NIO200 Installation Guide

V1.1

Content

1. General Information

1.1 Document Purpose

This installation guide is designed to let user quickly get necessary installation information about hardware as well as software so that the field installation can be well done through this first aid.

1.2 Definitions, Acronyms and Abbreviations

The following table lists definitions, acronyms, and abbreviations that are only suitable to this document.

Term	Description
API	Application Programming Interface
Backbone	Any data network (e.g. industrial Ethernet, IEEE 802.11, etc.) within a facility interfacing to the plants network.
Backbone Router	An entity in the ISA100.11a network with routing capability which serves as an interface between the radio network and the backbone network.
BBR	Backbone Router
Blacklisted channel	A channel on which transmission is prohibited.
Broadcast	Transmission intended for all the devices in an ISA100.11a network (used for advertisements with all devices including the BBR, or for receive links for field devices only).
CCA backoffs	The count of transmissions on an RF channel that were aborted due to CCA.
CGI	Common Gateway Interface
Channels	Divisions of radio frequencies supported in a wireless network.
Contract	An agreement between the system manager and a device in the network involving the allocation of network resources by the system manager to support a particular communication need of that device.
Device role	Device capabilities that will be accepted by the Security Manager.
DHCP	Dynamic Host Configuration Protocol – a method to automatically configure the IP settings of a host connected in a LAN.

Term	Description
EUI64, EUI-64	The 64-bit address of a device in the network; it is a unique identifier usually set at the manufacturing of the device.
Field	The geographic space that contains all the nodes of a wireless network.
Field device	A physical device designed to meet the rigors of plant operation that communicates via DPDU's conforming to the ISA100.11a protocol.
Gateway	An entity in the ISA100.11a network that serves as an interface between the ISA100.11a network and a client.
Graph (communication)	A collection of unidirectional interconnected devices, which defines a set of communication paths between a source device and a destination device.
Graph (Topology)	A graphical representation of the network topology.
GW	Gateway
Input/output	A device with minimum characteristics required to participate in an ISA100.11a network and which provides or uses data from other devices.
ISA100.11a	A communication protocol used in wireless networks, set up by the Wireless Compliance Institute.
JSON	JavaScript Object Notation
LAN	Local Area Network
Link	A momentary or persistent interconnecting path between two or more devices for the purpose of transmitting and receiving messaging.
MCS	Monitoring Control System
Network Address	The 128-bit address of a device in the network.
Packet Error Rate	The ratio, in percent, of the number of lost packets (DPDU's) to the total number of packets sent by the selected device to its parent.
Process value	The quantity being controlled or the measurement value.
Provision	To update settings on an entity in order to prepare it for working in the network.
Revision	The device software revision related to vendor/model.
Router	A device that has data routing capability.
Security Manager	An entity in the ISA100.11a network that assigns the security keys that are required for communication between devices.
SM	System Manager

Term	Description
Superframe	A collection of timeslots with a common repetition period and possibly other common attributes.
System Manager	An entity in the ISA100.11a network that supervises the various operational aspects of a network other than security.
TR	Transceiver – the BBR radio
User Application Process	From ISA100.11a standard: An active process within the highest portion of the application layer that is the user of OSI (Open Systems Interconnection) services.
UTC	Coordinated Universal Time – A universal timekeeping standard that is based on the Greenwich Mean Time (GMT). Local time is calculated in UTC and offset by the local time zone.
FD	Field Device
NIO210	NIO 200IAG – NEXCOM ISA100 Wireless All-in-One Gateway

2 Product Overview

2.1 About the NIO200 Gateway

NEXCOM NIO 200 is a powerful distributed network topology ISA100.11a / WirelessHART access point integrating 802.11n Mesh technology. With ISA100.11a / WirelessHART technology, NIO 200 can establish fully Mesh network to ensure robust and reliable communication for mission-critical industrial wireless applications. The integration of both 802.11n Mesh & ISA100.11a / WirelessHART technology gives a full Mesh infrastructure from field devices to Wi-Fi backbone, thus a concrete wireless connectivity can be assured. It's designed to meet CID2 and ATEX certified requirement and is perfect solution to critical data monitoring and sensing in oil & gas, chemical plant, etc…

2.2 Logical Interfaces

Interface	Description
Serial Port	The serial port is used as a kernel console and emergency backup.

Interface	Description
TCP	The NIO200 Gateway accepts the following TCP connections.
	➢ The NIO200 Gateway has an http server listening on port 80.
	➢ The NIO200 Gateway has an http server listening on port 8080.
	➢ The NIO200 Gateway has an https server listening on port 443.
	➢ The MODBUS TCP server is listening on TCP port 502.
	➢ The Standard GSAP interface is listening on TCP port 4900.
	➢ The GSAP over SSL is listening on TCP port 4901.
UDP	The NIO200 Gateway utilizes the NTP protocol to synchronize time with Internet time servers. The UDP port 123 must be open in both directions to allow time synchronization.

NOTE:	Not all interfaces are guaranteed to be up in all cases. Some might be disabled for specific applications.

