NIO31

Dual-port Modbus Gateway

User Guide

Version 1.1

EMBUX

Table of Contents

1. Introduction

1.1 Features

- Gateway of Modbus TCP to Modbus RTU/ASCII
- Two Configurable RS-232/422/485 serial ports
- Each serial port can be configured as Modbus Master or Modbus Slave mode
- Each serial port supports up 16 Modbus TCP master
- Each serial port supports up to 32 Modbus TCP slave
- One 10/100 Mbps Ethernet ports
- One serial console port
- Support Web configuration console
- Windows configuration utility included
- Support Telnet and serial console command

1.2 Specification

- **System:**
  - CPU: 32-bit microcontroller
- **Serial port:**
  - Port1: RS-232/422/485
  - Port2: RS-232
  - Baud rate: 1200 to 921600bps
  - Flow control: None/Hardware/Xon_Xoff
  - Data bit: 5 to 8
  - Stop bit: 1 to 2
- **Operation mode:**
  - Modbus Gateway:
    - Slave RTU
    - Slave ASCII
    - Master RTU
    - Master ASCII
  - S2E Gateway
    - TCP server
    - TCP client
  - Protection: 15KV ESD
- **Ethernet:**
  - 10/100 Mbps, RJ45
  - Protection: 1500V Magnetic isolation
- **Serial console port:**
  - RS-232: 115200 baud rate, None flow control, 8 bits data, 1 stop bit
- **Power:** 9~40VDC power jack and terminal block
- **Dimension:** 108 x 78 x 25 mm (H x W x D)

- **Operating Temperature:** 0~60°C
- **Storage Temperature:** -20~85°C

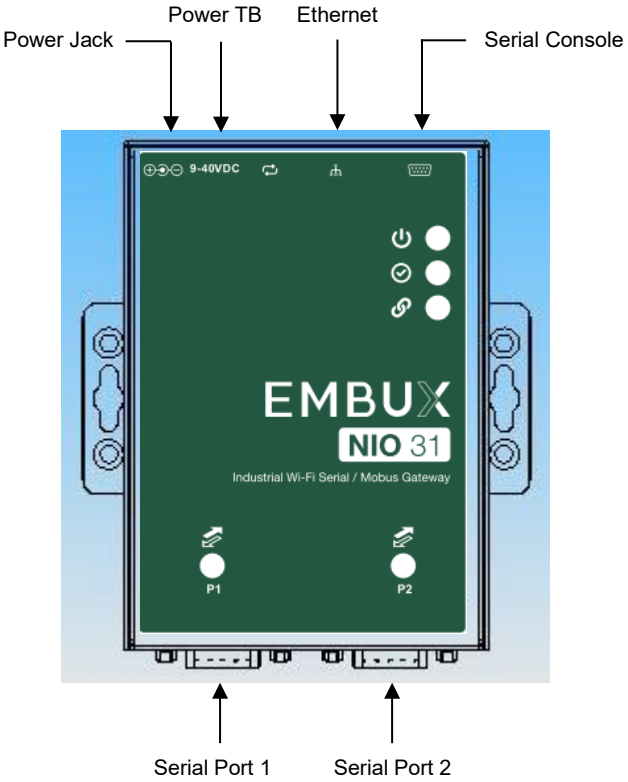
1.3 Packing List

- NIO31 Modbus Gateway

1.4 Optional Accessory

- Console Cable (RJ45 to DB9 Female, 100cm)
- DIN RAIL Mounting Kit
- PWR-12V-1A: 110~240VAC to 12VDC 1A Power Adaptor

2. Layout


Power Jack
Power TB
Ethernet
Serial Console
9-40VDC
EMBUX
NIO 31
Industrial Wi-Fi Serial / Mobus Gateway
P1
P2
Serial Port 1
Serial Port 2

3. Pin Assignment and Definition

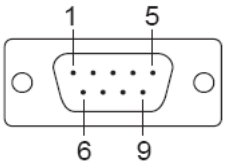
3.1 Power Connector

Connecting 9~40VDC power line with the NIO31 terminal block or the power jack. If the power is properly supplied, the Power LED will keep solid yellow color.

3.2 Serial Port Connector

Serial Port uses a Male DB9 connector and it includes RS-232, RS-422 or RS-485 signal and pin assignments are described as follow:

Pin No.	RS-232	RS-422	RS-485
1	DCD*	TXD-	-
2	RXD	TXD+	-
3	TXD	RXD+	DATA+
4	DTR*	RXD-	DATA-
5	GND	GND	GND
6	DSR*	-	-
7	RTS	-	-
8	CTS	-	-
9	-	-	-



3.3 LED Status

The LED provides the NIO31 operation information. The LED status is described as follow:

- **Power LED:** Power LED keeps ON if power (+9VDC to +40VDC) is correctly input to NIO31.
- **Ready LED:** Ready LED keeps ON when NIO31 firmware is ready for operation.
- **Link/Act LED:** Link and Activity LED will turn ON when the Ethernet cable is connected. When there is network data traffic, this LED will flash.
- **RX/TX LED:** The RX/TX LED is a dual color LED that indicates the serial data traffic. The Yellow LED stands for receiving data and Green LED means transmitting data.

