

EMBUX Technology Co., Ltd.

**Industrial Mesh Wi-Fi Serial/Ethernet
Device Gateway
NIO 51
User Manual**

EMBUX Technology Co., Ltd.

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CONTENTS

Preface	1
Copyright	1
Disclaimer	1
Acknowledgements	1
Regulatory Compliance Statements.....	1
Declaration of Conformity.....	2
Safety Information	5
Installation Recommendations.....	5
Safety Precautions.....	6
Technical Support and Assistance	7
Conventions Used in this Manual	8
Chapter 1: Product Overview.....	9
1.1 Introduction.....	9
1.2 Panel Layout	11
1.2.1 NIO 51 Top Panel View	11
1.2.2 NIO 51 Dimension	12
1.3 LED Indicators.....	13
1.4 Reset Button	13
1.5 Package Contents	14
1.6 Power and Serial Port Pin Assignment	15
Chapter 2: System Configuration	16
2.1 Quickly Access NIO 51 with Web Browser	16
2.2 Status	19
2.2.1 Status.....	19
2.2.2 Overview.....	20
2.2.2.1 System.....	20
2.2.2.2 Memory.....	21
2.2.2.3 Network	21
2.2.2.4 DHCP Leases.....	22
2.2.2.5 DHCPv6 Leases	22

2.2.2.6	Wireless.....	23
2.2.2.7	Associated Stations.....	23
2.2.3	Firewall	24
2.2.4	Routes.....	25
2.2.4.1	ARP	25
2.2.4.2	Active IPv4-Routes	25
2.2.4.3	Active IPv6-Routes	26
2.2.4.4	IPv6 Neighbors.....	26
2.2.5	System Log.....	27
2.2.6	Kernel Log.....	28
2.2.7	Processes.....	29
2.2.8	Real-time Graphic.....	29
2.2.8.1	Load	30
2.2.8.2	Traffic	31
2.2.8.3	Wireless.....	32
2.2.8.4	Connections	33
2.3	System.....	34
2.3.1	System	35
2.3.1.1	General Settings	35
2.3.1.2	Logging.....	37
2.3.1.3	Language and Style	37
2.3.2	Administration	38
2.3.2.1	Router Password.....	38
2.3.2.2	SSH Access	38
2.3.3	SNMP.....	39
2.3.4	Backup/Flash Firmware	40
2.3.4.1	Upgrade Firmware	40
2.3.4.2	Backup Configuration	42
2.3.4.3	Reset to default	43
2.3.7	Reboot.....	43
2.4	Network	44
2.4.1	Interfaces	44
2.4.1.1	Change Default IP Address.....	44
2.4.1.2	Interfaces Overview	45
2.4.1.3	LAN Interface Overview	46
2.4.1.4	DHCP Server	48
2.4.2	WiFi	49

2.4.2.1 Wireless Overview.....	49
2.4.2.2 Associated Stations.....	50
2.4.2.3 Wireless Configuration	50
2.4.3 DHCP and DNS.....	55
2.4.4 Hostnames	59
2.4.5 Static Routes	60
2.4.6 RSTP.....	62
2.4.7 Firewall	63
2.4.8 Diagnostics.....	67
2.5 MQTT and Modbus Setting	68
2.5.1 Serial.....	68
2.5.2 MQTT.....	69
2.5.3 Modbus and MQTT Publish/Subscribe	72
2.5.4 Modbus Log.....	74
Chapter 3: Product Specification.....	75
Chapter 4: Configuration Example	78
4.1 How to Configure 5G Mesh.....	78
4.2 How to Configure Client Router.....	79
4.3 How to Run Firmware Upgrade.....	86
4.4 How to Restore to Default Settings	87
Appendix	88
Wi-Fi and 3G/4G Redundant Function.....	88

PREFACE

This manual is for WLAN service providers or network administrators to set up a network environment using the NIO 51 product line.

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Acknowledgements

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Regulatory Compliance Statements

This section provides the FCC compliance statement for Class B devices and describes how to keep the system CE compliant.

Declaration of Conformity

Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

IMPORTANT NOTE:**Radiation Exposure Statement:**

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Country Code selection feature to be disabled for products marketed to the US/CANADA.

Operation of this device is restricted to indoor use only.

This device is intended only for OEM integrators under the following conditions:

The antenna must be installed such that 20 cm is maintained between the antenna and users.

The transmitter module may not be co-located with any other transmitter or antenna.

For all products market in US, OEM has to limit the operation channels in CH1 to CH11 for 2.4G band by supplied firmware programming tool. OEM shall not supply any tool or info to the end-user regarding to Regulatory Domain change.

As long as 3 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

IMPORTANT NOTE

In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users.

Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as shown in this manual.

CE

The product(s) described in this manual complies with all applicable European Union (CE) directives if it has a CE marking. For computer systems to remain CE compliant, only CE-compliant parts may be used. Maintaining CE compliance also requires proper cable and cabling techniques.

Safety Information

Before installing and using the device, note the following precautions:

- Read all instructions carefully.
- Do not place the unit on an unstable surface, cart, or stand.
- Follow all warnings and cautions in this manual.
- When replacing parts, ensure that your service technician uses parts specified by the manufacturer.
- Avoid using the system near water, in direct sunlight, or near a heating device.

Installation Recommendations

Ensure you have a stable, clean working environment. Dust and dirt can get into components and cause a malfunction. Use containers to keep small components separated.

Adequate lighting and proper tools can prevent you from accidentally damaging the internal components. Most of the procedures that follow require only a few simple tools, including the following:

- A Philips screwdriver
- A flat-tipped screwdriver
- A grounding strap
- An anti-static pad

Using your fingers can disconnect most of the connections. It is recommended that you do not use needle-nose pliers to disconnect connections as these can damage the soft metal or plastic parts of the connectors.

Safety Precautions

1. Read these safety instructions carefully.
2. Keep this User Manual for later reference.
3. Disconnect this equipment from any AC outlet before cleaning. Use a damp cloth. Do not use liquid or spray detergents for cleaning.
4. For plug-in equipment, the power outlet socket must be located near the equipment and must be easily accessible.
5. Keep this equipment away from humidity.
6. Put this equipment on a stable surface during installation. Dropping it or letting it fall may cause damage.
7. The openings on the enclosure are for air convection to protect the equipment from overheating. DO NOT COVER THE OPENINGS.
8. Make sure the voltage of the power source is correct before connecting the equipment to the power outlet.
9. Place the power cord in a way so that people will not step on it. Do not place anything on top of the power cord. Use a power cord that has been approved for use with the product and that it matches the voltage and current marked on the product's electrical range label. The voltage and current rating of the cord must be greater than the voltage and current rating marked on the product.
10. All cautions and warnings on the equipment should be noted.
11. If the equipment is not used for a long time, disconnect it from the power source to avoid damage by transient overvoltage.
12. Never pour any liquid into an opening. This may cause fire or electrical shock.
13. Never open the equipment. For safety reasons, the equipment should be opened only by qualified service personnel.
14. If one of the following situations arises, get the equipment checked by service personnel:
 - a. The power cord or plug is damaged.
 - b. Liquid has penetrated into the equipment.
 - c. The equipment has been exposed to moisture.
 - d. The equipment does not work well, or you cannot get it to work according to the user's manual.
 - e. The equipment has been dropped and damaged.
 - f. The equipment has obvious signs of breakage.
15. Do not place heavy objects on the equipment.
16. CAUTION: DANGER OF EXPLOSION IF BATTERY IS INCORRECTLY REPLACED. REPLACE ONLY WITH THE SAME OR EQUIVALENT TYPE RECOMMENDED BY THE MANUFACTURER. DISCARD USED BATTERIES ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS.

Technical Support and Assistance

1. For the most updated information of EMBUX products, visit EMBUX's website at www.embux.com.
2. For technical issues that require contacting our technical support team or sales representative, please have the following information ready before calling:
 - Product name and serial number
 - Detailed information of the peripheral devices
 - Detailed information of the installed software (operating system, version, application software, etc.)
 - A complete description of the problem
 - The exact wordings of the error messages

Warnings

Read and adhere to all warnings, cautions, and notices in this guide and the documentation supplied with the chassis, power supply, and accessory modules. If the instructions for the chassis and power supply are inconsistent with these instructions or the instructions for accessory modules, contact the supplier to find out how you can ensure that your computer meets safety and regulatory requirements.

1. Handling the unit: carry the unit with both hands and handle it with care.
2. Opening the enclosure: disconnect power before working on the unit to prevent electrical shocks.
3. Maintenance: to keep the unit clean, use only approved cleaning products or clean with a dry cloth.

Cautions

Electrostatic discharge (ESD) can damage system components. Do the described procedures only at an ESD workstation.

If no such station is available, you can provide some ESD protection by wearing an antistatic wrist strap and attaching it to a metal part of the computer chassis.

Conventions Used in this Manual



Warning:

Information about certain situations, which if not observed, can cause personal injury. This will prevent injury to yourself when performing a task.



Caution:

Information to avoid damaging components or losing data.



Note:

Provides additional information to complete a task easily.

CHAPTER 1: PRODUCT OVERVIEW

1.1 Introduction

NIO 51 brings the wireless connectivity from serial devices or Ethernet devices perfectly to Wi-Fi Mesh in smart factories. Wi-Fi Mesh can be used for device to AP or mesh backbone between APs.

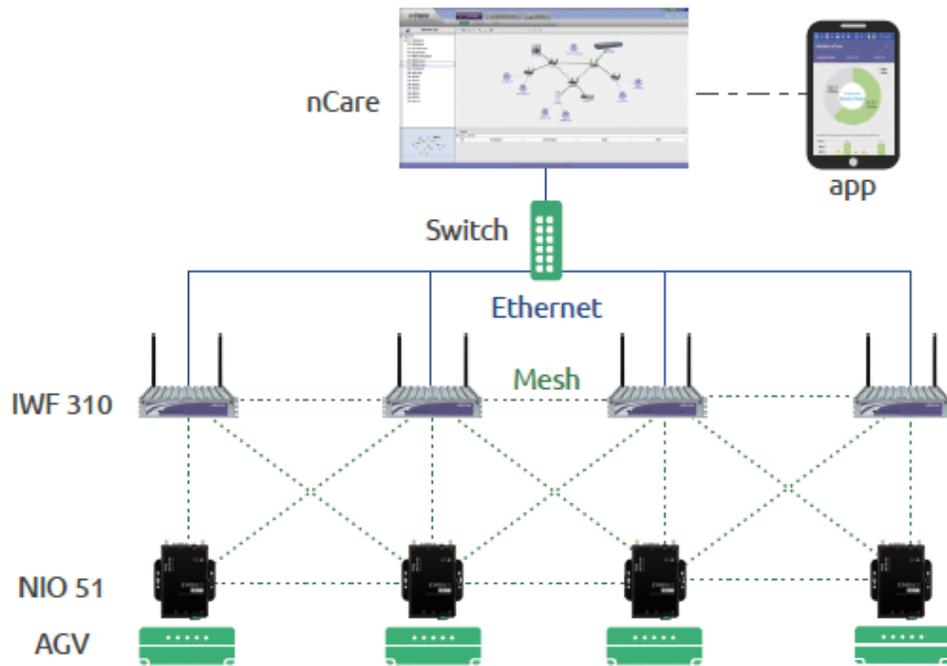
NIO 51 supports a variety of operation modes and high immunity to EMC high level protection, wide temperature and wide power range for harsh environment.

NIO 51 can also be managed and discovered by nCare I4.0 network manager. It's a very competitive solution against other device gateways in the market.

Key Features:

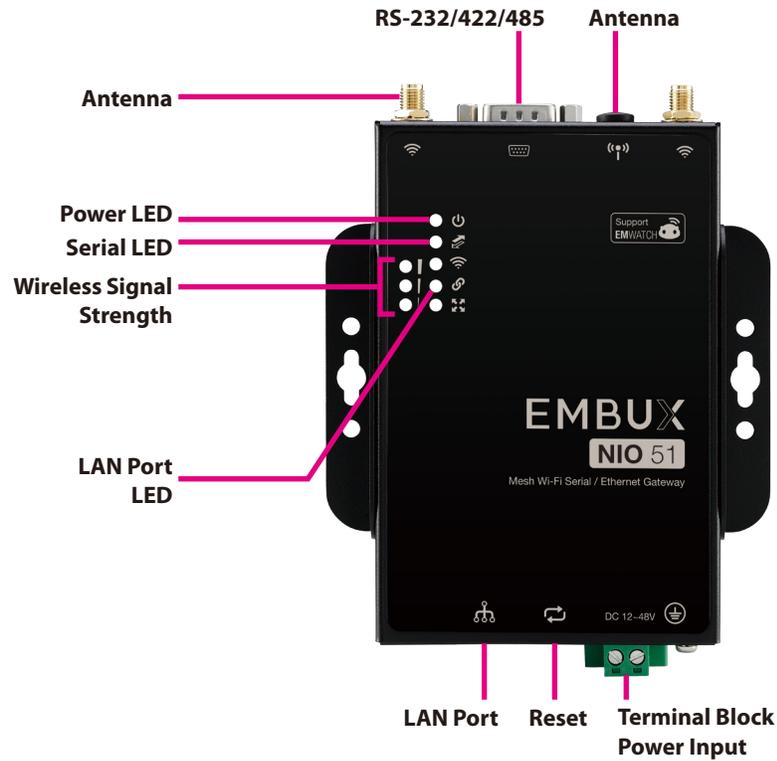
- ✓ IEEE 802.11a/b/g/n, 2X2 MIMO
- ✓ Dual band 2.4GHz/5GHz
- ✓ Support a variety of operation modes:
 - Serial to Wireless (Mesh or Client)
 - Serial to Ethernet
 - Ethernet to Wireless
- ✓ Support Modbus/TCP, Modbus/RTU
- ✓ Offline serial port buffer with 20 MB of storage
- ✓ High immunity to surge, ESD & EFT protection
(Surge: Level-3 / ESD, EFT : Level-4)
- ✓ Wide DC power range with 12 - 48V
- ✓ Wide operating temperature from -40°C to 70°C
- ✓ Remote Management by nCare

NIO 51 Mesh Application Scenarios



1.2 Panel Layout

1.2.1 NIO 51 Top Panel View



Icon Labels

	RS 232/422/485
	Antenna
	Power
	Serial Tx/Rx
	2.4/5GHz
	Link/Act
	Extension
	10/100M Ethernet
	Reset
	Earth GND



Note:

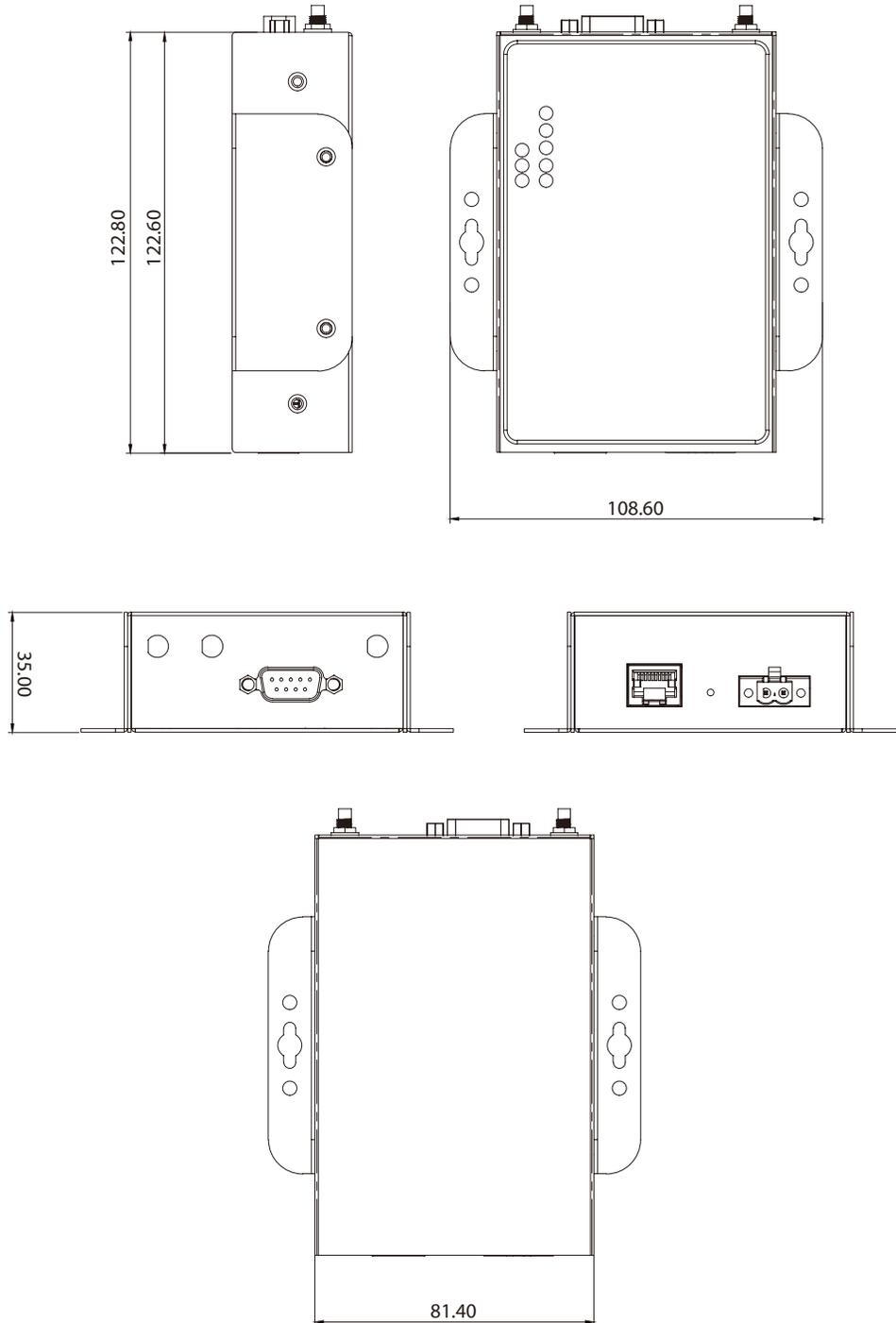
The recommended screw size is listed as below:

Length (minimal): 25 mm

Thread diameter (minimal): 4 mm

Screws of two.

1.2.2 NIO 51 Dimension



1.3 LED Indicators

Name	Color	Function
Power	Green Orange	Boot time is around 40 ~ 45s. LED color changes when booting up: Green (Steady on, 10s) ↓ Orange (Steady on, 30s) ↓ Green (Steady on, Ready)
Serial Tx/Rx	Green Red	Green: Tx, serial port to serial device. Red: Rx, serial device to serial port.
2.4/5 GHz	Green Blue	Green: 2.4 GHz Blue: 5 GHz
Link / Act	Green	Blinking: LAN port sending and receiving data.
Signal Strength (3 LEDs)	Green	1 Green LED: The signal strength is between 10% ~ 40%. 2 Green LEDs: The signal strength is between 40% ~ 70%. 3 Green LEDs: The signal strength is between 70% ~ 100%.

