Wi-Fi HaLow™ Compliant Wi-Fi Extender

EX-150AH

User's Manual

silex technology

Index

1. Introduction

Thank you for purchasing the Wi-Fi extender "EX-150AH".

This manual provides information on how to configure and use EX-150AH.

Please read the **1-2. Safety Instructions** carefully before using EX-150AH.

1-1. Introduction

1-1-1. About the Notation

This manual uses the following symbols to indicate specific information for operating EX-150AH.
Be sure to carefully read before using EX-150AH.

TIP : This symbol indicates important information that needs to be observed when operating EX-150AH. Make sure to read this information for safe and proper use.

Note : This symbol indicates information that is useful when using EX-150AH. If you experience difficulties operating EX-150AH, please refer to this information first.

1-1-2. Disclaimers

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- The content of this manual is subject to change without notice.
- This manual was prepared to accurately match the content of each OS, but the actual information shown on the computer monitor may differ from the content of this manual due to future OS version upgrades, modifications, and other changes.
- Although every effort was made to prepare this manual with the utmost accuracy, Silex Technology will not be held liable for any damages as a result of errors, setting examples, or other content.

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- Wi-Fi, Wi-Fi HaLow™, WPA2 and WPA3 are trademarks or registered trademarks of Wi-Fi Alliance.
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1-1-4. Glossary

The following explains the technical terms used in this manual.

Please refer to this as you read this manual.

Terms	Explanation
Web Page	EX-150AH's Web interface to use for configuration.
Host Name	Name of the device that the users can specify. The initial value is set based on the MAC address, but the users can change to make it easier to identify and manage.
IP Address	A value used to identify devices on network such as the Internet. Unlike the MAC address, this value can be changed by users.
MAC Address	This is a unique value assigned to network devices. Also called as 'Ethernet Address' for some devices or software programs. Some devices have multiple MAC addresses. MAC address cannot be changed and thus it can be used for device identification.
DHCP	A communication protocol for allocating and acquiring information which is needed for devices to connect to network. EX-150AH has a DHCP server function that distributes information to communicate, and a DHCP client function that obtains necessary communication information from another DHCP server.
DNS	This is a system that manages association between IP addresses and domain names (domain name is a name to identify a computer). Domain names are converted to corresponding IP addresses, while IP addresses are converted to corresponding domain names.
NAPT	Also known as IP masquerade. This function exchanges the IP address and port number when sending data to an external network such as the Internet.
Wi-Fi	One kind of wireless communication technology. If devices are compatible with this technology, they can communicate wirelessly with each other even if they are made from different manufacturers.
Access Point	A device or function that serves as a host unit when performing wireless communication. By connecting a station, PC, tablet, etc. to the Access Point on wireless LAN, users can communicate with the same network as the Access Point.
Wireless Station Device	In this document, it means all devices that connect to an Access Point via wireless LAN, such as stations, PCs, and tablets.
SSID	A name to use for grouping on wireless LAN. It must be set for both Access Point and wireless station device to perform wireless communication. Devices with a different SSID cannot communicate with each other.
Channel	A divided frequency band that multiple wireless devices can use for simultaneous communication. The channel needs to be set to communicate over wireless LAN. For wireless station devices, the same channel as the destination device will automatically be applied.

Terms	Explanation
Bandwidth	This is the frequency range to use for wireless LAN. Each channel is 20MHz for the 2.4GHz and 5GHz bands, and 1MHz for the 900MHz band. Setting a large value for the bandwidth will increase the amount of data that can be communicated at once, and will enable high-speed communication.
Authentication Method	A general term of authentication method to use for wireless LAN. Together with the encryption method, it ensures security of the wireless LAN. The same authentication method must be set to the Access Point and wireless station device.
Encryption Mode	A general term of communication encryption method. In this document, it refers to the encryption method to use for wireless LAN. The supported encryption methods will differ depending on each product. It ensures wireless LAN security in combination with the authentication method. The same encryption method must be set to the Access Point and wireless station device.
RSSI	Strength of the received wireless signals. When a value is large, it means the reception is stable.
IEEE 802.11ah	Wi-Fi standard that uses frequencies of the 900MHz band. Also known as "Wi-Fi HaLow™" or "S1G (Sub 1GHz)."

1-2. Safety Instructions

This page provides the safety instructions for safe use of EX-150AH.

To ensure safe and proper use, please read the following information carefully before using EX-150AH. The safety instructions include important information on safe handling of EX-150AH and on general safety issues.

< Indication of the warning >

	Warning	"Warning" indicates the existence of a hazard that could result in death or serious injury if the safety instruction is not observed.
	Caution	"Caution" indicates the existence of a hazard that could result in serious injury or material damage if the safety instruction is not observed.

< Indication of the symbol >

	This symbol indicates the warning and caution. (Example: "Danger of the electric shock")
	This symbol indicates the prohibited actions. (Example: "Disassembly is prohibited")
	This symbol indicates the necessary actions. (Example: "Remove the AC plug from an outlet")

Product installation

⚠ Warning
🚫	* Do not place any objects on top of EX-150AH. It may cause fire, electrical shock or malfunction. * Do not cover or wrap EX-150AH with cloth such as blankets or tablecloths. Accumulated heat may cause fire, accident, or malfunction.

⚠ Caution
❗	* When installing EX-150AH on a wall or in a high place, make sure that it is securely fixed so that it will not fall due to the weight of the cables.
🚫	* Do not use or store EX-150AH under the following conditions. It may cause malfunction. - Locations subject to vibration or shock - Shaky, uneven or tilted surfaces - Locations exposed to direct sunlight - Humid or dusty places - Wet places (kitchen, bathroom, etc.) - Near a heater or stove - Locations subject to extreme changes in temperature - Near strong electromagnetic sources (magnet, radio, wireless device, etc.)

Safe handling

⚠ Warning
❗	* When using the device connected to EX-150AH, strictly observe the warnings and cautions indicated by the manufacturer of that device, and use it in the correct procedure. Failure to do so may result in fire, electric shock, accident or malfunction. * If your network device has a ground wire, it must be used to prevent electrocution and power surges. Do not connect it to a gas pipe, water pipe, telephone line ground, lightning rod, etc. Doing so may cause malfunction or accident.
🚫	* Do not use EX-150AH with the equipment that directly affects the human life (medical equipment such as the life support equipment and operating room equipment) and with the system that has a significant impact on the human safety and the maintenance of public functions (nuclear equipment, aerospace equipment, etc.).

⚠ Caution
❗	* Metal parts of EX-150AH may become hot when it is in operation. Be careful not to touch it when moving or disconnecting EX-150AH.

Measures for abnormal operations

> ## ⚠ Warning
>
> | | * In the following cases, turn off the connected device and remove the power supply cable or plug. Failure to follow these instructions may cause fire or an electrical shock.
  - When EX-150AH emits a strange smell, smoke or sound or becomes too hot to touch.
  - When foreign objects (metal, liquid, etc.) gets into EX-150AH.
  - When EX-150AH is dropped or the case is broken or cracked. |

Ventilation

> ## ⚠ Warning
>
> | | * Do not cover up the vents on EX-150AH. The temperature inside may rise and cause fire or malfunction. |

Disassembly and modification are prohibited

> ## ⚠ Warning
>
> | | * Do not disassemble or modify EX-150AH. Failure to do so may cause fire, electric shock, or malfunction.
* Do not disassemble or modify the AC adapter (optionally available). Doing so may cause fire, electric shock, or malfunction. |

Notes on using the power supply, power cord, and AC adapter

⚠ Warning

🛈	* Be sure to use the specified power supply voltage. Using the power supply voltage other than the specified one may cause fire or electric shock. * Keep the cords and cables away from children. It may cause an electrical shock or serious injury.
🚫	* Do not move EX-150AH while the AC adapter or power supply cable is connected. Doing so may damage the cable and which may result in fire or electric shock. * Do not put anything on the AC adapter or power supply cable, and do not cover it. Also, do not use the AC adapter on a heat-retaining or moisture-retaining object (carpet, sponge, cardboard, styrofoam, etc.). There is a risk of overheating, which may cause fire, accident or malfunction. * Do not roll up or wrap the AC cord. It may cause fire or an electrical shock. * Do not plug or unplug the AC adapter, power supply cable or any other cables with wet hands. It may cause an electrical shock or malfunction.

⚠ Caution

🛈	* Verify all cables are connected properly and safely before using EX-150AH.
🔌	* When EX-150AH will not be used for an extended time, remove the power supply cable and power plug from the connected device and EX-150AH. * When removing EX-150AH, be sure to unplug the power supply cable and power plug of both EX-150AH and the connected device beforehand.
🚫	* Be sure to use the AC adapter specified by Silex Technology. Failure to do so may cause malfunction. * Do not place any objects on the cable, and do not bend, twist, or pull it excessively. * Keep cables and power cords away from the place where people walk by. It may cause injury if they trip over it. * When unplugging EX-150AH or the connected device, do not pull on the cord. The cord may break resulting in fire and/or electric shock. Pull only on the plug.

1-3. Notes on Usage

1-3-1. Use of Radio Waves

When using EX-150AH near the medical devices

The radio wave interference may adversely affect the operation of medical devices such as pacemakers. When using EX-150AH near the medical devices that require a high level of safety and reliability, check with the manufacturer or distributor of each medical device about the effects of radio waves.

When using EX-150AH near the following devices

 - Microwave oven, industrial/scientific equipment, etc.

The above devices use the same radio frequency band as the wireless LAN. Using EX-150AH near the above devices may cause radio wave interference. As the result, communication may be lost, the speed may slow down, or the operation of the above devices may be adversely affected.
Before using EX-150AH, make sure that no radio wave interference occurs. For example, if there is a microwave oven near EX-150AH, check the proper communication beforehand while actually using the microwave oven.

Do not use EX-150AH near a cellular phone, TV or Radio

A cellular phone, TV and radio use a different radio band than our products. Generally, if they are used near EX-150AH, it will not cause any problems. However, when they approximate EX-150AH, sound or image noise may occur.

If there is reinforced concrete/metal between wireless devices, they may not connect

EX-150AH can connect through wood or glass, but may have troubles connecting through reinforced concrete/metal.

EX-150AH complies with the certification of conformance to technical standards. Please pay attention to the following points:

- Please do not disassemble or remodel the product. Such action is prohibited by law.
- Please do not remove the certificate label. Using the product without a label is prohibited.

Radio waves of 900MHz band

Confirm that EX-150AH does not cause a radio interference with other wireless devices before using it. If an interference has occurred, stop using EX-150AH or change the wireless band. Or, try to create a barrier between the devices to avoid an interference.

Wireless devices using 2.4GHz band

The same frequency band of EX-150AH is used for a microwave, industry, science, medical equipment and licensed in room or low power (non-licensed) radio stations.

- Before you use EX-150AH, check that it does not interfere with other devices.
- If interference occurs, stop using EX-150AH or change the wireless band. Please consider to create a wall between these devices to avoid interference. Contact us for possible solution.

* The meaning of the symbols in the bottom of the unit:

```
┌─────────────────────────────────────┐
│   2.4      DS/OF        4            │
│  ▭▭▭     ▭▭▭        ▭▭▭           │
└─────────────────────────────────────┘
```
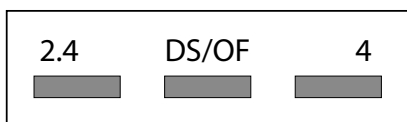
2.4	: Wireless devices using 2.4GHz frequency band
DS/OF	: DS-SS or OFDM is used as modulation.
4	: The range of interference is equal to or lower than 40m.
▭▭▭ ▭▭▭ ▭▭▭	: All bands can be used to avoid interference.

Notes on using 5GHz band

- Use of 5.2GHz band (W52) and 5.3GHz band (W53) outdoors is prohibited by the radio regulations.

1-3-2. Notes on Security

Because a wireless LAN uses electromagnetic signals instead of a LAN cable to establish communication with network devices, it has the advantage of allowing devices to connect to the network easily. However, a disadvantage of this is that within a certain range, the electromagnetic signals can pass through barriers such as walls, and if security countermeasures are not implemented in some way, problems such as the following may occur.

- Communication is intercepted by a third party

- Unauthorized access to the network

- Leakage of personal information (ID and Card information)

- Spoofing and the falsification of intercepted data

- System crashes and data corruption

Nowadays, wireless LAN cards or access points are equipped with security measures that address such security problems, so that you can enable security-related settings for wireless LAN products in order to reduce the likelihood of problems occurring.
We recommend that you make yourself fully acquainted with the possible implications of what might happen if you use a wireless product without enabling security features, and that you configure security-related settings and use wireless products at your own responsibility.

1-3-3. Standards Compliance

Notice to US Customers

Contains FCC ID : N6C-SDMAX
Contains FCC ID : N6C-SDMAH

FCC Rules, Part 15 §15.19(a)(3)
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.

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https://www.silextechnology.com/

FCC Rules Part 15
FCC CAUTION
Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Rules Part 15 Subpart B §15.105(b)
Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
-Reorient or relocate the receiving antenna.
-Increase the separation between the equipment and receiver.
-Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
-Consult the dealer or an experienced radio/TV technician for help.

FCC Rules Part 15 Subpart E §15.407(c)

Data transmission is always initiated by software, which is the passed down through the MAC, through the digital and analog baseband, and finally to the RF chip. Several special packets are initiated by the MAC. These are the only ways the digital baseband portion will turn on the RF transmitter, which it then turns off at the end of the packet.

Therefore, the transmitter will be on only while one of the aforementioned packets is being transmitted. In other words, this device automatically discontinue transmission in case of either absence of information to transmit or operational failure.

FCC Rules Part 15 Subpart E §15.407(g)

Frequency Tolerance: +/-20 ppm

FCC Rules Part 15 Subpart C §15.247(g) / Subpart E

This device and its antenna(s) must not be co-located or operation in conjunction with any other antenna or transmitter.

FCC Rules Part 15 Subpart C §15.247 and Subpart E

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines. This equipment should be installed and operated keeping the radiator at least 20cm or more away from person's body.

Notice to Canadian Customers

Contains IC : 4908A-SDMAX
Contains IC : 4908A-SDMAH
CAN RSS-Gen/CNR-Gen
CAN ICES-3 (B)/NMB-3 (B)

RSS-Gen Issue 5 §8.4

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

1. L'appareil ne doit pas produire de brouillage;
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

RSS-Gen Issue 5 §6.8

This radio transmitter 4908A-SDMAH has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Antenna type	Gain	Impedance
Rod antenna(X9000984-4GDSMB)	900MHz : 3.4dBi	50Ω

Le présent émetteur radio 4908A-SDMAH a été approuvé par Innovation, Sciences et Développement économique Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué pour tout type figurant sur la liste, sont strictement interdits pour l'exploitation de l'émetteur.

Type d'antenne	Gain	l'impédance
Antenne à tige(X9000984-4GDSMB)	900MHz : 3,4dBi	50Ω

RSS-247 Issue 2 §6.2.2.2

For indoor use only(5150-5350 MHz)

Pour usage intérieur seulement(5150-5350 MHz)

RSS-247 Issue 2 §6.4

Data transmission is always initiated by software, which is the passed down through the MAC, through the digital and analog baseband, and finally to the RF chip. Several special packets are initiated by the MAC. These are the only ways the digital baseband portion will turn on the RF transmitter, which it then turns off at the end of the packet. Therefore, the transmitter will be on only while one of the aforementioned packets is being transmitted. In other words, this device automatically discontinue transmission in case of either absence of information to transmit or operational failure.

La transmission des données est toujours initiée par le logiciel, puis les données sont transmises par l'intermédiaire du MAC, par la bande de base numérique et analogique et, enfin, à la puce RF. Plusieurs paquets spéciaux sont initiés par le MAC. Ce sont les seuls moyens pour qu'une partie de la bande de base numérique active l'émetteur RF,
puis désactive celui-ci à la fin du paquet. En conséquence, l'émetteur reste uniquement activé lors de la transmission d'un des paquets susmentionnés. En d'autres termes, ce dispositif interrompt automatiquement toute transmission en cas d'absence d'information à transmettre ou de défaillance.

RSS-102 Issue 5 §2.6

This equipment complies with ISED radiation exposure limits set forth for an uncontrolled environment and meets RSS-102 of the ISED radio frequency (RF) Exposure rules. This equipment should be installed and operated keeping the radiator at least 20cm or more away from person's body.

