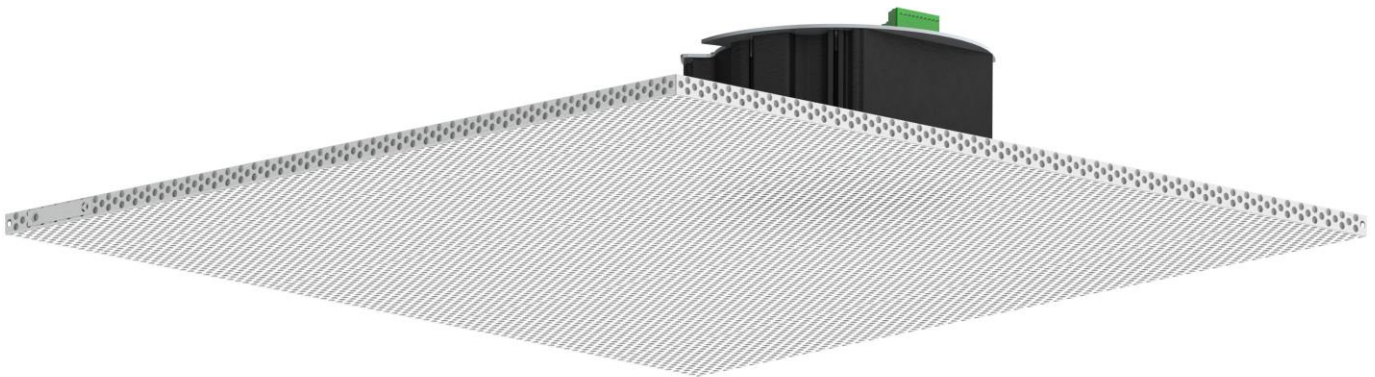# 2x2 Ceiling Speaker with SIP

Users Guide

Getting Started

This step by step guide will help you setup and install your Wahsega Labs speaker with SIP.

Important Notice

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Table of Contents

The Wahsega Labs product line offers the highest quality two-way audio and durability in the industry today. Each and every Wahsega Labs product is designed, developed and manufactured in the USA, ensuring a superior product at the best price available in the market.

Speaker Functionality

The initial functions of the Wahsega speaker with SIP include:

SIP intercom

- IP paging speaker
- Crystal clear audio
    - Multiple audio codecs, including G.722, G.711, DVI4, Speex, SILK, PCM and iLBC
    - Environmental noise suppression
- Extensive interoperability with most SIP servers and PBXs
- Peer-to-peer (P2P) mode available for decentralized communication

Multicast paging

- Eight priority levels of multicast paging, per classroom
- Pages and broadcasts play in order of priority

Web-based configuration

- All configuration options accessible through an easy-to-use HTTP Web interface
- Mic and speaker volume control within configuration webpages
- Remote firmware upgradeable

Primary inputs

- Built-in microphone
    - Two-way intercom communication
    - Available push-button override for sound reinforcement
- Two onboard relays for door control
    - Control two door locks *or*
    - Power and control one door lock

Secondary inputs

- Second RJ45 connector for easy installation and expansion
    - Able to drive second, auxiliary Wahsega speaker up to 20m away via Cat5e or Cat6 cable
- Compatible with standard panic buttons
    - Advanced panic button functionality, designed to reduce false alarm triggers with short press and long press options
- Classroom sound reinforcement with optional audio input wallplate
    - Audio input
    - Volume control
    - Activation button
    - LED indicator
    - Line-in microphone

Simple installation

- Power-over-Ethernet
    - PoE 802.3af powered
- QR code label for easy MAC address identification
- Simple 2x2 lay-in grid ceiling installation
- Standard earthquake tabs for added stability

Industrial temperature range (-40°C to +85°C)

Industry-leading standby power of < 1W

Integrated status LED

Quality Standards

- Wahsega Labs products achieve the highest standards of performance in the market by utilizing our complete quality assurance program encompassing software testing, product design and a multistage automated factory test program.