3.4 Factory Default Settings

IP Address: 192.168.2.127

Netmask: 255.255.255.0

Serial Port: RS-232

Baud rate: 115200

Data: No parity, 8 bits, 1 stop bit

Flow control: None

Serial Console port: RS-232

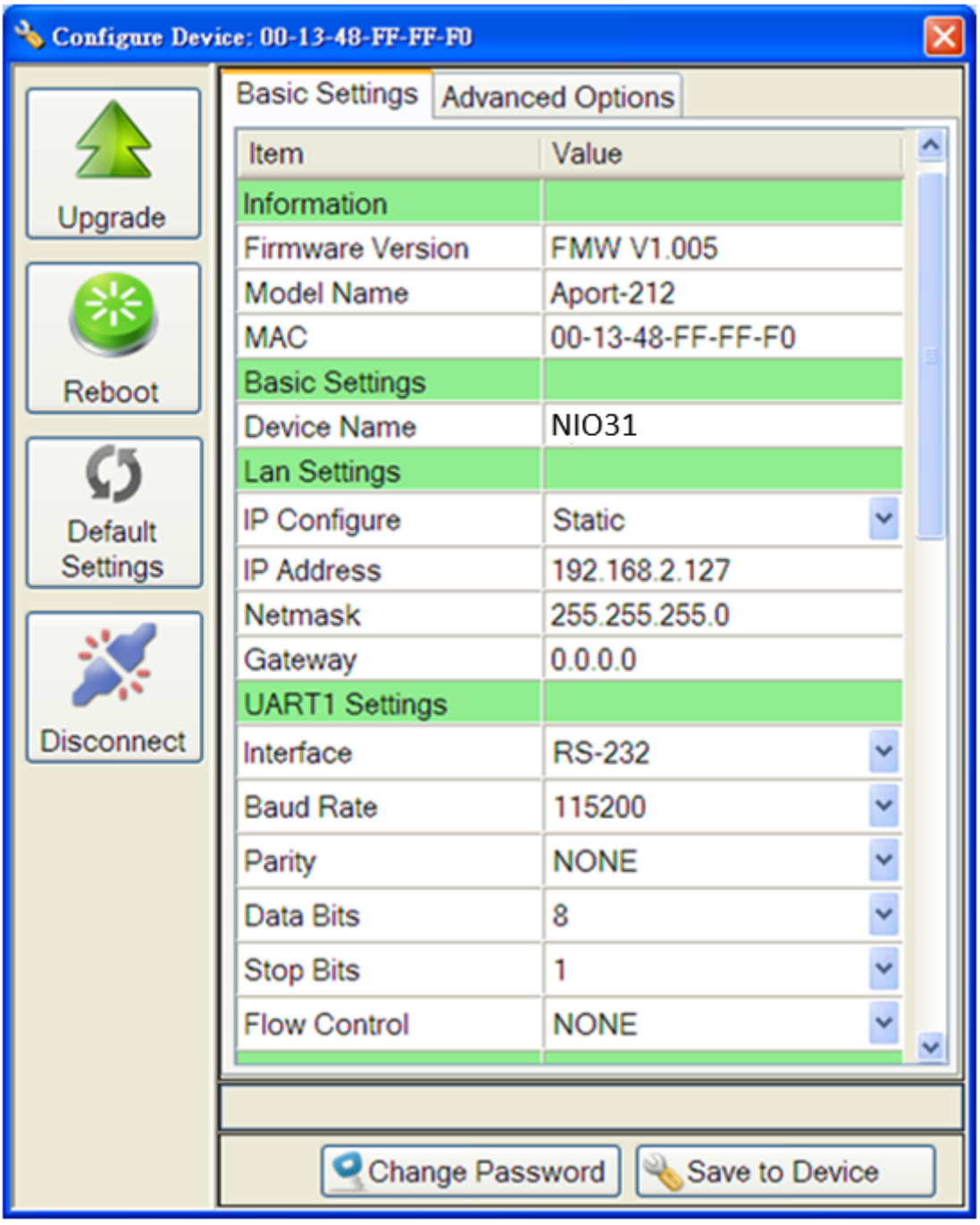
Baud rate: 115200

Data: No parity, 8 bits, 1 stop bit

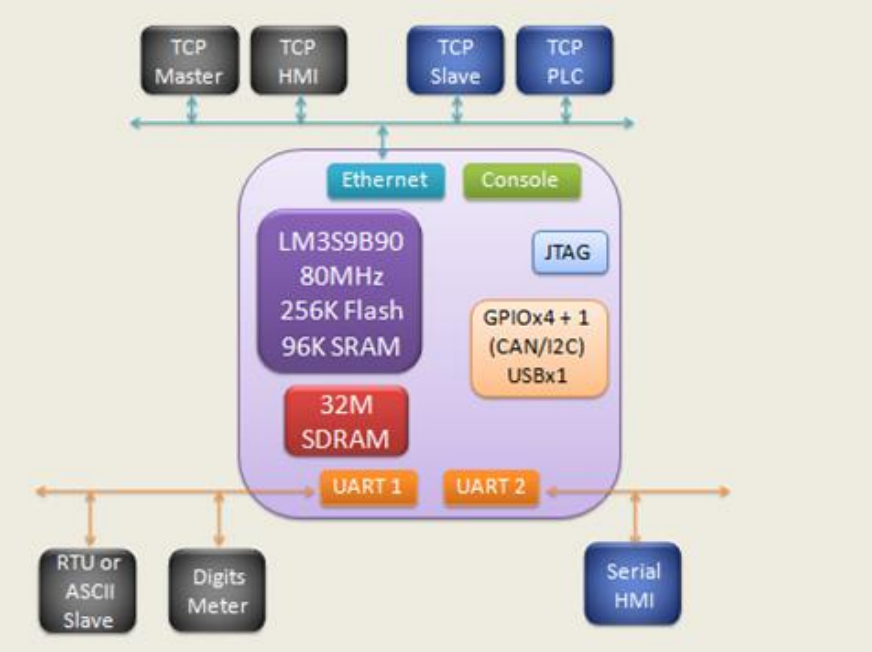
Flow control: None

Web console: http://192.168.2.127:5003

Telnet console: telnet 192.168.2.127 5001



4. Modbus Gateway Operation



Modbus gateway acts as a communication interpreter between Modbus TCP and Modbus RTU/ASCII. When Ethernet is connected to a Master device such as a Human Machine Interface (HMI), the serial port will be configured as a Slave RTU/ASCII to connect to Modbus slave device such as digital meter. On the contrary, if Ethernet is connected to a Slave device such as PLC, then serial port should be configured as a Mater RTU/ASCII.

4.1 Slave RTU / ASCII Mode

When Modbus Masters are Ethernet devices, up to 16 Master devices can access the same serial port to communicate with the serial Slave devices. Maximum 64 Master TCP request can be buffered and Unit ID (UID), which is used to address the serial device, can tell NIO31 which serial port to send the command. In figure slave RTU shown as follow data with UID 1 to 123 will go to port 1 and 124 to 247 will use port 2.

