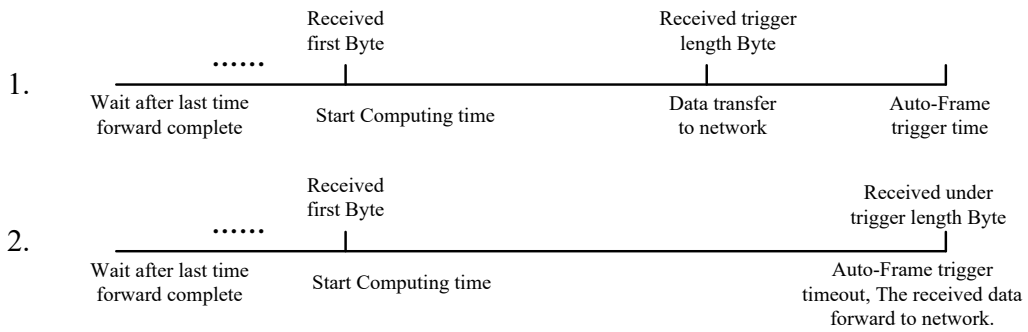


Figure 29. UART Auto-Frame Function

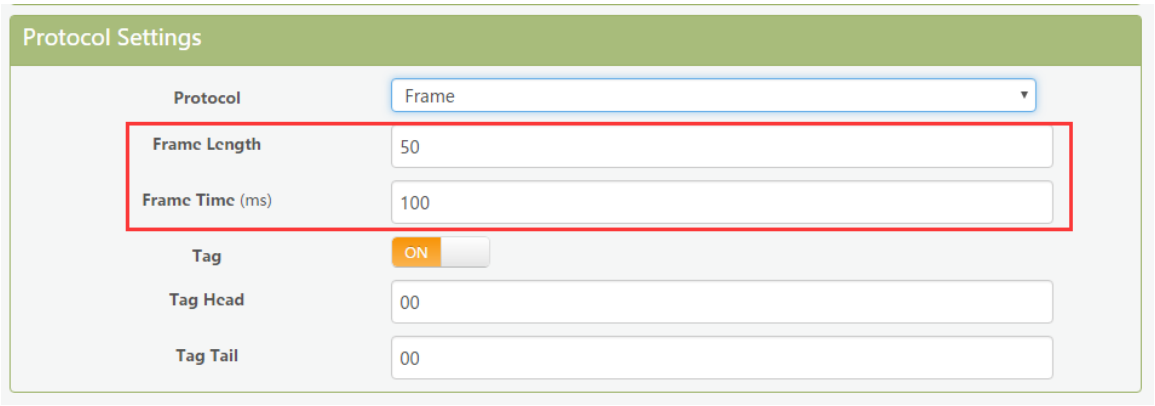


Figure 30. UART Auto-Frame Function

1.9.3. Tag Function

Eport E10 support lable function, if user select to open this function, The UART port will send all suitable one frame data to network.

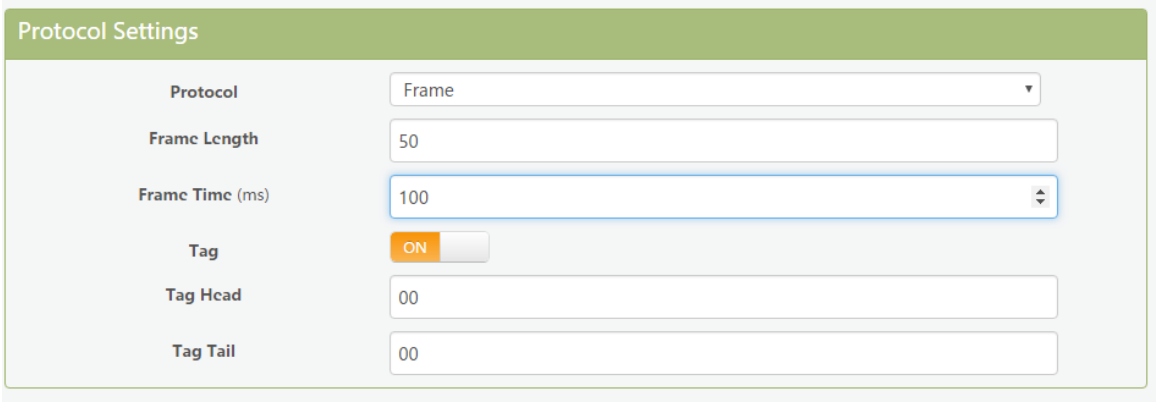


Figure 31. UART Auto-Frame Tag Function

1.10. Modbus Protocol

Products support ModbusRTU to ModbusTCP and ModbusTCP to ModbusRTU. It's very convenient to connect with Modbus device. Modbus protocol setting as below:

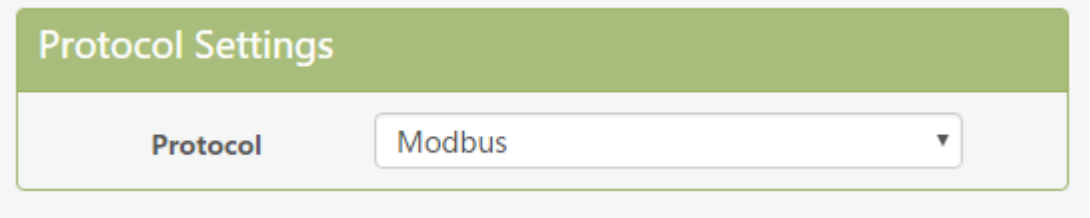


Figure 32. UART Modbus Function

1.11. Cli Command

Cli command is used for setting module configure parameters. Detailed command function and setting is in next chapter, Cli command can be set through UART port or Telnet function (Appendix C), The waiting time of below picture means use timeout time. If it exceeds default 300s when no Cli command is input, it will exit Cli command mode. When the Products receive continuous UART data of "+++", it will enter in Cli command. (The device working in transparent transmission mode by default) May also set the device working in Cli command mode by default or disable this function.

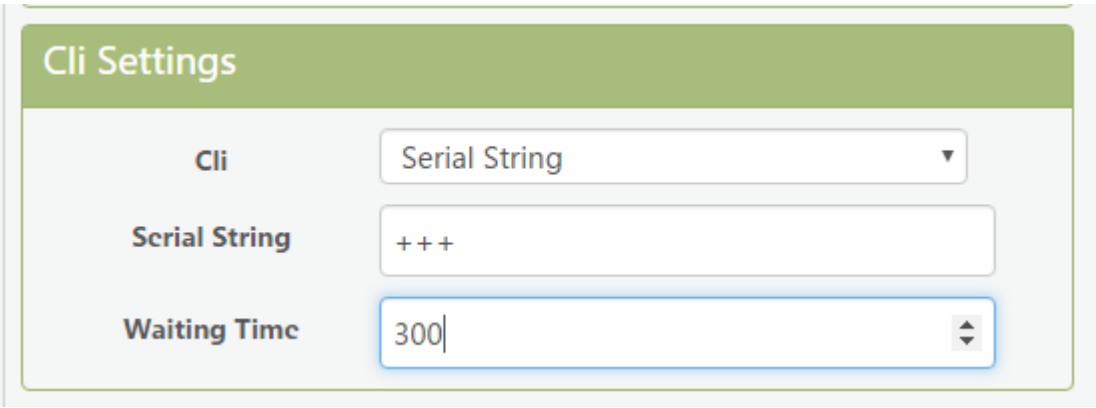


Figure 33. Cli Command Setting

1.12. UART Flow Control

Products support software and hardware UART flow control. If use hardware follow control, CTS/RTS Pins are used to control UART data. If use software follow control, then It allowed the device output UART data after receive single UART 0x11 data (Default: value can be modified). It will stop output UART data after receive single UART 0x13 data (Default: value can be modified).

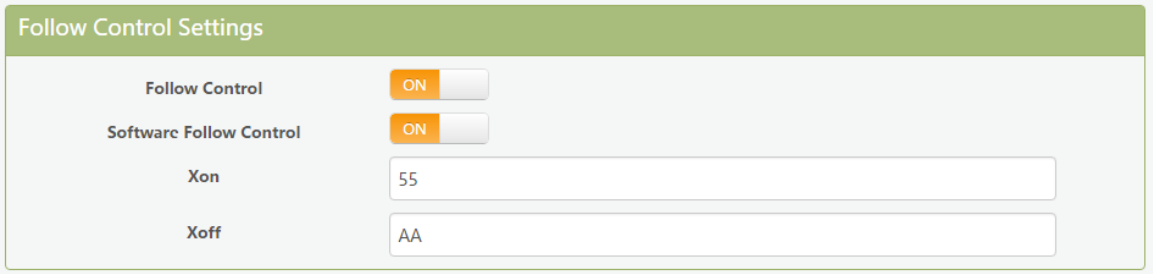


Figure 34. UART Flow Control

If set Flow Control to Half Duplex, it means enable the RS485 function. This is the default value. RS232 can also use this half duplex mode, just the data rate will be slowed down.

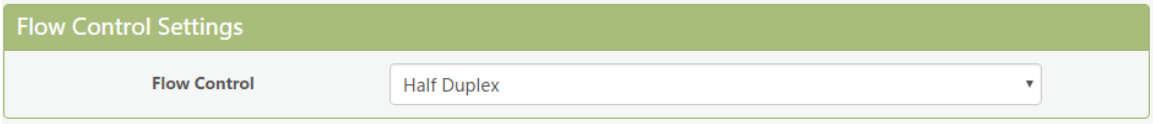


Figure 35. RS485 Function

1.13. Firmware Upgrade

Products support OTA (over the air) firmware upgrade. User can use webpage to upgrade its firmware, whether external or internal webpage (IP/hide such as 10.10.100.254/hide. Internal webpage can be also used for upgrade external webpage). Please check below example. IP address is assigned by router.

Figure 36. External Webpage

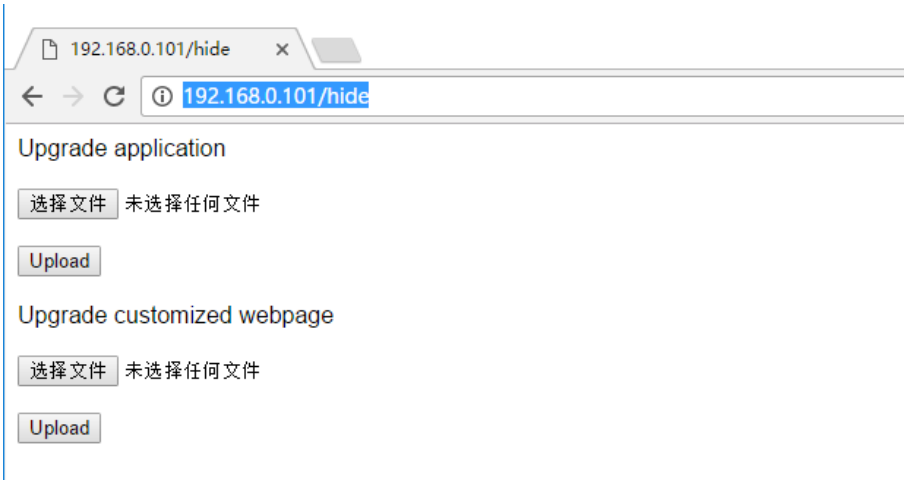


Figure 37. Internal Webpage

1.14. Webpage Function

Webpage function itself can be enabled or disabled.

Figure 38. Web Page Function Setting

1.15. Auto-IP Function

Auto-IP is used for local area when there is no DHCP server exist, devices will use the Class B 169.254 for communication. Connect device Ethernet with PC, the device will use default auto IP(Elfin series use 169.254.1.1, others use 169.254.173.207). The PC may use this IP to config the device or transfer data. As the following example.

