# Mesh Network System

# BR-400AN

# Installation Manual

**silex** technology

# INDEX

# 1 INTRODUCTION

This document describes the initial configuration and installation methods for BR-400AN.

BR-400AN can configure the Mesh type wireless network (hereinafter, "Mesh network"). Wired and wireless network devices can join the Mesh network and they can communicate with each other.

In this document, configuration and installation methods are explained in the following order.

Please see each chapter for details.

**Chapter2 Layout**
- Preparing floor plan image
- Determining of unit location
- Necessary items

**Chapter3 Configuration**
- Determination of configuration
- Configuration file
- Configuration write

**Chapter4 Installation**
- Product installation
- Operating check
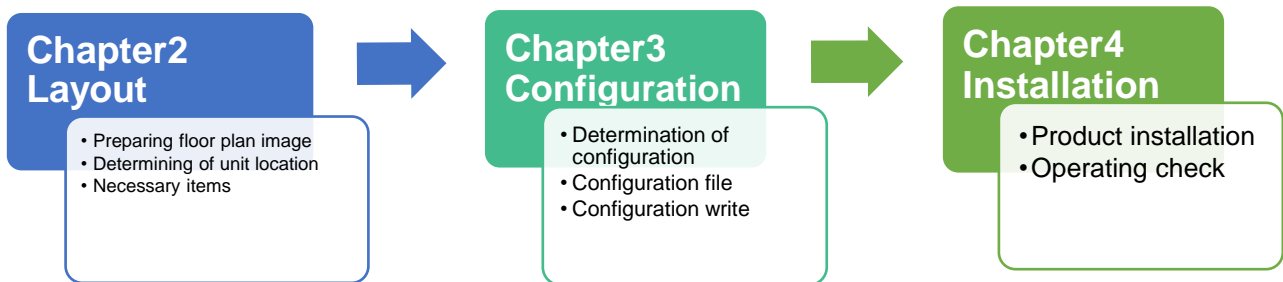
# 2 LAYOUT

## 2.1 Preparing Floor Plan Image

Please prepare the floor plan image of the floor where BR-400AN units are to be installed, which meets the following conditions.

(1) The scale is clearly indicated, or approximate distance / area can be confirmed.

(2) The spot of connection to the backbone network is specifically located.

(3) The location of electrical outlet can be identified.
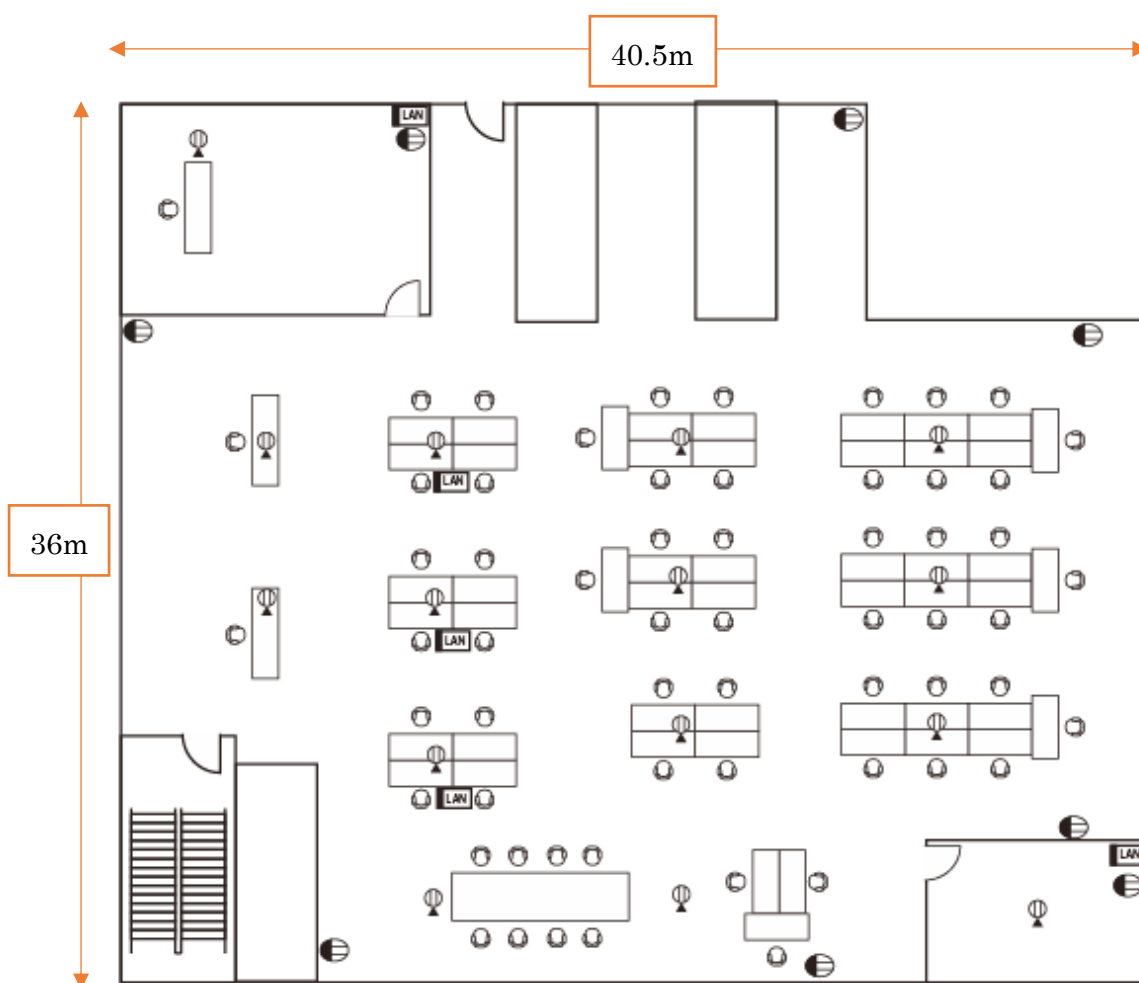


\* If you can create an image file of the floor plan using a scanner or camera, you can open it on Windows and use it as the background image. By using the floor plan image on Mesh Monitor, accurate management of each unit location is possible. For how to use the floor plan image as the background image on Mesh Monitor, refer to ☞**Appendix 5.6**.

## 2.2 Determination of Unit Locations

First of all, allocate the BR-400AN unit that connects to the backbone network, and then allocate other units by keeping 15-20m interval starting from the first unit. Make sure that each unit is allocated within a distance of 15-20m from the other one so that radio signals can reach.
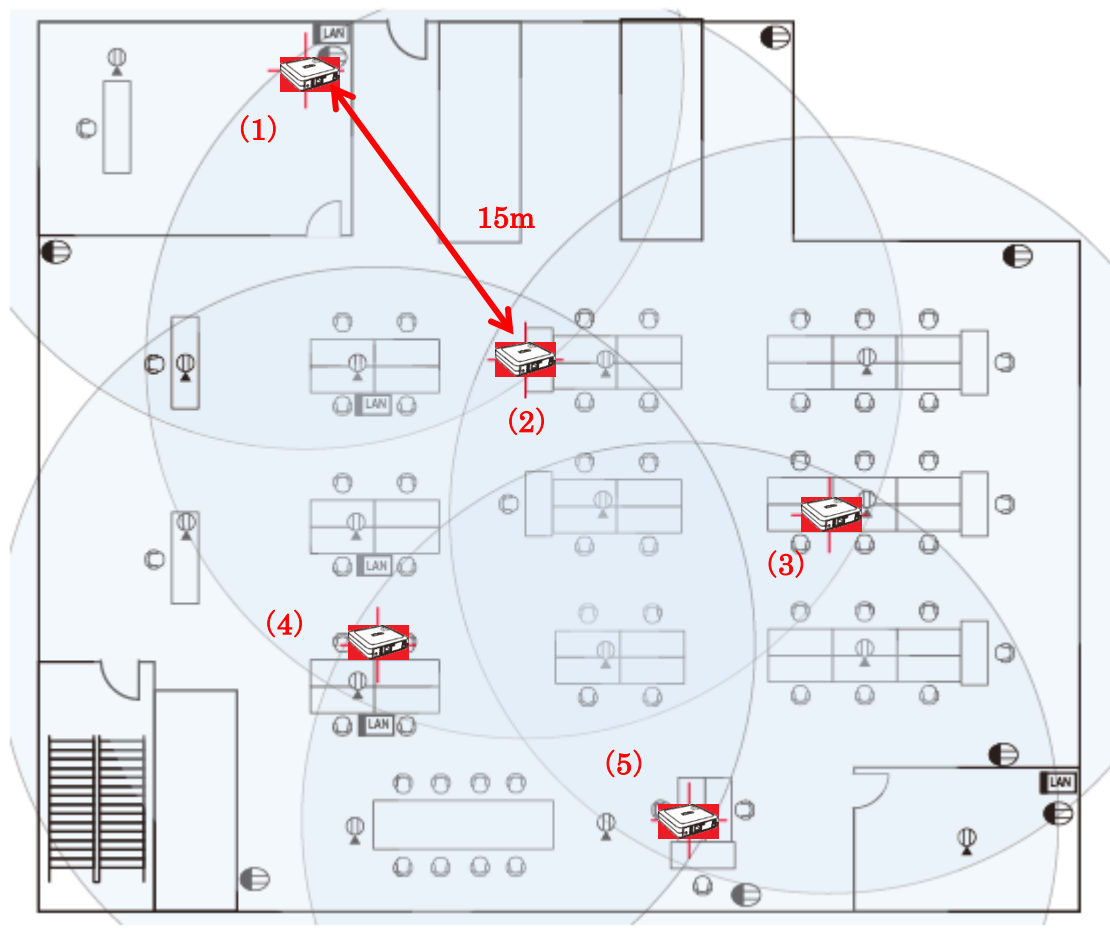


* When multiple BR-400AN units are connected to the backbone network via wired LAN, they have to be connected to the same subnetwork to configure the Mesh network.

