



Owner's Manual

S90i / S90 basic-port / S90-f/c
High Output RTL[®] Subwoofer

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DOCUMENT CONVENTIONS

This document contains general safety, installation, and operation instructions for the Wisdom Audio High Output RTL[®] Subwoofer. It is important to read this document before attempting to use this product. Pay particular attention to:

WARNING: Calls attention to a procedure, practice, condition or the like that, if not correctly performed or adhered to, could result in injury or death.

CAUTION: Calls attention to a procedure, practice, condition or the like that, if not correctly performed or adhered to, could result in damage to or destruction of part of or the entire product.

Note: Calls attention to information that aids in the installation or operation of the product.

Introduction

Congratulations on purchasing your **Wisdom Audio High Output RTL**[®] in-wall subwoofer. The S90's Regenerative Transmission Line technology delivers tremendous bass performance in terms of depth, dynamics, and distortion resulting in articulate bass that integrates seamlessly with high-resolution main speakers such as Wisdom Audio's Insight or Sage Series.

We recognize that setting up a **Wisdom Audio High Output RTL** subwoofer can be a bit more involved than connecting a common sealed or ported subwoofer, which is why we recommend that our systems be engineered and calibrated by Factory Personnel.

NOTE: You **MUST** use an SW-1, or SA-DSP amplifier. If using another brand of amplifier, you must make sure you use a specific type of surround processor as the S90 requires special 48dB Butterworth bandpass filter and PEQ settings for the RTL to work properly.

For the purposes of this manual, we will assume that you have an approved signal processor or amplifier with the necessary signal processing for the S90. The S90 (like all RTL subwoofers) requires a very specific non-standard EQ slope to ensure proper performance. Using a non-approved EQ or amplifier without the correct signal processing will cause poor performance from the S90. For an approved list of amplifiers and surround processors, please email us at info@wisdomaudio.com.

Overview

There is a class of bass enclosure that has been around since the 1950's, which can be generically described as a "low frequency tapped waveguide" or "tapped pipe." It was an idea that was a bit ahead of its time, since fully optimizing its use required both powerful drivers and complex modeling. Your Wisdom Audio S90 subwoofer uses a modern implementation of this old idea for high quality, low distortion bass reproduction. Utilizing sophisticated modeling software, we've optimized our enclosures and drivers specifically for this application. We call our unique implementation of this relatively old idea a "Re-generative Transmission Line" subwoofer, or "RTL" sub for short.

While the roots of the Regenerative Transmission Line go back to the 1950's, it is the combination of modern computer modeling and the vastly more powerful motors of contemporary driver design that make the RTL, not only realizable, but also an incredible solution. If you are into such things, check out US Patent 2,765,864 (filed in 1955), and an AES paper published in 1959, "Analysis of a Low Frequency Loudspeaker System".

For a partial and very simplified understanding of the RTL, consider that all dynamic drivers develop energy on both sides of the diaphragm, with the rear energy being 180° out of phase with the front energy. If you allow the driver to operate in free space (no enclosure), the front and rear energies cancel each other out at low frequencies, (long wavelengths).

In our Regenerative Transmission Line subwoofer, the energy from the back side of the driver is sent along a long, folded path in such a way that its lowest frequencies arrive back at the front side of the driver in phase, summing to an effective increase of up to 6 dB in output. Thus, energy is productively used from both sides of the woofer cone, doubling the effective surface area, thereby reducing cone motion, and substantially reducing distortion. As an example, the effective radiating surface area of two 5"x7" woofers in an S90 are equivalent to a 12" – 13" woofer in more conventional enclosure.

The results are quite stunning. Low frequencies are strikingly dynamic and responsive and integrate quite seamlessly with the fast and detailed Sage Series planar magnetic hybrids. As an example, the S90 can produce output in excess of 123 dB at 20 Hz.

Unpacking the S90

The **Wisdom Audio High Output RTL S90** subwoofer is a substantial piece of equipment. Please exercise caution when unpacking your S90 to ensure that you do not strain yourself from its (perhaps unexpected) weight.

CAUTION

Do not attempt to lift your S90 by yourself. Unpacking this subwoofer is clearly a two-person job. It is unwise for a single person to attempt doing so.

Do not attempt to lift your S90 while bending or twisting from the waist. Use your legs for lifting, not your back.

Always stand as straight as possible and keep the S90 close to your body to reduce strain on your back.

There are three different variants of the S90 Subwoofer. Below is a description of the types of installations each one is used for, and what comes with each type.

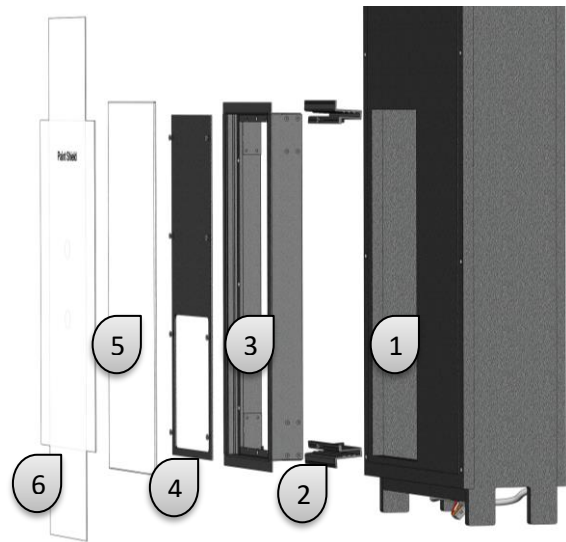
S90 Versions

Note: The S90 is available in a righthand output. Shown here is the standard lefthand.

