Sanders Sound Systems

Model 10e Electrostatic Speaker System

OWNERS MANUAL

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SETTING UP YOUR SPEAKERS

Setting up your new speakers is a three-part process that includes the following:

- Unpacking/Assembly/Positioning
- Electrical connections
- Adjustment of the balance between the woofers and electrostatic loudspeaker (ESL).

UNPACKING and ASSEMBLY

When you open the boxes, observe carefully how the packaging is arranged so you can repack items correctly in the future. When removing the woofer cabinets from their boxes, it is easier to lift the box off the speaker cabinet than to lift the cabinet out of the box.

To do so, open the box and remove the foam pad and any items that may be in the box with the woofer, such as parts inside a roll of bubble wrap or cables. Then roll the box over with the speaker in it, and lift the box up and away from the cabinet.

The roll of bubble wrap contains the power cord, feet, cones, nuts, and screws. Be sure to unpack these items before discarding the bubble wrap.

Begin assembly by turning the woofer cabinet on its back on a padded surface like a carpeted floor or a towel on a table. **Never place the cabinet face-down (woofer down) as this will damage the woofer.**

1) Attach either smooth feet or cones into the base of the cabinet. The smooth feet are for use on floors, while the sharp cones are for use on carpet. Speakers are not stable on carpet, so cones should be used to penetrate through the carpet and rest firmly on the floor below.

You may prefer to install the smooth feet first, even on carpet, so you can easily move the speakers around to find the location you prefer. Then install the cones after you have decided on the ideal position.

Both types of feet screw into steel inserts on the bottom of the speaker and can be adjusted by rotating them in or out to get the speaker level and stable.

Lock nuts are provided to insure the feet or cones won't shift position or rattle. Put them on the threaded shaft of the foot or cone before screwing it into the bottom of the speaker.

Once you have the feet or spikes adjusted to your satisfaction, ***gently*** tighten the nut against the bottom of the speaker to lock the foot or spike into position so it will not shift over time.

2) Attach the steel beams to the front edges of the woofer cabinet. Each beam is held in place by four socket-head screws that are in a small bag with an Allen wrench you can use to tighten them.

Note that the side of the beams with the Velcro faces towards you (when you are looking at the front of the cabinet). Install the screws by first mounting them on the end of the Allen wrench. Then insert them through the hole in the Velcro side of the beam. The end of the screw will then stick through the beam where you can screw it into the cabinet. Tighten them gently. When the beams are secure, it is a simple matter to attach the electrostatic panels, grill, and trim to them using the Velcro that is already attached to these parts for your convenience.

3) Position the electrostatic panels approximately 1/4" (6 mm) above the top of the steel tubing. The edge of the panels should be flush with the sides of the beams.

The panels' electrical connector hangs down near the left side of the woofer where you will see a mating connector on the woofer cabinet. The panels will only fit one way as if you try to install them backwards, the Velcro won't work.

Because the panel is held with Velcro, you can remove and readjust its position to get it fitted correctly.

4) Plug the panel's electrical connector into its mate on the woofer cabinet. The connectors are keyed so that they will only fit one way so you cannot make a mistake.

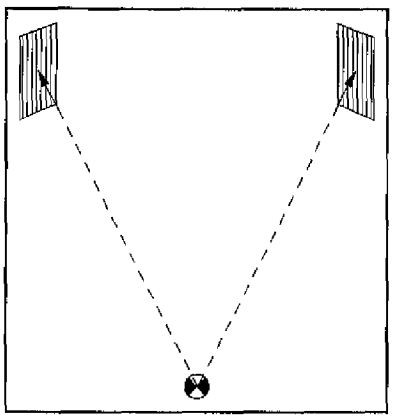
Note that the wires on the connector coming from the cabinet can be pulled out of the cabinet by several inches so you can easily position the connector. Adjust the connectors so that the connector will be hidden under the woofer grill and does not touch the woofer. Push any excess wire back inside the woofer cabinet.

Should you ever want to disconnect the panel, you can unplug the connector. Just remember to press the little lever on the connector to disconnect the catch so you can pull the connectors apart. They come apart very easily — but only if you have released the catch.

5) Attach the woofer grill. It is held in place with Velcro like the panel. Press it firmly into the bottom of the electrostatic panel so there is no gap between the panel and the grill as you press it into place on the rails.

6) There are wood trim strips that run the full length of the beams. These fit with their narrow side facing forward and their wide side on the side of the speaker. These are symmetrical so fit either way. They are held in place with Velcro.

POSITIONING


Equidistant to speakers

✓ All speakers sound best when they are equidistant from you. Because the Model 10's imaging is so much more precise than conventional speakers, they will reveal errors in equidistant placement more than conventional speakers. The section of this manual called "Advanced Positioning Techniques" will assist you in obtaining the exact positioning needed.

✓ Aim the speakers *directly* at your listening location — do not place them parallel to the wall.

✓ The speakers are designed to have a hard, reflective wall behind them — this will disperse the high frequencies throughout the room so they sound good when you are out of the sweet-spot. So do not put damping material on the wall behind the speakers unless you only listen at the sweet-spot and do not care about the sound when you are off-axis.

✓ The speakers may be positioned close to a wall — any wall, side or rear walls work equally well. You do not have to place them out in the room.

✓ Corner placement exaggerates undesirable bass and room resonances — it is best to avoid corner placement for speakers.