* When you connect a part of BR-400AN units to a different subnetwork via wired LAN, please separate them as a different Mesh network group.

* If there is a wall between the BR-400AN units, the radio signals may be blocked. In such a case, install another BR-400AN unit to use as a relay terminal to give an alternative path for the radio signals. Remember that the relay terminal also needs to be located within 15m distance from the units.

☞ For the layout and configuration sample, see **Appendix 5.5** and **Appendix 5.2**.

☞ For the radio characteristics and how to fix BR-400AN unit, refer to **Appendix 5.4**.

## 2.3  Necessary Items

Prepare the necessary quantity of BR-400AN units by reading the instructions on the previous chapter. It is recommended to have some extra units in case of emergency or unexpected trouble.

<Package contents >

・AC adapter (length of DC cable is 1.75m)

・Wall-mounting Bracket (Type VI), Wall-mounting screw (4), Board anchor(4)

・Network cable (1.5m)

For the configuration, a Windows PC is required. The requirement is as follows.

| Notebook PC and LAN Cable | Laptop with a LAN port<br>Windows 8.1 or Windows 10 |
|---|---|
| Necessary Utility | Configuration utility "AMC Manager®" and the plugin utility "Mesh Monitor" |
| Note | To use AMC Manager®, a license key needs to be purchased.<br>For details, please contact out customer support center.<br><br>For details on how to install and use AMC Manager® or Mesh Monitor, please refer to the user's manuals of these utilities. |

* This installation manual is prepared for the users who are in need of efficient installation and configuration to use several BR-400AN units. For this purpose, this document assumes that user have AMC Manager® and Mesh Monitor for unified management of the products. When you do not have these utilities, please refer to the setup guide and user's manual of BR-400AN.

# 3 CONFIGURATION

## 3.1 Determination of Configuration

> **Points:**
> (1) **Network Loop Avoidance** should be set to **ENABLE** on the BR-400AN unit which connects to the backbone network. For other units, set it to **DISABLE**.
> (2) When several Mesh groups are configured, use a different Mesh group and channel for each.
> (3) The wireless setting (SSID, authentication setting) can be the same even for above case.

Determine the product setting according to the installation plans of previous chapter. The below table shows the setting items that the users need to determine.

| Setting | Sample Setting | Description |
|---|---|---|
| Password | root | 1-15 character string |
| Mesh Group Name | SampleMeshID01 | 1-32 character string<br>If the Mesh network is established across the floors, set a different group name for each. |
| Mesh Encryption Key | Eeq27182818 | 1-32 character string |
| Channel | Ch 44 | Determine the channel according to your environment. (☞**Appendix 5.3 Wireless Channel Selection**)<br>When several Mesh networks are established, it is recommended to set a different channel for each. |
| Access Point Function | Enable | When this setting is enabled, BR-400AN can be used as Access Point. |
| SSID | SampleUserWLAN | 1-32 character string |
| Network Authentication | WPA2-PSK, AES | It is recommended to use the default setting. (WPA2-PSK AES) |
| Pre-Shared Key | Pleq3141593 | Set a unique password. |

Hereinafter, this document uses the sample configuration above to explain the configuration method.

## 3.2  Configuration File

Use AMC Manager® to create the configuration file to write.

*When the login password is not set to BR-400AN, please include that setting to the configuration file. If the login password is not set, the bulk configuration does not perform correctly.
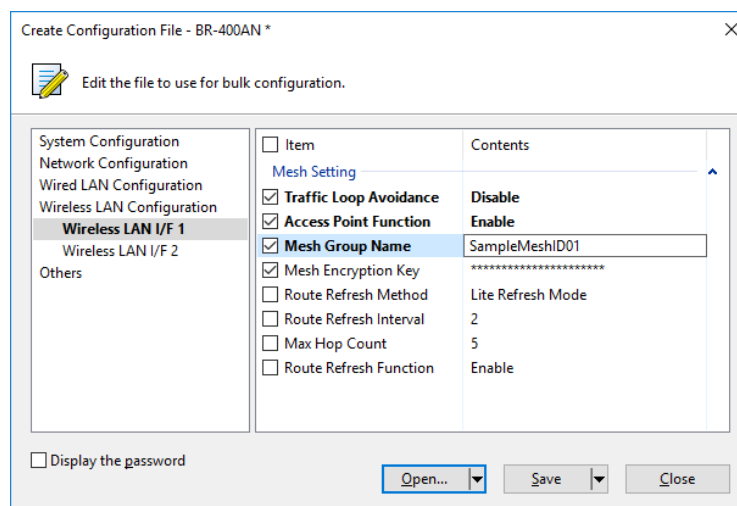
* To configure multiple Mesh groups, repeat 1-5 as many times as the number of groups.

1.  From the menu of AMC Manager®, click **Settings** - **Create Configuration File** - **Create from Template**. Select a template file for BR-400AN and click **OK**.
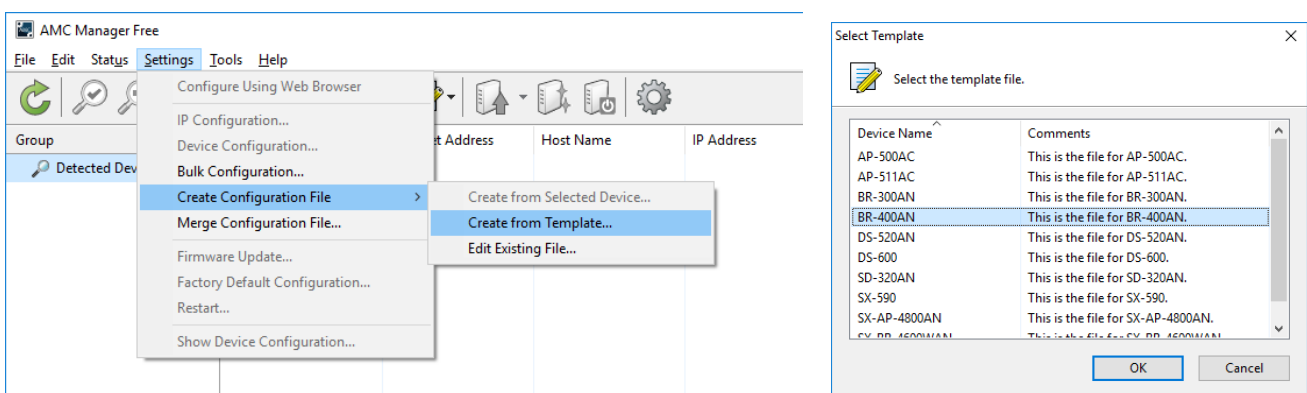
2.  Check the check boxes of the settings to configure and edit the settings. (See the table in the next page for reference.) When the edit is finished, click **Save**.

    * Only the setting whose check box is checked will be saved.

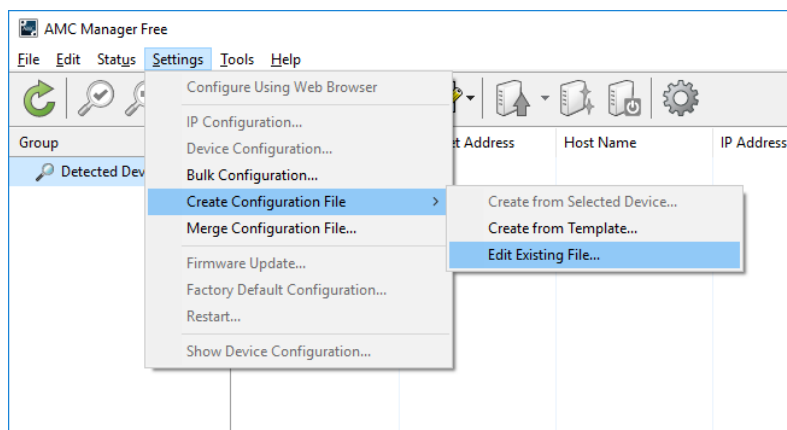| Settings of configuration file | | Sample Setting | Description |
|---|---|---|---|
| Category | Name | | |
| **System Configuration** | Password | root | Password for BR-400AN |
| **Wireless LAN I/F 1** | Mesh Group Name | SampleMeshID01 | Mesh group name |
| | Mesh Encryption Key | Eeq27182818 | Mesh group password |
| | Traffic Loop Avoidance | Disable (when not connected to backbone network) | Enable this when BR-400AN is connected to the backbone network. |
| | Access Point Function | Enable | This is disabled by default. When the AP function is used, enable it in the configuration file. |
| **Wireless LAN I/F 2** | SSID | SampleUserWLAN | SSID for Wi-Fi |
| | Network Authentication | WPA2-PSK | Authentication method for Wi-Fi |
| | Encryption Mode | AES | Encryption mode (WPA,WPA2) |
| | Pre-Shared Key | PIeq3141593 | |

\* For other settings of BR-400AN, refer to **Appendix 5.2**.