S90i

This version (i) is used when you are needing the S90 to have an exposed grille, such as flush mounting is a finished wall:

- (1) S90 Subwoofer Enclosure
- (2) Uni-grip clamps (x2)
- (3) Uni-grip frame
- (4) Port reduction plate
- (5) White Grille
- (6) Paint Shield



S90 basic-port

This version (basic-port) is used when installing the S90 behind fabric and a grille is not needed. This is common in theater installations:

- S90 Subwoofer Enclosure with Port Reduction Plate Installed



S90-f/c

This version (f/c) is used when installing the S90 in a remote location up to 24" away from the room it will be vented into:

- (1) S90 Subwoofer Enclosure
- (2) HVAC Grille
- (3) Extension Hose
- (4) Mounting Plate for S90
- (5) Hose clamps (x2)
- (6) Mounting Plate for Wall



Important Tip: Keep the Extension Tube as straight and short as possible for best performance. More bends and longer length reduce the performance and tuning. In addition, ensure the fabric or grille that covers the opening of the Wall Mounting Plate has an open area of 60%+ or the subwoofer will chuff and under-perform.

Subwoofer Placement (An Introduction)

Subwoofers offer somewhat greater flexibility in placement since the frequencies they reproduce are not readily localizable by the human ear. This is because the wavelengths they reproduce are more than 10 feet (3 meters) long, but our ears are located only about 6-7 inches (17 cm) apart. Thus, these extremely long waves do not meaningfully contribute to the imaging that the main speakers create.

However, this fact does not mean that the placement of the subwoofers has no effect on the sound quality in the room. Far from it. Subwoofers are the most likely to suffer from the response irregularities introduced by the room itself, operating, as they do, below approximately 80 Hz in most systems. This is not a property of subwoofers but rather a characteristic of low frequency reproduction of any form in a closed space. In fact, in a typical room where a stereo pair of full-range speakers are used, or a single subwoofer, it is common to see a variance exceeding 20 decibels (dB) in sound pressure level (SPL) between various seating positions. Is that a lot, and can we use an EQ to fix the issue?

The short answer is, yes, that is a lot. Unfortunately, equalization simply won't work, nor would we want to, even if we could. Here's why. For reference, 20dB is a factor of 100 in power. 100X! To put that in context, suppose you had a 50-watt power demand to reproduce a bass note at one seating location, and a 2nd seating location only 1 meter away had a 20dB depression in the response of the same note. To establish the same output at the 2nd seating location would require 100X more power, (5000 watts), to bring it to the same acoustic level. This is fully outside the capabilities of nearly all systems, and it would have driven any conventional system well beyond its limit. In addition, the EQ would affect all seating locations equally, and the first position would now have a 20dB peak. This is why equalization, in general, has limited value. But it is useful when an overall correction is needed. What, then, can be done so everyone experiences the same deep, articulate, and impactful bass? The answer lies in minimizing the acoustic variance.

Acoustic variance is caused by the low frequency waves (pressure and rarefaction cycles) reflecting around the room and interfering with themselves. At some frequencies and locations, the reflected waves sum to higher sound pressure levels (pressure/rarefaction cycles are more in phase). At other frequencies and locations, they sum to lower sound pressure levels, (pressure/rarefaction cycles are more out of phase). The dimensions of the room primarily dictate the interaction, but placement of the subwoofers, or bass radiators affect the excitation of these room modes, or standing waves, as they are often called. Careful placement of subwoofers can significantly

reduce and even eliminate some room modes. A single subwoofer can reduce variance if it is properly placed, but it is limited in what can be achieved. In practice, 2 should be considered a minimum where there is a single row of seating, but more should be used to minimize variance where multiple rows of seating are present or where uniform high-fidelity sound throughout the room is desired. Controlling variance and having the finest listening experience is one of the primary reasons to choose subwoofers over full range speakers.

Compared to full-range speakers, subwoofers have the advantage that they can be placed at various locations and in multiples around a room to mitigate the naturally occurring standing waves. How many and where to place them is a science unto itself and beyond the scope of this introduction. It is truly the job of an expert to provide guidance in placement. There are also professional tools and computer programs available now to aid in selecting the optimal, or as it is in many cases, the best compromise in placement. We recommend contacting us directly at info@wisdomaudio.com to arrange to run a subwoofer analysis on your room and to help you find the absolute best placement for each of your subwoofers.

