

## 30W 70V Coax Speaker Pair



**User's Manual**

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## SAFETY WARNINGS AND GUIDELINES

- Turn off and unplug all equipment prior to making electrical connections, including speaker wire connections.
- Reduce the volume level prior to making any change to the audio input source, e.g., changing radio stations or changing CDs.
- When using this speaker as part of a constant voltage speaker system, ensure that the amplifier power is at least 20% higher than the total power settings of the connected speakers.
- Most speaker damage is caused by clipping, which is heard as distortion. If you hear distortion, reduce the volume level until the audio is no longer distorted.
- Take care to ensure that the speaker wire connections are properly polarized. Inverted polarization can result in unnatural or attenuated sound, especially in the bass frequencies.
- Do not use chemical cleaners or solvents to clean this speaker. Use only a soft, dry cloth. Moisten the cloth with warm water for particularly stubborn deposits.

## INTRODUCTION

Thank you for purchasing these In-Ceiling Speakers! In-ceiling speakers are the ideal combination of sound quality and styling. Rather than cluttering the room with large box speakers trailing speaker wires, the speakers are virtually invisible, while filling the room with high fidelity audio. Featuring removable and paintable grilles, these 2-way speakers use polypropylene and mica woofer cones with rubber surrounds for deep, impactful bass, and PEI dome tweeters for sweeter and smoother high frequencies.

These 2-way speakers feature a built-in step-down transformer, allowing them to be used as part of a 70V or 100V constant voltage speaker array, with three 70V and two 100V taps. They can also be used as conventional 8-ohm speakers for use in a standard home theater audio system.

## FEATURES

- Polypropylene + mica cone woofers
- PEI dome tweeters
- 8-ohms nominal impedance
- Compatible with 70V and 100V constant voltage speaker systems
- Built-in step-down transformer with three 70V and two 100V taps
- Removable and paintable grille

## PACKAGE CONTENTS

Please take an inventory of the package contents to ensure you have all the items listed below.

2x Coaxial in-ceiling speakers

1x Grille removal tool

1x Roll grille putty

1x Cutout template

1x User's manual

## CONSTANT VOLTAGE VS 8-OHM SPEAKER SYSTEMS

A constant voltage speaker system differs from a traditional 8-ohm speaker system in that it uses a step-up transformer at the audio source to raise the voltage and lower the current on the transmission line. At the speaker end, a step-down transformer converts the signal back to a normal speaker level voltage. This reduces power loss during transmission, which allows for the use of longer speaker wire runs using smaller gauge wire.

Additionally, a constant voltage speaker system allows for the use of multiple speakers on each channel, without the need for complicated impedance calculations and configurations. In a constant voltage system, all speakers on a given channel are connected in parallel and the complicated impedance calculations are replaced by simple wattage calculations.

For example, if you want to connect two speakers per channel in a traditional 8-ohm speaker system, you must either connect them in series, which results in an overall 16-ohm impedance, or in parallel, which results in an overall 4-ohm impedance. In the first case, the 16-ohms impedance effectively halves the output power of your amplifier, resulting in lower overall volume levels. In the latter case, the 4-ohms impedance means that your amplifier will have to work harder and must be rated as stable at 4 ohms. Adding a third speaker to the mix would complicate it further, producing either a 24-ohm or 2.67-ohm overall impedance. Note that very few amplifiers are stable under 2-ohm loads, so that is usually not an option.

On the other hand, with a constant voltage system, you consider first the RMS output wattage of the amplifier. This should be reduced by 20% to compensate for insertion loss. For example, if using a 100-watt amplifier, the total load from speakers should not exceed 80 watts.

Each individual speaker on a given channel is set to a value such that the total does not exceed the rated power, less 20%. You do not need to worry about making the total as close as possible to the limit; just ensure that the total does not exceed the limit.

If all speakers are set to the same wattage value, they will all have the same volume level. If one speaker is set to a higher wattage value, it will be louder than the others, while a speaker set to a smaller value will be quieter than the others. This allows you to compensate for the environment in which the speaker is placed. For example, a speaker placed outside would need to be louder than a speaker placed in a small room.

## **SPEAKER WIRE PREPARATION**

Before attempting to make any connections it is best to look at the situation, get all the necessary materials together, and then make all the connections at once.

First, look at the back of your amplifier or receiver to determine what options it offers for making connections. Amplifiers and receivers typically employ either 5-way binding posts, spring-loaded terminals, or push terminals for the speaker connections.

