LevelOne

Managed Wireless Access Point,

User’s Manual

V1. 0_20160106

Table of Contents

About This Guide

Note: For best use of our product, it is recommended that you upgrade your Internet Explorer to version 10 or higher.

Purpose and Scope

This guide describes the features and functions of the WAP-6111/H、WAP-6112/H、WAP-6201、WAP-6202 Wireless Access Points. It provides an overview of the access points, as well as the information you need to install and configure your access point through the Web interface.

This guide will be updated as new information becomes available.

Web UI Style

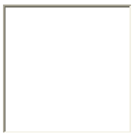
The Device's Web User Interface (Web UI) follows the web standards. A typical Web UI page includes the following elements:

◉ : **Radio Button:** Allows you to choose only one of a predefined set of options.

☑ : **Check Box:** Allows you to choose one or more options.

: **Button:** Allows you to click to perform an action.

: **Text Box:** Allows you to enter text information.



: **List Box:** Allows you to select one or more items from a list contained within a static, multiple line text box.

: **Drop-down List:** Allows you to choose one item from a list. When a drop-down list is inactive, it displays a single item. When activated, it drops down a list of items, from which you may select one.

Factory Default Settings

The following table lists the factory default settings of the Device.

Parameter	Default Value	Description
Administrator User Name	admin	Both the User Name and Password are case sensitive.
Administrator Password	admin	
LAN IP Address	192.168.1.253/255.255.255.0	You can use this IP address to access the Device through a Web browser.
SSID	LEVELONE_ABCDEF	To connect to the Device, wireless clients must use the same SSID as the Device. XXXXXX is the Device's serial number in hexadecimal format.

Table* 0-1 *Factory Default Settings

Chapter 1 Product Overview

This chapter describes the features and functions of the WA Series Wireless Access Points in brief.

1.1Key Features

- Support Fit AP and Fat AP modes, which can be switched easily
- Support automatic firmware and configuration update
- Support static IP and DHCP connection types
- Support DHCP server
- Support static DHCP
- Support multiple wireless modes
- Support multiple wireless security modes
- Support wireless MAC address filtering
- Support hidden SSID
- Support WMM (Wi-Fi Multimedia)
- Support firmware upgrade via the Web UI
- Support configuration backup and restore

⌖ **Note:**

The WA Series Wireless Access Points include multiple models. Features and specifications may vary depending on the specific model. For information on the feature and specification differences among them, please visit our website or contact our customer service department.。

1.2 Specification

- Conform to IEEE 802.11n, IEEE 802.11b and IEEE 802.11g standards
- Conform to IEEE 802.3 Ethernet and IEEE 802.3u Fast Ethernet standards
- Support TCP/IP, DHCP, etc.
- Each physical port supports auto-negotiation for the port speed and duplex mode
- Each physical port supports auto MDI/MDI-X
- Provide system and port LEDs
- Operating Environment:

  Temperature: 32° to 104° F (0° to 40° C)

  Relative Humidity: 10% to 90%, Non-condensing

  Height: 0m to 4000m

Chapter 2 Hardware Installation

This chapter describes the physical characteristics of the WA Series Wireless Access Points, and explains how to install them.

2.1 In-Wall Access Point

2.1.1 Panel Descriptions

The in-wall wireless access point supports IEEE 802.3af PoE. The dimension is 86 x 86 x 36 mm, It can be directly installed on standard 86 base box. Figure 2 1 shows the front panel.。

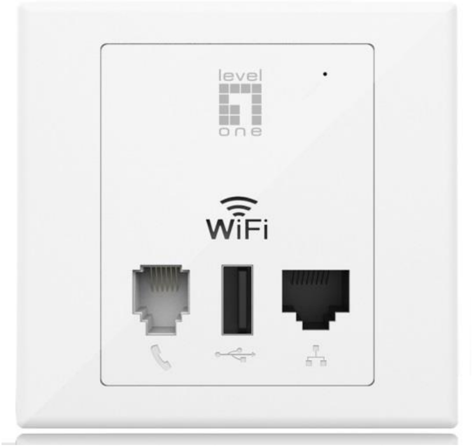


Figure 2-1 Front Panel – In-wall AP

1) Ports

Ports	Type	Description
PHONE	RJ11 Phone Port	Used to connect a telephone.
USB	USB Charging Port	Used to charge USB devices like a cell phone or MP3 player.
LAN	RJ45 Ethernet Port	The two LAN ports (10/100M, auto MDI/MDI-X) are used to connect computers or other Ethernet devices to the wired LAN.

Table 2-1 Description of Ports – In-wall AP

2.1.2 Preparing for Installation

1） Make sure that there is proper heat dissipation and adequate ventilation around the Device.

2） Position the Device out of direct sunlight and away from sources of heat and ignition.

3） Position the Device away from sources of electrical noise, such as high power radio transmitters, radar stations, and so on.

2.1.3 Items Required for Installation

1) Preparation of related devices:

（1） Broadband Internet connection

（2） PoE PSE (Power Sourcing Equipment) device like PoE switch

（3） PC with an Ethernet card and TCP/IP installed

2）Phillips screwdriver, crimping tool like crimping plier, etc.

2.1.4 Installing the Device

Before you install the Device, make sure your Internet connection and PSE device are working properly.

Follow these steps to install the Device:

1) Use your crimping tool to crimp a network cable and a telephone line to the corresponding wiring port on the Device. Make sure crimp the wires in the right order.

2) Mount the Device on a wall.

3) Connect the other end of the cable that you just crimped to a PoE PSE device (like PoE switch). As a PD (Powered Device), the Device will communicate with and receive power from the PSE via the cable.

4) Configure the Device: Connect your computer to the Device either via an Ethernet cable or wirelessly), and then configure the Device through its own Web interface. The Device in Fit AP mode can also be managed by a WAC-1000/ WAC-1001

5) Connect client devices: Connect each computer or other device in your network to the Device, via an Ethernet cable or wirelessly.

2.2 In-Ceiling Access Point

2.2.1 Panel Descriptions

The in-ceiling wireless access point supports IEEE 802.3af PoE. A system status LED is located at the front panel, a LAN port is located at the bottom panel, and a reset button is located at the side panel.

1）LED

LED	Description
System Status LED	The LED flashes twice per second when the system is operating properly, and it will flash slower if the system is under heavy load.

Table **2-2 Description of LED – In-ceiling AP**

2） Port

Port	Description
LAN	Gigabit Ethernet RJ45 port, auto MDI/MDI-X

Table **2-3** ***Description of Ports – In-ceiling AP***

3） Reset Button

If you forget the administrator password, you can use the **Reset** button to reset the Device to factory default settings. The operation is as follows: With the Device powered on, press and hold the **Reset** button for more than 5 seconds, and then release the button. The Device will restart with factory default settings.

⌖ **Note：** The reset operation will clear all custom settings on the Device, so do it with caution.

2.2.2 Preparing for Installation

1） Make sure that there is proper heat dissipation and adequate ventilation around the Device.

2） Position the Device out of direct sunlight and away from sources of heat and ignition.

3）Position the Device away from sources of electrical noise, such as high power radiotransmitters, radar stations, and so on.

2.2.3 Items Required for Installation

The following items are required for installation:

1. Broadband Internet connection
2. Tools and equipment
   - Wireless LAN controller or normal router
   - PC with an Ethernet card and TCP/IP installed
   - Power outlet
   - (Optional) PoE PSE (Power Sourcing Equipment) device like PoE switch
   - Ethernet cables
   - Phillips screwdriver.。

Installing the Device

Before you install the Device, make sure your Internet connection is working properly. In addition, it is recommended that you configure the Device before you deploy it in the network.

Follow these steps to install the Device:

1. Use the supplied power adapter to connect the Device to a power outlet.
2. Connect your computer to the Device either via an Ethernet cable or wirelessly, and then login to the Web UI to configure the Device.
3. After you configure the Device, unplug the power adapter, and the Ethernet cable, if used.
4. Mount the Device on a ceiling or wall.
5. If needed, use an Ethernet cable to connect other network device (like PoE switch, WLAN controller) to the LAN port of the Device.
6. Power the Device by using the supplied power adapter, a PoE adapter, or a PoE switch.
7. Connect client devices: Connect each computer or other device in your network to the Device wirelessly.

2.3 Desktop Access Point

2.3.1 Panel Descriptions

Depending on the model, the desktop wireless access points may have either one or two antennas. Here we take the WAP-6015 as an example. The WAP-6015 is a desktop wireless AP with two antennas, and the dimension is 200mm×124mm×28.4mm. Figure 2-2 shows the front panel of the WAP-6015.

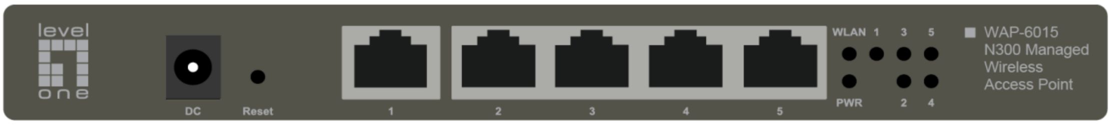


Figure 2-2 Front Panel – Desktop AP

1） LED

LED	Full Name	State	Description
PWR	Power LED	On	The Device is powered on.
		Off	The Device is powered off.
WLAN	Wireless Status LED	On	The wireless function is enabled.
		Flashing	The Device is sending or receiving data over the wireless network.
		Off	The wireless function is disabled.
1, 2, 3,4,5	LAN Port Status LED	On	A valid link is established on the corresponding port.
		Flashing	The corresponding port is sending or receiving data.
		Off	No link is established on the corresponding port.

Table 2-4 Description of LED –Desktop AP

2） Port

Port	Description
LAN	The five LAN ports (10/100M, auto MDI/MDI-X) are used to connect computers or other Ethernet devices to the wired LAN.
Antenna	Located at the real panel of the Device. Antennas are used to transmit and receive wireless signals.

Table 2-5 Description of Ports – Desktop AP

3） Reset Button

If you forget the administrator password, you can use the **Reset** button to reset the Device to factory default settings. The operation is as follows: With the Device powered on, press and hold the **Reset** button for more than 5 seconds, and then release the button. The Device will restart with factory default settings.

***Note*：**

The reset operation will clear all custom settings on the Device, so do it with caution.

2.3.2 Preparing for Installation

➢ Installation Guidelines

When determining where to place the Device, observe these guidelines:

- Make sure that the bench is level and stable.
- Do not place heavy objects on the Device.
- Make sure that there is proper heat dissipation and adequate ventilation around the Device.
- Position the Device out of direct sunlight and away from sources of heat and ignition.
- Position the Device away from sources of electrical noise, such as high power radio transmitters, radar stations, and so on.
- Please use the supplied power Adapter.

➢ Items Required for Installation

The following items are required for installation:

1. Broadband Internet connection
2. Tools and equipment
    - Wireless LAN controller or normal router
    - PC with an Ethernet card and TCP/IP installed
    - Ethernet cables
    - Power outlet

2.3.3 Installing the Device

Before you install the Device, make sure your Internet connection is working properly.

Follow these steps to install the Device:

1. Make sure the Device is powered off.
2. Place the Device upside down on a sturdy, flat bench.
3. Remove the adhesive backing from the supplied rubber feet. Attach the four rubber feet to the recessed areas on the bottom of the Device.
4. Turn the Device over to make it right side up on the bench.

2.4 Typical Deployment Scenarios

Here we take the WAP-6112/H as an example. The WAP-6112/H can operate in either Fit AP or Fat AP mode. Figure 2-2 depicts a typical Fit access point deployment, and Figure 2- depicts a typical Fat access point deployment.

As shown in Figure 2-, two access points act as Fit APs, a WAC-1000 / WAC-1001 controller acts as the gateway. The access points are managed by the WAC-1000 / WAC-1001, and clients access the network through the access points.

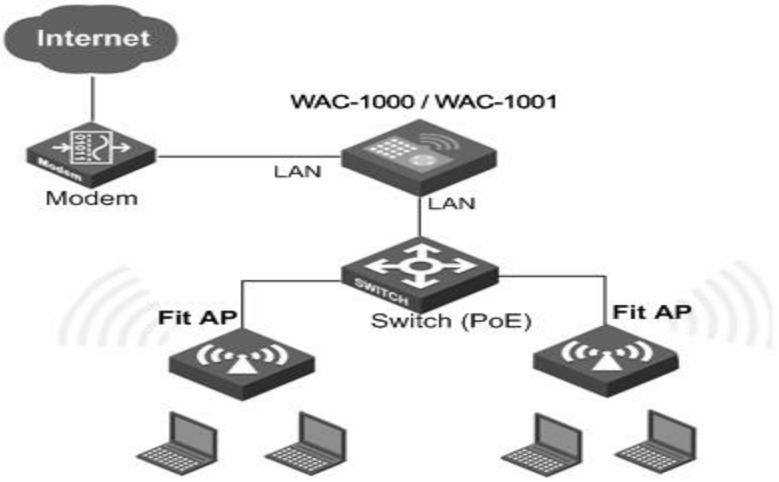


Figure 2-3 Fit Access Point Deployment

As shown in Figure 2-, an access point acts as a Fat AP. The access point is directly connected to the default gateway, and clients access the network through the access point.

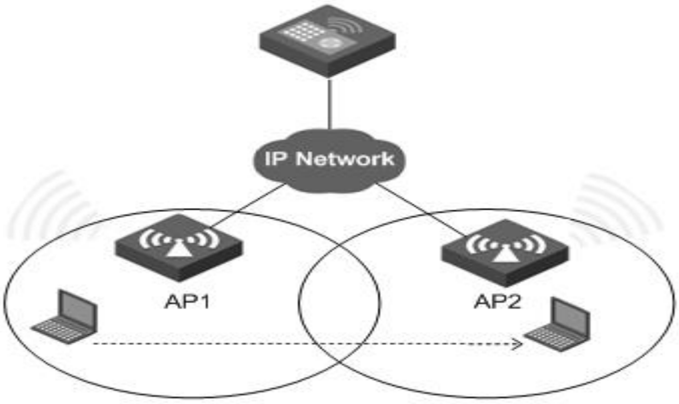


Figure 2-4 Fat Access Point Deployment

Chapter 3   Logging in to the Device

This chapter describes how to configure TCP/IP settings on your computer, and how to login to the Device. In addition, it briefly describes the layout of the Device's Web interface.

3.1 Configuring Your Computer

To configure the Device via Web UI, you need to properly configure TCP/IP settings on the computer that you use to manage the Device. To do this, follow these steps:

Step 1 Connect the computer to a LAN port of the Device, or connect the computer to the Device wirelessly.

Step 2 Install TCP/IP protocol on your computer. If it is already installed, please skip this step.

Step 3 Configure TCP/IP settings on your computer: set the IP address to an unused one in the 192.168.1.0/24 subnet, set the subnet mask to 255.255.255.0, and set the default gateway to the IP address of your gateway. Note: the Device's default LAN IP address is 192.168.1.253 with a subnet mask of 255.255.255.0.

Step 4 Use the Ping command to verify network connectivity between the computer and the Device. Open the command prompt on the computer, type **ping 192.168.1.253**, and then press **Enter**. The following uses Windows XP as an example.

A successful ping will look like this:

```
Pinging 192.168.1.253 with 32 bytes of data:
Reply from 192.168.1.253:   bytes=32 time<1ms TTL=255
Reply from 192.168.1.253:   bytes=32 time<1ms TTL=255
Reply from 192.168.1.253:   bytes=32 time<1ms TTL=255
Reply from 192.168.1.253:   bytes=32 time<1ms TTL=255
Ping statistics for 192.168.1.253:
     Packets:   Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
```

A n unsuccessful ping will look like this:

```
Pinging 192.168.1.253 with 32 bytes of data:

Request timed out.

Request timed out.

Request timed out.

Request timed out.

Ping statistics for 192.168.1.253:

Packets:    Sent = 4, Received = 0, Lost = 4 (100% loss),
```

If the Ping command is successful, the connection between the computer and the Device is working properly. If the Ping command fails, please do the following:

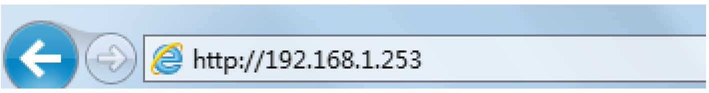
1） **Check physical connection:** Verify that the LAN LED on the Device and the LED on your computer’s network card are lit.

2）**Check TCP/IP settings:** Verify that your computer is on the same subnet as the Device’s LAN interface. E.g., if the Device’s LAN IP address is 192.168.1.253 (default), the computer’s IP address must be an unused IP address in the 192.168.1.0/24 subnet.

3.2 Logging to the Device

No matter what operating system is installed on your computer, such as, MS Windows, Macintosh, UNIX, or Linux, and so on, you can configure the Device through the Web browser (e.g., Internet Explorer, Firefox).

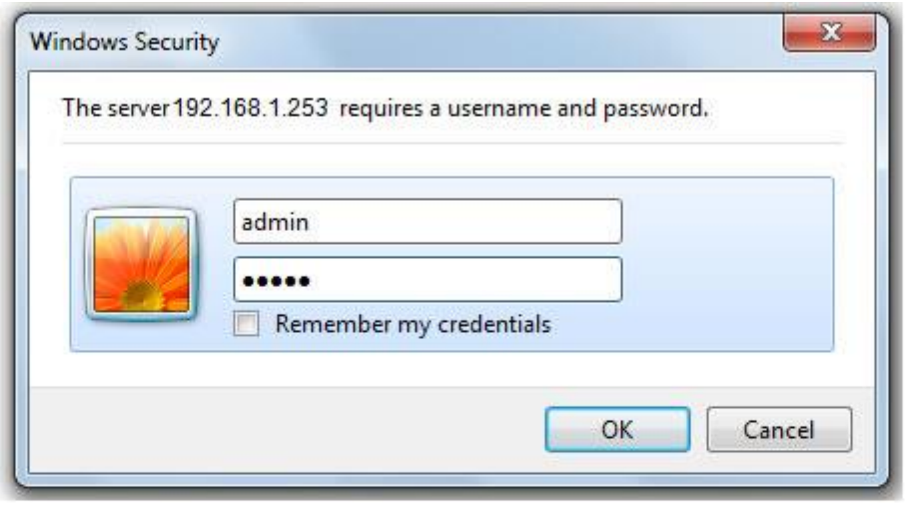
To login to the Device, do the following: Launch a Web browser, enter the Device’s LAN IP address (default is **192.168.1.253**) in the address bar, and then press **Enter**, as shown in Figure 3-1.。



http://192.168.1.253

Figure 3-1 Entering IP address in the Address Bar

The login window appears, as shown in Figure 3-2. The first time you login to the Device, you should enter the default login information (default user name and password both are **admin**), and then click **OK**.



Windows Security

The server 192.168.1.253 requires a username and password.

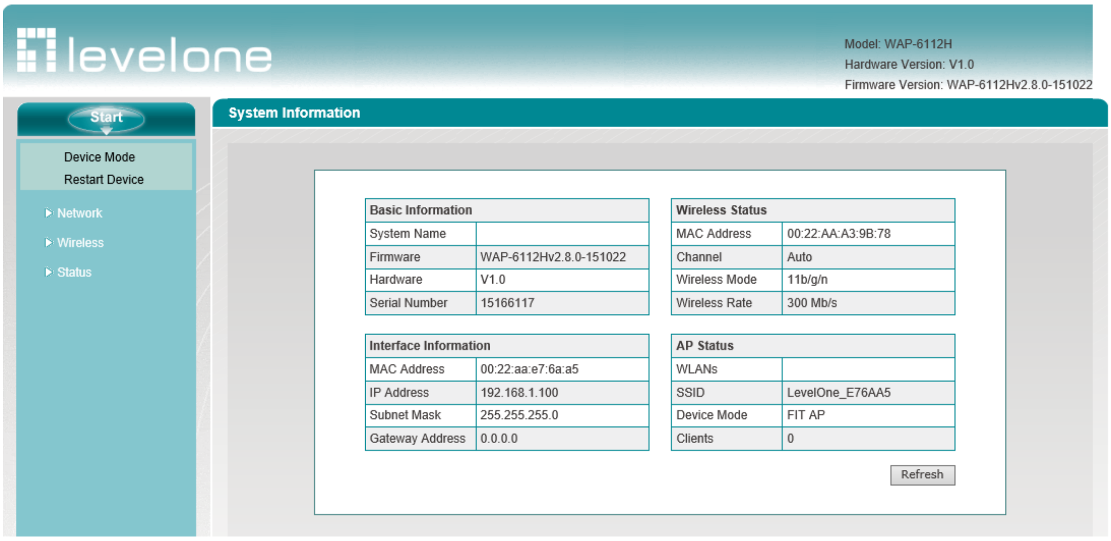
admin

●●●●●

□ Remember my credentials

Figure 3-2　Web UI Login Window

If the login is successful, the home page appears, as shown in ***Figure 3-3***.