Room Treatment

Room Treatment for subwoofers is quite different than that for satellite speakers, (primary listening speakers). The absorbers need to dissipate an enormous amount of energy and have a broad bandwidth without introducing their own resonances. This typically requires large absorbers that are placed at intersecting boundaries. It can also be done actively, but this again requires very powerful transducers to keep up with the demands of the primary subwoofers. Room treatment for subwoofers should always be considered a last resort for tweaking response irregularities, since, at best, they are only tweaks. The best approach is to use modeling software along with multiple subwoofers to control the standing waves in the room. This approach should be conducted by an experienced professional. Please contact your Wisdom Dealer for more information.

Room treatment for satellite speakers is quite different and can be very effective in changing the sound character of the room and improving detail, intelligibility, and imaging. More information on this can be found in other Wisdom publications not dedicated to subwoofer installation.

Professional Acoustic Design

Does this all sound too complicated? For good reason: it is complicated.

The difference between the average listening room and one that is professionally designed and implemented is huge. A great listening room will disappear to an astonishing degree, letting the experiences captured in your recordings speak to you directly. A well-designed room is also quieter and more comfortable. It can easily become a favorite retreat for peace and rejuvenation.

If you decide to investigate the possibility of improving your room with the help of a professional, it is important to find someone who focuses on residential spaces. Most acousticians are trained to deal with large spaces – airports, auditoriums, lobbies in commercial buildings, etc. The problems seen in “small” rooms (residential spaces) are quite different, and outside the experience of most acousticians. Find someone who specializes in and has a great deal of experience designing home studios, home theaters, and the like. Your Wisdom Audio dealer may be such a person; failing that, he/she can help you find such a professional.

References

Books on Acoustics

The Master Handbook of Acoustics, F. Alton Everest, TAB Books

Sound Reproduction: The Acoustics and Psychoacoustics of Loudspeakers and Rooms by Dr. Floyd Toole, Focal Press

Installing the S90 in a Wall (S90i)

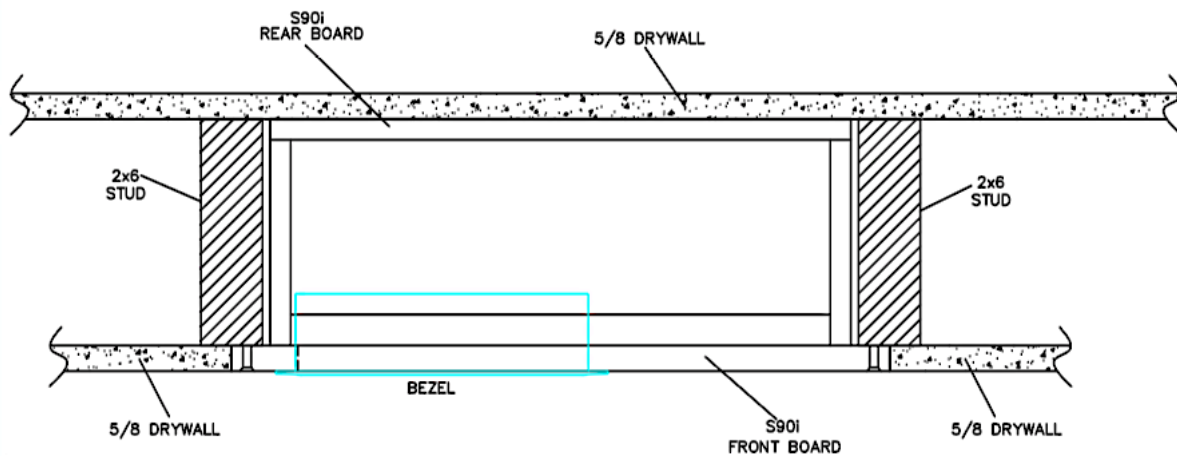
NOTE: Details of the F/C Kit Installation are covered in the F/C Kit Manual.

For the S90 Basic Port, it is left to the installer to ensure that it is properly secured and will not fall. The procedure for the electrical connections is the same for all S90 subs.

Your dealer has extensive knowledge of wall construction and will customize these installation instructions to suit the needs of your situation. The following provides an overview of the process for the various versions, beginning with the S90i installation in a standard stud wall, which is a very straightforward process.

Note, the Regenerative Transmission Line opening that vents the low frequencies into the room may be placed either up near the ceiling, or down near the floor. In most rooms, these are largely equivalent positions in terms of acoustics. The difference will usually be aesthetic rather than performance based.

As seen from above, a cross-sectional view of the S90 as mounted in a typical 2x6 stud wall looks like this:

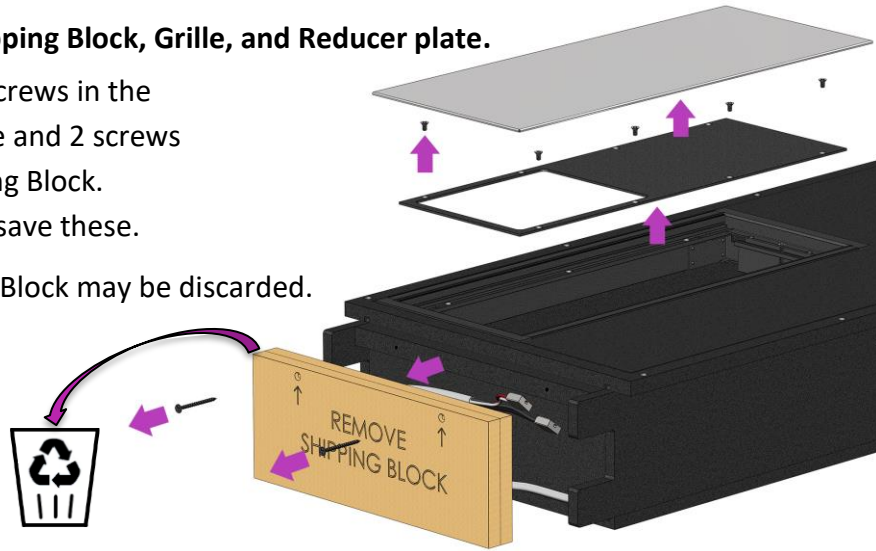


The front board of the S90 is made from 5/8" MDO plywood, which presents a smooth, paintable finish surface similar to drywall. It can be butted up against the 5/8" drywall, taped, and spackled, and painted like any other section of wall. It will also readily accept skim-coating if the construction calls for plaster walls.

1) Remove the Shipping Block, Grille, and Reducer plate.

- a) There are 8 screws in the Reducer Plate and 2 screws in the Shipping Block. Remove and save these.

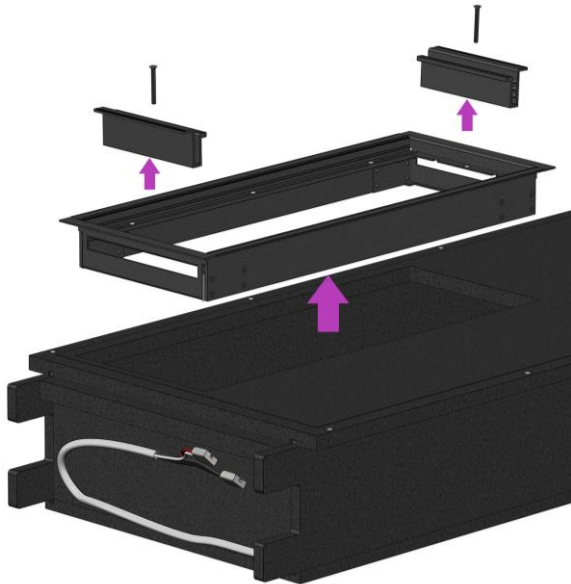
- b) The Shipping Block may be discarded.



2) Remove the Uni-grip Bezel Assembly

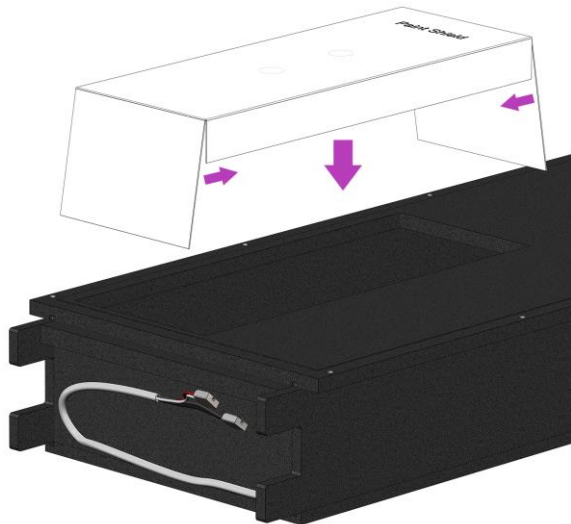
- a) Loosen and remove the 2 screws, the Uni-grip Clamps, and the Uni-grip Bezel from the S90i enclosure.

- b) Keep these components along with the Reducer Plate, Grille, and all Screws in a safe place, as these will be used later after the wall has been finished.



3) Install the Cardboard Paint Shield

- a) Fold the Paint Shield and insert it into the opening of the S90i. The paint shield is intended to prevent texture, and paint from entering the output port of the subwoofer.



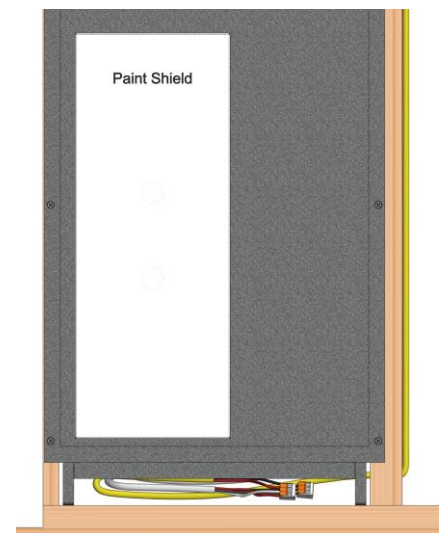
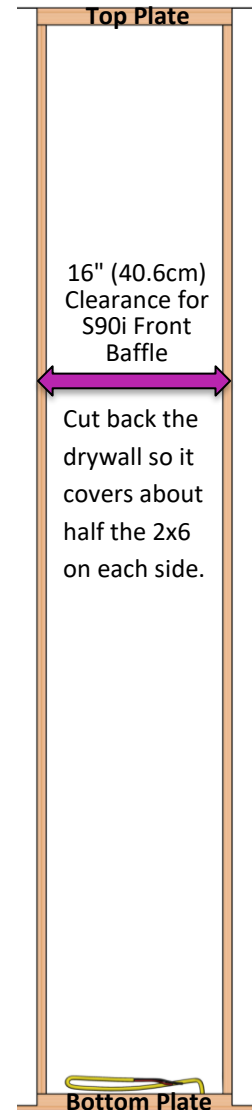
4) Select the 2x6 stud bay to be used and open it if necessary.