A 5-way binding post can accept bare speaker wire, spade plugs, pin plugs, and banana plugs, while spring loaded terminals and push terminals can accept either bare speaker wire or pin plugs. Refer to the documentation that came with your amplifier or receiver to determine the maximum size/gauge speaker wire the speaker terminals can accept.

These in-ceiling speakers feature push terminals, which can accept pin plugs or bare wire up to 14AWG, as well as bare wire leads for connecting a constant voltage speaker array.

If your amplifier can accept it, you should use 14AWG speaker wire. Using pin plugs is highly recommended for several reasons. Plugs are easier to connect, don't run the risk of stray wire strands shorting the connections, allow for use of heavier gauge speaker wire in most cases, and it is much easier to identify the polarity from a color coded ring on a plug than from a subtle marking along the length of a wire.

Because the speaker wires will necessarily be run through your walls, you must use in-wall rated wire. This is required by fire safety codes and ensures that the wire jacket will not act as an accelerant in the event of a fire.

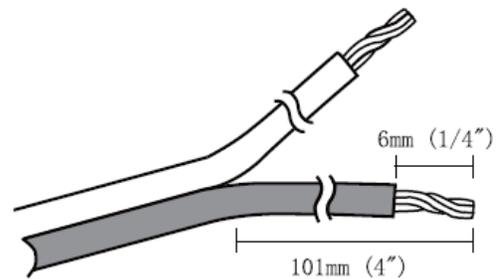
Rather than using fixed length speaker wires, it is best to get a roll and cut the wires to the length you will need them. This ensures that there is a minimum amount of excess wire. However, even if your amplifier is off-center, the lengths of wire used for each speaker pair should be identical. This keeps the impedance on each channel the same, which ensures

that the volume levels, frequency ranges, and tonalities are identical. Any excess wire should be snaked back and forth, not coiled, to avoid creating an inductor/antenna for stray radio signals.

Before making the actual connections, cut each length of wire to size. Note the markings on the wire that differentiate between each conductor. Sometimes the marking clearly identifies a positive and negative side. Some common clearly positive and negative markings or identifiers are:

Positive	Negative
Red	Black
Copper	Silver
+++	---

In many cases, the mark is a single stripe on the jacket of one of the connectors. In this case the side with the stripe is generally considered the positive side, but it really does not matter as long as you are consistent and always using the stripe as positive or always using it as negative.

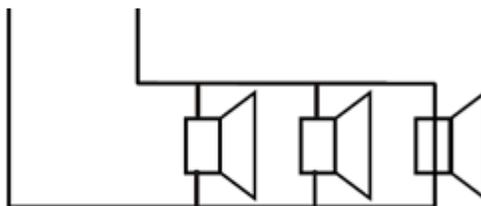


When you are ready to prepare your speaker wires, first separate about 4" of wire, then strip about 1/4" (6mm) insulation from the end and twist it to prevent stray strands. If you plan to use banana or pin plugs (highly recommended), install the plugs on the wire.

## SPEAKER WIRING

If using this speaker as a conventional 8-ohm speaker, most installations will consist of only a single speaker per channel. Wiring a speaker this way is straightforward, with a single two-conductor speaker wire running from the amplifier to the speaker's inputs.

However, when used as part of a constant voltage speaker system, most installations will consist of multiple speakers per channel. In this case, all speakers are connected in parallel, as shown in the diagram to the right.



These speakers use different colored wire leads attached to the different taps on the step-down transformer for the various wattage settings. The following tables show the different wattage values for each of the wire leads on each model.

24213		
Input	70V	100V
Black	Common	
Blue	6W	N/A
Brown	3W	6W
Yellow	1.5W	3W

24214		
Input	70V	100V
Black	Common	
Brown	20W	N/A
Orange	10W	20W
Blue	5W	10W

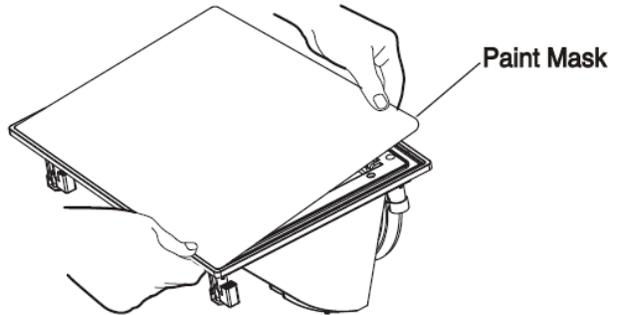
24215		
Input	70V	100V
Black	Common	
Red	30W	N/A
Blue	15W	30W
Yellow	7.5W	15W

## PAINTING

The grille and frame can be painted to match your ceiling, making the speaker even less noticeable. Perform the following steps to safely paint them without damaging the speaker.