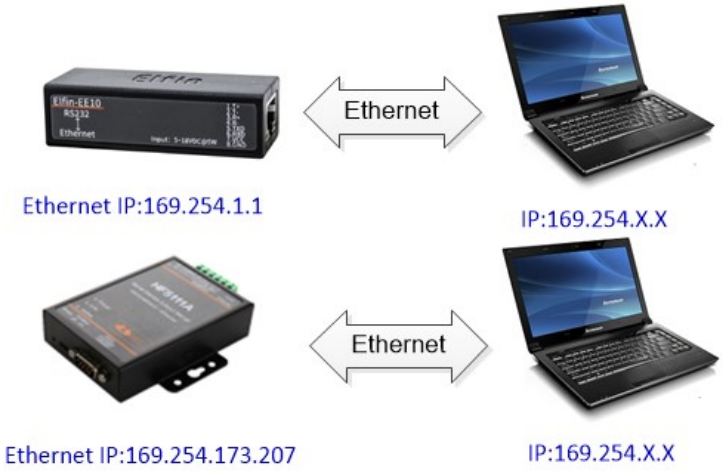


Figure 39. AUTO-IP Connection

The following use 169.254.173.207 to login HF5111B device webpage for config.

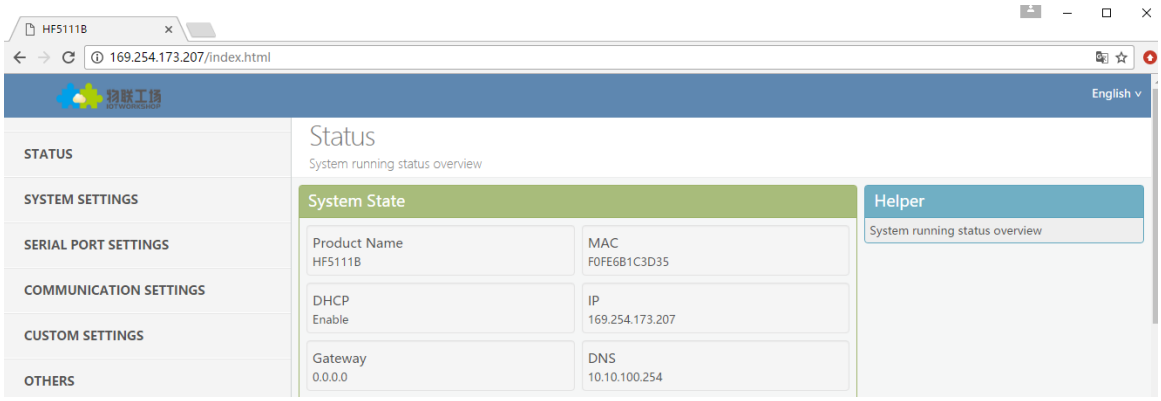


Figure 40. AUTO-IP Config Device

```
EPORT>Show

===System State===
Product ID:HF5111B
Software Version:V1.07c
Config Protected:OFF
System time:NTP Disabled
Up Time: 0-Day 0:1:36
Total Free Memory: 40320
MAX Block Size:38568

===NETWORK===
MAC:F0FE6B1C3D35
Ip Address:169.254.173.207
Gateway:0.0.0.0
```

Figure 41. Cli Command Query Device IP

1.16. NTP Function

NTP function is by default disabled. It can be enabled when set NTP server, port, timezone. More NTP function application can be seen for UART Fast Config document. (cn.ntp.org.cn is a public NTP server).

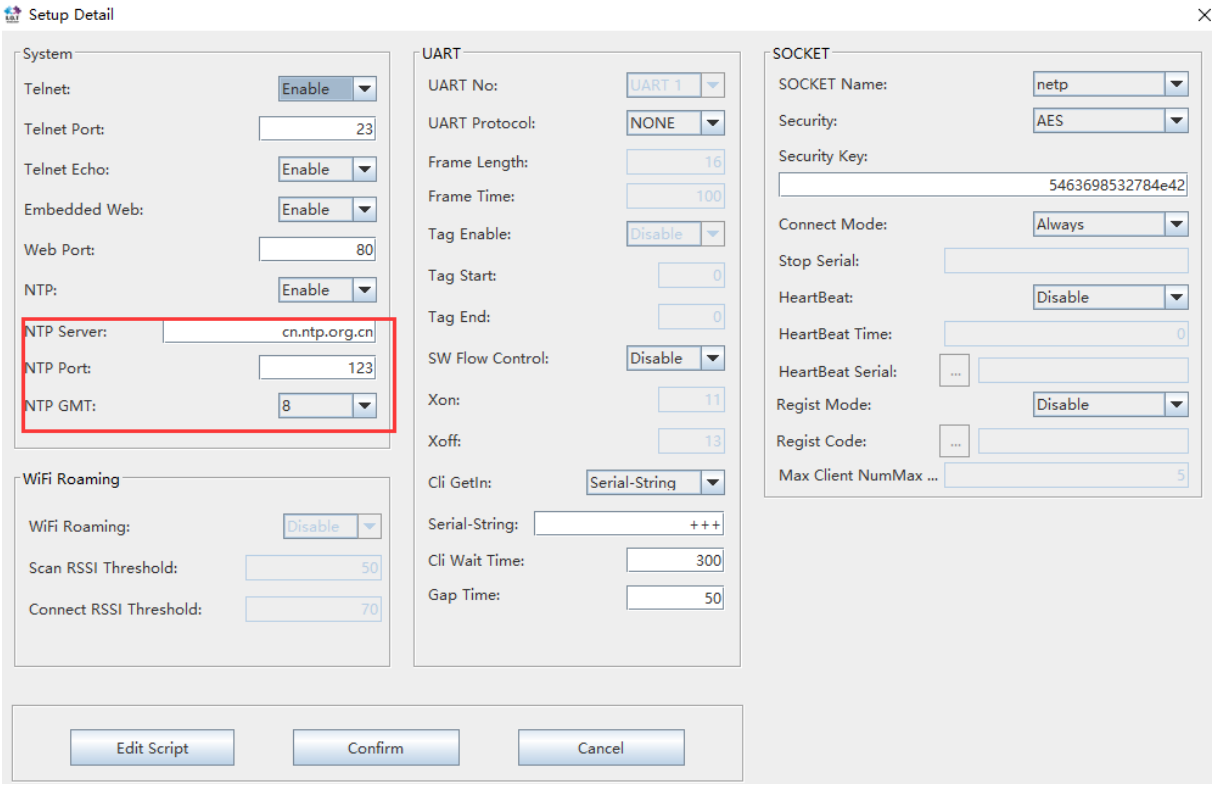


Figure 42. NTP Setting.

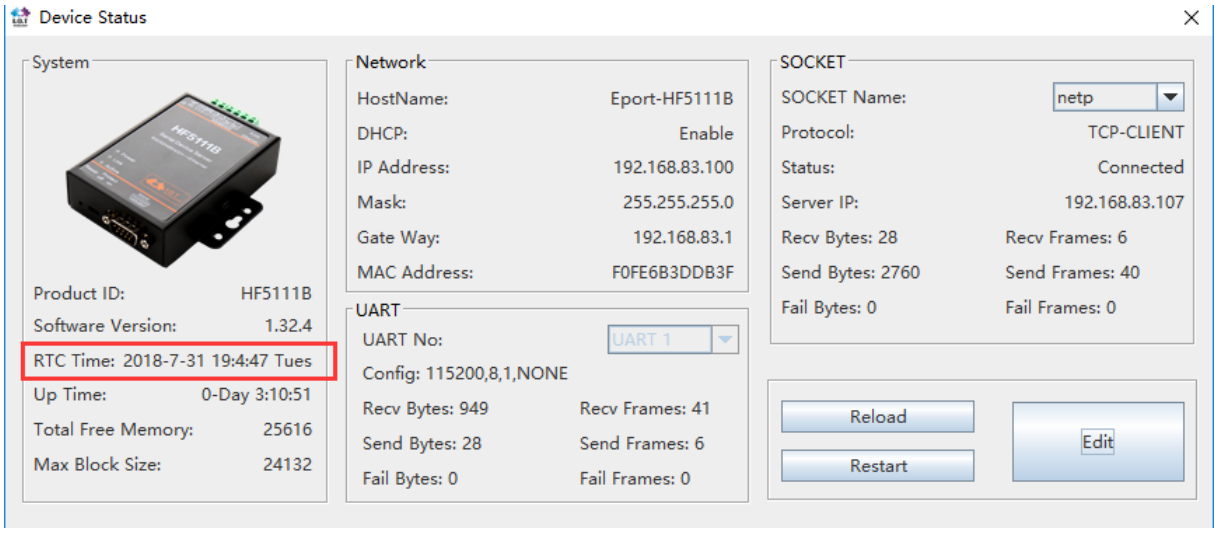


Figure 43. RTC Time

1.17. Register Function

Register function can be enabled in TCP Client transparent transmission mode. The device will add head data when connection is established or for each packet received from UART. Register packet support wildcard(%) character for special data such as MAC, VER. See detailed in IOTService tools.

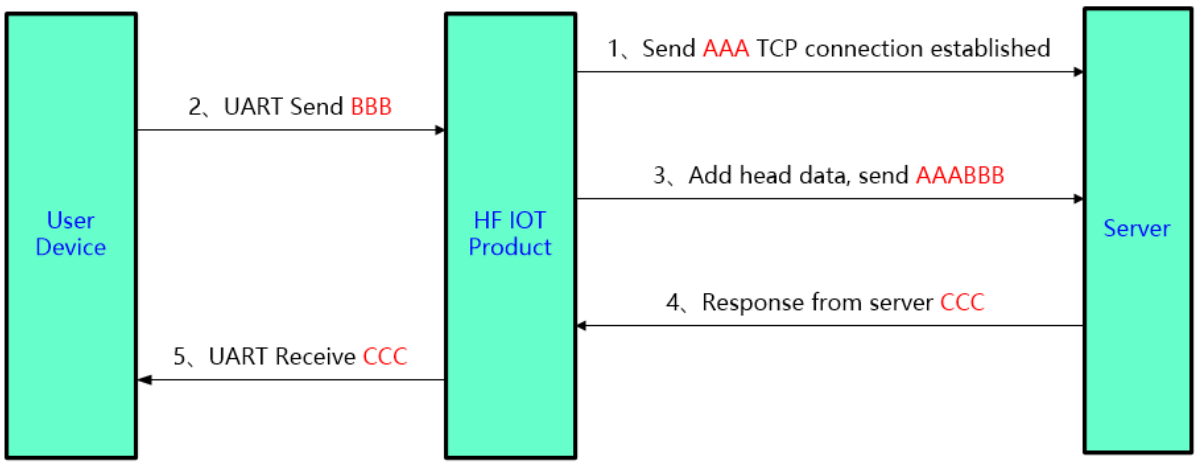


Figure 44. Register Function

Register function support link(means connection established send head) , data(means add header for each received UART data) or both(link and data all enabled). For the wildcard example such as %MAC, the header is the real device MAC address in ASCII format. Another example is %VER, it means the software version in HEX format.

