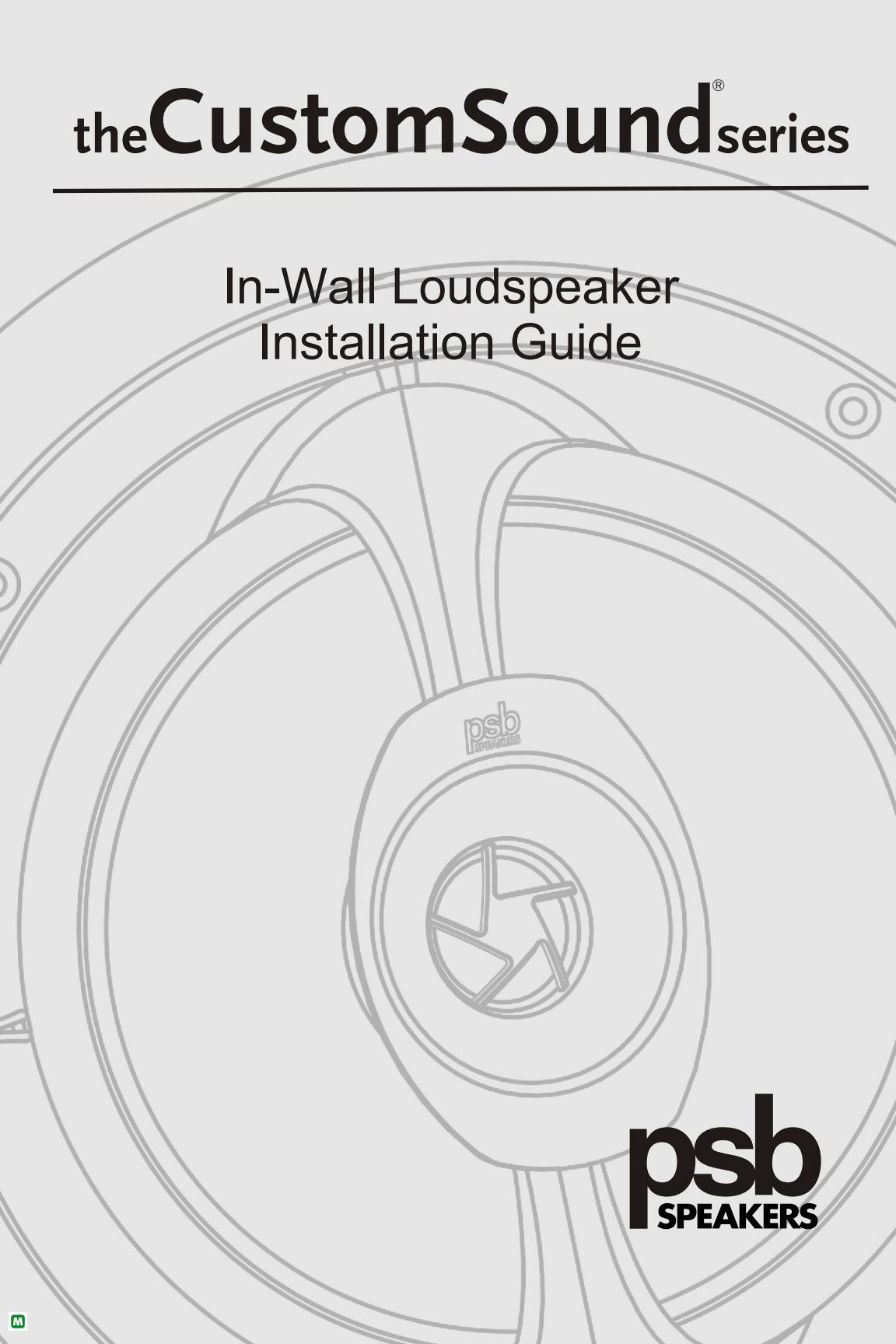
the CustomSound® series

In-Wall Loudspeaker Installation Guide



psb SPEAKERS

CONTENTS

I. MATERIALS AND TOOLS

The only other materials necessary to install CustomSound speakers are paint and extra fine sandpaper if you wish to change the color of Grills and/or Finish Frames from their standard white. Of course, wire cable of appropriate length and size will be necessary to connect speakers to amplifiers (or volume controls) in the music system.

A. Required Tools

The following tools are needed for normal, simple installations:

Tape Measure, Pencil, and Level

Utility Knife and Wallboard Saw (and extra blades)

Philips Screwdriver and Putty Knife

Drill and Bits (smaller for lead holes and larger for cabling)

Probe Wire (a heavy coat hanger can substitute for a short fish-tape)

Flashlight

B. Other Tools

Particularly when installing a quantity of speakers, or installing in wood paneling or other wall materials, the following tools are desirable for neater and more efficient installations:

Stud Finder (helpful—particularly with simple, wallboard-on-studs construction)

Metal Straight Edge (Ruler or Framing Square) and Masking Tape

Wallboard Rasp/Sanding Block (or a piece of wire lath around a block)

Awl or Worn Screwdriver (for initial, exploratory holes) and Hammer

Wire Cutters/Strippers and Electrical Tape

Battery Screwdriver and Power Drill and Extensions (with extra bits)

Jig Saw and Blades

Wallboard Router and Cutout Bits

II. LAYOUT

A. Listening Locations

Consider the desired, intended, and probable locations of listeners when considering speaker locations. Ideally, listeners should have a clear line-of-sight/hearing to all speakers in their listening area—not too far off axis and not obstructed by structure or furnishings—for most balanced frequency response. Where will listeners be—primary and secondary? Where will listeners' ears be—sitting, standing, walking? No installation is absolutely ideal, but considering listener locations with speaker location can greatly improve the final result—and simplify the effort and expense to achieve it.