Cet équipement est conforme aux limites d'exposition aux rayonnements énoncées pour un environnement non contrôlé et respecte les règles d'exposition aux fréquences radioélectriques (RF) CNR-102 de l'ISDE. Cet équipement doit être installé et utilisé en gardant une distance de 20 cm ou plus entre le radiateur et le corps humain.

2. About EX-150AH

2-1. Image of Using EX-150AH

EX-150AH can connect wireless station devices and wired devices, and transfer the data to IEEE 802.11ah compliant Access Points. By using with IEEE 802.11ah compliant Access Points, the data can easily be transferred to remote locations.

The following is the operation image.
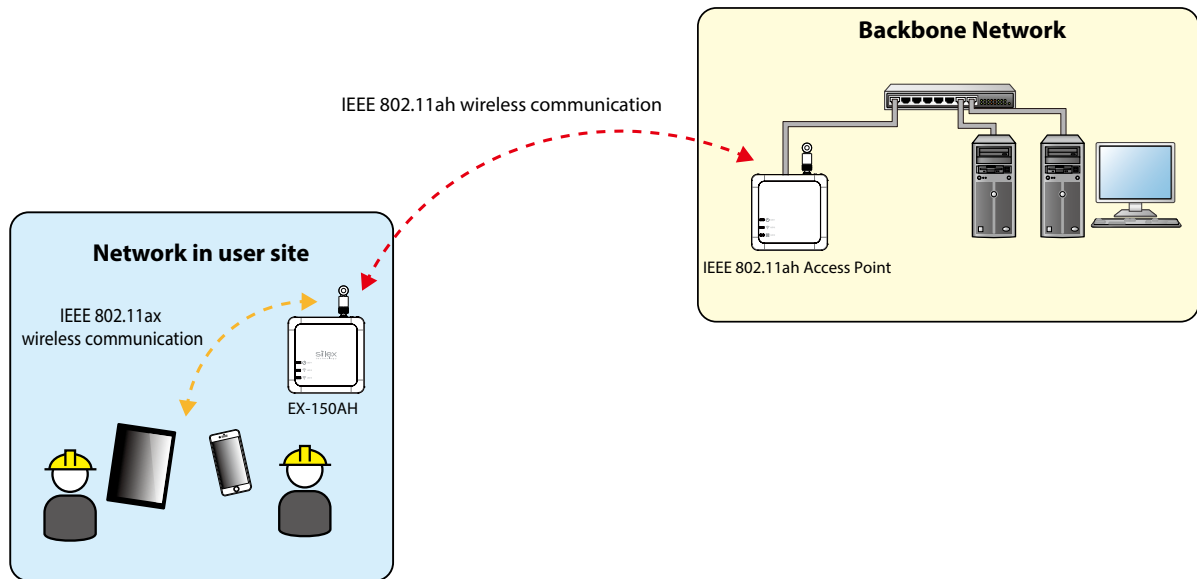
| | - | To use EX-150AH as shown above, the IEEE 802.11ah compliant Access Points need to be installed to locations where 900MHz band radio waves of EX-150AH can reach. |

2-2. Features

EX-150AH has the following features:

Long-distance IoT network with IEEE 802.11ah

EX-150AH establishes a network using 900MHz band wireless.

IEEE 802.11ah can achieve a much longer communication distance than the wireless LAN standard that operates at 2.4GHz/5GHz/6GHz of IEEE 802.11. It can avoid radio wave interference with them, and improve the radio wave coverage through wall transparency and obstacle diffraction.

Access Point function

EX-150AH has an Access Point function compatible with Wi-Fi 6 (IEEE 802.11ax).

Up to 8 wireless station devices can be connected.

Communication range can be extended for wireless stations

By converting 2.4GHz/5GHz band wireless LAN to 900MHz band using EX-150AH, a long distance network can be established with fewer devices compared to conventional Wi-Fi extenders and repeaters. This increases the flexibility of installation locations and greatly expands network coverage in a variety of applications, including medical facilities, offices, factories, schools, and commercial facilities.

Easy access to the EX-150AH's Web page

The Web page of EX-150AH can easily be accessed from a PC.

Security

The following authentication and encryption methods are supported.

Wireless LAN (900MHz)

Authentication Method	Encryption Mode
Open	(None)
Enhanced Open (OWE)	AES
WPA3-Personal (SAE)	AES

Wireless LAN (2.4GHz/5GHz)

Authentication Method	Encryption Mode
Open	(None)
Enhanced Open (OWE)	AES
WPA2-Personal (PSK)	AES
WPA3-Personal (SAE)	AES
WPA2/WPA3-Personal	AES

2 ways of power supply

As EX-150AH supports DC 12V to 24V power input, it can receive a power from the same power supply as the factory machines. If there is not a power supply, a USB Type-C device with VBUS voltage 5V/1.5A can also be used.

Wall-mountable

EX-150AH can be mounted on a wall using Bracket Type VI (optionally available).

Unified device management utility "AMC Manager®"

AMC Manager® provides the following functions.
- Remote control and monitoring
- Bulk configuration and version update

> **Note** - For details on AMC Manager®, please visit the Silex Technology's website.
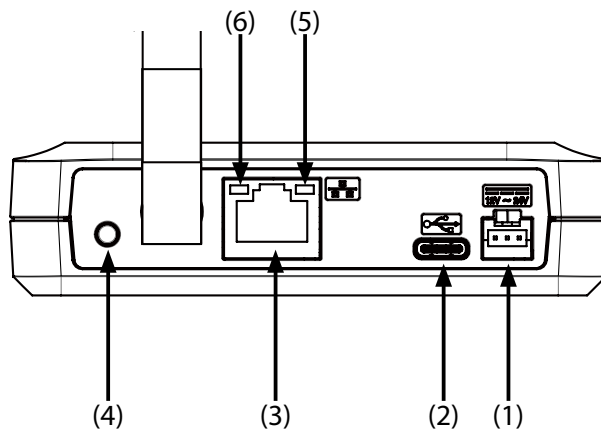
2-3. Parts and Functions

External Dimensions
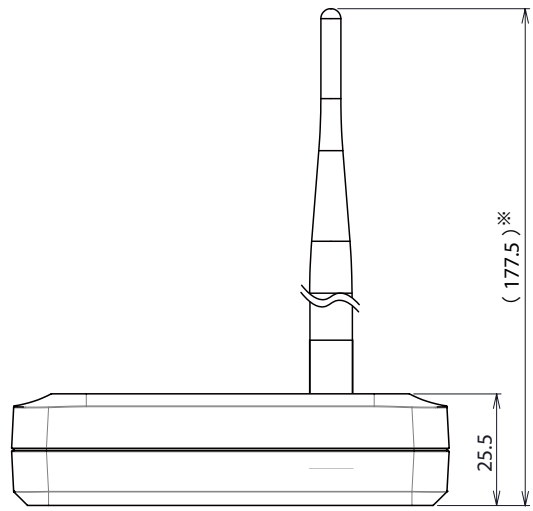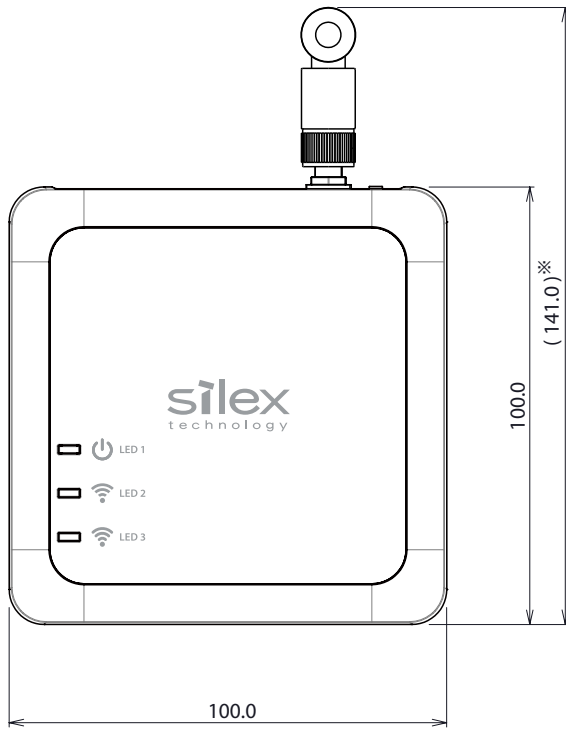
Unit: mm
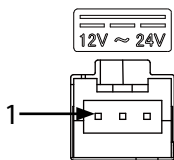∗) Reference dimensions

Parts and Functions

(1) DC connector

Connect the power supply cable.

PIN Number	Signal Name	Description
1	FG	-
2	GND	GND
3	VCC	DC 12V-24V

DC connecter : S03B-PASK-2（JST）

To connect to this connector, please use JST PAP-03V-S.

(2) DC connector (USB Type-C)

This is a USB Type-C power connector.

> TIP
> - Do not connect a power supply that supports DC 12V-24V while receiving a power from the USB Type-C connector. It may cause unintended operation or malfunction.

(3) LAN Port

Connect the PC or Ethernet HUB using a LAN cable.

(4) Push switch

By using the push switch, EX-150AH can be restarted or reset to the factory default setting.

For details, see **7-1-1. Manual Restart at the Unit Side** - **Restart by Using the Push Switch** or **7-3-1. Initialization Using the Push Switch on EX-150AH**.

(5) LED 4 (Orange)

(6) LED 5 (Green)

    Shows the Wired LAN device connection status.

LED 4	LED 5	Explanation
ON	ON	Connected in 100BASE -TX network
OFF	ON	Connected in 10BASE -T network
OFF	OFF	Wired LAN device is not connected.
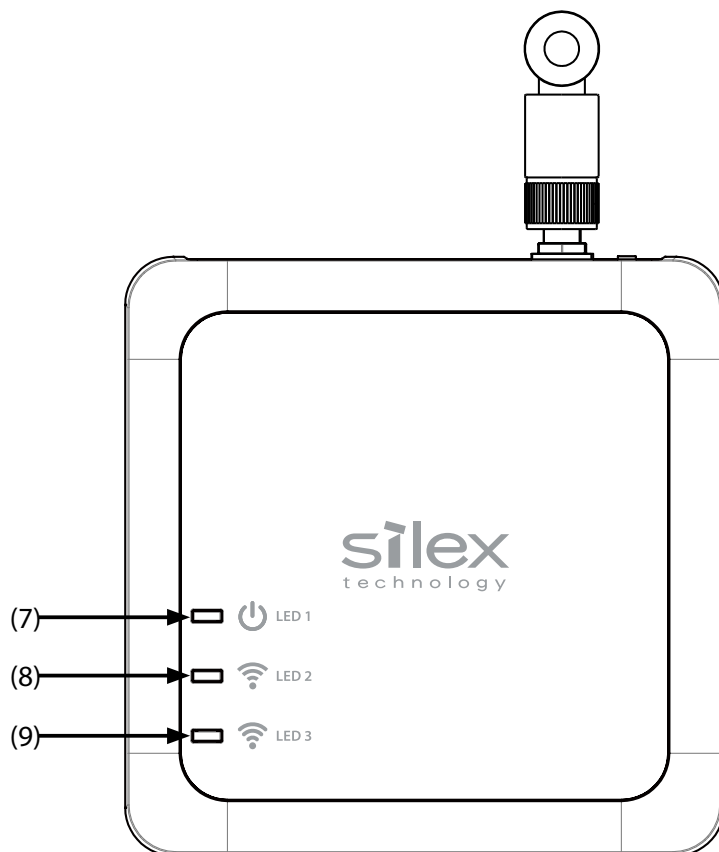
(7) LED 1 (POWER)

The meaning of the LED status is as follows.

Color	Light	Explanation
Green	ON	Powered on
-	OFF	Powered off

(8) LED 2 (IEEE 802.11ah wireless LAN)

The meaning of the LED status is as follows.

Color	Light	Explanation
Green	ON	Has connected to the IEEE 802.11ah Access Point An IP address has been assigned.
	BLINK (500-millisecond cycle)	Has connected to the IEEE 802.11ah Access Point Transferring data
Red	BLINK (500-millisecond cycle)	Has connected to the IEEE 802.11ah Access Point Failed in IP address assignment
Green/ Orange	Alternately ON (500-millisecond cycle)	Has connected to the IEEE 802.11ah Access Point Trying to assign an IP address
-	OFF	IEEE 802.11ah Access Point is not connected

(9) LED 3 (IEEE 802.11ax wireless LAN)

　　The meaning of the LED status is as follows.

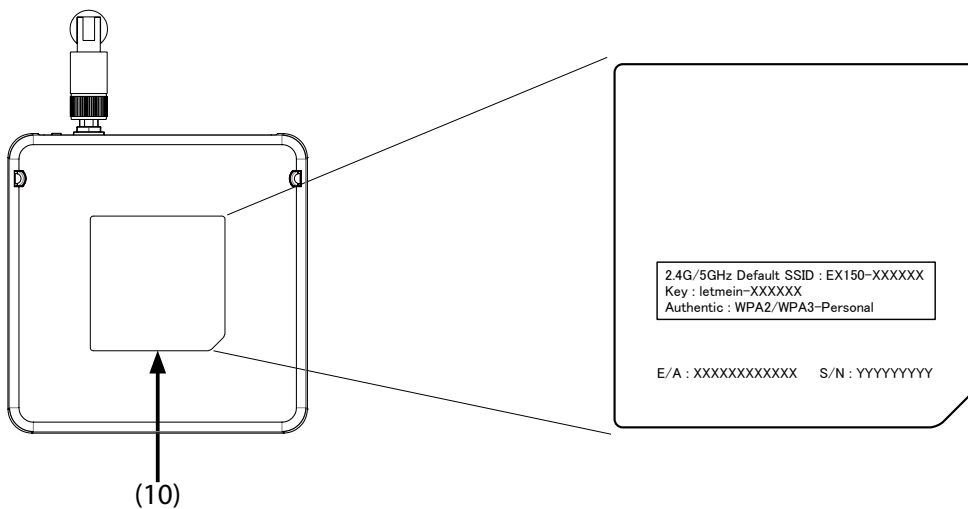| Color	Light	Explanation
Green	ON	Has connected to the IEEE 802.11ax wireless station device (1 to 7 devices) An IP address has been assigned.
	BLINK (500-millisecond cycle)	Has connected to the IEEE 802.11ax wireless station device (1 to 7 devices) Transferring data
Orange	ON	Has connected to the IEEE 802.11ax wireless station device (8 devices) An IP address has been assigned.
	BLINK (500-millisecond cycle)	Has connected to the IEEE 802.11ax wireless station device (8 devices) Transferring data
Red	BLINK (500-millisecond cycle)	Has connected to the IEEE 802.11ax wireless station device Failed in IP address assignment
Green/ Orange	Alternately ON (500-millisecond cycle)	Has connected to the IEEE 802.11ax wireless station device Trying to assign an IP address
-	OFF	IEEE 802.11ax wireless station device is not connected

LED1/LED2/LED3 work together under certain conditions.

The following describes the combined LED operation.

LED 1	LED 2	LED 3	Explanation
Blinks orange (1-second cycle)	OFF	OFF	Updating the firmware
Blinks red (200-millisecond cycle)	OFF	OFF	Internal error
Blinks green (500-millisecond cycle)			Processing initialization using a push switch *Green LEDs are flashing simultaneously
Blinks green (1-second cycle)	Blinks orange (1-second cycle)		RSSI is decreased (IEEE 802.11ah/ax) *Green/Orange LEDs are flashing simultaneously
Blinks green (1-second cycle)	Blinks orange (1-second cycle)	-	RSSI is decreased (IEEE 802.11ah) *Green/Orange LEDs are flashing simultaneously
Blinks green (1-second cycle)	-	Blinks orange (1-second cycle)	RSSI is decreased (IEEE 802.11ax) *Green/Orange LEDs are flashing simultaneously

TIP

- When the condition for combined LED operation is met, the LED display will switch to the corresponding combined operation.
- When multiple conditions are met for the combined LED operation, the latest one will be applied. Please note that the unused LEDs will not change. Also, the LED operation for other than RSSI decrease will remain unchanged.
- When RSSI decreases, the unused LEDs will not change. Also, the LED operation for other than RSSI decrease will remain unchanged.
- If RSSI decreases on both wireless LAN (IEEE 802.11ah) and wireless LAN (IEEE 802.11ax) interfaces, the combined operation of RSSI decrease (IEEE 802.11ah/ax) will perform.