- Wahsega Labs' ultimate goal is to provide a solution that is both cost effective and unsurpassed in quality. By leveraging existing relationships with suppliers to guarantee premium components at the lowest possible prices, we are able to ensure Wahsega Labs products are the finest quality in the market while still offered at highly competitive prices directly to installers.

- In order to achieve the greatest possible voice clarity, all voice and related algorithms have been individually tested to ensure the highest potential MOS score. The accumulated error syndrome, which can cause poor voice quality, is mitigated through this testing process.

- Wahsega Labs' engineering team utilizes a wide array of dedicated test servers to pull and build the various software projects multiple times per day. Each automatic build is then run through an extensive set of automated test cases to ensure the highest performance of each and every firmware version released. This test case coverage is expanded on a continual basis.

- All Wahsega Labs products are 100% factory tested at the board level through a bed of nails full functional test, not just an "is it close enough?" flying probe test. Every finished product is 100% tested again after the final assembly via an automated test station to ensure the highest production quality product for installers.

- To assure the highest quality standards, all Wahsega Labs products are designed, developed and manufactured in the USA.

The Wahsega 2x2 Ceiling Speaker with SIP may look like a standard 2x2 ceiling tile speaker, but it can receive audio from multicast IP broadcasts or from a SIP PBX, and it can act as an intercom for two-way conversations with the help of its built-in microphone.

The speaker may also be connected to a panic button to make emergency SIP calls and/or to a remote wall panel to access classroom sound reinforcement functions. Its two onboard relays can be controlled remotely to operate door locks for up to two doors per classroom.

In addition, a second, auxiliary speaker may be connected up to 20 meters away via Ethernet cable. This auxiliary speaker—which is powered by the first speaker—can be either in the same classroom as the primary speaker or in a separate classroom. Although powered the same way, these two applications function differently.

In a single-classroom application, the auxiliary speaker acts as a companion to the main speaker. The auxiliary speaker's volume can be adjusted independently, but it will always broadcast the same audio as the main speaker. In this application, the primary speaker controls features such as door locks, microphone, panic button and sound reinforcement.

In a two-classroom application, the auxiliary speaker has its own SIP account, enabling it to send and receive audio independent of the main speaker. It functions separately from the primary speaker, controlling door locks, microphone, panic button, and sound reinforcement of its own. To an end user, the auxiliary speaker appears to be completely autonomous; it is simply powered by the primary speaker.

Once your speaker is installed and configured, you will be able to receive SIP calls with no additional in-room setup. Two-way communication is clear and simple with a built-in microphone which transmits audio from the classroom to the caller.

If a panic button is connected to the speaker, it will make an emergency call to a preset SIP number on the PBX. To reduce the incidence of false panic calls, the panic button has two call modes: short press and long press. The short press call—which is a call placed after the button is depressed for any length of time **less** *than two seconds*—calls a first, preconfigured number, such as a front office. The long press call—a call placed after the button is depressed for *two or more seconds*—calls a second, preconfigured emergency number, such as 911.

If the installation includes a sound reinforcement wall panel, that panel will also have an audio input, volume control, activate button and LED indicator light.

Software Capabilities

The speaker's configuration is accessible using an HTTP Web interface, viewable from any Web browser on the same LAN. This allows access to various settings such as network/IP address, SIP account configuration, RTP multicast broadcast configuration, intercom/speaker behavior, panic button call numbers, and administrative functions such as firmware upgrade and configuration backup/restore. The configuration is stored in a `.JSON` file, which is human readable and can be edited by site administrators.

Getting Started

1. Connect the speaker's main Ethernet port—labeled *POE*—to a network using a Power-over-Ethernet (PoE) Ethernet connection. When connected, it will power on immediately, and the *LINK/ACTV* LED on the Ethernet port will begin to blink.