Sometimes, it is difficult to use UID as the device address, you can use address offset to provide the flexibility. If the address offset is applied, Slave address=UID+ address offset.

4.2 Response Time Out

Time out setting is used to check if the slave responses to the NIO31's Modbus command in time. In the case of time out, NIO31 will discard the request of Modbus TCP command and issue a TCP exception if it is enabled.

4.3 TCP Exception

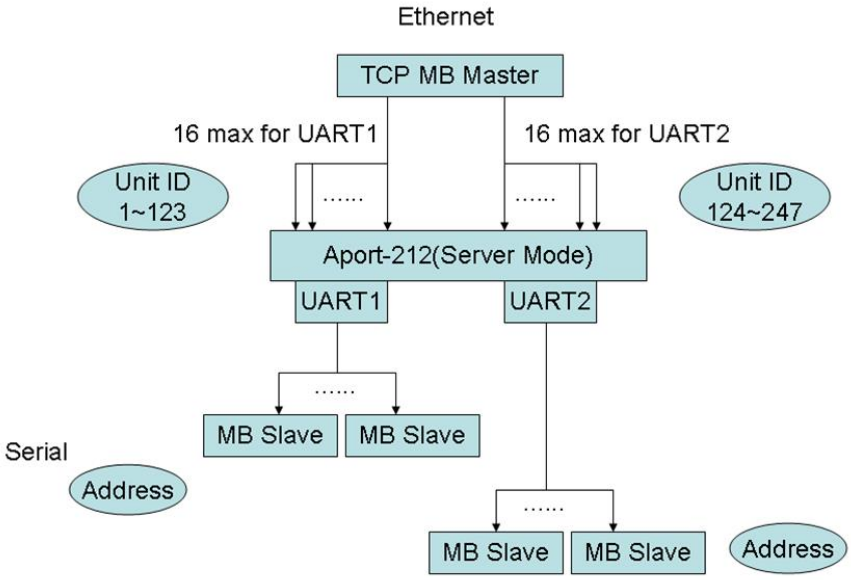
The function allows NIO31 to send the exception code to remote TCP devices. Currently two exception code is supported:

Exception code: 0x0A

1. Unknown UID
2. TCP request overflow

Exception code: 0x0B

1. Serial slave device time out



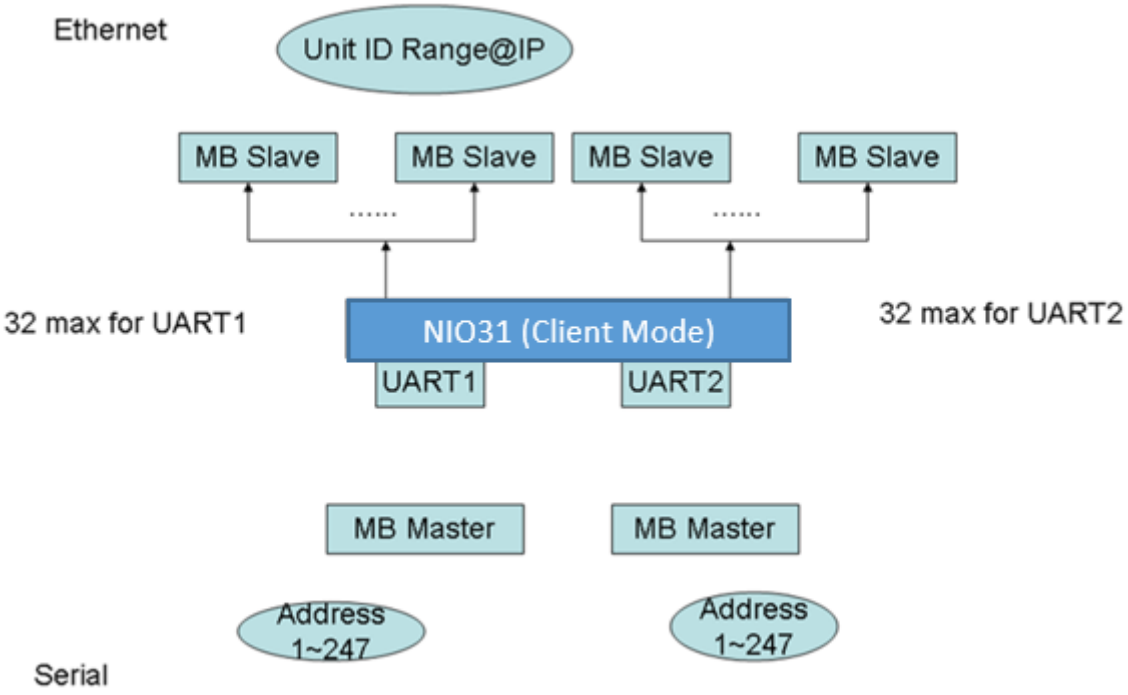
Slave RTU/ASCII Block Diagram

4.4 Master RTU / ASCII Mode

When Modbus Master are serial devices, up to 32 TCP slave devices can be accessed by a serial Modbus Master. NIO31 uses UID to decide the IP address and port of the TCP slave device to connect to. Except function is also available to serial Master when there is unknown TCP slave or connection is not established.

Exception code: 0x0A

1. Unknown address of TCP slave
2. TCP slave is not connected



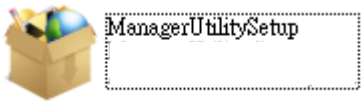
Master RTU/ASCII block diagram

4.5 S2E Gateway

NIO31 also supports Serial to Ethernet conversion when you select S2E mode. In the S2E mode, data is transferred to and from serial to Ethernet interface without any data conversion. Therefore NIO31 provides a transparent data tunnel between serial device to Ethernet device. NIO31 supports both TCP server and TCP client mode. In TCP server mode, NIO31 waits for TCP client device to initialize the connection. On the other hand in TCP client mode, NIO31 starts connection to the other TCP server.