2.3 Package Contents

Each NIO200 gateway package contains the following items:
- One NIO200 gateway
- Two simple wall mounting kit
- Three liquid-tight conduit (used only for DC power input and Ethernet port)
- Two-pin DC power connector for 12~48 VDC power input
- Grounding screws
- Five outdoor antenna for evaluation purpose (when deployed in field site, the antenna should be changed so that the wireless capability can fit the application requirement)
- One AC power adaptor with 12V output for evaluation purpose (when deployed in field site, DC power source may need to be changed)
- One CID2 warning letter

3 Getting Started

3.1　Installation background

The web-based administration is the preferred method to administer/configure the NIO200 Gateway. It requires a web browser and the IP of the NIO200 Gateway. The NIO200 Gateway is suggested to connect to the local LAN then powered on, and the IP/mask or the router must be accessible from the PC where the browser is running.

3.2　Hardware installation Guide

Hardware connection of NIO200 includes the power, Ethernet interfaces and RF connectors. The installation of NIO200 should be carefully done with standard waterproof connectors accessories in the package (CID2: conduit connector, ATEX: cable gland connector).

Note: the mounting of NIO200 should always let water proof connectors down to bottom position. The following picture illustrates the proper mounting direction of NIO200 in the field.

Water proof
connectors down to
bottom position

3.2.1 Water proof connector installation

To install conduit in NIO200 enclosure, please follow the steps below:

● Put conduit through cap nut and gland packing.	● Position the ferrule at the end of the conduit. (Just have the bottom	● Pass DC power cable or Ethernet cable through conduit

of ferrule cover the conduit, over-tighten may enlarge conduit diameter and loosen

- Connect connector into NIO200 enclosure, tighten locknut with body.

- Insert the conduit with ferrule into connector of NIO200 enclosure.

- Push gland packing and cap nut forwards to NIO200 conduit connector and tighten the cap nut

To install the conduit, user should implement with Flexible Metal Conduit, Liquid-tight which meets UL360 standard. Here is the requirement of the diameter and size information for the selection of Metal Conduit that mate with NIO200 conduit connectors.

Nominal size (inch)	Inner diameter min. (mm)	Inner diameter max. (mm)	Outside diameter min. (mm)	Outside diameter max. (mm)	Min bending radius (mm)	Packing length (m)
3/8"	12.29	12.80	17.50	18.00	50.50	30
1/2"	15.80	16.31	20.80	21.30	82.50	30
3/4"	20.83	21.34	26.20	26.70	108.00	30
1"	26.44	27.08	32.80	33.40	165.00	20
1-1/4"	35.05	35.81	41.40	42.20	203.00	20
1-1/2"	40.01	40.64	47.40	48.30	228.50	20

3.2.2 Power installation

1. Prepare DC power source (12~48 VDC) or standard PoE facility such PoE switch or PoE injector.
2. If use external DC power source, please carefully check if the polarity of power

Power pin
DC Input range:
12-48Vdc, 2.1-0.6A

PoE port
Connect to PoE switch or
PoE injector
range:57Vdc, 600mA
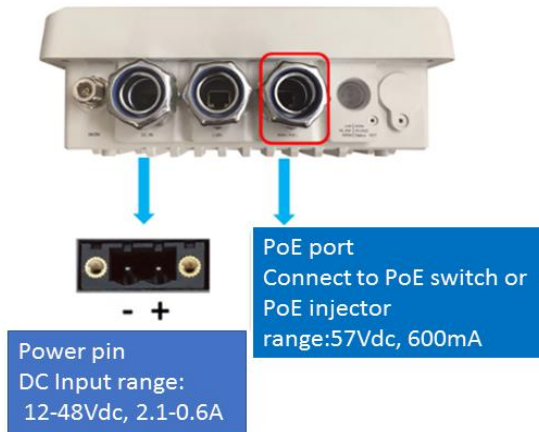
cord fits the polarity drawing in this diagram.

3. When use PoE power source, just plug the Ethernet cable into PoE port.

4. If the power connects correctly, then the "Power LED" will light accordingly.

3.2.3 Antenna installation

Wi-Fi antenna connector for Wi-Fi Mesh connection (WLAN 1 & WLAN 2)

ISA100/WirelessHART antenna connector

3.2.4 Earth grounding
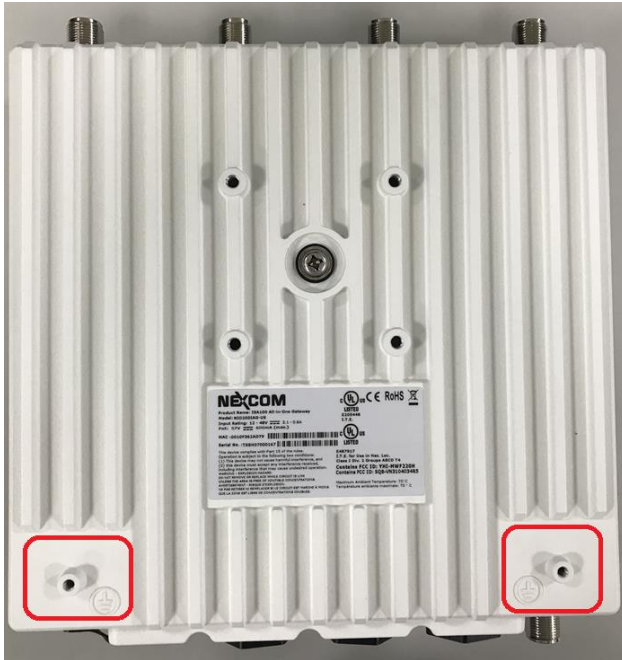
1. Be sure to ground the 0.75mm^2 ground screw with an appropriate grounding wire (Earth, Green/Yellow wire 18AWG, not included) by attaching it to a good earth ground connection.
2. There must be a disconnect device in front of "NIO200 series" to keep the worker or field side maintainer be cautious and aware to close the general power supply before they start to do maintenance.
3. The disconnect device hereby means a 20A circuit-breaker. Power installation must be performed with qualified electrician and followed with National Electrical Code, ANSI/NFPA 70 and Canadian Electrical Code, Part I, CSA C22.1.

