

# Installation and Tuning guide.

## USD Audio WaveGuide™

### "D" Series RotoMounts™

**Congratulations!** You have just purchased the most award winning and realistic sounding Loudspeaker system for the automobile environment.

The information included in this guide has been designed to help you get the most enjoyment and listening pleasure possible out of your new USD Audio WaveGuide™ loudspeaker system. It is important to us at USD Audio™ that you have the best experience with our product and service. Should you have a need concerning the installation and use of this product do not hesitate to call USD Audio at 714-997-2475. We will give you prompt, courteous information and help.

We are always interested in improving our products, so please share with us any ideas and experience that you have while installing and listening. We enjoy sharing your pride and fun in car audio.

#### Safety disclaimer and other legal mumbo-jumbo.

The USD Audio WaveGuide is designed for underdash installation in most vehicles. Make sure your installer has car audio installation training and experience. If you are going to install them yourself, make sure and take advantage of our technical services if you have any questions or trouble. The installer must understand safety associated with car audio installation. Under no circumstance should the WaveGuides be installed so that they could interfere with the safe operation of the vehicle's brakes, clutch or accelerator. Do not allow an installer to remove or disable ANY safety device or the emergency brake. Your safety and the safety of the people and property around you is important to USD Audio. USD Audio accepts no responsibility for installation quality or safety.

#### Assembly:

The RotoMount™ series WaveGuides are easy and fun to assemble. The kit comes with 2 large Guide "Bodies", 2 "Heads", 2 motor mounts, 2 Clamps, 2 compression drivers (also called 'motors' or 'drivers') and a hardware packet. Install the Heads onto the 'Neck' of the WaveGuide Bodies. The slip-joint will be tight fitting. To help make it easier, check that the edges of the neck and the base of the head where the neck fits into it are free of any debris and flashing. Once you have fit the head to the body, slip the clamp over the neck joint, so that the bolt holes in the clamp line up with the bolt holes in the head. Now for the fun part. Go ahead and do it. Everybody does. Put the WaveGuides up to your ears and listen to the noises that surround you. You will hear details that up to that point have escaped your normal listening. This will also allow you to get a feeling for the dispersion pattern of the WaveGuide. The loudest sounds will be within a 120 degrees area in front of the mouth of the WaveGuide. Ok, now that you have had fun with that, you can talk through the Guide now and in general make as much noise and silliness as you like.

Mount the motor mount onto the head of the WaveGuide with

the hardware from the hardware packet. Next, being very careful not to cross thread them, screw the motor into the motor mount. If you turn the motors anti-clockwise first, you will feel the threads drop together, then you can turn the motor clockwise to tighten.

We are now ready to start installation. Note: Removing the motor from the body during most of the mounting process will make handling the Guide easier.

#### Orientation:

With RotoMount, WaveGuides provide maximum flexibility and ease of installation. The RotoMount allows the compression driver of the WaveGuide to be angled in any position in a 360-degree radius, without any affect on sound reproduction. Always check for foot and pedal clearance when you select the mounting position.

The USD Audio WaveGuide is designed for underdash installation in most vehicles. The neck and head of the Guide goes along the kickpanel, with the Mouth of the Guide facing out from under the dash, toward the listener. In most cases, the guides should be positioned as far outboard as possible, without interfering with the safe operation of the vehicle (remember SAFETY FIRST).

**Very important:** Keep the Motor and throat of the Guides clean and clear of debris. Protrusions inside of the Guides throat and mouth can affect performance.

Installing the WaveGuides symmetrically is not mandatory. This is good, because many vehicle dashes are not the same height, depth or shape on the left and right. Excellent results are achieved with the left and right WaveGuides in slightly different mounting positions.

#### Mounting:

The Guides must be mounted solidly. Some professional installers will build a shelf or frame attached to the dash to support the mouth. One of the easiest and most effective methods of mounting the Guide is to attach them to the underside of the dash from three mounting brackets. Two brackets, one on each side of the mouth of the Guide and one bracket to support and mount the weight of the motor assembly.

Make the brackets out of strips of either aluminum, tin, very light steel or even plumbers tape.

**Flange:** The flange around the mouth of the Guide should be used for improved mounting ease. The brackets can be attached via pop rivets or flat head screws to the flanges around the mouth of the Guide, the rear mounting boss or body of the Guide.

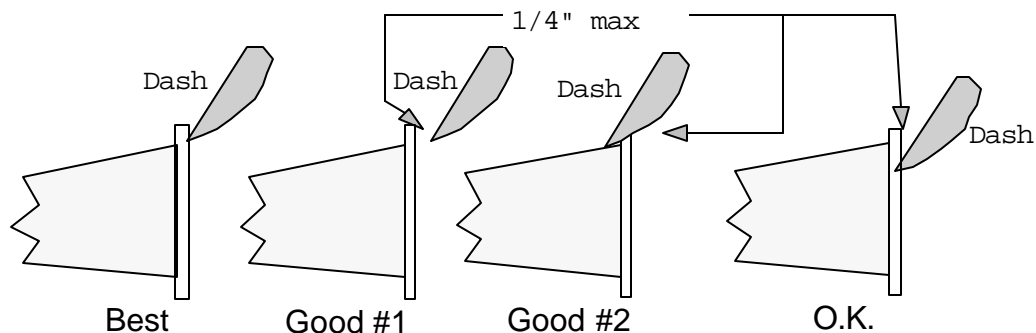
**Important Note:** If you need to mount the brackets to the 'body' part of the Guide, it is important to attach them with the flat or smooth head of the fastener on the inside of the Guide.

