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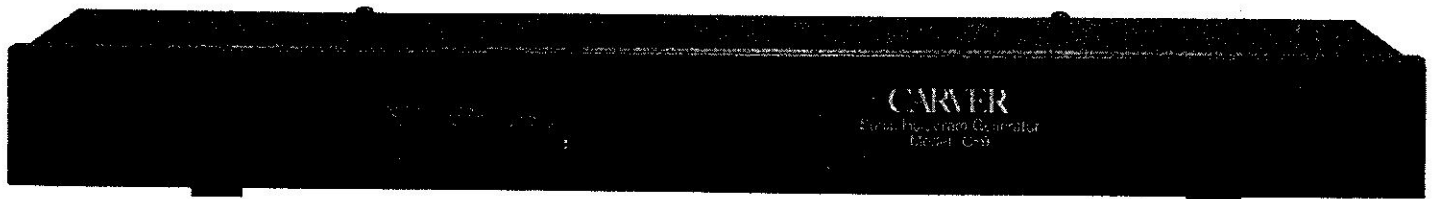
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Model C-9



Sonic Hologram Generator™

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NOTE: It is not possible to make the C-9 and Sonic Holography function properly without reading this owner's manual. Please follow all instructions and recommendations concerning placement of loudspeakers and listening chair exactly.

WARNING: To prevent fire or shock hazard, do not expose this equipment to rain or moisture.

TO AVOID ELECTRICAL SHOCK, DO NOT OPEN CHASSIS. NO USER-SERVICEABLE PARTS INSIDE. REFER ALL SERVICING TO QUALIFIED PERSONNEL.

IMPORTANT: Carefully unpack your C-9 and keep the original carton and packing materials for moving, shipment, or long-term storage.

CAUTION: When installing this equipment, read and follow all safety and operating instructions.

Personal Warranty Information

Serial Number: _____

Dealer: _____

Date of Purchase: _____

Personal ID Number/Location: _____

Introduction



Congratulations on purchasing a Carver C-9 Sonic Hologram Generator™. The C-9 and Sonic Holography will increase listening pleasure and enjoyment by bringing a completely new perspective to your favorite music not possible till now. For years, better, more sophisticated systems for recording and reproducing stereo have been offered as supposedly capable of further enhancing the "you-are-there" feel of a musical performance. However, certain problems with conventional stereo playback would always limit this "enhanced realism" to the space between the loudspeakers. Even with the addition of delay and other ambience-restoring equipment or loudspeaker systems, perceived realism was still a problem.

Needless to say, conventional stereo doesn't sound anything like a live, sonic event: Stereo reproduction is subject to fundamental distortions of spatial perspectives that just don't occur in real life. Everyone has become accustomed to the limits of stereo and has learned to listen to normal stereo imaging because they enjoy the music, not because it sounds like a real performance.

Enter Bob Carver's unique ideas and design research into the way humans perceive sound and how it applies to the stereo listening experience. Carver's logical, problem-solving breakthrough brings an actual improvement in the quality of listening through complex processing of the stereo signals, and a change in relationships between the listener and loudspeakers. Now, instead of flat, between-the-loudspeaker imaging associated with conventional stereo, Sonic Holography paints a sonic picture that's remarkably believable and convincing. A listener can actually pinpoint the location of individual artists and instruments far beyond the limits of the left/right loudspeakers. At times, sound even seems to come from outside the listening room.

This sense of performance is heightened by a perceived depth, as well as width, of the sonic stage created by Sonic Holography. The ambience or acoustic signature of a recording's location, which is vital to the sound of a live music event but masked during conventional stereo playback, is restored. The total effect makes your favorite music a full, three-dimensional experience of unparalleled realism and sense of being there.

To get the most from your C-9 and Sonic Holography, be sure to read all safety, installation, and operating information that follows in this manual. By carefully following the initial set-up instructions and recommendations, you'll be experiencing Sonic Holography in a relatively short period of time.

IT IS NOT POSSIBLE TO MAKE THE C-9 AND SONIC HOLOGRAPHY FUNCTION PROPERLY WITHOUT READING THIS OWNER'S MANUAL. PLEASE FOLLOW ALL INSTRUCTIONS AND RECOMMENDATIONS CONCERNING PLACEMENT OF LOUDSPEAKERS AND LISTENING CHAIR EXACTLY.

Warranty Card

It's highly unlikely your C-9 will ever need service but, should the unlikely occur, the Warranty Card is the ticket to Carver's three-year limited Parts/Labor Warranty Repair. Take a moment to fill out and return the Warranty Card that came in the C-9's packing kit. You should also fill out the warranty information in the space we provided earlier in this manual. Be sure to include any personal ID number used to further identify the C-9.

Before Going any Farther . . .

Here are some suggested do's and don'ts that will make setting-up and using the C-9 a safe, as well as enjoyable, experience:

- Don't operate the C-9 on any ac line voltage other than that specified on the rear panel.
- Make all connections to and from the C-9 with its power cord unplugged, and the power for all other components in your system switched off.
- If someone accidentally spills a drink on the C-9's chassis, unplug the unit and have it checked or cleaned by a qualified service technician.
- Of course, we've mentioned that there aren't any user-serviceable parts inside your C-9. Please resist any temptation to fiddle around inside the chassis. Avoid electrical shock and/or extreme embarrassment; refer all work to a qualified technician.

Again, keep the carton and packing materials the C-9 came in. Should you move, the best shipping container is the original carton. Hang on to this owner's manual, too. When your music system gets to its new home, the safety, installation, and operating instructions could be more than useful.

Installation

To install the C-9 with other stereo components and set-up your stereo system for Sonic Holography, the following items or materials will be necessary:

1. A steel tape measure (preferred) or nonstretchable wire, rope, etc. A piece of stout string will do in a pinch.
2. A temporary listening-chair that may be easily moved about.
3. Two dual-RCA plug to dual-RCA plug signal cables. (Be sure they're shielded.)
4. A length of adhesive tape (masking, "scotch," electrical, etc.).
5. Several favorite stereo music selections.
6. If planning to match-up the C-9's front panel with other 19-inch stereo components or install it in a case, the C-9 Appearance Panels and a philips-head screwdriver.

Placement

If you plan to mount the C-9 in a case or equipment rack, the Appearance Panels must first be drilled-out to provide mounting holes on each of the two panels. This allows the C-9 to be secured to the rack rails, once the panels are attached to either side of the chassis. (A template for drilling-out the Appearance Panels is included in the Appendix of this manual.) After the panels are attached to the C-9, secure it with the proper mounting hardware for that type of enclosure. You may want to remove the rubber feet on the underside of the C-9's chassis for rack installations.

If you're going to place the C-9 with 19-inch stereo components, and wish its front panel to match theirs, simply attach the Appearance Panels to either side of the chassis per instructions.

Regardless of how the C-9 will be placed in your stereo system, just be sure it's near enough to the preamp and amplifier so the signal cables will reach without excessive strain on the connections.

Operating Temperature

Heat, at least in normal amounts, shouldn't be any problem for the C-9. The C-9 doesn't generate much of its own and isn't sensitive to small amounts. But, you should never mount or stack the C-9 directly on top of power amplifiers. Unless your system uses Carver-designed Magnetic Field Amplifiers, conventional power amps can, and do, generate a lot of heat. In addition, the C-9's chassis could block vents on an amplifier necessary for proper cooling. If you've mounted the C-9 in an enclosed rack or case, forced-air cooling with a small rack fan is recommended. These fans can help prolong the life of electrical devices in a C-9 and other stereo components. Rack fans may be obtained from your stereo dealer or

electronic supply shop. Using a filter with the fan is also recommended to reduce dust in the enclosure. Be sure the filter is cleaned regularly.

Also, avoid mounting or placing the C-9 in direct sunlight. This can lead to an excessive heat build-up that could shorten certain components' life spans. Other locations to avoid include those near forced-air vents, large transformers, or other sources of dust and possible interference.

Signal Connections

The illustration insert details the rear panel connector group on the C-9. If your stereo system uses separate components, the connection of the C-9 will be fairly simple. Consult the interconnect diagram.

The C-9 is placed in the system's signal path between the outputs of the preamp and the inputs of the power amplifier. The connections for this set-up are as follows:

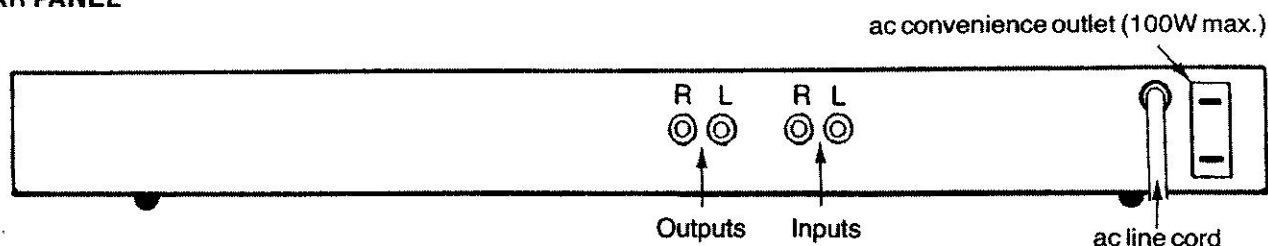
1. Connect the left main output of the preamp to the left input on the C-9, the right main output to the right input.
2. Connect the left output of the C-9 to the left channel input of the power amplifier, repeating the procedure for the right channel.