NOTE: It is important that you consult your Wisdom Audio Dealer when planning your subwoofer placement. See the section on [Subwoofer Placement](#).

- a) Ensure there is no plumbing, wiring, or firebreak in the stud bay. The S90 will use virtually all the available space in a standard 8' 2x6 stud bay.
- b) Should you be installing the S90i in an existing wall, cut back the drywall so it covers about half of the 2x6 on each side of the bay. The flange of the front board of the S90 will cover the other half.

5) Prepare the subwoofer wiring.

- a) There are a couple ways to wire the subwoofer input.
 - i) Bring the connecting wire through the top plate or bottom/sole plate of the same stud bay in which the S90i is located. The connection can be made in the space between the feet at the end of the S90i. If the S90i is “upside down,” with its feet at the top of the bay, the input cable needs to come through the top plate. This “upside down” orientation places the grille high on the wall, which may be preferred aesthetically (since it can appear as a surround speaker).
 - ii) Alternatively, if you have access to the adjacent stud bay, drill a hole through the 2x6 stud between where the S90i’s feet will be when it is in place, and feed the cable through the hole. You can then make the connection within the subwoofer bay or in the adjacent stud bay. If you choose an adjacent bay, you could put the connections inside a J-box for future serviceability if you so desire.



- 6) Stand the S90 in front of the bay in which it will reside; and prepare the electrical connections

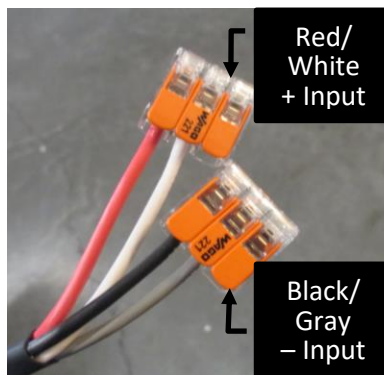
Making the S90 Connections

As with any system, before making connections, turn off the power to avoid any chance of inadvertently causing a problem (such as a short-circuit).

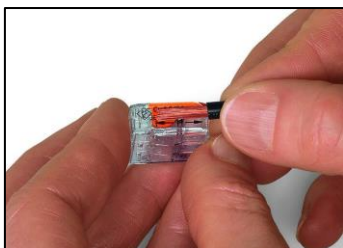
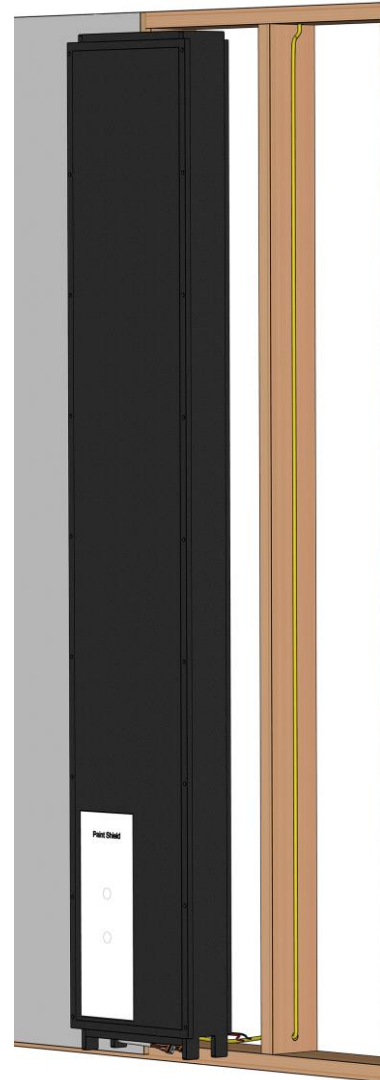
We recommend using heavy-gauge speaker wire, the gauge will vary dependent on your speaker run length. Please consult an authorized dealer to determine what gauge would be best for your application.

“Quick connect” WAGO® splicing connectors are provided at one end of the S90.

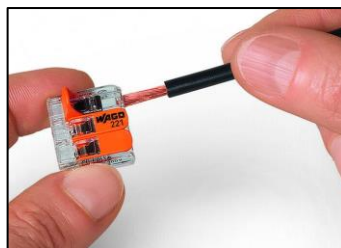
- As shown below, strip back the conductors from your amplifier 0.4" (11mm).
- Lift the lever of the empty terminal to open the clamping mechanism and insert a stripped conductor.