2. Locate and note your speaker's MAC address. It is printed as a QR code on a white sticker on the front of the speaker. Simply scan the QR code with a smartphone or tablet QR reader app, and it will give you the MAC address for that speaker.

3. Discover your speaker's IP address. When it boots, the speaker uses DHCP by default to automatically obtain a suitable IP address on your local area network (LAN). It also runs Simple Service Discovery Protocol (SSDP) so you can discover it from Windows Explorer or any SSDP-enabled application.
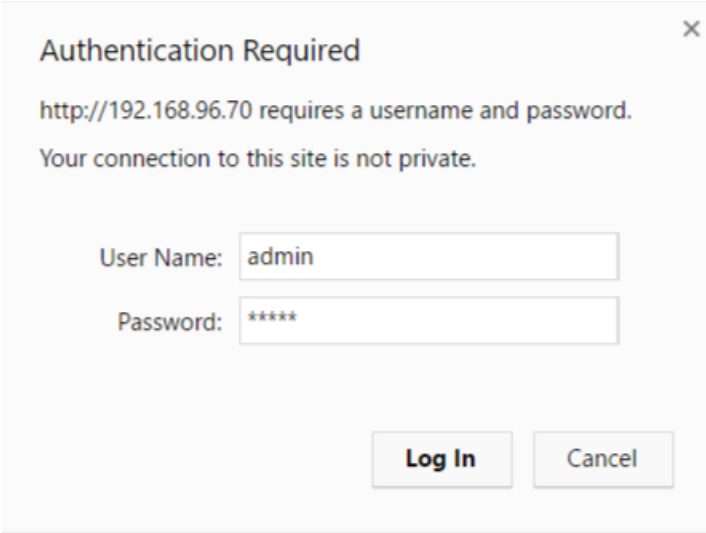
    From a Windows PC on the same LAN, open "My Computer." In the left-hand pane, go to the "Network" view.

    Right-click in the right-hand Network pane and select "Refresh." This will start a search for devices on the network. You may get a popup asking if you want to allow your PC to search the network, in which case you should click "yes" or "allow."

    If you are not using SSDP or cannot discover the speaker on your network, you can:

    - consult your DHCP server's logs to determine its IP address;
    - use a network discovery app (such as Fing on iOS and Android); or
    - use Wireshark to observe the DHCP network traffic.

4. Once the search is complete, the speaker will appear in the Network view as "Wahsega Speaker (:XX:XX)." The last two octets of its MAC address will be included in its name, so you can easily distinguish multiple units. Double-click the speaker's icon to open its Web interface.

5. Once you determine the speaker's IP address, navigate to that IP address in your Web browser (for example, `http://123.456.78.9`).

6. When you access the webpages, the speaker will ask for a username and password. The default username and password are *admin* and *admin*.

7. On the right side of the page is the Status bar. It shows the current SIP account status (default status is unconfigured and unregistered) and the speaker's system information (current IP address, Ethernet MAC address and system time).

8. To change the IP address settings, go to the *Network* page and modify settings in the *WAN* section. To set the network for DHCP, click the *Dynamic IP* radio button. For static IP addressing, click the *Static IP* radio button and fill in the relevant IP address fields with values from your network administrator.

9. To change the SIP account settings, go to the *Accounts* page and modify settings in the account. Most users will only need to set *Username/Number* (the phone number or extension assigned to this speaker) and *Domain* (the hostname or IP address of your SIP server). You may also provide an *Account Name*, which is used only for logging purposes, and a *Display Name*, which may be used by your SIP server depending on its configuration.