2.4G/5GHz Default SSID : EX150-XXXXXX
Key : letmein-XXXXXX
Authentic : WPA2/WPA3-Personal

E/A : XXXXXXXXXXXX   S/N : YYYYYYYYY

(10)

(10) Product label

The following settings are described.

2.4G/5GHz Default SSID	SSID for 2.4GHz/5GHz band
Key	Pre-Shared Key
Authentic	Authentication mode
E/A	MAC address of EX-150AH The format of MAC address is "E/A: 1CBCECXXXXXX".
S/N	Serial Number

2-4. Specifications

2-4-1. Hardware Specifications

Push Switch	1	
LED	TOP	LED 1 (Green/Orange/Red)
		LED 2 (Green/Orange/Red)
		LED 3 (Green/Orange/Red)
	LAN Port	LED 4 (Orange)
		LED 5 (Green)
Power supply	DC connector	Operating voltage DC12V to DC24V
	USB Type-C connector	Operating voltage DC5V
Operating environment	Temperature	-20 ℃ to 40 ℃
	Humidity	20% to 90%RH (Non-condensing)
Storage environment	Temperature	-20 ℃ to 60 ℃
	Humidity	20% to 90%RH (Non-condensing)
EMC	FCC Part15 Subpart B Class-B ICES-003 Class-B	
Radio regulation	FCC part15 Subpart C / Subpart E FCC Part 15.247 ISED RSS-247	

Wireless network interface

IEEE 802.11ah	Bandwidth	900MHz	
	Channel	1MHz bandwidth	903.5, 904.5, 905.5, 906.5, 907.5, 908.5, 909.5, 910.5, 911.5, 912.5, 913.5, 914.5, 915.5, 916.5, 917.5, 918.5, 919.5, 920.5, 921.5, 922.5, 923.5, 924.5, 925.5, 926.5
		2MHz bandwidth	905.0, 907.0, 909.0, 911.0, 913.0, 915.0, 917.0, 919.0, 921.0, 923.0, 925.0
		4MHz bandwidth	910.0, 914.0, 918.0, 922.0
		8MHz bandwidth	908.0, 916.0

IEEE 802.11a	Bandwidth	5GHz		
	Channel	W52	36, 40, 44, 48	
		W58	149, 153, 157, 161, 165	
IEEE 802.11b	Bandwidth	2.4GHz		
	Channel	1-11		
IEEE 802.11g	Bandwidth	2.4GHz		
	Channel	1-11		
IEEE 802.11n	Bandwidth	2.4GHz/5GHz		
	Channel	2.4GHz	1-11	
		5GHz	W52	36, 40, 44, 48
			W58	149, 153, 157, 161, 165
IEEE 802.11ac	Bandwidth	5GHz		
	Channel	W52	36, 40, 44, 48	
		W58	149, 153, 157, 161, 165	
IEEE 802.11ax	Bandwidth	2.4GHz/5GHz		
	Channel	2.4GHz	1-11	
		5GHz	W52	36, 40, 44, 48
			W58	149, 153, 157, 161, 165

TIP
- Use of 5GHz band (W52) outdoors is prohibited.

Wired network interface

LAN port : 1 port, 10BASE-T/100BASE-TX (auto-sensing)
Auto MDI/MDI-X

2-4-2. Software Specifications

TCP/IP	Network layer	ARP
		IP
		ICMP
	Transport layer	TCP
		UDP
	Application layer	DHCP(Client/Server)
		HTTP/HTTPS(Server)
		DNS(Client)
		TFTP
		SXSMP
Recommended Web browser		Microsoft Edge
		Google Chrome

2-5. Power Supply

EX-150AH can receive electrical power in the following two ways:

- Power supply (DC 12V to 24V)
- USB Type-C connector

Sample connection1: When using a power supply

Connect the power supply cable to the DC connector of EX-150AH.
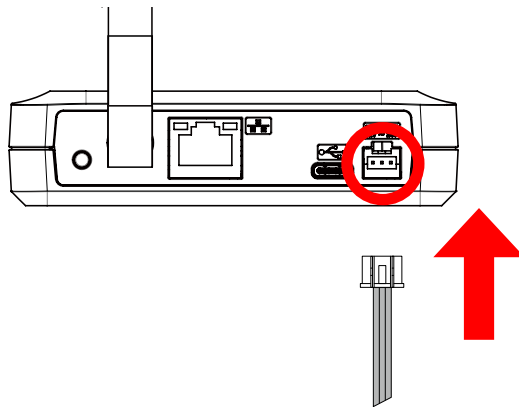
Sample connection2: When using a USB Type-C power connector

Connect the USB Type-C power connector to the USB Type-C connector of EX-150AH.
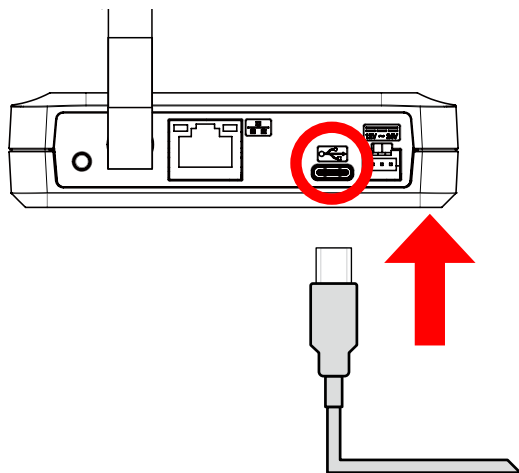
TIP
- Do not connect a power supply that supports DC 12V-24V while receiving a power from the USB Type-C connector. It may cause unintended operation or malfunction.
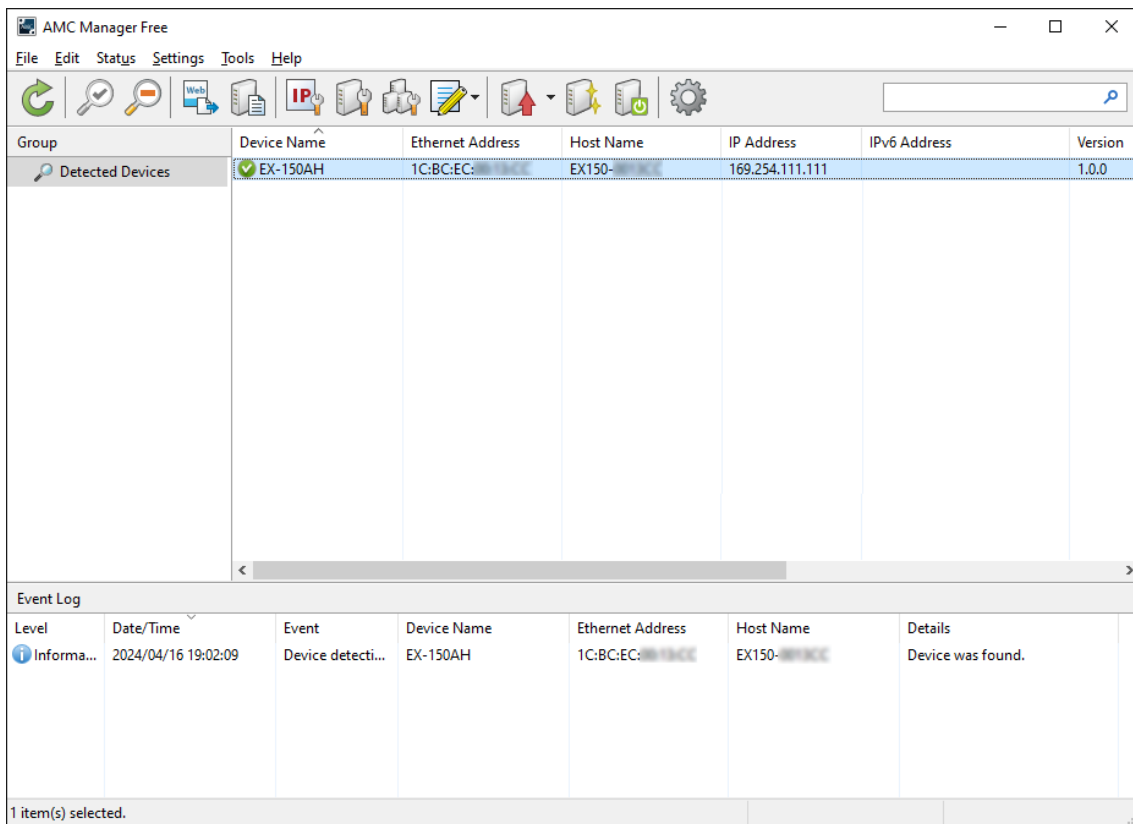
2-6. Optional Utilities

2-6-1. What's AMC Manager®?

AMC Manager® is the integrated device management utility that provides remote status monitoring and individual/bulk configuration for Silex devices over an IP network.

If AMC Manager® is used, the EX-150AH's operating status can be shown as a list.

There are two versions of AMC Manager® ; one is AMC Manager® Free (free version) and the other one is AMC Manager® (paid version). This manual uses AMC Manager® Free for explanation.

TIP
- If you want to use AMC Manager® (paid version), you need to purchase the license key. For how to purchase the license key, please contact Silex Technology. See **C. Product Information and Customer Services** for the contact information.
- Download and use the latest version of AMC Manager®.

2-6-2. How to Download AMC Manager®

AMC Manager® can be downloaded from the Silex Technology's website.
Access the URL below to download it.

https://www.silextechnology.com/

1. When the website is displayed, click **Support Center** in the bottom of the page.

2. Click **Software Download**.

3. In the **Software Download** page, click **AMC Manager®**.

4. Download AMC Manager®.

The download is now completed.

3. Configuration

3-1. Configuration Methods

Following configuration methods are available:

- Configure using the EX-150AH's Web page
  Access the EX-150AH's Web page to configure it. If you know the IP address of EX-150AH, you can configure it from your PC without AMC Manager®.

- Configure using AMC Manager®
  Use AMC Manager® to configure EX-150AH. Multiple units of EX-150AH can be configured at once with the configuration file created beforehand. The same file can be used when the similar configuration is required.

3-2. Connecting EX-150AH and PC

For configuration of EX-150AH, connect the PC to wireless LAN.

The following explains the connection procedure.

TIP - EX-150AH may not be able to connect some models of wireless station device using 5GHz wireless LAN. If such a connection failure occurs, please use 2.4GHz wireless LAN.
Also, for some wireless station devices, IEEE 802.11n will be used for connection via 5GHz wireless LAN. To connect using IEEE 802.11ax, please use 2.4GHz wireless LAN.

Note - EX-150AH can also be configured via wired LAN. Connect EX-150AH and the PC using a LAN cable and turn on it. Go on to **3-3. About EX-150AH's Web page** for further steps.

1. Change the network settings of the PC to allow accessing EX-150AH.

Sample network setting)

When there is no DHCP server in your environment, the default IP address of EX-150AH is "169.254.111.111".

Then, change the network settings of your PC as below:

　　IP address 　：　169.254.111.1
　　Subnet mask 　：　255.255.0.0

TIP - Make sure that the IP address set on the computer does not overlap with the IP address of EX-150AH.

2. Click the network icon on the notification area (system tray) to view the wireless networks.

3. Select the SSID configured on EX-150AH from a list and click **Connect**.
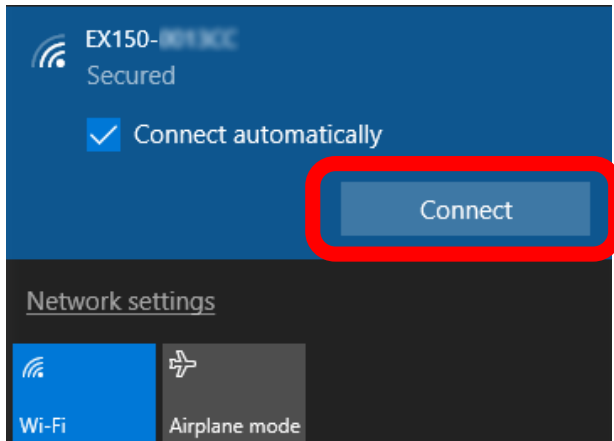
Note
- When EX-150AH has the factory default setting, "xxxxxx" of SSID (EX150-xxxxxx) is a last 6-digit of the MAC address.
- If **Connect automatically** is checked, your PC will automatically connect to EX-150AH every time it restarts.

4. Enter the Pre-Shared key to **Security key** and click **Next**.
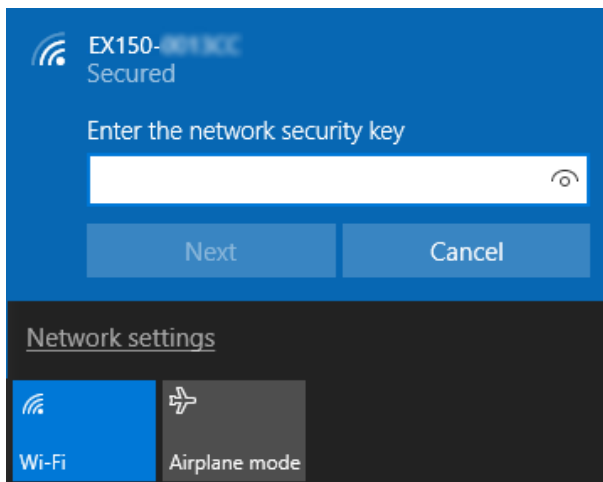
Note
- The default Pre-Shared key of EX-150AH is "letmein-xxxxxx". "xxxxxx" is a last 6-digit of the MAC address.

3-3. About EX-150AH's Web page

The following shows the Web page structure.
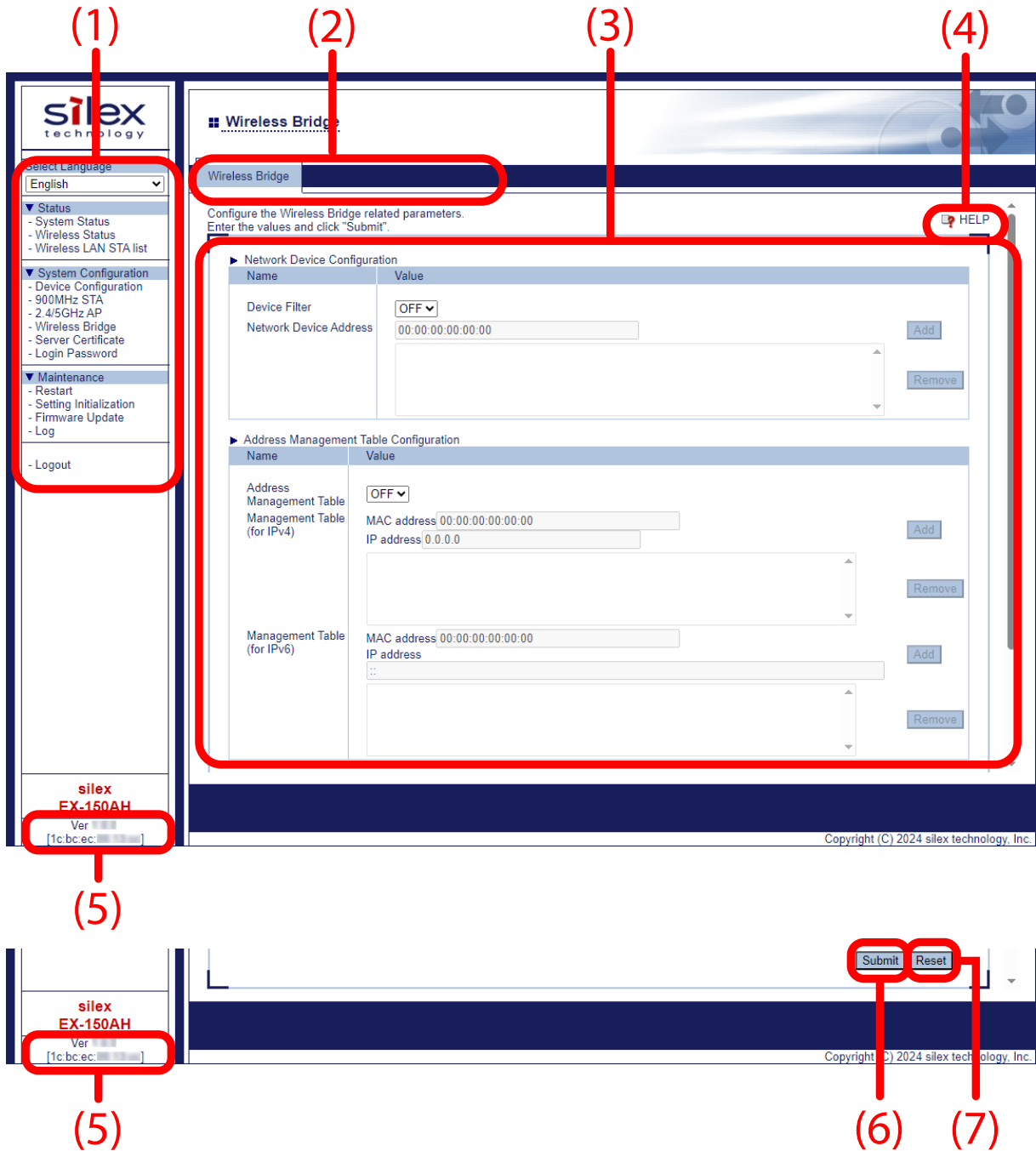
(1) Page menu

If clicked, the configuration page is changed.