3. When the **Save Configuration File** dialog is displayed, specify the file name and click **Save**.

    This time, the file name is set to "SampleMesh01-STD" as example.
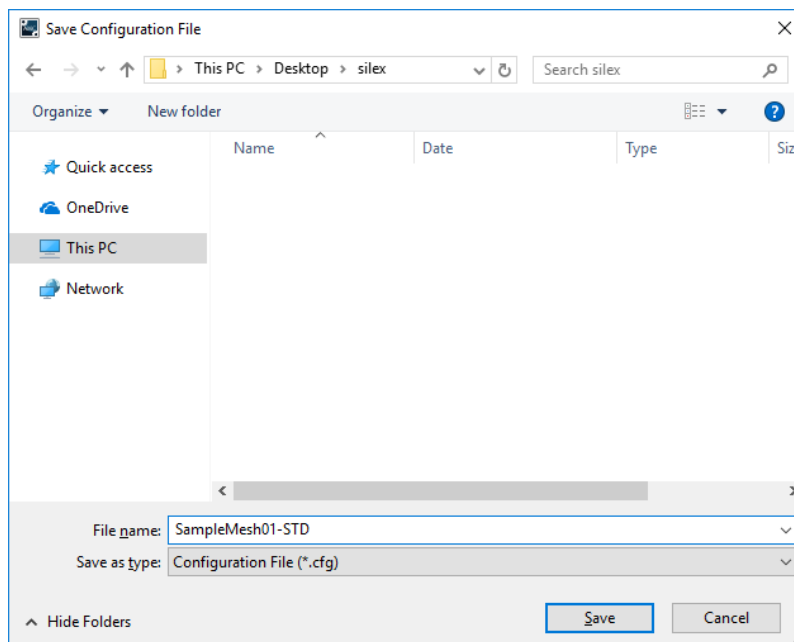
4.  Based on the configuration file saved at **3**, create the configuration file for the BR-400AN unit that connects to the backbone network.

    From the menu, click **Setting** - **Create Configuration File** - **Edit Existing File** and open the configuration file "SampleMesh01-STD.cfg" that you have created.



5.  Enable the traffic loop avoidance setting for the BR-400AN that connects to the backbone network, and click **Save As**. This time, the file name is set to "SampleMesh01-BC" as example. The configuration file has been created.

| Settings of configuration file | | Sample Setting | Description |
|---|---|---|---|
| Category | Name | | |
| **Wireless LAN I/F 1** | Traffic Loop Avoidance | Enable (when connected to the backbone network) | When the BR-400AN unit is connected to the backbone network, enable this setting. |
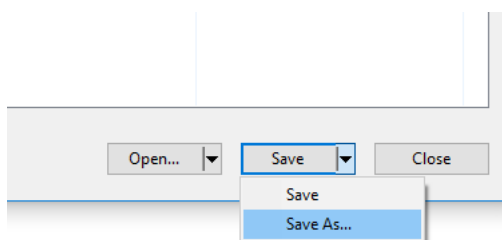


\* Please keep the created configuration file safe. The file is a record of configuration.

## 3.3 Configuration Write

The following explains the method of bulk configuration using the configuration file.

1. Put all BR-400AN units on one place and connect a PC to one of them using a network cable. Turn on all units.

\* When there are many BR-400AN units to configure, prepare the power strip. Or divide them into small groups (8 units or so) and then configure by each group.

2. Check that the BR-400AN units are displayed on the device list of AMC Manager® and select all of them. From the menu, click **Settings** - **Bulk Configuration**.
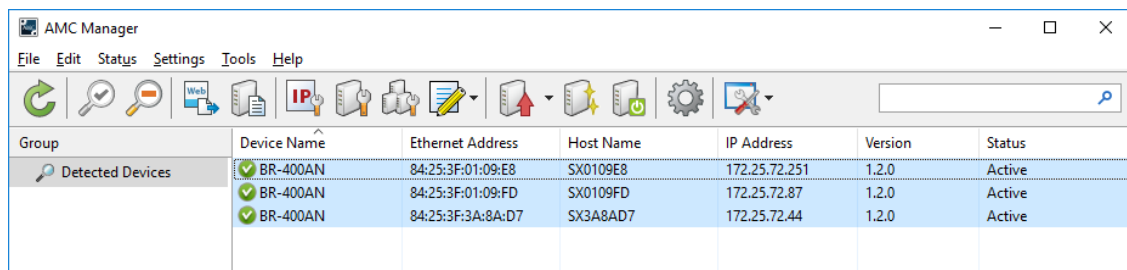


3. Select the units to configure in bulk and click **Select Config. File** to select the configuration file to write.
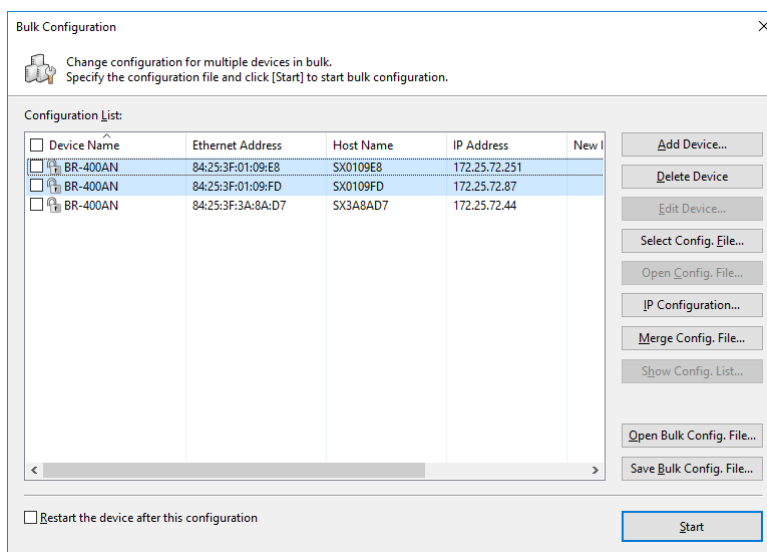
4. Check the check boxes of BR-400AN units to configure in bulk and click **Start**. When the password entry dialog is displayed, enter the default password (**root**).
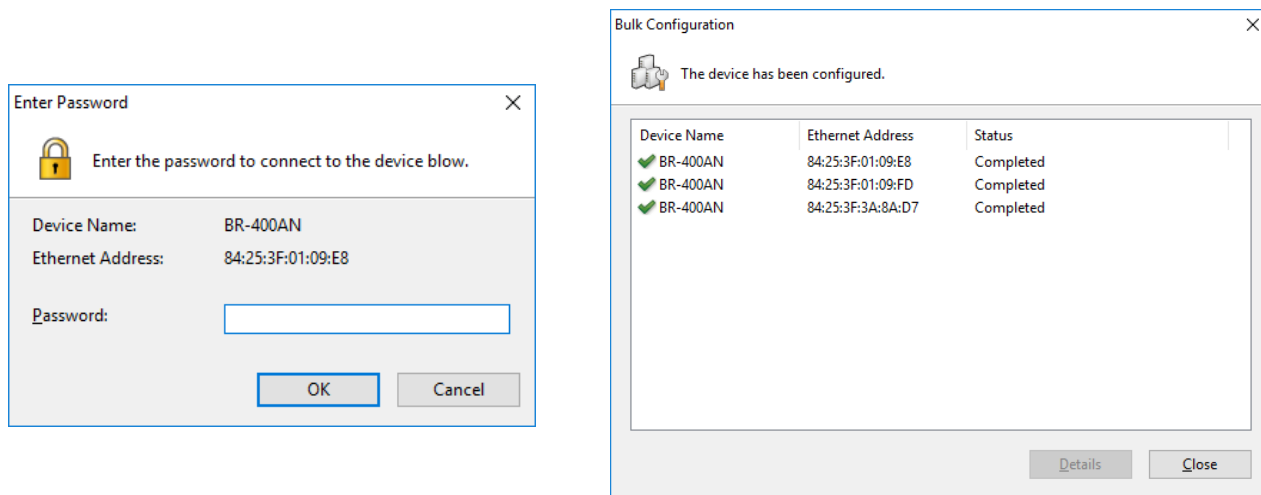


☞ For configuration under the environment where DHCP is not installed, refer to **Appendix 5.1 Bulk IP Address Configuration**.

\* Do not check the check box of **Restart the device after this configuration**.