    If a password is required for your SIP server or proxy server, provide it in the *Password* field. If your SIP server or proxy server requires an authentication username that is different from the name entered in *Username/Number*, enter it under the *Advanced* tab in the *Auth Username* field.
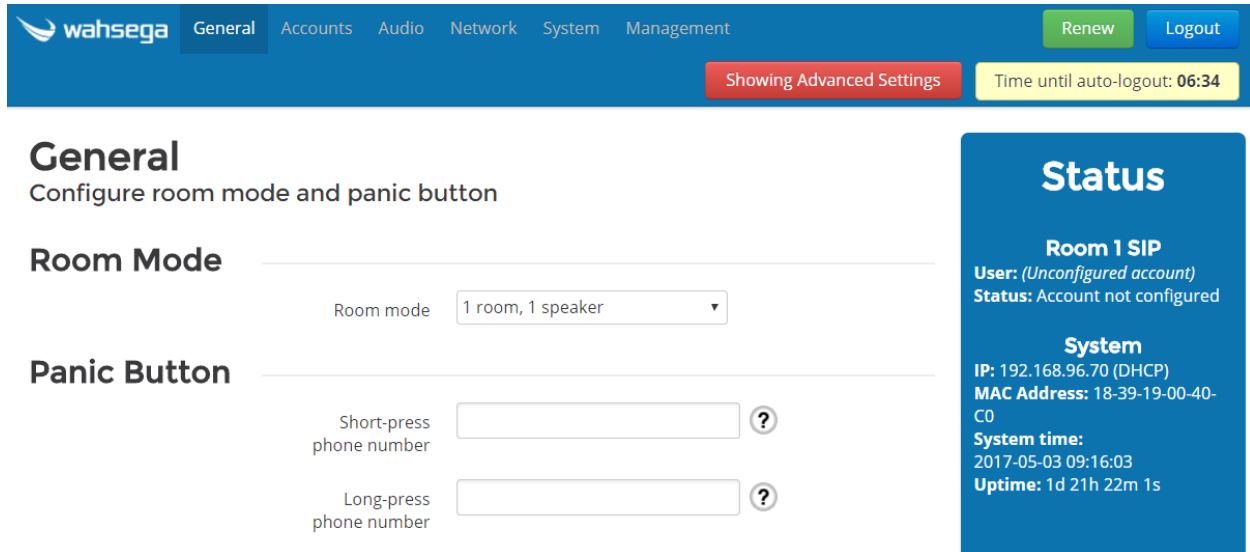
10.   After configuring the network and SIP settings for your speaker, use the configuration settings described in the next sections to customize the speaker, intercom, panic button and other functionality.

The Web interface is a set of webpages used to configure the various settings available on the speaker. It allows the speaker to be configured from any computer or device with a Web browser on the same network as the speaker.

General Settings

The *General* page configures settings for Room Mode and Panic Button.

Room Mode

- **Room Mode –** Configure the number of rooms and/or speakers controlled by this primary speaker.

    - **1 room, 1 speaker –** Single room, single speaker configuration.

    - **1 room, 2 speakers –** Single room, two speaker configuration.

    - **2 rooms (1 speaker each) –** Two room configuration. Multicast, SIP and audio settings will be independently configured for each room on Accounts and Audio webpages.

Panic Button

- **Short-press phone number –** The number or extension to call when the panic button is pressed for *less than two (2) seconds*.

- **Long-press phone number –** The number or extension to call when the panic button is pressed for *2 seconds or longer*.

Account Settings

The **Accounts** page configures settings for Multicast and SIP accounts for the primary speaker (Room 1) and second room speaker (Room 2), if applicable.

There are nine (9) priority levels in each room for Multicast and SIP calls. Four of the multicast streams are considered "high priority" and four are considered "low priority." The SIP account for each room is considered "medium priority," and its configuration options can be found in the middle of the list.

Room 1 Multicast

- **Account name –** The name to use to identify this Multicast account. It will only be shown on this page and in the system logs.
- **Multicast IP address –** The multicast IP address this account should listen on to receive RTP audio. Valid addresses range from `224.0.0.1` to `239.255.255.255`.
  - **Note:** Some addresses, particularly in the `224.xx.xx.xx` range, are globally reserved and should not be used! Consider using addresses in the `239.255.xx.xx` range, which are "Administratively Scoped Local Addresses."
- **Port –** The UDP port this account should listen on to receive RTP audio. Valid ports range from `1` to `65535`. Setting this to `0` will use the default RTP port, which is `5004`.

