

## ***ESL-4 Electrostatic Loudspeakers***

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**WARNING: Electrostatic Loudspeakers contain very high internal voltages.**

- **DO NOT touch the front and back stators simultaneously while music is playing.**
- **DO NOT use liquid or spray cleaning products to clean any part of the speakers.**
- **DO NOT remove the protective front plate or the electronics module from the base.**

# Connections

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## AC Power Connection

Because the ESL-4 speakers use an internal power supply to place a high voltage bias charge on the diaphragm they must be connected to an AC power source. Use ONLY the supplied AC adapters to provide 12VAC @ 100mA to each of the speakers. The power connector is on the back panel of the base to the right of the speaker terminals.

Once power is applied, the diaphragm will reach full charge in approximately 2 minutes. The speakers may be left powered on continuously as the power draw is extremely small. However, if you have no plan to use the speakers for an extended length of time, removing power will minimize dust buildup on the diaphragm.

## Signal Connection

Audio input is via the binding post on the rear of the base. In general, the longer the length of cable between amplifier and speaker, the greater the necessity for larger (lower gauge) wire. The basic rule is that the total resistance of the cable should not exceed 5% of the loudspeaker impedance. In the case of the ESL-4 with minimum impedance of 2.5 ohm, it is desirable to keep the wire impedance below 0.15 ohm. With typical amplifier to speaker distances of 10 – 12 feet standard #12 or #14 gauge speaker wire will work fine. For longer runs heavier wire may be required to avoid modifying the frequency and phase response of the speaker.

## Loudspeaker Phasing

Be consistent when connecting the speaker cables to the binding posts. Take care to assign the same color cable lead to the (+) terminal on both the left and right speakers. If low frequencies seem missing and you cannot discern a tight, coherent image, you may need to reverse the (+) and (-) connects on one of the speakers to correct the issue.

## Amplifier Requirements

The ESL-4 loudspeaker should be used with an amplifier rated between 60 – 150 Watts RMS into 8 ohm. The amplifier should be capable of continuously driving a 4 ohm load without overheating.

However good the loudspeaker, the final results will depend very largely on the acoustic characteristics of the listening room and the position of the loudspeakers in it. The subject of room acoustics is complex and beyond the scope of this manual. However some guidelines for speaker placement can be provided.

## Getting Started

The loudspeakers should be placed 2-3 feet from the rear wall, at least 2 feet from side walls of the listening room, and angled towards the listener. Ideally the distance between the speakers should be similar to the distance from the listener to the speaker system. This is not always possible in domestic environments.

NOTE: When moving the loudspeakers use the handle on the base.  
Never lift using the panel.

## Experimentation

*Toe-in* --- Try toeing(angling) your speakers directly at the listener and then facing straight into the room. You will notice tonal balance and imaging changes. Generally it is found that the ideal toe-in angle has the left speaker aimed at the listener's left shoulder and the right speaker aimed at his/her right shoulder. This provides the best compromise for a wide yet stable image. A simple yet effective method to achieve identical toe-in angles on both speakers is to take note of how much of the inside surface of the each speaker base is visible.

*Rear Wall Distance* --- Move your speakers slightly forward into the room. What happened to the bass response? What happened to the imaging? If imaging is more spacious and the bass response is tightened, this is a superior position. If the bass response becomes thin and lacks punch you may have the speakers placed too far from the rear wall. Try moving the speakers back six inches from the initial setup position and listen again. There will be a position where you will have the best compromise of good bass response and imaging.

*The extra mile* --- or inch as the case may be. Because the electrostatic loudspeakers are so coherent it will be found small changes in position can have large effects on imaging. Don't be afraid to pull out a tape measure to ensure that the left and right speakers are exactly the same distance(to the inch) from the listener.

# Electrostatic Advantages

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Where the world of traditional loudspeakers deals with cones and domes that are moved with magnetism, the world of electrostatic loudspeakers (ESLs) deals with charged electrons attracting and repelling each other.

An ESL consists of three pieces: stators, spacers, and the diaphragm. The diaphragm is what actually moves the air to create music. The stators remain stationary, one on either side of the diaphragm. The spacers provide a fixed working distance for the diaphragm to move between the stators.

As your amplifier sends music signals to an ESL, they are stepped up into two equal and opposite high-voltage signals that are applied to the stators. The resulting electrostatic field works to move the diaphragm back and forth to produce music. This technique is known as push-pull operation and is a major contributor to the low distortion of the ESL.

Since the diaphragm of an ESL is uniformly driven over its entire area, it can be extremely light and flexible. These two properties, low mass, and evenly distributed driving force, are two of the major advantages of ESLs. As a result of the low mass, the ESL can be very responsive to transients, perfectly tracing the musical signal. Because the diaphragm is uniformly driven, there are no resulting breakup modes to color the sound.

With these inherent qualities it is possible to manufacture a single ESL transducer with the capability of reproducing all the critical frequencies from above 350Hz to ultrasonics; something no magnetic driver has yet been able to do. The result is a dramatic improvement in imaging and clarity.

# Care and Cleaning

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## Care

Here are a few suggests to ensure a long life for your loudspeakers.

- Minimize exposure to excessive contaminates such as smoke and dust
- Minimize exposure to direct sunlight to avoid discoloration
- When not in use for extended periods, you should unplug them to reduce dust accumulation on the diaphragms
- If humidity in your area of the country regularly exceeds 80% it is recommended that the listening room be air conditioned for optimum performance.

## Cleaning

It is recommended that the diaphragm be cleaned yearly, more often if in a dusty environment. The first step is to leave the speaker unplugged from AC power over night to allow time for all residual charge to drain off the diaphragm. Then using a hand held brush attachment for a vacuum cleaner to remove the accumulated dust from the back of the diaphragm. Slow up and down strokes with gentle pressure is best. Don't be alarmed if the diaphragm sucks over and sticks to the stator while cleaning. No damage will result. To clean the front side of the diaphragm, remove the grill and repeat the cleaning procedure.

The grill cloth may be cleaned with a soft brush or a hand held vacuum cleaner. Use a dust free cloth or a soft brush to remove dust from the speaker base and frame.

**NOTE:** DO NOT use liquid or spray cleaning products to clean any part of the speakers.

# Specifications

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Description	2-way electrostatic hybrid
Drive Units	electrostatic panel (3 in wide x 37 in long) 1/16 in diaphragm spacing, 3kV bias voltage  6.5 in high excursion, neodymium woofer
Frequency Response	60Hz – 22kHz +/- 3dB on reference axis -6db at 48Hz (useful bass extension)
Crossover Frequency	325Hz (4 <sup>th</sup> order acoustic Linkwitz-Reilly)
Sensitivity	83dB spl (2.83V, 1m)
Impedance	5 ohm nominal (2.5 ohm @ 20kHz)
Recommended Amplifier Power	60W – 150 Watts RMS Must be capable of driving 4 ohm load
Speaker Cable Impedance	Not greater than 0.15 ohm
Dimensions	Height: 65 inches Width: 7.5 inches Depth: 13.5 inches
Weight	40 lbs each