B. Speaker Locations

Here are three simple ideals, which are never fully satisfied:

1. Locate speakers equidistant to listeners, preferably at ear level.
2. Locate speakers closer to each other than their distance from listeners.
3. Locate speakers symmetrically to each other and to their physical surroundings.

Ideally, listeners will be equidistant from front right and left and center channel speakers and from rear (or side) left and right surround channels for most accurate spatial imaging. If listeners are too close to front or to rear channel speakers the image cannot come together and flow seamlessly across. While ear-level mounting is ideal, the swivel tweeters can be aimed towards the listeners, increasing the accuracy of frequency response when speakers are located further off axis from listeners' ears. Most importantly, a center channel speaker should be located centered on the TV screen—to keep center channel sound coming from the center of the screen.

Balance adjustment can compensate for some physical location difference between left and right. Time-delay adjustment of surround sound can compensate for some physical location difference between front and rear. With mono signals equidistant, symmetrical location is still desired to minimize balancing requirements. Proximity to additional side wall, ceiling or floor surfaces will cause increases and decreases in frequency response which are very difficult to electronically equalize for smooth response overall—particularly when only some of the speakers are affected.

Ceiling locations are generally good locations, particularly for rear channel and secondary listening, allowing symmetrical layouts and the increased volume between floor joists for improved bass response. Some sound output will transmit through the wall behind (or floor above) a speaker; and, while this can be lessened with insulation and other installation techniques, it should be considered in finalizing locations.

All CustomSound models are designed to maintain the same tonal balance when different models are mixed in a system. The same model should be used in symmetrical listening locations in a system—front left and front right; rear left and rear right.

Any of the PSB in-wall systems can be used as surround speakers. We also offer dedicated surround systems with special radiation patterns optimized for use as a surrounds, such as the CW260.

Surround systems should be located via the following guidelines. If you are using one pair of surround speakers (a 5.1 system) the optimum location would be directly to the sides or to the sides and slightly back of the primary listening area. This will create the most enveloping surround field. Using 2 pair of surrounds (a 7.1 system) is recommended as it both creates a more diffuse and a more even sound field. There will be less variation for multiple seating positions. If your system has four surround speakers then one pair should be mounted to the left and right sides of the listener (connected as "sides") and the second pair mounted to the rear (connected as "rears"). If you could view your room layout from above the best surround speaker location would have each speaker a fairly even angle removed from its adjacent surround, that is, dispersed at equal angles around the listening area.

Surround speakers will give a more diffuse sound field (a good thing) if they are mounted fairly high on the walls and somewhat removed from the listener. Don't be afraid to mix in-wall and in-ceiling mounting.

The CW88R is a special ceiling mount (round) system for use where space is limited. In some rooms of the house, typically in bathrooms, space is limited such that there isn't room for two ceiling speakers. Mounting a single speaker forces a choice of whether to use the left or right channel signal. This can lead to strange effects were a number of the musicians or some of the members of a talk show drop out entirely. Creating a mono signal ahead of the driving amplifier is a possibility but adds unnecessary wiring complications. The CW88R solves these problems by offering a dual channel system built into one speaker assembly. The woofer utilizes dual voice coils with separate electrical crossovers for each. For high frequencies, the system features two tweeters both coaxially mounted and angled to give a modest stereo effect.

The location of subwoofers will interact with the dimensions of the room to determine the low frequency response of the overall system. Unlike with a free standing subwoofer the in-wall subwoofer can't be mounted away from the wall surfaces! The key question is: Where on the wall should they best be located?

Generally the main front speakers should be located first by following the guidelines for placement (above) with regard to angles around the listener. Their location is more critical than the location of the subwoofers. Once the main front speakers and surround speakers are located then you may want to mount the in-wall subwoofer in a spot that visually looks appropriate relative to the front speakers. This might be in the same stud bay but directly below the front left or right. Alternatively they may be mounted at just the same height as the other front speaker, yet outside them and more towards the corners. Either approach is generally acceptable. Be aware that mounting the in-wall subwoofer nearer a corner will generally increase the overall bass level and that will increase its output capability, a good thing.

Avoid mounting the subwoofers at the rear of the room or on the side walls far from the front wall. Although our sense of location for very low frequencies is poor it will still degrade the blend between bass and upper frequencies when the subwoofer and the front speakers are mounted far apart. An exception to this is when one subwoofer is mounted in the center of the front wall and a second subwoofer is mounted in the center of the rear wall. Recent studies have shown such a technique to generally give a very good low frequency room response.