Make sure the power to the preamp and power amplifier is switched off, and the power cord of the C-9 unplugged from any working receptacle. Make sure the RCA plugs are seated firmly in their respective jacks. If your stereo system uses an integrated amplifier (preamp/amp in one package) with access to the preamp and amplifier inputs, the connections are made the same way. Just remove the "straps" between the jacks and connect the cables.

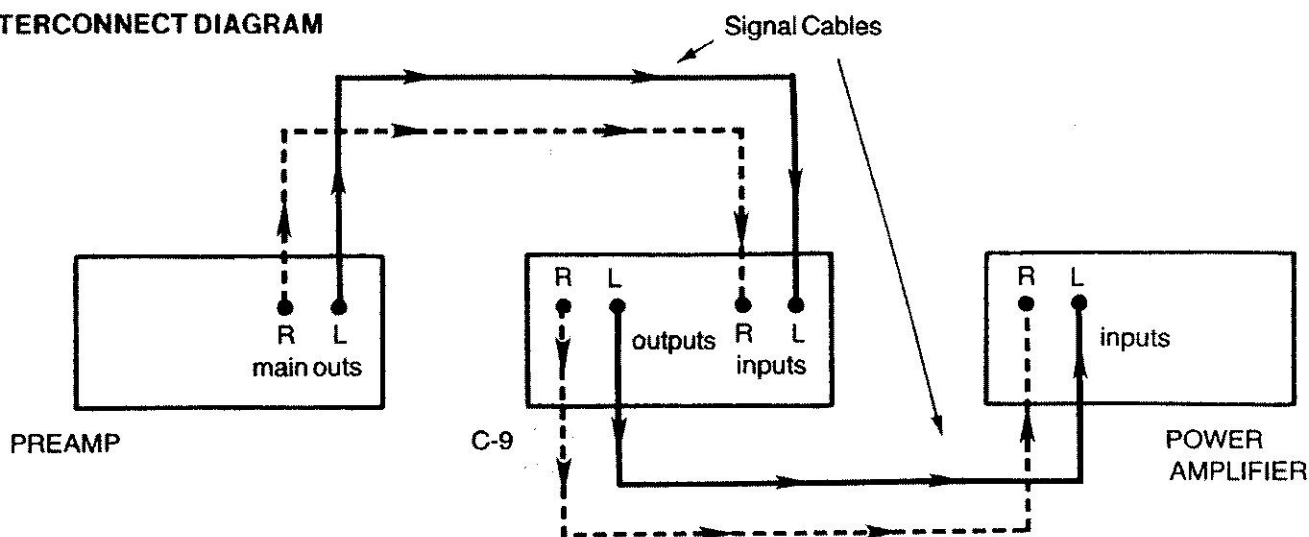
If your integrated amplifier or receiver combination has no access to the preamp and amplifier sections, there are other alternatives. The C-9 can also be connected to an external processor loop, or tape loop. Refer to the Applications section in this manual's Appendix for more information on different set-ups with the C-9.

When it comes to the interconnect cables themselves, make sure they're shielded and reach the adjoining components without placing excessive strain on the cable or connections. If you're using "old" cables to connect the C-9, carefully inspect them for broken, damaged connectors and shielding. A faulty cord can degrade the performance of the best stereo components. If you have any question about the condition of a cable, the best policy is to replace it. Avoid using signal cables that exceed 20 feet in length: Longer cables can induce noise interference that will also degrade audio quality.

REAR PANEL



INTERCONNECT DIAGRAM



Power

Since the C-9 has no power on/off switch of its own, we recommend connecting it to a switched convenience-receptacle on a preamp. If these receptacles are taken up by power amplifiers and other components, you should use a switched, multi-receptacle power bar. Plug any additional stereo components and the C-9 into the power bar (including the preamp). The power bar's on/off switch can serve as a master ac control for your whole stereo system. Make certain any power bar used for this purpose is rated to handle the total maximum wattage of every component in your stereo system.

Never plug or unplug the C-9 in an operating stereo system. The resulting transients can permanently damage the loudspeakers, and there is a chance of accidental electrical shock.

Cleaning

You'll want to wipe off the C-9's front panel and chassis from time-to-time with a soft, dry cloth. If you have something stubborn to remove, use a mild dish soap or detergent sparingly applied to a soft cloth; don't use alcohol, ammonia, or other strong solvents.

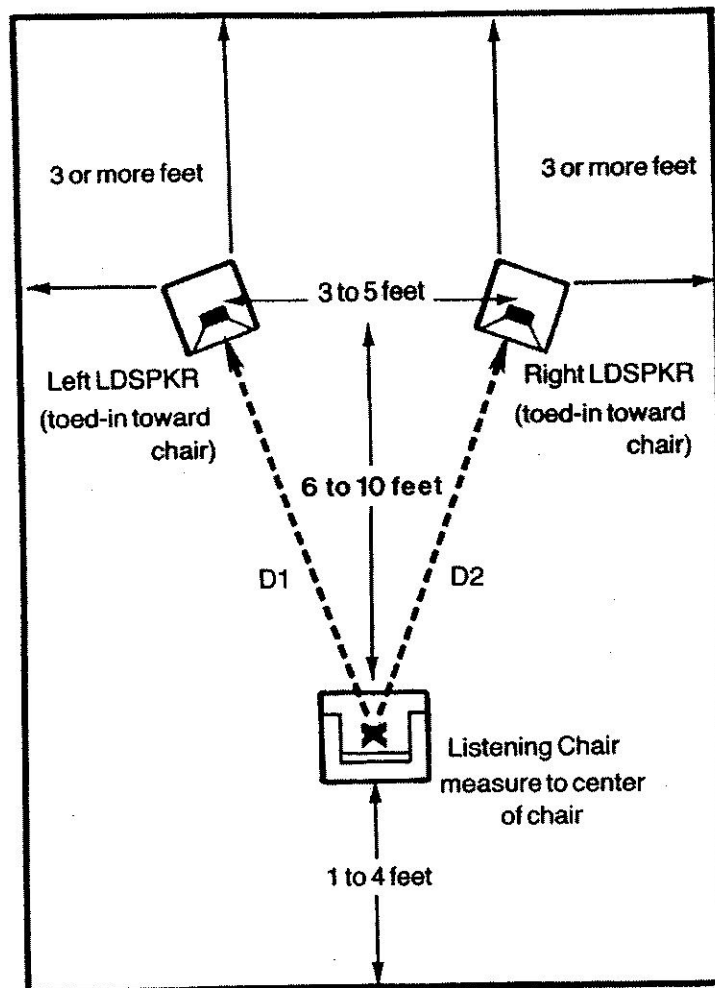
After installing and connecting the C-9 with the rest of your stereo system, you'll probably be tempted to begin playing music and fiddling around with controls. We urge you to resist this temptation for the moment. If you decide to try it anyway, not much will happen because you're only part way there. Successful Sonic Holography depends on proper loudspeaker placement and other important factors. Read the next chapter, and follow the instructions and recommendations exactly.

Initial Loudspeaker/Chair Placement

NOTE: You will NOT be able to create or completely enjoy musical images in Sonic Holography without following the instructions and recommendations concerning positioning of both loudspeakers and listening chair.

Making Sonic Holography work properly requires attention to many factors that usually aren't problems or considerations for normal stereo playback. The two most important factors are accurate relationships between the loudspeakers and listening chair, and dealing with reflected sound off surfaces in the listening room. The real key to this process is the

INITIAL SET-UP



relationships between the loudspeakers and chair. While minimizing room reflections is almost as important, a musical image in Sonic Holography will never occur unless the loudspeaker/listening chair relationship is achieved accurately and correctly. It might seem impractical, or a lot of trouble and effort, but you'll be amply rewarded by the stunning, live imaging Sonic Holography brings to your favorite music.

It may be the initial loudspeaker/listening chair placement will not work on a day-to-day basis in your listening room. While the relationships between the loudspeakers and the listening chair must always be the same, there are compromises that should suit the specific needs of your listening space, yet provide for good imaging. We know you want to begin listening to music in Sonic Holography right away. The following section will allow you to do that with the least amount of hassle, and the best first-time results.

To perform the set-up, you'll need the tape measure (or suggested substitute), temporary listening chair, and adhesive tape (masking, "scotch," electrical). To arrange your loudspeaker system and listening position for Sonic Holography, perform the following step-by-step:

STEP ONE: Move your loudspeakers out and away from the side walls, rear wall, and other reflective surfaces shown in the diagram above. The diagram represents a "universal" listening room with loudspeakers and the listening chair. The loudspeakers should be at least three feet from reflecting surfaces — measured from the wall behind the speakers, side walls and nearby adjoining corners.

Unless your loudspeakers are designed to rest on the floor, place them on stands — ideally, high enough so the midrange/high-frequency drivers are approximately at ear level with a seated listener. Move the speakers fairly close together — three to five feet from center-to-center. The loudspeakers should be positioned to place the listening chair on an axis with the direct sound from each.

STEP TWO: Take the temporary listening chair and place it six to ten feet in front of the loudspeakers. It's ideal to have a rear wall one to four feet behind the chair. If this isn't practical because of room dimensions, move the chair closer to the loudspeakers, not up against the rear wall.