3.2.5 Mounting of NIO200

Mounting method in NIO200 is default with simple wall mounting kit. If the installation is with pole mounting method, then user should purchase pole mounting kit for the installation. Here is the guide for both simple wall mounting method and pole mounting method:

A.Simple wall mounting method:

1. Screw the simple wall mounting kit to the bottom of NIO200 enclosure.

2. Be sure to fasten the mounting kit with horizontal position as below:
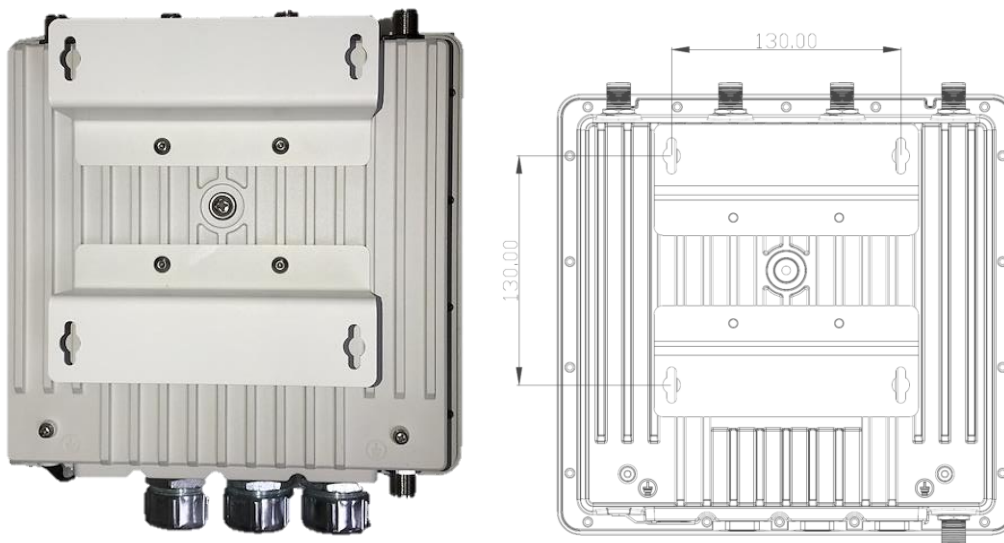
3. Hang on NIO200 to the wall with water proof connector at the bottom direction. The position of screw holes are 130mm width and height (as specified in right picture above)