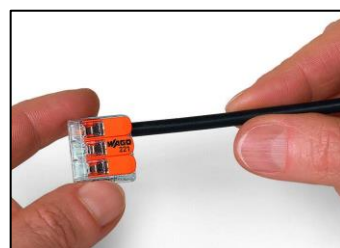
- Then, lower the lever to close the clamp and secure your input connection.



STRIP (11mm) 0.4"



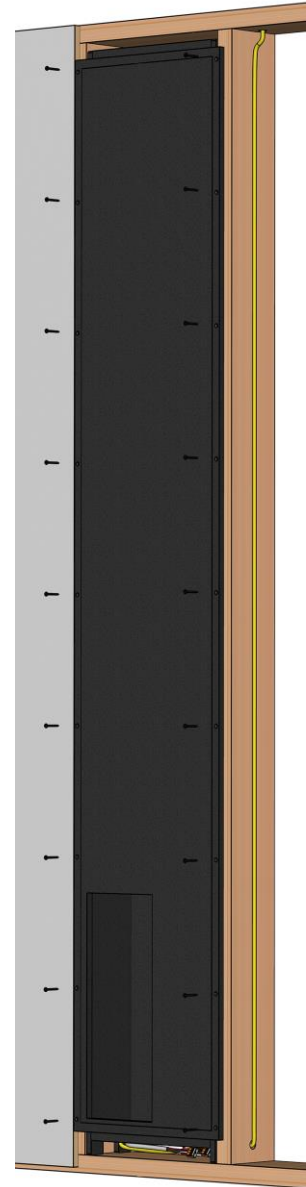
INSERT



CLAMP

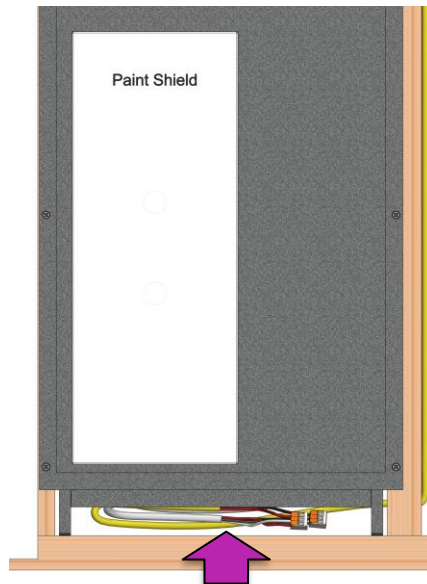
7) Stand the S90 in the stud bay and secure the S90 front board to the studs with eighteen 1-5/8" (40mm) long drywall screws.

- a) The S90 has predrilled, countersunk screw holes so standard #8 drywall screws will sit with their heads below the surface. As with other drywall joints, they can be taped and spackled without any trace. A total of eighteen 1-5/8" (40mm) long drywall screws are required.
- b) **NOTE:** The S90 should be attached in a manner that does not subject it to bending or torsional (twisting) forces that would stress the enclosure. No wooden or metal enclosure should be forced against an irregular surface. If the studs are curved or warped in an installation the installer must insert shims between the S90 front panel and the stud surfaces to avoid such stresses.



8) Wrap or Secure the wires so that they cannot rattle or vibrate.

- a) The wires and connections should be wrapped with a soft material that prevents it from directly touching adjacent hard surfaces. If access permits, the wires can also be secured using appropriate hardware.



Wrap Speaker Cables in soft material, (not shown), to prevent vibration.

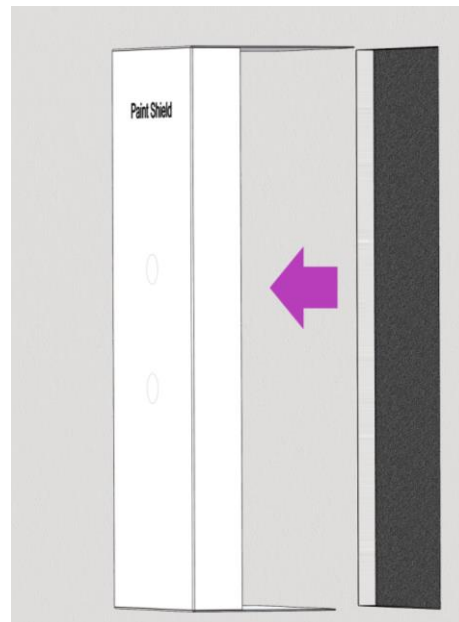
9) Check the following to ensure the S90 is ready for taping, texturing, and painting.

- a) Ensure the Paint Shield is installed.
- b) Ensure the connections have been made and are secure.

10) Paint and Finish Surface:

- a) The face of the S90 has a surface finish similar to drywall. It can be taped, mudded, and painted like any other section of wall. It will also readily accept skim-coating if the construction calls for plaster walls.
- b) Tape and mud the seams of all joints between the drywall and the S90 flange, taking care not to apply mud or skim-coat over the paint shield. Some excess is ok, as it will be cleaned up at the end.
- c) Apply paint to the wall and S90i.
- d) After painting, it is recommended to score or slice the paint along the edge of the paint shield to allow easy and clean removal. Remove and discard the shield.
- e) Any rough edges around the port opening should be covered by the Uni-Grip and Grille frame, but care should be taken to ensure a clean edge that does not impede the installation of the Uni-grip Bezel.