STEP THREE: Using a tape measure or nonstretchable measuring device, carefully measure from the left loudspeaker's top/center to the center of the

listening chair. Repeat the measurement for the right loudspeaker, making both distances (D1 and D2 in the diagram) EXACTLY THE SAME. Accuracy within $\frac{1}{4}$ inch is desired. If using a measuring device other than a steel tape measure, don't pull too hard on it, as this could cause an error. Have an assistant hold the measuring device to the center of the chair's seat, or secure it with a piece of tape.

If your loudspeakers are "odd shaped," and you aren't sure where to measure from, measure from the chair to the center of the midrange driver.

The goal of this step has been to place the listening chair at a point equidistant from both loudspeakers. This places a seated listener on what can be called the "stereo axis." Being on this acoustic centerline is very important to hearing a musical image in Sonic Holography. If you've performed Step Three carefully, a seated listener in the chair should have a ready-made window for initial experiments with Sonic Holography. You'll undoubtedly have to make some minor adjustments but this should get things going.

It's not enough to try and visually "guesstimate" the distances between the loudspeakers and listening chair. What might appear to be accurate probably won't be accurate enough for creating images in Sonic Holography so don't bother to try it this way.

When one loudspeaker is off, the stereo axis shifts. This places the listener in a position where imaging in Sonic Holography won't occur. The best plan is to perform the measurements as outlined in Step Three. Once you've made these measurements and positioned the loudspeakers and listening chair, take some tape to mark their locations on the floor. If you must move things around during this initial set-up, it will allow you to return things quickly to the proper positions without measuring again.

Function: What it Does

Sonic Holography is a complex method of processing stereo signals to correct the basic imaging-flaw inherent in conventional stereo playback. The problem with conventional stereo playback is that both ears hear the output of both loudspeakers. In order to understand why this is a problem, a comparison must be made between the way we hear a stereo recording of a live event played back through loudspeakers, as opposed to hearing an actual sonic event. Look at the diagrams.

Diagram A shows what occurs during playback in conventional stereo. A note played on a violin is recorded in stereo with a single microphone to pick up the sound. The signal from the microphone goes to a stereo mixer which takes and splits it electronically with a "pan pot." A pan pot can be

Diagram A: Stereo Playback

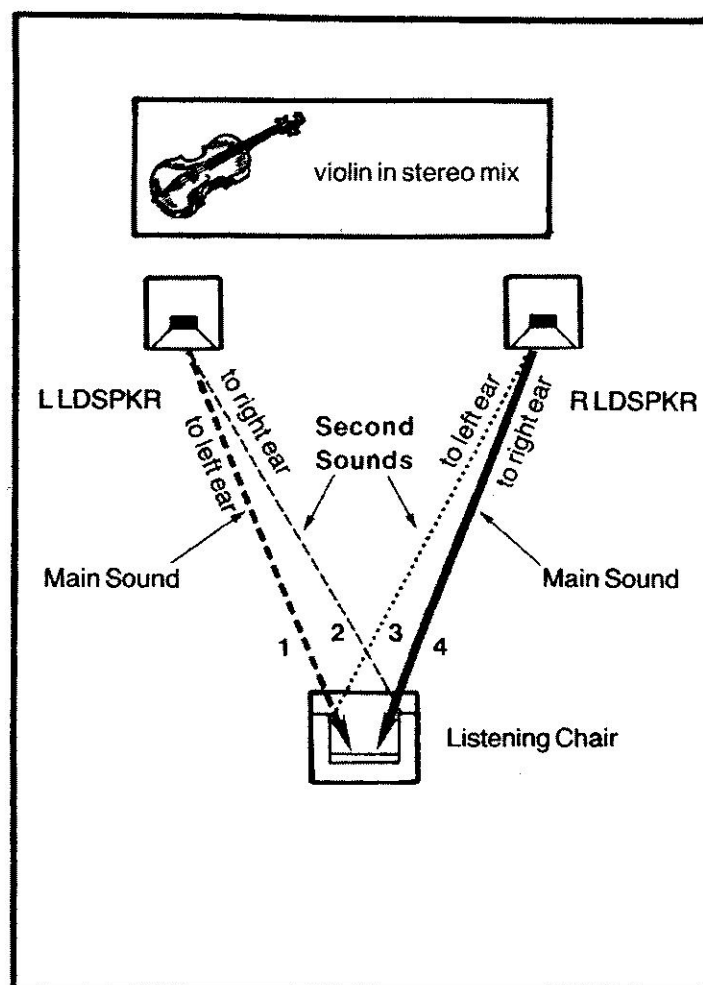
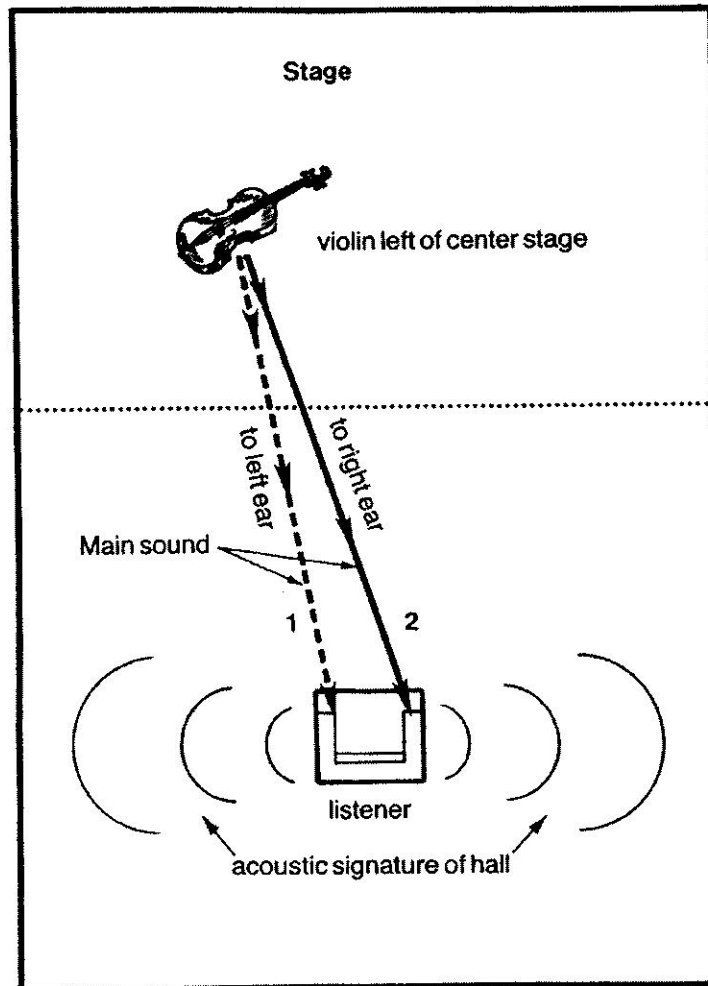


Diagram B: Live Event



compared to the balance control on a preamp. In this case, panned slightly left for a stronger signal in the left channel with some signal going to the right channel. This also simulates the violin's location in the left/right panorama of a stereo "stage." When the mixer's outputs are recorded and played back over loudspeakers, the sound of the violin note is reproduced by the left channel loudspeaker. The sound travels in a straight line to your left and right ears. Since the violin note was recorded in both stereo channels, some version of the original note will be reproduced by the right channel loudspeaker. The sound from the right loudspeaker arrives at your right ear, then, filtered by your head, at the left ear. As shown in Diagram A, this single violin note is represented in stereo playback by FOUR sound arrivals at your two ears.

Look at Diagram B — a representation of a live sonic event. Instead of electronically simulating the violin's location, it's actually left of center stage. As a member of the audience, a listener is facing straight ahead, looking at center stage. When a note is played on the violin, the sound arrives first at the left ear then, a fraction of a second later, at the right ear. Our ear/brain system uses the delay timing and phase relationships to locate the sound without having to look at the source. This localizing information is derived from the two sound arrivals.

In real life, a single sonic event — like the violin note — can never cause more than TWO sonic arrivals: One at the left ear and one at the right ear, as opposed to the FOUR arrivals occurring in conventional stereo playback. Those extra, second-sound arrivals confuse our ear/brain system. We can't perceive the location of the sound sources within a stereo recording because the clues are masked.

The C-9 Sonic Hologram Generator eliminates those extra sonic arrivals occurring in conventional stereo playback. In part, this is accomplished by cancelling out the unwanted second-sound arrivals from each loudspeaker to the opposite-side ear. Each ear is, then, free to concentrate its attention on the same-side loudspeaker. In other words, left ear hearing the left loudspeaker, right ear hearing the right loudspeaker.

Function: How it Works

The C-9's circuitry produces electronically-generated crosstalk signals from each stereo channel and feeds them to the opposite-side channel. The signals the C-9 generates are virtually identical to the unwanted, acoustic second-arrivals that confuse our ear/brain systems. The difference is that they're phase inverted. When these mirror-image signals

are reproduced by the loudspeakers, they cancel the acoustic crosstalk-signals arriving from the opposite loudspeaker.

This is a very simplified explanation of how Sonic Holography works. In addition to the electronic crosstalk-signals, the C-9 uses delay timing and filtering circuits for creating the same types of filtering and delay caused by our heads. That's important to more than hearing stereo program material without the confusing acoustic crosstalk. Sonic Holography will only work when the sound arrivals at each ear, from the opposite-side loudspeaker, are synchronized with the delays in the C-9's circuitry.