1.4 Reset Button

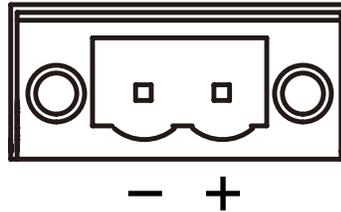
Name	Color	Function
Reboot	3 ~ 10s	LED Color Change: Green -> Orange -> Boot up
Reset to default	X > 10s	Green -> Orange (flash once) -> Green -> Orange -> Boot up

1.5 Package Contents

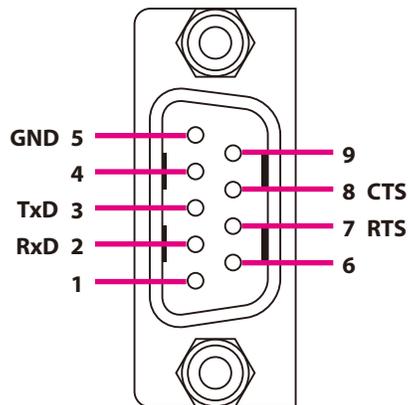
<p>NIO 51 unit x 1</p>	
<p>Dual band antenna x 2</p>	
<p>Wall-mount kit x 1 DIN-Rail kit x 1</p>	
<p>Terminal Block Connector x 1</p>	

1.6 Power and Serial Port Pin Assignment

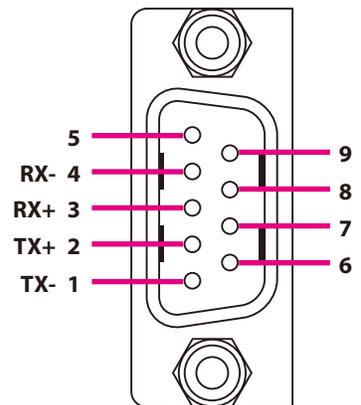
Terminal Block Power Input



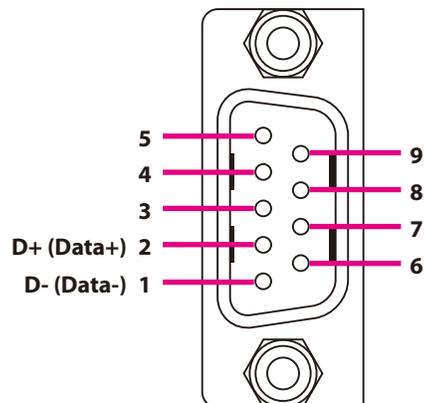
RS-232 Pin Assignment



RS-422 Pin Assignment



RS-485 Pin Assignment



CHAPTER 2: SYSTEM CONFIGURATION

2.1 Quickly Access NIO 51 with Web Browser

Login

To access the NIO 51 device, you can open a web browser to access the Web GUI via the default IP address **192.168.1.1**

The default administrator login settings are:

Login: **root**

Password: **admin**

The first page you would see is the login page like the below screenshot:



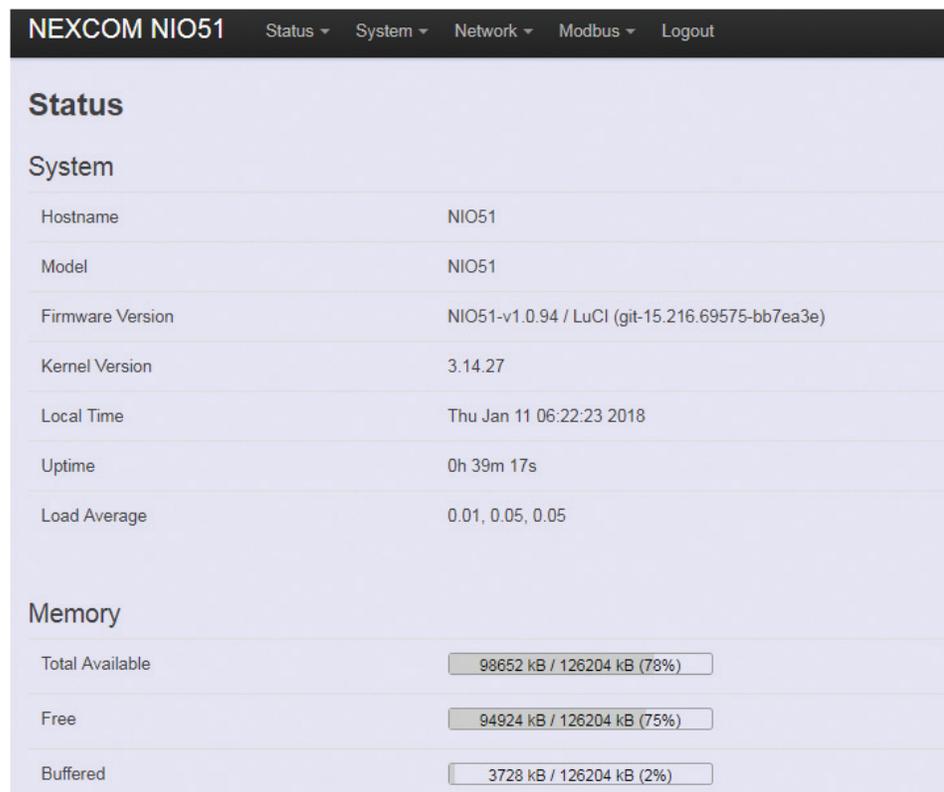
Authorization Required
Please enter your username and password.

Username

Password

Powered by LuCI (git-15.319.74171-1106b93) / IWF300 (US) v0.1.1

After successful login you will see the “Status” page of the web management interface with current information of System, Memory, Network, DHCP, Wireless, and Associated Stations. The device now is ready for configuration.



NEXCOM NIO51 Status System Network Modbus Logout

Status

System

Hostname	NIO51
Model	NIO51
Firmware Version	NIO51-v1.0.94 / LuCI (git-15.216.69575-bb7ea3e)
Kernel Version	3.14.27
Local Time	Thu Jan 11 06:22:23 2018
Uptime	0h 39m 17s
Load Average	0.01, 0.05, 0.05

Memory

Total Available	98652 kB / 126204 kB (78%)
Free	94924 kB / 126204 kB (75%)
Buffered	3728 kB / 126204 kB (2%)

Saving Changes

“Save & Apply” the configuration at the bottom of the Web GUI after you change the settings.



Unsaved Changes



“UNSAVED CHANGES” provides the information to see the parameters which were not saved and applied.



Click the “Save & Apply” button to save the parameters.

Auto Refresh

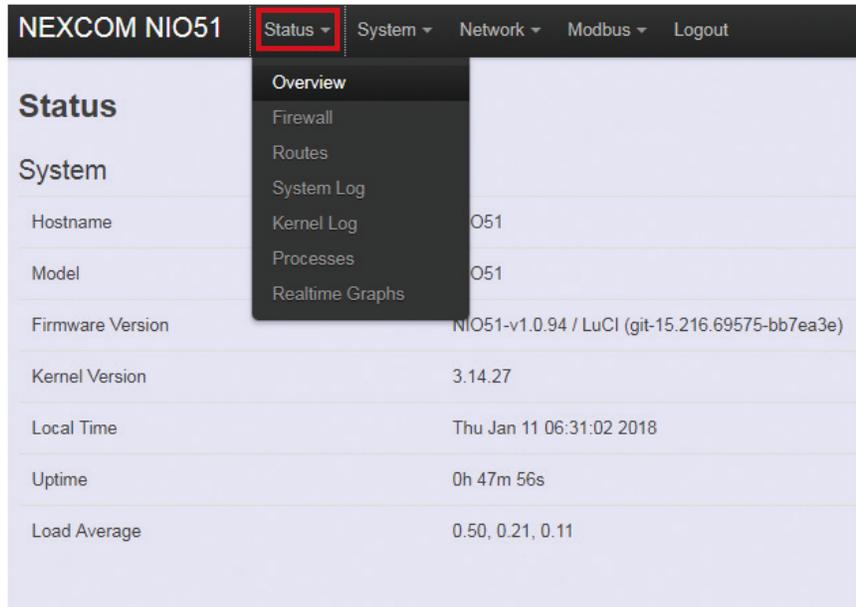


Click the “AUTO REFRESH” button to turn on/off the automatic Web GUI refresh function.

2.2 Status

2.2.1 Status

To display more detailed status, you can click the “Status” menu under the menu bar, then select the item of Overview, Firewall, Routes, System Log, Kernel Log, Process, and Real-time Graphs from the pull-down list like the below screen:



The screenshot shows the NEXCOM NIO51 web interface. The top navigation bar includes 'Status', 'System', 'Network', 'Modbus', and 'Logout'. The 'Status' menu is expanded, showing options: Overview, Firewall, Routes, System Log, Kernel Log, Processes, and Realtime Graphs. The main content area displays system information:

System	
Hostname	O51
Model	O51
Firmware Version	NIO51-v1.0.94 / LuCI (git-15.216.69575-bb7ea3e)
Kernel Version	3.14.27
Local Time	Thu Jan 11 06:31:02 2018
Uptime	0h 47m 56s
Load Average	0.50, 0.21, 0.11

2.2.2 Overview

To see the overall status of NIO 51, click “Overview” to display system information and the current settings of the NIO 51’s ports.

2.2.2.1 System

System	
Hostname	NIO51
Model	NIO51
Firmware Version	NIO51-v1.0.94 / LuCI (git-15.216.69575-bb7ea3e)
Kernel Version	3.14.27
Local Time	Thu Jan 11 06:31:53 2018
Uptime	0h 48m 46s
Load Average	0.80, 0.34, 0.16

Hostname:	Displays NIO 51 name.
Model:	Displays NIO 51 HW basic information.
Firmware Version:	Displays NIO 51 firmware version.
Kernel Version:	Displays NIO 51 current kernel version.
Local Time:	Displays NIO 51 current date and time.
Uptime:	Displays how long NIO 51 has been operating since last boot-up uptime.
Load Average:	CPU average loading. For example:

Load Average	0.94, 0.43, 0.24
--------------	------------------

CPU average loading: 94% in the past 1 minute.
43% in the past 5 minutes.
24% in the past 15 minutes.

2.2.2.2 Memory

Memory	
Total Available	101876 kB / 126316 kB (80%)
Free	99156 kB / 126316 kB (78%)
Buffered	2720 kB / 126316 kB (2%)

- Total Available:** Displays NIO 51 current available memory.
- Free:** Displays NIO 51 current free memory.
- Buffered:** Displays NIO 51 memory used for buffering.

2.2.2.3 Network

Network	
IPv4 WAN Status	 Type: dhcp Address: 10.15.1.138 Netmask: 255.255.255.0 Gateway: 10.15.1.254 DNS 1: 10.1.1.2 DNS 2: 10.1.1.6 DNS 3: 10.1.1.5 DNS 4: 10.1.1.1 DNS 5: 10.1.1.29 Connected: 7h 31m 37s
IPv6 WAN Status	 Not connected
Active Connections	38 / 16384 (0%)

- IPv4 WAN Status:** Displays current IPv4 connection information.
- IPv6 WAN Status:** Displays current IPv6 connection information.
- Active Connections:** Displays current active connections.

2.2.2.4 DHCP Leases

DHCP Leases			
Hostname	IPv4-Address	MAC-Address	Leasetime remaining
IM03-AndrewWang1	192.168.1.219	08:3e:8e:67:64:03	10h 25m 0s
IM03-JonesChen	192.168.1.215	9c:2a:70:1b:4c:9d	6h 1m 34s
?	192.168.1.142	94:a1:a2:87:6f:08	9h 22m 13s
NEXCOM-SQA	192.168.1.105	00:0d:f0:ac:c8:63	10h 34m 24s
River-Ubuntu	192.168.1.118	80:19:34:c9:04:00	6h 51m 48s

This displays information about hosts (personal computers or electronic devices) that are connected to NIO 51 including IPv4, MAC address and leasing time

2.2.2.5 DHCPv6 Leases

DHCPv6 Leases			
Hostname	IPv6-Address	DUID	Leasetime remaining
River-Ubuntu	fdfc:68c3:19eb::10b/128	0004767fcd07324b68cbab02958b2991f645	6h 51m 39s
NEXCOM-SQA	fdfc:68c3:19eb::3b0/128	000100011e1b93b70010f32db9b8	10h 34m 17s
IM03-JonesChen	fdfc:68c3:19eb::d25/128	000100011b2c6cb9206a8a9612c0	4h 14m 5s
NIFE-3600-SQA	fdfc:68c3:19eb::ed2/128	000100011e1c6e5e0010f32db9b8	5h 13m 27s

This displays information about hosts (personal computers or electronic devices) that are connected to NIO 51 including IPv6, DUID and leasing time.

2.2.2.6 Wireless

Wireless

Generic 802.11abgn Wireless Controller (radio0)

SSID: NIO51_11N_2G
Mode: Mesh
Channel: 11 (2.462 GHz)
Bitrate: ? Mbit/s
MAC: 00:10:F3:6E:E6:AA
Encryption: undefined

This displays wireless information about NIO 51.

SSID:	Displays the name of the wireless network.
Mode:	Displays the mode in this radio.
Channel:	Displays current channel used.
Bitrate:	Displays current wireless data rate.
MAC:	Displays MAC address of this radio.
Encryption:	Displays current encryption setting.

2.2.2.7 Associated Stations

Associated Stations

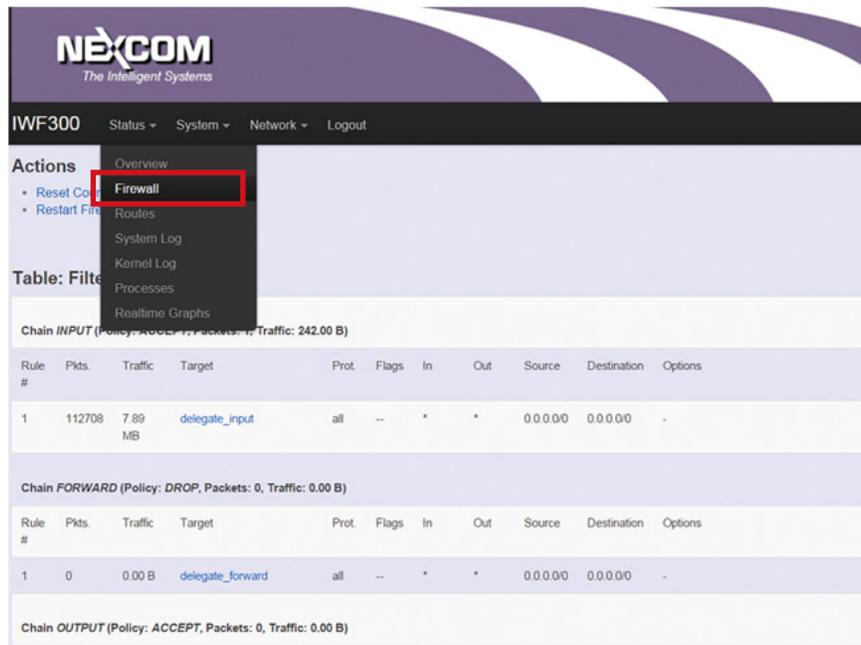
MAC-Address	Network	Signal	Noise	RX Rate	TX Rate
94:A1:A2:87:6F:08	Master "IWF300_11N_2G_PM"	-54 dBm	-95 dBm	54.0 Mbit/s, MCS 0, 20MHz	54.0 Mbit/s, MCS 0, 20MHz
80:19:34:C9:04:00	Master "IWF300_11N_2G_PM"	-61 dBm	-95 dBm	180.0 Mbit/s, MCS 12, 40MHz	150.0 Mbit/s, MCS 7, 40MHz
08:3E:8E:67:64:03	Master "IWF300_11N_2G_PM"	-70 dBm	-95 dBm	121.5 Mbit/s, MCS 6, 40MHz	108.0 Mbit/s, MCS 11, 40MHz
00:0D:F0:AC:C8:63	Master "IWF300_11N_2G_PM"	-73 dBm	-95 dBm	1.0 Mbit/s, MCS 0, 20MHz	26.0 Mbit/s, MCS 3, 20MHz

Displays current associated device information (personal computers or electronic devices) with NIO 51, including device's MAC address, signal level, noise and connecting data rate.

2.2.3 Firewall

Firewall setting is a particular function which allows user to connect or block two or more interfaces in device with sophisticated and specifically defined parameters in this Web page.

The settings in Firewall are suggested to keep it as factory default.



The screenshot shows the NEXCOM web interface for device IWF300. The 'Firewall' menu item is highlighted in red. The page displays three chains: INPUT, FORWARD, and OUTPUT, each with a table of rules.

Chain INPUT (Policy: ACCEPT, Packets: 1, Traffic: 242.00 B)

Rule #	Pkts.	Traffic	Target	Prot.	Flags	In	Out	Source	Destination	Options
1	112708	7.89 MB	delegate_input	all	--	*	*	0.0.0.0	0.0.0.0	-

Chain FORWARD (Policy: DROP, Packets: 0, Traffic: 0.00 B)

Rule #	Pkts.	Traffic	Target	Prot.	Flags	In	Out	Source	Destination	Options
1	0	0.00 B	delegate_forward	all	--	*	*	0.0.0.0	0.0.0.0	-

Chain OUTPUT (Policy: ACCEPT, Packets: 0, Traffic: 0.00 B)

2.2.4 Routes

This section displays information about routing list for current connected device.

2.2.4.1 ARP

ARP		
IPv4-Address	MAC-Address	Interface
192.168.1.105	00:0d:f0:ac:c8:63	br-lan
192.168.1.118	80:19:34:c9:04:00	br-lan
10.15.1.142	00:10:f3:50:99:c0	eth0.2
10.15.1.254	78:48:59:64:5b:44	eth0.2
192.168.1.142	94:a1:a2:87:6f:08	br-lan
192.168.1.110	c4:54:44:de:fe:a5	br-lan
192.168.1.206	94:a1:a2:87:6f:48	br-lan
192.168.1.219	08:3e:8e:67:64:03	br-lan
10.15.1.201	00:26:73:29:15:7c	eth0.2

Displays ARP information in NIO 51 including IPv4 address, MAC address and connecting interface.

2.2.4.2 Active IPv4-Routes

Active IPv4-Routes				
Network	Target	IPv4-Gateway	Metric	Table
wan	0.0.0.0/0	10.15.1.254	0	main
wan	10.15.1.0/24		0	main
lan	192.168.1.0/24		0	main

Displays active WAN and LAN port's IPv4 routing table.

2.2.4.3 Active IPv6-Routes

Active IPv6-Routes				
Network	Target	Source	Metric	Table
lan	fdcf:68c3:19eb:0:e5df:2aba:f91:5221		0	main
lan	fdcf:68c3:19eb::/64		1024	main
wan	ff02::1		0	local
wan	ff02::2		0	local
wan	ff02::c		0	local
wan	ff02::1:2		0	local
wan	ff02::1:3		0	local
wan	ff02::1:ff50:9e09		0	local
lan	ff00::/8		256	local
(eth0)	ff00::/8		256	local
wan	ff00::/8		256	local
lan	ff00::/8		256	local
lan	ff00::/8		256	local

Displays active IPv6 routing table of WAN and LAN port.

2.2.4.4 IPv6 Neighbors

IPv6 Neighbours		
IPv6-Address	MAC-Address	Interface
fdcf:68c3:19eb:0:1f4:f243:8e92:e881	80:19:34:c9:04:00	lan
fdcf:68c3:19eb:0:e5df:2aba:f91:5221	80:19:34:c9:04:00	lan
fdcf:68c3:19eb::3b0	00:0d:f0:ac:c8:63	lan
fdcf:68c3:19eb:0:21cf:78b5:a2c9:e438	00:0d:f0:ac:c8:63	lan
fdcf:68c3:19eb:0:b815:35d6:d6b7:df68	00:0d:f0:ac:c8:63	lan
fdcf:68c3:19eb:0:691a:9a70:b879:924d	80:19:34:c9:04:00	lan
fdcf:68c3:19eb:0:468:1e7:d4fe:8c9a	9c:2a:70:1b:4c:9d	lan
fdcf:68c3:19eb:0:f118:d10c:ab71:1676	80:19:34:c9:04:00	lan
fdcf:68c3:19eb:0:7c3e:bc4c:52e3:de5a	00:0d:f0:ac:c8:63	lan
fdcf:68c3:19eb:0:6046:1236:d6c8:82c1	00:0d:f0:ac:c8:63	lan
fdcf:68c3:19eb:0:c654:44ff:fede:fea5	c4:54:44:de:fe:a5	lan
fdcf:68c3:19eb:0:e151:5f16:e22f:fc7c	c4:54:44:de:fe:a5	lan
fdcf:68c3:19eb:0:61ad:92b6:99e2:bf9b	80:19:34:c9:04:00	lan

Displays connected device with IPv6 information.

2.2.5 System Log

IWF300
Status ▾ System ▾ Network ▾ Logout
UNSAVED CHANGES: 1

System Log

```

Mon Jan 4 08:59:27 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 08:59:27 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 09:00:12 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 09:00:12 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 09:00:37 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 09:00:37 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 09:01:03 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 09:01:03 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 09:01:28 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 09:01:28 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 09:02:13 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 09:02:13 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 09:02:38 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 09:02:38 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 09:03:04 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 09:03:04 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 09:03:29 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 09:03:29 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 09:03:49 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 09:03:49 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 09:04:14 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 09:04:14 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 09:04:21 2016 daemon.info hostapd: wlan0: STA 00:0d:f0:ac:c8:63 IEEE 802.11: disassociated
Mon Jan 4 09:04:39 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 09:04:39 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 09:05:04 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 09:05:04 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 09:05:29 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 09:05:29 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 09:05:50 2016 daemon.info dnsmasq-dhcp[1252]: DHCPINFORM(br-lan) 192.168.1.219 08:3e:8e:67:64:03
Mon Jan 4 09:05:50 2016 daemon.info dnsmasq-dhcp[1252]: DHCPACK(br-lan) 192.168.1.219 08:3e:8e:67:64:03 IM03-AndrewWang1
Mon Jan 4 09:05:55 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 09:05:55 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 09:06:15 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 09:06:15 2016 daemon.warn dnsmasq[1252]: possible DNS-rebind attack detected: ex01.nexcom.com.tw
Mon Jan 4 09:06:25 2016 daemon.info hostapd: wlan0: STA 00:0d:f0:ac:c8:63 IEEE 802.11: authenticated
Mon Jan 4 09:06:25 2016 daemon.info hostapd: wlan0: STA 00:0d:f0:ac:c8:63 IEEE 802.11: associated (aid 3)
Mon Jan 4 09:06:25 2016 daemon.info hostapd: wlan0: STA 00:0d:f0:ac:c8:63 WPA: pairwise key handshake completed (WPA)
Mon Jan 4 09:06:25 2016 daemon.info hostapd: wlan0: STA 00:0d:f0:ac:c8:63 WPA: group key handshake completed (WPA)

```

Displays the record of system activities. The administrator can monitor the system status by checking this log.