Room 1 SIP

- **Account name –** The name to use to identify this account. It will only be shown on this page and in the system logs.
- **Display name –** The name to report to the SIP server, which may be shown to other callers (depending on the SIP server's configuration).

- **Username/Number –** The phone number or extension this speaker is configured with on the SIP server.
- **Domain –** The hostname or domain name of the SIP server. Not used in peer-to-peer (P2P) mode.
- **Register with domain –** If checked, operates in normal SIP mode. If unchecked, operates in P2P mode.
- **Password –** If the SIP server requires a password to authenticate, enter it here.

Room 2 Multicast

- **See settings above if applicable.**

Room 2 SIP

- **See settings above if applicable.**

Audio Settings

The *Audio* page configures settings for speaker and microphone audio as well as codec selection.

Audio Settings

- **Speaker volume –** Increase or decrease decibel level of speaker output. Default level is 0 dB, or no change.

- **Microphone volume –** Increase or decrease decibel level of microphone input. Default level is +15 dB.

- **Microphone high-pass filter –** Eliminates low-frequency noise that can make speech difficult to understand.
    - **DC blocker only** – Eliminates hum from power lines while leaving other low-frequency sounds intact.
    - **High-pass mode –** Eliminates most noise below standard telephone frequencies.

- **Noise suppression –** This option reduces background noise such as fans and hums. It has no effect locally; it is only audible to the party on the other end of a call from the intercom.

SIP

- **Choose preferred codecs –** These settings enable/disable audio codecs and set their order of use for SIP calls. The system tries codecs at the top of the *Preferred* list before trying codecs at the bottom of the list.
    - To select your preferred codec(s), highlight the *Available* codec(s) you would like to use and click *Enable*. This will add the selected codec(s) to the *Preferred* list on the right.

    - To change the priority level of a preferred codec, simply highlight it in the *Preferred* list and click *Move Up* or *Move Down*.

Network Configuration

The **Network** page configures settings for TCP/IP networking.

WAN

- **Connection Type**

    - **Dynamic IP –** Choose this to use DHCP to assign an address automatically. Note that when using DHCP, you will have to determine the IP address assigned to the speaker using your DHCP server or through some other method in order to access the configuration webpages in the future.

    - **Static IP –** Choose this to enter IP address settings manually.

        - *Warning: If you enter a configuration that is not accessible from your network, you may be unable to communicate with the speaker! Double-check that the settings you enter are correct before rebooting the speaker to apply them.*

Additional Settings (advanced)

- **Enable IGMPv3 –** Check to enable IGMP version 3 on your speaker. If unchecked, IGMP version 2 (IGMPv2) will be used. Default setting is *disabled*. If you know that your routers have IGMPv3 enabled, you can safely enable this setting. *If unsure, leave disabled* to ensure support with routers that only use IGMPv2.

- **MTU size –** Maximum transmission unit allowed on the Ethernet connection. The standard for Ethernet networks is 1500, and you *should not change this value* unless directed by your network administrator.

STUN

- **Server/Port –** Enter your STUN server here if applicable. STUN servers may be required to operate with a public SIP server from behind a NAT or router.

RTP

- **Port Range –** Select the UDP port range to use for sending RTP audio network traffic during a call.

SNMP

- **SNMP Enabled –** SNMP is required to control relays in the speaker. *The speaker's relays cannot be used while SNMP is disabled*, so be sure to check this box if you may be using relays.

- **Port –** The port number used for SNMP.