Yet, there's another important factor that can affect the performance of the C-9 when it comes to creating an image in Sonic Holography. Just like unwanted second sound arrivals from opposite-side loudspeakers, strong sound reflections off walls, windows and other surfaces in the listening room can also confuse our ear/brain system. Since these reflections can dilute or ruin the effect of Sonic Holography, some time will have to be spent dealing with this aspect of a listening room.

A degree in architectural acoustics isn't required to reduce room reflections. Later in this manual, we've provided some information and guidelines for eliminating these reflections, often utilizing furnishings or objects already in your listening room.

C-9 Controls

With the C-9 installed and the loudspeakers and listening chair properly positioned, actual operation is simple. As shown in the illustration, three switches control the operating parameters.

1. **SONIC HOLOGRAM:** This switch takes the C-9 in or out of your stereo system's signal path. To engage the C-9, push this switch IN. For bypassing the C-9, leave it OUT. Signal will still pass through the C-9 but not be processed.

2. **LISTENING APERTURE:** The **NARROW** mode (switch IN) provides very precise matching of electrical and acoustic crosstalk signals. This setting requires even positioning of the listener's head along the stereo axis with only a small holographic listening window. If you've properly set up the loudspeakers and listening chair, you should be on the stereo axis when seated. However, the listener will have to remain relatively still, not shifting laterally off the stereo axis. The **WIDE** mode (switch OUT) sets the circuit parameters to provide a wider listening window, allowing more lateral movement without interfering with holographic imaging.

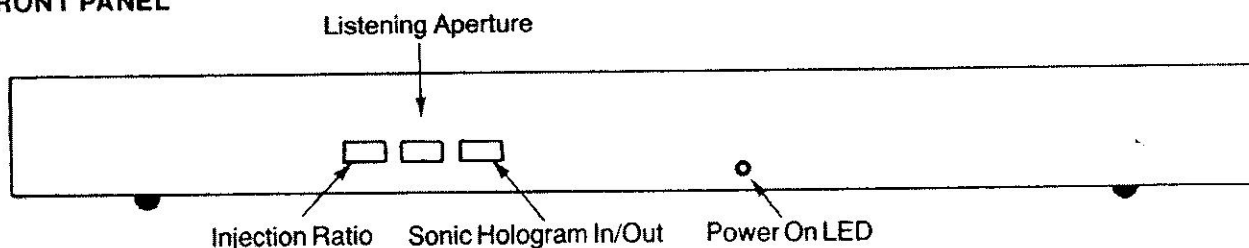
3. **INJECTION RATIO:** This switch controls the strength of the electronic crosstalk signals and alters the intensity of the holographic effects. Which position you select can depend, somewhat, on the recording techniques used with your favorite music. A common method is to use multiple close-positioned microphones, mixed down from a multitrack recording to stereo. For recordings made this way, the **NORMAL** (switch OUT) position will yield excellent results. This setting allows more conservative levels of electronic crosstalk to be injected into the stereo signals. The **THEORETICAL** setting (switch IN) is geared toward recordings made with few microphones, or with stereo microphone techniques (two-point XY, or three-point MS). This doesn't mean you can't use either mode for many different types of recordings made in different ways. On the contrary, you should feel free to experiment with different combinations of control settings. You'll probably find the **NORMAL** mode will give good, all-around results for most stereo recordings, but for an increased holographic effect, switch to **THEORETICAL**. The **THEORETICAL** mode provides increased crosstalk cancellation.

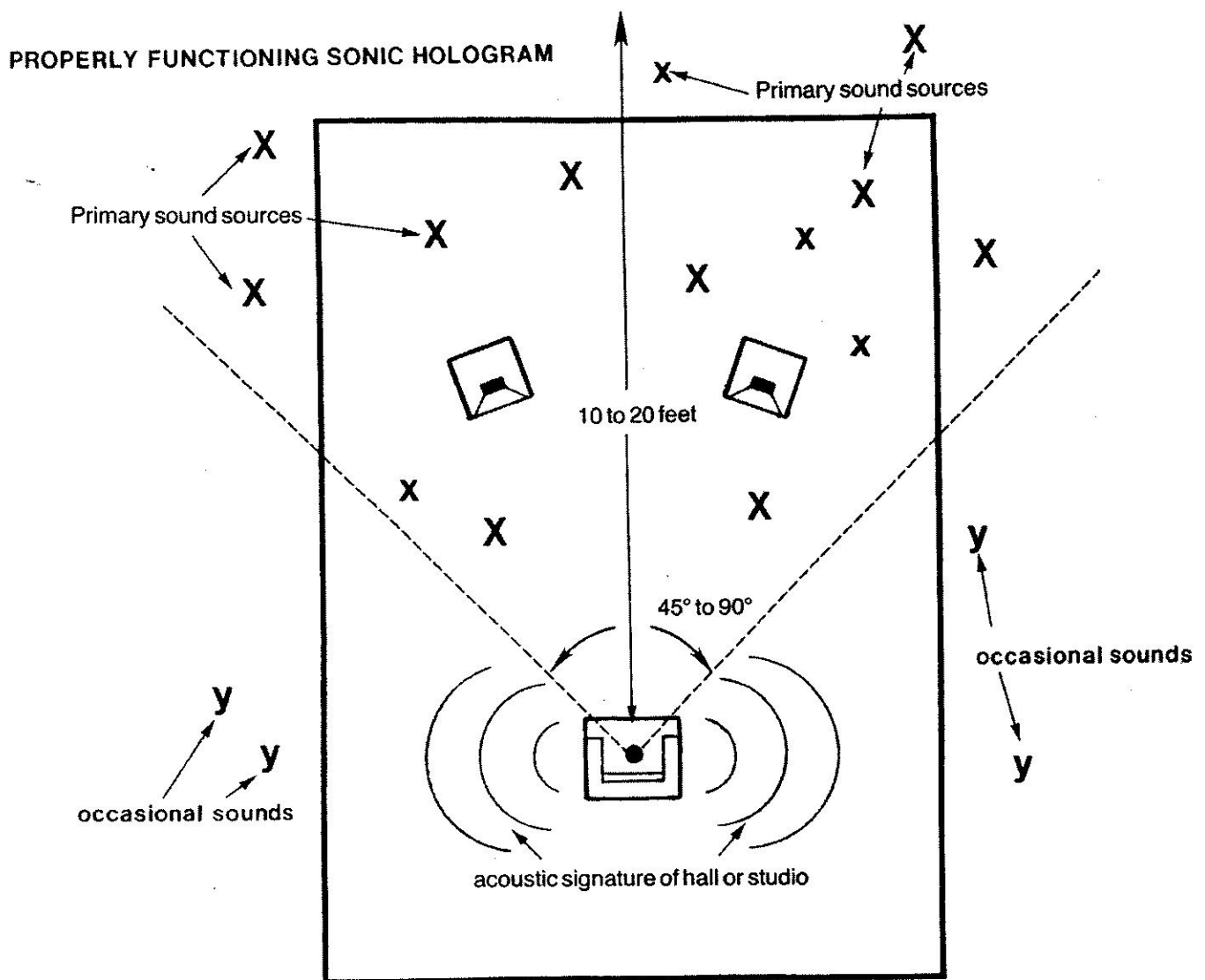
A Properly Functioning Image in Sonic Holography

Before listening to some musical selections in Sonic Holography, it's only fair to describe what you should be hearing and what to be listening for. With correctly positioned loudspeakers and listening chair, a Sonic Hologram should give you a sonic image as described and illustrated in the following section. The "X" marks individual sound sources (instruments, vocal artists, etc.).

Musical instruments, and other sound sources, will be spread out in a large arc in front of you with the arc's angle ranging from 45° to 90°. Sound images will exist to the left and right, extending well beyond the limits of the loudspeakers and, occasionally, all the way to the extreme left and right. You'll be able to perceive a sonic stage depth of 10 to 20 feet with sound images clearly floating behind and, from time-to-time, in front of the loudspeakers. You can actually turn your head and look at the sound images; these images will seem to stay put in space. Some sound images will seem to clearly emerge from outside the walls of the listening room. At the listening chair, you get the feel of the sonic signature or ambience of a location where the recording was made. From the stunning reverberation of a gothic cathedral to the subtle sonic signature of a recording studio, this sense of location helps to make the holographic image convincing, believable, and well-defined.

FRONT PANEL





Now that a properly functioning Sonic Hologram has been described in words, it's your turn to try Sonic Holography in your own listening space. So far, this manual has discussed the "nuts and bolts" end of Sonic Holography. If you've correctly established the initial relationship between the loudspeakers and listening chair, you should be able to experience Sonic Holography almost right away. But, before actually listening to Sonic Holography, take a couple of minutes to preflight your stereo system:

1. Visually check out and confirm that all components are connected in-phase (all left-channel outputs to left-channel inputs, right-channel outputs to right-channel inputs).
2. Check and confirm that the loudspeakers are properly wired in-phase (positive "+" loudspeaker outputs on the amplifier(s) should be connected to the positive terminals on the loudspeakers, negative "-" outputs to negative terminals on the loudspeakers).
3. If your system employs an external equalizer to flatten room response, it's recommended to switch it out of the stereo system's signal path. The simple act of moving the loudspeakers to the proper position will drastically

alter room response. Any room curve you've developed will no longer be valid. Wait until you've had a chance to experience and experiment with Sonic Holography before re-equalizing the room. Room response will also be altered by any sound treatments used to reduce room reflections, so wait until all phases of the set-up are complete to save time and trouble.