2.2.6 Kernel Log

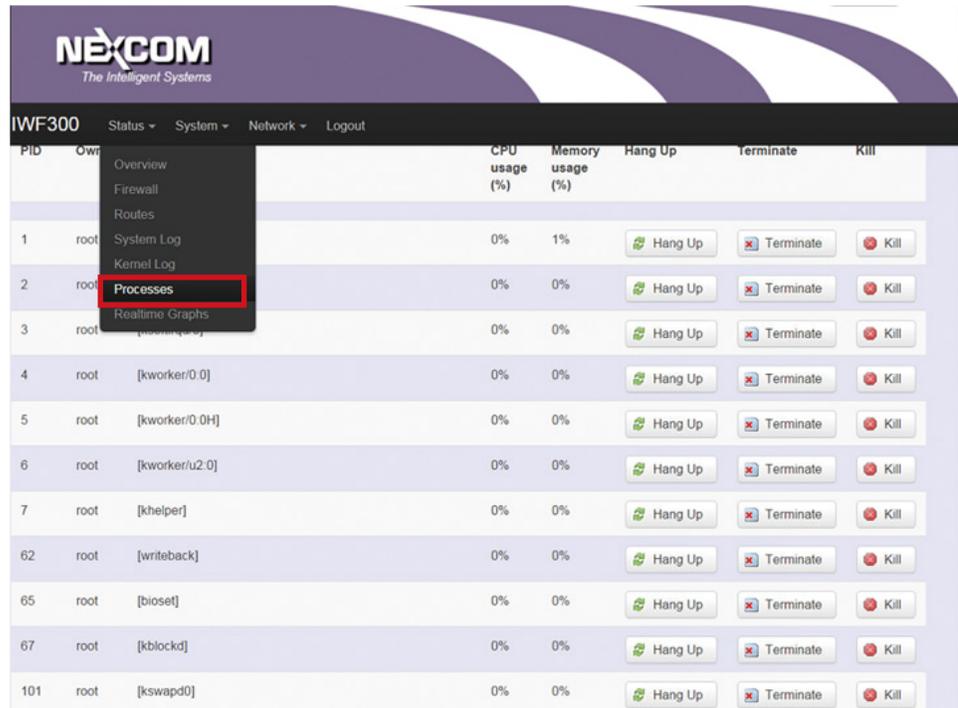
Kernel Log

```
[ 0.000000] Linux version 3.14.27 (kevin@debian603) (gcc version 4.8.3 (OpenWrt/Linaro GCC 4.8-2014.04 r371) ) #1 Wed Aug 5 12:20:03 CST 2015
[ 0.000000] MyLoader: syp=a56da565, boardp=a565a56d, parts=b565a565
[ 0.000000] bootconsole [early0] enabled
[ 0.000000] CPU0 revision is: 0001974c (MIPS 74Kc)
[ 0.000000] SoC: Atheros AR9344 rev 2
[ 0.000000] Determined physical RAM map:
[ 0.000000] memory: 08000000 @ 00000000 (usable)
[ 0.000000] Initrd not found or empty - disabling initrd
[ 0.000000] Zone ranges:
[ 0.000000] Normal [mem 0x00000000-0x07ffffff]
[ 0.000000] Movable zone start for each node
[ 0.000000] Early memory node ranges
[ 0.000000] node 0: [mem 0x00000000-0x07ffffff]
[ 0.000000] On node 0 totalpages: 32768
[ 0.000000] free_area_init_node: node 0, pgdat 80336420, node_mem_map 81000000
[ 0.000000] Normal zone: 256 pages used for memmap
[ 0.000000] Normal zone: 0 pages reserved
[ 0.000000] Normal zone: 32768 pages, LIFO batch:7
[ 0.000000] Primary instruction cache 64kB, VIPT, 4-way, linesize 32 bytes.
[ 0.000000] Primary data cache 32kB, 4-way, VIPT, cache aliases, linesize 32 bytes
[ 0.000000] pcpu-alloc: s0 r0 d32768 u32768 alloc=1*32768
[ 0.000000] pcpu-alloc: [0] 0
[ 0.000000] Built 1 zonelists in Zone order, mobility grouping on. Total pages: 32512
[ 0.000000] Kernel command line: board=DB120 console=ttyS0,115200 mtdparts=spi0.0:256k(u-boot)ro,64k(u-boot-env)ro,14528k(rootfs),1408k(kernel),64k(nvr
[ 0.000000] PID hash table entries: 512 (order: -1, 2048 bytes)
[ 0.000000] Dentry cache hash table entries: 16384 (order: 4, 65536 bytes)
[ 0.000000] Inode-cache hash table entries: 8192 (order: 3, 32768 bytes)
[ 0.000000] Writing ErrCtl register=00000000
[ 0.000000] Readback ErrCtl register=00000000
[ 0.000000] Memory: 126116K/131072K available (2370K kernel code, 122K rwdata, 500K rodata, 200K init, 187K bss, 4956K reserved)
[ 0.000000] SLUB: HWalign=32, Order=0-3, MinObjects=0, CPUs=1, Nodes=1
[ 0.000000] NR_IRQS:51
[ 0.000000] Clocks: CPU:560.000MHz, DDR:450.000MHz, AHB:225.000MHz, Ref:40.000MHz
[ 0.000000] Calibrating delay loop... 278.93 BogoMIPS (lpj=1394688)
[ 0.070000] pid_max: default: 32768 minimum: 301
[ 0.070000] Mount-cache hash table entries: 1024 (order: 0, 4096 bytes)
[ 0.080000] Mountpoint-cache hash table entries: 1024 (order: 0, 4096 bytes)
[ 0.080000] NET: Registered protocol family 16
[ 0.090000] MIPS: machine is Atheros DB120 reference board
[ 0.100000] registering PCI controller with io_map_base unset
[ 0.110000] -----(ath79_setup_ar934x_eth_cfg) AR934X_GMAC_REG_ETH_CFG=0x28041
[ 0.550000] bio: create slab <bio-0> at 0
```

Displays the record of kernel activities. The administrator can monitor the system status by checking this log.

2.2.7 Processes

This Webpage is designed for detailed troubleshooting/status monitoring by professional personnel in the field. Any improper termination or killing of individual process tasks may cause device malfunction. **It is suggested that the settings are kept as factory default.**



The screenshot shows the NEXCOM IWF300 web interface. The navigation menu is open, and 'Processes' is selected. The main content area displays a table of running processes. The table has the following columns: PID, Owner, CPU usage (%), Memory usage (%), Hang Up, Terminate, and Kill. The processes listed are:

PID	Owner	CPU usage (%)	Memory usage (%)	Hang Up	Terminate	Kill
1	root	0%	1%	Hang Up	Terminate	Kill
2	root	0%	0%	Hang Up	Terminate	Kill
3	root	0%	0%	Hang Up	Terminate	Kill
4	root	0%	0%	Hang Up	Terminate	Kill
5	root	0%	0%	Hang Up	Terminate	Kill
6	root	0%	0%	Hang Up	Terminate	Kill
7	root	0%	0%	Hang Up	Terminate	Kill
62	root	0%	0%	Hang Up	Terminate	Kill
65	root	0%	0%	Hang Up	Terminate	Kill
67	root	0%	0%	Hang Up	Terminate	Kill
101	root	0%	0%	Hang Up	Terminate	Kill

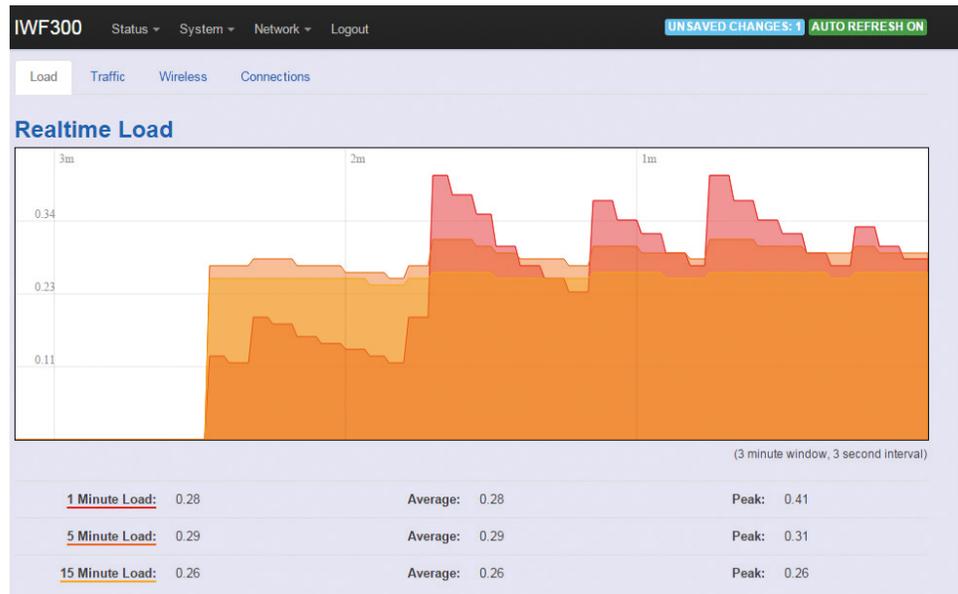
2.2.8 Real-time Graphic

This section provides utilities to monitor NIO 51 system information including real-time load, real-time Ethernet traffic, real-time wireless signal and real-time associated device traffic.

To monitor status in this section, please make sure the Web GUI "auto refresh" function must be "turn on".

AUTO REFRESH ON

2.2.8.1 Load

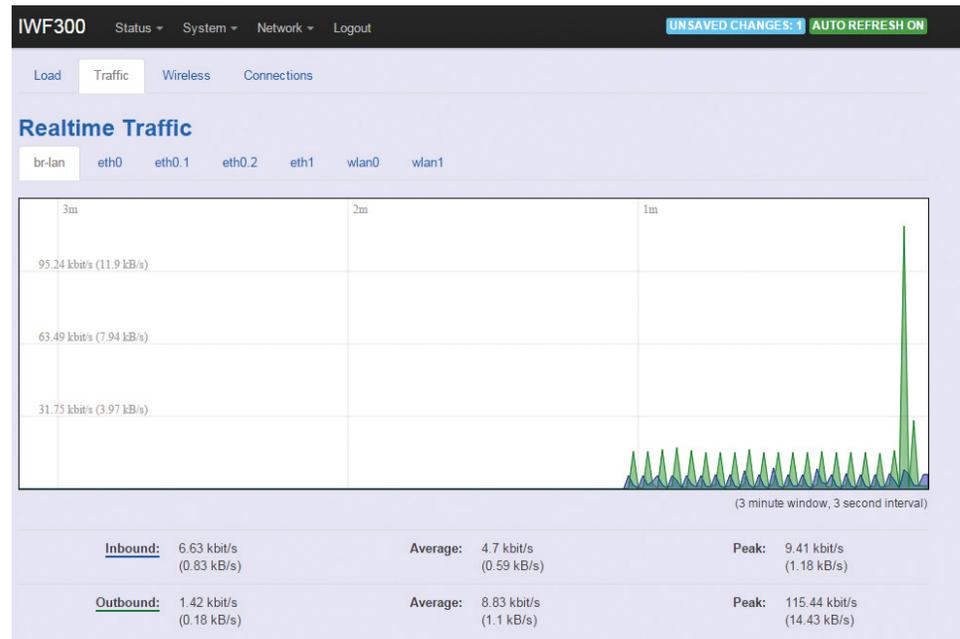


Displays real-time CPU average loading percentage.
For example:

1 Minute Load:	0.08	Average:	0.08	Peak:	0.33
5 Minute Load:	0.33	Average:	0.33	Peak:	0.39
15 Minute Load:	0.34	Average:	0.34	Peak:	0.36

1 minute	Minimum	8%	Average	8%	Peak	33%
5 minutes		33%		33%		39%
15 minutes		34%		34%		36%

2.2.8.2 Traffic

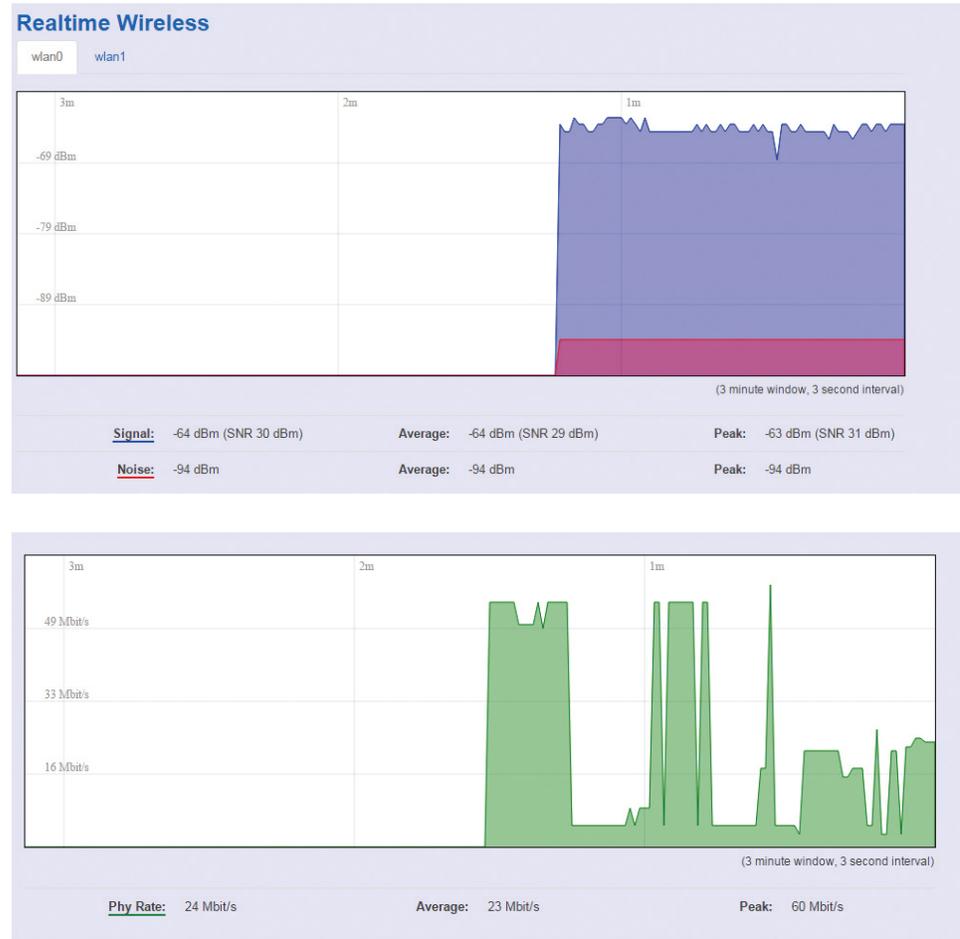


Displays NIO 51 Ethernet real-time traffic loading.

Inbound: Incoming data packet size.

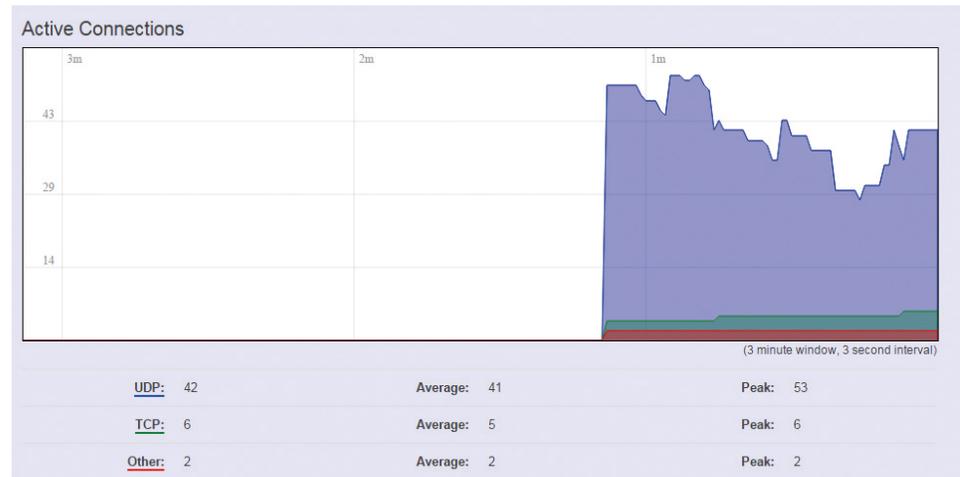
Outbound: Outgoing data packet size.

2.2.8.3 Wireless



Displays wireless real-time signal quality including signal level, noise and data rate.

2.2.8.4 Connections

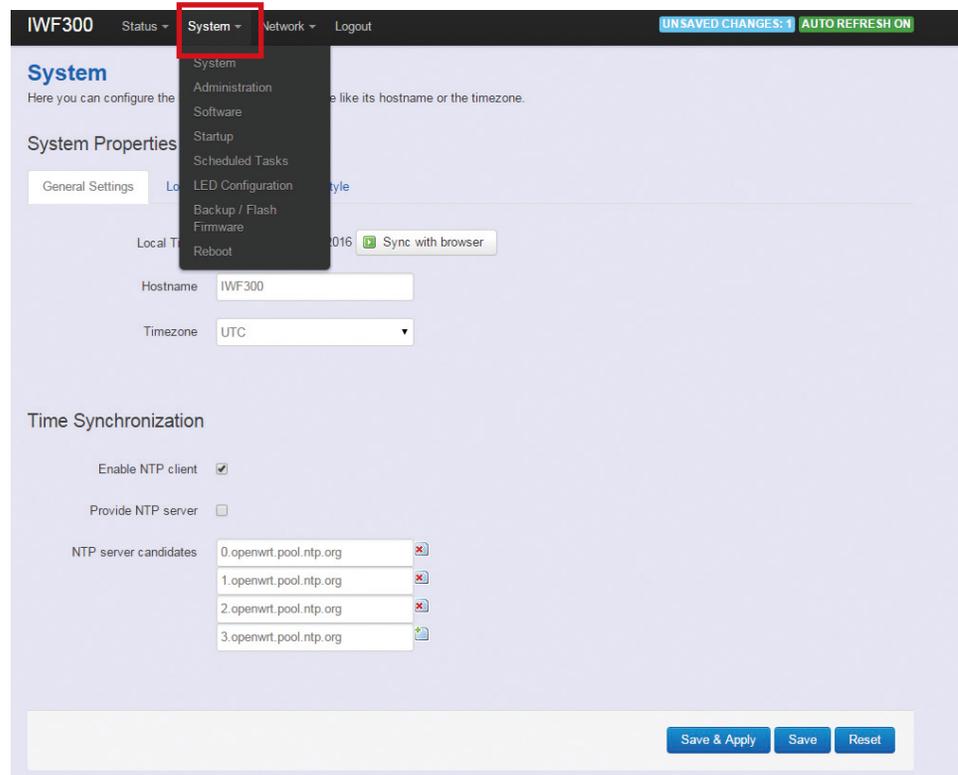


Network	Protocol	Source	Destination	Transfer
IPV4	ICMP	IM03-AndrewWang1.lan:0	IWF300.lan:0	602.29 KB (10279 Pkts.)
IPV4	UNKNOWN	0.0.0.0:0	all-systems.mcast.net:0	92.06 KB (2946 Pkts.)
IPV4	UDP	IM03-AndrewWang1.lan:17500	192.168.1.255:17500	57.95 KB (345 Pkts.)
IPV4	TCP	IM03-AndrewWang1.lan:57367	40.113.115.191:443	53.97 KB (573 Pkts.)
IPV4	TCP	IM03-AndrewWang1.lan:62255	IWF300.lan:80	19.43 KB (217 Pkts.)
IPV4	UDP	10.15.1.254:67	255.255.255.255:68	6.91 KB (21 Pkts.)
IPV4	TCP	IM03-AndrewWang1.lan:57369	tl-in-f125.1e100.net:5222	4.25 KB (55 Pkts.)
IPV4	TCP	IM03-AndrewWang1.lan:57366	91.190.218.53:12350	2.68 KB (48 Pkts.)
IPV4	UDP	IM03-AndrewWang1.lan:68	255.255.255.255:67	328.00 B (1 Pkts.)
IPV4	UDP	IWF300.lan:67	IM03-AndrewWang1.lan:68	328.00 B (1 Pkts.)
IPV4	UDP	IM03-AndrewWang1.lan:137	192.168.1.255:137	234.00 B (3 Pkts.)
IPV4	UDP	10.15.1.138:61033	10.1.1.2:53	118.00 B (1 Pkts.)
IPV4	UDP	10.15.1.138:43389	10.1.1.2:53	118.00 B (1 Pkts.)
IPV4	UDP	10.15.1.138:52009	10.1.1.2:53	118.00 B (1 Pkts.)

Displays NIO 51 real-time active connection information, including TCP and UDP connections.

2.3 System

To set up detailed configuration about the NIO 51 system, click the “System” under the menu bar, then select the items such as System, Administration, Software, Start up, Scheduled Tasks, LED configuration, Backup/Flash Firmware and Reboot from the pull-down list like the below screen:



2.3.1 System

2.3.1.1 General Settings

This section provides general settings of NIO 51 including Time, Host name, Time zone and NTP.

System
Here you can configure the basic aspects of your device like its hostname or the timezone.