5. Install Manager Utility Software

You can find many useful software utilities. You need to install Manager Utility first in order to configure the NIO31. To install the Manager Utility, please find the ManagerUtilitysetup.exe as shown following.



5.1 Broadcast Search

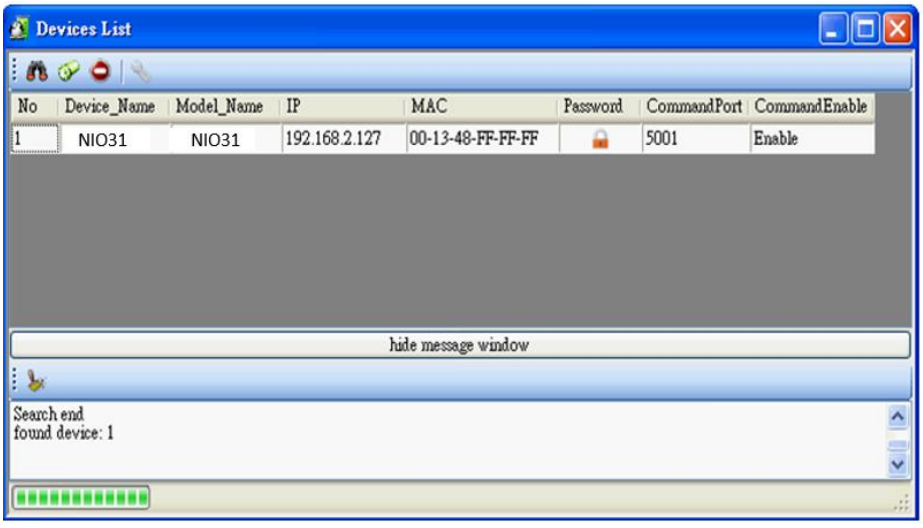
Once start Manager utility, you can click telescope icon to search the NIO31 in the network.

5.2 Configure NIO31

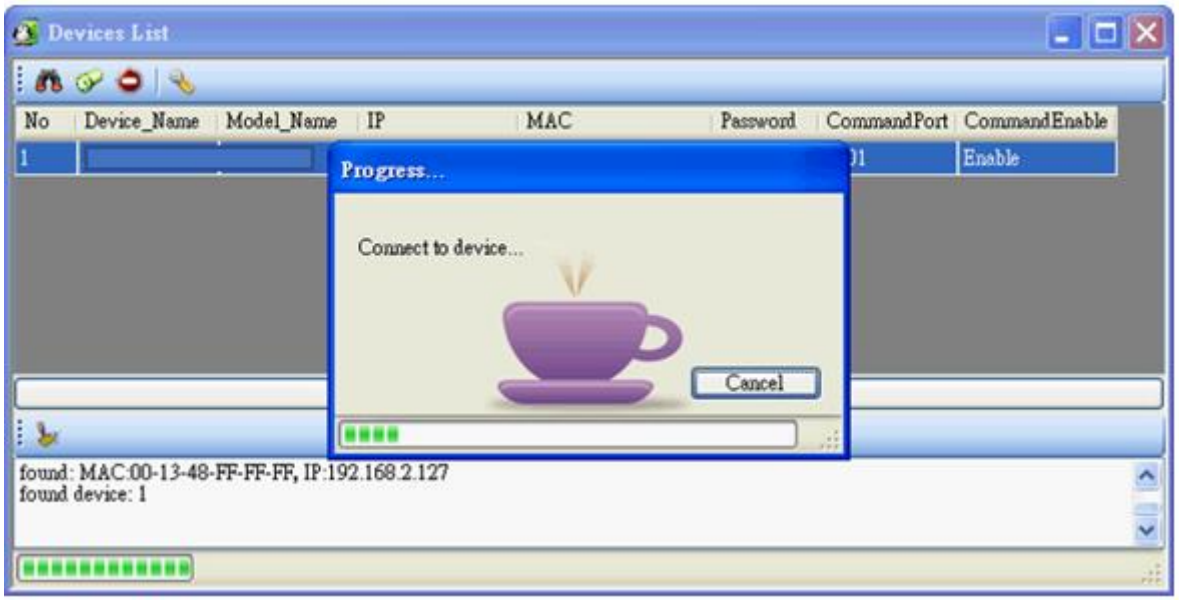
Once NIO31 is discovered, Manager will show following information.

Password: password is enabled. (default setting is disabled)

CommandEnable: Telnet command port is enabled.

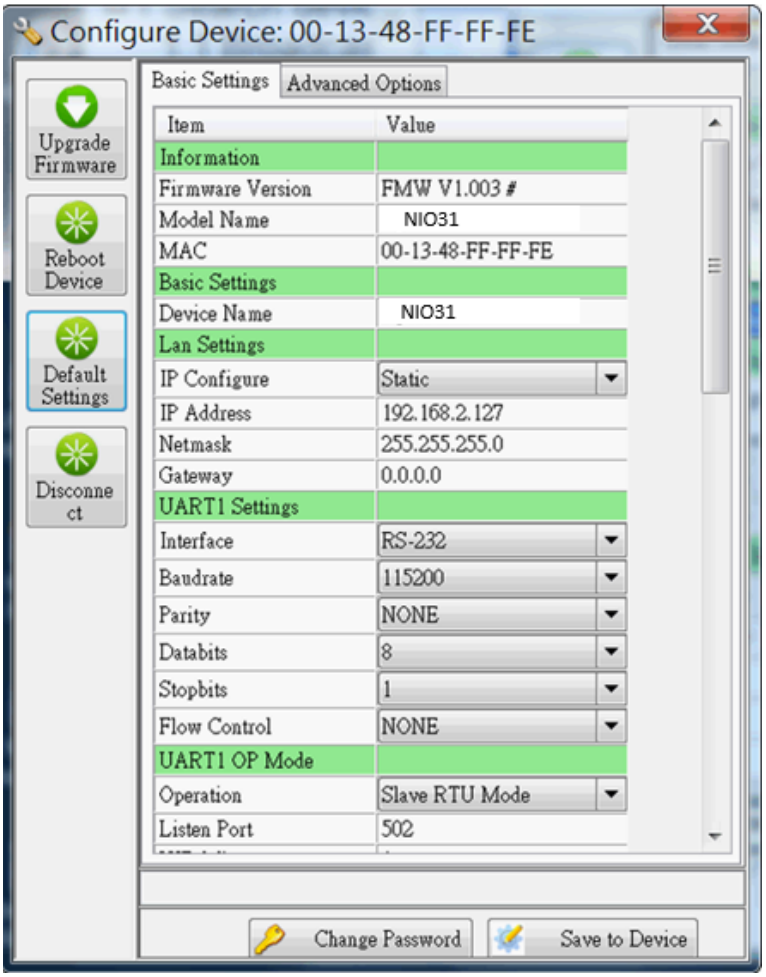


Double click the NIO31 to configure, you will see following screen.