1. Remove the center portion of the cardboard installation template/paint mask. The central portion is the paint mask, while the outer portion is the installation template.

2. Completely remove the grille by inserting a paper clip or the included grille removal tool into one of the holes and pulling to lift it off the frame.
3. Remove the foam insert and set it aside.
4. Insert the paint mask, covering the speaker while leaving the frame exposed.
5. Paint the speaker frame and grille. It is best to use spray paint to avoid paint clogging the holes in the grille.
6. Allow the paint to completely dry before proceeding with installation.  
Ensure that the holes in the grille are not blocked by paint.



## SPEAKER BREAK-IN

In the same way that a new car requires a break-in period before it can be safely operated at high engine RPMs, speakers require a break-in period before they can be safely operated at maximum volume levels. Proper break-in ensures that the moving parts of the speaker (the cone and cone suspension) are allowed to flex and soften, losing the initial stiffness and allowing the speaker to move through its full intended range. After the break-in period, the speakers will produce richer and fatter sounding lows, warmer and smoother sounding mids, and cleaner and more accurate highs, without any hint of distortion.

The best way to break-in speakers is simply to play normal music or watch movies at moderate volume levels. The amount of time required for speaker break-in varies based on the operating environment, but is typically in the area of 50~80 hours. It will take a bit longer in a cold or dry environment and a little less time in a warm or humid environment.

*Note that the break-in period does not have to be continuous.*

# INSTALLATION

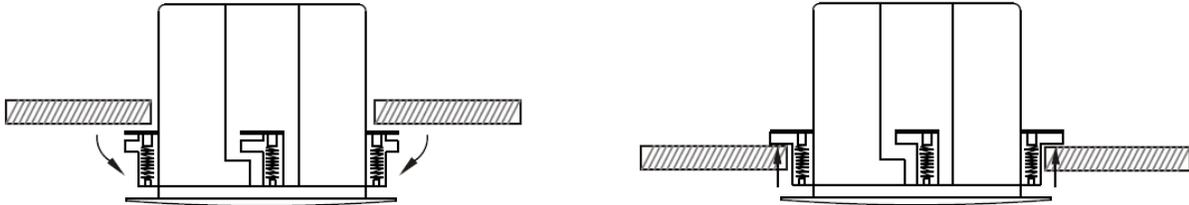
Perform the following steps to install the speaker into a drywall ceiling. The speaker can be mounted to a surface that is between 3/8" and 1-1/4" thick, with at least 5.5" internal clearance.

1. Determine where you will be installing the speaker. Use a stud finder to ensure that there is sufficient space between the desired location and the adjacent ceiling studs. Be sure and check for perpendicular framing members, as well. Use a pencil to mark the edges of the adjacent studs.
2. If you have not already done so, remove the center portion of the cardboard installation template/paint mask and set it aside. The central portion is the paint mask, while the outer portion is the installation template.
3. Position the installation template against the ceiling at the installation location.
4. Use a pencil to mark the cut line on the wall.
5. Remove the template from the wall and set it aside.
6. Drill a small hole in the middle of the cutout area. If the proposed installation location is not clear, you can more easily repair the small hole than if you cut without checking and find one or more obstructions.
7. Take a stiff piece of wire, such as a hanger, and bend it 90° about 7" from the end. Insert the wire past the bend, then rotate the wire 360° to check for hidden obstructions above the ceiling. Push it in to ensure that there is sufficient clearance above the ceiling.
8. Once you know your installation location is clear, use a drywall or keyhole saw to cut along the cut lines.
9. If you have not already done so, prepare your speaker wire in accordance with the guidelines in the *Speaker Wire Preparation* section above.  
**Important! Because the speaker wire will necessarily be routed through your walls and ceiling, you must use in-wall rated speaker wire.**
10. Route your speaker wire from the back of your amplifier, through the wall, to the installation location.

11. If you have not already done so, completely remove the grille by inserting a paper clip or the included grille removal tool into one of the holes and pulling to lift it off the frame.
12. Remove the foam insert from behind the grille and set it aside.
13. If you will be installing this speaker as part of a 70V or 100V constant voltage system, perform the following steps, otherwise skip ahead to step 14 below.
  - a. Determine the wattage rating of your amplifier, then multiply that value by 0.8 to determine the maximum wattage available to the speaker array.
  - b. Refer to the tables in the *SPEAKER WIRE* section above to determine the appropriate taps to use. The wattage ratings of the taps used on all speakers in the array must be less than the wattage value calculated in the previous step.