Each CustomSound speaker carton contains a full-size template of the front of the speaker. These templates can be used when initially locating speakers and then when marking and cutting out speaker locations. We encourage temporarily taping templates in the intended locations and then sitting in the primary listening location and considering the above guidelines again—also realizing that behind-the-wall conflicts will probably require some adjustment to the intended locations before they are final.

C. System and Supply

Typically, a cable with a wire pair must connect every speaker to the sources. This amplified and controlled source supply may go directly from a power amplifier or through a local, supplemental volume control. In some, mono-only systems, a single wire may "daisy chain", entering and exiting from one speaker to another—beginning and ending at the amplifier.

Increasingly, different source signals may be provided to different rooms/zones/speakers—at the same time. Increasingly, control systems allow adjustments from locations different/remote from the signal sources, switching, tone control, and amplification. Some rectangular models include a knockout in the baffle into which an infrared signal remote receiver can be installed. With increasing levels of multi-zone and remote control sophistication, it is increasingly desirable to have a simple volume control local to speakers distant from the main equipment. This control—for volume up and down and off and on—may be in a small, freestanding box or flush-mounted in a wall.

Overall, a musical source—audio or video—is fed first through a preamplifier with switching and tone controls—and then through a power amplifier and onwards to each speaker. The preamplifier provides a level of tone controls—bass, treble, and balance left to right. Surround processors, operating between the preamplifier and amplifier stages, can provide surround decoding and another level of channel balancing—front left, right, and center; surround left and right; and subwoofer. An equalizer before the amplifier can provide some adjustment to smooth response for field conditions and preferences. Multiple amplifiers may be used for multiple zones and speaker loads.

D. Obstructions

With tentative speaker locations determined, potential obstructions must be explored and the conflicts resolved: Structural; Mechanical—Electrical, Plumbing, and HVAC; and Furnishings.

Temporarily mark and view tentative speaker locations and the existing construction carefully to determine the existing structure and mechanical installations and potential obstructions. Adjust the speaker layout, the furnishings, the mechanical, and/or the structural to resolve the conflicts. Layout, review, and resolution on building plans can be a very efficient process. However, some conflicts will inevitably appear and need to be resolved as actual conditions are reviewed and as installation proceeds.

Most typically and very basically, residential walls are constructed of wooden studs—nominally 2" x 4", but measuring 1½" x 3½" (sometimes, particularly on exterior walls 2" x 6", measuring 1½" x 5½") and normally located on 16" centers—with 14½" between studs. This stud pattern usually begins from one, exterior corner and results in a smaller than normal spacing at the other corner. The full height "common" studs extend from a flat "sole" plate on the floor to a "top" plate (often doubled) at the top of the wall. Top headers of doubled 2" x 4"s (or larger) are placed on edge spanning over doorways and windows, and doubled sill headers run under window openings. "Trimmer/jack" partial studs run under the ends of all headers, doubled against full studs against the ends of all headers. Shorter partial "cripple" studs run over headers to the top plate and under sills to the bottom plate—at nominal spacing. Blocking may be between studs about mid-wall, behind cabinets and other fixtures mounted to the wall, and over and under ductwork through the stud cavity. Electrical receptacles and switches are mounted in electrical boxes, usually mounted to a stud. Removing electrical cover plates in finished walls is a good initial step to determine where studs are located.

Floors typically are constructed of wooden joists—nominally 2" x 8" or deeper, but measuring 1½" x 7¼" or deeper and normally located on 16" centers (but not uncommonly on 12" centers). Roofs typically are constructed of wooden

rafters—nominally 2" x 6" or deeper, but measuring 1½" x 5½" and located on 16" centers (but not uncommonly on 24" centers). Ceilings are usually backed by 1" x 3" strapping leveled beneath the floor joists or roof rafters and located on 16" centers.

Electrical cables run to, and most often from, all electrical boxes—which are grouped on circuits. Plumbing supply, drain and vent lines run to and from all plumbing fixtures—which are grouped on vertical risers. Heating supply lines circulate through radiation fixtures—which are grouped in zones off vertical risers. HVAC ductwork runs to all supply grills and from all return grills. Control wiring (sometimes tubing) runs to all controls.

Corner bay locations should be avoided since at least one corner bay is usually smaller than normal, which will decrease bass response, and closeness to the side wall will cause some unevenness in frequency response. Mechanical activity that occupies volume in the speaker wall cavity will decrease bass response and may transmit sound to other, unintended areas. Electrical power wiring should not run close to the speaker or it's audio supply; crossing away from the speaker and its supply has minimal effect.

E. Weather Resistance

CustomSound speakers are designed for outstanding durability as well as outstanding sonic performance. Polypropylene cones with rubber surrounds, stainless steel fasteners, aluminum grilles, and ABS plastic frames with UV resistance increase the range of locations where CustomSound speakers can continue to satisfy. It should be remembered that nothing is fully weatherproof (or soundproof or fireproof). Salt water, driving rains, direct sunlight, and freeze and thaw cycles will degrade all materials—even granite—over time. Almost any interior locations other than submerged, baked, or frozen are fine. Good exterior locations provide some protection from the weather, and these are usually also better locations for improved sonic performance. Porch ceilings and walls are fine. On exterior walls, some weather shelter is desirable—under overhanging eaves is fine. Totally exposed, unsheltered locations will not sound as good and will deteriorate over time.