\* Make sure to keep the record of which configuration file is used for each unit by pasting the post-it, etc. to each unit.
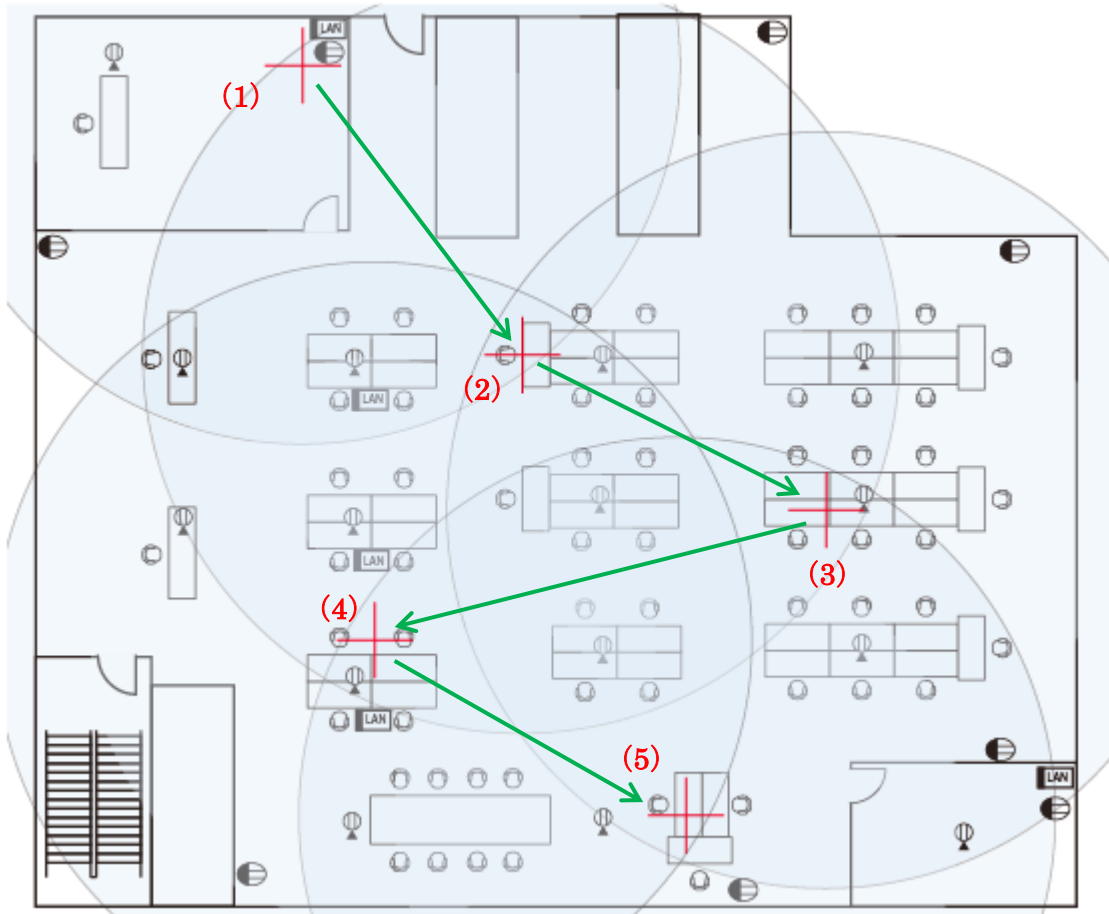
# 4 INSTALLATION

## 4.1 Product Installation

Allocate the BR-400AN units according to the location you have determined. First, allocate the BR-400AN unit which connects to the backbone network (1), and then allocate the other units (2)(3)(4)(5). Each time when you allocate the unit, check the radio signal status (refer to 4.1.2).



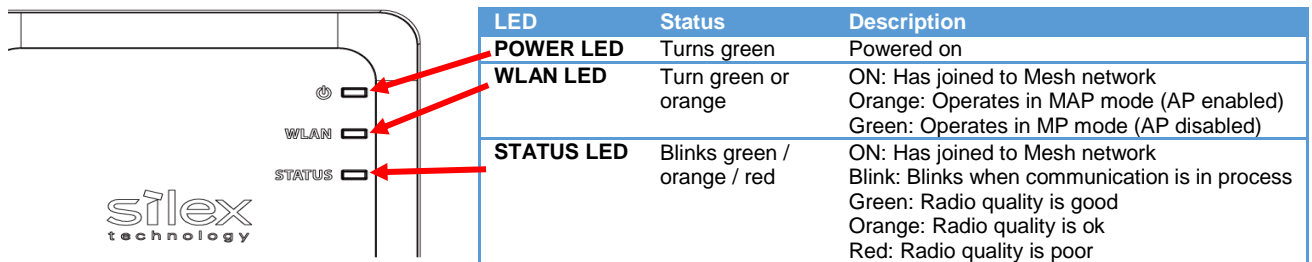### 4.1.1 Installation to Backbone Network

Connect BR-400AN to the backbone network using a network cable and turn on it. If the sample configuration of previous chapter is used, install the unit of "SampleMesh01-BC".

* When two or more BR-400AN units are connected to the backbone network, install one of them first to use it as the start point.

### 4.1.2 Installation of Others

Install the BR-400AN units starting from the one closer to the unit that connects to the backbone network. If the sample configuration of previous chapter is used, install the unit of "SampleMesh01-STD". Before you drill the wall to mount the unit, check the radio signal status by looking at the LED on top of the unit. Repeat (1)-(3) below as many times as the number of units.

Check 1      Allocate BR-400AN to the determined position and turn on it.

Check 2      Check the LED status on top of the unit in 1-2 mins. Check that WLAN LED turns on and STATUS LED blinks green.

Check 3      Turn off the unit, fix it to the location and then turn on it again.



| LED | Status | Description |
|-----|--------|-------------|
| **POWER LED** | Turns green | Powered on |
| **WLAN LED** | Turn green or orange | ON: Has joined to Mesh network<br>Orange: Operates in MAP mode (AP enabled)<br>Green: Operates in MP mode (AP disabled) |
| **STATUS LED** | Blinks green / orange / red | ON: Has joined to Mesh network<br>Blink: Blinks when communication is in process<br>Green: Radio quality is good<br>Orange: Radio quality is ok<br>Red: Radio quality is poor |

\* When BR-400AN configures the multiple routes, the LED light pattern will differ depending on the average quality of radio signal status on each route.

\* If the WLAN LED blinks, it means that the BR-400AN unit has failed to join the existing Mesh network. Adjust the location or direction of installation or otherwise install another unit to use it as a relay device to expand the wireless distance.

\* For notes on installation location, refer to ☞**Appendix 5.4**.

\* To check the radio signal status using the LED, the firmware must be version 1.1.0 or later.

If the firmware version is older than it, the LED blinks green regardless of the radio signal quality.
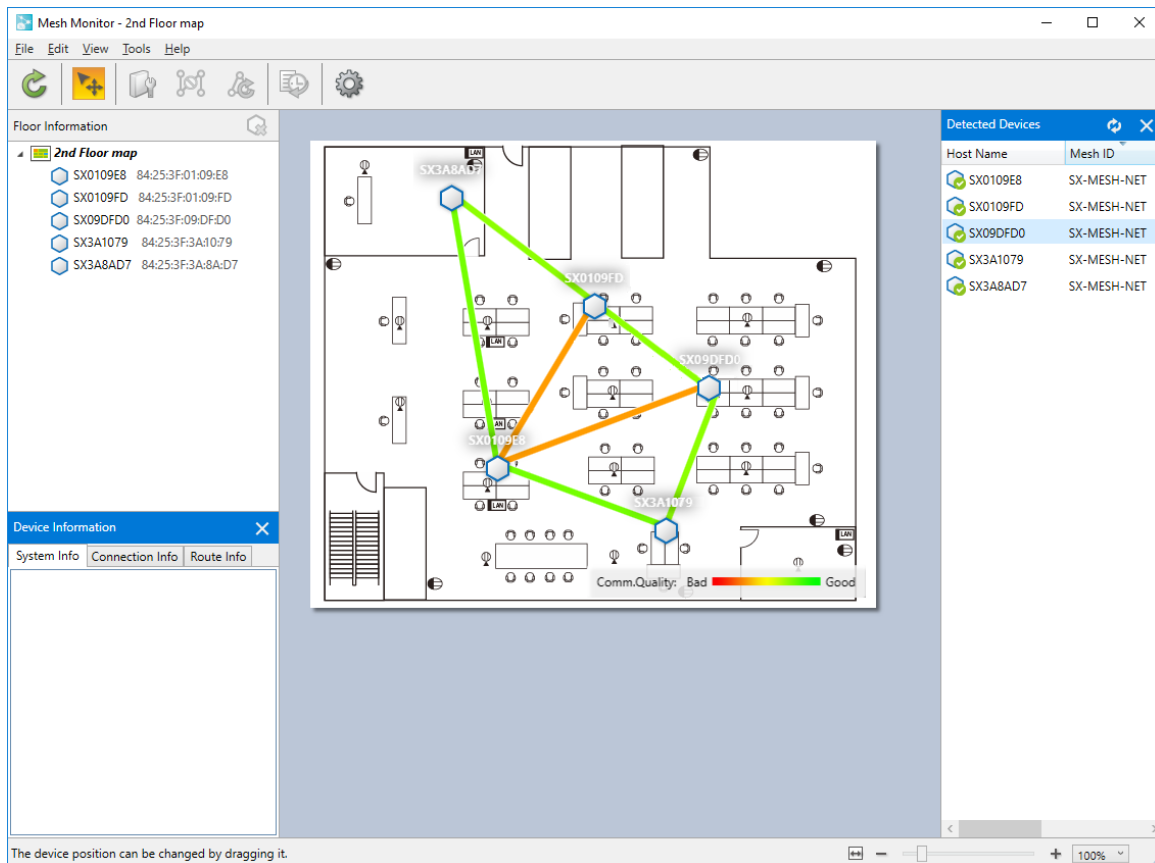
## 4.2 Operation Check

Use Mesh Monitor to see if the information can be retrieved from the installed BR-400AN units.