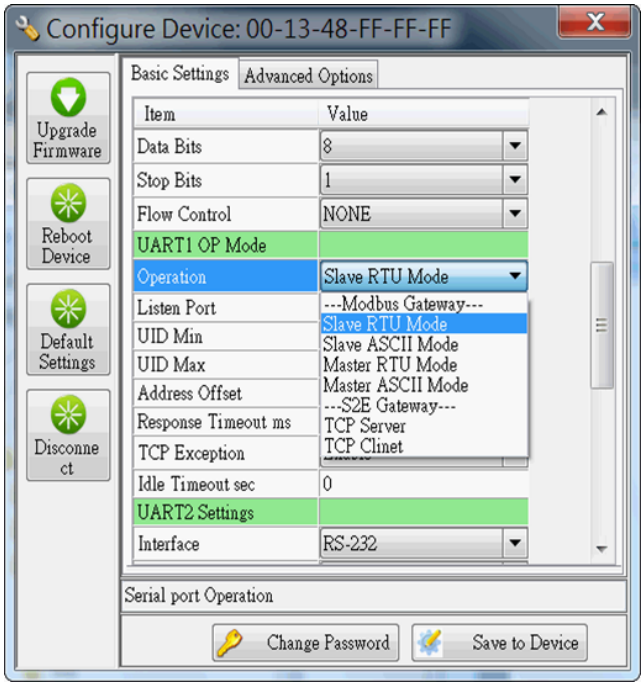
5.3 Basic Setting

Basic Setting is read only.



5.4 UART Operation Mode

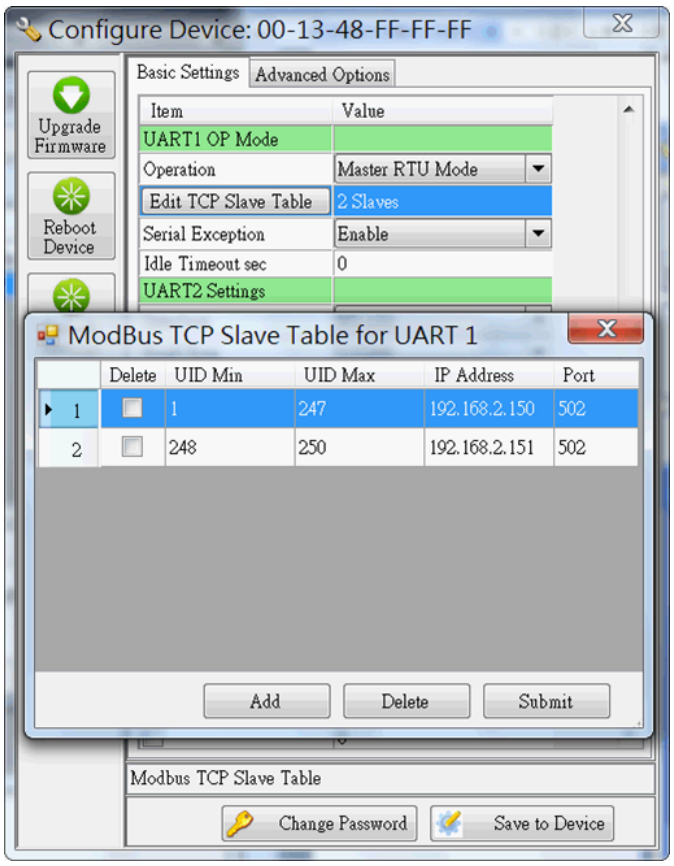
To configure NIO31 operation mode, please scroll down the screen to the UART operation mode section. UART1 refers to the port1.



5.5 Slave RTU or ASCII Mode

- **UID Min~Max:** The UID range that data to direct to this serial port.
- **Address offset:** The option allow Slave address to be Slave address=UID+Address offset.
- **Response timeout:** the timeout setting allows NIO31 to discard corresponding TCP request if the serial device does not response to the Modbus command in time.
- **TCP Exception:** Enable or disable the TCP exception function.
- **Idle Timeout:** Allow NIO31 to disconnect the TCP section if there is no data traffic and timeout.

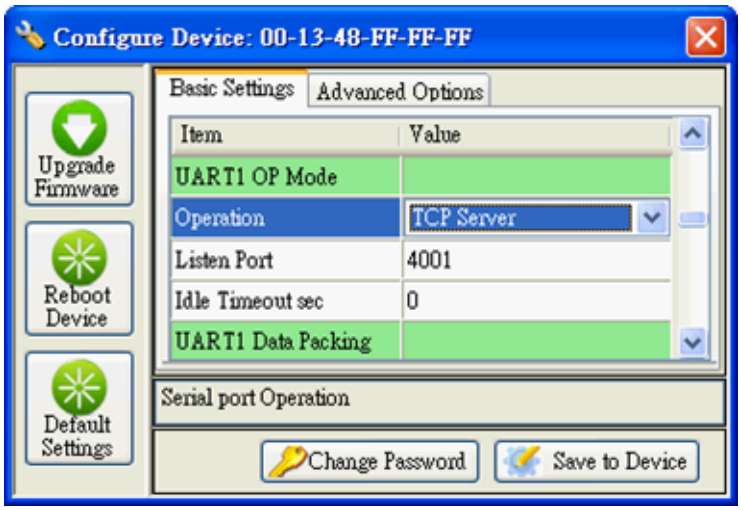
5.6 Master RTU or ASCII Mode



- Edit the TCP Slave Table as UID range and IP address mapping.
- **Serial exception:** Enable or disable serial exception.
- **Idle Timeout:** Allow NIO31 to disconnect the TCP section if there is no data traffic and timeout.