B. Pole mounting method:

Fasten screw for pole mounting

Pole

Fasten screw to fix pole mounting kit to bottom case

Pole mounting kit
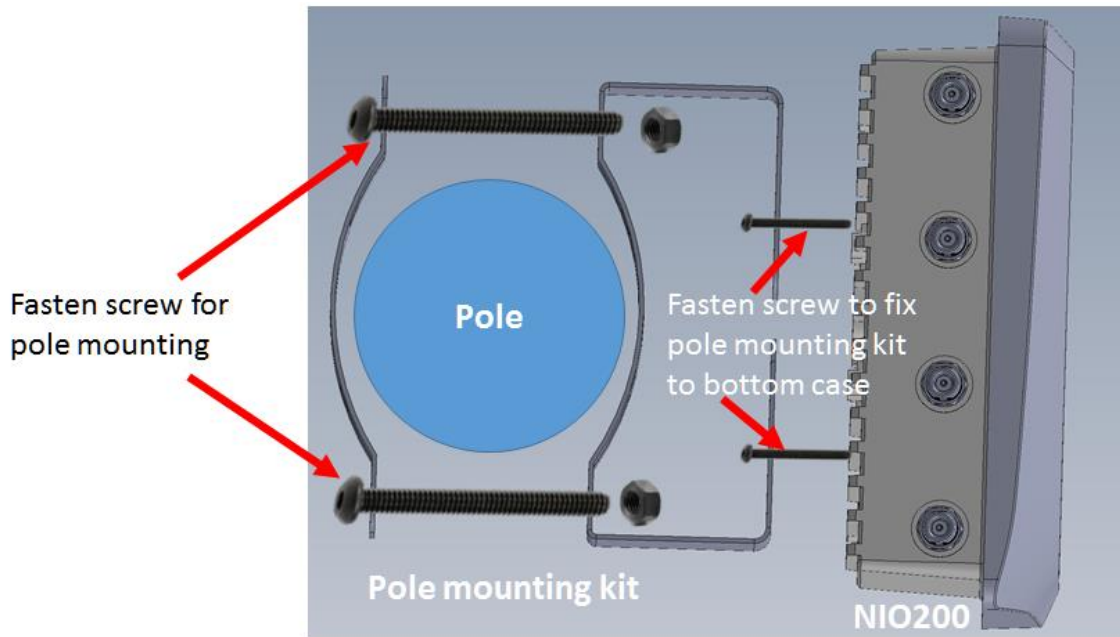
NIO200

3.3 Wi-Fi Mesh Network Configuration

3.3.1 Access to NIO200 Admin website

The NIO200 is pre-configured a static IP address **192.168.1.1** for connection directly to a computer. In order to communicate with the NIO200, the user must temporarily set the computer IP address to a static address (**192.168.1.100** for example) and may use an Ethernet cross-over cable to connect the NIO200 to the computer.
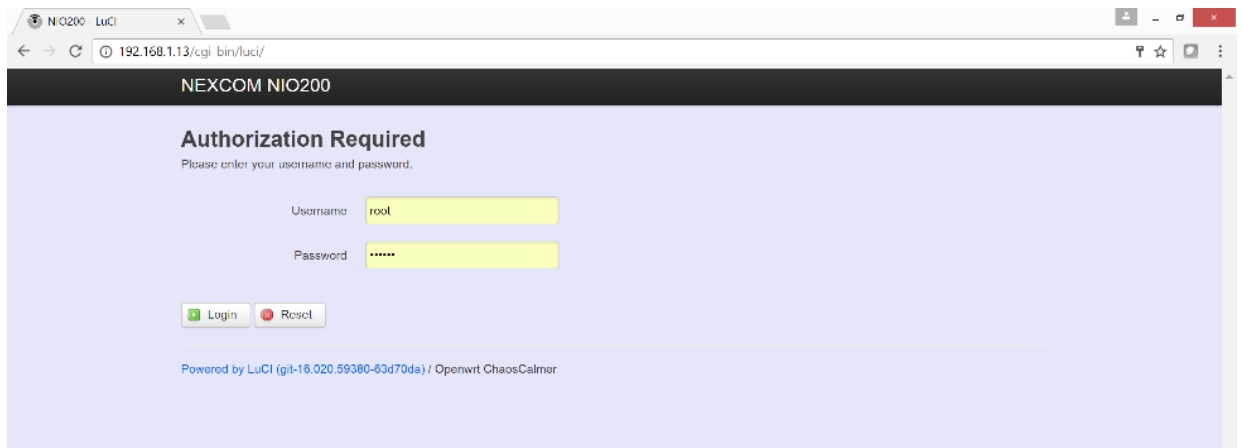
3.3.2 Configure the IP Address

Once the communication has been established with the NIO200, the user can log in the NIO200 Admin website to change the network configuration, including its IP address. To the access this website:

- In browser, open a connection to http://**192.168.1.1/** (or the user defined IP Address)

- Admin website requires authentication, the default *username* and *password* are *root* and *admin*.

Click "Login" button without password and the following web page will appear:

Select "Network -> Interface"
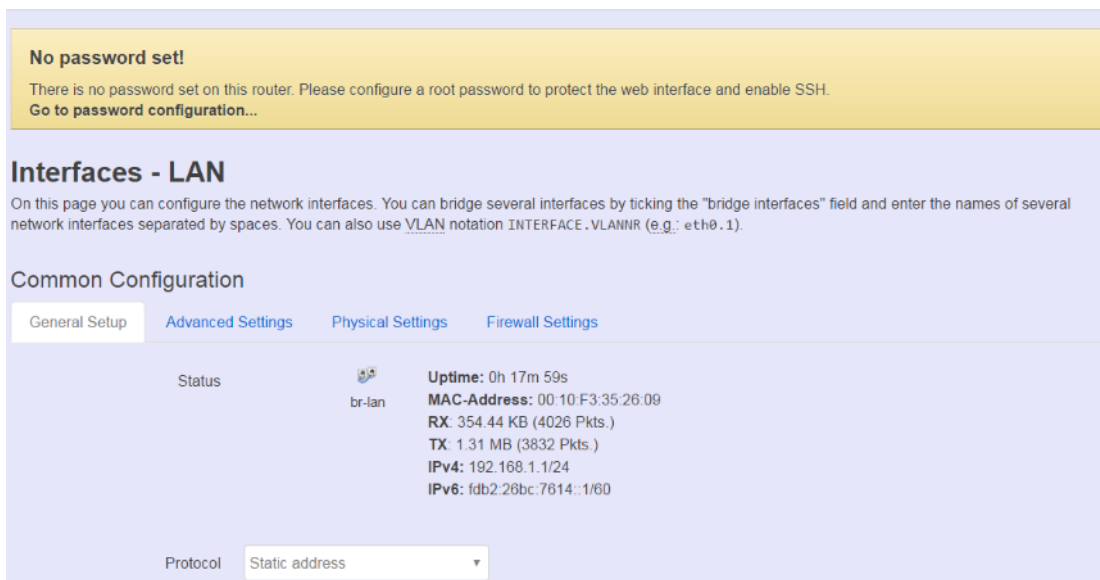

The following web page will appear.