4. Inspect the phono stylus and cartridge for proper phasing, wear, and tracking. Other than possibly damaging valuable LPs, a cartridge/stylus in poor shape can upset the balance of the program material before it gets to the rest of the stereo system. This can simulate certain acoustic problems that cause strong one-side imaging, with weak imaging on the other.

5. Set the balance control in the preamp to "center."

6. Be sure the program material used during the initial set-up is really recorded in stereo. If you've selected older recordings, check the liner or jacket to confirm this. Recordings "rechanneled for stereo playback" are just monaural recordings; you will not create a successful holographic image from program material of this kind. We suggest selecting a stereo recording with only a few instruments and the human voice for first-time attempts at Sonic Holography.

Test Flight for Sonic Holography

At this time, take a musical selection and place it on your turntable. Engage the C-9 (SONIC HOLOGRAM switched IN, LISTENING APERTURE set WIDE, INJECTION RATIO switched to THEORETICAL). Go back and sit in the listening chair to begin enjoying the amazing depth and life Sonic Holography brings to music.

If you're not getting the full imaging described earlier, that's okay. It will take a while to learn to hear the full effect created by Sonic Holography, and might require more adjustments to optimize the listening room's acoustics for the best results. If you've performed the initial set-up instructions exactly, you should get some holographic imaging right away. If this isn't happening, go back and make sure the loudspeakers and listening chair are correctly, accurately positioned. Retrace your steps and check the instructions before giving in or giving up. Sonic Holography is such a totally unique and pleasurable experience, it's worth the time spent doing it the right way.

Fine Tuning the Holographic Image

After listening to Sonic Holography with your stereo system properly set up, you'll be in a position to begin fine tuning the complete system — in short, the room, loudspeaker placements, your ears, and the room's acoustics. The subject of loudspeaker/listening room interaction, and how we perceive this interaction, is complex. You might have to go over the following section more than once to get a better understanding of what to do to get the best results. Different rooms and loudspeaker systems have some variations in response or interaction that can't be accounted for on an individual basis, so don't be afraid to experiment.

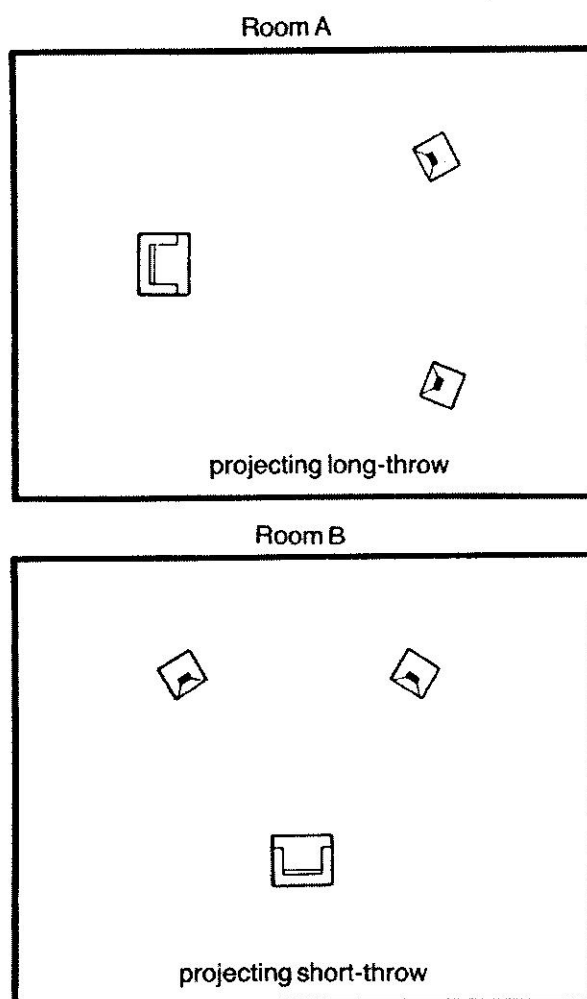
Loudspeaker Placements

If the loudspeakers are positioned properly for the initial set-up, you've noticed that this loudspeaker placement might not fit in with your normal lifestyle, room activities, or decor. Loudspeakers placed that far out in the room could interfere with traffic patterns, or maybe just look strange. If you've achieved a well-defined holographic image with the initial set-up, next try moving the loudspeakers back toward the wall behind them. Measure the distances between the loudspeakers and center of the listening chair just like you did during the initial set-up — EXACTLY, within $\frac{1}{4}$ inch. The object here is to find a point where the loudspeakers are as close to the wall behind them as possible, yet not losing the quality of a holographic image. Now, go back and listen to a single music selection. Each time the loudspeakers are moved back, check them against the same music selection. This will provide a good basis for comparison of any loudspeaker or room adjustment.

The purpose of keeping the loudspeakers away from the walls is to provide a direct, speaker-to-ear sound path with a minimum of extra, unwanted reflections off surfaces in the room. Just as the second-sound arrivals confuse the ear in normal stereo playback, early arrivals of reflected sound

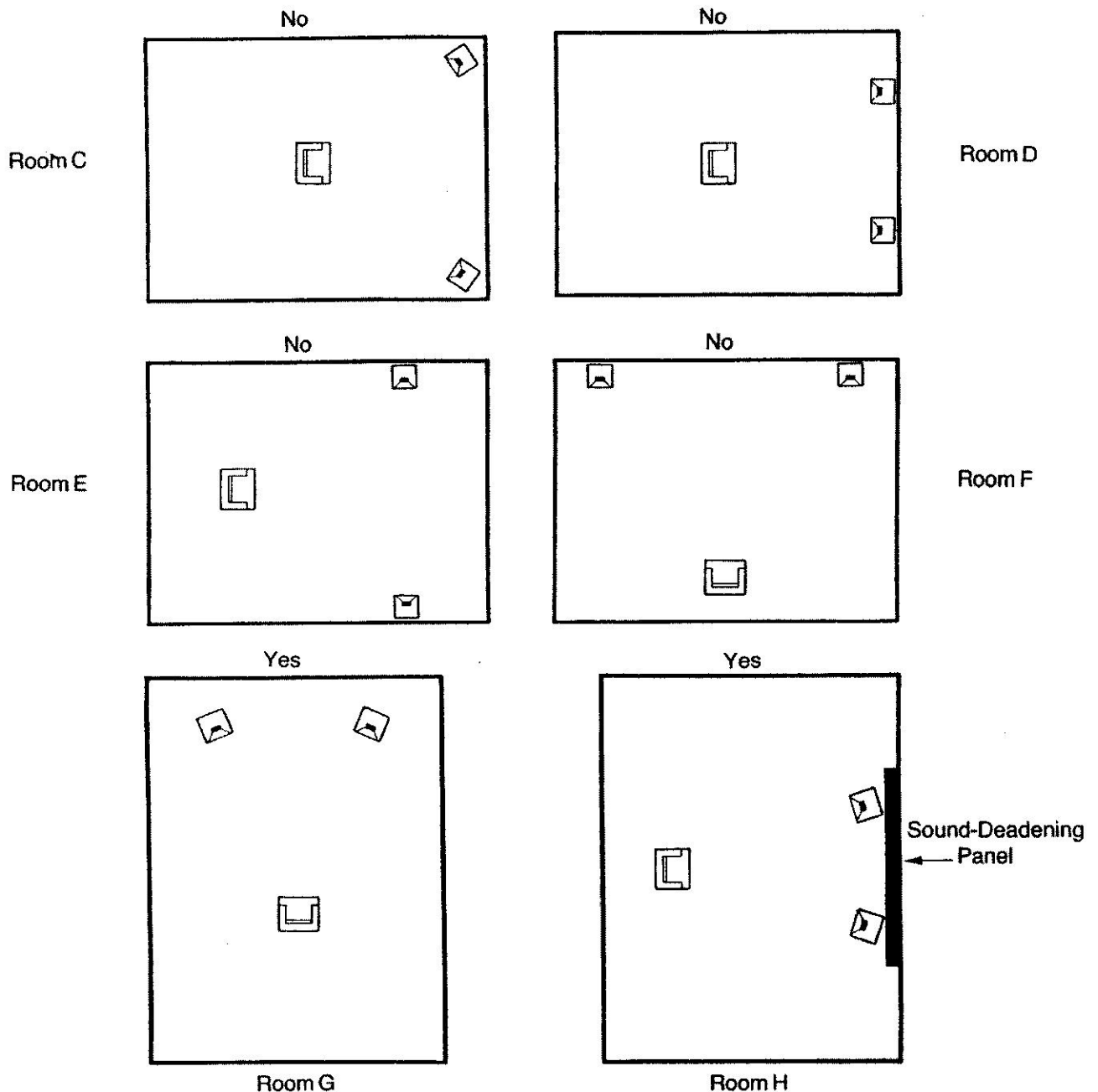
can further confuse the issue and ruin attempts at creating holographic images. Always keep in mind the importance of accurate loudspeaker/listening chair relationships, keeping the loudspeakers relatively close together (three to five feet, center-to-center).