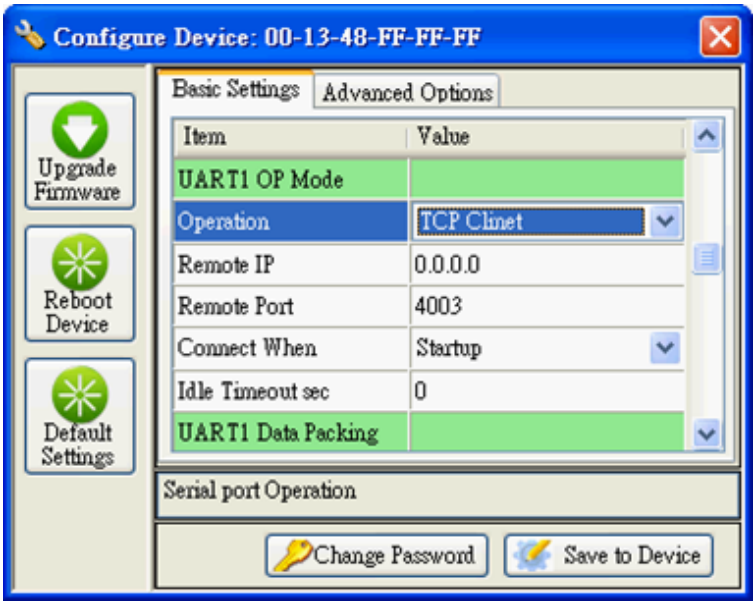
5.7 TCP Server Mode

When you use TCP server mode, you can select Listen port and Idle Timeout as followed.



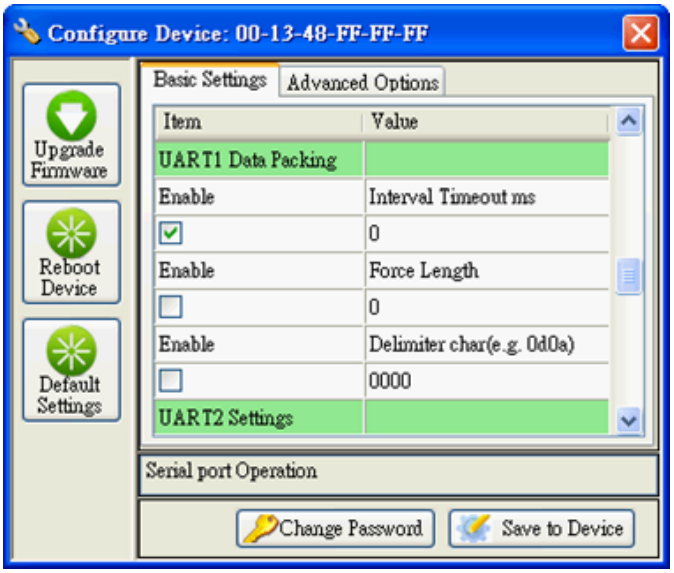
5.8 TCP Client Mode

When you use TCP client mode, you can select Remote IP, Port, when to connect and Idle Timeout as followed.



5.9 UART Data Packing

When choosing TCP server or TCP client mode, you can decide how to pack your serial data before sending them to TCP port. You can pack the data with time i.e. Interval Timeout, with data length, or with delimiter character such as carriage return.



- **Force Length:** Pack the length of serial data before forwarding data to Ethernet port.
- **Interval Timeout:** the period of time to forward data to Ethernet Port.
- **Delimiter Character:** Wait for the Delimiter Character before forwarding data to Ethernet port. The Delimiters are maximum two bytes Hex format ASCII code. If you use Carriage Return (CR)

and Line Feed (LF) as delimiters, you can specify 0D0A or 0d0a.

5.10 Advanced Options

Advanced options is used to select following settings.

5.11 Web Server Settings

- **Enable**: Enable and Disable Web server.
- **Listen Port**: Web server port number (default web server is 80, if you use port 6060, you can add port number at the end of the IP such as **http: //192.168.2.127:6060.**
- **Idle Time**: Disconnect when no traffic and timeout.
- **Alive Timeout**: Send an **ack** package when timeout. If no response, disconnect the section.

5.12 TCP Command Settings

- **Enable:** Enable or disable TCP Command port.
- **Listen Port:** Port number.
- **Idle time:** same as Web server settings.
- **Alive timeout:** same as Web server settings**.**

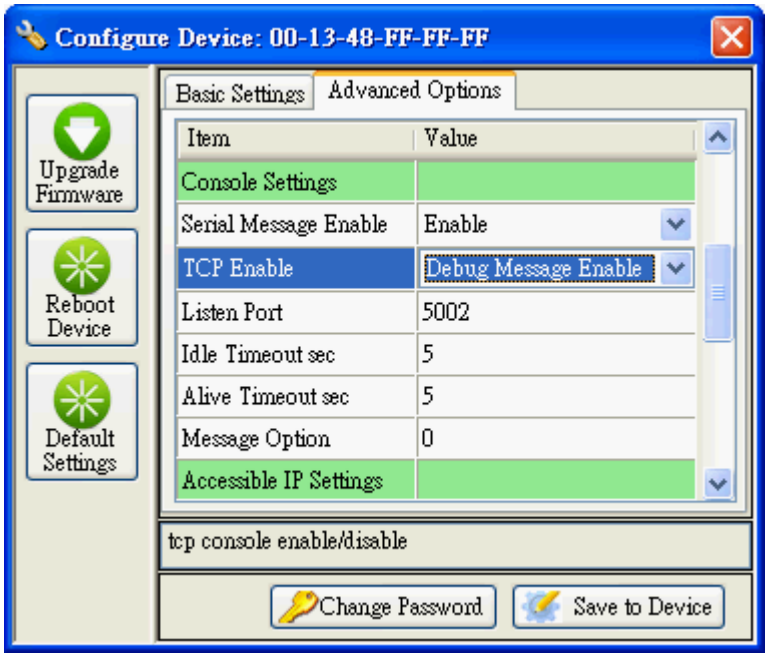
Please refer to the Appendix A for the Command set.