Interface Name: LAN

Bridge Interface: br-lan

IP address: 192.168.1. 1

Physical Interfaces: eth1/eth2/wlan0/wlan1

3.3.3 Change IPv4 address

Click the "Edit" button belonging to "br-lan" network interface icon.
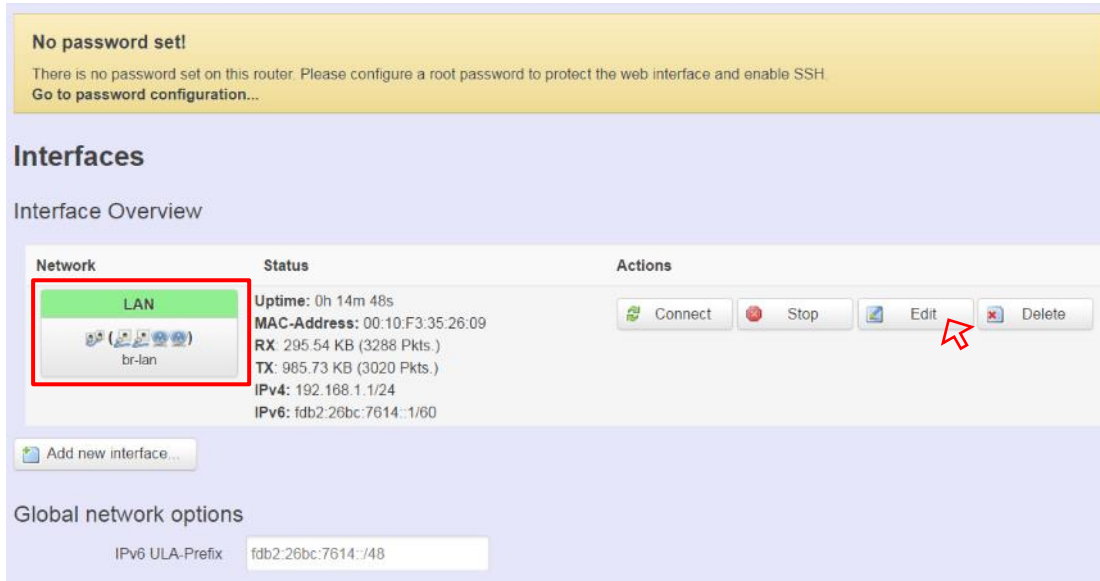
The following web page will appear.

As far as each interface is concerned, there are two configuration sections: "Common Configuration" and "DHCP Server".

Scroll down to the section "Common Configuration", and click

"General Setup" tab.

The IP address, default gateway, DNS servers could be changed and added by clicking the text areas of "IPv4 address", "IPv4 Gateway" and "Use custom DNS servers" and inputting values respectively.

After the configuration is finished, click "Save & Apply" button to save this setting.
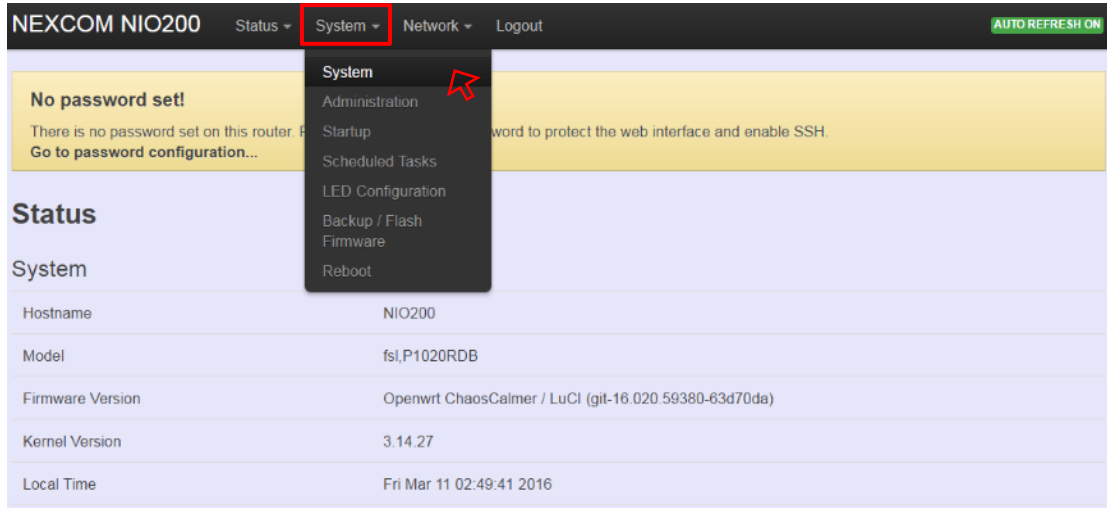

Warning:

After the IPv4 gateway and DNS servers are configured, user needs to go back to "Network -> Interface" page and click "Connect" button to take effect the setting.
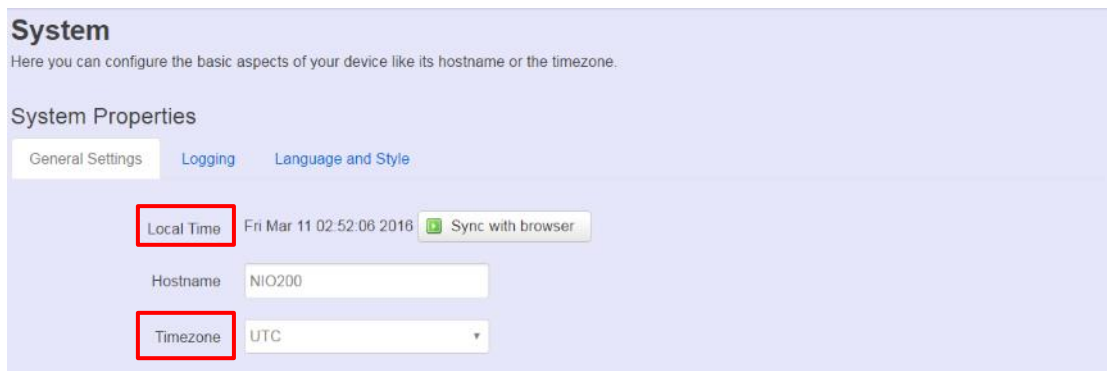
3.3.4 Enable NTP (Network Time Protocol)

Navigate to "System -> System", and then the web page below will appear.