Model: WAP-6112H
Hardware Version: V1.0
Firmware Version: WAP-6112Hv2.8.0-151022

System Information

Basic Information	
System Name	
Firmware	WAP-6112Hv2.8.0-151022
Hardware	V1.0
Serial Number	15166117

Wireless Status	
MAC Address	00:22:AA:A3:9B:78
Channel	Auto
Wireless Mode	11b/g/n
Wireless Rate	300 Mb/s

Interface Information	
MAC Address	00:22:aa:e7:6a:a5
IP Address	192.168.1.100
Subnet Mask	255.255.255.0
Gateway Address	0.0.0.0

AP Status	
WLANs	
SSID	LevelOne_E76AA5
Device Mode	FIT AP
Clients	0

Figure 3-3　Web UI Home Page

Home Description:

1）　The top-right corner of the page displays device model, software version, hardware version.

2）　This page displays the main menu bar on the left.

3)　The main operating page is located on the right of the page, in which you can configure various functions of the device, view the related configuration information and status information, etc.

Chapter 4 Fit AP

In this chapter, we first provide an overview of AP centralized management. Then we describe the features and parameters supported in **Fit AP** mode.。

AP Centralized Management Overview

4.1 Terminology

Client: A PC, laptop, or other terminals with a wireless Network Interface Card.

WLAN (Wireless Local Area Network): A WLAN is a type of local area network that uses high frequency radio waves rather than wires to transmit data.

WAC-1000 / WAC-1001 (Wireless LAn Controller): An WAC-1000 / WAC-1001, also known as WLAN controller, is a network device that is used to control and manage access points in the network.

AP (Access Point): An AP is a network device that acts as a base station for the wireless LAN, and acts as a bridge between wired and wireless networks.

Fat AP: A standalone AP that independently controls and manages wireless clients.

Fit AP: A simple AP that relies on WLAN controller to control and manage wireless clients. The Device in Fit AP mode can retrieve firmware and configuration file from the WLAN controller.

Intra-Controller Roaming: Intra-controller roaming occurs when a wireless client roams between APs managed by the same WLAN controller.

Layer 2 Roaming: Layer 2 roaming occurs when a wireless client roams between APs on the same subnet and VLAN.

4.2 Communication Process

The figure below shows the communication process between a fit AP and WAC-1000 / WAC-1001.

For the implementation of Fit AP + WAC-1000 / WAC-1001 solution, the first and crucial step is the issue of Fit AP's registration on the three-layer switch, and the WAC-1000 / WAC-1001 can manage Fit AP only after Fit AP is successful in registration. In the practical applications, it is common for WAC-1000 / WAC-1001＋Fit AP to register by crossing three-layer network. Our device has three ways of implementation: the first is the DNS mode, which requires the support from DNS, DHCP Server, and is relatively complex; the second is the DHCP Option43 attribute mode, that is, using the Option43 attribute of the DHCP Server; the third is to configure the WAC-1000 / WAC-1001 address on AP, and this method is relatively simple.

When the wireless controller WAC-1000 / WAC-1001 is connected with the Fit AP by crossing three-layer network, the Option 43 mode is used; when Fit AP is connected to the wireless controller by crossing three-layer network, Fit AP can directly obtain the IP address of the wireless controller through the Option 43 attribute of DHCP, thus completing the registration on the wireless controller. The specific process is shown in the figure below:

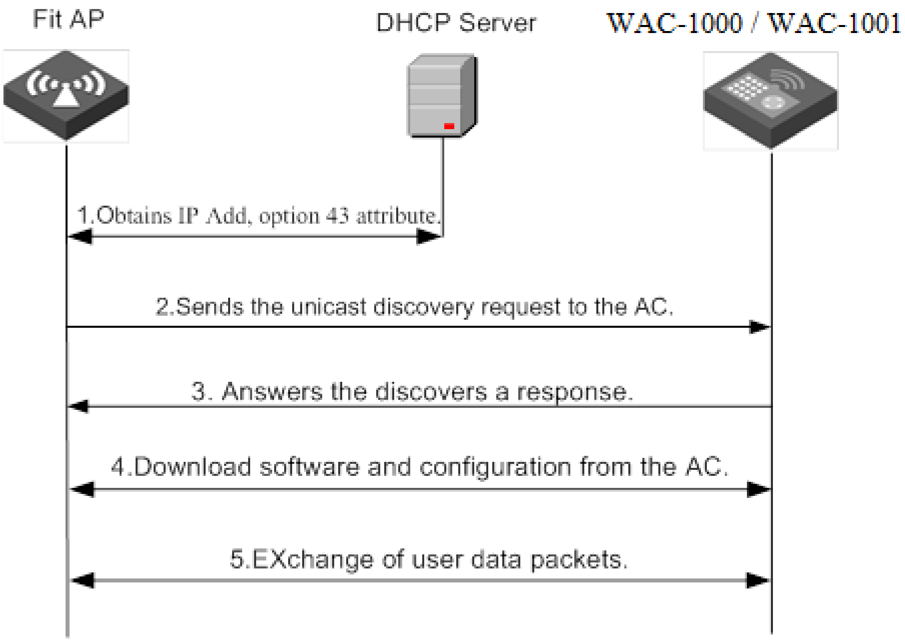

Fit AP
DHCP Server
WAC-1000 / WAC-1001
1.Obtains IP Add, option 43 attribute.
2.Sends the unicast discovery request to the AC.
3. Answers the discovers a response.
4.Download software and configuration from the AC.
5.EXchange of user data packets.

Figure 4-1 **WAC-1000 / WAC-1001 and AP centralized manager communicate on the second floor**

When the Fit AP and the wireless controller cross three layers of network connection, the registration procedure of the Fit AP in the wireless controller through the Option 43 attribute of DHCP server is as follows:

1) Fit AP obtains IP address, option 43 attribute (the attribute carries the IP address of the three-layer switches) through the DHCP server.

2) Fit AP will obtain the IP address of three-layer switch from the option 43 attribute, and then sends the unicast discovery request to the wireless controller.

3) The wireless controller of the wireless switch that receives the discovery request packet will check if the Fit AP has the access to this machine, and answers that it discovers a response if any.

4) Fit AP downloads the latest version of software from wireless controller of the wireless switch.

5) Fit AP downloads the latest configuration from the wireless controller.

6) Fit AP begins to work normally to exchange of user data packets with the wireless controller.

Tip:

(1) In the process of device operation, while the configuration file is modified on the AP, for instance, it joins in a service area, WAC-1000 / WAC-1001 will save the modified configuration file locally and send it to AP, and the configuration file will be deleted after WAC-1000 / WAC-1001 powers off.

(2) WAC-1000 / WAC-1001 will delete the configuration file saved before after recovering the AP to its factory configuration remotely.

(3) The AP uploaded configuration file will not be displayed in the configuration file list.

(4) AP can start transmitting user data immediately after successfully obtaining the software, configuration file.

4.3 Layer 2 Roaming

Mobility, or roaming, is a wireless client's ability to move from one AP coverage area to another without interruption in service or loss in connectivity.

The Device supports layer 2 roaming, which allows wireless clients to roam across access points on the same subnet and VLAN. To implement layer 2 roaming, you need to assign the same WLAN profile to the access points, so that they have the same SSID, on the same subnet and the same VLAN. Figure 4-2 shows intra-controller layer 2 roaming, which occurs when the two APs are joined.

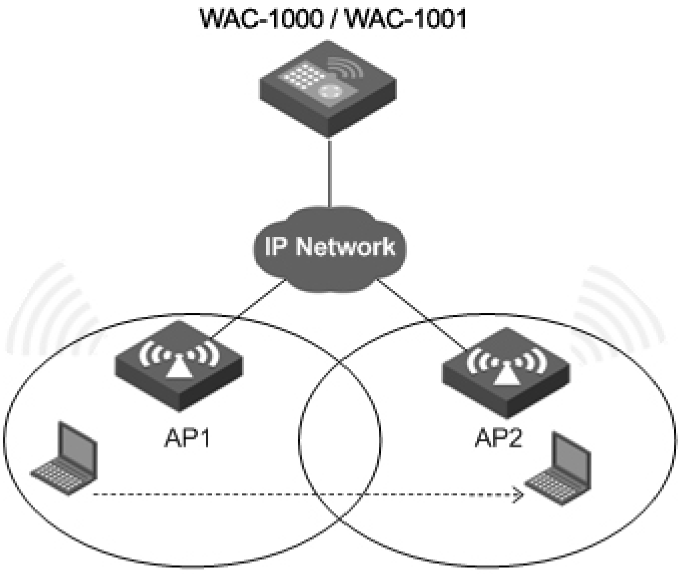


Figure 4-2 Intra-Controller Layer 2 Roaming

As shown in the above figure, AP1, AP2 are associated with WAC-1000 / WAC-1001.

1） A terminal is wirelessly associated with AP1, and AP1 is connected to WAC-1000 / WAC-1001.

2） The terminal disconnects its association with AP1, and roams into the AP2 connecting the wireless controller WAC-1000 / WAC-1001.

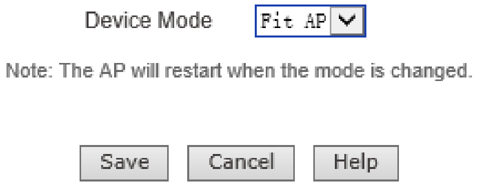
The process that the terminal is connected to AP2 is referred to as two-layer wireless roaming.

Way of implementation: Configure a service area on the device and enable the two-layer roaming function by adding AP1, AP2 into the same service area.

4.4 System mode:

The device supports fat AP mode and thin AP mode, and the device's factory default mode of operation is thin AP mode. If you need to change the working mode of the device, please go to **Start-> System mode** Page, or **Wireless configuration -> System mode** page for modification, while modifying via AC remotely.

Note: The AP will automatically restarted during switching of modes.



Device Mode: Fit AP

Note: The AP will restart when the mode is changed.

Figure 4-3 Working mode

4.5 Configuration of LAN port

The default IP address of the device LAN port is 192.168.1.253, and the IP address of the device's LAN port needs to be changed to adapt to the existing network, which can be modified by either of the following methods.

Method I: Local modification

Enter **Network parameters ->LAN port configuration** page to configure the LAN port IP address of the device. The access mode supported by the device LAN port: fixed IP access, dynamic IP access. These two access modes will be introduced respectively in the subsequent sections.

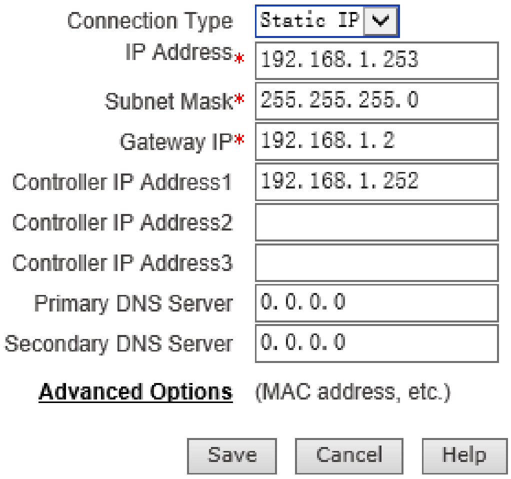
Method II: Remotely modification

When the device is connected to AC as a thin AP, the administrator can modify the device's LAN port IP address on AC through remote management. For configuration details, refer to Item 2.8

Advanced Configuration of Wireless Controller.

4.6 Fixed IP access

The default of LAN port access is fixed IP access. The following describes the meaning of the parameters for configuration of fixed IP access.



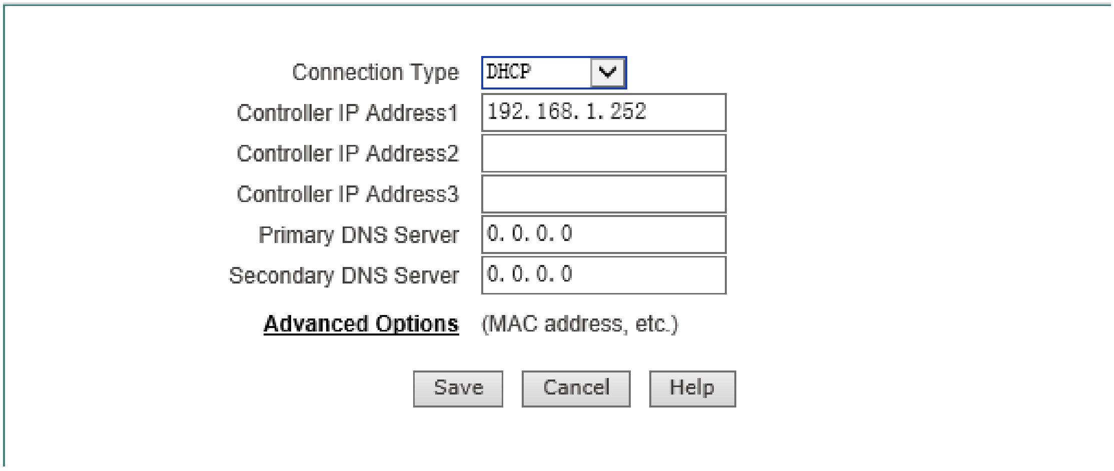
Connection Type	Static IP
IP Address*	192.168.1.253
Subnet Mask*	255.255.255.0
Gateway IP*	192.168.1.2
Controller IP Address1	192.168.1.252
Controller IP Address2	
Controller IP Address3	
Primary DNS Server	0.0.0.0
Secondary DNS Server	0.0.0.0
Advanced Options	(MAC address, etc.)

Figure 4-4 Fixed IP access

- Access mode: Selects fixed IP access here;
- IP address: The IP address of device LAN port, through which the administrator can manage this device;
- Subnet mask: It is the subnet mask of device LAN port, which should be consistent with the subnet mask of the network computer;
- Gateway address: The IP address of the device LAN port with the intranet as a gateway;
- AC address: Sets the IP address of AC.
- Primary/Secondary DNS server: Sets the IP address of the primary/secondary DNS server.
- MAC address: It is the MAC address of device LAN port, which needs no change if there are no special requirements.

4.7 Dynamic IP access

If the IP address of device LAN port is acquired from the DHCP server dynamically, select the access way of dynamic IP.



Connection Type: DHCP

Controller IP Address1: 192. 168. 1. 252

Controller IP Address2:

Controller IP Address3:

Primary DNS Server: 0. 0. 0. 0

Secondary DNS Server: 0. 0. 0. 0

Advanced Options (MAC address, etc.)

Figure 4-5 Dynamic IP access

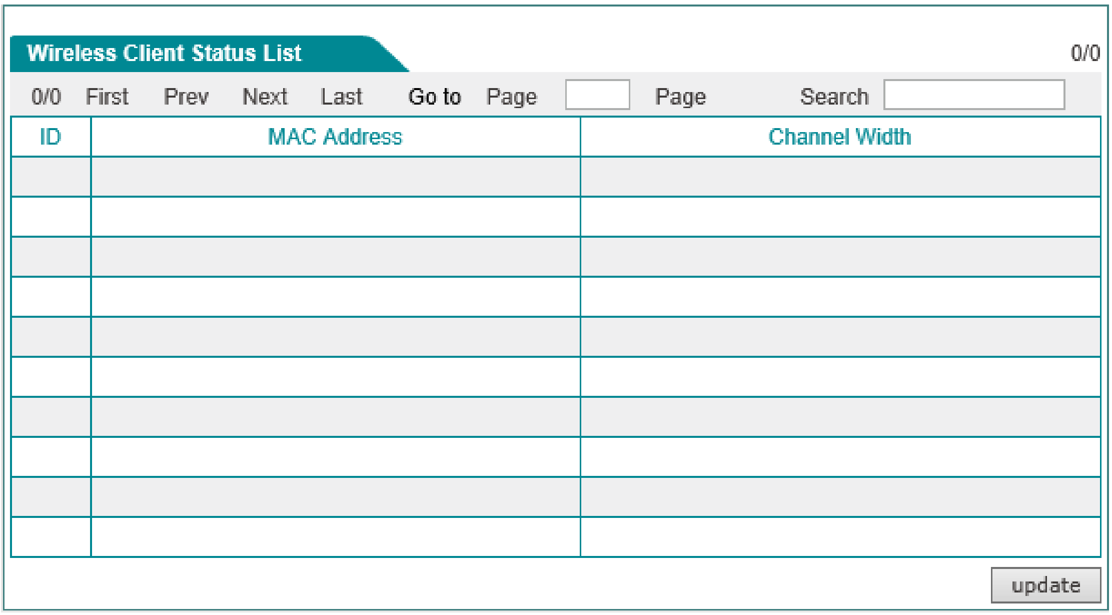
⌖ **Tip:**

1） After the address of the LAN port is modified, please log in the device using the new IP address of LAN port.

2） When the LAN access mode is dynamic IP access, please confirm the LAN port IP address at the DHCP server.

4.8 Status of wireless host

Enter **System status-> Wireless host status** page, to view the status of the host through a wireless access device.



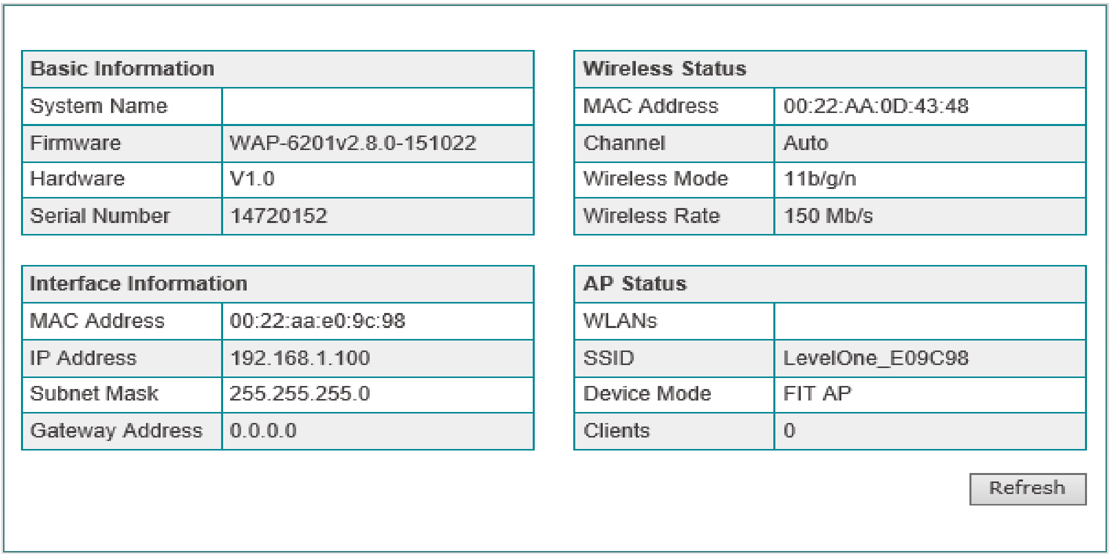
Wireless Client Status List 0/0

ID	MAC Address	Channel Width

Figure 4-6 Wireless host status list

4.9 System information

Enter**System State -> System information**page, and the administrators can view the information about the device.



Basic Information	
System Name	
Firmware	WAP-6201v2.8.0-151022
Hardware	V1.0
Serial Number	14720152

Wireless Status	
MAC Address	00:22:AA:0D:43:48
Channel	Auto
Wireless Mode	11b/g/n
Wireless Rate	150 Mb/s

Interface Information	
MAC Address	00:22:aa:e0:9c:98
IP Address	192.168.1.100
Subnet Mask	255.255.255.0
Gateway Address	0.0.0.0

AP Status	
WLANs	
SSID	LevelOne_E09C98
Device Mode	FIT AP
Clients	0

Figure 4-7 System information

Basic Information

Basic information bar displays device name, software version, hardware version and serial number of devices.

Wireless status

- MAC address: Shows the MAC address of the device broadcasting SSID;
- Channel: Displays the channel used by the device;
- Wireless mode: Displays the wireless mode selected for the device;
- Wireless rate: Displays the wireless rate of the device.

Interfacing information

Interface information bar shows device LAN port IP address, MAC address, subnet mask, and gateway address.

AP status

- Service area: Displays the service area to which the device is a member, and the device can be a member of up to 4 service areas at maximum;
- SSID: Displays the SSID of the service area where the device resides;
- Work mode: Displays the work mode of the device, FIT AP means thin AP;
- Number of clients: Shows the number of hosts for the access device.