5.13 Serial Console and Debug Port Settings

- **Serial Message Enable**: Enable serial console command only or enable console and debug message.
- **TCP Enable**: Enable TCP console command only or enable console and debug message.

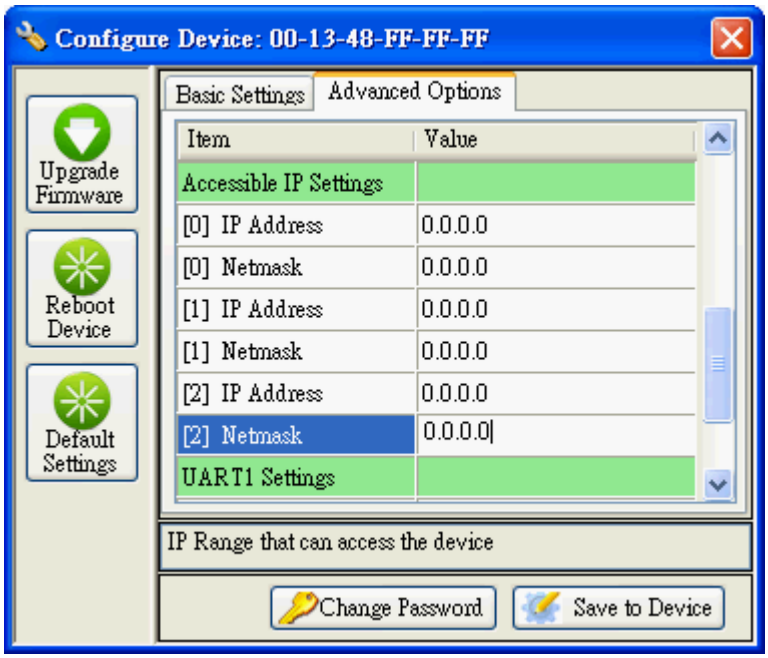
- **Listen port:** Debug port number.
- **Idle time**: same as Web server settings.
- **Alive timeout**: same as Web server settings.
- **Message Option**: Debug message option.

Please refer to the Appendix A for the Command set.



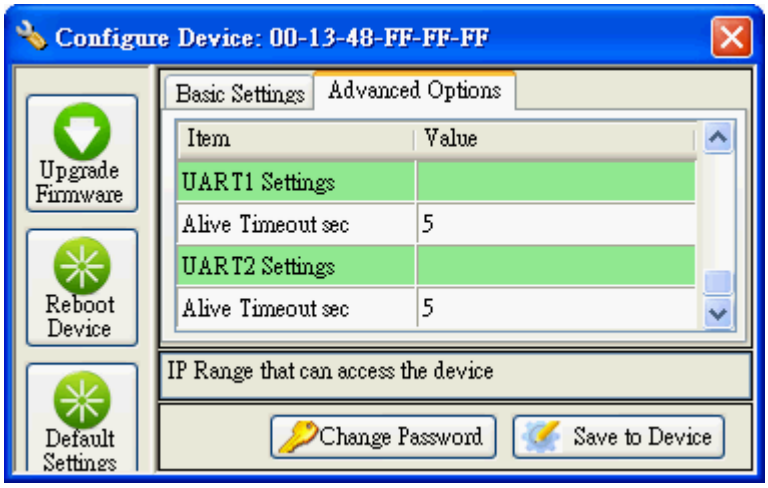
5.14 Accessible IP Settings

You can limit the user IP to access NIO31 by the Accessible IP settings. NIO31 will check if the remote IP comes from the allowed IP address. If not, it will deny the connection. 0.0.0.0 stands for no restriction in access.