- %MAC: MAC, ASCII format, Ex: ACCF23208888
- %HMAC: MAC, HEXformat, Ex: F0 FE 6B 88 90 90
- %GPS: location information upload, ASCII format, Ex: 21.623046,31.221429。
- %VER: Software version, 3 bytes, HEX format, Ex: 01 00 03 (stands for 1.0.03)
- %DATE: year, month, day time, YYYYMMDD, ASCII format, Ex: 20190211
- %TIME: Hour, minute, and second time. HHMMSS, range : 000000~235959，ASCII format, Ex: 165036
- %HOST: Hostname, set by AT+HOST, ASCII format, Ex: Eport-HF2411

Register example is as following. Set it to both and the content set with the user defined data of HF5111B with the wildcard MAC and VER

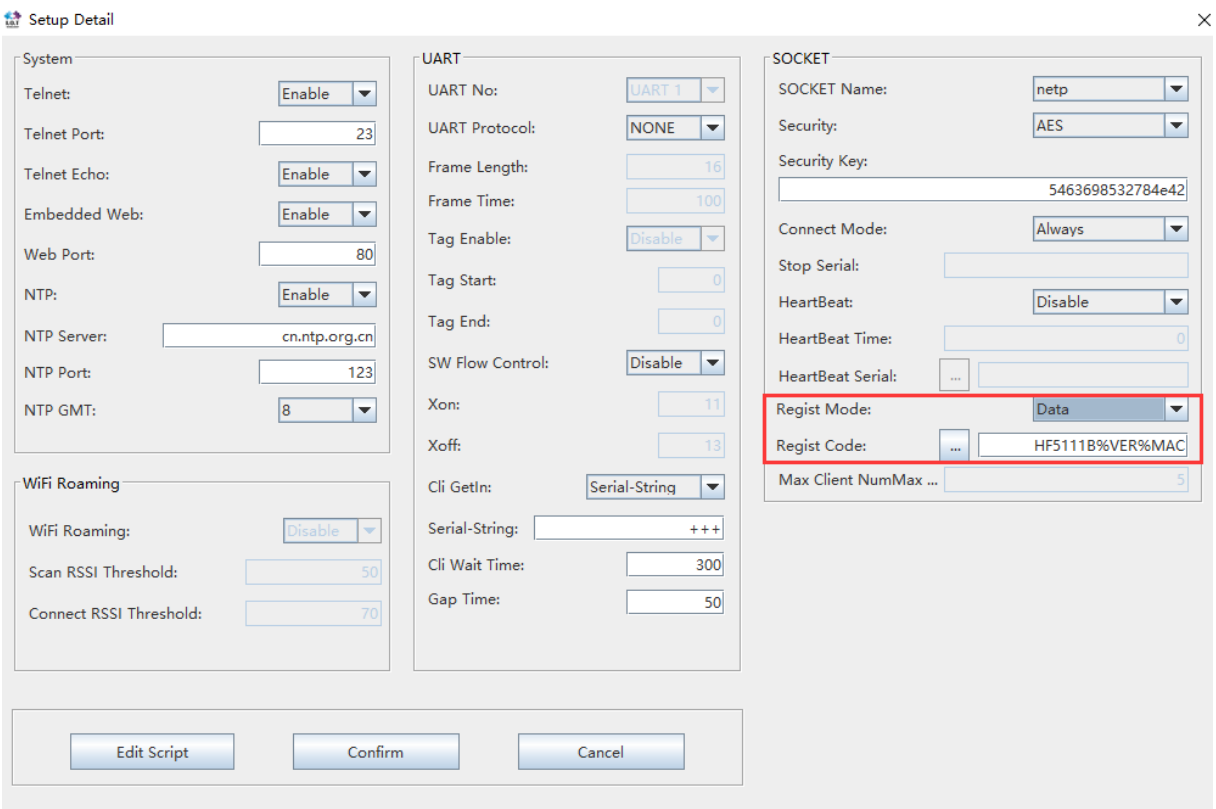


Figure 45. Register Function Example

Product UART receive a single byte “P”, it will send to server the following data in hex format：48 46 35 31 31 31 42 【HF5111B】 01 20 04【software version 1.32.4】 46 30 46 45 36 42 33 44 44 42 33 46【MAC address F0FE6B3DDB3F】 50【P】.

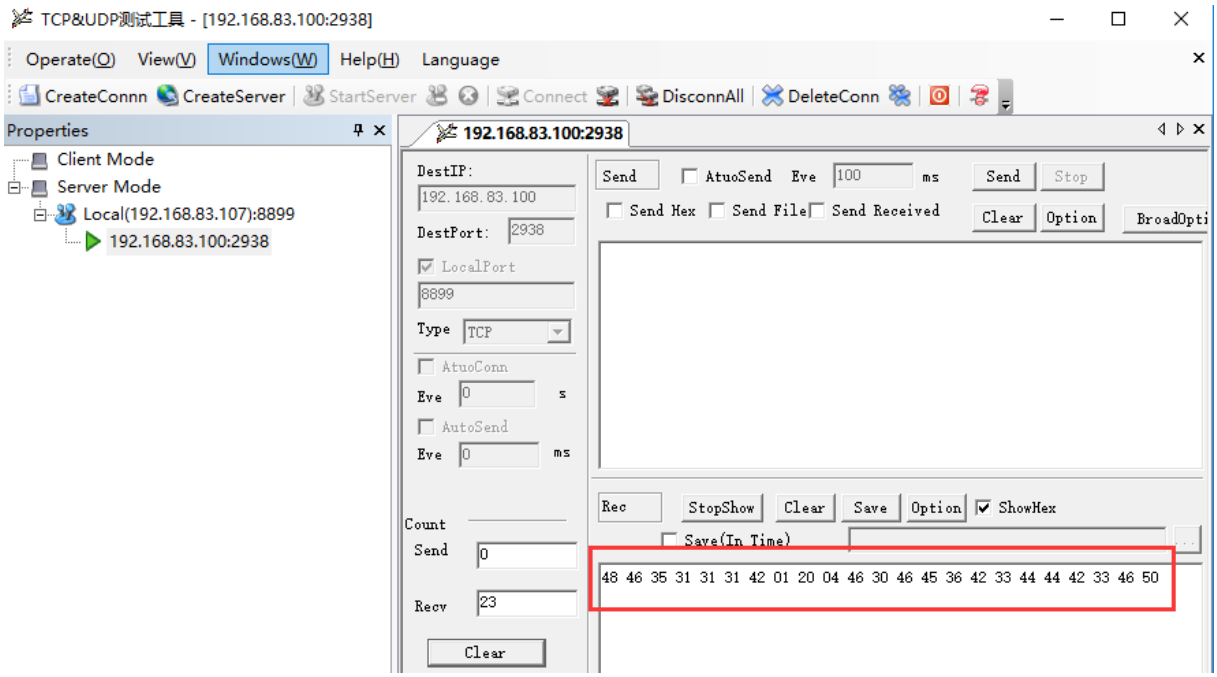


Figure 46. Server Received Data

1.18. Heartbeat Function

Heartbeat function can be enabled in TCP Client mode. Product will send heartbeat data for heartbeat time. It is very useful for server side to judge that the client is still alive.

Heartbeat data also support wildcard just like the register function.

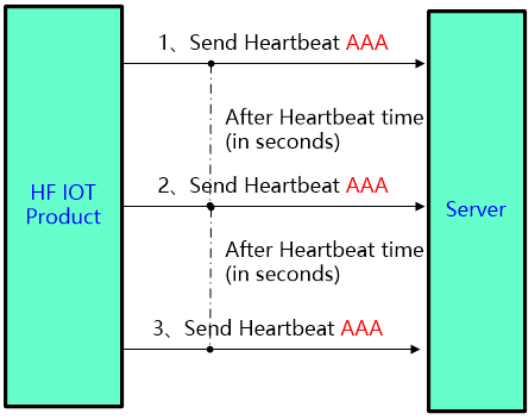


Figure 47. Heartbeat Function

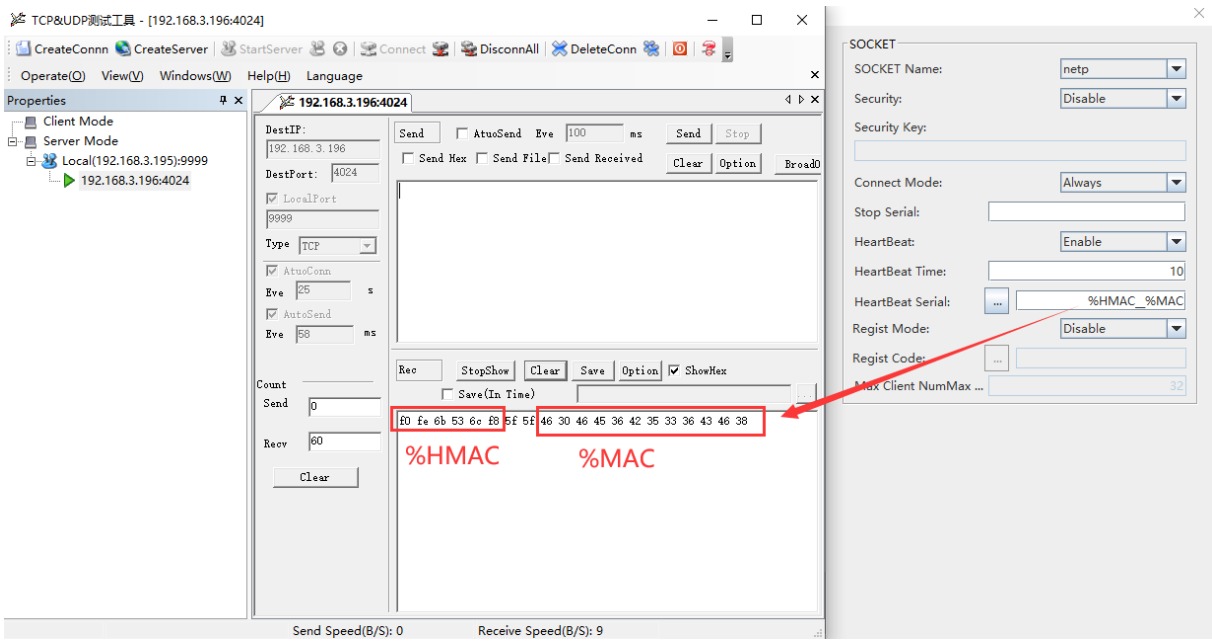


Figure 48. Heartbeat Function Setting

1.19. UART Fast Config

Products support not only UART CLI command for setting, but also special HEX format UART data to change part common parameters. See UART Fast Config document for detail.

http://www.hi-flying.com/download-center-1/application-notes-1/download-item-industry-products-application-manual-20180415

1.20. IOTService

IOTService tools is not only for local product management and config, but also used for remote management, firmware upgrade, virtual path, virtual com and D2D(device to device) communication via IOTBridge cloud we provide. See detail in IOTService tools document.

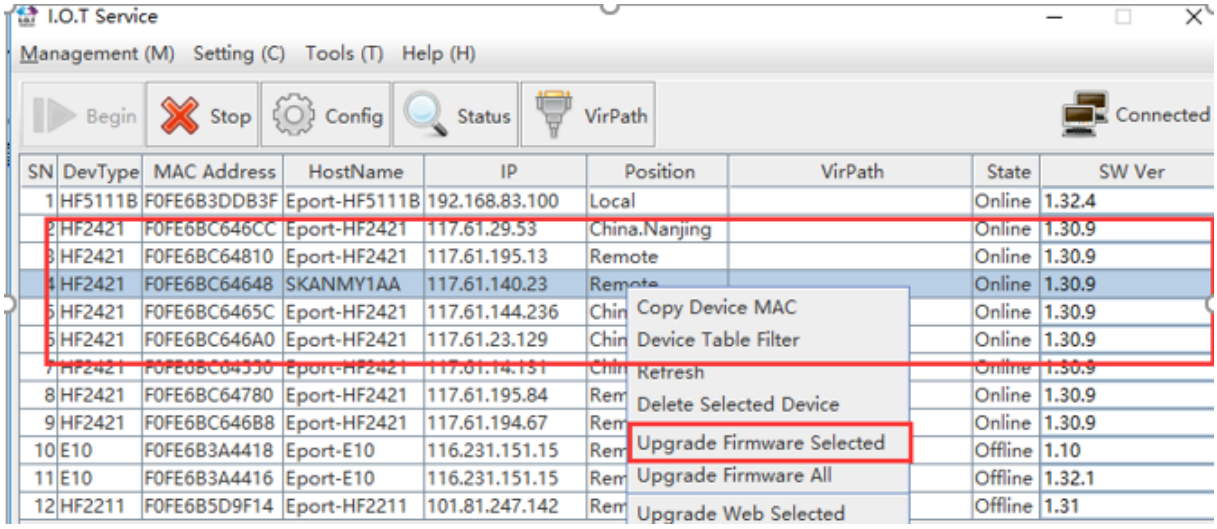


Figure 49. IOTService

1.21. Virtual Path

Virtual Path is used for virtual socket, virtual com, D2D communication either locally and remotely via IOTBridge cloud. See more in IOTService document.