- **Read-only community string –** The community string that will allow read-only access to SNMP variables on this device. SNMP community strings are sent in plain-text, so *do not re-use a password that's used for any secure logins or devices!*

- **Read-write community string –** The community string that will allow read-write devices to access the SNMP variables on this device. SNMP community strings are sent in plain-text, so *do not re-use a password that's used for any secure logins or devices!*

General System Configuration

The *System* page configures settings for the speaker's operating system and other administrative functions.

Authentication

- **Username –** Set the username and password used on the configuration webpages and Telnet shell. Default is *admin*.

Syslog (optional)

- **Report to server –** Configures a syslog server that can receive system logs from the speaker. This requires a PC or server running a syslog server to receive and store the logs.
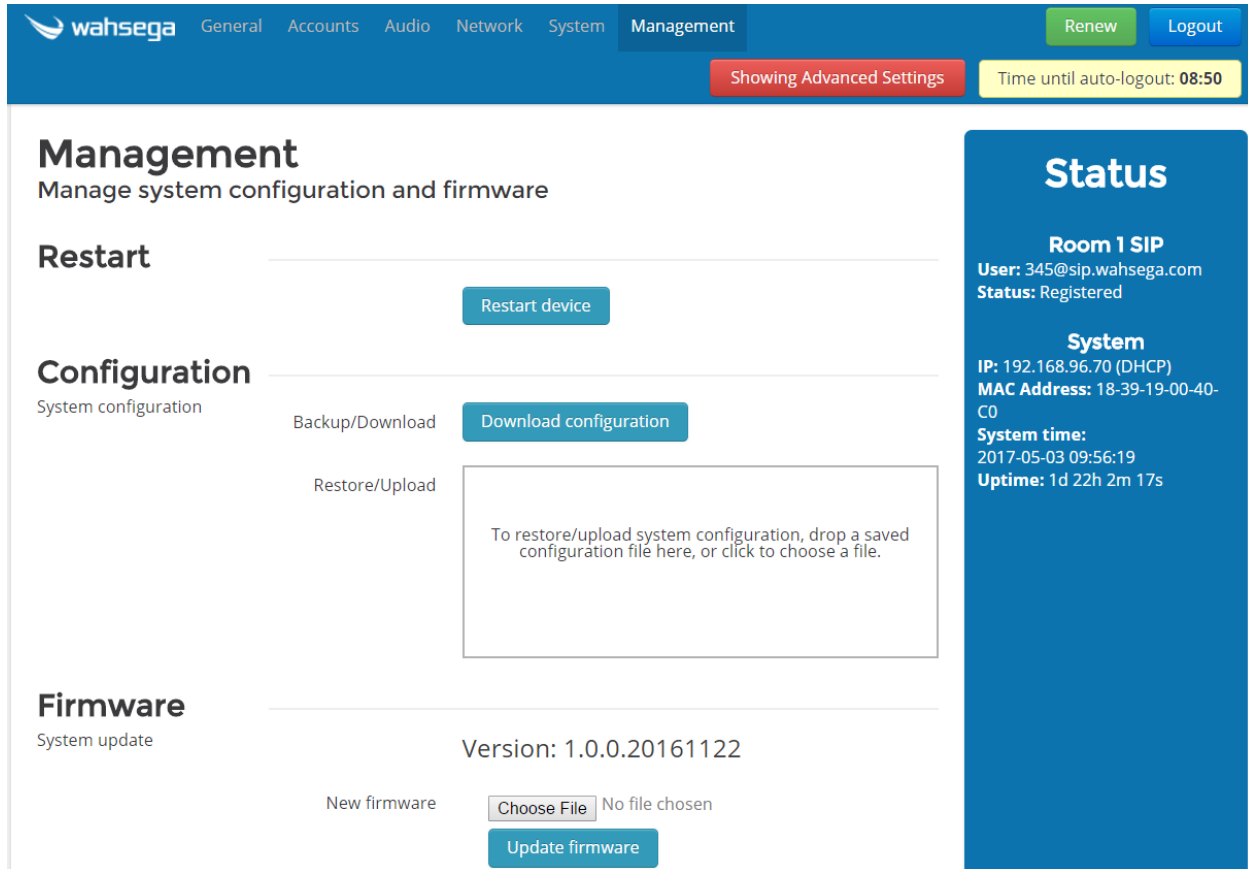
Date & Time

- **NTP Enabled –** Automatically determines the time of day using an NTP server. This is recommended, as the speaker does not have a battery-backed clock.