Click "General Settings" tab to configure "Local Time" and "Timezone" as shown below. Configure NTP server in the "Time Synchronization" section when necessary.

Before NTP server is working, NIO200 should have correct date/time by clicking "Sync with browser" and selecting "UTC" as Timezone.
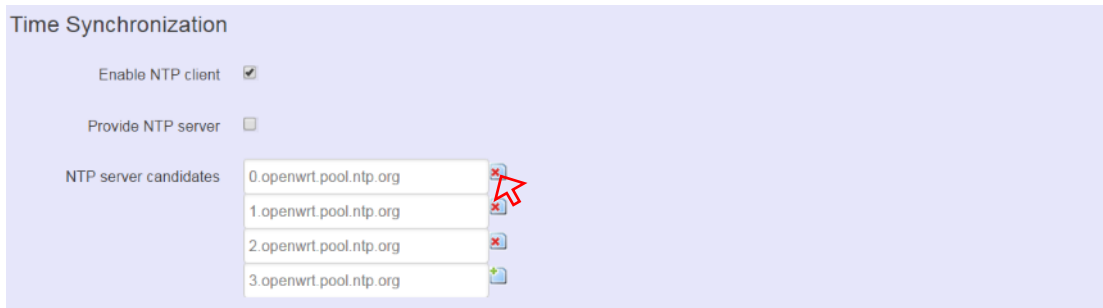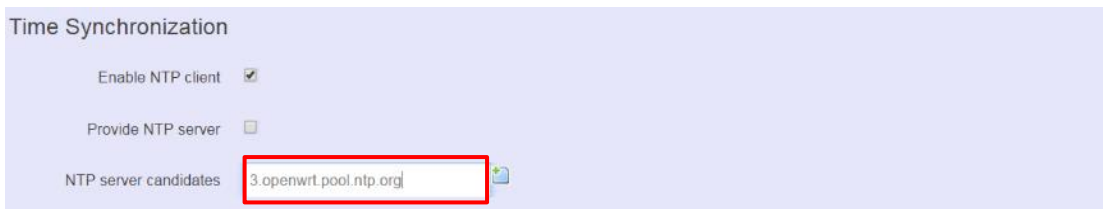
3.3.5 Select Time Zone
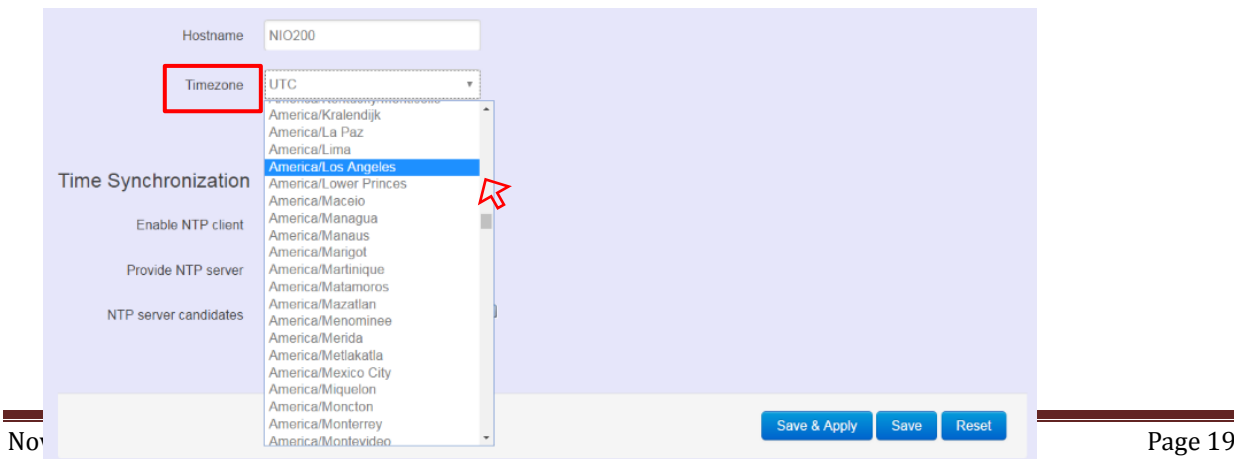
3.3.6 Select/Input Time Server

NTP client is enabled by default.

Click "X" button to delete the incorrect or unwanted time server.

Keep clicking "X" buttons until only one item is left. Point the mouse cursor to text area and input "time.nist.org".
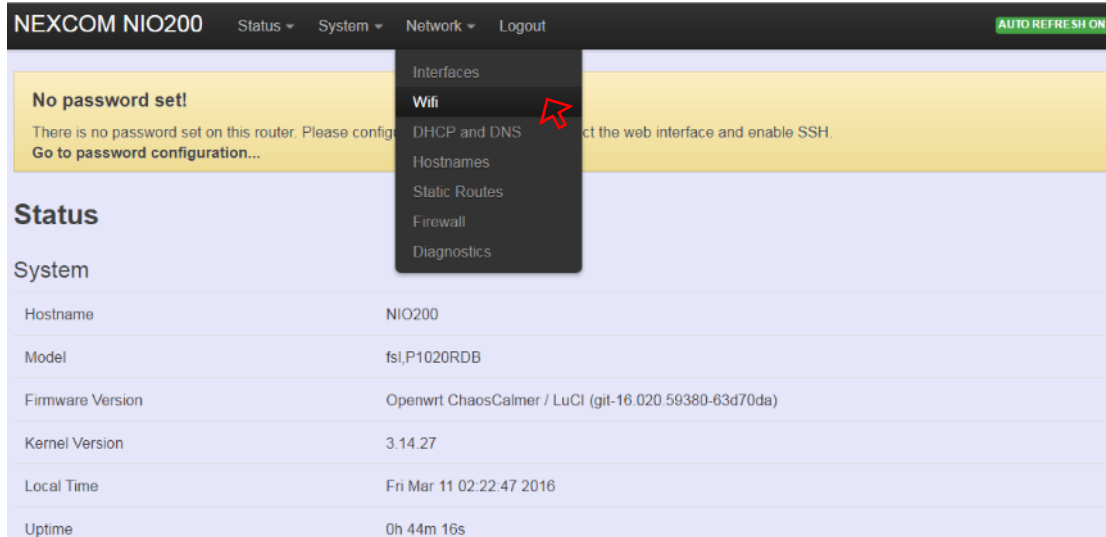