System Properties

General Settings | Logging | Language and Style

Local Time: Tue Jan 5 02:04:39 2016

Hostname:

Timezone:

Time Synchronization

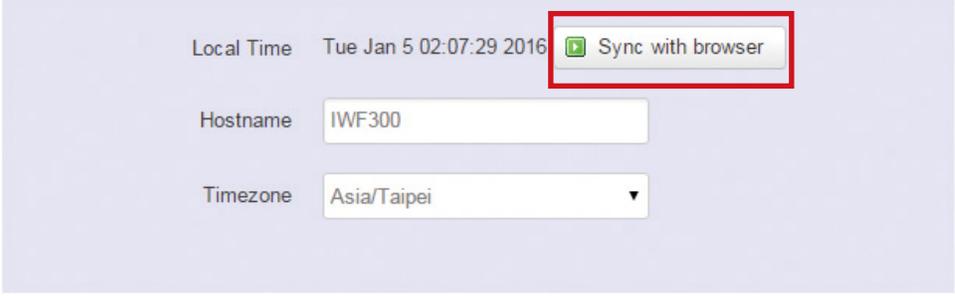
Enable NTP client

Provide NTP server

NTP server candidates

0.openwrt.pool.ntp.org	<input type="button" value="x"/>
1.openwrt.pool.ntp.org	<input type="button" value="x"/>
2.openwrt.pool.ntp.org	<input type="button" value="x"/>
3.openwrt.pool.ntp.org	<input type="button" value="x"/>

Click “Sync with browser” and let NIO 51 sync time with your current computer, then select your country from the Timezone pull-down list.

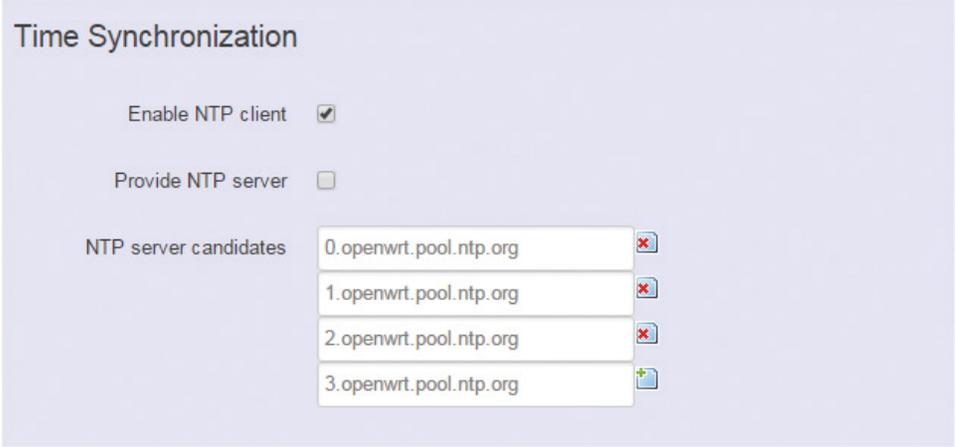


Local Time Tue Jan 5 02:07:29 2016

Hostname IWF300

Timezone Asia/Taipei ▼

Enter the address of an SNTP server to receive time updates.



Time Synchronization

Enable NTP client

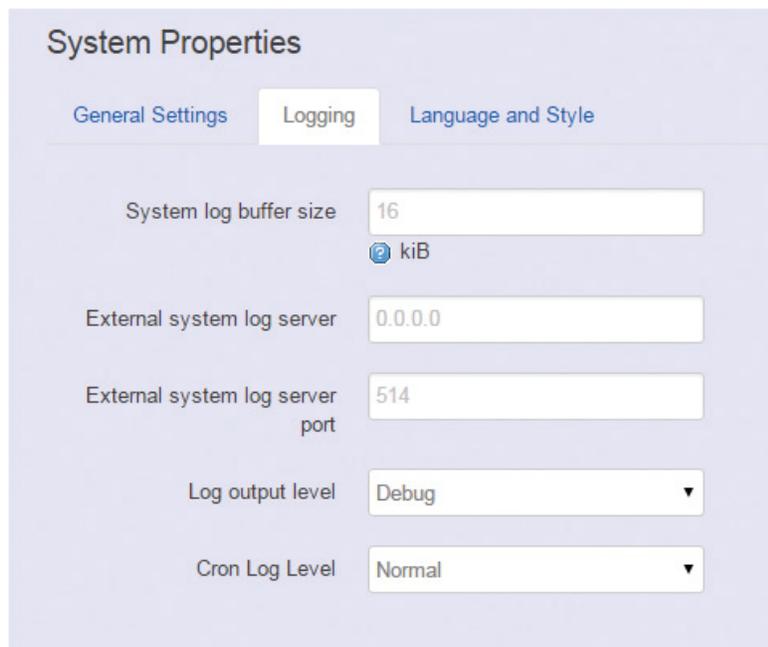
Provide NTP server

NTP server candidates

- 0.openwrt.pool.ntp.org
- 1.openwrt.pool.ntp.org
- 2.openwrt.pool.ntp.org
- 3.openwrt.pool.ntp.org

2.3.1.2 Logging

This section provides settings for log configuration.



System Properties

General Settings | **Logging** | Language and Style

System log buffer size: 16
 ⓘ kiB

External system log server: 0.0.0.0

External system log server port: 514

Log output level: Debug

Cron Log Level: Normal

System log buffer size: The size of log information. Unit: Kbytes.

External system log server: The server address of external log server.

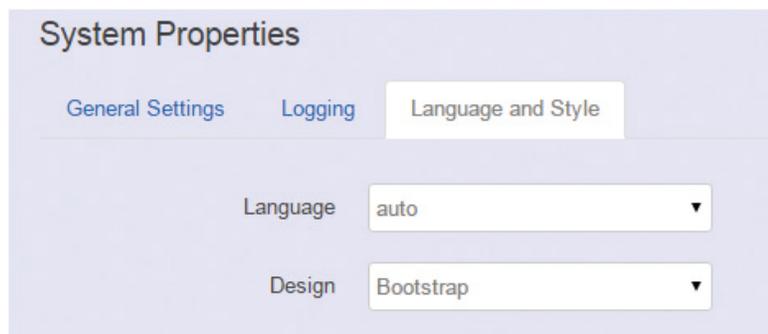
External system log server port: The port number of external log server.

Log output level: The output information of log, including Debug, Info, Notice, Warning, Error, Critical, Alert, and Emergency.

Cron Log Level: The minimal level for cron messages to be logged to syslog.

2.3.1.3 Language and Style

This section provides settings for language and Web GUI style. NIO 51 only provides English as default and EMBOX style of Web GUI.



System Properties

General Settings | Logging | **Language and Style**

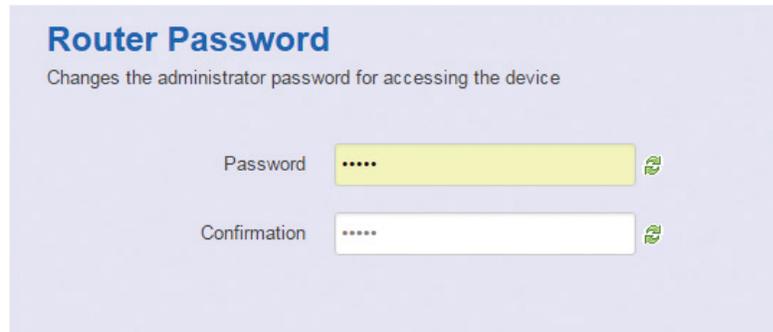
Language: auto

Design: Bootstrap

2.3.2 Administration

2.3.2.1 Router Password

To change the default password, enter the new password and confirm it.



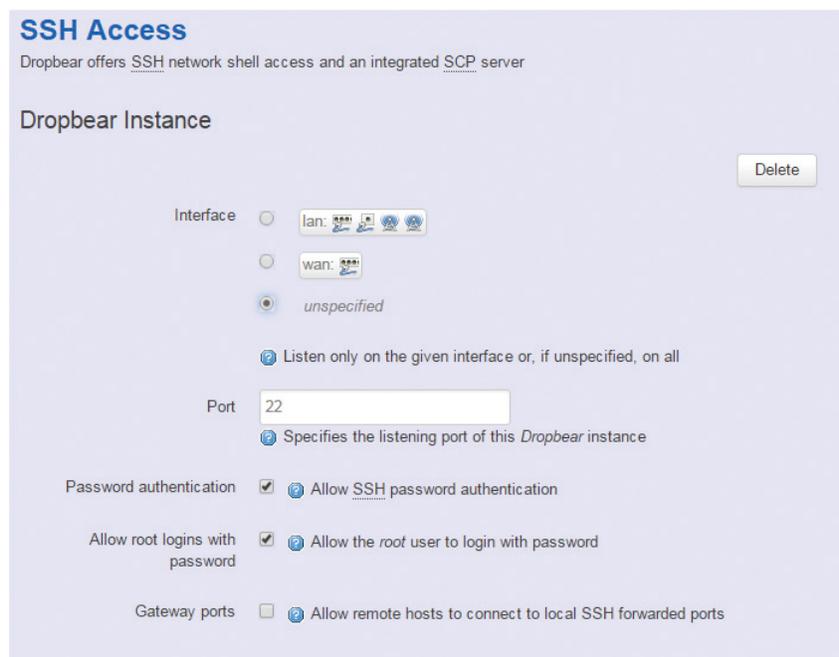
Router Password
Changes the administrator password for accessing the device

Password

Confirmation

2.3.2.2 SSH Access

Secure Shell (SSH). Enable your NIO 51 to be accessed via SSH-based application.



SSH Access
Dropbear offers [SSH](#) network shell access and an integrated [SCP](#) server

Dropbear Instance Delete

Interface lan: wan: unspecified

Listen only on the given interface or, if unspecified, on all

Port
 Specifies the listening port of this Dropbear instance

Password authentication Allow [SSH](#) password authentication

Allow root logins with password Allow the *root* user to login with password

Gateway ports Allow remote hosts to connect to local SSH forwarded ports

Interface: Select the interface.

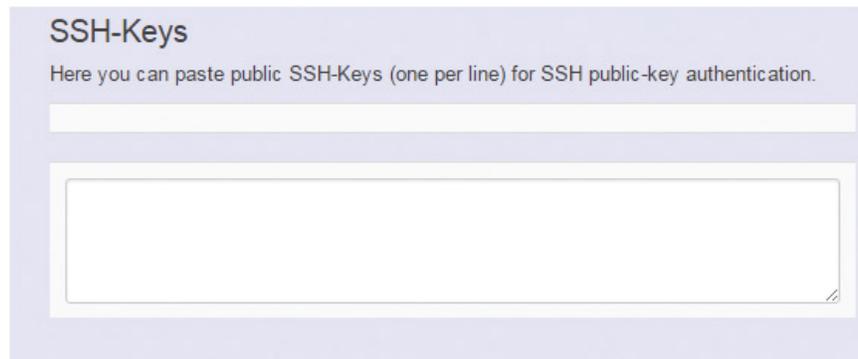
Port: Enter the port number.

Password authentication: Enable/Disable SSH password authentication.

Allow root logins with password: Enable/Disable the root user to login with password.

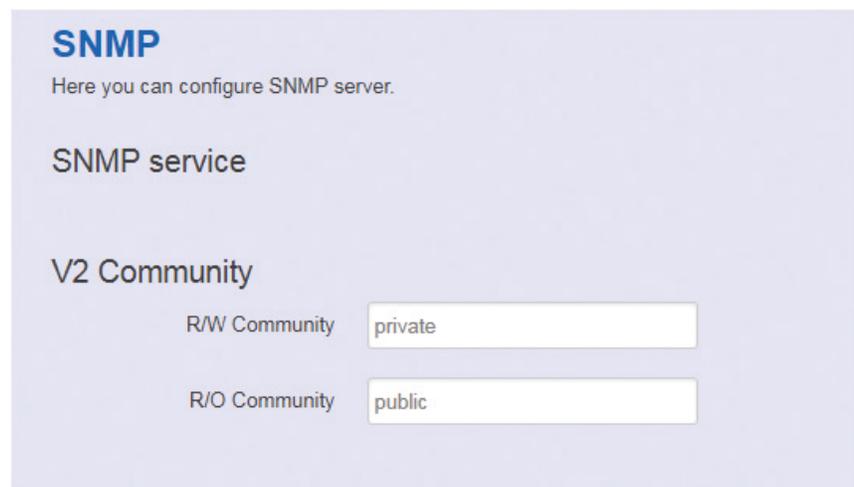
Gateway ports: Enable/Disable remote hosts to connect to local SSH forwarded ports.

Paste public SSH-Keys (one per line) for SSH public-key authentication.



SSH-Keys
Here you can paste public SSH-Keys (one per line) for SSH public-key authentication.

2.3.3 SNMP



SNMP
Here you can configure SNMP server.

SNMP service

V2 Community

R/W Community

R/O Community

R/W Community: SNMP Read-Write Community String - Used in requests for information from a device and to modify settings on that device.

R/O Community: SNMP Read-Only Community String - Enables a remote device to retrieve “read-only” information from a device.

2.3.4 Backup/Flash Firmware

2.3.4.1 Upgrade Firmware

To upgrade a new firmware onto the device, please select “System” from the menu bar, and then select “Backup/Flash Firmware”.

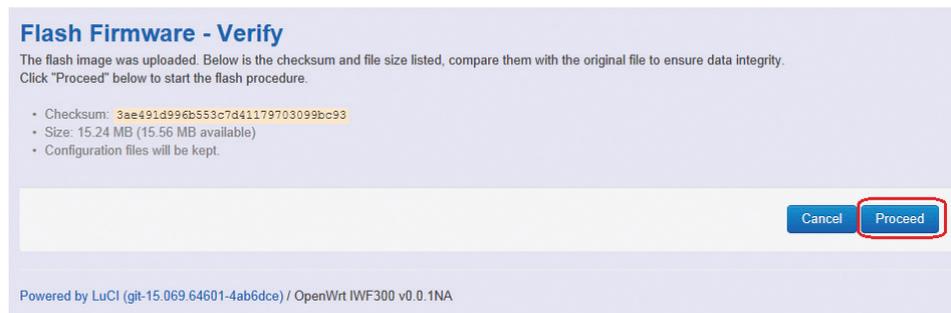


Please click “Browse” to select the new firmware.



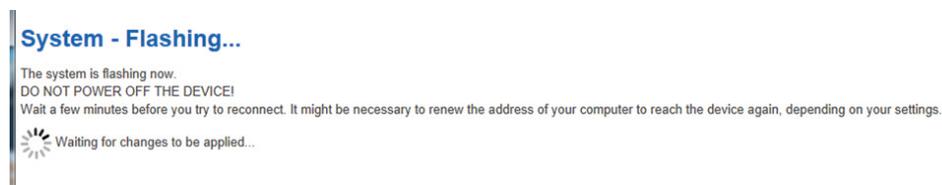
名稱	修改日期	類型
 NIO51_v1.0.95_US.bin	2018/1/29 下午 0...	BIN 檔案

Then the GUI will display the file checksum.



Click “Proceed” to start the upgrade process.

Note: After you click “Proceed”, the DUT firmware will be upgraded with the file you selected, and the upgrade progress will be displayed like below:



Note: The whole programming might take several minutes to complete the flash writing. **PLEASE DO NOT REBOOT OR POWER OFF THE DEVICE** before the whole progress completes.

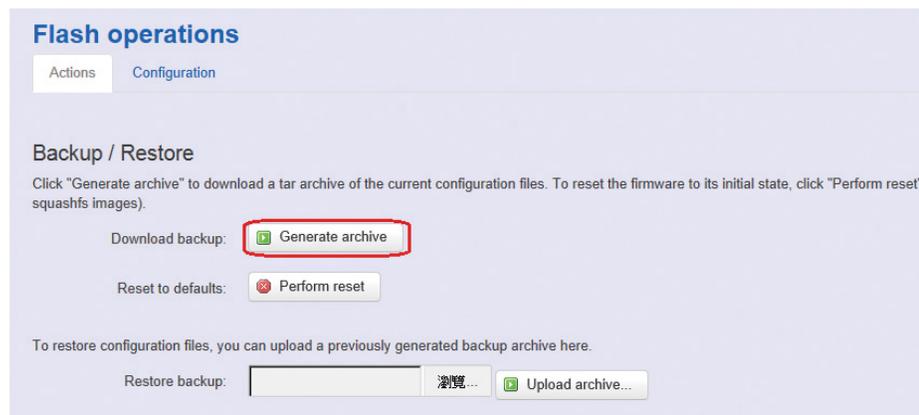
If the firmware upgrade is successful, the GUI should switch to the Login page.

You can also check the version via the “Firmware Version” field under the Status page.

NEXCOM NIO51		Status ▾	System ▾	Network ▾	Modbus ▾	Logout
Status						
System						
Hostname	NIO51					
Model	NIO51					
Firmware Version	NIO51-v1.0.94 / LuCI (git-15.216.69575-bb7ea3e)					
Kernel Version	3.14.27					

2.3.4.2 Backup Configuration

To backup your current configuration, please choose “System” from the menu bar, then select “Backup/Flash Firmware” and click the “Generate archive” button under the Backup / Restore section, like:



Then save it as a file in your PC.

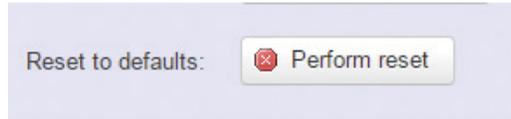
To restore the device to your previous configuration, please choose “System” from the menu bar, then select “Backup/Flash Firmware” and click “Browse” under the section to select your previous configuration file, then click the button “Upload archive...”, like:



Note: After restoring the file, the system will apply the changes and reboot automatically. Due to the settings from configuration backup, the IP address may change and you have to enter the new IP address accordingly. Otherwise, the new web page may not be accessible.

2.3.4.3 Reset to default

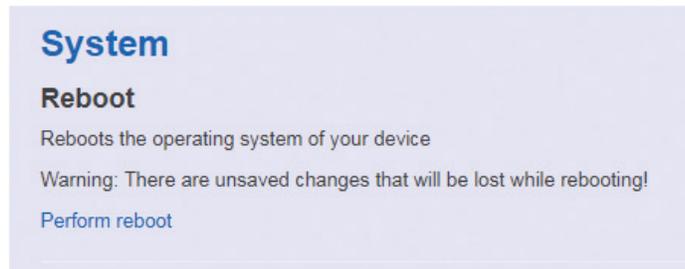
To reset NIO 51 to default settings, please click “Perform reset”.



Note: The whole programming might take several minutes to complete the process. **PLEASE DO NOT REBOOT OR POWER OFF THE DEVICE** before the whole progress completes.

2.3.7 Reboot

Click the “Perform Reboot” button to warm start the system. After the system finishes the reboot process, it will direct back to the Login page.



2.4 Network

2.4.1 Interfaces

2.4.1.1 Change Default IP Address

To set up a new IP address, please click “Network” from the menu bar, then select “Interfaces” and click “Edit”.

The screenshot displays the EMBOX web interface. At the top, a navigation bar contains 'Status', 'System', 'Network', 'Modbus', and 'Logout'. A dropdown menu is open under 'Network', with 'Interfaces' selected. Below the menu, the 'Status' section shows network statistics for 'br-lan' and an 'Actions' bar with 'Connect', 'Stop', 'Edit', and 'Delete' buttons. The 'Edit' button is highlighted with a red box. Below this is the 'Common Configuration' section with tabs for 'General Setup', 'Advanced Settings', 'Physical Settings', and 'Firewall Settings'. Under 'General Setup', the 'Status' section shows details for 'br-lan' and a form for configuring the IPv4 address. The 'IPv4 address' field is highlighted with a red box and contains the value '192.168.1.1'. The 'Protocol' is set to 'Static address' and the 'IPv4 netmask' is '255.255.255.0'.

Under the “IPv4 address” field, you can input the new IP address of this device, and then pull down the scroll bar to the bottom of the Web GUI page and click “Save & Apply” to save this new IP address into flash and apply it immediately.

Note: After applying new IP, it would take several minutes to switch to the Status page via the new IP address. Please enter the new IP address on the browser again if the GUI does not switch to new GUI page after 5 minutes.

DHCP Server

General Setup **Advanced Settings** IPv6 Settings

Ignore interface [Disable DHCP](#) for this interface.

Start:
Lowest leased address as offset from the network address.

Limit:
Maximum number of leased addresses.

Leasetime:
Expiry time of leased addresses, minimum is 2 minutes (2m).

[Back to Overview](#) **Save & Apply** Save Reset

2.4.1.2 Interfaces Overview

Interfaces

Interface Overview

Network	Status	Actions
LAN  br-lan	Uptime: 0h 48m 49s MAC-Address: 00:10:F3:6E:E6:AB RX: 144.29 KB (1441 Pkts.) TX: 281.02 KB (1470 Pkts.) IPv4: 192.168.1.1/24 IPv6: FDC1:5D2B:D1FB::1/60	Connect Stop Edit Delete

Connect: Link this interface to the network, functions like “Save & Apply”.