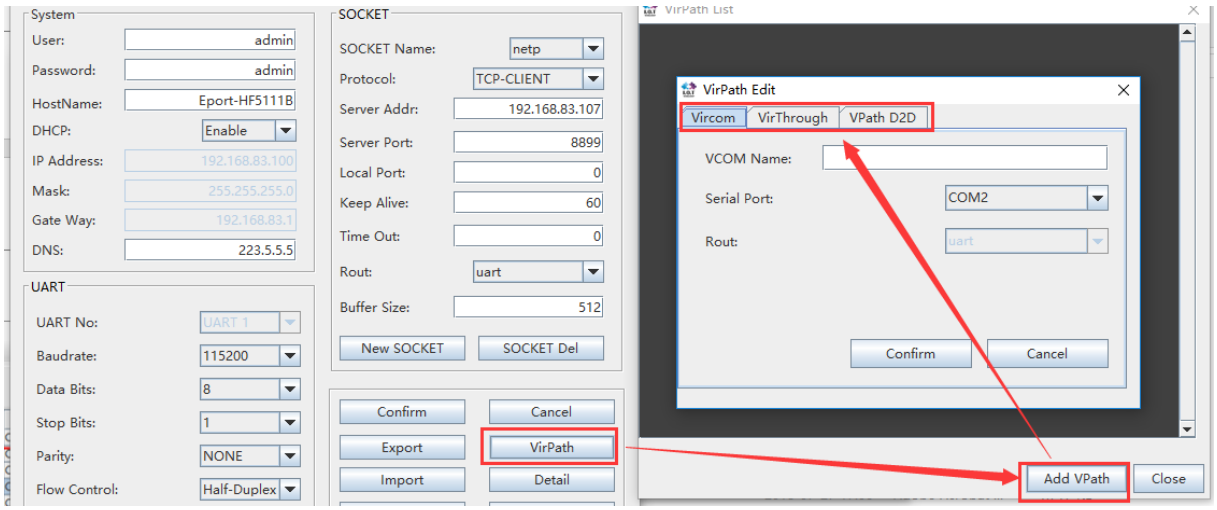


Figure 50. IOTService Virtual Path

1.22. Config Save

The product parameters can be exported and imported into other product. And the setting parameters can be saved as factory setting. Prevent the accident operation of restore to factory causing parameter lost

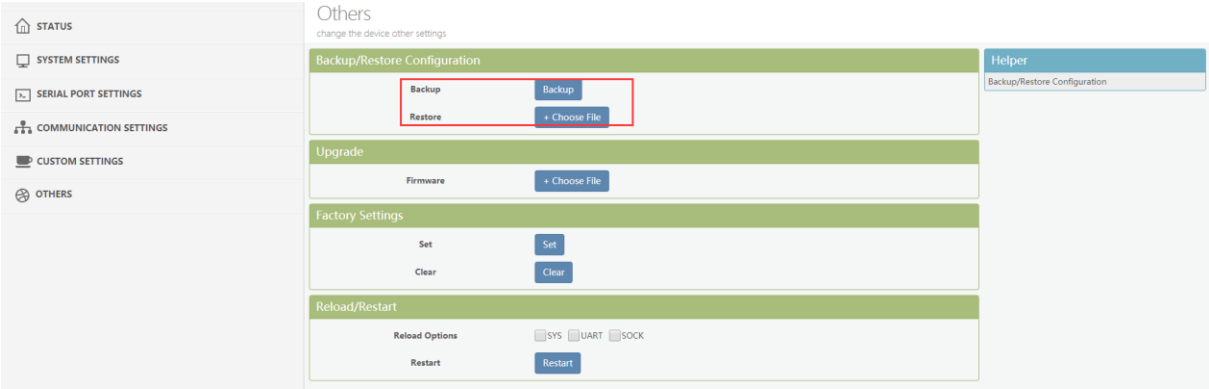


Figure 51. Import and Export Parameter

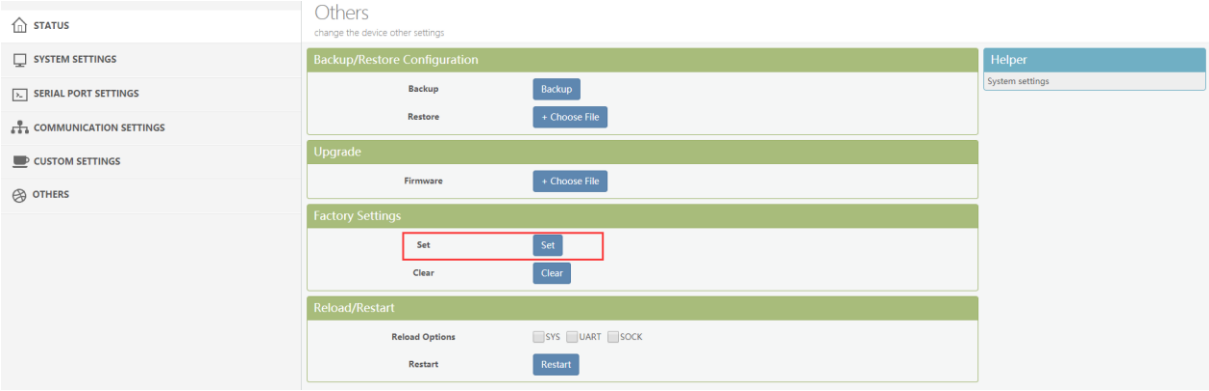


Figure 52. Save Current for Factory Default Parameter

1.23. HIS Script Funciton(Only 4G Product Support)

Hi-flying I.O.T script(HF IOT Script, short fot HIS). It is used for data transfer of IOT industrial device. When download the script in to the industrial device, the following functions can be achieved.

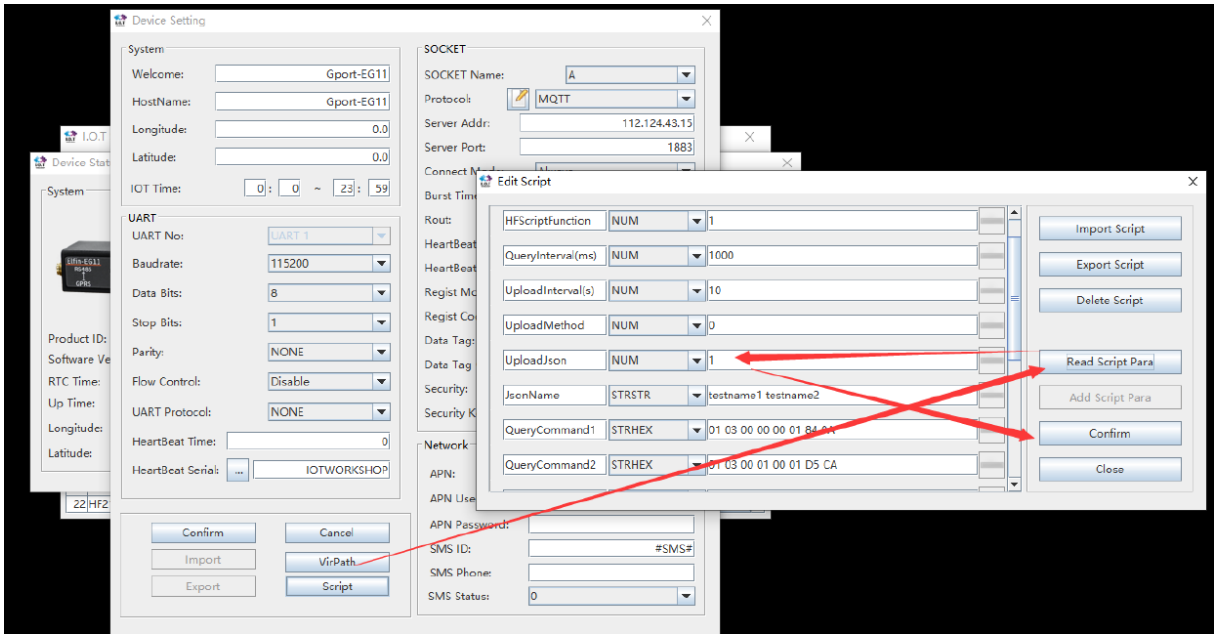
- Automatically send data to UART or Socket at regular time, which can be recognized as Modbus primary station.
- After receive data from UART or Socket, data will transferred based on script.

See following link for more about HIS Script.

http://www.hi-flying.com/download-center-1/application-notes-1/download-item-his-script

1.24. Modbus Master Function

Modbus Master is for query modbus slave, send the response packet to server.



See detail in following link

http://www.hi-flying.com/download-center-1/application-notes-1/download-item-industry-products-application-manual

2. CLI COMMAND NOTES

2.1. Working Mode

The device will enter default transparent transmission mode after powered on. User can switch to Cli command mode through special UART data. Module default UART parameters are as below:

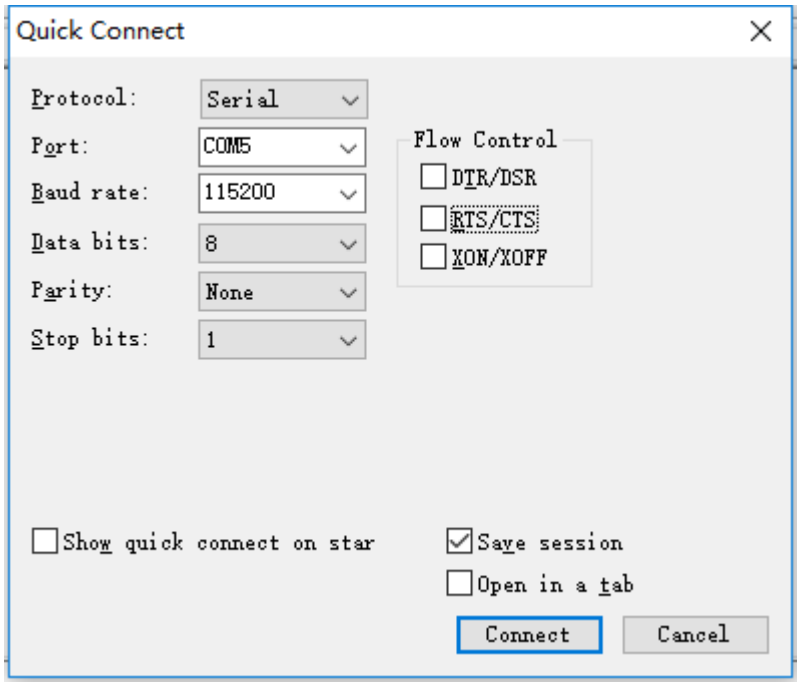


Figure 53. Products Default: UART Parameters

In Cli Command mode, User can use UART to set parameters.

Notes:

We recommend to use SecureCRT for UART debug tools.

2.1.1. Switch Transparent Transmission Mode to Cli Command Mode

Steps:

- Input “+++” via UART tools, the device will output “EPORT>” after received“+++”. Then the device already enters into Cli command mode.