✓ The bass frequencies in all speakers are adversely affected by room acoustics. Depending on your room dimensions and the positions of the speakers, bass resonances will occur that cause ragged bass frequency response.

This problem cannot be avoided — but it can be minimized by trying to produce an infinite number of infinitely small resonances instead of just a few large ones. Therefore, the worst bass will be produced with both speakers are positioned symmetrically in the room. This will have them at the same distances from walls and corners, which will cause them to produce the same two or three resonances and double their magnitude.

It is much better to place the speakers randomly in the room so that they are each at different distances from walls and corners. This will produce more resonances at many frequencies and will reduce the magnitude of those resonances so the bass response will be smoother than symmetrical placement. You don't ***have*** to use random placement, you can place the speakers symmetrically (most listeners do), but symmetrical placement will compromise the smoothness of the bass.

Random placement of the speakers refers only to their relationship to the walls and corners of the room. It does not apply to the relation ship of the speakers to your listening location, which must always be set up so that the speakers are equidistant from you and pointed directly at you.

ELECTRICAL CONNECTIONS and CROSSOVER INSTRUCTIONS

The digital crossover supplied with the Model 10e speaker system is the DBX Venu360, a very sophisticated and complete Loudspeaker Management System. It combines all the features of a digital crossover, equalizer, time-alignment system, Real Time Analyzer, and Room Correction System into one compact and powerful device.

The Venu360 has been designed for professional applications, so it has many more features than what are needed for a home audio system. To make setup and operation as simple and easy as possible, the following instructions are limited to only what is necessary for home use.

The crossover has been pre-programmed at the factory for the 10e speakers. However, because various amplifiers have different gains and power, speakers interact with the each room differently, and listeners have varying sound preferences, you can and should adjust the unit to achieve truly spectacular performance in your unique situation.

Adjustments fall into three categories -- essential, recommended, and optional. The essential adjustment is to obtain the optimum bass/treble balance by adjusting the gain of the bass. The recommended adjustment is to use the built-in Room Correction System to deal with bass resonances in your room. The optional adjustments are only for those who are technically inclined and wish to become very involved in experimenting with the many facets of their audio system that only an advanced, digital speaker management system can provide.

Begin by connecting the crossover between your preamp and amplifiers. Although the crossover has XLR connectors only, you can operate it either balanced or unbalanced. If you wish to use unbalanced RCA connectors, you can use XLR to RCA adapters on unbalanced interconnects or interconnects that have RCA connectors on one end and XLR connectors on the other.

The crossover will accept either analog or digital signals. Instructions for selecting the different inputs will be discussed later in these instructions. By default, the crossover is configured to accept analog inputs from a standard preamp. For analog operation, connect your interconnects as follows:

1) Connect your left preamp output to Input 1 on the crossover.
2) Connect your right preamp output to Input 2 on the crossover.
3) Connect Output 1 on the crossover to the left channel of your ESL amp.
4) Connect Output 2 on the crossover to the right channel of your ESL amp.
5) Connect Output 3 on the crossover to the left channel of your bass amp.
6) Connect Output 4 on the crossover to the right channel of your bass amp.

For digital operation, connect a single digital interconnect to Input 1. The crossover will operate using either S/PDIF or AES/EBU signals. As with analog interconnects, you can use an adapter to convert an S/PDIF, coaxial, RCA interconnect into an AES/EBU (XLR) interconnect.

Plug in the crossover. It will turn on when you do as there is no switch used or needed. Wait about 30 seconds for the unit to initialize.

ESSENTIAL ADJUSTMENT (Bass/Treble balance)

Start playing music that contains plenty of bass. You will see a vertical string of green metering lights on both the input and outputs showing dynamic music levels. If you over drive the unit, you will see an amber light near the top of the string just before clipping. The upper light is red. If you see the red light, you are over-driving the crossover and causing clipping distortion. Be sensible about levels.

Now adjust the bass gain to obtain an appropriate bass/treble balance. To do so, follow these steps:

1) Press the **Edit** button on the front panel of the crossover. You will see a small green light in the button showing that the unit is in the editing mode. You will also see an edit notice on the screen.

2) The large knob is used to navigate the menu. Turn it to highlight the item you want then press it in to select that item. In this case, rotate the knob to select the crossover module (the rectangle that says 2X4). When you have highlighted the crossover module, push the knob inward to select it. The crossover menu will then appear on the screen.

3) Turn the knob to scroll down the list until you highlight the bass gain. It is labeled **LOWS GAIN** (it is the 10^{th} parameter on the list). You can also use the up/down buttons just to the left of the knob to move vertically when navigating any menu. Select **LOWS GAIN** by pushing the knob.

4) Rotate the knob like you would any volume control to either increase or decrease the loudness of the bass to obtain what you find to be a pleasing balance between the bass and treble. As you rotate the knob, you will note that the level display numbers change in precise, $1/10^{th}$ dB steps. Also, the low pass section of the graphic crossover display moves up and down relative to the stationary high pass section. This shows that you are adjusting the entire bass region.

5) Press the **BACK** button twice to return to the main screen. The green light in the **EDIT** button will go out when you are back in the main screen.

You will see that there is now a red light on in the **STORE** button. It is notifying you that you should save your settings so that you can retrieve them later if needed. If you wish to save them, press the button. The name of the preset (the configuration file) will be shown on the screen. You can customize the name if you wish by following the instructions on the screen.

When done, press the store button a second time. The screen will show the name on the preset list. If you wish, you can move the preset to any location on the list by turning the knob. Press the **STORE** button a third time to actually save the preset.