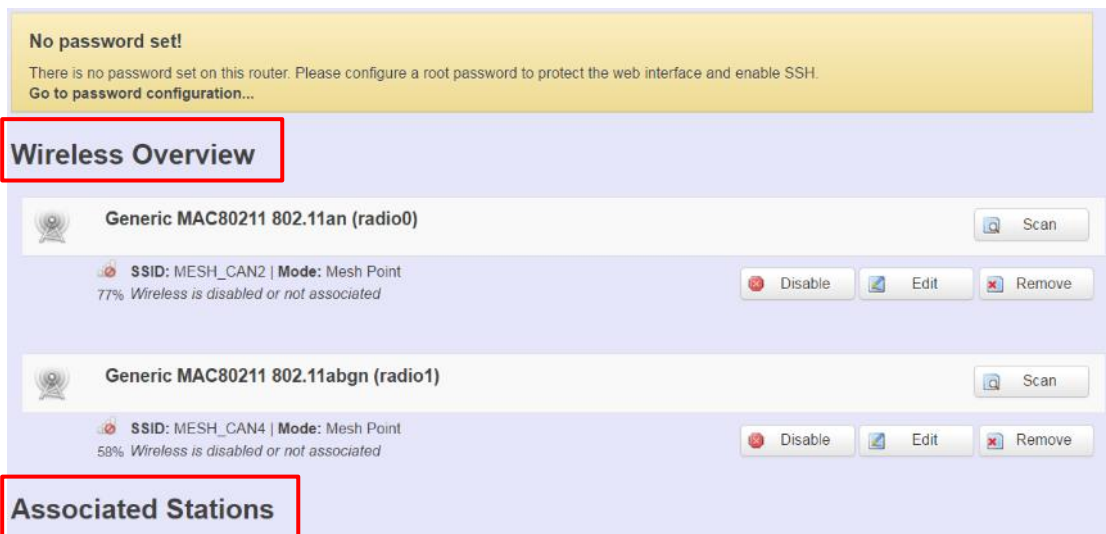If new time server is required, click "**+**" button.

3.3.7 Configure Wi-Fi Mesh Interface

For Wi-Fi configuration and status reporting, navigate to "Network -> Wi-Fi" and click.

The following web page is shown, and contains two sections: "Wireless Overview" and "Associated Stations".

"Wireless Overview" section lists available Wi-Fi interfaces: wlan0 and wlan1.

"Associated Stations" section lists run-time connection information for each Wi-Fi interface (mesh mode).

	SSID	MAC-Address	IPv4-Address	Signal	Noise	RX Rate	TX Rate
	MESH_CAN2	00:10:F3:35:26:27	?	-49 dBm	-95 dBm	150.0 Mbit/s, MCS 7, 40MHz	52.0 Mbit/s, MCS 5, 20MHz
	MESH_CAN2	00:0E:8E:67:62:69	?	-62 dBm	-95 dBm	26.0 Mbit/s, MCS 3, 20MHz	52.0 Mbit/s, MCS 5, 20MHz
	MESH_CAN2	00:10:F3:35:26:1E	?	-68 dBm	-95 dBm	15.0 Mbit/s, MCS 0, 40MHz	52.0 Mbit/s, MCS 5, 20MHz
	MESH_CAN4	00:10:F3:35:26:29	?	-66 dBm	-94 dBm	6.0 Mbit/s, MCS 0, 20MHz	52.0 Mbit/s, MCS 5, 20MHz
	MESH_CAN4	00:0E:8E:67:64:4D	?	-80 dBm	-94 dBm	26.0 Mbit/s, MCS 3, 20MHz	52.0 Mbit/s, MCS 5, 20MHz
	MESH_CAN4	00:10:F3:35:26:21	?	-70 dBm	-94 dBm	58.5 Mbit/s, MCS 6, 20MHz	52.0 Mbit/s, MCS 5, 20MHz

Take wlan0/radio0 interface for example.

No password set!
There is no password set on this router. Please configure a root password to protect the web interface and enable SSH.
Go to password configuration...

Wireless Overview

Generic MAC80211 802.11an (radio0)   Scan

SSID: MESH_CAN2 | **Mode:** Mesh Point   Disable   Edit   Remove
77% Wireless is disabled or not associated

Generic MAC80211 802.11abgn (radio1)   Scan

SSID: MESH_CAN4 | **Mode:** Mesh Point   Disable   Edit   Remove
58% Wireless is disabled or not associated

Associated Stations

Edit:

For editing the configuration profile of Wi-Fi interface, click this button

There are 2 configuration sections in the web page: "Device Configuration" and "Interface Configuration".