- **Daylight saving time –** Select this only if daylight saving time is currently in effect in your location. (For more information about DST rules and dates, see http://www.nist.gov/pml/div688/dst.cfm.)

- **Time zone –** Select the region that most closely matches your time zone. (Note that daylight saving time is *not* automatically applied based on region.)

System Description (optional)

- **System contact –** Identification and contact information for this device's administrator (usually an IT person).

- **System name –** Administratively-assigned name for this device. By SNMP convention, this is the device's fully-qualified domain name. Also available through SNMP as `sysname` (`1.3.6.1.2.1.1.1.5`), as defined by RFC 1213.

- **System location –** The physical location of this device (e.g., "3rd floor telephone closet"). Also available through SNMP as `sysLocation` (`1.3.6.1.2.1.1.6`), as defined by RFC 1213.

Firmware Management

The **Management** page has functions for managing the speaker's configuration and firmware.

Configuration

- **Backup/Download –** Use this to retrieve a copy of the speaker's current configuration and save to disk.

- **Restore/Upload –** Use this to upload a valid configuration file (.json format) that has been retrieved and saved from a speaker. *Note that a reboot will be required before the settings take effect.*

Firmware

- Use this to upload new firmware.
  - First, click "Choose File" and select the appropriate firmware file in `.bin` format.
  - Next, click "Update firmware."
  - Once the file has loaded and your device begins its update, it will restart automatically with the new firmware in place.

- *DO NOT UNPLUG THE SPEAKER OR INTERRUPT THE FIRMWARE UPGRADE PROCESS BEFORE IT COMPLETES, OR IT MAY BE RENDERED UNUSABLE.*