F. Tricks of the Trades—Nothing's Plumb, Square, or True

All people in construction realize that it is an exacting but inexact craft—nothing is exactly, absolutely plumb, square, or true. The craft is to understand and respect the tolerances of materials, tools, makers, and users—what will look right to the eye, is reasonably possible to build, and will retain it's position over years—within the budgets of money and time. Planning, measuring, and coordinating are important; but conflicts, tradeoffs, and imperfections are inevitable in the final construction. Pre-construction drawings are very valuable to further the process mentally before the physical begins. Post-construction, as-built drawings are valuable to assure performance and aid modification. However; no drawings will be entirely complete or consistent with the construction. Proceed with an open and responsive mind. Prepare to be surprised, challenged, and rewarded—to solve the many small riddles along the path to completion.

III. INSTALLATION

A. New Construction

The PSB in-walls covered in this manual use a particularly effective mounting technique with toggle style mounting clamps. They are so named because the

mounting clamp toggles out from a rest position prior to tightening down. As shipped, this mounting clamp parks on a flat on its mounting tower, thus staying out of the way for easy insertion of the system into the wall cutout. When a screwdriver is applied to the mounting screws it first turns the clamp 90 degrees, removing it from its resting place, and then brings the clamp down a track in the tower. With further tightening it finally clamps the wall firmly. This clamping style gives firm clamping for freedom from rattles, and great convenience of installation. The rectangular models have 6-8 of these clamping assemblies and the round and square versions have 4 each.

A template is provided for marking the speaker cutout. It has a series of slots for tracing the cutout and also an outline of the system to confirm that the flange won't interfere with any wall features.

For the new construction application, we offer Performance Enclosure and Pre-construction Bracket solutions. The Performance Enclosure (BBX-88) defines the optimal enclosure volume for our CustomSound Series products and is mounted between two studs behind drywall. The result is optimal low frequency response and an improvement in adjacent room isolation. The Pre-construction Brackets simplify installation in new construction application and can be used with or without the Performance Enclosure. Installation instructions are provided with both products.

At each intended speaker location measure and mark with a pencil the intended center of the speaker. Near the intended center make a small initial exploratory hole with an awl or (worn) screwdriver and hammer, a wallboard cutout saw, or a drill. If the awl, screwdriver or saw hits "solid" after the wallboard or plaster is pierced or if the drill produces sawdust after the initial wallboard/plaster dust, you have probably hit a wooden stud—which will obstruct that location. If drilling becomes harder after piercing the wallboard or plaster, remember it could be plumbing, mechanical, or electrical material. If you feel unusual resistance or sense an obstruction, stop. Consider the situation and carefully make another small exploratory hole about 1 1/2" to the side where you would prefer the speaker location to move.

When your small exploratory hole avoids obvious obstruction, enlarge that hole slightly with the screwdriver and hammer (or wallboard saw) until you can extend a short probe wire/fish-tape through the hole and determine the location of the stud on each side and other obstructions. Adjust your layout if necessary and then enlarge the hole slightly so that you can see into the wall cavity (aided by a flashlight) and confirm there are no further obstructions.

Continue this process of initial layout, exploratory holes, determining hole, and confirming hole at each intended location in a related group before proceeding with full cutouts. You can then modify the initial layout as required to avoid the inevitable discovered conflicts and maintain a desired layout for acoustical performance and visual aesthetics—while avoiding and minimizing any excess cutting and patching.

When final speaker locations are determined, use the template by placing it on the wall at the intended system location. Several thumbtacks can hold it in position. (Put the thumbtacks within the outline of the system and their holes won't show later.) Use a pencil or fine tipped pen to trace around the slots of the template. Bias the pencil or pen towards the inside of the slots to achieve the proper dimensions. A cutout of the dimensions determined by the template will include a little play to allow for cutting variation.

Now cut out the full rough-opening being careful to avoid over-cutting, breaking edges of the opening, or damaging surrounding paint or wallpaper finishes. A

wallboard handsaw, preferably with replaceable blades, is the normal tool. The Finish Frames are about 3/4" wide around the Grilles on the finish surface and extend about 5/8" beyond the rough opening cutout, which should be quite adequate cover with reasonable care in layout and cutout.

Check that openings are large enough and plumb by test fitting the speaker into the opening. A wallboard rasp block/plane is very useful to slightly expand and square up openings. A small level on or against the Frame easily confirms level and plumb.

Place the system into the wall cutout. If there is extra slack in the cutout then level and position the system before tightening the screws or after slightly tightening one or two of the screws. Use a number 2 Philips head screwdriver or any style and size that properly fits the screw head. Note: using bits that are too small will lead to damaging the screw head and may make it very difficult to sufficiently tighten or untighten the mounting screws.

Initial tightening may take considerable force as the screw forms a thread through the mounting leg. This will loosen as the screw continues to turn. Set driver torque with just enough force to start the screw turning. DO NOT OVERTIGHTEN. The system has been well designed to prevent stripping or damage from over tightening but PSB cannot be responsible for damage due to unreasonable force being used when mounting the system.