(2) Tab

The tab is displayed when there are multiple pages for the configuration. If the tab is clicked, the configuration page is changed.

(3) Configuration page

Each setting can be configured.

(4) Link to Help

The Help page is displayed. The Help page provides the detailed explanation of each setting.

(5) Firmware version / MAC address

The firmware version and MAC address of EX-150AH are displayed.

(6) Submit button

If clicked, the changes you made to the configuration page will be saved. (You may need to scroll-down the screen to find this button.)

(7) Reset button

If clicked, the changes you made to this configuration page will be cleared. (You may need to scroll-down the screen to find this button.)

TIP
- Be sure to set a password when you connect EX-150AH to a public network.
- Wireless bands for IEEE 802.11b/g or IEEE 802.11n/b/g are often in use by other people because the number of devices supporting these standards is growing rapidly. If these wireless modes are used, you may run into issues with having enough communication bandwidth.

Menu and Settings

Menu		Explanation
Status	System Status	Displays the system settings of EX-150AH.
	Wireless Status	Shows the wireless setting of EX-150AH. The wireless status is displayed for each 2.4GHz/5GHz band, IEEE 802.11ah.
	Wireless LAN STA list	Displays the status of wireless station devices connected to EX-150AH via 2.4GHz/5GHz band.
System Configuration	Device Configuration	Configure the basic communication settings.
	900MHz STA	Configure the setting for the IEEE 802.11ah wireless station device.
	2.4/5GHz AP	Configure the setting for the 2.4GHz/5GHz Access Point function.
	Wireless Bridge	Set the device that can communicate with the IEEE 802.11ah network.
	Server Certificate	Create a server certificate for EX-150AH.
	Login Password	Set the password to log in to EX-150AH.

Menu		Explanation
Maintenance	Restart	Restarts EX-150AH.
	Setting Initialization	Restores all settings to the factory defaults and restarts EX-150AH.
	Firmware Update	Updates the firmware.
	Log	Downloads the log of EX-150AH.
Logout		Log out of the Web page.

3-4. Displaying the EX-150AH's Web Page

The Web page can be displayed by the following methods.

Display the Web page using a method appropriate for your environment.

- Displaying a Web Page by entering the IP address directly

Connect EX-150AH and PC on wireless LAN, and enter the IP address of EX-150AH to the Web browser to display the Web page.

- Displaying a Web Page by using AMC Manager®

Connect EX-150AH and PC on wireless LAN, and display the Web page using AMC Manager®.

TIP
- The display of the EX-150AH's Web page may differ depending on your environment and Web browser.

Note
- The following is the factory default settings for wired LAN settings.

Setting Item	Default Value
DHCP Client	ENABLE
IP Address	169.254.111.111 (If an IP address is not obtained from DHCP server, 169.254.111.111 is used.)
Subnet Mask	255.255.0.0 (If an IP address is not obtained from DHCP server, 255.255.0.0 is used.)
Default Gateway	0.0.0.0 (If an IP address is not obtained from DHCP server, 0.0.0.0 is used.)
DNS Server (Primary)	0.0.0.0 (If an IP address is not obtained from DHCP server, 0.0.0.0 is used.)
DNS Server (Secondary)	0.0.0.0 (If an IP address is not obtained from DHCP server, 0.0.0.0 is used.)

3-4-1. Displaying a Web Page by Entering an IP Address to Web Browser

By entering the IP address of EX-150AH to the address bar of your Web browser, the Web page can be accessed.

Note - The following instructions will use Microsoft Edge and Windows 10 as examples. The display may vary depending on the OS or Web browser version.

1. Start the Web browser on the PC.

Enter the IP address of EX-150AH to the address bar and press the Enter key.
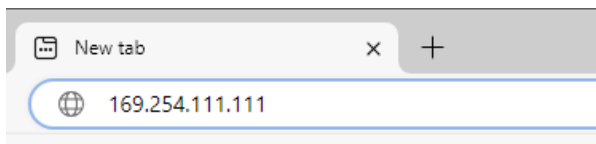
Note
- Change the network setting of the PC to allow communication with EX-150AH.
- When the IP address of EX-150AH is "169.254.111.111", change the wireless LAN network settings of the PC as follows.
  - IP address : 169.254.111.1
  - Subnet mask : 255.255.0.0

2. The login password configuration page appears.

Enter the password to configure for EX-150AH and click **Submit**.
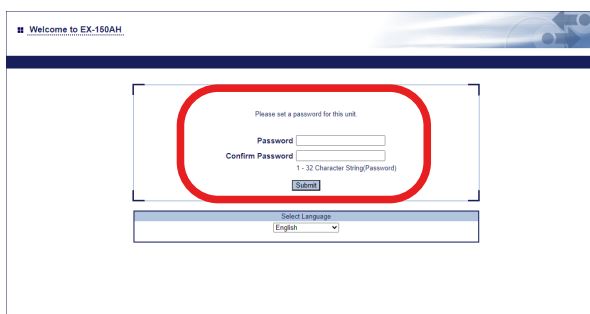
TIP
- Make a note of the password so that you can refer when you have forgotten it. Without the password, no settings can be changed unless EX-150AH is reset to the factory default settings.

Note
- The login password configuration page is displayed only when EX-150AH has the factory default settings. Once configured, it will not be displayed again.

3. When the login page is displayed, enter the configured password and click **Login**.

42
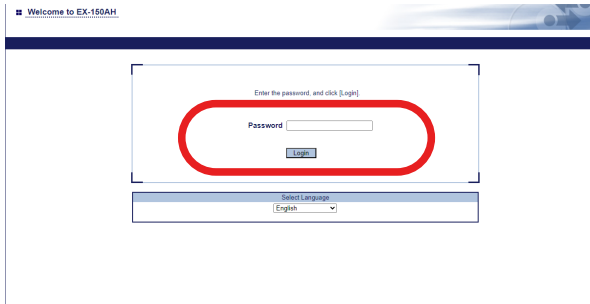
Web page has been displayed.

3-4-2. Displaying a Web Page by Using AMC Manager®

The Web page of EX-150AH can be accessed using AMC Manager®.

1. Start AMC Manager® in the PC.

The device list of AMC Manager® shows the discovered EX-150AH units.
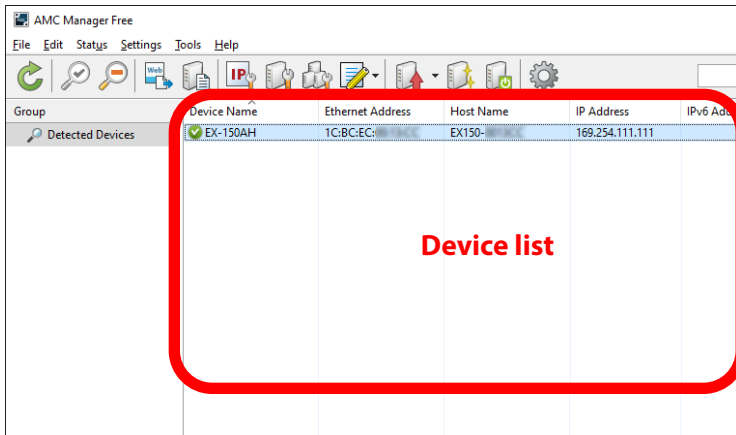
Note
- If the EX-150AH is not displayed on the device list, click the icon Refresh (   ).
- It may take approximately 1 min to show them on the device list depending on your environment.

2. Choose EX-150AH to configure, and click the icon **Configure using Web browser**(   ).
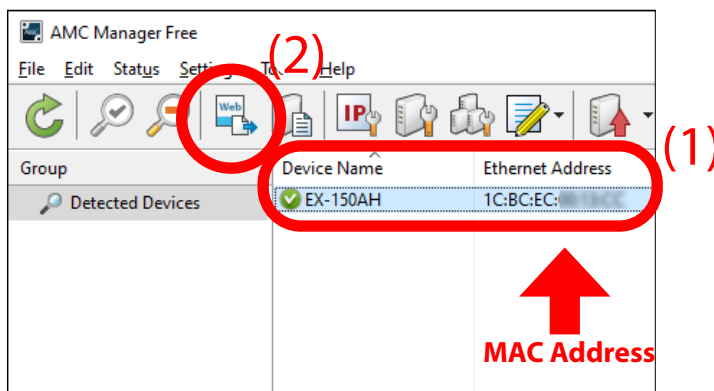
Note
- Check the MAC address that is noted on the product label to see if the displayed device is the correct one you want to configure.

3. The login password configuration page appears.

Enter the password to configure for EX-150AH and click **Submit**.

4. When the login page is displayed, enter the configured password and click **Login**.

Web page has been displayed.

3-5. Configuration Using AMC Manager®

For configuration using AMC Manager®, create a configuration file first, and then apply it to EX-150AH.
The following explains the procedure.

3-5-1. Create Configuration File

1. Click **Start** - **silex Tools** - **AMC Manager**.
The AMC Manager® will be started.
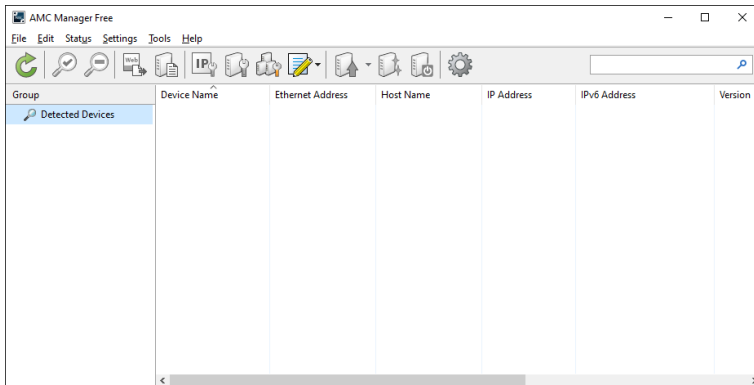
2. Create a configuration file using the template.
Click the icon Create the configuration file ( ) and click Create from Template from the toolbar.
In the Select Template window, select the device to configure and click **OK**.
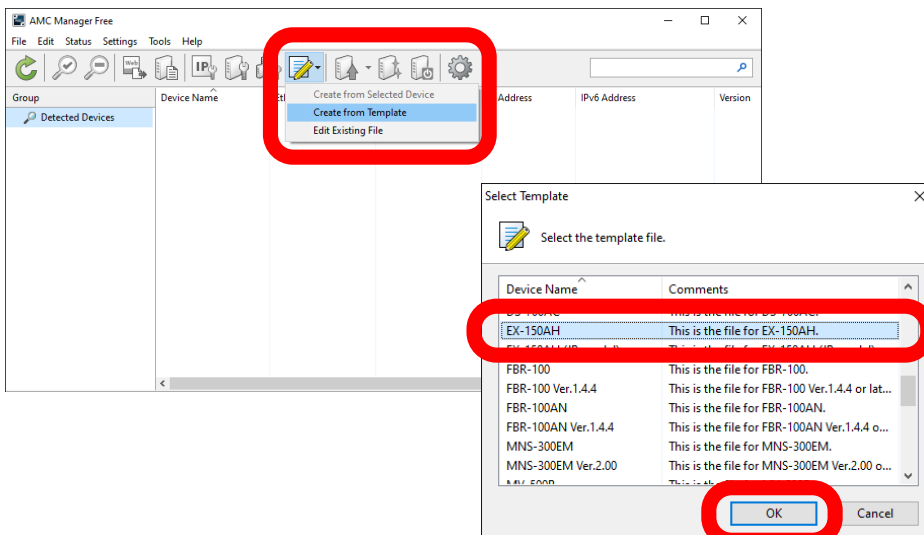
3. In the **Create Configuration File** window, check the check box of the items you want to use for the configuration file, edit the settings and click **Save**.

In the dialog to save the configuration file, specify the file name and click **Save**.
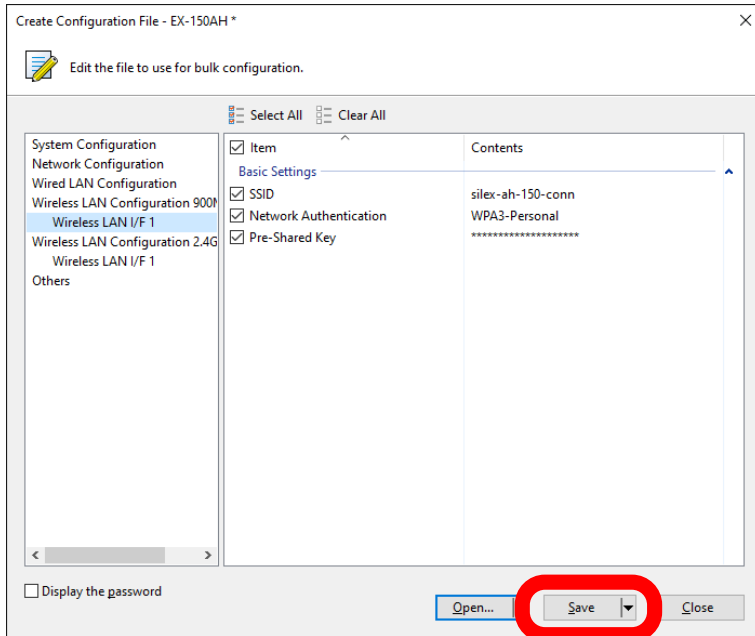
> *Note*
> - When EX-150AH is used for the first time, the login password needs to be set.
> - Change the following settings (**Wireless LAN I/F 1** under **Wireless LAN Configuration 900MHz**) according to the Access Point to connect.
>   - SSID
>   - Network Authentication
>   - Pre-Shared Key

3-5-2. Apply Configuration File

1. Connect the PC to EX-150AH.

For details on the connection method, see **3-2. Connecting EX-150AH and PC**.

2. Select the EX-150AH unit to configure from the device list of AMC Manager®, and click the icon **Configure multiple devices in bulk**(🗗).

For bulk configuration, the configuration file is used to send the settings to the devices.
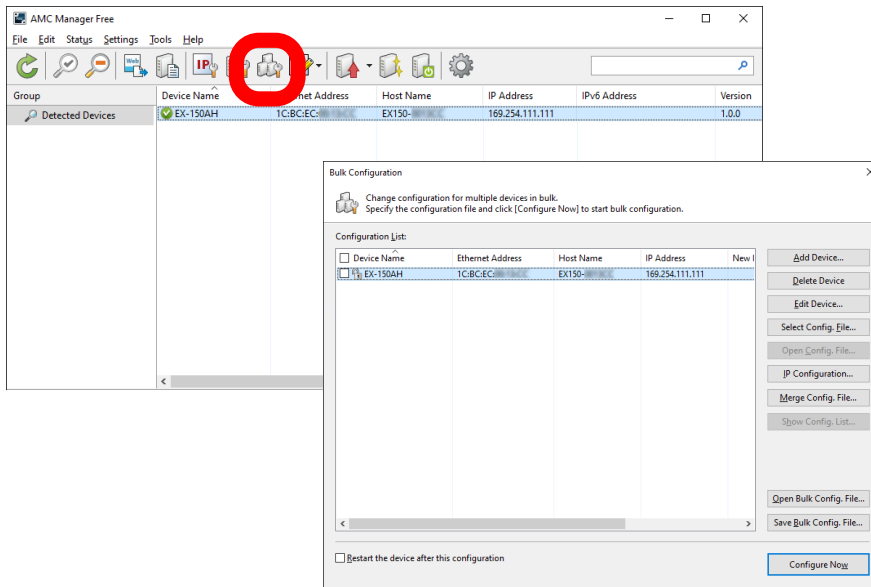
3. In the **Bulk Configuration** window, select the EX-150AH unit to configure from the **Configuration List** (1) and click the **Select Config. File** button (2).