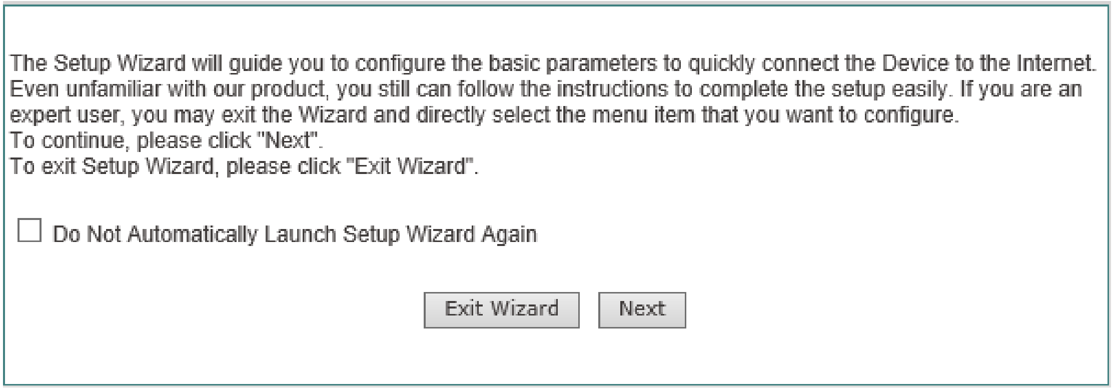
Chapter 5 Start menu

Starting from this chapter, the function parameters of the device that operates in fat AP mode are described. The parameters already introduced in Chapter 4 Thin AP Configuration will not be detailed again subsequently.

Start menu is located on the top of the Level 1 menu bar of the WEB interface, providing the interface for 5 common pages, including: configuration wizard, running status, port flow, system modes, device reboot. With the **Start** menu, you can quickly configure the basic parameters required by the device in working properly, view the information about device LAN port, and view the statistics data of wired/wireless devices' real-time traffic.

5.1 Configuration Wizard

When the work mode of the device is configured as fat AP, the page will go directly to the page the **Configuration Wizard** page, as shown in Figure 5-1:



The Setup Wizard will guide you to configure the basic parameters to quickly connect the Device to the Internet. Even unfamiliar with our product, you still can follow the instructions to complete the setup easily. If you are an expert user, you may exit the Wizard and directly select the menu item that you want to configure.
To continue, please click "Next".
To exit Setup Wizard, please click "Exit Wizard".

☐ Do Not Automatically Launch Setup Wizard Again

Figure 5-1 Home page of configuration wizard

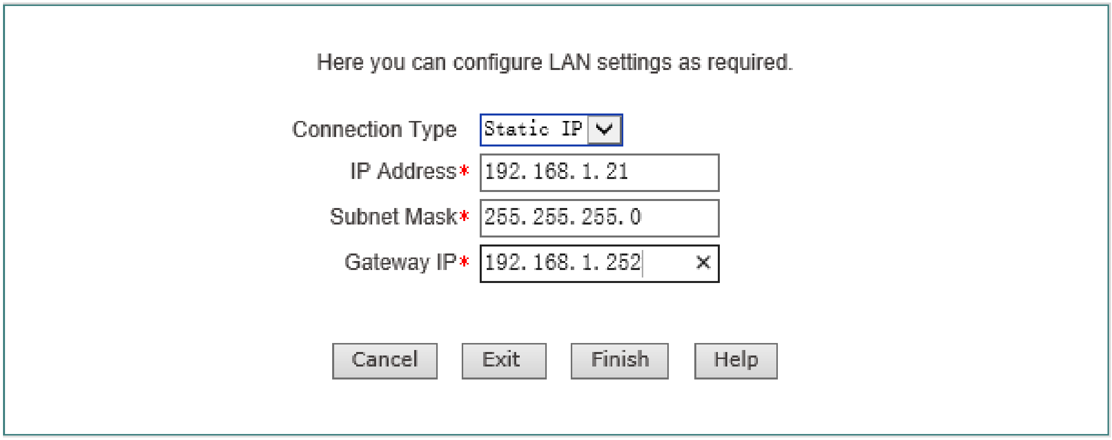
- In logging next time, the wizard will no longer automatically pop up: When checked, you can go directly to the**System Information**page in logging next time;
- Exit the wizard: Exits the Configuration Wizard and returns to the system information page;
- Next: Enters into the**Configuration Wizard ->LAN port configuration**page.

LAN access mode consists of: fixed IP access, dynamic IP access. As Figure 5-2 shown in the page, choose the access mode of the device depending upon your real situation.

1） Fixed IP access

The default of LAN port access is fixed IP access. Please enter the relevant parameters depending upon your situation, and then click

< Complete >, to save the configuration to the LAN port.



Here you can configure LAN settings as required.

Connection Type: Static IP

IP Address*: 192. 168. 1. 21

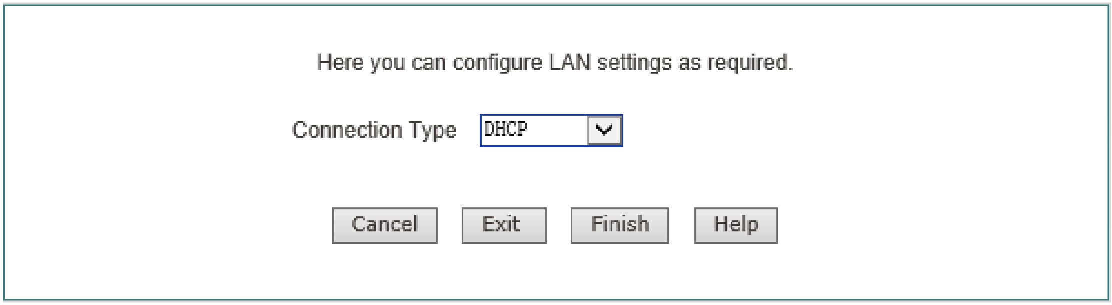
Subnet Mask*: 255. 255. 255. 0

Gateway IP*: 192. 168. 1. 252

Figure 5-2 LAN port configuration - Fixed IP access

2） Dynamic IP access

If you acquire the IP address for configuring LAN port in a dynamic manner, please click <Complete> directly in the interface as shown in the figure below, and save the configuration to the LAN port.



Here you can configure LAN settings as required.

Connection Type: DHCP

Figure 5-3 Configuration Wizard - Dynamic IP access

Tip:

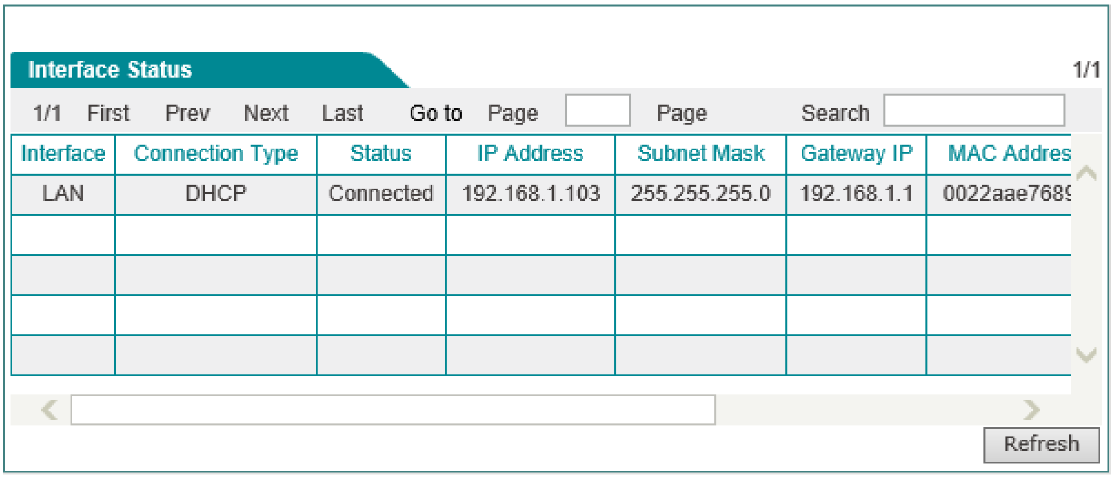
1） Configuration Wizard's operation can take effect only by clicking <Complete >.

2） After the address of the LAN port is modified, please log in the device using the new IP address of LAN port.

3） When the LAN access mode is dynamic IP access, please confirm the LAN port IP address at the DHCP server.

5.2 Running status

This section describes the **Start-> Running status** page, in which you can view the information about the device's LAN port. As Figure 5-4 shown in the interface, the connection type, connection status, IP address and other information about LAN port can be viewed.



Interface	Connection Type	Status	IP Address	Subnet Mask	Gateway IP	MAC Addres
LAN	DHCP	Connected	192.168.1.103	255.255.255.0	192.168.1.1	0022aae7689

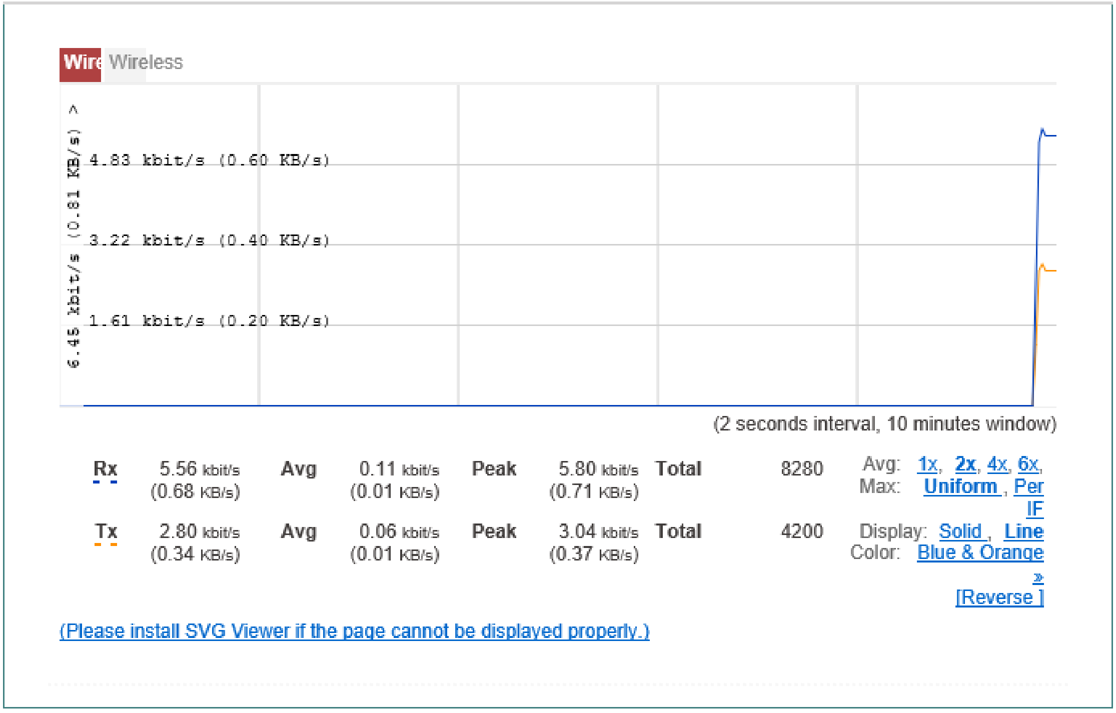
Figure 5-4 Information about running status

5.3 Port flow

This section describes the **Start-> Port flow** page, as shown in Figure 5-5. You can view the average, maximum, sum and current realtime rate for wired ports to receive and send data, wireless ports, and provide different units (kbit/s and KB/s) for them.

Tip:

If this page fails to display properly, please click the hyperlink "if it does not display properly, please install svgviewer" to have the svgviewer plug-in installed.



(2 seconds interval, 10 minutes window)

Rx	5.56 kbit/s (0.68 KB/s)	Avg	0.11 kbit/s (0.01 KB/s)	Peak	5.80 kbit/s (0.71 KB/s)	Total	8280	Avg: 1x, 2x, 4x, 6x, Max: Uniform , Per IF
Tx	2.80 kbit/s (0.34 KB/s)	Avg	0.06 kbit/s (0.01 KB/s)	Peak	3.04 kbit/s (0.37 KB/s)	Total	4200	Display: Solid , Line Color: Blue & Orange » [Reverse]

(Please install SVG Viewer if the page cannot be displayed properly.)

Figure 5-5 Port flow

- Wired: Click this tab to view the dynamic diagram of a device in receiving and sending dynamic data;
- Wireless: Click this tab to view the dynamic diagram of a device in receiving and sending wireless data;
- Timeline: The x-coordinate in the flow chart. You can click on the timeline options (1x, 2x, 4x, 6x in the figure) in the figure to determine the display effect;
- Flowline: The y-ordinate in the flow chart. You can choose the display results as needed (standardization, maximization as shown in the figure);
- Display: Provides two display options, solid effect and hollow effect;
- Color: It can be selected for display according to needs and preferences, such as red, blue, black etc;
- Reverse: Click the Reverse button, and the colors can swap to receive and send data.

5.4 System mode:

In the **Start -> System mode** page, you can configure the work mode of the device, please refer to the section: System mode.

5.5 Restarting device

If you need to restart the device, just enter into the **Start-> Restart device** page to click <Restart>.

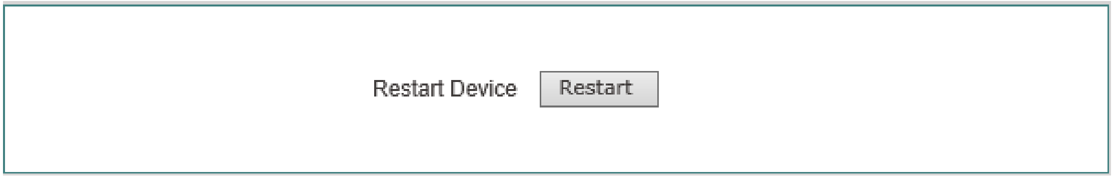


Figure 5-6 Restart device

⌖ **Tip**: Upon restarting, all users will be disconnected from the device.

Chapter 6 Network parameters

In the network parameters menu, you can configure the basic network parameters for the device, including LAN configuration, DHCP server.

This chapter mainly introduces the **Network parameters -> DHCP server** page, including DHCP server settings, static DHCP and DHCP client list.

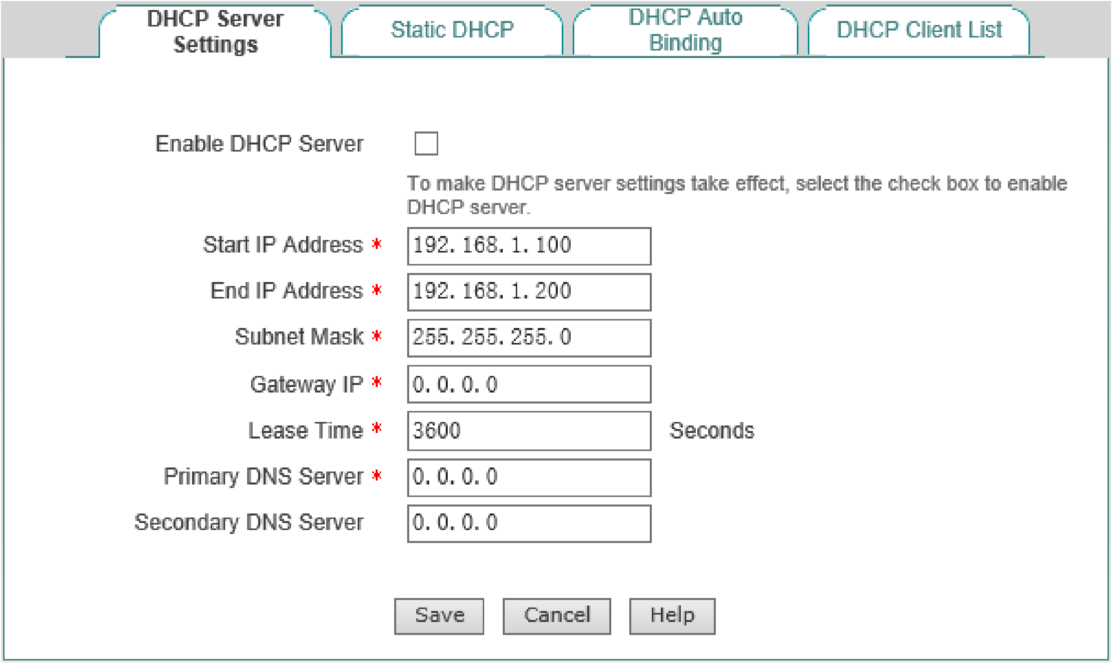
Configuration of LAN port

In the **Network parameters ->LAN configuration** page, you can configure the LAN port of the device, please refer to the section: **LAN port configuration** for details.

DHCP server

6.1 DHCP server settings

The the DHCP server functions on the device are disabled by default.



Enable DHCP Server □

To make DHCP server settings take effect, select the check box to enable DHCP server.

Start IP Address *	192. 168. 1. 100
End IP Address *	192. 168. 1. 200
Subnet Mask *	255. 255. 255. 0
Gateway IP *	0. 0. 0. 0
Lease Time *	3600 Seconds
Primary DNS Server *	0. 0. 0. 0
Secondary DNS Server	0. 0. 0. 0

Figure 6-1 Configuring the DHCP service

- Enable DHCP server: Select to enable the device's DHCP server function;

- Origin and destination address: The IP address fields the DHCP server assigns to the network computer automatically (which should be on the same network segment as the IP address of the device LAN port);
- Subnet mask: The subnet mask automatically assigned by the DHCP server to the network computer (which should be consistent with that of the LAN port of the device);
- Gateway address: The gateway IP address the DHCP server automatically assigns to the network computer (which is set to the LAN IP address of the device with Intranet as a gateway);
- Leasing time: The leasing time for the network computers to obtain the IP address assigned by the device(Unit: Seconds).
- Primary DHCP server: The IP address of the primary DNS server assigned by the DHCP server to the network computers automatically.
- Secondary DNS server: The IP address of the secondary DNS server assigned by the DHCP server to the network computers automatically.

Tip:

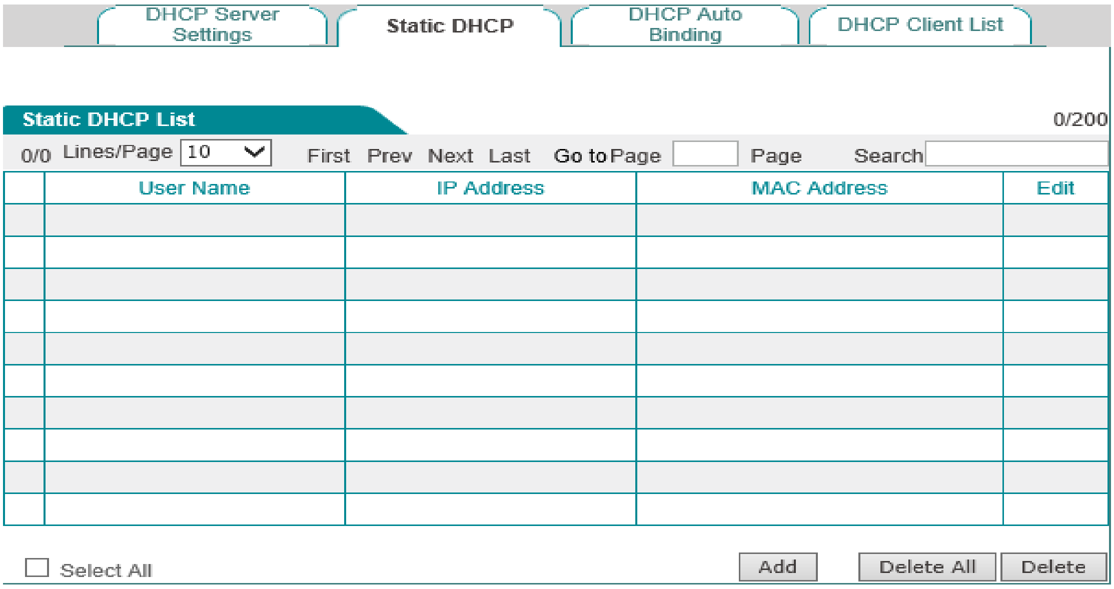
1. If the device's DHCP server function is to be used, network computer's TCP/IP protocol can be set to "obtain an IP address automatically".
2. In the case where the Intranet already has a DHCP server, it is not recommended to enable the DHCP server function of the device.

6.2 Static DHCP

This section describes the static DHCP list and the way to configure a static DHCP.