The parameters in the "Device Configuration" are related to physical settings of Wi-Fi radio.

The parameters in the "Interface Configuration" are related to network settings of Wi-Fi interface, which is built upon the Wi-Fi radio.

Scan: For displaying the list of all access points around with the same frequency band as this radio has, click this button.

3.3.8 Configure Physical Settings for Radio

The physical settings (radio parameters of Wi-Fi interface) exists in this "Device Configuration" section.

■ Clicking "General Setup" tab.

There are 4 basic types of physical settings required for radio: 802.11 protocol, 5GHz Channel, Bandwidth, and Transmit Power.

There are 2 options for "802.11 protocol": N (802.11n) and Legacy (802.11a).

There are 10 options for channel selection in 5GHz band.

Width: There are 4 options for bandwidth selection. 2 options ("20MHz" and "40MHz") are used for AP or STA client mode. 2 options ("40 plus" and "40 minus") are used for mesh mode
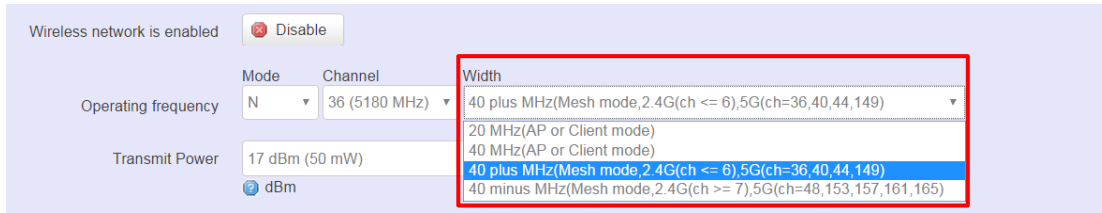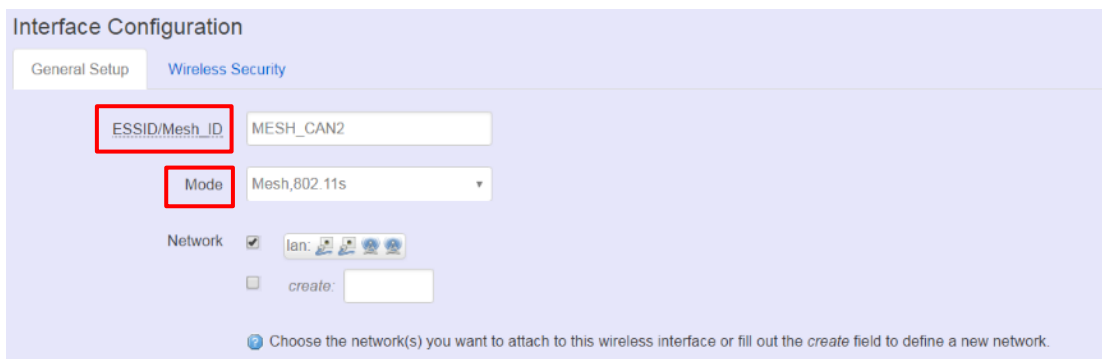

Transmit Power: There are 14 options.
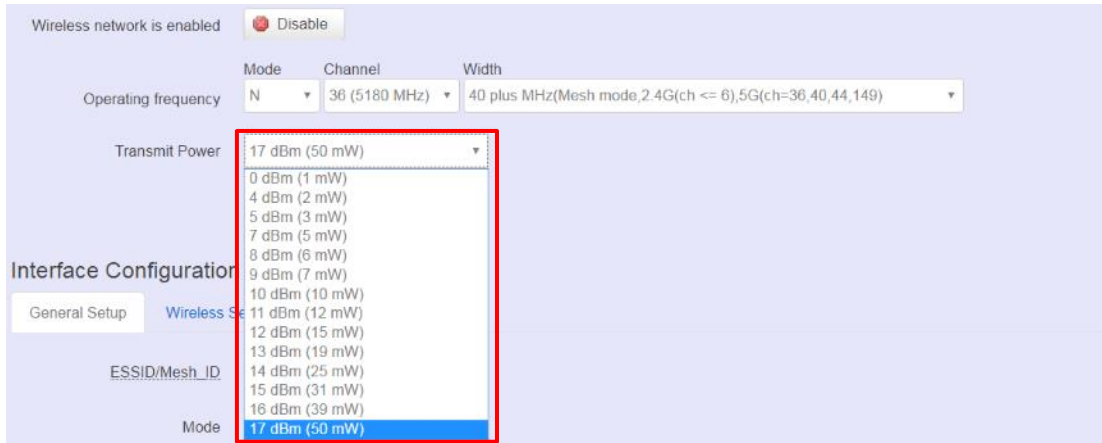
3.3.9 Network Settings of Wi-Fi Interface

The network settings (network parameters of Wi-Fi interface) exists in this "Interface Configuration" section.

Clicking "General Setup" tab

ESSID/Mesh ID: (Default: "MESH_CAN2") Network name.

All products with the same ID (or network name) and radio physical settings (802.11 protocol and channel) are connected together automatically.

Mode: (Default: "Mesh, 802.11s") Wireless network topology. Only mesh is supported.

For further software setup and testing examples, please refer to the User Manual