When a file selection dialog appears, select the configuration file that you have created and click **Open**.
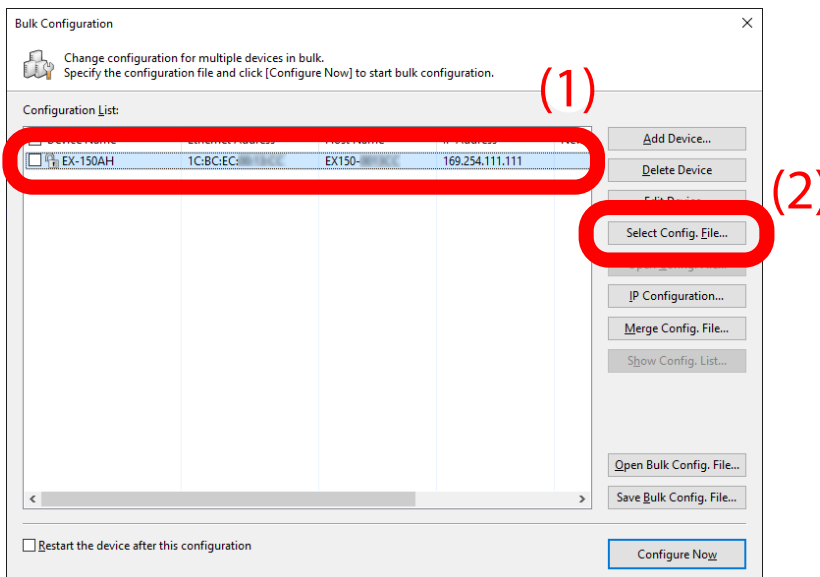
4. The selected file is displayed at **Configuration File Name**.

Click **IP Configuration** for the IP address configuration.

When you are using the DHCP server to automatically configure the IP address, skip this and go on to **6**.
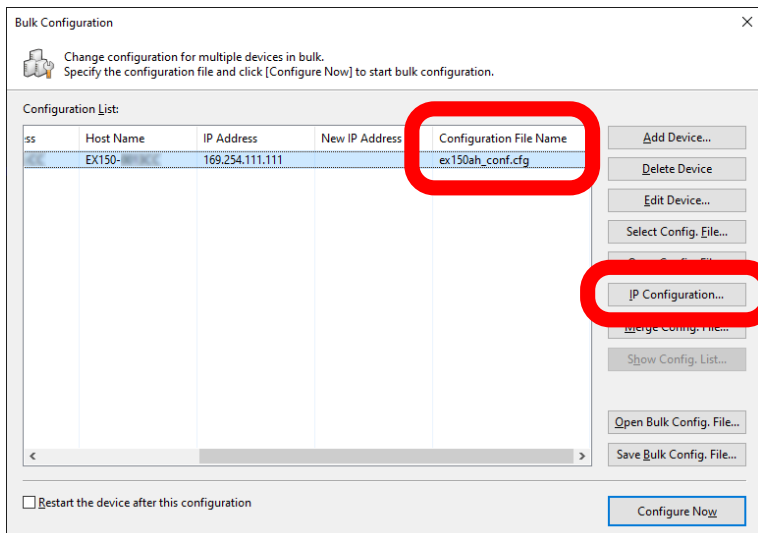
5. In the **IP Address Configuration** window, specify the range of IP address to configure for EX-150AH, and click **OK**.
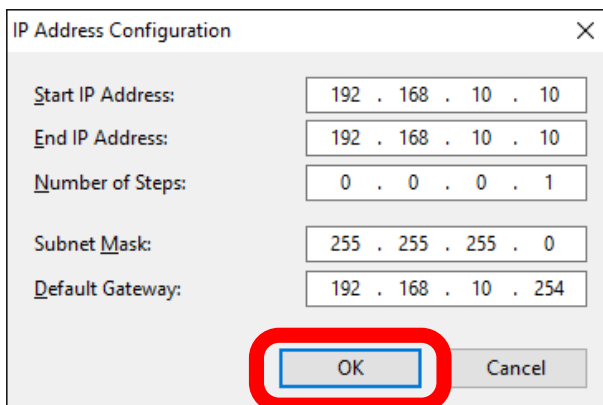
6. The IP addresses to configure are pre-assigned and displayed under **New IP Address**.
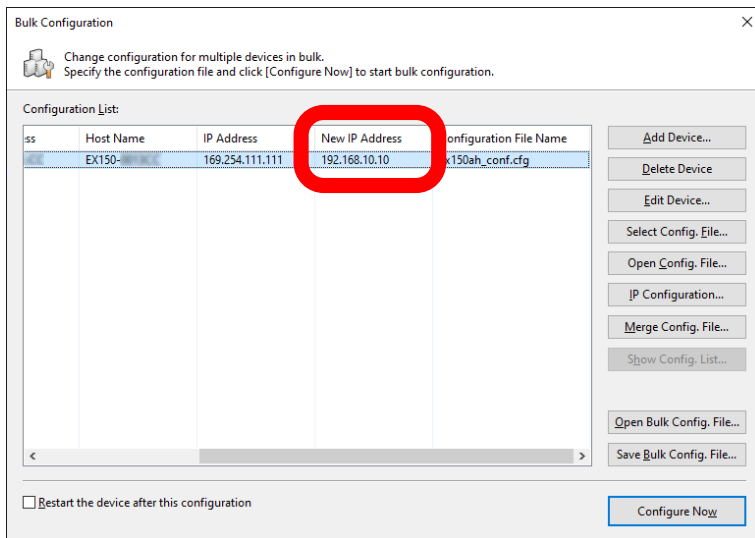
7. Check the check boxes of EX-150AH units to configure (1) and click **Configure Now** (2).
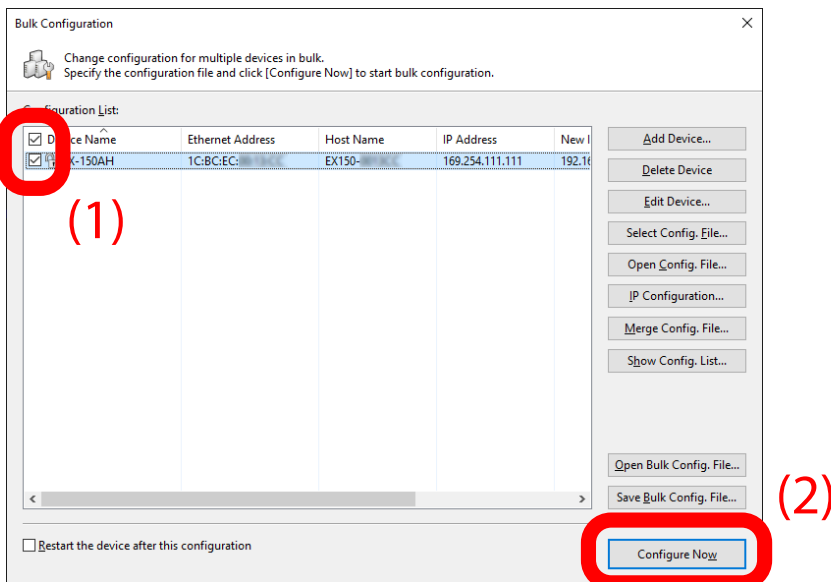
8. The configuration performs and the result is displayed.
Click **Close**.
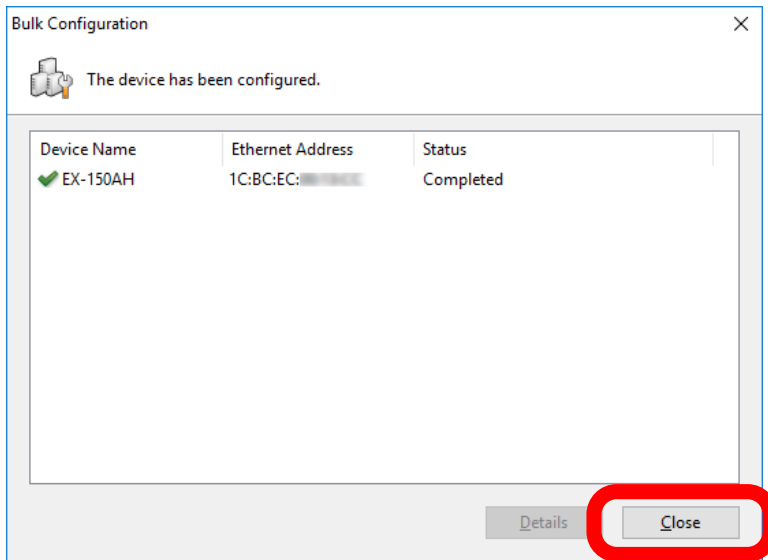
9. When there are more EX-150AH units to configure, repeat the process of **1** to **8** and configure them one by one.

The configuration has now been completed.

4. Establishing Network for Long Distance Transfer

4-1. Configuring Network and Access Point Function

The following explains how to change the network settings and 2.4GHz/5GHz band Access Point function.

1. Display the EX-150AH's Web page.

Note
- For how to display the EX-150AH Web page, see **3-4. Displaying the EX-150AH's Web Page**.

2. Click **System Configuration** - **Device Configuration** from the page menu.

- Wireless LAN STA list
- System Configuration
  - Device Configuration
  - 2.4/5GHz AP
  - Wireless Bridge
  - Server Certificate
  - Login Password
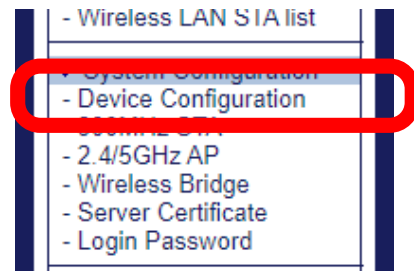
3. The **Device Configuration** page is displayed.
Change the settings at **TCP/IP** appropriately for the network where EX-150AH is installed.

TIP
- To receive an IP address from a DHCP server of the IEEE 802.11ah Access Point, select **ENABLE** for **DHCP Client**. By defaults, it is set to **ENABLE**. Also, set "0.0.0.0" for **IP Address**. If an IP address assignment fails for some reason, the request for assignment will continue to be sent to the DHCP server until it is successfully configured.

Note
- For details on each configuration item, see **A-1. Device Configuration**.

4. Check the settings and click **Submit**.

5. Click **System Configuration** - **2.4/5GHz AP** from the page menu.

6. The **2.4/5GHz AP** page is displayed.

Change **SSID**, **Channel**, etc. under **Wireless LAN** appropriately for the wireless network where EX-150AH is connected.

If **WPA2-Personal**, **WPA3-Personal**, or **WPA2/WPA3-Personal** is selected for **Network Authentication**, the settings of **Security Configuration** are displayed.

Set the Pre-Shared Key.

Change the setting at **Extension Configuration** as necessary.

| **Note** | - | For details on each configuration item, see **A-3-1. 2.4/5GHz AP**. |

7. Check the settings and click **Submit**.

8. The completion page is displayed.

Click **Restart**. The new settings will take effect after EX-150AH is restarted.

> **Note**
> - If you do not want to apply the configuration change, reset it to the previous settings and click **Submit** at the bottom right of the Web page. Remember that the changes will take effect after the restart.

9. The restart progress page is displayed.

When the login page is displayed, the configuration is completed.

4-2. Configuring the IEEE 802.11ah Settings

The following describes how to establish a network that can transfer data from the wireless station device and wired device to a remote location by using an IEEE 802.11ah Access Point and EX-150AH.

Note
- For an image of using an IEEE 802.11ah Access Point and EX-150AH, see **2-1. Image of Using EX-150AH**.

4-2-1. Checking the IEEE 802.11ah Access Point Settings

To connect EX-150AH to an IEEE 802.11ah Access Point, check the following settings of the Access Point and take a note of it.
- SSID
- Network Authentication
- Pre-Shared Key

TIP
- The name of each setting will differ depending on the product. For details, refer to the user's manual of IEEE 802.11ah Access Point.

4-2-2. Configuring EX-150AH

The following explains how to configure EX-150AH.

1. Display the EX-150AH's Web page.

> *Note*
> **-** For how to display the EX-150AH Web page, see **3-4. Displaying the EX-150AH's Web Page**.

2. Click **System Configuration** - **900MHz STA** from the page menu.
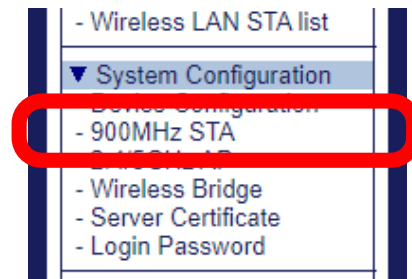
3. The **900MHz STA** page is displayed.
For the following items, set the same settings as those you have checked at **4-2-1. Checking the IEEE 802.11ah Access Point Settings**.

- SSID
- Network Authentication
- Pre-Shared Key

Change the setting at **Extension Configuration** as necessary.

  - For details on each configuration item, see **A-2. 900MHz STA**.

Note

4. Check the settings and click **Submit**.

5. The completion page is displayed.

Click **Restart**. The new settings will take effect after EX-150AH is restarted.

> ▶ Setting is completed.
> To take effect of this setting, please restart.
>
> Restart
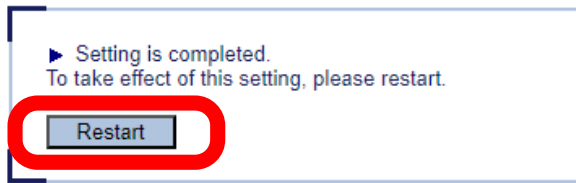
Note - If you do not want to apply the configuration change, reset it to the previous settings and click **Submit** at the bottom right of the Web page. Remember that the changes will take effect after the restart.

6. The restart progress page is displayed.

When the login page is displayed, the configuration is completed.

5. Connecting Wireless Station Devices

5-1. Connecting Wireless Station Devices

For how to connect your PC or Tablet to EX-150AH as a wireless station device, see **3-2. Connecting EX-150AH and PC.**

5-2. Connecting IEEE 802.11ah Access Point

For how to connect an IEEE 802.11ah Access Point, see **4-2. Configuring the IEEE 802.11ah Settings**.

6. Basic Functions

6-1. Checking Status for Connected Wireless Station Devices

The operating status of the connected wireless station device can be checked on the Web page. The status includes MAC address of devices and the radio strength.

This chapter describes how to check the operating status of the wireless station device.

1. Display the EX-150AH's Web page.

> *Note*
> - For how to display the EX-150AH Web page, see **3-4. Displaying the EX-150AH's Web Page**.

2. Click **Status** - **Wireless LAN STA list** from the page menu.
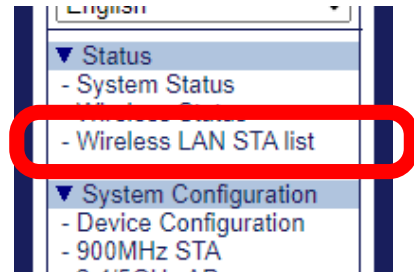
3. The **Wireless LAN STA list** page is displayed.

It shows the status of the wireless station devices connected to EX-150AH.

> *TIP*
> - The IP address is displayed only when the device filter is **OFF**. When it is **ON**, the IP address is displayed only for devices whose MAC addresses are registered to **Network Device Address**.