TIP: You can quickly save your changes anytime by pressing the **STORE** button three times without bothering to read prompts on the screen. This will automatically save your changes to the same preset.

This is all you must do to use your speakers. Even this small amount of adjustment is more than you can do with most speakers and will provide excellent sound quality. But the system can be improved more if you use room correction to eliminate the nasty bass resonances that are present in all rooms. The next section describes how to do this.

RECOMMENDED ADJUSTMENT (Room Correction)

No matter how perfect a loudspeaker is, it will interact with the room, which will degrade its frequency response. Bass resonances caused by the shape and dimensions of each room are the most troublesome as these are very intense and commonly cause "muddy" and "boomy" bass.

In the past, dealing with these resonances has required expensive laboratory equipment and special engineering skills to measure the room's frequency response and apply mirror-image equalization to suppress these resonances so that a speaker could produce linear, clean bass frequency response in any room. Computers now make it possible for anyone to do so.

The key to making this easy is the crossover's Automatic Equalization (AEQ) system. While no automatic system can do a complete and perfect job on its own, the AEQ will do most of the work for you. You then only have to make a few minor adjustments to tailor the frequency response to your exact preferences.

To begin, set up the measurement microphone that is included with your speakers. Connect the included microphone cable to the microphone. Plug the other end of the cable into the **RTA MIC INPUT** on the front of the crossover. RTA stands for Real Time Analyzer, which the crossover also has and you may wish to use later. Place the microphone at your listening location.

To achieve the very best possible frequency response at your listening location, you should place the microphone as near as possible to where your ears will be when you are listening to music. If you do not have a microphone stand, place the mic on the top of the back of your listening chair.

1) Press the **WIZARD** button. Select "Run AutoEQ/Level Assist Wizard." The crossover will take several seconds for it to configure itself. It will then prompt you to do various things as it takes you through the room correction process. Because the answers to some of its questions may not be obvious to you, I will walk you through the process.

2) The first prompt will be to select AutoEQ. The wizard will automatically have highlighted **AEQ** on the screen. All you have to do is press the knob to select it.

3) The next screen will ask you to select a wizard option. Select "AUTOEQ ONLY."

4) The wizard will ask you to select a "Target Curve." Select "RECOMMENDED CURVE."

5) The next screen asks you to connect and place the mic. You have already done this. So just press "select" to move on.

6) The wizard will automatically send out some test tones and adjust the signal level to meet its needs. Follow the instructions on the screen.

7) It will ask for the number of measurements you want to do. Select 4.

8) The wizard will make a measurement by sending out test tones to each channel. This only takes a few seconds.

9) The wizard will ask you to change the mic position and take another measurement. Ignore this. Do not change the mic position. The reason for changing the mic position is that the crossover is designed for professional use where the engineer is trying to get the best average frequency response over a wide listening area in an auditorium or concert hall. By doing so, he will compromise the frequency response at any one spot. By comparison, we want to produce the best

possible frequency response at your listening location. So take all four measurements at your listening location only.

10) When all four measurements have been made, the wizard will do its calculations and adjust the unit's parametric equalizers to produce linear frequency response at your listening location. This will take several seconds. When it is done, select "Continue."

11) The wizard will ask if you want to run AutoEQ for another system. Select "no."

12) The message "Auto Wizard Complete" will appear and the unit will reconfigure itself for normal operation. This will take several seconds.

13) When done press the **BACK** button to return to the main screen.

14) Following the AutoEQ process (or any other major change), the crossover will automatically mute its outputs to protect your downstream equipment. You will know that the outputs are muted because you will see a red light in the button at the bottom of all the channels. You will need to unmute these by pressing the mute buttons. The red light will go out. Note that you can mute or unmute any channel anytime by simply pressing the button for that channel. This is a very handy feature.

15) The crossover will have adjusted the parametric equalizers in the AEQ module so that your system should have pleasing frequency response. However, this will not be entirely satisfactory. You will need to make some further adjustments manually.

The AEQ wizard expects to have to adjust the treble frequencies due to fact that the wide dispersion characteristics present in most speakers cause strong room interactions. The 10e speakers do not have this problem. Because they direct their sound directly to the listener instead of out into the room, there is no loudspeaker/room interactions in the 10e speakers above 500 Hz.

This is due to a phenomenon known as precedence effect. This is where your ears can detect the difference between a speaker's direct sound and its delayed reflections. In the 10e, your brain will ignore the reflections (because they have long delays over 40 milliseconds) and will therefore accept only the direct sound from the speakers.

But a microphone doesn't have a brain so does not recognize the precedence effect. It will think that the delayed sounds are ruining the frequency response like they do in wide dispersion speakers, and the wizard will correct what it perceives as frequency response errors from the microphone.

But the wizard's corrections will actually degrade the frequency response that you hear from the 10e's electrostatic panels, which is already inherently linear. So it is necessary for you to eliminate the corrections produced by the wizard above 500 Hz.

To do so, press the **EDIT** button and select the **AEQ** module. You will then see a graph of the corrections made by the wizard and a list of all 14 parametric equalizers that are available for use. Each of these equalizers has four parameters (Type, Frequency, Gain, and Q). Probably the wizard only used some of these equalizers.

Scroll down the list of equalizers while observing the graph. When you scroll into an equalizer that is active, you will see its correction (a peak or dip on the graph) fill in with solid blue.