**Route status check using Mesh Monitor**

The Mesh route of the installed units can be checked using Mesh Monitor.

Check that the installed units are turned on and the Mesh route is established for each unit.



* For how to use Mesh Monitor, refer to **Appendix 5.6 Basic Use of Mesh Monitor**.

# 5 APPENDIX

## 5.1 Bulk IP Address Configuration (When DHCP is Not Installed)

When BR-400AN does not have a fixed IP address and is turned on in the environment where DHCP is not installed, BR-400AN starts with a LinkLocal Address. It is possible to use BR-400AN with the LinkLocal Address, but usually, the fixed IP address is used in many cases.

The following explains the bulk configuration of IP address using the below setting.

| Name | Sample Setting | |
|---|---|---|
| IP Address | 192.168.1.101- 192.168.1.124 | Prepare the valid IP address. Assign the sequential addresses as many as the number of BR-400AN units. |
| Netmask | 255.255.255.0 | Contact your network administrator. |
| Default Gateway | 192.168.1.254 | Contact your network administrator. |

(1) Connection

The bulk configuration of IP address is used for initial configuration. Connect a laptop to one of the BR-400AN units to configure.

*For bulk configuration of IP address, a password needs to be registered to BR-400AN in advance.

* IP address of the laptop needs to be changed beforehand. Change the IP address of the laptop to the one that can be communicated with BR-400AN units after the bulk configuration.

| Sample IP address setting for bulk configuration | Sample IP address setting for PC |
|---|---|
| 192.168.0.10 - 192.168.0.30 | 192.168.0.100 |
| 172.25.10.10 - 172.25.10.25 | 172.25.10.100 |

* LinkLocal Address is the address that is defined as "169.254.x.x". The IP address of the PC can easily be identified by executing the IPCONFIG command at the command prompt.

(2) Search

Start AMC Manager® and search for the BR-400AN units.

When the BR-400AN units are displayed in the list, select the units to change the IP address and click
**Settings** - **Bulk Configuration**.

(3) Bulk Configuration

In the **Bulk Configuration** window, click **IP Configuration**. When the IP address configuration dialog is
displayed, enter the setting. For details on each setting, refer to the list of configuration items in the
appendix.
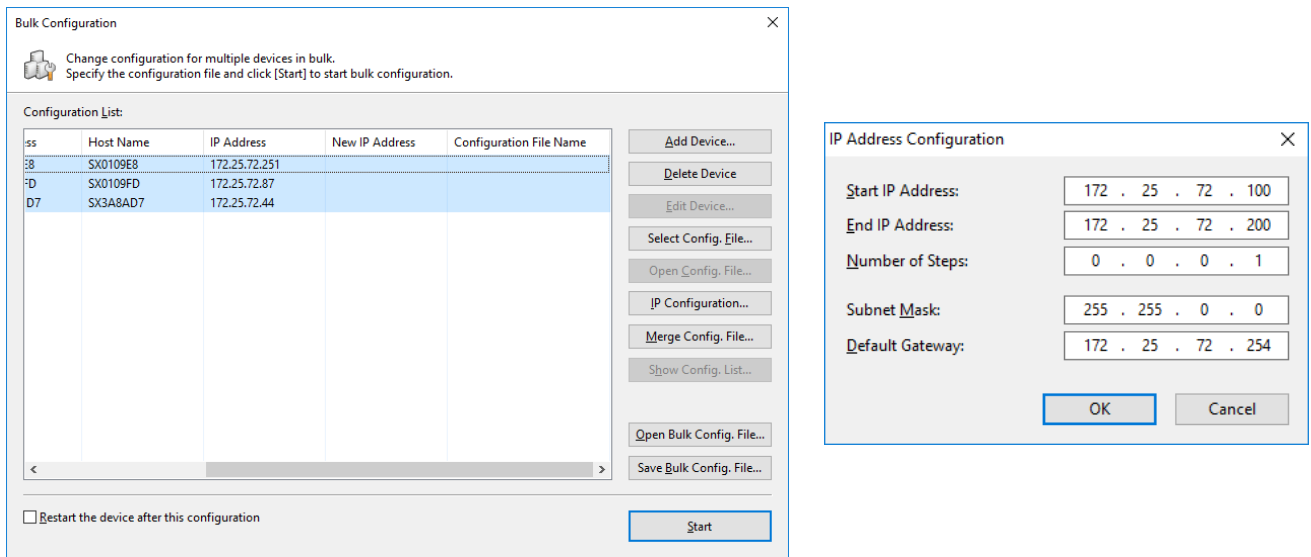


After **OK** is clicked in the IP address configuration window, IP address is pre-assigned and displayed
under **New IP Address** in the list. Click **Start** when they are correct. The progress bar is displayed when
the IP address configuration is in progress and the result of configuration is displayed when it is
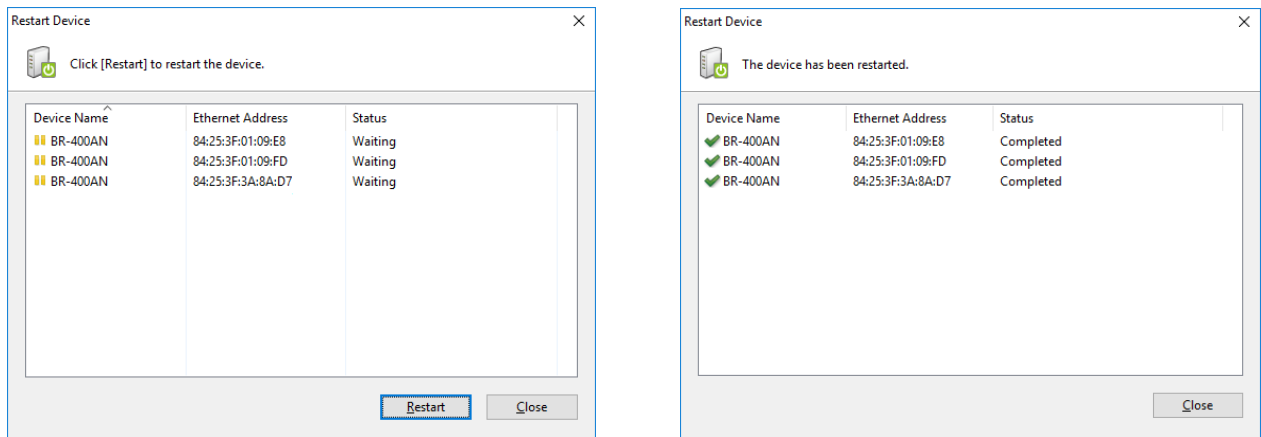completed. Click **Close** then.
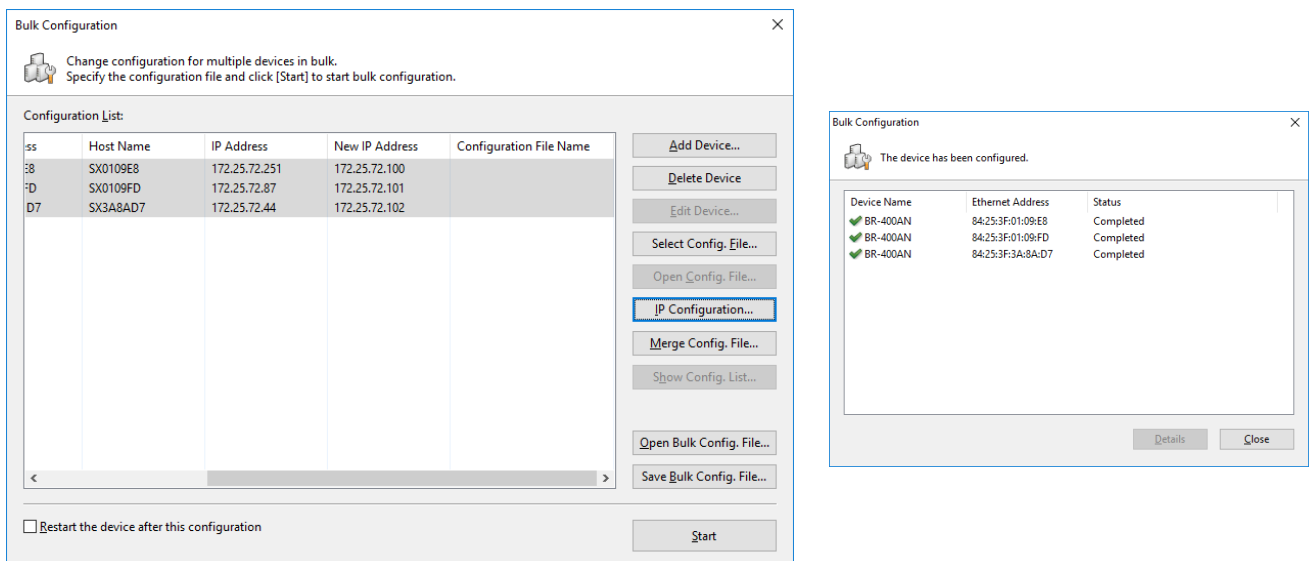
(4) Restart

To take effect of the new IP address, restart BR-400AN using AMC Manager®.