Should it ever be necessary to remove the system from the wall, then unscrew each leg (counter clockwise) in turn. As you unscrew the screw head will lie flat in the frame until near the end of its travel, where the screw starts to rise. STOP AT THAT POINT. Further turning will remove the screw from the assembly and will make it more difficult to remove the system. The dog leg clamps are held at the top of the mounting tower and should not fall off or down into the wall cavity, unless excessive force and continued counter-clockwise turning are used.

When each mounting screw is back out as described above you should be able to remove the system. Because the clamps are not parked in the starting position as when the system was first mounted, some of them may interfere with the system's removal. Usually some wiggling can jostle each clamp into a position where it isn't interfering. Using a manual screwdriver to apply slight counterclockwise pressure should also turn a clamp out of the way. (Start with the screws on one end of the system and turn each slightly. Angle the system out a little more as each clamp moves out of the way.)

B. Enclosure Volume and Insulation

CustomSound speakers are designed for optimum performance in standard wall cavities. A normal studded wall cavity is about 3 1/2" x 14 1/2" x 93" with a volume of about 2.7 cubic feet (75 liters). Changes in cavity volume most affect bass performance—response and maximum output. Slightly wider or narrower stud spacing and the resulting cavity volume will not significantly affect performance. Significant increases in cavity depth and the resulting volume—50% more with 2" x 6" wall studs or more than twice as much with floor joists—contribute to improved, more easily attainable bass performance. Volumes less than half the design volume will curtail bass performance and should be avoided.

Reaching through the rough-in opening and adding a bead of glue or caulking along the junction of the stud and the wallboard at both sides of the opening, both front and back, will increase the stiffness of the cavity enclosure near the speaker. This will

also provide insurance against possible buzzing from air movement in the cavity.

Bass response is affected by the shape of the wall cavity, as well as by the size and resulting volume of the cavity. Sound radiated from the speaker driver inside the cavity reflects back from the boundaries of the cavity. The strongest effects are resonances at the frequencies whose wavelengths are multiples of the cavity dimensions, which emphasize or de-emphasize these specific frequencies—with resulting unevenness in overall response. Several, straightforward steps will avoid and lessen these negative effects:

1. Do not locate speakers at the mid-points of wall or ceiling cavities—where the distance from the speaker driver to both ends of the wall cavity will be the same and resonance effects will be doubled. One-third and one-quarter points should also be avoided for the same reason, although the negative effects will be less.
2. Have standard (unfaced) fiberglass insulation loosely fill the wall cavity, (or at least at both ends of the cavity and at the mid-points between the speaker driver and the ends in both directions). This insulation allows the sound to travel through in both directions, but mixes the lengths of travel and absorbs some sound energy (particularly resonant sound) as heat to lessen any resonant effects. If the wall cavity is fully insulated, it should be left in place, removing only a portion of the insulation directly behind the speaker system to avoid physically obstructing the normal operation of the system or over-damping the sound output. The insulation also reduces transmission of sound through the cavity rear wall to neighboring spaces.

IV. WIRING

A. Rough-in Wiring

Typically, a cable with a wire pair connects each speaker to the signal sources, either directly or through a local volume control. The speakers must be wired appropriately for the intended control. The impedance loads of speakers must be balanced with the capabilities of the amplifier(s). In some, mono only systems a single wire may "daisy chain', entering from one speaker to another—beginning and ending at the amplifier. If biamplification or biwiring is desired for increased dynamic response and power handling, a second cable pair of wires must be run to the speaker. Wire size should increase with longer runs—usually 16 AWG stranded copper wire is minimal, with 12AWG desirable for longer runs. Additionally, a control wire is required to any IR sensor installed on a speaker baffle. Audio cable should avoid the electrical power wiring to avoid interference, which can be audible—never running directly adjacent to it and crossing at right angles, when necessary. Holes are normally located in the middle one-third of the framing depth to minimize structural effects. If wire is within 1" of the front face of the framing, it should be covered with (standard) steel protection plates to prevent later fasteners from piercing the cable.

Wiring should be run to each back frame and inserted through one of the integral wire clamps (no other fastener is required). Leave some additional wire at every end, in case of a later shift; and dress the wire into the wall cavity, away from the opening.

B. Finish Wiring

When you install the baffle-mounted speakers, the ends of each wire need to be

separated, stripped, twisted and inserted into the correct, spring-loaded terminal post. Polarity needs to be maintained—typically +/rib/writing/red/right—for uncompromised performance. The ends of the wires through each terminal post should be pushed over slightly to avoid any contact with the wire strands through the other terminal post or with the crossover circuit board. The terminal posts are spaced so that the wires can be connected, if desired, using standard banana jacks either through the ends or the sides of the posts.

The CW383 has a second set of terminal posts to allow bi-amping or bi-wiring the tweeter and the woofer separately. When wiring to both sets of terminal posts (or to the terminal posts and the second terminals location), the two short (white) wire jumpers on the crossover circuit board need to be cut to separate the input signals to the woofer and the tweeter.

The CW88R is essentially a stereo speaker with both channels combined in one chassis. As such it should be wired as a conventional stereo zone. Leads for both left and right channels are connected to two separate pairs of binding posts on the back or the CW88R. It makes no difference which pair of terminals is connected as left or as right but it is very important that you observe the right conventions for polarity. Be sure that the amplifier + or red terminals, in both cases, go to the speaker's + (red) terminals. If only one channel is to be connected (or a mono feed) then the unused speaker channel should be shorted for best frequency response.