The logo for USD Audio, featuring the letters 'USD' in a large, stylized, italicized font with a horizontal line through them, and the word 'Audio' in a smaller, simpler font below it.

A u d i o

*The Custom Advantage*

## WaveGuide to Dash Relationship.



Remember to keep the inside of the Guide smooth.

Find suitable mounting locations under the dash for you to screw the brackets onto. Many times you can mount them to the kick-panel and the console. Be very careful to select locations to drill that will not damage wiring or other vehicle devices behind the dash. Once you have found the best locations for attaching the brackets, bend the brackets to fit. Trim off excess of strips and mount.

The installer should trim the flange to contour it to fit the bottom of the dash (see illustration. above). This maximizes the Guides' acoustic coupling to the lower dash surface, thereby giving a lower cut-off frequency and the best possible vertical dispersion. Improving image height and staging width. Gaps and protrusions larger than 1/4" can affect performance. To help improve the junction, you may want to use a weather strip material to seal the mouth of the Guide to the dash.

Always maximize foot room clearance! If the WG seem to be **"To Low,"** you may want to trim off the top and bottom flanges around the mouth of the WG.

In some cars, you can simply raise the WG behind the dash so that the mouth flows onto the the bottom of the dash, and in the **"Best"** illustration above. By raising the WG, you will gain about .75 inches, which does not sound like a lot, but it can make all the difference. If you cannot get the WG behind the dash board, you should trim the top flange like in the **"Good #2"** illustration. If the WG still seems "to low," trim off the bottom flange. This will give you another .5 to .75 inches of clearance. I have not seen a car that this has not been enough to fit and have excellent foot room.

The best and easiest way that we have found to trim the flanges, is to use a table saw with a fence. If you do not have a table saw, you can cut off the flange with a hand saw, or if you take a Scratch Awl or a sharp blade, you can "score" the back of the flange and snap off the flange. Make sure that you measure twice before you cut!

**Console:** In some vehicles that have center consoles, the mouth of the WG may appear to be too wide. Never fear, you can fit the WG's in a number of ways. Sometimes it is possible to put the tip of the WG mouth behind the console. If this will not work you can Cut up to 2 inches off of the tip of the WG mouth.

**Mounting the Motor:** You MUST support the motor with it's own bracket(s). Use the third bracket to support it. Drill slotted mounting holes into the rear mounting bracket. This way you

can adjust the angle, and the relationship of the Guide to the lower part of the dash. Bend to fit and mount to the firewall, dash support or anything solid.

**Aiming:** The mounting angle of the Guide will be determined by the amount of foot clearance available. Remember to always allow more than adequate foot room clearance.

It is OK to point or aim the WaveGuides. They can be angled up or straight and/or left or right. To determine the best positioning, you will need to do some listening tests. Don't be afraid to experiment in this department. A lot of people do not maximize the performance of their Guides because they do not spend time on this.

A good starting point is to move the Guides as far out to the kick panels as possible. The wider out you can install them, the closer you will be to center stage. Angling them will not necessarily raise the height of the sound stage. Experiment with the angle up and the pointing in toward the center. Most vehicles will perform best with the mouth aligned with the under dash and the motor mounted slightly lower, pointing the Guides upward. The only way not to mount the Guide is pointing downward.

### Making Grills:

Here are a few of the easiest ways to make grills for the WGs.

**Method 1.** Once you have fit the WGs to the vehicle, simply wrap the mouth area in a grill cloth using spray adhesive. This is the fastest and easiest, but not the prettiest.

**Method 2.** Use the "L" shaped Perforated Metal supplied with the WG. Place the short 'L' part of the Perf metal on the top of the WG, and then bend the bottom under the WG to have it "clamp" onto the the mouth of the WG. Wrap in grill cloth and snap back on. You can use double sided tape to make that more secure too.

**Method 3.** Start the same as with Method 2, but instead of bending the bottom under the WG, take a marking pen and draw a line along the bottom of the WG. Remove the Perf metal and cut along the line. Now the Perf metal grill should be the same height as the mouth of the WG. Wrap the grill in cloth an use double side sticky tape attach it to the front of the WG.

**Method 4.** Go custom. For a complete set directions on doing this, call us at 714-997-2475 and we will mail it out to you!

**Important Note:** You MUST use acoustically transparent grill material...not just visually transparent. Remember, just because

you can see through it does not mean that it passes sound.