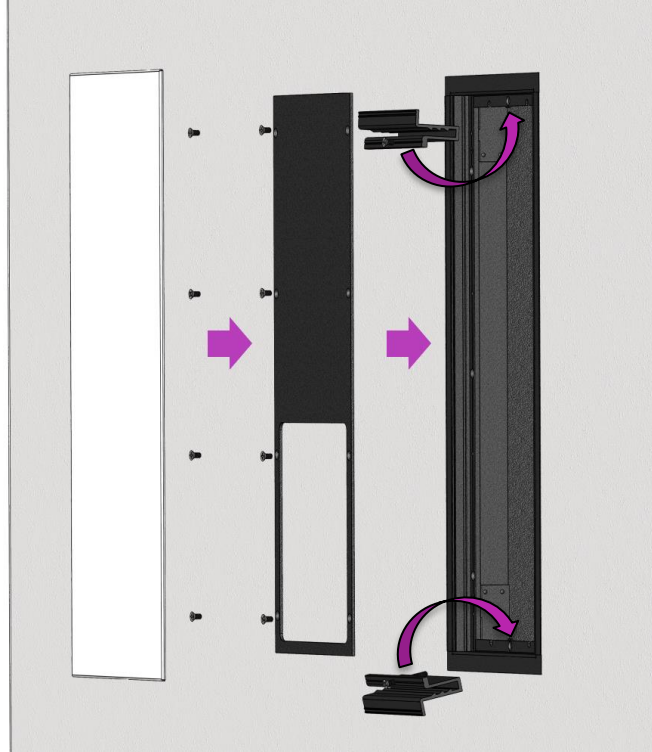
11) Remove the paint shield after the S90i has been finished (taped, textured, and painted to match the surrounding wall/ceiling).



Continued on next page

12) Reinstall the Uni-grip Bezel Assembly and attach the grille.

- a) Clear any rough edges from the port opening and insert the Uni-grip Bezel assembly.
- b) Install the Uni-grip Clamps by slipping them over the back edge of the Uni-grip frame and inserting the 1-1/2" long 8-32 flathead screws. Tighten the screws.
- c) Insert the Reducer Plate into the opening of the Bezel, ensuring the open end of the Reducer Plate is at the far end of the S90 enclosure. Insert and tighten all 8 Screws.
- d) Install the grille to the front of the Uni-grip Bezel. Heavy texture may need to be trimmed to ensure the grille fits flush on the assembly.



North American Warranty

Standard Warranty

When purchased from and installed by an authorized Wisdom Audio dealer, Wisdom Audio loudspeakers are warranted to be free from defects in material and workmanship under normal use for a period of 10 years from the original date of purchase.

IMPORTANT: Wisdom Audio loudspeakers are designed for installation and operation in environmentally controlled conditions, such as are found in normal residential environments. When used in harsh conditions such as outdoors or in marine applications, the warranty is three years from the original date of purchase.

During the warranty period, any Wisdom Audio products exhibiting defects in materials and/or workmanship will be repaired or replaced, at our option, without charge for either parts or labor, at our factory. The warranty will not apply to any Wisdom Audio products that has been misused, abused, altered, or installed and calibrated by anyone other than an authorized Wisdom Audio dealer.

Any Wisdom Audio product not performing satisfactorily may be returned to the factory for evaluation. Return authorization must first be obtained by either calling or writing the factory prior to shipping the component. The factory will pay for return shipping charges only if the component is found to be defective as mentioned above. There are other stipulations that may apply to shipping charges.

There is no other express warranty on Wisdom Audio products. Neither this warranty nor any other warranty, express or implied, including any implied warranties of merchantability or fitness, shall extend beyond the warranty period. No responsibility is assumed for any incidental or consequential damages. Some states do not allow limitations on how long an implied warranty S90 and other states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights, which vary from state to state. This warranty is applicable in the United States and Canada only. Outside of the U.S. and Canada, please contact your local, authorized Wisdom Audio distributor for warranty and service information.

Obtaining Service

We take great pride in our dealers. Experience, dedication, and integrity make these professionals ideally suited to assist with our customers' service needs.

If your Wisdom Audio loudspeaker must be serviced, please contact your dealer. Your dealer will then decide whether the problem can be remedied locally, or whether to contact Wisdom Audio for further service information or parts, or to obtain a Return Authorization. The Wisdom Audio Service Department works closely with your dealer to solve your service needs expediently.

IMPORTANT: Return authorization must be obtained from Wisdom Audio's Service Department BEFORE a unit is shipped for service.

It is extremely important that information about a problem be explicit and complete. A specific, comprehensive description of the problem helps your dealer and the Wisdom Audio Service Department locate and repair the difficulty as quickly as possible.

A copy of the original bill of sale will serve to verify warranty status. Please include it with the unit when it is brought in for warranty service.

WARNING: All returned units must be packaged in their original packaging, and the proper return authorization numbers must be marked on the outer carton for identification. Shipping the unit in improper packaging may void the warranty, as Wisdom Audio cannot be responsible for the resulting shipping damage.