Look first thing to check is for a severe amount of equalization boost around the crossover point of 170 Hz. If there is a large amount of equalization there, most likely the panel and the woofer are out-of-phase. Try reversing the phase of one of the drivers, re-run the AEQ and see if the equalization boost disappears.

You can reverse the phase of one driver mechanically by reversing the speaker cable to either both panels or both woofers — or you can do it electronically in the Venu360. To do it electronically, press the **BACK**

button to leave the **AEQ**, then select the crossover module. Scroll down its parameters until you get to the "LOWS POLARITY", select it, then change the polarity from "NORMAL" to "INVERTED." Then run the **AEQ** again to see if the large equalization peak is gone. If it is, then you know that the drivers were out of phase and you should leave the polarity inverted.

When you find a correction that is above 500 Hz, select the **GAIN** parameter of that equalizer and adjust it to 0 dB. As you do so, you will see its equalization on the graph disappear. Eliminate all corrections above 500 Hz.

Correcting frequency response dips or depressions in the bass is risky. It is easy to over drive amplifiers and woofers if excessive equalization is used. This is because each 3 dB of boost requires twice the amplifier power and doubles the woofer's excursion. Since depressions in the bass frequency response are hard to hear, it generally is best to avoid boosting them — or at least avoid excessive boost.

So when you have eliminated all the equalization above 500 Hz, look for any equalization boosts greater than 4 dB in the bass frequencies below 100 Hz. If you find any, reduce the gain of the appropriate equalizer to no more than 4 dB.

When you are done adjusting the parametric equalizers, go to the top of the list and make sure that the AutoEQ is turned on. If it isn't, do so now by selecting it and then turning the knob. Press the **BACK** button twice to return to the main screen.

The frequency response of the speaker will now be linear, but with a slight bass boost that most listeners prefer. Only you can decide how much bass you find pleasing. So feel free to readjust the bass/treble balance as you did earlier to get exactly the balance you prefer.

To do so, play music that contains a lot of bass. Adjust the bass/treble balance as you deem most satisfying. Store your changes by pressing the **SAVE** button three times.

When you are done making adjustments, you may want to reduce the brightness of the display. You can do so by selecting the Utilities menu and scrolling down to the 6th item, which is "LED backlighting". Select "Dim" and the display will be very subtle.

OPTIONS

If you are technically inclined and want to use the crossover in a more extensive fashion, there are some additional features that may interest you.

Changing between analog and digital inputs involves two separate adjustments. Start by pressing the **UTILITY** button. Select "XLR Input Format."

The screen will then show a list of options. Select "XLR 1 Format: . . . " This label will be followed by whatever format is currently selected such as "Analog 1" or "AES 1&2." Note that AES is the term used to identify a digital input.

Once selected, you will be presented with a choice of formats. Select the one you desire. If you are currently in analog mode, and you want to change to digital mode, select "AES 1&2." This will input digital bit streams into Channels 4 and 5 so the system will operate the same as when you had a pair of analog interconnects plugged into Channels 1 and 2.

Switching from digital to analog is done the same way. Just select "Analog 1" to change to analog. When you are finished, Press the **BACK** button three times to return to the main screen.

The digital input has automatic sampling conversion. It will accept sampling rates between 32 KHz and 96 KHz. It will accept up to 24 bits. It operates on linear PCM bit streams like CD. It will not accept compressed formats like MP3.

Once you have changed the format, you will need to connect those channels to the unit's first XLR input. To do so, press the **CONFIG** button. Turn the selector knob to highlight IN1, which is the first XLR channel input. You will find this just before the AEQ module. Select it by pressing the knob.

You may note that there is also an IN1 at the beginning of the string of modules. Ignore this as the input has been routed directly to the output section for simplicity. So pick the IN1 that is in the middle of the string of modules.

Scroll down the list of inputs offered and select either "Route AES1" to switch to a digital input or "Route Analog1" to switch from digital back to analog.

Press the **DOWN** button to go to IN2 (the right channel) and select it by pressing the knob. Select the input you want (either AES2 or Analog2), just like you did for IN1.

If you switch to digital inputs you will see that they are on inputs 4 and 5. So you will see IN4 and IN5 on the display instead of the analog inputs IN1 and IN2.

Press the **BACK** button. The configuration menu will then ask if you want to save or abort the changes you just made. Select "Apply Changes" so that your changes will become active. It will take several seconds for the unit to automatically change all its configuration settings.

When you switch to using a digital input, in most cases, the level will be too loud. So turn down the master input level before attempting to play a digital source.

To do so, press the **EDIT** button. Scroll to IN4 and select it. There you will see the master gain. Select it. Then turn it down by -12 dB. Press the **BACK** button and then the **DOWN** button to go to IN5. Adjust it to -12 dB. These adjustments should get you to a loud, but safe output level. If the system doesn't play loudly enough, you can increase the levels later. Of course, if you switch back to analog operation, you will probably want to increase the levels back to +6 dB.

Be sure you have changed the input interconnects appropriately. You will use a pair of interconnects into Inputs 1 & 2 for stereo analog operation. You will use a single cable into Input 1 for stereo digital operation.

When you are finished reconfiguring the unit, you will find that it has automatically muted all the inputs and outputs. Unmute them by pressing all the red-lighted buttons.