Notes:

”+++” should be in one frame. Other data is not allowed before or after “+++”

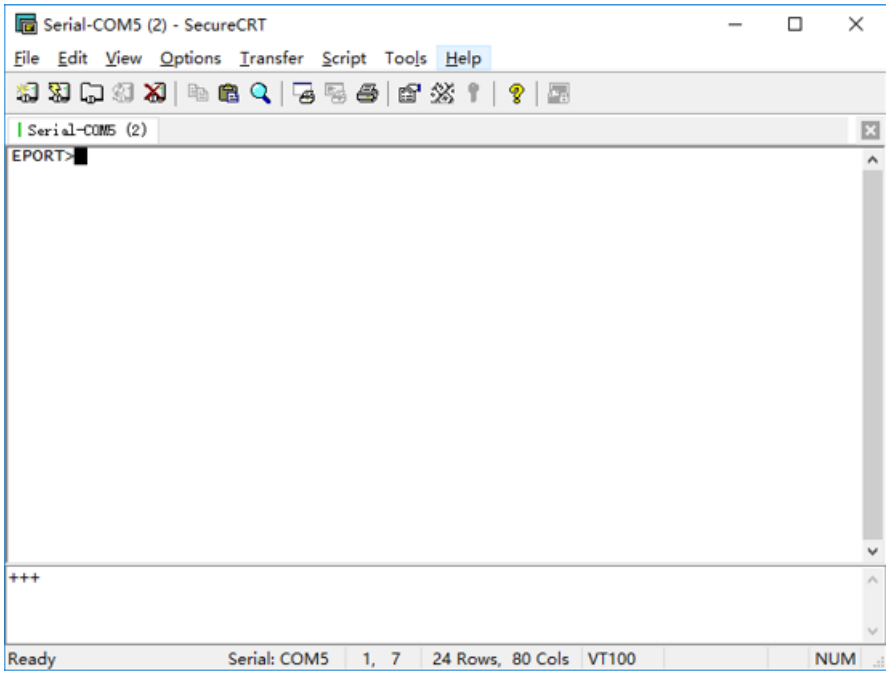


Figure 54. Switch Transparent Transmission Mode to Cli Command Mode

<Notes>:

In Cli command mode, users can set or query parameters. Cli command details see next chapter

2.2. Cli Command Overview

Cli command can be input through terminal (SecureCRT or other UART tools) or by user device MCU programming. As below picture, we use SecureCRT tool. Press “Tab” key, it will list current available Cli command or directory. If intput first character and then press “Tab” key, it will show the Cli command fit with the first character.

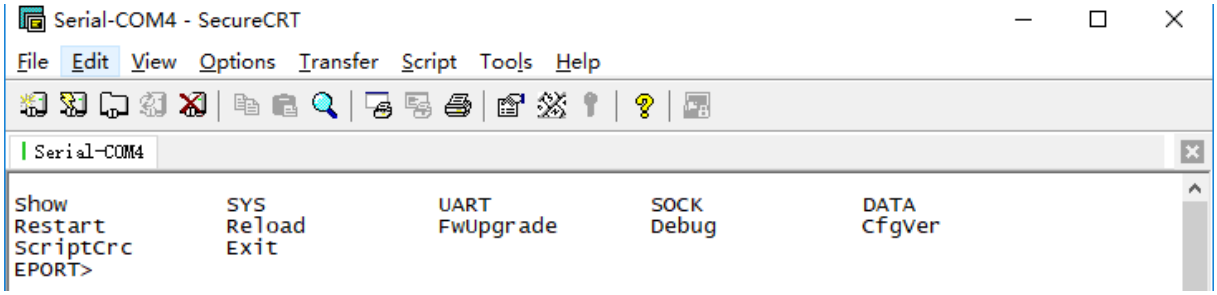


Figure 55. Cli Command Root Directory

2.2.1. Cli Command Format

Cli command is in ASCII format. The usage is similar to Linux terminal. Command format as following:

- Format Notes
  - **< >**: Cli command name or directory.
  - **[ ]**: Cli command parameters.
- Command Message

<CMD> [para-2 para-3 para-4…]<CR>

- <CMD>: Main directory or command name；
- [para-n] : command parameters. If have multiple directory, it can also can be the son directory. As below example；

```
EPORT>SYS Auth
User            Passwrod        Quit
```

- <CR>: Command Terminator, “Enter” key, HEX data: 0x0a or 0x0d

<Notes>

If the input command does not exist, UART will output again “EPORT>” to allow next command input. The Cli command is case sensitive.

```
EPORT>sys
EPORT>SYS
EPORT/SYS>
```

If need enter son directory, press “space” key between the directorys.

```
EPORT>SYS Auth
EPORT/SYS/Auth>
```

If need to display all the directory or commands in the current directory, press “Tab” key to query.

```
EPORT/SYS>
Auth     Network Telnet  Web     Ipv6
MAC      JCMD    Quit
```

If need to display current command parameter, press Tab key to query after command.

```
EPORT/SYS/Network>DHCP
Enable  Disable
```

2.2.2. Show Command

- Function: Show all system information, including the system running status, Network status, UART status and socket status.
- Format:
  - Query

Show [SYS/UART/SOCK]

- Parameter:

  Show all information if no parameters. Parameter can be one of the following:
  - SYS: System running status
  - UART: UART status
  - SOCK: Socket status

```
EPORT>Show

===System State===
Product ID:E-10
Software Version:V1.04
Up Time: 0-Day 0:21:39
Total Free Memory: 48400
MAX Block Size:46816

===NETWORK===
MAC:ACCF23FF4771
Ip Address:192.168.0.106
GateWay:192.168.0.1

===UART Status===
Config:115200,8,1,NONE,NONE
State:In CLI
Recv Bytes:26    Recv Frames:24
Send Bytes:0     Send Frames:0
Failed Bytes:0   Failed Frames:0

===SOCK Status===
SOCK Name:netp
State:Server Created
Client IP:
Recv Bytes:0     Recv Frames:0
Send Bytes:0     Send Frames:0
Failed Bytes:0   Failed Frames:0
```

2.2.3. SYS Directory

- Function: Display/Set all system related information
- Format:
  - Tab Query

```
EPORT/SYS>
Version         Auth            Network         Telnet          Web
NTP             MAC             JCMD            NAT             Ping
ProductID       CustomerID      UserID          CfgProtect      FactoryCfg
Script          XmlLoad         Language        Quit
```

2.2.4. SYS/Version Command

- Function: Display software version
- Format:
  - Query

<Version>

```
EPORT/SYS>Version
1.32.4
```

2.2.5. SYS/Auth Directory

- Function: Display/Set web or Telnet Cli command login directory. (see appendix for detail)
- Format:
  - Tab Query

```
EPORT/SYS/Auth>
User            Password        Quit
```

2.2.6. SYS/Auth/User Command

- Function: Display/Set web or Telnet Cli command login user name. (function see appendix)
- Format:
  - Query

<User>

  - Set

<User> [value]

- Parameter:

  Login user. Default: **admin**. Setting is valid immediately,

  - value: set value. Length range 1～29 characters

```
EPORT/SYS/Auth>User
admin
```

2.2.7. SYS/Auth/Password Command

- Function: Display/Set web or Telnet Cli command login password(function see appendix)
- Format:
  - Query

<Password>

- Set

<Password> [value]

- Parameter:

  Login password. Default: **admin** . Setting is valid immediately

  - value: set value. Length range 1～29 characters

```
EPORT/SYS/Auth>Password
admin
```

2.2.8. SYS/Network Directory

- Function: Display/Set network information.
- Format:
  - Tab Query

```
EPORT/SYS/Network>
Show            DHCP            DNS             HostName        Lan
Mode            EthMode         Quit
```

2.2.9. SYS/Network/Show Command

- Function: Display network related information
- Format:
  - Query

<Show>

2.2.10. SYS/Network/DHCP Command

- Function: Display/Set DHCP Client function
- Format:
  - Query

<DHCP>

  - Set

<DHCP> [Enable/Disable]

- Parameter:

  Setting is valid after reboot.

  - Enable: Enable DHCP function. The device will get DHCP IP from router when Ethernet port is connected to router LANN port. Default: **Enable**.
  - Disable: Disable DHCP function. Allocate device static IP address according to the hit of intputting IP and gateway address.

2.2.11. SYS/Network/DNS Command

- Command: Display/Set DNS IP address.
- Format:
  - Query

<DNS>

  - Set

<DNS> [IP]

- Parameter:

  When DHCP function is Disabled, this setting is valid. Setting is valid after reboot.

- IP Address: DNS server address. Default: **223.5.5.5**.

2.2.12. SYS/Network/Hostname Instruction

- Function: Display/Set Hostname.
- Format:
  - Query

  <Hostname>
  - Set

  <Hostname> [name]
- Parameter:

  Hostname is the name which show in router DHCP client list. Setting is valid immediately.
  - Name Address: Hostname, length range: 1~29 characters.

2.2.13. SYS/Network/Lan Instruction

- Function: Display/Set Lan parameter. Only Wi-Fi product support this.
- Format:
  - Query

  <Lan>
  - Set

  <Lan> [ip mask Enable/Disable]
- Parameter:

  Set LAN parameters. Setting is valid after reboot.
  - ip: LAN IP
  - mask: LAN submask.
  - Enable/Disable: Enable/Disable LAN DHCP Server function.

```
EPORT/SYS/Network>Lan 1.1.1.1 255.255.255.0 Enable
SET-OK
EPORT/SYS/Network>Lan
Dhcpd:Enable
Ip:1.1.1.1
Mask:255.255.255.0
```

2.2.14. SYS/Network/Mode Instruction

- Function: Display/Set network working mode parameter. Only HF2211/HF2221 support this.
- Format:
  - Query

  <Mode>
  - Set

  <Mode> [Router/Bridge]
- Parameter:

  Set product works in router or bridge mode. Setting is valid after reboot.
  - Router: Router mode, default value.
  - Bridge: Bridge mode

2.2.15. SYS/Network/EthMode Instruction

- Function: Display/Set Ethernet working mode parameter. Only HF2211/HF2221 support this.
- Format:
  - Query

  <EthMode>
  - Set

  <EthMode> [WAN/LAN]
- Parameter:

  Set Ethernet working mode. Setting is valid after reboot.
  - WAN: Ethernet works in WAN mode. Default value. When Wi-Fi is working in STA mode, Ethernet is by changed to LAN mode.
  - LAN: Ethernet works in LAN mode.

2.2.16. SYS/Telnet Instruction

- Function: Display/Set Telnet function.
- Format:
  - Query

  <Telnet>
  - Set

  <Telnet> [Enable/Disable]
- Parameter:

  See appendix for detailed Telnet function usage. Telnet is used for remote send Cli command or transmit data, Setting is valid after reboot.
  - Enable: Enable Telnet function. Default: **Enable**.
    - Input Port Numbver: Telnet Port Number. Default: **23**
    - Input Echo Mode: Enable/Disable Cli command echo function. Default: **Enable**
  - Disable: Disable Telnet function.

2.2.17. SYS/Web Instruction

- Function: Display/Set Web config function.
- Format:
  - Query

  <Web>
  - Set

  <Web> [Enable/Disable]
- Parameter:

  Webpage is used for config module working parameters. Setting is valid after reboot.
  - Enable: Enable Web config function. Default: **Enable**.
    - Input Port Number: Web Port Number. Default: **80**
  - Disable: Disable Web config function

2.2.18. SYS/NTP Instruction

- Function: Display/Set NTP function.

- Format:
  - Query

<NTP>

  - Set

<NTP> [Enable/Disable]

- Parameter:

  Setting is valid immediately

  - Enable: Enable NTP function. Input NTP server, port and timezone according to command line.
    - NTP Server Address: domain name or IP address.
    - NTP Server Port: 0~127
    - GMT: range -12~14.
  - Disable: Disable NTP function. Default value.

```
EPORT/SYS>NTP Enable
Input NTP Server Address:1.1.1.1
Input NTP Server port[123]:123
Input GMT[8]:8
SET-OK
Try to connect NTP...
```

2.2.19. SYS/MAC Instruction

- Function: Display/Set MAC address.
- Format:
  - Query

<MAC>

  - Set

<MAC> [8888 value]

- Parameter:

  Global unique MAC Address. It is not allowed to modify it.

  - value: MAC address value.