6-2. Filtering Devices on IEEE 802.11ah Network

If the device filter is used, the wireless station devices and wired devices can communicate over the IEEE 802.11ah network only when their MAC addresses are registered to **Network Device Address**.
This chapter describes how to use the device filter.
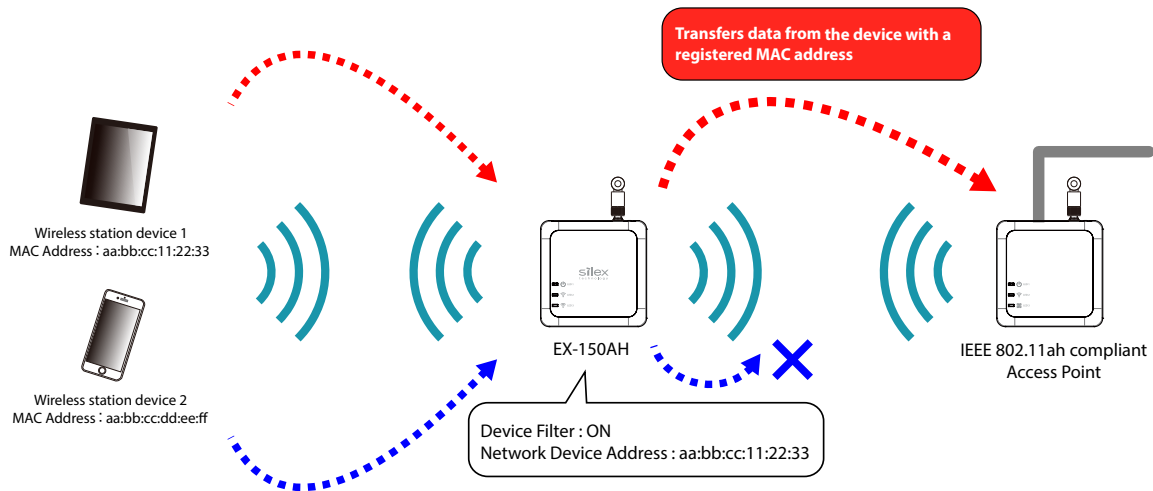
Note
- Using a device filter can reduce unnecessary communication with the IEEE 802.11ah network.
- The device filter only filters communication over the IEEE 802.11ah network. Communication will still be active on other wireless or wired station devices that are connected to EX-150AH.
- To allow only the specified wireless station devices to connect EX-150AH, see **6-4. MAC Address Filter Setting**.

1. Display the EX-150AH's Web page.
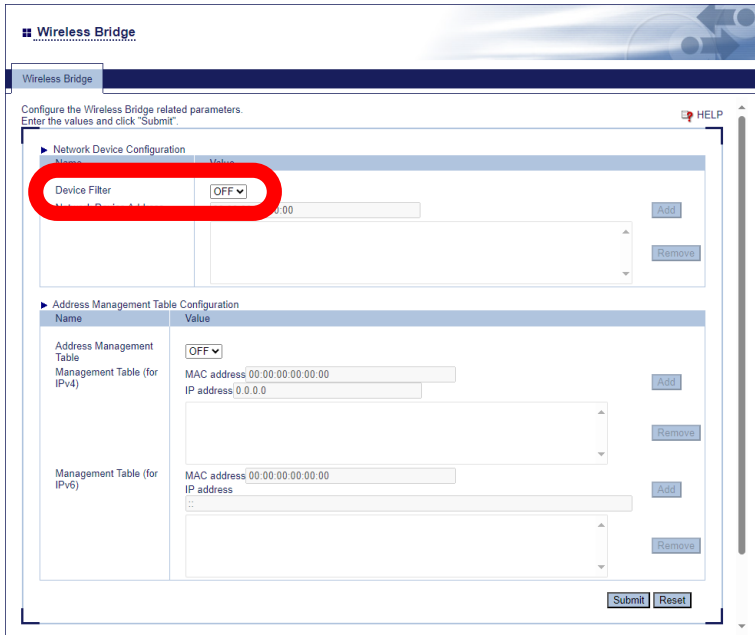
Note
- For how to display the EX-150AH Web page, see **3-4. Displaying the EX-150AH's Web Page**.

2. Click **System Configuration** - **Wireless Bridge** from the page menu.
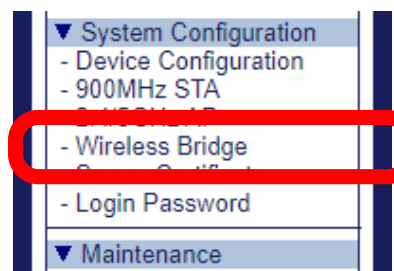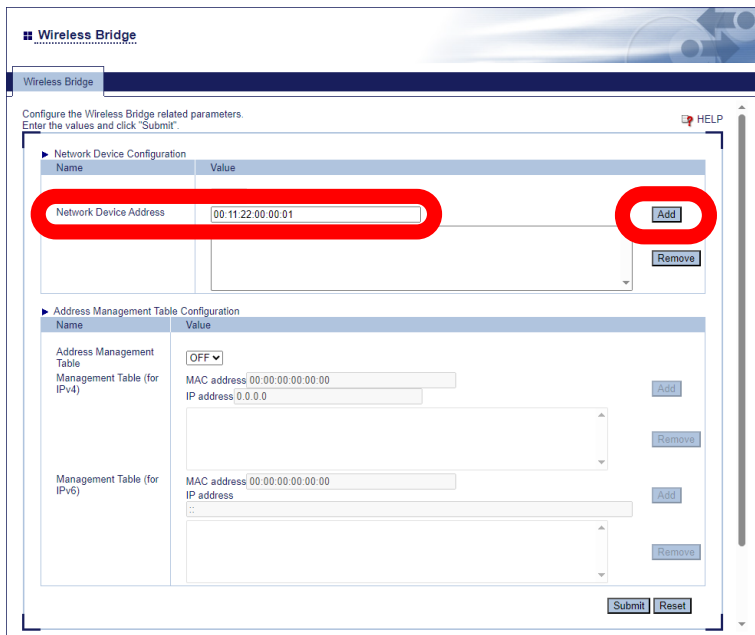
3. The **Wireless Bridge** page is displayed.

Select **ON** for **Device Filter**.

4. For **Network Device Address**, enter the MAC address of the device to allow data transfer over the IEEE 802.11ah network, and click **Add**.

Repeat this when there are multiple MAC addresses.

Note
- Up to 16 MAC addresses can be registered.

5. Check the settings and click **Submit**.

6. The completion page is displayed.

Click **Restart**. The new settings will take effect after EX-150AH is restarted.

> **Note**
> - If you do not want to apply the configuration change, delete the MAC address you have added and click **Submit** at the bottom right of the Web page. Remember that the changes will take effect after the restart.

7. The restart progress page is displayed.

When the login page is displayed, the configuration is completed.

6-3. Register a combination of MAC address and IP address

When data is transferred from the connected device to an IEEE 802.11ah Access Point, the MAC address of EX-150AH and the IP address of the connected device will be used.

The combination information of the MAC address and IP address for the connected wireless/wired station devices is stored, and when data is sent from an IEEE 802.11ah Access Point, it is transferred to the wireless/wired station device based on the combination information.

The combination information is registered automatically when EX-150AH starts communication with devices. If the address management table feature is used, up to 16 sets of combination information can be registered or deleted for each IPv4 address and IPv6 address.

MAC Address: Uses an address of the device connected to EX-150AH
IP Address: Uses an address of the device connected to EX-150AH

MAC Address: Uses an address of EX-150AH
IP Address: Uses an address of the device connected to EX-150AH

Wireless station device 1
MAC Address : aa:bb:cc:11:22:33
IP Address : 10.0.0.20

EX-150AH

IEEE 802.11ah compliant
Access Point

Transfers data to the specified destination according to the address management table

Transfers data to the following destination
MAC Address: MAC address of EX-150AH
IP Address: IP address of the device connected to EX-150AH

Wireless station device 1
MAC Address : aa:bb:cc:11:22:33
IP Address : 10.0.0.20

Wireless station device 2
MAC Address : aa:bb:cc:dd:ee:ff
IP Address : 10.0.0.21

EX-150AH

IEEE 802.11ah compliant
Access Point

Address Management Table : ON
Registered Information : aa:bb:cc:11:22:33 <---> 10.0.0.20

TIP
- If the destination information is the MAC address and IP address that are not saved on EX-150AH, the transfer may fail.

6-3-1. About Address Management Table Feature

How to register combination of MAC address and IP address will differ depending on whether the address management table feature is enabled or disabled (ON/OFF).

If this function is ON, combination information is managed by the management table. The information will automatically be registered to the management table, and it will be retained even if EX-150AH is restarted.

If this function is OFF, the management table is not used. The combination of MAC address and IP address will automatically be registered, but it will be cleared when EX-150AH is restarted.

TIP
- Only unicast address is supported for MAC address and IP address.
- EX-150AH checks the existence of device information to save at 5 sec interval. If EX-150AH is turned off before the saving process is completed, the device information is not saved in the address management table.
- Up to 16 sets of combination information can be registered to the management table for each IPv4 address and IPv6 address. If 16 sets of combination information are already registered, new one cannot be added. Delete unnecessary information then.

6-3-2. Registering Address to Management Table

Following explains how to register combination of MAC address and IP address to management tables (IPv4/IPv6).

1. Display the EX-150AH's Web page.

Note
- For how to display the EX-150AH Web page, see **3-4. Displaying the EX-150AH's Web Page**.

2. Click **System Configuration** - **Wireless Bridge** from the page menu.
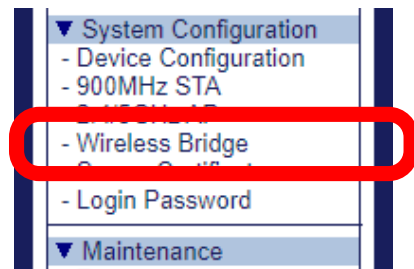
3. The **Wireless Bridge** page is displayed.

Select **ON** for **Address Management Table**, enter the MAC address and IP address and click **Add**.

Repeat the same process to register more sets of information.

> **Note**
> - To register a combination of MAC address and IPv6 address, add it to **Management Table (for IPv6)**.

4. The combination information is listed in the management table.

Click **Submit**.

5. The completion page is displayed.

Click **Restart**. The new settings will take effect after EX-150AH is restarted.
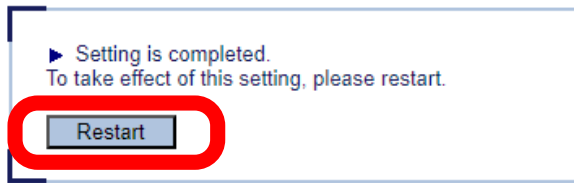
Note - If you do not want to apply the configuration change, reset it to the previous settings and click **Submit** at the bottom right of the Web page. Remember that the changes will take effect after the restart.

6. The restart progress page is displayed.

When the login page is displayed, the configuration is completed.

6-3-3. Deleting Address from Management Table

Following explains how to delete combination of MAC address and IP address from management tables (IPv4/IPv6).

1. Display the EX-150AH's Web page.

Note
- For how to display the EX-150AH Web page, see **3-4. Displaying the EX-150AH's Web Page**.

2. Click **System Configuration** - **Wireless Bridge** from the page menu.
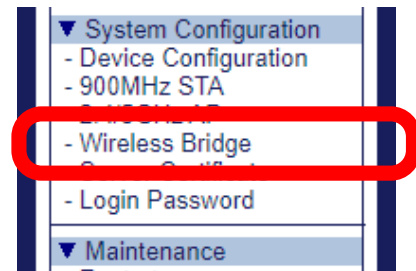
3. The **Wireless Bridge** page is displayed.
At the address management table, select combination of MAC address and IP address from the list and click **Remove**. Repeat the same process to delete more sets of information.
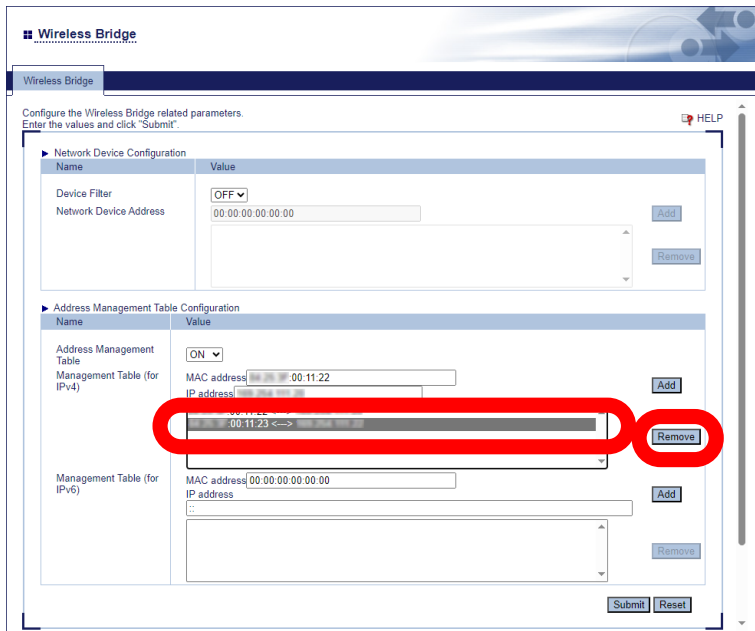
Note
- To select multiple items, hold down the Ctrl key to select them.
- To remove a combination of MAC address and IPv6 address, click **Remove** at **Management Table (for IPv6)**.

4. Click **Submit**.

5. The completion page is displayed.

Click **Restart**. The new settings will take effect after EX-150AH is restarted.

> **Note** - If you do not want to apply the configuration change, reset it to the previous settings and click **Submit** at the bottom right of the Web page. Remember that the changes will take effect after the restart.

6. The restart progress page is displayed.

When the login page is displayed, the configuration is completed.

6-4. MAC Address Filter Setting

By configuring the MAC Address Filter, it is possible to block access from particular wireless station devices to EX-150AH.

When "ALLOW" is selected for MAC Address Filter, only registered MAC addresses are allowed to communicate.

Wireless station device 1
MAC Address：aa:bb:cc:11:22:33

Wireless station device 2
MAC Address：aa:bb:cc:dd:ee:ff

EX-150AH

MAC Address Filter：ALLOW
MAC Address List：aa:bb:cc:11:22:33

6-4-1. Filter Type

By registering the MAC Address to a list, access of wireless station devices is allowed or denied based on the filter type below.

Filter Type	Operation
DISABLE	Does not use MAC Address filter. All wireless station devices are allowed to access.
ALLOW	Allows access only from wireless station devices with the registered MAC Address.
DENY	Denies access from wireless station devices with the registered MAC Address.

6-4-2. MAC Address Filter

Register the MAC Address of devices to allow/deny access to EX-150AH.

Up to 30 MAC Addresses can be registered.

To register, create a list of MAC Addresses as a text file and import it to EX-150AH from the Web page.

To change the contents of the MAC Address list, update the MAC Address list file accordingly and import it again.
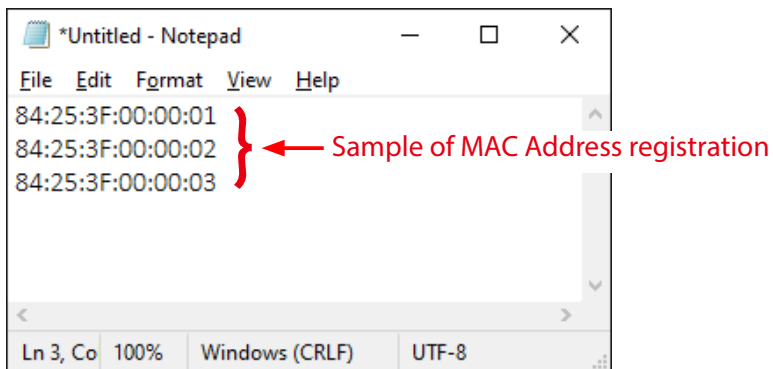
	-	Create the MAC Address list as a text file using an editor, etc. and save it with any file name.
Note	-	In MAC Address list, one MAC Address needs to be described per line.
	-	For the line feed code, use CR+LF or LF.

6-4-3. MAC Address Filter Settings

Following explains how to configure the MAC Address filter.

1. Display the EX-150AH's Web page.

> 📝 **Note**
> - For how to display the EX-150AH Web page, see **3-4. Displaying the EX-150AH's Web Page**.