The first two sample rooms show the loudspeakers and listening chair in perfect positions for Sonic Holography but, as we've mentioned, it may not be practical to leave them there. It's your mission to find a point where considerations for successful Sonic Holography can co-exist happily with the aesthetic considerations of room decor. Look at the diagram:



Room A, where the loudspeakers project the long throw of the room, yields a large front-to-back depth of the sonic stage. Room B, where the loudspeakers project the short span of the room, has exceptional sonic stage width and moderate front-to-back depth. Obviously, the choice of positioning depends on personal taste, as well as furnishings and overall room arrangement. Neither example takes strong sound reflections from room surfaces into account. (With a stereo system operating in the room the sound reflections are there; that's what gives you different results between the two.)

The next sample rooms show configurations that won't cut it when it comes to Sonic Holography, though these same set-ups are often quite acceptable for conventional stereo playback.



The loudspeaker placement in Rooms C to F violate basic rules for successful imaging in Sonic Holography. Other than poor loudspeaker placement, side/boundary-wall reflections will destroy chances of a good holographic image taking "form." Better room arrangements are illustrated in Rooms G and H. Room G has the loudspeakers closer to the wall, just as described earlier in this section. The loudspeakers are located as close to the wall as possible without losing or degrading a holographic image. Room H uses a "trick" to get the loudspeakers almost against the wall behind them. This trick consists of a sound-deadening panel placed behind the loudspeakers, right against the wall. We'll come back to Room H in a moment.

Refer back to the diagram of Room B. Room B compares favorably to both

Rooms G and H. What makes it so good for Sonic Holography? First, as in the initial set-up, the loudspeakers are away from corners, side walls, and the wall behind the loudspeakers. The listener is seated with a reflective wall behind — about one to four feet. This places the listener in a sound field made up of direct sound from the loudspeakers and reflected sound from the rear wall.

In Room H, with the loudspeakers still away from the side walls and corners, the listener has a nearby rear wall to ensure front-to-back depth in the holographic image. As in any good placement for Sonic Holography, the loudspeakers are toed-in toward the listening chair. This places the listener on-axis with direct sound from the loudspeakers, further reducing side-wall reflections at the same time. Yet, the loudspeakers are less than

one foot from the wall behind them. The secret is that sound-deadening panel placed against the wall.

This sound-deadening or sound-absorbing panel eliminates or reduces rearward reflections. The net effect is much like having the loudspeakers several feet away from the wall in question. This panel should extend three to five feet along the wall, beyond the outer edge of the loudspeakers (to the left and right). For best results, the panel should run vertically from floor to ceiling. If your listening room has high ceilings, the panel probably won't have to be taller than eight feet. A sound-deadening panel can be constructed from a wide range of materials including cork squares, acoustical tile, type B sound-deadening board, etc. To improve the appearance, and depending on the type of material used, the panels may be cloth or carpet covered to blend in with the natural decor of the room, making a panel less noticeable to the "untrained" eye. Be creative! Just as long as the decorative material doesn't reflect sound (no mirrors, glass, or exposed wood). Room H's arrangement, with its sound-deadening panel, is a good choice for listening rooms with smaller dimensions.

If your loudspeakers are "odd" shaped, or have a less-than-traditional radiation pattern, a good rule-of-thumb is to place them as far away from the rear and side walls as possible. If the loudspeakers have a dipole radiation pattern, it may require treating the back of the loudspeaker cabinet with sound-absorbing material, in addition to moving them out and away from the walls.

Dealing With Room Reflections

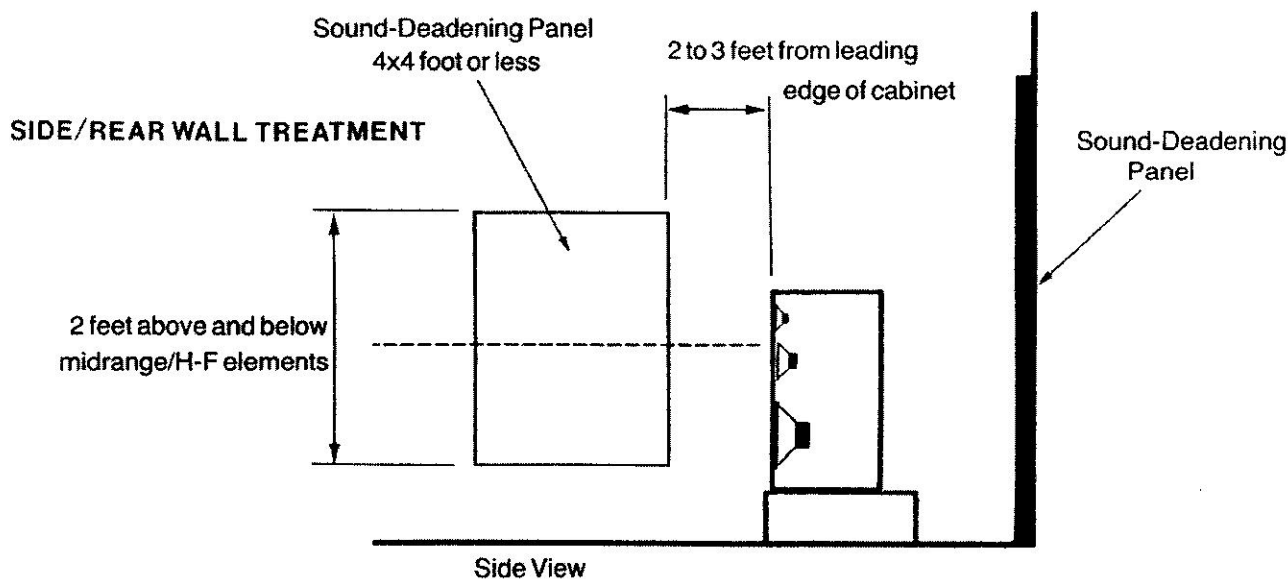
If it's not possible to locate the loudspeakers as recommended in the preceding section, the only answer is to eliminate or control early sound-reflections off surfaces in the listening room. You should try the sound-deadening panel arrangement shown in the last section (Room H), or some of the following ideas to get the most from the C-9 and Sonic Holography.

The object of acoustically treating the listening room is to create what's known as a "live end/dead end" configuration. This design makes the area around the loudspeakers acoustically "dead," while the area around the listener is kept "live." This allows random sound reflections to reach a listener long after the direct sound, establishing a uniform sound field. This technique is often used in the design of recording studio control rooms for similar reasons — and it works. You won't have to go to the lengths a studio engineer does in treating a room, but the concepts and principles are basically the same.

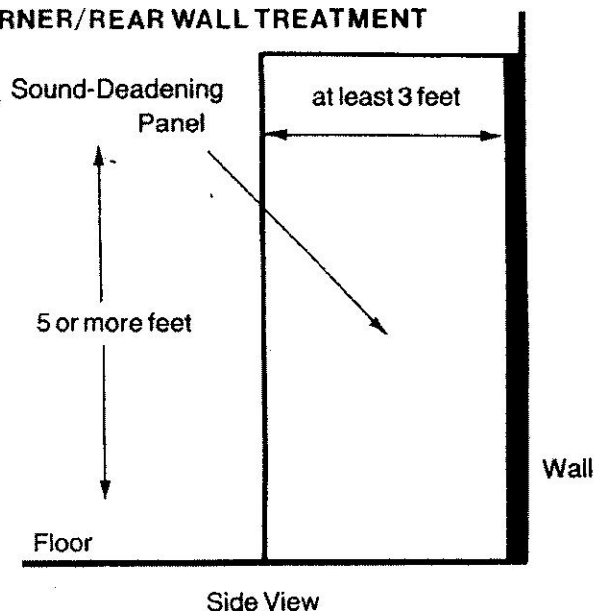
If you're not sure what an acoustically live room is, compared to an acoustically dead room, step into a tile bathroom or shower stall. Snap your fingers. The resulting reverberation comes from the sound of the fingers snapping, and sound from it bouncing off the hard, tile walls. A tile bathroom or shower stall can be said to be an acoustically live room. By comparison, snap your fingers inside a clothes closet packed with clothing. You hear the fingers snap but not much else. No reverberation. The clothing inside the closet absorbs the sound and minimizes reflections off the closet walls. The clothes closet can be said to be acoustically dead.

The reflections to attack in the listening room first are the usually strong, side-wall reflections that originate from surfaces near each loudspeaker. Any treatment should be applied to the wall extending two feet above and below the midrange and high-frequency loudspeaker elements, starting two to three feet from the leading edge of the loudspeaker cabinet. The treatment itself may be quite simple. Open, full book cases or record shelves, heavy fabric hangings, or draperies made of heavy material will work well as an acoustic treatment for many situations. You can use a smaller version of the sound-deadening panel used behind the loudspeakers in sample Room H. Locate the panel approximately as shown in the diagram. Actual location will depend on loudspeaker height and other factors.