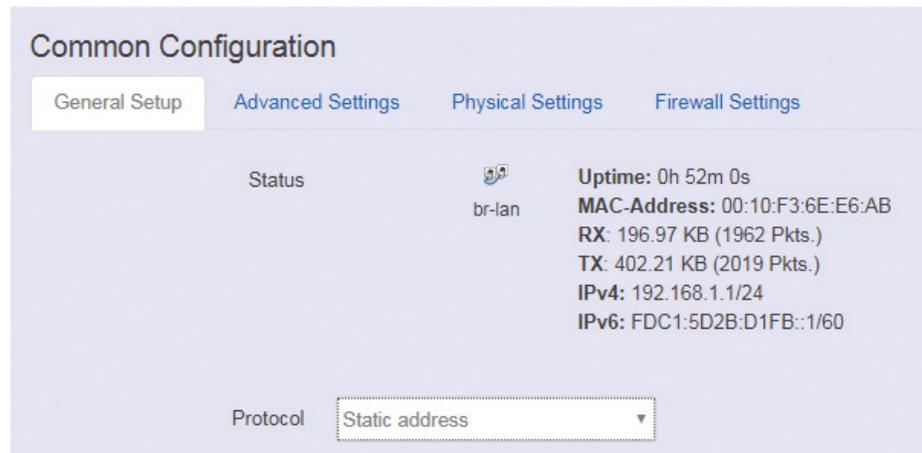
Stop: Disable the interface to link to the network.

Edit: Modify LAN port group settings.

Delete: Delete this interface group.

2.4.1.3 LAN Interface Overview

On this page you can configure the network interfaces. You can bridge several interfaces by ticking the “bridge interfaces” field and enter the names of several network interfaces separated by spaces.



<General Setup>

The default protocol is static address setting. It is suggested that a static IP is used for the LAN port.

Static address

Static IP (Manual): Choose this option if you do not have a DHCP server in your network, or if you wish to assign a static IP address to NIO 51.

DHCP client

When Dynamic IP (DHCP) is selected, the DHCP client will be functional once this selection is made.

Unmanaged

This interface has no configuration interface or options.

PPP

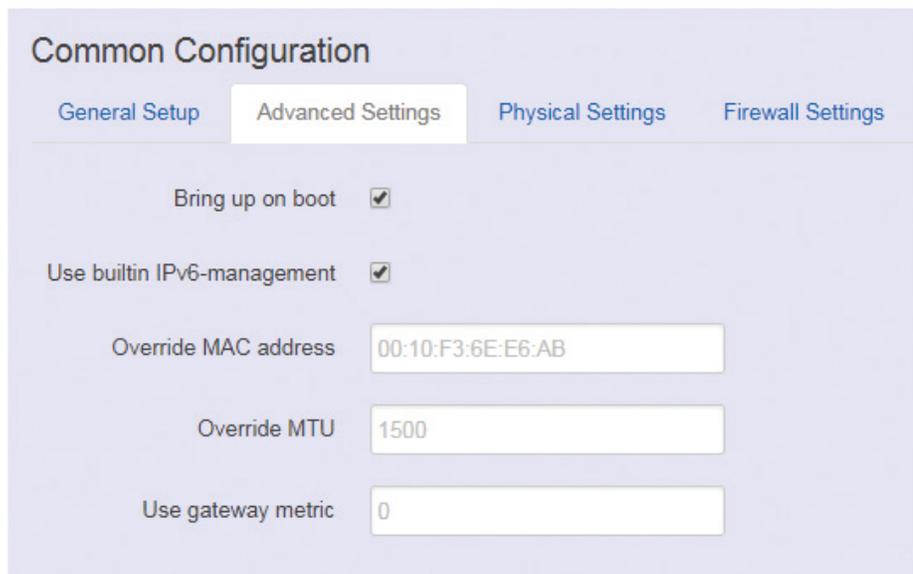
Used to provide point to point link for connecting NIO 51 to old serial modem.

PPPoE

Used for cable modem or ADSL users to link NIO 51 to your internet provider.

<Advanced Settings>

Advanced settings and configuration, it is advised that generic users leave the settings unchanged.



Common Configuration

General Setup | **Advanced Settings** | Physical Settings | Firewall Settings

Bring up on boot

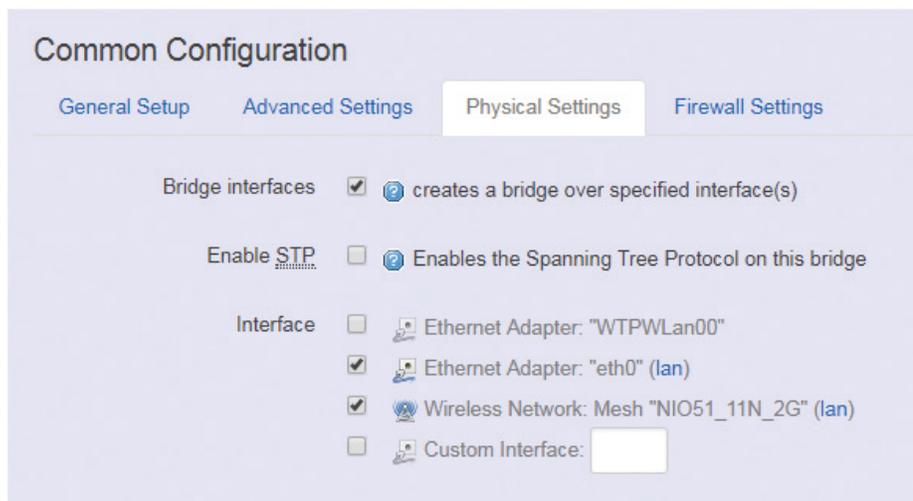
Use builtin IPv6-management

Override MAC address

Override MTU

Use gateway metric

<Physical Settings>



Common Configuration

General Setup | Advanced Settings | **Physical Settings** | Firewall Settings

Bridge interfaces ⓘ creates a bridge over specified interface(s)

Enable STP ⓘ Enables the Spanning Tree Protocol on this bridge

Interface ⓘ Ethernet Adapter: "WTPWLan00"

ⓘ Ethernet Adapter: "eth0" (lan)

ⓘ Wireless Network: Mesh "NIO51_11N_2G" (lan)

ⓘ Custom Interface:

Bridge interfaces

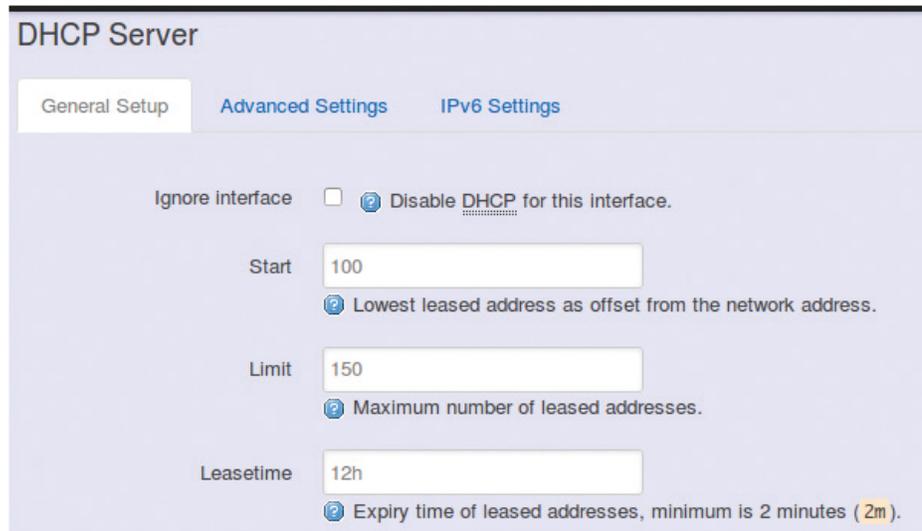
You can bridge an interface group for your LAN interface. After enabling bridge interfaces, select the interfaces to bridge.

Interface

Select the interfaces for your bridge group. Select both the Ethernet adapter (most likely eth0.1 or eth1) and the wireless network.

2.4.1.4 DHCP Server

<General Setup>

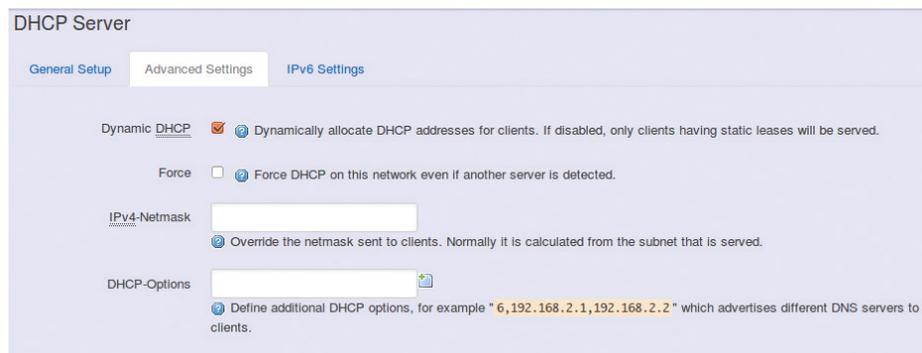


The screenshot shows the 'DHCP Server' configuration page with the 'General Setup' tab selected. The page contains the following settings:

- Ignore interface:** A checkbox is unchecked, and the radio button for 'Disable DHCP for this interface.' is selected.
- Start:** A text input field contains the value '100'. Below it, a help icon indicates: 'Lowest leased address as offset from the network address.'
- Limit:** A text input field contains the value '150'. Below it, a help icon indicates: 'Maximum number of leased addresses.'
- Leasetime:** A text input field contains the value '12h'. Below it, a help icon indicates: 'Expiry time of leased addresses, minimum is 2 minutes (2m).'

Ignore Interface: Select this option to disable your DHCP server, you will need a static IP or another DHCP server for your network interfaces. Default is “enable DHCP”.

<Advanced Settings>



The screenshot shows the 'DHCP Server' configuration page with the 'Advanced Settings' tab selected. The page contains the following settings:

- Dynamic DHCP:** A checkbox is checked, and the radio button for 'Dynamically allocate DHCP addresses for clients. If disabled, only clients having static leases will be served.' is selected.
- Force:** A checkbox is unchecked, and the radio button for 'Force DHCP on this network even if another server is detected.' is selected.
- IPv4-Netmask:** A text input field is empty. Below it, a help icon indicates: 'Override the netmask sent to clients. Normally it is calculated from the subnet that is served.'
- DHCP-Options:** A text input field is empty. Below it, a help icon indicates: 'Define additional DHCP options, for example "6,192.168.2.1,192.168.2.2" which advertises different DNS servers to clients.'

Dynamic DHCP: Dynamically allocate DHCP addresses for clients. If disabled, only clients with static leases will be served.

Force: Force DHCP on this network even if another server is detected.

2.4.2 WiFi

2.4.2.1 Wireless Overview



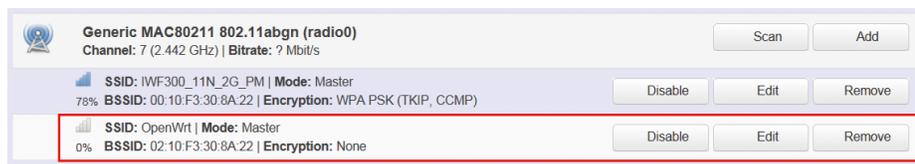
To set up the Wireless configuration, please select “Network” in the tab, then select “WiFi”, which would show you the current status of radio interfaces.

Wireless Overview includes channel, SSID, MAC address and security setting information.

Scan: Scan any AP nearby the Radio, we can check how many APs are nearby this AP and avoid using the same channel.



Add: Add a new virtual AP in the same radio interface. You will see the new interface after clicking “Add”.



Disable: Disable the radio interface.

Edit: Configure the radio interface.

Remove: Remove radio interface. Please note that the radio must be disabled first when you don't want to use the radio interface.

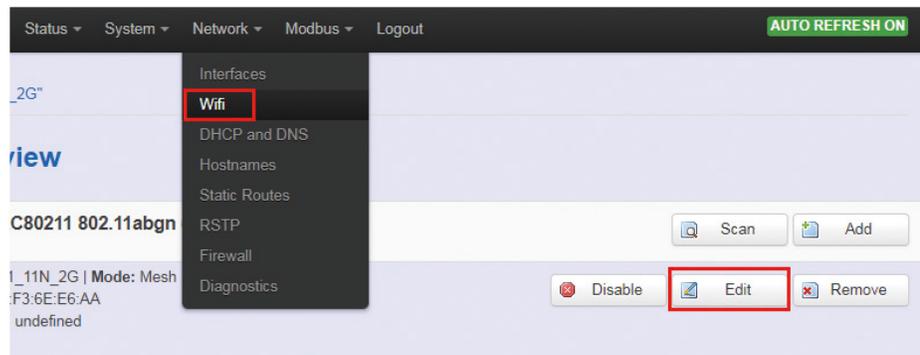
2.4.2.2 Associated Stations

Associated stations show wireless client connection information. It includes the SSID, MAC/IP address, RSSI signal strength and Tx/Rx rate of the wireless client connected.

Associated Stations						
SSID	MAC-Address	IPv4-Address	Signal	Noise	RX Rate	TX Rate
IWF300_11N_2G_PM	9C:2A:70:1B:4C:9D	192.168.1.215	-53 dBm	-93 dBm	162.0 Mbit/s, MCS 12, 40MHz	104.0 Mbit/s, MCS 13, 20MHz

2.4.2.3 Wireless Configuration

Please select "Network" -> "Wifi" and click Edit to configure wireless settings.



The **Device Configuration** section covers physical settings of the radio hardware such as channel, transmit power and so forth.

Device Configuration

General Setup | **Advanced Settings**

Status: SSID: NIO51_11N_2G | Mode: Mesh
MAC: 00-10-F3-6E-E6-AA
Encryption: undefined

Wireless network is enabled

Operating frequency: Mode: N | Band: 2.4 GHz | Channel: 11 (2462 MHz) | Width: 40 -MHz(Mesh mode,2.4G(ch >= 7),5G(ch=48,153,157,161,165))

Transmit Power: 10 dBm (10 mW)

<General Setup>

Wireless network is enabled: Enable or disable the radio interface.

Operating frequency: Select radio frequency and channel bandwidth for signal transmission.

For channel bandwidth, please note you need to confirm AP/client mode or mesh mode and the channel you will use.

The screenshot shows a dropdown menu titled "Width" with the following options:

- 40 MHz(AP or Client mode)
- 20 MHz(AP or Client mode)
- 40 MHz(AP or Client mode)
- 40 plus MHz(Mesh mode, 2.4G(ch <= 6), 5G(ch=36,40,44,149))
- 40 minus MHz(Mesh mode, 2.4G(ch >= 7), 5G(ch=48,153,157,161,165))

Transmit Power: Select the transmit power of a radio.

<Advanced Settings>

The screenshot shows the "Device Configuration" page with the "Advanced Settings" tab selected. The settings include:

- Distance Optimization:** A text input field with a help icon and the description "Distance to farthest network member in meters."
- Fragmentation Threshold:** A text input field.
- RTS/CTS Threshold:** A text input field.

Distance Optimization: Specify the ACK timeout by entering the value manually. ACK timeout can be entered by defining the link distance. A value too short for the ACK timeout may cause transmission time out and no packets can be received. A value too long may cause low throughput rate.

Fragmentation Threshold: Default=off. Specify the Fragmentation threshold by entering the value manually [300-2346 bytes]. This is the maximum size for a packet before data is fragmented into multiple packets. Setting the Fragmentation threshold too low may result in poor network performance. Only minor modifications of this value are recommended.

RTS/CTS Threshold: Default=off. RTS/CTS (Request to Send / Clear to Send) is the optional mechanism used by the 802.11 wireless networking protocol to reduce frame collisions introduced by the hidden node problem. RTS/CTS is an additional method to implement virtual carrier sensing in Carrier sense multiple access with collision avoidance (CSMA/CA). Specify the RTS threshold by entering the value manually [0-2346 bytes]. Typically, sending RTS/CTS frames does not occur unless the packet size exceeds this threshold.

The **Interface Configuration** section covers SSID operation mode and encryption.

The screenshot shows the 'Interface Configuration' page with two tabs: 'General Setup' and 'Mesh Security'. The 'General Setup' tab is selected. The 'ESSID/Mesh_ID' field is set to 'NIO51_11N_2G'. The 'Mode' dropdown menu is set to 'Mesh,802.11s'. Under the 'Network' section, the 'lan:' checkbox is checked, and the 'create:' checkbox is unchecked.

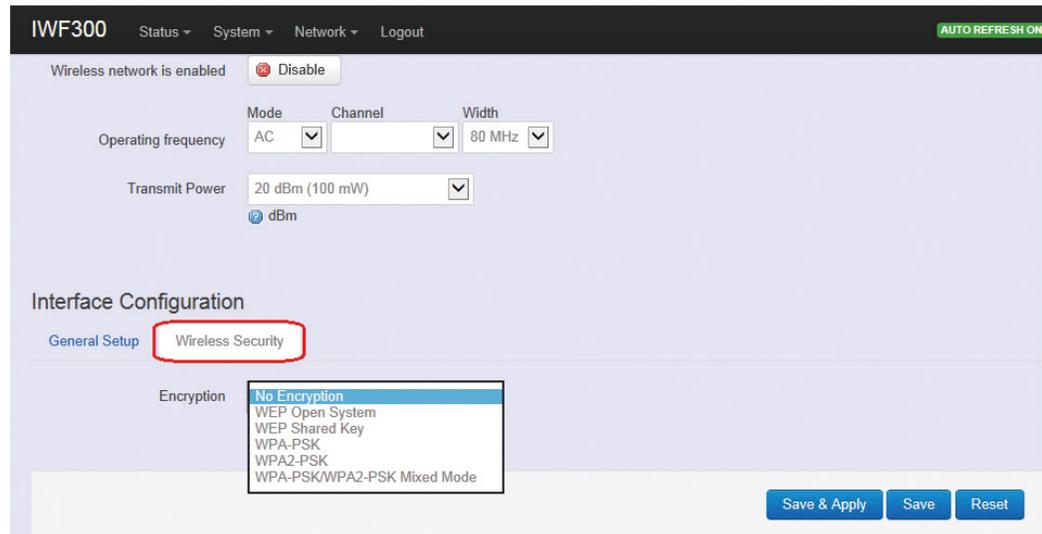
<General Setup>

ESSID: Edit the SSID. The default SSID for radio0 is NIO51_11N and default SSID for radio1 is NIO51_11N_2G.

Mode: Select the operation mode:

- Client Router
- 802.11s (Mesh mode)

<Wireless Security>



Encryption: To setup the Security on Radio, please select one of the Encryption method:

- No Encryption
- WEP Open System: WEP provides a basic level of security, preventing unauthorized access to the network. WEP uses static shared keys that are manually distributed to all clients that want to use the network.
- WEP Shared Key: WEP provides a basic level of security, preventing unauthorized access to the network, and encrypting data transmitted between wireless clients and an access point. WEP uses static shared keys that are manually distributed to all clients that want to use the network.
- WPA-PSK: Clients using WPA for authentication.
- WPA2-PSK: Clients using WPA2 for authentication.
- WPA-PSK/WPA2-PSK Mixed Mode: Clients using WPA or WPA2 for authentication.

Interface Configuration

General Setup | **Wireless Security**

Encryption: WPA-PSK/WPA2-PSK Mixed M

Cipher: auto

Key: 12345678

Cipher: It is recommended to select TKIP and CCMP (AES).

- Force CCMP (AES)
- Force TKIP
- Force TKIP and CCMP (AES)

Encryption: WPA-PSK/WPA2-PSK Mixed M

Cipher: Force TKIP and CCMP (AES)

Key: 12345678

The cycle icon will display the characters you just input.

For mesh security, please input the same shared key for each mesh device.

Interface Configuration

General Setup | **Mesh Security**

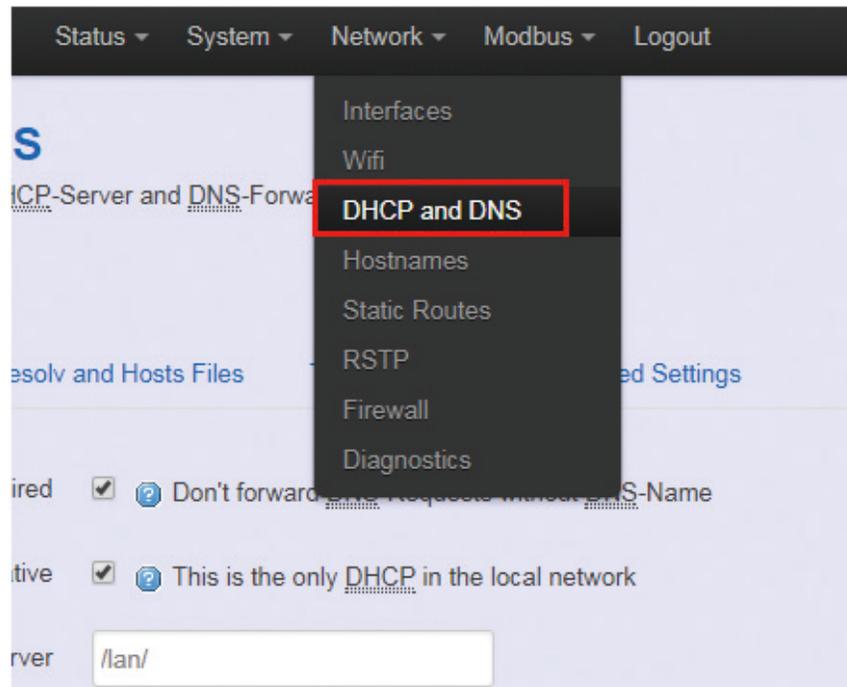
Encryption: Enable Encryption

Key:

2.4.3 DHCP and DNS

A combined DHCP-Server and DNS-Forwarder for NAT firewall is provided in NIO 51.