The RTA will allow you to observe the frequency response of your system in real time. You can then adjust the crossover's parametric equalizers manually to alter the response in whatever way you wish.
To operate the RTA, connect the mic to the crossover as you would for AutoEQ, then press the **RTA** button. The RTA menu will appear. Let me comment on its parameters to assure that you understand how to use them. Most of the settings will be appropriate by default. But I will discuss most of them so you have a better understanding of what they do and how to use them.

Set the **RTA source** to **RTA MIC**.

Set the **RATE** to **SLOW** (fast will make it difficult to evaluate the graph).

Set the **GRAPH OFFSET** to around 30 dB. You may adjust this later to place the bar graph in a convenient position on the screen. This will depend to a large degree on how loudly you are producing a pink noise signal that the mic is receiving.

Set the **SIGNAL GENERATOR** to **OFF**.

Set the **SIGNAL TYPE** to **PINK**. This produces all frequencies in a random manner similar to white noise. However, pink noise has the high frequencies mildly rolled off to approximate the energy distribution of music. The RTA is calibrated to operate using pink noise, so be sure to use pink noise when you are taking measurements of your room.

Select **SINE** if you want to produce sine waves. The frequency of the sine can be selected further down in the list under **SINE FREQUENCY**. Remember that sine waves are ***not*** suitable when using the RTA (which works only with pink noise). ·

Set the **SIGNAL ROUTE** for either **IN1**(Input 1, left channel) or **IN2**. You can select to run all the channels together if you wish, but usually you want to learn the frequency response of the channels individually. So test them one at a time.

Set the **SIGNAL AMPLITUDE** to -60 dB.

You are now ready to run the RTA to observe your system's frequency response. This will be the combined frequency response of the room/speaker interaction — not the frequency response of the speakers themselves. To measure the frequency response of a speaker will require that you place the speaker in an anechoic chamber or out-of-doors.

To begin a measurement, switch the signal generator to on. Then turn up the signal amplitude until you hear pink noise at a moderate level. Typically you will have to increase the level by 40 dB or more. Expect to see -20 to -10 on the menu. The front panel meters should be roughly in the middle of their range. There should be no clipping as indicated by any red lights flashing.

At this point, you should see the RTA bar graph active on the screen. It operates in 1/3 octave bands so you will see 31 frequency bands with their frequencies listed under them. The bars will be moving, but you can gain a very good idea of the frequency response by observing them.

Based on the height of the bars on the graph, you can easily see if you have any serious peaks or dips in the frequency response. If so, write down the frequencies involved and their amplitude. You can then go to the **PEQ** module and set up one of the unused parametric equalizers to compensate for the frequency response error.

CAUTION: As mentioned previously, correcting frequency response dips or depressions in the bass is risky. It is easy to over drive amplifiers and woofers if excessive equalization is used. So generally it is best to avoid boosting them.

It is peaks in the bass frequency response that cause boomy/muddy bass. These should be aggressively suppressed. If the bass is then somewhat lean, increase the overall bass gain in the crossover module rather than attempting to equalize specific depressions in the bass.

Remember that frequency response errors above 500 Hz are not real when using 10e speakers. Your ears will only hear the direct sound from the electrostatic panel, which is very linear. So do not attempt to "correct" apparent frequency response errors in the treble.

You can tailor the frequency response in any way you like using the parametric equalizers in the PEQ menu. For example, if you wanted to reduce the brightness of the treble, you could go to the upper PEQ module (which controls the electrostatic panel) any adjust any unused parametric equalizer. Set the type to "high shelf", select a midrange frequency like 3 KHz, adjust the slope to 3 dB, then adjust the gain by -2 or -3 dB to depress the highs slightly.

You can see the changes you are making on the graph. If you are playing music, you can hear the effect you are producing while you make adjustments. To learn more about the operation of the Venu360, you can download its 112 page user's manual from the DBX website: www.dbxpro.com.

COMMENTS ON CABLES

Surprisingly, some expensive interconnects are poorly designed in that they lack shielding. Avoid these as they often cause buzzing sounds or even allow radio stations to be produced through your speakers. Properly shielded interconnects will have an outer covering made of fine braided wire that forms a metal shield around the wire(s) inside the shield. This is known as *coaxial* wire. Always used shielded interconnects.

Some speaker cable has very high capacitance and can cause high-quality, wide-bandwidth amplifiers to oscillate at very high frequencies. You cannot hear this oscillation as it is supersonic, but it will cause the amplifier to operate at full-power and can overheat and damage both the amplifier and the speakers. If you notice that one or both channels of any amplifier is running much hotter than normal, suspect a supersonic oscillation.

One brand of cable is notorious for causing this problem and that is Goertz (Alpha core) cable. It is built as two thin ribbons sandwiched together, one on top of the other. Do not use this brand or type of cable on wide-bandwidth solid state amplifiers (these are amplifiers that are capable of linear high frequency response to 100 KHz or beyond). You may use it on tube amplifiers because they have much more limited bandwidth and cannot reproduce the high frequencies where the oscillation occurs. But because electrostatic speakers are capacitors, it is best to avoid all high capacitance cables as this just taxes your amplifier more.

Speaker cables exert most of their influence on the sound of speakers by interacting with passive, high-level crossovers present in most speaker systems to change the frequency response of the speaker. Because Sanders Sound Systems speakers do not have passive crossovers, cables will have little if any effect. The only basic requirement for the woofer cables is that they be large — at least 14 gauge, so that the amplifiers will not be isolated from their drivers by excessive impedance.