2.2.20. SYS/JCMD Instruction

- Function: Display/Set Jason command function.
- Format:
  - Query

<JCMD>

  - Set

<JCMD> [Enable/Disable]

- Parameter:

  Json command is used for config module. IOTService software use this mechanism. If disable JCMD function, IOTService is no longer valid. Setting is valid after reboot.

  - Enable: Enable JCMD function. Default: **Enable**.
  - Disable: Disable JCMD function.

2.2.21. SYS/NAT Instruction

- Function: Display/Set IOTBridge function.
- Format:
  - Query

<NAT>

  - Set

<NAT> [Enable/Disable]

- Parameter:

  IOTBridge is our cloud server provided for remote management. Setting is valid after reboot.

  - Enable: Enable NAT function. Default: **Enable**.
  - Disable: Disable NATfunction.

```
EPORT/SYS>NAT
Enable
Server:bridge.iotworkshop.com
Port:48899
```

2.2.22. SYS/Ping Instruction

- Function: Ping Command.
- Format:
  - Query

<Ping> [address]

- Parameter:
  - address: IP address or domain name.
    - Timeout: Destination is not available.
    - Success: Destinatioin is available.

```
EPORT/SYS>Ping www.baidu.com
Success
```

2.2.23. SYS/ProductID Instruction

- Function: Show product ID, it is used for product distinguish in IOTService or webpage.
- Format:
  - Query

<ProductID>

- Parameter:
  - Show product ID value.

```
EPORT/SYS>ProductID
HF2211
```

2.2.24. SYS/CustomerID Instruction

- Function: Show customer ID, it is used for product name shown in IOTService or webpage.
- Format:
  - Query

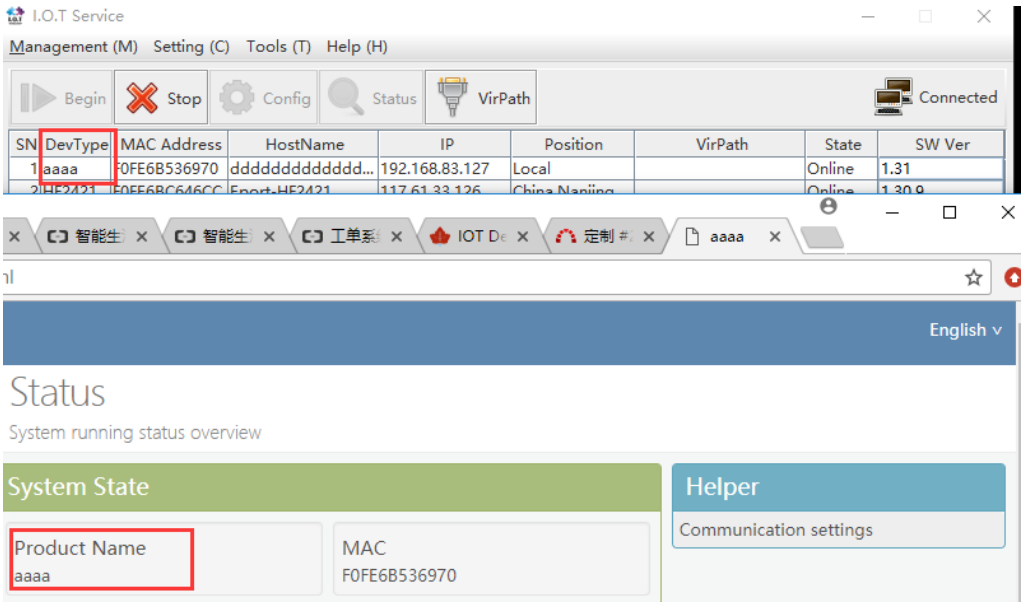
<CustomerID>

- Set

<CustomerID> [data]

- Parameter:
  - data: Customer ID value, default is same as ProductID.

```
EPORT/SYS>CustomerID aaaa
SET-OK
EPORT/SYS>CustomerID
aaaa
```



2.2.25. SYS/UserID Instruction

- Function: Show user ID, it is used in IOTBridge for bound device to IOTBridge account.
- Format:
  - Query

<UserID>

  - Set

<UserID> [data]

- Parameter:
  - data: User ID value, default is blank.

2.2.26. SYS/Cfgprotect Instruction

- Function: Show Protect switch status. It is not allowed to change prameters when Protect is ON.
- Format:
  - Query

<Cfgprotect>

- Parameter:
  - OFF: Protect is off. Parameters are allowed to modify.
  - ON: Protect is on. Parameters are not allowed to modify.

2.2.27. SYS/FactoryCfg Instruction

- Function: Save or Clear user parameters to factory default.
- Format:
  - Query

  <FactoryCfg>
  - Set

  <Factory Cfg> [Enable/Disable]
- Parameter:
  - Enable: Save user current parameters to factory setting. When do restore to factory operation, it will restore to this saved user value.
  - Disable: Clear saved factory setting. When do restore to factory operation, it will restore to the orginal factory value..

2.2.28. SYS/Script Instruction

- Function: Show script function. See script document for detailed usage.
- Format:
  - Query

  <Script>

2.2.29. UART Directory

- Function: Display/Set UART information directory.
- Format:
  - Tab key query

```
EPORT/UART>
Show            Baudrate        Databits        Stopbits        Parity
Buf             FlowCtrl        SWFlowCtrl      Cli-Getin       Cli-WaitTime
Proto           Frame           Edit            Clean           Quit
```

2.2.30. UART/Show Instruction

- Function: Display UART information function.
- Format:
  - Query

  <Show>

2.2.31. UART/Baudrate Instruction

- Function: Display/Set UART baud rate function.
- Format:
  - Query

  <Baudrate>
  - Set

  <Baudrate> [value]
- Parameter:

  Setting is valid immediately.
  - Value: Default: **115200.** Can choose 300, 600, 1200, 2400, 4800, 9600, 38400, 57600, 115200, 230400, 460800. Different product may support different range.

2.2.32. UART/Databits Instruction

- Function: Display/Set UART data bits function.
- Format:
  - Query

  <Databits>
  - Set

  <Databits> [value]
- Parameter:

  Setting is valid immediately.
  - Value: Default: **8bits.** Can choose 5, 6, 7, 8. Different product may support different range.

2.2.33. UART/Stopbits Instruction

- Function: Display/Set UART stop bits function.
- Format:
  - Query

  <Stopbits>
  - Set

  <Stopbits> [value]
- Parameter:

  Setting is valid immediately.
  - Value: Default: **1bits.** Can choose 1, 2. Different product may support different range.

2.2.34. UART/Parity Instruction

- Function: Display/Set UART parity function.
- Format:
  - Query

  <Parity>
  - Set

  <Parity> [value]
- Parameter:

  Setting is valid immediately.
  - Value: Default: **None.** Can choose NONE, EVEN, ODD. Different product may support different range.

2.2.35. UART/Buf Directory

- Function: Display/Set UART Buffer directory.
- Format:
  - Tab key query

```
EPORT/UART/Buf>
BufSize GapTime Quit
```

2.2.36. UART/Buf/Bufsize Instruction

- Function: Display/Set UART buffer size function.
- Format:
  - Query

  <Bufsize>
  - Set

  <Bufsize> [value]
- Parameter:

  Buffer is used for cache UART received data. If the received data of one frame is larger than buffer size. The data frame will be break into two packets send to network. Setting is valid immediately.
  - Value: Default: **512**. Length range: 32～8192 bytes. Different product may support different range.

2.2.37. UART/Buf/GapTime Instruction

- Function: Display/Set UART free frame gap time.
- Format:
  - Query

  <GapTime>
  - Set

  <GapTime> [value]
- Parameter:

  GapTime is used for setting UART free frame time gap. If the received data gap time is more than setting value, the data packet will be breaked into two frames.
  - Value: Default: **50ms**. Length Range: 10～1000ms.

2.2.38. UART/Buf/FlowCtrl Command

- Function: Display/Set UART flow control function.
- Format:
  - Query

  <FlowCtrl>
  - Set

  <FlowCtrl> [para]
- Parameter:

  Flow control includes software flow control and hardware flow control. Software flow control priority is higher than hardware. If enable software flow control, the hardware flow control pin (CTS/RTS) will be useless. Software flow control use special UART data for control. Hardware flow control use CTS/RTS pin control. Setting is valid immediately.
  - para: One of the following parameters.
    - FlowCtrl: Flow control function.
    - Half-Duplex: Enable RS485 half-duplex mode, UART0_RTS is used for RS485 control pin. Default value.
    - Disable: Disable Flow control function. .

2.2.39. UART/Buf/SWFlowCtrl Command

- Function: Display/Set UART software flow control function.
- Format:
  - Query

<SWFlowCtrl>

  - Set

<SWFlowCtrl> [Enable/Disable]

- Parameter:

  Enable software flow control function. The device UART can output data After UART received Xon single-byte enable data. When UART received Xoff single-byte disable data. It will disable the device UART output data.

  - Enable: Enable software flow control function, When in enable status, it allow UART data output when bootup by default.
    - Xon: Enable UART output data. Default: **0x11**.
    - Xoff: Disable UART output data. Default: **0x13**.
  - Disable: disable software flow control function. Default: **Disable**.

2.2.40. UART/Cli-Getin Command

- Function: Display/Set Cli command function
- Format:
  - Query

<Cli-Getin>

  - Set

<Cli-Getin> [Serial-String/Always/Disable]

- Parameter:

  Set Cli command parameters. Setting is valid immediately.

  - Serial-String: Enable specific data to enter into Cli command mode.
    - [Input Serail String]: Default: **+++,** Range1~10 bytes. Also can input hex format data. The HEX data are separated by Spaces, Like【30 31 32 33 34】, When it recieved string data “01234”, then It can enter into Cli command.
  - Always: Always work in Cli command mode when device power on.
  - Disable: Disable Cli command mode. UART and Telnet both can’t use Cli Command.

2.2.41. UART/Cli-WaitTime Command

- Function: Display/Set Cli command wait time
  - Format

<Cli-WaitTime>

  - Set

<Cli-WaitTime> [timeout]

- Parameter:

  Set Cli command mode timeout exit time. If there is no Cli command sent for the waitfime, It will exit Cli command mode to transparent transmission, Setting is valid immediately.

- timeout: Default: **300s**, Range 0: Disable WaitTime function, 1～300s.

2.2.42. UART/Proto command

- Function: Display/Set UART protocol function
- Format:
  - Query

  <Proto>
  - Set

  <Proto> [NONE/Modbus/Frame]
- Parameter:

  Setting is valid immediately.
  - NONE: Default: **None**, transparent transmission, the received UART data will be directly sent to network.
  - Modbus: Modbus RTU to Modbus TCP.
  - Frame: Enable auto-frame function. Relevant parameters are set in Frame command.

2.2.43. UART/Frame Directory

- Function: Display/Set UART frame directory.
- Format:
  - Tab key query

```
EPORT/UART/Frame>
FrameLen        FrameTime       Tag             Quit
```

2.2.44. UART/Frame/FrameLen Command

- Function: Display/Set UART auto-frame frame length
- Format:
  - Query

  <FrameLen>
  - Set

  <FrameLen> [value]
- Parameter:

  Set UART auto-frame length, Setting is valid immediately.
  - value: Default: **8**, Range: 8～1400.

2.2.45. UART/Frame/FrameTime Command

- Function: Display/Set UART auto-frame time
- Format:
  - Query

  <FrameTime>
  - Set

  <FrameTime> [value]
- Parameter:

  Set UART auto-frame time, Setting is valid immediately.

- value: Default: **100ms**, Range: 100～10000.

2.2.46. UART/Frame/Tag Command

- Function: Display/Set UART auto-frame Tag
- Format:
  - Query

<Tag>

  - Set

<Tag> [Enable/Disable]

- Parameter:

  Set UART auto-frame tag. Only transmit data from tag head to tag tail. Filter the other datas. Setting is valid immediately.