## Crossover for the WaveGuide.

The WaveGuide D-2 RT can go down to 600 - 800 Hz. and the WaveGuide D-1 RT can go down to 1.4 KHz - 1.5 KHz. This will depend upon the dash coupling. I have had the best sound by crossing the D-2 RT at 800 Hz and the D-1 RT at 1.4 KHz. We do not recommend crossing these drivers any lower than the recommended frequencies. Both models come with built in crossovers at the recommended frequencies. We also offer a Passive X-over system for both 'D' models. The PXD-1 and the PXD-2. The PXD-1 is for the D-1 RT WaveGuide only. It is a 2-way x-over at 1.4KHz High and Lowpass. The PXD-2 is for use with the USD Audio D-2 RT only. It is a 2-way passive x-over with a center frequency of 775Hz. The PXD-2 has built-in Equalization, Impedance compensation and Attenuation for the WaveGuide to improve the frequency response and sound. Both of these X-overs allow you to hook up a 5, 6 or 8 inch woofer to the WaveGuides and create an incredible 2-way speaker system.

## Tuning tips by Eric Holdaway.

**Setting Crossover Frequency:** Make sure that all of the speakers in the system are working.

Second, in systems using Active x-overs, you need to set the x-over frequency. The best way to do this is with a RTA and pink noise. This method will work on all of your speaker systems for dialing in the exact freq. that you want. On the D-1 RT the x-over freq. is about 1.4KHz, and for the D-2 RT x-over freq. will be 800 Hz.

**Important Note:** Do NOT change the volume of the signal once you have started this test. Using pink noise and the RTA, play only the WG's at a low volume, full range or at least down to 400 HZ.

Measure the freq. response of the WG on the RTA. For the D-2 RT, you need to record the level at 800 Hz. For this example, let's say that at 800Hz the SPL measures 90 dB. Start raising the x-over freq. The object is to raise the x-over freq. until you get a 3 dB reduction at 800Hz. When the SPL reading for 800Hz goes down to 87dB, you have set the x-over freq. for the high pass to the WG. You should do this for all of the speaker in the system to make sure that you are accurate on x-over Freqs.

Once you have all of the X-over freq. selected, adjustment the gains on the x-over and amps to achieve the flattest frequency response possible.

**Phase relationship:** Next, check to insure the proper phase relationships between the drivers, i.e. WG to Midbass / midbass to subwoofer. You do this by looking at the x-over frequencies on a Real Time Analyzer (RTA) and see if there is a dip in the response curve at the x-over frequencies.

If the crossover point is 800 Hz, and you have a dip at 800 Hz, but not at the subwoofer x-over point, then the WaveGuides maybe "out" of phase with the midwoofer. At this point, do not change the volume level of the system. Note how loud the 800 Hz level is on the RTA reading. Reverse the polarity of both Guides and remeasure the loudness of 800 Hz. If the 800 Hz level is now higher, then you have improved the relative phase between the two pairs of drivers. If 800 Hz. is less loud, then the

relative phase is worse and you should return to the original wiring. This test is valid for all speakers.

**Equalization:** Any equalizer is usable with the "D" models. Even a 7 band in-dash will yield surprising performance. The more bands of equalization that you have, the more you can control the response curve. For show cars and competition, I recommend the use of a third octave equalizer, with separate left and right equalization controls, but any equalizer is useable.

When using an equalizer, be moderate on boosting frequencies. It is possible to over boost a frequency and add distortion. Always start by cutting the peaks first. Then boost a little to fill in the valleys. Always look for a smooth, and even slope. Now, if you are seeing a dip/hole at 500Hz, 630Hz and/or 800Hz, do not be tempted to boost those levels more than a couple of dB at the most. First, try moving your microphone around. In most cases you will see these frequencies fill in. These dips are usually not really there, but are artifacts of a one microphone measurement. If you do boost these frequencies, in most cases you will degrade the sound quality, imaging and run the risk of damaging the Guides voice coils. So, before you add into any of these frequencies, listen to the sound, then change them and relisten.

Once you have a nice curve on the RTA, you just about turn it off. The sound is more important than the shape of the curve. You need to start listening and start "peek'n & tweak'n." Remember, tuning can be a time consuming, aggravating, and frustrating task. Take your time. Keep your adjustment small and only adjust one thing at a time. Use music that you are familiar with. I like to use a female vocal with open-clear instrumentation as my main musical format. You will achieve excellent result through experience -

***I promise. EH.***

## Midbass locations.

Experimentation has shown that the best installation location for the midbass is in the front of the listening compartment. Several possibilities exists in the front of all vehicles.

The kickpanel/firewall area, aiming toward the upper middle part of the roof. Or directly in front of the seat, on the floor, angled up toward the windshield, or the Doors (You can angle the midbass in the door up too. It can have a profound impact by doing this.)

If the midbass cannot fit into the Frontal area of the vehicle, then we recommend the rear side panels of the vehicle. The third choose for locating the midbass is the rear deck area.

## **USD Audio, Inc.**

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Prices, Specifications, Materials, Colors, Product availability subject to change without notice.