2. Click **System Configuration** - **2.4/5GHz AP** from the page menu.
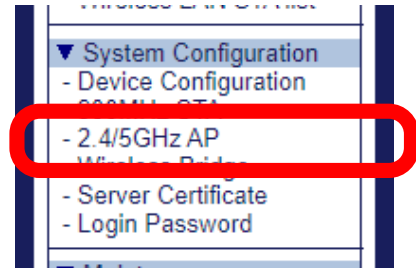
3. The **2.4/5GHz AP** page is displayed.
Click **MAC Address Filter** tab to display the MAC address filter page.
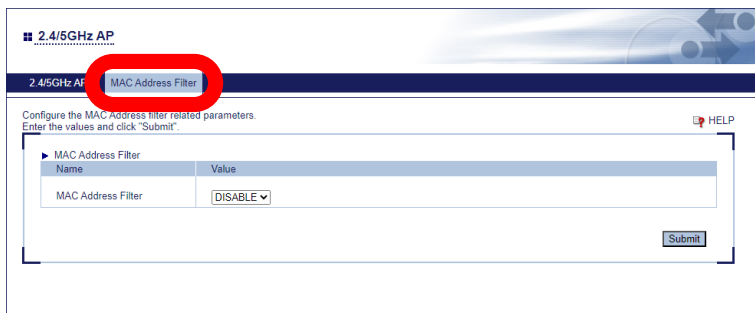
4. Select **MAC Address Filter**.
Click **Choose File** and specify a file containing a list of the MAC Addresses.
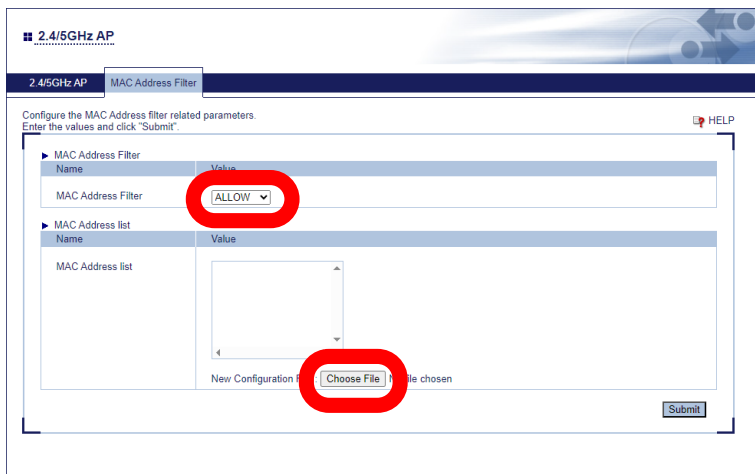
5. Check the configuration file you have selected is displayed at the **New Configuration File** field. Click **Submit**.

6. The completion page is displayed.
Click **Restart**.

> *Note*
> - If you do not want to apply the configuration change, delete the MAC address you have added and click Submit at the bottom right of the Web page. Remember that the changes will take effect after the restart.
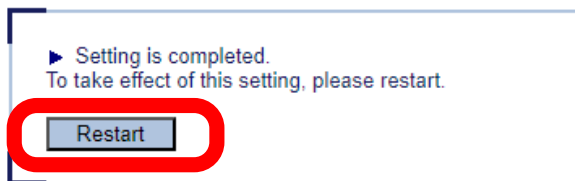
7. The restart progress page is displayed.
When the login page is displayed, the configuration is completed.

6-5. Login Password Setting

The following explains how to change the EX-150AH's login password.

1. Display the EX-150AH's Web page.

> **Note**
>
> - For how to display the EX-150AH Web page, see **3-4. Displaying the EX-150AH's Web Page**.

2. Click **System Configuration** - **Login Password** from the page menu.
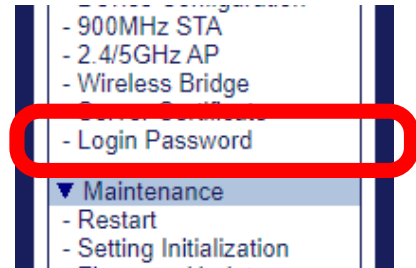
3. The **Password Configuration** page is displayed.
Enter the password to both **New Password** and **Confirm New Password** and click **Submit**.

> **TIP**
>
> - If other settings are clicked from the left menu before clicking **Submit**, the entered values will be cleared. Be sure to click **Submit** to save the current values when you move to the other page.
> - Make a note of the password so that you can refer when you have forgotten it. Without the password, no settings can be changed unless EX-150AH is reset to the factory default settings.

4. The completion page is displayed.

Click **Restart**. The new settings will take effect after EX-150AH is restarted.

▶ Setting is completed.
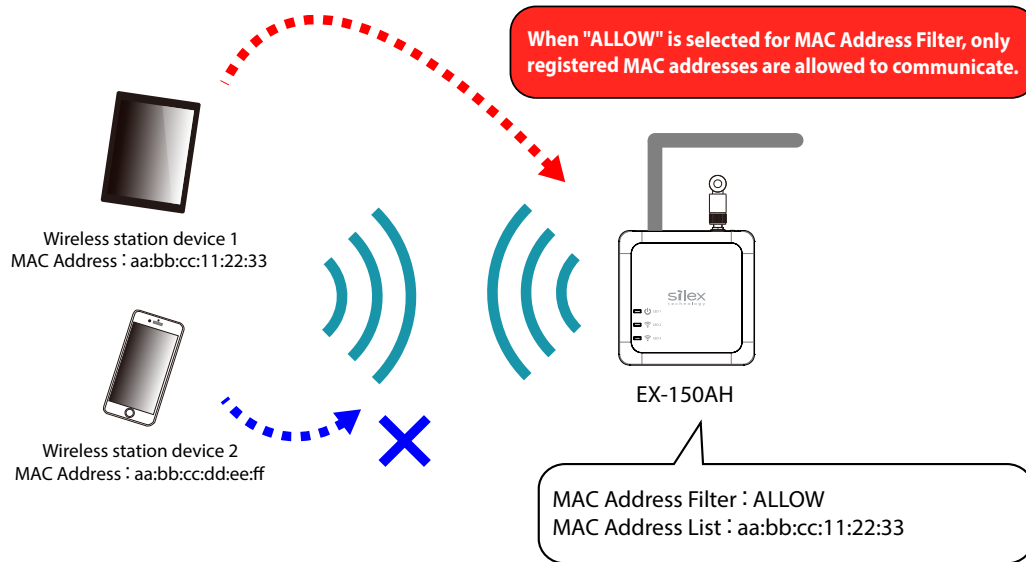To take effect of this setting, please restart.
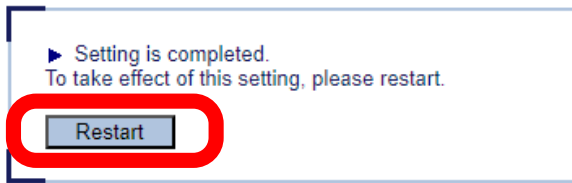
Restart

Note
- If you do not want to apply the configuration change, reset it to the previous settings and click **Submit** at the bottom right of the Web page. Remember that the changes will take effect after the restart.

5. The restart progress page is displayed.

When the login page is displayed, the configuration is completed.

7. Maintenance Functions

7-1. Restarting

This chapter explains how to restart EX-150AH.

7-1-1. Manual Restart at the Unit Side

Restart by Unplugging the Power Supply Cable

1. Remove the power supply cable of EX-150AH and re-insert it again.
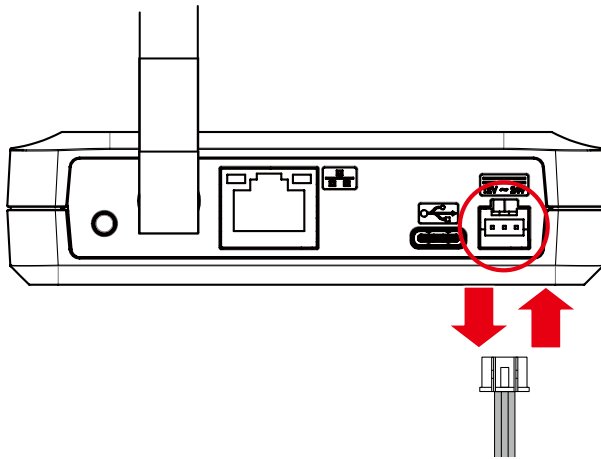
> **Note** - When the power is supplied from the USB Type-C power connector, unplug the USB Type-C cable and plug it again.

2. When the LED1 turns green, the restart is completed.

Restart by Using the Push Switch

1. Make sure that EX-150AH is turned on, press and hold the push switch (1) and release it in 4 sec (2).
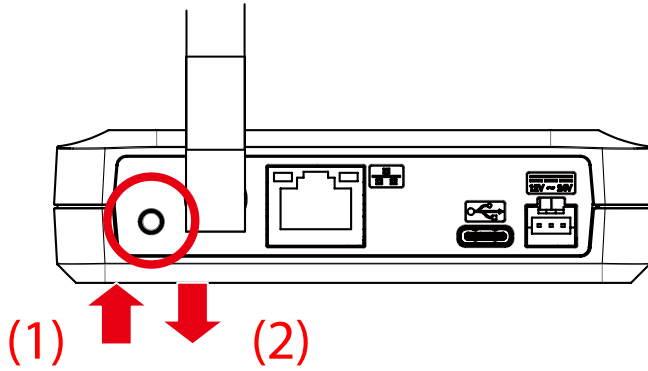
TIP - If the push switch is held down for 5 sec or longer, EX-150AH will be initialized.

2. EX-150AH will restart.

7-1-2. Remote Restart from the Web Page

1. Display the EX-150AH's Web page.

> **Note**
> - For how to display the EX-150AH Web page, see **3-4. Displaying the EX-150AH's Web Page**.

2. Click **Maintenance** - **Restart** from the page menu.
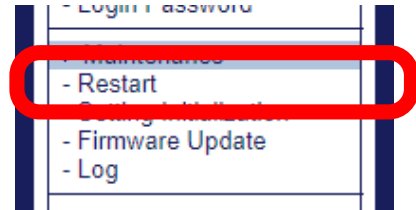
3. When the **Restart** page is displayed, click **Yes**.
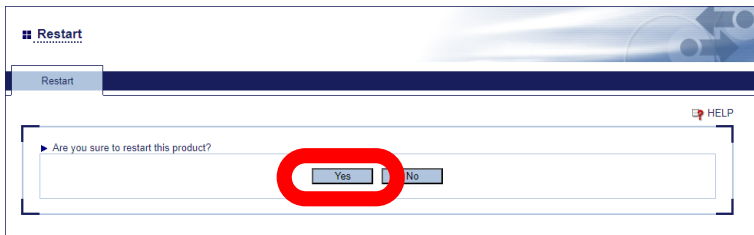
4. The restart progress page is displayed.
When the login page is displayed, the configuration import is completed.

7-2. Updating Firmware

This chapter explains how to update the EX-150AH firmware.

TIP - The firmware update takes a time if it is done over IEEE 802.11ah wireless network.

7-2-1. Downloading the Firmware

The latest firmware file can be downloaded from our website.
See the instructions below to download the firmware file.

1. Access our website below.

URL	
USA	https://www.silextechnology.com/

2. When the website is displayed, click **Support Center** in the bottom of the page.

3. Click **Networking Product Resources**.

4. Select the product model and download the firmware file.

7-2-2. Updating the Firmware

1. Display the EX-150AH's Web page.

> *Note* - For how to display the EX-150AH Web page, see **3-4. Displaying the EX-150AH's Web Page**.

2. Click **Maintenance** - **Firmware Update** from the page menu.
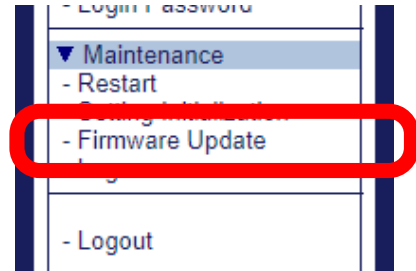
3. The **Firmware Update** page appears.
Click the button to the right of **New firmware**, and select the latest firmware (APEX-150AH.bin) that has been downloaded to the PC.
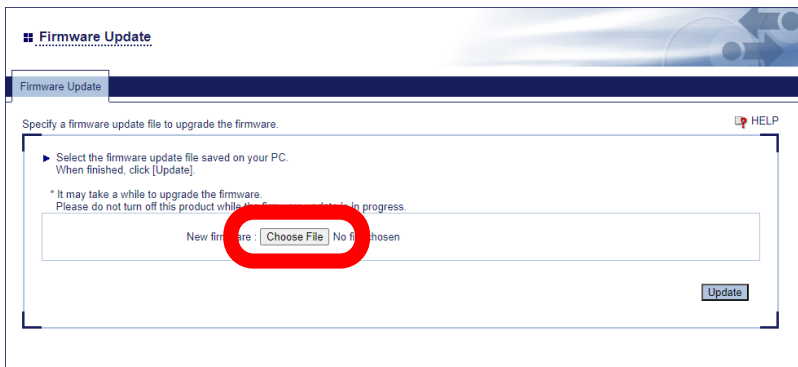
4. Click **Update**.

5. A confirmation dialog is displayed. Click **OK**

6. The firmware update will begin.

7. When the login page is displayed, the firmware update is completed.
Check the version information at the bottom left of the login page.

5. A confirmation dialog is displayed. Click **OK**

7-3. Factory Default Configuration

This chapter explains how to reset EX-150AH to the factory default settings.

7-3-1. Initialization Using the Push Switch on EX-150AH

1. Press and hold the push switch of EX-150AH and release it in 5 sec or longer to start the factory default configuration.
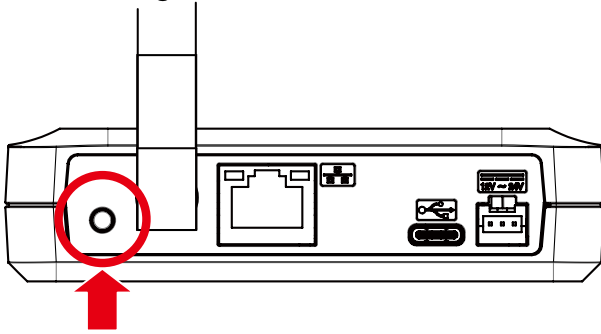
2. When the LED1/LED2/LED3 start blinking green together (1), release the push switch (2).
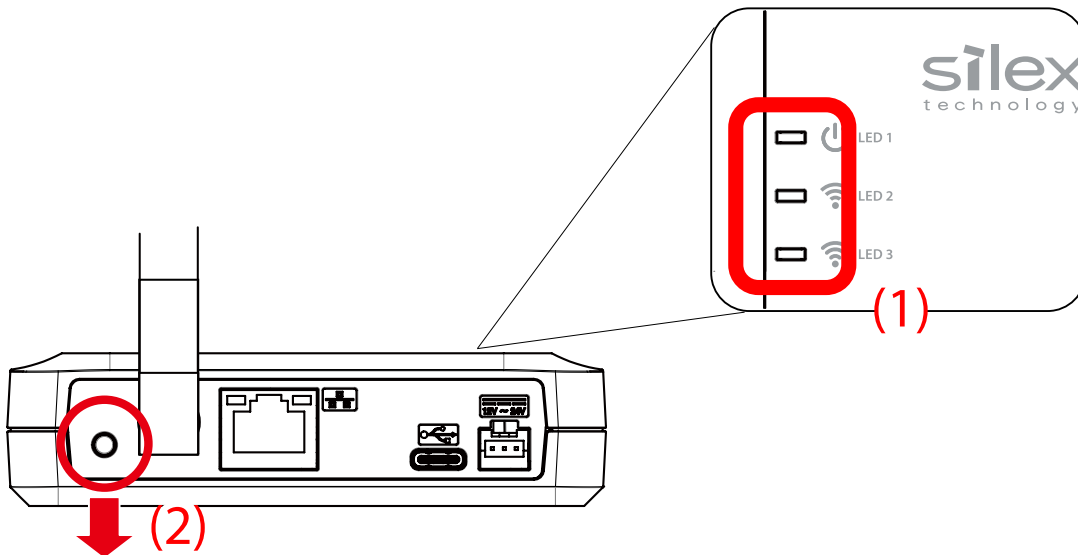
3. The factory default configuration begins.
When the LED1 turns green, the factory default configuration is completed.