Click "Network" -> "DHCP and DNS" in the GUI menu. The "DHCP and DNS" page will appear. There are four categories of settings or lease status: "Active DHCP Leases", "Active DHCPv6 Leases", "Static Leases", and "Server Settings".



Scroll to the following screen in the "DHCP and DNS" window.

Active DHCP Leases			
Hostname	IPv4-Address	MAC-Address	Leasetime remaining
IWR1-Austin	192.168.1.193	a0:a8:cd:56:f9:f5	11h 28m 47s

Active DHCPv6 Leases			
Hostname	IPv6-Address	DUID	Leasetime remaining
There are no active leases.			

This screen displays the lease information to which DHCP server assigns automatically, including **Hostname**, **IP address**, **MAC address** (or **DUID**), and Remaining Lease-time (DUID stands for the DHCP Unique Identifier). Please look at the frame in red above.

The next category that users can scroll to is “Static Leases” as follows.

Static leases are used to assign fixed IP addresses and symbolic hostnames to DHCP clients by calculating MAC-Address. They are also required for non-dynamic interface configurations where only hosts with a corresponding lease are served.

Static Leases

Static leases are used to assign fixed IP addresses and symbolic hostnames to DHCP clients. They are also required for non-dynamic interface configurations where only hosts with a corresponding lease are served.
Use the *Add* Button to add a new lease entry. The *MAC-Address* identifies the host, the *IPv4-Address* specifies to the fixed address to use and the *Hostname* is assigned as symbolic name to the requesting host.

Hostname	MAC-Address	IPv4-Address	IPv6-Suffix (hex)
This section contains no values yet			

 Add

Add: Add a new lease entry.

After clicking the “Add” button, a new entry with 4 blank input boxes will appear. Allow users to fill in the information such as the **MAC-Address** (identifies the host), the **IPv4-Address** (specifies the fixed address to use) and the **Hostname** (is assigned as symbolic name to the requesting host).

Static Leases

Static leases are used to assign fixed IP addresses and symbolic hostnames to DHCP clients. They are also required for non-dynamic interface configurations where only hosts with a corresponding lease are served.
Use the *Add* Button to add a new lease entry. The *MAC-Address* identifies the host, the *IPv4-Address* specifies to the fixed address to use and the *Hostname* is assigned as symbolic name to the requesting host.

Hostname	MAC-Address	IPv4-Address	IPv6-Suffix (hex)
<input style="width: 100%;" type="text"/>			
<input type="button" value="Delete"/>			

 Add

Delete: Delete the followed entry.

Scroll to the screen identified as “Server Settings” category. There are 4 tabs to select more options for DHCP and DNS services in NIO 51.

<General Settings>

Server Settings

General Settings [Resolv and Hosts Files](#) [TFTP Settings](#) [Advanced Settings](#)

Domain required [Don't forward DNS-Requests without DNS-Name](#)

Authoritative [This is the only DHCP in the local network](#)

Local server
[Local domain specification. Names matching this domain are never forwarded and are resolved from DHCP or hosts files only](#)

Local domain
[Local domain suffix appended to DHCP names and hosts file entries](#)

Log queries [Write received DNS requests to syslog](#)

DNS forwardings
[List of DNS servers to forward requests to](#)

Rebind protection [Discard upstream RFC1918 responses](#)

Allow localhost [Allow upstream responses in the 127.0.0.0/8 range, e.g. for RBL services](#)

Domain whitelist
[List of domains to allow RFC1918 responses for](#)

Domain required: Default value is checked.

Authoritative: Default value is checked.

<Resolve and Hosts Files>

Server Settings

[General Settings](#) [Resolv and Hosts Files](#) [TFTP Settings](#) [Advanced Settings](#)

Use `/etc/ethers` [Read /etc/ethers to configure the DHCP-Server](#)

Leasefile
[file where given DHCP-leases will be stored](#)

Ignore resolve file

Resolve file
[local DNS file](#)

Ignore `/etc/hosts`

Additional Hosts files

<TFTP Settings>

IWF300 [Status](#) [System](#) [Network](#) [Logout](#) [AUTO REFRESH ON](#)

Server Settings

[General Settings](#) [Resolv and Hosts Files](#) [TFTP Settings](#) [Advanced Settings](#)

Enable TFTP server

By default, TFTP server is not enabled.

<Advanced Settings>

IWF300 Status System Network Logout AUTO REFRESH ON

Server Settings

General Settings Resolv and Hosts Files TFTP Settings **Advanced Settings**

Filter private Do not forward reverse lookups for local networks

Filter useless Do not forward requests that cannot be answered by public name servers

Localise queries Localise hostname depending on the requesting subnet if multiple IPs are available

Expand hosts Add local domain suffix to names served from hosts files

No negative cache Do not cache negative replies, e.g. for not existing domains

Additional servers file
This file may contain lines like 'server=/domain/1.2.3.4' or 'server=1.2.3.4' for domain-specific or full upstream DNS servers.

Strict order DNS servers will be queried in the order of the resolvfile

Bogus NX Domain Override
List of hosts that supply bogus NX domain results

DNS server port
Listening port for inbound DNS queries

DNS query port
Fixed source port for outbound DNS queries

Max. DHCP leases
Maximum allowed number of active DHCP leases

Max. EDNS0 packet size
Maximum allowed size of EDNS.0 UDP packets

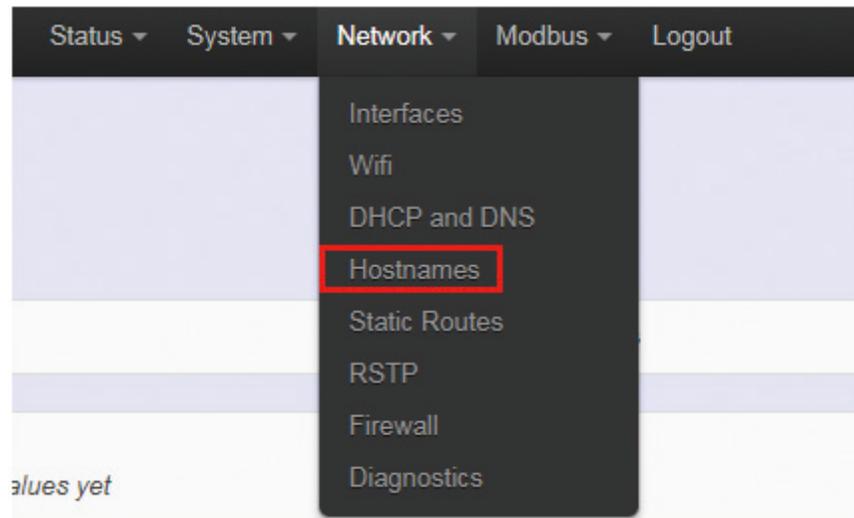
Max. concurrent queries
Maximum allowed number of concurrent DNS queries

Max. DHCP Leases: Default value is unlimited.

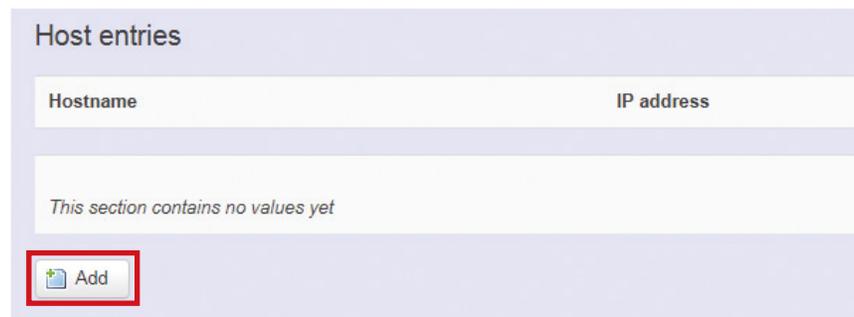
Max. concurrent queries: Default value is 150.

2.4.4 Hostnames

Clicking the “Network” -> “Hostnames” in the GUI menu will bring up the “Hostnames” page.



For devices that do not have hostname or do not resolve automatically, a hostname-IP paired to a specific device must be assigned.



Add: Create a host entry (hostname-IP pair) for a specific device.

(For example, **Hostname** => “Test-Device”; **IP address** => “192.168.1.251”)

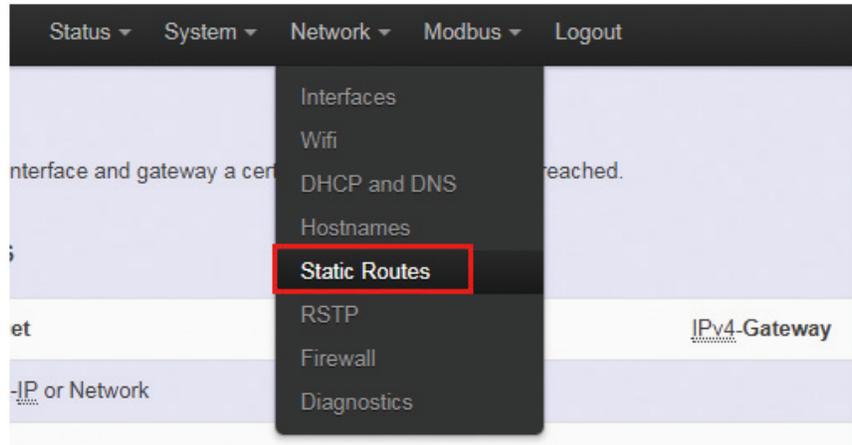


Delete: Delete the followed host entry.

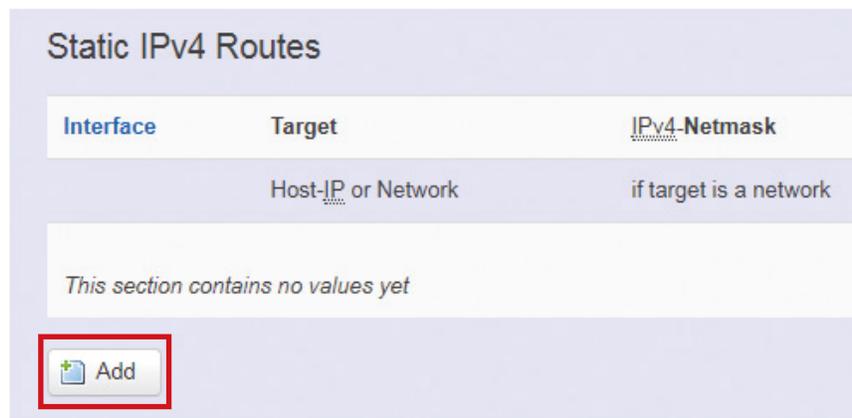
2.4.5 Static Routes

Clicking “Network” -> “Static Routes” in the GUI menu will bring up the “Routes” page for two categories: “Static IPv4 Routes” and “Static IPv6 Routes”.

Static routes specify the interface and gateway which certain host or network can be reached over. Such pair (interface and gateway) is called a route.



For IPv4 network, scroll down to the “Static IPv4 Routes” screen as follows.



Add: Add an entry for a route to an IPv4 network or host.

For example: Target network = 192.168.10.0;
 Netmask = 255.255.255.0; NIO 51 WAN IP = 192.168.0.1;
 The route to be assigned will be “wan” for interface and
 “192.168.0.253” for gateway.
 Leave “Metric” and “MTU” field to default values as 0 and 1500
 respectively.

Routes
 Routes specify over which interface and gateway a certain host or network can be reached.

Static IPv4 Routes

Interface	Target	IPv4-Netmask	IPv4-Gateway	Metric	MTU	
wan	192.168.10.0	255.255.255.0	192.168.0.253	0	1500	Delete

Add

Delete: Delete a followed route entry.

For IPv6 network, scroll down to the “Static IPv6 Routes” screen as follows.

IWF300 Status System Network Logout

Static IPv6 Routes

Interface	Target	IPv6-Gateway	Metric	MTU
IPv6-Address or Network (CIDR)				
This section contains no values yet				

Add

Add: Add an entry for a route to an IPv6 network or host.

Clicking the “Add” button will show the following entry.

Static IPv6 Routes

Interface	Target	IPv6-Gateway	Metric	MTU	
lan			0	1500	Delete

Add

Save & Apply Save Reset

Clicking the “Save & Apply” button will activate the entries.

2.4.6 RSTP

Normally, when an AP LAN port connects to a LAN switch, enabling RSTP is required. For NIO 51, RSTP is not required.

Click “Network” -> “RSTP” in the GUI menu, and navigate to the RSTP page for configuring RSTP attributes in NIO 51.

Rapid STP
RSTP is Rapid Spanning Tree Protocol

RSTP Settings

Enable RSTP

RSTP bridge Settings

RSTP bridge name

Priority (0~15)
ⓘ A multiple of 4096 and ranges from 0 to 15*4096 = 61440

Hello Time (s)

Max Age Time (s)

Forward Delay Time (s)

Priority: Used to decide which switch is the root bridge. The smaller the value; the higher the Priority. If switch has same Priority, compare MAC address. Root bridge can decide Hello Time, Max Age, Forwarding Delay of the entire network.

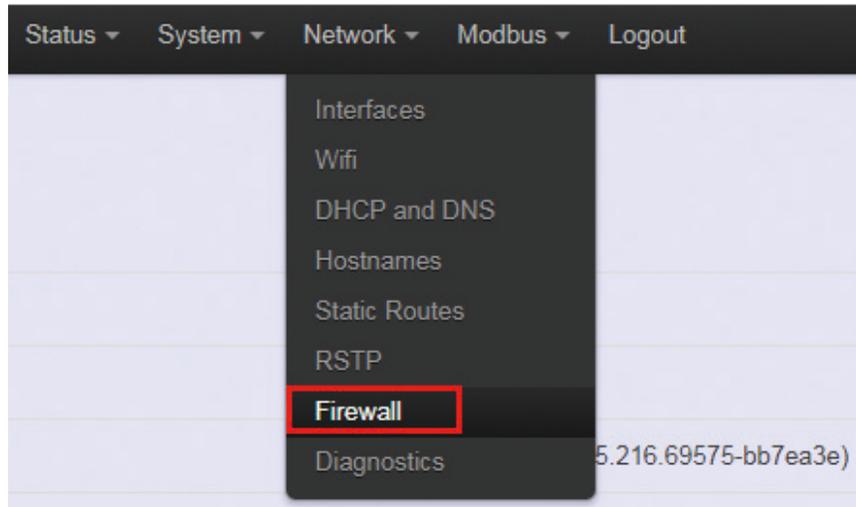
Hello Time: The hello time is the time between each bridge protocol data unit (BPDU) that is sent on a port. This time is equal to 1 second by default.

Max Age Time: Cannot receive BPDU in specified max age time, system will re-establish RSTP topology. This time is 6 seconds by default.

Forward Delay Time: The forward delay is the time that is spent in the listening and learning state. This time is equal to 4 seconds by default.

2.4.7 Firewall

Click “Network” -> “Firewall” in the GUI menu, and navigate to the firewall attributes configuration page.

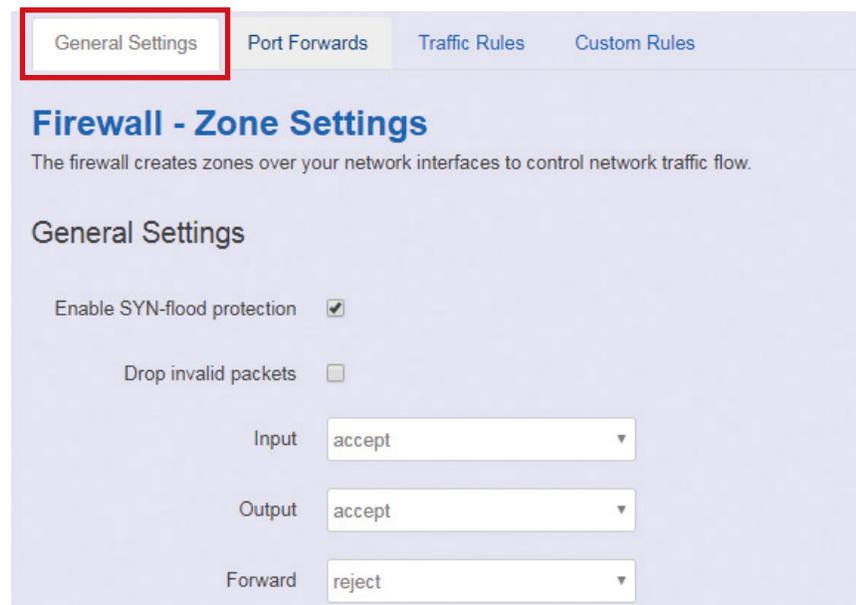


<General Settings>

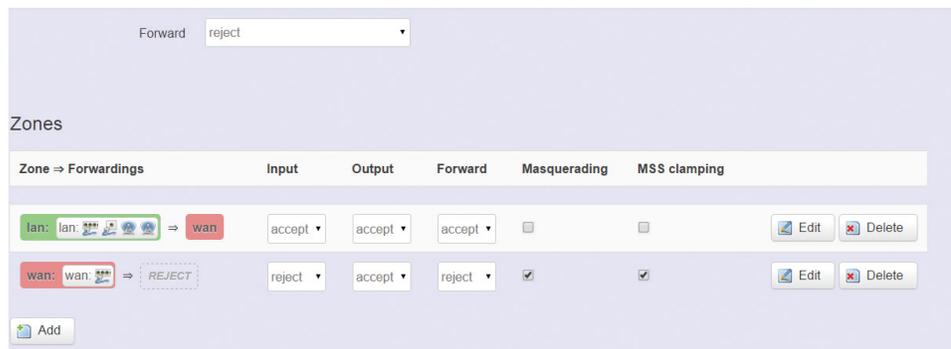
Clicking the “General Settings” tab on the top of the screen will show the “Zone Settings” configuration including “General Settings” and “Zones” categories.

In the “General Settings” category, there are 5 basic options for traffic control over interfaces:

“Enable SYN-flood protection” (default: enabled), “Drop invalid packets” (default: disabled), “Input” (default: accept), “Output” (default: accept), and “Forward” (default: reject).



In the “Zones” category, create or edit zones over your network interfaces to control network traffic flow.



There are 3 control buttons for “Zones” settings:

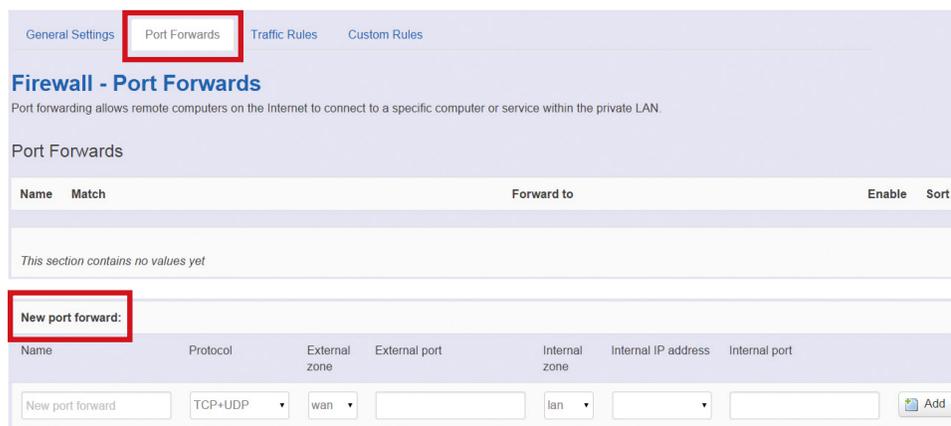
Edit: Edit the followed flow entry.

Delete: Delete the followed flow entry.

Add: Create a new entry for traffic flow among zones over interfaces.

<Port Forwards>

Clicking the “Port Forwards” tab on the top of the screen will show the tables for port forwarding. Adding or editing a specific forwarding table allows remote computers on the internet to connect to a specific computer or service within the private LAN.



In the “New port forward” category, there is only one button for flow editing:

Add: Create a new flow entry for port forwarding among zones.

<Traffic Rules>

Clicking the “Traffic Rules” tab on the top of the screen will bring up the policy tables of 2 categories: “Traffic Rules” and “Source NAT”.

Firewall - Traffic Rules
Traffic rules define policies for packets traveling between different zones, for example to reject traffic between certain hosts or to open WAN ports on the router.