*For example, if the array will consist of one model 24214 speaker pair and one model 24215 speaker pair connected to a 70V 100-watt amplifier, the positive speaker lead should be connected to the 10W (orange) leads on the 24214 speakers and to the 15W (blue) leads on the 24215 speakers, resulting in a total of 50 watts, which is less than the 80 watts maximum load.*
  - c. Using a wire nut of the appropriate size (not included), connect the negative speaker wire lead from the amplifier or previous speaker in the array and the negative speaker wire lead to the next speaker in the array (if applicable), to the black common lead on the speaker.
  - d. Using a wire nut of the appropriate size (not included), connect the positive speaker wire lead from the amplifier or previous speaker in the array and the positive speaker wire lead to the next speaker in the array (if applicable) to the appropriately colored lead on the speaker, corresponding to the wattage value you determined in step 13b above.
14. If installing this speaker as part of an 8-ohm audio system, perform the following steps, otherwise skip ahead to step 15 below.
  - a. Press down on the red and black terminals on the speaker and remove the red and black leads to the step-down transformer.

- b. Press down on the black terminal and insert the negative speaker wire lead from the amplifier.
  - c. Press down on the red terminal and insert the positive speaker wire lead from the amplifier.
15. Ensure that the mounting tabs on the speaker assembly are turned inwards.
16. Position the speaker into the hole.
17. Using a #2 Phillips screwdriver, tighten each mounting screw to turn the mounting tabs back outward. Continue tightening until the mounting tabs are firmly against the back of the ceiling surface and the speaker is secure. Do not over-tighten the screws to avoid damage to the mounting tabs.



18. Reposition the foam insert inside the grille, then insert the grille into the speaker frame.
19. Ensure that your amplifier is powered off and unplugged from the power source.
20. Connect the amplifier end of the speaker wire to one of the speaker level, 70V, or 100V outputs on your amplifier, taking care to match the polarity markings on the speaker wire or plugs.
21. Repeat the above steps for additional speakers, as desired.

***Congratulations, your speakers are installed and ready for use!***

## TROUBLESHOOTING

Q1: The sound from one of the speakers is muddy, with attenuated bass response.

A1: Double check the polarity of the speaker wire connections.

Q2: The sound from one of the speakers is louder or quieter than the other speakers in a constant voltage system.

A2: Check the wattage settings of the affected speaker. If it is higher than that of the other speakers, it will be louder. Similarly, if it is set to a lower value, it will be quieter than the other speakers. To get the same volume level, set the switch to the same wattage setting as is used on the other speakers.

Q3: The sound from all the speakers is scratchy, harsh, or fuzzy sounding.

A3: You are hearing audible distortion, which can cause damage to both the speakers and the amplifier. Reduce the volume level until distortion can no longer be heard in any part of the audio signal.

## SPECIFICATIONS

Model	24213	24214	24215
Input	8 ohms, 70V, 100V	8 ohms, 70V, 100V	8 ohms, 70V, 100V
70V Wattage Taps	6W, 3W, 1.5W	20W, 10W, 5W	30W, 15W, 7.5W
100V Wattage Taps	6W, 3W	20W, 10W	30W, 15W
Frequency Response	65 Hz ~ 20 kHz	55 Hz ~ 20 kHz	48 Hz ~ 20 kHz
Power Handling Capacity	30 watts nominal, 60 watts maximum	40 watts nominal, 80 watts maximum	50 watts nominal, 100 watts maximum
Woofers	5.25" polypropylene + mica cone	6.5" polypropylene + mica cone	8" polypropylene + mica cone
Tweeter	0.5" PEI dome	0.5" PEI dome	0.5" PEI dome
Crossover	12dB @ 4.5kHz	12db @ 4.2kHz	12dB @ 4.2kHz
Sensitivity	86dB ±2dB (1.0m/2.83V)	87dB ±2dB (1.0m/2.83V)	89dB ±2dB (1.0m/2.83V)
Coverage	120° conical	120° conical	120° conical
Cut-out Dimensions	ø6.89" (ø175mm)	ø8.07" (ø205mm)	ø9.69" (ø246mm)
Overall Dimensions	ø8.4" x 3.0" (ø213 x 75 mm)	ø9.4" x 5.0" (ø240 x 127 mm)	ø11.0" x 5.9" (ø280 x 151 mm)
Mounting Depth	2.44" (62mm)	4.27" (111mm)	5.35" (136mm)