C. Tricks of the Trades—Drilling

When running wire through wooden framing, drill clean holes slightly larger and aligned with each other to be able to pull cable through in longer sections with minimal snagging. Auger style drill bits with threaded tips are self-feeding, can chew through an occasional nail, and save much strain (although they can become jammed in thick timbers). Right angle drills help in narrow spots to get holes drilled and to maintain hole alignment. Short spade bits also get the job done more easily in tight spots between studs.

V. GRILLES

A. Installing and Removing

Install Grilles by aligning one edge and corner against the Finish Frame and then working the edges and corners of the Grille into the Finish Frame—avoiding force which can bend the grill or scratch the edges of the Finish Frame. A putty knife is useful to ease the process.

To ensure that Grilles in ceiling locations will not vibrate loose, small dabs of putty can be inserted at several locations into the groove between the Finish Frame and the Baffle before the Grille is inserted and edges embedded. Alternatively, Grille edges can be bent very slightly inward at several spots on each side to "bite" the baffle wall of the groove more securely.

Removing a Grille is most easily accomplished without scratching the finish by inserting an unfolded paper clip or a small brad nail into a perforation and gently pulling forward at several locations near a corner to start the removal.

B. Grille Alternatives—Scrims, Hole Shapes and Sizes

Grilles must be designed for acoustical transparency and also for visual

opaqueness, weather resistance, and paintability. We use aluminum for weather resistance. The relatively small perforations in a slightly thicker material improve paintability and strength, while maintaining acoustical transparency. The removable scrim feature allows the scrim to be removed during grille painting then re-applied, to avoid fabric contamination. The slight decrease in high frequency output is accounted for in the crossover design. If the scrim cannot/is not being used, flip the baffle mounted "HIGH" switch down to optimize the response.

VI. PAINTING

A. Construction Dust and Paint Shield

The Construction Dust and Paint Shield should be installed when the speaker drivers are installed, if construction is not yet completed. The shield fits snugly to protect the drivers. It can be removed after painting and other construction is completed by squeezing the finger holds in the shield and pulling the shield out from the frame. Construction dust or paint on the speaker drivers will negatively affect their performance and, if significant, void their warranty. If a removable Baffle with drivers will be installed later, the construction dust and paint shield should be installed after the Finish Frame is installed to close the opening and avoid any excess drywall compound, plaster, or paint on the unexposed sections of the Finish Frame.

B. Painting Finish Frames

The Finish Frame is made of ABS plastic and can be painted following standard practices and techniques. Be sure the frame is clean and dry, free of any mold release agent residue and of any construction dust. Lightly and evenly scuff with extra fine sandpaper, rounding square edges slightly, to ensure good paint adhesion. Apply two to three coats, thinned slightly with a paint conditioner, to produce an even surface. Imperfections can be sanded between coats. Spraying will yield best results.

C. Painting Grilles

The Grille is made of painted aluminum and can be painted following standard practices and techniques. Apply two or three coats of paint, thinned well with a paint conditioner to avoid blocking Grille perforations while increasing paint coverage of the sides of the holes. Spraying will yield best results. A roller tends to deposit too much paint, blocking holes. While the paint is wet, blocked holes can be cleared individually with a paper clip, or small nail (#18 wire brad is the closest size). Some excess paint can be removed using a dry brush to pick-up the excess paint and then brushing it out on a scrap of paper or rag and repeating the process. It may be preferable to wipe the wet paint off with thinner or a rag and begin painting more carefully again. With a contrasting color it is important to paint the sides of the perforation holes to show consistent color off axis. This is best done by spraying or brushing carefully from several angles side to side and up and down. Allow a painted Grille to dry thoroughly before carefully installing it in the Finish Frame.

VII. SETUP

A. Swivel Tweeter

A number of our in-wall offerings give different means of aiming the sound towards the listening area. This is done to achieve the best possible frequency balance (and hence the most transparent sound) wherever the listeners may sit. If your speaker includes an aimable tweeter as with the CW383, CW363, CW262, CW180 etc. then, with the grille off, gently turn the tweeter and its surrounding SonicGuide or mount

until it aims as nearly toward the center of the listening area as its design allows. Do not overstress the turning assembly, also take care not to touch the silver dome of the tweeter element as they are very fragile. The SonicGuide is a constant directivity waveguide that greatly improves response smoothness by preventing the sound from radiating backward to the woofer cone. Additionally, when used as a surround speaker, you may prefer to aim the tweeter away from the ears of listeners to provide more diffuse, less direct sound. A small pivot of the tweeter with listeners nearby, is the equivalent of turning a cabinet speaker slightly.

In the case of the CW363 and CW262 and also the CW180, the plate (or gimbal ring for the CW180) of the high frequency elements will also rotate. This second degree of mechanical movement lets you aim the sound not only laterally but also to incline it upwards on downwards. Since many systems are wall mounted at an elevation higher than the listener position, this second degree of freedom will further assure the smoothest response

In the case of the CW383 and the CW260, the upper range elements are mounted on a plate that can be removed and reoriented in 90 degree increments. This is useful if the system is wall mounted with the long axis horizontal rather than with the more typical vertical orientation. Simply unscrew the 4 mounting screws and turn the plate as required. Generally the best orientation is when the units on the plate are in a vertical (not horizontal) line.