Using the DHCP service to automatically configure TCP/IP properties for the network computers is very convenient, but it can cause a computer to be assigned with different IP address at different times. And some Intranet computers may need a fixed IP address, in this case, the static DHCP function is required, to bind the computer's MAC address with an IP address, as shown in Figure 6-2. When a computer having this MAC address requests the address from the DHCP server (device) , the device will find a corresponding fixed IP address based on its MAC address and assign it to the computer.

1） Static DHCP list

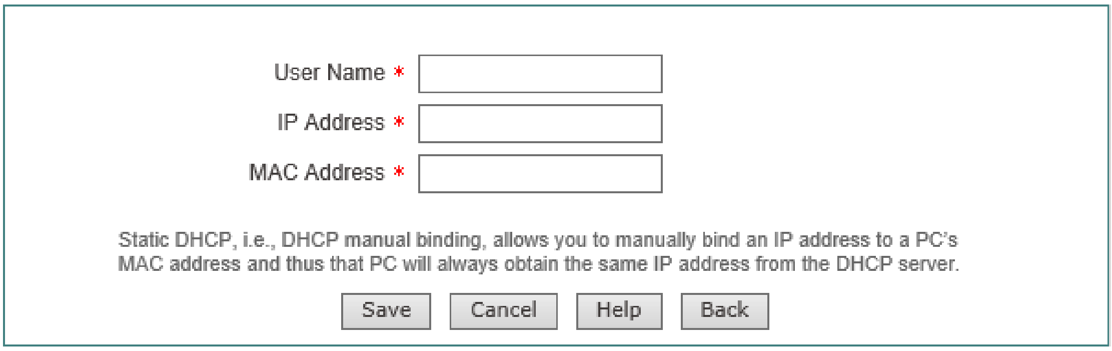


	User Name	IP Address	MAC Address	Edit

Figure 6-2 Static DHCP list

2） Static DHCP configuration

Click <Add new entry> in the page as shown in Figure 6-2, to enter into the **Static DHCP configuration** page as shown below. Below shows the meaning of the parameters for configuring static DHCP.



Static DHCP, i.e., DHCP manual binding, allows you to manually bind an IP address to a PC's MAC address and thus that PC will always obtain the same IP address from the DHCP server.

Figure 6-3 Static DHCP configuration

- User name: Configure the user name of the computer bound by this DHCP;
- IP address: The reserved IP address, which must be the valid IP address within the address range specified by the DHCP server;
- MAC address: The MAC address of the computer to use this reserved IP address in a fixed way;

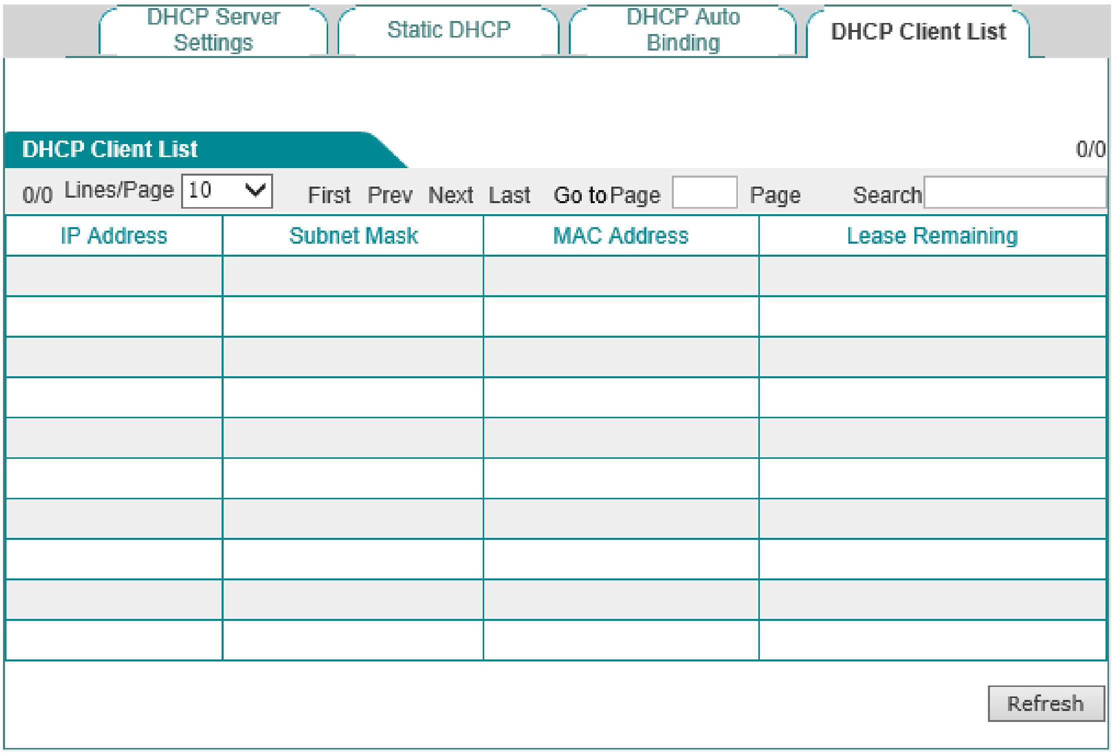
Tip:

1） After the setting is successful, the device will assign the preset IP address for the specified computer in a fixed way;

2） The assigned IP addresses must be within the range provided by the DHCP server.

6.3 DHCP client list

For the IP address already assigned to the network computer, its information can be viewed in the DHCP client list. Information as shown in the figure below: The DHCP server assigns the IP address of 192.168.1.100 in the address pool to the network computers whose MAC address is 6C:62:6D:E9:6D:13, and the rest of the time for the computer to lease this IP address is 85,954 seconds.



0/0 Lines/Page 10

IP Address	Subnet Mask	MAC Address	Lease Remaining

Figure 6-4 DHCP client list

6.4 Case of DHCP configuration

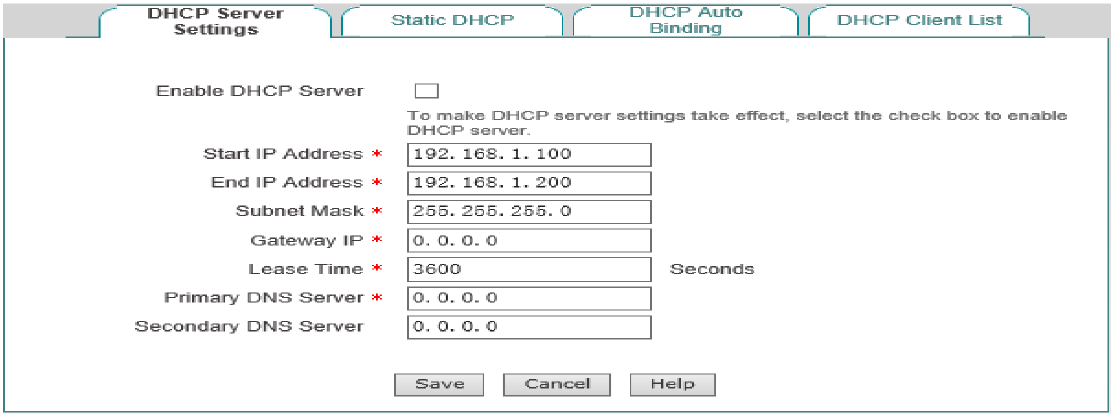
Application requirements

In this case, the DHCP function must be enabled on the device, with the origin address as 192.168.1.10, and a total of 50 addresses can be assigned; here, the host with the MAC address of00:21:85:9B:45:46 assigns the fixed IP address of 192.168.1.15, and the host with the MAC address of00:1F:3C:0f:07:F4assigns the fixed IP address of192.168.1.10.

Configuration steps

The first step is to enter into the **Network parameters -> DHCP server -> DHCP service settings** page;

The third step is to enable the DHCP function, configure the related DHCP service parameters (as shown in Figure 6-5), and click <Save> after the end of configuration.



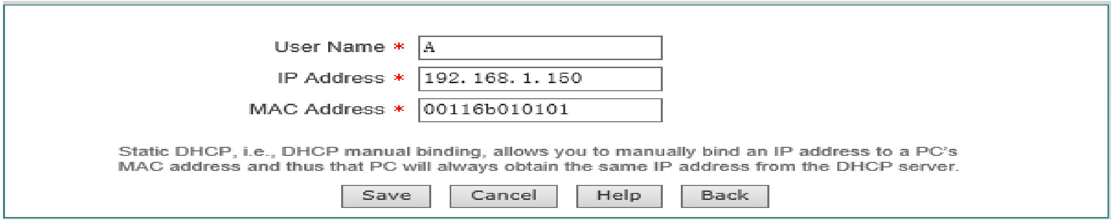
Enable DHCP Server □

To make DHCP server settings take effect, select the check box to enable DHCP server.

Start IP Address *	192. 168. 1. 100	
End IP Address *	192. 168. 1. 200	
Subnet Mask *	255. 255. 255. 0	
Gateway IP *	0. 0. 0. 0	
Lease Time *	3600	Seconds
Primary DNS Server *	0. 0. 0. 0	
Secondary DNS Server	0. 0. 0. 0	

Figure 6-5 DHCP service settings - Instance

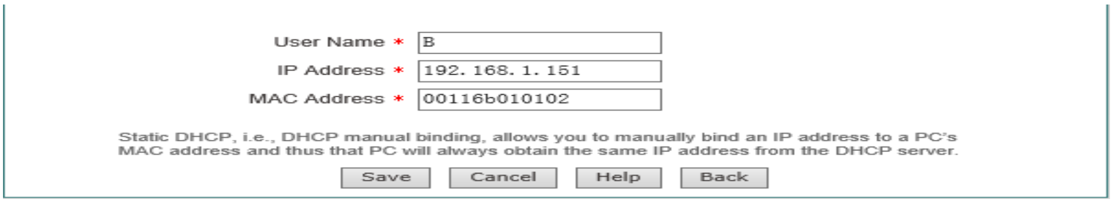
The third step is to enter the**Network parameters -> DHCP server-> Static DHCP** page, and click <Add new entry>, to configure the two static DHCP instances in the request (such as Figure 6-6, Figure 6-7);



User Name *	A
IP Address *	192. 168. 1. 150
MAC Address *	00116b010101

Static DHCP, i.e., DHCP manual binding, allows you to manually bind an IP address to a PC's MAC address and thus that PC will always obtain the same IP address from the DHCP server.

Figure 6-6 Static DHCP configuration - Instance A

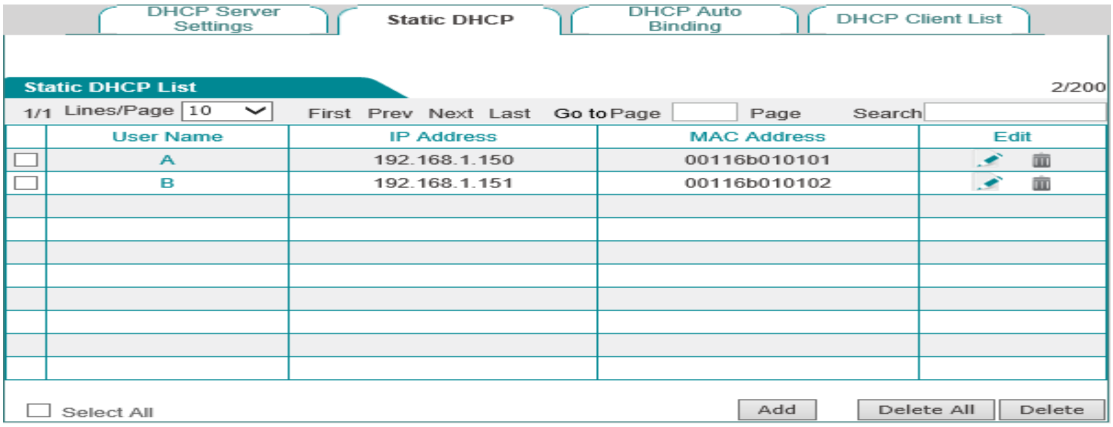


User Name *	B
IP Address *	192. 168. 1. 151
MAC Address *	00116b010102

Static DHCP, i.e., DHCP manual binding, allows you to manually bind an IP address to a PC's MAC address and thus that PC will always obtain the same IP address from the DHCP server.

Figure 6-7 Static DHCP configuration - Instance B

At this point, the configuration is complete, and you can view the information about 2 static DHCP entries in the "static DHCP information list", as shown in Figure 6-8.



Static DHCP List 2/200

1/1 Lines/Page 10

	User Name	IP Address	MAC Address	Edit
□	A	192.168.1.150	00116b010101	✎ 🗑
□	B	192.168.1.151	00116b010102	✎ 🗑

□ Select All

Figure 6-8 Static DHCP information list - Instance

Chapter 7 Wireless configuration

In the wireless configuration, the relevant wireless functions and parameters are set in the device, including: system mode, wireless basic configuration, wireless security configuration, wireless MAC address filtering, and wireless advanced configuration. In addition, you can also view the status information about the wireless host.

System mode:

In the **Start-> System mode** page, the work mode of the device can be configured, please refer to the section: System mode.

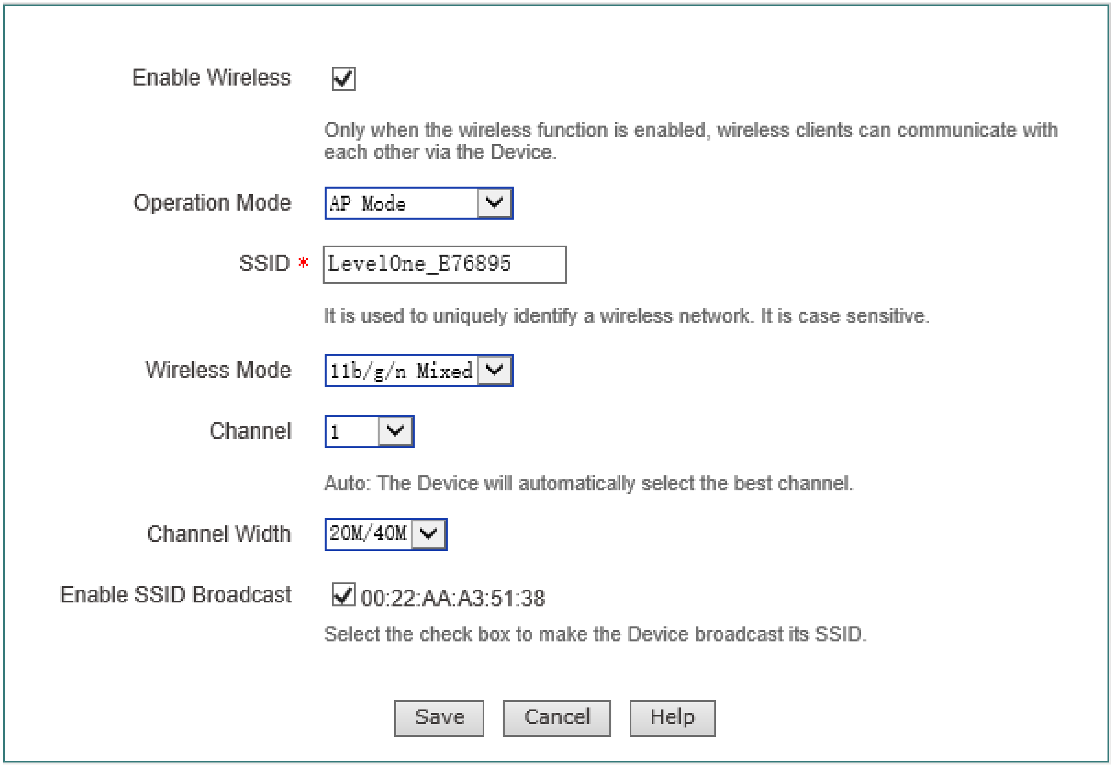
Wireless basic configuration

This section describes the **Wireless Configuration -> Wireless basic configuration** page and the configuration methods. In this page, you can configure the AP work mode, SSID, wireless mode, channel, channel bandwidth, enabling or disabling the SSID broadcast and other functions of the device. IN This section, the AP working mode is used: The wireless basic configuration is introduced in the order of AP Mode and WDS.

WDS (Wireless Distribution System) wireless distributed system, is a protocol for two access points (AP) in wireless connection. Throughout the WDS wireless network, multiple APs are connected by the way of bridging or repeater, make the entire LAN be dominated by wireless mode.

The WDS configuration provided by the device consists of three modes: Bridge Mode, Repeater Mode and Lazy Mode, which only plays a bridging function only in the practical application, and in configuration, the LAN IP of the device must be in the same network segment, while the parameters for security mode and channel bandwidth for connecting with each other must be consistent.

7.1 AP Mode



Enable Wireless ☑

Only when the wireless function is enabled, wireless clients can communicate with each other via the Device.

Operation Mode: AP Mode

SSID *: LevelOne_E76895

It is used to uniquely identify a wireless network. It is case sensitive.

Wireless Mode: 11b/g/n Mixed

Channel: 1

Auto: The Device will automatically select the best channel.

Channel Width: 20M/40M

Enable SSID Broadcast ☑ 00:22:AA:A3:51:38

Select the check box to make the Device broadcast its SSID.

Figure 7-1 AP Mode

- Enable wireless function: Only after the wireless function is enabled can the wireless clients be connected to the device, to have wireless communications through the device, connect and access the cable network to which the device is connected;

- AP work mode: Selecting the AP Mode, namely the pure AP mode, in which the peer device can be a single client;

- SSID (Service Set Identification) is used to uniquely identify a character string of wireless network, and is case sensitive.

- Wireless mode: This parameter is used to set the modes of the wireless device, to providing four options: only 11g, only 11n, 11b/g/n hybrid and 11g/n hybrid:

  - Only 11g: pure 802.11g mode, in which the maximum rate is up to 54M bps. The wireless sites compatible with the IEEE 802.11g standard can be connected to the device;

  - Only 11n: pure 802.11n mode, in which the maximum rate is up to 300M bps. The wireless sites compatible with the IEEE 802.11n standard can be connected to the device;

  - 11b/g/n hybrid: The wireless sites in compliance with IEEE 802.11b, 802.11g or 802.11n standard will be connected according to their modes, with the maximum rates of 11M bps, 54M bps and 300M bps respectively;

  - 11g/n hybrid: The wireless sites in compliance with IEEE 802.11g or 802.11n standard will be connected according to their modes, with the maximum rates of 54M bps and 300M bps respectively;

- Channel: This parameter is used to select the frequency bands in which the wireless network works, with the available range from 1 to 13, and it provides automatic options, which means that the device can automatically select the optimal frequency band. If there is more than one wireless device, the settings of frequency band of the devices cannot affect each other;
- Channel bandwidth: The channel bandwidth occupied by the wireless data transmission, with the options: 20M/40M 和 20M. Note that this parameter works only with the wireless site accessed using the 802.11n standard; for those using the 802.11b or 802.11g standard, only the channel bandwidth of 20M can be used:
  - 20M/40M: When 20M/40M is selected, it means the wireless sites accessed using the 802.11n standard will use the channel bandwidths of 20M or 40M according to the results of the negotiation with the accessed peer end;
  - 20M: When 20M is selected, it means the wireless sites accessed by using the 802.11g standard will use the channel bandwidth of 20M.
- SSID broadcast: Enables or disables the SSID broadcast function. If this function is enabled, the device will broadcast its own SSID to all the wireless sites so that the wireless sites without SSID (null) will get the correct SSID, to be able to connect to the device, and join into the wireless network with this SSID identifier. This function is enabled at risk (illegal sites are very easy to get the SSID information), so it is generally recommended to disable this function.