  - Enable: Enable auto-frame tag function.
    - TagHead: LabelHead. Default: **0x55**, Single byte data.
    - TagTail: LabelTail. Default: **0xAA**, Single byte data.
  - Disable: Default: Value.

2.2.47. UART/Edit Command

- Function: Set UART parameter
- Format:
  - Set

<Edit> [baudrate databits stopbits parity]

- Parameter:

  Set all UART communication parameter including baud rate, data bit, stop bit and parity.

2.2.48. UART/Clean Command

- Function: Clear UART transmit-receive data information
- Format:
  - Set

<Clean>

- Parameter:

  Clear the UART data count (Data packet/Frame/Error packet and so on) shown in webpage.

2.2.49. SOCK Directory

- Function: Display/Set Socket channel directory.
- Format:
  - Tab key query

```
EPORT/SOCK>
Show     New     netp     UDP     Quit
```

Netp and UDP are created socket channel. Itsupport maximum 5 Sockets.

2.2.50. SOCK/Show Command

- Function: Display Socket information function.

- Format:
  - Query

<Show>

2.2.51. SOCK/New Command

- Function: Set new Socket information
- Format:
  - Set

<New> [name]

- Parameter:

  There is a default socket created(netp). It supports max 5 socket channel. Every channel can be set as TCP/UDP/HTTP and so on. Setting is valid immediately.

  - Name: Socket name. Range 1～19 characters.
    - Input Sock Proto: Choose one communication method of the following.
      - TCP-SERVER: TCP Server Mode. It supports max 5 TCP Client connection.
      - TCP-CLIENT: TCP Client Mode. It is used for connecting server.
      - UDP-SERVER: UDP Server Mode. Special function. Product will record the last received UDP package source IP and Port information. The received UART data will be send to this IP and port, not the setting destination.
      - UDP-CLIENT: UDP Client Mode.
      - HTTP: HTTP Protocol transmission. The received UART data will transform to HTTP format and it will remove the HTTP header information and only output the HTTP data to UART.
      - TELNETD: Telnetd Mode. Use Telnet to config the UART Console equipment.

    TCP Server Mode:

    - Input Local Port[0]: Set local port, Range 1～65535, 0 is random port. For TCP Server and UDP application, set it to a fixed 1~65535(TCP port 80 is used for its webpage). For TCP Client application, usually set it to 0.
    - Input Buffer size[512]: Set Buffer size. Default: 512 bytes, Range:1～1400.
    - Input KeepAlive[60]: Set TCP keepalive, Heartbeat time, Defalut 60s, Range: >=0.
    - Input Timeout[300]: Set TCP timeout, If exceed setted time and don't received any network data package, It will break TCP connection. If working in TCP client mode, it will reconnect immediately. If it work in TCP server mode, the TCP client need to create the connction. Set this value to 0 is to close the function. The function is used for TCP to restore abnormal connection. Recommend to enable. Default: 300s, Range 0～600.
    - Input Sock Security[Disable]: Security options, Used for data special encryption. Default: disable no encryption.
      - Disable: No encryption

- TLS: TLS1.2 encryptioin, We use no certificate method. Only support in TCP client mode.
- AES: AES encryption, CBC method，TCP/UDP all support this.
- DES3: DES3 encryption, TCP/UDP all support this.
  - Input key: AES or DES3 key. For AES encryptiont, the key is fixed 16 bytes length, the IV value is the same as key. For DES3 encryption, the key is fixed 24 bytes length, the IV value the first 8 Bytes of key. The key can be ASCII or Hex format data. Hex format data need to use “space” character as separator, ex, “01 02 03…”

- Input Rout[uart]: Set the Socket channel output. Can choose UART and other created Socket or use as Log print using.

TCP Client Mode (Only list out difference)

- Input Server Address: Set server IPv4 address or domain name.
- Input Server Port: Set server port
- Input Local Port[0]: Same as above
- Input Buffer size[512]: Same as above
- Input KeepAlive[60]: Same as above
- Input Timeout[300]: Same as above.
- Input Sock Security[Disable]: Same as above
- Input Connect Mode[Always]: Set TCP Client connection mode
  - Always: TCP persistent connection. If TCP break, it will reconnect immediately.
  - Burst: It will establish connection once UART received data. If set stop function, It will disconnect after network received stop data.
    - Input Stop Serial: Set Burst Mode Stop bits. It can be ASCII or Hex format data, Hex format data need use space as separator , 1～10 bytes.
- Input Rout[uart]: Same as above

UDP Server/ UDP Client

HTTP Mode

- Input HTTP type[POST]: HTTP request type. Default: POST. Can choose POST or GET.
- Input HTTP path[/]: HTTP request path, Need start by“/”. The longest byte is 64 bytes.
- Input HTTP version[1.0]: HTTP Protocol Version. Default: 1.0, Can choose 1.0 or 1.1
- Input HTTP parameters: Add HTTP head information, end by “Enter” key.If want to end the input, direct input “Enter” key. All HTTP header data length should be less than 250 bytes.

2.2.52. SOCK/netp directory

- Function: Display/Set Socket netp channel directory.
- Format:
  - Tab key query

```
EPORT/SOCK/netp>
Show            Name            Proto           Server          ServerPort
LocalPort       BufSize         KeepAlive       Timeout         Security
HeartBeat       ConnectMode     MaxAccept       Rout            Save
Clean           Del             Quit
```

Every created Socket channel can be modified through name. The above command function is the same as New Socket command description

2.2.53. SOCK/netp/MaxAccept Command

- Function: Display/Set socket accep number when works in TCP server mode.
- Format:
  - Query

  <MaxAccept>
  - Set

  < MaxAccept > [number]
- Parameter:

  Set max socket accept number. Default is 5 or 20, range 1~5 or 1~20 depends on different product. If set to 1, the data will be output according to the sequence connection established. Only after the queue in the front break then output the data of the next connection in the queue. Setting is valid after reboot..

2.2.54. SOCK/netp/clean Command

- Function: Clear netp channel data packets information
- Format:
  - Set

  <Clean>
- Parameter:

  The network data packets information can be checked from webpage. The command will reset the data count.

2.2.55. SOCK/netp/save Command

- Function: Save socket setting. Only after the save command will the parameters setting be saved into flash. Otherwise it will loose after reboot.
- Format:
  - Set

  <Save>

2.2.56. DATA Directory

- Function: Display/Set Cli command mode communication
- Format:
  - Tab Query

```
EPORT/DATA-Str>
Hex     Quit
```

Default: data sent in ASCII format. Also can change to send by HEX, The command is used for Cli command mode to transfer data.

2.2.57. Restart Command

- Function: Restart instruction.
- Format:
  - Set

<Restart>

2.2.58. Reload Instruction

- Function: Restore Factory setting instruction.
- Format:
  - Set

Reload [SYS/UART/SOCK]

- Parameter:

  Reload to factory setting, if add the following parameters, it will only restore corresponding parameters. Parameter can include one of the below three:
  - SYS: Restore system setting relevant paramter
  - UART: Restore UART setting relevant paramter
  - SOCK: Restore Socket relevant paramter

2.2.59. WIFI Directory

- Function: Display/Set Wi-Fi Function
- Format:
  - Tab Query

```
EPORT/WIFI>
Show            Mode            Status          Scan            Rssi
Roaming         HideSSID        Quit
```

2.2.60. WIFI/Show Instruction

- Function: Show Wi-Fi status
- Format:
  - Set

<Show>

```
EPORT/WIFI>Show

===WIFI Status===
Mode:AP
AP SSID:DDDD
Connected

STA SSID:Sam401
Disconnected
```

2.2.61. WIFI/Mode Command

- Function: Display/Set Wi-Fi working mode.
- Format:
  - Query

<Mode>

- Set

<Mode> [AP/STA/APSTA]

- Parameter:

  Set Wi-Fi working mode. Setting is valid after reboot..

  - AP: Default value
    - Input AP SSID: Input AP SSID,1~31 characters.
    - Input AP Key: Input AP key, 8~63 characters
  - STA: STA mode
    - Input STA SSID: Input STA SSID,1~31 characters.
    - Input STA Key: Input STA key
  - APSTA: AP+STA mode, only HF2211/HF2221 support..

2.2.62. WIFI/Status Instruction

- Function: Show Wi-Fi status, same as Show command

2.2.63. WIFI/Scan Command

- Function: Display Wi-Fi scan result.
- Format:
  - Query

<Scan>

```
EPORT/WIFI>Scan
CH,SSID,BSSID,RSSI
11,Caoyu,78:96:82:A2:C6:A2,10
11,Sam401,D4:EE:07:2D:14:1E,100
11,UPGRADE-AP,20:DC:E6:48:35:9E,39
10,ChinaNet-yRMx,38:E3:C5:A2:87:D5,100
6,xiaoheizi,B0:95:8E:06:CB:16,34
6,Caoyu,AA:25:93:B8:45:E2,5
6,Caoyu,D0:C7:C0:24:6C:40,20
1,TP-LINK_FF03AA,78:A1:06:FF:03:AA,15
```

2.2.64. WIFI/Rssi Command

- Function: Display Wi-Fi STA signal strength.
- Format:
  - Query

<Rssi>

Signal strength, range: 0~100%

```
EPORT/WIFI>Rssi
0
```

2.2.65. WIFI/Roaming Command

- Function: Display/Set Wi-Fi STA auto switch function.
- Format:
  - Query

<Roaming>

- Set

<Roaming> [Enable/Disable]

- Parameter:
  Set Wi-Fi auto switch, need to use IOTService to config..
  - ScanRssi: Start to find same SSID with stronger signal strength when the currect AP signal strength weaken to this setting value.
  - ScanInterval: scan interval in seconds.
  - ReconnectRssi: Connect to same SSID with stronger signal strength higher than this value.

```
EPORT/WIFI>Roaming
Roaming:Disable
ScanRssi:0
ScanInterval:0
ReconnectRssi:0
```

2.2.66. WIFI/HideSSID Command

- Function: Display/Set Wi-Fi AP SSID hide function.
- Format:
  - Query

  <HideSSID>
  - Set

  <HideSSID> [On/Off]

2.2.67. Exit Command

- Function: Exit Cli Command mode instruction
- Format:
  - Set

  <Exit>

2.2.68. Quit Command

- Function: Quit the current and go the father Cli command directory.
- Format:
  - Set

  <Quit>

2.2.69. WIFI/FwUpgrade Command

- Function: Do upgrade function.
- Format:
  - Set

  <FwUpgrade> [url]
- Parameter:
  Upgrade firmware according to this setting. If download OK, it will response with “Upgrade OK!”, if download fail, it response with “Upgrade FAIL”. Run new firmware after reboot.
  - url: url resource, ex: http://192.168.0.101/mfw.bin

APPENDIX A:REFERENCES

A.1. Test Tools

IOTService, UART, Network test tools:

Download Address: http://www.hi-flying.com/index.php?route=download/category&path=1_4

APPENDIX B:TELNET COMMUNICATION FUNCTION

B.1. Telnet Use Scene:

a）Remote management device

b）Remote management uart equipment

B.2. Telnet Features:

a）Telnet support echo mode,

b）Telnet only support one Client port.