Electrostatic speakers will operate best with cables that have extremely low inductance, low capacitance, and moderately high impedance. Sanders Sound Systems manufactures cables that are ideal for this purpose, but most other cables will be satisfactory as long as their inductance is very low (excessive inductance will adversely affect the high frequency response of the speakers). You can find a detailed discussion of this on the "Cable White Paper" found on the website www.sanderssoundsystems.com.

Each speaker has an internal **POWER SUPPLY** to energize the electrostatic panels. This is why each speaker must be plugged into the mains. You may use the supplied 10-foot power cord, or the any special power cord you prefer. Note that since the power supply is not involved in any audio circuits, there is no reason to believe that using a special cord or power conditioner would have any affect on the sound. Power conditioners should be avoided on the Magtech bass amp as most cannot deliver sufficient current to power the amplifier properly.

VOLTAGE SELECTION and FUSE REPLACEMENT

The speaker's power supply can be adjusted to operate on any mains voltage anywhere in the world. There is a voltage selector on the back of the speaker where the power cord attaches. You will see that it is a little drawer that has a number on it (either 120 or 240).

This drawer can be removed by pressing the clips along the sides of the drawer inwards. These clips are designed so they cannot accidentally be released. You will need to insert a small tool like a ball point pen, a paper clip, or a small screwdriver into the recess next to each clip so you can

press it inward toward the drawer. When both clips are moved inward, the drawer will release and pop out where you can grasp it with your fingers and remove it.

The fuse drawer can be rotated so that you can select either 120 or 240 volts. The 120 volt position is used for any mains voltage between 100 to 120. The 240 volt position is used for any mains voltage between 220 and 240. After making your voltage selection, simply insert the fuse drawer fully into its recess until you hear a "click." The last little bit of motion will be against a spring, so you will have to push firmly to seat it.

The drawer also has the fuse for the speaker's power supply in it. If this fuse fails, it means that there is a problem in the power supply that needs to be fixed. Do not simply insert a new fuse and plug the speaker back in without identifying the problem and repairing it.

The correct fuse is any value between 250 and 500 mA (milliamps). This is a standard metric 5 x 20 mm fuse and should be a fast blow type.

COMMENTS ON AMPLIFIERS

What good does it do to have a wonderfully designed amplifier if it is usually overloaded and full of distortion? Power is the most important amplifier specification.

While most of the power is required in the bass (which is why the included Magtech bass amplifier is very powerful), the electrostatic panel requires a surprisingly large power amplifier because high voltages are required and these are only available from powerful amplifiers. Therefore it is best to drive the panel with a ***minimum*** of a 60 watt/channel tube amplifier or a 250 watt/channel solid state amplifier, and more is better.

Low-power amplifiers will work, but they will cause distortion if you play them loudly on dynamic material. They may not sound obviously distorted, but they may sound "strained", "harsh", lack detail and dynamics, or have other audible flaws. What is the point of having wonderful speakers if the amplifier cannot drive them adequately and ruins their sound? So please use powerful amplifiers.

CLASS D (SWITCHING) AMPLIFIERS are not recommended. They do not drive ESLs with linear frequency response. They may fail due to the difficult load presented by an ESL. They produce much noise. In summary, they are not high fidelity amplifiers.

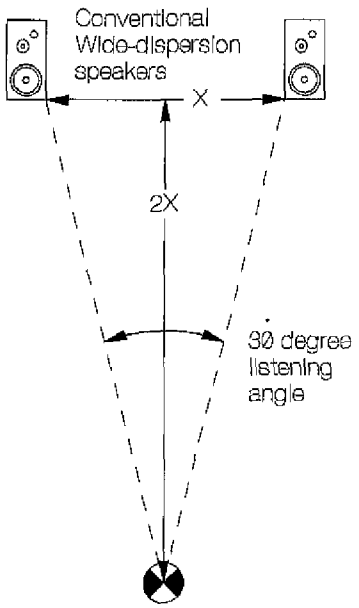
If you have a Class D amplifier, you may safely use it on the bass of the Model 10 speaker. You can then use the Magtech amplifier on the panels instead of on the woofers. The Magtech uses the same advanced technology used in the Sanders' ESL amp, so it will drive the panels beautifully.

ADVANCED POSITIONING TECHNIQUES

This section is to help you position Sanders Sound Systems speakers so they produce incredibly precise images — far more precise than any other type of speaker. To do this, the speakers must be placed exactly equidistant from you so that the sound from each speaker arrives at your ears at ***exactly*** the same time. Also, each speaker needs to be aimed at your preferred listening location. This "sweet spot" or "focus" is where the sound will be best, although it will be satisfactory anywhere in the room.

The following suggestions can help you achieve precise positioning. Although not essential, an assistant will be very helpful during this process.

Place the speakers about where you want them and connect the speaker cables. The exact speaker position and geometry are critical and can be disturbed by connecting the cables. So connect the cables now — before you finalize speaker position.



Begin by adjusting the listening angle. How wide should the listening angle ("sound stage") be? Conventional speakers can only fill a listening-angle about 30° wide — their distance from each other can only be about half their distance from you. If wider, they will produce the well-known fault where there is a "hole-in-the-middle" of the sound image.

Because Sanders Sound Systems speakers are phase-coherent and have a dipole dispersion pattern, they can be placed much further apart than most speakers and still completely fill the sound-stage. We encourage you to take advantage of this fact and place them very widely so you can enjoy a huge sound stage.