Tip:

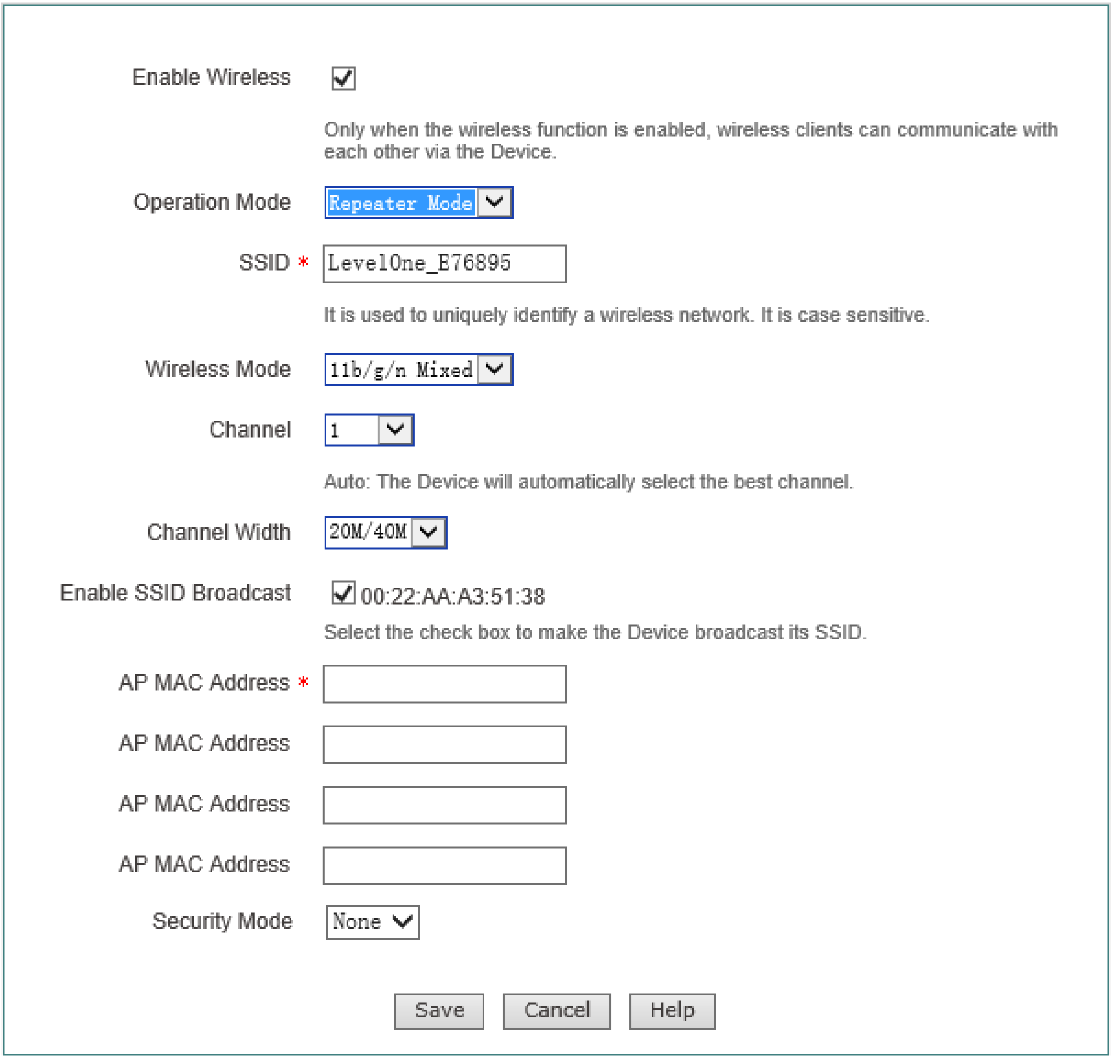
1） The device enables the wireless function by default and its work mode is AP Mode;

2） After the wireless parameters are modified, the device's wireless module will reboot, and rebooting of the wireless module will disconnect all wireless connections;

3） The AP work modes function differently, and should be selected according to the specific occasions, uses in configuration.

7.2 Repeater Mode

The device can exchange data with the network devices and single clients in Bridge Mode, Repeater Mode, Lazy Mode when its work mode is set to Repeater Mode, to realize network connectivity.



Enable Wireless ☑

Only when the wireless function is enabled, wireless clients can communicate with each other via the Device.

Operation Mode: Repeater Mode

SSID *: LevelOne_E76895

It is used to uniquely identify a wireless network. It is case sensitive.

Wireless Mode: 11b/g/n Mixed

Channel: 1

Auto: The Device will automatically select the best channel.

Channel Width: 20M/40M

Enable SSID Broadcast ☑ 00:22:AA:A3:51:38

Select the check box to make the Device broadcast its SSID.

AP MAC Address *:

AP MAC Address:

AP MAC Address:

AP MAC Address:

Security Mode: None

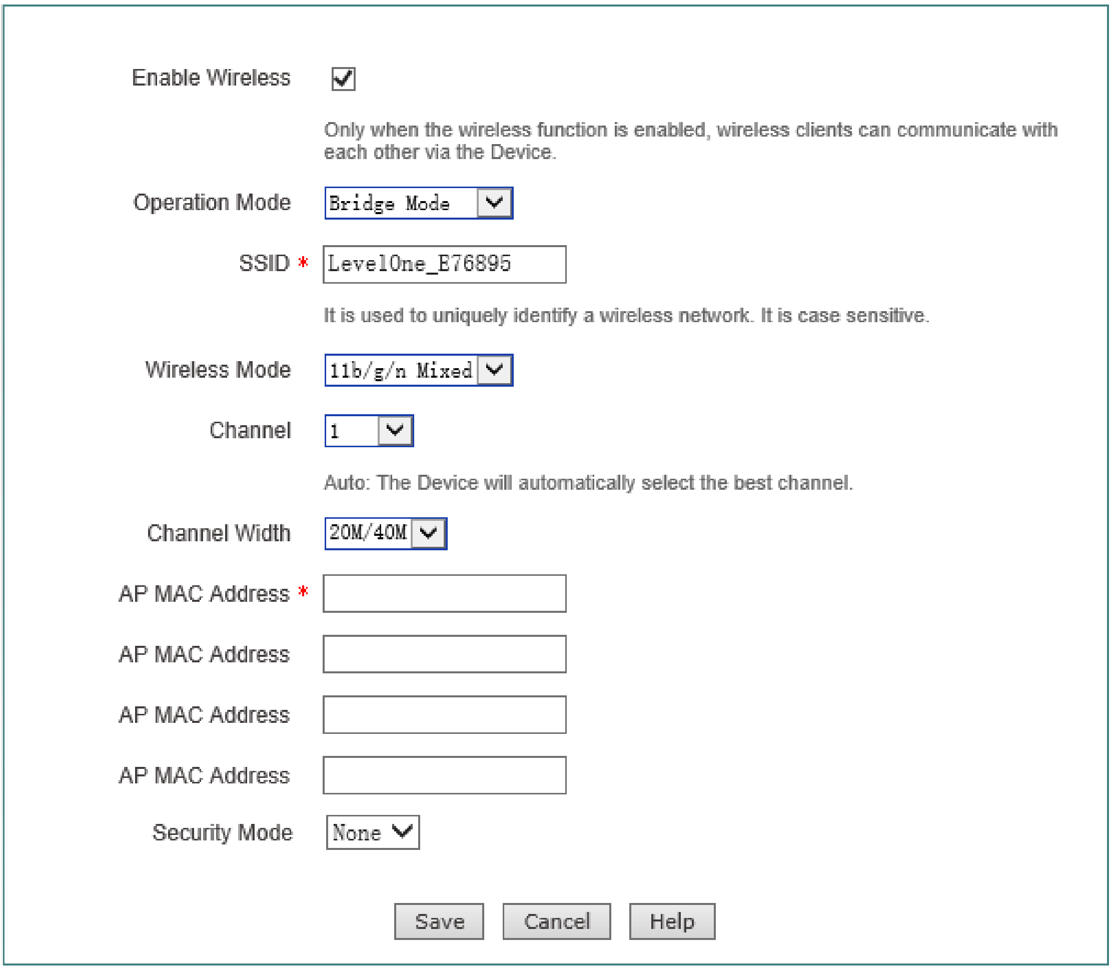
Figure 7-2 Repeater Mode

For the meaning of enabling wireless function, AP work mode, SSID, wireless mode, channel, channel bandwidth, enabling SSID broadcast, see the section: AP Mode for relevant explanations, and these terms will no longer be detailed if any in the subsequent configuration;

- MAC address of AP: MAC address of the peer device.
- Security mode: The encryption mode used in the establishment of connection through the WDS function, including four options, "No security mechanism", "WEP", "TKIP" and "AES".
  - No security mechanism: It means that no encryption algorithms will not be used to protect communication data in the data exchange process;
  - WEP: It means that the WEP encryption algorithm is used to protect data during the data exchange process. For details, please refer to the section: WEP;
  - TKIP: It means that the TKIP encryption algorithm is used to protect data during the data exchange process. For details, please refer to the section: WPA-PSK/WPA2-PSK;
  - AES: It means that the AES encryption algorithm is used to protect data during the data exchange process. For details, please refer to the section: WPA-PSK/WPA2-PSK.

7.3 Bridge Mode

Bridge Mode, in which the device is connected to two or more wired networks, and the device will no longer send wireless signals to other clients, to exchange data with the network devices in Bridge Mode, Repeater Mode, Lazy Mode. The meaning of related configuration parameters is the same as the Repeater Mode .



Enable Wireless ☑

Only when the wireless function is enabled, wireless clients can communicate with each other via the Device.

Operation Mode: Bridge Mode

SSID *: Level0ne_E76895

It is used to uniquely identify a wireless network. It is case sensitive.

Wireless Mode: 11b/g/n Mixed

Channel: 1

Auto: The Device will automatically select the best channel.

Channel Width: 20M/40M

AP MAC Address *:

AP MAC Address:

AP MAC Address:

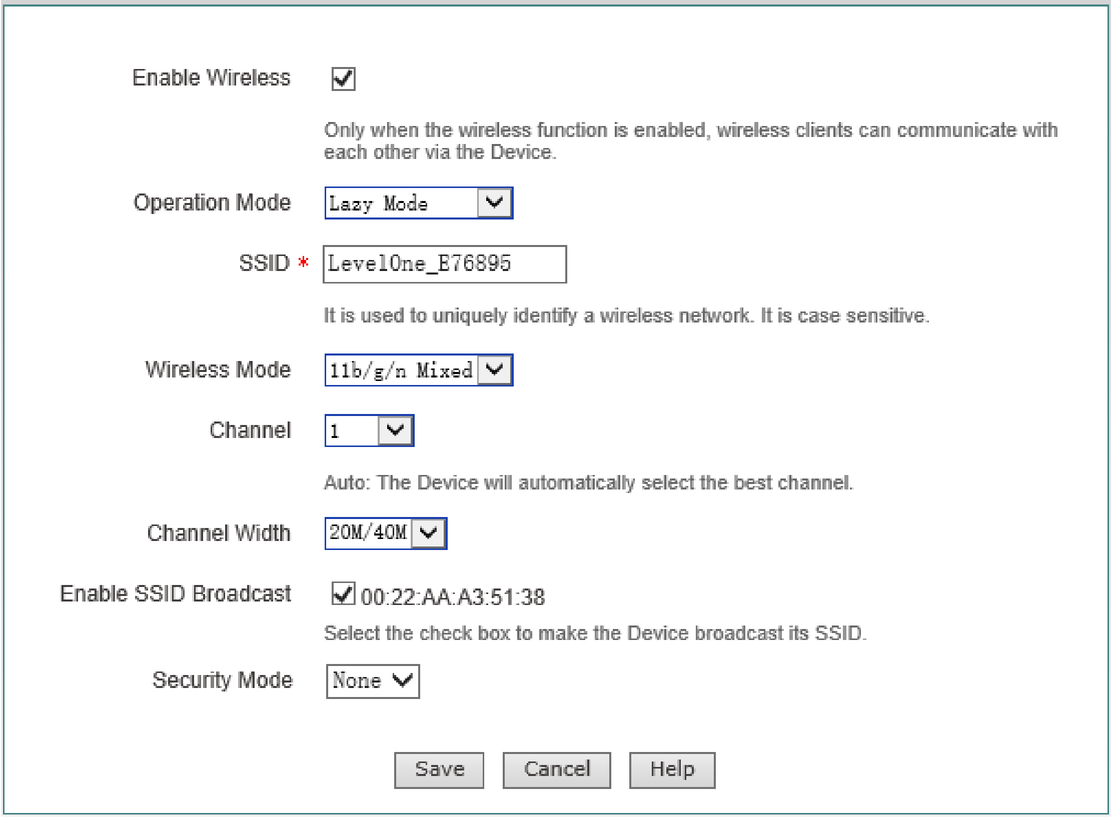
AP MAC Address:

Security Mode: None

Figure 7-3 Bridge Mode

7.4 Lazy Mode

The device can exchanges data with network devices and single clients in the Repeater Mode, Bridge Mode mode when its work mode is Lazy Mode, to realize network connectivity. The meaning of related configuration parameters is the same as AP Mode and Repeater Mode.



Enable Wireless ☑

Only when the wireless function is enabled, wireless clients can communicate with each other via the Device.

Operation Mode: Lazy Mode

SSID *: LevelOne_E76895

It is used to uniquely identify a wireless network. It is case sensitive.

Wireless Mode: 11b/g/n Mixed

Channel: 1

Auto: The Device will automatically select the best channel.

Channel Width: 20M/40M

Enable SSID Broadcast ☑ 00:22:AA:A3:51:38

Select the check box to make the Device broadcast its SSID.

Security Mode: None

Figure 7-4 Lazy Mode

7.5 Wireless configuration instance

This section lists configuration instances where the device works in the AP Mode, Repeater Mode and other AP work modes according to the four AP work modes of the device.

I. AP Mode configuration instance

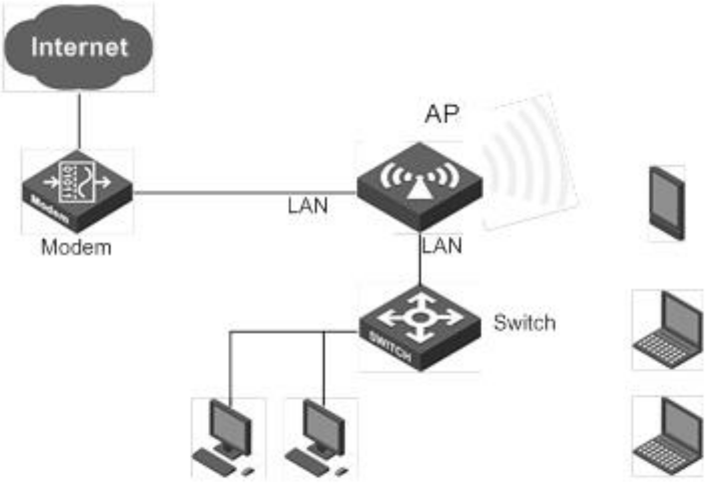


Figure 7-5 AP Mode networking environment

1. **Requirements:**Some home users want to put desktop computer, laptop, Tablet PC, smartphones on the Internet via wireless devices, and prevent users other than their home from accessing to wireless devices. Here, the gateway address is 192.168.1.1.

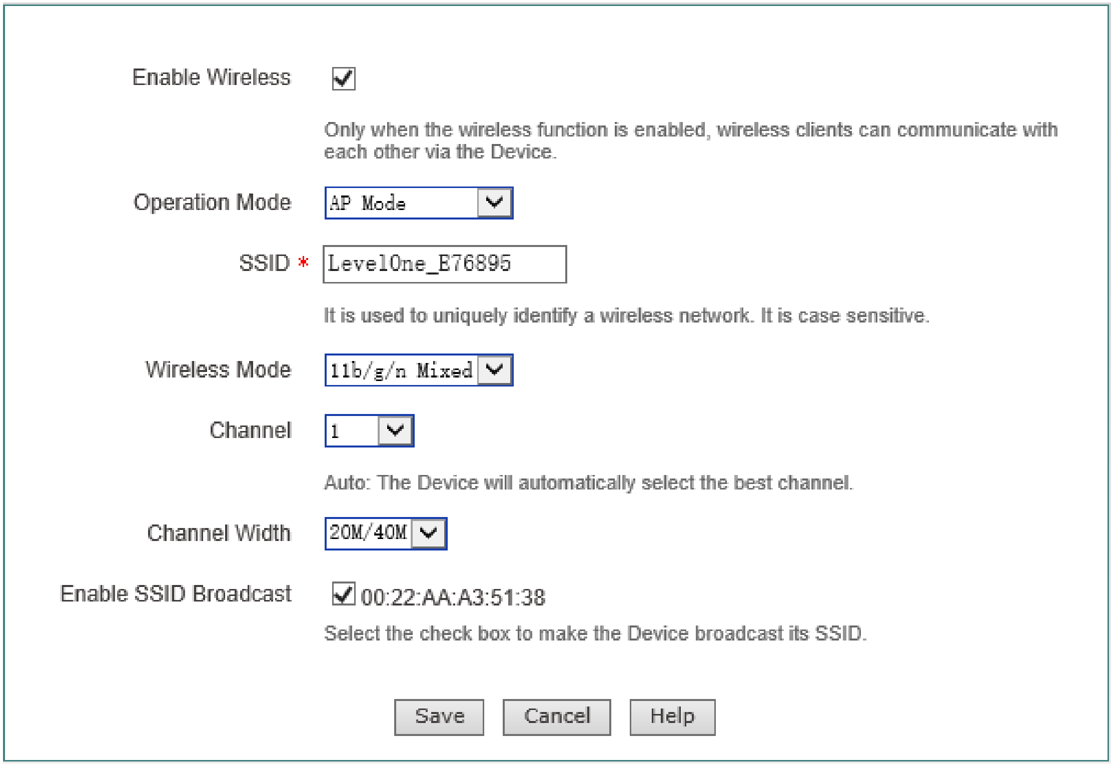
2. **Analysis:**Desktop computers are connected via a network cable to the LAN port of the wireless device; laptop, Tablet PC, etc. are wirelessly connected to a wireless device and need to be authenticated.

3. **Configuration steps:**

   1) Configure the TCP/IP properties for network computer;

   2) Upon logging in the device, change the work mode of the device to fat AP; then configure the LAN port of the device, here, the gateway address is set as 192.168.1.1;

   3) Enter into the **Wireless Configuration -> Wireless basic configuration** page, configure the device's wireless basic parameters, as shown in the figure below, the AP work mode is set to: AP Mode.



Enable Wireless ☑

Only when the wireless function is enabled, wireless clients can communicate with each other via the Device.

Operation Mode: AP Mode

SSID *: LevelOne_E76895

It is used to uniquely identify a wireless network. It is case sensitive.

Wireless Mode: 11b/g/n Mixed

Channel: 1

Auto: The Device will automatically select the best channel.

Channel Width: 20M/40M

Enable SSID Broadcast ☑ 00:22:AA:A3:51:38

Select the check box to make the Device broadcast its SSID.

Figure 7-6 AP Mode configuration

   4) Enter into the **Wireless configuration -> Wireless security configuration** page, to configure the authentication methods and key for wireless communication.

Through the above configuration, wireless users can connect to the wireless devices so long as they pass the authentication, and access to the Internet through it.

II. WDS configuration instance

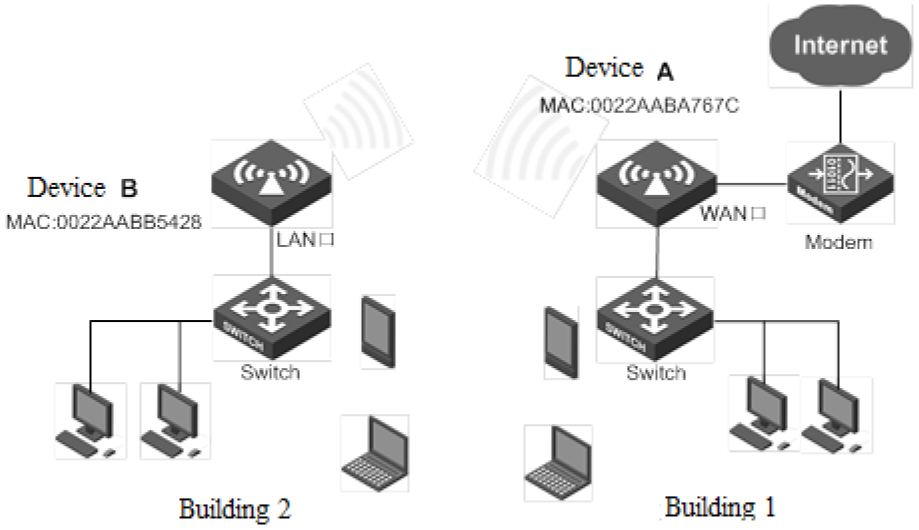


Figure 7-7 Repeater Mode networking environment

1. **Requirements:**The office personnel in Building 2 need to be wirelessly connected to Device A, and access to the Internet through the gateway. The related parameters of Device A are as follows:

Item	Parameters	Item	Parameters
Address of LAN port	192.168.1.253/24	Gateway address	192.168.1.1
SSID	UTT-HIPER-b87a9a	MAC	0022AABA767C
Wireless mode	11b/g/n hybrid	Channel	6
Security mode	WPA-PSK/WAP2-PSK	Pre-shared key	123456789
Encryption algorithm	Automatic	WPA version	Automatic

2. **Analysis:**The following solutions can be used to achieve the goal

   Solution I: Devices A and B are set to Repeater Mode mode.

   Solution II: Devices A and B are set to Bridge Mode mode.

   Solution III: Devices A and B are set to Repeater Mode, Bridge Mode respectively.

   Solution IV: Devices A and B are set to Repeater Mode, Lazy Mode mode respectively.