Traffic Rules

Name	Match	Action	Enable	Sort
Allow-DHCP-Renew	IPv4-UDP From any host in wan To any router IP at port 68 on this device	Accept input	<input checked="" type="checkbox"/>	↑ ↓ Edit Delete
Allow-Ping	IPv4-ICMP with type echo-request From any host in wan To any router IP on this device	Accept input	<input checked="" type="checkbox"/>	↑ ↓ Edit Delete

In the “Traffic Rules” category, the flow entries of traffic rule define policies for packets traveling between different zones (for example, to reject traffic between certain hosts or to open WAN ports on the router).

Open ports on router:

Name	Protocol	External port
New input rule	TCP+UDP	

New forward rule:

Name	Source zone	Destination zone
New forward rule	lan	wan

In “Source NAT” category, specific flow entries of masquerading that allow fine grained control over the source IP used for outgoing traffic (for example, to map multiple WAN addresses to internal subnets) can be added or edited.

Source NAT

Source NAT is a specific form of masquerading which allows fine grained control over the source IP used for outgoing traffic, for example to map multiple WAN addresses to internal subnets.

Name	Match	Action	Enable	Sort
This section contains no values yet				

New source NAT:

Name	Source zone	Destination zone	To source IP	To source port
<input type="text" value="New SNAT rule"/>	<input type="text" value="lan"/>	<input type="text" value="wan"/>	<input type="text" value="-- Please choos"/>	<input type="text" value="Do not rewrite"/>

Add and edit: Create a new entry with default values, and edit at once if required.

Please remember to click the “Save & Apply” button to activate the new settings.

<Custom Rules>

Custom rules allow you to execute arbitrary iptables commands which are not otherwise covered by the firewall framework. The commands are executed after each firewall re-start, right after the default rule-set has been loaded.

IWF300 Status System Network Logout

General Settings Port Forwards Traffic Rules **Custom Rules**

Firewall - Custom Rules

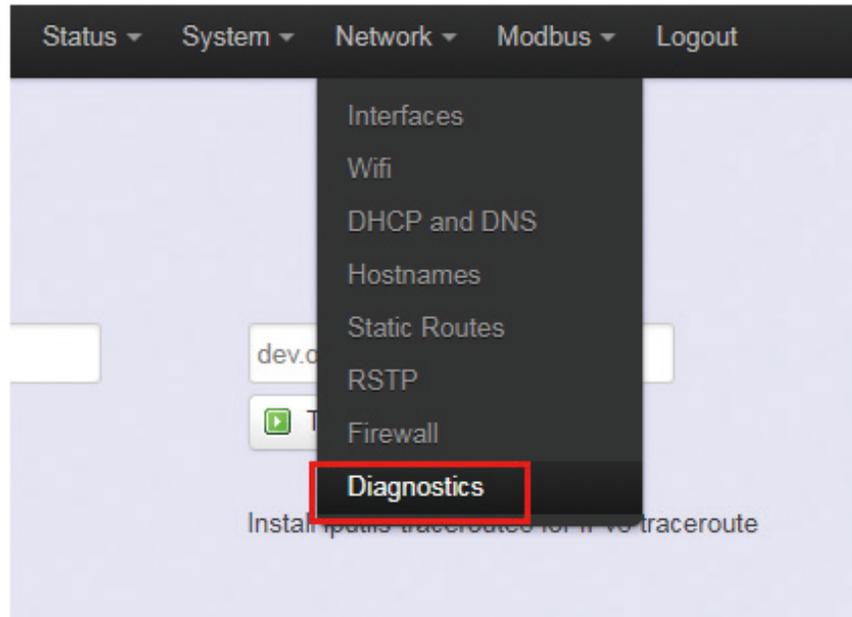
Custom rules allow you to execute arbitrary iptables commands which are not otherwise covered by the firewall framework. The commands are executed after each firewall restart, right after the default ruleset has been loaded.

```
# This file is interpreted as shell script.
# Put your custom iptables rules here, they will
# be executed with each firewall (re-)start.

# Internal uci firewall chains are flushed and recreated on reload, so
# put custom rules into the root chains e.g. INPUT or FORWARD or into the
# special user chains, e.g. input_wan_rule or postrouting_lan_rule.
```

2.4.8 Diagnostics

Click “Network” -> “Diagnostics” in the GUI menu, and navigate to the “Diagnostics” web page.



In this page, there are 3 utilities for users to diagnose interface settings and network paths: Ping, Traceroute, and Nslookup.



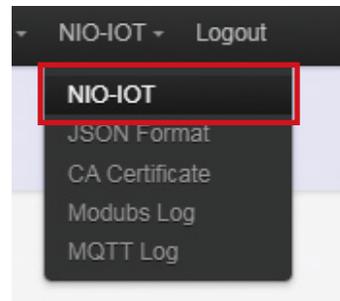
Ping: Test the reachability of a host on an Internet Protocol (IP) network and measure the round-trip time for messages sent from the originating host to a destination host and back. The only required parameter is the name or IP address of the destination host.

Traceroute: Track the route packets taken from an IP network on their way to a given destination host. The only required parameter is the name or IP address of the destination host.

Nslookup: Query the Domain Name System (DNS) to obtain domain name or IP address mapping.

2.5 MQTT and Modbus Setting

Select NIO-IOT to configure serial' Modbus and MQTT settings.



2.5.1 Serial

Click "Edit" in Serial to configure serial settings.

SERIAL

UART Mode:

Baudrate:

Parity:

Databits:

Stopbits:

Flow Ctl:

Timeout (ms):
ⓘ UART Recv/Send Timeout Value Range - 0: Auto, 1 ~ 65535 milliseconds.

Terminator:

UART mode: Select RS-232 or RS-422 or RS-485.

Model: Select "None" for RS-232/RS-422/RS-485 and select "RTU" for Modbus/RTU.

Baudrate: 300 bps to 961200 bps.

Parity: None, Odd, Even.

Databit: Data bits 8.

Stopbit: Stop bits 1

Flow Ctl: None, RTS/CTS, XON/XOFF

Timeout: This field specifies how long NIO 51 will wait for a response before ignoring the Modbus/RTU request.

- 0: Auto
- 1 ~ 65535 milliseconds: If the serial device does not respond within the specified time, NIO 51 will ignore the Modbus/RTU request.

Terminator: You may need to add termination resistors in some critical RS-485 environments to prevent the reflection of serial signals. NIO 51 built-in 120 Ω and termination resistor can be enabled.

2.5.2 MQTT

Configures how the gateway connects to the MQTT broker. Please click “Edit” in Protocol to configure MQTT settings.



IOT Overview

Serial

UART Mode	Baudrate	Serial Parameter	Terminator	 Edit
RS-232	115200	N/8/1	Disable	

Protocol

Mode	Broker Name	Domain/IP	Status	 Edit
MQTT	Embox_broker	Embox.broker	DISCONNECTED	

Tag

TAG	Protocol	Modbus ID	Start Address	 Add
<i>No station configuration exist</i>				

The following are MQTT parameters for configuration.

IOT Settings

Protocol Mode	<input type="text" value="Modbus to MQTT"/>
Broker Name	<input type="text" value="Embux_broker"/>
Broker Domain/IP	<input type="text" value="Emubx.broker"/>
Broker Port	<input type="text" value="1883"/>
Keep Alive	<input type="text" value="60"/> <small>📘 Defines the longest period of time that the broker and</small>
SSL/TLS Encryption	<input type="text" value="Disable"/>
Anonymous Login	<input type="text" value="Disable"/> <small>📘 Connect without using username and password. (Ser</small>
User Name	<input type="text" value="NEXCOM_USER"/>
User Password	<input type="text" value="NEXCOM_PASSWORD"/>
Scan Rate(s)	<input type="text" value="3"/> <small>📘 Time range between publish : 1 ~ 65535 seconds.</small>
Clean Data After Restart	<input type="checkbox"/>
Send JSON Format	<input checked="" type="checkbox"/>

Parameters	Description
Protocol Mode	Select Modbus to MQTT for MQTT function.
Broker Name	A convenient name that is easy to remember.
Broker Domain/IP	Broker domain name or IP.
Broker Port	Default is 1883.
Keep Alive	Start counting to 60 seconds after sending data. If no data is transferred within 60 seconds, NIO 51 will send a packet to the broker. If there is no response, the TCP connection will be closed.
SSL/TLS Encryption	Enable or disable SSL/TLS Encryption, which will require the user to upload the CA certificate file. (NIO-IOT -> CA certificate)
Anonymous Login	Connect without using username and password. (Server must enable anonymous login)

Parameters	Description
User Name	Name for SSL/TLS Encryption.
User Password	Password for SSL/TLS Encryption.
Scan Rate(s)	Time interval between two publishes.
Clean Data After Restart	Check this option to clean disconnection buffer data after restarting NIO 51.
Send JSON Format	<p>Check this option to enable JSON Format. Users can modify the JSON Format in the *.txt file and upload it to NIO 51.</p> 

2.5.3 Modbus and MQTT Publish/Subscribe

Configuration for Modbus/RTU and Modbus/TCP setting and MQTT publish/subscribe settings.

Click “Edit” or “Add” in Tag to configure Modbus information.

IOT Overview

Serial

UART Mode	Baudrate	Serial Parameter	Terminator	 Edit
RS-232	115200	N/8/1	Disable	

Protocol

Mode	Broker Name	Domain/IP	Status	 Edit
MQTT	Embox_broker	Embox.broker	DISCONNECTED	

Tag

TAG	Protocol	Modbus ID	Start Address	 Add
<i>No station configuration exist</i>				

The following are Modbus parameters for configuration.

Tag Name

Modbus Protocol

TCP Timeout

Modbus IP

Modbus Port

Modbus ID

Modbus Function

Start Address

Data Type

Data Number

SWAP

Publish Topic
 Limited to 128 character

Subscribe Topic
 Limited to 128 character

Qos
 Quality of Service Levels

Parameters	Description
Tag Name	User define for different tags.
Modbus Protocol	Select Modbus/TCP or Modbus/RTU device.
TCP Timeout	This field specifies how long the NIO 51 will wait for a response before closing the TCP connection.
Modbus IP	Modbus device IP.
Modbus Port	Modbus device TCP port.
Modbus ID	Modbus device ID.
Modbus Function	Modbus Function code for device.
Start Address	Start address of Modbus data.
Data Type	Modbus data type.
Data Number	Data length.
Publish Topic	Publish topic to MQTT broker.
Subscribe Topic	Subscribe topic from MQTT broker.
QoS	<p>MQTT QoS for publish.</p> <ul style="list-style-type: none"> • 0 (at most once): The fastest method, QoS 0 requires only 1 message. It is an unreliable transfer mode. The message will be delivered only once and is not acknowledged. • 1 (at least once): QoS 1 guarantees that the message will be delivered at least once. The sender sends a message and waits for an acknowledgement. • 2 (exactly once): QoS 2 is the safest and slowest quality of service level, this level guarantees that each message is received only once by the intended recipients.

2.5.4 Modbus Log

The logs include Serial/Modbus configuration changes, sending and receiving of serial data and TCP connection.

Modbus Gateway Log Message

Debug Mode Disabled.

```
Thu Jan 11 08:52:45 2018:
Thu Jan 11 08:52:45 2018: ***** Start NIO51 Modbus Gateway *****
Thu Jan 11 08:52:45 2018: Copyright ((c)) 2017 NEXCOM International Co., Ltd
Thu Jan 11 08:52:45 2018: This application secrets of NEXCOM International Co., Ltd.
Thu Jan 11 08:52:45 2018: No part may be reproduced or transmitted in any form by any means or
Thu Jan 11 08:52:45 2018: for any purpose without the express written permission of
Thu Jan 11 08:52:45 2018: NEXCOM International Co., Ltd.
Thu Jan 11 08:52:45 2018:
Thu Jan 11 08:52:45 2018: Version 1.11a
Thu Jan 11 08:52:45 2018:
Thu Jan 11 08:52:45 2018:   UART Configure
Thu Jan 11 08:52:45 2018:   Device   : /dev/ttyATH0
Thu Jan 11 08:52:45 2018:   Mode    : RS485
Thu Jan 11 08:52:45 2018:   Speed   : 115200
Thu Jan 11 08:52:45 2018:   Configure : n81
Thu Jan 11 08:52:45 2018:   Terminal : Disable
Thu Jan 11 08:52:45 2018:   Timeout  : 0 (ms)
Thu Jan 11 08:52:45 2018:   TCP Configure
Thu Jan 11 08:52:45 2018:   Mode    : Server
Thu Jan 11 08:52:45 2018:   Port Number: 502
Thu Jan 11 08:52:45 2018:   Timeout  : 180 (s)
Thu Jan 11 08:52:45 2018: ready to accept...
```

CHAPTER 3: PRODUCT SPECIFICATION

Wi-Fi Radio

- IEEE 802.11a/b/g/n, 2x2 MIMO

Serial Interface

- RS232/422/485 with isolation
 - Data bits: 8
 - Stop bits: 1
 - Parity: none, even
 - Baud rate: 300bps ~ 921.6Kbps

Ethernet Interface

- 10/100Mbps

Power Requirements

- Input voltage: 12~48VDC, 2-pin removable terminal block
- Input current: 1.67A@12VDC

LED Indicator

- 1 x Power/status
- 1 x Serial status
- 3 x RSSI indicator
- 1 x Wi-Fi 2.4/5GHz indicator
- 1 x Link/Act indicator
- 1 x Extension module

Factory Default/Reset Button

- Press reset button 10 seconds for factory default

Connector Type

- DC input: Phoenix contact terminal block
- Ethernet: RJ-45 connector
- Serial signal: DB9

Wi-Fi Operating Mode

- EZ Mesh
- Client router

Wi-Fi Security (Client Mode)

- WEP (64/128)
- WPA/WPA2 mixed
- WPA2-personal (PSK+CCMP/AES), WPA2-enterprise

Protocol

- Modbus TCP
- Modbus RTU
- Transparent mode for serial to Wi-Fi/Ethernet

Serial Port Characteristics

- Flow control: XON/XOFF, RTS/CTS
- Serial data log: 64KB
- Offline port buffering: 20MB
- Min. concurrent TCP client number: 10

Software Watchdog

Dimension

- 81.4 x 122.6 x 35 (W x D x H) (mm)

Weight: 450g

Mounting

- Wall mounting
- DIN mounting

Construction

- SGCC chassis with fanless design

Certification

- EMI: FCC, CE Class A
- RF
 - FCC: Part 15C
 - CE: EN300328, EN301893
- EN 62368-1 (pending)
- EMC
 - EN301 489-1/17, FCC Part 15 subpart B, EN55032/55024
 - IEC61000-4-2: level 4
 - IEC61000-4-4: level 4
 - IEC61000-4-5 Surge: level 3

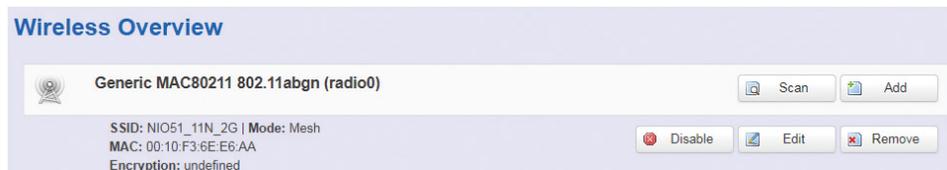
Environment

- Operating temp: -40°C ~ 70°C
- Storage temp: -40°C ~ 85°C
- Relative humidity: operating 5% ~ 95%, non-condensing
- RoHS compliant
- Vibration
 - Random: 2Grms @ 5~500Hz, IEC60068-2-64
 - Sinusoidal: 2Grms @ 5~500Hz, IEC60068-2-6
- Shock: 50G, half sine, 11ms, IEC60068-27

CHAPTER 4: CONFIGURATION EXAMPLE

4.1 How to Configure 5G Mesh

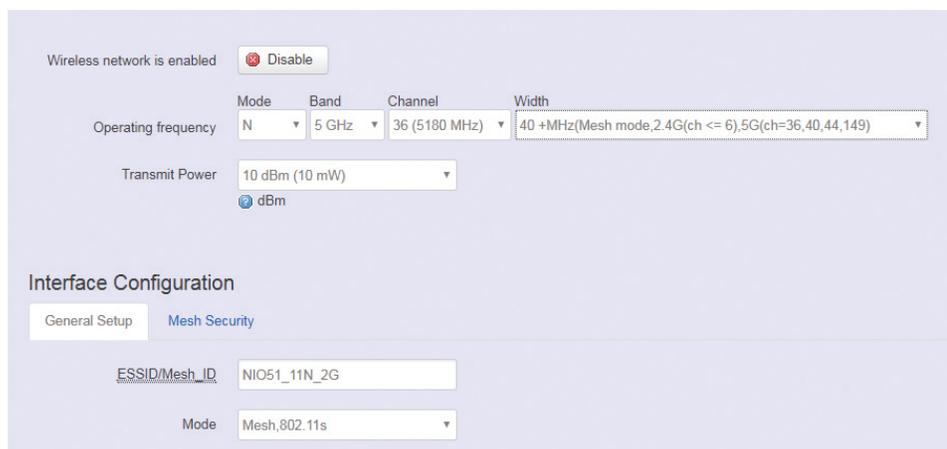
Step 1. In the “Network” -> “Wifi” page, press the “Edit” button.



Step 2. Select the 5G channel. Mode = **Mesh 802.11s**

Step 3. If your 5G channel is 36, 40, 44, 149, select the 40MHz (Only for mesh mode... ch=36, 40, 44, 149) option.

If your 5G channel is 48, 153, 157, 161, 165, select the 40MHz (Only for mesh mode... ch=48, 153, 157, 161, 169) option.



Step 4. Press the “Save & Apply” button.



4.2 How to Configure Client Router

Wi-Fi Setting

Step 1. Please select "Network" -> "Wifi" and click Edit.

Step 2. Configure Channel SSID and "Client router" mode.

For channel setting, you can select "auto" to scan the channel automatically or you can select the channel if you already know the AP channel that you want to connect.



Wireless network is enabled

Operating frequency	Mode	Band	Channel	Width
N	2.4 GHz	auto	40 MHz(Client mode)	

Transmit Power: 15 dBm (31 mW)



Interface Configuration

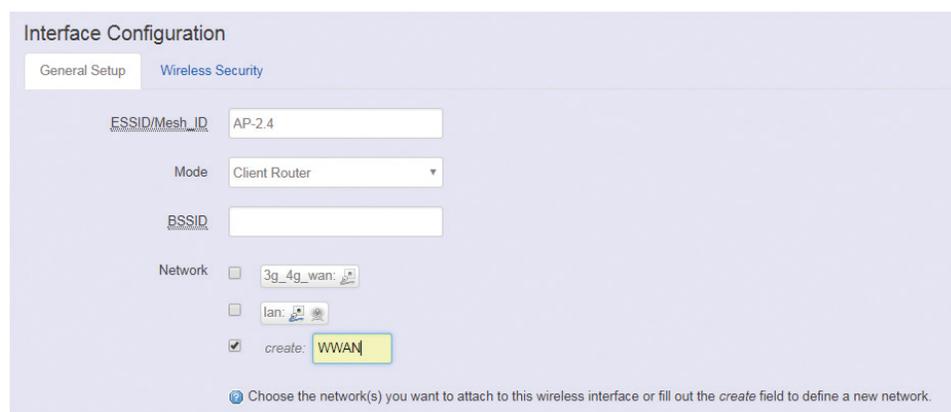
General Setup | **Wireless Security**

ESSID/Mesh_ID: NIO51_11N_2G

Mode: Client Router

BSSID:

Step 3. For Network, click "create" and enter WWAN (Wireless WAN) in the text field, then add new network interface.



Interface Configuration

General Setup | **Wireless Security**

ESSID/Mesh_ID: AP-2.4

Mode: Client Router

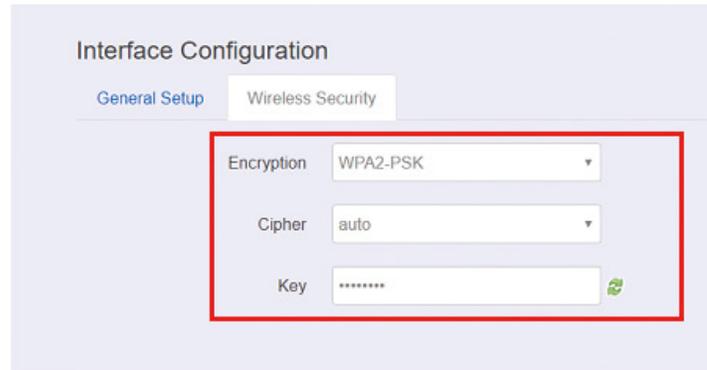
BSSID:

Network:

- 3g_4g_wan
- lan
- create: WWAN

Choose the network(s) you want to attach to this wireless interface or fill out the create field to define a new network.

Step 4. Configure the WPA2 password.



Interface Configuration

General Setup Wireless Security

Encryption WPA2-PSK

Cipher auto

Key *****

Step 5. Press the "Save & Apply" button.