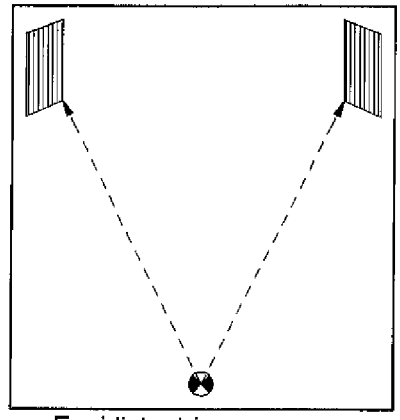
Sanders' speakers are deliberately made to be directional so that the sound quality is the most realistic possible. It is three-dimensional and has a "holographic" quality.

Wide-dispersion speakers send most of their sound away from you into the room where it reflects off room surfaces before reaching you. You are actually listening to the room more than the speakers. Because these reflections travel varying distances before they reach you, they are delayed by varying amounts. When the speaker produces a transient sound (and music is mostly transient in nature), you hear the sound from many directions and at slightly different times. This "smears" the transient and produces "muddy" sound and a poor image.

Sanders' speakers direct the sound directly to you instead of throughout the room. You hear the *speaker* instead of the *room*. This is why Sanders' speakers sound more clear than even very good conventional speakers.

Sound clarity and image quality is a function of timing and distance. So to get the best performance, you will need to get your speakers precisely positioned. This requires that you have both speakers an equal distance from you and that they are pointed directly at you. To avoid reflections from the wall behind you, it is best that your listening chair be well-away from the wall or that the wall has an absorbent surface in the area directly behind your head.

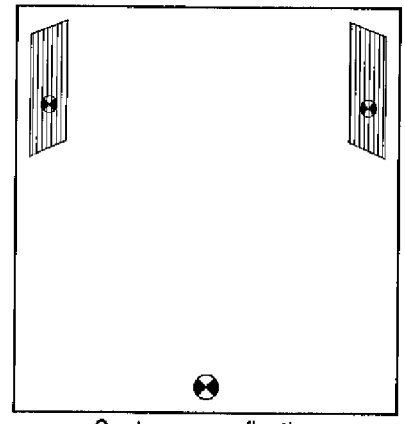
This may seem like extra effort that is unique to Sanders' speakers, but this is not true. *All* speakers perform best when they are accurately positioned. Because wide-dispersion speakers confuse the sound from the speakers with the sound from the room, they are incapable of producing high-quality images. Therefore errors in positioning are not as obvious as with Sanders' speakers.



Equidistant inner corners

Position the base of each speaker equidistant from your ideal listening location. You can use a tape-measure, string, or thread to gauge the distance from your chair to each speaker. Use the center of the back or seat of your chair as one reference point and the inner edge of each speaker as the other. You can have an assistant at your chair hold one end of the tape or string while you check the distance to each speaker. If you don't have an assistant, you can use a pin to hold the end of the string by sticking the pin in the center or back of your chair and tying the string or thread to it. ***The anchor point must be solid and stable*** to get accurate measurements!

Next, adjust each speaker so it is pointed directly at your chair. Although you can do this by obtaining identical measurements to both lower corners of each speaker, an easier and more precise way to do this is to observe the reflection of a flashlight in the ESL diaphragms. Hold the flashlight just above your head while you search for its reflection.

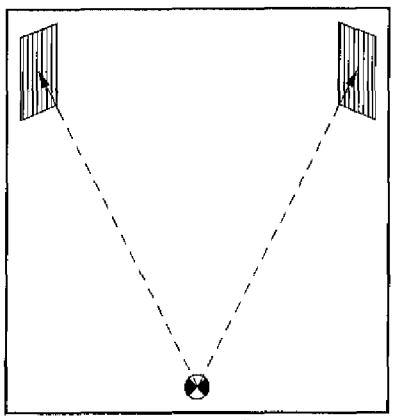


Center your reflection

Get your reflection in both speakers centered from side-to-side while sitting in your listening chair. To avoid altering the previous measurement, pivot the speakers on their inner corners — the one you used as the reference point.

When your reflection is centered side-to-side in both speakers, check to see that it is at the same height in both speakers. It doesn't have to be centered from top to bottom, but the reflection of your ears should be at least a foot from the bottom edge of the ESL. If not, the rear foot of the speaker can be screwed in or out to adjust the vertical angle of the speaker.

The speakers should now be correctly positioned, but it is a good idea to double-check by measuring from your chair to your reflection in each speaker's electrostatic cell.



Equidistant to reflections

How precise should you be? The wavelength of a 10 KHz tone is about one inch. An error of ½" will place this frequency a full 180° out-of-phase — just like you had reversed the wires to one speaker. So ideally, the speakers should be within a quarter wave — for 10 KHz, this would be a quarter inch of being equidistant from you.

NOTE: **If your speakers do not sound balanced (left to right), the most likely reason is that they are not equidistant from you.** An error of one just inch will ruin left/right balance.

Balance also will be ruined if the speakers are not pointed directly at you.

CLEANING / MAINTENANCE

The speakers do not require any maintenance. You may dust them as you would any fine furniture. You may use furniture wax on the cabinets as you would any fine furniture.

Never spray any substance into the electrostatic cells, as the electrostatic diaphragms could be damaged. If the electrostatic panels are dusty, you may gently wipe them with a damp sponge.

TROUBLESHOOTING

The speakers are rugged and reliable, and problems are extremely rare. This section is included to just make it easy to correct problems if they arise.