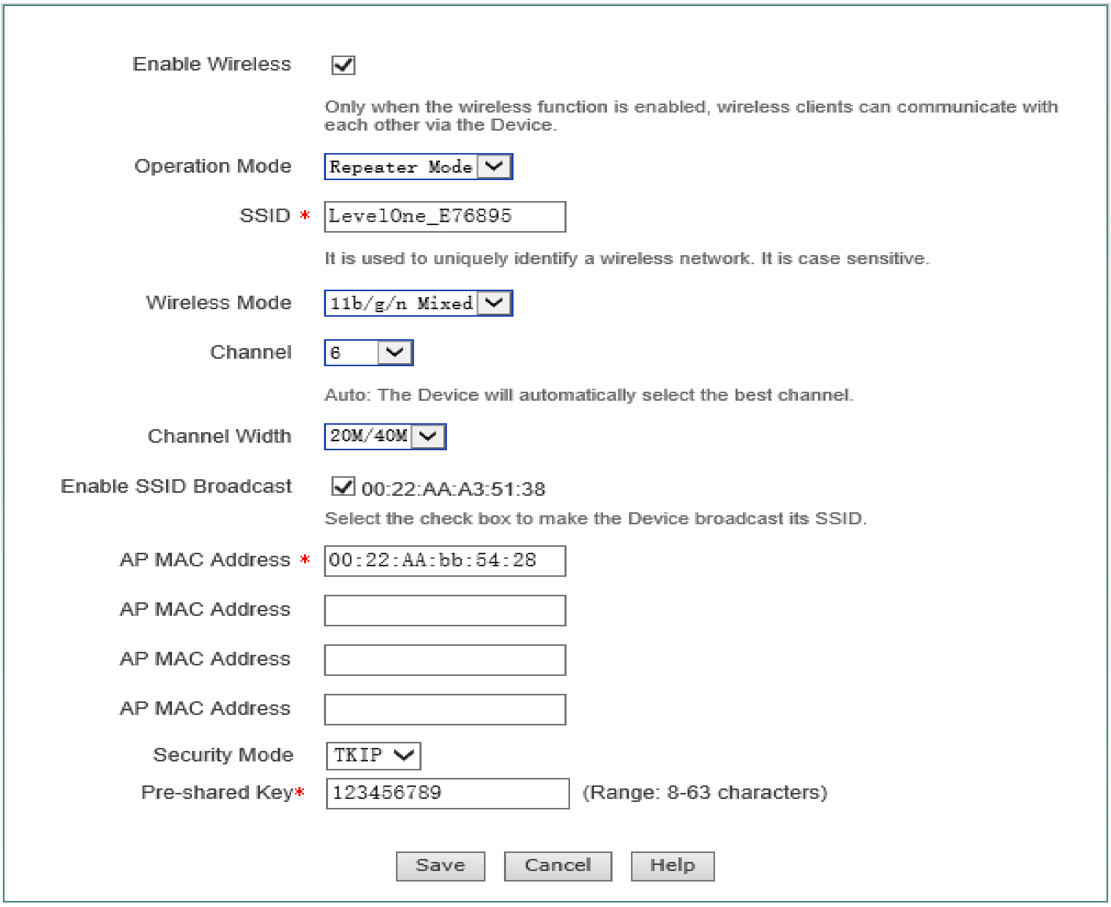
   Solution V: Devices A and B are set to Bridge Mode, Lazy Mode mode respectively.

3. **Configuration steps:**

   Solution I: Both are Repeater Mode

1) To configure the LAN port of Devices A, B, enter **Network parameters -> LAN configuration** to configure the IP address (on the same network segment) of the LAN port IP address of Devices A and B, with the gateway address directed to the export gateway;

2) Configure the AP mode of Device A as Repeater Mode, with the MAC address of AP as the MAC address of Device B, and the configuration content is shown in the figure below:



Enable Wireless ☑

Only when the wireless function is enabled, wireless clients can communicate with each other via the Device.

Operation Mode: Repeater Mode

SSID *: LevelOne_E76895

It is used to uniquely identify a wireless network. It is case sensitive.

Wireless Mode: 11b/g/n Mixed

Channel: 6

Auto: The Device will automatically select the best channel.

Channel Width: 20M/40M

Enable SSID Broadcast ☑ 00:22:AA:A3:51:38

Select the check box to make the Device broadcast its SSID.

AP MAC Address *: 00:22:AA:bb:54:28

AP MAC Address:

AP MAC Address:

AP MAC Address:

Security Mode: TKIP

Pre-shared Key*: 123456789 (Range: 8-63 characters)

Figure 7-8 Repeater Mode instance

3) Configure the AP mode of Device B as Repeater Mode, and the SSID, wireless mode, channel, channel bandwidth, security mode, pre-shared key are configured in the same way as Device A, and the AP MAC address is: 0022AABA767C (the MAC address of Device A);

Through the above configurations, the office personnel in Building 2 can connect to Device A through Device B in Building 1, and access to the Internet through a gateway.

Tip:

1） The gateway of the computer in Building 2 is directed to the LAN port of Device A;

2） The IP address of LAN port of Device B is in the same network segment as the LAN port address of Device A.

4. **Connectivity verification:**

Ping the LAN IP address of Device A on a computer in Building 2. If it can be pinged successfully, then it means that the connection between the two wireless devices has been established.

Solutions II, III, IV, V can follow Solution I.

⌖ **Tip:**

1） The device in Bridge Mode cannot be connected to the wireless single clients, such as laptops, smart phones, etc;

2） The devices in Lazy Mode can be connected to the wireless single clients;

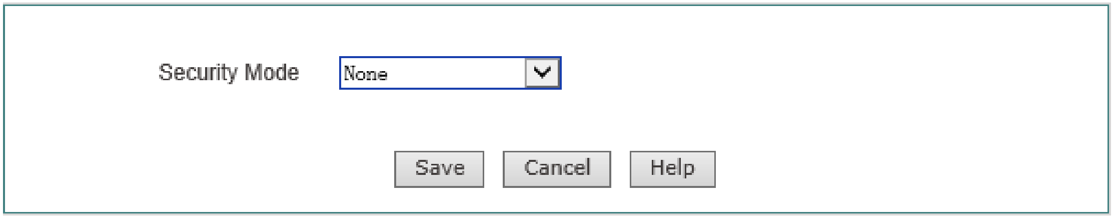
3） In configuration, the SSID and key of Devices A, B must be kept consistent,and the MAC address of AP is that of the peer device (It is not required to configure the MAC address of the peer device when the AP mode is Lazy Mode);

4） Device A and B must be in the same network segment.

Wireless security configuration

This section describes the **Wireless configuration** -> **Wireless security configuration** interface and configuration methods, this device provides three wireless security mechanisms, WEP, WPA/WPA2, WPA-PSK/WPA2-PSK, while users are allowed not to use the security mechanism. In the following sections, the meaning of their configuration parameters are described separately.

7.6 No security mechanism

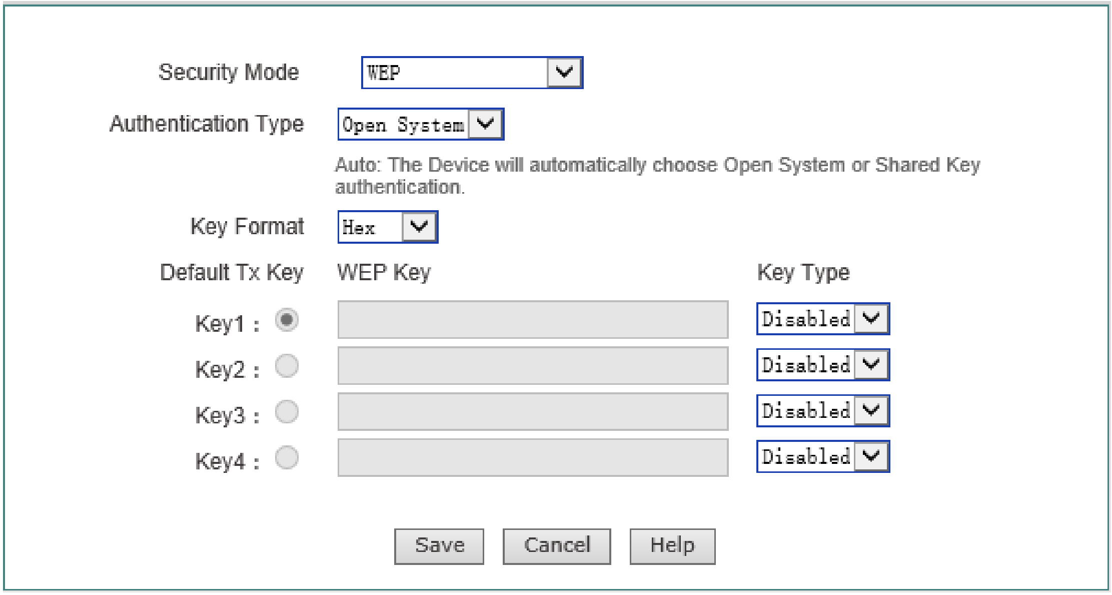


Security Mode: None

Figure 7-9 WEP

◈ No security mechanism: Means that the client can access to the network without using any security mechanism for authentication.

7.7 WEP



Security Mode: WEP

Authentication Type: Open System

Auto: The Device will automatically choose Open System or Shared Key authentication.

Key Format: Hex

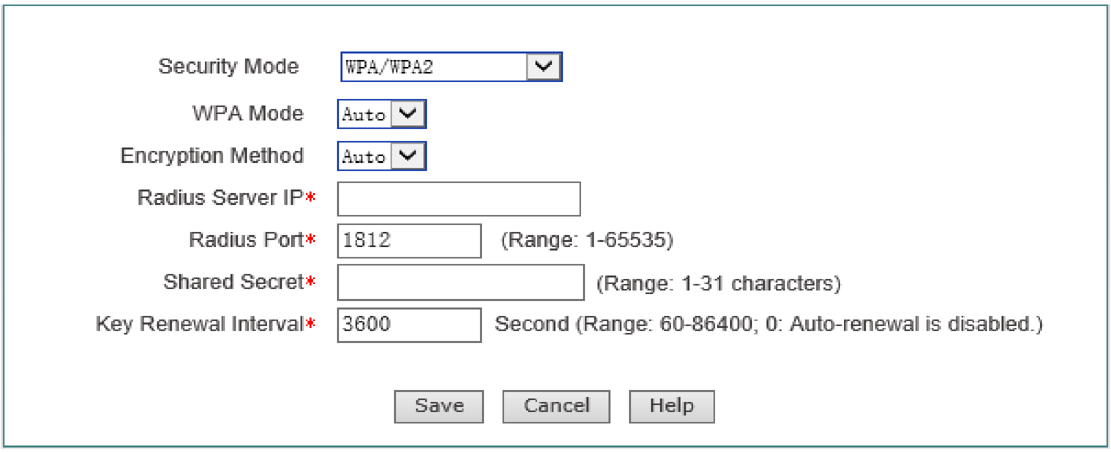
Default Tx Key	WEP Key	Key Type
Key1 : ●		Disabled
Key2 : ○		Disabled
Key3 : ○		Disabled
Key4 : ○		Disabled

Figure 7-10 WEP

- Security mechanism: Selecting "WEP" here means that the device will use the most basic WEP security mechanism provided by the 802.11 Protocol;
- Authentication type: When using the WEP encryption mechanism, three options, automatic, open systems, Shared keys are available:
  - Auto: Means that the device can automatically choose Open System or Pre-shared key mode according to the requests of wireless clients.
  - Open system: At this point, the wireless client host can pass the authentication and be associate with the wireless devices on the premise of providing no authentication key; but a correct key must be provided if data transmission is to be made.
  - Shared key: At this point, the wireless client host must provide the correct key to pass the authentication; otherwise, it cannot be associated with the wireless devices, and cannot perform data transmission.
- Key format: Two formats hexadecimal code and ASCII code are provided:
  - When the hexadecimal code is used, the key characters can be 0 ~ 9, A, B, C, D, E, F.
  - When the ASCII code is used, the key characters can be all ASCII codes.
- Key selection: The user can enter 1 ~ 4 keys according to needs, and these 4 keys can be in different types.
- WEP key: Sets the key value, and the length of the key is affected by key types:
  - When choosing a 64 - bit key, you can input 10 hexadecimal characters or 5 ASCII characters.
  - When choosing a 128 - bit key, you can input 26 hexadecimal characters or 13 ASCII characters.

- Key types: Selects key types, and provides three options, Disable, 64 bits, 128 bits. Among them, Disable means not to use the current key, but 64 bits, 128 bits, and used to specify the length of the WEP key.

7.8 WPA/WPA2



Security Mode	WPA/WPA2	
WPA Mode	Auto	
Encryption Method	Auto	
Radius Server IP*		
Radius Port*	1812	(Range: 1-65535)
Shared Secret*		(Range: 1-31 characters)
Key Renewal Interval*	3600	Second (Range: 60-86400; 0: Auto-renewal is disabled.)

Figure 7-11 WPA/WPA2

- Security mechanism: Selecting "WPA/WPA2" here means that the device will use WPA or WPA2 security mechanism. Under the security mechanism, the device will make authentication and obtain the key using the Radius server;

- WPA version: Sets the security mode this device will use:
  - Auto: Means that the device can automatically choose WPA or WPA2 security mode according to the requests of wireless clients.
  - WPA: Means that the device will use the security mode of WPA.
  - WPA2: Means that the device will use the security mode of WPA2.

- Encryption algorithm: It is the security algorithm used to encrypt wireless data, with the options like Auto, TKIP and AES.
  - Auto: Means that the device will automatically choose encryption algorithms according to needs.
  - TKIP: Means that all wireless data will use TKIP as the encryption algorithm.
  - AES: Means that all wireless data will use AES as the encryption algorithm.

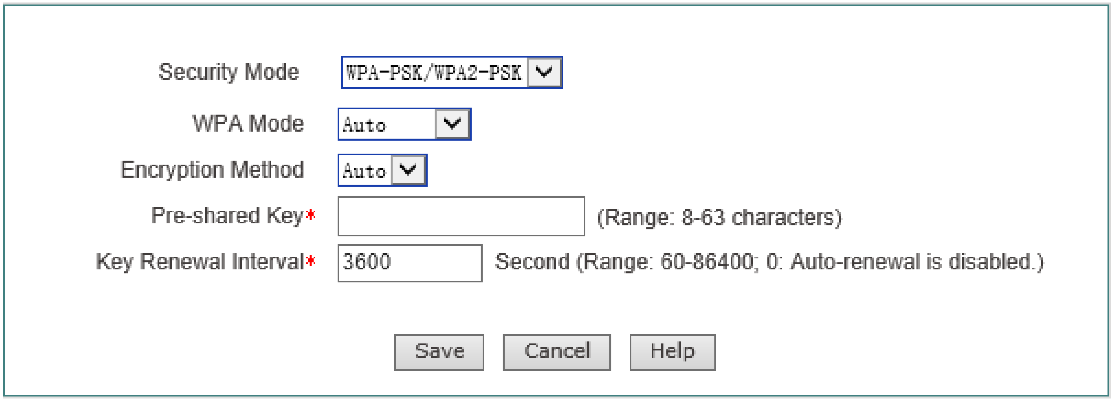
- Radius Server IP: It is the IP address of the Radius server used to the authenticate wireless hosts.

- Radius port: The service port number used by the Radius server for authenticating wireless hosts.

- Radius password: Sets the password for accessing to the Radius service.

- Key update cycle: It is the timed update cycle used to specify the key. Value range is 60 ~ 86400, in the unit of seconds. The default value is 3600, which means no update when the value is 0.

7.9 WPA-PSK/WPA2-PSK



Security Mode: WPA-PSK/WPA2-PSK

WPA Mode: Auto

Encryption Method: Auto

Pre-shared Key*: (Range: 8-63 characters)

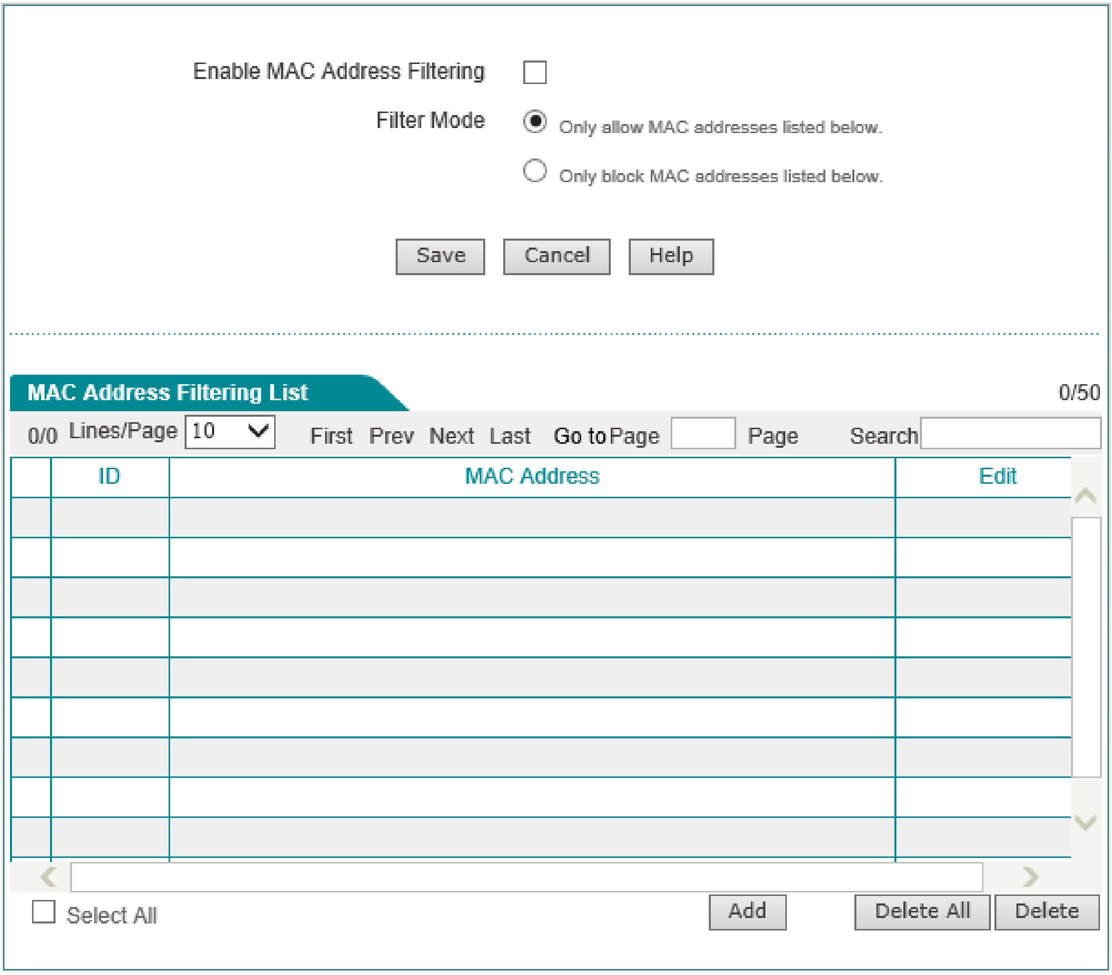
Key Renewal Interval*: 3600 Second (Range: 60-86400; 0: Auto-renewal is disabled.)

Figure 7-12 WPA-PSK/WPA2-PSK

- Security mechanism: Here, you can select "WPA-PSK /WPA2-PSK", which means that the device will use WPA-PSK /WPA2-PSK security mechanism. Under this security mechanism, this device will use the WPA mode based on the Pre-Shared key.
- WPA version: Sets the security mode this device will use:
  - Auto: Means that the device can automatically choose WPA-PSK or WPA2-PSK security mode according to the requests of wireless clients.
  - WPA: Means that the device will use the security mode of WPA-PSK.
  - WPA2: Means that the device will use the security mode of WPA2-PSK.
- Encryption algorithm: It is the security algorithm used to encrypt wireless data, with the options like Auto, TKIP and AES.
  - Auto: Means that the device will automatically choose encryption algorithms according to needs.
  - TKIP: Means that all wireless data will use TKIP as the encryption algorithm.
  - AES: Means that all wireless data will use AES as the encryption algorithm.
- Pre-shared key: The preset initialization key, with the value of 8 ~ 63 characters.
- Key update cycle: It is the timed update cycle used to specify the key. Value range is 60 ~ 86400, in the unit of seconds. The default value is 3600, which means no update when the value is 0.

Filtering of wireless MAC address

This section describes the **Wireless configuration-> Wireless MAC address filtering** page and the configuration of wireless MAC address filtering. By setting the MAC address filtering function, you can enable or disable wireless hosts to or from access to the device and the wireless network.