Sound panels made from cork or acoustical tile can be covered with a variety of other sound-absorbing materials, too. Since side-wall sound treatments are relatively small (usually less than four feet by four feet), you



CORNER/REAR WALL TREATMENT



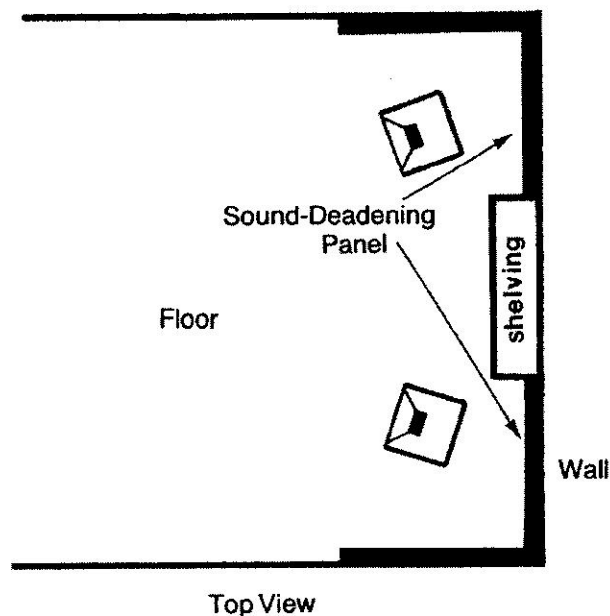
could use attractive grill cloths or foam panels to improve the appearance. However, loudspeaker grill cloths or covers are not, obviously, effective sound absorbers. Scrap carpeting can be effective when used with other sound-absorbing materials.

Materials for the sound-deadening panels can be easily obtained from sources as varied and different as lumber yards and electronic supply shops. If you can't permanently attach a sound-deadening panel to a wall, use picture hangers capable of supporting a panel. None of this stuff weighs much so this method should work in almost any circumstance.

Also, be sure to deal with room reflections equally. If you eliminate the reflections from one wall and not the other, the resulting reflections will create an audible imbalance in the holographic image. The sound images will be well-defined on one side, smeared or fuzzy on the untreated side.

The next room reflections to deal with are rear wall/corner reflections. Corners are easy to treat because so many furnishings fit perfectly in these areas of the listening room. You can use special treatments if you don't have furnishings that fit in corners. This type of sound-deadening panel should extend vertically above the loudspeakers (five or more feet), and down the rear and side walls around the loudspeaker (at least three feet). Consult the diagram.

The wall directly behind the loudspeakers should be as nonreflective as possible, particularly if loudspeakers have been placed a less-than-ideal distance away from it. If there's a large window between the loudspeakers, it should be covered with heavy draperies to reduce reflections off the glass. Lightweight drapery material isn't a good sound absorber, but many fiberglass or foam-backed thermal drapes with pleats will work just fine. Of course, if there's no window to worry about, a wall can be treated with sound-deadening panels, or just book shelves and record cabinets



extending vertically as high as possible, and completely between the loudspeakers. Since the loudspeakers are placed only a few feet apart, this shouldn't be much of a problem for even a modest set of shelves or cabinets.

Sound reflecting off the floor can be a severe problem if it's bare wood or tile, even if the loudspeakers are properly elevated on stands. The only possible solution here is to cover the floor with shag or plush-pile carpeting. If installing wall-to-wall carpeting isn't on your agenda when installing the C-9, use a rug made from similar materials that extends from the base of each loudspeaker stand to a foot short of the listening chair. Upholstered, low furniture, placed a distance forward of the loudspeakers, can also break up floor reflections.

Loudspeaker Designs and Early Reflections

Sonic Holography uses signal delays of a fraction of a millisecond. In some loudspeakers, reflections with similar delays can be caused by protruding edge moldings, grillwork, or other front/surface irregularities that might dilute an image in Sonic Holography. Most modern loudspeakers use sound-absorbing materials, rounded corners, or even unconventional designs to reduce these early reflections. In all fairness, most loudspeakers with "conventional" front panels won't have any serious reflection problems that could hurt or weaken holographic images. If sound images remain fuzzy and unresolved, even with close attention to all other factors, there's a possibility it could be the result of early reflection off front-panel irregularities. The solution to this problem consists of placing a cut-out of acoustic felt around the various elements in your loudspeakers ($\frac{3}{4}$ inch is best for this purpose). Be careful working around loudspeaker drivers mounted in cabinets. Don't use scissors, knives, or other sharp objects on the baffle or front panel of the loudspeaker.

Learning to Listen to Sonic Holography

Now that the listening room has been optimized, you should be sitting back and enjoying music like you've never heard it before in Sonic Holography. But, because most of us have spent years listening to conventional stereo playback, it could take some extra time to get used to "locking up" on the sonic images. We suggest trying a variety of different recordings, after the initial set-up period, to help you gradually become accustomed to the new perspectives in audio provided by Sonic Holography.

If, after several hours of listening, it is still a problem for you to hear holographic imaging, a way to shock your senses is to switch the Sonic Hologram Generator out of the signal path. The three-dimensional sound field of the Sonic Hologram collapses back into the space between the loudspeakers, and the life and depth disappear like somebody waved a magic wand. The point is, you'll remember why you purchased a C-9 in the first place.

One stumbling block to experiencing the full impact of Sonic Holography is the sensory conflict it can create between your ears and eyes. On the one hand, your ears provide the brain with sensory clues and characteristics of a large sound field but your eyes provide a different message. They tell your brain you're only in a small room which shouldn't sound that way. As much as you might feel this can be intellectualized or reasoned away, you'd be surprised. It has taken an awfully long time for humans to "learn" how to see and hear and, at this stage in our development, they've become reflexes. So, don't be too surprised by the fact it may take several hours before fully perceiving the superior imaging and stunning realism of Sonic Holography. A quick cure is to select a good live or location recording which used stereo microphone techniques and/or simple arrangements. Next, switch off the lights and listen to the selection in the dark. Switch the C-9 in, then try to focus your ears' attention on the sounds of the different instruments, hearing where they are. Listen for sounds localized or floating in space behind the loudspeakers — or even in front of them. If the recording was made in a club, concert hall or other large acoustic environment, try to get the feel of that location's ambience or sonic signature. After listening in the dark for a while, give your senses a real shock by switching the C-9 out of the system. Go back and listen. Now can you hear the difference between conventional stereo and Sonic Holography?

Troubleshooting the Sonic Hologram

If you try the suggestions in the preceding section without getting the hang of Sonic Holography, and further adjustments in room acoustics or loudspeaker/listening chair positions still don't yield the proper results, there could be some overlooked problems causing this inability to hear imaging in Sonic Holography. Check the following list:

1. Are the loudspeakers properly positioned, equidistant from the listening chair? Double check all measurements with a steel tape measure or other nonstretchable measuring device.
2. Are the loudspeakers two or more feet from all walls, corners, and other

sound-reflective surfaces? (Even if we haven't convinced you to set up the system as instructed, you should still try it for one day's listening just to see if the C-9 is working properly, and to learn what Sonic Holography **should** sound like.)

3. Have you devoted time and attention to reducing or controlling early sound reflections off surfaces in the listening room? Pay close attention to the side walls, and floor, as well as the wall directly behind the loudspeakers. Is the wall behind the listener reflective for good, front-to-back imaging of the Sonic Hologram?

4. Are the loudspeakers wired in-phase? Visually confirm that the positive terminals on the amplifier are connected to the appropriate positive terminals on the loudspeakers, negative terminals on the amplifier to the negative terminals on the loudspeakers. Confirm this with a listening test. Switch the C-9 out of the system, then play some music rich in bass or low-frequency program material. Switch the preamp from stereo to mono mode. Listen to the bass in mono making sure it's full, smooth and centered between the loudspeakers. If the bass sounds weak or fuzzy in mono, the loudspeakers probably have been wired out-of-phase. Reverse the leads on one loudspeaker to correct this problem. If the loudspeakers are out-of-phase, you won't even get a decent conventional stereo playback, let alone imaging in Sonic Holography.

Appendix

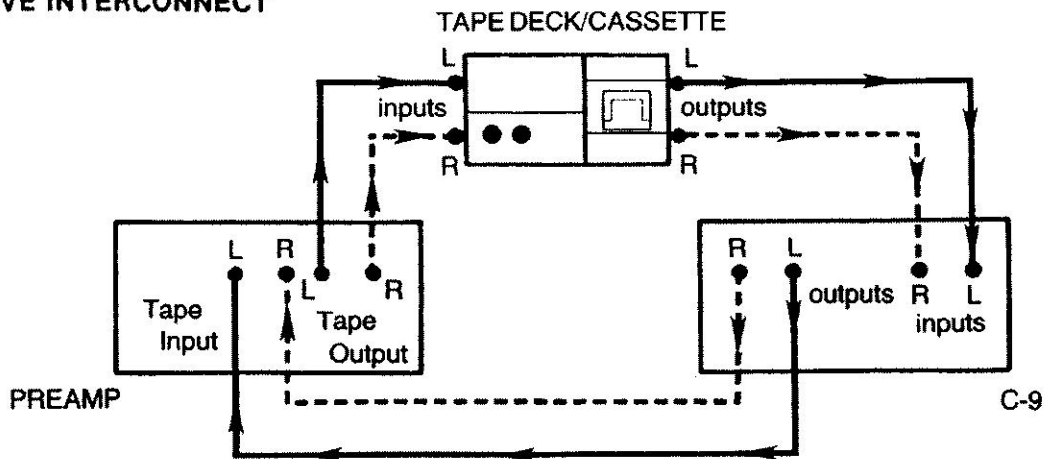
Section 1: Applications

The C-9 may be connected in other parts of the stereo system's signal path — other than between the preamp's main outputs and the power amplifier's inputs. In the case of an integrated amplifier (without access to the preamp/amplifier sections), the C-9 may be connected to a Tape or External Processor loop. For this set-up, the Tape (or External Processor) left output is connected to the left channel; input of the C-9 and the right Tape output to the C-9's right input. Signals are returned to the respective Tape inputs from the left/right outputs of the C-9.