Select the BR-400AN units from the list and click **Settings** - **Restart** from the menu. The device restart window is displayed.

Check that the device status is 'Waiting' and click **Restart**. When the result of restart is displayed, click **Close**.



   * When the password entry screen is displayed, enter the password (the default password: **root**).

The bulk IP address configuration is completed.

Check that the BR-400AN units can be discovered from AMC Manager®. Change the IP address of the PC if necessary, when the PC does not have the IP address communicable to the BR-400AN units.

## 5.2  List of Configuration Items

**AMC Manager® can configure the following settings.**

| Contents of configuration file | | Sample Setting | Note |
|---|---|---|---|
| Category | Name | | |
| System Configuration | Password | root | Set the password for BR-400AN. This is used when BR-400AN is configured via Web browser or by using AMC Manager®. |
| | Host Name | SX-MESH-001 | This host name is displayed on AMC Manager® and Mesh Monitor. |
| Network Configuration | IP Address | 192.168.1.101 | |
| | Subnet Mask | 255.255.255.0 | |
| | Default Gateway | 192.168.1.254 | |
| | DHCP Client | Disable | Enable this setting to automatically configure the IP address using DHCP server. |
| | DNS Server (Primary) | 192.168.33.44 | Set the DNS primary server address. |
| | DNS Server (Secondary) | 192.168.55.66 | Set the DNS secondary server address. |
| | Local Time Zone | +9:00 | Set the local time zone. |
| | NTP Client | Disable | Set whether to enable the NTP protocol. |
| | NTP Server Address | 0.0.0.0 | Set the domain name or IP address of the NTP server to retrieve the time information from. |
| Wired LAN Configuration | Link Mode | AUTO | Set the physical network type. |
| Wireless LAN Configuration | Channel Bandwidth | 20Mhz | Set the frequency bandwidth. When the wireless mode is 802.11n/b/g or 802.11n/a, this setting needs to be configured. |
| | Extended Channel | Lower | Set the selection method for the extended channel. |
| | DFS Primary Channel (W53) | 52 | Set the destination channel to switch into when radar signals are detected at W53. |
| | DFS Primary Channel (W56) | 100 | Set the destination channel to switch into when radar signals are detected at W56. |
| | Use DFS Band | Disable | When this setting is enabled, DFS band channels can be used. |
| | Wireless Mode | 802.11n/a | Set the type of IEEE 802.11 wireless standard. |
| | Channel(2.4GHz) | 11 | |
| | Channel(5GHz) | 40 | |
| | TX Power | 100% | Set the transmission power of wireless LAN. If a larger value is set, the transmission power becomes |

| | | | stronger. |
|---|---|---|---|
| Wireless LAN I/F 1 | Traffic Loop Avoidance | Disable | Enable this setting when BR-400AN is connected to the backbone network. Disable this for others. |
| Wireless LAN I/F 1 | Access Point Function | Enable | Enable/Disable the Access Point function. |
| Wireless LAN I/F 1 | Mesh Group Name | SampleMeshID01 | Mesh group name |
| Wireless LAN I/F 1 | Mesh Encryption Key | Eeq27182818 | Mesh group password |
| Wireless LAN I/F 1 | Route Refresh Mode | Lite Refresh Mode | Refresh method for the Mesh route |
| Wireless LAN I/F 1 | Route Refresh Interval | 5 | Refresh interval for the Mesh route |
| Wireless LAN I/F 1 | Max Hop Count | 5 | Set the number of the BR-400AN units to create the Mesh route for. |
| Wireless LAN I/F 1 | Route Refresh Function | Enable | Enable/Disable the regular optimization of the Mesh route. |
| Wireless LAN I/F 2 | SSID | SampleUserWLAN | SSID for Wi-Fi |
| Wireless LAN I/F 2 | Network Authentication | WPA2-PSK | Authentication method for Wi-Fi |
| Wireless LAN I/F 2 | WEP | Disable | Enable/Disable the encryption mode (WEP) |
| Wireless LAN I/F 2 | WEP Key Index | 1 | Set the WEP key number (1-4) to use. |
| Wireless LAN I/F 2 | WEP Key(1)-WEP Key (4) | Kysyt | |
| Wireless LAN I/F 2 | Encryption Mode | AES | Encryption mode (WPA,WPA2) |
| Wireless LAN I/F 2 | Pre-Shared Key | PIeq3141593 | Set the pre-shared key to use for WPA,WPA2-PSK. |
| Wireless LAN I/F 2 | Group Key Renew Interval | 60 | Set the refresh interval for the encryption key (min). |
| Wireless LAN I/F 2 | Stealth Mode | Disable | Enable/Disable the stealth mode. |
| Wireless LAN I/F 2 | Filter Type | Allow | Set the security type of the MAC address filter. Allow: Allows communication only from the registered MAC address. Deny: Allows any communications except for communication from the registered MAC address. |
| Wireless LAN I/F 2 | Ethernet Address(1)-(16) | 00:11:22:33:44:55 | Registers the MAC address to filter. |
| Wireless LAN I/F 2 | Server IP | 172.11.22.33 | Specify the RADIUS server address. |
| Wireless LAN I/F 2 | Authentication Port | 1812 | |
| Wireless LAN I/F 2 | Shard Secret | RADIUSKEY01 | |
| Others | Time before turning into Configuration Mode | 6 | Set the period of time until the configuration mode turns on after the push switch is pressed. |

* For details on each configuration item, refer to "BR-400AN User's Manual".

## 5.3 Wireless Channel Selection
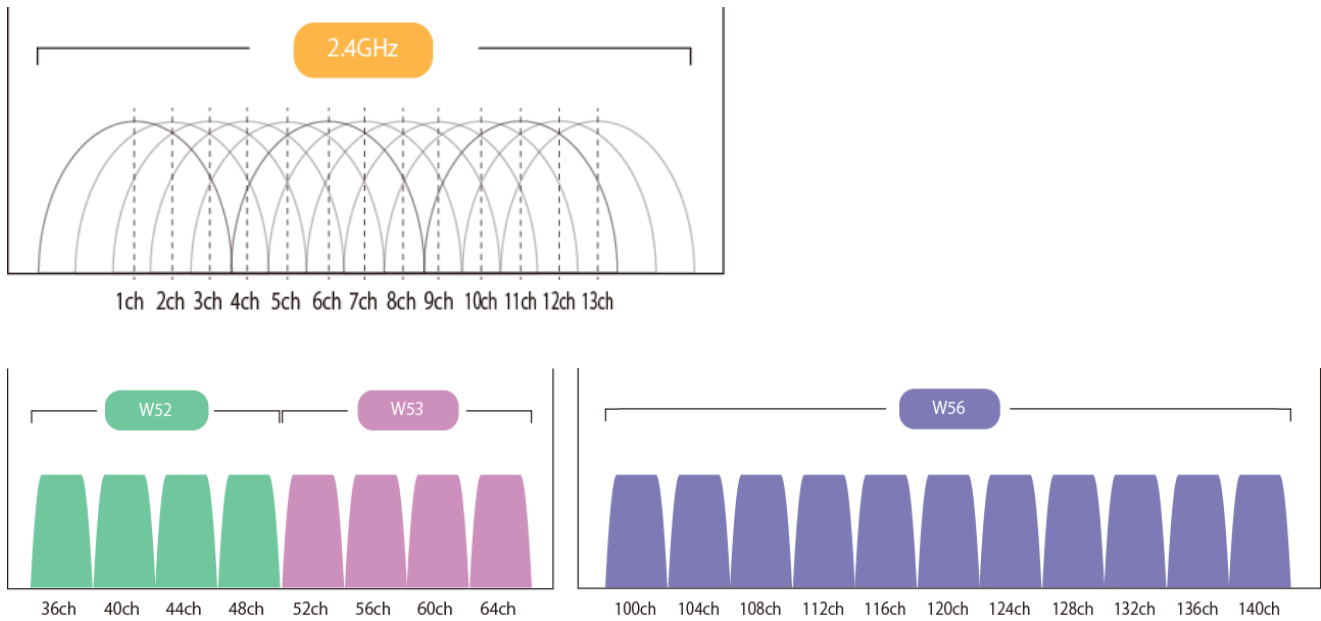


| Channel | Indoor use | Outdoor use | Note |
|---|---|---|---|
| 2.4GHz (all channels) | Supported | Supported | Be careful NOT to interfere with adjacent channels when 2.4GHz is used. See above image for reference. (e.g. 1ch, 6ch, 11ch) |
| 5GHz (W52) | Supported | Not supported | It is recommended to use W52 when BR-400AN is used indoor. |
| 5GHz (W53) | Supported | Not supported | This is DFS band. See the notes on use below (*). |
| 5GHz (W56) | Supported | Supported | This is DFS band. See the notes on use below (*). |

* Keep a distance from microwave ovens, Bluetooth devices, cordless phones, etc., as 2.4GHz radio signals will interfere with them.