Enable MAC Address Filtering □

Filter Mode ● Only allow MAC addresses listed below.

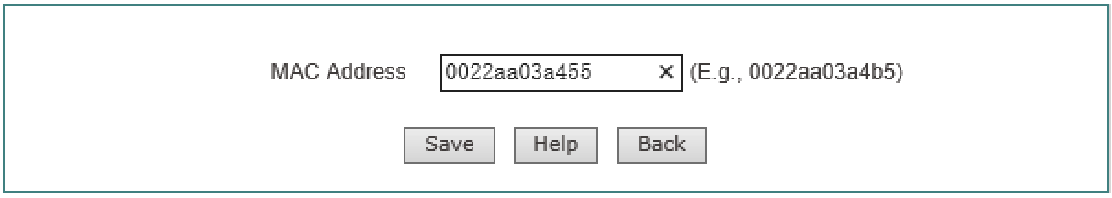
○ Only block MAC addresses listed below.

Save
Cancel
Help
MAC Address Filtering List
0/50
0/0 Lines/Page 10
First Prev Next Last Go to Page Page
Search

	ID	MAC Address	Edit

Figure 7-13 Filtering of wireless MAC address

- Enable MAC address filtering: enable or disable the MAC address filtering function, checking it means to enable it;
- Filtering rules: Sets the rules for MAC address filtering;
  - Permission: It indicates that only the wireless clients that correspond to the MAC addresses in the MAC address filtering information list are allowed to access to the device and it is prohibited to connect the wireless clients out of the filtering table;
  - Prohibition: It indicates that only the wireless clients that correspond to the MAC addresses in the MAC address filtering information list are prohibited to access to the device, and the wireless clients out of the filtering table are allowed to access;
- Add new entry: Click this button to enter into**Wireless MAC address filtering**page to configure the MAC addresses to be filtered, as shown in the figure below.



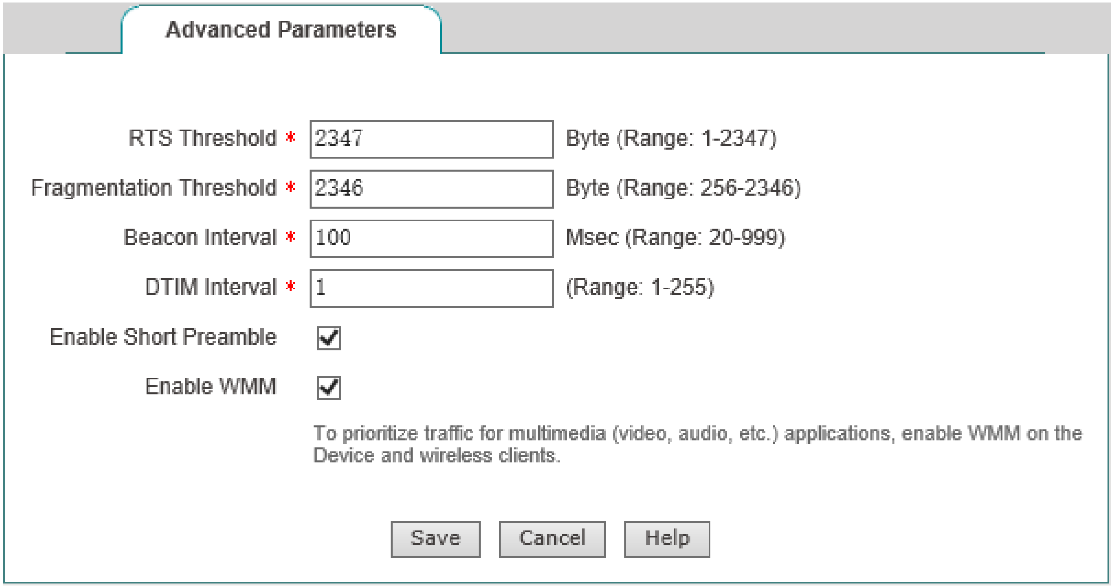
MAC Address 0022aa03a455 (E.g., 0022aa03a4b5)

Figure 7-14 Configuration of MAC address filtering

Wireless Advanced Configuration

This section describes the meaning of the wireless advanced parameters in the **Wireless Configuration-> Wireless advanced configuration**.

In this page, you can set wireless advanced parameters, and under normal circumstances, keep the default values of these parameters. If you have special needs, you can configure in this page.



RTS Threshold *	2347	Byte (Range: 1-2347)
Fragmentation Threshold *	2346	Byte (Range: 256-2346)
Beacon Interval *	100	Msec (Range: 20-999)
DTIM Interval *	1	(Range: 1-255)
Enable Short Preamble	☑	
Enable WMM	☑	

To prioritize traffic for multimedia (video, audio, etc.) applications, enable WMM on the Device and wireless clients.

Figure 7-15 Wireless Advanced Configuration

- RTS threshold: When a packet exceeds this threshold, it will activate the RTS mechanism. Before transmitting data frames, the device will send RTS (Request to Send) packet to the destination site for negotiation; after receiving an RTS frame, the wireless site will respond to the device by sending a CTS (Clear to Send) frame, which means wireless communication can be made between both of them. Value range is generally 1~2347 bytes, and the default is 2347 bytes;

  The RTS mechanism is used to avoid data transmission conflicts in the wireless LAN. The transmission frequency of the RTS packet needs to be set reasonably, and setting of the RTS threshold requires weighing. If this parameter is set to low, the transmission rate of RTS packets is increased, consuming more bandwidths, which may significantly affect the throughput of other network packets. But the more frequently the RTS packet is sent, the more quickly the system can recover from disruption or conflict;

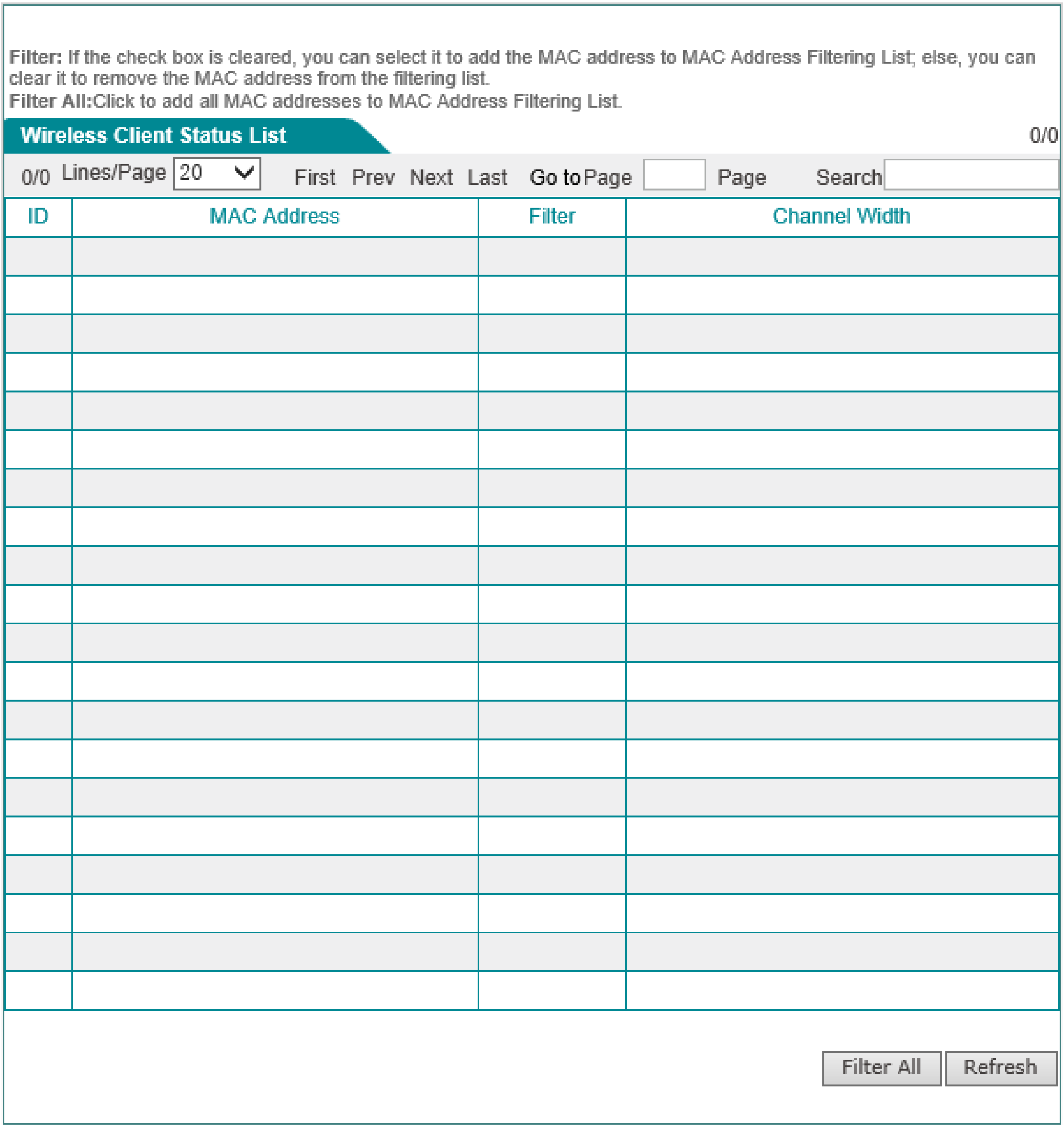
- Segmentation threshold: It is used to define the maximum transmission length of the wireless data packets allowed by the wireless MAC layer to be transmitted, when the length of Data frames exceeds this value, they will automatically be segmented into multiple data frames, and then transmitted again. If the segmented transmission is interrupted, only the parts that are not sent successfully need to be sent, and the throughput of segmented packets is generally low. Value range is generally 256~2346 bytes, and the default is 2346 bytes.

The transmission efficiency for large segments is high, but if there is a clear conflict in the wireless network, or if the network is used at a high frequency, the reduction of segments can improve the reliability of data transfer. In most cases, keep the default value as 2346;

- Beacon interval: The device synchronizes the wireless network connection through regular Radio Beacon frames. This parameter is used to define the transmission interval of beacon frames which are transmitted periodically at the specified time interval. Value range is generally 20~999 ms, and the default is 100 ms.
- DTIM interval: This parameter is used to specify the transmission interval for the Delivery Traffic Indication Message (DTIM). DTIM interval is used to decide the frequency of beacon frames containing Traffic Indication Map (TIM) to be transmitted. TIM will issue a warning to the sites entering into the sleep status, by indicating that the data is to be received. DTIM is usually the multiple of beacon interval. Its use range is 1~255, and its default value is 1;
- Enable Short Preamble: Enables or disables Short Preamble.
  - When enabled, the short preamble type will be used; the short preamble type can provide better performance. Because the use of short preamble can minimize costs, thus maximizing the network data throughput;
  - When disabled, the long preamble type (Long Preamble) will be used; the long preamble type will be able to provide more viable connections and a large range of connections;
- Enable WMM: Allows you to enable or disable the WMM support. WMM (Wi-Fi Multimedia) is a subset of the 802.11e standard. WMM allows wireless traffic to have a priority range based on the data type. Time-sensitive information, such as video or audio, will have a higher priority than the normal traffic. To use the WMM function properly, wireless clients must also support WMM.

Status of wireless host

This section describes the **Wireless Configuration -> Wireless host status** page. Through the "List of the wireless host status information", you can view the status information of the wireless hosts currently connected to the device. In addition, through the "List of the wireless host status information", you can also easily set the MAC address filtering function.



Filter: If the check box is cleared, you can select it to add the MAC address to MAC Address Filtering List; else, you can clear it to remove the MAC address from the filtering list.
Filter All: Click to add all MAC addresses to MAC Address Filtering List.

Wireless Client Status List
0/0
0/0 Lines/Page 20
First Prev Next Last Go to Page Page Search

ID	MAC Address	Filter	Channel Width

Figure 7-16 Status of wireless host

- ID: Serial number;
- MAC address: The MAC address of the wireless host;
- Filter: Selecting it to indicate that the current MAC address has been added into the "List of MAC address filter information" (which can be viewed in the**Wireless configuration --> Wireless MAC address filtering**page), while not selecting it means that the current MAC address filtering is not set;
- Channel bandwidth: The theoretical data transfer rate of the data channel;
- All filter: Click <All filter>, to conduct the MAC address filtering for all wireless hosts whose filtering is not enabled in the current list, and to add all the MAC addresses to the "MAC address filtering list";
- Refresh: Click <Refresh>, to view the latest wireless host status and statistical information.

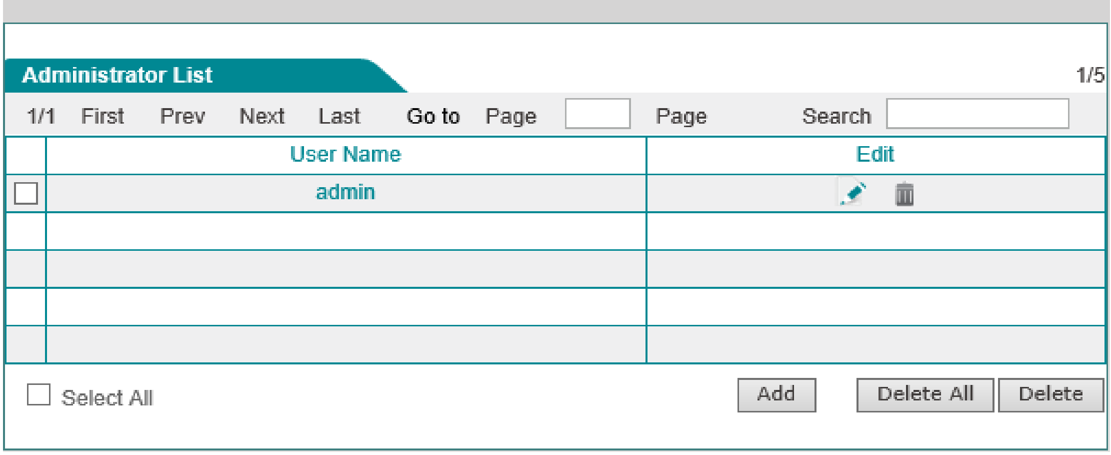
Chapter 8 System management

In the **System Management** main menu, you can enter the **Administrator configure, clock management, configuration management, software upgrade, and scheduled task** pages. This chapter mainly describes how users set the device clock; how to back up and import the configuration files; how to upgrade device, etc.

8.1 Administrator configuration

Enter into the **System Management-> Administrator configuration** page, to view and configure the device administrator's user name and password.

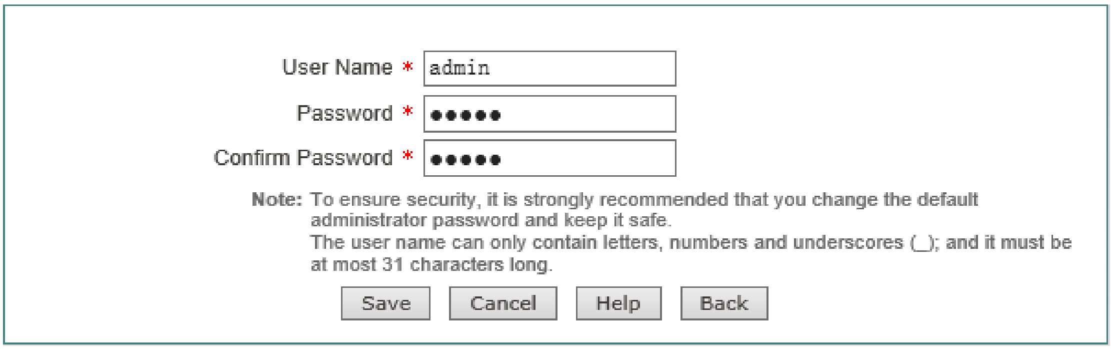
1) Administrator configuration information list



	User Name	Edit
□	admin	

Figure 8-1 Status of wireless host

2) Description of administrator configuration parameters



User Name * admin

Password * ●●●●●

Confirm Password * ●●●●●

Note: To ensure security, it is strongly recommended that you change the default administrator password and keep it safe.
The user name can only contain letters, numbers and underscores (_); and it must be at most 31 characters long.

Figure 8-2 Status of wireless host

- User name: Customize the user name of the administrator who logs in the WEB interface;
- Password, confirm password: Customize the password of the administrator who logs in the WEB interface;

3) Modification of administrators' factory user name, password

For security reasons, we strongly recommend to modify the initial administrator user name and password, and to keep them with care.

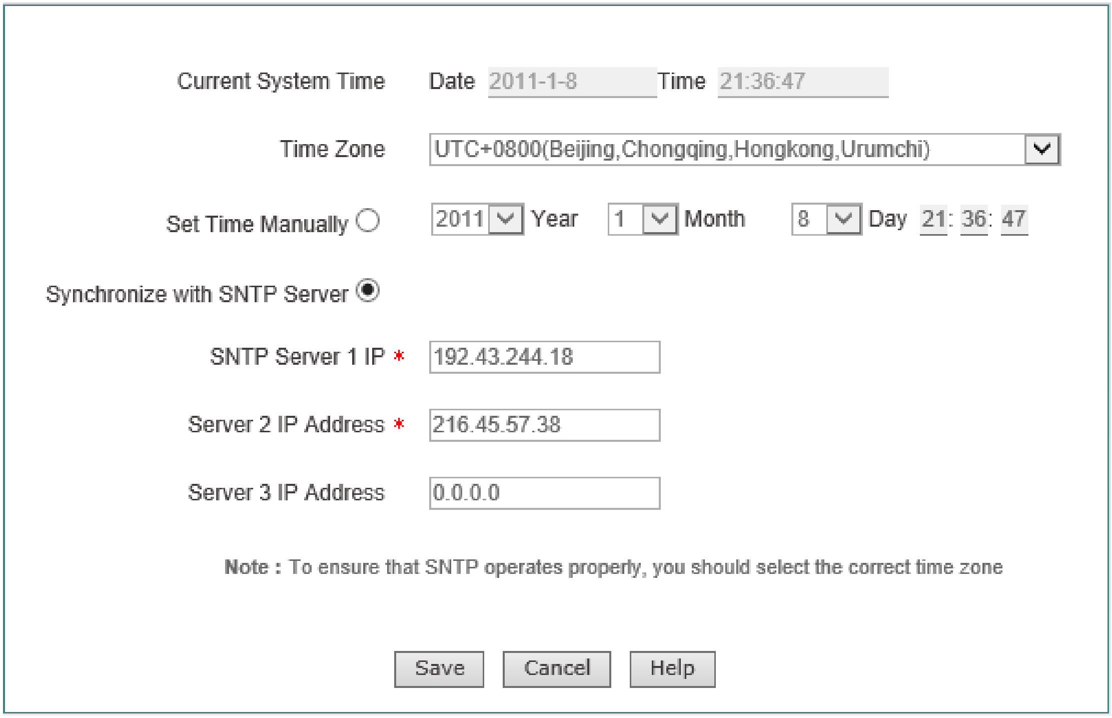
Enter into the **System Management-> Administrator configuration** page, click on the Edit icon with the user name as "admin", enter into the configuration page to modify the factory user name and password. After modification, you must use the new user name and password to log into the device.

8.2 Clock management

This section describes the **System Management-> Clock management** page.

In order to guarantee that the functions of the device relating to time work normally, the clock of the device needs to be accurately set, to make it synchronize with the local standard time.

The device provides two ways of setting system time, "Manual setup time" and "Network time synchronization". It is recommended to use the "Network time synchronization" function to obtain the standard time, and the device will automatically get the standard time from the Internet after it connects Internet in bootup.