In either case, carefully pivot the swivel tweeter to aim it towards or away from primary listeners. **Be careful to touch only the plastic perimeter —do not touch the aluminum dome or the plastic phase vane and protector directly in front of the dome. Denting the aluminum dome causes irreparable damage not covered by warranty.**

B. High and Mid Frequencies Switches

In-wall systems are balanced in design for as much bass as possible. Bass is a difficult commodity to deliver in the desired quantity in the limited cavities of in-wall installations. Increasing bass response is effectively decreasing high and mid frequencies response (regardless of what some labels may indicate).

Adjusted high frequencies response may be desirable when the speakers are installed in locations surrounded by hard surfaces that reflect the sound output with very little absorption, causing a "hardness" to the sound (and/or with some electronics). Adjusted mid frequencies response may be preferred when the speakers are insta!led close to adjacent walls which can emphasize some upper bass frequencies (and/ or with some electronics). Decreasing mid frequencies is generally desirable to smooth the crossover transition and avoid an upper bass "hump" in systems where bass is supplemented by a subwoofer. Decreasing high and mid frequencies increases relative bass response, while decreasing efficiency and sound power output.

To modify the response, simply flip the baffle-mounted switch or switches to the alternate position—upper/left, is the normal position; lower/right is the decreased position. These heavy-duty switches are designed to handle the currents of high level sound without compromise.

C. Bipole and Dipole Switches

The CW260 is especially suited to surround usage with its 2 switchable radiation patterns. Both patterns tend to send more energy to angles away from the listener

and so contribute to a spacious sound. Pattern one is “Dipole” radiation. It creates a distinct null in energy for angles straight out from the speaker. If a listener sits within this null he will hear very little energy directly from the CW260. The sound from the system will only reach the listener after several bounces off of the room walls. This will give the maximum diffusion of the surround field but also has the most rigorous mounting requirements. The dipole setting should really only be used if the system can be mounted with the listener within 10 degrees of an axis straight out from the system. Contrary to the comments above to mount the system high on the wall, the CW260, when set to dipole will work best if it is near ear level.

If these mounting criteria can't be met then it is better to use the system with its switch set to “bipole”. This setting also creates a more diffuse sound field by sending the majority of sound away from the listening area. It just does so to a more moderate degree.

A second switch sets the overall treble level. The “+” position gives greater treble energy and will tend to flatten the “power response” when used in the dipole setting. The second position gives a more flat direct sound field and may better suit “bipole” operation, especially if the listening area is near the axis of the small full range elements (45 degrees forwards or backwards of the system).

D. Listening—Balance, Range, and Imaging

Our goal is to provide listeners with completely convincing, "being there" performance. In-wall installations place greater physical limits on systems than freestanding box systems. However, their performance, particularly considering the physical limits and the resulting minimal intrusion into the listening space, can be startling.

Final judgments on the quality of the sound output are of course personal. We encourage listening to the speakers with clear and familiar recordings—particularly of female and male voices and acoustic instruments—to convince and satisfy listeners of the natural tonal balance, wide frequency and dynamic range, and spatial imaging delivered.

Notes on environmental protection

At the end of its useful life, this product must not be disposed of with regular household waste but must be returned to a collection point for the recycling of electrical and electronic equipment. The symbol on the product, user's manual and packaging, point this out.

The materials can be reused in accordance with their markings. Through re-use, recycling of raw materials, or other forms of recycling of old products, you are making an important contribution to the protection of our environment.

Your local administrative office can advise you of the responsible waste disposal point.

	CW383	CW363	CW262	CW260	CWS8
Description	8" Rectangular	6.5" Rectangular	6.5" Rectangular	6.5" Rectangular Surround	8" Rectangular Dual Subwoofer
Frequency Range					
Response					
On Axis @ 0° ±3dB	45-21,000Hz	50-21,000Hz	50-21,000Hz	50-21,000Hz*	39-200Hz (with CWA-1)
Sensitivity					
Typical Listening Room	90dB	87dB	87dB	87dB	87dB
Impedance					
Nominal	4 Ohms	4 Ohms	8 Ohms	8 Ohms * 4 Ohms dipole	4 Ohms
Input Power					
Recommended	40-200 Watts	30-150 Watts	30-150 Watts	30-150 Watts	40-200 Watts
Acoustic Design					
Tweeter (Nominal)	1" (25mm)	3/4" (19mm)	3/4" (19mm)	2 x 2" (50mm)	
Midrange (Nominal)	4" (102mm)	3" (76mm)			
Woofer (Nominal)	8" (203mm)	6 ½" (165mm)	6 ½" (165mm)	6 ½" (165mm)	2 x 8" (203mm)
EQ Adjustment	Treble and Midrange Level Switches	Treble and Midrange Level Switches	Treble and Midrange Level Switches	Bipole/Dipole and Treble Level Switches	Via CWA-1
Dimensions (W x H x D)					
Overall	11" x 18 1/4" x 4" (280mm x 464mm x 102mm)	9 ½"x 15 3/8" 3 1/2" (241mm x 390mm x 89mm)	9 ½"x 15 3/8" 3 1/2" (241mm x 390mm x 89mm)	9 ½"x 15 3/8" 3 1/2" (241mm x 390mm x 89mm)	11" x 18 1/4" x 4" (280mm x 464mm x 102mm)
Rough-in/Mounting Hole	9 3/4" x 17" (248mm x 432mm)	8 ½"x 14 5/16" (215mm x 364mm)	8 ½"x 14 5/16" (215mm x 364mm)	8 ½"x 14 5/16" (215mm x 364mm)	9 3/4" x 17" (248mm x 432mm)
Cover/Overlap	11/16" (18mm)	9/16" (14.5mm)	9/16" (14.5mm)	9/16" (14.5mm)	11/16" (18mm)
Pre-Construction Bracket (Optional)	CK-88	CK-66	CK-66	CK-66	CK-88
Features	3-way Swinging Tweeter	3-way Rotating & Swinging SonicGuide	2-way Rotating & Swinging SonicGuide	Dipole/Bipole Switching *Flat total radiated power to 10kHz	High Power Woofers