* The wireless products that use the DFS band (W53, W56) are required to avoid interference with weather radar, etc.. When radar signals are detected, BR-400AN needs to release its channel and use a different channel. As this process takes about 1 minute, communication is lost then.

* BR-400AN has the following restrictions on use of the DFS band.

   - If radar signals are detected again during the radar monitoring period (1min) that comes after radar signals are detected when BR-400AN is started or operating, BR-400AN may not be able to join the network of adjacent MP/MAP.

   - If BR-400AN is restarted after it has detected radar signals and switched the channel, BR-400AN starts with the pre-configured channel NOT with the channel it switched. If the channel is different from the adjacent MP/MAP, BR-400AN will not be able to join the same network.

## 5.4    How to Fix BR-400AN

### When BR-400AN is mounted on a wall

Use the brackets that come with BR-400AN when
mounting it on the wall. For installation method, refer to the
contained guide "Wall-Mounting Bracket Type VI
Installation". As BR-400AN emits radio signals, BR-400AN
needs to be installed on a higher position, making the top
surface of BR-400AN (the surface with a Silex logo) face
towards the destination device (as shown in the image on
the right). The height should be about 2m from the ground.
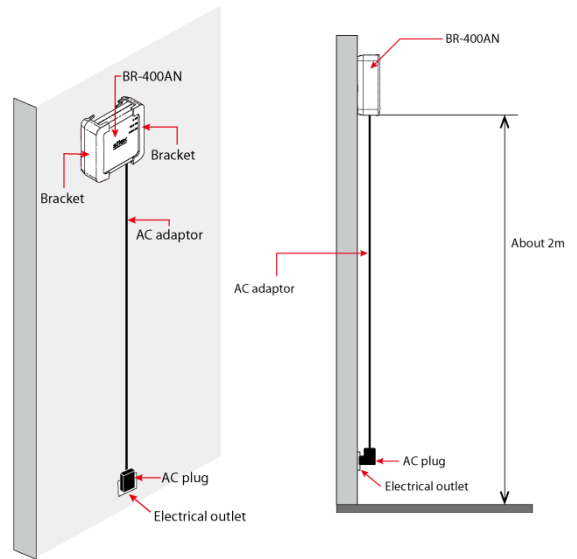
### When BR-400AN is placed on a table

Be careful of the following points when BR-400AN is placed on the table.

① Make sure that top surface of BR-400AN (surface with Silex logo) faces
   upward.

② Prepare a nonmetallic table (wood table is good).

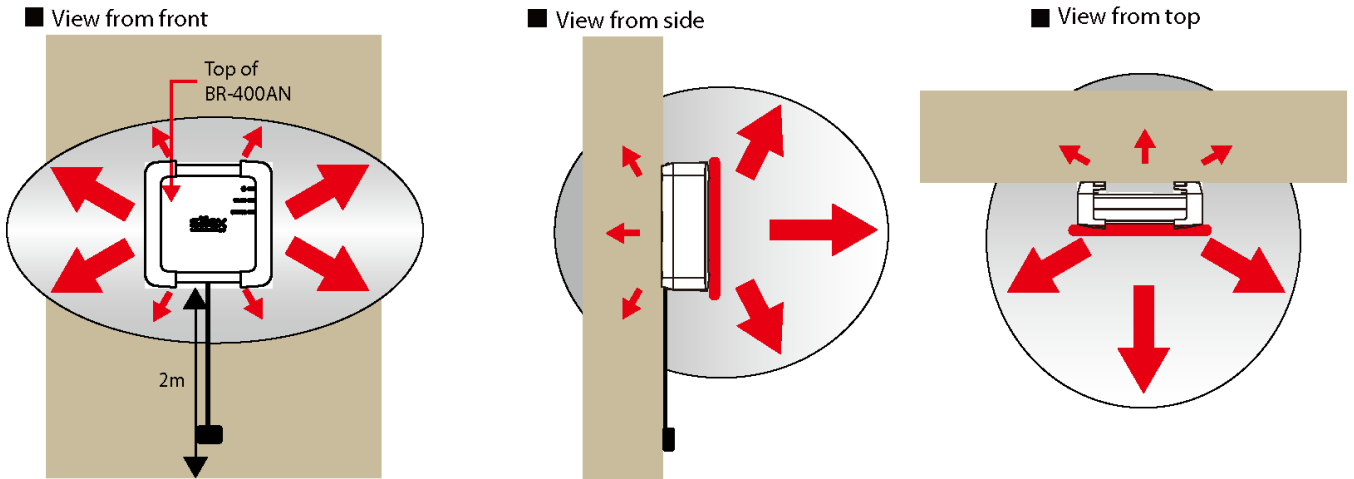③ Set BR-400AN to a higher position as possible. Do not place it on the
   floor.
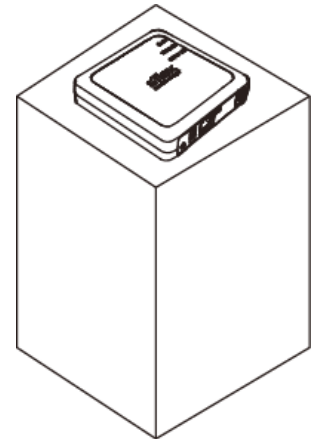
Do not place BR-400AN under the following conditions. It causes malfunction.

 - Locations subject to vibration or shock     - Locations exposed to direct sunlight
 - Wet places (kitchen, bathroom, etc.)        - Shaky, uneven or tilted surfaces
 - Locations subject to vibration or shock     - Humid or dusty places
 - Near heat sources such as heater, stove, etc.
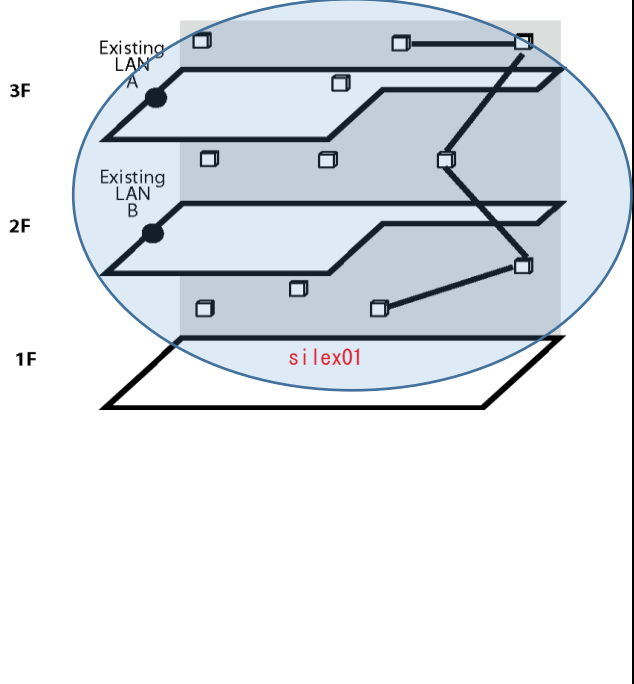 - Objects that interfere or absorb radio signals (cordless phone, vase, aquarium, etc.)

**Radio characteristics**

BR-400AN emits the radio signal as below. Make sure that the top surface of BR-400AN faces the destination device.



■ View from front
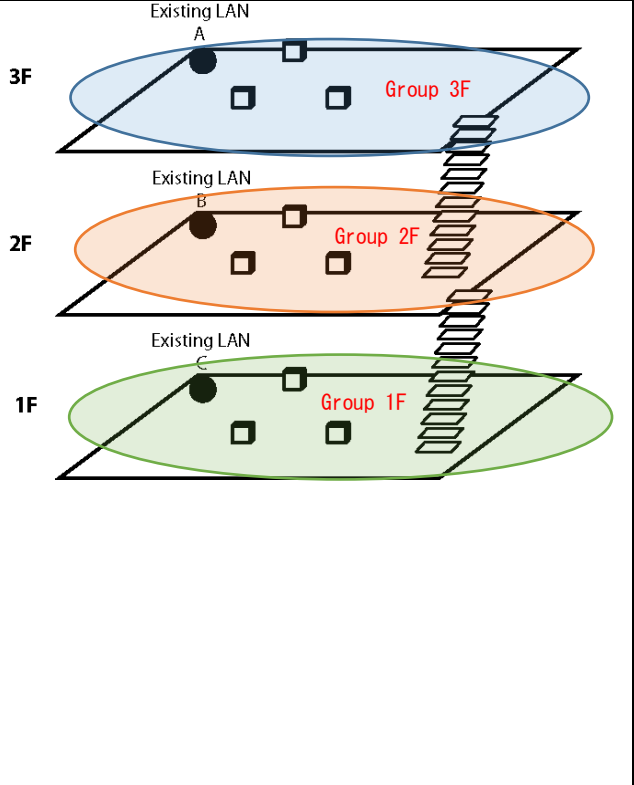
Top of BR-400AN

2m

■ View from side

■ View from top

# 5.5 Layout Sample

## Sample1. SILEX TECHNOLOGY Corporate Headquarters

Mesh Group Name: silex01

Channel: 6ch

Traffic Loop Avoidance: The unit A, B that connect to the

existing LAN…ON

Other than A,B…OFF

Only one Mesh network is established because wireless communication can be reached across the floors through the stairwell.