Save & Apply Save Reset

Configure WWAN Interface Setting

Step 1. Please select "Network" -> "Interface" and click WWAN Edit.

The screenshot shows the 'Interfaces' configuration page with an 'Interface Overview' table. The table has three columns: Network, Status, and Actions. There are two rows: WWAN and LAN. The WWAN row is highlighted in light blue, and the LAN row is highlighted in light green. The WWAN row shows 'Client "AP-2.4"' and statistics: Uptime: 0h 0m 0s, MAC-Address: 00:00:00:00:00:00, RX: 0.00 B (0 Pkts.), TX: 0.00 B (0 Pkts.). The LAN row shows 'br-lan' and statistics: Uptime: 0h 17m 43s, MAC-Address: 00:10:F3:6E:E6:AB, RX: 516.52 KB (5311 Pkts.), TX: 1.09 MB (5561 Pkts.), IPv4: 192.168.1.1/24, IPv6: FDC1:5D2B:D1FB::1/60. Both rows have 'Connect', 'Stop', 'Edit', and 'Delete' buttons.

Step 2. It is suggested that DHCP client is selected if your AP has DHCP server function. Click "Switch protocol" to switch the DHCP client mode for WWAN interface.

The screenshot shows the 'Common Configuration' page for the WWAN interface. The 'General Setup' tab is active. It displays the 'Status' as 'Client "AP-2.4"' and 'Uptime: 0h 0m 0s'. Below this, the 'Protocol' is set to 'DHCP client' in a dropdown menu. At the bottom, there is a 'Really switch protocol?' section with a 'Switch protocol' button.

Step 3. Because WWAN interface is used for AP connection, please make sure that Wireless Network is selected in the "Physical Settings" tab.

The screenshot shows the 'Interfaces - WWAN' configuration page. The 'Physical Settings' tab is active. It contains a 'Bridge interfaces' section with a checkbox and a note: 'creates a bridge over specified interface(s)'. Below this is the 'Interface' section with three radio button options: 'Ethernet Adapter: "eth0" (lan)', 'Wireless Network: Client "AP-2.4" (WWAN)', and 'Custom Interface:'. The 'Wireless Network: Client "AP-2.4" (WWAN)' option is selected and highlighted with a red box.

Step 4. You can enable firewall for the WWAN interface or select “unspecified” to disable firewall.

Interfaces - WWAN

On this page you can configure the network interfaces. You can bridge several interfaces by ticking the "bridge" network interfaces separated by spaces. You can also use VLAN notation `INTERFACE.VLANNR` (e.g.: `eth0.1`).

Common Configuration

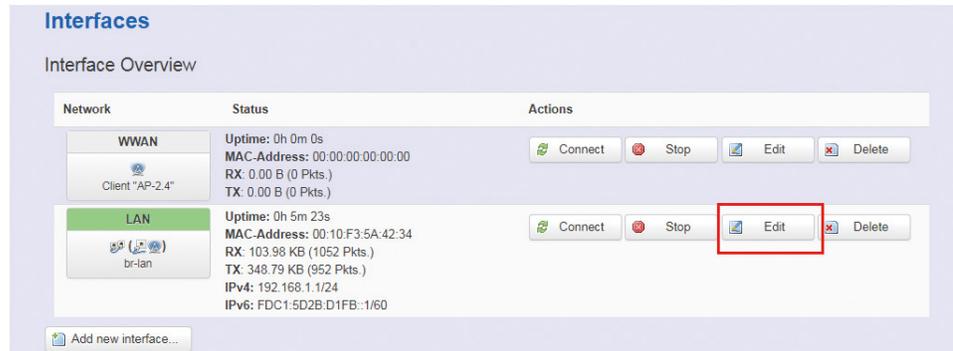
General Setup Advanced Settings Physical Settings **Firewall Settings**

Create / Assign firewall-zone

- lan: lan: 
- wan: 3g_4g_wan:  **WWAN:** 
- unspecified -or- create:

Configure LAN Interface Setting

Step 1. Please select "Network" -> "Interface" and click LAN Edit.



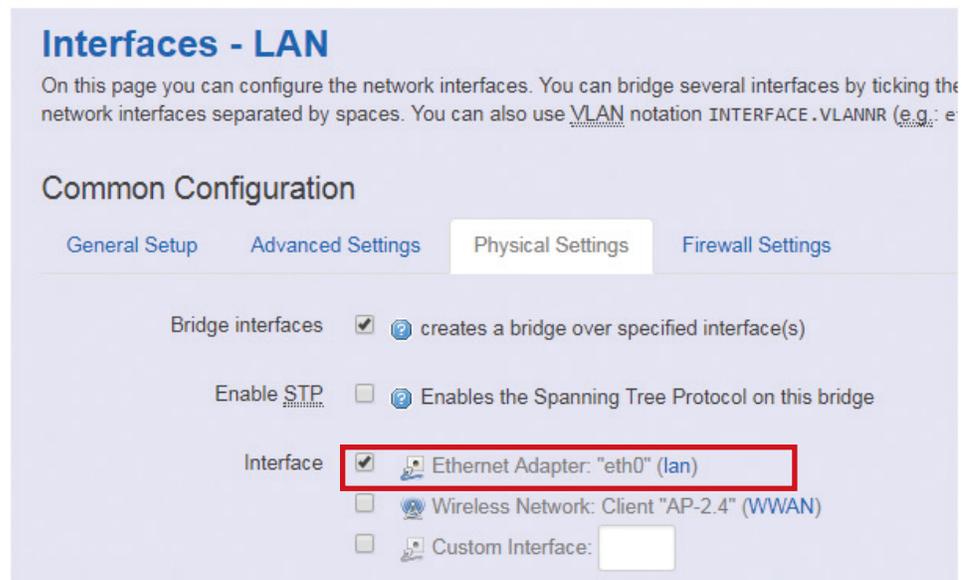
Interfaces

Interface Overview

Network	Status	Actions
WWAN Client "AP-2.4"	Uptime: 0h 0m 0s MAC-Address: 00:00:00:00:00:00 RX: 0.00 B (0 Pkts.) TX: 0.00 B (0 Pkts.)	Connect Stop Edit Delete
LAN br-lan	Uptime: 0h 5m 23s MAC-Address: 00:10:F3:5A:42:34 RX: 103.98 KB (1052 Pkts.) TX: 348.79 KB (952 Pkts.) IPv4: 192.168.1.1/24 IPv6: FDC1:5D2B:D1FB::1/60	Connect Stop Edit Delete

Add new interface...

Step 2. Because LAN interface is used for device LAN connection, please make sure that Ethernet Adapter is selected in the "Physical Settings" tab.



Interfaces - LAN

On this page you can configure the network interfaces. You can bridge several interfaces by ticking the network interfaces separated by spaces. You can also use VLAN notation INTERFACE.VLANNR (e.g.: eth0.1).

Common Configuration

General Setup Advanced Settings **Physical Settings** Firewall Settings

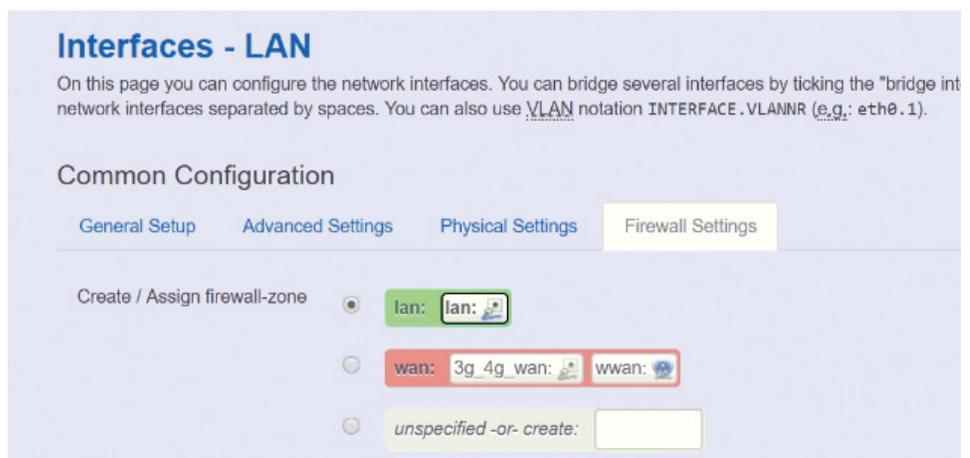
Bridge interfaces creates a bridge over specified interface(s)

Enable STP Enables the Spanning Tree Protocol on this bridge

Interface Ethernet Adapter: "eth0" (lan)

Wireless Network: Client "AP-2.4" (WWAN)

Custom Interface:



Interfaces - LAN

On this page you can configure the network interfaces. You can bridge several interfaces by ticking the "bridge int network interfaces separated by spaces. You can also use VLAN notation INTERFACE.VLANNR (e.g.: eth0.1).

Common Configuration

General Setup Advanced Settings **Physical Settings** Firewall Settings

Create / Assign firewall-zone

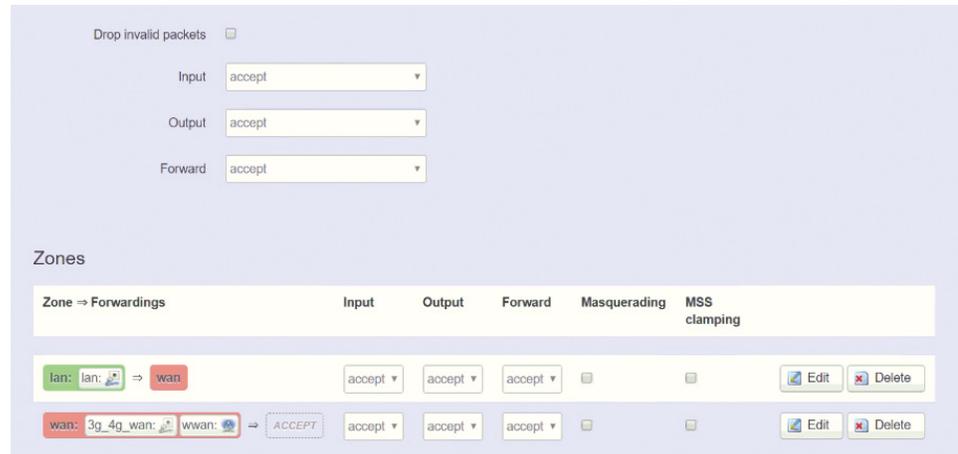
lan: lan:

wan: 3g_4g_wan: wwan:

unspecified -or- create:

Configure Firewall Setting

Step 1. Please select "Network" -> "Firewall" and select "accept" to accept input and forward packets.



Drop invalid packets

Input: accept

Output: accept

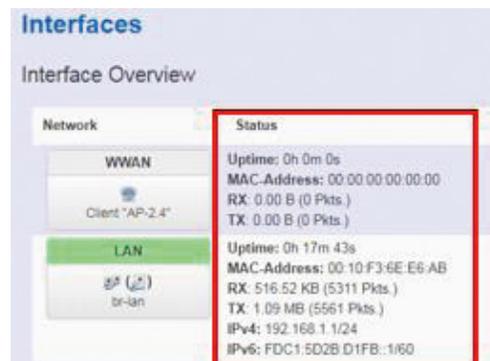
Forward: accept

Zones

Zone => Forwards	Input	Output	Forward	Masquerading	MSS clamping
lan: lan: => wan	accept	accept	accept	<input type="checkbox"/>	<input type="checkbox"/>
wan: 3g_4g_wan: => wwan:	ACCEPT	accept	accept	<input type="checkbox"/>	<input type="checkbox"/>

Verify Network Status

Step 1. Please select "Network" -> "Interface" to check the LAN IP and WLAN (WWAN) IP address status.

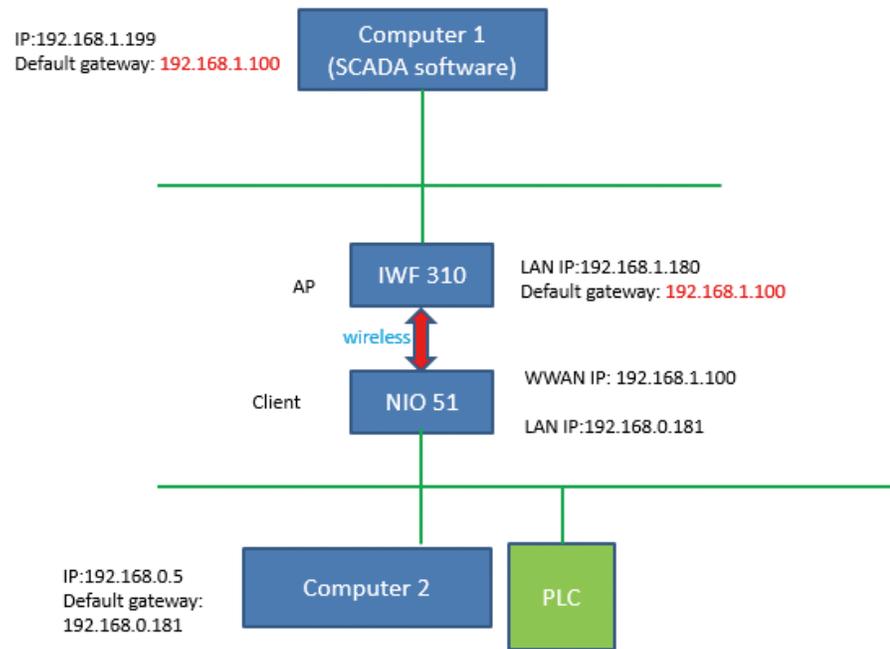


Interfaces

Interface Overview

Network	Status
WWAN Client "AP-2.4"	Uptime: 0h 0m 0s MAC-Address: 00:00:00:00:00:00 RX: 0.00 B (0 Pkts.) TX: 0.00 B (0 Pkts.)
LAN br-lan	Uptime: 0h 17m 43s MAC-Address: 00:10:F3:6E:E6:AB RX: 516.52 KB (5311 Pkts.) TX: 1.09 MB (5561 Pkts.) IPv4: 192.168.1.1/24 IPv6: FDC1:5D2B:D1FB::1/60

Network Infrastructure Example



4.3 How to Run Firmware Upgrade

Step 1. In the “System” -> “Flash firmware” page, select your image and press the “Flash image” button.



Flash new firmware image
Upload a sysupgrade-compatible image here to replace the running firmware. Check “Keep settings” to retain the current configuration (requires an OpenWrt compatible firmware image).

Keep settings:

Image: openwrt-iwf300-webgui-v010-US.bin

Step 2. Press the “Proceed” button, then the image will be flashed to the device, please wait for 2 minutes.



Flash Firmware - Verify
The flash image was uploaded. Below is the checksum and file size listed, compare them with the original file to ensure data integrity. Click “Proceed” below to start the flash procedure.

- Checksum: **9ebcf94a12237ebae11213811f52cdf**
- Size: 15.24 MB (15.56 MB available)
- Note: Configuration files will be erased.

Powered by LuCI (git-15.236.28194-084d435) / OpenWrt (EU) v0.1.0

4.4 How to Restore to Default Settings

Step 1. In the “System” -> “Flash firmware” page, press the “Platform reset” button.



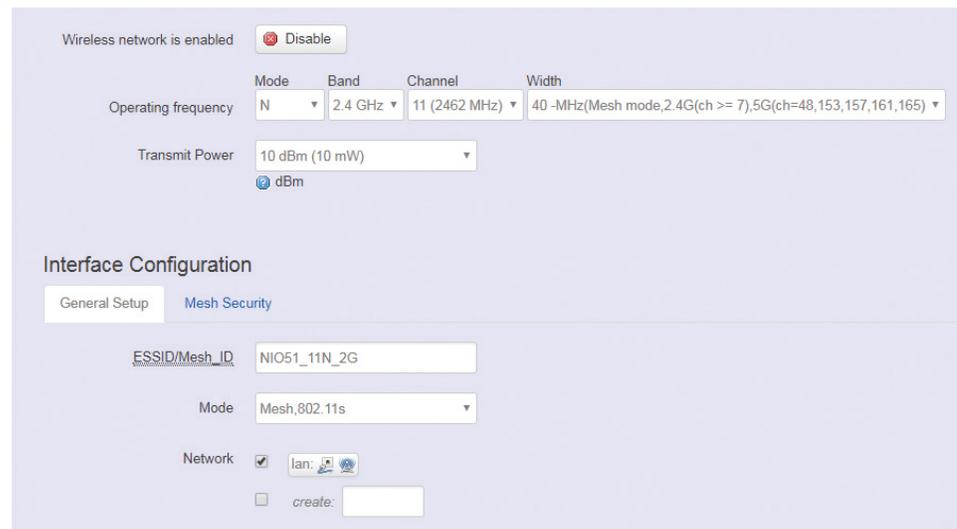
NIO 51 Default Parameters:

LAN port default IP = 192.168.1.1

WAN port default IP = DHCP Client

Login user name: root

Login password: admin

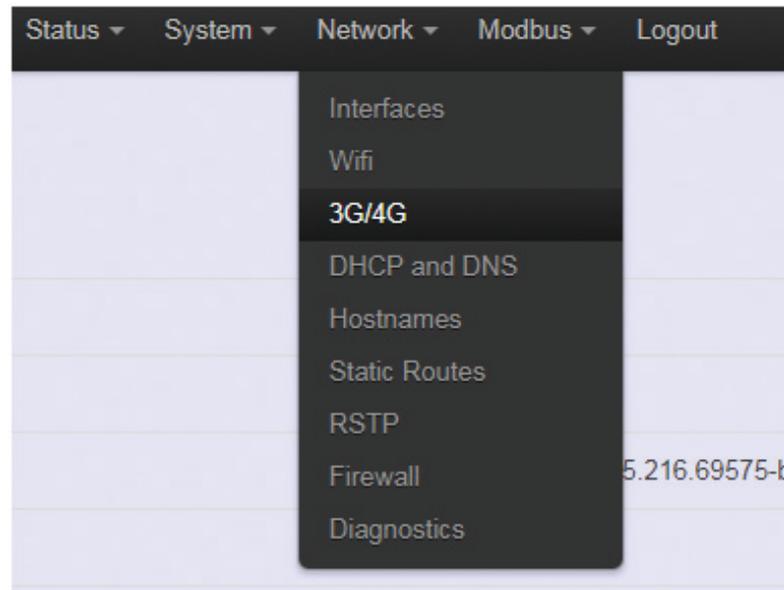


APPENDIX

Wi-Fi and 3G/4G Redundant Function

NIO 51 supports Wi-Fi and 4G redundant function. The main application area for this function is in industrial vehicles. Industrial vehicles use Wi-Fi or 4G when arriving to or leaving from stations. The 3G/4G function is a project based function.

The standard NIO 51 does not include a 3G/4G module, please install the 3G/4G module in the mini PCI slot of NIO 51 and then install an antenna and SIM card. After finishing the installation, the 3G/4G setting will show up in the Web GUI. Please select "Network" -> "3G/4G" to configure.



3G/4G Parameters

3G/4G Parameters

APN	<input type="text" value="internet"/>
PIN	<input type="text" value="****"/>
Auto Connect	<input style="border: none;" type="text" value="Redundancy"/>
Ping Interval(seconds)	<input type="text" value="10"/>
Remote IP(1) Address	<input type="text" value="192.168.100.100"/>
Remote IP(2) Address	<input type="text" value="8.8.8.8"/>
Remote IP(3) Address	<input type="text" value="185.114.227.160"/>

Please select “Redundancy” to enable Wi-Fi and 4G redundant function. You will then need to enter Remote IP address.

When NIO 51 cannot ping Remote IP(1), NIO 51 will ping Remote IP(2) and then Remote IP(3). If you only configured remote IP(1), NIO 51 will activate 3G/4G connection directly.

When NIO 51 can ping Remote IP(1) to Remote IP(3), NIO 51 will stop 3G/4G connection .

Remote IP(2) and Remote IP(3) settings are not required.

APN: The service provider may use access point network (APN) information to connect 3G/4G service. Please enter the access point network (APN) information here.

PIN: SIM card PIN code.

Auto Connect:

- **None:** Never connect 3G/4G.
- **Yes:** Always connect 3G/4G, it is suggested that Wi-Fi is disabled.
- **Redundancy:** Enable Wi-Fi and 4G redundant function.

Ping interval: Ping interval between two Remote IPs.

Remote IP(1) address: When Redundancy function is enabled, you can configure wireless remote IP(1).

Remote IP(2) address: When Redundancy function is enabled, you can configure wireless remote IP (2).

Remote IP(3) address: When Redundancy function is enabled, you can configure wireless remote IP (3).

Check 3G/4G Connection Status

Please select "Status" -> "Overview", and then check the 3G/4G status. You can check the telecom operator's IP and gateway, 3G/4G information, etc.

Network	
3G/4G Status	Module Vendor: Quectel Module Model: EC25 SIM Status: SIM Ready Network Status: "FDD LTE","46692","LTE BAND 7",3400 Connect Operator: "Chunghwa Telecom" Register Status: Registered RSSI: -73dBm Address: 10.73.202.45 Gateway: 10.64.64.64