Your dealer can order a new set of shipping materials for you if you need to ship your loudspeaker and no longer have the original materials. There will be a charge for this service. We strongly recommend saving all packing materials in case you need to ship your product.

If the packaging to protect the unit is, in our opinion or that of our dealer, inadequate to protect the unit, we reserve the right to repackage it for return shipment at the owner's expense. Neither Wisdom Audio nor your dealer can be responsible for shipping damage due to improper (that is, non-original) packaging.

Specifications

All specifications are subject to change at any time to improve the product.

- **Number of required amplifier channels:** 1
- **Frequency response:** 20Hz – 80 Hz \pm 2dB
- **Impedance:** 4 Ω
- **Sensitivity:** 93 dB/2.83V/1m
- **Continuous Power Rating:** 500w
- **Power handling, peak:** 1000w
- **Maximum SPL:** 123dB / 20 Hz /1m
- **Dimensions:** See appropriate dimensions drawings on next page
- **Shipping weight, each:** 65 lbs. (30 kg)

For more information, see your Wisdom Audio dealer or contact:

Wisdom Audio

1572 College Parkway, Suite 164

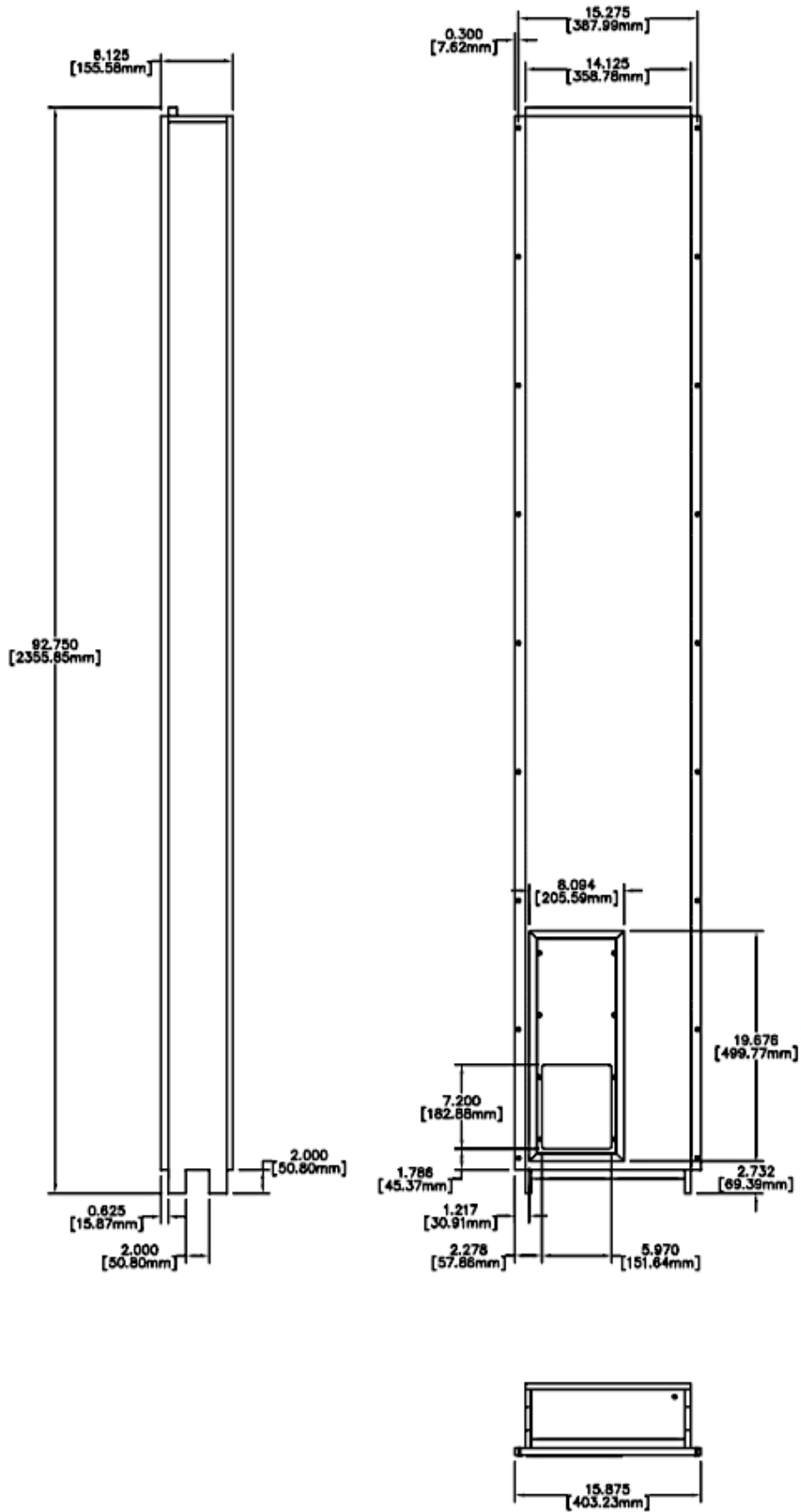
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S90 Dimensions





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