7-3-2. Initialization from the Web Page

1. Display the EX-150AH's Web page.

> *Note* - For how to display the EX-150AH Web page, see **3-4. Displaying the EX-150AH's Web Page.**

2. Click **Maintenance** - **Setting Initialization** from the page menu.
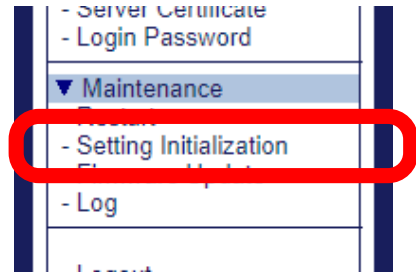
3. The **Setting Initialization** page is displayed.
Click **Yes**.
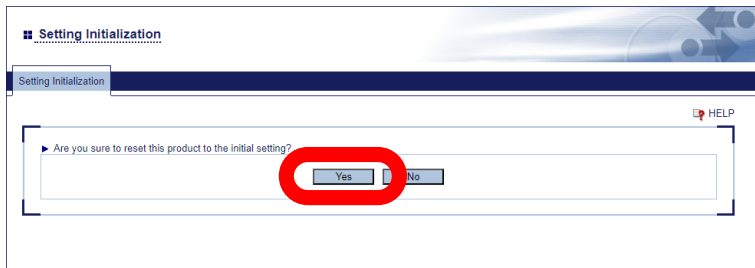
4. A confirmation dialog is displayed.
Click **OK**.

5. The restart progress page is displayed.
When the login password configuration page is displayed, the factory default configuration is complete.

A. List of All Settings

A-1. Device Configuration

General Configuration

Item	Host Name
Details	Set the host name. Be sure to use a unique name that is not used by other devices.
Range	1 to 32 characters
Default Value	EX150-xxxxxx (xxxxxx is the last 6 digits of the MAC address, and letters are uppercase)
Note	The following symbols and spaces cannot be used. `~!@#$^&*()=+[]{}|;:'",<>/?

Wired LAN Configuration

Item	Link Speed
Details	Set a link speed for wired LAN.
Range	AUTO 10 BASE-T-Half 10 BASE-T-Full 100 BASE-TX-Half 100 BASE-TX-Full
Default Value	AUTO

TCP/IP

Item	DHCP Client
Details	When this setting is enabled, an IP address is automatically obtained from a DHCP server. To assign an IP address using DHCP, the DHCP server must be running in your subnetwork. * If the DHCP server is not running, values of the following setting items will be applied. - IP Address - SubNet Mask - Default Gateway - DNS Server (Primary) - DNS Server (Secondary)
Range	ENABLE/DISABLE
Default Value	ENABLE

Item	IP Address
Details	Set the IP address. If the **DHCP Client** is enabled on your network, the IP address obtained from it will be applied.
Range	0.0.0.0 to 255.255.255.254 * IP addresses of "x.x.x.255", "0.x.x.x" (except for 0.0.0.0), and "127.x.x.x" cannot be used.
Default Value	169.254.111.111

Item	Subnet Mask
Details	Set the subnet mask. If the **DHCP Client** is enabled on your network, the Subnet Mask obtained from it will be applied. When set to "0.0.0.0", a subnet mask appropriate for the IP address is automatically assigned.
Range	0.0.0.0 to 255.255.255.255
Default Value	255.255.0.0

Item	Default Gateway
Details	Set the gateway address. If the **DHCP Client** is enabled on your network, the Default Gateway obtained from it will be applied. When set to "0.0.0.0", this setting is disabled.
Range	0.0.0.0 to 255.255.255.255
Default Value	0.0.0.0

Item	DNS Server (Primary)
Details	Set a primary DNS address. When **DHCP Client** is enabled, the DNS address obtained by DHCP will be applied.
Range	0.0.0.0 to 255.255.255.255
Default Value	0.0.0.0

Item	DNS Server (Secondary)
Details	Set a secondary DNS address. When **DHCP Client** is enabled, the DNS address obtained by DHCP will be applied.
Range	0.0.0.0 to 255.255.255.255
Default Value	0.0.0.0

A-2. 900MHz STA

Wireless LAN

Item	SSID
Details	Set the SSID of the wireless network. The SSID is an ID that distinguishes a wireless LAN network from others. For wireless devices to communicate with each other on a wireless network, they must share the same SSID.
Range	1 to 32 characters
Default Value	silex-ah-150-conn

Item	Network Authentication
Details	Set the authentication method to use to connect with Access Point.
Range	Open / Enhanced Open / WPA3-Personal
Default Value	WPA3-Personal
Note	Open 　Allows all access without authentication. Enhanced Open 　Allows all access without authentication but performing AES-CCMP-128 encryption. WPA3-Personal 　Performs network authentication using AES-CCMP-128 encryption and SAE.

Security Configuration

Item	Pre-Shared Key
Details	Set the Pre-Shared Key when the **Network Authentication** is **WPA3-Personal**.
Range	8 to 63 characters
Default Value	LetMeConnect_SX150AH
Note	This setting must be the same as that of your Access Point you wish to connect to.

Extension Configuration

Item	Transfer Rate
Details	Set the transmission rate. When **AUTO** is selected, the transfer rate is set automatically.
Range	AUTO / MCS0 / MCS1 / MCS2 / MCS3 / MCS4 / MCS5 / MCS6 / MCS7
Default Value	AUTO

Item	Tx Power(%)
Details	Set the transmission strength for wireless LAN. Lower transmission strength narrows the radio wave range of EX-150AH and reduces interference with other wireless networks.
Range	10 to 100 (Unit: 10)
Default Value	100

Item	Weak RSSI threshold(dBm)
Details	Set the threshold to notify a drop in the RSSI for the Access Point connected in an IEEE 802.11ah network. If the RSSI of the Access Point falls below the specified value, it will be notified by an LED.
Range	-35 to -95
Default Value	-75

A-3. 2.4/5GHz AP

A-3-1. 2.4/5GHz AP

Wireless LAN

Item	Location
Details	Select a location to use the IEEE 802.11ax wireless LAN. The available frequency bands and communication channels vary depending on the selected value.
Range	Indoor Use / Outdoor Use
Default Value	Outdoor Use

Item	Frequency Band
Details	Set the frequency to use for the IEEE 802.11ax wireless LAN.
Range	2.4GHz / 5GHz
Default Value	2.4GHz

Item	Channel
Details	Set the channel to use for the IEEE 802.11ax wireless LAN.
Range	When **Frequency Band** is **2.4GHz** : AUTO / 1 to 11 When **Frequency Band** is **5GHz** : AUTO / 36 / 40 /44 / 48 / 149 / 153 / 157 / 161 / 165
Default Value	AUTO

Item	SSID
Details	Set the SSID for the IEEE 802.11ax wireless LAN.
Range	1 to 32 characters
Default Value	EX150-xxxxxx (xxxxxx is the last 6 digits of the MAC address, and letters are uppercase)

Item	Network Authentication
Details	Set the authentication method to use to connect with the wireless station device.
Range	Open / Enhanced Open / WPA2-Personal / WPA3-Personal/ WPA2/WPA3-Personal
Default Value	WPA2/WPA3-Personal

Security Configuration

Item	Pre-Shared Key
Details	Set the Pre-Shared Key when the **Network Authentication** is **WPA2-Personal**, **WPA3-Personal**, **WPA2/WPA3-Personal**.
Range	8 to 63 characters
Default Value	letmein-xxxxxx (xxxxxx is the last 6 digits of the MAC address, and letters are uppercase)

Extension Configuration

Item	Weak RSSI threshold(dBm)
Details	Set the threshold to notify a drop in the RSSI for the wireless station device connected in an IEEE 802.11ax network. If the RSSI of the wireless station device falls below the specified value, it will be notified by an LED.
Range	-35 to -95
Default Value	-75

A-3-2. MAC Address Filter

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MAC Address Filter

Item	MAC Address Filter
Details	Configure the access control setting for all MAC addresses. DISABLE : MAC address filter function is disabled. ALLOW : Allows access only from the devices registered to MAC address filter list. DENY : Denies access from the devices registered to MAC address filter list.
Range	DISABLE / ALLOW / DENY
Default Value	DISABLE

Item	MAC Address list
Details	This is a list of MAC addresses registered in the MAC address filter.
Range	-
Default Value	None

A-4. Wireless Bridge

Network Device Configuration

Item	Device Filter
Details	Enable/Disable filtering for the devices registered to the **Network Device Address**.
Range	ON / OFF
Default Value	OFF

Item	Network Device Address
Details	This is a function to restrict the devices that can communicate over the IEEE 802.11ah network. Only devices with the registered MAC address can communicate with IEEE 802.11ah Access Point.
Range	MAC Address
Default Value	(None)

Address Management Table Configuration

Item	Address Management Table
Details	Enable/Disable the address management table feature (**ON**/**OFF**). When **ON** is set, combination information of MAC address and IP address will be used from management tables (IPv4/IPv6) for the connected device.
Range	ON / OFF
Default Value	OFF

Item	Management Table (for IPv4)
Details	Register combination of MAC address and IP address (IPv4).
Range	Up to 16 sets of MAC address and IP address (IPv4)
Default Value	(None)

Item	Management Table (for IPv6)
Details	Register combination of MAC address and IP address (IPv6).
Range	Up to 16 sets of MAC address and IP address (IPv6)
Default Value	(None)

A-5. Server Certificate

Server Certificate Create

Item	Common Name
Details	Set a name of EX-150AH.
Range	1 to 64 characters
Default Value	EX150-xxxxxx (xxxxxx is the last 6 digits of the MAC address, and letters are uppercase)

Item	Organizational Unit Name
Details	Enter the organization unit name.
Range	Up to 64 characters
Default Value	(None)

Item	Organization Name
Details	Enter the organization name.
Range	Up to 64 characters
Default Value	(None)

Item	Locality Name
Details	Enter the locality/city name.
Range	Up to 128 characters
Default Value	(None)

Item	State or Province Name
Details	Enter the state/province name.
Range	Up to 128 characters
Default Value	(None)

Item	Country/Region code
Details	Enter the code (two characters) representing your country or region.
Range	Up to 2 characters
Default Value	US

A-6. Login Password

Please input the password.

Item	New Password
Details	Set the login password for EX-150AH. The password is used for authentication when the user tries to update settings from a Web browser or to use **AMC Manager®**.
Range	1 to 32 characters
Default Value	(None)

B. Troubleshooting

This chapter provides the solutions for possible troubles you may experience when you are configuring or using the EX-150AH.

B-1. Problems During the Setup

I don't know the IP Address of EX-150AH.

Solution	Use "AMC Manager®". AMC Manager® can search for EX-150AH units connected to a network. For details, see **3-5. Configuration Using AMC Manager®**.

EX-150AH does not show up in the wireless network list on Windows.

If EX-150AH is not displayed in the wireless network list on Windows, you need to check the installation status, network environment and computer settings.

If you intend to setup EX-150AH via a wireless network, please confirm that the wireless adapter is enabled on your PC.	
Solution	Please confirm that the wireless adapter is enabled on your PC by checking the Windows network settings or the wireless LAN switch on your PC.

If you intend to setup EX-150AH via a wireless network, please confirm that EX-150AH is NOT placed in a location subject to weaker radio wave signals.	
Solution	Reconsider the location and surrounding conditions.

An error occurs when accessing the Web page of EX-150AH.

If an error occurs when accessing the Web page, you need to check your PC and Web browser settings.

EX-150AH may not be in the same network segment (environment without a router) as your PC.	
Solution	During the initial configuration, place EX-150AH and PC in the same network segment.

If EX-150AH has been used in another network, it may have the settings not allowing the communication with your PC.	
Solution	Please reset EX-150AH to the factory default setting. See **7-3. Factory Default Configuration** for details on how to reset EX-150AH to the factory default settings.

If your Web browser is configured to use a proxy server, access to the local network might be blocked.	
Solution	Disable use of the proxy server temporarily or enable access to the local network on your Web browser.

How should I determine the way to assign an IP address to EX-150AH?

There are two ways to assign an IP address to EX-150AH; one is to Get IP address automatically from DHCP server and the other is to Assign IP address manually. Choose the way to assign an IP address according to your environment.

	When there is a DHCP server in the network environment:
Solution	You can use Get IP address automatically from DHCP server. As EX-150AH is set by default to Get IP address automatically, EX-150AH will obtain an IP address appropriate to your network environment from the DHCP server just by powering up EX-150AH. See **7-3. Factory Default Configuration** for details on how to reset EX-150AH to the factory default settings.

	When there is no DHCP server in the network environment: When you do not prefer getting an IP address from DHCP server:
Solution	Please use Assign IP address manually. Keep in mind of the following points regarding the IP address to assign to EX-150AH. - Assign an IP address unique in the network. - Assign an IP address that has the same address class as the PC that will use EX-150AH. e.g. When an IP address of the PC is "192.168.0.xx", assign an address such as "192.168.0.100" that is not used by other network devices. (Tips about the IP address) - An IP address is a unique number for identifying network devices. An IP address is indicated with four numbers divided by a period (.), for example "192.168.0.1". The integer from 0-255 is used for each number. - An IP address is, depending on the number assigned, categorized to 3 classes below. - Numbers making up the IP address are either network numbers indicating network, or host numbers indicating each network device; each number indicates the different meaning based on the IP address class. Each class is categorized as the following diagram which is indicating a network number as n, and a host number as u. - An IP address with the same network number must be assigned to the network devices in the same network segment. - There is an address range in the IP address called the private address that could be used freely. In the LAN environment not directly connected to the internet, an IP address is assigned within the range of the private address. {table below}

First 1 digits in IP address	Class	Definition of IP address n: network number u: host number	Size of the network to be used	Private address
0 - 127	A	n.u.u.u	Large network	10.0.0.0 - 10.255.255.255
128 - 191	B	n.n.u.u	Mid-size network	172.16.0.0 - 172.31.255.255
192 - 223	C	n.n.n.u	Small network	192.168.0.0 - 192.168.255.255

B-2. Problems on Wireless Access Point Function

I cannot connect to EX-150AH wirelessly.

Please check the operation status and configuration of EX-150AH.

The wireless LAN setting may differ between EX-150AH and the connected wireless station device.	
Solution	Connect a LAN cable to EX-150AH and check the wireless LAN settings.

The wireless station device may be connected to a different Access Point that has the same SSID.	
Solution	Set a different SSID between EX-150AH and the Access Point that the wireless station device is unintentionally connected. Or, set the transmission strength lower for that Access Point to shorten the wireless coverage. * It is possible to see if the wireless station device is properly connected by accessing the Web page of EX-150AH. For details, see **6-1. Checking Status for Connected Wireless Station Devices**.

Connection is interrupted and disconnected.

EX-150AH may be installed at a location subject to weaker radio wave signals.	
Solution	Please reconsider the location of installation and condition of use.

Communication speed is too slow.

The connected wireless station device may not support the latest wireless standard.	
Solution	Use the wireless station device that supports IEEE 802.11ax. * The communication speed of IEEE 802.11ah wireless LAN is slower compared to the wireless LAN of IEEE 802.11ax. When communication is processed over IEEE 802.11ah, the speed may be slower.

I cannot connect to the wireless station device after it is connected to EX-150AH.

EX-150AH or the wireless station device may not be working properly.	
Solution	Check the status of LEDs on EX-150AH. Confirm that the connected wireless station device is turned on.

NAT function or NAPT function may not be configured correctly on the destination IEEE 802.11ah Access Point.	
Solution	If the wireless station device cannot be accessed from a device connected to the wired LAN side of the IEEE 802.11ah Access Point to which EX-150AH is connected, check the settings of NAT and NAPT functions on the IEEE 802.11ah Access Point.

C. Product Information and Customer Services

C-1. Product Information

The services below are available from the Silex Technology website. For details, please visit the Silex Technology website.

URL	
USA	https://www.silextechnology.com/

- Latest firmware download   - Latest software download
- Latest manual download   - Support information (FAQ)

C-2. Customer Support Center

Customer Support is available for any problems that you may encounter.

If you cannot find the relevant problem in this manual or on our website, or if the corrective procedure does not resolve the problem, please contact Silex Technology Customer Support.

Contact Information	
USA	support@silexamerica.com

Note - Visit the Silex Technology website for the latest FAQ and product information.