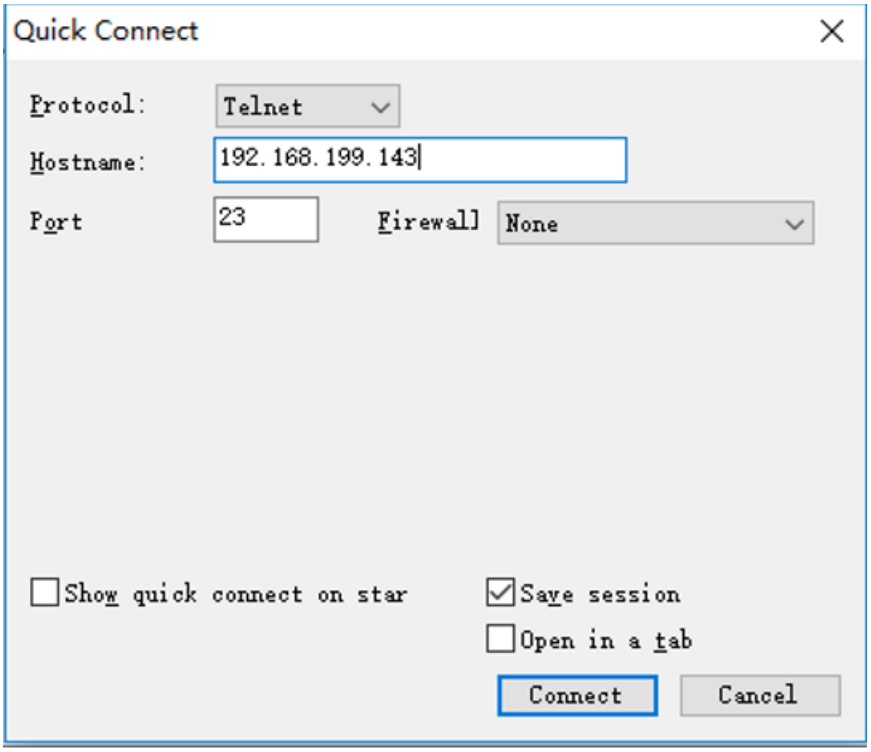
c）Telnet port number is 23

d）Telnet connected with TCP, If Client port don't transmit data in 300s, It will auto disconnect.

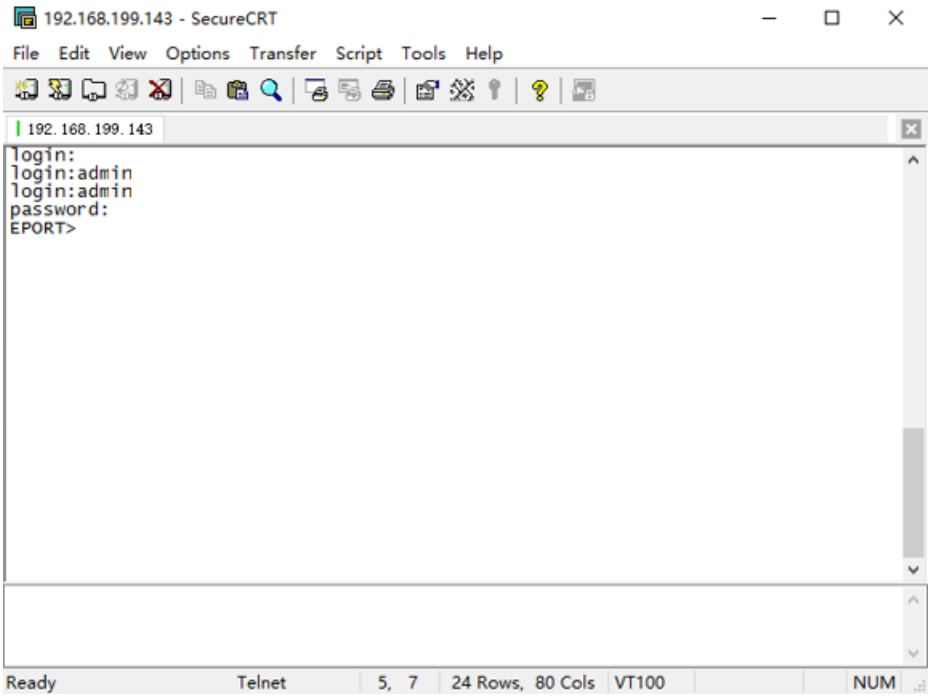
B.3. Telnet Usage:

Telnet function default as ON, If can't connect, Pls use webpage or configuration to check the function is on or off.

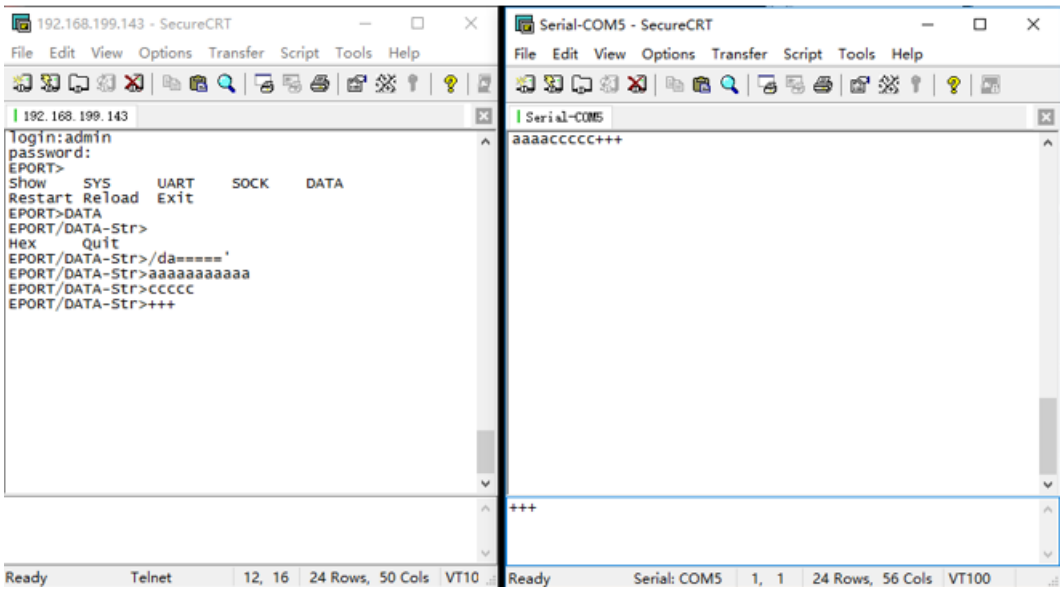
a）Configure Secure CRT module and connect parameter, Equipment need to connect with LAN, Can use equipment LAN IP to access , If need remote to access the equipment, It need router have public IP address as port and mapped to internal website, Then can remote access equipment.



b）Use webpage account and password login in module, Then interface will show “EPORT>” .



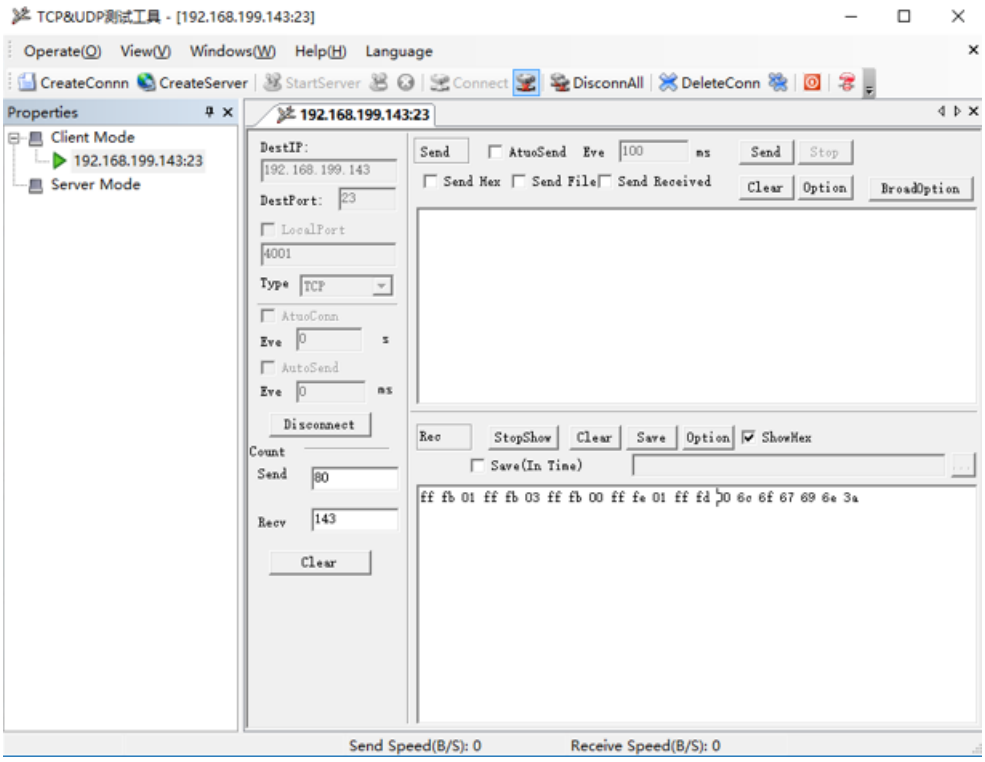
c）Later use are same as UART cli command, And can realise Telnet data with UART data transparent transmission application.,



Telnet Software implementation principle:

Step 1 Establish TCP connection with module

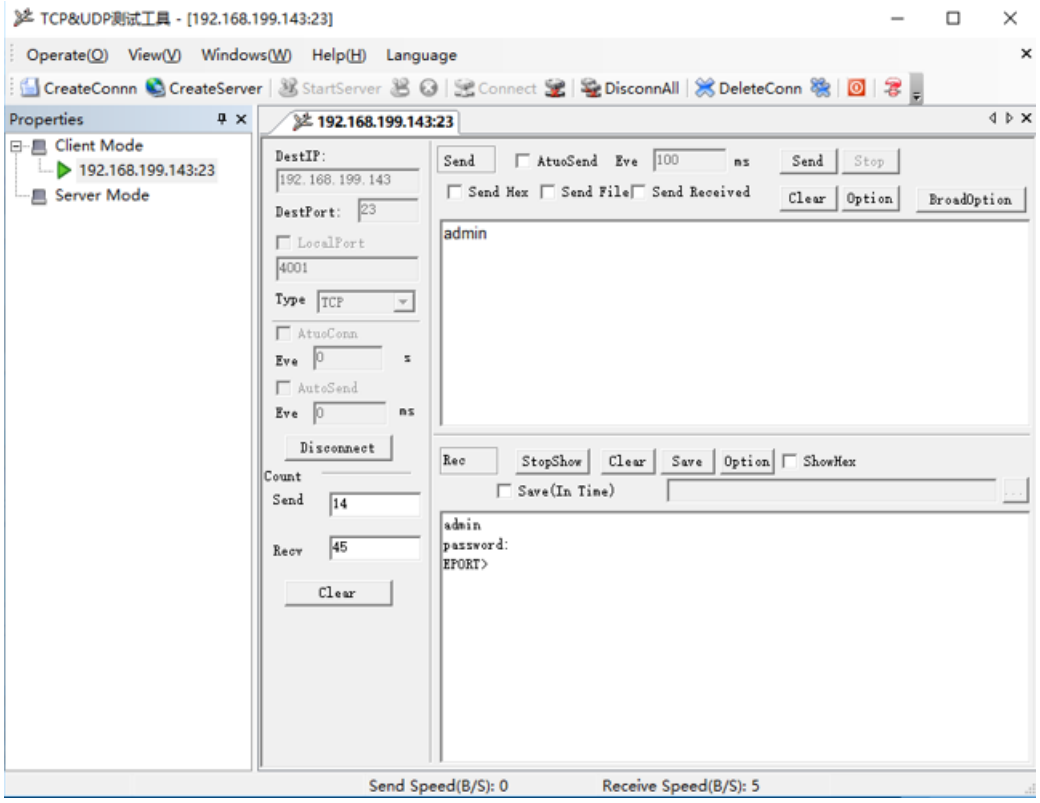
Step 2 Module send “login”, Client port send user name(need end with Enter key,Tools can type Ctrl+Enter)



Step 3 Module send 0xFF 0xFB 0x01 Close telnet input display.

Step 4 Module send password, Client port send login password

Step 5 Module send 0xFF 0xFC 0x01 Open telnet input display



Step 6 It can send and receive Cli command After Enter into Cli command mode.