Software-based Factory Reset

If you need to erase the configuration settings in your 2x2 Ceiling Speaker with SIP, you can do so in one of two ways. **Option A** returns only IP settings to factory default, and **Option B** returns all of the speaker's settings to factory default.
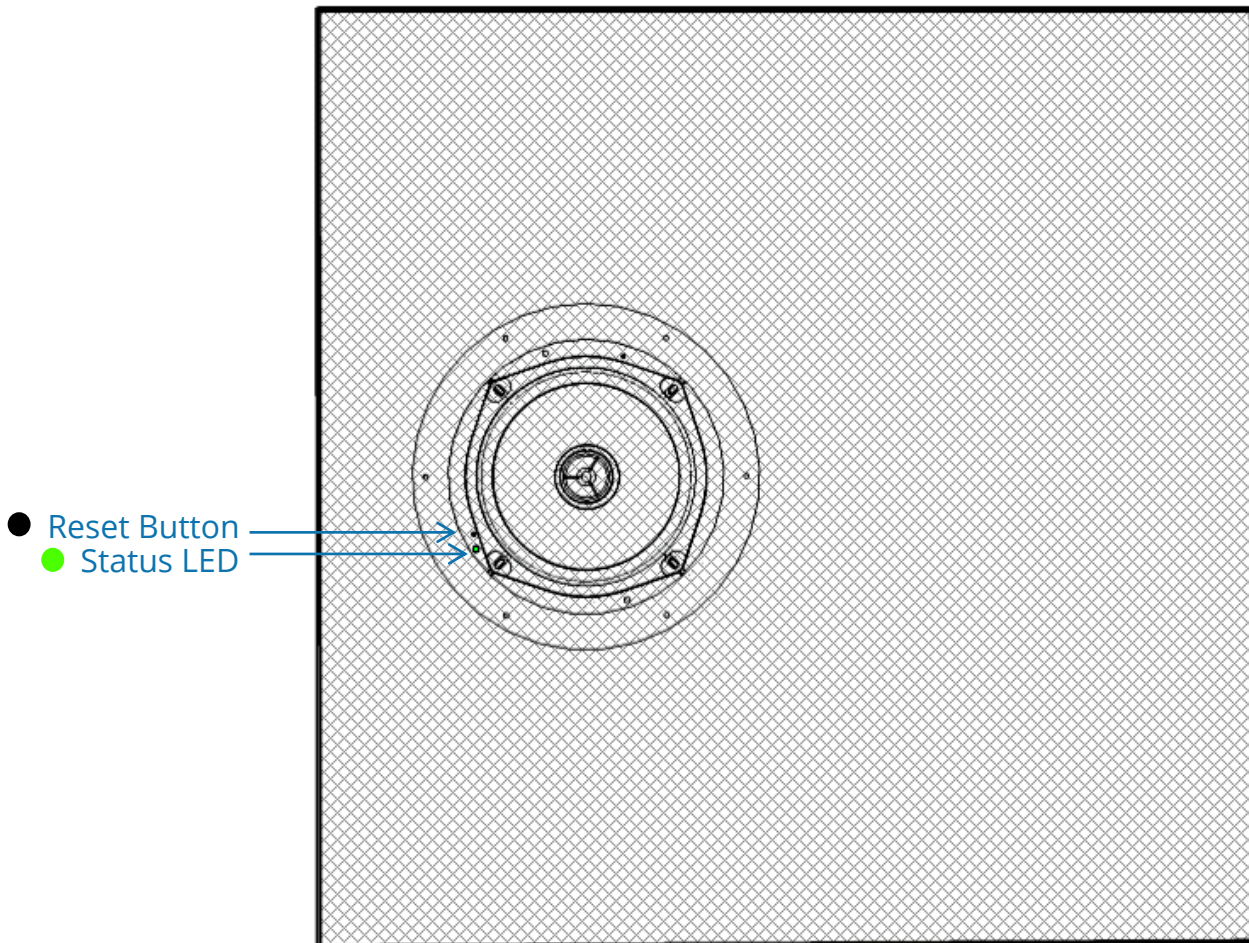
Reset Button
Status LED

Figure 1

Option A – Steps for activating a partial factory reset:

1. Start with the PoE cable plugged in and the speaker powered **on**.

2. Find the green status LED on the face of the speaker. Next to the status LED, locate the small, black reset button.

3. Press and hold the reset button until the status LED begins to blink. (If the status light does not begin to blink, reposition and try again.)

4. Once the status light begins to blink, release the button, and the LED should return to a solid green.

5. You have successfully reset your ceiling speaker's IP address to its default DHCP address. You will need to use this new, dynamic IP address to access your speaker's configuration webpages again.

Option B – Steps for activating a full factory reset:

1. Start with the PoE cable unplugged and the speaker powered **off**.

2. Plug in the PoE cable and apply power to your ceiling speaker. As soon as power is applied, hold the reset button as the status light begins to blink.

3. Once the status light starts to blink, continue to hold the button for **at least five (5) seconds.**

4. After 5 seconds, the status light will flash more slowly, indicating that the file system has been reformatted and all data has been erased from the device.

5. Unplug and restart your speaker for the new settings to take effect.

6. If you have previously changed the IP address of your ceiling speaker to a static IP address, keep in mind that restoring factory default settings will return your speaker to dynamic IP (DHCP) mode. You will need to use the new, dynamic IP address to gain access to your speaker's configuration webpages once again.

7. You have successfully reset your configuration!

2x2 Ceiling Speaker
with SIP

WL-SPKR-22-SIP-1

WL-SPKR-22-SIP-2

WL-SPKR-22-B

User's Guide

Rev 053017