Current System Time Date 2011-1-8 Time 21:36:47

Time Zone UTC+0800(Beijing,Chongqing,Hongkong,Urumchi)

Set Time Manually ○ 2011 Year 1 Month 8 Day 21: 36: 47

Synchronize with SNTP Server ●

SNTP Server 1 IP * 192.43.244.18

Server 2 IP Address * 216.45.57.38

Server 3 IP Address 0.0.0.0

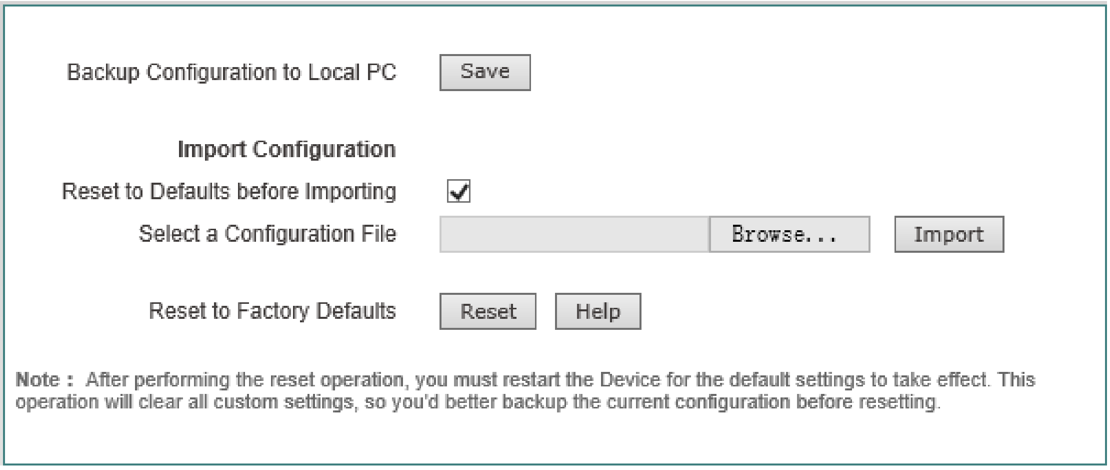
Note : To ensure that SNTP operates properly, you should select the correct time zone

Figure 8-3 Clock management

- Current system time: Displays the current date and time information of the device (unit: Y-M-D, H:M:S).
- Time zone selection: Selects the international time zone in which the device resides. Only choosing a correct time zone can the network time synchronization function work properly.
- Manual time setting: Manually enters the current date and time (unit: Y-M-D, H:M:S);
- Network time synchronization: After using the network time synchronization function to set up the right NTP server, and when the device is connected to the Internet, it will automatically synchronize the time with the set NTP server. The addresses of two NTP servers preset by the system by default are 192.43.244.18, 129.6.15.28, which generally requires no change. If you need to know more about the NTP knowledge and the server, just visit http://www.ntp.org.

8.3 Configuration management

This section describes the configuration methods of **System management -> Configuration management**. In this page, you can back up the current configuration file to a local PC, import the new configuration file to the device and restore the factory configuration of the device.



Backup Configuration to Local PC [Save]

Import Configuration

Reset to Defaults before Importing ☑

Select a Configuration File [Browse...] [Import]

Reset to Factory Defaults [Reset] [Help]

Note： After performing the reset operation, you must restart the Device for the default settings to take effect. This operation will clear all custom settings, so you'd better backup the current configuration before resetting.

Figure 8-4 Configuration management

1) Backup configuration files

Click on the <Save> button in the above figure, to back up the configuration file to the local PC, with the format of the configuration file as .xml.

2) Import configuration file

In the previous figure, click < Browse ... >, and select the configuration file saved on the local PC. Then click <Import> again. If you have checked the check box "Restore factory configuration before import", click the <Import> button, and the device will be restore to the factory settings.

3) Restore to factory settings of device

If users need to restore the device to its factory settings, enter into the **Systems management -> Configuration management** page, and click <Restore>.

Tip:

1） Do not cut off the device power supply in loading configuration, in order to avoid unexpected errors.

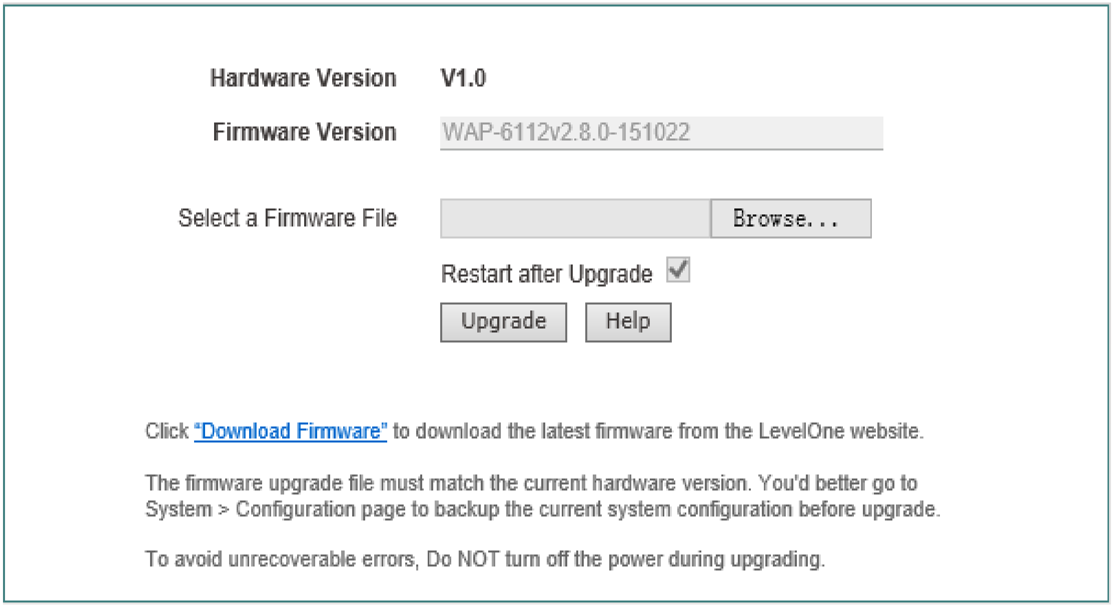
2） Restoring the device's factory settings will delete all the custom settings. It is strongly recommended that before restoring the factory configuration, first back up its configuration files.

3） The user name and password of the device's factory administrator are as follows: admin, and the default LAN port IP address/subnet mask is: 192.168.1.253/ 255.255.255.0.

4） After clicking <Restore>, the device needs to be rebooted before restoring its factory settings.

8.4 Software upgrade

This section describes the **System management-> Software upgrade** page and the software upgrade procedure. In this page, you can view the information of the currently running version, and download the latest software from the LevelOne web site.



Hardware Version V1.0

Firmware Version WAP-6112v2.8.0-151022

Select a Firmware File [Browse...]

Restart after Upgrade ☑

[Upgrade] [Help]

Click "Download Firmware" to download the latest firmware from the LevelOne website.

The firmware upgrade file must match the current hardware version. You'd better go to System > Configuration page to backup the current system configuration before upgrade.

To avoid unrecoverable errors, Do NOT turn off the power during upgrading.

Figure 8-5 Software upgrade

- Version information: Displays the information of the current hardware version, software version;

- Download the latest version: Goes to the official website of LevelOne to download the latest version of the software.

Upgrading steps:

Step 1: Download the latest software

Click on the hyperlink "Download the latest version" and go to the official site of LevelOne to download the latest version of the software to your local PC.

Step 2: Select the upgrade path

In the "Select the upgrade file" text box, enter the path for upgrading the software on the local PC, or select the new software on the local PC by clicking < Browse ... >.

Step 3: Update device software

After selecting software, click on the <Upgrade> button, to update the device software.

Tip:

1) Please select an appropriate type of the latest software: The hardware version for the downloaded software must be consistent with the hard versions of the current products;

2) It is recommended that before upgrading, enter into **Systems management -> Configuration management** to back up the current configuration of the system.

3) It is strongly recommended to upgrade when the device load is low (less users).

4) Upgrading device software on a regular basis enables the device to get more functions or to have a better working performance. The right software upgrading will not change the current device settings.

5) During the upgrading process, the device's power supply cannot be cut off, otherwise it will cause unpredictable errors and even irreversible damages to the hardware.

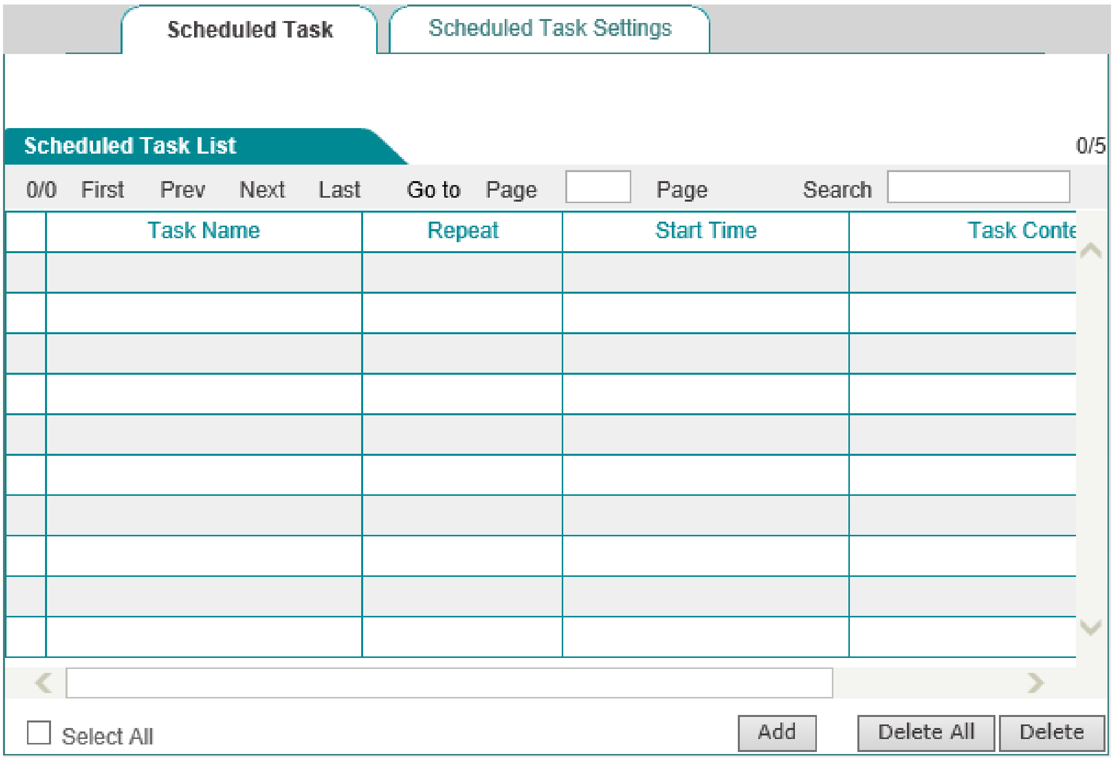
6) After the completion of upgrading, the software will automatically restart to take effect, without the need of human intervention.

8.5 Scheduled task

This section describes the **System management-> Scheduled task** page. By configuring scheduled tasks, administrators can predefine the actions completed by the device at a specified time.

1) List of scheduled tasks

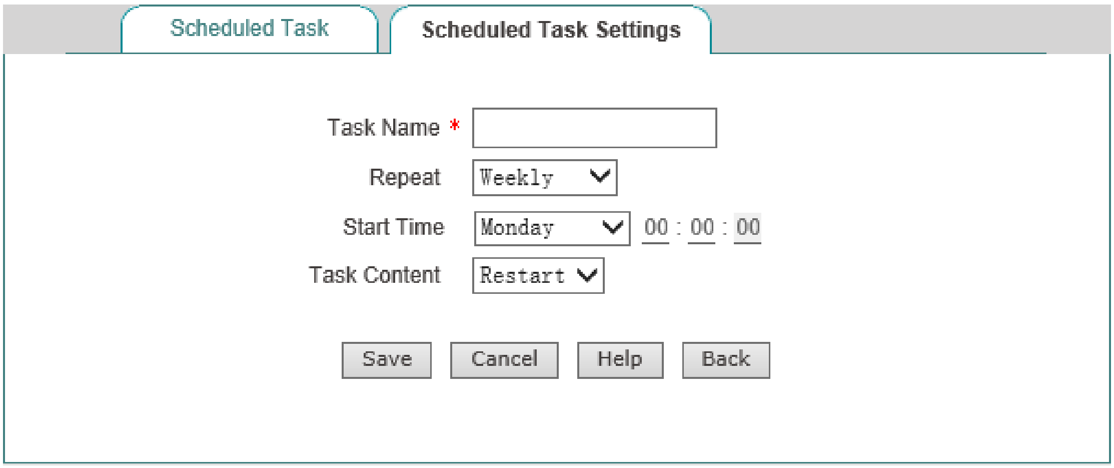
The scheduled task list is an editable list. You can operate the instances in the list.



	Task Name	Repeat	Start Time	Task Conte

Figure 8-6 List of scheduled tasks

2) Description of scheduled task parameters



Task Name *

Repeat: Weekly

Start Time: Monday 00 : 00 : 00

Task Content: Restart

Figure 8-7 Configuration of scheduled tasks

- Task name: Name of the custom tasks;
- Startup type: Indicates time cycle, and the options are: every week, every day, every hour, every minute;
- Running time: Means the specific time for implementation of these tasks, whose setting varies based on the startup types;
- Task content: Selects the appropriate task content.

Chapter 9 System status

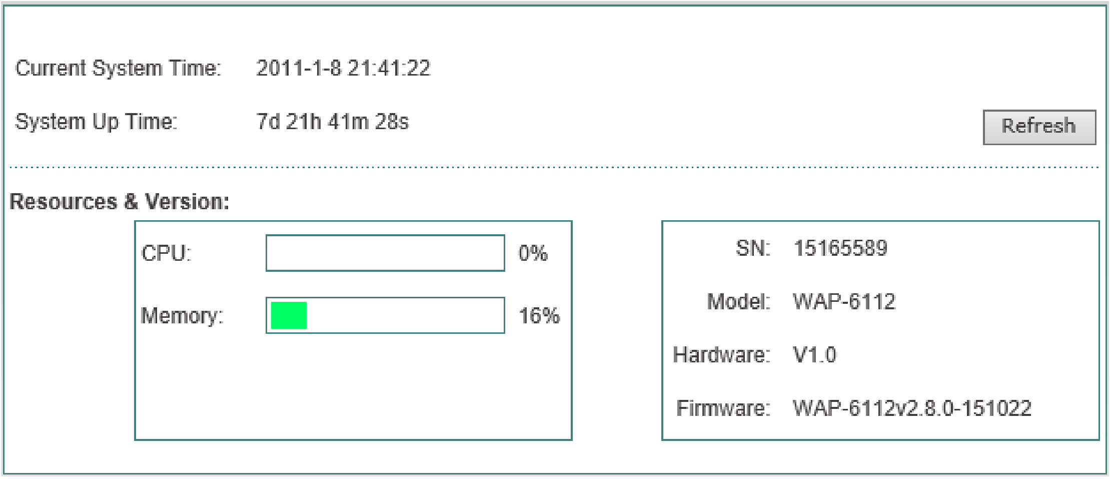
In System status, you can easily view the running state of the device, and the system information and history of the device.

9.1 Running status

The running status described in this section is the same as **Start-> Running status** page, please refer to the section: Running Status.

9.2 System information

In the **System status -> System information** page, network administrators can understand system-related information and view system history; through information systems, network administrators can understand network problems or potential problems, which helps improve the network performance and enhance network security.



Current System Time: 2011-1-8 21:41:22

System Up Time: 7d 21h 41m 28s

Resources & Version:

CPU: 0%

Memory: 16%

SN: 15165589

Model: WAP-6112

Hardware: V1.0

Firmware: WAP-6112v2.8.0-151022

Figure 9-1 System information

- Current system time: Displays the current date and time information of the device (Unit: Y-M-D, H:M:S);
- System running time: Displays the time from starting of the device at this time to viewing the time;
- CPU utilization: Shows the percentage of the current CPU utilization.
- Memory usage: Shows the percentage of the current memory usage.

- Serial number: Shows the internal serial number of product (which may be different from the surface serial number);
- Device model: Displays the product model of the device;
- Hardware version: Displays the hardware version number of the device. When the device hardware version is V1.0, it is not described in the software;
- Software version: Displays the software version number of the device.
- Refresh: Click < Refresh >, and you can view the latest system information.

Tip:

Figure 9-1 The usage of CPU, memory is different and the displayed colors are different:

- Green when the usage is [0, 50%);
- Orange when the usage is [50%, 70%);
- Red when the usage is [70%, 100].

Appendix A FAQ

Q1. How to connect a Windows XP PC to the Device wirelessly?

Step 1: Configuring TCP/IP Settings

1. Right-click **Network Neighborhood** and select **Properties**.
2. Right-click **Wireless Network Connection** and select **Properties**.
3. Double-click **Internet Protocol (TCP/IP)** to open the **Internet Protocol (TCP/IP) Properties** window.
4. Do one of the following:

    1) If a DHCP server is available on your network, and you want IP settings to be assigned automatically, select **Obtain an IP address automatically** and **Obtain DNS server address automatically**.

    2) If you want to set the IP address and other settings manually, do the following:

        - Select **Use the following IP address**, enter the static IP address (a free IP address in 192.168.1.0/24) in **IP address** box, 255.255.255.0 in **Subnet mask** box, and enter the IP address of your default gateway in **Default Gateway** box.
        - Select **Use the following DNS server addresses**, and enter the IP addresses of DNS servers in **Preferred DNS Server** and **Alternate DNS Server** (optional) boxes. If the primary DNS server is unreachable, the secondary DNS server is used.

5. Click **OK** to finish the configuration.

Step 2: Connecting the PC to Your Wireless Network

1. Make sure your wireless network adapter is enabled.
2. Right-click the wireless network icon in the lower right corner of your screen, and click **View Available Wireless Networks**.
3. In the list of wireless networks that appears, click the network you want to connect to, and then click **Connect**.
4. If prompted, enter the network security key, and then click Connect.
5. If the connection is successful, the word **Connected** appears to the right of your network name.

Q2. A-2 How to connect a Windows 7 PC to the Device wirelessly?

1. **Step 1: Configuring TCP/IP Settings**
2. **Click Start > Control Panel > Network and Internet > Network and Sharing Center > Change Adapter Settings.**
3. **Right-click Wireless Network Connection and select Properties.**
4. **Double-click Internet Protocol Version 4 (TCP/IPv4) to open the Internet Protocol Version 4(TCP/IPv4) Properties window.**
5. **Do one of the following:**
6. **If a DHCP server is available on your network, and you want IP settings to be assigned automatically, select Obtain an IP address automatically and Obtain DNS server address automatically.**
7. **If you want to set the IP address and other settings manually, do the following:**
8. **Select Use the following IP address, enter the static IP address (a free IP address in 192.168.1.0/24) in IP address box, 255.255.255.0 in Subnet mask box, and enter the IP address of your default gateway in Default Gateway box.**
9. **Select Use the following DNS server addresses, and enter the IP addresses of DNS servers in Preferred DNS Server and Alternate DNS Server (optional) boxes. If the primary DNS server is unreachable, the secondary DNS server is used.**
10. **Click OK to finish the configuration.**
11. **Step 2: Connecting the PC to Your Wireless Network**
12. **Make sure your wireless network adapter is enabled.**
13. **Click the wireless network icon 📶 in the lower right corner of your screen.**
14. **In the list of wireless networks that appears, click the network you want to connect to, and then click Connect.**
15. **If prompted, enter the network security key, and then click OK.**
16. **If the connection is successful, the word Connected appears next to your network name.**

Q3. How to reset the Device to factory default settings?

Note

The reset operation will clear all custom settings on the Device, so do it with caution.

1. Remember the administrator password

Normally, you can reset the Device to factory default settings via the Web UI. The operation is as follows: Go to the **System > Configuration** page, click **Reset**, and restart the Device after the reset operation is complete.

2. Forget the administrator password

If you forget the administrator password, you cannot login to the Device’s Web UI. However, you can use the Reset button to reset the Device to factory default settings. The operation is as follows: With the Device powered on, press and hold the Reset button for more than 5 seconds, and then release the button. The Device will restart with factory default settings.

Appendix B Hex ASCII Codes

Appendix A Table of ASCII Codes in Hexadecimal Form

Character	Enter	ESC	Space	!	"	#	$	%	&	’	(	)	*	+	,
Hex Code	0D	1B	20	21	22	23	24	25	26	27	28	29	2A	2B	2C
Character	-	.	/	0	1	2	3	4	5	6	7	8	9	:	;
Hex Code	2D	2E	2F	30	31	32	33	34	35	36	37	38	39	3A	3B
Character	<	=	>	?	@	A	B	C	D	E	F	G	H	I	J
Hex Code	3C	3D	3E	3F	40	41	42	43	44	45	46	47	48	49	4A
Character	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
Hex Code	4B	4C	4D	4E	4F	50	51	52	53	54	55	56	57	58	59
Character	Z	[	\	]	^	-	a	b	c	d	e	f	g	h	i
Hex Code	5A	5B	5C	5D	5E	5F	61	62	63	64	65	66	67	68	69
Character	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x
Hex Code	6A	6B	6C	6D	6E	6F	70	71	72	73	74	75	76	77	78
Character	y	z	{	|	}	~									
Hex Code	79	7A	7B	7C	7D	7E									

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```
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```

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```
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(which makes passes at compilers) written
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signature of Ty Coon, 1 April 1989
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