\* 2 types of configuration files need to be created; the one enables the traffic loop avoidance and the other one disables it.



## Sample 2. ○○ building

Mesh Group Name a:Group3F, Channel a:36ch

Mesh Group Name b:Group2F, Channel b:40ch

Mesh Group Name c:Group1F, Channel c:44ch

Traffic Loop Avoidance: OFF for all

\* To make STA terminals communicate across the floors, set the same SSID, authentication method, encryption mode, encryption key to the units whose Access Point function is enabled.

\* If the Mesh network cannot be established across the floors, a different Mesh group name needs to be configured for each floor. In this case, 3 types of configuration files need to be created using a different Mesh group name on each.

## Sample 3. △△ center

Mesh Group Name A:Room A, Channel a:36ch

Mesh Group Name b:Room B, Channel b:40ch

Traffic Loop Avoidance : OFF for all

* If the radio signals are hard to reach even on the same floor, a different Mesh group name needs to be set for each.

* To make STA terminals communicate across the rooms, set the same SSID, authentication method, encryption mode, encryption key to the units whose Access Point function is enabled.

* In this case, 2 types of configuration files need to be created using a different Mesh group name for each.
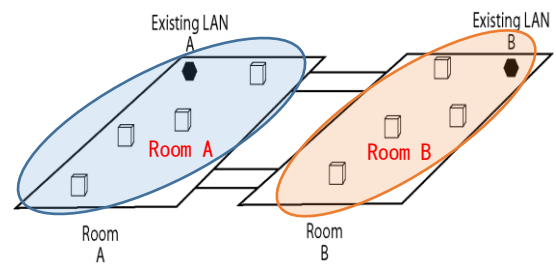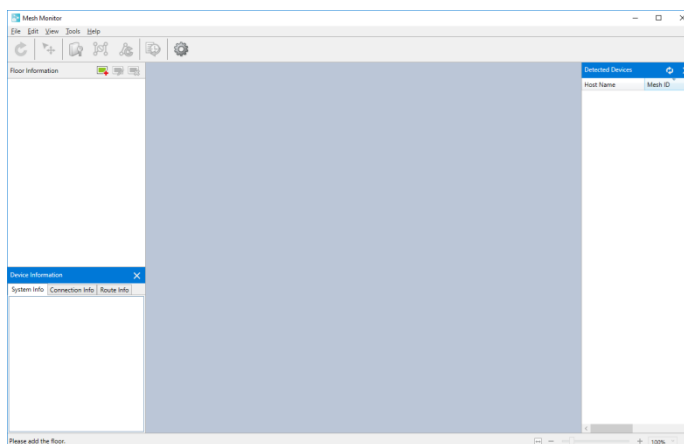
## 5.6 Basic Use of Mesh Monitor

The following explains how to check the Mesh network using Mesh Monitor.

1. Start AMC Manager® and click the icon **Start the plug-in tools** in the tool bar and choose **Start Mesh Monitor**.
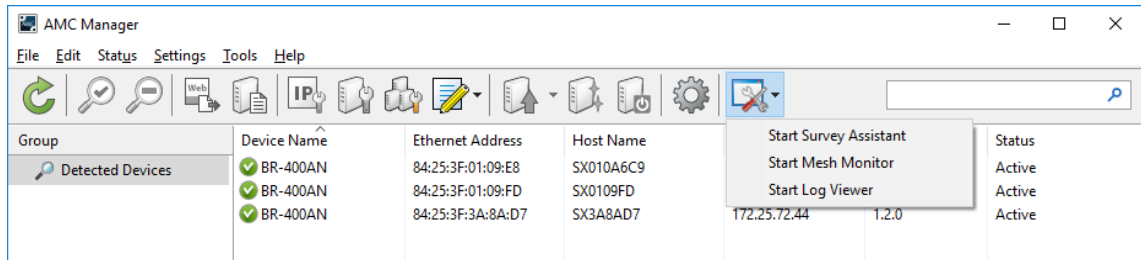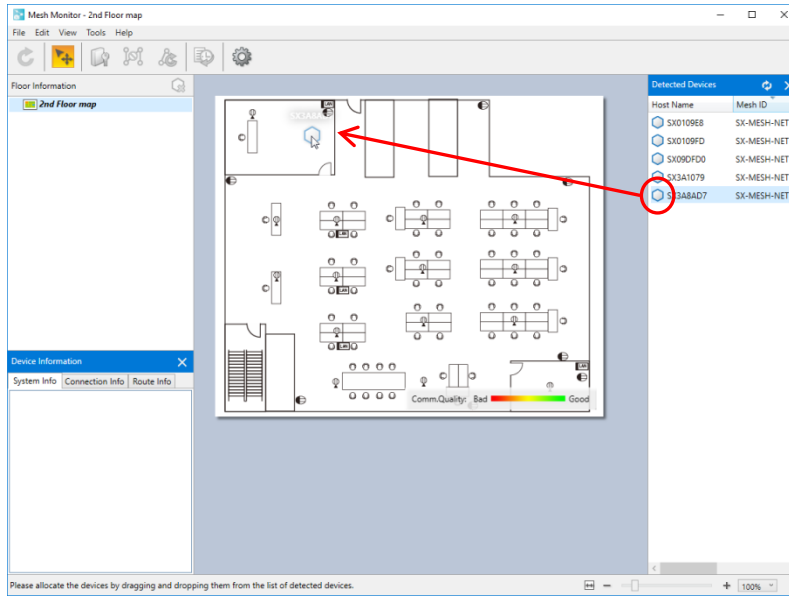


2. Mesh Monitor will start.



3. Click the icon **Add floor** to display the **Add Floor Information** window. Type a name of floor to create, click **Browse** to choose a background image file, and then click **OK**.
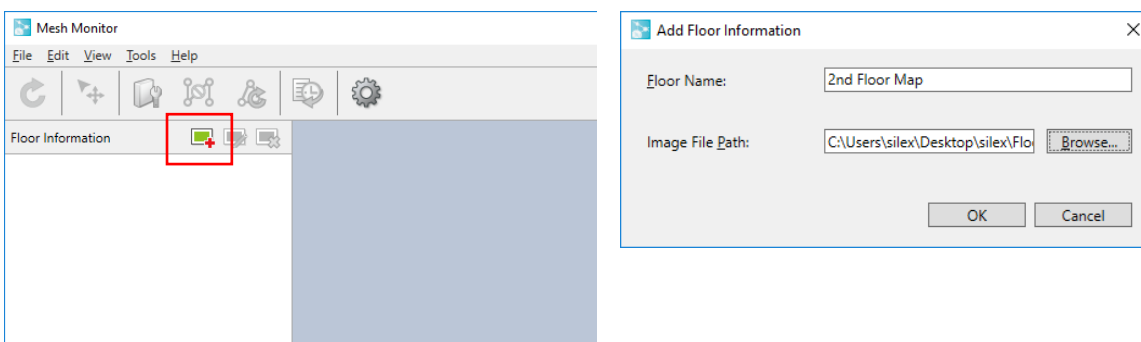
4. Drag and drop a Mesh device on the floor map from the device list.



5. Repeat **4** to allocate Mesh devices on the floor map. Every time when a Mesh device is allocated on the floor map, Mesh Monitor adds Mesh routes based on the information of that device.
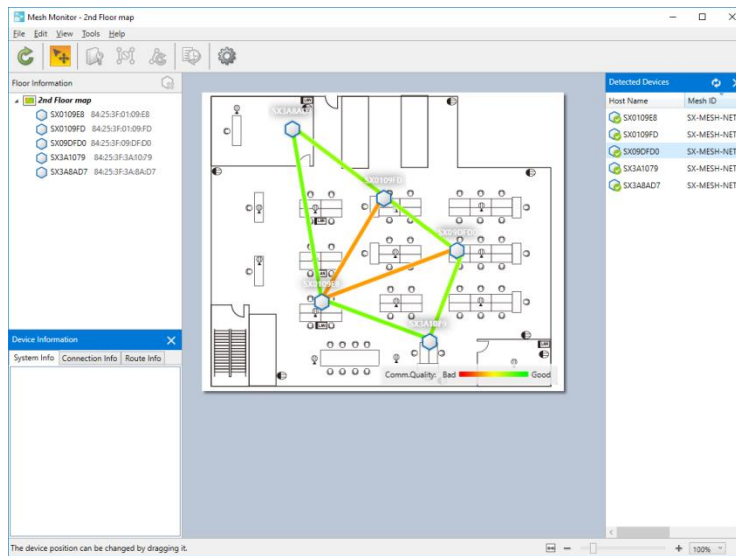


* Up to 32 Mesh devices can be allocated per floor.

* For details on how to use Mesh Monitor, refer to "Mesh Monitor User's Manual".

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