ELECTROSTATIC AMPLIFIER FUSE-BLOWING — may be of two types. The first is where the amplifier blows fuses on loud music. The other is when it blows fuses the moment you turn it on. This will not occur in amplifiers that have a turn-on delay circuit, and is rare in modern amplifiers.

Blowing fuses at turn-on is due to the fact that most amplifiers require a couple of seconds to stabilize their power supplied when turned on. When connected to an ESL, they may blow fuses only during this unstable period. To be sure, you first must check to be sure that it is just a simple turn-on instability problem and not a short-circuit or other amplifier problem.

To test, disconnect one of the speaker wires from each channel. Then turn on the amplifier — it should not blow fuses with the speakers disconnected. If it does, the amplifier is defective.

If it works properly, *leave the amplifier on* while you reconnect the speaker wires (being careful not to short the amplifier terminals with the loose wires). It should NOT blow fuses, and it should play music properly. If so, probably you can solve the problem by increasing the size of the fuses up to the manufacturer's maximum allowed value.

If despite larger fuses the problem persists, then you will have to connect the amplifier to the speakers through a delay relay (a delay of between 2 and 5 seconds is adequate). External, electronic delay relays are available from electronic parts houses, and your dealer probably can help install it. The amplifier manufacturer may be helpful as well.

When playing music loudly through an ESL, even high quality amplifiers may blow fuses. If this occurs, consult the owner's manual, your dealer, or the manufacturer to find the largest fuse that is safe to use with your amplifier. Replacing the stock one with a larger one (within the safe range specified by the manufacturer) will often solve this problem. If it doesn't, you will need a more powerful amplifier.

AMPLIFIER OVER-HEATING — should never occur. ESLs are "wattless" speakers. This means they don't dissipate your amplifier's power as heat like magnetic speakers do. Therefore, the amplifier should run cool — only a bit warmer than if it were just idling. If either channel of the amplifier runs hot, something is wrong. That "something" usually is supersonic oscillation caused by high-capacitance speaker cables or a defective component elsewhere in your system. DC offset in the output stages of the amplifier can also be a problem. This is *not* a speaker problem — it means there is a problem with the cables or in the electronics. Try changing cables. If that doesn't work, you will need to service the amplifier or other offending component.

TUBE AMPLIFIER OUTPUT IMPEDANCE — should be set as low as possible. As a minimum requirement, you must use the amplifier's 4Ω connection. If a lower one is available, us it. If

your amplifier doesn't have a 4Ω (or lower) connection, it probably will not be suitable for driving electrostatic loads as it will tend to roll-off the high frequencies.

AMPLIFIER INSTABILITY — can be a problem if the amplifier was designed to only drive resistive loads, not capacitive loads like electrostatic speakers. Oscillation may be noticed as a harsh quality in the high frequencies and/or amplifier overheating. If this happens, try a different amplifier. Be sure you are not using high capacitance speaker cables. If a different amplifier solves the problem, then your amplifier may need service. If different speaker cables solve the problem, then retire the problem-causing ones.

MOMENTARY AMPLIFIER SHUT-DOWN — is caused by inappropriate activation of an amplifier's protection circuitry. You may experience this problem when playing music loudly and the amplifier completely shuts down for several seconds, then returns to normal operation — only to trip off again a few moments later. It will repeat the cycle as long as you try to play music loudly.

The problem here is that the amplifier is not designed to drive low impedance, electrostatic loads. Although the amplifier may not seem to be harmed when it shuts down in this way, repeated activation may eventually lead to failure of the output transistors. You should switch to a different amplifier.

BUZZING NOISES — are caused either by "ground loops" or unshielded interconnects. Ground loops grounding problems with your equipment — most commonly your preamp. It is not a failing of any part of your system, it is simply an interaction. The problem usually is caused by having one or more components grounded to the mains circuit. Lifting the ground (by using a 3 pin to 2 pin adaptor on the power cable) often will stop the buzz. Also, it is good practice to have all components plugged into the same outlet strip.

Surprisingly, some expensive interconnecting cables have no shielding. If lifting the mains ground doesn't stop the buzz, change interconnects. Be sure the test interconnect has a metal shield around a central conductor ("coaxial cable"). For testing at least, use an inexpensive cable because you can be sure they are properly designed and shielded.

SPECIFICATIONS

Speaker dimensions	15.5" x 18" x 69" (40 x 46 x 176 cm)
Speaker net weight	82 pounds (32.6 KG)
System shipping weight	275 pounds (125 KG)
ESL size	15x 42.3" (38 x 107 cm)
ESL power handling	No practical limit
ESL impedance	112Ω @ 500 Hz falling to 1.2Ω @ 20 KHz
Bass power handling	250 watts continuous, 1000 watts, momentary
Bass driver	10"
Woofer impedance	4Ω
Bass design	Transmission line
Sensitivity	90 dB
Frequency response	20 Hz to 32 KHz, electronically adjustable

WARRANTY

Sanders electronics and speakers are warranted to be free from defects in material and workmanship for as long as the original purchaser owns them.

During this period, Sanders will, at its option and without charges, either repair any part or assembly of parts that is found to be defective in material or workmanship, or replace the product with one of comparable quality, subject to the following limitations and exclusions:

This warranty shall not apply to any product which has been subject to misuse, abuse, negligence, or accident.

To obtain warranty service, contact the factory using the contact information listed below. The purchaser is responsible for paying shipping costs to the factory.

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