	CW28	CW26	CW88R	CW180R/S
Description	8" Rectangular	6.5" Rectangular	8" Stereo Coaxial	8" Coaxial
Frequency Range				
Response				
On Axis @ 0° ±3dB	45-20,000Hz	55-20,000Hz	45-20,000Hz	38-21,000Hz
Sensitivity				
Typical Listening Room	88dB	87dB	86dB	90dB
Impedance				
Nominal	8 Ohms	8 Ohms	8 Ohms	8 Ohms
Input Power				
Recommended	20-160 Watts	20-125 Watts	20-100 Watts	20-100 Watts
Acoustic Design				
Tweeter (Nominal)	1" (25mm)	1" (25mm)	2 x 1" (25mm)	1" (25mm)
Midrange (Nominal)				
Woofer (Nominal)	8" (203mm)	6.5" (165mm)	8" (203mm)	8" (203mm)
EQ Adjustment	Treble and Midrange Level Switches	Treble and Midrange Level Switches	Double voice coil woofer	Treble and Midrange Level Switches
Dimensions (W x H x D)				
Overall	10 9/16" x 14 11/16" x 3 13/16" (268mm x 376mm x 97mm)	9 1/16" x 12 11/16" x 3 1/16" (230mm x 322mm x 78mm)	11 1/16" dia. x 3 5/8" (281mm dia. x 92mm)	11 1/8" x 11 1/8" x 4" (283mm x 283mm x 102mm)
Rough-in/Mounting Hole	9 1/4" x 13 5/16" (235mm x 338mm)	7 11/16" x 11 3/8" (195mm x 289mm)	9 11/16" dia. (246mm) dia.	9 7/8" (251mm) dia. for Round 9 7/8" (251mm) sq. for Square
Cover/Overlap	11/16" (18mm)	11/16" (18mm)	11/16" (18mm)	11/16" (18mm)
Pre-Construction Bracket (Optional)	CK-28	CK-26	CK-80R	CK-8R/CK-8S
Features	2-way Swinging tweeter	2-way Swinging tweeter	Stereo 2-way Swinging tweeter	2-way Rotating & Swinging SonicGuide

	160R/S	CW80R	CW60R	CW50R
Description	6.5" Coaxial	8" Coaxial	6.5" Coaxial	5.25" Coaxial
Frequency Range				
Response				
On Axis @ 0° ±3dB	51-21,000Hz	45-20,000Hz	55-20,000Hz	65-20,000Hz
Sensitivity				
Typical Listening Room	87dB	87dB	86dB	86dB
Impedance				
Nominal	8 Ohms	8 Ohms	8 Ohms	8 Ohms
Input Power				
Recommended	10-100 Watts	20-100 Watts	20-75 Watts	20-60 Watts
Acoustic Design				
Tweeter (Nominal)	3/4" (19mm)	1" (25mm)	3/4" (19mm)	3/4" (19mm)
Midrange (Nominal)				
Woofer (Nominal)	6 1/2" (165mm)	8" (203mm)	6 1/2" (165mm)	5 1/4" (133mm)
EQ Adjustment	Treble and midrange level switches			
Dimensions (W x H x D) Overall	9 1/2" x 9 1/2" x 3 11/16" (241mm x 241mm x 94mm)	11 1/16" dia. x 3 5/8" (281mm dia. x 92mm)	9 7/16" dia. x 3" (240mm dia. x 76mm)	7 13/16" dia. x 2 15/16" (198mm dia. x 75mm)
Rough-in/Mounting Hole	8 3/8" (212mm) dia. for Round 8 3/8" (212mm) sq. for Square	9 11/16" dia. (246mm) dia.	8" dia. (203mm) dia.	6 ½" dia. (165mm) dia.
Cover/Overlap	5/8" (16mm)	11/16" (18mm)	11/16" (18mm)	11/16" (18mm)
Pre-Construction Bracket (Optional)	CK-6R/CK-6S	CK-80R	CK-60R	CK-50R
Features	2-way Rotating & Swinging SonicGuide	2-way Swinging tweeter	2-way Swinging tweeter	2-way Swinging tweeter

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