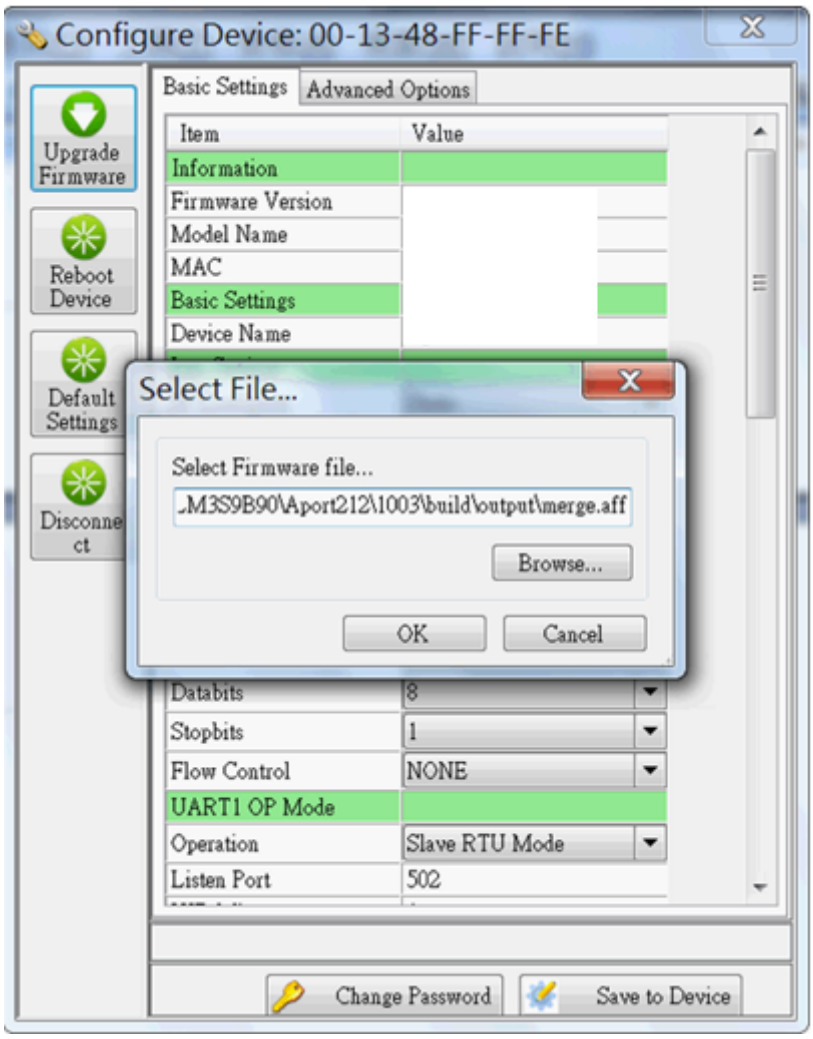
5.15 Alive Check Timeout

This setting allows user to configure the Alive Timeout settings for UART1 and UART2.

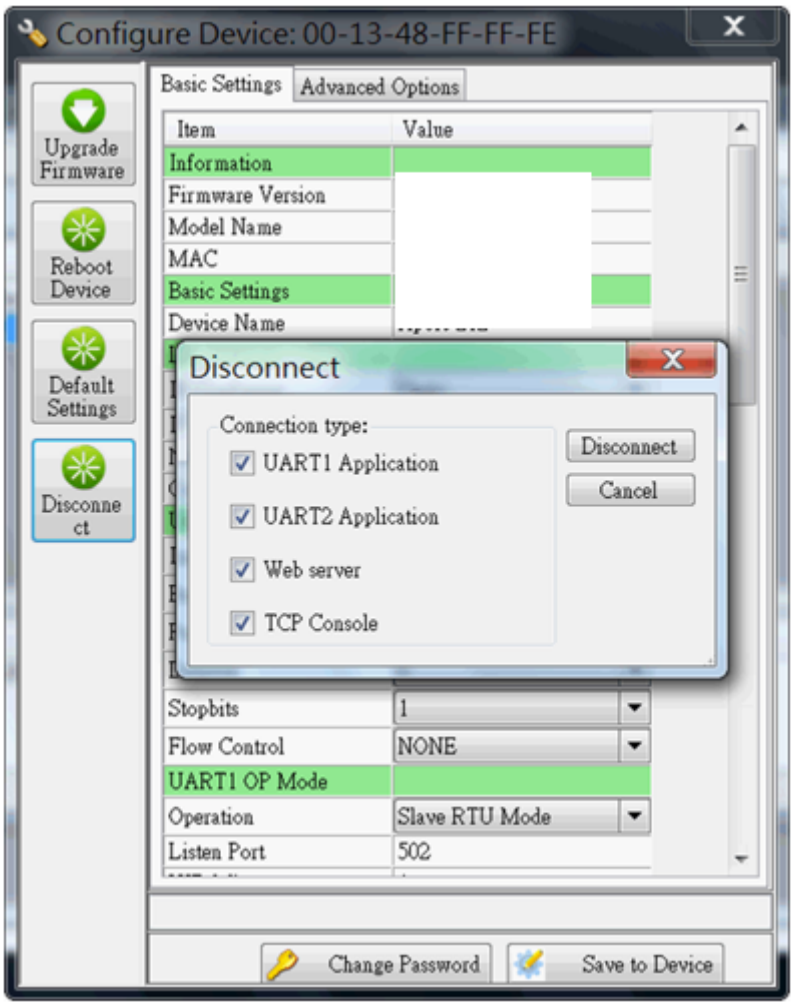


5.16 Quick Command Button

- **Upgrade Firmware:** Use this button to upgrade NIO31 firmware if necessary.



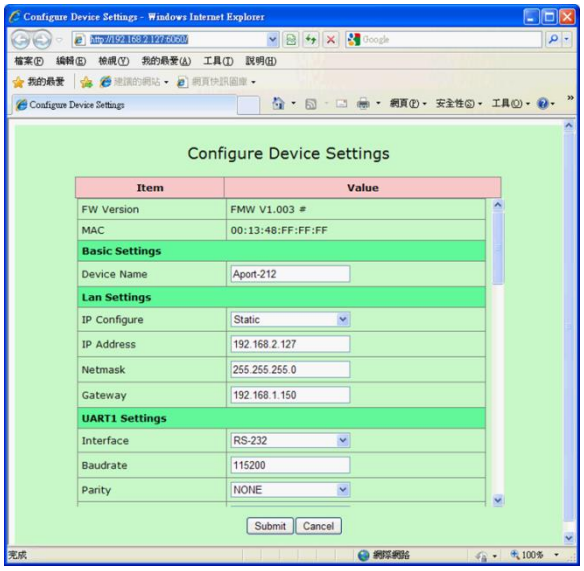
- **Reboot device:** This button will force remote NIO31 reboot.
- **Default settings**: This button will load the factory default settings to NIO31.
- **Disconnect**: This button can use to stop the serial UART operation, TCP console or Web Console.



5.17 Web Console

Web console allows user to use web browser to configure NIO31. To open the web console, enter the IP address and port number as **http://192.168.2.127:5003.**

User can use Web browser to configure the Basic setting of NIO31.



5.18 Login with Password

If password is enabled, you need to use:

User: admin

Password: (your password) to start the web console

5.19 Command Line Interface

NIO31 supports Command Line Interface (CLI) configuration. Users can use CLI in Telnet console port and serial console to write their own manager utility software. Make sure the Command option is Enable in TCP Command Setting and Serial Console setting.

The Command format is:

[G/S]:Command=Parameter{carriage return}

For example:

G:ip_ip=

Will get the ip address

A;ip_ip=192.168.2.127

All command are terminated by a carriage return (0x0d).

```
G:ip_ip=
A:ip_ip=192.168.2.127
G:txt_dn=
A:txt_dn=Aport-212
```

Remember to save and reboot the NIO31 by command

S;save=1 & reboot=1

Please refer to Appendix A for the Command list.