Another set-up variation is placing the C-9 in the return signal path from the outputs of a tape deck or cassette machine. Simply connect the respective outputs from the tape machine to the inputs on the C-9. Take the C-9's outputs and return them to the Tape inputs on the preamplifier or integrated amp. Switch the monitor on the tape machine to source or engage the "play" mode. Adjust the appropriate levels on the inputs of the tape machine for optimum signal levels. This is not a preferred way of interconnecting the C-9 with your system but, if nothing else is available it will work just fine.

NOTE: The C-9's rear-panel convenience outlet is designed to provide additional common-point powering for accessory devices and components. This outlet is "live" as long as the C-9 is plugged into a working ac receptacle (100W maximum).

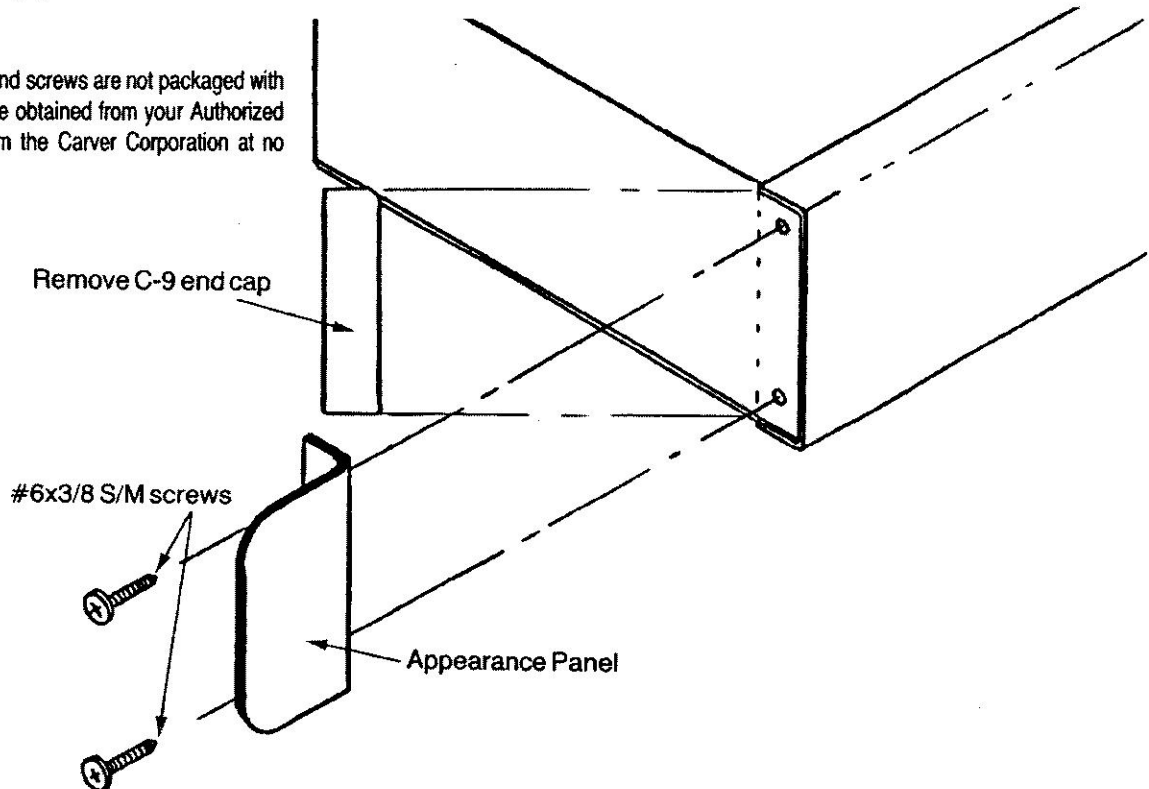
ALTERNATIVE INTERCONNECT



NOTICE: The purchase of a Carver C-9 Sonic Hologram Generator gives implied license only to use the apparatus to play sound recordings, but not to make sound recordings.

Section 2: Appearance Panel Installation

Appearance Panels and screws are not packaged with this unit. They may be obtained from your Authorized Carver Dealer or from the Carver Corporation at no charge.



If you are planning to simply match the C-9's front panel with other 19-inch-wide stereo components, proceed with Steps 2 and 3.

STEP 1: For rackmounting purposes ONLY: Drill holes per template on last page of this owner's manual.

For rackmounting, two holes must first be drilled in each panel. Carefully cut out the template. Align the rounded corners of the Appearance Panels. Next, take a center punch or drift and mark the hole locations as indicated by the crosses on the template.

Don't waste your time trying to drill through the template — a sure way of scarring the Appearance Panels and ruining the template.

Remove the template and drill "pilot holes" at the punch marks with a $\frac{1}{16}$ - or $\frac{3}{32}$ -inch drill bit. Pilot holes make it easier to keep things centered on the punch marks. Drill the holes out to $\frac{3}{16}$ -inch.

STEP 2: Remove the C-9 end caps (one at each end).

STEP 3: Install the Appearance Panels with two #6x $\frac{3}{8}$ S/M screws provided. Once both panels are secured to the chassis you may complete the installation (either stack, or secure the C-9 in rack with the proper hardware).

Section 3: Specifications

Rated Output:	2V rms
Maximum Output:	6V rms
Total Harmonic Distortion:	less than 0.05% (20 Hz to 20 kHz)
IM Distortion:	less than 0.05% (SMPTE)
TIM Distortion:	less than .001%
Noise:	less than 100 μ V, IHF A-weighted
Image Resolution	5° horizontal, 20° vertical (in THEORETICAL mode)
Size:	1 $\frac{5}{8}$ "/3 $\frac{1}{8}$ "/17 $\frac{3}{4}$ " (W/O panels)
Weight:	3.2 lbs.
Power:	120V, 60 Hz; 220V, 50 Hz (optional)

IMPORTANT: Carefully unpack your C-9 and keep the original carton and packing materials for moving, shipment, or long-term storage.

NOTE: It is not possible to make the C-9 and Sonic Holography function properly without reading this owner's manual. Please follow all instructions and recommendations concerning placement of loudspeakers and listening chair exactly.

Features and specifications subject to change without notice.

Section 4: Service/Warranty

Troubleshooting

If you're having trouble or suspect a problem, try some simple troubleshooting first. More likely than not, the problem lies elsewhere in the system — not with the C-9.

Replace any suspect cables and/or inspect connections between the preamp, preamp control settings, the power amplifiers, and the C-9. Inspect speaker wires and terminals on the amplifier and loudspeakers for disconnects or possible shorts, etc. Make sure the C-9 is plugged into a working outlet. If the C-9's power on LED still fails to light-up, remove for service inspection.

If the problem still exists, contact:

CARVER CORPORATION CUSTOMER SERVICE
19210 33rd Ave. W.
Lynnwood, WA 98036

Your inquiry will be promptly responded to; we're glad to help. You might be directed to a Carver Authorized Service Center, or be asked to return the unit to the factory. We must have the serial number of your C-9 before its return can be authorized. When shipped to a service center or the factory, make sure it's in the original carton, well sealed. If convenient, your Carver dealer should be consulted and might be able to offer additional assistance.

Carver Corporation Limited Warranty

NOTICE: The following warranty information is exclusive to the United States only. Please see your Carver dealer or distributor for the correct warranty information for your area and locale.

Carver Corporation is proud of its products which have been built with care using advanced technology and premium parts. Your unit has been crafted to perform properly for many years. Carver Corporation offers to you, the owner of a new Carver product, the following warranty:

The Carver Corporation Warranty for each of its products is in effect for three years from the date of original retail purchase. The Carver Corporation Warranty covers defects in materials and workmanship. However, the following are excluded: a) damage caused during shipment, b) damage caused by accident, misuse, abuse or operation contrary to instructions specified in the Carver Corporation owner's manual, c) units where the serial number has been defaced, modified or removed, d) damage resulting from modification or attempted repair by any person other than authorized by Carver Corporation.

The Carver Corporation Warranty extends to the original owner or subsequent owner(s) during the three-year warranty period as long as the original dated purchase receipt is presented whenever warranty service is required.

If your Carver Corporation product ever requires service, write to or call Carver Corporation (Attention: Customer Service Department), 19210 33rd Ave. W., Lynnwood, Washington 98036. You will be directed to an authorized Carver Corporation Service Station or receive instructions to ship the unit to the factory. Please save the original shipping carton and packing materials in case shipping is required. Please do not ship by Parcel Post. Be sure you have received authorization from Carver Corporation and include a complete description of the problem, the associated components and connections, and a copy of the purchase receipt. Initial shipping costs are not paid by Carver Corporation, return shipping costs will be prepaid if repairs were covered by the scope of this Warranty.

All implied warranties, including warranties of merchantability and fitness for particular purpose, are limited in duration to the three-year length of this warranty, unless otherwise provided by state law.

Carver Corporation's liability is limited to the repair or replacement, at our option, of any defective product and shall not, in any event, include property or any other incidental or consequential damages which may result from the failure of this product.

Some states do not allow limitations on how long an implied warranty lasts and/or do not allow the exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions 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. We suggest that you attach your purchase receipt to this Warranty and keep these in a safe place. Thank you for your choice of a Carver Corporation product.

Carver Corporation
19210 33rd Ave. W.
Lynnwood, Washington 98036

Template

